Operation & Maintenance (O&M) Report Review February 22, 2024

BY: PETROLEUM RESTORATION PROGRAM TEAM 6 WSP

Agenda

- Site Manager Review (slides 3-13)
- Remedial Action (RA) Summary Report Tables (slide 15)
- System Performance Not Just Runtime (slide 16)
- System Runtime (cont.) (slide 17)
- Approved Downtime (slide 18)
- Milestones (slides 19-20)
- Options To Enhance The System (slide 21)
- Data Required During Operations and Maintenance (O&M) (slide 22)
- Check For Submerged Well Screens (slide 23)
- Options during RA (slide 24)
- When To Turn A System Off (slide 25)
- Vapor Emissions (slides 26-27)
- Treatment (slide 28
- Emission Sampling (slides 29-30)
- Carbon Tables (slides 31-32)
- System Maintenance (slide 33)
- Recommendations (slide 34)
- Case Study (slides 36-40)
- Closing Discussion/Questions (slide 41)


Kyrsteen Webster

Site Manager Review

Permanent AS/SVE System.

SVE System Stub Up Piping/Flex Hose Connections & Vapor Phase Carbon Vessel

AS/SVE System Control Panel w/ Telemetry

Site Manager Review

O&M Basics.

Before you get started you must make sure all the required documents are in the report and ALL work was done as scoped per rule.

Before.

	Task 3									
●	3-2.	Mobilization, Light Duty Vehicle (car or 1/2 ton truck) - > 100 miles each way	Per Round Trip	1	$ 857.32	$ 857.32	0	1	$ 857.32	0
KW	8-1.	Monitoring Well Sampling with Water Level, ≤ 100 foot depth	Per Well	7	$ 182.34	$ 1,276.38	0	7	$ 1,276.38	0
NA	8-7.	Water Level or Free Product Gauging	Per Well	2	$ 26.46	$ 52.92	0	2	$ 52.92	0
●	8-11.	Electronic Data Deliverables (EDD)	Per Sampling Event	1	$ 41.08	$ 41.08	0	1	$ 41.08	0
●	9-27.	Water, BTEX + MTBE (EPA 602, EPA 624, EPA 8021 or EPA 8260)	Per Sample	7	$ 46.95	$ 328.65	0	7	$ 328.65	0
●	9-30.	Water, Polycyclic Aromatic Hydrocarbons, including 1-methylnaphthalene + 2-methylnaphthalene (EPA 610 [HPLC], EPA 625, EPA 8270 or EPA 8310)	Per Sample	3	$ 104.17	$ 312.51	0	3	$ 312.51	0
●	9-41.	Water, Lead, Total (EPA 200.7, EPA 200.8, EPA 6010 or EPA 6020)	Per Sample	3	$ 12.71	$ 38.13	0	3	$ 38.13	0
	17-1.	System O&M Package - Small	Per Month	3	$ 3,054.58	$ 9,163.74	0	3	$ 9,163.74	0
	18-2.	Medium Holding Tank - 2,000 to 6,000 gal. capacity - Long Term > 6 mos.	Per Month	3	$ 344.85	$ 1,034.55	0	3	$ 1,034.55	0
	18-18.	AS/SVE System - Small - Long Term > 6 mos.	Per Month	3	$ 3,390.41	$ 10,171.23	0	3	$ 10,171.23	0
	19-21.	Operation & Maintenance Report, Quarterly or Non-Annual	Per Report	1	$ 2,129.51	$ 2,129.51	0	1	$ 2,129.51	0
	21-8.	P.E. Project Oversight for Remediation System Operation and Maintenance	Per Month	3	$ 1,280.00	$ 3,840.00	0	3	$ 3,840.00	0

Schedule of Pay Items 03-14-22

NOTE: Adapt file not submitted before report submittal

NOTE: Original field notes needs fac id #

9/8/2023

Site Manager Review

O&M Basics.

Before you get started you must make sure all the required documents are in the report and ALL work was done as scoped per rule.

After RTC.

	Task 3										
KW	3-2.	Mobilization, Light Duty Vehicle (car or 1/2 ton truck) - > 100 miles each way	Per Round Trip	1	$ 857.32	$ 857.32	0	1	$ 857.32	0
KW	8-1.	Monitoring Well Sampling with Water Level, ≤ 100 foot depth	Per Well	7	$ 182.34	$ 1,276.38	0	7	$ 1,276.38	0
NA	8-7.	Water Level or Free Product Gauging	Per Well	2	$ 26.46	$ 52.92	0	0	$ -	2
KW	8-11.	Electronic Data Deliverables (EDD)	Per Sampling Event	1	$ 41.08	$ 41.08	0	1	$ 41.08	0
KW	9-27.	Water, BTEX + MTBE (EPA 602, EPA 624, EPA 8021 or EPA 8260)	Per Sample	7	$ 46.95	$ 328.65	0	7	$ 328.65	0
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KW	17-1.	System O&M Package - Small	Per Month	3	$ 3,054.58	$ 9,163.74	0	3	$ 9,163.74	0
KW	18-2.	Medium Holding Tank - 2,000 to 6,000 gal. capacity - Long Term > 6 mos.	Per Month	3	$ 344.85	$ 1,034.55	0	3	$ 1,034.55	0
KW	18-18.	AS/SVE System - Small - Long Term > 6 mos.	Per Month	3	$ 3,390.41	$ 10,171.23	0	3	$ 10,171.23	0
KW	19-21.	Operation & Maintenance Report, Quarterly or Non-Annual	Per Report	1	$ 2,129.51	$ 2,129.51	0	1	$ 2,129.51	0
KW	21-8.	P.E. Project Oversight for Remediation System Operation and Maintenance	Per Month	3	$ 1,280.00	$ 3,840.00	0	3	$ 3,840.00	0

Site Manager Review

Cross-reference the inspector report.

7692 US HWY 27 Ft. White, Fl
Eastern - Tuesday - Sunny - 90's 06/27/23
9:45 ATL mob to site MTK Tstorm (MT)
in Lt duty Truck Dodge RAM 1500
12:00 ATL arrive onsite (MT). Devon
w/ggs (DW) onsite. Sign HASP.
12:10 Check System. System Running
↳ Locate wells for readings. Make
repair to pump / poly tank fittings
13:30 Begin SSO injection per HASP. Collect well
Readings. Collect DO / ORP see log.

FIELD INSPECTION SUMMARY FORM

EXPECTED START DATE: 06/27/23 Expected Event Duration: 1 days
ACTUAL START DATE: 06/27/23

ACTIVITIES OBSERVED / COMMENTS:

INSPECTION DATE: 06/27/23
EXPECTED START TIME: 11:00 AM
OBSERVED TIMES: On Site Off Site
INSPECTOR: 11:00 AM 1:15 PM
CONTRACTOR: 10:45 unk
SUBCONTRACTOR:

WEATHER:
85°, hot

This is a one day event to monitor the peroxide injection system

The injection system is running upon arrival. The facility is an active Chevron gas station and convenience store. The Agency Term Contractor or ATC, ATLAS was on-site. The HASP is available on-site.

The system, contained in an enclosed trailer, is solar powered and is a peroxide injection system utilizing 10 injection points or wells (INJ-1 & 2 and INJ-4 thru 12) to inject a peroxide mixture into the formation. The injections occur in numerical order starting with INJ-1 and each well injection is for 4 minutes per well (about .5 to .75 gallons) followed by an injection of water. After each INJ well has received an injection the system is idle while system depressurization occurs and then the injection cycle starts over with the INJ-1 well. The injection wells are screened from 37 feet to 45 feet BLS.

The systems smart screen shows a total of **3191 gallons** of peroxide injection fluid injected, (photos).

Today the ATC is expecting a delivery of peroxide product drums and will re-fill the main tank when it arrives. The ATC will also mix up the weekly dosage of the SOS (oxidizer) solution and inject this into each active injection well. The ATC will mix 75 LBS of the SOS solution (to equal 300 lbs. for per month). The inspector is able to observe part of the SOS set-up & injection. The oxidizer solution had not yet arrived when the inspector departed site. There were no issues with the tasks observed today.

A site walk about was conducted and all the trenching and surface completions were still in good condition.

