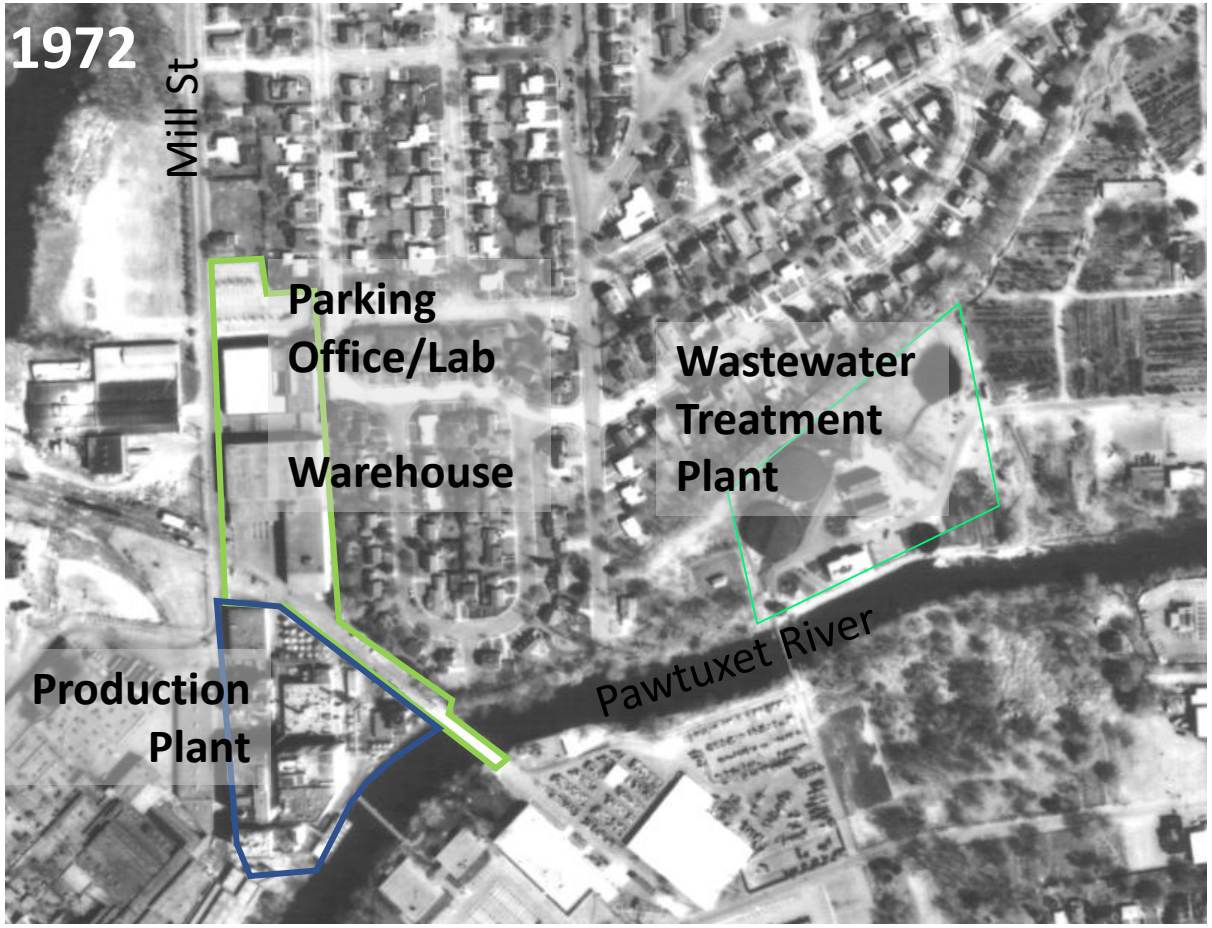
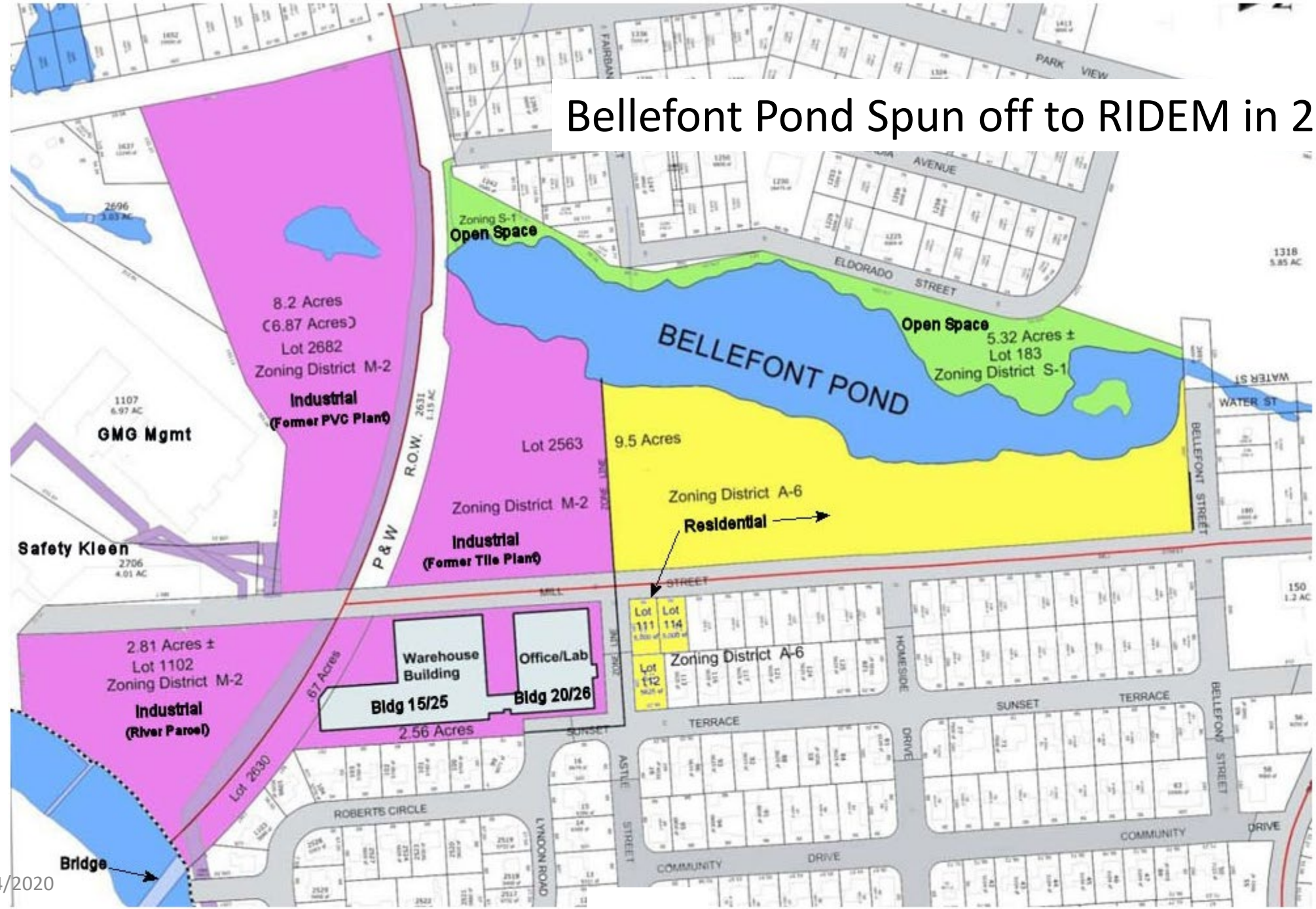
SOB (2016): RCRA Site, 3 unique areas



