

92

Location Moses Lake Date 5/16
 Project / Client May 2016

WP-136 door hanger

Time	0	2	4	6
Temp	17.4	17.2	17.4	

purged 5 gal
 sample time 1216

WP-177

Time	0	2	4	6
Temp	15.1	15.3		

purged 5 gal

WP-65

Time	0	2	4	6
Temp				

Had to collect from hose
 ran about 7 gal
 sample time 1420

WP-105 door hanger

Time	0	2	4	6
Temp	17.8	17.6	17.6	17.7

purged 8 gal

93

Location Moses Lake Date 5/16
 Project / Client May 2016 private well

NEW ROE WP-152

Time	0	2	4	6
Temp				

5 gallons purged
 sample 1541

* WP-71B door hanger at WP-71B

WP-10

Time	Temp
0	17.5
2	17.3
4	17.3
6	17.5

spigot on
 northside of
 apartments
 purged 5 at first then
 purged 10 gal
 total

sample time 1410

WP-155

Time	0	2	4	6
Temp	17.6	17.6	17.6	17.5

purged 5 gal
 sample time 1630

END DAY 1

94

Location Moses Lake Date 5/17Project / Client May 2016Private well samplingWP-121 Totalizer: 68690

Time	0	2	4	6
Temp	17.6	17.6	17.4	17.6

WP-121A1: 0850

WP-121 C1: 0856

purged 5 gal

Garage had some odors maybe engine oil. Took one FB for PFC because locations are close

WP-119

Time	0	2	4	6
Temp	16.7	16.5	16.7	16.6

purged 10 gal temp started high dropped to 15.1 then stabilized

119

NW ~~121~~ A1: 0930

DWP129A1 0938

NW ~~121~~ C1 0945Totalizer 1
108095.8

FB for PFC taken near David's person

95

Location Moses Lake Date 5/17Project / Client May 2016Private well sampling

WP-11 Refused sampling 1030 we offered ^{(b)(6)} the fact sheet and ^{(b)(6)} said ^{(b)(6)} has seen the website

WP-27

Time	0	2	4	6
Temp	16.7	16.7	16.6	16.7

pump was running so there was air in line

Sample time 1100

WP-28

Time	0	2	4	6
Temp	18.3	18.3	18.3	18.3

Sample time 1120

96

Location Moses Lake Date 5/17
 Project / Client May 2016
Sampling event

WP-04

Sample time 1200

Hungry non-potable sign at
 CWC on outside and one
 on well house. gave two
 signs to lady in office.

WP-131

Sample time: 1330

temp	17.9	17.9	17.9
time	0	2	4

Water was sudsy at first
 purged 10 gal

WP-125 total per 449537.5

time	0	2	4
temp	17.6	17.6	

have contractor remove flow thing

97

Location _____ Date _____
 Project / Client _____

installed 2 signs for no
 drink.

NWP125A1 1400
 NWP125B1 1406
 NWP125C1 1411
 1605FBWP125 1415

WP-137

Time	0	2	4	6
TEMP	17.8	18.0		

purged 10 gal

End Day 2

98

Moses Lake
May 2016

5/17/16

WP-74

Time	0	2	4	6
Temp	18.3	18.3	18.3	18.3

air in line owner does +
need us to call sample anytime

sample time 0905

WP-71A

Time	0	2	4	6
Temp	16.1	16.1	16.1	16.1

water was pulsing and a
steady stream was not possible.
see picture

sample time 0930

WP-57 left door hanger

Time	0	2	4	6
Temp	15.6	15.5	15.6	15.5

purged 5 gal

N: 0950

D: 1000

99

Moses Lake
May 2016

5/17/16

WP-144 left door hanger

Time	0	2	4	6
Temp	17.4	17.5	17.4	17.5

sampled from spigot in front.

purged 5 gal

sample time: 1015

WP-180

One well house two spigots
(b) (6) wasn't home so
neighbor let us sample out
of (b) (6)

Time	0	2	4	6
Temp	18.7	18.7	18.6	18.4

purged 5 gal

sample time 1040

WP-124

sample

Time	0	2	4	6
Temp	17.2	17.2	17.3	17.2

purged 5 gal

Moses Lake

4D
3ms/MSD

WP124A1 1115
 WP124C1 1120
 total 117er 275513.0

1605FBWP124 1110

WP-69

Time	0	2	4	6
TEMP	17.3	17.3	17.3	

purged 10 gal

Sample time 1203
 Duplicate 1158

WP-52 dioxane only

Time	0	2	4	6
TEMP	17.8	17.8	17.7	17.6

only collecting on dioxane
 in place of WP-45 because
 the water is turned off

Sample time 1412

WP-45

Time	0	2	4	6
Temp	20.0	20.1	20.2	20.4

purged 15 gal

N: 1450
 D: 1500

part
 May 2016
 Williams, Kinser

Well ID	Sample ID	Date	Sample	Notes
WP-179	1605NWP179	5/6/16 1385	P	-
WP-70	1605NWP70A1 11	1 0918 0922 0922	11	-
WP-123	1605NWP123A	11 0951	11	-
WP-129	1605NWP129	11 1032	11	-
WP-120	1605NWP120	5/6/16 1043	P	-
WP-122	1605NWP122	5/16 1128	P	msmsd
WP-127	1605NWP127	5/16 1207	P	-
WP-138	1605NWP138	5/16 1251	P	-
WP-139	1605NWP139	5/16 1327	P	-
WP-143	1605NWP143	5/17 1527 5/17 1527 5/17 1527	P	-
WP-178	1605NWP178	5/16 1445	P	-
WP-167	1605NWP167	5/16 1356	P	-
WP-168	1605NWP168 1605NWP168	5/16 1523 1526	P+FD	-
WP-156	1605NWP156	5/16 1777	P	-

part
 May 2016
 Williams, Kinser

Well ID	Sample ID	Date	Sample	Notes
WP-179	1605NWP179	5/16/16 1385	P	-
WP-70	1605NWP70A1 11	5/16/16 1385	11	-
WP-123	1605NWP123A1	5/16/16 1385	11	-
WP-129	1605NWP129	5/16/16 1385	11	-
WP-120	1605NWP120	5/16/16 1385	P	-
WP-122	1605NWP122	5/16/16 1385	P	MSMSD
WP-127	1605NWP127	5/16/16 1385	P	-
WP-138	1605NWP138	5/16/16 1385	P	-
WP-139	1605NWP139	5/16/16 1385	P	-
WP-143	1605NWP143	5/17/16 1385	P	-
WP-178	1605NWP178	5/16/16 1385	P	-
WP-167	1605NWP167	5/16/16 1385	P	-
WP-168	1605NWP168 1605DWP168	5/16/16 1385	P+FD	-
WP-156	1605NWP156	5/16/16 1385	P	-

5/16/16

Moses Lake

Sample ID	Date/Time	Sample	Notes
1605 NWP154			
1605 NWP169	5/16 1628	P	-
1605 NWP145	5/16 1655	P	-
1605 NWP36	5/17 0842	P	-
1605 NWP52	5/17 1049	P+FD	msd
1605 NWP54	5/17 1117	P	-
1605 NWP09	5/17 1144	P	-
1605 NWP147	5/17 1218	P	-
1605 NWP50	5/17 1330	P	-
1605 NWP43	5/17 1358	P	-
1605 NWP42	5/17 1433	P	-
1605 NWP128	5/17 1550	P	-
1605 NWP150	5/17 1631	P	-
1605 NWP149	5/17 1641	P	-
1605 NWP153	5/18 0918	P+FD	msd
1605 NWP153	5/18 0922	P	-
1605 NWP154	5/18 0936	P	-
1605 EBJWP	5/18 0945	EB	-
1605 NWP171	5/18 1032	P	-
1605 NWP170	5/18 1051	P	-
1605 NWP111	5/18 1144	P+FD	-
1605 NWP111	5/18 1146	P	-
1605 NWP33	5/18 1207	P	-
1605 NWP173	5/18 1304	P	-
1605 NWP14	5/18 1348	P	-

WP-71B	1605 NWP71B	5/18	1435	P	-
WP-148	1605 NWP148	5/18	1620	P	-

Moses Lake
Private Wells / EPA 5/16/16
Samplers: Jake Williams & Blair Kinser

0815

Weather: Partly Cloudy
Temp: 54° F

Scope: Sampling at Moses Lake has been split between 3 teams. Our team is to collect water samples from private wells in the Moses Lake area. Wells are being sampled for VOCs, in particular TCE.

0835

Arrived @ (b) (6) to sample WP-179.

Purge: 7 gallon total

	Time	Temp C°
0841	0	22.4
0843	2	22.4
0845	4	22.1
0847	6	23.4
0849	8	23.4
0851	10	23.5
		Stable

Moses Lake
 Apr A - May 2016 Event
 Private Wells / EPA 5/16/16

Samples collected @ 0851

Arrived @ (b) (6) @ 0905
 to sample WP-70.

Totalizer Reading PrePurge:
~~2364.5 BCK~~
 237064.5 BCK

ge with teflon line to reduce
 in spray & damage to electrical

Time	Min	Temp
0912	0	15.1 °C
0914	2	15.1 °C
0916	4	15.0 °C
0918	6	15.1 °C

Purged 3 gallons total

0918 Sampled port A
 0920 Sampled port B
 0922 Sampled port C

Moses Lake
 Private Wells / EPA 5/16/16

(b) (6)
 Arrived (b) (6) 0942
 to sample WP-125

Time	Temp °C
0	16.7
2	16.1
4	16.0
6	16.0

Stable

WTF, totalizer: 204680.7
 A part Sample: 0959

Arrived @ (b) (6) 1010
 to sample WP 129

Purge @ front of house

Time	Minute	Temp °C
1015	0	20.1
1017	2	16.2
1019	4	15.7
1021	6	15.2

cont'd
 next page

Moses Lake
Private Wells / EPA

5/16/16

Time	Minute	Temp °C
1023	8	15.3
1025	10	15.4 *
1027	12	N/A

* Stable temp.

Totalizer = ~~120799.9~~ 30h
120799.5

Sampled @ 1032

Arrived @ (b) (6)
WP-120 @ 1043

No one home place departing 1045
Sample from north spigot

Time	Temp
0	15.9
2	15.7
4	15.7
6	15.7

Moses Lake
Private Wells / EPA

5/16/16

Sample #1 m: 1056

Arrived @ (b) (6) 1123
WP-122 ← to sample

Began purge 1129

Time	Minute	Temp
1129	0	16.9°C
1131	2	16.8°C
1133	4	17.1°C
1135	6	17.1°C
1137	8	17.0°C

Stable

Purged 8 gallons

Began sample 1138

Moses Lake
Private Wells / EPA

5/16/16

(b) (6)

Arrived @
to sample WP-127 @ 1158

Time	Temp
0	16.5
2	16.0
4	16.0
6	16.0

Sample time: 1207

Lunch Break

Arrived @ WP-138 1245

(b) (6)

Time	Minute	Temp °C
1252	0	17.4
1254	2	17.1
1256	4	17.0
1258	6	17.0

Stalle

Moses Lake
Private Wells / EPA

5/16/16

Sample Time 1259

Weather: Partly Cloudy
Temp: 68°

(b) (6)

Arrived @ WP-143 1305
to sample WP-143

Not able to sample well but stopping
piston valve from opening. Will get tools
tonight to remove.

Arrived at WP-139 @ 1315

Time	Temp
0	17.8
2	18.0
4	18.1
6	18.43
8	18.4
10	18.5

Stable

Moses Lake May 2016 Event
Private Wells / EPA 5/16/16

Sample time: 1327

WP-143

The team was able to find an adjustable
wrench to open the valve. When opened
water flowed the team is assuming
the well is turned off @ this time.

Arrived @ (b) (6) 1345
to sample WP-168 ~~7~~ ⁸

Purge - 4 gallons

me	Minute	Temp °C
1349	0	16.0
1351	2	15.8
1353	4	15.8
1355	6	15.9

Stable

Sample Time 1356

Moses Lake 5/16/16
Private Wells / EPA

Arrived @ (b) (6) 1435
WP-178

Time	Temp °C
0	16.1
2	16.0
4	16.0
6	16.2

Sample time: 1445

Arrived @ (b) (6) 1504
WP-168 to sample

Began Purge 1516

Time	Minute	Temp °C
1516	0	16.8
1518	2	16.9
1520	4	16.9
1522	6	16.9

Stable

Sample Time 1523 Dup 1526

Moses Lake May 2016 Event
Private Wells / EPA 5/16/16

Arrived @ (b) (6) 1543
WP-154

Left a day far to sample @
different time/day

Arrived @ (b) (6) 1602
to get right of Entry WP-145

Arrived @ (b) (6) 1545
to get right of Entry

Arrived @ (b) (6) 1619
WP-164

	Time	Temp
	0	15.3
	2	15.3
	4	15.3
	6	15.5

2al. purged

Sample Time 1628

Moses Lake 5/16/16
Private Wells / EPA
(b) (6) 1645

ROE Signed @ WP-145

Time	Temp
0	16.4
2	15.5
4	15.6
6	15.7

Sample time: 1655

Arrived @ (b) (6)
WP-156

Began Purge Time	Min	Temp
1710	0	16.5°C
1712	2	16.6°C
1714	4	16.4°C
1716	6	16.4°C

Used equipment will need to take
equipment blank

Moses App. Ac. May 2016 Event 5/17/16

Private Wells / EPA

End of - 5/16/16

Sample Time 1717

implers Jake Williams & Blair Hines
5/17/16

Arrived @ (b) (6) 08:24
WP-86

Time	Temp C°
0	16.4
2	16.4
4	16.3
6	16.2

Stable Purged 5.6 gallons

Sample time 8:42

Analyzer 1577, 203.6

At 0900 Left for airport
to ship samples from yesterday

Moses Lake 5/17/16
Private Wells / EPA

Completed Shipment of Samples
@ 1017

Arrived @ (b) (6) 1032
~~WP-09~~ WP-52
BCH

Began Purge

Time	Minute	Temp (°C)
1038	0	14.6
1040	2	14.8
1042	4	16.0
1044	6	16.1
1046	8	16.2

Purged 8 gallons
Stable

Sample Time 1048
MS & MSD

Duplicate Sample Time 1052

No one home left door tag

Moses Lake May 2016 Event
Private Wells / EPA 5/17/16

Arrived at (b) (6) 1105
WP-54

Received ROE

Began Purge

Time / Temp

0	15.8
2	15.9
4	15.9
6	15.9

• Stable

4 gal. purged

Sample time: 11/7

Moses Lake 5/17/16
Private Wells / EPA

Arrived at (b) (6) 1126
WP-09

Began Purge

Time	Minute	Temp °C
1130	0	17.7
1132	2	17.5
1134	4	17.4
1136	6	16.6
1138	8	16.1
No one home - left door tag		
1140	10	16.0
1142	12	16.2

Stable

Purged 8 gallons

Sample time 1142

Moses Lake 2016 Event 5/17/16
Private Wells / EPA

Arrived at
WP-128

(b) (6)

Tried sampling

(b) (6)

no samples

were collected will wait when
owners are home.

Arrived at
WP-147

(b) (6)

1204

Time	Temp °C
0	16.3
2	16.3
4	16.4
6	16.4

Stable

Sample time 1218

Lunch

Moses Lake 5/17/16
Private Wells / EPA

Arrived
WP-50

(b) (6)

1320

Time	Min	Temp °C
1323	0	16.2
1325	2	16.1
1327	4	16.1
1329	6	16.1

Stable

Purge 5 gallons

Sample Time 1330

No Answer @ door left door-tag.

Moses Lake
 App A - May 2016 Event
 Private Wells / EPA 5/17/16

Arrived @ (b) (6) 1344
 WP - 85

Time	Min	Temp °C
1348	0	16.5
1350	2	16.3
1352	4	16.2
1354	6	16.2

stable

Sample Time 1355

Arrived @ (b) (6) 1420
 WP-82

Time / Temp °C

0	16.2
2	15.9
4	15.3
6	15.2
8	15.1

13 gal. purged, stable

Moses Lake
 Private Wells / EPA 5/17/16

Sample Time 1433

3-Flag Condos 1523
 WP-143

No steady stream possible
 Purged 20 gallon obtaining
 sample via split apparatus.

Sample Time 1527

Arrived at (b) (6) 1539
 WP-128

Purge Time	Minute	Temp °C
1543	0	15.6
1545	2	15.6
1547	4	15.4
1549	6	15.6

Sample Time 1550

5/17/16

(b) (6)

1601

Place Pre-sampling
hanger door

(b) (6)

1612

WP-150

Time	Temp °C
0	17.8
2	17.7
4	17.7
6	17.7

Purged 4 gal.

Sample time: 1631

5/17/16

(b) (6)

1645

Arrived at
WP-144

Purge

Time	Min	Temp
1645	0	15.8
1647	2	15.8
1649	4	16.0
1651	6	16.0

Moses Lake App A May 2016 Event

5/18/16

Private Wells / EPA

Samplers: Jake Williams & Blair Kinser

Weather: Sunny
Temp: 66°F

Arrived at
WP-151

(b) (6)

0847

No water running from taps.
Well was disconnected. No one was
home. left tag at the door. (b) (6)

(b) (6)

Arrived at
WP-153

(b) (6)

0905

Began Purge

Time	Minute	Temp
0910	0	16.4
0912	2	16.4
0914	4	16.4
0916	6	16.4

Stable

Sample time 0918 includes MS/A

Dup Sample Time 0922

Moses Lake

5/18/16

Private Wells / EPA

Arrived at
WP-154

(b) (6)

Time	Temp
0	17.6
2	17.6
4	17.7
6	17.7

Sample time: 0936

Equipment Blank Taken 0945

5/18/16

Arrived at
WP-171

(b) (6)

1010

25min Purge

Time	Minute	Temp
1012	0	15.1
1014	2	15.2
1016	4	15.3
1018	6	15.5
1020	8	15.7

New Well Coords
47° 9' 17" N 119° 19' 36" W
Well ID - ABP863

Well located in back of house
at (b) (6) which is a (b) (6) house.

1022	10	15.8
1024	12	15.4
1026	14	15.3
	15	Purged 10 gallons

Sample time 1032

5/18/16

Noted Well @
Well ID ABP011

(b) (6)

Coords

47° 49' 17" N 114° 19' 37" W

Time	Minute	Temp
1043	0	14.7
1045	2	15.2
1047	4	15.1
1049	6	15.1

Purged
12 gallons
Stable

WP-170 Assumed 3ch

Description: Located approximately
150ft west of the detached structure
@ (b) (6) Well has
piston style spigot within 5ft from
it where samples were obtained
notes:

Owner did come out to confirm
that the well was for (b) (6)
(b) (6) also may require an ROE.
Sample Time 1051

Moses Lake
Private Wells/ EPA

5/18/16

Moses Lake

5/18/16

Arrived at
WP-111

(b) (6)

1135

Begin Time	Purge Min	Temp °C
1138	0	17.2
1140	2	16.4
1142	4	16.2
1144	6	16.3

stable

purged 12.5 gallons

Sample time 1144

uplicate Sample time 1146

Arrived at
WP-33

(b) (6)

1155

No one home door tag left at front door

Begin Time	Purge Min	Temp °C
1200	0	15.5
1202	2	16.0
1204	4	16.0
1206	6	15.8

stable

Purged 8 gallons

Sample Time 1207

5/18/16

Arrived at (b) (6) 1236
WP-173

No one home left door tag on front door.

Will sample at spigot @ front back of house since well house is locked. The piston style spigot is painted (b) (6) located east of well house. Sampling was conducted through (b) (6).

Time	Minute	Temp °C
1252	0	15.2
1254	2	15.8
1256	4	15.8
1258	6	15.5
1300	8	15.4
1302	10	15.3

Purged 9 gallons

Sample time 1304

5/18/16

(b) (6)
WP-83
Totalizer Reading
1929404

Arrived at (b) (6) 1334
WP-14

Began	Purge Minute	Temp °C
1339	0	19.6
1341	2	19.6
1343	4	19.5
1345	6	19.5

Purge 5 gallons

Totalizer Reading:
1728251.1

Sample Time 1346

Moses Lake
App May 2016 Event
Private Wells / EPA 5/18/16

(b) (6)

Arrived at
WP-713

Began Purge

Time	Minute	Temp °C
1428	0	17.3
1430	2	17.3
1432	4	17.3
1434	6	17.3

stable

Purged 5 gallons

Sample time 1435
using equipment

Moses Lake
Private Wells / EPA 5/18/16

(b) (6)

Arrived at
WP-148

1610

Time	Minute	Temp °C
1613	0	16.2
1615	2	16.2
1617	4	16.2
1619	6	16.2

Purged 7 gallons

Sample Time 1620.

End of day.

Private Wells and Monitoring Wells Groundwater Sampling Field Report August 2016 Field Sampling Event

Moses Lake Wellfield Superfund Site Moses Lake, Washington



Field Investigation:
16-18 August 2016

Report Prepared:
August 2016

By: Technical Services Branch



**US Army Corps
of Engineers** ®
Seattle District

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APPENDICES

APPENDIX A – Site and well location map

APPENDIX B – Field Sampling Photos

APPENDIX C – Field Notes, Acknowledgement Form, Private Well SOP

1.0 BACKGROUND AND OBJECTIVE OF INVESTIGATION

1.1 Background

The Site is located within and beyond the northwestern region of the City of Moses Lake, Washington. The Site encompasses approximately 15 square miles and includes the Grant County International Airport and surrounding area (formerly the Larson Air Force Base (LAFB)), commercial facilities, and residences.

Previous environmental investigations conducted at the Site identified contamination of soil and groundwater resulting from historic operation of the former LAFB and industrial activities associated with the aircraft industry. Potential source areas are scattered throughout the Site and approximately 1000 acres of groundwater have been identified as contaminated to date.

Previous investigations focused primarily on the former LAFB. The former LAFB occupied approximately 9607 acres and was active from 1942 until 1966. In 1988, three municipal wells operated by the City of Moses Lake were found to be contaminated with trichloroethene (TCE). Additionally, TCE was historically detected in two domestic wells operated by the Skyline Water System, Inc., a private water provider located in unincorporated Grant County south of the former LAFB property. Domestic (residential) and commercial (light or heavy industrial) private wells locations outside the former base have also had detections of TCE. TCE concentrations associated with the Site have been found to exceed EPA's National Primary Drinking Water Standards (the Maximum Contaminant Level (MCL)) under the Federal Safe Drinking Water Act. The MCL represents the maximum level (i.e., concentration) of the contaminant allowed in drinking water, and is set at 5 µg/L for TCE.

Based on the TCE detections described above, between 1989 and 1993 the City chose to fix the three contaminated City water-supply wells south of the Airport by extending the casings down to the lower basalt aquifers. In addition, the Skyline community, which was dependent on the Skyline water system, received an alternative water source (bottled water) between 1997 and 2003. In 2003, USACE completed construction of a replacement water-supply well, which draws water from a deeper, uncontaminated groundwater aquifer, and currently provides drinking water to the Skyline community.

Following findings of contaminated domestic (private) wells and upon request from Region 10 EPA, USACE began a private well groundwater sampling program in 2001. The groundwater sampling program has been used to ensure that humans are not exposed to contaminant concentrations above the MCL, and to monitor TCE plume migration.

In 2002, following two private well monitoring events, a whole house filter (WHF) system was designed and installed at five residential sites where it was determined that TCE contamination could potentially exceed the drinking water standard for TCE (5 µg/L).

Groundwater monitoring wells have been installed over the last 22 years in order to monitor contamination at the Site. Groundwater elevation data are collected where available to evaluate groundwater flow direction and are also used to evaluate plume migration at groundwater monitoring wells.

An IROD was signed in September 2008 (EPA 2008) for cleanup actions in areas with soil and groundwater contamination that exceed risk-based concentrations. The IROD required groundwater pump and treat systems to be installed for two of five identified TCE plumes. The IROD further specified that cleanup levels will be attained throughout all the plumes, but active remediation may be discontinued if it can be demonstrated that natural attenuation (through dilution) can remediate the remnant plumes in a reasonable timeframe (within the estimated 30 years for cleanup).

The IROD specifies that information gathered during groundwater monitoring, as well as design and operation of the selected groundwater pump and treat system, be used to determine the need for refinement of the selected groundwater remedy to meet groundwater restoration goals. The COCs monitored in the groundwater sampling program are as follows:

- trichloroethene (TCE)
- cis-1,2-dichloroethene (cis-DCE)
- trans-1,2-dichloroethene (trans-DCE)
- vinyl chloride (VC)
- 1,1-dichloroethene (1,1-DCE)
- 1,2-dichloroethane (DCA)
- 1,1,1-trichloroethane (TCA)
- 1,1-dichloroethane (1,1-DCA)

Only TCE, however, has a cleanup level established in the IROD, and the other VOCs have either never been detected or have been detected only at levels far below any established MCL or risk-based cleanup level.

1.2 Groundwater Sampling Event Summary and Objectives

In coordination with the US Environmental Protection Agency (USEPA) Region 10, one USACE environmental field team deployed to conduct the August 2016 Moses Lake Wellfield groundwater sampling event during a single mobilization. The events described in this report involve USACE field teams verifying sample point locations; discussion of sampling techniques; recording groundwater observations; collecting groundwater samples; and delivering those samples to the lab for analysis. Environmental sampling team members responsible for the August 2016 field event were Karah Haskins and Alex Meincke.

All of the work described in this report was accomplished in accordance with the Moses Lake Wellfield Superfund Site Quality Assurance Project Plan. In addition, the teams followed the guidance presented in: the Seattle District, USACE Safety and Health Plan; USACE Safety Manual EM 385-1-1; Seattle District, USACE, Sampling Standard Operating Procedures (SOP).

The private wells designated for sampling are displayed on a map found at Appendix A. These wells have been selected based on the approved 2016 Work Plan (USACE 2015)

One environmental field team deployed to the Site and collected groundwater samples from 15 private well systems, and deployed passive diffusion bags and collected depth to water at 24 monitoring wells:

Karah Haskins and Alex Meincke collected groundwater samples from 15 private well systems and deployed 24 passive diffusion bags in monitoring wells between 16 and 18 August 2016. Deployed passive diffusion bags will be sampled in November 2016.

The objectives of groundwater sampling at Moses Lake are to: 1) collect representative samples from designated private well systems and monitoring wells yielding data of known and sufficient quality to evaluate TCE concentrations and define existing TCE plumes; 2) to assure compliance with the requirements of USEPA; and 3) to make critical project - specific decisions based on the evaluated data.

2.0 DESCRIPTION OF WORK

2.1 Activities Prior to the August 2016 Groundwater Sampling Event

For all properties designated for sample collection, owners (and renters if applicable) were contacted to coordinate sample collection times during the scheduled field sampling week. Many of the owners allowed the sampling teams to work on their property while they were not at home.

For private well sampling, the field team was tasked with determining the most appropriate cold-water tap or other sample port as close to each wellhead as practical, while comparing notes on sample points collected during previous sampling events. The team was briefed that groundwater samples would not be collected from taps delivering chlorinated, aerated, softened or filtered water.

2.2 Private Well Sampling Procedures

During the August groundwater sampling event, samples were collected from a total of 13 private wells consisting of: 5 private well system hose bibs (WP-04, WP-27, WP-131, WP-167, and WP-168), and ten WHF systems (WP-14, WP-70, WP-83, WP-86, WP-119, WP-121, WP-123, WP-124, WP-125 and WP-129).

USACE has determined private well and WHF groundwater purging shall to consist of: allowing water flow at the sampling port at a rate of approximately 0.5 to 1 gallon per minute (gpm), while measuring the temperature of the water stream with a digital thermometer every two minutes until stabilization is achieved. These procedures follow the general principles of the New Hampshire private well system water sampling guidance.

While purging continued, the field team monitored the surrounding area and flowing water for unusual observations and odors as purge water was captured in a five gallon bucket. They recorded the start time of the purging in the field logbook immediately after opening each hose bib sample point and establishing the flow rate. While one team member used the digital

thermometer to measure water temperatures, the other recorded the temperatures every two minutes until the parameters stabilized.

Upon reaching stabilization, the approximate total purged volume was recorded in the project field book along with any other significant observations. The team then conducted the sample collection activities.

Prior to collecting a water sample, the team reduced the flow rate at each tap to approximately 150 to 200 ml/min. to minimize sample water turbulence and aeration. Prior to sample collection at each private well system, the samplers donned clean Nitrile gloves to prevent exposure to contaminants and cross-contamination. All groundwater samples were collected in pre-cleaned certified containers obtained from the analytical laboratory.

All sample containers were filled with water directly from each tap – forming a meniscus at the top of each vial to provide zero headspace samples as required. Sample point location and components of each plumbing system were noted to assist in data interpretation. In addition, each team placed handle tags (indicating that water samples were taken by USACE on that date and time) on the front doors of homes sampled if nobody was home during sample collection.

After the sample containers are filled, sample labels describing project, location, analysis, team members, preservative, sampling date, and collection time are placed on the containers. The samples are then packaged in bubble wrap bags and plastic zipper type bags, placed into pre-iced sample shipping coolers and prepared for shipment as described in Section 3.0. All sampling teams worked to ensure each property was left just as they found it with no damage done, and any doors or gates closed as required.

2.3 Whole House Filter Sampling Procedures

In coordination with USEPA and affected Moses Lake area homeowners, granular activated carbon (GAC) water filters have been installed in private well systems showing TCE results of 3.5 µg/l or greater. Each GAC filter system consists of two lightweight composite GAC filter tanks (acting as lead and lag filters), associated piping, bag filters (to prevent GAC particles from entering the household plumbing system), pressure gauges and valved/regulated sample collection ports.

Groundwater samples were collected from ten WHF systems (WP-14, WP-70, WP-83, WP-86, WP-119, WP-121, WP-123, WP-124, WP-125 and WP-129) during the August 2016 sampling event. Each system was purged according to the revised private well sampling SOP consisting of allowing water flow at a hose bib nearest the wellhead at a rate of approximately 0.5 to 1 gpm, while measuring the temperature of the water stream with a digital thermometer every two minutes until stabilization is achieved. During purging, continuous temperature readings were recorded using a digital thermometer until water temperature stabilization was achieved. Once water temperature had stabilized, the hose bib was closed, and the field team prepared to collect samples from the pre-determined WHF sample ports (labeled “A” for the lead inlet port, “B” for the lead outlet port, and “C” for the lag outlet port).

WHF sample collection consists of opening each designated sample port valve fully to allow the maximum restricted flow rate of approximately 150 to 200 ml/min to flow into a capture

bucket for a few seconds to ensure organic matter or air bubbles have been flushed out of the system. Restrictors have been placed on the sampling lines to provide a smooth, non-turbulent stream at a low-flow rate to minimize loss of volatiles that may be present in the water stream. Next, the sampling team immediately fills three pre-preserved VOA vials to zero headspace. New Nitrile gloves were donned before collecting samples at each port. All discharged water was directed into a five gallon plastic bucket for transfer to ground surface away from the shed or pump house GAC filter location after the samples were collected.

2.4 Monitoring Well PDB Deployment Procedures

The PDBs were purchased from ALS Environmental laboratory under license by the US Geological Survey and The General Electric Company, both co patent-holders. The 1 ¼" diameter low-density polyethylene PDBs were pre-filled with 220 ml or 330 ml of ASTM Type II certified, laboratory-grade, deionized water. Each filled PDB was then heat sealed by the laboratory prior to shipment to USACE via overnight delivery in hermetically sealed pouches.

The environmental field team deployed PDBs in preparation for the November 2016 sampling event. PDB deployment consisted of the following procedures:

1. The team verified each monitoring well location and identification number with project maps and the sample matrix. They verified work can proceed safely in the vicinity of moving vehicular traffic as required. The PDBs were prepared over clean sheets of aluminum foil prior to being placed into each well. The team used a pry bar, socket wrench or pinhead hex wrench as needed to open each flush mount monitoring well cover plate, and a Masterlock #485 padlock key for the standard "stick-up" well completions. The team donned new Nitrile gloves for groundwater sample collection.
2. The team collected depth to groundwater using a water level meter.
2. The team verified the number of PDBs, weights and anchor length required for each individual well. Where extra volume is required for November 2016 sampling, the team deployed 330ml PDBs.
3. The team ensured that all PDBs were lowered to the required depth and secured to the well cap.
4. Finally, the team securely capped and locked each monitoring well riser and cover plate when finished.

2.5 Sampling Event Activities and Observations

2.5.1 Private Well Sampling

USACE environmental field team consisted of Karah Haskins and Alex Meincke. The environmental field team collected samples at their own pre-assigned set of 10 whole house filter well system sample ports and five private well system hose bibs.

During the period of 16-18 August, 2016, the team collected groundwater samples from the following private well systems with whole house filters installed: WP-14, WP-70, WP-83, WP-86,

WP-119, WP-121, WP-123, WP-124, WP-125, and WP-129. During that same time period, the team collected groundwater samples from the following private well systems: WP-04, WP-27, WP-131, WP-168, and WP-169.

All required 40 ml VOA sample vials were obtained by the USACE contract lab ARI, and delivered to USACE pre-preserved with maleic and ascorbic acid.

Trip blanks were sent inside each sample shipping cooler delivered to the analytical lab.

Even though a right of entry permit has been signed, and verbal or written permission granted to collect samples at each designated location, the sampling team always attempted to contact the owner or resident at each private well location before beginning the field sampling activities. Upon arrival at each private well property designated for sample collection, the team verified they were at the correct address using maps, notes, and the sampling matrix, and verified through field documentation they were ready to collect samples at the correct sampling point (hose bib, or suitable water discharge port nearest to the wellhead).

Per modified SOP, sampling point valves were opened, and water allowed to flow at approximately 0.5 gpm into a capture bucket. Next, water temperature readings were measured every two minutes until stabilization was achieved. During the November sampling event, water temperature stabilization averaged approximately eight minutes elapsed purging time with most locations reaching stabilization within six minutes as shown in Table 1 below.

Table 1: Private Well Stabilized Water Temperatures and Purge Times

Well Location ID	Stable Temp. °C	Total Purge Time (Minutes)
WP-04	16.4	6
WP-14	19.8	6
WP-27	14.6	6
WP-70	19.6	6
WP-83	16.9	6
WP-86	16.6	6
WP-119	19.3	6
WP-121	23.1	6
WP-123	18.8	6
WP-124	18.6	6
WP-125	16.6	6
WP-129	Sprinkler was running. No purging occurred.	
WP-131	13.8	6
WP-167	15.0	6
WP-168	Sprinkler was running. No purging occurred.	

Upon achieving stabilization, the final stabilized readings were entered into the project field book. Prior to collecting a water sample, the flow rate at each tap was reduced to approximately 100 to 200 ml/min. to minimize sample aeration and turbulence. The sampling team donned new Nitrile gloves prior to sample collection at each residence. In the case of the

WHF sample ports, restrictors on the sample ports provided a stream of sample water at approximately 150 to 200 ml/min. All sample containers were filled with water directly from each tap – forming a meniscus at the top of each vial to provide zero headspace samples as required.

Significant Observations Made During Private Well/WHF Sampling

Due to the presence of containerized chemicals near the sample point, one field blank sample was collected at WP-83 using reagent-grade water.

Teflon sample tubing was attached to the hose bib at WP-167 to mitigate turbulent water flow. Water was allowed to run through tubing to flush out any contaminants prior to sampling. At WP-125 the flow restrictor was removed from the A port because water was not flowing at a rate acceptable for sampling. Also, at WP-125 rust colored water was observed from purge spigot after filters. This color dissipated almost immediately, but then returned after two minutes of purging. Again it was only for a few seconds and then water was clear again. All piping seemed to be intact. WHF system was installed in 2015 so system is relatively new.

All samples were hand delivered to ARI in Tukwila, WA on 18 August 2016.

2.5.2 Passive Diffusion Bag Deployment

The USACE environmental field team deployed new PDBs into a pre-assigned set of 24 PDB monitoring wells during the August 2016 mobilization in preparation for the November 2016 event.

The team generally worked from the north end of the Site and moved to the far south end. A total of 24 monitoring wells were fitted with new PDBs. The PDBs were installed in the following order: 14BW02; 14EX04; 14BW01; 14EX03; 12CW04; 12BW05; 04CW05; 12BW07; 12EX01; 02BW01; 04CW07; 12BW08; 12EX02; 04BW09; 14BW03; 14EX05; 12CW03; 12BW04; 12CW02; 12BW03; 12CW01; 12BW02; 12CW05; 12BW06.

The team first verified each monitoring well location and identification number with project maps and the sample matrix. The team also verified that work could proceed safely in the vicinity of moving vehicular traffic or other physical, biological, or environmental hazards that may have been present near each monitoring well.

Each team member donned new Nitrile gloves PDB deployment.

The sampling team recommends continued use of protective mesh PDB sleeves in wells with steel risers due to a greater potential for damage to the PDB membranes (monitoring wells 12EX01, 12EX02, 14EX03, 14EX04, and 14EX05).