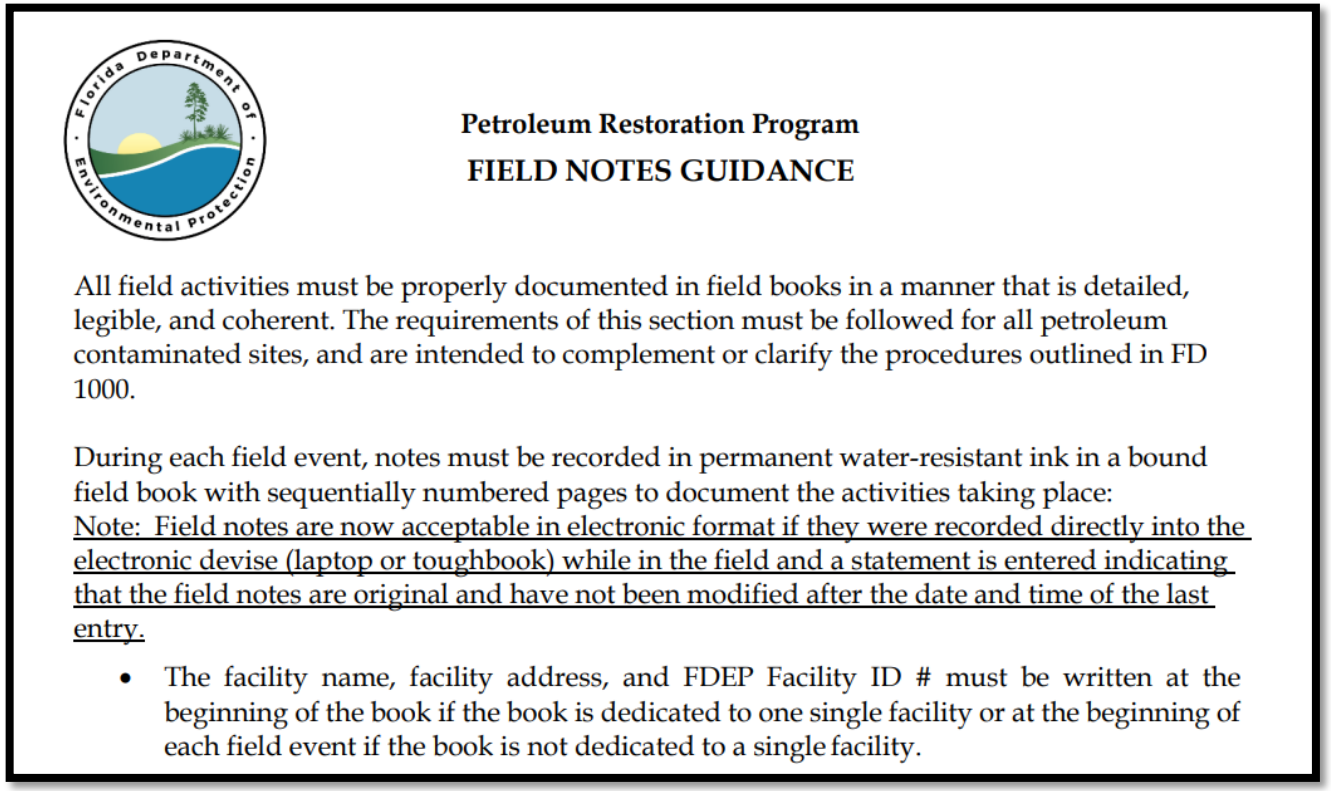
Please see site photographs.

NOTE: Field Notes above are purposely missing information.

Site Manager Review

Field Notes Guidance.

- Field Notes must follow the most current field notes guidance located on the Petroleum Restoration Program (PRP) website.
- All fieldwork must be accompanied by a Field Work Notice (FWN).
- Other things to consider when looking at O&M field Notes:
  - Field Notes that are accompanied by an attestation from a P.E. (line item 21-8 P.E. Project Oversight) should be signed & dated with an attestation. This pay item is subject to proration based on system runtime.



Petroleum Restoration Program

FIELD NOTES GUIDANCE

All field activities must be properly documented in field books in a manner that is detailed, legible, and coherent. The requirements of this section must be followed for all petroleum contaminated sites, and are intended to complement or clarify the procedures outlined in FD 1000.

During each field event, notes must be recorded in permanent water-resistant ink in a bound field book with sequentially numbered pages to document the activities taking place:
Note: Field notes are now acceptable in electronic format if they were recorded directly into the electronic devise (laptop or toughbook) while in the field and a statement is entered indicating that the field notes are original and have not been modified after the date and time of the last entry.

- The facility name, facility address, and FDEP Facility ID # must be written at the beginning of the book if the book is dedicated to one single facility or at the beginning of each field event if the book is not dedicated to a single facility.

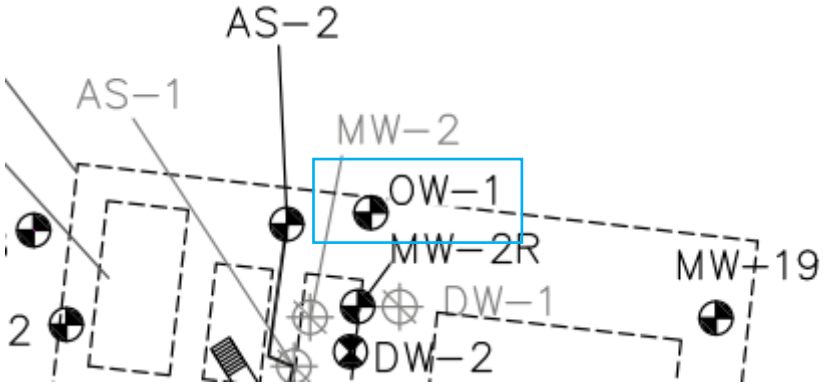
Link: https://floridadep.gov/sites/default/files/Field-Notes-Guidance_081717_1.pdf

Pulling it all together

Does the Conclusion & Recommendation make sense?

CONCLUSIONS & RECOMMENDATIONS

Air sparging efforts performed during the nine quarters of O&M completed thus far have been largely successful in reducing volatile and semi-volatile groundwater contaminant concentrations within the former source area. Groundwater test results from the ninth quarter sampling event, confirm that Benzene still is present in OW-1 above its GCTL limit. In addition, Total Xylenes concentrations observed in OW-1 elevated above GCTL limits and Ethylbenzene concentrations in OW-1 elevated above NADC limits. Apex believes with the relocation of the air sparge remediation well (AS-1 abandoned and air redirected to AS-2), OW-1 will begin to get the influence it needs to show decreasing levels of contaminants in future sampling events. FDEP recommended Apex reinstall



Sample		TRPHs	Naph-thalene	1-Methyl-naph-thalene	2-Methyl-naph-thalene	Acen-aph-thene	Acen-aph-thylene	Anthra-cene	Benzo (g,h,i) pery-lene	Fluoran-thene	Fluor-ene	Phenan-threne
Location	Date	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
GCTLs		**5000**	**14**	**28**	**28**	**20**	**210**	**2100**	**210**	**280**	**280**	**210**
NADCs		**50000**	**140**	**280**	**280**	**200**	**2100**	**21000**	**2100**	**2800**	**2800**	**2100**
OW-1	5/4/2018	**12500**	4.17	0.418	0.044 U	0.292	0.025 U	0.038 U	0.039 U	0.039 U	0.0757 I	0.035 U
	6/11/2019	4600	**253**	**58.3**	**71.4**	0.69	0.030 U	0.057 I	0.15 U	0.018 U	0.67	0.35 I
	3/17/2020	3600	**83.1**	22.8	11.3	0.33 I	0.030 U	0.043 U	0.15 U	0.018 U	0.35 I	0.16 U
	6/16/2020	**5200**	**52.5**	**30.4**	6.7	0.38 I	0.030 U	0.049 I	0.15 U	0.018 U	0.41 I	0.17 I
	9/17/2020	**6200**	**45.7**	**31.5**	4.4	0.44 I	0.030 U	0.043 U	0.15 U	0.018 U	0.41 I	0.16 U
	12/22/2020	4200	**130**	**53.7**	35.9	0.64	0.030 U	0.043 U	0.15 U	0.018 U	0.55	0.20 I
	04/27/2021	4100	**37.7**	**33.8**	4.0	0.60	0.030 U	0.043 U	0.15 U	0.018 U	0.52	0.16 U
	7/30/2021	2500	**79.2**	**41.1**	6.6	0.81	0.031 U	0.070 I	0.023 U	0.018 U	0.73	0.019 U
	10/28/2021	NA	**116**	**57.5**	**46.0**	**0.87**	0.031 U	**0.027 I**	0.023 U	0.018 U	**0.77**	**0.16 I**
	11/18/2021	**2700**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2/8/2022	**4600**	**111**	**57.4**	**62.8**	**0.89**	0.031 U	**0.044 I**	0.023 U	0.018 U	**0.82**	**0.22 I**
	5/19/2022	NS	**72.1**	**48.4**	**42.1**	0.73	0.031 U	0.041 I	0.023 U	0.018 U	0.71	0.18 I
	8/18/2022	NS	0.60 I	0.036 U	0.063 U	0.068 I	0.029 U	0.083 I	0.021 U	0.017 U	0.016 U	0.018 U
	11/9/2022	NS	0.27 U	0.036 U	0.063 U	0.018 U	0.029 U	0.019 U	0.021 U	0.017 U	0.016 U	0.018 U
	2/9/2023	NS	3.0	1.5 I	0.10 I	0.12 I	0.028 U	0.018 U	0.021 U	0.016 U	0.074 I	0.017 U

Are we on to something?

Pulling it all together

We've made it!!

