



March 16, 2020

Project No. 19119232

Ms. Maureen Hatfield

MC-127

VCP-CA Section, Remediation Division

Texas Commission on Environmental Quality

P.O. Box 13087

Austin, TX 78711-3087

**RE: DNAPL RECOVERY ACTIVITIES QUARTERLY REPORT – 3RD QUARTER 2019
UNION PACIFIC RAILROAD HOUSTON WOOD PRESERVING WORKS FACILITY
4910 LIBERTY ROAD FACILITY, HOUSTON, TEXAS
POST-CLOSURE CARE PERMIT NO. HW-50343; INDUSTRIAL SWR NO. 31547**

Dear Ms. Hatfield:

Golder Associates Inc. (Golder), on behalf of Union Pacific Railroad Company (UPRR), submits this 4th Quarter 2019 summary report for the dense non-aqueous phase liquid (DNAPL) recovery activities conducted at the UPRR Houston Wood Preserving Works Facility (the Site). As detailed in the Response Action Plan (RAP) dated November 24, 2014, a 24-month DNAPL recovery pilot test was conducted at the Site that consisted of manual DNAPL recovery on a monthly basis of selected wells. Following the 24-month testing period, the DNAPL recovery activities have continued monthly following the same procedures detailed in the RAP, except with the increased frequency of bi-monthly (twice a month) DNAPL recovery activities that were initiated in June 2019. The following monitoring wells are included as part of the DNAPL recovery activities:

Well Name	Zone
MW-57A	A-TZ
MW-78A	A-TZ
MW-12B	B-TZ
MW-32B	B-CZ
MW-41B	B-TZ
MW-57B	B-CZ
MW-70B	B-CZ
MW-75B	B-CZ
MW-23C	C-TZ
MW-34CR	C-TZ
MW-44C	C-TZ
MW-45C	C-TZ
MW-46C	C-TZ

Figure 1 shows the location of the DNAPL recovery wells.

The DNAPL recovery activities consist of measuring the depth to groundwater surface, the depth to groundwater/DNAPL interface, and the total depth of the well relative to the top of casing prior to DNAPL recovery. Using a peristaltic pump or submersible pump, DNAPL is pumped from the bottom of the well until groundwater returns in the pump discharge. The volume of recovered DNAPL is estimated from each well based on the volume pumped, and the well is gauged to measure the total depth of the well and depth to residual DNAPL following pumping. Recovered DNAPL is temporarily stored at the Containment Storage Area. The most recent waste manifest for the recovered DNAPL and groundwater are provided in Attachment 1.

A summary of the DNAPL recovery measurements from February 2013 through December 2019 is provided in Table 1. A graph of DNAPL thicknesses prior to each monthly recovery efforts over time from January 2018 through December 2019 is presented on Figure 2, with a graph of the same information dating back to the beginning of the DNAPL recovery from February 2013 through December 2019 presented on Figure 3. Observations from the recent recovery activities are provided below for each of the groundwater bearing units (GWBUs):

- A-TZ Wells: Two monitoring wells in the A-TZ have had measurable DNAPL detected: MW-57A and MW-78A. No measurable DNAPL has been detected in MW-57A since August 2015. However, a trace of DNAPL was noted at MW-57A in January 2019 through May 2019, but not enough DNAPL had accumulated in the well to be measured.

DNAPL thickness in MW-78A had decreased from 6.23 feet thick in November 2014 to a low of 0.88 feet thick in February 2019. However, since June 2019, DNAPL thicknesses have increased to approximately 5.42 feet in late December 2019.

B-TZ/B-CZ Wells: Wells MW-12B, MW-32B, MW-41B, MW-57B, MW-70B and MW-75B completed in either the B-TZ or B-CZ were evaluated for DNAPL recovery during this period. At the beginning of the recovery activities, monitoring wells with the thickest DNAPL measurements included MW-12B and MW-41B on the west side of the Site (Figure 1). DNAPL thicknesses in well MW-12B gradually decreased from 14.16 feet in April 2013 to 0.11 feet thick in August 2015. From August 2015 to February 2019, the DNAPL thickness in MW-12B had been stable with fluctuations between 0.19 feet (August 2018) to 0.39 feet (February 2019). However, from February 2019 through the beginning of October 2019, DNAPL thickness in MW-12B increased approximately 2.64 feet to 3.03 feet thick (October 2, 2019). Beginning in early October 2019, DNAPL thickness in MW-12B increased to a historical peak of 27.08 feet thick (November 15, 2019) and then decreased to 18.08 feet thick through the end of December 2019. Based on field observations, the viscosity of the DNAPL in MW-12B appears to have increased over the past few months. The DNAPL in MW-12B was too thick for the pump used for recovery from early October 2019 through December 2019. Apart from the recovery of 0.5 gallons at the peak of the DNAPL thickness in November 2019, no DNAPL was recovered. UPRR is planning to install a dedicated DNAPL pump in MW-12B during the 1st Quarter 2020 to resume recovery activities at this well.

In November 2019, Golder collected a sample from MW-12B of the creosote DNAPL to be analyzed for physical properties including viscosity, density, and specific gravity (by ASTM Methods D445, D1481, and API RP40, respectively). The creosote sample was collected on November 1, 2019 and sent to

Integrated Geosciences Laboratories, LLC in Houston, Texas (through ALS Laboratory, Houston, TX) for analysis. A copy of the analytical report is provided under Attachment 2. The physical property results were then compared to similar analyses that were conducted in 2007 of a creosote sample from MW-12B. The results from the November 2019 and the 2007 analyses are summarized in the following table.

Creosote Sample	Temperature (°F)	Specific Gravity	Density (g/cc)	Viscosity (centistokes)	Viscosity (centipoise)
MW-12B (2007)	70	1.0557	1.0536	202	192
	100	1.0499	1.0426	58.7	61.1
	130	1.0431	1.0285	25.6	26.3
MW-12B (2019)	70	1.0508	1.0506	217.857	228.888
	100	1.0478	1.0405	72.424	75.356
	130	1.0429	1.0283	28.162	28.959

Comparing the viscosity between the two samples, the 2019 sample from MW-12B appears to be approximately 19% more viscous (centipoise) compared to the 2007 sample.

DNAPL thickness in monitoring well MW-41B was initially as thick as 10.65 feet in May 2013 and decreased during the initial months of DNAPL recovery. DNAPL thickness in MW-41B had been relatively stable at about 4 feet thick between August 2017 and April 2019 fluctuating only about 0.26 feet in the monthly measurements (3.92 feet to 4.18 feet) (Figure 2). However, from February 2019 to mid-November 2019, DNAPL thicknesses in MW-41B increased approximately 2.7 feet to 6.69 feet thick (November 15, 2019). From mid-November 2019 through December 2019 DNAPL thickness has decreased approximately 5.38 feet to 1.31 feet thick (December 30, 2019).

No DNAPL was recovered in MW-41B during the December recovery events due to problems pumping the DNAPL with the submersible pump used to recover DNAPL from the well. Based on recent field observations, the DNAPL appeared to be more viscous similar to observations at MW-12B. UPRR is planning to install a dedicated DNAPL pump in MW-41B during the 1st Quarter 2020 to resume recovery activities at this well.

Monitoring well MW-32B had a DNAPL thickness of 6.23 feet at the beginning of the recovery activities in February 2013. During the first 12 months, DNAPL thicknesses in the well generally decreased to less than two-feet thick by September 2013. DNAPL thicknesses in this well were below 0.30 feet from July 2017 to May 2019. However, DNAPL thickness in MW-32B increased approximately 4.36 feet from May 2019 to late October 2019 (4.54 feet thick), then reduced to 0.7 feet thick on November 15, 2019. Thicknesses fluctuated between 0.7 and 0.89 feet between November and mid-December 2019 and then increased to 2.12 feet at the end of December 2019.

DNAPL thickness in well MW-57B decreased from 1.28 feet thick in July 2013 to less than measurable (trace DNAPL noted) thickness in January 2014 through early October 2014. Since June 2016, no measurable DNAPL has been detected in MW-57B. A trace amount of DNAPL was noted in MW-57B in January 2019 through May 2019, but no DNAPL has been detected since May 2019.

Well MW-70B had measurable DNAPL at 1.61 feet at the beginning of the recovery activities (February 2013). During the first 12 months of recovery activities, DNAPL thicknesses generally decreased to less than one-foot thick, then increased to just over one foot thick in early October 2014. Between April 2018 and May 2019, DNAPL thickness in MW-70B fluctuated between 0.49 feet (April 2018) and 0.29 feet (February 2019). From May 2019 to early October 2019, DNAPL thicknesses in MW-70B increased approximately 1.46 feet to 1.94 feet thick. Beginning in mid-October 2019 through early December 2019, DNAPL thicknesses decreased to non-measurable or trace levels. DNAPL was detected at a thickness of 0.65 feet on December 18, 2019 and increased to 3.25 feet in late December 2019.

Well MW-75B had measurable DNAPL at 3.1 feet in February 2013. DNAPL thicknesses in MW-75B generally decreased to less than one-foot thick and have been generally less than 0.5 feet thick since January 2018. However, from the beginning of June 2019 through mid-December 2019, no measurable DNAPL has been detected in MW-75B. Only trace amounts of DNAPL were noted through early October 2019, and no DNAPL was observed from mid-October 2019 to mid-December 2019. On December 30, 2019, DNAPL thickness in MW-75B had increased from non-measurable to 1.85 feet thick. However, during the recovery attempts at MW-75B on December 30, 2019, only water was recovered and no DNAPL was able to be removed from the well.

- C-TZ Wells: Wells MW-23C, MW-44C, MW-45C, and MW-46C completed in the C-TZ were evaluated for DNAPL recovery. Monitoring well MW-23C had an initial DNAPL thickness in November 2014 of 2.09 feet. From November 2014 through April 2019, DNAPL thicknesses had steadily decreased to less than one foot in the well. Between January 2018 and the beginning of April 2019, DNAPL thickness in MW-23C fluctuated between 0.34 feet (February 2018) and 0.5 (November 2018). Starting in late April 2019, DNAPL thicknesses in MW-23C increased approximately 2 feet to 2.68 feet thick in the beginning of December 2019. Since the beginning of December, DNAPL thicknesses have decreased approximately 1 foot to 1.7 feet thick (December 30, 2019).

Wells MW-34CR, MW-44C, MW-45C, and MW-46C are near each other on the northeast side of the Site. Well MW-34C was gauged in October 2013, and no DNAPL was measured in the well (the well historically had DNAPL sporadically present). In May 2014, replacement well MW-34CR was installed and gauged as part of the recovery program. However, no DNAPL has been detected in this well. The well was observed to be damaged in April 2019. During the first half of 2019, DNAPL thickness in MW-44C ranged from 0.38 feet in February 2019 to 0.64 feet in April 2019, with no measurable DNAPL since June 2019 events (trace DNAPL noted in mid-June 2019 and no DNAPL noted from the end of June through December 2019). DNAPL has not been detected in MW-45C since August 2015. DNAPL thickness in well MW-46C fluctuated between 0.41 feet in February 2019 to 0.58 feet in April 2019. Similar to well MW-44C, no measurable DNAPL has been observed in MW-46C since June 2019 (trace DNAPL noted in mid-June 2019 and no DNAPL noted from the end of June through the end of December 2019).

- **DNAPL Recovery:** From February 2013 to December 2019, an estimated 706 gallons of creosote DNAPL have been recovered from the wells. Monthly DNAPL recovery volumes increased after the January 2015 event due to a change in pumping techniques. Over the past six months, recovery has ranged from approximately 2 to 13.00 gallons per month (Table 1).