Two sizes of PDBs were ordered: The bags consisted of the standard 220 ml size, and a larger 330 ml bag selected to accommodate primary and field duplicate samples where required. In some wells, two 330 ml PDBs were connected in tandem and lowered to the mid-screen depth to accommodate primary, field duplicate, and MS/MSD sample volumes as required. Two PDBs were installed at two mid-screen depths if a designated well had two screened intervals (as found in wells 04CW07, 12BW03, and 12BW04). All PDBs and stainless steel anchor weights

were purchased from ALS Environmental, and shipped to the District office by UPS overnight delivery.

Following the established PDB deployment procedures, both environmental team members worked together using a table of Moses Lake monitoring well logs to determine the number of required weights, length of nylon suspension line, and number of PDBs required at each designated well. Wells deeper than 200 feet generally required two steel weights to allow proper PDB positioning. Each team member donned a new pair of Nitrile gloves prior to working on PDB assemblies at each well. Steel weights, suspension lines, and PDBs were quickly assembled on a strip of clean aluminum foil on the tailgate of the sampling vehicle. The prepared assembly of PDB, suspension lines, and weights was lowered into place at each well within 10 to 15 minutes to reduce the possibility of contaminants entering the diffusion bags during deployment.

At each specific well, the team lowered the weight into the well first, followed by the suspension line and PDB. The team worked to keep the assembly centered within the well casing as they slowly lower it to the well bottom. When the team felt the weight hit well bottom, they pulled up the line approximately one inch and tied it off securely to the casing plug or well cap. This method ensured the PDB would always be centered at the mid-well screen depth. Finally, the well cap was locked, or the cover plate secured with locking bolts depending on type of well encountered – stick up or flush mount.

All laboratory-filled PDBs arrived at the USACE office in good condition prior to field deployment. Each PDB was packed in groups of 10 into sealed foil pouches to prevent inadvertent contamination until deployment into the designated monitoring wells. No specific difficulties or problems were noted during PDB deployment.

Significant Observations Made During Passive Diffusion Bag Sampling

No mesh sleeve was used at 14EX05 because an insufficient number of sleeves were sent. The team took extra precaution when lowering PDB. The team mistakenly had a 10ft anchor line attached to 12CW03 so 24 hours after deploying the team raised the PDB 5ft and retied string. Many small ants were observed at 04BW09.

3.0 INVESTIGATION DERIVED WASTE

No investigation-derived waste was generated during this sampling event. All residual PDB water or purged well water was transferred directly to ground surface on each property away from the sample collection point.

4.0 PACKAGING AND SHIPMENT

As mentioned in the narrative of each sampling event, groundwater samples were packaged in shipping coolers on ice and under chain of custody hand delivered directly to laboratory.

All sample shipping coolers were prepared for laboratory delivery in the following manner: Each cooler was lined (sides and bottom) with plastic “bubble-wrap” sheets for shock absorption. A large 30-gallon plastic garbage bag was then placed into the cooler to contain the

sample water in the event of container breakage during shipment to the laboratories. The glass sample vials were labeled, placed into plastic zip-seal bags, and placed into foam shipping blocks or bubble-wrap bags for shock protection. All the samples were placed in the shipping coolers as indicated on the corresponding chain of custody forms. Gallon size plastic zipper bags of cubed ice bags were placed between and on top of the samples in each cooler to ensure maintenance of the required four degrees centigrade (plus/minus two degrees) sample preservation temperature. The completed chain of custody (COC) forms were placed in gallon size plastic zipper bags and taped to the inside of each cooler lid. Two custody seals were affixed to the outside of each cooler. The custody seals were placed so that the coolers could not be opened without breaking the seals. Each cooler was then securely sealed with fiber tape. The field team ensured drain plugs were securely taped inside and out to prevent possible water leakage.

The laboratory was informed of the sample delivery and ensured the samples were properly accepted and checked in upon receipt the following morning after the sample containers were shipped. All sample coolers and sample containers were accounted for at the contract laboratory following each shipment.

5.0 LABORATORY ANALYSIS

Chemical analyses performed on the samples were as follows: VOCs (Method 524.3).

6.0 DECONTAMINATION PROCEDURES

PDB weights, flow cells and associated tubing, water level indicator meters, and water volume measurement containers used by each team were decontaminated at the end of the project with an Alconox®-water solution followed by triple rinsing using distilled water in the USACE Geology Laboratory.

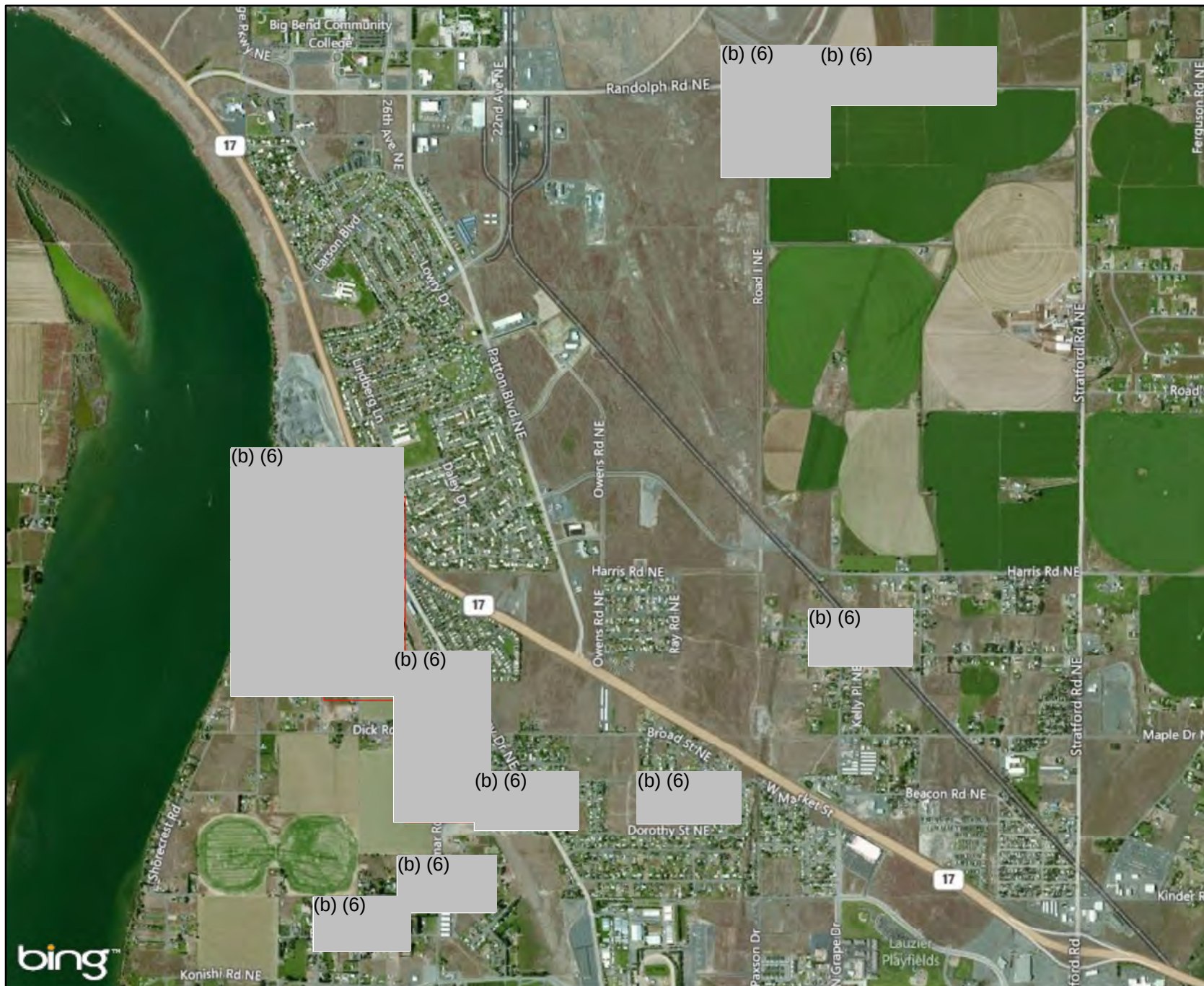
7.0 PROTECTION LEVEL

All sampling activities were conducted under Worker Protection Level D. For this project, personnel protective equipment included reflective safety vests, safety splash protection glasses, Nitrile gloves, and safety steel toe boots. New pairs of Nitrile gloves were donned prior to handling acid-preserved sample containers and between each unique private well sample point or monitoring well.

End of Field Sampling Report

Appendix A
Site and Well Location Maps

2016 MOSES LAKE SAMPLING MAPBOOK



Legend

- Well Location (69)
- Uncertain Location (6)

Location Map



0 1,250 2,500
Feet

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2016 MOSES LAKE SAMPLING MAPBOOK (A7 - PAGE 1 OF 23)



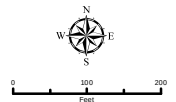
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Legend

- Well Location (1)
- Uncertain Location (0)

Location Map

(b) (6)



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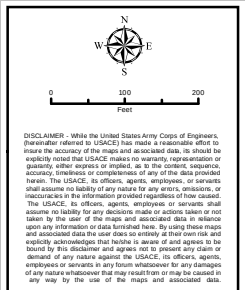
(b) (6)

Legend

- Well Location (2)
- Uncertain Location (0)

Location Map

(b) (6)



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2016 MOSES LAKE SAMPLING MAPBOOK (K1 - PAGE 5 OF 23)

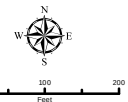


(b) (6)

Legend

- Well Location (6)
- Uncertain Location (0)

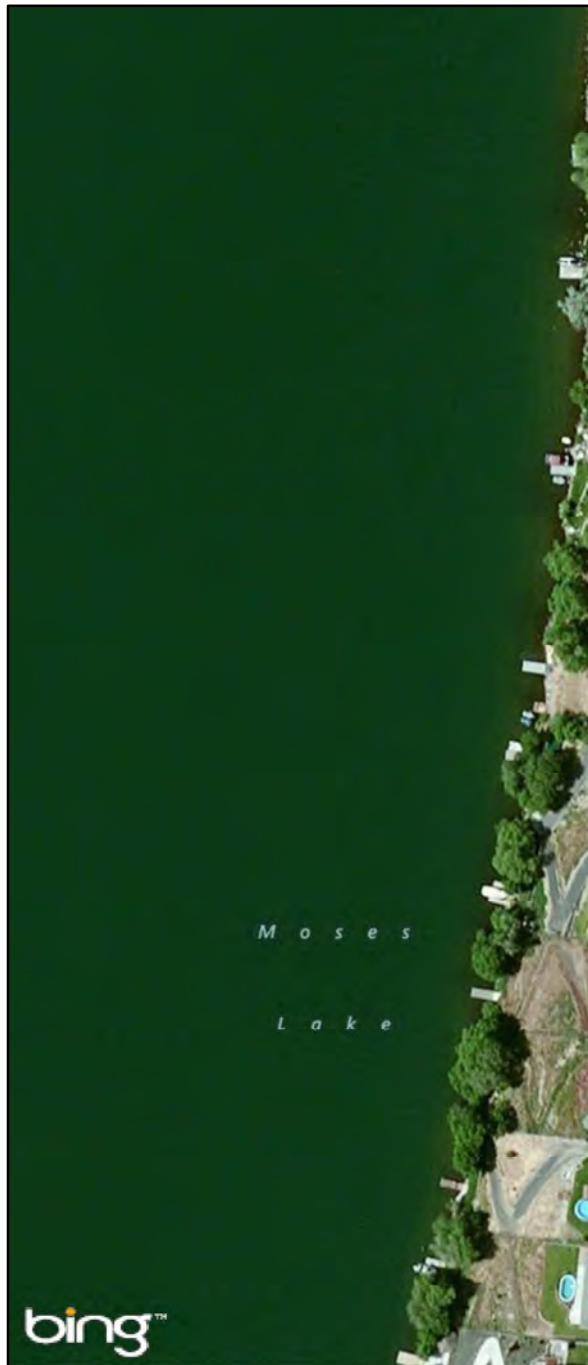
Location Map



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2016 MOSES LAKE SAMPLING MAPBOOK (L1 - PAGE 6 OF 23)



(b) (6)

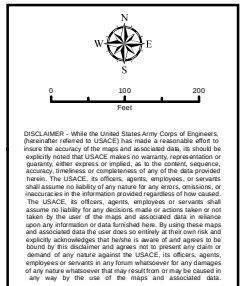


(b) (6)

Legend

- Well Location (15)
- Uncertain Location (0)

Location Map



2016 MOSES LAKE SAMPLING MAPBOOK (L2 - PAGE 7 OF 23)



Legend

- Well Location (7)
- Uncertain Location (0)

Location Map



0 100 200
Feet

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2016 MOSES LAKE SAMPLING MAPBOOK (M1 - PAGE 8 OF 23)



Legend

- Well Location (16)
- Uncertain Location (0)

Location Map



0 100 200
Feet

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2016 MOSES LAKE SAMPLING MAPBOOK (P2 - PAGE 15 OF 23)

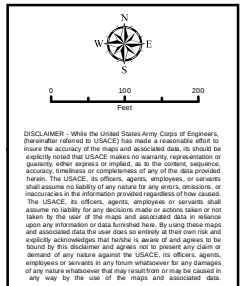


(b) (6)

Legend

- Well Location (5)
- Uncertain Location (3)

Location Map





(b) (6)

Legend

- Well Location (7)
- Uncertain Location (0)

Location Map

0 100 200
Feet

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(b) (6)

2016 MOSES LAKE SAMPLING MAPBOOK (S6 - PAGE 21 OF 23)



(b) (6)

Legend

- Well Location (1)
- Uncertain Location (0)

Location Map

0 100 200
Feet

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(b) (6)

(b) (6)



2016 MOSES LAKE SAMPLING MAPBOOK (E2)



Legend

- Well Locations
(18)

Location Map



0 400 800
Feet

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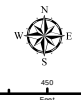
2016 MOSES LAKE SAMPLING MAPBOOK (F2)



Legend

Well Locations
(31)

Location Map



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2016 MOSES LAKE SAMPLING MAPBOOK (G2)



Legend

 Well Locations
(25)

Location Map



0 400 800
Feet

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APPENDIX B

Field Sampling Photos



160816-WP27-1



160817-Installing PDBs



160817-WP14-1



160817-WP70-1



160817-WP70-2



160817-WP83-1



160817-WP83-2



160817-WP83-3



160817-WP83-4



160817-WP86-1



160817-WP83-5



160817-WP119-1



160817-WP121-1



160817-WP123-1



160817-WP121-2



160817-WP125-1



160817-WP125-2



160817-WP125-4



160817-WP125-3



160817-WP129-1

Appendix C

Field Notes

Moses Lake

8/16

August Sampling Event

14BN02 (1)

WL: 106.50'

14EX04 (1)

WL: 106.70'

14BN01 (2) 330

WL: 93.31'

14EX03 (1)

WL: 93.76'

12CH04 (1)

WL: 103.30

12BN05 (1)

WL: 87.45

Moses Lake

8/16

04CH05 (1)

WL: 100.84

* Who mows grass around wells? Should request that they do south of boring

12BN07 (1)

WL: 86.78

12EX01

WL: 86.70

WRP-27

Time

Temp

0	1	2	4
15.3	15.4	15.4	15.4

xSAMPLE TIME: 1406

Moses Lake

Date 8/16

Project / Client

August Sampling / PDB

02BW01 (1)
WL: 137.51'

04CW07 Dual

WL: 160.88

12BW08 (1)
WL: 120.78

12EX02 (1)

WL: 120.99

End 8/16
8/17

04BW09 (1)

WL: 82.45'

weird small ants everywhere

14BW03 (1)
WL: 84.91'14EX05 (1)
WL: 84.77'No sleeve, was careful
10m away

Moses Lake

Date

Project / Client

August Sampling / PDB

12CW03 (1)
WL: 109.68

12BW04 Dual

WL: 97.87

WP-04

Time 10:12 | 14:16
Temp 16.4 | 16.4 | 16.4
purged about 5 gal

* Sample Time 0925

Well water only used.
spraying gravel & filling tubes

(b) (6)

WP-121 owner not home

78101.0

Time 0:21 | 4:16
Temp 23.1 | 23.1 | 23.1

Sample Time A: 1015

purged
15 gal

Location Moses Lake Date 8/17

Project / Client August Sampling / PDB

WP-119

Time	0	2	4	6
Temp	19.3	19.4	19.3	19.3

Purged: 10 gal
 Totalizer: 204950.8
 * Sample Time A: 1040

WP-123

Time	10	12	4	16
Temp	18.8	18.8	18.9	18.8

Purged: 10 gal
 Totalizer: 278623.3
 * Sample: 1103

WP-125

* Thru flow controller
 Rust colored water originally
 coming out of purge spigot
 in well house. disappears after
 2-3 seconds. after 30 seconds
 more rust color came through tube

Time	10	2	4	6
Temp	14.6	14.6	14.6	14.6

Totalizer: 562451.2 * Sample Time: 1125

Location Moses Lake Date 8/17

Project / Client August Sampling / PDB

WP-124

Time	0	2	4	6
Temp	12.7	18.6	18.5	18.6

Purged 5 gal
 Totalizer 292767.4
 * Sample time 1155

WP-896

No purge because sprinkler
 was running & connected
 to normal purge spigot.

Totalizer 0654354.5
 * Sample time 1305

WP-131

Time	0	2	4	6
Temp	16.6	16.7	16.6	16.6

Purged 15 gal first
 Then purged 5 gal
 Sample: 1334

Location Moses Lake Date 8/17
 Project / Client August sampling of
PDB

WP-70 (MS/MSD)

Time	0	2	4	6
Temp	19.6	19.6	19.6	19.6

Purged: 5 gal

Totalizer: 250430.1

* Normal: 1355

* FD: 1400

WP-81-129

water was running no
purge

Sample Time: 1424
 Totalizer: 162732.5

WP-167

Time	0	2	4	6
Temp	15.0	15.1	15.0	15.0

Purged 10 gal

* Sample: 1448

Location Moses Lake Date 8/17
 Project / Client August Sampling of
PDB

WP-He8

No purge sprinkler was
 running. Sample was
 taken from Teflon tubing

Sample time 1500

WP-83

Time	0	2	4	6
Temp	16.9	16.9	17.0	16.9

Purged 10 gal

* Sample 1548

Field blank because lawn
 mower

* 1608 ~~PDB~~ FB WP83: 1535

WP-14 SPRINKLERS were running

Time	0	2	4	6
Temp	16.4	16.4	16.4	16.4

Purged 15 gal

Dupicate 1610

Normal 1605

Totalizer 1989092.7

- END DAY 2 -

110

Location MOSES Lake

Date

8/18

Project / Client August Sampling & PDB Deploy12CWD2 (1)WL: ~~128.75~~ 128.75'12BWD3 (1) Dual

WL: 128.38

* 12CWD3 need to raise 5 feet because we used wrong anchor line

12CWD1 (1)

WL: 150.73

12BWD2 (1)

WL: 118.69

12CWD5 (1)

WL: 155.81'

12BWD4installed 2332
forgot to at 12BWD5

WL: 117.97

Location

Date

111

Project / Client

School

* gate entrance is about 12 ft wide & on other side of field.

* fence is about 4 ft high

* road is ~30 ft wide

* crosswalk near area proposed. would most likely not be able to use during drilling

* curb is ~6" tall

* October then blow out sprinklers

Private Wells and Monitoring Wells Groundwater Sampling Field Report November 2016 Field Sampling Event

Moses Lake Wellfield Superfund Site Moses Lake, Washington



Field Investigation:
14-16 November 2016

Report Prepared:
December 2016

By: Technical Services Branch



**US Army Corps
of Engineers**®
Seattle District

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1.0 BACKGROUND AND OBJECTIVE OF INVESTIGATION

1.1 BACKGROUND

The Moses Lake Wellfield Superfund Site is located between the Grant County Airport and the City of Moses Lake, Washington. The Site includes the former Larson Air Force Base (LAFB) property, Port of Moses Lake property and adjacent private properties affected by Site groundwater contamination. The Site is listed on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 National Priorities List (NPL) for Uncontrolled Hazardous Waste Sites.

The Moses Lake Wellfield Superfund Site is an area of approximately 15 square miles, which includes the former LAFB, commercial facilities, and residences. The former LAFB occupied approximately 9,607 acres three miles northwest of the City of Moses Lake. The United States Air Force was active at the site from 1942 until 1966. During 1988 and 1989, the Washington State Department of Health confirmed the presence of trichloroethylene (TCE) above the Federal Maximum Contaminant Level (MCL) in three City of Moses Lake municipal wells and two Skyline community wells. The Seattle District, US Army Corps of Engineers (USACE) completed a Remedial Investigation (RI) phase in 2003. Appendix A of this report shows the general location map and a site map.

During the course of the RI, several private wells were tested and found to be contaminated with TCE. In 2001, the USACE contracted installation of carbon filtration units – known as whole house filter systems (WHF) - at five of those wells. Several years of groundwater monitoring data has been evaluated since the original WHF systems were installed.

The final results of the Phase I RI released in a report in March 1993 indicated that TCE was consistently found in shallow alluvial and upper basalt (α -basalt) groundwater in the central area of the former base.

On October 14, 1992, the affected areas of the former LAFB and off-site down gradient areas, termed the "Moses Lake Wellfield Contamination", were listed on the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980 for Uncontrolled Hazardous Waste Sites. The former LAFB property is one part of the Moses Lake Wellfield Superfund Site; the site also includes the contaminant plume.

Chemical results from 1993 and 1994 combined with historical data indicated that TCE occurred in the central and southern portion of the former LAFB in alluvial and α -basalt groundwater. In 2004, USACE confirmed TCE contamination in the next lower basalt aquifer (c-basalt). As of 1995, the data suggest that more than one source may have contributed TCE to the alluvial and α -basalt groundwater in the central portion of the former LAFB.

In 1998, URS Greiner completed a sampling round of private water wells and wells for Class A and Class B water systems east, south and southwest of the previously known TCE plume. There were eight detections of TCE during this study. Four wells that were previously outside the plume extent were found to be above the detection limit.

1.2 GROUNDWATER SAMPLING EVENT SUMMARY AND OBJECTIVES

In coordination with the US Environmental Protection Agency (USEPA) Region 10, two USACE environmental field teams deployed to conduct the November 2016 Moses Lake Wellfield groundwater sampling event during a single mobilization. The events described in this report involve USACE field teams verifying sample point locations; discussion of sampling techniques; recording groundwater observations; collection of groundwater samples; and shipment of those samples by overnight delivery for laboratory analysis. Environmental sampling team members responsible for the November 2016 field event were Joseph Marsh, Jeff Weiss, Jacob Williams and Peter Gibson.

All of the work described in this report was accomplished in accordance with the Moses Lake Wellfield Superfund Site Quality Assurance Project Plan (QAPP). In addition, the teams followed the guidance presented in: the Seattle District, USACE Safety and Health Plan; USACE Safety Manual EM 385-1-1; Seattle District, USACE, Sampling Standard Operating Procedures (SOP).

The private wells and monitoring wells designated for sampling are displayed on a map found at Appendix A. These wells have been selected based on their down-gradient locations relative to the inferred flow direction of TCE-contaminated groundwater and validated sampling analytical data from previous monitoring events.

The two environmental field teams deployed to the Site and collected groundwater samples from a total of 15 private well systems, and 32 monitoring wells during the November 2016 sampling event as summarized below:

Team 1: Joseph Marsh and Jeff Weiss collected groundwater samples from 8 monitoring wells fitted with dedicated bladder pumps, and 24 monitoring wells fitted with laboratory-prepared passive diffusion bag samplers. Team 1 also deployed new passive diffusion bag samplers into 42 monitoring wells scheduled for sampling during the January, 2017 sampling event. Team 1 also collected static water level data from all sampled monitoring wells. These activities were conducted from 14-17 November, 2016.

Team 2: Jacob Williams and Peter Gibson collected groundwater samples from 10 private whole-house filter systems, and 5 private well systems. These activities were conducted from 15 through 16 November, 2016.

The objectives of groundwater sampling at Moses Lake are to: 1) collect representative samples from designated private well systems and monitoring wells yielding data of known and sufficient quality to evaluate TCE concentrations and define existing TCE plumes; 2) to assure compliance with the requirements of USEPA; and 3) to make critical project - specific decisions based on the evaluated data.

2.0 DESCRIPTION OF WORK

2.1 ACTIVITIES PRIOR TO THE NOVEMBER 2016 GROUNDWATER SAMPLING EVENT

The USACE project team worked to collect signatures on Department of the Army Right of Entry forms as required before conducting the well sampling on private, city or county government property. For most properties, previously signed Right of Entry forms were still valid. For all properties designated for sample collection, owners (and renters if applicable) were contacted to coordinate sample collection times during the scheduled field sampling week.

Prior to conducting sampling activities at each location, both teams verified the address or well location and map location matched, and that the Right of Entry form had been signed prior to arriving at each sampling location.

Each team was responsible for identifying potential health and safety hazards at each sampling location. If a hazard is verified at a private well sampling location, an alternate hose bib connected to the same water source may be selected in a safer area of the subject property. In the case of hazardous monitoring well conditions, the well may be situated in an active construction zone requiring the cancellation of sampling at that well until the next scheduled sampling event.

Also for private well sampling, the field team was tasked with determining the most appropriate cold-water tap or other sample port as close to each wellhead as practical. At each location, the team worked to collect water samples from the same sample point selected during previous sampling events to ensure consistent results. The team was briefed that groundwater samples would not be collected from taps delivering chlorinated, aerated, softened or filtered water.

2.2 PRIVATE WELL SAMPLING PROCEDURES

During the November 2016 groundwater sampling event, samples were collected from a total of 15 private wells consisting of: 5 private well system hose bibs (WP-4, WP-27, WP-131, WP-167, WP-168, and 10 WHF systems (WP-14, WP-70, WP-83, WP-86, WP-119, WP-121, WP-123, WP-124, WP-125, and WP-129).

USACE (in cooperation with USEPA) has determined private well and WHF groundwater purging shall to consist of: allowing water flow at the sampling port at a rate of approximately 0.5 to 1 gallon per minute (gpm), while measuring the temperature of the water stream with a digital thermometer every two minutes until stabilization is achieved. These procedures follow the general principles of the New Hampshire private well system water sampling guidance.

During purging, the flow rate at each location was verified by graduated cylinder. While purging continued, the field team monitored the surrounding area and flowing water for unusual observations and odors as purge water was captured in a five gallon bucket. They

recorded the start time of the purging in the field logbook immediately after opening each hose bib sample point and establishing the flow rate. While one team member used the digital thermometer to measure water temperatures, the other recorded the temperatures every two minutes until the parameters stabilized.

Upon reaching stabilization, the approximate total purged volume was recorded in the project field book along with any other significant observations. The team then conducted the sample collection activities.

Prior to collecting a water sample, the team reduced the flow rate at each tap to approximately 150 to 200 ml/min. to minimize sample water turbulence and aeration. The samplers donned protective eyewear and new, clean, Nitrile gloves to prevent exposure to contaminants and cross-contamination. All groundwater samples were collected in pre-cleaned certified containers obtained from the analytical laboratory.

All sample containers were filled with water directly from each tap – forming a meniscus at the top of each vial to provide zero headspace samples as required. Sample point location and components of each plumbing system were noted to assist in data interpretation. A photographic record of each sample point was made by the team. In addition, each team placed handle tags (indicating that water samples were taken by USACE on that date and time) on the front doors of homes sampled if nobody was home during sample collection. A photo was taken of the handle tag and front of house in that case for the project files.

After the sample containers have been filled, sample labels describing project, location, analysis, team members, preservative, sampling date, and collection time are placed on the containers. The samples are then packaged in bubble wrap bags and plastic zipper type bags, placed into pre-iced sample shipping coolers and prepared for shipment as described in Section 3.0. All sampling teams worked to ensure each property was left just as they found it with no damage done, and any doors or gates closed as required.

2.3 WHOLE HOUSE FILTER SAMPLING PROCEDURES

In coordination with USEPA and affected Moses Lake area homeowners, granular activated carbon (GAC) water filters have been installed in private well systems showing TCE results of 3.5 µg/l or greater. Each GAC filter system consists of two lightweight composite GAC filter tanks (acting as lead and lag filters), associated piping, bag filters (to prevent GAC particles from entering the household plumbing system), pressure gauges and valved/regulated sample collection ports.

As described previously, groundwater samples were collected from 10 WHF systems during this November 2016 sampling event. Each system was purged according to the revised private well sampling SOP consisting of allowing water flow at a hose bib nearest the wellhead at a rate of approximately 0.5 to 1 gpm, while measuring the temperature of the water stream with a digital thermometer every two minutes until stabilization is achieved. Purge flow rates

averaged approximately 0.5 gpm as measured with graduated cylinder, and purged water at each location was captured in a five gallon bucket to verify purged volumes. During purging, continuous temperature readings were recorded using a digital thermometer until water temperature stabilization was achieved. Once water temperature had stabilized, the hose bib was closed, and the field team prepared to collect samples from the pre-determined WHF sample ports (labeled "A" for the lead inlet port, "B" for the lead outlet port, and "C" for the lag outlet port).

WHF sample collection consists of opening each designated sample port valve fully to allow the maximum restricted flow rate of approximately 150 to 200 ml/min to flow into a capture bucket for a few seconds to ensure organic matter or air bubbles have been flushed out of the system. Restrictors have been placed on the sampling lines to provide a smooth, non-turbulent stream at a low-flow rate to minimize loss of volatiles that may be present in the water stream. Next, the sampling team immediately fills three pre-preserved VOA vials to zero headspace. New Nitrile gloves were donned before collecting samples at each port. All discharged water was directed into a five gallon plastic bucket for transfer to ground surface away from the shed or pump house GAC filter location after the samples were collected.

After filling the sample containers, sample labels describing project, location, analysis, team members, preservative, sampling date, and collection time were placed on each container and the container was placed in a plastic zipper bag. The bagged sample vials were placed into bubble wrap bags. Finally, the filled sample containers were placed into pre-iced shipping coolers to begin sample cooling to the required 4° Celsius sample preservation temperature prior to shipment to the analytical laboratory. One set of trip blanks were required and included per sample shipping cooler.

2.4 MONITORING WELL SAMPLING PROCEDURES

2.4.1 MONITORING WELL SAMPLING USING DEDICATED BLADDER PUMPS

Moses Lake monitoring well groundwater purging and sampling was performed in accordance with the Seattle District's Low-Flow Ground Water Purging and Sampling SOP, prepared in March 1999 and revised on 1 Sep 2009. Data generated during purging were recorded on the MicroPurge/Low-Flow Sampling Log forms (Appendix C).

The team verified each monitoring well location and identification number with project maps and tables. They verified work can proceed safely in the vicinity of moving vehicular traffic, heavy industry, and other hazards as required. The team used a pry bar, socket wrench or pinhead hex wrench as needed to open each flush mount monitoring well cover plate, and a Masterlock #485 padlock key for the standard "stick-up" well completions. Prior to purging each well, the depth to static water level in each well was measured and checked periodically to monitor draw down as a guide to flow rate adjustment (no greater than 0.4 foot drawdown is permitted to prevent sampling stagnant casing water).

Purging operations at each well commenced once the following equipment was prepared: the MP20 MicroPurge® Controller equipped with an adjustable pressure regulator was connected to the Well Wizard® bladder pumps via airline and quick connect fittings. Another airline was quick-connected to a pressurized CO₂ cylinder to drive the pump. Pump flow rates were then adjusted during a “pre-purge” period to maximize withdrawal rates and minimize excessive drawdown in each well. The evacuated pre-purge volume at each well was intended to flush out a bladder pump and tubing volume prior to monitoring stabilization parameters. Finally, a QED MicroPurge® basics MP20 Flow Cell was connected to the pump’s discharge line at ground surface to measure established stabilization parameters (pH, specific conductivity, temperature, DO, ORP, and turbidity).

Depth to water measurements during purging were monitored and recorded to verify that minimal drawdown occurred. A graduated measuring cup was used to determine the volume purged. Generally, acceptable low-flow rates are no greater than 500 milliliters per minute (ml/min.), and are typically closer to 400 ml/min. for the Well Wizard® bladder pump systems, depending upon the amount of water level drawdown detected during pumping at each well. Purge data was recorded on the micro-purge logs every two minutes.

Low-flow purging continued until three consecutive measurements of the stabilization parameters met stabilization requirements.

Stabilization parameter requirements for all private well and bladder pump monitoring wells are as follows:

Temperature	+/- 0.2 °C
Specific Conductivity	+/- 0.020 millisiemens/centimeter (mS/cm)
DO	+/- 0.2 milligrams/liter (mg/l)
pH	+/- 0.2 units
ORP	+/- 20 millivolts (mV)

At each monitoring well, groundwater sample collection would begin immediately after achieving stabilization of water quality parameters during low flow purging.

Prior to sample collection, the samplers donned protective eyewear and new, clean, Nitrile gloves to prevent exposure to contaminants and cross-contamination. All groundwater samples were collected in pre-cleaned, certified containers obtained from the analytical laboratory.

All sample containers were filled immediately following purging by disconnecting the flow-through cell from the pump tubing system, and capturing water directly from the discharge end of the tubing. All sample containers were carefully filled at a low-flow rate to minimize agitation. During sample collection, significant physical observations were recorded in the Micropurge/Low-Flow Sampling Log data forms and project field book as needed.

After filling the sample containers, sample labels describing project, location, analysis, team members, preservative, sampling date, and collection time were placed on each container and the container was placed in a plastic zipper bag. The bagged sample vials were placed into bubble wrap bags. Finally, the filled sample containers were placed into pre-iced shipping coolers to begin sample cooling to the required 4° Celsius sample preservation temperature prior to shipment to the analytical laboratory. One set of trip blanks were required and included per sample shipping cooler.

At the conclusion of groundwater sampling at each well, the flush mount well covers were bolted closed and stick up well caps padlocked.

2.4.2 MONITORING WELL SAMPLING USING PASSIVE DIFFUSION BAGS

Passive diffusion bags (PDBs) were been selected by the Moses lake Project Delivery Team as the most appropriate, cost-effective method for groundwater sample collection from Moses Lake monitoring wells lacking dedicated bladder pumps. The PDBs were purchased from ALS Environmental laboratory under license by the US Geological Survey and The General Electric Company, both co patent-holders. The 1 ¼" diameter low-density polyethylene PDBs were pre-filled with 220 ml or 330 ml of ASTM Type II certified, laboratory-grade, deionized water. Each filled PDB was then heat sealed by the laboratory prior to shipment to USACE via overnight delivery in hermetically sealed pouches.

USACE ensures a minimum of 14 days of PDB equilibration time before returning to the Moses Lake site for groundwater sample collection per established PDB guidance. During this event, both sampling teams worked to collect the PDB samples as described in Section 2.5.3. PDB retrieval and sampling consisted of the following procedures:

1. The team verified each monitoring well location and identification number with project maps and the sample matrix. They verified work can proceed safely in the vicinity of moving vehicular traffic as required. The PDBs were prepared over clean sheets of aluminum foil prior to being placed into each well. The team used a pry bar, socket wrench or pinhead hex wrench as needed to open each flush mount monitoring well cover plate, and a Masterlock #485 padlock key for the standard "stick-up" monitoring well completions. The team donned new Nitrile gloves for groundwater sample collection.
2. The team carefully hauled each weighted PDB to the surface using the nylon suspension line. The sampling team carefully cut the top corner off each PDB and filled each sample vial. The team filled each vial just to overflowing and maintained a reverse meniscus. There was no down time once the PDB has been brought to the surface until sample collection was complete at each well. Any residual sample water in the used PDBs was discharged to ground surface.
3. Each PDB represented a unique sample ID number based on the well ID (and sample interval if two PDBs are deployed into one well). With the exception of the MS/MSD, all QC samples were submitted "blind" to the laboratory using a separate unique sample ID number not

labeled as duplicate or trip blank per USACE standard sampling procedure. One set of trip blanks were required and included per sample shipping cooler. An extra laboratory-prepared PDB was shipped to the site and was used for collection of the trip and field blanks at the direction of the USACE project chemist.

4. Once recovered and sampled, the empty PDBs and suspension lines were discarded as non-hazardous municipal waste. In addition, gloves, paper towels, bags, and other solid waste materials were disposed of as municipal waste. The PDBs and other solid waste material were placed into a large plastic garbage bag and tied securely prior to disposal. The stainless steel weights were decontaminated and returned to the Seattle District, USACE office.

5. Finally, the team securely capped and locked each monitoring well riser and cover plate when finished.

2.5 SAMPLING EVENT ACTIVITIES AND OBSERVATIONS

2.5.1 TEAM 1 MONITORING WELL BLADDER PUMP SAMPLING

Groundwater sample collection commenced immediately after achieving stabilization of water quality parameters during low flow purging at each well using dedicated bladder pump systems as described previously. Following their standard field protocols, Team 1 worked from the far north end of the Site, moving to the far south end sampling each designated well as it was encountered. The project well maps and sample matrix were used to ensure samples were collected at the correct locations. The team used one 15 lb. compressed CO₂ cylinder acquired from Oxarc in Moses Lake to drive the pump systems, airlines, pump controllers, and flow cells to conduct the sampling of dedicated bladder pumps.