Monitoring Well	OW-1	Facility Name	Dixie County Road Dept.	Baseline Sampling Date	6/11/2019
		Facility ID #	159202584	System Startup Date	12/16/2019

Constituent Concentration Group Milestones (ug/l)

Projected Cleanup Time (yrs)	Actual Sampling Date	Actual Cleanup Time (yrs)	Group 1 Benzene		Group 2 Sum Toluene, Ethylbenzene, & Xylenes		Group 3 Naphthalenes		Group 4 MTBE		Group 5 TRPH		Group 6 PAH (I)		Group 7 PAH (II)	
			Proj.	Actual	Proj.	Actual	Proj.	Actual	Proj.	Actual	Proj.	Actual	Proj.	Actual	Proj.	Actual
0.00	6/11/2019	0.00	7	6.7	51	51.43	1	0.6	0	0	NS	NS	0	0	0	0.151
0.25	3/17/2020	0.25	6	*87*		687.5		117.2		0	#VALUE!	3600	0	0	0	*0.68*
0.50	6/16/2020	0.50	6	*92*		320		89.6		0	#VALUE!	5200	0	0	0	*1.009*
0.75	9/17/2020	0.76	5	*184*		245.1		81.6		0	#VALUE!	6200	0	0	0	*0.85*
1.00	12/22/2020	1.02	5	*276*		965		219.6		0	#VALUE!	4200	0	0	0	*1.39*
1.25	4/27/2021	1.36	4	*151*		312.1		75.5		0	#VALUE!	4100	0	0	0	*1.12*
1.50	7/30/2021	1.62	4	*272*		466.1		126.9		0	#VALUE!	2500	0	0	0	*0.73*
1.75	10/28/2021	1.87	4	*189*		462.6		219.5		0	#VALUE!	2700	0	*0.17*	0	*1.93*
2.00	2/8/2022	2.15	3	*201*		755.6		231.2		0	#VALUE!	4600	0	*0.17*	0	*2.078*
2.25	5/19/2022	2.42	3	*99*		523.9		162.6		0	#VALUE!	NS	0	0	0	0
2.50	8/18/2022	2.67	2	*6.7*		51.4		0.6		0	#VALUE!	NS	0	0	0	*0.151*
2.75	11/9/2022	2.90	2	1.6		8.53		0.28		0	#VALUE!	NS	0	0	0	0
3.00	2/9/2023	3.15	2	*5.7*		31.45		3		0	#VALUE!	NS	0	0	0	*0.194*
3.25	5/4/2023	3.38	1	2		10.3		0		0	#VALUE!	NS	0	0	0	*0.041*
3.50	8/3/2023	3.63	1	1		10.5		4.81		0	5000	*NS*	0		0	*0.356*
3.75			1								5000		0		0	
4.00			1								5000		0		0	
Remediation Goal (ug/l)			1		90		70		20		5000		0		0	

Required Components

O&M Components for a Quarterly or Non-Annual Report.

Link: https://floridadep.gov/sites/default/files/ATC%20Report%20Types%20Guidance-Final-111318.pdf

19-21. Operation and Maintenance Report, Quarterly or Non-Annual: [Per Report]. This pay item contains all information needed to evaluate the progress of the approved site remediation activities and includes telemetry monitoring data. This report must include a conclusions and recommendations section and all applicable O&M report tables. Registered P.E. certification (SPI 21-31) is not required, unless there are significant proposed changes to the approved RAP.

Summary description of activities completed	O&M reports should include the PRP Milestone Workbook with designated milestone wells, baseline concentrations, defined cleanup target level and individual well data. (per guidance)
Updated tables of cumulative water level, free product thickness, soil/water/vapor analytical data for historic and current testing, including qualifiers, qualifier codes, and bold results that exceed applicable target cleanup level.	Materials documentation and invoice.
	Field notes (per guidance)
Water and air sampling logs (per guidance)	Copy of executed access agreement
Sample chain of custody form	Photographic documentation of activities
Laboratory analytical report(s)	Waste disposal manifests
ADaPT zip file including the lab EDD, error log, field EDD and merged database file	All other applicable information required by listed guidance and rule.
System parameter readings (pressure, vacuum, flow rates and totals, telemetry system operation records and % run time calculations	Description of deviation from the task requirements
	Recommendations for next scope of work needed to move the site towards closure

Required Components

O&M Components for an Annual Report.

19-22. Operation and Maintenance Annual Report: [Per Report]. This pay item requires a more substantial degree of evaluation than quarterly reports, including summary, conclusions, discussion and recommendations of how the system may be modified or optimized to more cost-effectively and efficiently continue site remediation. The report must evaluate progress relative to cleanup milestone concentration objectives, establish new milestones if necessary and include telemetry monitoring. The report must include a conclusions and recommendations section and all applicable O&M reporting tables. The report must be signed and sealed by a registered P.E. (SPI 21-32).

Summary description of activities completed	O&M reports should include the PRP Milestone Workbook with designated milestone wells, baseline concentrations, defined cleanup target level and individual well data. (per guidance)
Updated tables of cumulative water level, free product thickness, soil/water/vapor analytical data for historic and current testing, including qualifiers, qualifier codes, and bold results that exceed applicable target cleanup level.	
Water and air sampling logs (per guidance)	Materials documentation and invoice.
Sample chain of custody form	Field notes (per guidance)
Laboratory analytical report(s)	
ADaPT zip file including the lab EDD, error log, field EDD and merged database file	Copy of executed access agreement
	Photographic documentation of activities
System parameter readings (pressure, vacuum, flow rates and totals, telemetry system operation records and % run time calculations	Waste disposal manifests
	All other applicable information required by listed guidance and rule.
Startup and O&M reports should include text, graphs, a milestone worksheet and the PRP RA Summary Report with its various worksheets; site summary, site performance summary, treatment well details, process summary, maintenance summary, GWR performance, AS performance, SVE performance, MPX performance, GW elevation (with and without FP), GWR analytical, MW analytical, SVE analytical, VVE-MPX well data, AS well data, GW RW data, and system influent monitoring parameters. (per guidance)	Description of deviation from the task requirements
	Recommendations for next scope of work needed to move the site towards closure
	Registered Professional Engineer review, evaluation, and certification (per guidance)

Runtime Calculations

Example Site, Excel Sheet (Right).

Key things to take away.

- Agency Term Contractor (ATC) Runtimes MUST be confirmed.
- O&M site visits should be approximately 30 days apart.
  - What is the justification if greater/less than 30 days?
- Runtime calculations can be saved in an excel workbook to compare O&M performance from quarter to quarter.
- **BE CAREFUL** with partial reports, Keeping track of payments can save you from easy invoice errors.
- Calculations are always included in the Deliverable Review Letter for the approval of payments.

Site Name: EXAMPLE
FAC ID#: XXXX
Runtime Calculations Y1Q4

AS

Start Date	End Date	# of Days	Start Runtime	End Runtime	Monthly % Runtime		
01/01/23	02/01/23	31	6119.0	6800.0	91.53	0.92	*PAID
02/01/23	03/01/23	28	6800.0	6970.0	25.30	0.25	
03/01/23	04/01/23	31	6970.0	8100.0	151.88	1.52	
						2.69	

SVE

Start Date	End Date	# of Days	Start Runtime	End Runtime	Monthly % Runtime		
01/01/23	02/01/23	31	5000.0	5740.0	99.46	0.99	100
02/01/23	03/01/23	28	5740.0	5910.0	25.30	0.25	Prorated
03/01/23	04/01/23	31	5800.0	6500.00	94.09	0.94	100
						2.19	

Y1Q1 | Y1Q2 | Y1Q3 | Y1Q4

John Wright, P.E.

RA Summary Report Tables

Table 1A	Site Summary
Table 1B	Site Performance Summary
Table 1C	Treatment Well Details
Table 1D	Remedial Process Summary
Table 1E	Remedial System Maintenance Summary
Table 1F	Site Operation and Maintenance Summary
Table 1G	Well Construction Details
Table 3	Soil Vapor Extraction Performance Summary
Table 4	Groundwater Elevation Summary
Table 6	Groundwater Monitoring Well Analytical Summary
Table 7	Vapor Treatment System Analytical Summary
Table 8	SVE Well Data
Table 10	System Influence Monitoring Parameter

System Performance Not Just Runtime

If the System Is Running, Is It Performing?

Key Things To Verify:

- Mass Recovery.
- Dissolved Oxygen, Pressures, and Flows.
- Depth to Water and Plume Capture.

System Runtime

- Must Be > 80% To Receive Full Payment.
- Calculated in RA Report Tables 2, 3A, 3B, and 3C.
- If Runtime < 80% Proration Is Required For:
  - Section 17 - O & M.
  - Section 18 - System Use (Unless State Owned).
  - Section 21-8 – Professional Engineer (PE) Oversight of O & M.

Approved Downtime

- Approved Downtime Is Entered Into Runtime Calculation Tables.

- Approved Downtime Allowed For:
  - Annual Sampling.
  - Severe Weather.
  - Conditions Outside Control of Contractor.