DNAPL thicknesses in the wells are still near or below their respective historical maximum thicknesses with the exceptions of MW-12B and MW-70B, which experienced historical DNAPL thickness peaks during the fourth quarter of 2019 (Figure 3). Dedicated DNAPL pumps will be installed in wells MW-12B and MW-41B during the 1st Quarter 2020. UPRR will continue to monitor the DNAPL thicknesses twice per month as discussed in the response to the TCEQ 4th Technical Notice of Deficiency (TNOD) letter (April 11, 2019).

If you have any questions or need additional information, please feel free to call me at (512) 671-3434 or Mr. Kevin Peterburs of UPRR at (414) 267-4164.

Sincerely,

Golder Associates Inc.



Michelle Hermiston, P.G.
Project Hydrogeologist



Eric Matzner, P.G.
Principal Hydrogeologist



CC: Waste Program Manager, TCEQ Region 12, Houston
Mr. Kevin Peterburs, UPRR – Milwaukee, WI

Attachments: Table 1 - Summary of DNAPL Recovery Measurements
Figure 1 – In-Well DNAPL Thickness – December 2019
Figure 2 - DNAPL Recovery Activities January 2018 – December 2019
Figure 3 - DNAPL Recovery Activities February 2013 – December 2019
Attachment 1 – Recovered DNAPL Waste Manifest
Attachment 2 – November 2019 MW-12B DNAPL Sample Physical Properties Laboratory Report

TABLES

TABLE 1

**SUMMARY OF DNAPL RECOVERY MEASUREMENTS
UPRR HOUSTON, TX - WOOD PRESERVING WORKS**

DNAPL Recovery Date	MW-12B				MW-23C				MW-32B			
	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)
2/14/2013	9.06	39.87	5.93	2.5	NM	NM	NM	0	6.01	30.06	6.23	2
4/3/2013	9.41	39.95	5.85	1	NM	NM	NM	0	4.86	33.61	2.68	1
4/22/2013	8.61	31.64	14.16	0.5*	NM	NM	NM	0	5.62	36.08	0.21	0.25
5/30/2013	8.47	37.62	8.18	1.5*	NM	NM	NM	0	5.86	32.21	4.08	2
6/29/2013	9.62	38.22	7.58	1.5	NM	NM	NM	0	6.79	33.59	2.7	1.5
7/22/2013	11.16	39.04	6.76	1	NM	NM	NM	0	7.14	33.91	2.38	1.5
8/26/2013	11.31	39.61	6.19	1	NM	NM	NM	0	7.48	33.83	2.46	1
9/27/2013	11.17	40.63	5.17	1	NM	NM	NM	0	7.23	34.39	1.9	1
10/31/2013	11.09	43.71	2.09	1	NM	NM	NM	0	7.16	34.96	1.33	0.53
11/27/2013	11.17	44.06	1.74	1	NM	NM	NM	0	7.29	35.03	1.26	0.53
12/31/2013	11.02	44.62	1.18	1	NM	NM	NM	0	7.16	35.16	1.13	0.5
1/30/2014	11.34	45.12	0.68	1	NM	NM	NM	0	6.72	34.82	1.47	0.53
3/3/2014	11.17	44.32	1.48	1	NM	NM	NM	0	6.53	34.52	1.77	0.53
3/31/2014	11.03	44.53	1.27	1	NM	NM	NM	0	6.29	34.21	2.08	0.53
4/30/2014	10.92	44.26	1.54	1	NM	NM	NM	0	6.42	34.67	1.62	0.53
5/27/2014	10.81	44.34	1.46	1	NM	NM	NM	0	6.36	34.72	1.57	0.53
6/26/2014	10.72	44.61	1.19	1	NM	NM	NM	0	6.21	34.61	1.68	0.53
7/31/2014	10.13	44.96	0.84	1	NM	NM	NM	0	6.06	34.33	1.96	0.25
8/27/2014	10.26	45.12	0.68	1	NM	NM	NM	0	6.18	34.98	1.31	0.25
10/3/2014	10.17	44.91	0.89	1	NM	NM	NM	0	6.06	34.72	1.57	0.25
11/3/2014	10.29	44.97	0.83	1	22.51	70.71	2.09	0.25	6.18	34.91	1.38	0.25
11/24/2014	10.27	44.99	0.81	1	22.56	70.92	1.88	0.5	6.21	35.16	1.13	0.5
12/22/2014	10.23	44.71	1.09	1	22.47	70.81	1.99	0.5	6.14	35.02	1.27	0.75
1/29/2015	10.16	44.96	0.84	1	22.26	71.04	1.76	0.5	5.71	35.29	1	0.75
2/26/2015	10.12	44.96	0.84	1.5	22.06	71.09	1.71	0.5	6.02	35.29	1	1
3/26/2015	9.96	45.21	0.59	1.5	22.17	71.12	1.68	0.25	5.46	35.36	0.93	1
4/27/2015	9.89	45.37	0.43	1.5	22.23	71.06	1.74	0.5	5.21	35.29	1	1
5/26/2015	9.72	45.61	0.19	2	22.17	71.14	1.66	0.5	5.07	35.46	0.83	1
7/6/2015	7.12	45.96	0.24	2	19.01	71.39	1.41	0.5	4.06	35.66	0.63	1
8/3/2015	7.26	46.09	0.11	2	19.16	71.46	1.34	0.75	4.29	35.71	0.58	1
8/27/2015	8.09	46.01	0.19	1	20.34	71.51	1.29	0.75	5.05	35.77	0.52	1
10/5/2015	7.12	45.86	0.34	1	19.02	71.57	1.23	0.5	4.31	35.96	0.33	1
11/5/2015	6.86	45.81	0.39	1	18.59	71.59	1.21	0.5	4.02	35.91	0.38	1
12/3/2015	6.46	45.79	0.41	1	18.33	71.67	1.13	0.5	3.92	35.96	0.33	1
12/28/2015	6.23	45.62	0.58	1.25	23.21	71.61	1.19	0.75	3.73	35.91	0.38	1
2/3/2016	6.04	45.55	0.65	1.5	17.96	71.64	1.16	0.5	3.61	35.87	0.42	1
3/3/2016	5.96	45.61	0.59	1.5	17.92	71.71	1.09	0.5	3.51	35.91	0.38	1
3/31/2016	6.06	45.72	0.48	1.5	17.86	71.79	1.01	0.5	3.56	35.92	0.37	1
5/3/2016	6.13	45.66	0.54	1	NM	NM	NM	0	3.67	35.87	0.53	0.5
6/2/2016	6.21	45.61	0.59	1	22.9	71.51	1.29	0.5	3.74	35.92	0.48	0.5
7/8/2016	6.29	45.72	0.48	1	23.09	71.52	1.28	0.25	3.91	35.96	0.44	0.5
8/3/2016	6.34	45.77	0.43	1	23.16	71.66	1.14	0.25	4.03	35.49	0.91	0.5
8/30/2016	6.47	45.69	0.51	1	23.31	71.61	1.19	0.5	4.22	36.09	0.31	0.5
9/30/2016	6.59	45.81	0.39	1	23.39	71.81	0.99	0.5	4.33	35.91	0.49	0.5
11/3/2016	6.64	45.92	0.28	1	23.41	71.98	0.82	0.5	4.47	35.99	0.41	0.5
11/30/2016	6.86	45.86	0.34	0.5	23.59	71.91	0.89	0.75	4.62	35.91	0.49	0.5
1/4/2017	7.02	45.81	0.39	0.5	23.74	71.82	0.98	0.75	4.83	36.02	0.38	0.25
2/7/2017	6.97	45.69	0.51	0.5	23.67	71.74	1.06	0.75	4.81	35.91	0.49	0.25
3/2/2017	6.91	45.64	0.56	0.5	23.54	76.82	0.98	0.75	4.66	35.97	0.43	0.25
4/3/2017	6.82	45.71	0.49	0.5	23.46	76.96	0.84	0.75	4.57	36.01	0.39	0.25
4/27/2017	6.74	45.64	0.56	0.5	23.21	77.04	0.76	0.5	4.51	36.06	0.34	0.25
5/29/2017	6.89	45.77	0.43	0.5	23.49	77.21	0.59	0.25	4.74	36.03	0.37	0.25
7/5/2017	7.01	45.71	0.49	0.5	23.61	77.27	0.53	0.25	4.86	36.13	0.27	0.25
8/1/2017	7.14	45.63	0.57	0.75	23.79	77.17	0.63	0.25	4.99	36.24	0.16	0.25
9/5/2017	7.03	45.6	0.6	1	23.67	77.29	0.51	0.25	4.78	36.24	0.16	0.25
10/4/2017	7.07	45.69	0.51	1	23.61	77.36	0.44	0.25	4.89	36.29	0.11	0.25
11/2/2017	7.11	45.76	0.44	1	23.74	77.42	0.38	0.25	4.96	36.26	0.14	0.25
11/29/2017	7.16	45.71	0.49	1	23.81	77.4	0.40	0.25	5.06	36.31	0.09	0.25
1/2/2018	6.96	45.82	0.38	1	23.67	77.43	0.37	0.25	4.93	36.27	0.13	0.25
2/7/2018	7.13	45.87	0.33	1	23.86	77.46	0.34	0.25	5.16	36.21	0.19	0.25
3/1/2018	7.36	45.96	0.24	1	23.96	77.41	0.39	0.25	5.38	36.13	0.27	0.25

TABLE 1

**SUMMARY OF DNAPL RECOVERY MEASUREMENTS
UPRR HOUSTON, TX - WOOD PRESERVING WORKS**

DNAPL Recovery Date	MW-12B				MW-23C				MW-32B			
	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)
4/2/2018	7.29	45.94	0.26	1	23.9	77.32	0.48	0.5	5.31	36.18	0.22	0.25
5/1/2018	8.17	45.91	0.29	1	24.47	77.39	0.41	0.5	6.12	36.23	0.17	0.5
6/1/2018	8.49	45.86	0.34	1	24.81	77.31	0.49	0.5	6.41	36.19	0.21	0.5
6/29/2018	8.62	45.81	0.39	1	24.99	77.37	0.43	0.5	6.59	36.11	0.29	0.75
8/3/2018	8.79	45.96	0.24	1	25.12	77.39	0.41	0.5	6.74	36.19	0.21	0.75
8/31/2018	8.32	46.01	0.19	0.75	24.81	77.43	0.37	0.5	6.47	36.23	0.17	0.75
9/28/2018	8.27	45.93	0.27	0.5	24.69	77.39	0.41	0.5	6.41	36.19	0.21	0.75
11/2/2018	8.16	45.91	0.29	0.5	24.57	77.36	0.44	0.5	6.33	36.21	0.19	0.5
11/29/2018	8.01	45.9	0.30	0.5	24.36	77.3	0.50	0.5	6.21	36.27	0.13	0.25
1/2/2019	7.96	45.87	0.33	0.5	24.29	77.31	0.49	0.5	6.09	36.29	0.11	0.25
2/2/2019	7.82	45.89	0.31	0.5	24.21	77.44	0.36	0.5	5.97	36.24	0.16	0.5
2/28/2019	7.69	45.81	0.39	0.5	24.16	77.36	0.44	0.5	5.86	36.21	0.19	0.25
4/2/2019	7.61	45.8	0.4	0.5	24.08	77.32	0.48	0.5	5.79	36.24	0.16	0.25
4/25/2019	7.49	45.76	0.44	1	24.01	77.16	0.64	0.5	5.86	36.29	0.11	0.25
5/29/2019	7.51	45.71	0.49	1	24.11	77.11	0.69	0.5	5.91	36.21	0.19	0.25
6/12/2019	6.81	45.52	0.68	1.5	24.39	76.71	1.09	1	5.46	35.91	0.49	0.5
6/30/2019	6.67	45.06	1.14	2	24.32	76.67	1.13	0.75	5.39	35.42	0.98	1
7/16/2019	6.62	45.11	1.09	2	24.26	76.61	1.19	1	5.32	35.36	1.04	1
8/2/2019	6.69	45.01	1.19	1.5	24.31	76.49	1.31	1.5	5.41	35.26	1.14	1.5
8/15/2019	6.79	44.76	1.44	2	24.22	76.36	1.44	1.5	5.61	35.19	1.21	1.5
8/28/2019	6.88	44.71	1.49	2	24.29	76.41	1.39	1.5	5.72	35.22	1.18	1.5
9/17/2019	6.93	43.96	2.24	3	24.36	76.29	1.51	1.5	5.81	35.17	1.23	1.5
10/2/2019	6.86	43.17	3.03	0	24.32	76.09	1.71	1.5	5.77	35.02	1.38	1.5
10/16/2019	6.71	30.29	15.91	0	25.75	75.89	1.91	1.5	4.36	33.42	2.98	1.5
10/31/2019	6.53	21.63	24.57	0	26.33	75.29	2.51	1.5	3.43	31.86	4.54	1.5
11/15/2019	7.21	19.12	27.08	0.5	25.69	ND	0	0	3.47	35.7	0.7	1
12/3/2019	7.55	27.37	18.83	0	26.11	75.12	2.68	1.5	4.33	35.51	0.89	0
12/18/2019	12.68	35.9	10.3	0	26.13	77.4	0.4	0.25	4.71	35.61	0.79	1.5
12/30/2019	8.08	28.12	18.08	0	26.48	76.1	1.7	0.13	5.04	34.28	2.12	1.5
Total DNAPL Pumped (gal)	90.75				41				63.49			