During this sampling event, Team 1 collected groundwater samples from a pre-determined set of 8 monitoring wells fitted with dedicated bladder pumps: 99AW01, 92BW01, 00AW11, 92BW02, 91BW04, 99BW18, 99AW09, and 99BW10.

Even though a right of entry permit has been signed, and verbal or written permission granted to collect samples at each designated monitoring well, the sampling team always attempted to contact the property owner for each monitoring well location before beginning the field sampling activities.

Team 1 worked to measure static water levels in all sampled monitoring wells (bladder pump and PDB wells).

Other than property owner notifications, no special access procedures were required for any of the other bladder pump monitoring wells sampled during this event.

Prior to sample collection, the samplers donned protective eyewear and new, clean, Nitrile gloves to prevent exposure to contaminants and cross-contamination. All sample containers were filled immediately following low-flow purging by disconnecting the flow-through cell from the pump tubing system, and capturing pumped groundwater directly from the discharge end

of the pump tubing. During sample collection, physical observations were recorded in the Micro-purge/Low-Flow Sampling Log data forms.

Stabilization of water quality parameters during purging occurred within 6-10 minutes during this event. Measured temperatures ranged from 13.29° C at well 91BW04 to 14.90° C at well 99AW09. Specific conductivity ranged from 0.35mS/cm (well 99BW10) to 0.61 mS/cm (well 00AW11). Dissolved oxygen measurements varied widely from 9.80 ppm (well 00AW11) to 23.10 ppm (well 99BW10). PH values ranged from 6.87 units (well 99BW10) to 7.64 units (well 91BW04). Oxygen reduction potential ranged from 116 mV (well 99AW01) to 235 mV (well 99BW10).

Significant Observations Made During Team 1 Bladder Pump Sampling

Team 1 had to clear yellow jackets out of the well 92BW02 casing before being able to safely purge and sample the well. No other significant observations were made during this event.

2.5.2 TEAM 2 PRIVATE WELL AND WHF SYSTEM SAMPLING

While environmental field team 1 worked independently on their set of wells, Team 2 collected samples at their own pre-assigned set of 10 whole house filter well system sample ports, and 5 private well system hose bibs.

During the period of 15-16 November 2016, Team 2 collected groundwater samples from the following 10 private well systems with whole house filters installed: WP-14, WP-70, WP-83, WP-86, WP-119, WP-121, WP-123, WP-124, WP-125, and WP-129. During that same time, they collected groundwater samples from the following 5 private well systems: WP-04, WP-27, WP-131, WP-167, and WP-168.

All required 40 ml VOA sample vials were obtained from Vendor ESS by the USACE contract lab ARI, and delivered to USACE pre-preserved with maleic and ascorbic acid.

Trip blanks were sent inside each sample shipping cooler delivered to the analytical lab.

Upon arrival at each private well property designated for sample collection, the team verified they were at the correct address using maps, notes, and the sampling matrix, and verified through field documentation they were ready to collect samples at the correct sampling point (hose bib, or suitable water discharge port nearest to the wellhead. The team always attempted to contact the owner or resident at each private well location before beginning the field sampling activities.

Per modified SOP, sampling point valves were opened, and water allowed to flow at approximately 0.5 to 1 gpm into a capture bucket. Next, water temperature readings were measured every two minutes until stabilization was achieved. During the November sampling event, water temperature stabilization ranged from 6 to 14 minutes elapsed purging time with most locations reaching stabilization within six minutes as shown in Table 1 below.

TABLE 1: PRIVATE WELL STABILIZED WATER TEMPERATURES AND PURGE TIMES

Well Location ID	Stable Temp. °C	Total Purge Time (Minutes)
WP-04	15.9	6
WP-14	19.8	10
WP-27	15.0	6
WP-70	15.4	8
WP-83	13.5	6
WP-86	13.2	8
WP-119	13.3	6
WP-121	13.4	8
WP-123	12.4	10
WP-124	14.7	6
WP-125	14.0	6
WP-129	17.7	12
WP-131	14.5	14
WP-167	15.0	6
WP-168	14.7	6

Upon achieving stabilization, the final stabilized readings were entered into the project field book. Prior to collecting a water sample, the flow rate at each tap was reduced to approximately 100 to 200 ml/min. to minimize sample aeration and turbulence. The sampling team donned new Nitrile gloves prior to sample collection at each residence. In the case of the WHF sample ports, restrictors on the sample ports provided a stream of sample water at approximately 150 to 200 ml/min. All sample containers were be filled with water directly from each tap – forming a meniscus at the top of each vial to provide zero headspace samples as required. A photographic record of each sample point was made by the team.

Significant observations made during Private Well/WHF Sampling

WP-04 – a large pile of gravel has been placed in front of the well house door, requiring the team to climb over the material to gain access to the wellhead. No other significant observations were made during this event.

2.5.3 PASSIVE DIFFUSION BAG SAMPLING AND DEPLOYMENT

In addition to collecting bladder pump-derived groundwater samples, Team 1 also collected all designated PDB samples during the November 2016 event.

The 24 selected PDB wells were: 02BW01; 04BW09; 04CW05; 04CW07; 12BW02; 12BW03; 12BW04; 12BW05; 12BW06; 12BW07; 12BW08; 12CW01; 12CW02; 12CW03; 12CW04; 12CW05; 12EX01; 12EX02; 14BW01, 14BW02, 14BW03, 14EX03, 14EX04, and 14EX05.

All required 40 ml amber glass VOA sample vials were obtained from Vendor ESS (certified new, clean, QC Class) by the USACE contract lab ARI, and delivered to USACE pre-preserved with maleic and ascorbic acid.

The teams first verified each monitoring well location and identification number with project maps and the sample matrix. The teams also verified that work could proceed safely in the vicinity of moving vehicular traffic or other physical, biological, or environmental hazards that may have been present near each monitoring well.

Each team member donned new Nitrile gloves for groundwater sample collection at each well. Once the wells were unlocked and opened, one team member lifted the well riser plug and began hauling the PDB vertically to the surface.

Once each PDB was raised to the surface, the sampling team worked together to carefully cut the top corner off each bag using decontaminated steel scissors. Next, one person held the open sample vials and the other carefully and slowly tilted the bags - open side down - toward each open sample vial. The pre-preserved vials were filled just to overflowing to maintain a reverse meniscus. Then the vials were immediately capped making sure there were no bubbles or headspace per standard VOC sampling procedure. This entire sampling process can be completed within one minute to minimize loss of volatiles while preventing introduction of contaminants into the water from surface sources. After all required vials were filled; any residual sample water remaining in the used PDBs was discharged to ground surface. Therefore, no Investigation-derived waste (IDW) water was generated during this sampling event.

The sampling teams continued use of protective mesh PDB sleeves in wells with steel risers due to a greater potential for damage to the PDB membranes (monitoring wells 12EX01, 12EX02, 14EX03, 14EX04, and 14EX05).

Once recovered and sample water removed, the PDBs and suspension lines were discarded as non-hazardous municipal waste. In addition, gloves, paper towels, bags, and other solid waste materials were disposed of as municipal waste. The PDBs and other solid waste material were placed into a large plastic garbage bag and tied securely prior to disposal. The stainless steel weights were decontaminated and reused during the deployment of the new pre-filled PDBs for the next sampling event.

Significant Observations Made During Passive Diffusion Bag Sampling

Well vaults were found to be flooded and required pumping out with a hand pump to permit sample collection at wells 12BW06, 12CW05, and 12EX02. The 4-inch "J" plug should be replaced in well 12CW05 to keep the well watertight.

Numerous rust particles were observed on the PDBs and PDB suspension lines installed in wells 14EX03 and 14EX04.

No other significant observations were made during this event.

3.0 INVESTIGATION-DERIVED WASTE

No investigation-derived waste was generated during this sampling event. All residual PDB water or purged well water was transferred directly to ground surface on each property away from the sample collection point.

4.0 SAMPLE PACKAGING AND DELIVERY

As mentioned in the narrative of each sampling event, groundwater samples were packaged in shipping coolers on ice and under chain of custody for overnight shipment to the USACE contract laboratory Analytical Resources, Inc. during the course of the sampling event.

All sample shipping coolers were prepared for laboratory delivery in the following manner: Each cooler was lined (sides and bottom) with plastic "bubble-wrap" sheets for shock absorption. A large 30-gallon plastic garbage bag was then placed into the cooler to contain the sample water in the event of container breakage during shipment to the laboratories. The glass sample vials were labeled, placed into plastic zip-seal bags, and placed into foam shipping blocks or bubble-wrap bags for shock protection. All the samples were placed in the shipping coolers as indicated on the corresponding chain of custody forms. Gallon size plastic zipper bags of cubed ice bags were placed between and on top of the samples in each cooler to ensure maintenance of the required four degrees Celsius (plus/minus two degrees) sample preservation temperature. The completed chain of custody (COC) forms were placed in gallon size plastic zipper bags and taped to the inside of each cooler lid. Two custody seals were affixed to the outside of each cooler. The custody seals were placed so that the coolers could not be opened without breaking the seals. Each cooler was then securely sealed with fiber tape. The field team ensured drain plugs were securely taped inside and out to prevent possible water leakage.

The laboratory was informed of the sample delivery and ensured the samples were properly accepted and checked in upon receipt the following morning after the sample containers were shipped. All sample coolers and sample containers were accounted for at the contract laboratory following each shipment.

5.0 LABORATORY ANALYSIS

Chemical analyses performed on the samples were as follows: VOCs (Method 524.3).

6.0 DECONTAMINATION PROCEDURES

PDB weights, flow cells and associated tubing, water level indicator meters, and water volume measurement containers used by each team were decontaminated at the end of the project with an Alconox®-water solution followed by triple rinsing using distilled water in the USACE Geology Laboratory.

7.0 PROTECTION LEVEL

All sampling activities were conducted under Worker Protection Level D. For this project, personnel protective equipment included reflective safety vests, safety splash protection glasses, Nitrile gloves, and safety steel toe boots. New pairs of Nitrile gloves were donned prior to handling acid-preserved sample containers and between each unique private well sample point or monitoring well.

End of Field Sampling Report

APPENDIX A

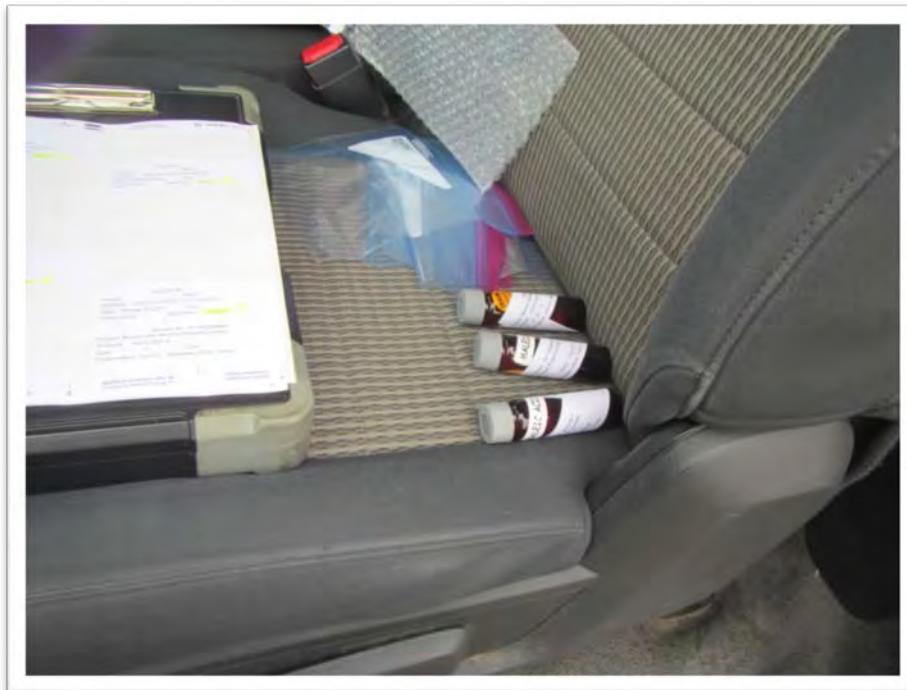
Site and Well Location Maps

(Available in USACE Project Files)

APPENDIX B

Field Sampling Photos

Figure 1



(161115-00AW11-1) Filled and labeled sample vials prior to being bagged and loaded into sample shipping cooler.

Figure 2



(161115-99BW18-1) Jeff Weiss shown monitoring water quality parameters while purging well 99BW18.

Photographer: Joseph Marsh



Figure 3



(161116-04BW04-1) Preparations for deployment of new PDBs. All work is performed on clean aluminum foil.

Figure 4



(161118-00BW11-1) Well 00BW11 shown behind an additional security fence requiring coordination for sampling in the future.

Photographer: Joseph Marsh



Figure 5



(20161115-141951) Door handle tag left after sample collection or if team was unable to collect sample to inform residents who are not at home.

Figure 6



(20161115-142119) Photo of a totalizer gauge monitored and recorded before and after WHF system sampling.

Photographer: Jacob Williams



Figure 7



(20161115-151928) Detail photo of totalizer gauge showing 183,659.5 gallons have passed through the gauge since it was installed.



APPENDIX C

Field Notes

SEATTLE DISTRICT, USACE
ENVIRONMENTAL SAMPLING FIELD BOOK

PROJECT: MOSES LAKE WELDFIELD
MONITORING WELL SAMPLING

BOOK 6

FY16
FY17



Rite in the Rain®
ALL-WEATHER
**ENVIRONMENTAL
FIELD BOOK**
No 550

TEAM 1 FIELD NOTES

Nov 2016

4

Location Moses Lake, WA

Date

Project / Client MOSES LAKE WELLFIELD

SUPERFUND SITE

TEAM 1: Joseph Marsh, JEFF WEISS

Groundwater Sampling Table

SAMPLE ID	WELL	2016 SAMPLE DATE	TIME	Analysis VOCs (524.3)
1611N99AW01	99AW01	11-14	1428	3
1611N92BW01	92BW01	11-15	0835	3
1611N00AW11	00AW11	11-15	0904	3
1611N92BW02	92BW02	11-15	0937	3
1611N91BW04	91BW04	11-15	1016	3
1611N99AW09	99AW09	11-15	1142	9 MS MSD
1611D99AW09	F.D. 99AW09	11-15	1158	3
1611N99BW18	99BW18	11-15	1116	3
1611N99BW10	99BW10	11-15	1316	3
1611N12CW04	12CW04	11-16	1045	3
1611N12BW05	12BW05	11-16	1026	3
1611N04CW05	04CW05	11-16	1111	3
1611N12EX01	12EX01	11-16	1308	3
1611N12BW07	12BW07	11-16	1249	3
1611N04BW09	04BW09	11-16	1336	3
1611N14EX05	14EX05	11-16	1415	3
1611N14BW03	14BW03	11-16	1357	3
1611N12CW03	12CW03	11-16	1441	3
1611N12BW04A	12BW04A	11-16	1505	3
1611N12BW04B	12BW04B	11-16	1515	3
1611N14EX03	14EX03	11-16	1621	3

Location

Date

Project / Client

Moses Lake Wellfield
NOV 2016 Sampling table
continued

(Team 1)

SAMPLE ID	WELL	DATE	TIME	Analysis VOCs (524.3)
1611N14BW01	14BW01	11-17	0806	9 MS MSD
1611D14BW01	F.D. 14BW01	11-17	0820	3
1611N14EX04	14EX04	11-17	0900	3
1611N14BW02	14BW02	11-17	0825	3
1611N12CW02	12CW02	11-17	0915	3
1611N12BW03A	12BW03A	11-17	0936	3
1611N12BW03B	12BW03B	11-17	0940	3
1611N12BW06	12BW06	11-17	1035	9 MS MSD
1611D12BW06	F.D. 12BW06	11-17	1050	3
1611N12CW05	12CW05	11-17	1058	3
1611N12BW08	12BW08	11-17	1200	3
1611N12EX02	12EX02	11-17	1218	3
1611N12CW01	12CW01	11-17	1136	3
1611N12BW02	12BW02	11-17	1121	3
1611N02BW01	02BW01	11-17	1322	3
1611N04CW07A	04CW07A	11-17	1343	3
1611N04CW07B	04CW07B	11-17	1350	3
1611PDTB01	Pre deploy TB	11-16	0830	3 PDB trip
1611FBMWO1	Field blank	11-17	1402	3
1611TB03	TB	11-15	1500	32
1611TB04	TB	11-16	0915	32
1611TB05	TB	11-17	0938	32

11-14-16

Location

Date

Project / Client

Moses Lake Wellfield

November 2016 event
GW Sampling

Team 1

FIELD NOTES

Joseph Marsh + Jeff Weiss on site -

1200 - site tour - well familiarization -

1300 - P/U 15Lb. CO₂ cylinder at OXARE1340 → setup at 99AW01 - calibrate
flow cell, prepurge, then micropurge to stability

1426 = Sample time - no problems noted.

close + lock well. samples kept on ice
under chain of custody overnight.

- site tour + inspection of drilling site

Note - well site 04CW08 now has
chain link fence surrounding property
with locked gate. check to ensure we
have access to property. New ROE
form will likely have to be signed.

1600 - end of day.

11-15-16

0730 - calibrated flow cell - Mob. to site

0815 - 92BW01 setup - prepurging, then
micropurge to stability

0835 - Sample time close + lock well

Mob. to 04CW01 purged to stability
no issues noted.

0904 Sample time, close + lock well.

Location

Date

11-15-16

Project / Client

Moses Lake Wellfield

GW Sampling

Team 1

Field Notes Continued

Mob. to 92BW02 yellow jacket in
pro. casing. - long reach for air line

Micropurge to stability after pre purge

0937 = Sample time, close + lock well

Mob. to 91BW04 pre purge then
micropurge to stability

1016 = Sample time, close + lock well.

Setup at 99BW18 - prepurging
- Throttle set higher than Normal - 60psi
micropurge to stability

1116 = Sample time, close + lock well.

Mob. over to 99AW09 - prepurging
Then micropurge to stabilization

1142 = Sample time (P/ms msd) 1158 = (FD Time)

1210 -

1240 Lunch

1250 - Mob. to 99BW10, flush mount well
gpsi to drive pump - pre purge
then micropurge to stability1316 = Sample time, close + lock well.
Changeover to PDB deployments - samples kept
on ice under coc.
04CW01 PDB deployed (220ml)

Nov 2016

Location _____ Date 11-15-16
11-16-16

Project / Client Moses Lake Wellfield

Field Notes Cont Team 1

1500 - 04BW01 PDB installed - one 220ml.
 wells closed + locked
 - Northern end well tour - Crab Creek area.
 1600 - end of day

11-16-2016

0800 PDB installation begins
 04BW04 ✓
 04CW02 ✓
 04BW05 ✓
 04BW06 ✓
 04CW03 ✓
 91AW07 ✓
 12BW01 ✓

No problems noted.

1016 - 12BW05 SWL = 88.22'
 PDB pulled for sampling
 1026 sample time - New 220 ml
 PDB deployed
 12CW04 SWL = 99.84' → 2 330ml PDBs installed
 PDB pulled for sampling, sample time 1045
 set up @ 04CW05 SWL = 97.71'
 PDB pulled - sample time 1111 hrs
 New 220 ml PDB installed

Location _____ Date 11-16-16 9

Project / Client Moses Lake Wellfield
 Team 1 Notes cont.

1230 - 12BW07 SWL = 87.65'
 pulled PDB, sample time = 1249
 Deployed New 220ml PDB. close/lock well.
 → 2 330ml Bgs found in well.

12EX01 SWL = 87.70'
 pulled PDB for sampling sample time = 1308
 installed one 220ml PDB
 close + lock wells

04BW09 SWL = 83.53'
 sample time 1336 - redeploy new
 220 ml PDB

1349 - 14BW03 SWL = 85.82'
 pulled PDB, sample time = 1357
 deploy New bag, close + lock well

14EX05 SWL = 85.76'
 pulled PDB sample time = 1415

1432 - 12CW03 SWL = 106.74'
 pulled PDB, sample time = 1441

12BW04 SWL = 97.64'
 dual zone - 2 PDBs pulled
 A time = 1505 B time = 1515

Moses Lake Wellfield

11-16-16

11-17-16

Team / Notes

04BW07 (Dropping PDB - 220 ml.
(Deploying))

04CW04 Dropping PDB 220 ml.
(Deploying)

1611 14EX03 SWL = 93.94'
PDB pulled sample time = 1621

1630 - Drove by Airport well 00BW11 -
Noted New security fence surrounding
well site - must coordinate with Port in Jan.
for Jan 17 sampling event for access.
→ 11-17-16

14BW01 SWL = 93.62'

PDB pulled (2x330)

(P) Sample time 0806 (FD) 0820
one bag deployed - close + lock well

14BW02 SWL = 104.58'

PDB pulled sample time = 0825

14EX04 SWL = 104.80'

PDB pulled sample time 0900

PDB installed - close + lock wells

Moses Lake Wellfield

Team / Notes cont.

12CW02 SWL = 153.89'
PDB pulled sample time = 0915
PDB 220ml installed = 2 weights

12BW03 SWL = 125.31'

Dual interval PDBs pulled

Interval A = 0936 sample time

Interval B = 0940 sample time

Dual interval PDBs installed 220 ml each

12BW06 SWL = 114.27' ^{newly flooded}

PDBs - 2 330 ml for P/MSWD/FP

(P) Time = 1035 (FD) Time = 1050

securely close well cap

12CW05 SWL = 140.14'

PDBs removed for sampling sample time = 1058

installed new PDB. ^(*Needs New)
*Vault flooded - water pumped out ("J" plug 4")

12BW02 SWL = 112.85'

PDB pulled sample time 1121

New 220ml PDB installed - well
closed securely.

12CW01 SWL = 134.92'

pulled PDB - sample time = 1136
replaced New PDB in well.

12

Location

Date _____

11-17-16

Project / Client

Moses Lake Well Field

Team / Notes Cont.

12B.W08 SWL = 115.73'

PDB pulled for sampling

Sample time = 1200)

~~125x~~ Close + secure well

12EX02 SWL = 115.88'

PDB piled for sampling

1218 = Sample time, Deploy new 200mL PDB
close + Bit down Vault cover plate
(Water in Vault removed with
hand pump.)

Lunch Break

02BWD1 SWL = 129.26'

pulled PDB for sampling

1322 = Sample time, deploy new bag.
Close + secure well.

04CW07 SWL = 146.0'

PDBs (2 intervals) retrieved for

Sampling A time = 1343

B Time = 1350

Deploy 2 PODs per plan

1500 - Field work complete

1600 - Shipped 3 sample coolers to AICI via Airport Fedex.

11-18-16 - Return to District Office mission complete

Date _____

13

Project / Client

Location MOSES Lake Date 11/15/16
 Project / Client MW well Field

Jake, Peter

1200 Arrived at WP27.
 15.2°C starting temp.

WP27

Time	0	2	4	6	8
Temp (°C)	15.2	15.2	15.1	15.0	

2 gal^{PR}

2 gal purged. Sample
 taken at 1245.

Ouplete at 1247

WP25 Arrived at 1:40
 Totalizer 634562.0

Time	0	2	4	6
Temp	14.2	14.2	14.3	14.0

Purge from spicket on front
 side of well house.

3 gal purged
 Sample taken at 1:55

Date 11/15/16 115

MW
Jake, Peter

WP124 Arrived 2:05

Time	0	2	4	6	8
Temp	14.7	14.8	14.7	14.7	

Purge from spicket on side of house
 Sample taken at 2:15

Totalizer - 818180.1

WP121 Arrived 2:27

Time	0	2	4	6	8
Temp	12.1	13.4	13.5	13.4	13.4

Purged 10 gal.

Totalizer: 83562.5 gal

Sample time:

A: 1442

B: 1444

C: 1446

MLW Nov. '16 Date 11/15/16

Project / Client

peter, Jake

1500: Arrived at WP-129

Time	0	2	4	6	8	10	12
Temp	18.9	18.3	18.1	18.0	17.8	17.7	17.7

purged 25 gal.

Totalizer: 183659.7

Sample time: 1520

1556: Arrived at WP-70
Totalizer: 267749.4

Time	0	2	4	6	8
Temp	15.5	15.2	15.4	15.5	15.4

Purged 10 gal.

Sample time: 1605

Location Moers Lake '16 Date 11/16/16

Project / Client

Peter, Jake

WP14 Arrived: 8:40
Purge started: 8:45

Time	0	2	4	6	8	10
Temp	20.0	19.8	19.6	19.9	19.8	19.8

15 gal purged

Totalizer: 2159368.5
Samples taken at 8:55.

2005: Arrived at WP-83

Purge started at 9:15.

Time	0	2	4	6
Temp	13.5	13.5	13.5	13.5

10 gal purged

Samples taken at 9:30
Totalizer: 2367352.0

Location MLW Nov. '16 Date 11/16/16

Project / Client

peter, Jake

0955: Arrived at WP-04
 - Big pile of gravel blocking well house; had to climb over side.

Time	0	2	4	6
Temp	16.0	16.0	16.0	15.9

Purge 3 gal.

Sample time: 1007

1020: Arrived at WP-86
 10:25 Purge started

Time	0	2	4	6	8
Temp	13.6	13.3	13.2	13.2	13.2

8 gal. purged

Totalizer: 1729763.9

Samples taken at 10:40

Location MLW Nov. '16 Date 11/16/16 119

Project / Client

peter, Jake

1100: Arrived at WP-119

Time	0	2	4	6
Temp	13.2	13.3	13.3	13.3

Purged 10 gal.

Totalizer: 216945.1 gal.

Sample times:

A: 1109

B: 1111

C: 1113

1130: Arrived at WP-123

Purge started at 11:35

Time	0	2	4	6	8	10	12
Temp	11.5	12.0	12.2	12.4	12.4	12.4	12.4

Purged 13 gal

DNP: 1151

Totalizer: 365982.7

Sample times: A: 1147 B: 1149 C: 1151

MLW NOV. '16 Date 11/16/16

Project / Client

Peter, Jake

1420: Arrived at WP-131

Time	0	2	4	6	8
Temp	14.3	14.6	13.5	13.9	14.1

Time	10	12	14	16
Temp	14.5	14.5	14.5	

Purged 20 gal.

Sample time: 1435

1445: Arrived at WP-167

Time	0	2	4	6
Temp	14.9	15.0	15.0	15.0

Purged 18 gal.
Sample time: 1453

Location MLW NOV. '16 Date 11/16/16 121

Project / Client

Peter, Jake

1500: Arrived at WP-168

1505 Purged started

Time	0	2	4	6
Temp	14.7	14.7	14.7	14.7

10 gal purged

Sample taken at 15:11

APPENDIX B – Comprehensive 2016 Analytical Results

Chemical Name				1,1,1-TCA	1,1-DCA	1,1-DCE	1,2-DCA	cis-1,2-DCE	trans-1,2-DCE	TCE	VC	Ben-zene	Ethyl-benzene	Toluene	m,p-xylene	o-xylene	DRO	GRO	MRO	PFOS	PFOA	PFHpA	PFNA	PFBS	PFHxS	1,4 - dioxane	
Analysis Method				EPA Method 524																	EPA Method 537						Method 522
CAS RN				71-55-6	75-34-3	75-35-4	107-06-2	156-59-2	156-60-5	79-01-6	75-01-4	71-43-2	100-41-4	108-88-3	179601-23-1	95-47-6	DRO	GRO	MOIL	1763-23-1	335-67-1	375-85-9	375-95-1	375-73-5	355-46-4	123-91-1	
MCL				µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	
Well ID	Sample Name	Sample Type	Sample Date																								
Monitoring Wells																											
00AW11	1605N00AW11	N	5/21/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	1.32	0.05 U																
00AW11	1611N00AW11	N	11/15/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	1.64	0.10 U																
00BW01	1605N00BW01	N	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																
00BW02	1605N00BW02	N	5/17/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.19 J	0.05 U																
00BW03	1605N00BW03	N	5/17/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																
00BW04	1605N00BW04	N	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																
00BW05	1605N00BW05	N	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																
00BW05	1605D00BW05	FD	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																
00BW06	1605N00BW06	N	5/17/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.07 J	0.05 U																
00BW07	1605N00BW07	N	5/17/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																
00BW09	1605N00BW09	N	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																
00BW10	1605N00BW10	N	5/20/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U															0.03 J	
00BW11	1605N00BW11	N	5/17/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U	0.03	0.04 U	0.04 U	0.05 U	0.04 U	100	9.06 U	60 U								
00BW11	1605D00BW11	FD	5/17/2016									0.03	0.04 U	0.04 U	0.05 U	0.04 U	100	9.06 U	60 U								
00BW12	1605N00BW12	N	5/18/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	17.0	0.05 U															0.09	
00BW13	1605N00BW13	N	5/22/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																
00BW14	1605N00BW14	N	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																
00BW15	1605N00BW15	N	5/19/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.38	0.07 U	1.97	0.05 U															0.06 U	
00BW16	1605N00BW16	N	5/23/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																
00BW16	1605D00BW16	FD	5/23/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																
01BW01	1605N01BW01	N	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																
02BW01	1602N02BW01	N	2/24/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	10.9	0.10 U																
02BW01	1605N02BW01	N	5/20/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	10.7	0.05 U															0.06 U	
02BW01	1605D02BW01	FD	5/20/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	9.99	0.05 U																
02BW01	1611N02BW01	N	11/17/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	11.1	0.10 U																
02BW02	1605N02BW02	N	5/20/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.07 J	0.05 U																
04BW01	1605N04BW01	N	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																
04BW04	1605N04BW04	N	5/18/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.30	0.05 U									0.0112 J	0.00627 J	0.00262 J	0.0200 U	0.0900 U	0.0217 J		
04BW05	1605N04BW05	N	5/19/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 J	0.07 U	2.66	0.05 U															0.06 U	
04BW06	1605N04BW06	N	5/20/2016	0.04 U	0.07 U	0.06 U	0.07 U	2.74	0.07 U	13.2	0.05 U																
04BW07	1605N04BW07	N	5/22/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																
04BW09	1602N04BW09	N	2/24/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	21.8	0.10 U																
04BW09	1605N04BW09	N	5/22/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	20.1	0.05 U																
04BW09	1611N04BW09	N	11/16/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	24.0	0.10 U																
04CW01	1605N04CW01	N	5/18/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.44	0.05 U									0.052	0.105	0.0169	0.0200 U	0.0318 J	0.252		
04CW01	1605D04CW01	FD	5/18/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.48	0.05 U									0.0711	0.14	0.0215	0.0200 U	0.0423 J	0.334		
04CW02	1605N04CW02	N	5/19/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 J	0.05 U																
04CW03	1605N04CW03	N	5/21/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	2.05	0.05 U																

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Chemical Name				1,1,1-TCA	1,1-DCA	1,1-DCE	1,2-DCA	cis-1,2-DCE	trans-1,2-DCE	TCE	VC	Ben-zene	Ethyl-benzene	Toluene	m,p-xylene	o-xylene	DRO	GRO	MRO	PFOS	PFOA	PFHpA	PFNA	PFBS	PFHxS	1,4 - dioxane	
Analysis Method				EPA Method 524																	EPA Method 537						Method 522
CAS RN				71-55-6	75-34-3	75-35-4	107-06-2	156-59-2	156-60-5	79-01-6	75-01-4	71-43-2	100-41-4	108-88-3	179601-23-1	95-47-6	DRO	GRO	MOIL	1763-23-1	335-67-1	375-85-9	375-95-1	375-73-5	355-46-4	123-91-1	
MCL				µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	
Well ID	Sample Name	Sample Type	Sample Date																								
04CW04	1605N04CW04	N	5/22/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.40	0.05 U																
04CW05	1602N04CW05	N	2/24/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	2.38	0.10 U																
04CW05	1605N04CW05	N	5/22/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	2.41	0.05 U																
04CW05	1605D04CW05	FD	5/22/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	2.07	0.05 U																
04CW05	1611N04CW05	N	11/16/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	2.25	0.10 U																
04CW07	1602N04CW07A	N	2/24/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	5.52	0.10 U																
04CW07	1602N04CW07B	N	2/24/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	5.73	0.10 U																
04CW07	1605N04CW07A	N	5/23/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	6.01	0.05 U																
04CW07	1605N04CW07B	N	5/23/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	5.66	0.05 U																
04CW07	1611N04CW07A	N	11/17/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	5.79	0.10 U																
04CW07	1611N04CW07B	N	11/17/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	6.10	0.10 U																
04CW08	1605N04CW08	N	5/23/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																
12BW01	1605N12BW01	N	5/22/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																
12BW02	1602N12BW02	N	2/22/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	8.45	0.10 U																
12BW02	1605N12BW02	N	5/20/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	7.77	0.05 U															0.06 U	
12BW02	1611N12BW02	N	11/17/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	7.89	0.10 U																
12BW03	1602N12BW03A	N	2/23/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	1.62	0.10 U																
12BW03	1602N12BW03B	N	2/23/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.65	0.10 U																
12BW03	1605N12BW03A	N	5/22/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.94	0.05 U																
12BW03	1605N12BW03B	N	5/22/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.51	0.05 U																
12BW03	1611N12BW03A	N	11/17/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.61	0.10 U																
12BW03	1611N12BW03B	N	11/17/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.47	0.10 U																
12BW04	1602N12BW04A	N	2/24/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	18.2	0.10 U																
12BW04	1602N12BW04B	N	2/24/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	19.0	0.10 U																
12BW05	1605N12BW05	N	5/22/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	85.5	0.05 U																
12BW04	1605N12BW04A	N	5/22/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	17.3	0.05 U																
12BW04	1605N12BW04B	N	5/22/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	20.2	0.05 U																
12BW04	1611N12BW04A	N	11/16/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	20.8	0.10 U																
12BW04	1611N12BW04B	N	11/16/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	20.6	0.10 U																
12BW05	1602N12BW05	N	2/24/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	79.9	0.10 U																
12BW05	1611N12BW05	N	11/16/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	92.2	0.10 U																
12BW06	1602N12BW06	N	2/23/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	6.73	0.10 U																
12BW06	1602D12BW06	FD	2/23/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	6.28	0.10 U																
12BW06	1605N12BW06	N	5/23/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	4.84	0.05 U																
12BW06	1611N12BW06	N	11/17/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	6.20	0.10 U																
12BW06	1611D12BW06	FD	11/17/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	5.91	0.10 U																
12BW07	1602N12BW07	N	2/24/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	63.8	0.10 U																
12BW07	1605N12BW07	N	5/19/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	75.3	0.05 U															0.06 U	
12BW07	1611N12BW07	N	11/16/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	71.0	0.10 U																
12BW08	1602N12BW08	N	2/22/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	9.38	0.10 U																
12BW08	1605N12BW08	N	5/23/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	7.45	0.05 U																