Milestones

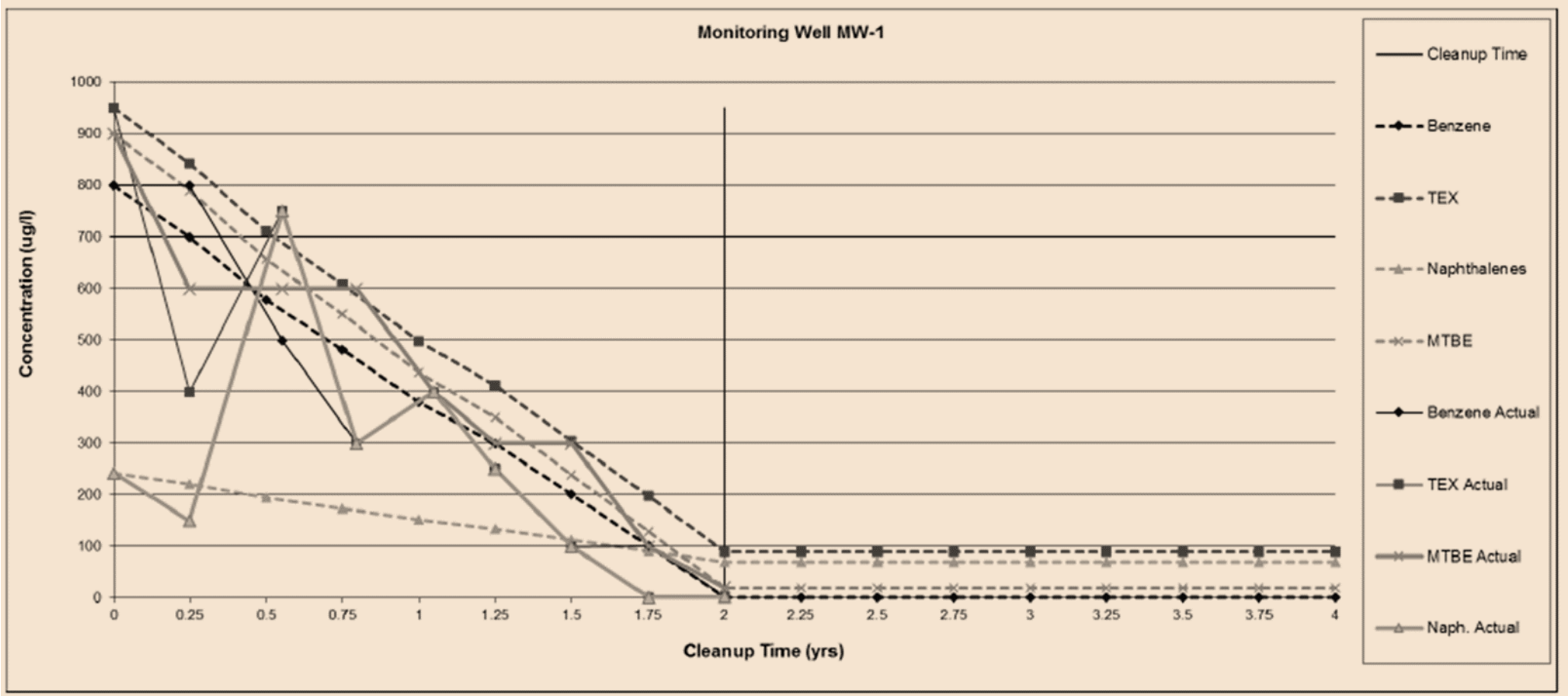
TABLE 1B: SITE PERFORMANCE SUMMARY

Facility Name:	DEP BMC	Startup Date:	2/12/2006
Facility Address:	2600 Blairstone Road, Tallahassee	System Type:	0
FDEP FAC ID:	123456789		

Key Wells Meeting All Milestones (yes/no)

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16
MW-1																
MW-2																
MW-3																
MW-4																
MW-5																
MW-6																
MW-7																

Milestones


Monitoring Well MW-1
Concentration (ug/l)
1000
900
800
700
600
500
400
300
200
100
0
0
0.25
0.5
0.75
1
1.25
1.5
1.75
2
2.25
2.5
2.75
3
3.25
3.5
3.75
4
Cleanup Time (yrs)
Cleanup Time
Benzene
TEX
Naphthalenes
MTBE
Benzene Actual
TEX Actual
MTBE Actual
Naph. Actual

Options To Enhance System

1. Pulsing The System.
   - Zoned Operation.
   - Cycle The Entire System.
2. Add Treatment Points/Modify Flow.
3. Switching To Episodic Treatment.
   - Allows Use of Smaller Equipment.
4. Changing To Bio-Sparging.
   - Uses Less Power and Equipment.
   - Vapors May Be An Issue.
   - Difficult With Shallow Water Table.

Data Required During O&M

- System Influence Parameters.
  - Water/Product Levels.
  - Dissolved Oxygen.
  - Recovered Vapor Concentrations.
- Ground Water Quality - Monitoring Wells.
  - Source Area and Down Gradient.
  - Sampled Quarterly For the First Year.
- Regulatory Requirements.
  - Air Emission Treatment For At Least 30 Days.
  - May Be Discontinued If Less Than 13.7 pounds/day.
  - Treated Water Discharge Sampling.

Check For Submerged Well Screens

NOTE:
Screen Interval
5’-15’.

Sample			Benzene	Toluene	Ethylbenzene	Total Xylenes	MTBE	Naphthalene	1-Methyl naphthalene	2-Methyl naphthalene	TRPH	EDB	1,2-Di-chloroethane	Total Lead
FDEP GCTLs			1**	40**	30**	20**	20	14	28	28	5,000	0.02**	3**	15**
FDEP NADCs			100	400	300	200	200	140	280	280	50,000	2	300	150
Location	Date	DTW	All results in micrograms per liter (µg/L)											
MW-1	04/06/16	7.20	1.0 U	3.1 I	**205**	**2,490**	1.0 U	**318**	**73.7**	**130**	**14,000**	0.0095 U		2.9 I
	05/10/17	9.82	6.2 U	6.0 U	**139**	**1,520**	4.6 U	**99.8**	21.4	22.2	**6,620**			
	08/07/18	5.03	0.31 U	0.30 U	**36.6**	**204**[a]	0.23 U	**31.2**	13.00	14.6	2,830			
	12/12/18	6.74	0.62 U	0.60 U	**39.9**	**348**	0.46 U	**30.7**[a]	22.30	18.7[a]	3,840			
	08/20/19	4.24	0.30 U	0.33 U	2.0	18.4	0.51 U	3.9	1.5 I	2.8	780 U			
	12/17/19	6.14	0.30 U	0.33 U	**51.6**	**441**	0.51 U	**60.3**	25.0	**44.8**	2,600			
	05/25/22	10.32	0.30 U	0.71 U	**53.0**	**150**	1.6 U	**56.4**	18.7	**32.5**				
	01/13/23	5.04	0.30 U	0.33 U	4.3	4.3 I	1.2 U	3.4	1.7 I	2.9				
	07/17/23	6.54	0.30 U	0.33 U	16.9	**24.0**	1.2 U	9.5	6.1	9.1				
	12/11/23	5.92	0.30 U	0.33 U	3.4	12.4	1.2 U	3.4	1.5 I	2.1				
MW-2	04/06/16	6.95	10 U	**5,890**	**1,410**	**13,600**	10 U	**487**	**50.5**	**89.1**	**27,800**			
	05/10/17	9.52	7.8 U	**842**	**486**	**4,950**	5.7 U	**182**	**35.8**	**57.7**	**14,100**			
	08/07/18	4.81	1.6 U	**170**	**114**	**1,030**	1.1 U	12.6	3.0	0.31 U	4,520			
	12/12/18	6.43	1.6 U	**44.0**	**105**	**1,030**	1.1 U	**108**[a]	**38.2**[a]	**60.3**[a]	4,410			
	08/20/19	3.95	0.30 U	0.33 U	0.30 U	2.1 U	0.51 U	0.29 U	0.19 U	0.68 U	750 U			
	12/17/19	5.86	0.30 U	**19.3**	**85.4**	**663**	0.51 U	**38.6**	12.5	20.2	1,800			
	05/25/22	10.09	0.30 U	**706**	**291**	**2,920**	1.6 U	**87.1**	14.3	25.9				
	01/13/23	4.77	0.30 U	0.70 I	11.9	5.8	1.2 U	3.9	1.3 I	1.6 I				
	07/17/23	6.33	0.30 U	**118**	**105**	**1,760**	1.2 U	**37.8**	9.2	14.5				
	12/11/23	5.63	0.30 U	31.4	**38.8**	**635**	1.2 U	**17.4**	5.2	6.4				

Options During RA

- 62-780.700, F.A.C., Allows The Following To Be Proposed and Justified During Remedial Action Plan (RAP) Implementation.
- Supplemental Assessment.
  - Collect Soil Data.
  - Additional Monitoring Wells.
- RAP Modification.
  - Add Treatment Wells – Deeper, Shallower.
  - Source Removal.
  - Add Innovative Technology - Biological or Chemical Treatment.
- Natural Attenuation Monitoring.