SEMS Doc ID 648204

SOB (2016): RCRA Site, 3 unique areas

Bellefont Pond Spun off to RIDEM in 2000



RCRA Remedy

Soil: remove shallow soils that are above regulatory limits for PCBs and replace with clean soil cap (risk-based remedy)

Groundwater: CVOCs (mono and di-chlorobenzene) control migration, and monitor for restoration and protectiveness

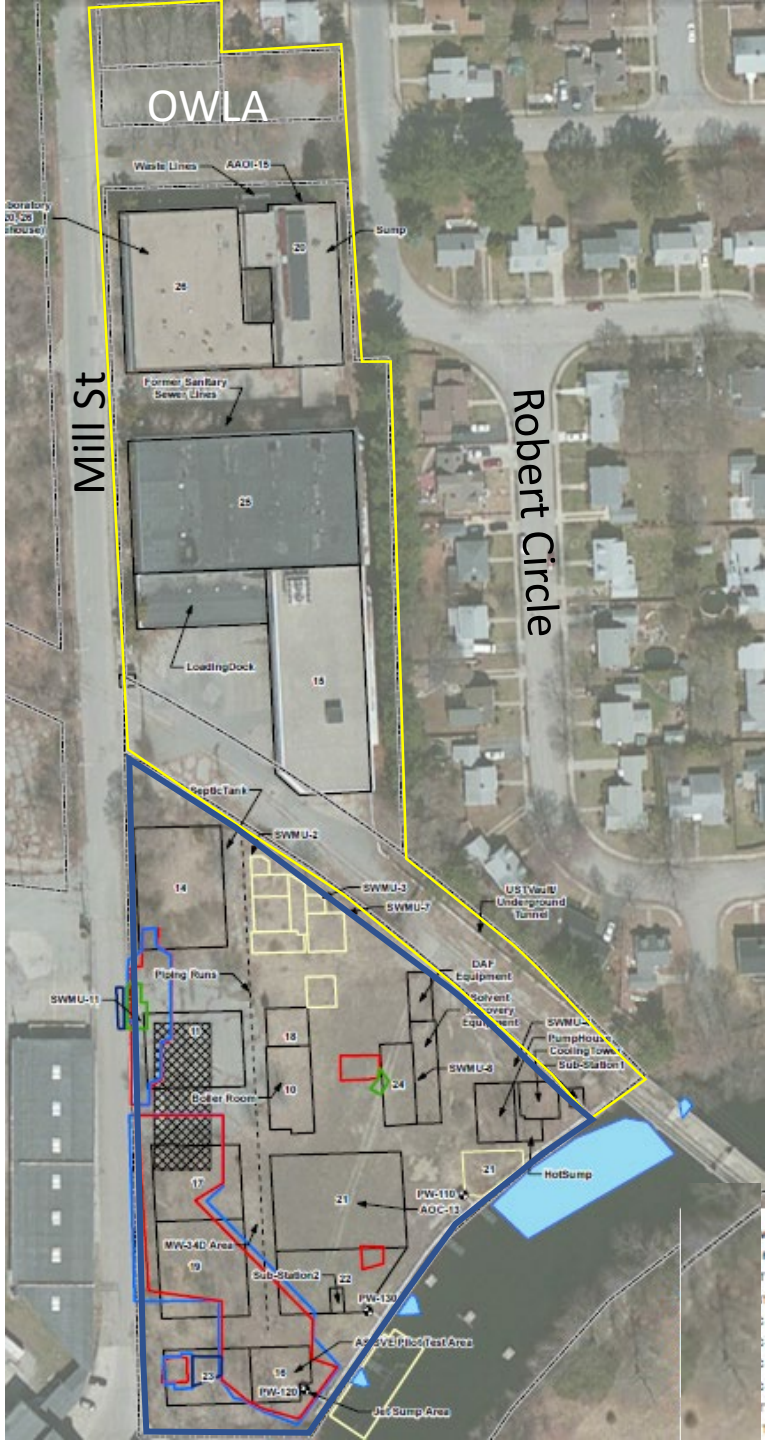
Sediment: PCB and chlorobenzene -periodically monitor the sand cap that has been in place and effective since 1996 IRM

Status:

Consent Decree: not executed for RA.

Soil: 9/30/2019 remedy complete, closure and M&M plan documents submitted for EPA approval. ELUR (approved by RIDEM) filing pending.

Groundwater: 9/30/2019 Remedy implemented. Performance monitoring ongoing. One year report to be submitted (details M&M plan). Effectiveness remains uncertain. More characterization work needs to be done.



Office/Warehouse Area

Remove shallow soils along former rail spur, replace with clean soil and vegetate

Restrict future use to non-residential

Maintain the parking and vegetated areas

March 1, 2017

REMEDIAL ACTION CLOSURE REPORT

Property Identification:
BASF Facility
180 Mill Street
Cranston, Rhode Island 02910

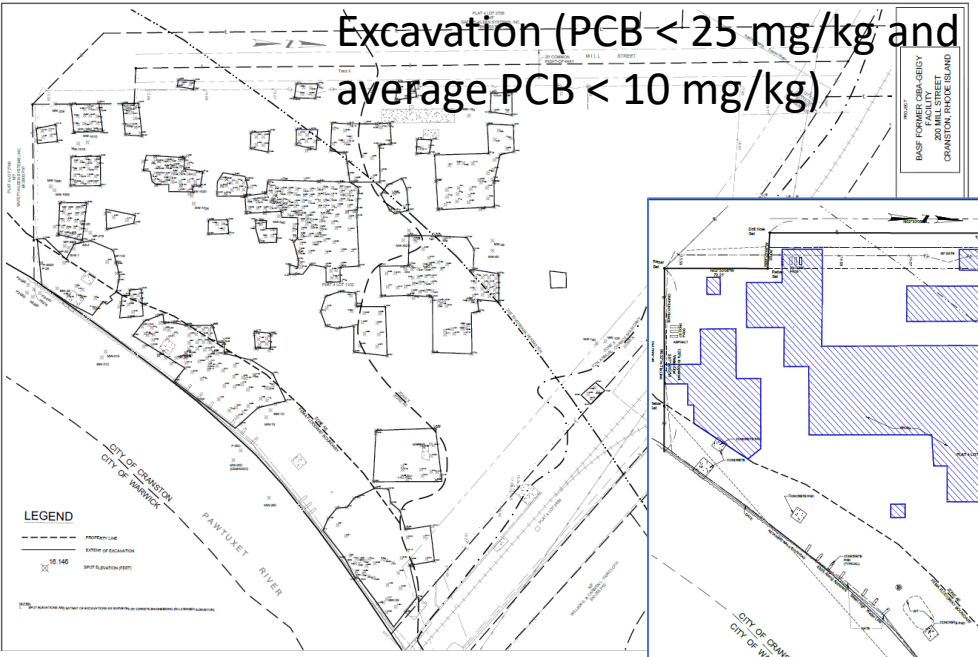
Cranston_ELUR for Parcels 111, 112 and 114 (Final 09-01-17).pdf