Notes:

* - indicates DNAPL and groundwater mixture

--- - No DNAPL pumped

DTW - Depth to water (feet Below Top of Casing (BTOC))

DTD - Depth to DNAPL (feet BTOC)

MW-12B- TD measured at 46.2 instead of 45.8, August 28, 2015.

MW-23C- added 5 feet to TOC due to capping after 2/3/2016

ND - Not detected

NM - Not measured

PoP - Product on probe, not measureable

TR- Trace amount of DNAPL Extracted

TABLE 1

**SUMMARY OF DNAPL RECOVERY MEASUREMENTS
UPRR HOUSTON, TX - WOOD PRESERVING WORKS**

DNAPL Recovery Date	MW-33BR				MW-34C/MW-34CR (July 2014)				MW-41B			
	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)
2/14/2013	3.72	ND	0	0	NM	NM	NM	0	8.91	41.1	3.71	3
4/3/2013	4.02	PoP	0	0	NM	NM	NM	0	9.37	41.6	3.21	1.5
4/22/2013	3.63	ND	0	0	NM	NM	NM	0	8.62	41.6	3.21	0.5*
5/30/2013	3.59	ND	0	0	NM	NM	NM	0	8.73	34.16	10.65	2
6/29/2013	6.07	ND	0	0	NM	NM	NM	0	9.72	37.12	7.69	2
7/22/2013	9.68	ND	0	0	NM	NM	NM	0	10.31	39.29	5.52	1.5
8/26/2013	9.86	ND	0	0	NM	NM	NM	0	10.09	34.55	10.26	2.5
9/27/2013	9.57	ND	0	0	NM	NM	NM	0	9.63	37.29	7.52	2
10/31/2013	9.32	ND	0	0	21.63	NM	NM	0	9.52	38.16	6.65	2
11/27/2013	9.16	ND	0	0	NM	NM	NM	0	9.57	38.39	6.42	2
12/31/2013	8.97	ND	0	0	NM	NM	NM	0	9.42	39.36	5.45	2
1/30/2014	7.41	ND	0	0	NM	NM	NM	0	9.06	39.17	5.64	2
3/3/2014	7.16	ND	0	0	NM	NM	NM	0	8.62	38.06	6.75	2
3/31/2014	7.04	ND	0	0	NM	NM	NM	0	8.52	37.74	7.07	2
4/30/2014	6.88	ND	0	0	NM	NM	NM	0	8.36	37.21	7.6	2
5/27/2014	6.72	ND	0	0	NM	NM	NM	0	8.26	37.29	7.52	2
6/26/2014	6.52	ND	0	0	NM	NM	NM	0	8.02	37.47	7.34	2
7/31/2014	6.29	ND	0	0	19.06	ND	0	0	8.21	37.92	6.89	2
8/27/2014	6.47	ND	0	0	18.96	ND	0	0	8.07	38.29	6.52	1.5
10/3/2014	6.32	ND	0	0	18.81	ND	0	0	8.02	38.13	6.68	2
11/3/2014	NM	NM	NM	0	19.06	ND	0	0	8.22	38.29	6.52	2
11/24/2014	NM	NM	NM	0	19.11	ND	0	0	8.27	38.47	6.34	2
12/22/2014	NM	NM	NM	0	19.06	ND	0	0	8.16	38.39	6.42	2
1/29/2015	NM	NM	NM	0	18.79	ND	0	0	8.02	39.16	5.65	1.5
2/26/2015	NM	NM	NM	0	18.71	ND	0	0	7.92	39.06	5.75	2.5
3/26/2015	NM	NM	NM	0	18.67	ND	0	0	7.83	38.74	6.07	2.5
4/27/2015	NM	NM	NM	0	18.79	ND	0	0	8.02	38.61	6.2	3
5/26/2015	NM	NM	NM	0	18.63	ND	0	0	7.91	38.72	6.09	3
7/6/2015	NM	NM	NM	0	17.29	ND	0	0	6.03	38.96	5.85	2.5
8/3/2015	NM	NM	NM	0	17.21	ND	0	0	6.09	39.01	5.8	2.5
8/27/2015	NM	NM	NM	0	18.46	ND	0	0	7.39	39.14	5.67	2
10/5/2015	NM	NM	NM	0	17.29	ND	0	0	6.32	39.34	5.47	2
11/5/2015	NM	NM	NM	0	16.78	ND	0	0	6.01	39.51	5.3	2
12/3/2015	NM	NM	NM	0	16.44	ND	0	0	5.76	39.56	5.25	2
12/28/2015	NM	NM	NM	0	16.16	ND	0	0	5.62	39.63	5.18	2.25
2/3/2016	NM	NM	NM	0	15.98	ND	0	0	5.32	39.72	5.09	3
3/3/2016	NM	NM	NM	0	15.98	ND	0	0	5.17	39.81	5	3
3/31/2016	NM	NM	NM	0	15.98	ND	0	0	5.26	39.77	5.04	3
5/3/2016	NM	NM	NM	0	15.79	ND	0	0	5.52	39.96	4.85	3
6/2/2016	NM	NM	NM	0	15.97	ND	0	0	5.67	40.07	4.74	3
7/8/2016	NM	NM	NM	0	16.06	ND	0	0	5.72	40.01	4.8	3
8/3/2016	NM	NM	NM	0	16.17	ND	0	0	5.79	40.09	4.72	3
8/30/2016	NM	NM	NM	0	16.31	ND	0	0	5.91	40.26	4.55	3
9/30/2016	NM	NM	NM	0	16.42	ND	0	0	6.06	40.13	4.68	3
11/3/2016	NM	NM	NM	0	16.51	ND	0	0	6.11	40.29	4.52	3
11/30/2016	NM	NM	NM	0	16.72	ND	0	0	6.26	40.42	4.39	3
1/4/2017	NM	NM	NM	0	16.94	ND	0	0	6.39	40.56	4.25	3
2/7/2017	NM	NM	NM	0	16.91	ND	0	0	6.44	40.51	4.3	3
3/2/2017	NM	NM	NM	0	16.78	ND	0	0	6.29	40.76	4.05	3
4/3/2017	NM	NM	NM	0	16.71	ND	0	0	6.21	40.67	4.14	2.5
4/27/2017	NM	NM	NM	0	16.61	ND	0	0	6.19	40.87	3.94	3
5/29/2017	NM	NM	NM	0	16.84	ND	0	0	6.14	40.29	4.52	3
7/5/2017	NM	NM	NM	0	17.01	ND	0	0	6.34	40.57	4.24	2.5
8/1/2017	NM	NM	NM	0	17.17	ND	0	0	6.42	40.79	4.02	3
9/5/2017	NM	NM	NM	0	17.11	ND	0	0	6.36	40.68	4.13	3
10/4/2017	NM	NM	NM	0	17.06	ND	0	0	6.29	40.69	4.12	2.5
11/2/2017	NM	NM	NM	0	17.17	ND	0	0	6.41	40.73	4.08	3
11/29/2017	NM	NM	NM	0	17.29	ND	0	0	6.52	40.82	3.99	2.5
1/2/2018	NM	NM	NM	0	17.52	ND	0	0	6.72	40.72	4.09	2.5
2/7/2018	NM	NM	NM	0	18.11	ND	0	0	6.97	40.79	4.02	2.5
3/1/2018	NM	NM	NM	0	18.38	ND	0	0	7.16	40.63	4.18	2

TABLE 1

**SUMMARY OF DNAPL RECOVERY MEASUREMENTS
UPRR HOUSTON, TX - WOOD PRESERVING WORKS**

DNAPL Recovery Date	MW-33BR				MW-34C/MW-34CR (July 2014)				MW-41B			
	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)
4/2/2018	NM	NM	NM	0	18.29	ND	0	0	7.13	40.71	4.1	2
5/1/2018	NM	NM	NM	0	18.33	ND	0	0	8.26	40.76	4.05	2
6/1/2018	NM	NM	NM	0	18.62	ND	0	0	8.71	40.81	4	2.25
6/29/2018	NM	NM	NM	0	18.91	ND	0	0	9.02	40.71	4.1	2.5
8/3/2018	NM	NM	NM	0	19.06	ND	0	0	9.13	40.76	4.05	2.5
8/31/2018	NM	NM	NM	0	18.77	ND	0	0	8.89	40.86	3.95	2
9/28/2018	NM	NM	NM	0	18.64	ND	0	0	8.77	40.76	4.05	2
11/2/2018	NM	NM	NM	0	18.57	ND	0	0	8.61	40.71	4.1	2
11/29/2018	NM	NM	NM	0	18.39	ND	0	0	8.41	40.81	4	2
1/2/2019	NM	NM	NM	0	18.26	ND	0	0	8.22	40.83	3.98	2
2/2/2019	NM	NM	NM	0	18.19	ND	0	0	8.16	40.89	3.92	2
2/28/2019	NM	NM	NM	0	18.02	ND	0	0	8.03	40.76	4.05	3
4/2/2019	NM	NM	NM	0	17.96	ND	0	0	7.93	40.69	4.12	3
4/25/2019	NM	NM	NM	0	Well Damaged			0	7.76	40.28	4.53	3
5/29/2019	NM	NM	NM	0	Well Damaged			0	7.71	40.07	4.74	3
6/12/2019	NM	NM	NM	0	Well Damaged			0	7.52	39.63	5.18	3
6/30/2019	NM	NM	NM	0	Well Damaged			0	7.46	39.52	5.29	3
7/16/2019	NM	NM	NM	0	Well Damaged			0	7.39	39.46	5.35	3
8/2/2019	NM	NM	NM	0	Well Damaged			0	7.46	39.42	5.39	0
8/15/2019	NM	NM	NM	0	Well Damaged			0	7.51	39.31	5.5	3
8/28/2019	NM	NM	NM	0	Well Damaged			0	7.57	39.21	5.6	3
9/17/2019	NM	NM	NM	0	Well Damaged			0	7.66	39.02	5.79	3
10/2/2019	NM	NM	NM	0	Well Damaged			0	7.61	38.76	6.05	3
10/16/2019	NM	NM	NM	0	Well Damaged			0	5.21	38.67	6.14	3
10/31/2019	NM	NM	NM	0	Well Damaged			0	5.21	38.67	6.14	3
11/15/2019	NM	NM	NM	0	Well Damaged			0	4.81	38.12	6.69	2
12/3/2019	NM	NM	NM	0	Well Damaged			0	6.46	39.27	5.54	3
12/18/2019	NM	NM	NM	0	Well Damaged			0	6.51	41.7	3.11	0
12/30/2019	NM	NM	NM	0	Well Damaged			0	6.99	43.5	1.31	0
Total DNAPL Pumped (gal)	0				0				213.5			

Notes:

* - indicates DNAPL and groundwater mixture

--- - No DNAPL pumped

DTW - Depth to water (feet Below Top of Casing (BTOC))

DTD - Depth to DNAPL (feet BTOC)

MW-44C not measured 3/1/18 - 5/1/18; couldn't locate well due to construction.