When To Turn A System Off?

Evaluate Ground Water Data.

- Toluene Most Biodegradable.
- Xylenes Least Biodegradable.
- Look For High Baseline Concentrations.

Evaluate Vapor Influent Data.

- Are you Recovering Any Mass?
- Does Pulsing Change Recovery?

Collect Soil Confirmation Data.

Natalie Monteiro, P.E.

Vapor Emission

Regulatory Requirements

- 62-780.700(4) & (11) & BPSS 4.
- Treatment for Vacuum extraction systems.
  - At least the first 30 days.
  - <= 13.7 lbs/day total Hazardous Air Pollutants (HAPs) (usually use Total petroleum hydrocarbons (TPH)) or 5.5 lbs/day for any single HAP.

Treatment

- Applies to Air Sparge/Multiphase extraction (AS/MPX).
- Biosparge (BS) must be
  - Operated to minimize volatilization of contaminants.
  - Confirmed during Startup (usually Organic Vapor Analyzer (OVAs)).

Emission Sampling

Influent/Effluent.

- Startup 24 hr. turn around time (TAT) may be used.
- Weekly first month (Startup = Week 1).
- Monthly first quarter.
- Quarterly thereafter.
- Pay item 9-68, Air Total Petroleum Hydrocarbons (TPH mg/m3).
- Lab analysis TO-13/TO-14 to isolate 24 EPA HAPs in petroleum (rare).
- Concentration (mg/m3) x flowrate (ft3/min) x conversion factors = lbs/day.

Emission Sampling

- As with groundwater, confirm concentrations/dates are correct.
- Influent: elevated implies good system recovery.
- Effluent: > 13.7 lbs/day, shut system & change out Granular Activated Carbon (GAC).
- If effluent > influent it implies that the GAC is spent, consider Remove/Replace GAC.

Pre-Carbon Emission Rates

TABLE 5: VAPOR TREATMENT SYSTEM ANALYTICAL SUMMARY

Facility Name: Raceway #831 **Facility ID#:** 378630721

If Non-Detect Use MDL "U"
Not Sampled = NS
Analytical Results = mg/m^3

Sample Location	Sample Date	Hour Meter	System Vacuum (in of H20)	Flow Rate (scfm)	OVA (ppm)	Benzene	Toluene	Ethyl Benzene	Total Xylenes	Total VOA	TPH	Emission Rate (lb/day)	Total Mass Recovered (lbs)
Pre-Carbon	12/14/2020	3	118	550	0.0	0.44	1.6	1.1	3.3	6.4	380	18.8	18.8
Pre-Carbon	12/15/2020	23	135	248	4.3	0.64	2.2	1.1	4.1	8.0	780	17.4	33.9
Pre-Carbon	12/16/2020	38	137	208	570.4	1.1	3.6	1.3	4.7	10.7	880	16.5	44.4
Pre-Carbon	12/23/2020	210	125	32.9	53.4	2.5	12	3.7	21	39.2	1,500	4.4	119.3
Pre-Carbon	12/29/2020	329	117	228	22.7	0.62 I	3.7	1.3 I	6.0	11.6	350	7.2	148.1
Pre-Carbon	1/6/2021	496	170	267	370.1	0.72 I	5.0	0.74 I	2.6 I	9.1	280	6.7	196.4
Pre-Carbon	2/3/2021	1,081	150	285	161.6	0.95 I	6.8	1.2 I	5.2	14.2	380	9.7	397
Pre-Carbon	3/2/2021	1,716	150	586	27.9	1.9	21	3.2	24	50	600	31.6	944
Pre-Carbon	5/6/2021	3136	143	133.6	3.1	0.44 U	1.0 U	0.36 U	1.2 U	3	36	0.4	1,892
Pre-Carbon	6/8/2021	3905	197	70.0	0.0	0.44 U	1.0 U	0.36 U	1.2 U	3	36	0.2	1,903
Pre-Carbon	9/14/2021	5970	78	204	5.4	0.44 U	1.0 U	0.36 U	1.2 U	3	36	0.7	1,941

Post-Carbon

TABLE 5: VAPOR TREATMENT SYSTEM ANALYTICAL SUMMARY

Facility Name: Raceway #831 **Facility ID#:** 378630721

If Non-Detect Use MDL "U"
Not Sampled = NS
Analytical Results = mg/m^3

Sample Location	Sample Date	Hour Meter	System Vacuum (in of H20)	Flow Rate (scfm)	OVA (ppm)	Benzene	Toluene	Ethyl Benzene	Total Xylenes	Total VOA	TPH	Emission Rate (lb/day)	Total Mass Recovered (lbs)
Post-Carbon	12/14/2020	3	118	550	0.0	0.44 U	1.0 U	0.36 U	1.2 U	3.0 U	36 U	<0.061	<0.061
Post-Carbon	12/15/2020	23	135	248	0.0	0.44 U	1.0 U	0.44	1.7	2.1	70	1.56	0.7
Post-Carbon	12/16/2020	38	137	208	501.9	0.44 U	1.0 U	0.62	2.4	3.0	730	13.65	5.5
Post-Carbon	12/23/2020	210	125	32.9	66.9	0.44 U	1.0 U	0.56 I	3.1 I	3.7 I	680	2.01	61.6
Post-Carbon	12/29/2020	329	117	228	113.3	4.2	1.9 I	0.50 I	2.2 I	8.8	840	17.22	109.3
Post-Carbon	1/6/2021	496	170	267	1,028	1.9 I	8.0	0.55 I	2.6 I	13.1	500	12.0	211.0
Post-Carbon	2/3/2021	1,081	150	285	181.5	0.44 U	1.9 I	0.90 I	4.9 I	7.7	280	7.2	444.7
Post-Carbon	3/2/2021	1,716	150	586	31.2	0.44	8.8	2.0	17	28	120	6.3	623.2
Post-Carbon	5/6/2021	3136	143	133.6	0.3	0.44 U	1.0 U	0.36 U	1.2 U	3	36	0.4	823.0
Note: Carbon vessels by-passed August 12, 2021													

