



Environmental Protection Division

# Remediation System Optimization

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# System Optimization

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- Ensuring the Remedial Action (RA) system is most effectively treating contamination.
- Utilize data collected from Operation & Maintenance (O&M) events to determine effectiveness.
- Can be evaluated and applied at different stages of remediation.
  - System Design
  - Startup
  - Throughout system operation

# Why Optimize?

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Uncertainty of where to focus remedial efforts after treating the target area

- Soil heterogeneity can cause contamination pockets that may be difficult to reach.
- Some areas may be receptive to the remedial approach, while others appear unaffected.
  - a.) Modify System?
  - b.) Change the remediation approach?

Potential savings on costs associated with O&M and sampling.

The subsurface dynamics change with the implementation of remediation systems.

# Remedial Action Evaluation

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The facility status will vary when the site manager receives a site.

- Involvement with Site Assessment (SA) and Remedial Action Plan (RAP) phases
- Received at Remedial Action Construction (RAC)/RA Startup

# Remedial Action Evaluation

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The facility status will vary when the site manager receives a site.

- Received during the continuation of O&M
- Currently in Natural Attenuation Monitoring/Post Active Remedial Monitoring (NAM/PARM) with apparent contaminant rebounding of recalcitrant compounds

# O&M Reports

Things to consider when reviewing submitted O&M Reports:

- O&M Reports provide the information needed to evaluate the effectiveness of the remediation system.
- Tracks the progress of remediation.
- Illustrates the influence that the remediation system has on Contaminants of Concern (COCs) in the subsurface.

TABLE 2: SYSTEM PERFORMANCE SUMMARY

Facility Name: Former Yates Oil #308 Facility ID No.: 49/8735492

Site Visit Date	Time	Days Between Site Visits	Days Since Startup	AS System						SVE System						System Status	
				Flow Rate (scfm)	Hour Meter	Total Treatment Days	Scheduled Downtime (days)	Operational %		Flow Rate (scfm)	Hour Meter	Total Treatment Days	Scheduled Downtime (days)	Operational %		AS	SVE
								Between Visits	Since Startup					Between Visits	Since Startup		
02/12/25	10:45			12	2.0					305	2.6					2	2
02/13/25	13:26	1.1	1.1	19	29	1.1		100%	100%	297	29	1.1		100%	100%	1	1
02/14/25	13:10	1.0	2.1	25	52	2.1		100%	100%	262	53	2.1		100%	100%	1	1
02/20/25	15:40	6.1	8.2	29	199	8.2		100%	100%	349	199	8.2		100%	100%	1	1

Treatment System Status Codes:

Code	Arrive	Depart
1	on	on
2	off	on
3	off	off
4	on	off

# O&M Reports

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## Important information found in O&M Reports

- Reading/analyzing groundwater analytical data.
  - Influence the Remedial system has in the subsurface at key monitoring wells
- Current system configuration
  - Operational Parameters
- Location of contaminant plume
  - Comprehensive annual sampling
- System run time



# Reading/analyzing influence data for key wells

- Dissolved Oxygen
- Pressure/vacuum measurements
- Groundwater elevation levels
- Location and levels of dissolved contaminant concentrations

TABLE 3: MONITOR WELL INFLUENCE DATA

Facility Name: Former 7-Eleven Food Store #10058  
 Facility ID#: 488512569

DATE	1/9/2025											
Well ID	MW-5R			MW-7			MW-8			MW-11		
	Stress in H <sub>2</sub> O	DO mg/L	DTW ft	Stress in H <sub>2</sub> O	DO mg/L	DTW ft	Stress in H <sub>2</sub> O	DO mg/L	DTW ft	Stress in H <sub>2</sub> O	DO mg/L	DTW ft
Baseline	0.0	0.27	6.98	0.0	0.61	6.80	0.0	1.55	7.06	0.0	1.27	6.99
Reading 1	1.3	5.05	3.03	0.3	4.34	4.15	0.8	4.91	5.32	0.4	3.71	5.88
Reading 2	1.0	5.74	4.50	0.5	4.77	6.23	0.7	5.20	6.60	0.6	5.56	6.37

DATE	1/16/2025											
Well ID	MW-5R			MW-7			MW-8			MW-11		
	Stress in H <sub>2</sub> O	DO mg/L	DTW ft	Stress in H <sub>2</sub> O	DO mg/L	DTW ft	Stress in H <sub>2</sub> O	DO mg/L	DTW ft	Stress in H <sub>2</sub> O	DO mg/L	DTW ft
Baseline	0.0	0.24	7.11	0.0	0.32	6.94	0.0	2.52	7.16	0.0	2.68	7.12
Reading 1	0.7	4.95	4.54	0.1	4.58	6.37	0.5	4.36	6.89	0.5	4.61	6.51
Reading 2	0.7	5.17	5.07	0.3	4.79	6.61	0.5	4.43	6.91	0.4	4.46	6.75

DATE	1/23/2025											
Well ID	MW-5R			MW-7			MW-8			MW-11		
	Stress in H <sub>2</sub> O	DO mg/L	DTW ft	Stress in H <sub>2</sub> O	DO mg/L	DTW ft	Stress in H <sub>2</sub> O	DO mg/L	DTW ft	Stress in H <sub>2</sub> O	DO mg/L	DTW ft
Baseline	0.0	0.32	6.92	0.0	1.61	6.75	0.0	1.80	6.97	0.0	3.18	6.85
Reading 1	0.9	5.28	4.29	0.3	5.18	6.38	1.0	5.01	6.96	0.5	4.72	6.45
Reading 2	1.2	5.35	4.82	0.0	5.76	6.52	1.1	3.91	6.83	0.7	5.33	6.70

DATE	1/30/2025											
Well ID	MW-5R			MW-7			MW-8			MW-11		
	Stress in H <sub>2</sub> O	DO mg/L	DTW ft	Stress in H <sub>2</sub> O	DO mg/L	DTW ft	Stress in H <sub>2</sub> O	DO mg/L	DTW ft	Stress in H <sub>2</sub> O	DO mg/L	DTW ft
Baseline	0.0	0.24	7.09	0.0	0.45	6.92	0.0	2.90	7.14	0.0	3.59	7.09
Reading 1	0.8	5.44	4.68	0.4	5.21	6.41	1.0	5.59	6.91	0.6	4.86	6.63
Reading 2	0.9	5.55	4.83	0.5	5.11	6.69	1.0	4.14	6.98	0.5	4.80	6.84

# O&M Reports

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Things to consider when evaluating the performance of the remediation system

- Check to see if the treatment points are addressing the impacted zone
- Are the contaminant concentrations at key monitoring wells reducing at an acceptable rate?
- Contaminant plume migration
- Groundwater contaminant rebound

# Performance Control

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Ways to optimize Air Sparge/Vertical Extent (AS/VE) system performance

- Applied vacuums to the VE wells and sparge pressures for AS wells
- Well configuration where the vacuums/pressures are applied.
- Is influence seen at the target plume area?

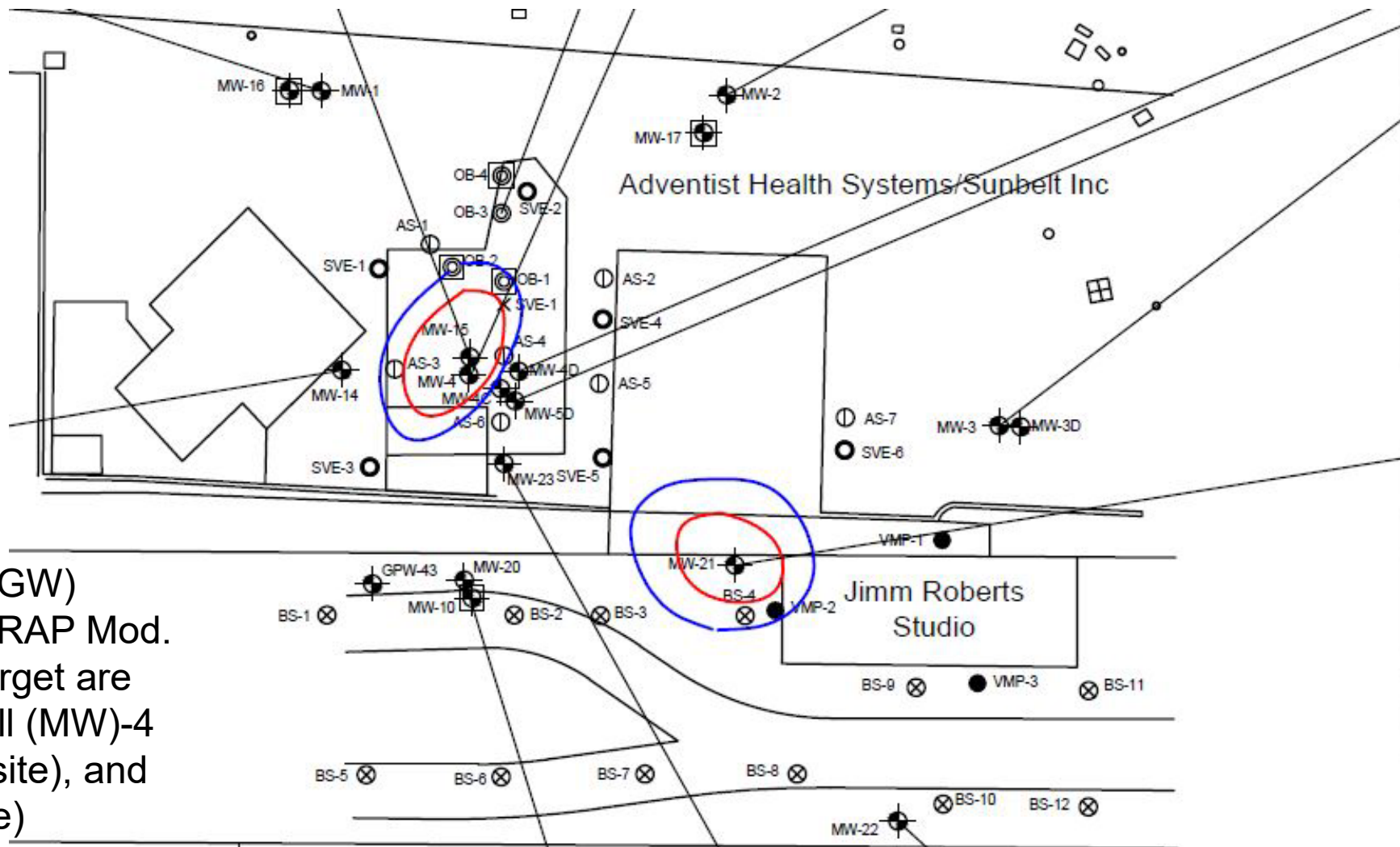
# Example

# A Brief Site History

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- Site received during NAM sampling.
- AS/SVE system operational for 4 yrs. and moved to NAM.
- COC rebound occurred and RAP Mod approved for AS/Bio Sparge (BS)/Soil Vapor Extraction (SVE).
- Operating for approx. 1 yr.

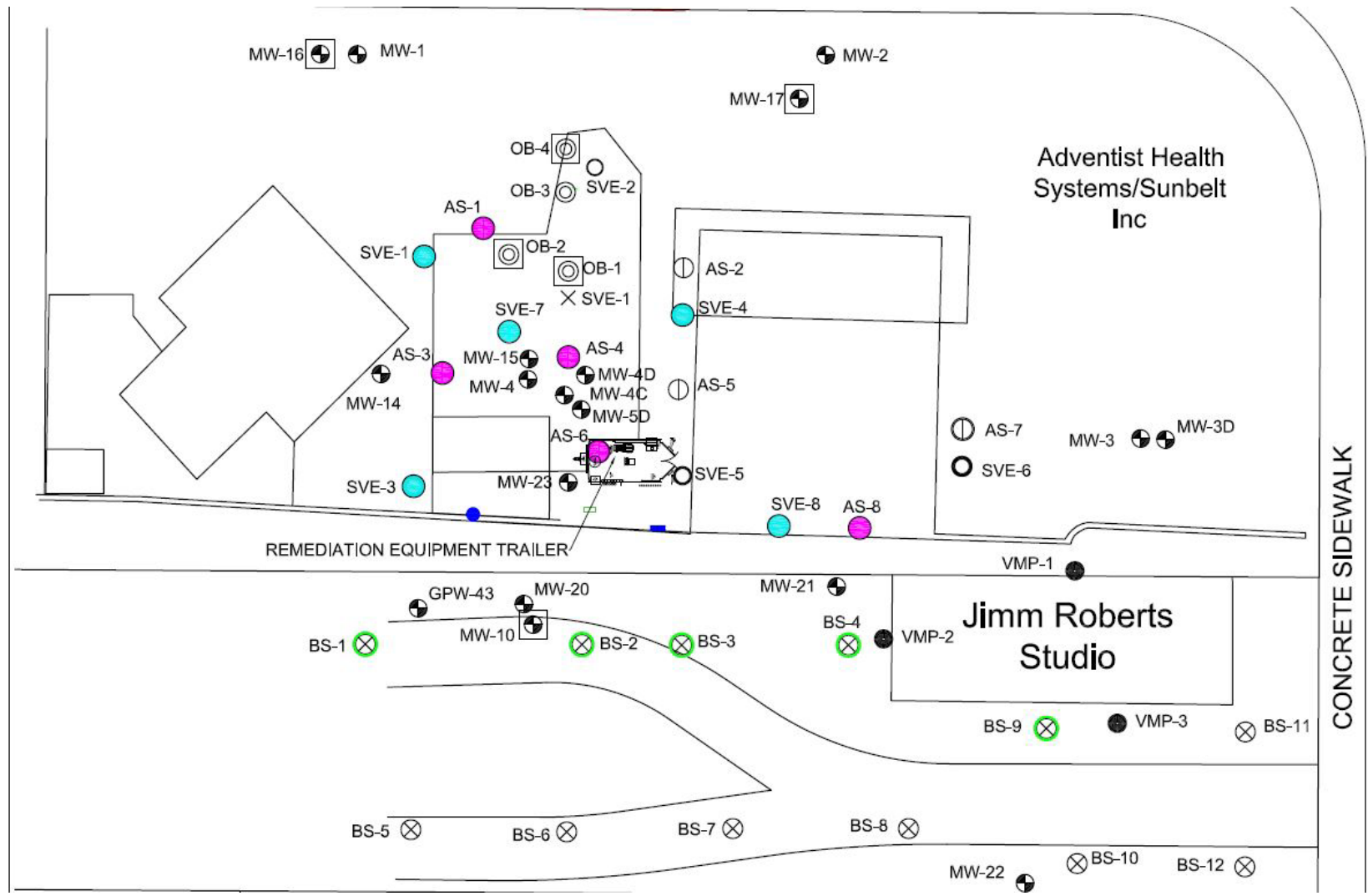




- Groundwater (GW) plume prior to RAP Mod. Key wells to target are Monitoring Well (MW)-4 & MW-15 (on-site), and MW-21 (off-site)

- AS/BS/SVE system is to focus on remediating COCs found in monitoring wells MW-4, MW-15, and MW-21.

- AS-8 & SVE-8 installed to treat GW in vicinity of MW-21



B= Base Line

K= Key Well

Location	Screen Interval	Date	Analytical Results = µg/l												
			NADC	100	400	300	200	NA	200	2	150	140	280	280	50000
			GCTL	1	40	30	20	NA	20	0.02	15	14	28	28	5000
			DTW	Benzene	Toluene	Ethyl Benzene	Total Xylenes	Total VOAs	MTBE	EDB	Total Lead	Naphthalene	1-Methyl Naphthalene	2-Methyl Naphthalene	TRPH
Active Remediation	10.5 - 20.50	10/23/06	13.91	0.5 U	<u>660</u>	<u>1200</u>	<u>4700</u>	6560	0.44 U	NA	NA	<u>220</u>	<u>98</u>	<u>170</u>	<u>12000</u>
		01/20/10	NM	<b>14.80</b>	8.20	255	<u>1230</u>	1508	6.80	NA	NA	0.39 U	0.9	0.2 U	3200
		07/21/10	13.35	<b>3.52</b>	<u>266</u>	<u>567</u>	<u>2360</u>	3197	1.0 U	NA	NA	<b>78.2</b>	24	<b>36.3</b>	<b>5730</b>
		10/26/10	14.15	<b>32.00</b>	<u>336</u>	<u>607</u>	<u>3100</u>	4075	38.60	0.71 U	NA	<u>47</u>	19	24.0	NA
		01/24/11	16.16	<b>20.50</b>	<b>365.00</b>	<u>177</u>	<u>2260</u>	2830	10 U	0.72 U	NA	<b>66.2</b>	25	<b>38.4</b>	3980
		04/26/11	15.95	0.5 U	<u>141 L</u>	<u>303 L</u>	<u>960</u>	1104	1.0 U	0.69 U	NA	<u>15.8</u>	18.8	13.6	4580
		08/09/11	14.45	<b>20.10</b>	<b>154.00</b>	<u>427</u>	<u>2100</u>	2701	20.10	1.3 U	NA	<u>166 J</u>	<b>90.8 J</b>	<b>153 J</b>	4260
		01/10/12	NM	<b>12.10</b>	<u>137 L</u>	<u>124 L</u>	<u>1120</u>	1393	1.0 U	0.60 U	NA	<u>22.8</u>	19.9	<b>29.6</b>	4640
		04/12/12	17.63	<b>12.50</b>	<b>144.00</b>	<u>198</u>	<u>1960</u>	2315	10.00	NA	NA	<b>52.6</b>	<b>41.0</b>	<b>66.5</b>	<b>6190</b>
		07/23/12	15.71	<b>13.60</b>	<u>113 L</u>	<u>422 L</u>	<u>2860</u>	2874	7.27	NA	NA	<b>63.4</b>	16.5	26.0	3,850 L
		10/22/12	13.30	<b>1.35</b>	5.33	14.90	<u>104</u>	126	1.0 U	NA	NA	4.2	1.8	2.5	329
		01/16/13	16.28	0.71 U	<b>51.00</b>	<u>110</u>	<u>600</u>	895	0.60 U	NA	NA	<u>17.0</u>	7.3	11.0	1100
		06/07/13	15.52	0.71 U	22.00	<b>97.00</b>	<u>780</u>	900	0.60 U	NA	NA	<b>15.0</b>	16.0	22.0	1000
09/06/13	12.65	0.71 U	2.90	20.00	<u>130</u>	154	0.60 U	NA	NA	6.8	8.9	12.0	370		
12/06/13	15.00	0.71 U	1.60	22.00	<u>160</u>	184	0.60 U	NA	NA	9.2	12.0	17.0	630		
01/21/15	13.59	0.20 U	0.41	13.20	<u>70</u>	84	0.30 U	NA	NA	4.8	10.6	15.8	838		
07/28/15	15.73	0.50 U	0.51 U	<b>91.00</b>	<u>300</u>	391	0.44 U	NA	NA	<b>43.0</b>	<b>29.0</b>	<b>35.0</b>	3400		
03/22/16	14.79	0.50 U	0.51 U	<u>140</u>	<u>790</u>	830	0.44 U	NA	NA	<b>71.0</b>	<b>37.0</b>	<b>55.0</b>	NS		
05/27/16	15.61	1.0 U	1.40	<u>200</u>	<u>1300</u>	1501	0.88 U	NA	NA	NA	NA	NA	NA		
09/26/16	14.04	0.50 U	0.51 U	<u>140</u>	<u>590</u>	730	0.44 U	NA	NA	<u>45</u>	28	<u>44</u>	2000		
01/09/18	14.39	0.25 U	0.24 U	<u>95</u>	<u>280</u>	375	0.44 U	NA	NA	<u>37</u>	24	<u>35</u>	1300		
04/08/19	15.14	0.25 U	0.24 U	<u>110</u>	<u>310</u>	420	0.44 U	NA	NA	<u>52</u>	<u>56</u>	<u>86</u>	NA		
12/06/21	14.13	0.25 U	0.24 U	30	<u>48</u>	78	0.44 U	NA	NA	13	<u>36</u>	<u>56</u>	1800		
01/30/23	12.95	0.71 U	0.72 U	19	<u>68</u>	87	0.60 U	NA	NA	11	<u>39</u>	<u>61</u>	3,900 U		
04/19/23	15.52	0.71 U	0.72 U	22	<u>52</u>	74	0.60 U	NA	NA	<u>16</u>	<u>71</u>	<u>110</u>	3,900 U		
07/13/23	14.40	0.71 U	0.72 U	23	<u>54</u>	77	0.60 U	NA	NA	<u>33</u>	<u>120</u>	<u>190</u>	NA		
10/18/23	12.68	0.71 U	0.72 U	5.7	15	20.7	0.60 U	NA	NA	3.7	13	21	NA		

- Benzene-Toluene-Ethylbenzene-Total Xylenes (BTEX) & naphthalene compounds for key well MW-15 have been reduced to below their respective Groundwater Cleanup Target Levels (GCTLs).