ND - Not detected

NM - Not measured

PoP - Product on probe, not measureable

TR- Trace amount of DNAPL Extracted

TABLE 1

**SUMMARY OF DNAPL RECOVERY MEASUREMENTS
UPRR HOUSTON, TX - WOOD PRESERVING WORKS**

DNAPL Recovery Date	MW-44C				MW-45C				MW-46C			
	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)
2/14/2013	18.96	62.95	7.85	1	21.26	69.9	0.7	0.25	21.07	71.3	1.6	0.25
4/3/2013	19.34	70.47	0.33	0.25*	21.39	70.39	0.21	0.25*	20.61	72.36	0.54	0.25*
4/22/2013	18.62	70.64	0.16	0.25*	21.03	70.47	0.13	0.25*	20.61	72.61	0.29	0.25*
5/30/2013	18.43	70.01	0.79	0.25*	21.16	70.25	0.35	0.25*	20.59	71.61	1.29	0.25*
6/29/2013	19.34	70.32	0.48	0.25	21.93	70.32	0.28	0.25*	21.09	72.34	0.56	0.25*
7/22/2013	20.36	70.26	0.54	0.25	22.72	70.39	0.21	0.25*	21.96	72.16	0.74	0.25*
8/26/2013	20.62	70.39	0.41	0.25	22.86	70.31	0.29	0.25	22.23	72.32	0.58	0.25
9/27/2013	20.39	70.61	0.19	0.25	22.66	70.17	0.43	0.25	22.09	72.09	0.81	0.25
10/31/2013	20.17	70.75	0.05	0.07	22.59	70.42	0.18	0.13	22.41	72.34	0.56	0.2
11/27/2013	20.09	70.78	0.02	0.00	22.52	70.49	0.11	0	22.31	72.47	0.43	0.07
12/31/2013	20.01	70.8	PoP	0.00	22.39	70.46	0.14	0	22.03	72.53	0.37	0.07
1/30/2014	19.67	70.42	0.38	0.25	22.13	70.35	0.25	0	21.81	72.55	0.35	0.07
3/3/2014	19.29	70.17	0.63	0.25	21.86	70.09	0.51	0	21.57	72.05	0.85	0.25
3/31/2014	19.17	70.02	0.78	0.25	21.71	69.63	0.97	0.25	21.43	72.12	0.78	0.13
4/30/2014	19.02	69.81	0.99	0.25	21.59	69.74	0.86	0.25	21.27	71.81	1.09	0.25
5/27/2014	18.92	69.71	1.09	0.00	21.52	69.67	0.93	0.25	21.34	71.71	1.19	0.25
6/26/2014	18.81	69.52	1.28	0.25	21.59	69.77	0.83	0.25	21.17	71.6	1.3	0.25
7/31/2014	18.66	69.37	1.43	0.25	21.21	69.96	0.64	0.25	20.39	71.43	1.47	0.25
8/27/2014	18.53	69.47	1.33	0.25	21.13	70.12	0.48	0.25	20.22	71.61	1.29	0.25
10/3/2014	18.41	69.23	1.57	0.25	20.13	70.41	0.19	0.25	20.14	71.39	1.51	0.25
11/3/2014	18.52	69.37	1.43	0.25	20.29	70.36	0.24	0.25	20.27	71.47	1.43	0.25
11/24/2014	18.57	69.49	1.31	0.5	20.34	70.48	0.12	0.25	20.38	71.53	1.37	0.5
12/22/2014	18.51	69.31	1.49	0.5	20.31	70.41	0.19	0.25	20.37	71.42	1.48	0.5
1/29/2015	18.39	69.39	1.41	0.5	20.17	70.51	0.09	0.25	20.13	71.48	1.42	0.5
2/26/2015	18.42	69.51	1.29	0.5	20.11	70.59	0.01	0	20.09	71.38	1.52	0.5
3/26/2015	18.39	69.42	1.38	0.25	19.26	70.52	0.08	0	20.17	71.02	1.88	0.25
4/27/2015	18.29	69.52	1.28	0.5	20.17	70.48	0.12	0.25	20.22	71.56	1.34	1
5/26/2015	18.17	69.57	1.23	0.75	20.12	70.41	0.19	0.25	20.12	71.61	1.29	1
7/6/2015	16.29	69.86	0.94	0.5	18.07	70.49	0.11	0.25	18.17	71.93	0.97	0.75
8/3/2015	16.18	69.82	0.98	0.5	18.16	70.56	0.04	TR*	18.24	71.98	0.92	0.75
8/27/2015	17.46	69.74	1.06	0.25	19.03	70.54	0.06	TR*	19.39	72.03	0.87	0.5
10/5/2015	16.83	69.86	0.94	0.25	18.39	ND	0	0	18.72	72.34	0.56	0.5
11/5/2015	16.62	69.79	1.01	0.25	17.96	ND	0	0	18.51	72.26	0.64	0.5
12/3/2015	16.46	69.73	1.07	0.25	17.72	ND	0	0	18.62	72.36	0.54	0.5
12/28/2015	16.32	69.77	1.03	0.25	17.62	ND	0	0	18.42	72.31	0.59	0.5
2/3/2016	16.17	69.74	1.06	0.25	17.42	ND	0	0	18.29	72.46	0.44	0.25
3/3/2016	16.12	69.79	1.01	0.25	17.39	ND	0	0	18.23	72.49	0.41	0.25
3/31/2016	16.06	69.71	1.09	0.25	17.33	ND	0	0	18.24	72.54	0.36	0.25
5/3/2016	16.27	69.59	1.21	0.25	17.47	ND	0	0	18.39	72.39	0.51	0.25
6/2/2016	16.38	69.63	1.17	0.25	17.52	ND	0	0	18.43	72.43	0.47	0.25
7/8/2016	16.47	69.71	1.09	0.25	17.62	ND	0	0	18.54	72.49	0.41	0.25
8/3/2016	16.59	69.7	1.1	0.25	17.69	ND	0	0	18.51	72.53	0.37	0.25
8/30/2016	16.67	69.58	1.22	0.25	17.76	ND	0	0	18.72	72.57	0.33	0.25
9/30/2016	16.79	69.49	1.31	0.5	17.86	ND	0	0	18.83	72.46	0.44	0.25
11/3/2016	16.86	69.71	1.09	0.5	17.92	ND	0	0	18.89	72.41	0.49	0.25
11/30/2016	17.03	69.94	0.86	0.75	18.09	ND	0	0	19.12	72.32	0.58	0.25
1/4/2017	17.22	70.11	0.69	0.75	18.22	ND	0	0	19.27	72.46	0.44	0.25
2/7/2017	17.29	70.01	0.79	0.5	18.17	ND	0	0	19.19	72.39	0.51	0.25
3/2/2017	17.17	70.16	0.64	0.5	17.96	ND	0	0	19.03	72.31	0.59	0.25
4/3/2017	17.06	70.21	0.59	0	17.89	ND	0	0	18.97	72.39	0.51	0.25
4/27/2017	17.01	70.29	0.51	0	17.67	ND	0	0	18.84	72.31	0.59	0.5
5/29/2017	17.23	70.24	0.56	0.25	17.84	ND	0	0	18.94	72.47	0.43	0.25
7/5/2017	17.33	70.34	0.46	0.25	17.96	ND	0	0	19.12	72.34	0.56	0.5
8/1/2017	17.39	70.39	0.41	0.25	18.09	ND	0	0	19.23	72.27	0.63	0.5
9/5/2017	17.36	70.43	0.37	0.25	18.16	ND	0	0	19.29	72.34	0.56	0.5
10/4/2017	17.31	70.41	0.39	0.25	18.21	ND	0	0	19.36	72.3	0.6	0.5
11/2/2017	17.42	70.4	0.4	0.25	18.32	ND	0	0	19.42	72.36	0.54	0.5
11/29/2017	17.49	70.36	0.44	0.25	18.43	ND	0	0	19.57	72.34	0.56	0.5
1/2/2018	17.67	70.31	0.49	0.5	18.73	ND	0	0	19.81	72.39	0.51	0.5
2/7/2018	17.77	70.34	0.46	0.5	18.62	ND	0	0	19.96	72.46	0.44	0.5
3/1/2018	NM	NM	NM	0	18.79	ND	0	0	20.02	72.32	0.58	0.5

TABLE 1

**SUMMARY OF DNAPL RECOVERY MEASUREMENTS
UPRR HOUSTON, TX - WOOD PRESERVING WORKS**

DNAPL Recovery Date	MW-44C				MW-45C				MW-46C			
	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)
4/2/2018	NM	NM	NM	0	18.72	ND	0	0	19.81	72.39	0.51	0.5
5/1/2018	NM	NM	NM	0	19.31	ND	0	0	20.62	72.46	0.44	1
6/1/2018	18.31	70.17	0.63	0.75	19.47	ND	0	0	20.87	72.51	0.39	1
6/29/2018	18.79	70.39	0.41	0.75	19.67	ND	0	0	20.97	72.57	0.33	1
8/3/2018	18.97	70.36	0.44	0.75	19.77	ND	0	0	21.11	72.59	0.31	1
8/31/2018	18.87	70.39	0.41	0.5	19.41	ND	0	0	20.96	72.48	0.42	0.5
9/28/2018	18.82	70.41	0.39	0.75	19.32	ND	0	0	20.91	72.43	0.47	0.5
11/2/2018	18.67	70.44	0.36	0.75	19.26	ND	0	0	20.77	72.39	0.51	0.75
11/29/2018	18.47	70.46	0.34	0.25	19.16	ND	0	0	20.52	72.34	0.56	0.5
1/2/2019	18.42	70.41	0.39	0.5	19.02	ND	0	0	20.49	72.46	0.44	0.5
2/2/2019	18.29	70.41	0.39	0.5	18.93	ND	0	0	20.43	72.49	0.41	0.5
2/28/2019	18.16	70.42	0.38	0.5	18.77	ND	0	0	20.34	72.37	0.53	0.5
4/2/2019	18.09	70.39	0.41	0.5	18.71	ND	0	0	20.18	72.32	0.58	0.5
4/25/2019	18.02	70.16	0.64	0.5	18.63	ND	0	0	20.14	72.36	0.54	0.5
5/29/2019	18.61	70.23	0.57	0.5	18.47	ND	0	0	20.06	72.39	0.51	0.5
6/12/2019	18.29	ND	Trace	0	18.81	ND	0	0	18.02	ND	Trace	0
6/30/2019	18.16	ND	0	0	18.71	ND	0	0	18.09	ND	0	0
7/16/2019	18.09	ND	0	0	18.66	ND	0	0	18.12	ND	0	0
8/2/2019	18.17	ND	0	0	18.72	ND	0	0	18.17	ND	0	0
8/15/2019	18.22	ND	0	0	18.79	ND	0	0	18.09	ND	0	0
8/28/2019	18.29	ND	0	0	18.86	ND	0	0	18.17	ND	0	0
9/17/2019	18.39	ND	0	0	18.97	ND	0	0	18.23	ND	0	0
10/2/2019	18.32	ND	0	0	18.89	ND	0	0	18.17	ND	0	0
10/16/2019	15.06	ND	0	0	16.23	ND	0	0	16.34	ND	0	0
10/31/2019	14.89	ND	0	0	15.94	ND	0	0	16.06	ND	0	0
11/15/2019	14.21	ND	0	0	15.69	ND	0	0	15.81	ND	0	0
12/3/2019	16.11	ND	0	0	15.71	ND	0	0	15.91	ND	0	0
12/18/2019	16.51	ND	0	0	15.91	ND	0	0	16.11	ND	0	0
12/30/2019	16.65	ND	0	0	16.11	ND	0	0	16.22	ND	0	0
Total DNAPL Pumped (gal)	26.57				5.63				31.54			