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Chemical Name				1,1,1-TCA	1,1-DCA	1,1-DCE	1,2-DCA	cis-1,2-DCE	trans-1,2-DCE	TCE	VC	Ben-zene	Ethyl-benzene	Toluene	m,p-xylene	o-xylene	DRO	GRO	MRO	PFOS	PFOA	PFHpA	PFNA	PFBS	PFHxS	1,4 - dioxane	
Analysis Method				EPA Method 524																	EPA Method 537						Method 522
CAS RN				71-55-6	75-34-3	75-35-4	107-06-2	156-59-2	156-60-5	79-01-6	75-01-4	71-43-2	100-41-4	108-88-3	179601-23-1	95-47-6	DRO	GRO	MOIL	1763-23-1	335-67-1	375-85-9	375-95-1	375-73-5	355-46-4	123-91-1	
MCL				µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	
Well ID	Sample Name	Sample Type	Sample Date																								
12BW08	1611N12BW08	N	11/17/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	8.87	0.10 U																
12CW01	1602N12CW01	N	2/22/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	3.74	0.10 U																
12CW01	1605N12CW01	N	5/23/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	3.16	0.05 U																
12CW01	1611N12CW01	N	11/17/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	3.61	0.10 U																
12CW02	1602N12CW02	N	2/23/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.37	0.10 U																
12CW02	1605N12CW02	N	5/22/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.33	0.05 U																
12CW02	1611N12CW02	N	11/17/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.29 U	0.10 U																
12CW03	1602N12CW03	N	2/24/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.28	0.10 U																
12CW03	1605N12CW03	N	5/22/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.31	0.05 U																
12CW03	1611N12CW03	N	11/16/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.30 U	0.10 U																
12CW04	1602N12CW04	N	2/24/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.51	0.10 U																
12CW04	1605N12CW04	N	5/22/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.44	0.05 U																
12CW04	1611N12CW04	N	11/16/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.52	0.10 U																
12CW05	1602N12CW05	N	2/23/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.80	0.10 U																
12CW05	1605N12CW05	N	5/23/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.65	0.05 U																
12CW05	1611N12CW05	N	11/17/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.62	0.10 U																
12EX01	1602N12EX01	N	2/24/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.27	0.10 U	6.58	0.10 U																
12EX01	1605N12EX01	N	5/22/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.28	0.07 U	5.46	0.05 U																
12EX01	1611N12EX01	N	11/16/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.18 J	0.10 U	4.21	0.10 U																
12EX02	1602N12EX02	N	2/22/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	4.81	0.10 U																
12EX02	1605N12EX02	N	5/23/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	5.02	0.05 U																
12EX02	1611N12EX02	N	11/17/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	4.47	0.10 U																
14BW01	1602N14BW01	N	2/23/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	59.0	0.10 U																
14BW01	1605N14BW01	N	5/19/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	68.3	0.05 U															0.06 U	
14BW01	1611N14BW01	N	11/17/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	59.5	0.10 U																
14BW01	1611D14BW01	FD	11/17/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	59.1	0.10 U																
14BW02	1602N14BW02	N	2/23/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	22.2	0.10 U																
14BW02	1605N14BW02	N	5/22/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	21.9	0.05 U																
14BW02	1611N14BW02	N	11/17/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	20.5	0.10 U																
14BW03	1602N14BW03	N	2/24/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	9.35	0.10 U																
14BW03	1602D14BW03	FD	2/24/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	9.11	0.10 U																
14BW03	1605N14BW03	N	5/22/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	9.17	0.05 U																
14BW03	1611N14BW03	N	11/16/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	9.98	0.10 U																
14EX03	1602N14EX03	N	2/23/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.35	0.10 U	32.4	0.10 U																
14EX03	1605N14EX03	N	5/22/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.34	0.07 U	35.4	0.05 U																
14EX03	1605D14EX03	FD	5/22/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.36	0.07 U	37.3	0.05 U																
14EX03	1611N14EX03	N	11/16/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.40	0.10 U	35.4	0.10 U																
14EX04	1602N14EX04	N	2/23/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	18.7	0.10 U																
14EX04	1605N14EX04	N	5/22/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	17.2	0.05 U																
14EX04	1611N14EX04	N	11/17/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	16.5	0.10 U																
14EX05	1602N14EX05	N	2/24/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.15 J	0.10 U	3.61	0.10 U																

APPENDIX B – Comprehensive 2016 Analytical Results

Chemical Name				1,1,1-TCA	1,1-DCA	1,1-DCE	1,2-DCA	cis-1,2-DCE	trans-1,2-DCE	TCE	VC	Ben-zene	Ethyl-benzene	Toluene	m,p-xylene	o-xylene	DRO	GRO	MRO	PFOS	PFOA	PFHpA	PFNA	PFBS	PFHxS	1,4 - dioxane	
Analysis Method				EPA Method 524																	EPA Method 537						Method 522
CAS RN				71-55-6	75-34-3	75-35-4	107-06-2	156-59-2	156-60-5	79-01-6	75-01-4	71-43-2	100-41-4	108-88-3	179601-23-1	95-47-6	DRO	GRO	MOIL	1763-23-1	335-67-1	375-85-9	375-95-1	375-73-5	355-46-4	123-91-1	
MCL				µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	
Well ID	Sample Name	Sample Type	Sample Date																								
14EX05	1605N14EX05	N	5/22/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.13 J	0.07 U	3.67	0.05 U																
14EX05	1611N14EX05	N	11/16/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.13 J	0.10 U	4.57	0.10 U																
91AW07	1605N91AW07	N	5/21/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.10 J	0.05 U																
91AW09	1605N91AW09	N	5/20/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.18 J	0.05 U																
91AW14	1605N91AW14	N	5/18/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	3.94	0.05 U								0.119	0.143	0.0196	0.0592	0.0765	0.395			
91AW15	1605N91AW15	N	5/17/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 J	0.05 U																
91AW17	1605N91AW17	N	5/19/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.15 J	0.05 U																
91BW02	1605N91BW02	N	5/17/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																
91BW03	1605N91BW03	N	5/20/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	26.6	0.05 U																
91BW04	1602N91BW04	N	2/23/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.24	0.10 U																
91BW04	1605N91BW04	N	5/22/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.15 J	0.05 U																
91BW04	1611N91BW04	N	11/15/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.15 U	0.10 U																
92BW01	1602N92BW01	N	2/23/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	25.6	0.10 U																
92BW01	1602D92BW01	FD	2/23/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	25.3	0.10 U																
92BW01	1605N92BW01	N	5/21/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	21.0	0.05 U																
92BW01	1605D92BW01	FD	5/21/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	21.8	0.05 U																
92BW01	1611N92BW01	N	11/15/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	21.9	0.10 U																
92BW02	1605N92BW02	N	5/21/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.74	0.07 U	7.27	0.05 U																
92BW02	1611N92BW02	N	11/15/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.87	0.10 U	8.21	0.10 U																
99AW01	1605N99AW01	N	5/21/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																
99AW01	1611N99AW01	N	11/14/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.13 U	0.10 U																
99AW08	1605N99AW08	N	5/20/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.16 J	0.05 U																
99AW09	1605N99AW09	N	5/23/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	1.74	0.05 U																
99AW09	1611N99AW09	N	11/15/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	2.38	0.10 U																
99AW09	1611D99AW09	FD	11/15/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	2.13	0.10 U																
99BW01	1605N99BW01	N	5/19/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	32.2	0.05 U															0.1	
99BW09	1605N99BW09	N	5/21/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																
99BW10	1602N99BW10	N	2/23/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	14.9	0.10 U																
99BW10	1605N99BW10	N	5/23/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	12.0	0.05 U																
99BW10	1611N99BW10	N	11/15/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	12.0	0.10 U																
99BW11	1605N99BW11	N	5/23/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																
99BW12	1605N99BW12	N	5/19/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.36 U	0.05 U															0.05 J	
99BW12	1605D99BW12	FD	5/19/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.34 U	0.05 U																
99BW14	1605N99BW14	N	5/21/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																
99BW15	1605N99BW15	N	5/18/2016	0.04 U	0.07 U	0.06 U	0.07 U	1.71	0.07 U	7.16	0.05 U															0.25	
99BW16	1605N99BW16	N	5/18/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	1.14	0.05 U								0.348	0.336	0.0427	0.0201	0.162	0.718	0.03		
99BW18	1602N99BW18	N	2/23/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	9.12	0.10 U																
99BW18	1605N99BW18	N	5/23/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	6.49	0.05 U																
99BW18	1611N99BW18	N	11/15/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	6.62	0.10 U																
Private Wells																											
WP-03	1605DWP03	FD	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.23	0.07 U	1.06	0.05 U																

APPENDIX B – Comprehensive 2016 Analytical Results

Chemical Name				1,1,1-TCA	1,1-DCA	1,1-DCE	1,2-DCA	cis-1,2-DCE	trans-1,2-DCE	TCE	VC	Ben-zene	Ethyl-benzene	Toluene	m,p-xylene	o-xylene	DRO	GRO	MRO	PFOS	PFOA	PFHpA	PFNA	PFBS	PFHxS	1,4 - dioxane	
Analysis Method				EPA Method 524																	EPA Method 537						Method 522
CAS RN				71-55-6	75-34-3	75-35-4	107-06-2	156-59-2	156-60-5	79-01-6	75-01-4	71-43-2	100-41-4	108-88-3	179601-23-1	95-47-6	DRO	GRO	MOIL	1763-23-1	335-67-1	375-85-9	375-95-1	375-73-5	355-46-4	123-91-1	
MCL				µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	
Well ID	Sample Name	Sample Type	Sample Date																								
WP-03	1605NWP03	N	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.23	0.07 U	1.16	0.05 U																
WP-04	1602NWP04	N	2/22/2016	0.10 U	0.10 U	0.10 U	0.10 U	2.08	0.10 U	6.14	0.10 U																
WP-04	1605NWP04	N	5/17/2016	0.04 U	0.07 U	0.06 U	0.07 U	2.09	0.07 U	6.23	0.05 U																
WP-04	1608NWP04	N	8/17/2016	0.20 U	0.20 U	0.20 U	0.20 U	1.89	0.20 U	5.84	0.20 U																
WP-04	1611NWP04	N	11/16/2016	0.10 U	0.10 U	0.10 U	0.10 U	1.98	0.10 U	5.92	0.10 U																
WP-09	1605NWP09	N	5/17/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																
WP-10	1605NWP10	N	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																
WP-105	1605NWP105	N	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.45	0.05 U																
WP-111	1605NWP111	N	5/18/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.22	0.05 U																
WP-111	1605DWP111	FD	5/18/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.20	0.05 U																
WP-116	1605NWP116	N	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.46	0.07 U	1.92	0.05 U																
WP-120	1605NWP120	N	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.35	0.05 U																
WP-122	1605NWP122	N	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.17 J	0.05 U																
WP-126	1605NWP126	N	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.14 J	0.07 U	0.99	0.05 U																
WP-127	1605NWP127	N	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.89	0.05 U																
WP-128	1605NWP128	N	5/17/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.42	0.05 U																
WP-130	1605NWP130	N	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.45	0.05 U																
WP-131	1602NWP131	N	2/24/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.88	0.10 U																
WP-131	1605NWP131	N	5/17/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.11 J	0.07 U	3.12	0.05 U																
WP-131	1608NWP131	N	8/17/2016	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	1.69	0.20 U																
WP-131	1611NWP131	N	11/16/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	1.30	0.10 U																
WP-136	1605NWP136	N	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	1.19	0.05 U																
WP-137	1605NWP137	N	5/17/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	1.31	0.05 U																
WP-138	1605NWP138	N	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.55	0.05 U																
WP-139	1605NWP139	N	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.80	0.05 U																
WP-143	1605NWP143	N	5/17/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.57	0.05 U																
WP-144	1605NWP144	N	5/18/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.25	0.05 U														0.04 J		
WP-145	1605NWP145	N	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.32	0.05 U																
WP-147	1605NWP147	N	5/17/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.16 J	0.05 U																
WP-148	1605NWP148	N	5/18/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.16 J	0.05 U																
WP-149	1605NWP149	N	5/17/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.07 J	0.05 U																
WP-150	1605NWP150	N	5/17/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.08 J	0.05 U																
WP-152	1605NWP152	N	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.20	0.05 U																
WP-153	1605NWP153	N	5/18/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.26	0.05 U																
WP-153	1605DWP153	FD	5/18/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.25	0.05 U																
WP-154	1605NWP154	N	5/18/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.29	0.05 U																
WP-155	1605NWP155	N	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.29	0.05 U																
WP-156	1605NWP156	N	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.38	0.05 U																
WP-165	1605NWP165	N	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.16 J	0.05 U																
WP-167	1602NWP167	N	2/23/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	1.35	0.10 U																
WP-167	1605NWP167	N	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	2.21	0.05 U																

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Chemical Name				1,1,1-TCA	1,1-DCA	1,1-DCE	1,2-DCA	cis-1,2-DCE	trans-1,2-DCE	TCE	VC	Ben-zene	Ethyl-benzene	Toluene	m,p-xylene	o-xylene	DRO	GRO	MRO	PFOS	PFOA	PFHpA	PFNA	PFBS	PFHxS	1,4 - dioxane	
Analysis Method				EPA Method 524																	EPA Method 537						Method 522
CAS RN				71-55-6	75-34-3	75-35-4	107-06-2	156-59-2	156-60-5	79-01-6	75-01-4	71-43-2	100-41-4	108-88-3	179601-23-1	95-47-6	DRO	GRO	MOIL	1763-23-1	335-67-1	375-85-9	375-95-1	375-73-5	355-46-4	123-91-1	
MCL				µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	
Well ID	Sample Name	Sample Type	Sample Date																								
WP-167	1608NWP167	N	8/17/2016	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	2.17	0.20 U																
WP-167	1611NWP167	N	11/16/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	1.80	0.10 U																
WP-168	1602NWP168	N	2/23/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	2.04	0.10 U																
WP-168	1605NWP168	N	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	2.04	0.05 U																
WP-168	1605DWP168	FD	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	2.47	0.05 U																
WP-168	1608NWP168	N	8/17/2016	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	2.26	0.20 U																
WP-168	1611NWP168	N	11/16/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	2.47	0.10 U																
WP-169	1605NWP169	N	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	1.51	0.05 U																
WP-170	1605NWP170	N	5/18/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.71	0.05 U																
WP-171	1605NWP171	N	5/18/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																
WP-172	1605NWP172	N	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.47	0.05 U																
WP-173	1605NWP173	N	5/18/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																
WP-177	1605NWP177	N	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.07 J	0.05 U																
WP-178	1605NWP178	N	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.21	0.05 U																
WP-179	1605NWP179	N	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.09 J	0.05 U																
WP-180	1605NWP180	N	5/18/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 J	0.05 U																
WP-27	1602NWP27	N	2/24/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	1.36	0.10 U																
WP-27	1602DWP27	FD	2/24/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	1.34	0.10 U																
WP-27	1605NWP27	N	5/17/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	1.66	0.05 U																
WP-27	1608NWP27	N	8/16/2016	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	1.56	0.20 U																
WP-27	1611NWP27	N	11/15/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	1.25	0.10 U																
WP-27	1611DWP27	FD	11/15/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	1.43	0.10 U																
WP-28	1605NWP28	N	5/17/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	1.57	0.05 U																
WP-33	1605NWP33	N	5/18/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.60	0.05 U																
WP-45	1605NWP45	N	5/18/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.70	0.05 U															0.06 U	
WP-45	1605DWP45	FD	5/18/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.73	0.05 U															0.06 U	
WP-50	1605NWP50	N	5/17/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																
WP-52	1605NWP52	N	5/17/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.17 J	0.05 U															0.06 U	
WP-52	1605DWP52	FD	5/17/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.19 J	0.05 U																
WP-54	1605NWP54	N	5/17/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																
WP-57	1605NWP57	N	5/18/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.41	0.05 U																
WP-57	1605DWP57	FD	5/18/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.44	0.05 U																
WP-65	1605NWP65	N	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.38	0.05 U																
WP-66	1605NWP66	N	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.35	0.07 U	1.52	0.05 U																
WP-68	1605NWP68	N	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.59	0.05 U																
WP-69	1605DWP69	FD	5/18/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.18 J	0.07 U	1.57	0.05 U																
WP-69	1605NWP69	N	5/18/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.18 J	0.07 U	1.54	0.05 U															0.06 U	
WP-71A	1605NWP71A	N	5/18/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.18 J	0.05 U																
WP-71B	1605NWP71B	N	5/18/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.40	0.05 U																
WP-74	1605NWP74	N	5/18/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.21	0.07 U	1.13	0.05 U															0.06 U	
WP-82	1605NWP82	N	5/17/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.09 J	0.05 U																

APPENDIX B – Comprehensive 2016 Analytical Results

Chemical Name				1,1,1-TCA	1,1-DCA	1,1-DCE	1,2-DCA	cis-1,2-DCE	trans-1,2-DCE	TCE	VC	Ben-zene	Ethyl-benzene	Toluene	m,p-xylene	o-xylene	DRO	GRO	MRO	PFOS	PFOA	PFHpA	PFNA	PFBS	PFHxS	1,4 - dioxane		
Analysis Method				EPA Method 524																	EPA Method 537							Method 522
CAS RN				71-55-6	75-34-3	75-35-4	107-06-2	156-59-2	156-60-5	79-01-6	75-01-4	71-43-2	100-41-4	108-88-3	179601-23-1	95-47-6	DRO	GRO	MOIL	1763-23-1	335-67-1	375-85-9	375-95-1	375-73-5	355-46-4	123-91-1		
MCL				µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L		
Well ID	Sample Name	Sample Type	Sample Date																									
Private Wells with Whole House Filters																												
WP-119 (Influent)	1602NWP119A1	N	2/24/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.16 J	0.10 U	2.92	0.10 U																	
WP-119 (Influent)	1605NWP119A1	N	5/17/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.18 J	0.07 U	3.54	0.05 U									0.0400U	0.0200 U	0.0100 U	0.0200 U	0.0900 U	0.0300 U			
WP-119 (Effluent)	1605NWP119C1	N	5/17/2016																	0.0400U	0.0200 U	0.0100 U	0.0200 U	0.0900 U	0.0300 U			
WP-119 (Influent)	1605DWP119A1	FD	5/17/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.18 J	0.07 U	3.76	0.05 U									0.0400U	0.0200 U	0.0100 U	0.0200 U	0.0900 U	0.0300 U			
WP-119 (Influent)	1608NWP119A1	N	8/17/2016	0.20 U	0.20 U	0.20 U	0.20 U	0.17 J	0.20 U	3.57	0.20 U																	
WP-119 (Influent)	1611NWP119A1	N	11/16/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.25	0.10 U	3.02	0.10 U																	
WP-119 (Mid)	1611NWP119B1	N	11/16/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U																	
WP-119 (Effluent)	1611NWP119C1	N	11/16/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U																	
WP-121 (Influent)	1602NWP121A1	N	2/24/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.14 J	0.10 U	3.16	0.10 U																	
WP-121 (Influent)	1602DWP121A1	FD	2/24/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.12 J	0.10 U	3.32	0.10 U																	
WP-121 (Influent)	1605NWP121A1	N	5/17/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.17 J	0.07 U	4.06	0.05 U									0.0400U	0.0200 U	0.0100 U	0.0200 U	0.0900 U	0.00442 J	0.06 U		
WP-121 (Effluent)	1605NWP121C1	N	5/17/2016																	0.0400U	0.0200 U	0.0100 U	0.0200 U	0.0900 U	0.0300 U			
WP-121 (Influent)	1608NWP121A1	N	8/17/2016	0.20 U	0.20 U	0.20 U	0.20 U	0.15 J	0.20 U	4.23	0.20 U																	
WP-121 (Influent)	1611NWP121A1	N	11/15/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.15 J	0.10 U	3.34	0.10 U																	
WP-121 (Mid)	1611NWP121B1	N	11/15/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U																	
WP-121 (Effluent)	1611NWP121C1	N	11/15/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U																	
WP-123 (Influent)	1602NWP123A1	N	2/24/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.30	0.10 U	2.21	0.10 U																	
WP-123 (Influent)	1605NWP123A1	N	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.26	0.07 U	3.71	0.05 U																	
WP-123 (Influent)	1608NWP123A1	N	8/17/2016	0.20 U	0.20 U	0.20 U	0.20 U	0.17 J	0.20 U	3.14	0.20 U																	
WP-123 (Influent)	1611NWP123A1	N	11/16/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.49	0.10 U	2.77	0.10 U																	
WP-123 (Mid)	1611NWP123B1	N	11/16/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U																	
WP-123 (Mid)	1611DWP123B1	FD	11/16/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U																	
WP-123 (Effluent)	1611NWP123C1	N	11/16/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U																	
WP-124 (Influent)	1602NWP124A1	N	2/24/2016	0.10 U	0.10 U	0.10 U	0.10 U	1.00	0.10 U	3.83	0.10 U																	
WP-124 (Influent)	1605NWP124A1	N	5/18/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.88	0.07 U	3.87	0.05 U									0.0400U	0.0200 U	0.0100 U	0.0200 U	0.0900 U	0.0300 U			
WP-124 (Effluent)	1605NWP124C1	N	5/18/2016																	0.0400U	0.0200 U	0.0100 U	0.0200 U	0.0900 U	0.0300 U			
WP-124 (Influent)	1608NWP124A1	N	8/17/2016	0.20 U	0.20 U	0.20 U	0.20 U	0.93	0.20 U	4.03	0.20 U																	
WP-124 (Influent)	1611NWP124A1	N	11/15/2016	0.10 U	0.10 U	0.10 U	0.10 U	1.45	0.10 U	4.85	0.10 U																	
WP-125 (Influent)	1602NWP125A1	N	2/24/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.76	0.10 U	2.95	0.10 U																	
WP-125 (Mid)	1602NWP125B1	N	2/24/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U																	
WP-125 (Effluent)	1602NWP125C1	N	2/24/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U																	
WP-125 (Influent)	1605NWP125A1	N	5/17/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.92	0.07 U	3.70	0.05 U									0.0400U	0.0200 U	0.0100 U	0.0200 U	0.0900 U	0.0300 U	0.06 U		
WP-125 (Mid)	1605NWP125B1	N	5/17/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																	
WP-125 (Effluent)	1605NWP125C1	N	5/17/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U									0.0400U	0.0200 U	0.0100 U	0.0200 U	0.0900 U	0.0300 U			
WP-125 (Influent)	1608NWP125A1	N	8/17/2016	0.20 U	0.20 U	0.20 U	0.20 U	0.73	0.20 U	3.44	0.20 U																	
WP-125 (Influent)	1611NWP125A1	N	11/15/2016	0.10 U	0.10 U	0.10 U	0.10 U	1.02	0.10 U	3.98	0.10 U																	
WP-129 (Influent)	1602NWP129A1	N	2/24/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	3.13	0.10 U																	
WP-129 (Influent)	1605NWP129A1	N	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.11 J	0.07 U	3.12	0.05 U																	
WP-129 (Influent)	1608NWP129A1	N	8/17/2016	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	1.46	0.20 U																	
WP-129 (Influent)	1611NWP129A1	N	11/15/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.11 J	0.10 U	3.39	0.10 U																	

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Chemical Name				1,1,1-TCA	1,1-DCA	1,1-DCE	1,2-DCA	cis-1,2-DCE	trans-1,2-DCE	TCE	VC	Ben-zene	Ethyl-benzene	Toluene	m,p-xylene	o-xylene	DRO	GRO	MRO	PFOS	PFOA	PFHpA	PFNA	PFBS	PFHxS	1,4 -dioxane		
Analysis Method				EPA Method 524																	EPA Method 537							Method 522
CAS RN				71-55-6	75-34-3	75-35-4	107-06-2	156-59-2	156-60-5	79-01-6	75-01-4	71-43-2	100-41-4	108-88-3	179601-23-1	95-47-6	DRO	GRO	MOIL	1763-23-1	335-67-1	375-85-9	375-95-1	375-73-5	355-46-4	123-91-1		
MCL				µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L		
Well ID	Sample Name	Sample Type	Sample Date																									
WP-14 (Influent)	1602NWP14A1	N	2/23/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.71	0.10 U	2.85	0.10 U																	
WP-14 (Influent)	1605NWP14A1	N	5/18/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.85	0.07 U	3.22	0.05 U																	
WP-14 (Mid)	1605NWP14B1	N	5/18/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																	
WP-14 (Effluent)	1605NWP14C1	N	5/18/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																	
WP-14 (Influent)	1608NWP14A1	N	8/17/2016	0.20 U	0.20 U	0.20 U	0.20 U	0.85	0.20 U	3.14	0.20 U																	
WP-14 (Influent)	1608DWP14A1	FD	8/17/2016	0.20 U	0.20 U	0.20 U	0.20 U	0.92	0.20 U	3.45	0.20 U																	
WP-14 (Influent)	1611NWP14A1	N	11/16/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.89	0.10 U	3.11	0.10 U																	
WP-70 (Influent)	1602NWP70A1	N	2/24/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.19 J	0.10 U	3.06	0.10 U																	
WP-70 (Influent)	1605NWP70A1	N	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.23	0.07 U	2.98	0.05 U																	
WP-70 (Mid)	1605NWP70B1	N	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																	
WP-70 (Effluent)	1605NWP70C1	N	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																	
WP-70 (Influent)	1608NWP70A1	N	8/17/2016	0.20 U	0.20 U	0.20 U	0.20 U	0.20 J	0.20 U	3.66	0.20 U																	
WP-70 (Influent)	1608DWP70A1	FD	8/17/2016	0.20 U	0.20 U	0.20 U	0.20 U	0.23	0.20 U	3.89	0.20 U																	
WP-70 (Influent)	1611NWP70A1	N	11/15/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.29	0.10 U	3.52	0.10 U																	
WP-83 (Influent)	1602NWP83A1	N	2/23/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.24	0.10 U	1.28	0.10 U																	
WP-83 (Influent)	1605NWP83A1	N	5/17/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.23	0.07 U	1.05	0.05 U																	
WP-83 (Mid)	1605NWP83B1	N	5/17/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																	
WP-83 (Effluent)	1605NWP83C1	N	5/17/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																	
WP-83 (Influent)	1608NWP83A1	N	8/17/2016	0.20 U	0.20 U	0.20 U	0.20 U	0.22	0.20 U	1.05	0.20 U																	
WP-83 (Influent)	1611NWP83A1	N	11/16/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.29	0.10 U	1.12	0.10 U																	
WP-86 (Influent)	1602NWP86A1	N	2/23/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	2.31	0.10 U																	
WP-86 (Influent)	1605NWP86A1	N	5/17/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	2.13	0.05 U																	
WP-86 (Mid)	1605NWP86B1	N	5/17/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																	
WP-86 (Effluent)	1605NWP86C1	N	5/17/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																	
WP-86 (Influent)	1608NWP86A1	N	8/17/2016	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	1.03	0.20 U																	
WP-86 (Influent)	1611NWP86A1	N	11/16/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	2.07	0.10 U																	
Quality Control Samples																												
	1602TB01	TB	2/23/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U																	
	1602TB03	TB	2/23/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U																	
	1602TB04	TB	2/24/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U																	
	1602TB05	TB	2/24/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U																	
	1602PDTB01	TB	2/24/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U																	
	1602TB02	TB	2/24/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U																	
	1602PDTB02	TB	2/24/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U																	
	1605TB10	TB	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																	
	1605TB14	TB	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																	
	1605TB01	TB	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U	0.03 U	0.04 U	0.04 U	0.05 U	0.04 U		9.06 U										
	1605TB11	TB	5/16/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																	
	1605TB02	TB	5/17/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U	0.03 U	0.04 U	0.04 U	0.05 U	0.04 U		9.06 U										
	1605TB12	TB	5/18/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																	
	1605TB16	TB	5/18/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																	

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Chemical Name				1,1,1-TCA	1,1-DCA	1,1-DCE	1,2-DCA	cis-1,2-DCE	trans-1,2-DCE	TCE	VC	Ben-zene	Ethyl-benzene	Toluene	m,p-xylene	o-xylene	DRO	GRO	MRO	PFOS	PFOA	PFHpA	PFNA	PFBS	PFHxS	1,4 - dioxane		
Analysis Method				EPA Method 524																	EPA Method 537							Method 522
CAS RN				71-55-6	75-34-3	75-35-4	107-06-2	156-59-2	156-60-5	79-01-6	75-01-4	71-43-2	100-41-4	108-88-3	179601-23-1	95-47-6	DRO	GRO	MOIL	1763-23-1	335-67-1	375-85-9	375-95-1	375-73-5	355-46-4	123-91-1		
MCL				µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L		
Well ID	Sample Name	Sample Type	Sample Date																									
Collected at WP-156	1605EBJWBC	EB	5/18/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																	
	1605TB03	TB	5/19/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.09 J	0.05 U																	
	1605TB04	TB	5/19/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																	
	1605TB05	TB	5/20/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																	
	1605TB06	TB	5/20/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																	
	1605TB07	TB	5/20/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																	
	1605TB08	TB	5/20/2016	0.04 U	0.07 U	0.06 U	0.07 U	0.10 U	0.07 U	0.06 U	0.05 U																	
	1608TB01	TB	8/16/2016	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U																	
	1608PDTB01	TB	8/18/2016	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U																	
	1611TB03	TB	11/14/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U																	
	1611TB04	TB	11/14/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.06 J	0.10 U																	
	1611TB05	TB	11/14/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U																	
	1611TB01	TB	11/15/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U																	
	1611TB02	TB	11/15/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U																	
	1611PDTB01	TB	11/16/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.08 J	0.10 U																	
Collected at 04CW07	1611FBMW01	FB	11/17/2016	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U																	
Collected at WP-83	1608FBWP83	FB	8/17/2016	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U																	

1,1,1-TCA	1,1,1-Trichloroethane
1,1-DCA	1,1-Dichloroethane
1,1-DCE	1,1-Dichloroethene
1,2-DCA	1,2-Dichloroethane
CIS-1,2-DCE	Cis-1,2-Dichloroethene
TRANS-1,2-DCE	Trans-1,2-Dichloroethene
TCE	Trichloroethene
VC	Vinyl Chloride
DRO	Diesel Range Organics
GRO	Gasoline Range Organics
MRO	Motor Oils
PFOS	Perfluorooctanesulfonic Acid (PFOS)
PFOA	Perfluorooctanoic Acid (PFOA)
PFHpA	Perfluoroheptanoic Acid
PFNA	Perfluorononanoic Acid (PFNA)
PFBS	Perfluorobutanesulfonic Acid (PFBS)
PFHxS	Perfluorohexanesulfonic Acid (PFHxS)

APPENDIX C – 2016 Whole House Filter Efficiency Memorandum



U.S. ARMY CORPS of ENGINEERS
Seattle District

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Technical Services Branch, Engineering Division

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MEMORANDUM

DATE: 7 June 2016

FROM: Karah Haskins – Technical Project Lead, USACE Seattle District

TO: Rod Lobos - Moses Lake RPM, Region 10

SUBJECT: Moses Lake Whole House Filter Efficiency Evaluation

The purpose of this memorandum (memo) is to evaluate results for Siemens AWC-1230 Whole House Filter (WHF) systems installed in September 2014 and April 2015 at Moses Lake residential wells WP-123 and WP-125. This memo evaluates whether the filters worked sufficiently for a year after installation to protect residents from exposure to trichloroethene (TCE) greater than the Maximum Contaminant Level (MCL), which is 5 µg/L. In addition, this memo evaluates whether there is sufficient evidence to support the reduction in filter sampling frequency from quarterly sampling.

WHF systems are installed at private wells when TCE concentrations are greater than or equal to 3.5 µg/L TCE. More information on the WHF systems can be found in Appendix A of the 2015 Work Plan. The granular activated carbon (GAC) in the WHF vessels is replaced annually to compensate for performance reduction due to dissolved solids, iron, biofilm, and adsorption of other organic constituents. Annual change-out also protects against buildup of nitrates in the system, which can be transformed to toxic nitrites under certain conditions. The validity of conclusions stated in this report are limited to the observed flow and contaminant concentration ranges discussed herein and the assumption that WHF GAC will be replaced annually.

The following is a summary of the actions taken at WP-123 and WP-125:

- **WP-123:** All three sampling ports were sampled during five sampling events after the WHF was installed at WP-123 in September 2014. The GAC filters were replaced over a year later during the November 2015 event; however, the absence of detectable concentrations in the mid and effluent ports during the five sampling events (October 2014 to November 2015) indicate that the filters were protective of human health.

Appendix C

- **WP-125:** All three sampling ports were sampled during four sampling events at WP-125 (May 2015 through February 2016).

Flow rates were calculated using flow meter readings recorded at the time of quarterly sampling and are presented in **Table 1**. The average flow rates were 477 and 1051 gallons per day for WP-123 and WP-125, respectively. Detected concentrations of TCE and cis-dichloroethene (cis-DCE) collected at the lead sample port (influent) are also summarized in **Table 1**.

Overall, the WHFs are working sufficiently to ensure protection of human health. There were no detections of TCE or cis-DCE in the mid or effluent ports. The average flow rates and the TCE concentrations were similar to those observed during the WHF efficiency evaluation for WP-14, 70, 83, and 86 (summarized in a prior WHF efficiency analysis memo dated September 23, 2014) and WP-119, WP-121, WP-124, and WP-129 (summarized in a prior WHF efficiency analysis memo dated July 14, 2015). This evidence suggests that the WHFs are working sufficiently to protect human health at the current amount of TCE mass loading and volume of flow through the filters.

The technical team recommends continuing to sample the WHF influent ports quarterly at WP-123 and 125 to evaluate seasonal trends. However, the results of this memo conclude that the sampling frequency for the mid and effluent ports can be reduced to annual sampling and still protect human health based on the current flow rates, TCE concentrations, and assumption of annual replacement of WHFs.

Appendix C

Table 1. Moses Lake WHF Systems - Flow Meter Readings and Detected Analytes

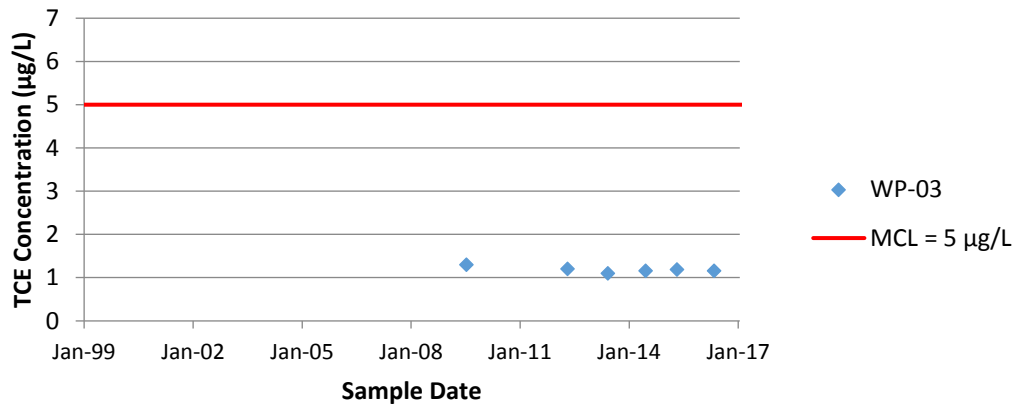
Well ID	Date	Event	Flow Meter Reading (gal)	Quarterly Flow Rate (gal/day)	Lead Influent		Mid/Effluent Detect?
					TCE µg/L	CIS-DCE µg/L	
WP-123	10/2/2014	end of Q1	6,425	428	3.71	0.18	N
	11/20/2014	end of Q2	14,898	173	2.7	0.31	N
	2/26/2015	end of Q3	22,565	78	2.57	0.43	N
	5/7/2015	end of Q4	35,632	187	2.77	0.25	N
	8/1/2015	end of Q5	151,681	1,349	2.21		N
			avg flow	477	gal/day		
				151,681	gal/yr		
Well ID	Date	Event	Flow Meter Reading (gal)	Quarterly Flow Rate (gal/day)	Lead Influent		Mid/Effluent Detect?
					TCE µg/L	CIS-DCE µg/L	
WP-125	5/7/2015	end of Q1	15,596	678	2.68	0.62	N
	8/18/2015	end of Q2	85,420	678	2.85	0.57	N
	11/17/2015	end of Q3	198,065	1,238	3.72	1.02	N
	2/24/2016	end of Q4	332,053	1,353	2.95	0.76	N
			avg flow	1,051	gal/day		
				332,053	gal/yr		

1 - Systems were installed in September 2014 (WP-123) and April 2015 (WP-125), which = time 0.