B= Base Line

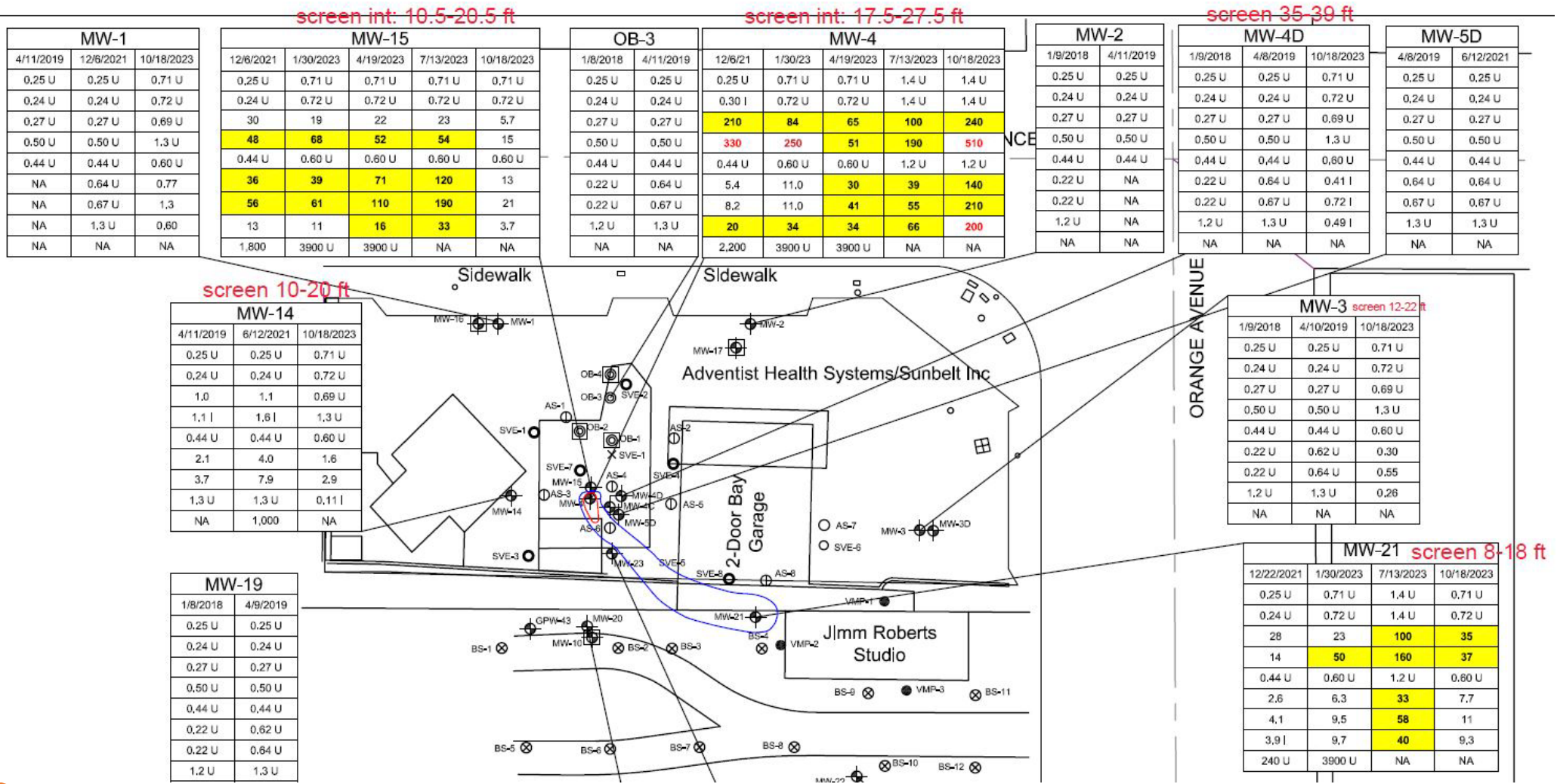
K= Key Well

Location	Screen Interval	Date	NADC	100	400	300	200	NA	200	2	150	140	280	280	50000
			GCTL	1	40	30	20	NA	20	0.02	15	14	28	28	5000
			DTW	Benzene	Toluene	Ethyl Benzene	Total Xylenes	Total VOAs	MTBE	EDB	Total Lead	Naphthalene	1-Methyl Naphthalene	2-Methyl Naphthalene	TRPH
MW-21	8 - 18.00	06/26/17	13.94	1.0 U	1.0 U	300.0	800	1100.0	0.88 U	NA	NA	41	19	27	1,900
		01/08/18	12.20	0.50 U	0.48 U	180.0	1000	1180.0	0.88 U	NA	NA	56	30	54	1,100
		04/09/19	NM	0.25 U	0.24 U	95.0	350	445.0	0.44 U	NA	NA	27	18	28	NA
		12/22/21	12.25	0.25 U	0.24 U	28	14	42	0.44 U	NA	NA	3.9 I	2.6	4.1	240 U
		01/30/23	11.74	0.71 U	0.72 U	23	50	73	0.60 U	NA	NA	9.7	6.3	9.5	3,900 U
		07/13/23	12.14	1.4 U	1.4 U	100	160	260	1.2 U	NA	NA	40.0	33.0	58.0	NA
		10/18/23	10.68	0.71 U	0.72 U	35	37	72	0.60 U	NA	NA	9.3	7.7	11	NA
MW-4	17.5 - 27.50	06/09/94	NM	1260	22000.0	2100	16720	42080.0	1000 U	0.02 U	24	1140	260	550	36000
		04/12/05	13.60	10 U	2300 J	1000	3500	6800.0	10 U	0.02 U	NA	320	74	120	1000
		10/19/05	11.92	NA	NA	NA	NA	NA	NA	NA	0.079	NA	NA	NA	NA
		09/26/16	14.30	0.50 U	1.1	190	600	791.1	0.44 U	NA	NA	24	7.3	10	1100
		01/09/18	14.65	0.50 U	0.63 I	360	840	1200.0	0.88 U	NA	NA	94	27	30	1500
		04/08/19	15.41	0.50 U	0.48 U	400	600	1000.0	0.88 U	NA	NA	93	20	27	NA
		12/06/21	14.42	0.25 U	0.30 I	210	330	540.3	0.44 U	NA	NA	20	5.4	8.2	2200
		01/30/23	13.21	0.71 U	0.72 U	84	250	334	0.60 U	NA	NA	34	11	11	3,900 U
		04/19/23	15.89	0.71 U	0.72 U	65	51	116	0.60 U	NA	NA	34	30	41	3,900 U
		07/13/23	14.67	1.4 U	1.4 U	100	190	290	1.2 U	NA	NA	66	38	55	NA
10/18/23	12.99	1.4 U	1.4 U	240	510	750	1.2 U	NA	NA	200	140	210	NA		

Active

Remediation

- MW-4 was not being sampled during the operation of the previous remedial system.
- GW COCs are not reducing as consistently as MW-15 (notice the screen interval of MW-4 is different than that of MW-15).



**MW-1**

4/11/2019	12/6/2021	10/18/2023
0.25 U	0.25 U	0.71 U
0.24 U	0.24 U	0.72 U
0.27 U	0.27 U	0.69 U
0.50 U	0.50 U	1.3 U
0.44 U	0.44 U	0.60 U
NA	0.64 U	0.77
NA	0.67 U	1.3
NA	1.3 U	0.60
NA	NA	NA

**MW-15** screen int: 10.5-20.5 ft

12/6/2021	1/30/2023	4/19/2023	7/13/2023	10/18/2023
0.25 U	0.71 U	0.71 U	0.71 U	0.71 U
0.24 U	0.72 U	0.72 U	0.72 U	0.72 U
30	19	22	23	5.7
48	68	52	54	15
0.44 U	0.60 U	0.60 U	0.80 U	0.60 U
36	39	71	120	13
56	61	110	190	21
13	11	16	33	3.7
1,800	3900 U	3900 U	NA	NA

**OB-3** screen int: 17.5-27.5 ft

1/8/2018	4/11/2019
0.25 U	0.25 U
0.24 U	0.24 U
0.27 U	0.27 U
0.50 U	0.50 U
0.44 U	0.44 U
0.22 U	0.64 U
0.22 U	0.67 U
1.2 U	1.3 U
NA	NA

**MW-4** screen int: 17.5-27.5 ft

12/6/21	1/30/23	4/19/2023	7/13/2023	10/18/2023
0.25 U	0.71 U	0.71 U	1.4 U	1.4 U
0.30 I	0.72 U	0.72 U	1.4 U	1.4 U
210	84	65	100	240
330	250	51	190	510
0.44 U	0.44 U	0.44 U	0.60 U	1.2 U
5.4	11.0	30	39	140
8.2	11.0	41	55	210
20	34	34	66	200
2,200	3900 U	3900 U	NA	NA

**MW-2** screen int: 35-39 ft

1/9/2018	4/11/2019
0.25 U	0.25 U
0.24 U	0.24 U
0.27 U	0.27 U
0.50 U	0.50 U
0.44 U	0.44 U
0.22 U	NA
0.22 U	NA
1.2 U	NA
NA	NA

**MW-4D** screen int: 35-39 ft

1/9/2018	4/8/2019	10/18/2023
0.25 U	0.25 U	0.71 U
0.24 U	0.24 U	0.72 U
0.27 U	0.27 U	0.69 U
0.50 U	0.50 U	1.3 U
0.44 U	0.44 U	0.60 U
0.22 U	0.64 U	0.41 I
0.22 U	0.67 U	0.72 I
1.2 U	1.3 U	0.49 I
NA	NA	NA

**MW-5D** screen int: 35-39 ft

4/8/2019	6/12/2021
0.25 U	0.25 U
0.24 U	0.24 U
0.27 U	0.27 U
0.50 U	0.50 U
0.44 U	0.44 U
0.64 U	0.64 U
0.67 U	0.67 U
1.3 U	1.3 U
NA	NA

**MW-14** screen 10-20 ft

4/11/2019	6/12/2021	10/18/2023
0.25 U	0.25 U	0.71 U
0.24 U	0.24 U	0.72 U
1.0	1.1	0.69 U
1.1 I	1.6 I	1.3 U
0.44 U	0.44 U	0.60 U
2.1	4.0	1.6
3.7	7.9	2.9
1.3 U	1.3 U	0.11 I
NA	1,000	NA

**MW-3** screen 12-22 ft

1/9/2018	4/10/2019	10/18/2023
0.25 U	0.25 U	0.71 U
0.24 U	0.24 U	0.72 U
0.27 U	0.27 U	0.69 U
0.50 U	0.50 U	1.3 U
0.44 U	0.44 U	0.60 U
0.22 U	0.62 U	0.30
0.22 U	0.64 U	0.55
1.2 U	1.3 U	0.26
NA	NA	NA

**MW-19**

1/8/2018	4/9/2019
0.25 U	0.25 U
0.24 U	0.24 U
0.27 U	0.27 U
0.50 U	0.50 U
0.44 U	0.44 U
0.22 U	0.62 U
0.22 U	0.64 U
1.2 U	1.3 U

**MW-21** screen 8-18 ft

12/22/2021	1/30/2023	7/13/2023	10/18/2023
0.25 U	0.71 U	1.4 U	0.71 U
0.24 U	0.72 U	1.4 U	0.72 U
28	23	100	35
14	50	160	37
0.44 U	0.60 U	1.2 U	0.60 U
2.6	6.3	33	7.7
4.1	9.5	58	11
3.9 I	9.7	40	9.3
240 U	3900 U	NA	NA

- | MW-23    | - WELL ID                                  |
|----------|--|
| 4/8/2019 | - DATE                                     |
| 0.25 U   | - BENZENE                                  |
| 0.24 U   | - TOLUENE                                  |
| 0.27 U   | - ETHYLBENZENE                             |
| 0.50 U   | - TOTAL XYLENES                            |
| 0.44 U   | - METHYL TERT-BUTYL ETHER                  |
| 0.64 U   | - 1-METHYLNAPHTHALENE                      |
| 0.67 U   | - 2-METHYLNAPHTHALENE                      |
| 1.3 U    | - NAPHTHALENE                              |
| NA       | - TOTAL RECOVERABLE PETROLEUM HYDROCARBONS |
- SHADED** INDICATES EXCEEDANCE OF GCTLs
- RED** INDICATES EXCEEDANCE OF NADCS

# Observations

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- Current RA System appears to effectively treat key MWs intersecting the water table (MW-15 & MW-21)
- Focus remedial efforts on the COCs in depth of the screen interval of MW-4 (17-27 ft BLS)
- Determine if additional AS wells need to be installed deeper (currently screened at 28-30 ft below land surface (BLS)).
- Another RAP Mod perhaps?

# What has been done?

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- RAP Mod Approved for two additional AS wells installed to 35 ft BLS (approximately 5 ft deeper than existing AS wells)
- MW-4 is showing a positive response with increasing dissolved oxygen (DO) and decreasing COCs
- Continue to observe MW influence data and groundwater contaminant trends during system operation

Prior to RAP Mod, MW-4 did not show elevated D.O. Readings

WELL NO.	MW-4
WELL DEPTH	
SCREEN INT.	

DATE	DTW	D.O.	Vac/Press	Obs.
11/2/2022	10.46	0.49	2.5	NM
11/3/2022	10.55	0.30	2.9	NM
11/4/2022	10.38	0.52	2.5	NM
11/11/2022	8.62	0.48	2.4	NM
11/16/2022	9.40	0.60	0.8	NM
11/22/2016	9.34	0.50	1.00	NM
12/21/2022	11.00	8.70	0.70	NM
1/30/2023	13.21	6.11	0.90	NM
2/27/2023	14.38	0.81	0.00	NM
3/20/2023	15.05	0.64	0.00	NM
4/19/2023	15.89	0.26	0.00	NM
5/16/2023	16.42	7.10	0.00	NM
6/14/2023	15.55	0.72	0.00	NM
7/13/2023	14.67	0.97	0.00	NM
8/24/2023	14.33	2.66	0.00	NM
9/27/2023	13.03	1.20	0.00	NM
10/18/2023	NM			
12/8/2023	13.48	1.51	0.00	NM
1/17/2023	14.24	1.64	0.00	NM
2/14/2024	14.20	1.71	0.00	NM
3/12/2024	14.31	1.63	0.00	NM
4/15/2024	15.24	0.71	0.00	NM
5/15/2024	15.84	1.42	0.80	NM
6/17/2024	16.22	1.37	1.00	NM
7/16/2024	15.39	0.89	0.80	NM
9/3/2024	13.58	0.99	0.00	NM
10/16/2024	9.50	3.85	0.00	NM
11/18/2024	11.40	0.90	0.00	NM
12/10/2024	12.65	0.62	0.00	NM
1/15/2025	12.48	4.55	0.00	NM
2/13/2025	14.52	5.11	0.00	NM
3/17/2025	15.40	4.87	0.00	NM
4/17/2025	15.66	6.17	0.00	NM
5/15/2025	14.63	6.80	0.00	NM
6/16/2025	13.56	6.42	0.00	NM
7/15/2025	13.30	6.81	0.00	NM

After 2<sup>nd</sup> RAP Mod implementation D.O. values increase

Rap Mod  
Active

AS-9	AS-10
2	2
35	35
33-35	33-35
6/7	6/7

Date	Flow			Date	Pressure		
	Mani-fold	Mani-fold	Well-head		Mani-fold	Mani-fold	Well-head
9/3/2024	1.2	6.0	5.1	9/3/2024	1.5	6.0	5.1
10/16/2024	1.2	5.5	2.5	10/16/2024	1.2	6.5	4.6
11/18/2024	1.2	3.5	5.6	11/18/2024	1.2	7.0	5.0
12/10/2024	1.0	7.0	5.7	12/10/2024	1.5	7.0	5.8
1/15/2024	3.0	8.5	7.9	1/15/2024	2.0	8.4	7.9
2/13/2025	5.0	8.0	7.3	2/13/2025	5.7	8.1	7.2
3/17/2025	5.5	8.4	8.4	3/17/2025	5.0	8.2	9.0
4/17/2025	5.5	9.5	8.8	4/17/2025	6.0	9.0	8.9
5/15/2025	7.0	9.0	8.5	5/15/2025	6.0	8.5	8.0
6/16/2025	4.0	10.0	8.8	6/16/2025	5.0	9.5	8.1
7/15/2025	4.5	10.5	8.7	7/15/2025	4.5	10.0	8.4

Make sure to check system readings

B= Base Line  
K= Key Well

NADC	100	400	300	200	NA	200	140	280	280	50000
GCTL	1	40	30	20	NA	20	14	28	28	5000

Location	Screen Interval	Date	DTW	Benzene	Toluene	Ethyl Benzene	Total Xylenes	Total VOAs	MTBE	Naphthalene	1-Methyl Naphthalene	2-Methyl Naphthalene	TRPH
MW-4	17.5 - 27.50	06/09/94	NM	<u>1260</u>	<u>22000.0</u>	<u>2100</u>	<u>16720</u>	42080.0	1000 U	<u>1140</u>	<u>260</u>	<u>550</u>	<u>36000</u>
		04/12/05	13.60	10 U	<u>2300 J</u>	<u>1000</u>	<u>3500</u>	6800.0	10 U	<u>320</u>	74	120	1000
		10/19/05	11.92	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		09/26/16	14.30	0.50 U	1.1	<u>190</u>	<u>600</u>	791.1	0.44 U	<u>24</u>	7.3	10	1100
		01/09/18	14.65	0.50 U	0.63 I	<u>360</u>	<u>840</u>	1200.0	0.88 U	<u>94</u>	27	30	1500
		04/08/19	15.41	0.50 U	0.48 U	<u>400</u>	<u>600</u>	1000.0	0.88 U	<u>93</u>	20	27	NA
		12/06/21	14.42	0.25 U	0.30 I	<u>210</u>	<u>330</u>	540.3	0.44 U	<u>20</u>	5.4	8.2	2200
		01/30/23	13.21	0.71 U	0.72 U	<u>84</u>	<u>250</u>	334	0.60 U	<u>34</u>	11	11	3,900 U
		04/19/23	15.89	0.71 U	0.72 U	<u>65</u>	<u>51</u>	116	0.60 U	<u>34</u>	<u>30</u>	<u>41</u>	3,900 U
		07/13/23	14.67	1.4 U	1.4 U	<u>100</u>	<u>190</u>	290	1.2 U	<u>66</u>	<u>38</u>	<u>55</u>	NA
		10/18/23	12.99	1.4 U	1.4 U	<u>240</u>	<u>510</u>	750	1.2 U	<u>200</u>	<u>140</u>	<u>210</u>	NA
		01/17/24	14.24	7.1 U	7.2 U	<u>250</u>	<u>470</u>	720	6.0 U	<u>170</u>	<u>96</u>	<u>150</u>	<u>5300</u>
		04/15/24	15.24	3.6 U	3.6 U	<u>290</u>	<u>580</u>	870	3.0 U	<u>180</u>	<u>88</u>	<u>130</u>	NA
		07/16/24	15.39	1.4 U	1.4 U	<u>76</u>	<u>180</u>	256	1.2 U	<u>30</u>	9.5	11	NA
		10/16/24	9.50	3.6 U	3.6 U	<u>170</u>	<u>420</u>	590	3.0 U	<u>56</u>	21	<u>33</u>	NA
		01/15/25	12.48	1.4 U	1.4 U	<u>100</u>	<u>300</u>	400	1.2 U	<u>91</u>	<u>50</u>	<u>82</u>	NA
04/07/25	15.66	0.71 U	0.70 U	0.98 I	2.4	3.38	0.60 U	0.027 U	0.032 U	0.039 U	NA		
07/15/25	13.30	0.71 U	0.70 U	7.0	<u>21</u>	28	0.60 U	2.8	18	<u>29</u>	NA		

Groundwater contaminant concentrations are now showing a decreasing trend in MW-4

MW-15			
1/15/2025	4/17/2025	7/15/2025	10/15/2025
0.71 U	0.071 U	0.071 U	0.71 U
0.72 U	0.70 U	0.70 U	0.72 U
34	3.3	0.66 U	2.7
120	9.0	0.75 U	8.9
0.60 U	0.60 U	0.060 U	0.60 U
74	15	0.32 U	8.2
140	28	0.039 U	14
11.0	2.5	0.030 I	1.6
NA	NA	NA	NA