Cranston_ELUR for Parcels 1108 and 2630 (Final 09-01-17).pdf

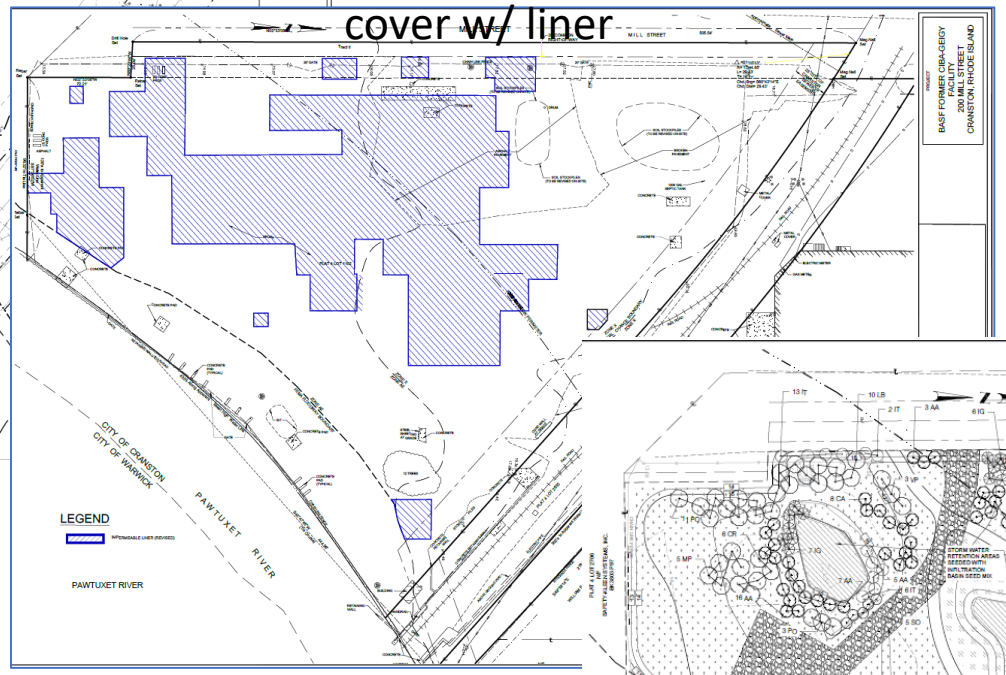
All lots sold in 2017

Former Plant (Lot 1102)

Excavation (PCB < 25 mg/kg and average PCB < 10 mg/kg)



Where PCB >10 mg/kg remains, cover w/ liner



Install RIDEM soil cap where PCB > 1 mg/kg

January 24, 2020

CORRECTIVE MEASURES IMPLEMENTATION CLOSURE REPORT:
Soil Remedy for Former Production Area (Lot 1102)

Property Identification:
BASF Former Ciba-Geigy Facility
200 Mill Street
Cranston, Rhode Island
AEI Project No. 363655

Prepared for:
BASF Corporation
100 Park Avenue
Florham Park, New Jersey 07932

Prepared by:

AEI Consultants
112 Water Street, 5th Floor
Boston, Massachusetts 02109

Remedy complete 9/30/19
Closure report 1/24/20

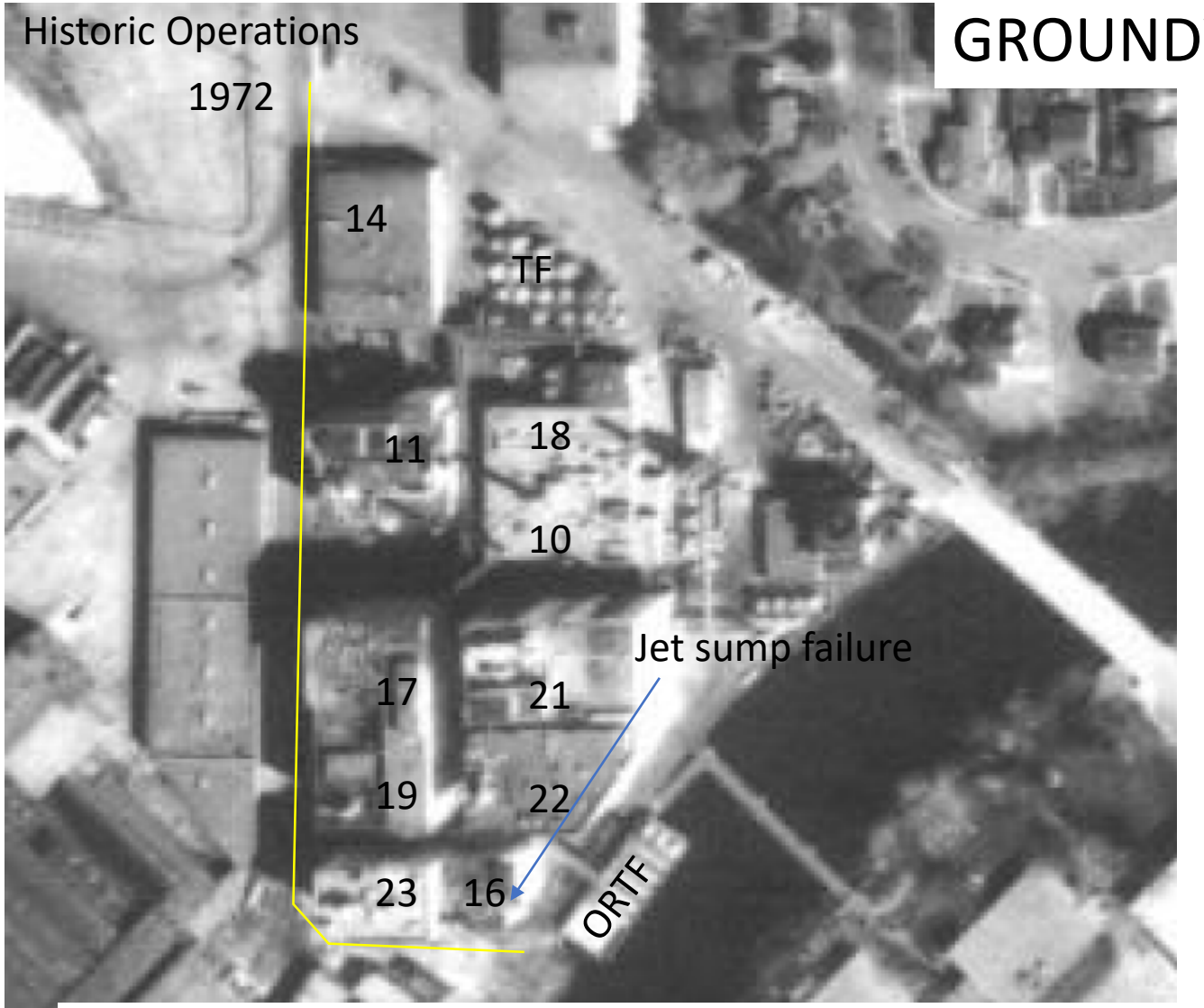
DRAFT

Post Remediation Clean Soil Cover Management Plan (CSCMP)
200 Mill Street, Providence, Rhode Island
Lot 1102 Plat No. 4