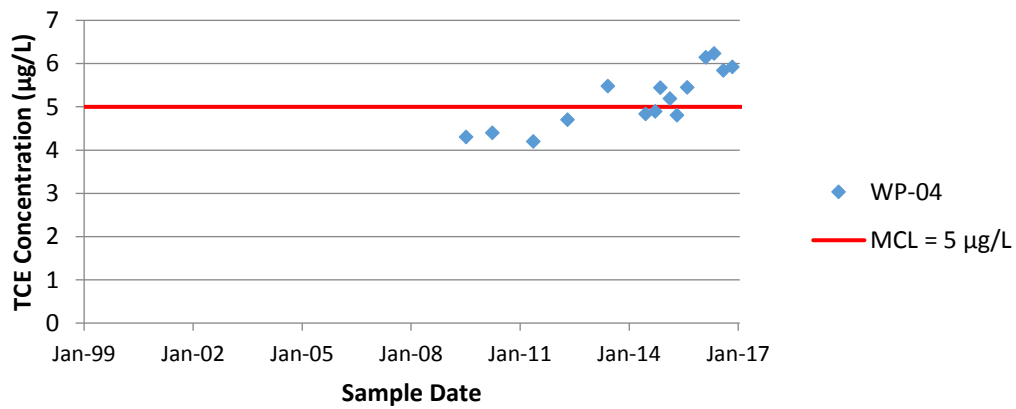
APPENDIX D – TCE Time-Series Graphs

Appendix D - Private Wells

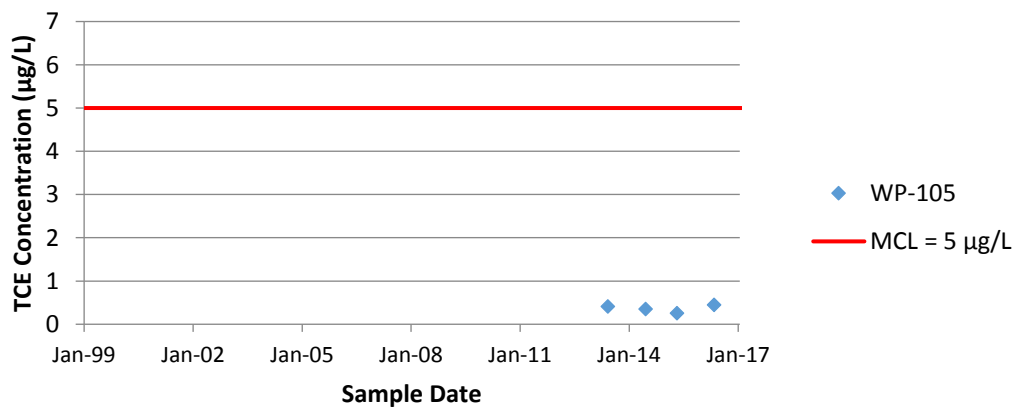
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Private Well WP-04

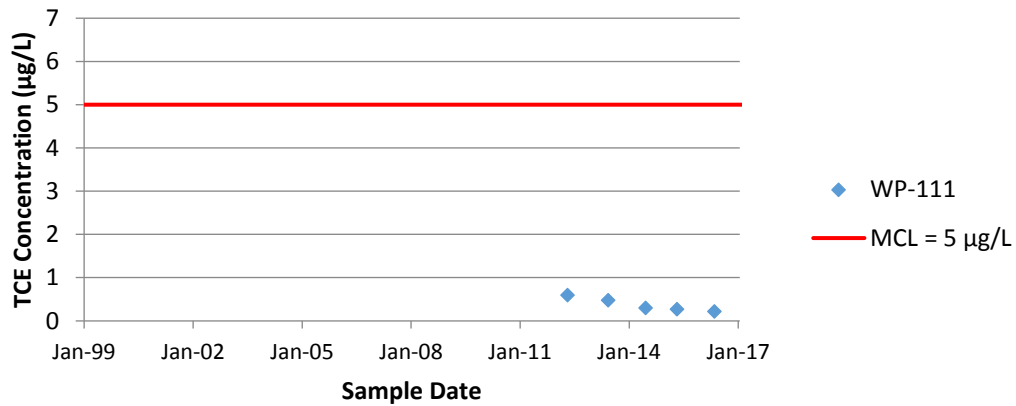


Private Well WP-105

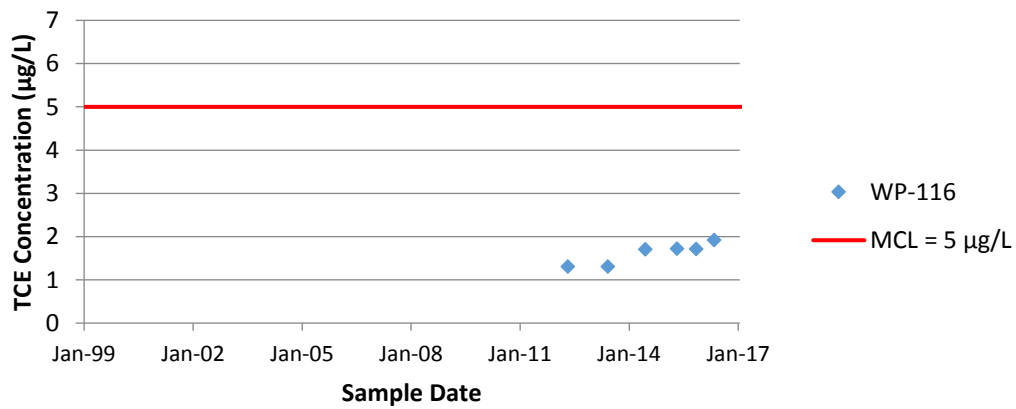


Appendix D - Private Wells

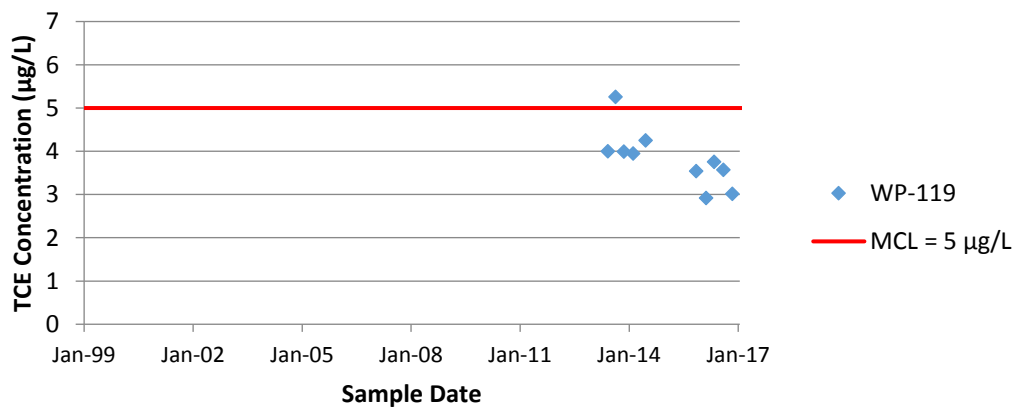
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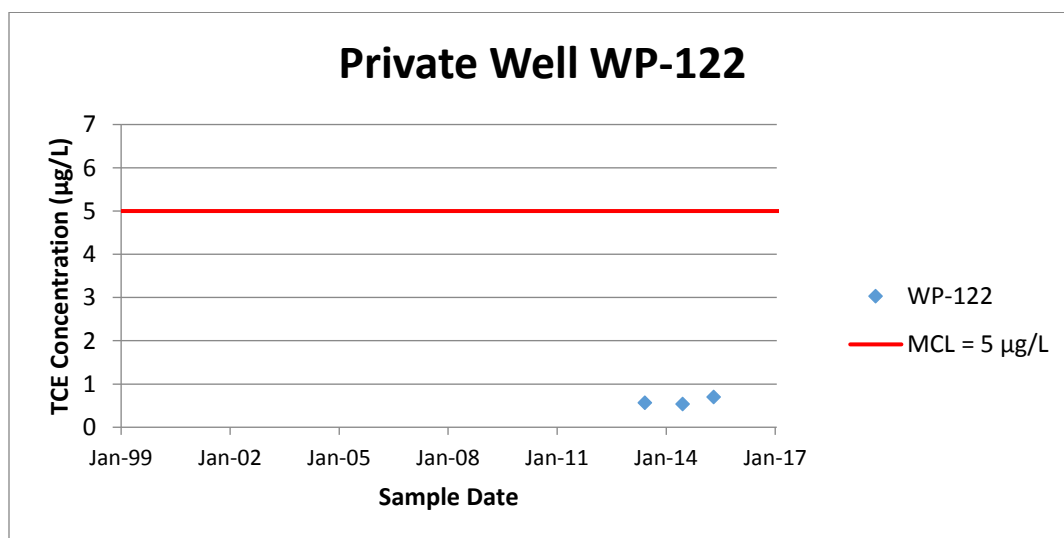
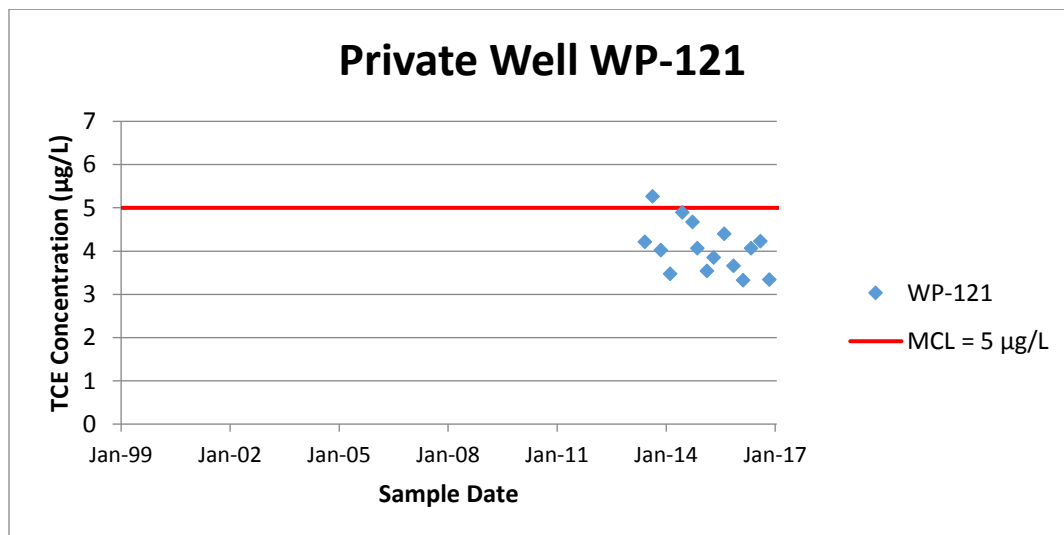
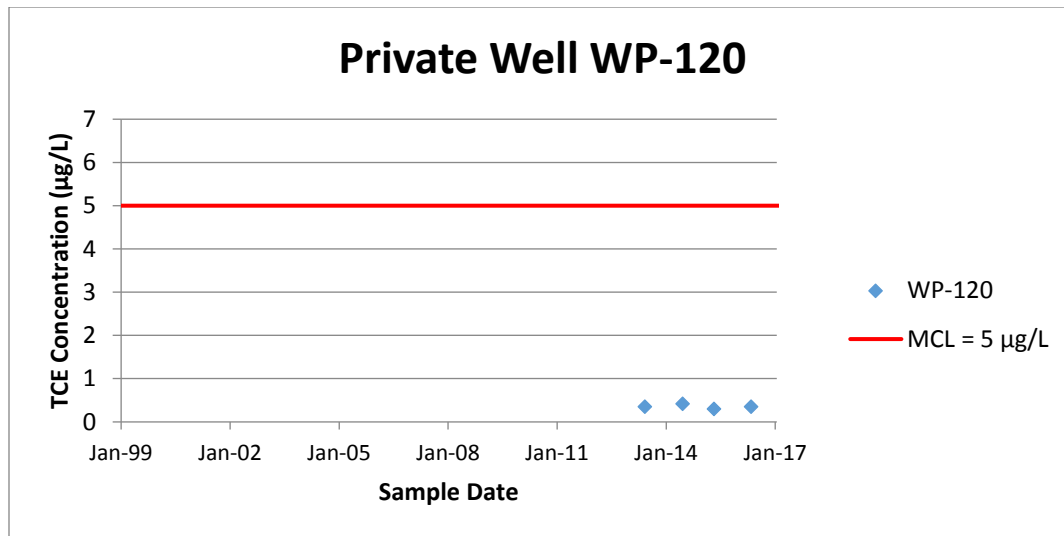
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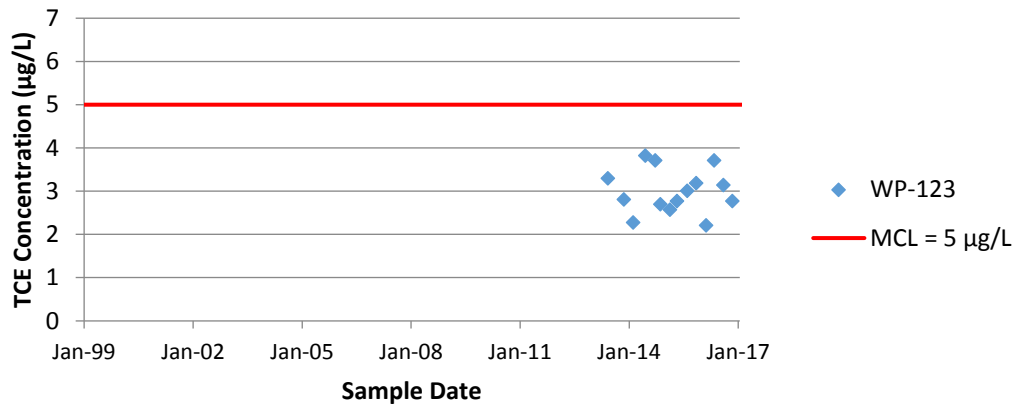


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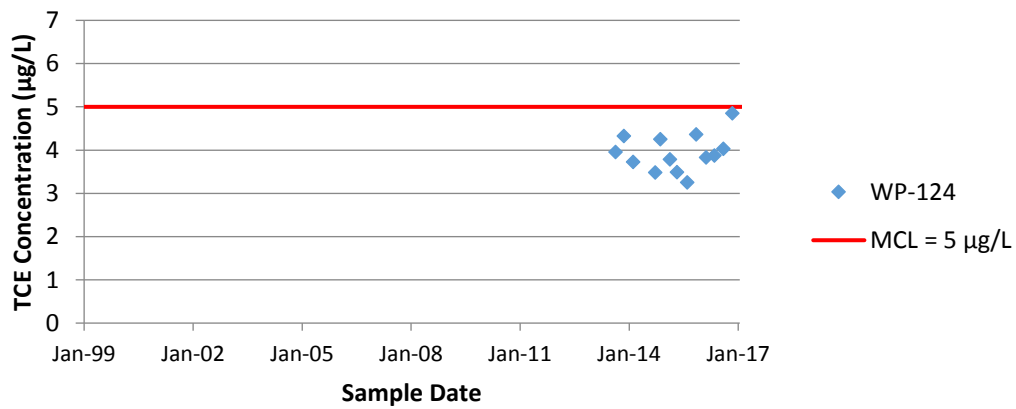


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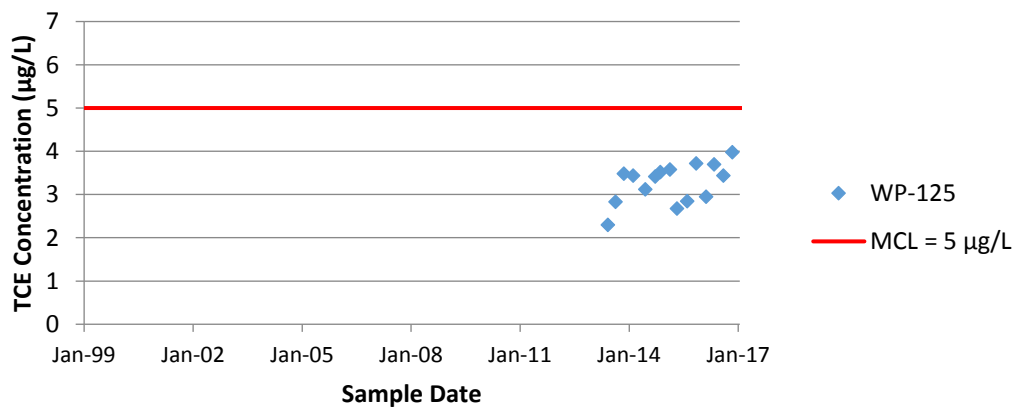
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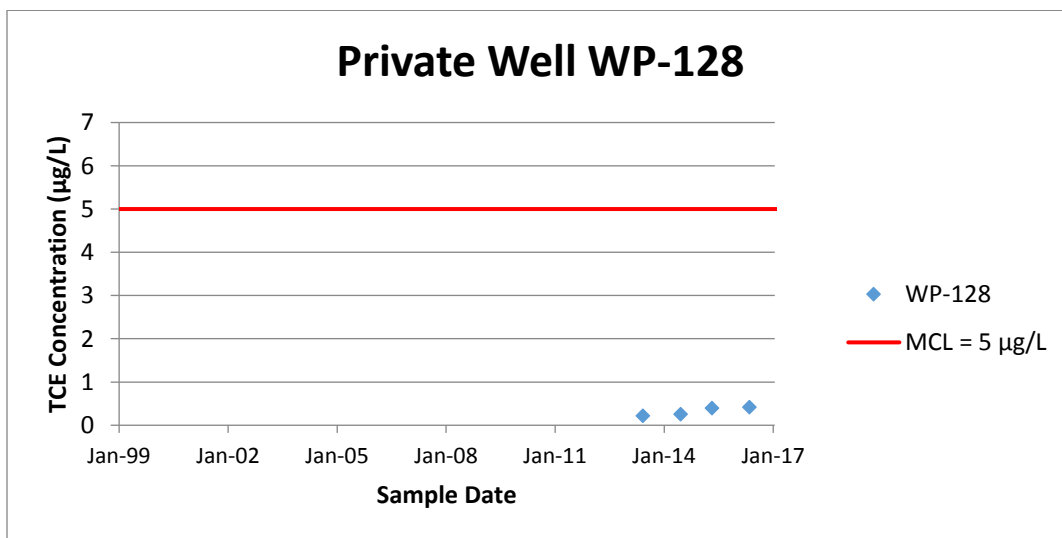
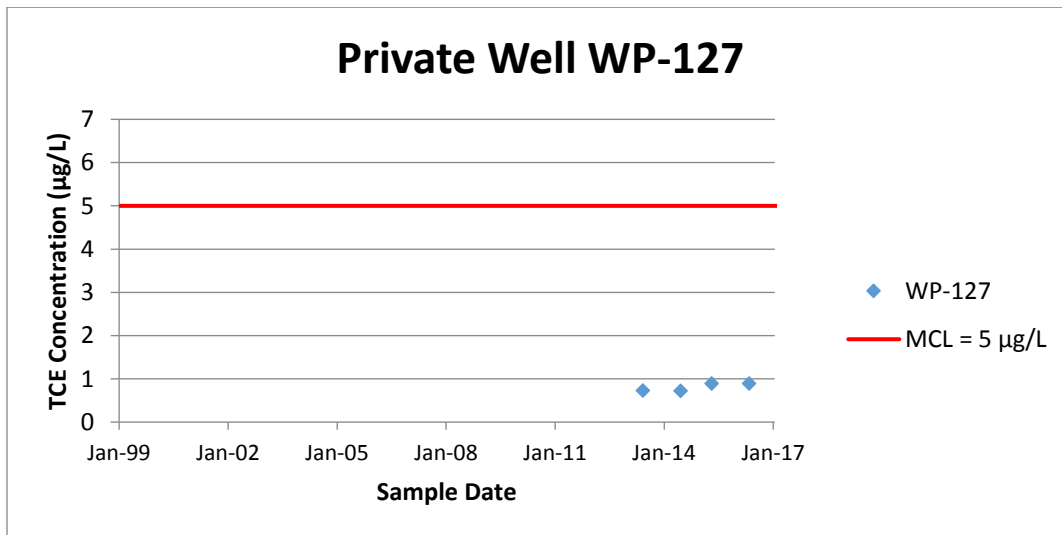
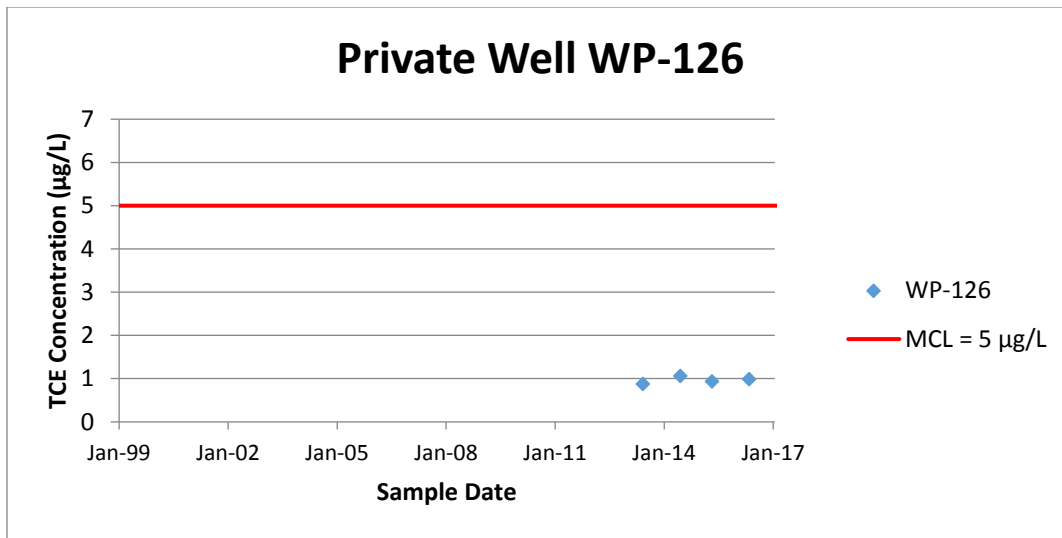
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Private Well WP-125

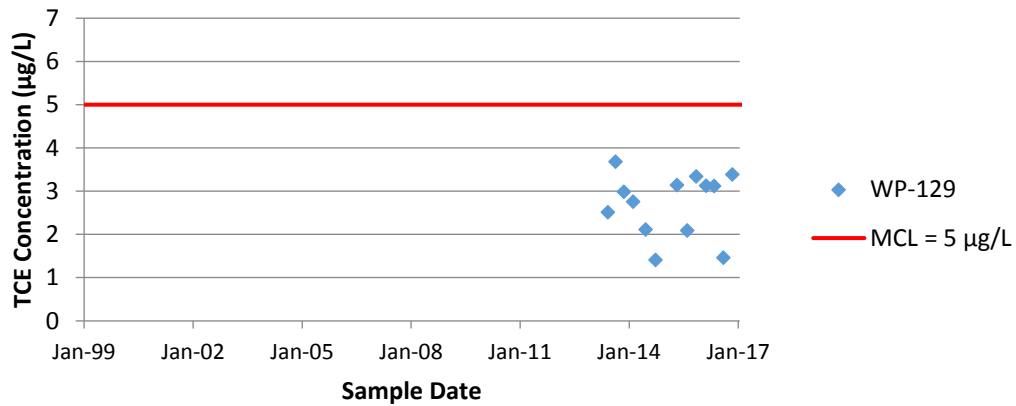


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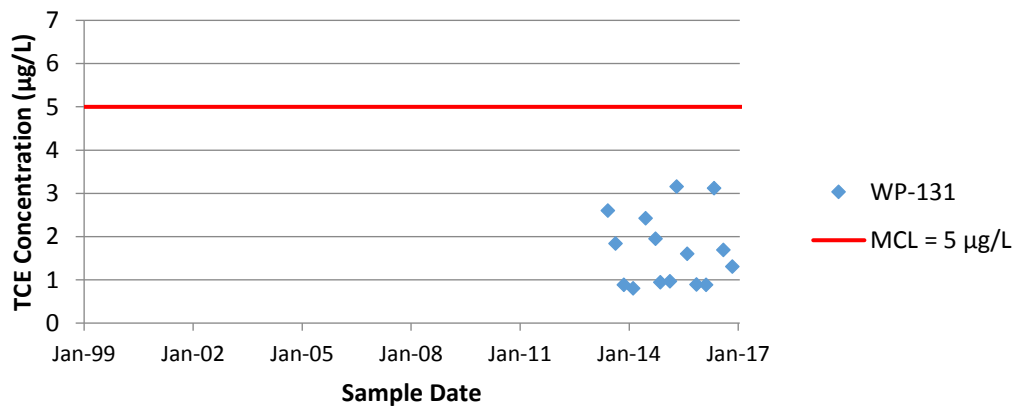


Appendix D - Private Wells

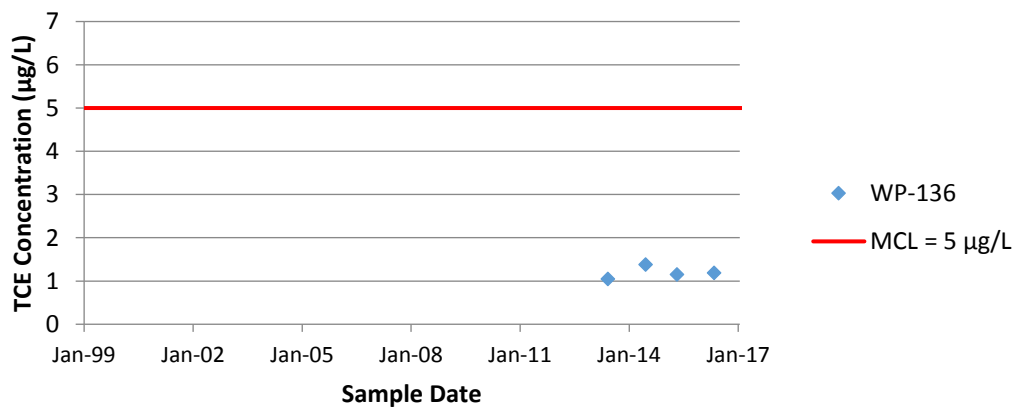
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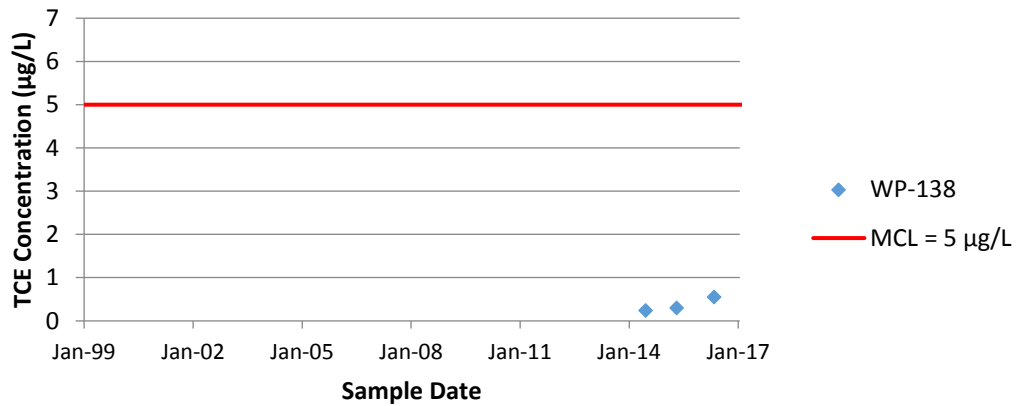


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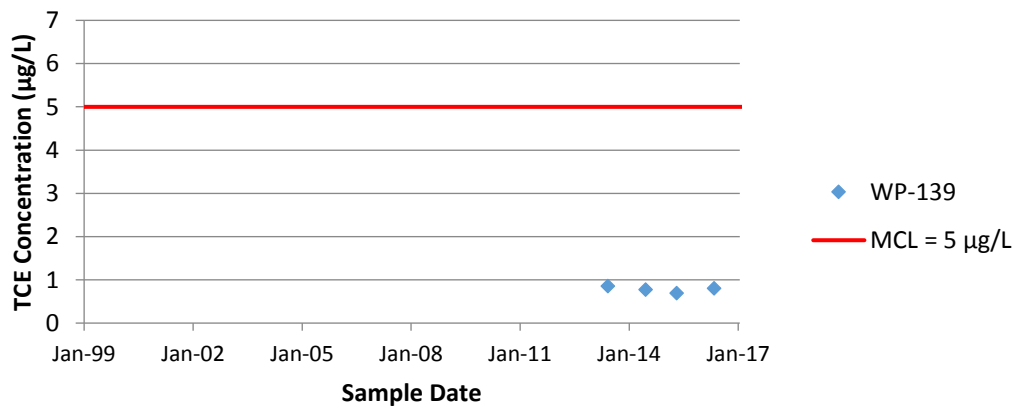


Appendix D - Private Wells

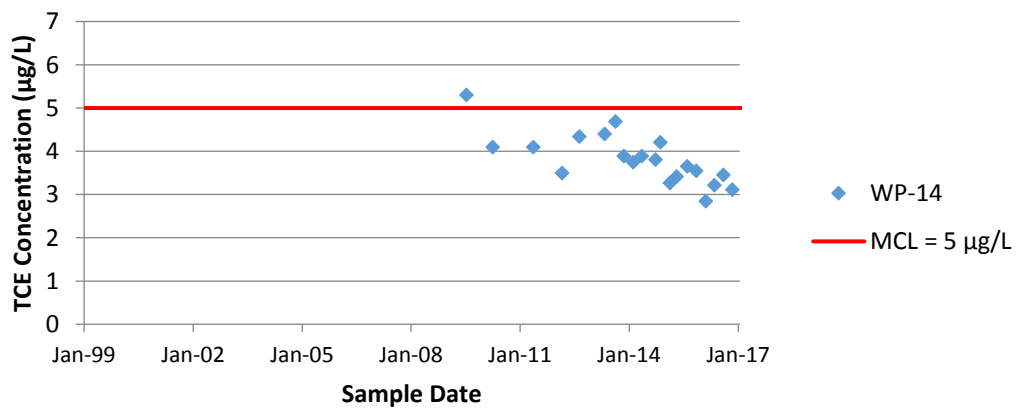
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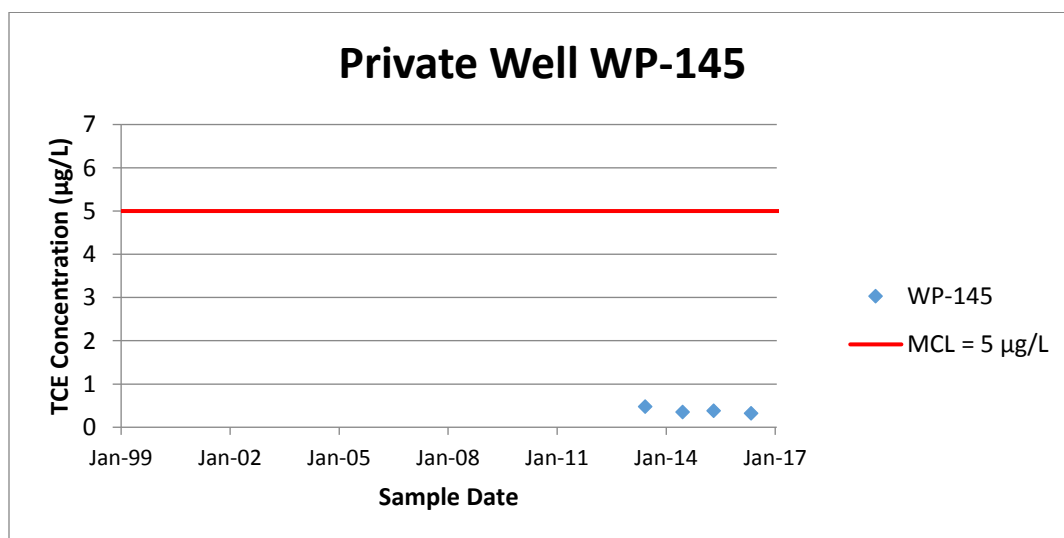
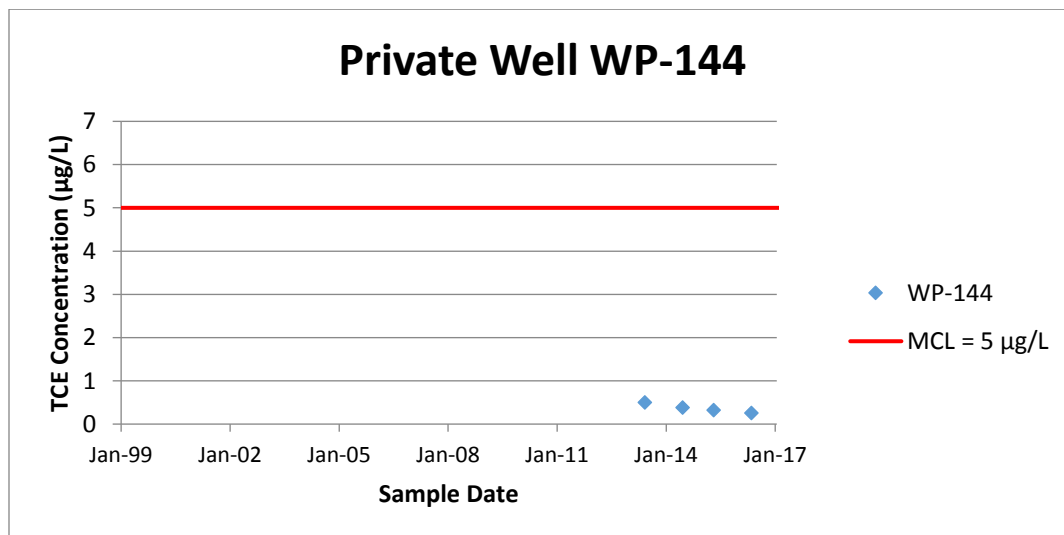
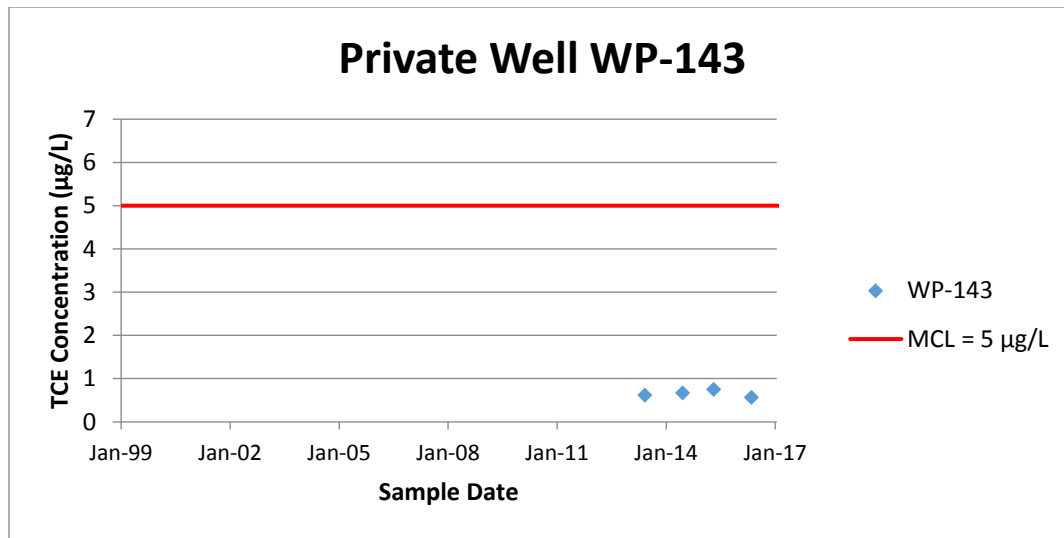
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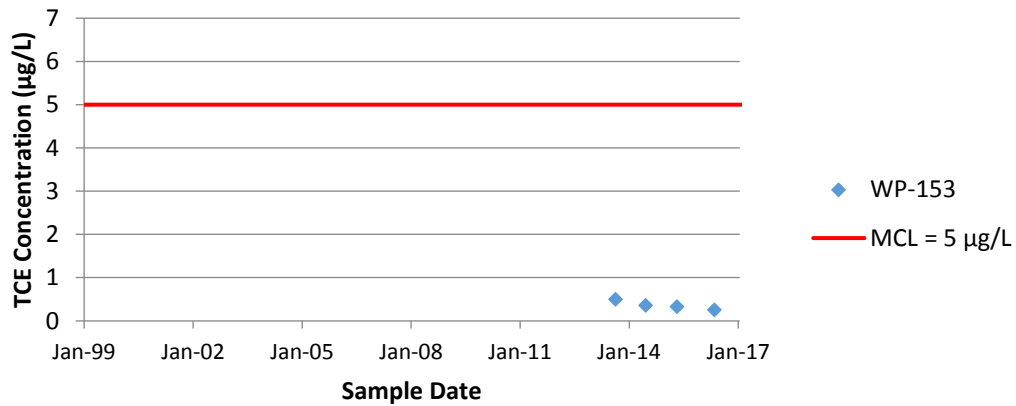


Appendix D - Private Wells

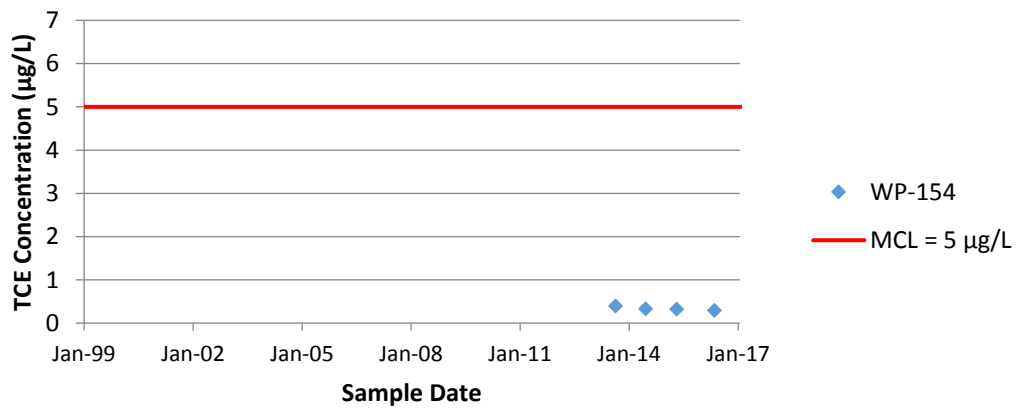


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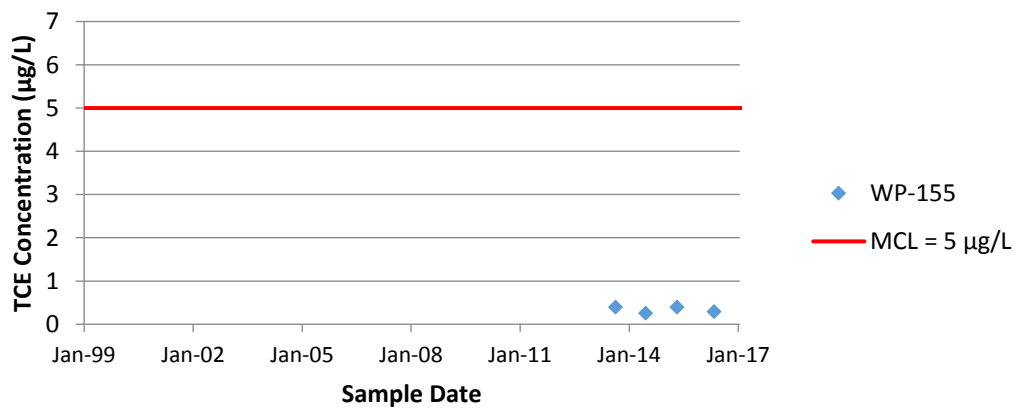
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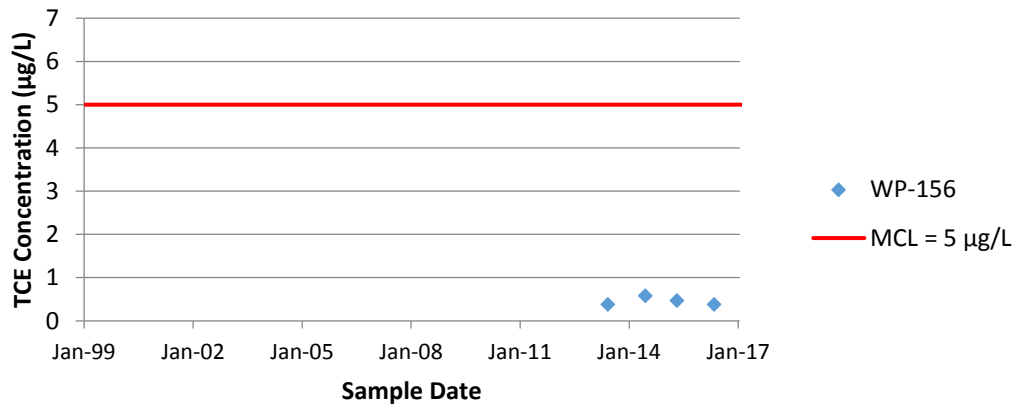