Notes:

* - indicates DNAPL and groundwater mixture

--- - No DNAPL pumped

DTW - Depth to water (feet Below Top of Casing (BTOC))

DTD - Depth to DNAPL (feet BTOC)

ND - Not detected

NM - Not measured

PoP - Product on probe, not measureable

TR- Trace amount of DNAPL Extracted

TABLE 1

**SUMMARY OF DNAPL RECOVERY MEASUREMENTS
UPRR HOUSTON, TX - WOOD PRESERVING WORKS**

DNAPL Recovery Date	MW-57A				MW-57B				MW-70B			
	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)
2/14/2013	10.56	22.12	4.78	0.5	28.56	41.41	1.54	0.25	6.57	34.09	1.61	0.25
4/3/2013	10.32	24.79	2.11	0.5	28.09	42.36	0.59	0.25*	6.79	35.26	0.44	0.25
4/22/2013	10.71	25.85	1.05	0.5	27.06	42.17	0.78	0.25	6.06	35.12	0.58	0.25
5/30/2013	10.63	24.16	2.74	0.5	27.13	41.63	1.32	0.25	6.19	34.67	1.03	0.25
6/29/2013	12.16	23.82	3.08	2	18.26	42.07	0.88	0.25	8.01	34.92	0.78	0.25*
7/22/2013	13.21	23.05	3.85	2	16.34	41.67	1.28	0.75	8.22	34.07	1.63	0.25*
8/26/2013	12.91	25.32	1.58	1	18.01	42.31	0.64	0.25	8.17	35.09	0.61	0.25
9/27/2013	12.72	25.71	1.19	0.75	17.74	42.51	0.39	0.25	8.32	35.34	0.36	0.25
10/31/2013	12.72	25.92	0.98	1	17.61	42.61	0.29	0.07	8.26	35.39	0.31	0.07
11/27/2013	12.61	25.98	0.92	1	17.54	42.67	0.23	0.07	8.12	35.42	0.28	0.07
12/31/2013	12.46	26.09	0.81	1	17.36	42.74	0.16	0.07	7.89	35.51	0.19	0.07
1/30/2014	11.79	26.15	0.75	0.25	17.04	ND	Trace	0	7.84	35.06	0.64	0.07
3/3/2014	11.02	26.25	0.65	0.25	16.51	ND	Trace	0	7.09	35.05	0.65	0.13
3/31/2014	10.83	26.41	0.49	0.25	16.41	ND	Trace	0	6.87	35.17	0.53	0.07
4/30/2014	10.71	26.31	0.59	0.25	16.29	ND	Trace	0	6.72	35.01	0.69	0.07
5/27/2014	10.74	26.16	0.74	0.25	16.13	ND	Trace	0	6.64	34.86	0.84	0.07
6/26/2014	10.61	26.29	0.61	0.25	16.02	ND	Trace	0	6.52	34.97	0.73	0.25
7/31/2014	10.35	26.18	0.72	0.25	15.84	ND	Trace	0	6.26	34.76	0.94	0.25
8/27/2014	10.22	26.26	0.64	0.25	15.71	ND	Trace	0	6.84	34.86	0.84	0.25
10/3/2014	10.09	26.04	0.86	0.25	15.61	ND	Trace	0	6.71	34.61	1.09	0.25
11/3/2014	10.17	26.16	0.74	0.25	NM	NM	NM	0	6.79	34.79	0.91	0.25
11/24/2014	10.13	26.29	0.61	0.25	NM	NM	NM	0	6.77	34.93	0.77	0.25
12/22/2014	10.06	26.34	0.56	0.25	NM	NM	NM	0	6.69	34.86	0.84	0.25
1/29/2015	9.73	26.51	0.39	0.25	NM	NM	NM	0	6.48	34.92	0.78	0.25
2/26/2015	9.87	26.42	0.48	0.25	NM	NM	NM	0	6.39	34.81	0.89	0.5
3/26/2015	9.81	26.32	0.58	0.25	NM	NM	NM	0	6.27	34.91	0.79	0.25
4/27/2015	9.82	26.47	0.43	0.5	NM	NM	NM	0	6.19	34.99	0.71	0.25
5/26/2015	9.71	26.56	0.34	0.5	NM	NM	NM	0	6.07	35.11	0.59	0.5
7/6/2015	7.41	26.82	0.08	TR*	NM	NM	NM	0	5.03	35.32	0.38	0.25
8/3/2015	7.29	26.86	0.04	TR*	12.32	ND	PoP	0	5.12	35.37	0.33	TR*
8/27/2015	8.11	ND	0	TR*	13.04	ND	0	0	6.31	35.41	0.29	TR*
10/5/2015	7.72	ND	0	0	12.62	ND	0	0	5.72	35.47	0.23	0.25
11/5/2015	7.39	ND	0	0	12.27	ND	0	0	5.41	35.42	0.28	0.25
12/3/2015	7.13	ND	0	0	12.02	ND	0	0	5.13	35.63	0.07	0.25
12/28/2015	NM	NM	NM	0	NM	NM	NM	0	5.02	35.26	0.44	0.25
2/3/2016	NM	NM	NM	0	NM	NM	NM	0	4.86	35.21	0.49	0.25
3/3/2016	NM	NM	NM	0	NM	NM	NM	0	4.92	35.17	0.53	0.25
3/31/2016	NM	NM	NM	0	NM	NM	NM	0	4.91	35.24	0.46	0.25
5/3/2016	NM	NM	NM	0	NM	NM	NM	0	5.13	35.29	0.36	0.25
6/2/2016	7.26	ND	0	0	12.32	ND	0	0	5.26	35.36	0.29	0.25
7/8/2016	7.39	ND	0	0	12.44	ND	0	0	5.34	35.31	0.34	0.25
8/3/2016	7.46	ND	0	0	12.52	ND	0	0	5.42	35.39	0.26	0.25
8/30/2016	7.58	ND	0	0	12.67	ND	0	0	5.61	35.21	0.44	0.25
9/30/2016	7.69	ND	0	0	12.81	ND	0	0	5.74	35.03	0.62	0.25
11/3/2016	7.77	ND	0	0	12.92	ND	0	0	5.79	35.11	0.54	0.25
11/30/2016	7.92	ND	0	0	13.16	ND	0	0	6.03	35.23	0.42	0.25
1/4/2017	8.07	ND	0	0	13.24	ND	0	0	6.17	35.09	0.56	0.5
2/7/2017	8.18	ND	0	0	13.29	ND	0	0	6.26	35.01	0.64	0.5
3/2/2017	8.02	ND	0	0	13.17	ND	0	0	6.16	35.09	0.56	0.5
4/3/2017	8.06	ND	0	0	13.04	ND	0	0	6.09	35.13	0.52	0.5
4/27/2017	8.01	ND	0	0	13.14	ND	0	0	6.12	35.2	0.45	0.5
5/29/2017	8.34	ND	0	0	13.41	ND	0	0	6.29	35.06	0.59	0.5
7/5/2017	8.41	ND	0	0	13.57	ND	0	0	6.39	35.14	0.51	0.25
8/1/2017	8.52	ND	0	0	13.69	ND	0	0	6.47	35.21	0.44	0.25
9/5/2017	8.46	ND	0	0	13.79	ND	0	0	6.56	35.34	0.31	0.25
10/4/2017	8.41	ND	0	0	13.71	ND	0	0	6.63	35.39	0.26	0.25
11/2/2017	8.52	ND	0	0	13.91	ND	0	0	6.74	35.31	0.34	0.25
11/29/2017	8.67	ND	0	0	14.02	ND	0	0	6.79	35.29	0.36	0.25
1/2/2018	8.91	ND	0	0	13.06	ND	0	0	6.34	35.34	0.31	0.25
2/7/2018	8.98	ND	0	0	12.42	ND	0	0	6.42	35.31	0.34	0.25
3/1/2018	9.22	ND	0	0	12.58	ND	0	0	6.67	35.21	0.44	0.5

TABLE 1

**SUMMARY OF DNAPL RECOVERY MEASUREMENTS
UPRR HOUSTON, TX - WOOD PRESERVING WORKS**

DNAPL Recovery Date	MW-57A				MW-57B				MW-70B			
	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)
4/2/2018	9.16	ND	0	0	12.46	ND	0	0	6.61	35.16	0.49	0.5
5/1/2018	9.34	ND	0	0	13.04	ND	0	0	7.22	35.23	0.42	1.25
6/1/2018	9.67	ND	0	0	13.29	ND	0	0	7.42	35.29	0.36	1
6/29/2018	9.87	ND	0	0	13.47	ND	0	0	7.58	35.21	0.44	1
8/3/2018	10.02	ND	0	0	13.61	ND	0	0	7.69	35.29	0.36	0.75
8/31/2018	9.91	ND	0	0	13.47	ND	0	0	7.42	35.36	0.29	0.5
9/28/2018	9.86	ND	0	0	13.36	ND	0	0	7.33	35.28	0.37	0.5
11/2/2018	9.77	ND	0	0	13.21	ND	0	0	7.22	35.24	0.41	0.75
11/29/2018	9.56	ND	0	0	13.01	ND	0	0	7.06	35.21	0.44	0.5
1/2/2019	9.52	ND	Trace	0	13.03	ND	Trace	0	6.96	35.31	0.34	0.5
2/2/2019	9.41	ND	Trace	0	12.91	ND	Trace	0	6.87	35.36	0.29	0.5
2/28/2019	9.32	ND	Trace	0	12.83	ND	Trace	0	6.74	35.29	0.36	0.5
4/2/2019	9.27	ND	Trace	0	12.76	ND	Trace	0	6.67	35.27	0.38	0.5
4/25/2019	9.16	ND	Trace	0	12.71	ND	Trace	0	6.74	35.21	0.44	0.5
5/29/2019	9.06	ND	Trace	0	12.70	ND	Trace	0	6.71	35.17	0.48	0.5
6/12/2019	9.39	ND	0	0	12.93	ND	0	0	6.43	34.84	0.81	1
6/30/2019	9.21	ND	0	0	12.86	ND	0	0	6.48	34.61	1.04	1
7/16/2019	9.17	ND	0	0	12.79	ND	0	0	6.43	34.49	1.16	1.5
8/2/2019	9.22	ND	0	0	12.84	ND	0	0	6.48	34.31	1.34	1.5
8/15/2019	9.29	ND	0	0	12.92	ND	0	0	6.51	34.07	1.58	2
8/28/2019	9.33	ND	0	0	12.96	ND	0	0	6.57	34.09	1.56	2
9/17/2019	9.46	ND	0	0	12.86	ND	0	0	6.51	34.01	1.64	2
10/2/2019	9.74	ND	0	0	12.83	ND	0	0	6.46	33.71	1.94	2.5
10/16/2019	10.39	ND	0	0	13.67	ND	0.00	0.00	6.42	ND	0	0
10/31/2019	11.92	ND	0	0	14.21	ND	0.00	0.00	6.43	ND	Trace	0
11/15/2019	11.14	ND	0	0	6.21	ND	0.00	0.00	4.75	ND	0	0
12/3/2019	13.75	ND	0	0	13.51	ND	0.00	0.00	5.01	ND	0	0
12/18/2019	14.09	ND	0	0	13.51	ND	0.00	0.00	5.53	35	0.65	0
12/30/2019	14.42	ND	0	0	13.51	ND	0.00	0.00	5.71	32.4	3.25	0.13
Total DNAPL Pumped (gal)	15.5				2.71				39.00			