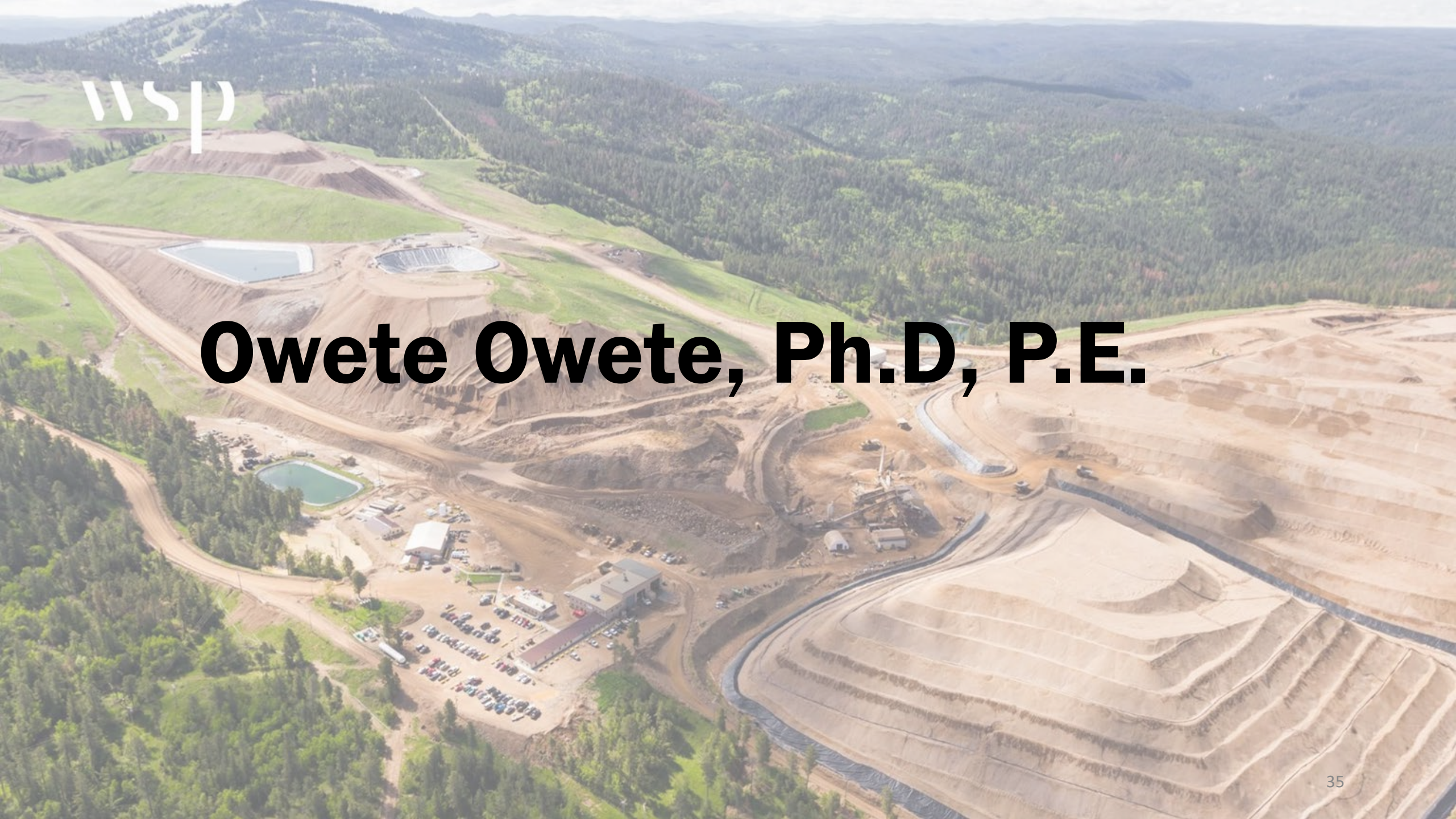
System Maintenance

Date:	Type:	System Maintenance Description
12/14/2020	Startup	System startup, SVE only for two hours, followed by AS/SVE
12/15/2020	Startup	System startup second day
12/16/2020	Startup	System startup third day
12/23/2020	O&M	Checked system performance and gauged system oil
12/29/2020	O&M	Checked system performance and gauged system oil, adjusted flow to AS-15 & AS-6
1/6/2021	O&M	Checked system performance and gauged system oil
1/11/2021	System shut down	System shut down due to carbon breakthrough
1/14/2021	Carbon change	Used carbon removed and replaced with fresh carbon; system restarted

Recommendations

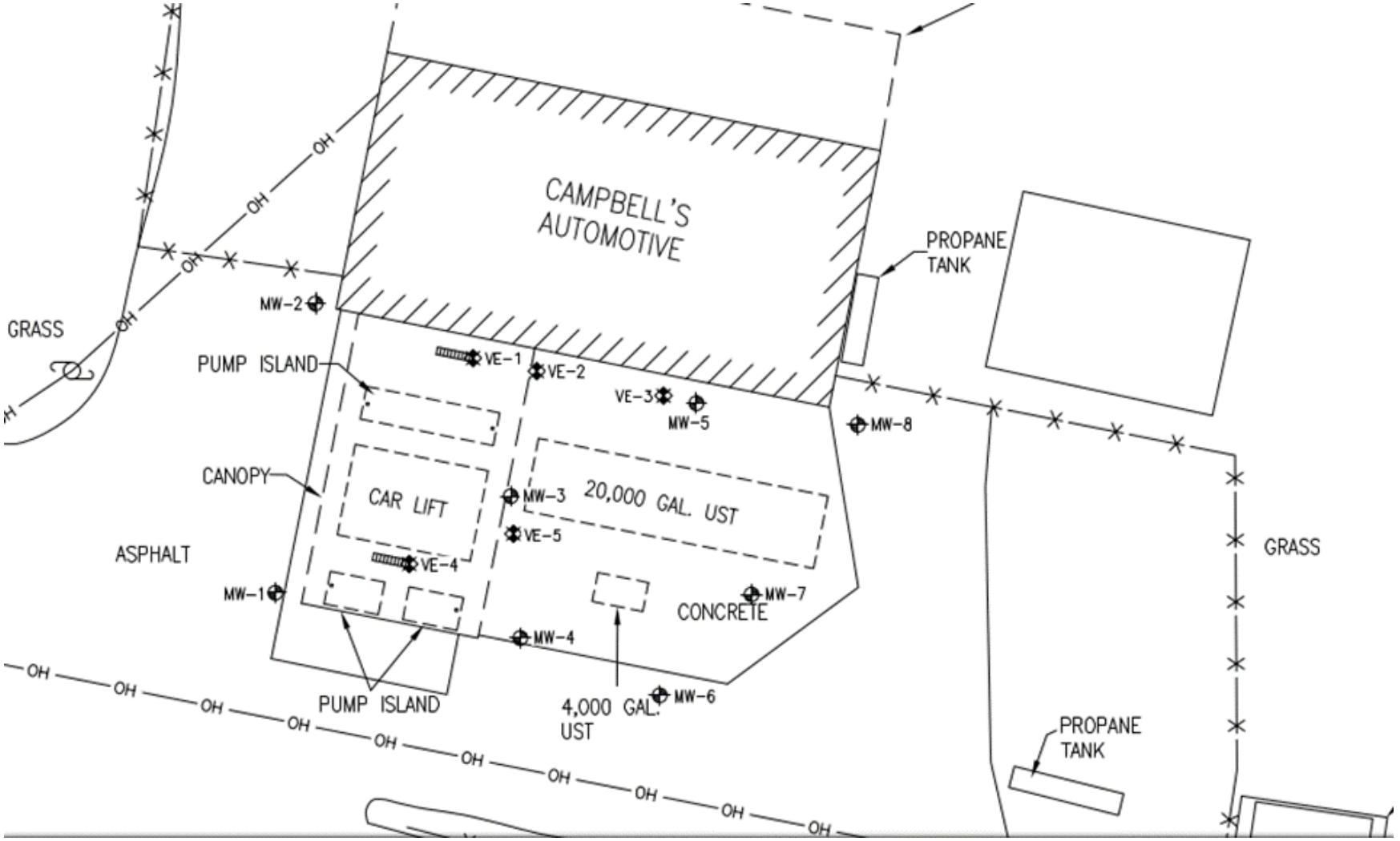
Things to think about when reviewing a recommendation by the ATC.

- How long has the system been running?
- Overall system effectiveness (good or bad)?
- How much money is left under the cap?
- Other Funding Considerations?
- Conditional Closure agreements in place?
- Should we change our approach or transition to RAPMOD/NAM?

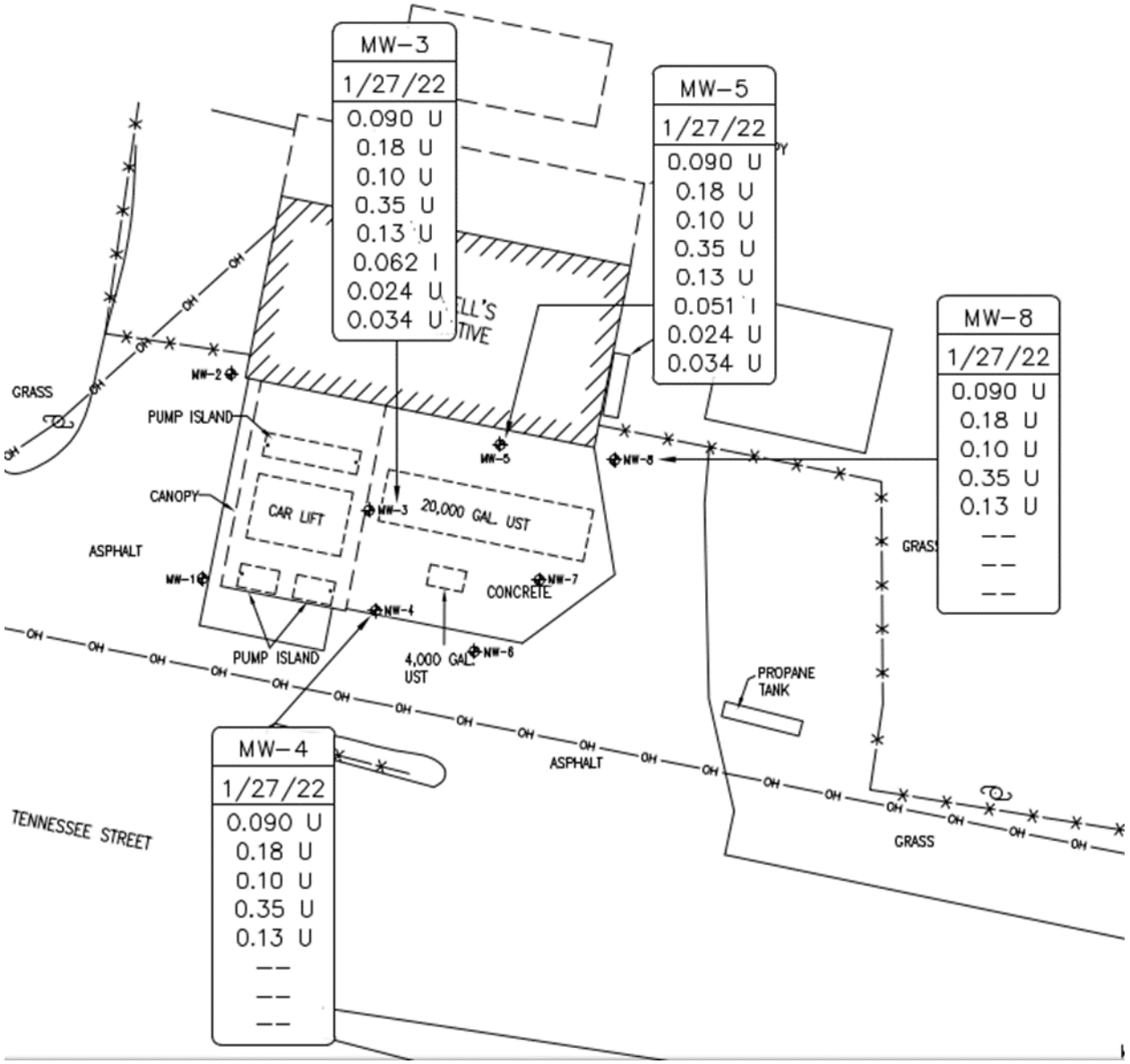


Owete Owete, Ph.D, P.E.