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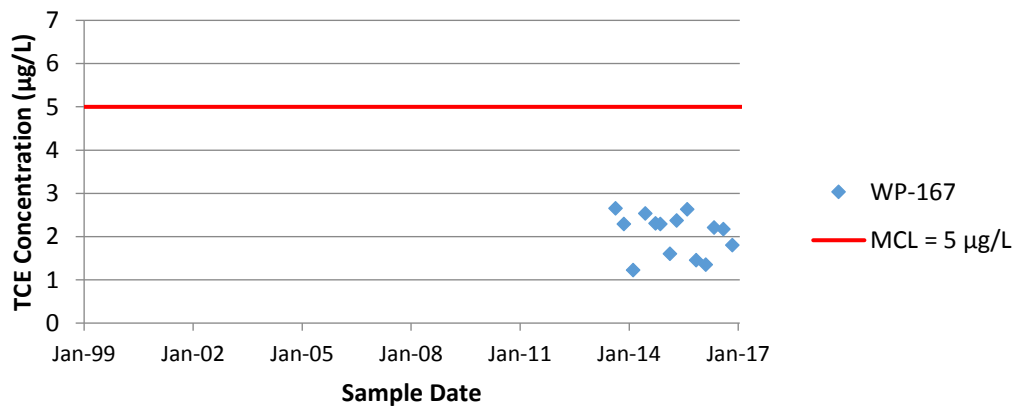


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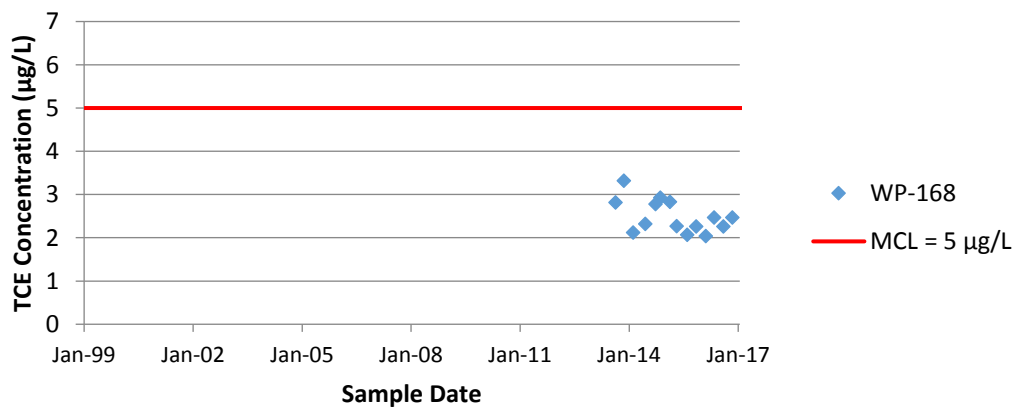
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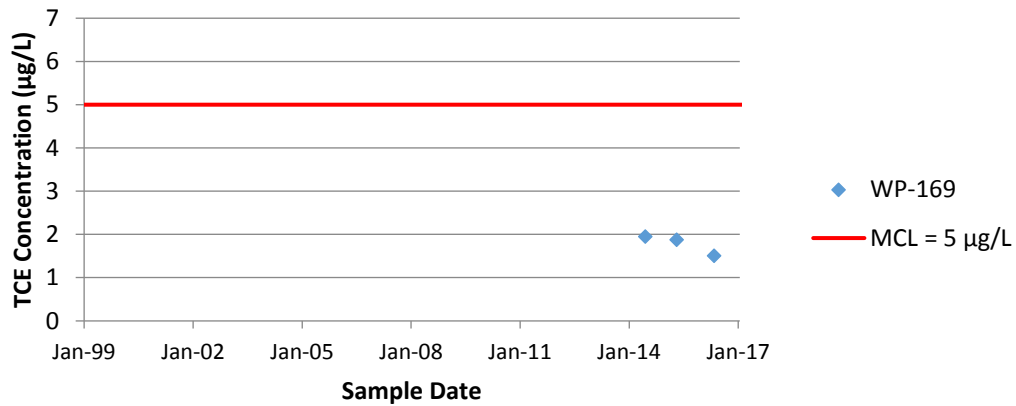


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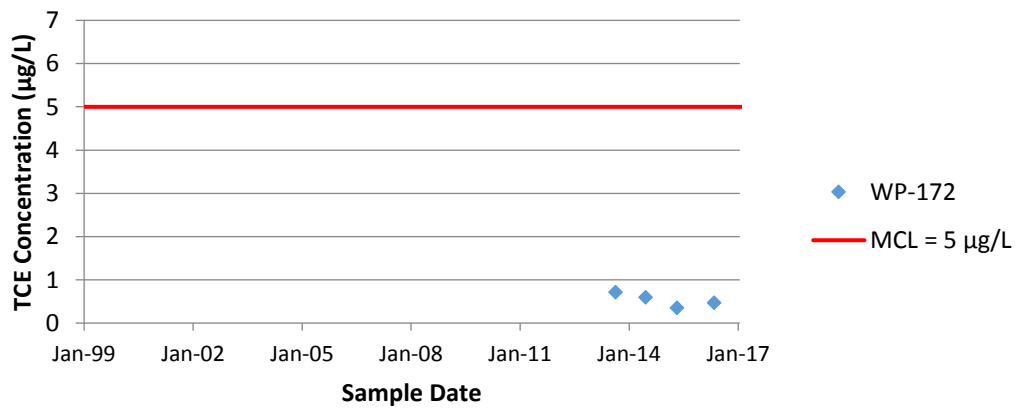


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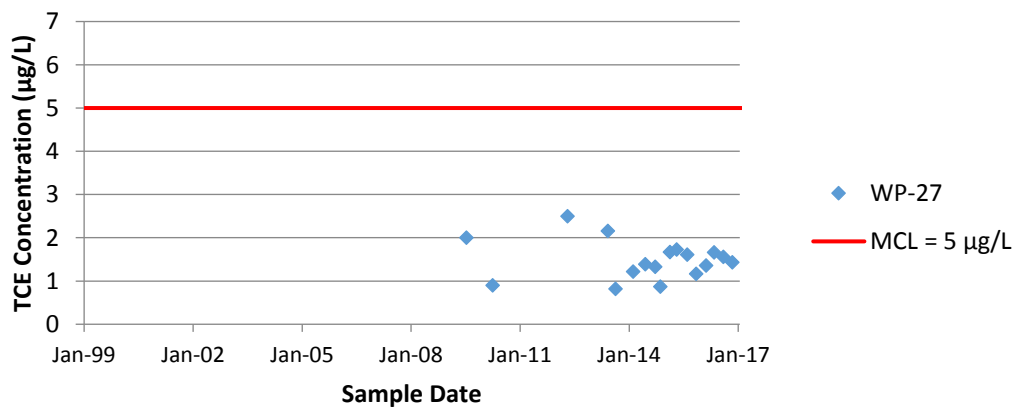
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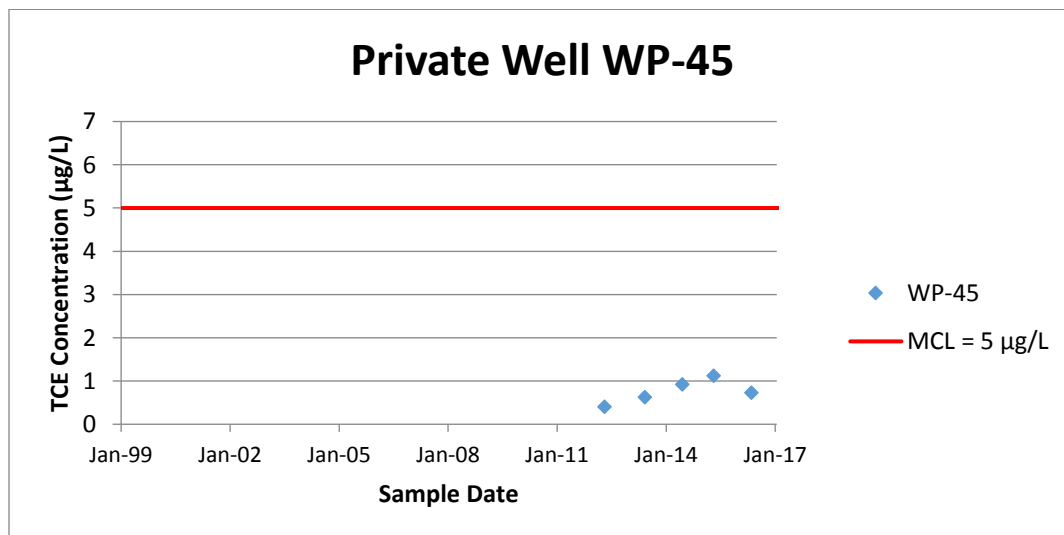
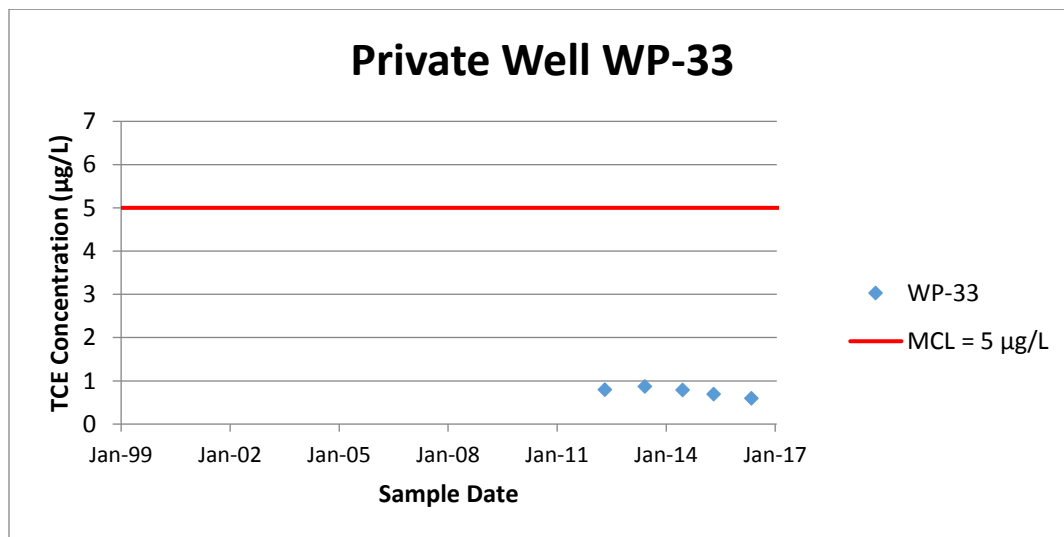
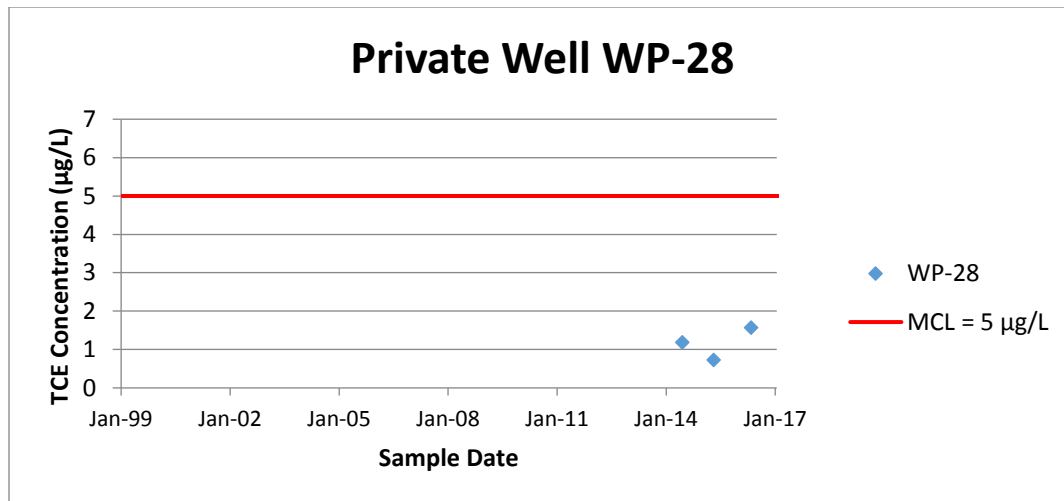
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Private Well WP-27

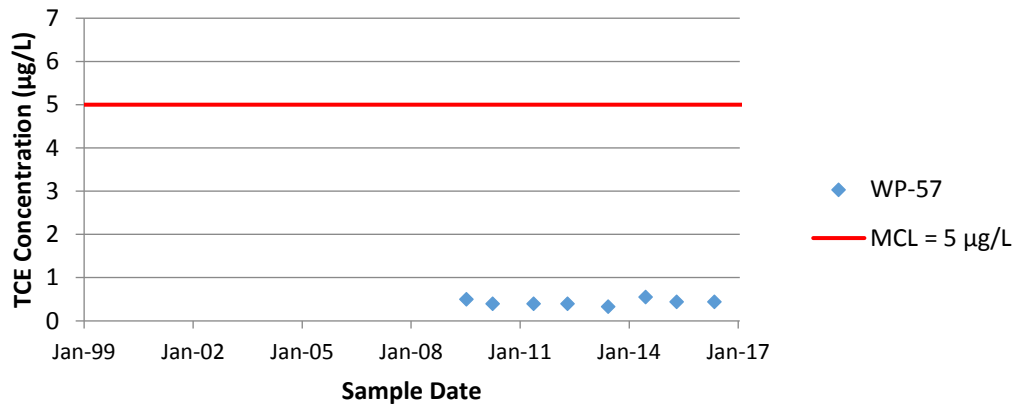


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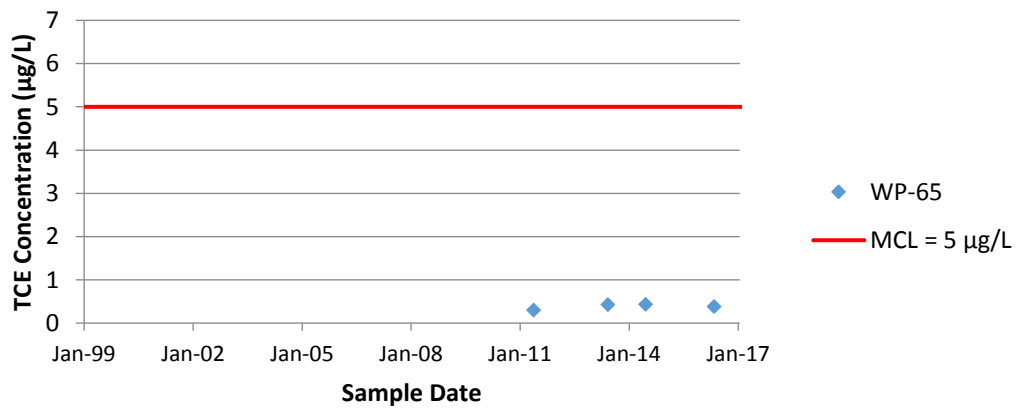


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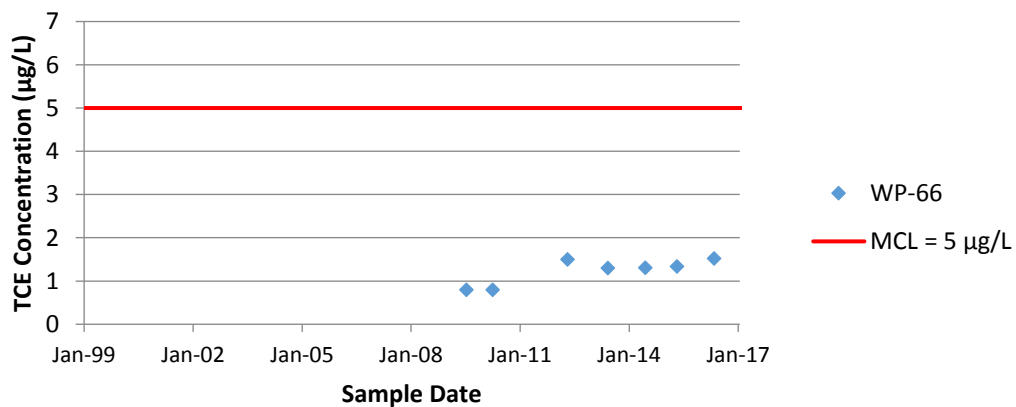
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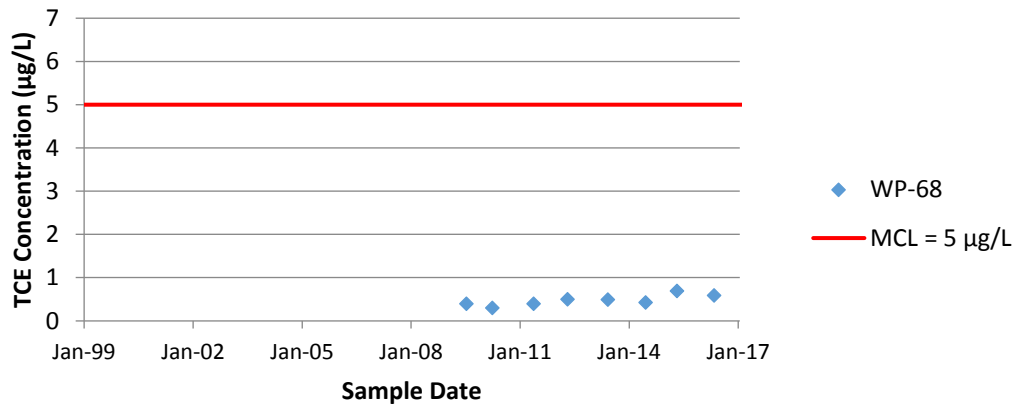


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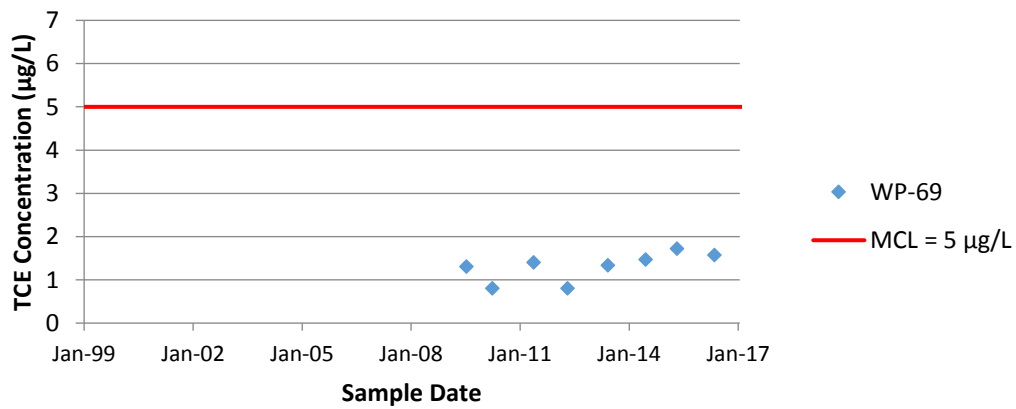


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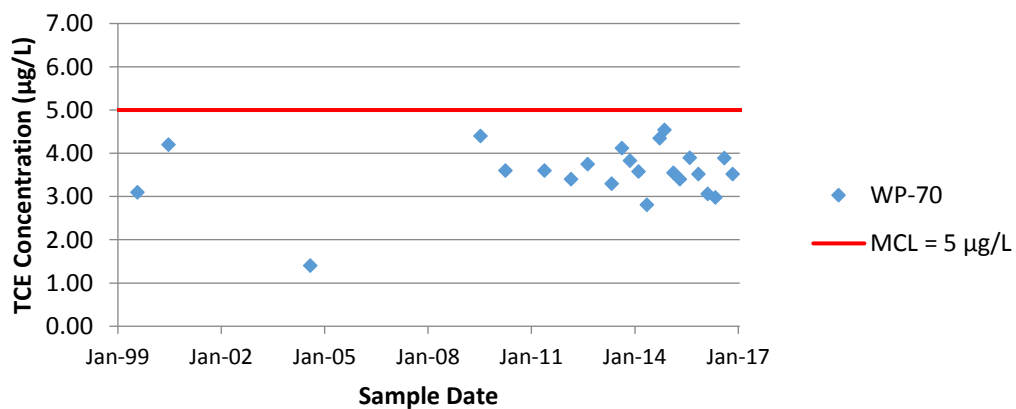
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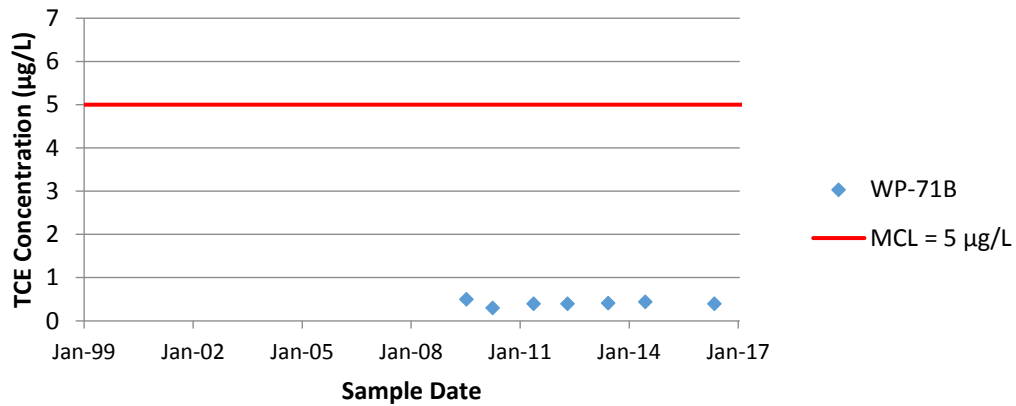


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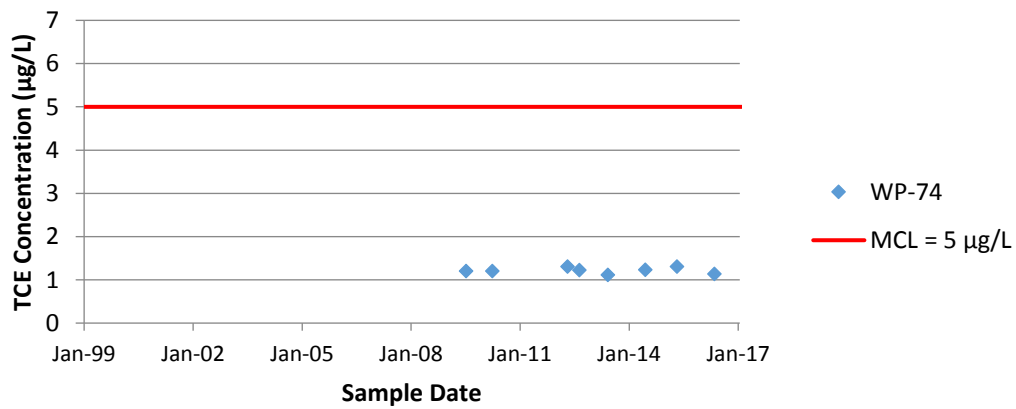


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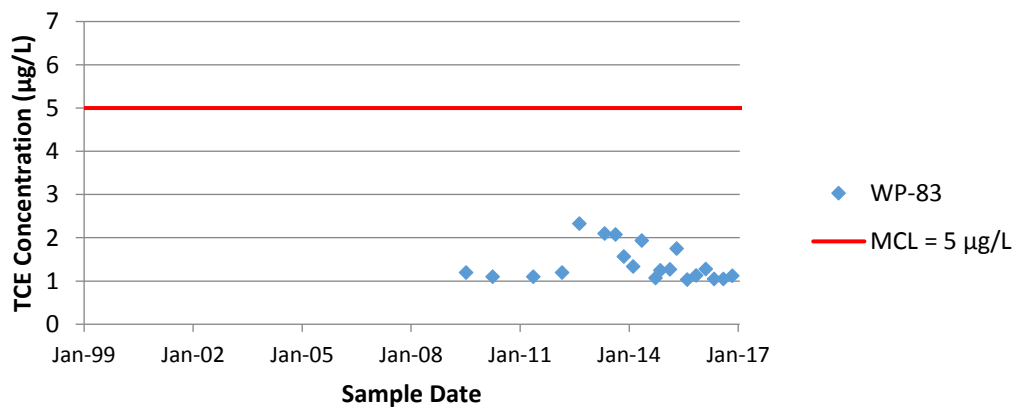
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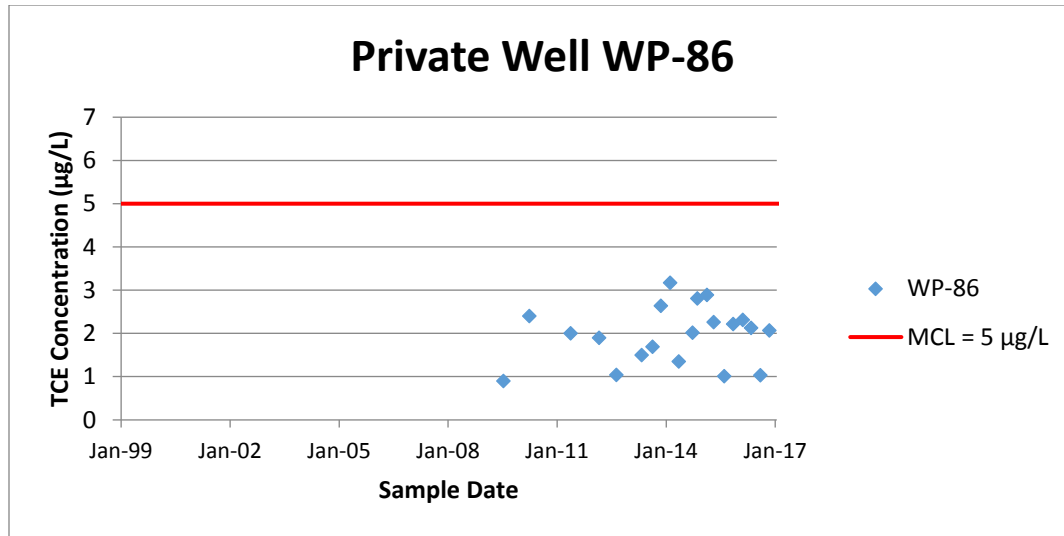
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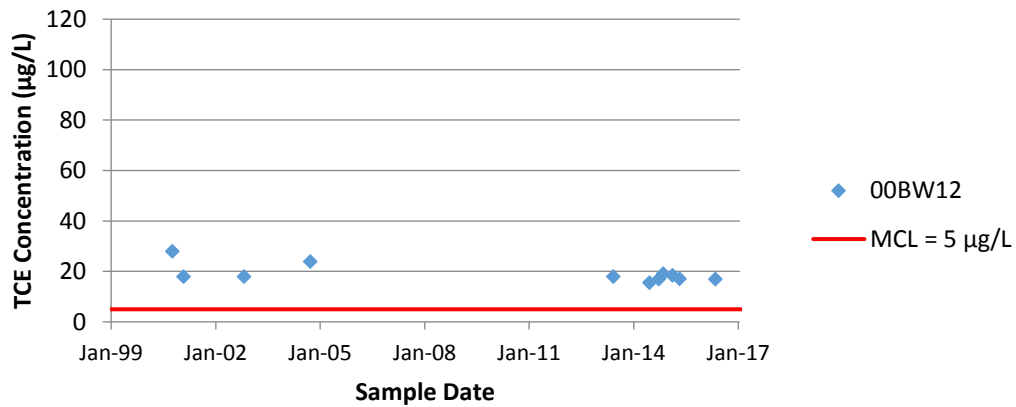


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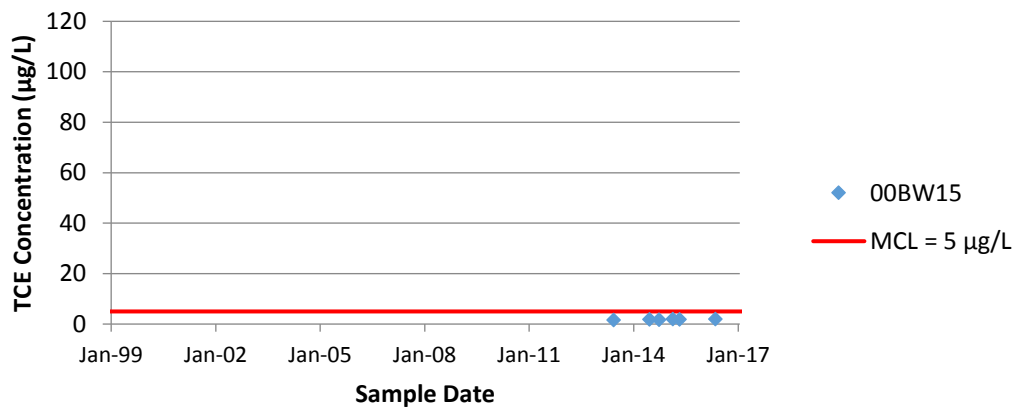


Appendix D - Monitoring Wells

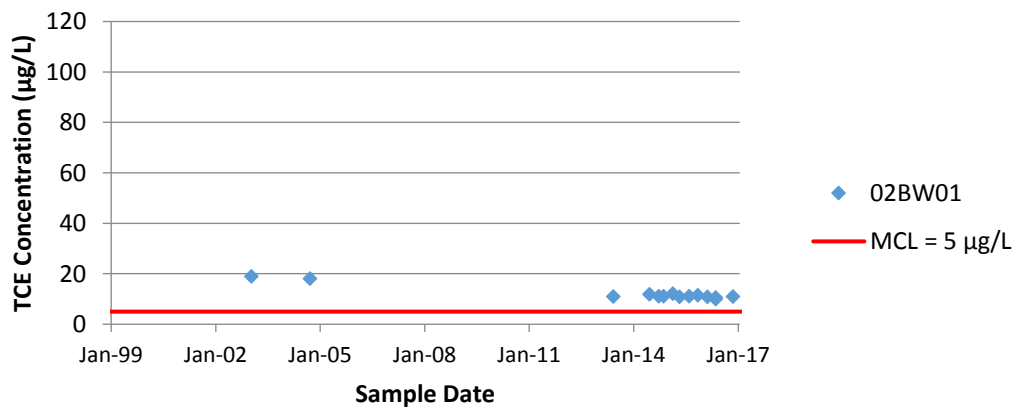
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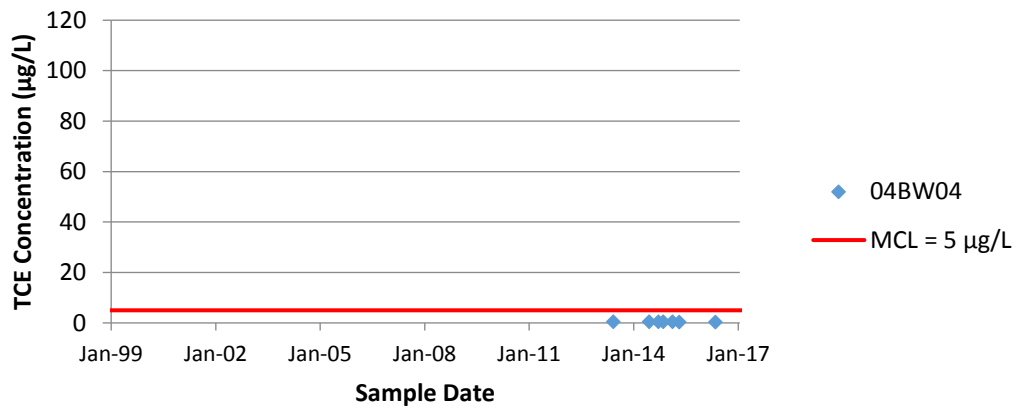


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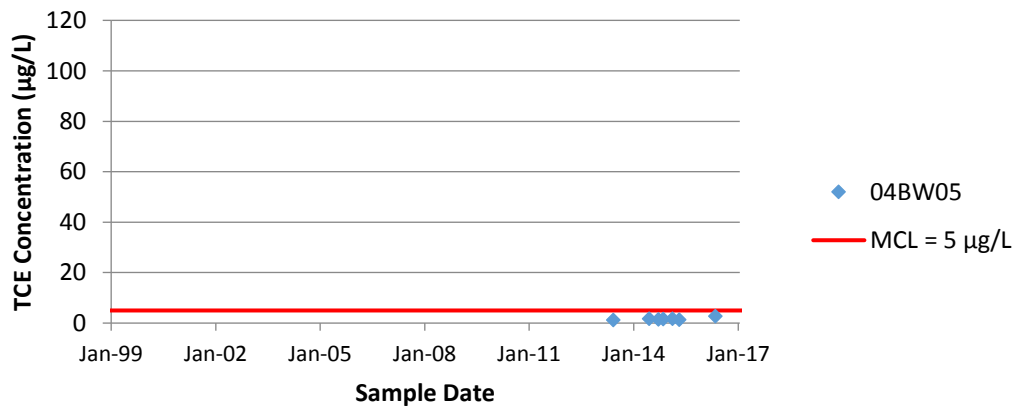


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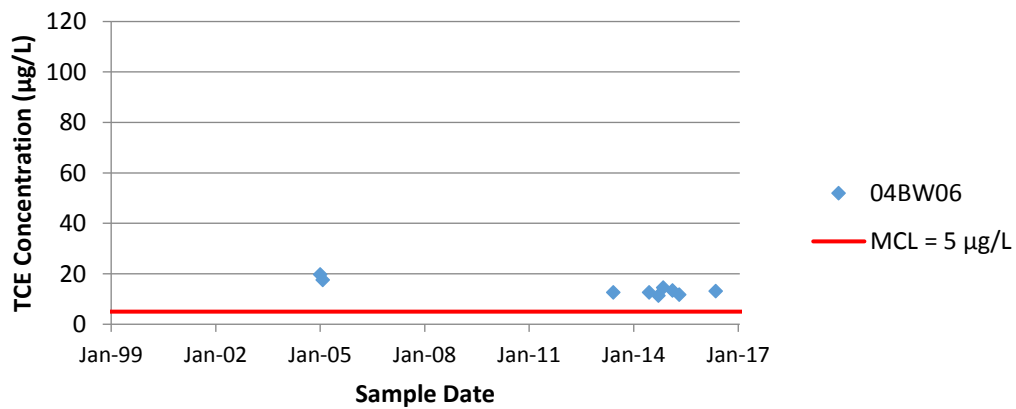
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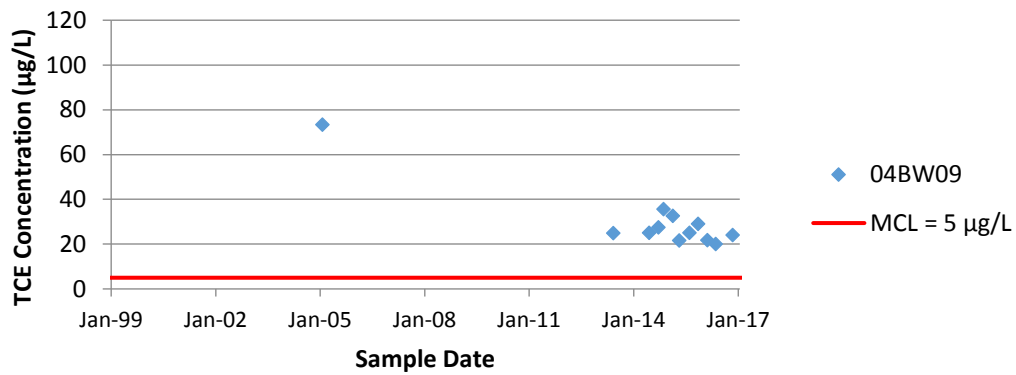