Notes:

* - indicates DNAPL and groundwater mixture

--- - No DNAPL pumped

DTW - Depth to water (feet Below Top of Casing (BTOC))

DTD - Depth to DNAPL (feet BTOC)

ND - Not detected

NM - Not measured

PoP - Product on probe, not measureable

TR- Trace amount of DNAPL Extracted

TABLE 1

**SUMMARY OF DNAPL RECOVERY MEASUREMENTS
UPRR HOUSTON, TX - WOOD PRESERVING WORKS**

DNAPL Recovery Date	MW-75B				MW-78A				Approx DNAPL Recovered (gal)
	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)	
2/14/2013	10.01	34.1	3.1	0.25	NM	NM	NM	0	9.75
4/3/2013	13.71	36.47	0.73	0.25	NM	NM	NM	0	5.00
4/22/2013	9.72	36.72	0.48	0.25	NM	NM	NM	0	2.75
5/30/2013	9.61	35.09	2.11	0.75	NM	NM	NM	0	7.50
6/29/2013	10.61	35.61	1.59	0.75	NM	NM	NM	0	7.00
7/22/2013	9.74	35.71	1.49	0.75	NM	NM	NM	0	6.50
8/26/2013	10.76	35.93	1.27	0.75	NM	NM	NM	0	6.50
9/27/2013	10.52	36.39	0.81	0.5	NM	NM	NM	0	5.75
10/31/2013	10.31	36.47	0.73	1	NM	NM	NM	0	5.07
11/27/2013	10.39	36.51	0.69	1	NM	NM	NM	0	4.74
12/31/2013	10.13	36.72	0.48	1	NM	NM	NM	0	4.71
1/30/2014	12.62	36.49	0.71	0.75	NM	NM	NM	0	4.67
3/3/2014	12.12	36.35	0.85	0.75	NM	NM	NM	0	4.91
3/31/2014	12.01	36.27	0.93	0.75	NM	NM	NM	0	4.98
4/30/2014	11.84	36.02	1.18	0.75	NM	NM	NM	0	5.10
5/27/2014	11.71	35.79	1.41	0.75	NM	NM	NM	0	4.85
6/26/2014	11.58	35.91	1.29	0.5	NM	NM	NM	0	5.03
7/31/2014	11.32	35.82	1.38	0.5	NM	NM	NM	0	4.75
8/27/2014	11.19	36.09	1.11	0.5	NM	NM	NM	0	4.25
10/3/2014	11.09	36.01	1.19	0.5	NM	NM	NM	0	4.75
11/3/2014	11.16	36.19	1.01	0.75	9.31	19.12	6.23	2.00	7.25
11/24/2014	11.21	36.27	0.93	0.5	9.39	19.62	5.73	2.00	8.00
12/22/2014	11.26	36.19	1.01	0.5	9.34	19.86	5.49	2.00	8.25
1/29/2015	11.06	36.34	0.86	0.5	9.14	21.29	4.06	2.00	7.75
2/26/2015	11.09	36.34	0.86	0.5	9.17	19.97	5.38	2.5	10.00
3/26/2015	10.93	36.42	0.78	0.5	9.12	20.31	5.04	0.75	7.25
4/27/2015	10.78	36.52	0.68	0.5	9.17	20.46	4.89	2	10.50
5/26/2015	10.61	36.72	0.48	0.75	9.09	20.59	4.76	2.5	12.25
7/6/2015	8.52	36.91	0.29	0.75	7.01	21.16	4.19	2	10.50
8/3/2015	8.66	36.96	0.24	0.75	7.12	21.39	3.96	2.5	10.75
8/27/2015	9.31	36.91	0.29	0.75	7.96	21.51	3.84	2	8.25
10/5/2015	8.62	37.02	0.18	0.5	7.23	21.67	3.68	2	8.00
11/5/2015	8.34	36.93	0.27	0.5	7.02	21.56	3.79	2	8.00
12/3/2015	8.12	36.81	0.39	0.5	6.83	21.67	3.68	2	8.00
12/28/2015	8.01	36.72	0.48	0.5	6.71	21.52	3.83	2.25	9.00
2/3/2016	7.82	36.19	1.01	0.25	6.52	21.67	3.68	2	9.00
3/3/2016	7.74	36.27	0.93	0.5	6.46	21.72	3.63	2	9.25
3/31/2016	7.67	36.39	0.81	0.5	6.49	21.86	3.49	2	9.25
5/3/2016	7.79	36.47	0.68	0.5	6.57	21.94	3.41	2	7.75
6/2/2016	7.71	36.42	0.73	0.5	6.65	21.91	3.44	2	8.25
7/8/2016	7.8	36.53	0.62	0.5	6.71	21.97	3.38	2	8.00
8/3/2016	7.89	36.59	0.56	0.5	6.82	22.04	3.31	2	8.00
8/30/2016	7.96	36.64	0.51	0.5	6.94	22.21	3.14	2	8.25
9/30/2016	7.91	36.51	0.64	0.5	7.04	22.39	2.96	2	8.50
11/3/2016	7.86	36.36	0.79	0.5	7.11	22.49	2.86	2	8.50
11/30/2016	7.97	36.47	0.68	0.75	7.29	22.67	2.68	2	8.75
1/4/2017	8.04	36.36	0.79	0.75	7.42	22.74	2.61	2	8.75
2/7/2017	8.12	36.21	0.94	0.75	7.48	22.93	2.42	2.5	9.00
3/2/2017	8.01	36.26	0.89	0.75	7.36	23.26	2.09	2	8.50
4/3/2017	7.93	36.43	0.72	0.75	7.29	23.34	2.01	2	7.50
4/27/2017	7.86	36.52	0.63	0.75	7.36	23.42	1.93	2	8.00
5/29/2017	7.94	36.41	0.74	0.75	7.51	23.51	1.84	2	7.75
7/5/2017	8.04	36.36	0.79	0.75	7.79	23.59	1.76	2	7.25
8/1/2017	8.16	36.31	0.84	0.75	7.89	23.51	1.84	2	8.00
9/5/2017	8.22	36.47	0.68	0.75	7.81	23.48	1.87	2	8.25
10/4/2017	8.29	36.56	0.59	0.75	7.89	23.51	1.84	2	7.75
11/2/2017	8.37	36.51	0.64	1	7.97	23.59	1.76	2	8.50
11/29/2017	8.33	36.59	0.56	1	8.02	23.67	1.68	2	8.00
1/2/2018	8.07	36.72	0.43	1	8.17	23.82	1.53	2	8.25
2/7/2018	8.17	36.91	0.24	1	8.29	23.97	1.38	2	8.25
3/1/2018	8.31	36.94	0.21	1	8.47	23.91	1.44	2	7.50

TABLE 1

**SUMMARY OF DNAPL RECOVERY MEASUREMENTS
UPRR HOUSTON, TX - WOOD PRESERVING WORKS**

DNAPL Recovery Date	MW-75B				MW-78A				Approx DNAPL Recovered (gal)
	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)	DTW (ft BTOC)	DTD (ft BTOC)	DNAPL Thickness (ft)	DNAPL Pumped (gal)	
4/2/2018	8.26	36.89	0.26	0.75	8.39	23.97	1.38	2.25	7.75
5/1/2018	8.92	36.96	0.19	0.75	9.02	24.06	1.29	2	9.00
6/1/2018	9.34	36.91	0.24	0.75	9.21	24.13	1.22	2	9.75
6/29/2018	9.67	36.82	0.33	0.75	9.39	24.21	1.14	2.25	10.50
8/3/2018	9.84	36.87	0.28	0.75	9.47	24.31	1.04	2	10.00
8/31/2018	9.71	36.91	0.24	0.75	9.32	24.47	0.88	2	8.25
9/28/2018	9.62	36.84	0.31	0.75	9.22	24.39	0.96	2	8.25
11/2/2018	9.57	36.88	0.27	0.75	9.09	24.27	1.08	2	8.50
11/29/2018	9.41	36.92	0.23	1	8.96	24.22	1.13	2	7.50
1/2/2019	9.28	36.96	0.19	1	8.78	24.39	0.96	2	7.75
2/2/2019	9.22	36.91	0.24	1	8.71	24.47	0.88	2	8.00
2/28/2019	9.16	36.93	0.22	1	8.67	24.42	0.93	2	8.75
4/2/2019	9.06	36.91	0.24	1	8.58	24.43	0.92	2	8.75
4/25/2019	9.02	36.72	0.43	1	8.49	24.31	1.04	2	9.25
5/29/2019	9.07	36.67	0.48	1	8.42	24.26	1.09	2	9.25
6/12/2019	8.92	ND	Trace	0	8.67	23.96	1.39	2	9.00
6/30/2019	8.66	ND	Trace	0	9.36	23.77	1.58	2	9.75
7/16/2019	8.62	ND	Trace	0	9.29	23.62	1.73	2	10.50
8/2/2019	8.67	ND	Trace	0	9.34	23.57	1.78	2	8.00
8/15/2019	8.69	ND	ND	0	9.42	23.06	2.29	2	12.00
8/28/2019	8.72	ND	Trace	0	9.51	23.01	2.34	2	12.00
9/17/2019	8.61	ND	Trace	0	9.39	22.76	2.59	2	13.00
10/2/2019	8.53	ND	Trace	0	9.27	22.58	2.77	2	10.50
10/16/2019	NM	NM	NM	0	10.16	21.63	3.72	2	8.00
10/31/2019	NM	NM	NM	0	10.41	21.79	3.56	2.5	8.50
11/15/2019	7.91	ND	0	0	8.01	21.62	3.73	1.5	5.00
12/3/2019	8.24	ND	0	0	8.41	22.12	3.23	2	6.50
12/18/2019	4.99	ND	0	0	8.38	ND	0	0	1.75
12/30/2019	7.79	35.3	1.85	0	9.16	19.93	5.42	1.5	3.25
Total DNAPL Pumped (gal)	52.75				139				706.06

Notes:

* - indicates DNAPL and groundwater mixture

--- - No DNAPL pumped

DTW - Depth to water (feet Below Top of Casing (BTOC))

DTD - Depth to DNAPL (feet BTOC)