Case Study


CAMPBELL'S AUTOMOTIVE
PROPANE TANK
GRASS
MW-2
PUMP ISLAND
VE-1
VE-2
VE-3
MW-5
MW-8
CANOPY
CAR LIFT
MW-3
20,000 GAL. UST
VE-5
ASPHALT
VE-4
MW-1
MW-7
CONCRETE
MW-4
PUMP ISLAND
4,000 GAL. UST
MW-6
PROPANE TANK
GRASS
OH

Case Study


MW–3
1/27/22
0.090 U
0.18 U
0.10 U
0.35 U
0.13 U
0.062 I
0.024 U
0.034 U
MW–5
1/27/22
0.090 U
0.18 U
0.10 U
0.35 U
0.13 U
0.051 I
0.024 U
0.034 U
MW–8
1/27/22
0.090 U
0.18 U
0.10 U
0.35 U
0.13 U
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MW–4
1/27/22
0.090 U
0.18 U
0.10 U
0.35 U
0.13 U
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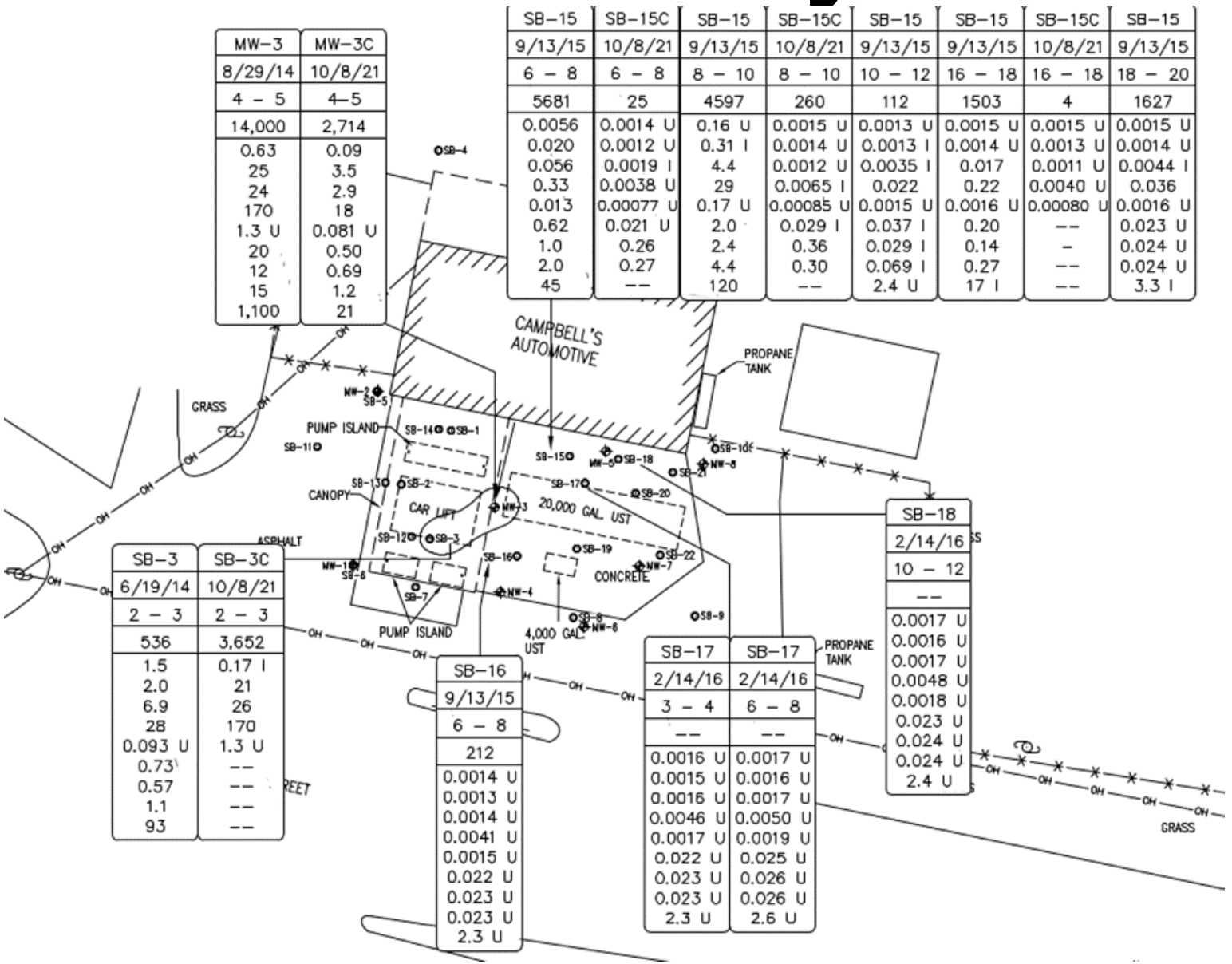
GRASS
PUMP ISLAND
CANOPY
CAR LIFT
20,000 GAL. UST
ASPHALT
CONCRETE
PUMP ISLAND
4,000 GAL. UST
PROPANE TANK
ASPHALT
GRASS
TENNESSEE STREET
MW-1
MW-2
MW-3
MW-4
MW-5
MW-6
MW-7
MW-8
OH

Case Study



MW-3	MW-3C
8/29/14	10/8/21
4 – 5	4–5
14,000	2,714
0.63	0.09
25	3.5
24	2.9
170	18
1.3 U	0.081 U
20	0.50
12	0.69
15	1.2
1,100	21

SB-15	SB-15C	SB-15	SB-15C	SB-15	SB-15	SB-15C	SB-15
9/13/15	10/8/21	9/13/15	10/8/21	9/13/15	9/13/15	10/8/21	9/13/15
6 – 8	6 – 8	8 – 10	8 – 10	10 – 12	16 – 18	16 – 18	18 – 20
5681	25	4597	260	112	1503	4	1627
0.0056	0.0014 U	0.16 U	0.0015 U	0.0013 U	0.0015 U	0.0015 U	0.0015 U
0.020	0.0012 U	0.31 I	0.0014 U	0.0013 I	0.0014 U	0.0013 U	0.0014 U
0.056	0.0019 I	4.4	0.0012 U	0.0035 I	0.017	0.0011 U	0.0044 I
0.33	0.0038 U	29	0.0065 I	0.022	0.22	0.0040 U	0.036
0.013	0.00077 U	0.17 U	0.00085 U	0.0015 U	0.0016 U	0.00080 U	0.0016 U
0.62	0.021 U	2.0	0.029 I	0.037 I	0.20	--	0.023 U
1.0	0.26	2.4	0.36	0.029 I	0.14	–	0.024 U
2.0	0.27	4.4	0.30	0.069 I	0.27	--	0.024 U
45	--	120	--	2.4 U	17 I	--	3.3 I