MW-1		
10/18/2023	10/16/2024	10/15/2025
0.71 U	0.71 U	0.71 U
0.72 U	0.72 U	0.72 U
0.69 U	0.69 U	0.66 U
1.3 U	1.3 U	0.75 U
0.60 U	0.60 U	0.60 U
0.77	0.032 U	0.032 U
1.3	0.039 U	0.039 U
0.60	0.027 U	0.027 U
NA	NA	NA

MW-4			
1/15/2025	4/17/2025	7/15/2025	10/15/2025
1.4 U	0.71 U	0.71 U	0.71 U
1.4 U	0.70 U	0.70 U	0.70 U
100	0.98 I	7.0	1.0
300	2.4	21	2.7
1.2 U	0.60 U	0.060 U	0.060 U
50	0.032 U	18	0.23
82	0.039 U	29	0.14 I
91	0.027 U	2.8	0.37
NA	NA	NA	NA

OB-3	
1/8/2018	4/11/2019
0.25 U	0.25 U
0.24 U	0.24 U
0.27 U	0.27 U
0.50 U	0.50 U
0.44 U	0.44 U
0.22 U	0.64 U
0.22 U	0.67 U
1.2 U	1.3 U
NA	NA

MW-2	
1/9/2018	4/11/2019
0.25 U	0.25 U
0.24 U	0.24 U
0.27 U	0.27 U
0.50 U	0.50 U
0.44 U	0.44 U
0.22 U	NA
0.22 U	NA
1.2 U	NA
NA	NA

MW-4D		
10/18/2023	10/16/2024	10/15/2025
0.71 U	0.71 U	0.71 U
0.72 U	0.72 U	0.72 U
0.69 U	0.69 U	0.66 U
1.3 U	1.3 U	0.75 U
0.60 U	0.60 U	0.60 U
0.41 I	0.032 U	0.032 U
0.72 I	0.039 U	0.039 U
0.49 I	0.027 U	0.027 U
NA	NA	NA

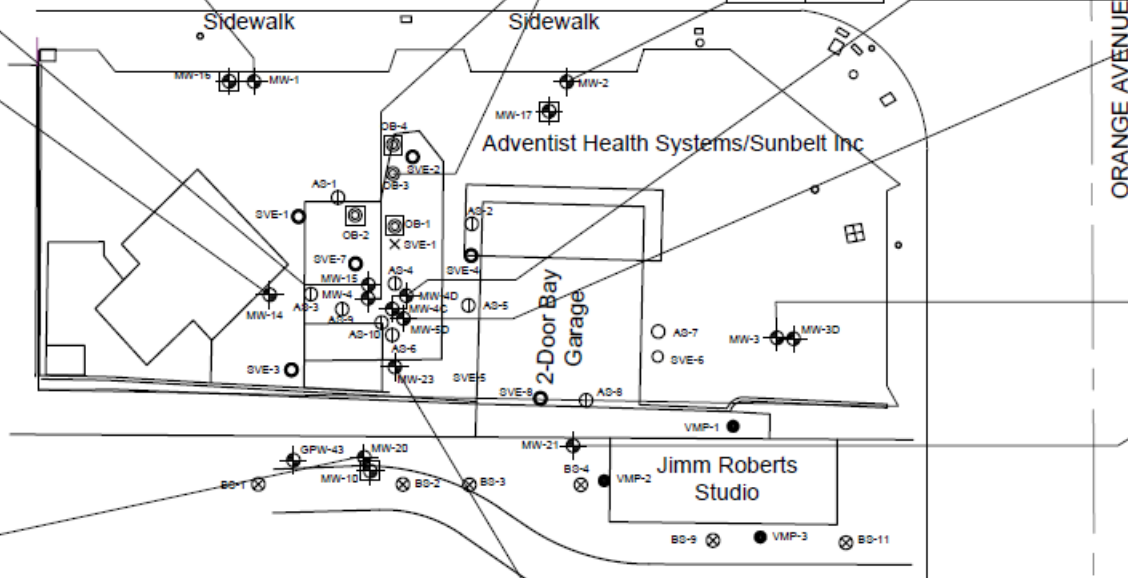
MW-5D	
4/8/2019	6/12/2021
0.25 U	0.25 U
0.24 U	0.24 U
0.27 U	0.27 U
0.50 U	0.50 U
0.44 U	0.44 U
0.64 U	0.64 U
0.67 U	0.67 U
1.3 U	1.3 U
NA	NA

MW-14		
10/18/2023	10/16/2024	10/16/2025
0.71 U	0.71 U	0.71 U
0.72 U	0.72 U	0.72 U
0.69 U	0.69 U	0.66 U
1.3 U	1.3 U	0.75 U
0.60 U	0.60 U	0.60 U
1.6	5.1	0.058 I
2.9	8.0	0.039 U
0.11 I	0.49	0.027 U
NA	NA	NA

MW-20	
4/10/2019	12/22/2021
0.25 U	0.25 U
0.24 U	0.24 U
2.3	1.6
0.50 U	0.50 U
0.44 U	0.44 U
5.7	4.0
8.5	5.2
2.0 I	1.2 U
NA	240 U

MW-3		
10/18/2023	10/16/2024	10/15/2025
0.71 U	0.71 U	0.71 U
0.72 U	0.72 U	0.72 U
0.69 U	0.69 U	0.66 U
1.3 U	1.3 U	0.75 U
0.60 U	0.60 U	0.60 U
0.30	0.032 U	0.032 U
0.55	0.039 U	0.039 U
0.26	0.027 U	0.027 U
NA	NA	NA

MW-21			
1/30/2023	7/13/2023	10/18/2023	1/17/2024
0.71 U	1.4 U	0.71 U	0.71 U
0.72 U	1.4 U	0.72 U	0.72 U
23	100	35	4.1
50	160	37	14
0.60 U	1.2 U	0.60 U	0.60 U
6.3	33	7.7	0.032 U
9.5	58	11	0.039 U
9.7	40	9.3	0.027 U
3900 U	NA	NA	NA



- | MW-23    | - WELL ID                                  |
|----------|--|
| 4/8/2019 | - DATE                                     |
| 0.25 U   | - BENZENE                                  |
| 0.24 U   | - TOLUENE                                  |
| 0.27 U   | - ETHYLBENZENE                             |
| 0.50 U   | - TOTAL XYLENES                            |
| 0.44 U   | - METHYL TERT-BUTYL ETHER                  |
| 0.64 U   | - 1-METHYLNAPHTHALENE                      |
| 0.67 U   | - 2-METHYLNAPHTHALENE                      |
| 1.3 U    | - NAPHTHALENE                              |
| NA       | - TOTAL RECOVERABLE PETROLEUM HYDROCARBONS |

- SHADED** INDICATES EXCEEDANCE OF GCTLs
- RED** INDICATES EXCEEDANCE OF NADCS

# Current GW COC Plume Map

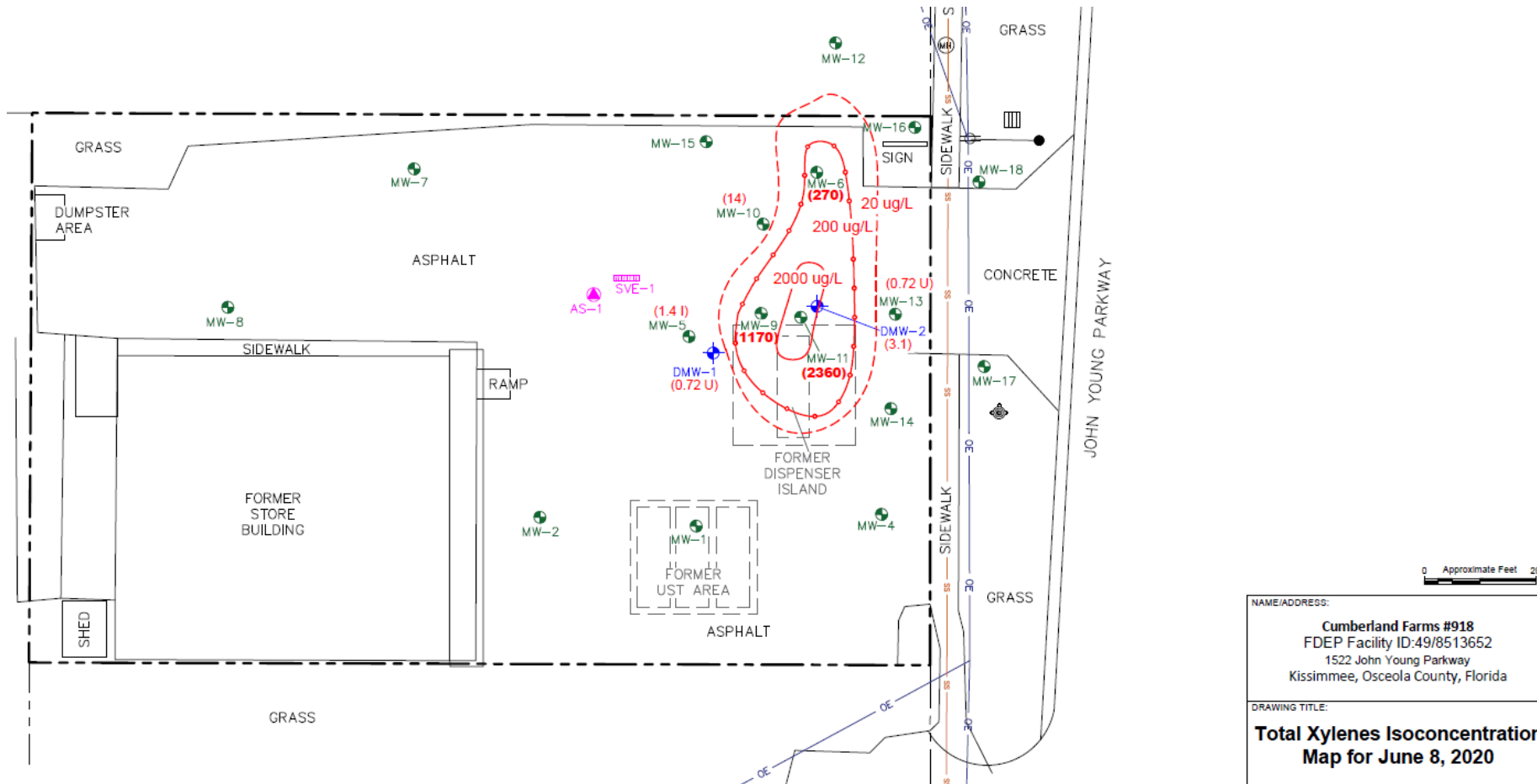
# Example

# Brief Site History

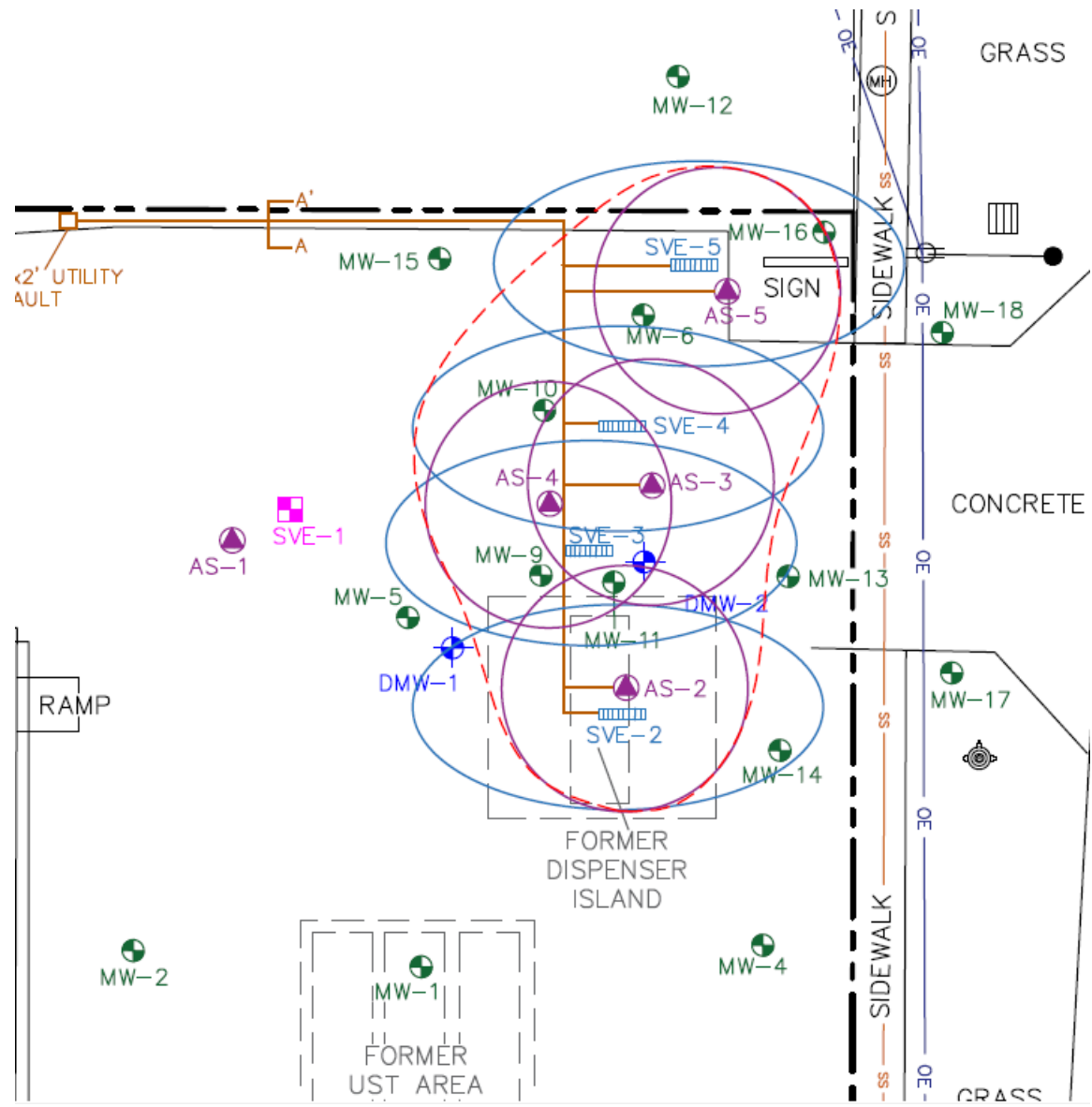
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- SA/NAM activities from 1994 – 2005.
- RAP for AS/SVE system approved 2007 (never implemented).
- RAP Mod approved for episodic AS/SVE in 2020.





- GW Plume is to the north of former dispenser island.
- MWs 6, 9 & 11 are over Natural Attenuation Default Concentrations (NADCs) for total xylenes (source wells).



- Proposed to install 4 AS and 4 SVE wells.
- Conduct episodic O&M events.

# What has been done?

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- 12 monthly AS/SVE episodic events conducted.
- 20 lbs hydrocarbons (HCs) removed from subsurface (10 lbs more than assumed in RAP).
- COCs in MW-6 decreased below GCTLs
- COCs in MWs-9 Decreased below NADCs
- COCs in MW-11 Remain above NADCs & MW-13 is now above GCTLs for ethylbenzene, total xylenes and naphthalene

**TABLE 3A: GROUNDWATER ANALYTICAL SUMMARY - VOCs**

Facility ID#: 49 8513652

Facility Name: Cumberland Farms #918  
1522 John Young Parkway, Kissimmee

Sample		Benzene	Toluene	Ethyl- benzene	Total Xylenes	MTBE	Lead
Location	Date	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
GCTLs		1**	40**	30**	20**	20	15*
NADCs		100	400	300	200	200	150
MW-6	10/30/1997	ND	ND	ND	ND	ND	
	11/20/1997	ND	ND	ND	ND	ND	
	5/19/1999	ND	ND	ND	ND	ND	
	5/19/2000	2	<1	7	<1	1	
	10/2/2001	1	<1	7.7	2	<1	
	8/29/2002	2	<1	15.6	<2	<1	
	2/12/2003	5	<1	24	<3	<1	
	5/22/2003	8	<1	41	<3	<1	
	8/20/2003	4	<1	9.3	<2	<1	
	11/12/2003	9.5	2	75.2	2	<1	
	2/10/2004	13.4	5.8	167	80	<1	
	6/14/2004	10.9	14.6	180	161.4	<1	
	10/13/2004	7.8	1.6	91.9	29.9	<1	
	11/29/2004	10.1	<1	172	82	<1	
	4/19/2005	15.6	23.6	419	506	<0.28	
	7/19/2005	11	10.8	322	473	<1	
	11/21/2005	3.9	1.1	93.3	30.6	<0.28	
	11/3/2006	6.8	183	271	674	<5	
	8/7/2019	1.6 U	13.7	237	367	1.1 U	
	6/8/2020	0.62 U	11.3	160	270	0.46 U	
1/4/2023	0.31 U	0.30 U	12.1	0.96 I	0.23 U		
6/26/2023	0.31 U	0.30 U	0.36 U	0.72 U	0.23 U		
3/15/2024	0.31 U	0.30 U	0.36 U	0.72 U	0.23 U		
6/14/2024	0.31 U	0.30 U	0.36 U	0.72 U	0.23 U		
9/18/2024	0.31 U	0.30 U	0.72 I	0.72 U	0.23 U		

BTEX COCs in MW-6 have been decreased to below GCTLs.

Active remediation began on 12/11/2023.

Episodic events remediated GW impacts found in vicinity of MW-6.

**TABLE 3A: GROUNDWATER ANALYTICAL SUMMARY - VOCs**

Facility ID#: 49 8513652

Facility Name: Cumberland Farms #918  
1522 John Young Parkway, Kissimmee

Sample		Benzene	Toluene	Ethyl-benzene	Total Xylenes	MTBE	Lead
Location	Date	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
<b>GCTLs</b>		<b>1**</b>	<b>40**</b>	<b>30**</b>	<b>20**</b>	<b>20</b>	<b>15*</b>
<b>NADCs</b>		<b>100</b>	<b>400</b>	<b>300</b>	<b>200</b>	<b>200</b>	<b>150</b>
MW-9	8/29/2005	10.1	2450	729	3660	<0.28	
	11/22/2005	6	307	221	1914	<0.28	<2.2
	11/3/2006	<50	1170	818	3040	<50	<7.5
	8/7/2019	1.6 U	96.3	302	730	1.1 U	
	6/8/2020	1.6 U	171	498	1170	2.3 U	
	1/4/2023	0.31 U	5.9	88.3	27.1	0.23 U	
	6/26/2023	0.31 U	44.5	70.9	186	0.23 U	
	3/15/2024	0.78 U	25.9	123	386	0.57 U	
	6/14/2024	0.31 U	0.30 U	0.36 U	0.72 U	0.23 U	
	9/18/2024	0.62 U	14.8	145	164	0.46 U	

BTEX COCs in MW-9 have been decreased to below NADCs.

Active remediation began on 12/11/2023.

O&M PARAMETERS FIELD LOG

CFI #918  
 FDEP FAC ID 49 8513652  
 Atlas Project No. EGFL051900

TOTAL  
 RUN TIME 30

Date		7/16/24	7/16/24		7/17/24		7/18/24		7/19/24	
Technician(s)		Jamie Hedding	Jamie Hedding		Jamie Hedding		Jamie Hedding		Jamie Hedding	
Parameter		Baseline	Reading	Obs	Reading	Obs	Reading	Obs	Reading	Obs
MW-5	Pressure ("H2O)	-	0		0		0		0	
	DTW (ft btoc)	6.4	5.63		6.22		6.24		6.25	
	DO (mg/L)	2.6	1.8		1.73		1.75		1.7	
MW-6	Pressure ("H2O)	-	-4.2		0		-0.8		0	
	DTW (ft btoc)	6.17	4.32		5.25		5.33		5.3	
	DO (mg/L)	5.11	8.81	b	8.44	b	8.61	b	8.69	b
MW-9	Pressure ("H2O)	-	0		0		0		0	
	DTW (ft btoc)	6.38	4.82		6.05		6.15		6.13	
	DO (mg/L)	2.1	7.61	b	6.75	b	6.83	b	6.99	b
MW-10	Pressure ("H2O)	-	0.4		1.2		1		1.1	
	DTW (ft btoc)	6.13	4.9		5.95		6		6.03	
	DO (mg/L)	3.11	2.75	sb	4.86	b	5.11	b	5.33	b
MW-11	Pressure ("H2O)	-	-1.9		-2.2		-2.4		-2.2	
	DTW (ft btoc)	6.25	4.48		5.95		6.03		6	
	DO (mg/L)	1.89	5.19	sb	5.93	b	6.04	b	6.26	b
MW-12	Pressure ("H2O)	-	0		0		0		0	
	DTW (ft btoc)	6.94	6.8		6.82		6.81		6.82	
	DO (mg/L)	2.08	1.91		1.85		1.9		1.85	
MW-13	Pressure ("H2O)	-	0		0		0		0	
	DTW (ft btoc)	5.88	5.05		5.69		5.73		5.74	
	DO (mg/L)	2.12	1.75		1.59		1.7		1.62	

BTEX COCs in MW-6 have been decreased to below GCTLs.