ND - Not detected

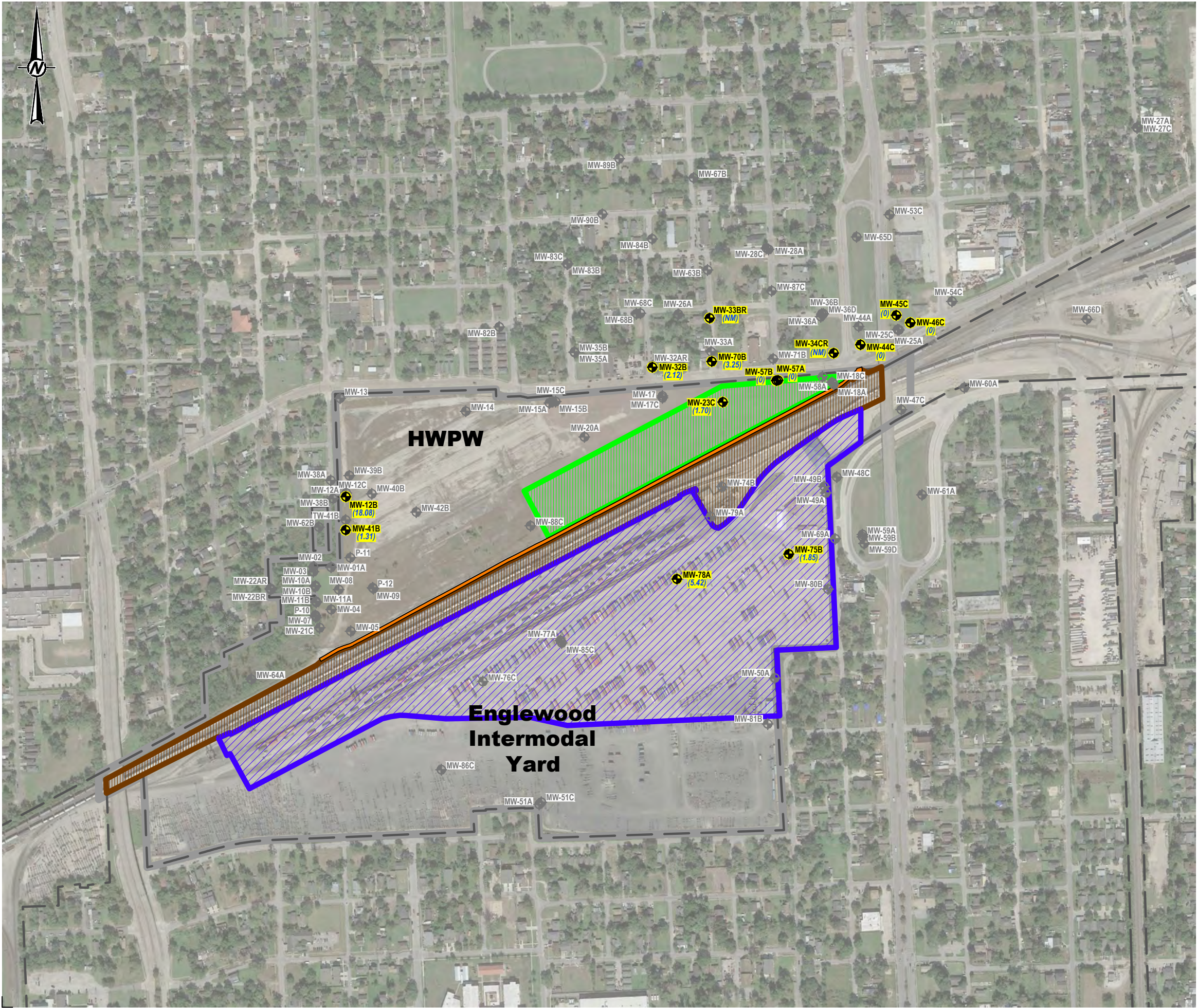
NM - Not measured

PoP - Product on probe, not measureable

TR- Trace amount of DNAPL Extracted

FIGURES

Path: \\usarpc\usarpc\Projects - Round Rock\2019\1919232 - HWPW\2020-2\Fish - File Name: FIG 1 - In-Well DNAPL Thickness (December 2019).dwg | Last Edited By: adiamond | Date: 2020-02-14 | Time: 2:54:05 PM | Printed By: adiamond | Date: 2020-02-14 | Time: 2:54:49 PM



LEGEND

- UPRR PROPERTY BOUNDARY
- MONITORING WELL LOCATION
- MONITORING WELL LOCATION USED FOR DNAPL RECOVERY
- (0.84) IN WELL DNAPL THICKNESS (FT)
- RAILROAD BALLAST CAP AREA
- ASPHALT CAP AREA
- SOIL CAP AREA
- CONCRETE CAP AREA

REFERENCE(S)

BASE MAP FROM GOOGLE EARTH, IMAGERY DATED 10/28/17.



CLIENT
UNION PACIFIC RAILROAD CO.

PROJECT
HOUSTON WOOD PRESERVING WORKS

TITLE
IN-WELL DNAPL THICKNESS
DECEMBER 2019

CONSULTANT	YYYY-MM-DD	2020-02-14
	DESIGNED	AJD
	PREPARED	AJD
	REVIEWED	SB
	APPROVED	ECM



IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B

Figure 2
DNAPL Recovery Activities January 2018 - December 2019
UPRR Houston Wood Preserving Works

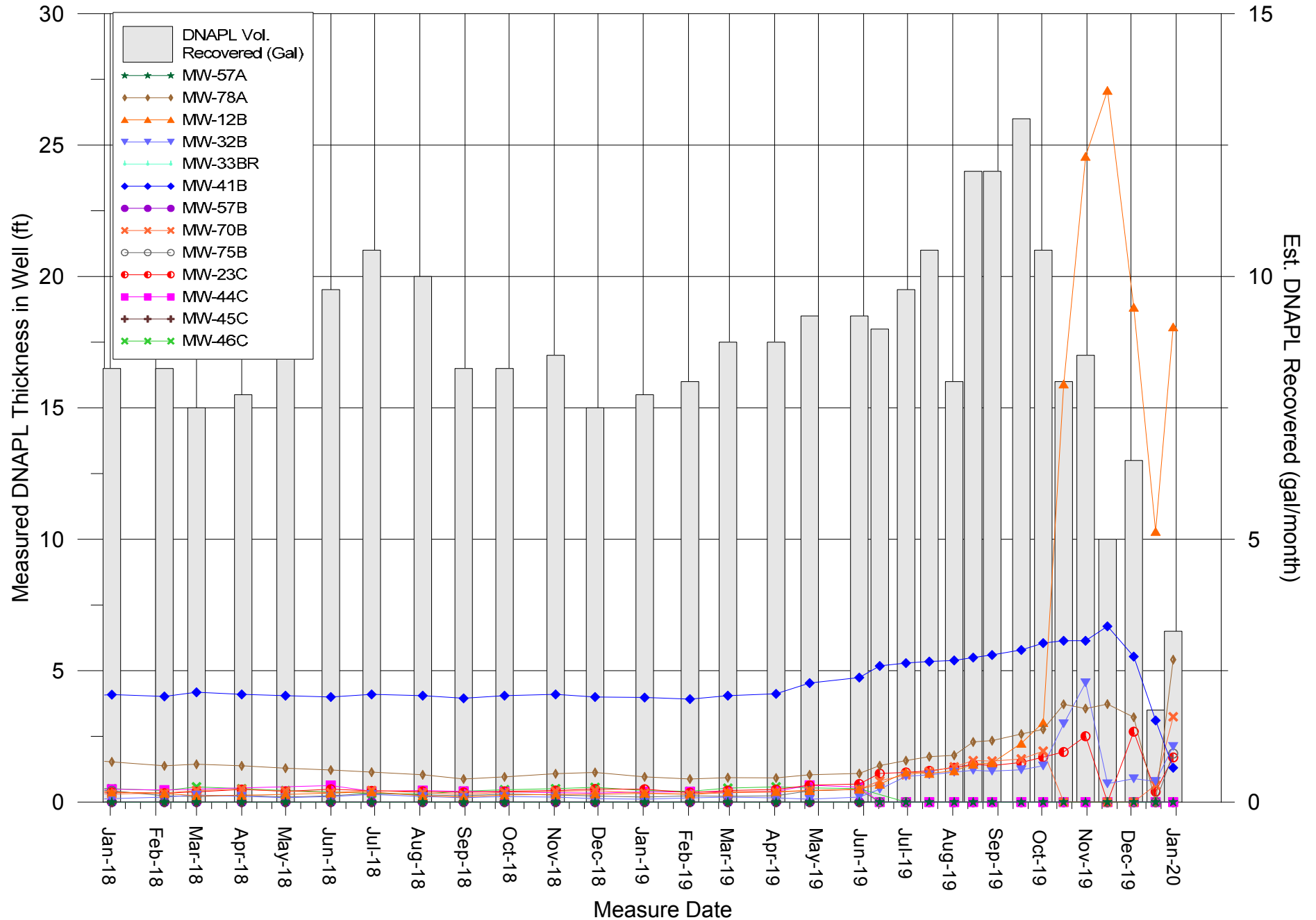
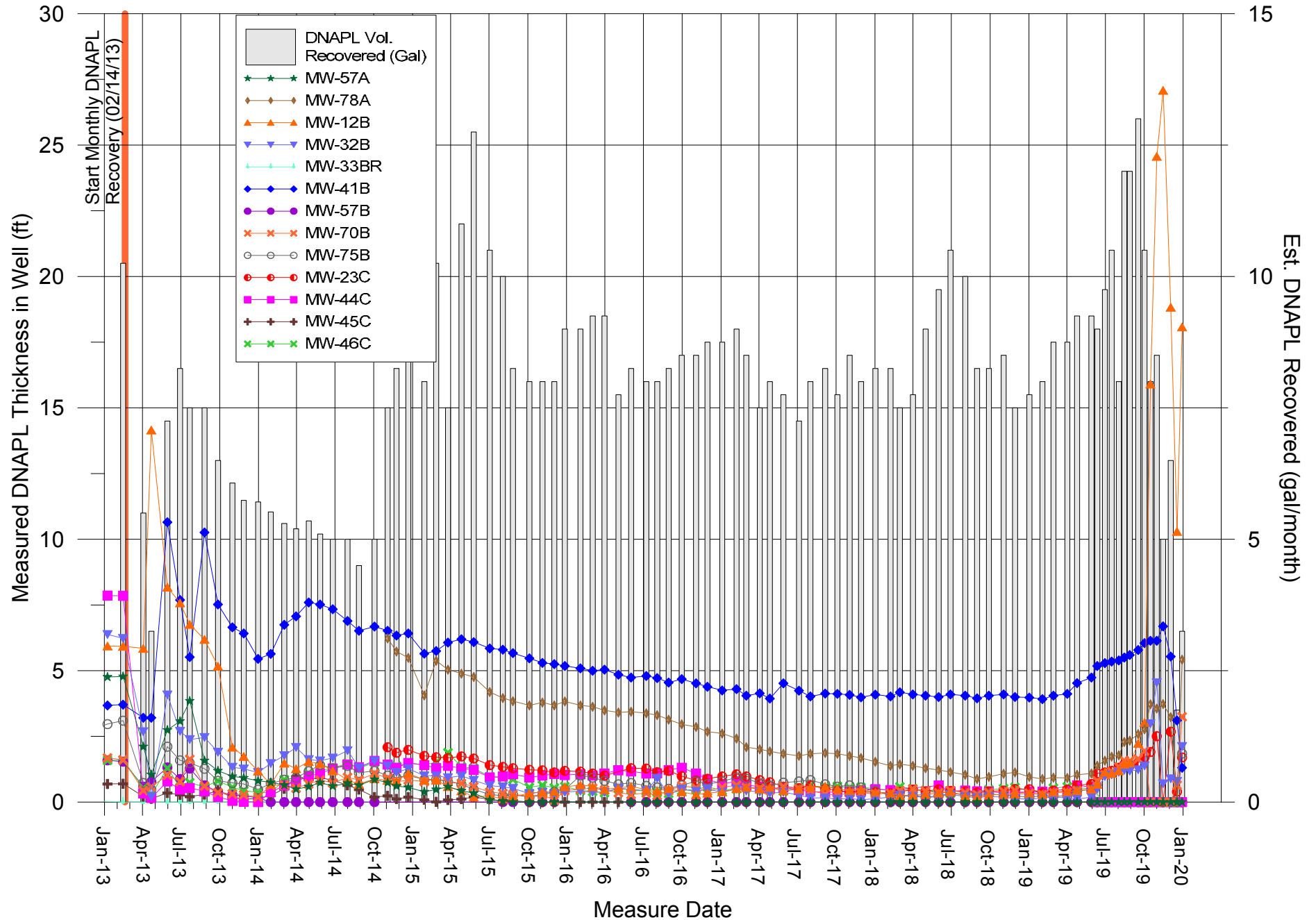


Figure 3
DNAPL Recovery Activities February 2013 - December 2019
UPRR Houston Wood Preserving Works



ATTACHMENT 1

Recovered DNAPL Waste Manifest

Projects #1-0-0
Please print or type.