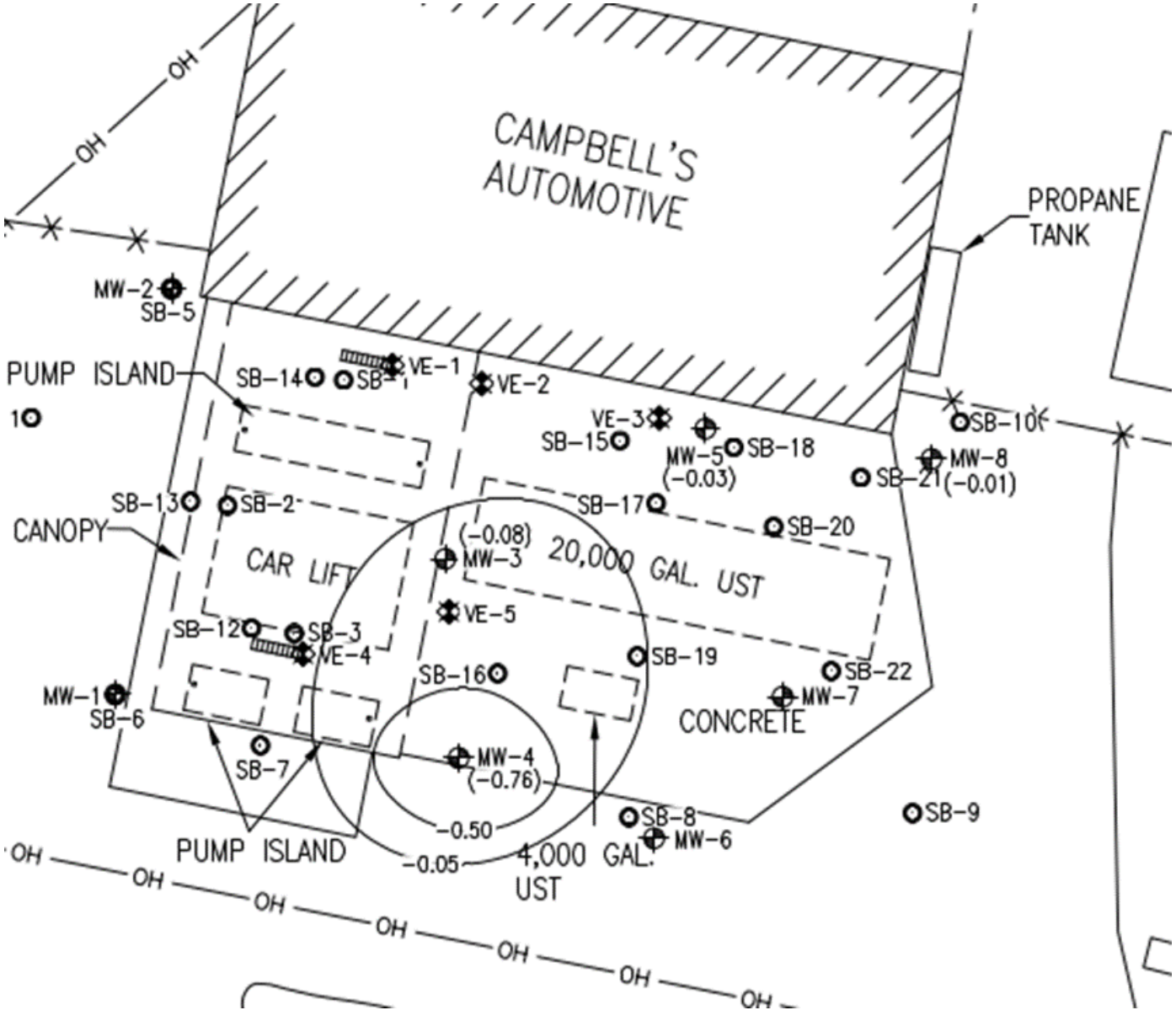
SB-3	SB-3C
6/19/14	10/8/21
2 – 3	2 – 3
536	3,652
1.5	0.17 I
2.0	21
6.9	26
28	170
0.093 U	1.3 U
0.73	--
0.57	--
1.1	--
93	--

SB-16
9/13/15
6 – 8
212
0.0014 U
0.0013 U
0.0014 U
0.0041 U
0.0015 U
0.022 U
0.023 U
0.023 U
2.3 U

SB-17	SB-17
2/14/16	2/14/16
3 – 4	6 – 8
--	--
0.0016 U	0.0017 U
0.0015 U	0.0016 U
0.0016 U	0.0017 U
0.0046 U	0.0050 U
0.0017 U	0.0019 U
0.022 U	0.025 U
0.023 U	0.026 U
0.023 U	0.026 U
2.3 U	2.6 U

SB-18
2/14/16
10 – 12
--
0.0017 U
0.0016 U
0.0017 U
0.0048 U
0.0018 U
0.023 U
0.024 U
0.024 U
2.4 U

Case Study


CAMPBELL'S AUTOMOTIVE
PROPANE TANK
OH
MW-2
SB-5
PUMP ISLAND
SB-14
SB-1
VE-1
VE-2
VE-3
SB-15
MW-5
(-0.03)
SB-18
SB-10
MW-8
(-0.01)
SB-21
SB-13
SB-2
CANOPY
SB-17
SB-20
(-0.08)
MW-3
CAR LIFT
20,000 GAL. UST
VE-5
SB-12
SB-3
VE-4
SB-19
SB-22
SB-16
MW-1
SB-6
MW-7
CONCRETE
SB-7
MW-4
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SB-8
MW-6
SB-9
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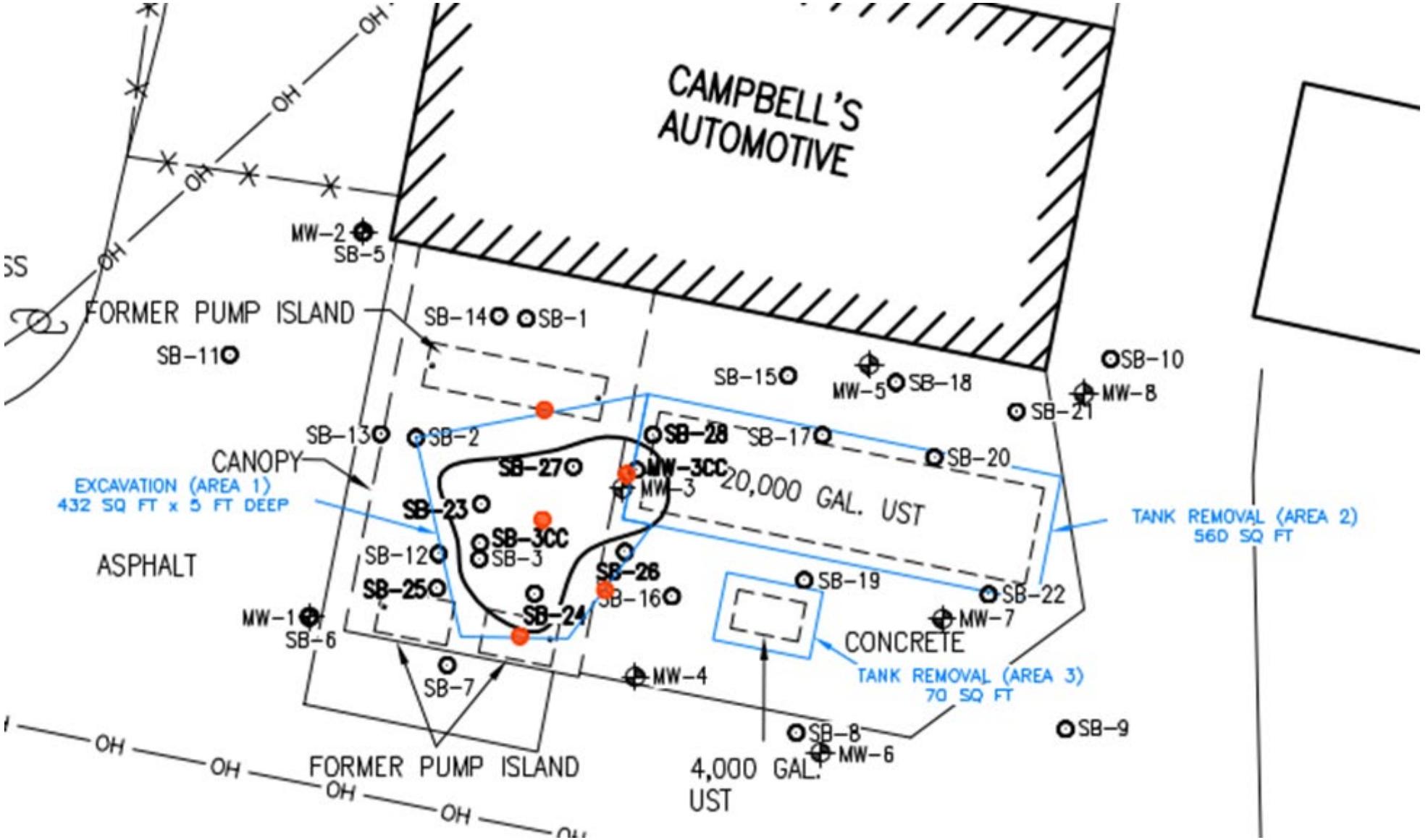
PUMP ISLAND
4,000 GAL. UST

Case Study


CAMPBELL'S AUTOMOTIVE
OH
MW-2
SB-5
FORMER PUMP ISLAND
SB-14
SB-1
SB-11
SB-15
MW-5
SB-18
SB-10
MW-8
SB-21
SB-13
SB-2
SB-28
SB-17
SB-20
CANOPY
SB-27
MW-3CC
MW-3
20,000 GAL. UST
EXCAVATION (AREA 1)
432 SQ FT x 5 FT DEEP
SB-23
TANK REMOVAL (AREA 2)
560 SQ FT
SB-3CC
SB-3
ASPHALT
SB-12
SB-26
SB-25
SB-16
SB-19
SB-22
MW-1
SB-6
SB-24
MW-7
CONCRETE
SB-7
MW-4
TANK REMOVAL (AREA 3)
70 SQ FT
SB-8
SB-9
MW-6
FORMER PUMP ISLAND
4,000 GAL.
UST

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Further Discussion / Questions?