AS/SVE Episodic events influencing groundwater in the vicinity of MWs 6, 9, and 11.

There is no significant influence in the vicinity of MW-13.

**TABLE 3A: GROUNDWATER ANALYTICAL SUMMARY - VOCs**

Facility ID#: 49 8513652

Facility Name: Cumberland Farms #918  
1522 John Young Parkway, Kissimmee

Sample		Benzene	Toluene	Ethyl- benzene	Total Xylenes	MTBE	Lead
Location	Date	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
GCTLs		1**	40**	30**	20**	20	15*
NADCs		100	400	300	200	200	150
MW-11	11/22/2005	13.1	2050	1230	3530	<.28	<.2.2
	6/28/2006	<25.0	1740	734	3070	<25.0	<.7.5
	8/7/2019	3.1 U	273	507	1350	2.3 U	
	6/8/2020	3.1 U	540	608	2360	2.3 U	
	1/4/2023	3.1 U	223	906	2060	2.3 U	
	6/26/2023	3.1 U	148	394	1620	2.3 U	
	3/15/2024	3.1 U	141	549	1910	2.3 U	
	6/14/2024	0.78 U	362	665	2420	0.57 U	
9/18/2024	3.1 U	82.6	371	809	2.3 U		
MW-12	11/22/2005	0.13	1.3	0.63	3.4	0.61	13.6
	11/3/2006	<1.0	<1.0	<1.0	<3.0	<1.0	<.7.5
	8/7/2019	0.31 U	0.3 U	0.36 U	0.72 U	0.23 U	
	1/4/2023	0.31 U	0.30 U	0.36 U	0.72 U	0.23 U	
	6/26/2023	0.31 U	0.30 U	0.36 U	0.72 U	0.23 U	
	3/15/2024	0.31 U	0.30 U	0.36 U	0.72 U	0.23 U	
	6/14/2024	0.31 U	0.30 U	0.36 U	0.72 U	0.23 U	
	9/18/2024	0.31 U	0.30 U	2	2.9 I	0.23 U	
MW-13	6/28/2006	12.4	4.5	373	1525	<1.0	<.7.5
	8/7/2019	0.39 I	1.3	144	283	0.23 U	
	6/8/2020	0.31 U	0.30 U	0.36 U	0.72 U	0.23 U	
	1/4/2023	0.31 U	0.30 U	0.36 U	2.0 I	0.23 U	
	6/26/2023	0.31 U	14.5	167	362	0.23 U	
	3/15/2024	0.31 U	3.3	42.5	112	0.23 U	
	6/14/2024	1.6 U	62.3	195	637	1.1 U	
	9/18/2024	0.62 U	6.9	101	186	0.46 U	

BTEX COCs in MW-11 remain above NADCs.

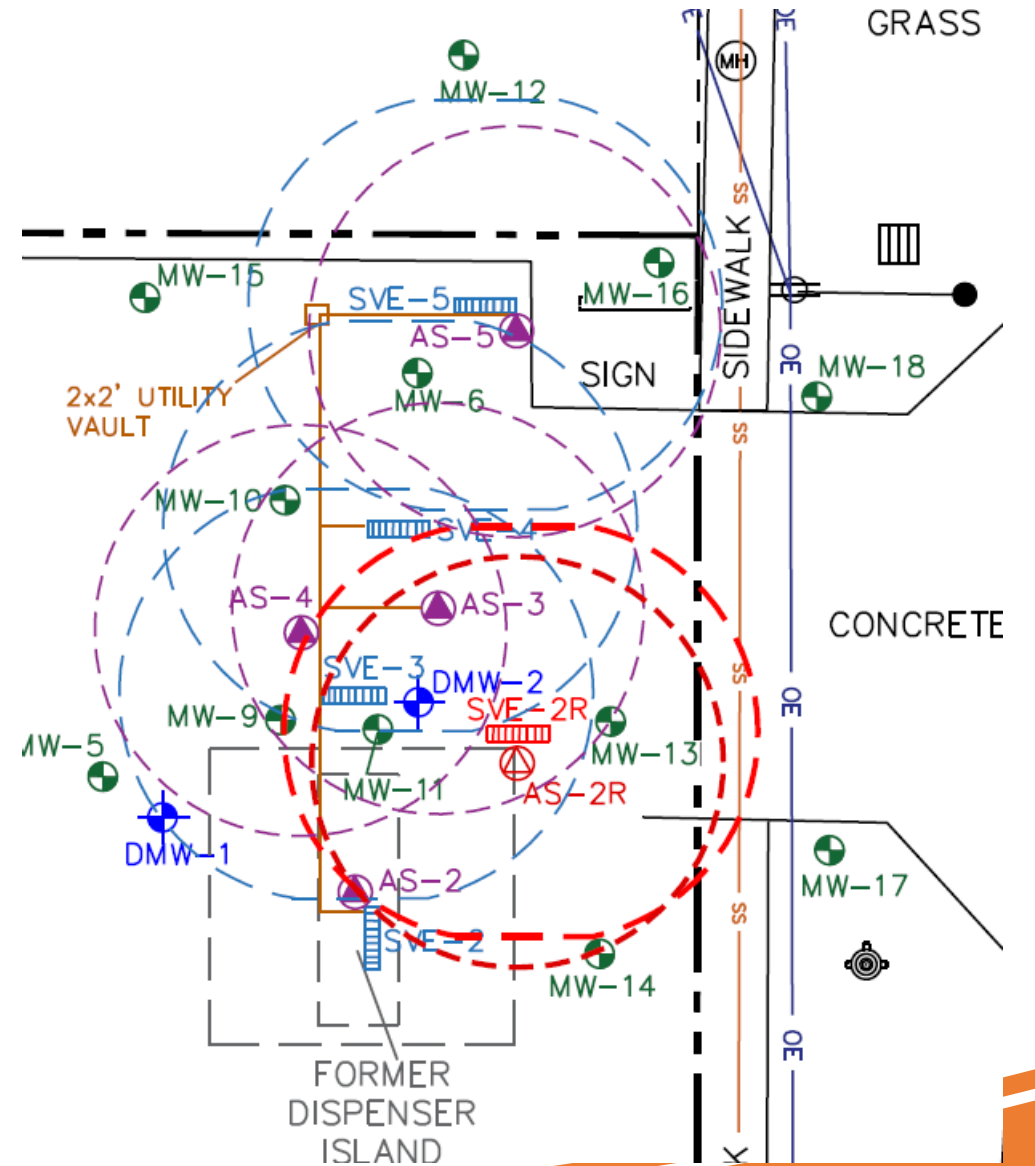
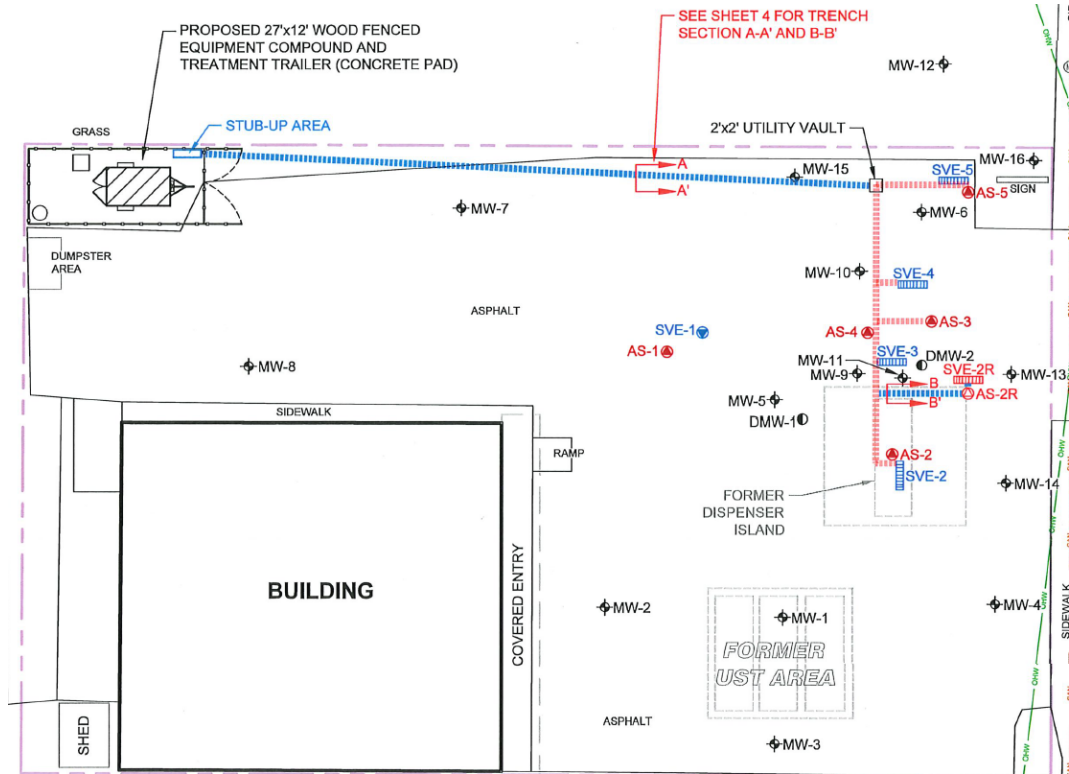
Apparent rebound of COCs in vicinity of MW-13 (previously under GCTLs).

Additional remediation needed to address impacts in vicinity of MW-13 and continue efforts at MW-11.

# What has been done?

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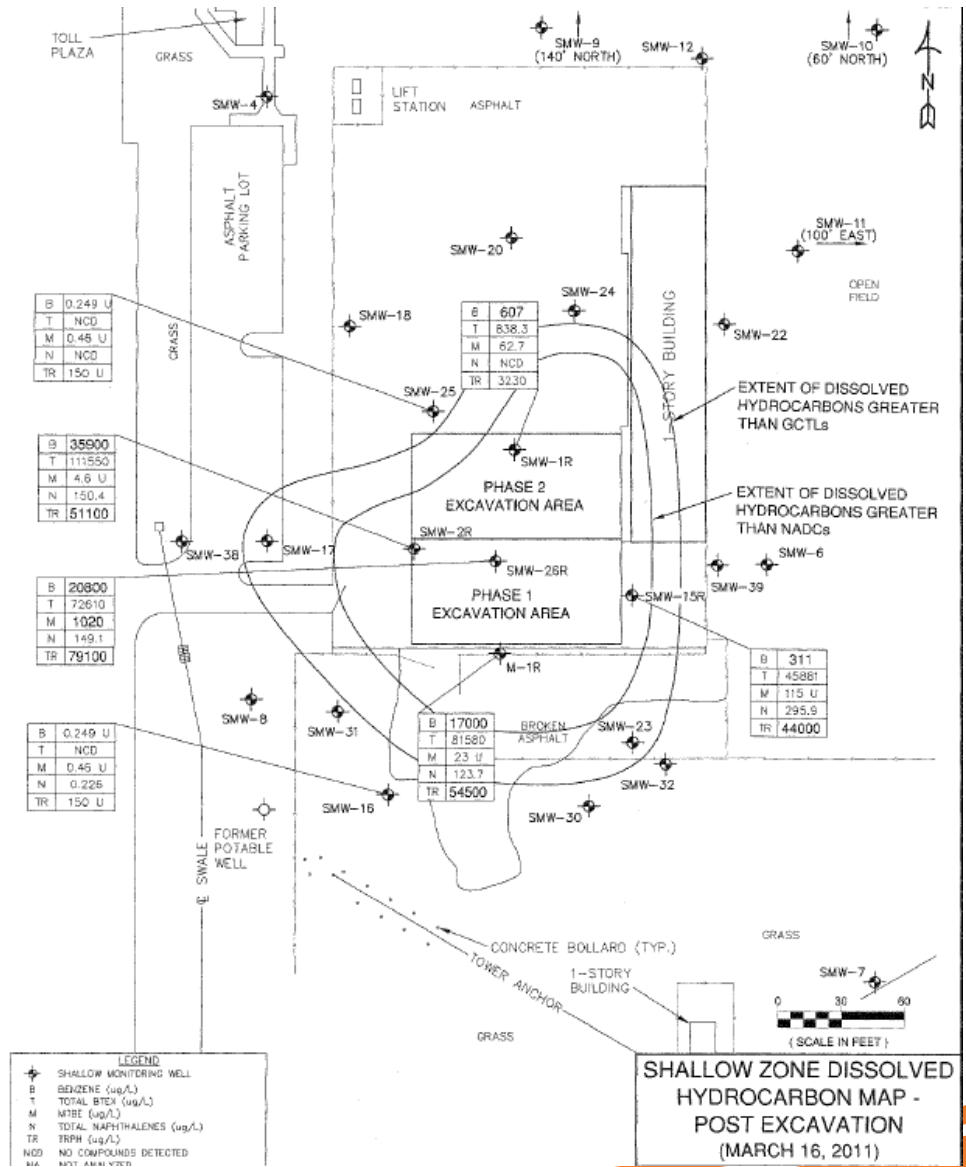
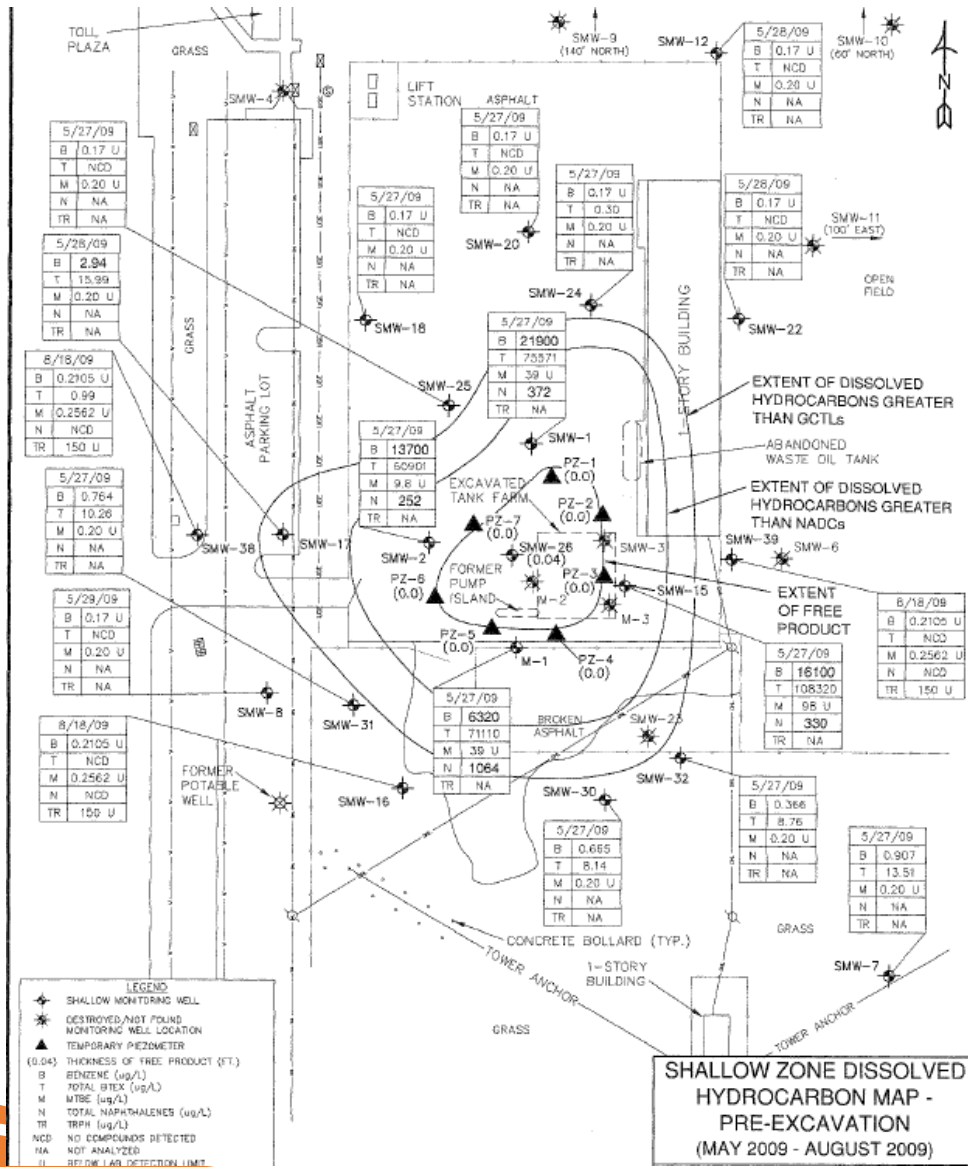
- RAP Mod approved in May 2025.
- Change episodic AS/SVE treatments to a permanent system.
- Install an additional AS & SVE well to remediate groundwater COCs in vicinity of MW-13.

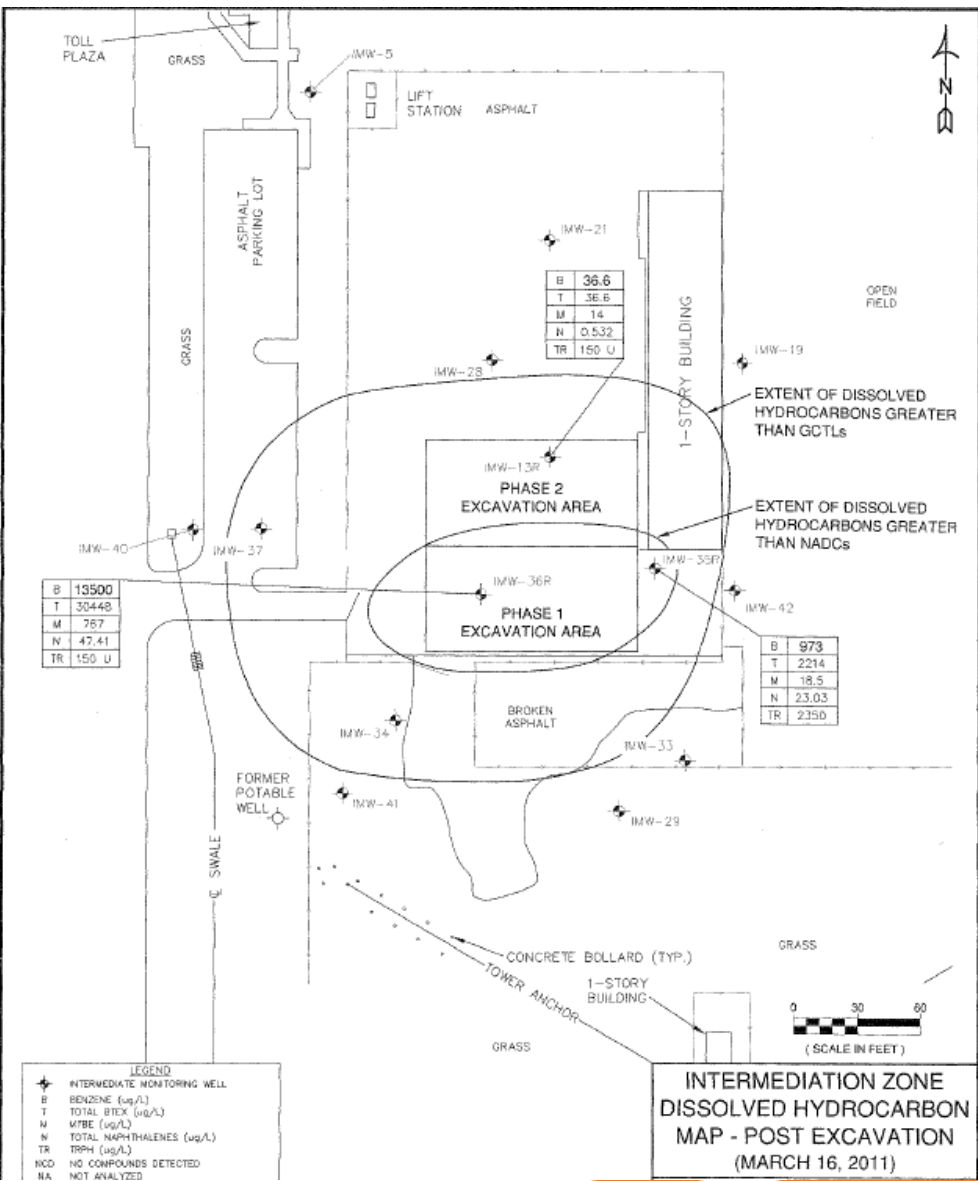
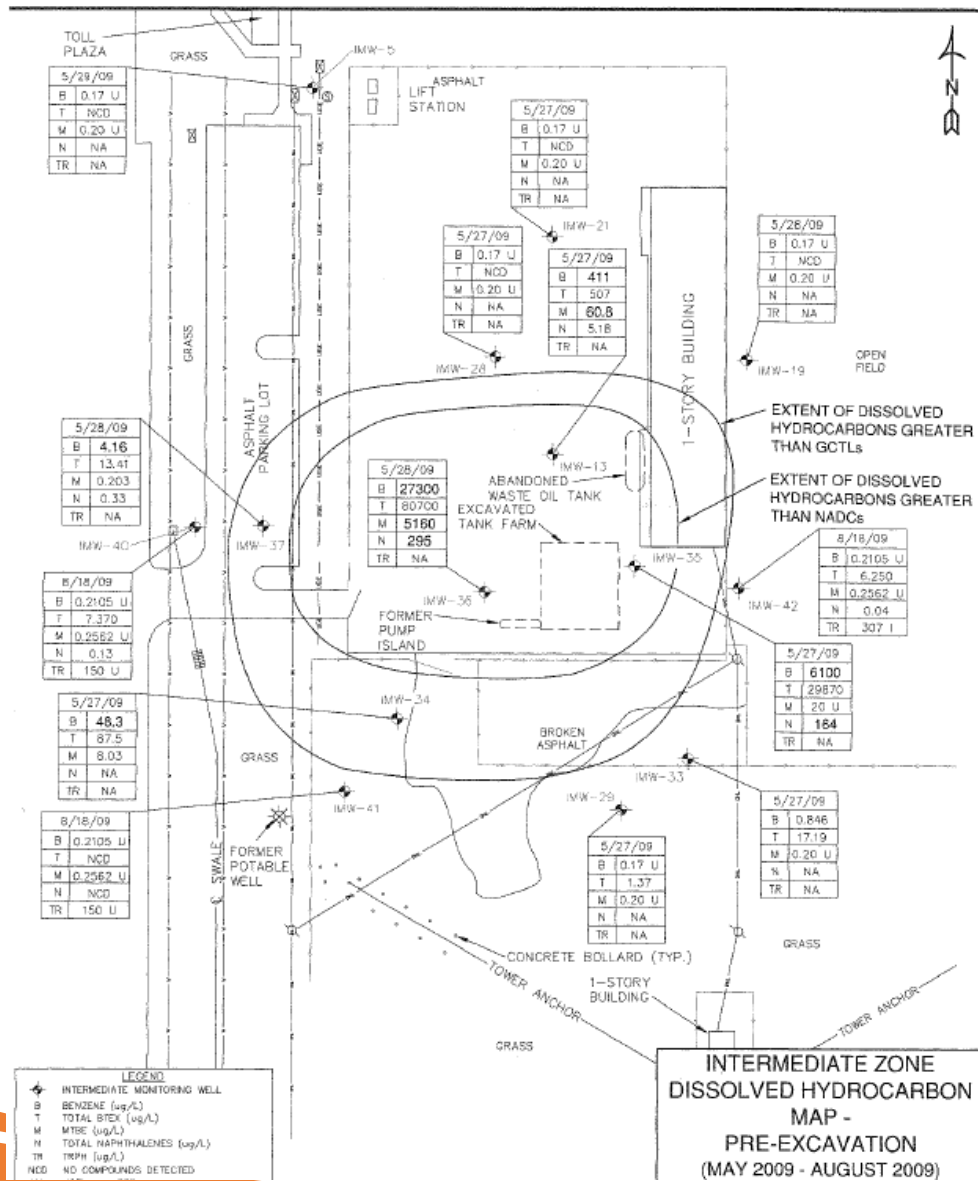