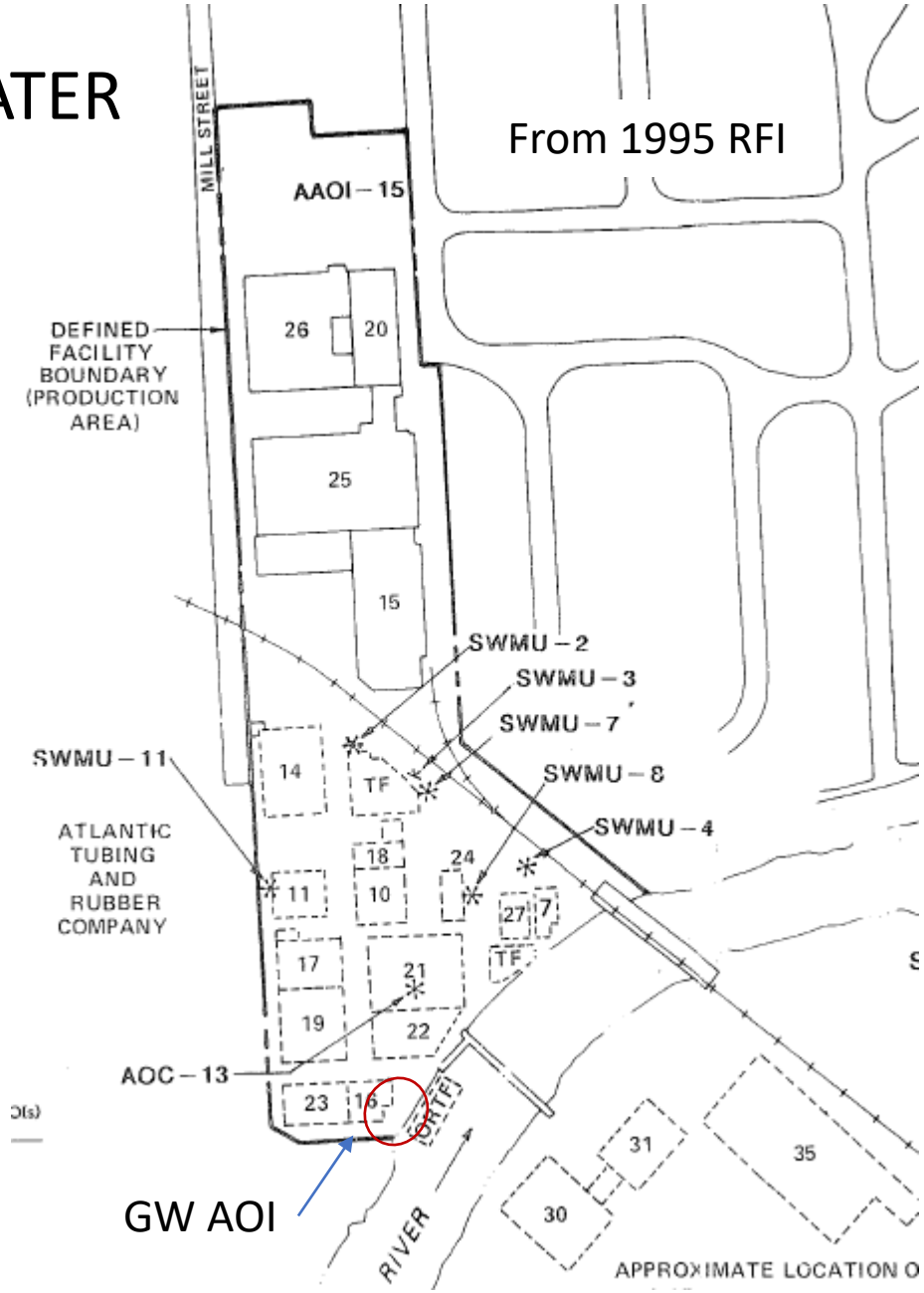
- Post-closure soil cap monitoring and maintenance plan (10/30/19)
- ELUR- Exhibit A Legal Description
  - Exhibit B-Site Map or Survey
  - Exhibit C- Soil Management Plan
  - Exhibit D- Clean Soil Cover Management Plan
  - Exhibit E- Remedial Approval Letter

EA Engineering is the BASF contractor implementing the CSCMP and ELUR requirements over the past year.