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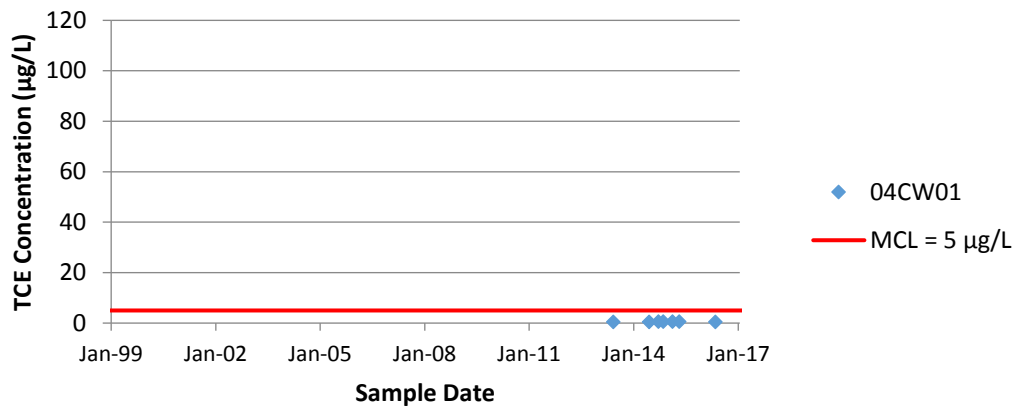


Appendix D - Monitoring Wells

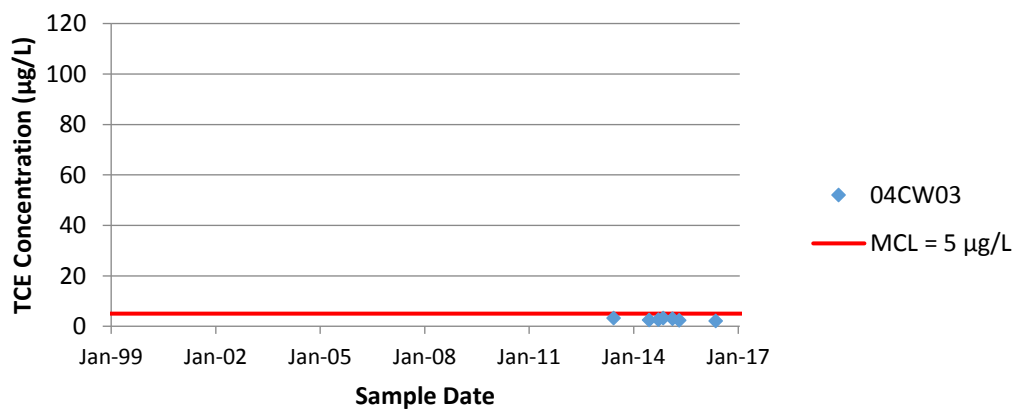
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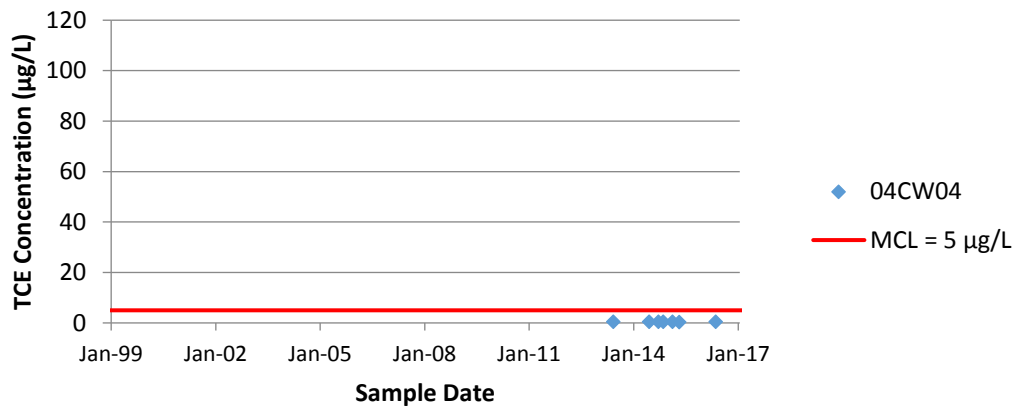


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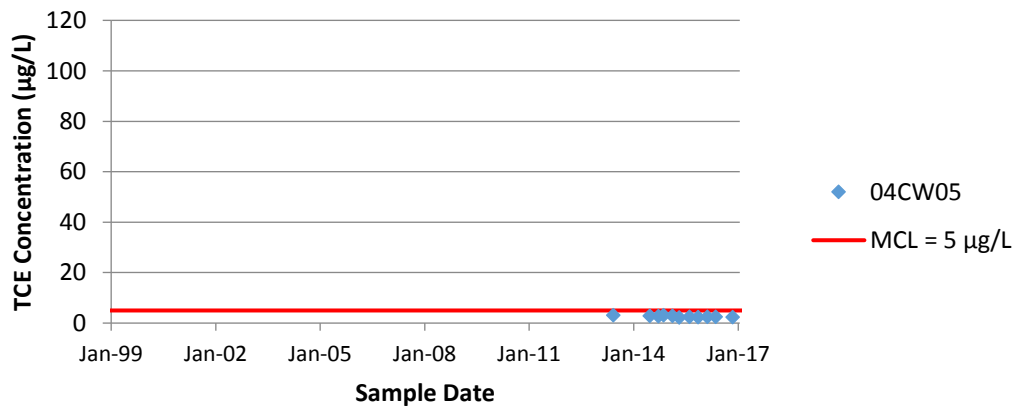


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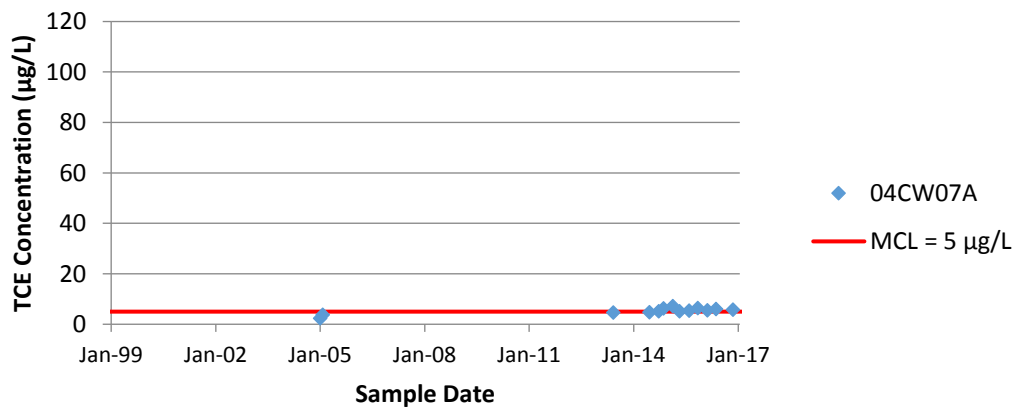
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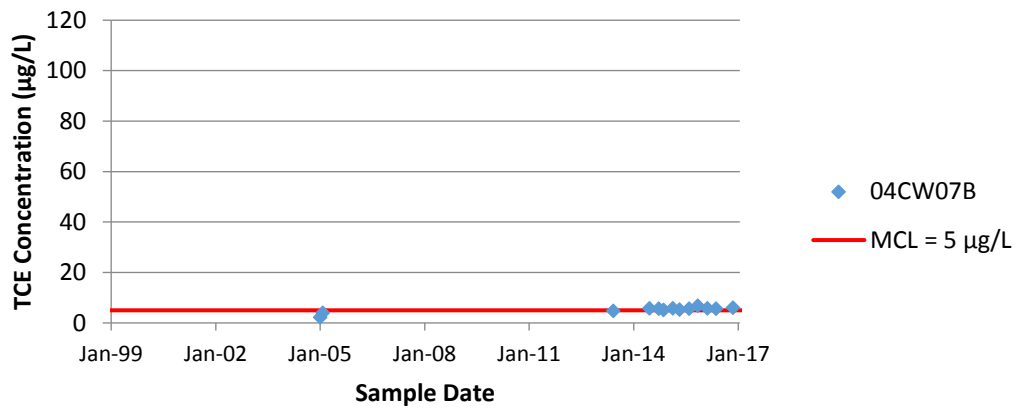


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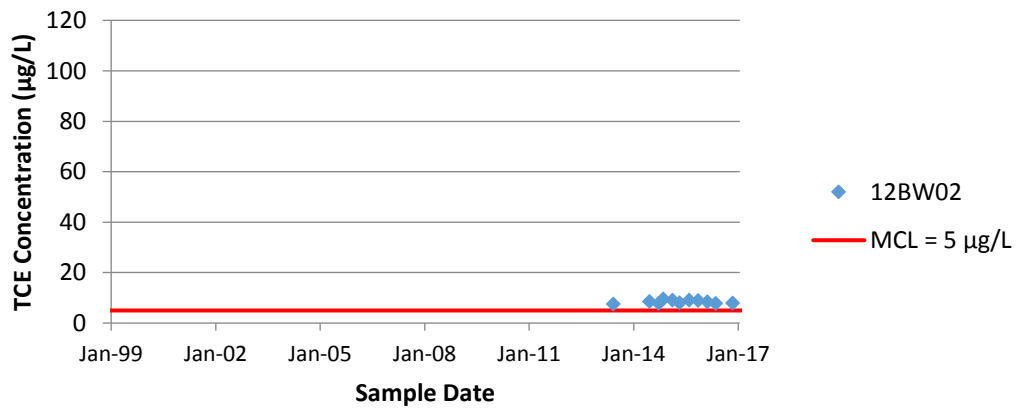


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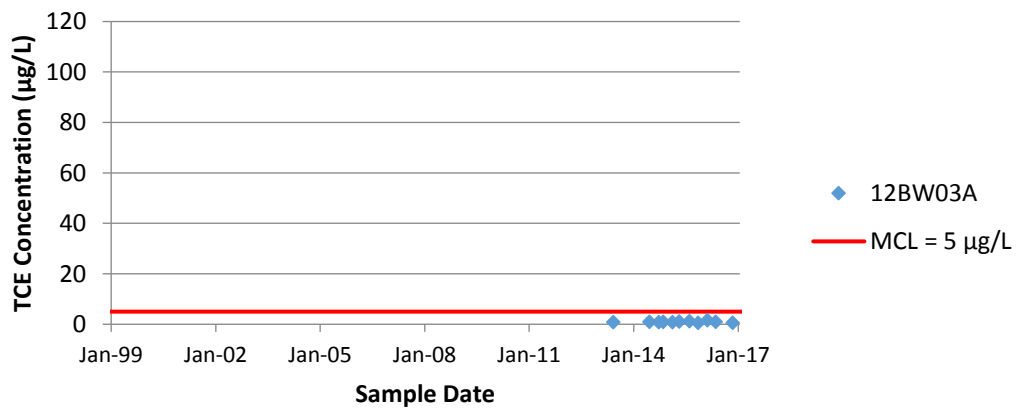
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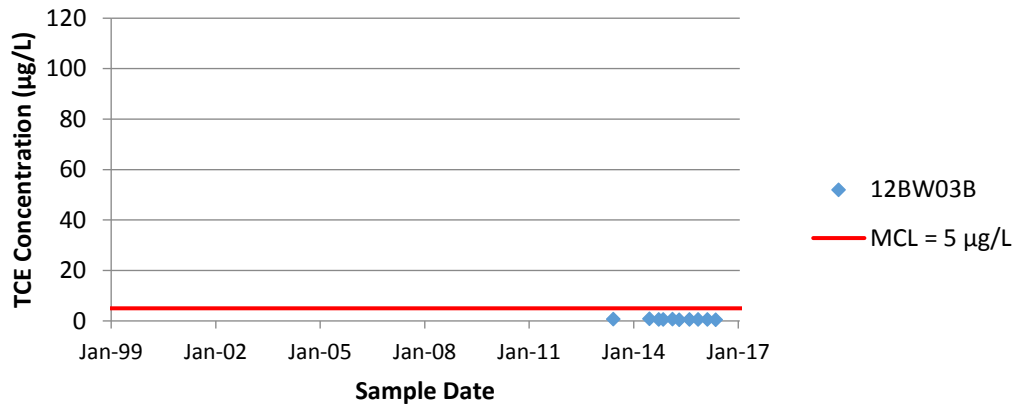


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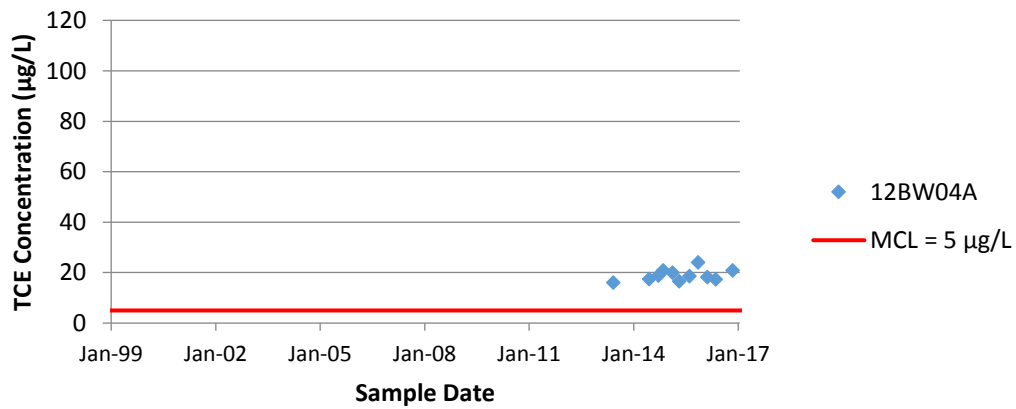


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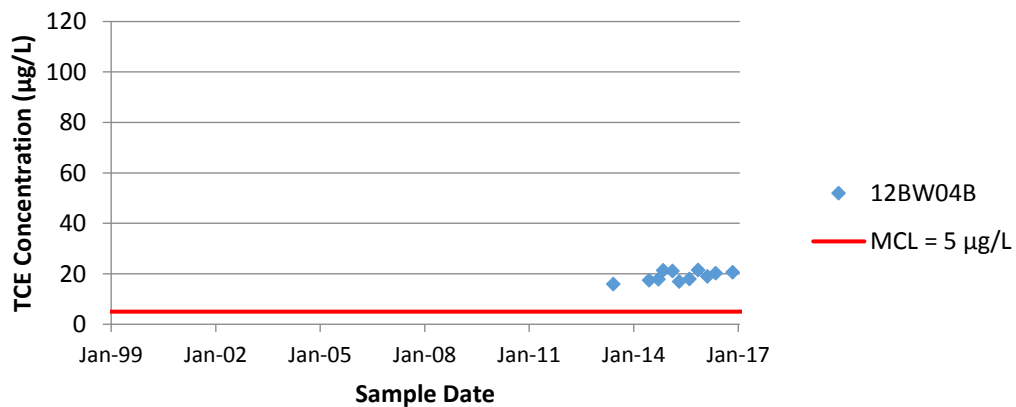
Monitoring Well 12BW03B