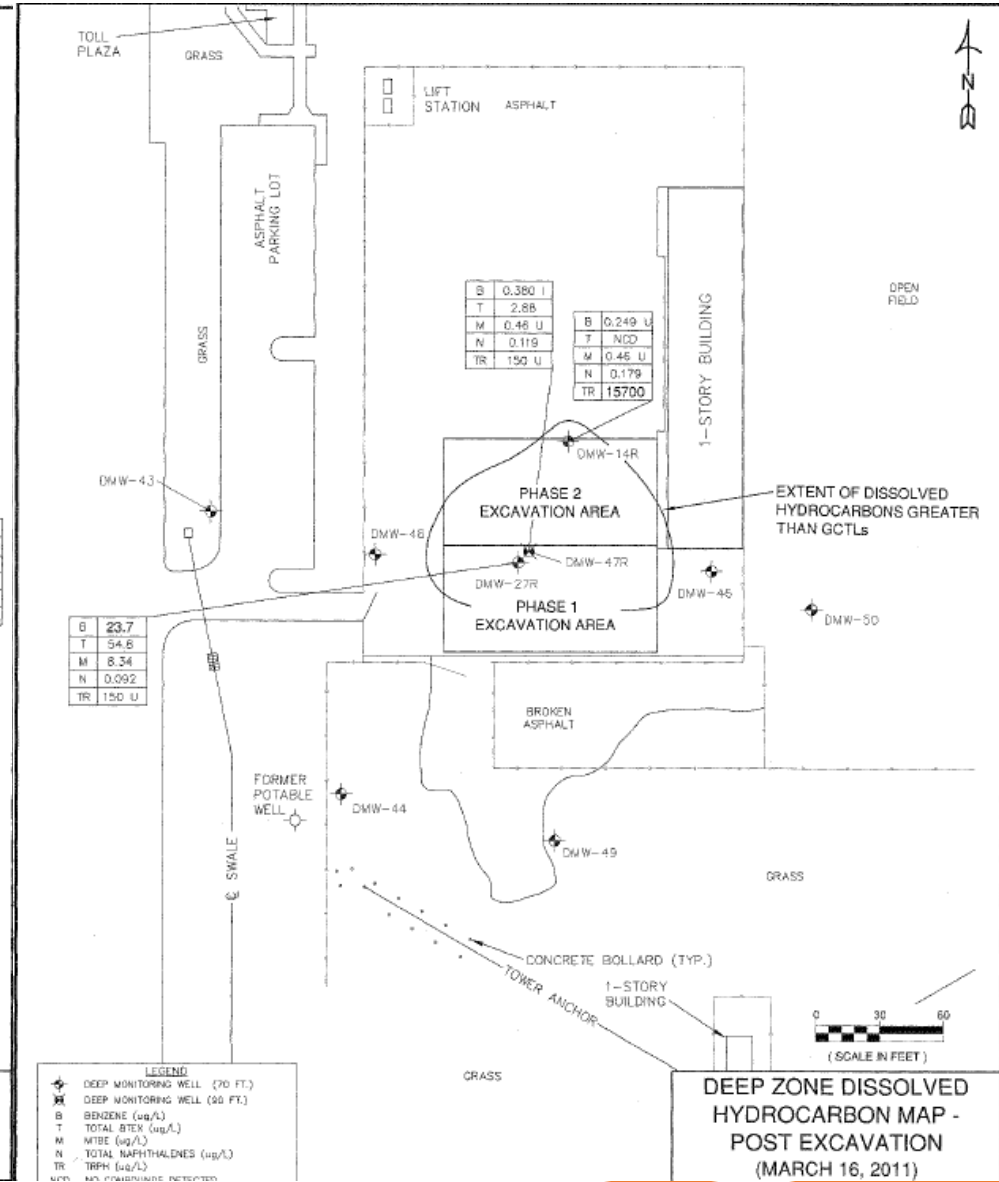
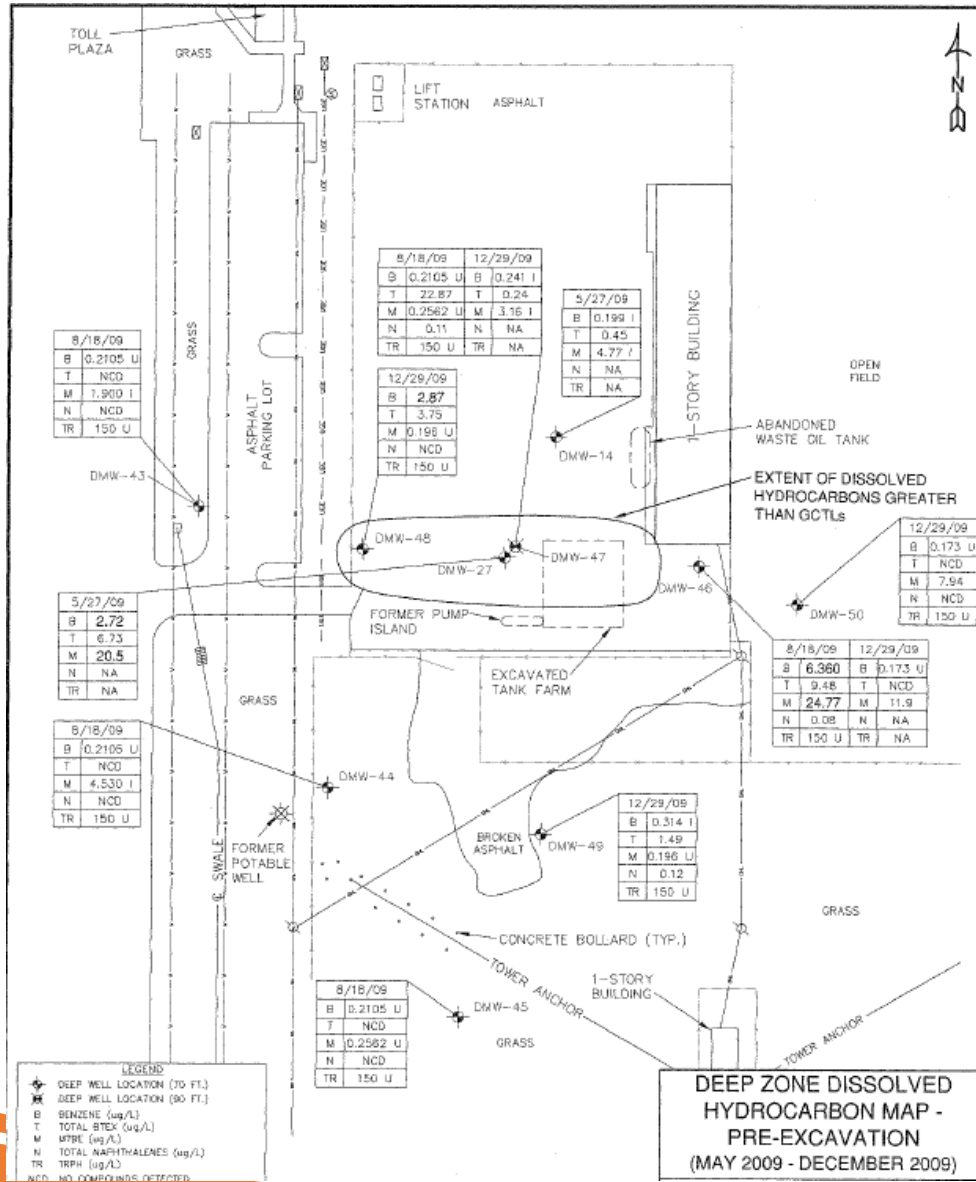
# Site History

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- Site Assessment Report (SAR) Approved in 2010.
- Source Removal conducted in 2010.
- Approx. 8,000 tons impacted soil removed.
- RAP Approved for AS/SVE in 2011.







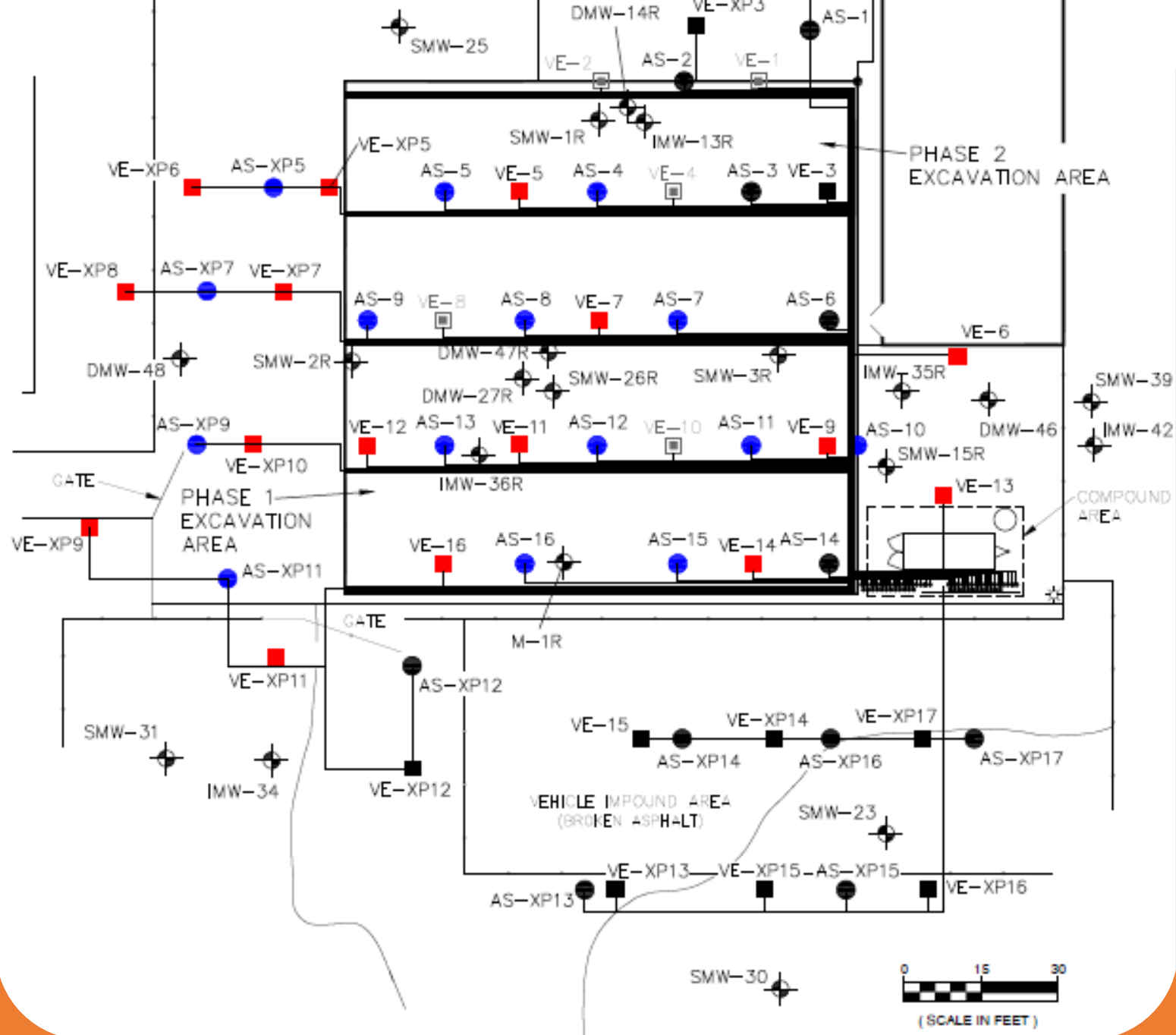
# Brief O&M Summary

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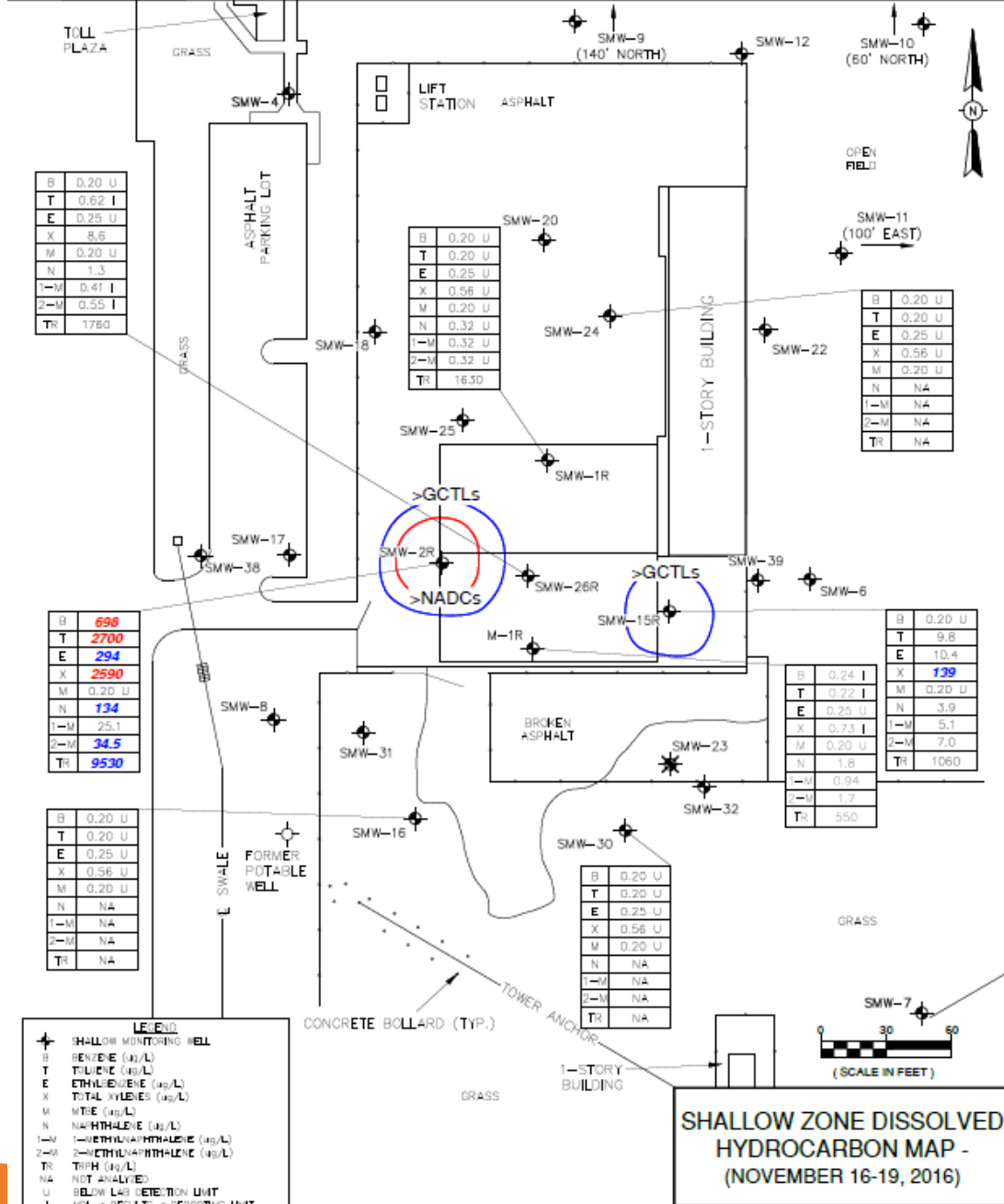
- AS/SVE system operational since 2012.
- Most of the dissolved GW contamination has been reduced to the shallow zone of the surficial aquifer.
- Remediation system effective in reducing COCs to localized zones.