2000010247

E

Order #: 173745

Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST		1. Generator ID Number TXD000820266 / 31547		2. EPA ID# TX		3. Emergency Response Phone 877-577-2669		4. Manifest Tracking Number 014355625 FLE																																													
5. Generator's Name and Mailing Address Union Pacific Railroad 1400 Douglas St, Stop 1030 Omaha, NE 68177 UP Railroad Houston Wood Preserving Works 4910 Liberty Rd Houston TX 77026																																																					
6. Generator's Phone: 414-387-4164 ATTN: Kevin Peterburs 6. Transporter 1 Company Name: Environmental Management P#: None State ID#: TX U.S. EPA ID Number: TXD065141378																																																					
7. Transporter 2 Company Name: Stericycle Specialty Waste U.S. EPA ID Number: MKS000110924																																																					
8. Designated Facility Name and Site Address Clean Harbors Deer Park, L.P. 2027 Independence Pkwy South LaPorte TX 77571 State ID#: 56089																																																					
Facility's Phone: 281-830-2300																																																					
<table border="1"><thead><tr><th rowspan="2">9a. H&I</th><th rowspan="2">9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))</th><th colspan="2">10. Containers</th><th rowspan="2">11. Total Quantity</th><th rowspan="2">12. Unit Wt/Vol</th><th colspan="2">13. Waste Codes</th></tr><tr><th>No.</th><th>Type</th><th></th><th></th></tr></thead><tbody><tr><td>1</td><td>RQ, NA3082, Hazardous waste, liquid, n.o.s. (creosote), 9, PG III, ERG 171</td><td>1</td><td>DM</td><td>15</td><td>G</td><td>09132195</td><td>F034</td></tr><tr><td>2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></tbody></table>										9a. H&I	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers		11. Total Quantity	12. Unit Wt/Vol	13. Waste Codes		No.	Type			1	RQ, NA3082, Hazardous waste, liquid, n.o.s. (creosote), 9, PG III, ERG 171	1	DM	15	G	09132195	F034	2								3								4							
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2																																																					
3																																																					
4																																																					
14. Special Handling Instructions and Additional Information 01 F Covered creosote WR # 21809 (PF CH1209245) 55G																																																					
15. GENERATOR'S/OFFEROR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent. I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.																																																					
Generator's/Officer's Printed/Typed Name: Kevin Peterburs Signature: Kevin Peterburs Month: 12 Day: 30 Year: 19																																																					
16. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit: _____ Date leaving U.S.: _____																																																					
17. Transporter Acknowledgment of Receipt of Materials Transporter 1 Printed/Typed Name: Kevin Medina Signature: Kevin Medina Month: 12 Day: 30 Year: 19 Transporter 2 Printed/Typed Name: _____ Signature: _____ Month: _____ Day: _____ Year: _____																																																					
18. Discrepancy 18a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection Manifest Reference Number: _____																																																					
18b. Alternate Facility (or Generator) U.S. EPA ID Number: _____																																																					
Facility's Phone: _____																																																					
18c. Signature of Alternate Facility (or Generator) Month: _____ Day: _____ Year: _____																																																					
19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)																																																					
1 01 HCLD 2 3 4																																																					
20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in item 18a Printed/Typed Name: Terrysa Woods Signature: T. Woods Month: 1 Day: 6 Year: 20																																																					

ATTACHMENT 2

November 2019 MW-12B DNAPL
Sample Physical Properties
Laboratory Report



10450 Stancliff Rd. Suite 210
Houston, TX 77099
T: +1 281 530 5656
F: +1 281 530 5887

November 08, 2019

Eric Matzner
Golder Associates Inc.
2201 Double Creek Drive
Suite 4004
Round Rock, TX 78664

Work Order: **HS19110201**

Laboratory Results for: **Houston TX-Wood Preserving Works**

Dear Eric,

ALS Environmental received 1 sample(s) on Nov 01, 2019 for the analysis presented in the following report.

The analytical data provided relates directly to the samples received by ALS Environmental and for only the analyses requested. Results are expressed as "as received" unless otherwise noted.

QC sample results for this data met EPA or laboratory specifications except as noted in the Case Narrative or as noted with qualifiers in the QC batch information. Should this laboratory report need to be reproduced, it should be reproduced in full unless written approval has been obtained by ALS Environmental. Samples will be disposed in 30 days unless storage arrangements are made.

If you have any questions regarding this report, please feel free to call me.

Sincerely,

Generated By: JUMOKE.LAWAL
Dane J. Wacasey

Client: Golder Associates Inc.
Project: Houston TX-Wood Preserving Works
Work Order: HS19110201

SAMPLE SUMMARY

Lab Samp ID	Client Sample ID	Matrix	TagNo	Collection Date	Date Received	Hold
HS19110201-01	DNAPL-1620-MW12B-20191101	Organic		01-Nov-2019 09:00	01-Nov-2019 10:40	☐

Client: Golder Associates Inc.
Project: Houston TX-Wood Preserving Works
Work Order: HS19110201

CASE NARRATIVE

Work Order Comments

- The analysis for Viscosity with Density, was subcontracted to Integrated Geosciences Laboratories, LLC in Houston, TX. Final report attached.
-

Client: Golder Associates Inc.
Project: Houston TX-Wood Preserving Works
WorkOrder: HS19110201

DATES REPORT

Sample ID	Client Samp ID	Collection Date	Leachate Date	Prep Date	Analysis Date	DF
Batch ID: R350075 (0)		Test Name : SUBCONTRACT ANALYSIS - VISCOSITY			Matrix: Organic	
HS19110201-01	DNAPL-1620-MW12B-20191101	01 Nov 2019 09:00			08 Nov 2019 11:56	1

Client: Golder Associates Inc.
Project: Houston TX-Wood Preserving Works
WorkOrder: HS19110201

**QUALIFIERS,
ACRONYMS, UNITS**

Qualifier	Description
*	Value exceeds Regulatory Limit
a	Not accredited
B	Analyte detected in the associated Method Blank above the Reporting Limit
E	Value above quantitation range
H	Analyzed outside of Holding Time
J	Analyte detected below quantitation limit
M	Manually integrated, see raw data for justification
n	Not offered for accreditation
ND	Not Detected at the Reporting Limit
O	Sample amount is > 4 times amount spiked
P	Dual Column results percent difference > 40%
R	RPD above laboratory control limit
S	Spike Recovery outside laboratory control limits
U	Analyzed but not detected above the MDL/SDL

Acronym	Description
DCS	Detectability Check Study
DUP	Method Duplicate
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
MBLK	Method Blank
MDL	Method Detection Limit
MQL	Method Quantitation Limit
MS	Matrix Spike
MSD	Matrix Spike Duplicate
PDS	Post Digestion Spike
PQL	Practical Quantitation Limit
SD	Serial Dilution
SDL	Sample Detection Limit
TRRP	Texas Risk Reduction Program

CERTIFICATIONS,ACCREDITATIONS & LICENSES

Agency	Number	Expire Date
Arkansas	19-028-0	27-Mar-2020
California	2919, 2019-2020	30-Apr-2020
Dept of Defense	ANAB L2231	20-Dec-2021
Florida	E87611-28	30-Jun-2020
Illinois	2000322019-2	09-May-2020
Kansas	E-10352 2019-2020	31-Jul-2020
Kentucky	123043, 2019-2020	30-Apr-2020
Louisiana	03087, 2019-2020	30-Jun-2020
Maryland	343, 2019-2020	30-Jun-2020
North Carolina	624-2019	31-Dec-2019
North Dakota	R-193 2019-2020	30-Apr-2020
Oklahoma	2019-067	31-Aug-2020
Texas	TX104704231-19-23	30-Apr-2020



INTEGRATED GEOSCIENCES LABORATORIES, LLC

*Environmental * Geotechnical * Core Analysis*

6016 Centralcrest Street • Houston, Texas 77092
Telephone (713) 316-1800 • Fax (877) 255-9953

November 8, 2019

Dane Wacasey.
Project Manager,
ALS Group, U.S.A
10450 Stancliff Rd, Suite 210,
Houston, TX 77099.

Re: IGL File No: **49151**
Project Name: HS19110201.
Project Number: HS19110201
Site Location:

Subject: Final Report: DNAPL; 3-Point Density, Specific Gravity & Viscosity at 70°F,
100°F, 130°F – (ASTM D445, D1481).

Dear Dane Wacasey,

As you have been informed, Integrated Geosciences Laboratories, LLC acquired PTS Laboratories effective September 1, 2019. Therefore, all communications regarding future and current projects (including this) are being executed in the new name.

Please find enclosed report for Physical Properties analyses conducted upon samples received from your “**HS19110201**” project. All analyses were performed by applicable ASTM, EPA, or API methodologies. The samples are currently in storage and will be retained for thirty days past the completion of testing at no charge. Please note that the samples will be disposed of at that time. You may contact me regarding storage, disposal, or return of the samples.

Integrated Geosciences Laboratories appreciate the opportunity to be of service. If you have any questions or require additional information, please contact me or Emeka Anazodo at (713) 316-1800.

Sincerely,
Integrated Geosciences Laboratories, LLC.

C.A.Umeh

Chidi Umeh
Technical Consultant.
Encl.

Project Name: HS19110201
Project Number: HS19110201

IGL File No: 49151
Client: ALS Group, U.S.A

TEST PROGRAM - 20191106

FLUID ID	Date	Time	Fluid Type		DNAPL; 3-Point Density, Specific Gravity & Viscosity at (70°F, 100°F, 130°F)	Fluid Cleaning	Comment
			Method:		ASTM D445, D1481	Proprietary	
Date Received: 20191106							
DNAPL-1620-MW-12B- 20191101	11/1/19	0900	Ground Water		X	X	250 ml
TOTALS:					1	1	

Laboratory Test Program Notes

Standard TAT for basic analysis is 10-15 business days. completion of analyses.

Dynamic viscosity at three temperatures (70, 100, 130°F), includes density and specific gravity tests.

Integrated Geosciences Laboratories, LLC

IGL File No: 49150
 Client: ALS Group, U.S.A
 Report Date: 11/07/19

VISCOSITY, DENSITY, and SPECIFIC GRAVITY DATA (METHODOLOGY: ASTM D445, ASTM D1481, API RP40)

Project Name: HS19110201
 Project No: HS19110201

SAMPLE ID	MATRIX	TEMPERATURE, °F	SPECIFIC GRAVITY	DENSITY, g/cc	VISCOSITY	
					centistokes	centipoise
DNAPL-1620-MW-12B-20191101	DNAPL	70	1.0508	1.0506	217.857	228.888
		100	1.0478	1.0405	72.424	75.356
		130	1.0429	1.0283	28.162	28.959

QUALITY CONTROL DATA

Date: 11/07/19
 FLUID TYPE: Cannon® CVS S3
 TEMPERATURE, °F: 70
 DENSITY, MEASURED: 0.8616
 DENSITY, PUBLISHED: 0.8615
 RPD: 0.01
 VISCOSITY, MEASURED: 4.50
 VISCOSITY, PUBLISHED: 4.47
 RPD: 0.70
 CVS Lot #: 17301

CVS = Certified Viscosity Standard

PAGE 1 OF 1

COMMENTS

TIME 1626 hrs

RIGHT SOLUTIONS | RIGHT PARTNER