Monitoring Well 12BW04A

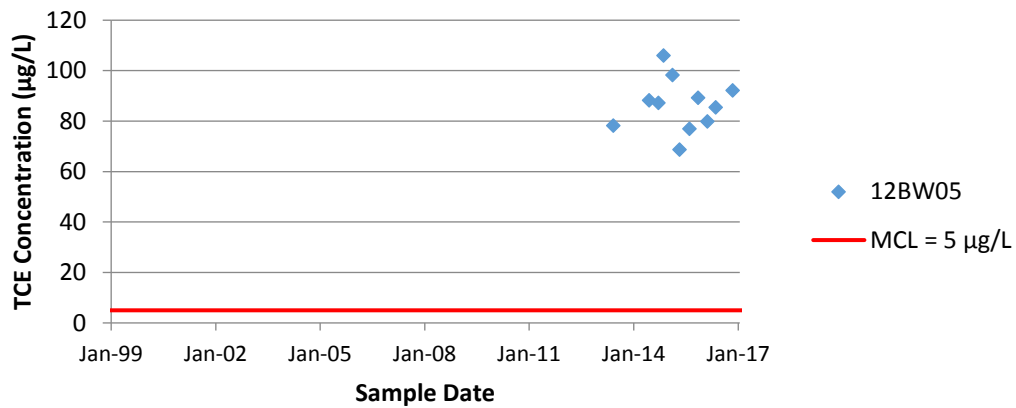


Monitoring Well 12BW04B

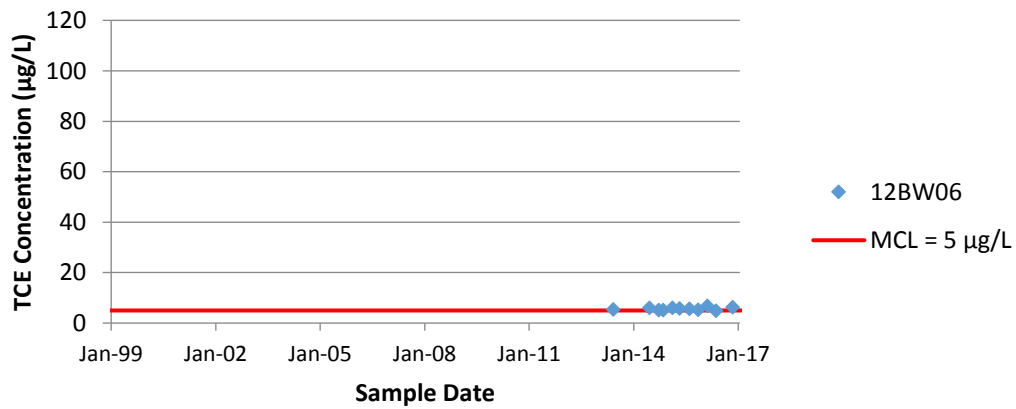


Appendix D - Monitoring Wells

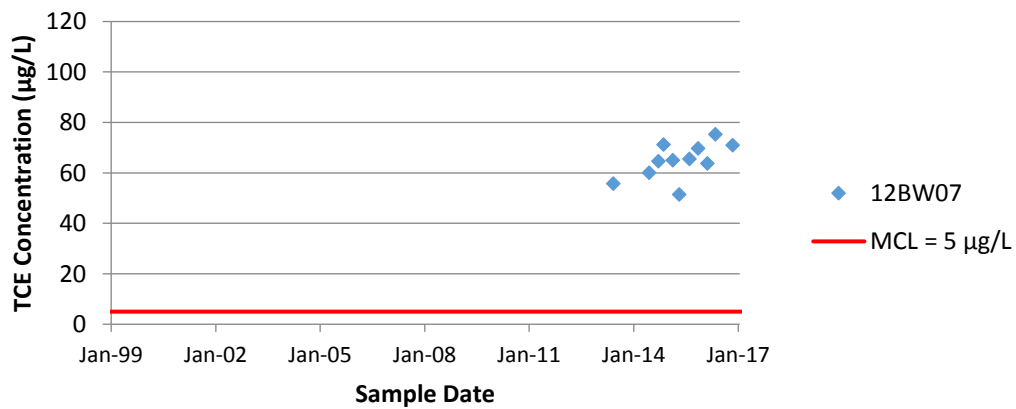
Monitoring Well 12BW05



Monitoring Well 12BW06

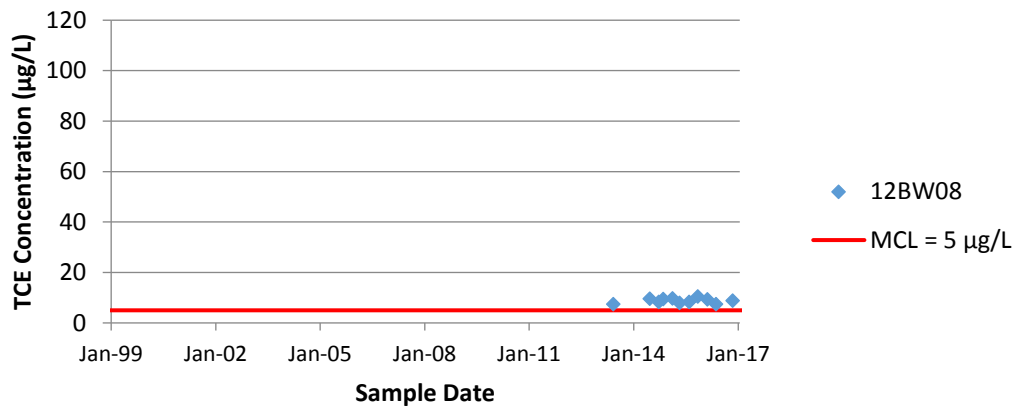


Monitoring Well 12BW07

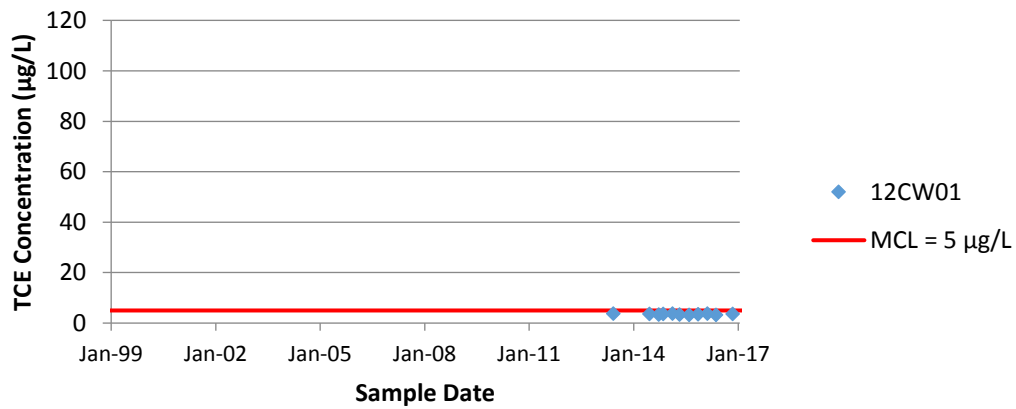


Appendix D - Monitoring Wells

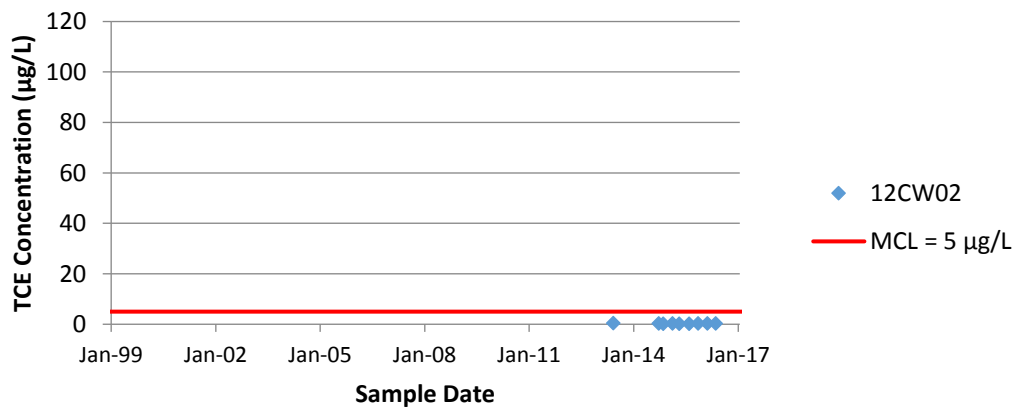
Monitoring Well 12BW08



Monitoring Well 12CW01

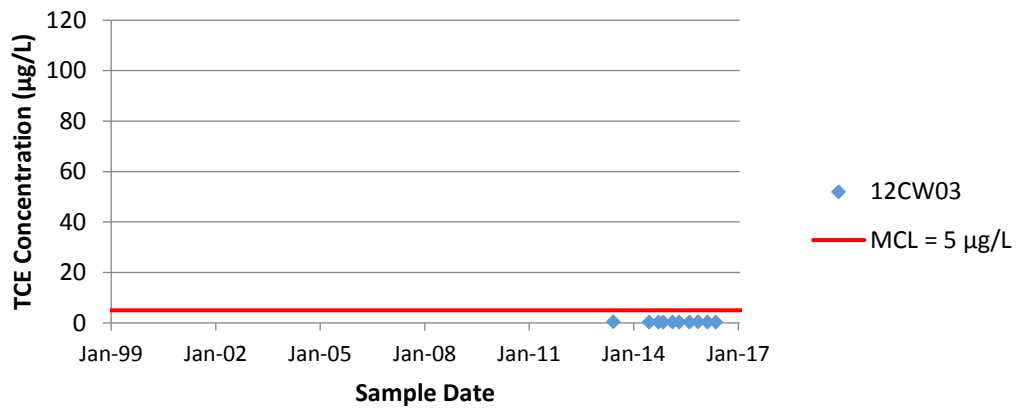


Monitoring Well 12CW02

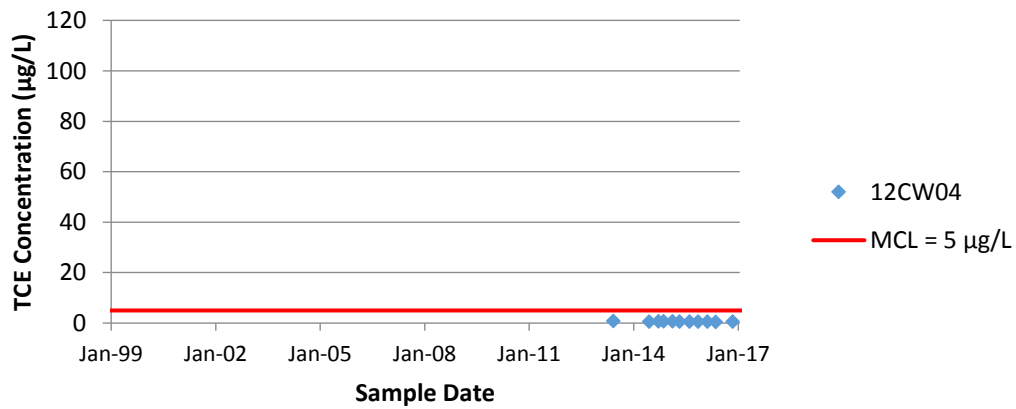


Appendix D - Monitoring Wells

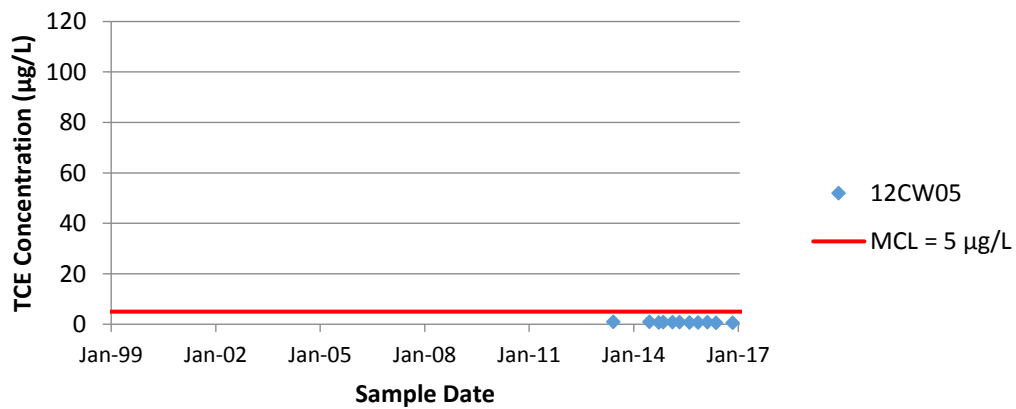
Monitoring Well 12CW03



Monitoring Well 12CW04

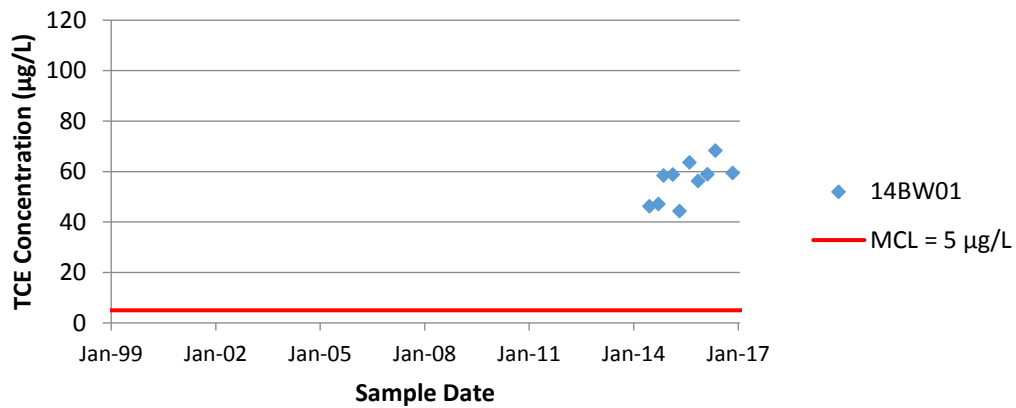


Monitoring Well 12CW05

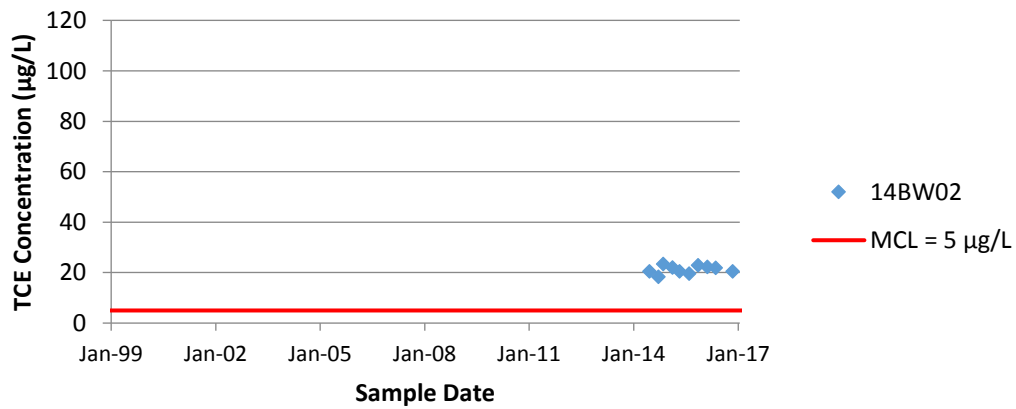


Appendix D - Monitoring Wells

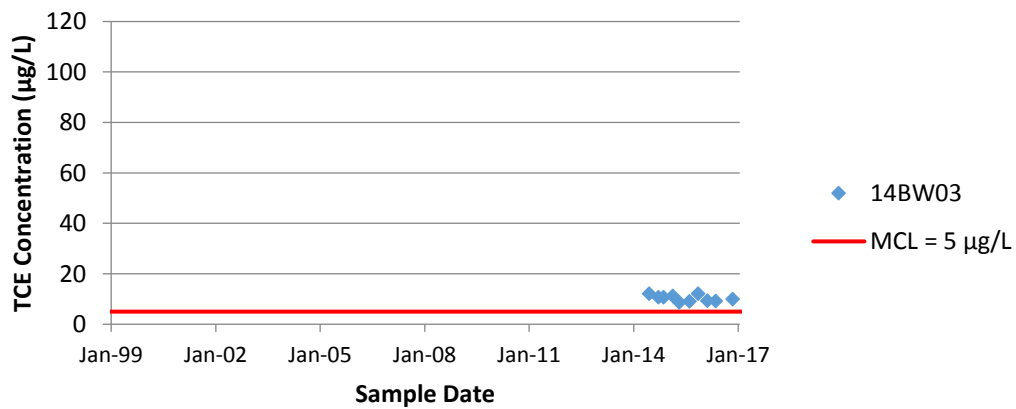
Monitoring Well 14BW01



Monitoring Well 14BW02

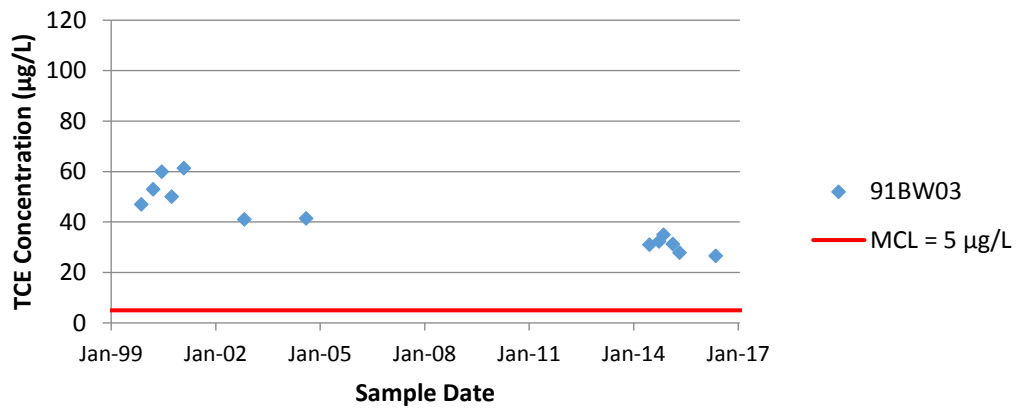


Monitoring Well 14BW03

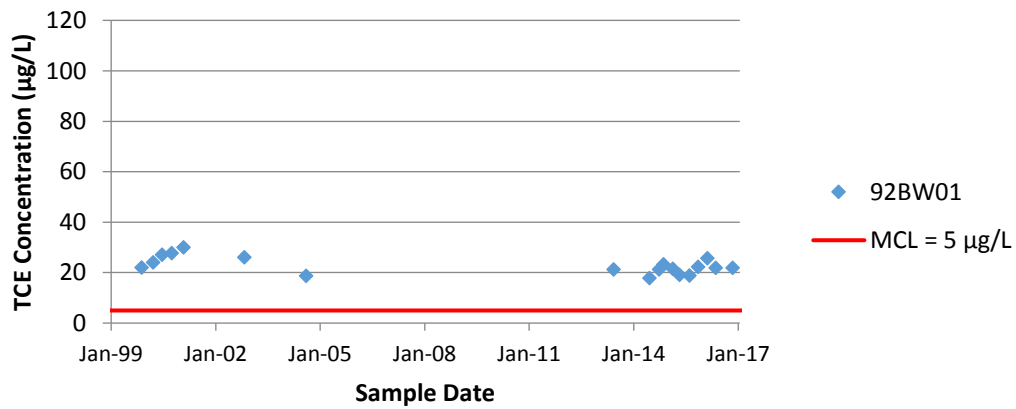


Appendix D - Monitoring Wells

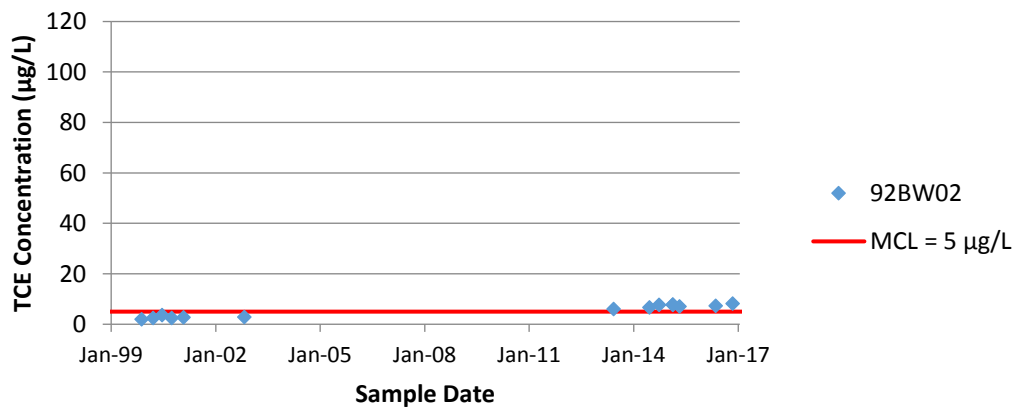
Monitoring Well 91BW03



Monitoring Well 92BW01

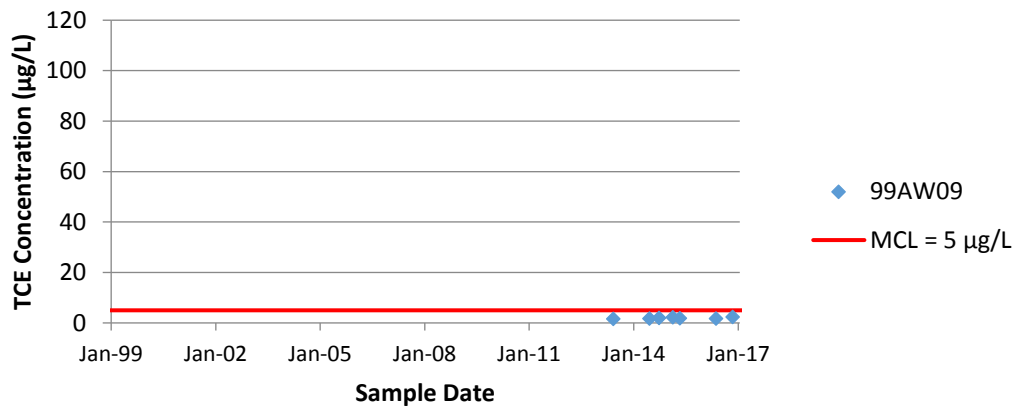


Monitoring Well 92BW02

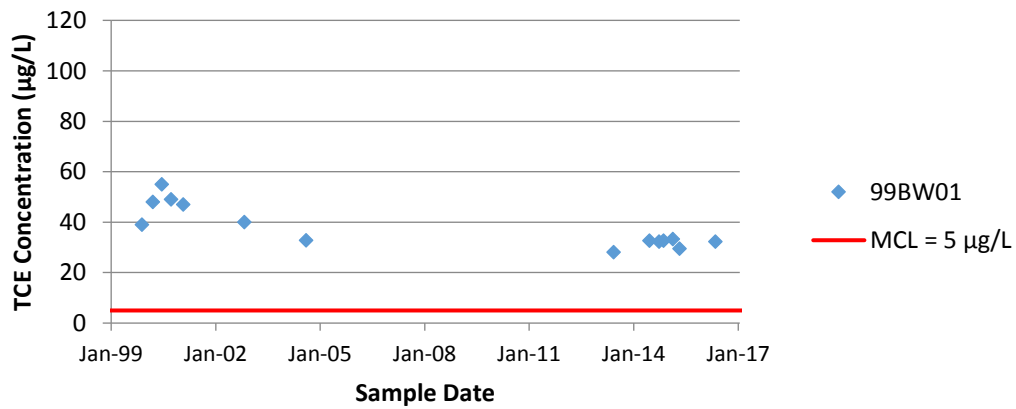


Appendix D - Monitoring Wells

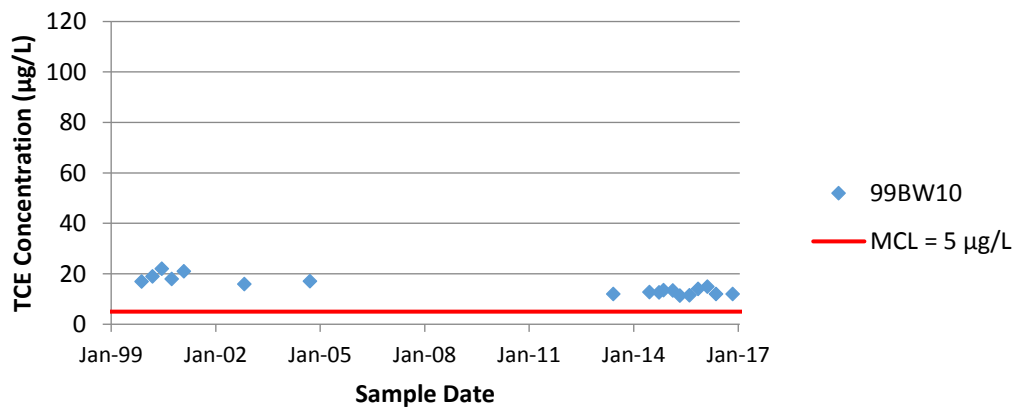
Monitoring Well 99AW09



Monitoring Well 99BW01

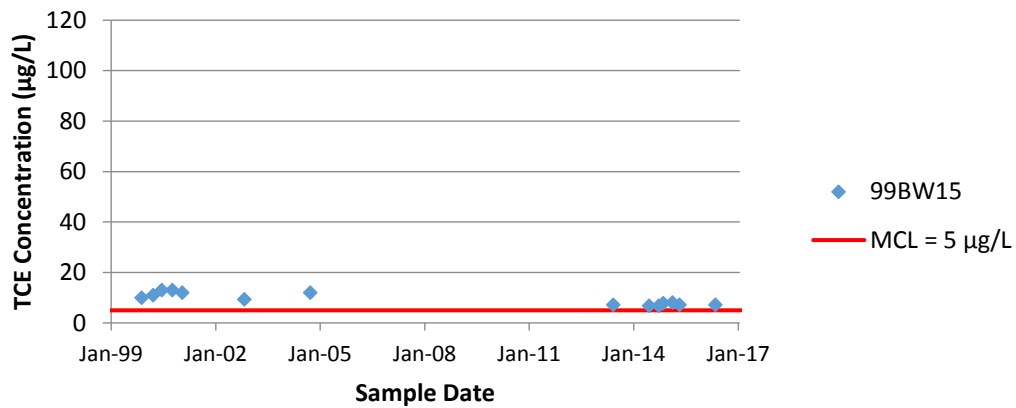


Monitoring Well 99BW10

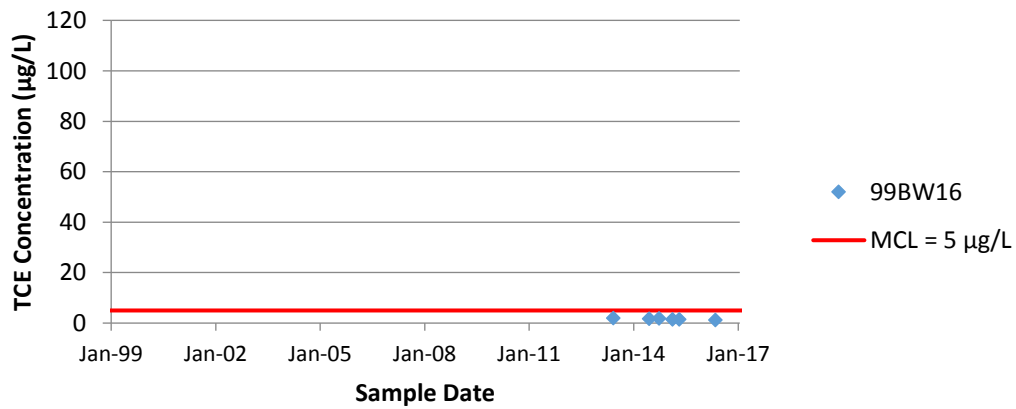


Appendix D - Monitoring Wells

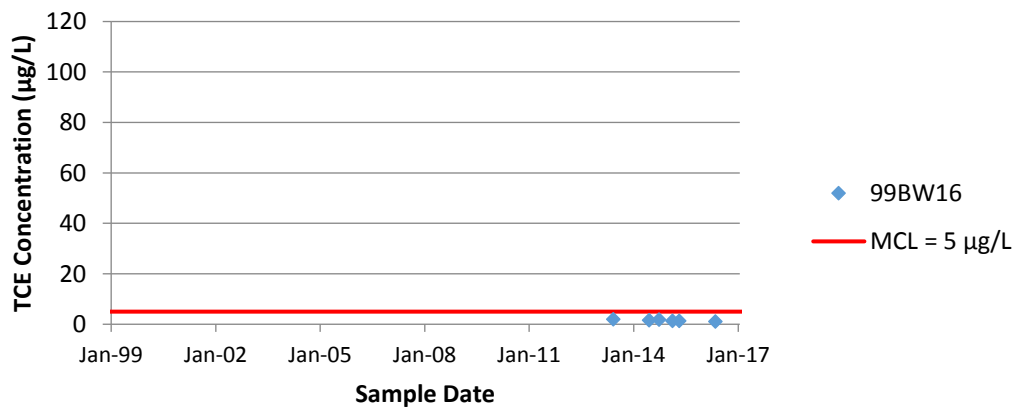
Monitoring Well 99BW15



Monitoring Well 99BW16



Monitoring Well 99BW16



APPENDIX E - Laboratory Data Packages (CD only)

APPENDIX F - Quality Control Summary Report

Final
QUALITY CONTROL SUMMARY REPORT

2016
MOSES LAKE WELLFIELD SUPERFUND SITE
GROUNDWATER MONITORING AND WHOLE HOUSE FILTER PROGRAM
MOSES LAKE, WASHINGTON

CERCLIS ID# WA988466355

Prepared by

U.S. ARMY CORPS OF ENGINEERS

SEATTLE DISTRICT

4735 East Marginal Way South

Seattle, Washington 98134



Prepared for

U.S. ENVIRONMENTAL PROTECTION AGENCY

REGION 10

1200 6th Avenue

Seattle, Washington 98101



February 17, 2016

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ACRONYMS AND ABBREVIATIONS

ADR	Automated Data Review
DOD	Department of Defense
eQAPP	Electronic Quality Assurance Project Plan
EPA	U.S. Environmental Protection Agency
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
MS	Matrix Spike
MSD	Matrix Spike Duplicate
PCB	Polychlorinated biphenyls
QAPP	Quality Assurance Project Plan
QC	Quality Control
QSM	Quality Systems Manual
RPD	Relative Percent Difference
SDG	Sample Delivery Group
TCMX	Tetrachloro-m-xylene
TOC	Total Organic Carbon
USACE	U.S. Army Corps of Engineers Seattle District
%R	Percent Recovery
mg/L	Milligrams per liter
ug/L	Micrograms per liter

1 Introduction

This Quality Control Summary Report (QCSR) presents Stage 2a and Stage 4 data validation results for samples collected during the February 2016 through November 2016 sampling period. Data validation was performed in accordance with the Final 2016 Work Plan with Quality Assurance Project Plan - for Moses Lake Wellfield Superfund Site, Moses Lake, Washington (QAPP) (USACE, March 2016), U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 5.0 (DOD QSM) (DoD, July 2013), and Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (CLPNFG) (USEPA, June 2008). Laboratory Data Consultants, Inc., an independent subcontractor to the U.S. Army Corps of Engineers, Seattle District (USACE), performed the data validation task.

This QCSR was based on the outcome of the data review and data validation performed on all laboratory reports submitted by Analytical Resources, Inc. in Tukwila, WA.

The purpose of this QCSR is to provide the project management and data end-users (1) an overview of data quality in terms of precision, accuracy, representativeness, comparability, sensitivity, and completeness, (2) specific data quality anomalies and their effects on data usability, and (3) recommendations to the extent of data usage.

Following the requirements outlined in the QAPP, samples were analyzed with analytical protocols defined in:

- Measurement of Purgeable Organic Compounds in Water by Capillary Column Gas Chromatography/Mass Spectrometry (Method 524.3) EPA 815-B-09-009, June 2009.
- Determination of 1,4-Dioxane in Drinking Water by Solid Phase Extraction and Gas Chromatography/Mass Spectrometry with Selected Ion Monitoring (Method 522) EPA-600-R-08-101, Version 1.0 September 2008
- Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (Method 8260C) Revision 3 August 2006
- Semi-Volatile Petroleum Products by Gas Chromatograph Equipped with Flame Ionization Detector (Method NWTPH-Dx)

2 Quality Control Activities

During the February 2016 through November 2016 sampling events a total of 336 samples analyzed for volatile organic compounds (VOCs), 20 samples were analyzed for 1,4-dioxane, and 18 samples were analyzed for perfluorinated alkyl acids. The sample identification, collection dates, analyses requested/performed, and validation levels and well identification numbers (IDs) are presented in the DVR attachments.

All sample results were subjected to Stage 2a data validation, which consists of an evaluation of quality control (QC) summary results for sample holding times, surrogates, matrix spike/matrix spike duplicates (MS/MSD), laboratory control sample/laboratory control sample duplicates (LCS/LCSD), method blanks, trip blanks, field blanks, equipment blanks, and field duplicate samples.

A Stage 4 evaluation of the quality control (QC) summary forms as well as initial and continuing calibrations and the raw data was performed on only private drinking water wells.

Based on the data review, the chain-of-custody (COC) forms and sample receipt forms submitted in the analytical reports were clear and complete in all cases. Cooler temperatures were within the $4\pm 2^{\circ}\text{C}$ criteria.

3 Data Quality Assessment

Based on the outcomes of the data validation, the following sections evaluate if the quality of the data collected during this sampling event achieves the data quality objectives (DQOs) specified in the QAPP. Data quality was determined based on various quality measures commonly referred to as data quality indicators (DQIs) - precision, accuracy/bias, representativeness, comparability, completeness and sensitivity (quantitation limits).

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3.1 Data Quality Indicators

Data quality indicators are defined in the following sections. Quality control (QC) parameters evaluated in the data review/validation and the corresponding DQIs are presented as attachments to the DVRs. Definitions of the data quality indicators are provided as follows:

3.1.1 Precision

Precision is defined as the degree of mutual agreement among independent measurements as the result of repeated application of the same process under similar conditions. Analytical precision is evaluated via the relative percent difference (RPD) values of matrix spike/matrix spike duplicate (MS/MSD) and laboratory control sample/laboratory control sample duplicate (LCS/LCSD). The RPD values of field duplicate analyses represent the combined precision of sample collection and analysis procedures, as well as sample heterogeneity.

3.1.2 Accuracy

Accuracy is a statistical measurement of correctness and includes components of random and systematic errors. It is quantified as the degree of agreement between a measurement with a known reference. Analytical accuracy is evaluated via the percent recovery (%R) values of initial and continuing calibration (percent difference [%D] or percent drift [%Df]), internal standards, surrogate spikes, MS/MSD, LCS/LCSD, in conjunction with method blank, trip blank, and field blank results. Results of blanks assist in identifying the type and magnitude of effects contributed to the system error introduced via field and/or laboratory procedures.

3.1.3 Representativeness

Representativeness is the level of confidence that the analytical data reflects the actual field condition. Representativeness is ensured by maintaining sample integrity during collection, preparation, and analysis. The evaluation of associated method, trip, and field blanks also assists in identifying artifacts that may skew the representativeness of the samples.

3.1.4 Comparability

Comparability is the confidence with which one data set can be compared to another data set. Using standard methods throughout the data generation processes ensures the comparability of data generated in separate sampling days or events.

3.1.5 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. Data is complete and valid if it meets all acceptance criteria including accuracy, precision, and any other criteria specified by the particular analytical method being used. Four calculations of completeness are specified in the project QAPP.

Contract compliance completeness falling below the target level may result in the issuance of a corrective action request for the project laboratory. Contract compliance failures are usually the result of lack of corrective action. The impact of contract compliance deficiencies varies with the specific correction action failure and is determined during the data usability assessment.

$$\text{Contract Completeness} = \frac{\# \text{ contract compliant results} \times 100\%}{\# \text{ results reported}}$$

Analytical completeness is used to assess the laboratories ability to generate high quality data. This may be a reflection of contract compliance or other issues and requires detail assessment of the cause for qualification during data usability assessment.

$$\text{Analytical Completeness} = \frac{\# \text{ unqualified results} \times 100\%}{\# \text{ results reported}}$$

(Estimated results are considered as useable for project decision making.)

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Technical completeness is a measure which reflects the laboratories ability to produce usable results. The impact of failure to meet this goal will results in serious impacts to data usability (rejected results) and may result in termination of the contract.

$$\text{Technical Completeness} = \frac{\# \text{ useable results}^{\dagger}}{\# \text{ results reported}} \times 100\%$$

Field sampling completeness reflects whether the samples planned for collection were actually acquired.

$$\text{Field Sampling Completeness} = \frac{\# \text{ samples collected}}{\# \text{ samples planned}} \times 100\%$$

The minimum goals for completeness are as follows: 1) Contract = 100%, 2) Analytical = 90% or greater, 3) Technical = 90% or greater and 4) Field = 100%. The goal for holding times is 100%. Estimated results are treated as usable results for technical completeness. These are considered minimum goals.

3.1.6 Sensitivity

Sensitivity depicts the level of ability an analytical system (i.e., sample preparation and instrumental analysis) of detecting a target component in a given sample matrix with a defined level of confidence. Factors affecting the sensitivity of an analytical system include: analytical system background (e.g., laboratory artifact or method blank contamination), sample matrix (e.g., mass spectrometry ion ratio change, co-elution of peaks, or baseline elevation), instrument instability, and field procedures (including sample transport).

To evaluate if the analytical sensitivity achieved the project expectation, sample-specific project quantitation limits (PQLs) were compared against the reporting limit (RL) goals set forth in the QAPP. In addition, sample results were compared to detections of target analytes in method blanks, and trip blanks to identify potential effects of laboratory background and field procedures on sensitivity.

3.2 Data Quality Indicator Evaluation

The following subsections present an evaluation of the data. The assessment is intended to reconcile the existing data quality with the project DQOs. Assessment is presented herein in terms of the data quality indicators. The qualified data are presented in the DVR attachments.

DQIs for VOC data met the project goals with the following exceptions:

Precision – No RPDs were outside criteria.

Accuracy/Bias – The following QC outliers indicate potential bias of VOC data:

- May 2016: One MS/MSD pairs exceeded the %R acceptance criteria for trichloroethene. No data were qualified due to low or high %R when the associated sample concentration was significantly greater than the spiked concentration.

MS/MSD and LCS/LCSD outlier reports can be found in the DVR attachments.

Representativeness – The following QC outliers indicate potential impact on sample representativeness:

- May 2016: Trichloroethene was detected in one trip blank. The trichloroethene results in samples 1605D99BW12 and 1605N99BW12 were qualified as non-detected (U) due to trip blank contamination.
- November 2016: Trichloroethene was detected in two trip blanks. The trichloroethene results in samples 1611 N 12CW02, 1611 NCW03, 1611 N91 BW04, and 1611 N99AW01 were qualified as non-detected (U) due to trip blank contamination.

Field QC sample data can be found in the DVR attachments.

Completeness – The following list represents completeness outliers for the VOC data:

February 2016

Appendix F

- The contract completeness level attained for the field samples was 99.0 percent. Due to quality control exceedances, 5 out of 480 results were qualified as estimated. Percent contract compliance does not consider surrogate outliers or MS/MSD outliers when associated LCS recoveries are in control.
- The analytical completeness level attained for the field samples was 99.0 percent. Due to quality control exceedances, 5 out of 480 results were qualified as estimated, or non-detected. Holding time completeness was 100%.
- The technical completeness, which included all QC parameters, attained for the field samples was 100 percent. No results were rejected.

May 2016:

- The contract completeness level attained for the field samples was 97.6 percent. Due to quality control exceedances, 36 out of 1524 results were qualified as estimated. Percent contract compliance does not consider surrogate outliers or MS/MSD outliers when associated LCS recoveries are in control.
- The analytical completeness level attained for the field samples was 97.6 percent. Due to quality control exceedances, 36 out of 1524 results were qualified as estimated, or nondetected. Holding time completeness was 100%.
- The technical completeness, which included all QC parameters, attained for the field samples was 100 percent. No results were rejected.

August 2016:

- The contract completeness level attained for the field samples was 97.5 percent. Due to quality control exceedances, 4 out of 160 results were qualified as estimated. Percent contract compliance does not consider surrogate outliers or MS/MSD outliers when associated LCS recoveries are in control.
- The analytical completeness level attained for the field samples was 97.5 percent. Due to quality control exceedances, 4 out of 160 results were qualified as estimated, or non-detected. Holding time completeness was 100%.
- The technical completeness, which included all QC parameters, attained for the field samples was 100 percent. No results were rejected.

November 2016

- The contract completeness level attained for the field samples was 98.2 percent. Due to quality control exceedances, 10 out of 544 results were qualified as estimated. Percent contract compliance does not consider surrogate outliers or MS/MSD outliers when associated LCS recoveries are in control.
- The analytical completeness level attained for the field samples was 98.2 percent. Due to quality control exceedances, 10 out of 544 results were qualified as estimated, or non-detected. Holding time completeness was 100%.
- The technical completeness, which included all QC parameters, attained for the field samples was 100 percent. No results were rejected.

See the DVRs for full completeness reports of each sampling event.

Sensitivity – The target quantitation limits generally meet QAPP requirements. The following exception was noted:

- Target compounds detected below the limit of quantitation (flagged J by the laboratory) should be considered estimated.

Reporting limit outliers are presented in the DVR attachments.

4 Performance Evaluation Samples

One PE sample (15MLW11PE1) was submitted to the laboratory and analyzed for the purpose of evaluating the accuracy of the performance of the measurement or analytical procedures used by the laboratory.

5 Data Usability

The overall quality of the data is acceptable. All project DQIs were met with the exception of those noted above. All sample preservation requirements and all holding times were met. All instrument performance checks and calibrations were performed as required. All calibration factors and internal standard percent recoveries were within acceptance criteria. All surrogate, MS/MSD and LCS/LCSD percent recoveries and RPDs were within acceptance criteria with the exception described in Section 3.2.1. Method blanks, trip blanks, and field blanks were performed at the required frequency. Field duplicates were collected at the required frequency and the precision was considered acceptable. Therefore, all data except those identified above are considered usable with consideration of their data review qualifiers.

6 References

DoD, 2010, Department of Defense Quality Systems Manual for Environmental Laboratories, Version 5.0, July 2013.

EPA, 2008, Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review, USEPA-540-R-08-01, Washington, D.C.

EPA, 2009, Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use, January 2009, EPA 540-R-08-005, Washington, D.C.

Laboratory Data Consultants, Inc., 2006, Automated Data Review, Version 1.5.0.160.

USACE. 2016. Final 2016 Work Plan with Quality Assurance Project Plan. Groundwater Monitoring and Whole-House Filter Program for Moses Lake Wellfield Superfund Site. Former Larson AFB. Moses Lake, Washington. Original December 3, 2015. Final update March 25, 2016.

EPA, 2009, Measurement of Purge able Organic Compounds in Water by Capillary Column Gas Chromatography/Mass Spectrometry: Method 524.3 Version 1, June 2009. USEPA-815-B-09-009. Cincinnati, OH

APPENDIX G – Data Validation Report (CD only)

APPENDIX H – Washington Department of Ecology - New Private Well Query



DEPARTMENT OF
ECOLOGY
State of Washington

WATER WELL REPORT

Original & 1st copy - Ecology, 2nd copy - owner, 3rd copy - driller

Construction/Decommission ("x" in circle)

☒ Construction

☐ Decommission ORIGINAL INSTALLATION

Notice of Intent Number

PROPOSED USE: ☒ Domestic ☐ Industrial ☐ Municipal	
☐ DeWater ☐ Irrigation ☐ Test Well ☐ Other	
TYPE OF WORK: Owner's number of well (if more than one) _____	
☒ New well ☐ Reconditioned Method: ☐ Dug ☐ Bored ☐ Driven	
☐ Deepened ☐ Cable ☒ Rotary ☐ Jetted	
DIMENSIONS: Diameter of well <u>6</u> inches, drilled <u>140</u> ft.	
Depth of completed well <u>140</u> ft.	
CONSTRUCTION DETAILS	
Casing ☒ Welded <u>6</u> " Diam. from <u>4.3</u> ft. to <u>110</u> ft.	
Installed: ☐ Liner installed _____ " Diam. from _____ ft. to _____ ft.	
☐ Threaded _____ " Diam. From _____ ft. to _____ ft.	
Perforations: ☐ Yes ☒ No	
Type of perforator used _____	
SIZE of perfs _____ in. by _____ in. and no. of perfs _____ from _____ ft. to _____ ft.	
Screens: ☐ Yes ☒ No ☐ K-Pac Location _____	
Manufacturer's Name _____	
Type _____ Model No. _____	
Diam. _____ Slot size _____ from _____ ft. to _____ ft.	
Diam. _____ Slot size _____ from _____ ft. to _____ ft.	
Gravel/Filter packed: ☐ Yes ☒ No Size of gravel/sand _____	
Materials placed from _____ ft. to _____ ft.	
Surface Seal: ☒ Yes ☐ No To what depth? <u>18</u> ft.	
Material used in seal <u>Dry Bentonite</u>	
Did any strata contain unusable water? ☒ Yes ☐ No	
Type of water? <u>Surface</u> Depth of strata <u>34'-42', 68'-84'</u>	
Method of sealing strata off <u>Cased</u>	
PUMP: Manufacturer's Name _____	
Type: _____ H.P. _____	
WATER LEVELS: Land-surface elevation above mean sea level _____ ft.	
Static level <u>36</u> ft. below top of well Date <u>5/6/15</u>	
Artesian pressure _____ lbs. per square inch Date _____	
Artesian water is controlled by _____ (cap, valve, etc.)	
WELL TESTS: Drawdown is amount water level is lowered below static level	
Was a pump test made? ☐ Yes ☒ No If yes, by whom? _____	
Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.	
Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.	
Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.	
Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)	
Time _____ Water Level _____ Time _____ Water Level _____ Time _____ Water Level _____	
Date of test _____	
Bailer test _____ gal./min. with _____ ft. drawdown after _____ hrs.	
Airtest <u>20</u> gal./min. with stem set at <u>138</u> ft. for <u>2</u> hrs.	
Artesian flow _____ g.p.m. Date <u>5/6/15</u>	
Temperature of water _____ Was a chemical analysis made? ☐ Yes ☒ No	

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

☐ Driller ☐ Engineer ☒ Trainee Name (Print) Cole

Driller/Engineer/Trainee Signature D. Cole

Driller or trainee License No. 3165T

IF TRAINEE: Driller's License No. 1267

Driller's Signature: Phil Manton

CURRENT

Notice of Intent No. WE 20147

Unique Ecology Well ID Tag No. B#W097

Water Right Permit No. NO

Property Owner Name (b) (6)

Well Street Address _____

City Moses Lake County Grant

Location SW 1/4-1/4 SW 1/4 Sec 8 Twn 19 R 28

(s, t, r Still REQUIRED)

EWM ☒
Or
WWM ☐

Lat/Long Lat Deg _____ Lat Min/Sec _____

Long Deg _____ Long Min/Sec _____

Tax Parcel No. (Required) 12 0919000

CONSTRUCTION OR DECOMMISSION PROCEDURE		
Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information. (USE ADDITIONAL SHEETS IF NECESSARY.)		
MATERIAL	FROM	TO
Topsoil	0'	1'
Cobbles & Gravel	1'	28'
Gravel	28'	34'
Gravel & H ₂ O	34'	40'
Gravel H ₂ O & Brown Clay	40'	42'
Brown Clay	42'	68'
Tan Soft Clay & Sand	68'	84'
H ₂ O	84'	91'
Sticky Brown Clay	91'	102'
Gray Clay	102'	106'
Brown Clay	106'	108'
Brown Basalt & Brown Clay	108'	140'
Brown Basalt Soft H ₂ O		
RECEIVED		
MAY 18 2015		
Department of Ecology Eastern Regional Office		
Start Date <u>5/6/15</u> Completed Date <u>5/6/15</u>		

Appendix H



WATER WELL REPORT

Original & 1st copy - Ecology, 2nd copy - owner, 3rd copy - driller

Construction/Decommission ("x" in circle)

☒ Construction☐ Decommission ORIGINAL INSTALLATION

Notice of Intent Number

PROPOSED USE: ☒ Domestic ☐ Industrial ☐ Municipal
☐ DeWater ☐ Irrigation ☐ Test Well ☐ Other

TYPE OF WORK: Owner's number of well (if more than one) _____
☒ New well ☐ Reconditioned Method: ☐ Dug ☒ Bored ☐ Driven
☐ Deepened ☐ Cable ☒ Rotary ☐ Jetted

DIMENSIONS: Diameter of well 6 inches, drilled 240 ft.
 Depth of completed well 240 ft.

CONSTRUCTION DETAILS
 Casing ☒ Welded 6 " Diam. from 12 ft. to 118 ft.
 Installed: ☒ Liner installed 4 " Diam. from 20 ft. to 240 ft.
☐ Threaded _____ " Diam. From _____ ft. to _____ ft.

Perforations: ☒ Yes ☐ No
 Type of perforator used Saw cut
 SIZE OF perfs 1/4 in. by 7 in. and no. of perfs 90 from 200 ft. to 240 ft.

Screens: ☐ Yes ☒ No ☐ K-Pac Location _____
 Manufacturer's Name _____
 Type _____ Model No. _____
 Diam. _____ Slot size _____ from _____ ft. to _____ ft.
 Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Gravel/Filter packed: ☐ Yes ☒ No Size of gravel/sand _____
 Materials placed from _____ ft. to _____ ft.

Surface Seal: ☒ Yes ☐ No To what depth? 18 ft.
 Material used in seal Dry Bentonite
 Did any strata contain unusable water? ☒ Yes ☐ No
 Type of water? Surface Depth of strata 48' - 55'
 Method of sealing strata off Cased off

PUMP: Manufacturer's Name _____
 Type: _____ H.P. _____

WATER LEVELS: Land-surface elevation above mean sea level _____ ft.
 Static level 63 ft. below top of well Date 2/10/16
 Artesian pressure _____ lbs. per square inch Date _____
 Artesian water is controlled by _____ (cap, valve, etc.)

WELL TESTS: Drawdown is amount water level is lowered below static level
 Was a pump test made? ☐ Yes ☒ No If yes, by whom? _____
 Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.
 Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.
 Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.
 Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

 Date of test _____
 Bailer test _____ gal./min. with _____ ft. drawdown after _____ hrs.
 Airtest 60 gal./min. with stem set at 238 ft. for 2 hrs.
 Artesian flow _____ g.p.m. Date 2/10/16
 Temperature of water _____ Was a chemical analysis made? ☐ Yes ☒ No

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

☒ Driller ☐ Engineer ☐ Trainee Name (Print) D. Cole
 Driller/Engineer/Trainee Signature D. Cole
 Driller or trainee License No. 3165
 IF TRAINEE: Driller's License No. _____
 Driller's Signature: _____

CURRENT

Notice of Intent No. W362415
 Unique Ecology Well ID Tag No. BEU 598
 Water Right Permit No. NO
 Property Owner Name (b) (6)
 Well Street Address _____
 City Moses Lake County Grant
 Location NE 1/4-1/4 NW 1/4 Sec 8 Twn 19 R 28 EWM ☒
 (s, t, r Still REQUIRED) Or VVW ☐
 Lat/Long Lat Deg _____ Lat Min/Sec _____
 Long Deg _____ Long Min/Sec _____
 Tax Parcel No. (Required) 120664 110

CONSTRUCTION OR DECOMMISSION PROCEDURE
 Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information. (USE ADDITIONAL SHEETS IF NECESSARY.)

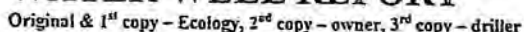
MATERIAL	FROM	TO
TOPSOIL	0	1'
Cobbles	1'	24'
Gravel	24'	48'
Gravel & H ₂ O	48'	53'
Gravel & Brown clay	53'	55'
H ₂ O	55'	94'
Brown clay Dry	94'	115'
Tan clay	115'	125'
Gray clay STICKY	125'	131'
Brown Basalt	131'	153'
Brown clay	153'	157'
Gray Basalt	157'	226'
Red Basalt Covey	226'	237'
Gray Basalt Hard	237'	240'
H ₂ O Brown Broken Basalt		
Black Basalt H ₂ O		

RECEIVED

APR 26 2016

 Department of Ecology
 Eastern Regional Office

 Start Date 2/10/15 Completed Date 2/10/15

☒ Construction☐ Decommission *ORIGINAL INSTALLATION*

Notice of Intent Number

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

CURRENT

Notice of Intent No.

Unique Ecology Well ID Tag No.

Water Right Permit No.

Property Owner Name

Well Street Address

City Moses Lake County Grant

Location SW 1/4-1/4 SW 1/4 Sec 9 Twn 19 R 28
(s, t, r Still REQUIRED)

EWM ☒
Or
WWM ☐

Lat/Long Lat Deg Lat Min/Sec

Long Deg _____ Long Min/Sec _____

Tax Parcel No. (Required) 313487000

[illegible]



WATER WELL REPORT

Original & 1st copy - Ecology, 2nd copy - owner, 3rd copy - drillerDEPARTMENT OF
ECOLOG
State of Washington

Construction/Decommission ("x" in circle)

☒ Construction☐ Decommission *ORIGINAL INSTALLATION*

Notice of Intent Number _____

PROPOSED USE: ☐ Domestic ☐ Industrial ☒ Municipal
☐ DeWater ☐ Irrigation ☐ Test Well ☐ Other

TYPE OF WORK: Owner's number of well (if more than one) _____

☒ New well ☐ Reconditioned Method: ☐ Dug ☐ Bored ☐ Driven
☐ Deepened ☐ Cable ☒ Rotary ☐ Jetted

DIMENSIONS: Diameter of well 20 inches, drilled 70.5 ft.Depth of completed well 72 ft.

CONSTRUCTION DETAILS

Casing ☒ Welded 20" Diam. from +1.5 ft. to 37.5 ft.Installed: ☐ Liner installed _____ " Diam. from _____ ft. to _____ ft.☐ Threaded _____ " Diam. From _____ ft. to _____ ft.Perforations: ☐ Yes ☒ No

Type of perforator used _____

SIZE of perfs _____ in. by _____ in. and no. of perfs _____ from _____ ft. to _____ ft.

Screens: ☒ Yes ☐ No ☐ K-Pac Location _____Manufacturer's Name Alloy Machine WorksType S.S Model No. Pipe SizeDiam. 18" Slot size 100 from 39.2 ft. to 60.4 ft.Diam. 18" Slot size sump from 60.4 ft. to 70.5 ft.Gravel/Filter packed: ☐ Yes ☒ No Size of gravel/sand _____

Materials placed from _____ ft. to _____ ft.

Surface Seal: ☒ Yes ☐ No To what depth? 18 ft.Material used in seal Bentonite ChipsDid any strata contain unusable water? ☐ Yes ☒ No

Type of water? _____ Depth of strata _____

Method of sealing strata off _____

PUMP: Manufacturer's Name _____

Type: _____ H.P. _____

WATER LEVELS: Land-surface elevation above mean sea level _____ ft.

Static level 35.9 ft. below top of well Date 3-31-16

Artesian pressure _____ lbs. per square inch Date _____

Artesian water is controlled by _____ (cap, valve, etc.)

WELL TESTS: Drawdown is amount water level is lowered below static level

Was a pump test made? ☒ Yes ☐ No If yes, by whom? TP@DYield: 1020 gal./min. with 42 ft. drawdown after 2.5 hrs.Yield: 1515 gal./min. with 1.35 ft. drawdown after 3 hrs.Yield: 1930 gal./min. with 2 ft. drawdown after 2 hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
<u>1min</u>	<u>38.53</u>	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

Date of test 6-9-16

Bailer test _____ gal./min. with _____ ft. drawdown after _____ hrs.

Airtest _____ gal./min. with stem set at _____ ft. for _____ hrs.

Artesian flow _____ g.p.m. Date _____

Temperature of water 58 Was a chemical analysis made? ☒ Yes ☐ No

CURRENT

Notice of Intent No. WE23419Unique Ecology Well ID Tag No. BIB 315

Water Right Permit No. _____

Property Owner Name City Of Moses LakeWell Street Address 8213 Randolph Rd NECity Moses Lake County GrantLocation NW1/4-1/4 SW1/4 Sec 27 Twn 20n R 28 EWM ☒

(s, t, r Still REQUIRED)

Or
WWM ☐

Lat/Long

Lat Deg _____

Lat Min/Sec _____

Long Deg _____

Long Min/Sec _____

Tax parcel No. (Required) 12-0682-301

CONSTRUCTION OR DECOMMISSION PROCEDURE

Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information. (USE ADDITIONAL SHEETS IF NECESSARY.)

MATERIAL	FROM	TO
Fine silty topsoil.	0	1
Course gravels and cobbles.	1	8
Grey brown clayey course gravel, cobbles.	8	21
Boulder	21	24
Medium to course gravel, cobbles.	24	41
Looser medium to course sand and gravels,	41	50
some visicular basalt gravel with light brown silt.		
Wet medium to course gravel, cobbles.	50	57
Grey brown weathered basalt.	57	63
Fractured grey basalt, oxidized	63	70.5

RECEIVED

JUN 20 2016

Department of Ecology
Eastern Washington Office

Start Date 3-22-16Completed Date 4-7-16

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

☒ Driller ☐ Engineer ☐ Trainee Name (Print) Matt Call

Driller/Engineer/Trainee Signature _____

Driller or trainee License No. 2467

IF TRAINEE: Driller's License No: _____

Driller's Signature: Matt CallDrilling Company Tacoma Pump @ DrillingAddress 30316 Mountain HwyCity, State, Zip Graham, Wa, 98338

Contractor's _____

Registration No. TACOMPD203PFDate 6-16-16

ECY 050-1-20 (Rev 02-2010) To request ADA accommodation including materials in a format for the visually impaired, call Ecology Water Resources Program at 360-407-6872. Persons with impaired hearing may call Washington Relay Service at 711. Persons with speech disability may call TTY at 877-833-6341.