■ SVE Wells

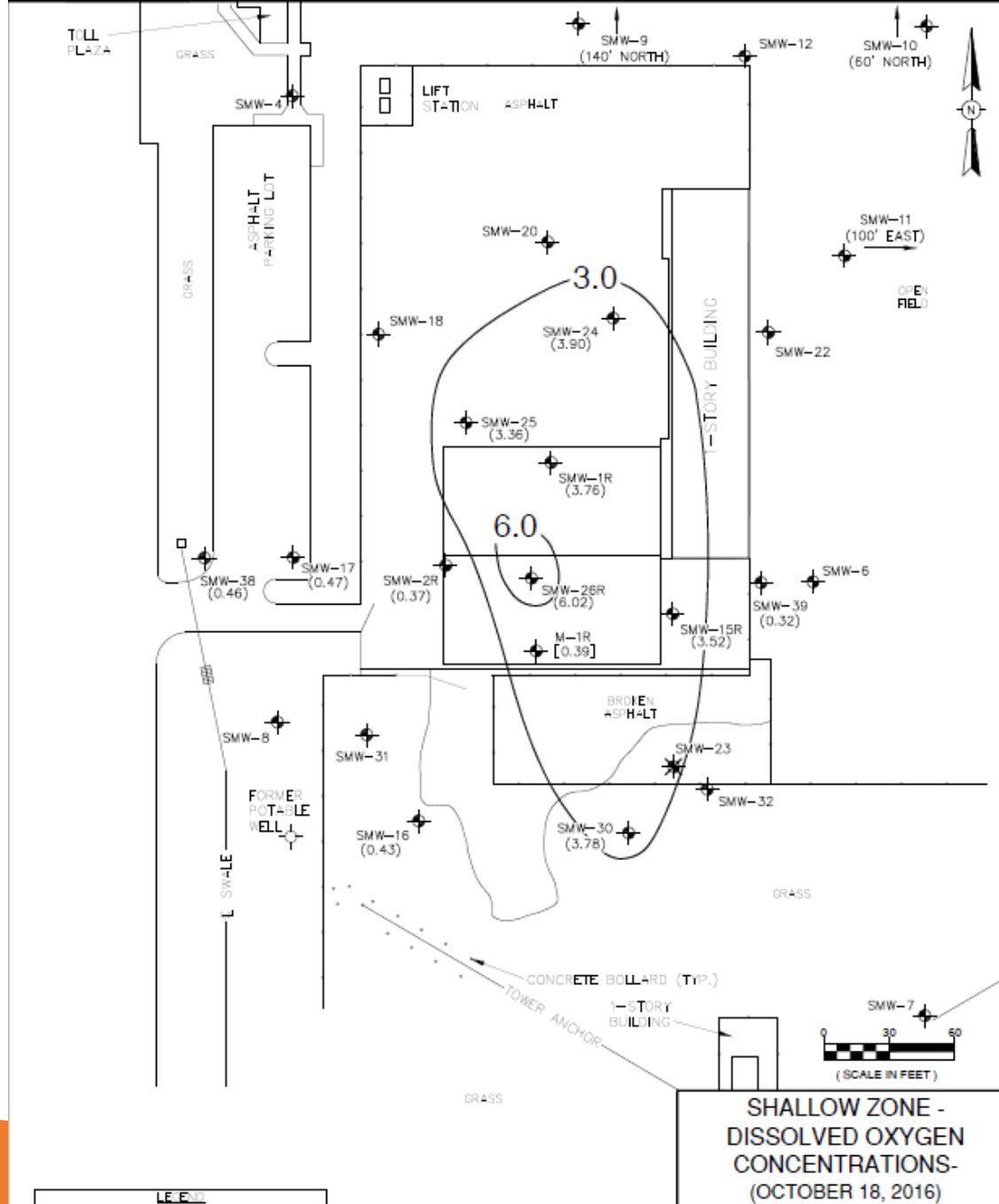
● AS Wells



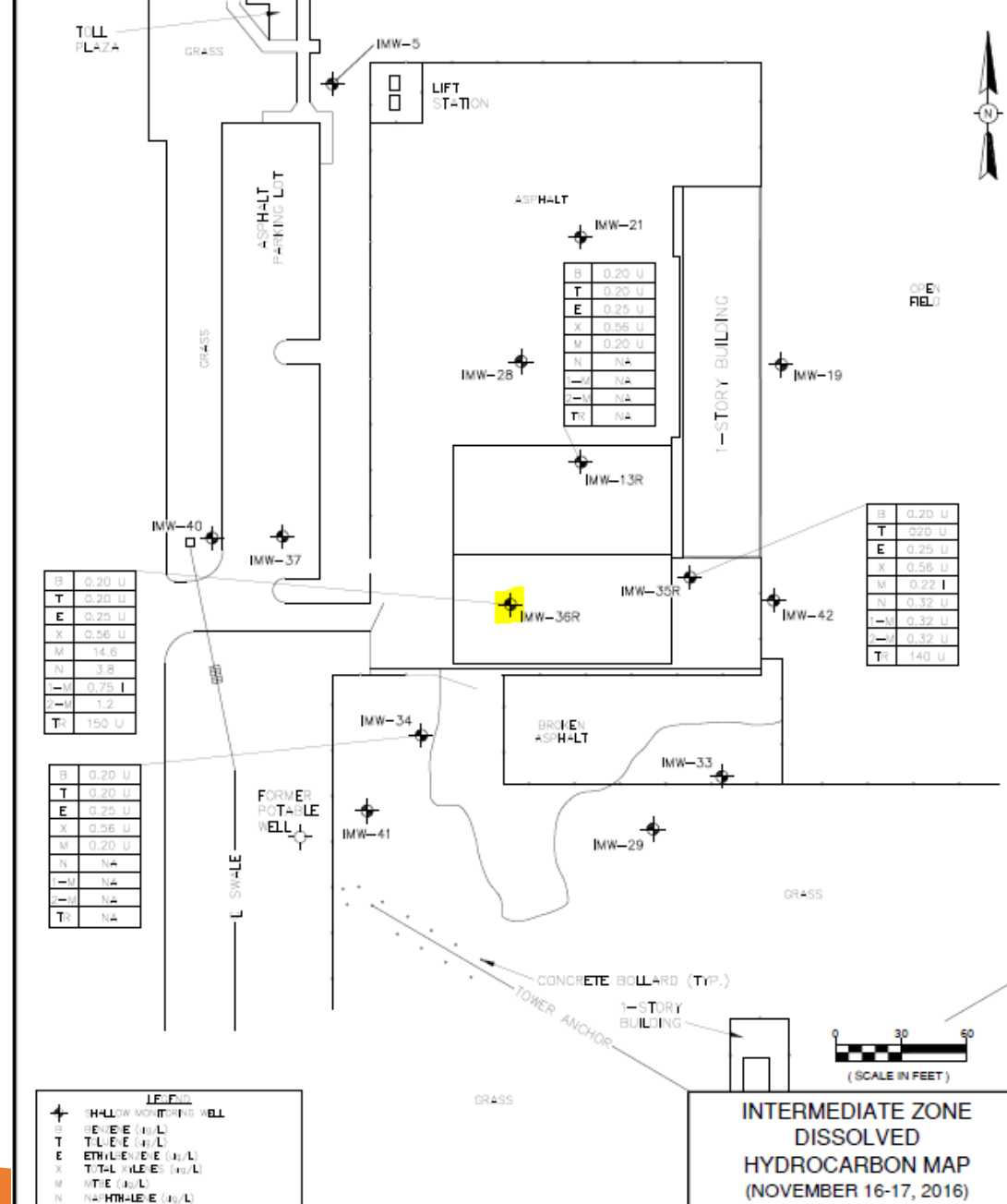
- When the site was received, COCs were limited to two MWs in the Shallow zone (SMW-2R & SMW-15R).
- The intermediate and deeper zones of the surficial aquifer appeared to have been remediated.



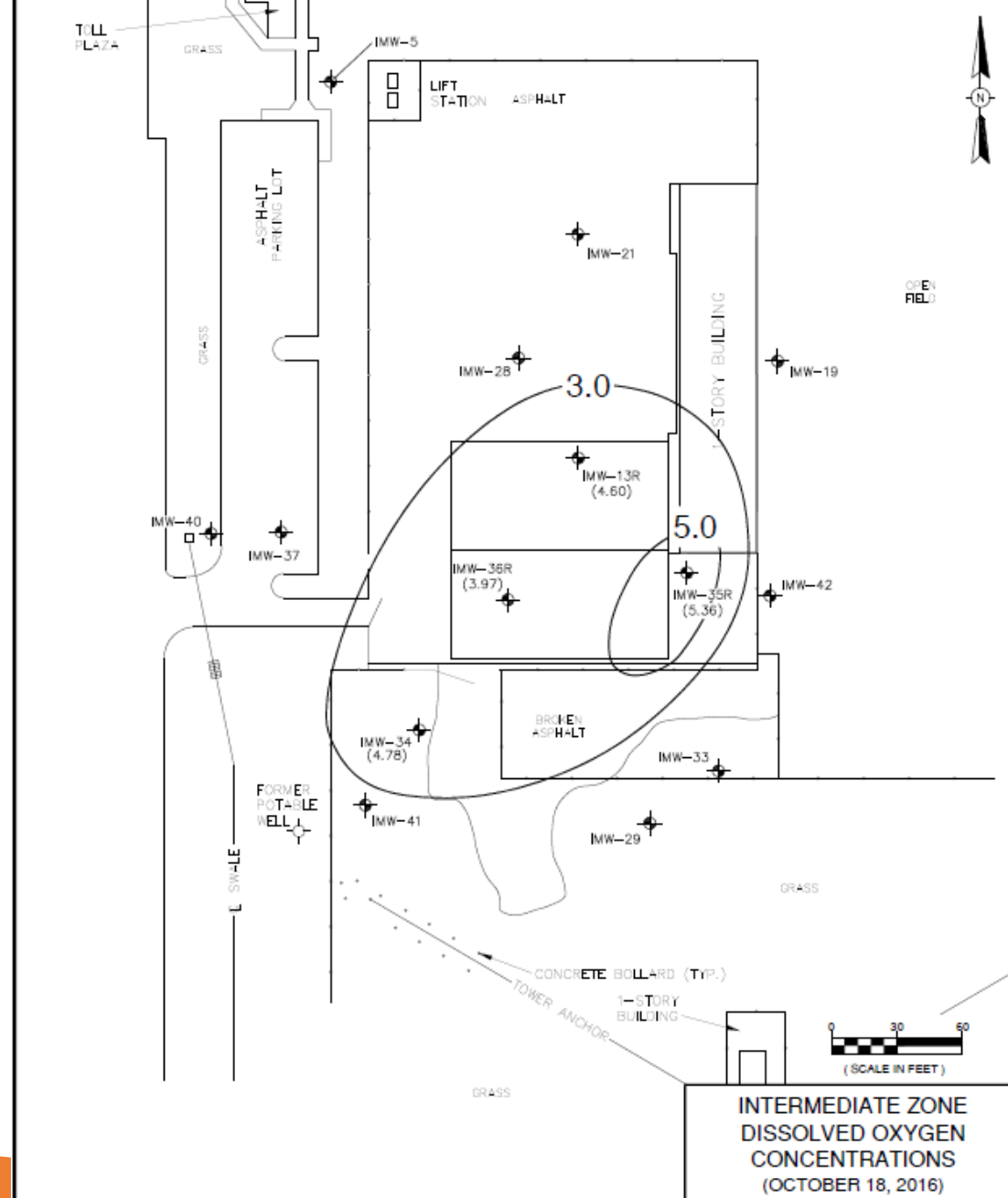
- DO concentrations were measured at 0.37 mg/L for SMW-2R and 3.52 mg/L for SMW-15R.
- Time to evaluate the treatment well array to see if influence can be reached for SMW-2R.



- Intermediate zone appears to have been remediated.
- IMW-36R has been highlighted.



- Figure depicting the dissolved oxygen concentrations for the intermediate zone.



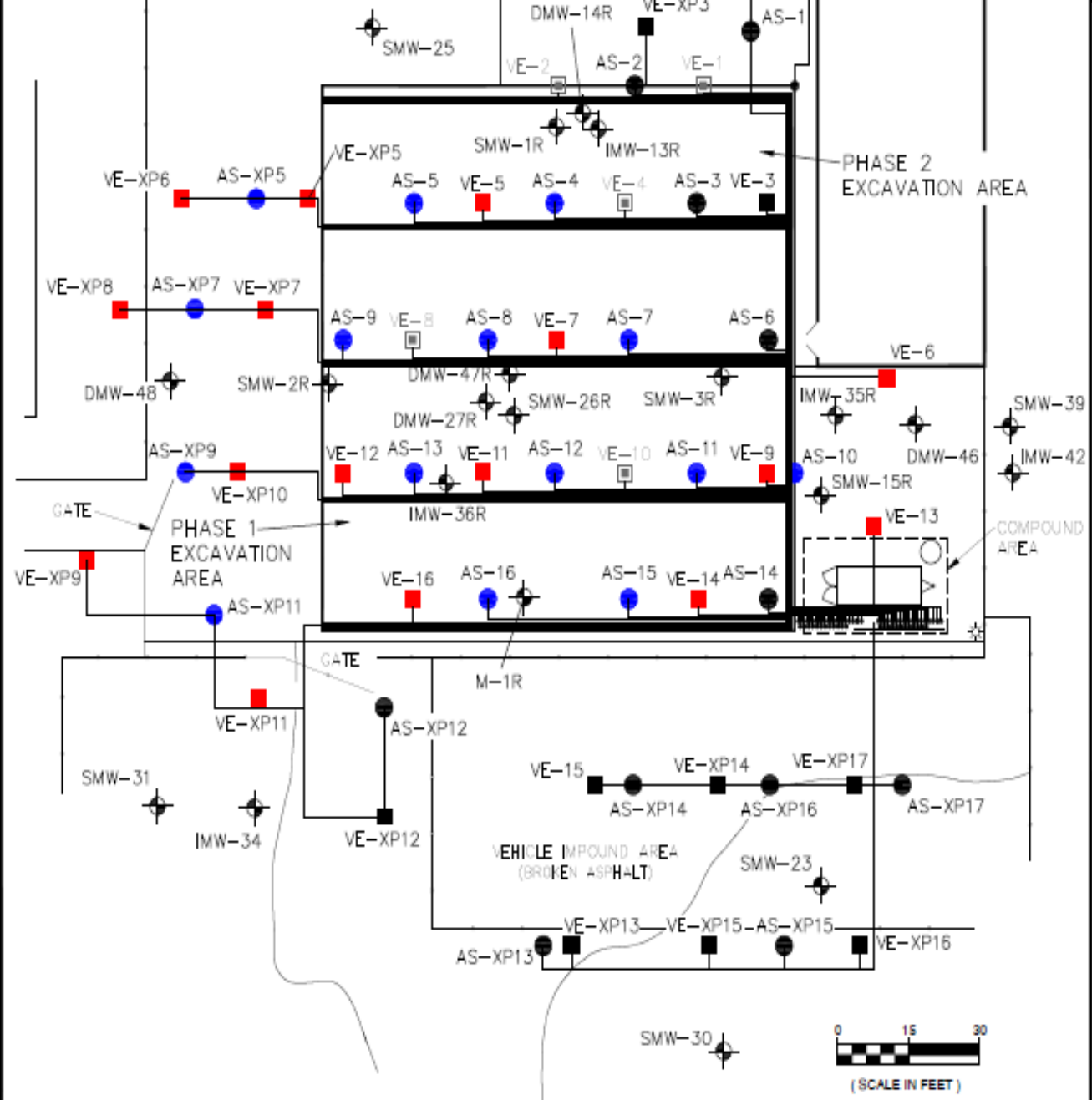
SMW-2  SMW-2R	6-16 / 7-17  Baseline	10/29/1987	NM	48000	72000	4800	28000	152800	--	0.0023	6				--	
		2/23/1988	NM	--	--	--	--	--	--	--	--	50 U				
		5/31/2005	10.35	13400 D	18900 D	1160 D	13360	46820	41.6	0.063	11	395 D	85.9 D	190 D	19,900 D	
		4/10/2007	13.32	7634	8380	457	13958	30429	30.67	--	--	292	125	333	--	
		5/27/2009	11.05	13700	22000	301	24900	60901	9.8 U	--	--	135	43.8	73.1	--	
		3/16/2011	13.41	35900 D	62300 D	3350 D	10000 D	111550	4.6 U	--	--	107 D	15.1 D	28.3 D	51,100 D	
		6/13/2012	NM	1.3 ft of free product												
		11/7/2012	11.25	29000	53800	3580	17600	103980	210 U	--	--	509	101	224	37,300	
		2/11/2013	13.22	15400	41900	4590	25700	87590	110 U	--	--	338	54.8	96.5	34,800	
		5/6/2013	12.97	6150	21400	3080	22500	53130	53 U	--	--	1260	154	440	19,900	
		8/19/2013	12.30	1610	4910	569	5700	12789	11 U	--	--	225	88.7	127	16,200	
		2/6/2014	14.88	968	7050	852	6560	15430	0.20 U	--	--	155	47.9	57.4	12,100	
		5/7/2014	13.83	379	4660	548	4420	10007	0.20 U	--	--	101	27.8	46.2	10,900	
		8/14/2014	12.02	389	3910	524	3780	8603	10 U	--	--	107	20.5	15.2	10,200	
		11/20/2014	13.21	666	4170	390	3600	8826	10 U	--	--	127	32.2	48.7	10,200	
2/17/2015	11.13	109	909	146	1340	2504	3.0 U	--	--	38.7	10.4	16.1	6,480			
B= Base Line			NADC	100	400	300	200	NA	200	2	150	140	280	280	50,000	
K= Key Well			GCTL'S	1**	40**	30**	20**	NA	20	0.02**	15**	14	28	28	5,000	
Location	Screen Int.	Date	DTW	Benzene	Toluene	Ethyl Benzene	Total Xylenes	Total VOA	MTBE	EDB	Total Lead	Naptha- tene	Methyl nap. 1	Methyl nap. 2	TRPH	
SMW-2R Cont.		5/18/2015	14.63	123	533	64.8	531	1251.8	3.0 U	--	--	5.6	0.98	0.99	3,590	
		8/19/2015	10.55	41.8	341	28.7	410	821.5	1.5 U	--	--	11.4	2.6	3.5	4,840	
		11/23/2015	10.95	169	854	127	1070	2220	1.5 U	--	--	53.9	10.9	17.0	6,590	
		2/18/2016	10.85	53.8	241	45.4	513	853.2	0.50 U	--	--	19	3.5	4.8	2,600	
		5/24/2016	13.06	83.9	339	27.4	434	884.3	0.20 U	--	--	3.4	1.3 U	1.3 U	5,400	
		8/26/2016	14.23	31.9	74.9	12.4	130	249.2	0.20 U	--	--	8.6	2.5	2.1	3,390	
		11/17/2016	12.41	698	2700	294	2590	6282	0.20 U	--	--	134	21.5	34.5	9,530	

IMW-36	31-36 / 35-40	5/12/2006	11.14	5670	2170	533	2394	10767	1030	0.089	--	54.8	9.80	22.5	2,702
		4/10/2007	13.26	15530	11150	1294	8163	36137	1408	--	--	87.1	23.2	47.4	--
IMW-36R	Baseline	5/28/2009	12.60	27300	33800	3300	16300	80700	5160	--	--	214	28.3 I	52.2	--
		3/16/2011	13.74	13500 D	10800 D	948 D	5200 D	30448	767 D	--	--	33.1 D	5.29	9.02	150 U
		6/13/2012	15.82	5900	5000	658	3530	15088	78.7 I	--	--	51.8	9.8	16.3	6,090
		11/7/2012	11.55	5420	2260	725	3910	12315	62.3 I	--	--	79	10.6	18	5,580
		2/11/2013	13.58	95.1	21.2	4.5	19.1	139.9	86.3	--	--	0.67 I	0.38 U	0.38 U	769
		5/6/2013	12.86	18.4	1.2	1.1	2.1 I	22.8	25.8	--	--	0.43 I	0.39 U	0.39 U	140 U
		8/19/2013	12.65	12.3	0.51 I	0.55 I	0.95 I	14.31	18.5	--	--	0.76 I	0.38 U	0.38 U	140 U
		2/6/2014	15.10	4.3	0.20 U	0.38 I	0.66 U	4.68	32.9	--	--	0.38 U	0.38 U	0.38 U	140 U
		5/7/2014	13.81	4.8	0.20 U	0.28 U	0.66 U	4.8	28.3	--	--	0.38 U	0.38 U	0.38 U	140 U
		8/14/2014	12.31	3.5	0.20 U	0.28 U	0.66 U	3.5	10.2	--	--	0.32 U	0.32 U	0.32 U	140 U
		11/20/2014	13.49	1.0	0.20 U	0.28 U	0.66 U	1.0	18.9	--	--	0.32 U	0.32 U	0.32 U	140 U
		2/17/2015	11.33	2.4	0.40 U	0.20 U	0.51 U	2.4	26.7	--	--	0.33 U	0.33 U	0.33 U	140 U
		5/18/2015	19.24	0.58 I	0.40 U	0.20 U	0.51 U	0.58 I	23.7	--	--	1.3	0.31 U	0.31 U	140 U
		8/19/2015	10.41	0.20 U	0.40 U	0.20 U	0.51 U	NCD	2.1	--	--	0.32 U	0.32 U	0.32 U	140 U
		11/24/2015	11.31	0.20 U	0.40 U	0.20 U	0.51 U	NCD	44.5	--	--	0.54 I	0.32 U	0.32 U	140 U
2/18/2016	10.91	2.3	0.20 U	0.25 U	0.56 U	2.3	34.4	--	--	0.38 I	0.32 U	0.32 U	140 U		
<b>B= Base Line</b>			NADC	100	400	300	200	NA	200	2	150	140	280	280	50,000
<b>K= Key Well</b>			GCTL'S	1**	40**	30**	20**	NA	20	0.02**	15**	14	28	28	5,000
Location	Screen Int.	Date	DTW	Benzene	Toluene	Ethyl Benzene	Total Xylenes	Total VOA	MTBE	EDB	Total Lead	Napth- tane	Methyl nap. 1	Methyl nap. 2	TRPH
IMW-36R Cont.		5/24/2016	13.16	0.52 I	0.20 U	0.25 U	0.56 U	0.52	31.3	--	--	0.42 I	0.32 U	0.32 U	140 U
		8/26/2016	14.41	0.51 I	0.20 U	0.25 U	0.56 U	0.51	43.4	--	--	0.32 U	0.32 U	0.32 U	140 U
		11/17/2016	12.79	0.20 U	0.20 U	0.25 U	0.56 U	NCD	14.6	--	--	3.8	0.75 I	1.2	150 U