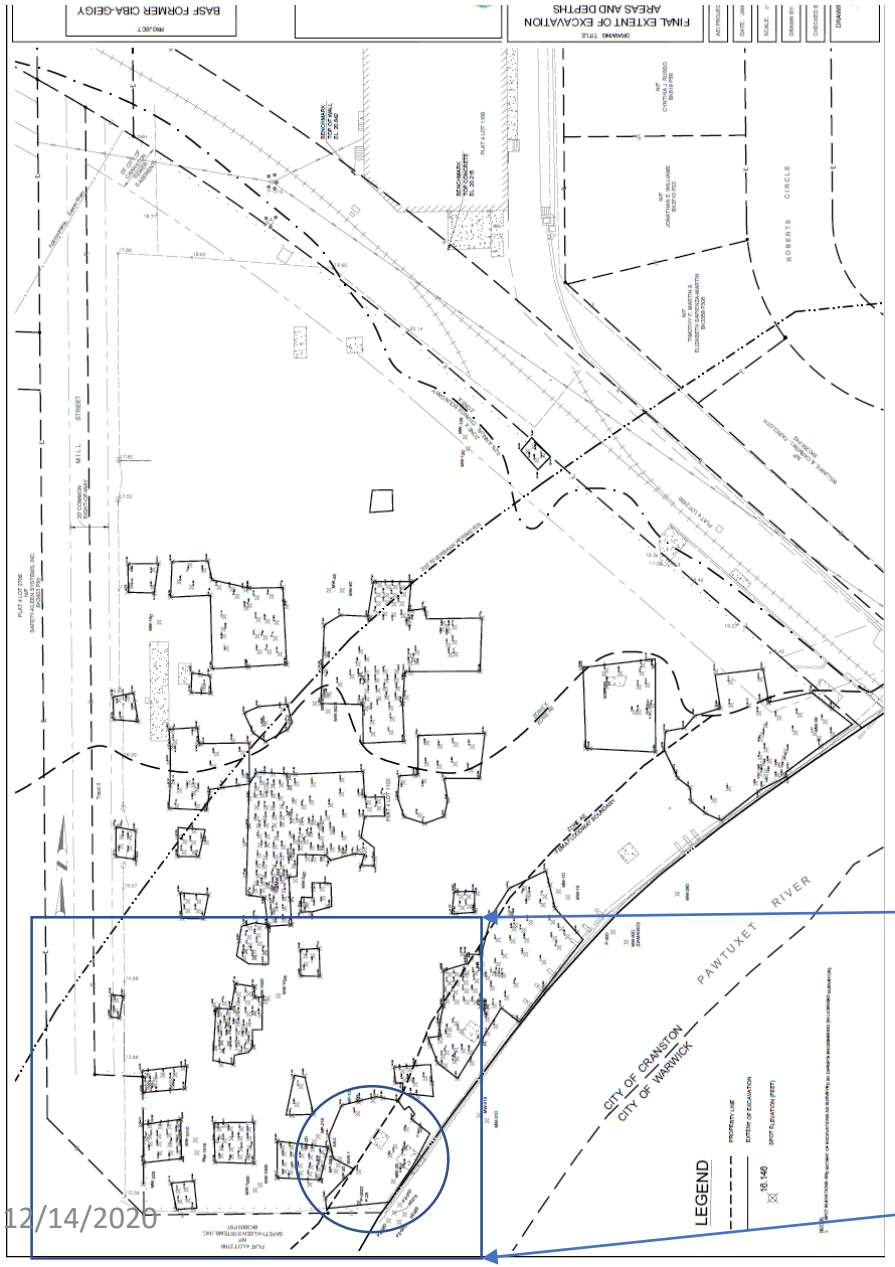
GROUNDWATER



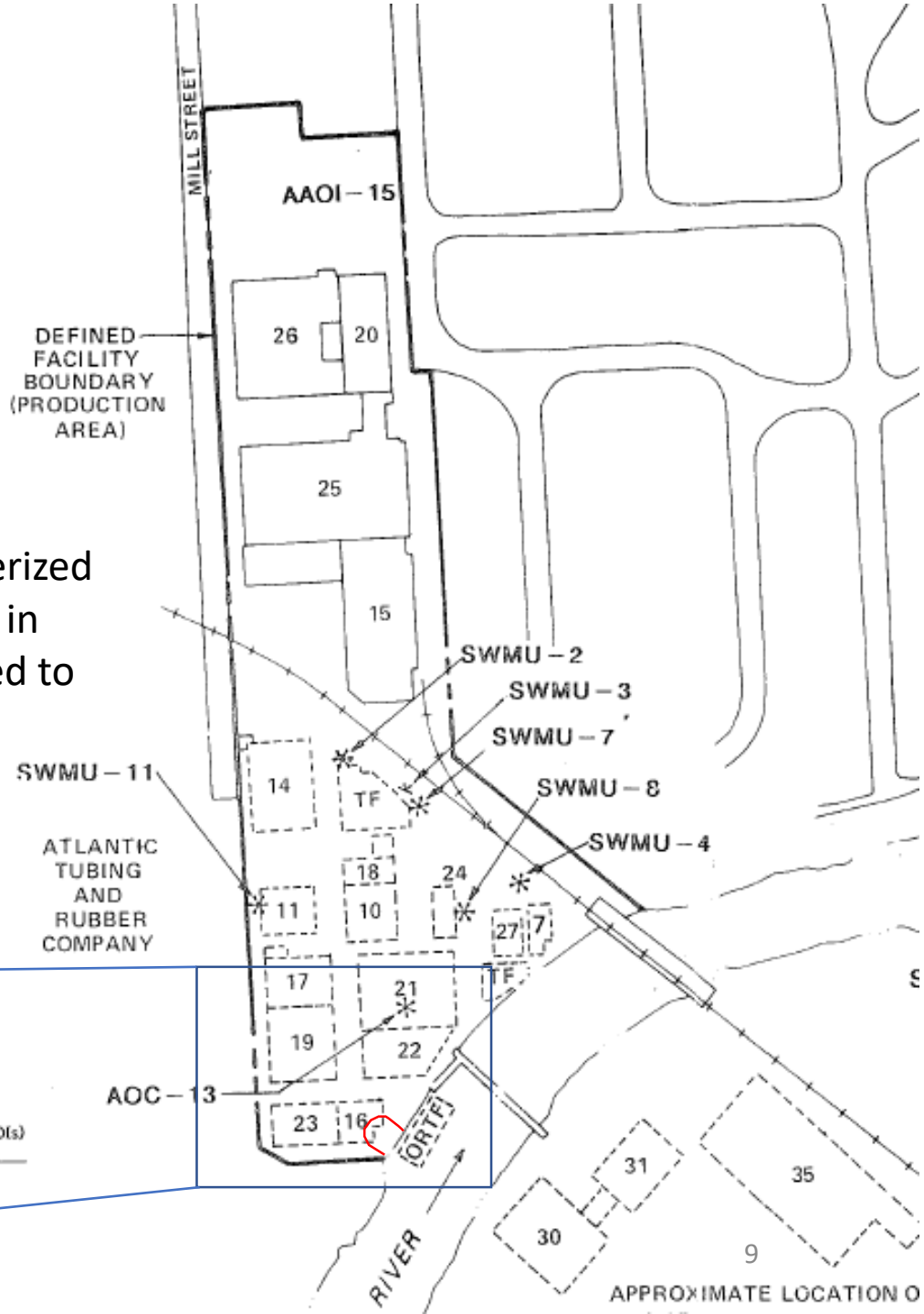
Jet Sump Area: There was a boiler plant jet sump failure in the southern portion of the site and observation of possible solvent in the sump in the mid-1970s. Footings for the boiler plant were exposed and a large area beneath the building was filled in with concrete for structural support in approximately 1978 (based on interview with facility staff). This area coincides with the elevated soil concentrations denoted in the 2007 MIP investigation at MIP-1, MIP-2, MIP-5, and MIP-7 (see **Figure 3-2** for 2007 MIP locations).