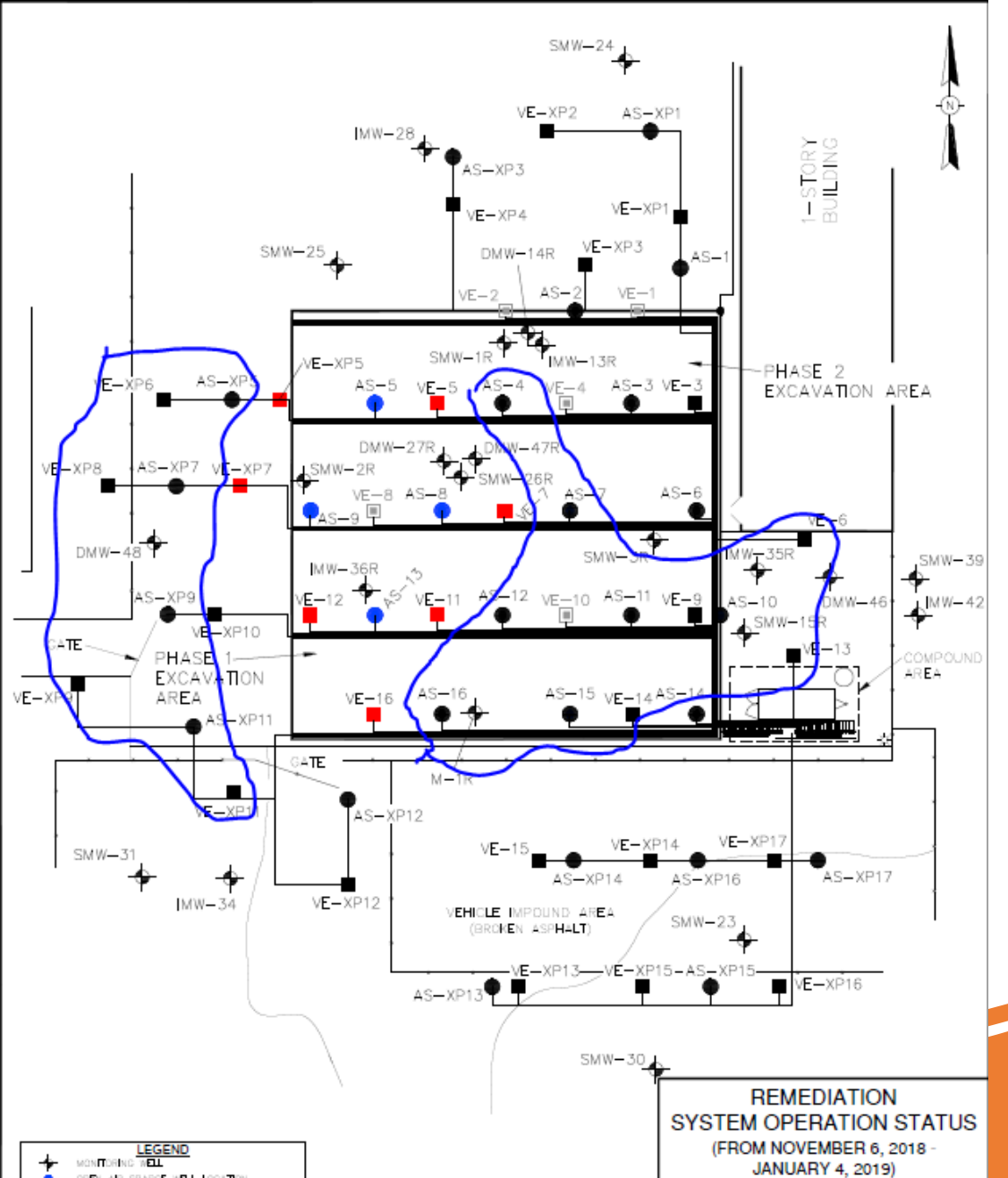
# Adjusting treatment point operation

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- The number of treatment points of the remediation system were reduced to target the area of residual contamination located at monitoring well SMW-2R.

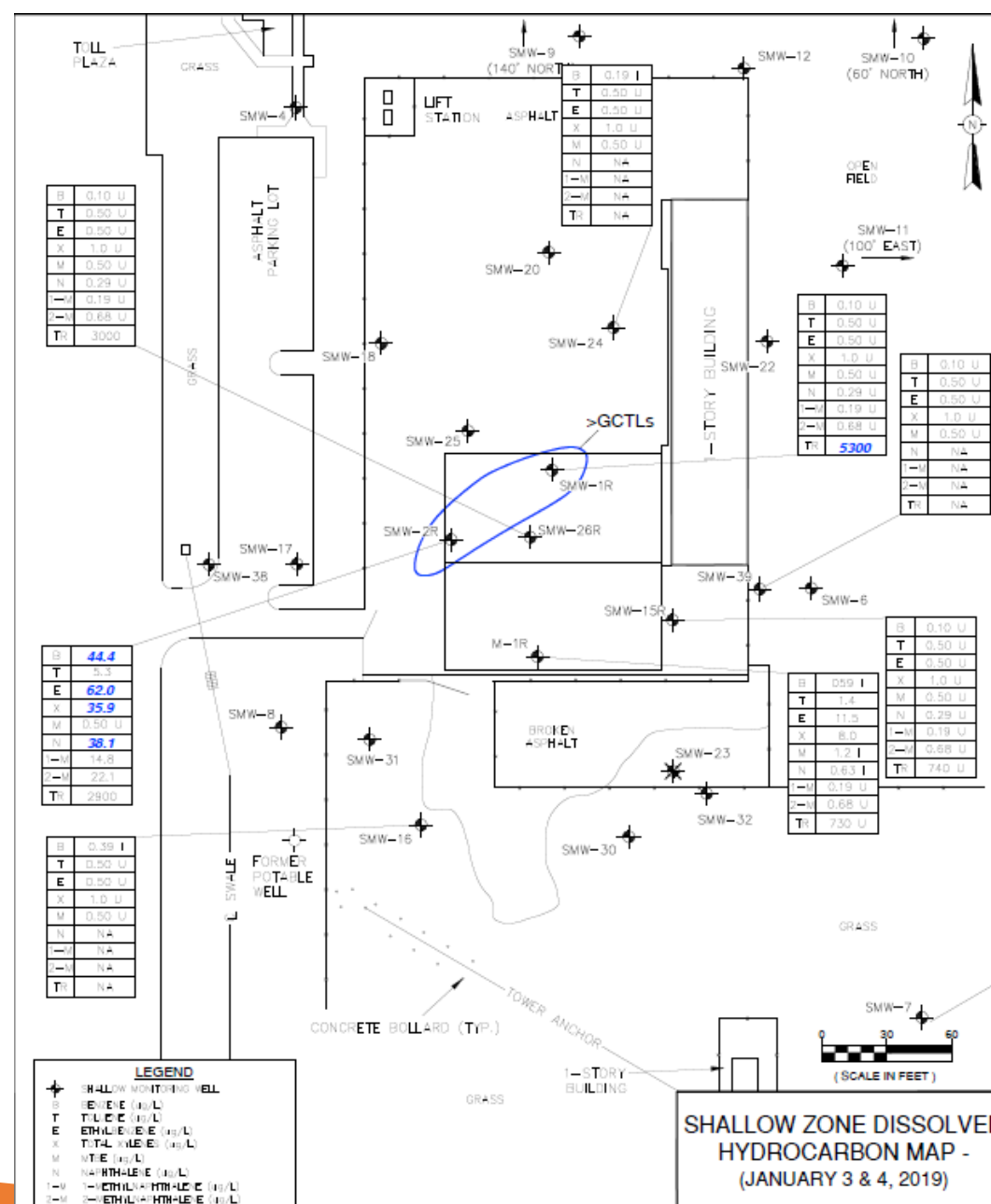


• Remedial System prior to optimization

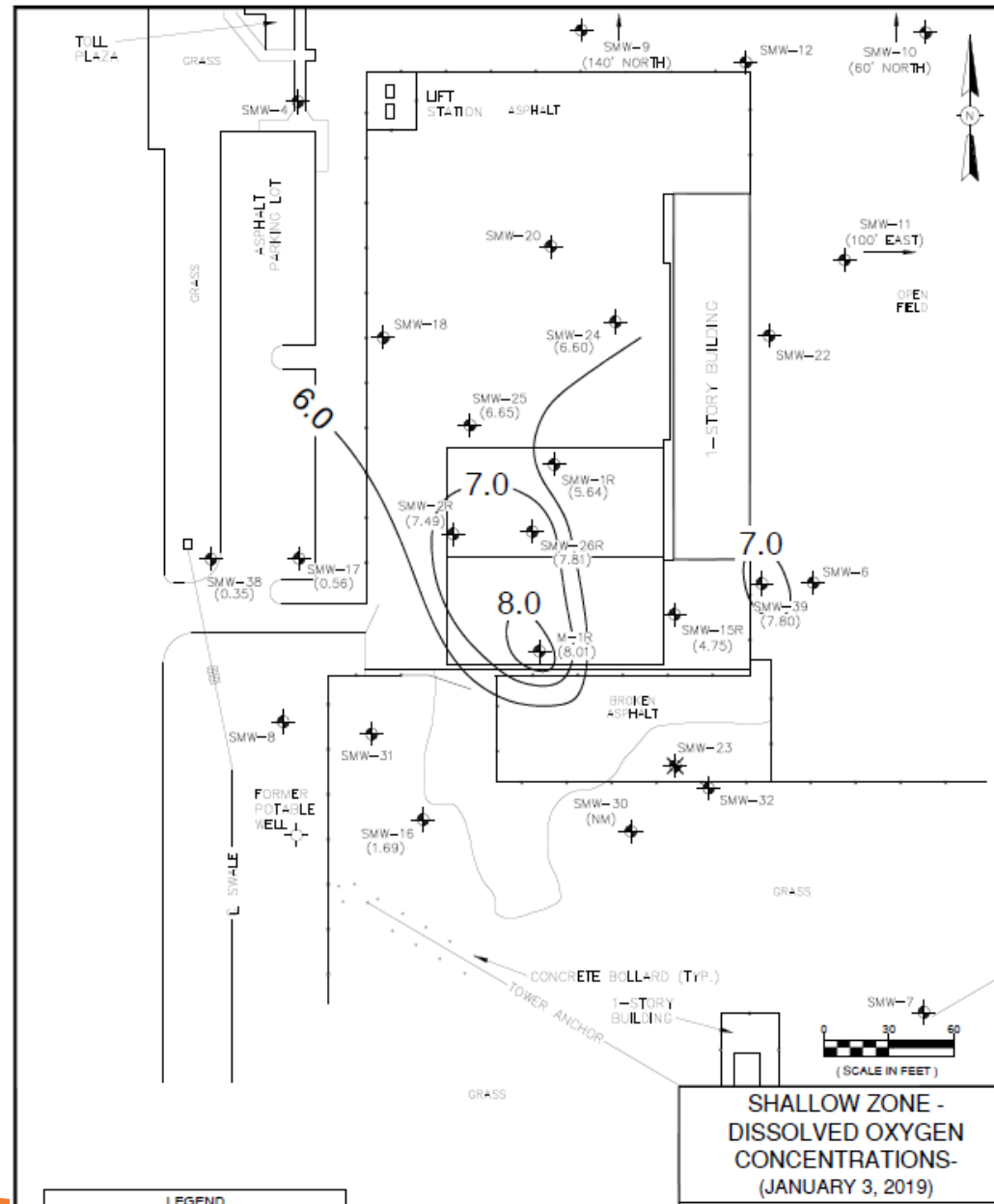


• Remedial System after optimization

- The contaminant concentrations in the vicinity of monitoring well SMW-2R were reduced to below their respective NADCs.



- DO concentrations have improved in the vicinity of monitoring well SMW-2R.
- Figure illustrates DO conc. of 7.49 mg/L in SMW-2R.

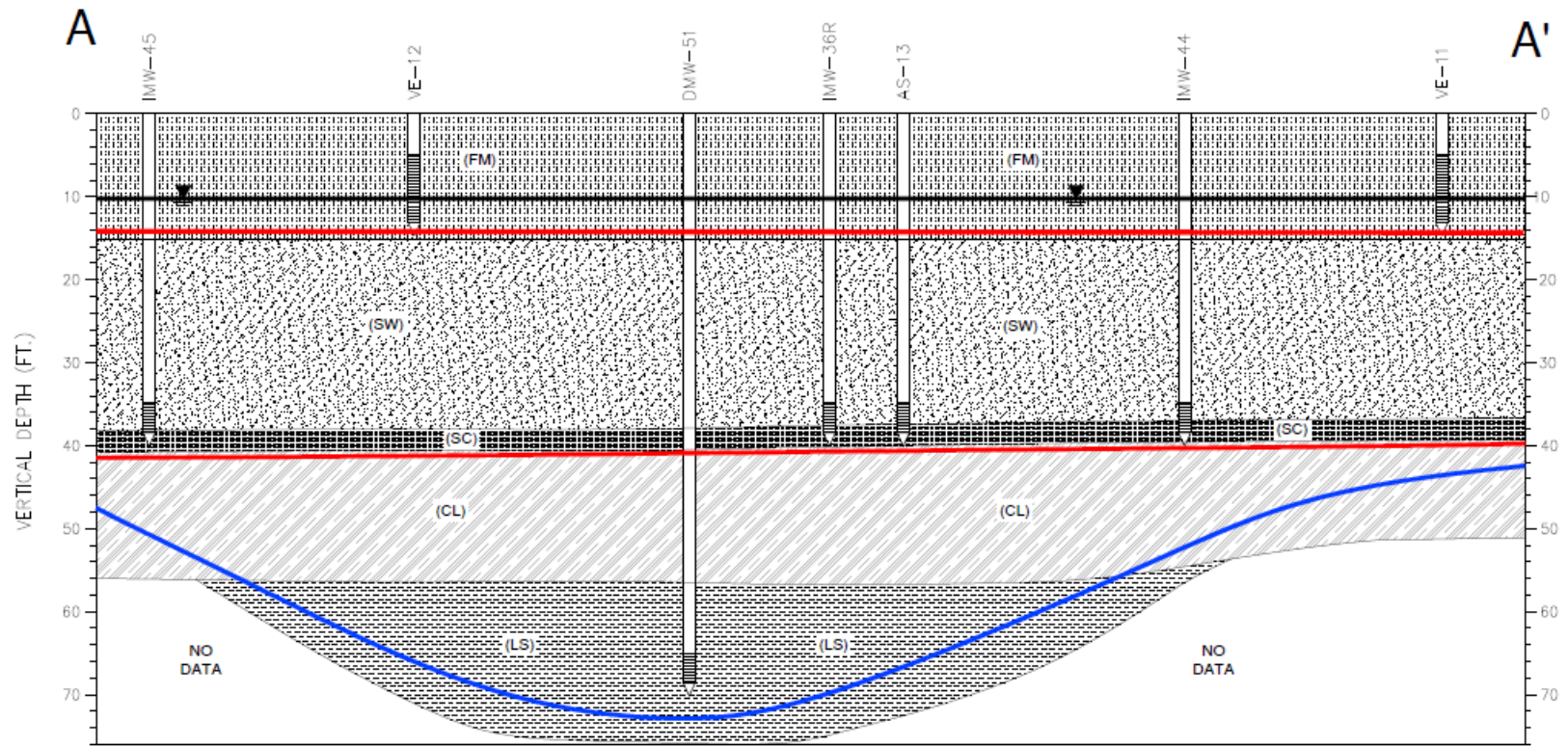





# Additional Assessment

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- Rebounding in monitoring well IMW-36R.
- Seven additional intermediate monitoring wells were installed to an approximate depth of 40 ft BLS.
- One deep monitoring well installed to a depth of 70 ft BLS for vertical delineation.
- The additional assessment gave a more accurate depiction of the current groundwater contamination due to the rebounding. Also provided the new target area to focus remedial efforts.



**LEGEND**

-  FILL MATERIAL (DARK BROWN SANDY SILT) (FM)
-  SANDS (OCCISIONALLY TRACE CLAY) (SW)
-  SANDY CLAY (SC)
-  CLAY (OCCISIONALLY ~10% SAND) (CL)
-  LIMESTONE (LS)
-  ESTIMATED EXTENT OF GCTL EXCEEDANCE
-  ESTIMATED EXTENT OF NADC EXCEEDANCE

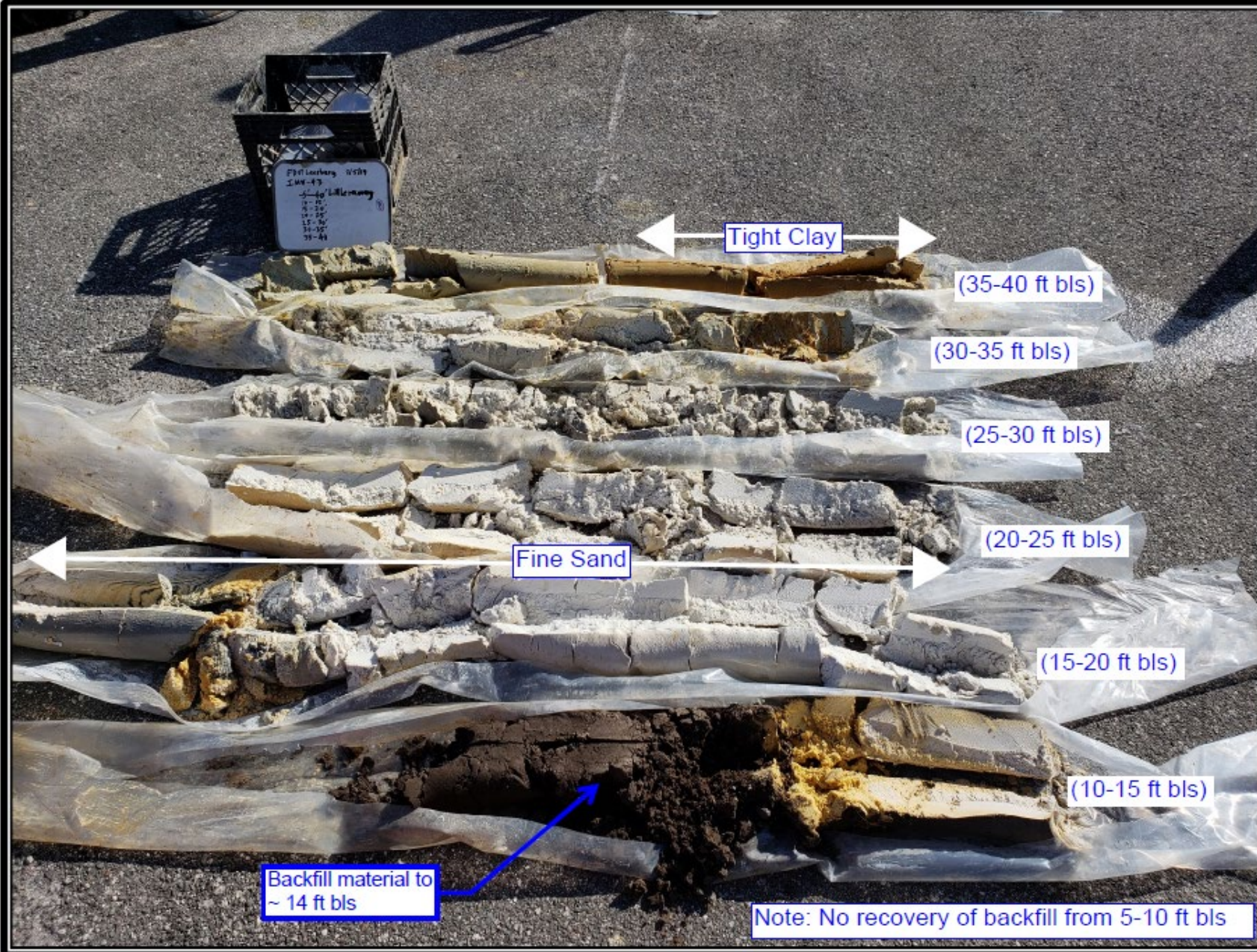
LITHOLOGIC CROSS SECTION A-A'

- IMW-43 boring log indicates OVA spike around 15-20' bls and around 35 bls.
- Clay found at 36' bls to end of boring.

Boring/Well Number: <b>IMW-43</b>		Permit Number:		FDEP Facility Identification Number: 35/8622973	
Site Name: FDOT Leesburg		Borehole Start Date: <b>2/5/19</b> End Date: <b>2/5/19</b>	Borehole Start Time: <b>12:25</b> <input type="checkbox"/> AM <input checked="" type="checkbox"/> PM End Time: <b>3:45</b> <input type="checkbox"/> AM <input checked="" type="checkbox"/> PM		
Environmental Contractor: ESI		Geologist/Logger Name: Ben Marshall		Environmental Technician's Name: Scott Hooker	
Drilling Company: PDS	Pavement Thickness (inches): <b>~ 2</b>	Borehole Diameter (inches): <b>8</b>	Borehole Depth (feet): <b>40</b>		
Drilling Method(s): Post Hole digger then Sonic	Apparent Borehole DTW (in feet from soil moisture content): <b>14</b>	Measured Well DTW (in feet after water recharges in well):	OVA (list model and check type): Tiger-PID <input type="checkbox"/> FID <input checked="" type="checkbox"/> PID		
Disposition of Drill Cuttings [check method(s)]: (describe if other or multiple items are checked): <b>backfill material spread over grass</b>					
Borehole Completion (check one): <input checked="" type="checkbox"/> Well <input type="checkbox"/> Grout <input type="checkbox"/> Bentonite <input type="checkbox"/> Backfill <input type="checkbox"/> Other (describe)					

Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Unfiltered OVA	Filtered OVA	Net OVA	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Lab Soil and Groundwater Samples (list sample number and depth or temporary screen interval)
PH SC	4-5	-	N/A	NA	N/A	0	5	Dark brown silty sand (~90% sand)	SW	D	
	9-10					0.4	10	Dark brown sand		D	
	14-15					39.8	15	Dark brown sand/silt into top sand (staining at 15-16')		W	
	19-20					87.3	20	white fine sand with some staining (petro odor)			
	24-25					8.5	25	white fine sand			
	29-30					0.7	30	As above			
	34-35					40.2	35	Mix white sand with clays (~20% clays)	SC		
	39-40					0.9	40	Tight clay ~ 36.5' bls to bottom borehole	CL	D	

Sample Type Codes: PH = Post Hole; HA = Hand Auger; SS = Split Spoon; ST = Shelby Tube; DP = Direct Push; SC = Sonic Core; DC = Drill Cuttings  
 Moisture Content Codes: D = Dry; M = Moist; W = Wet; S = Saturated



IMW-43 Soil Cores (taken 2/5/19)



IMW-43 Soil Staining at 15-16 ft bls (taken 2/5/19)

Boring/Well Number: <b>DMW-51</b>		Permit Number:		FDEP Facility Identification Number: 35/8622973							
Facility Name: FDOT Leesburg		Borehole Start Date: 2/4/19	Borehole Start Time: 1000	<input checked="" type="checkbox"/> AM	<input type="checkbox"/> PM						
		End Date: 2/4/19	End Time: 1510	<input type="checkbox"/> AM	<input checked="" type="checkbox"/> PM						
Environmental Contractor: Earth Systems		Geologist's Name: Brian Dinning		Environmental Technician's Name: Scott Hooker							
Drilling Company: Preferred Drilling	Pavement Thickness (inches): 4.2	Borehole Diameter (inches): 8	Borehole Depth (feet): 70								
Drilling Method(s): PH/SC	Apparent Borehole DTW (in feet from soil moisture content): 15	Measured Well DTW (in feet after water recharges in well):	OVA (list model and check type): Tiger PID <input checked="" type="checkbox"/> PID								
Disposition of Drill Cuttings [check method(s)]: <input checked="" type="checkbox"/> Drum <input checked="" type="checkbox"/> Spread <input type="checkbox"/> Backfill <input type="checkbox"/> Stockpile <input type="checkbox"/> Other (describe if other or multiple items are checked): <i>backfill spread over grass</i>											
Borehole Completion (check one): <input checked="" type="checkbox"/> Well <input type="checkbox"/> Grout <input type="checkbox"/> Bentonite <input type="checkbox"/> Backfill <input type="checkbox"/> Other (describe)											
Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Unfiltered OVA	Filtered OVA	Net OVA	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Lab Soil and Groundwater Samples (list sample number and depth or temporary screen interval)
PH	4-5	12	NA	NA	NA	φ	5	Dark brown fine sand	SW	D	
SC	9-10					φ	10	Dark brown medium-fine sand	SW	D	
	14-15					φ	15	Dark brown medium fine sand w/ trace fine gravel	SP	W	
	19-20					φ	20	White fine sand	SW	W	
	24-25					φ	25	White fine sand w/ trace clay	SC	W	
	29-30					21.2	30	As above	SC	W	
	34-35					66.2	35	Light gray medium fine sand w/ some clay, odor	SC	W	
	39-40					63.1	40	As above	SC	W	
	44-45					17.8	45	Orange + gray clay w/ some fine sand	CL	W	
	49-50					93.8	50	As above	CL	W	
	54-55					27.3	55	Orange clay w/ some fine sand + trace limestone	CL	W	
59-60					1.1	60	Limestone				

Sample Type Codes: PH = Post Hole; HA = Hand Auger; SS = Split Spoon; ST = Shelby Tube; DP = Direct Push; SC = Sonic Core; DC = Drill Cuttings  
Moisture Content Codes: D = Dry; M = Moist; W = Wet; S = Saturated

Boring/Well Number: DMW-51		FDEP Facility Identification Number: 35/8622973		Site Name: FDOT Leesburg		Borehole Start Date: End Date:					
Sample Type	Sample Depth Interval (feet)	Sample Recovery (inches)	SPT Blows (per six inches)	Unfiltered OVA	Filtered OVA	Net OVA	Depth (feet)	Sample Description (include grain size based on USCS, odors, staining, and other remarks)	USCS Symbol	Moisture Content	Lab Soil and Groundwater Samples (list sample number and depth or temporary screen interval)
SC	64-65					φ	65	Limestone			3
	69-70					φ	70	Limestone			3

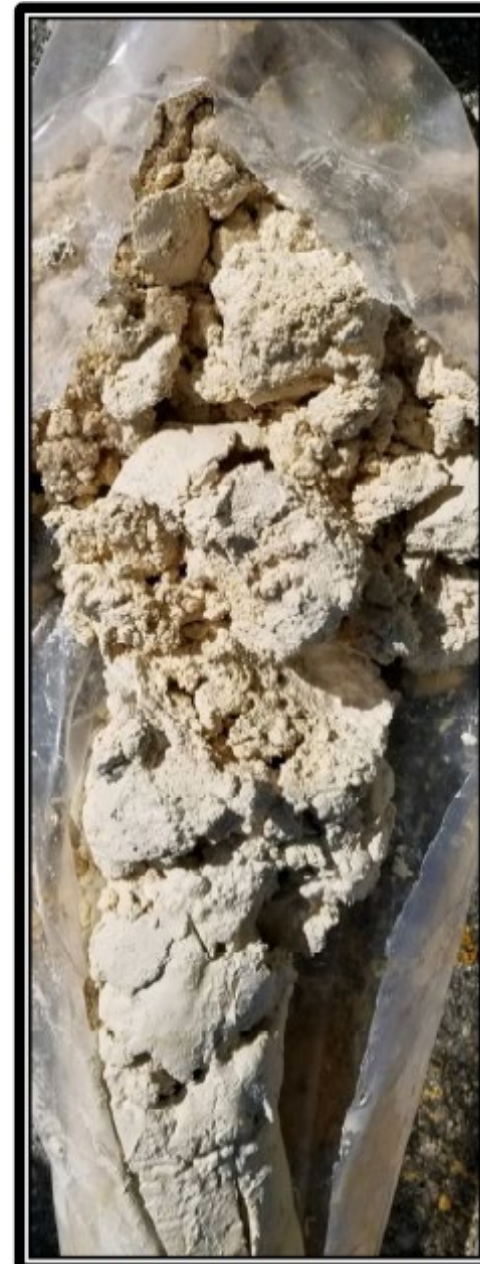
Sample Type Codes: PH = Post Hole; HA = Hand Auger; SS = Split Spoon; ST = Shelby Tube; DP = Direct Push; SC = Sonic Core; DC = Drill Cuttings  
Moisture Content Codes: D = Dry; M = Moist; W = Wet; S = Saturated



DMW-51 (55-60 ft bls)

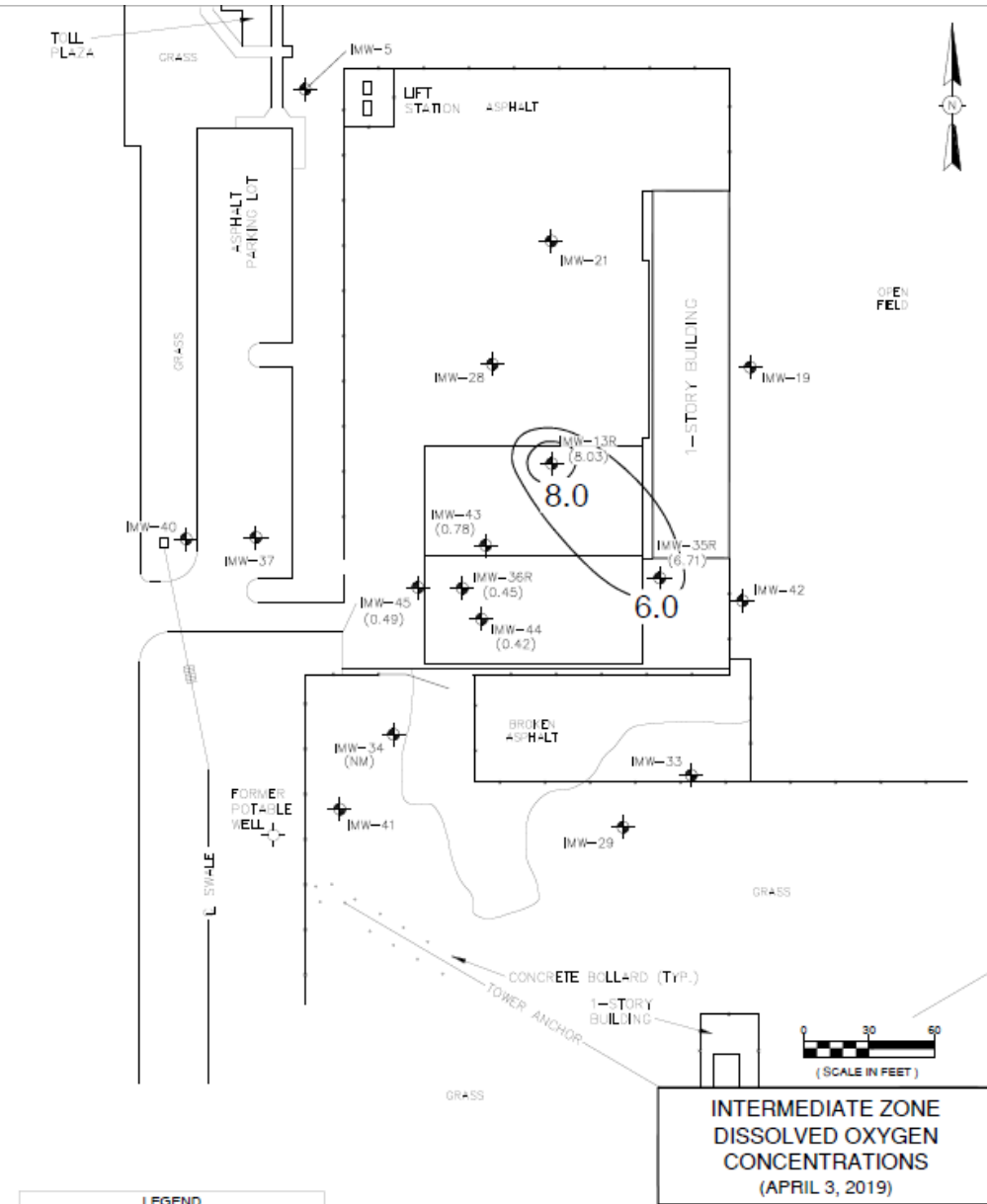
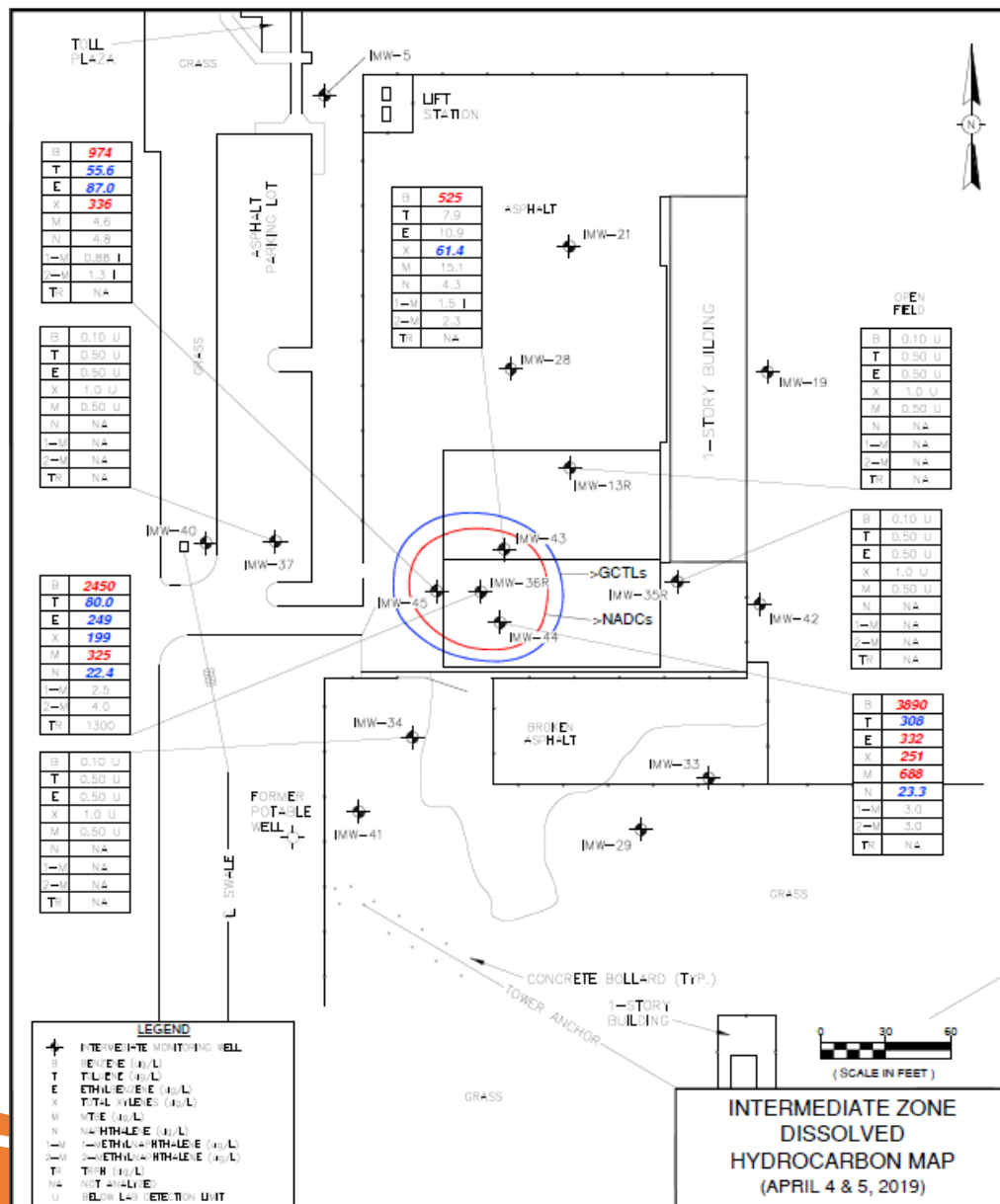


DMW-51 (60-65 ft bls)



DMW-51 (65-70 ft bls)

**DMW-51 Soil Cores (taken 2/4/19)**



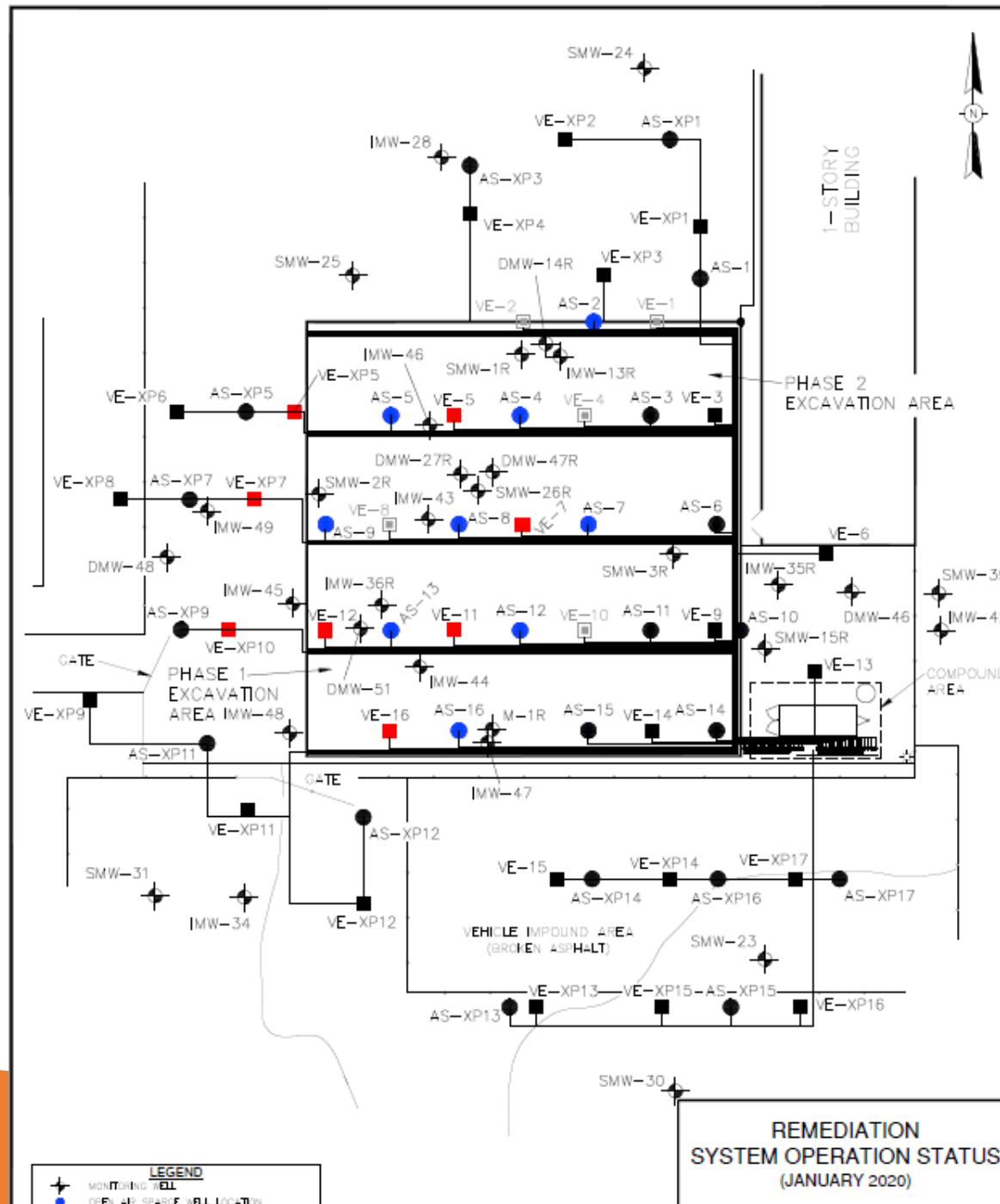
GW NADC plume defined in the intermediate zone. DO influence less than 1 mg/L in target area.

# RA System Adjustments

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- Additional monitoring points have been included in the AS/SVE well array to further remediate the contamination discovered in the intermediate zone of the surficial aquifer.
- A RAP Mod Scope of Work was generated for the potential addition of sparge points to address the areas in the subsurface that are not receiving influence from the current treatment network.

- The AS/SVE well array was increased to further remediate GW contamination discovered in the intermediate zone of the surficial aquifer.





# System Optimization - Takeaways

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- Evaluating the effectiveness a remediation system has on subsurface contamination is a dynamic process.
- It is important to utilize the information received from O&M reports to make changes needed for system optimization.
- Ask questions.

# Thank You

Brian Nicolson, P.E.  
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