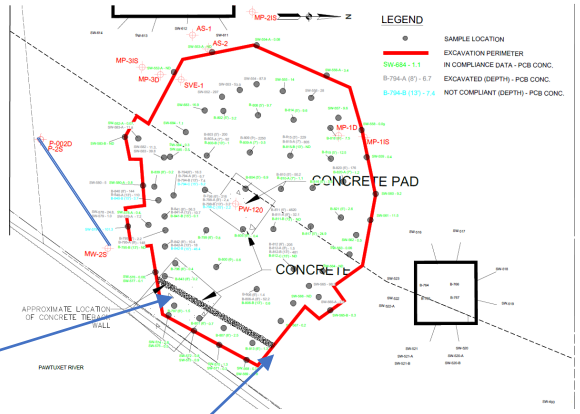
Area of impact implied by soil and GW data (historic and recent)
= Jet sump release + halo.

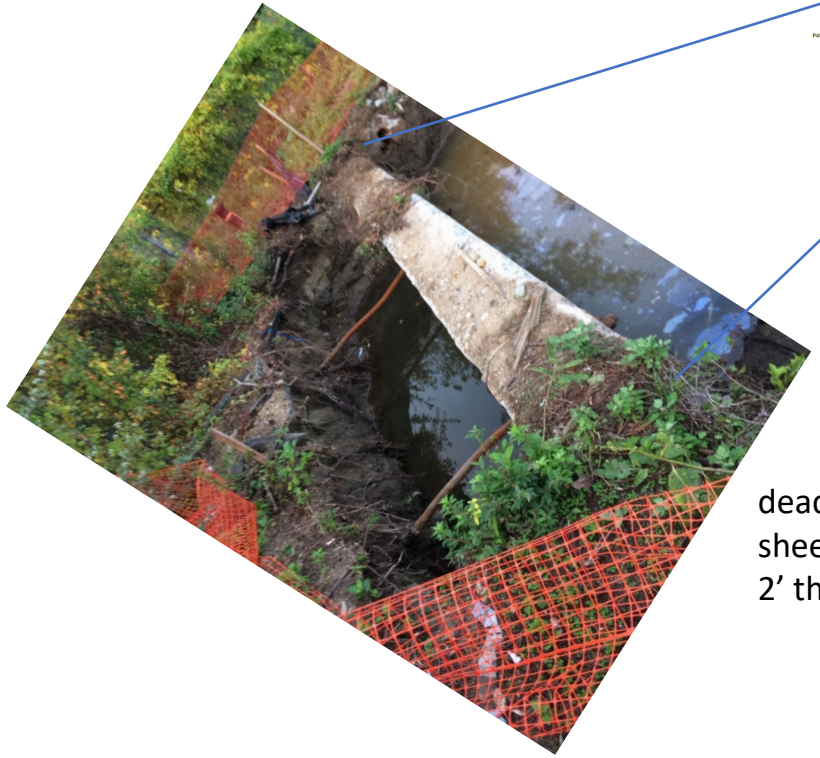


TP-5 area characterized by high PCB levels in soil. Area excavated to up to 15’ bgs



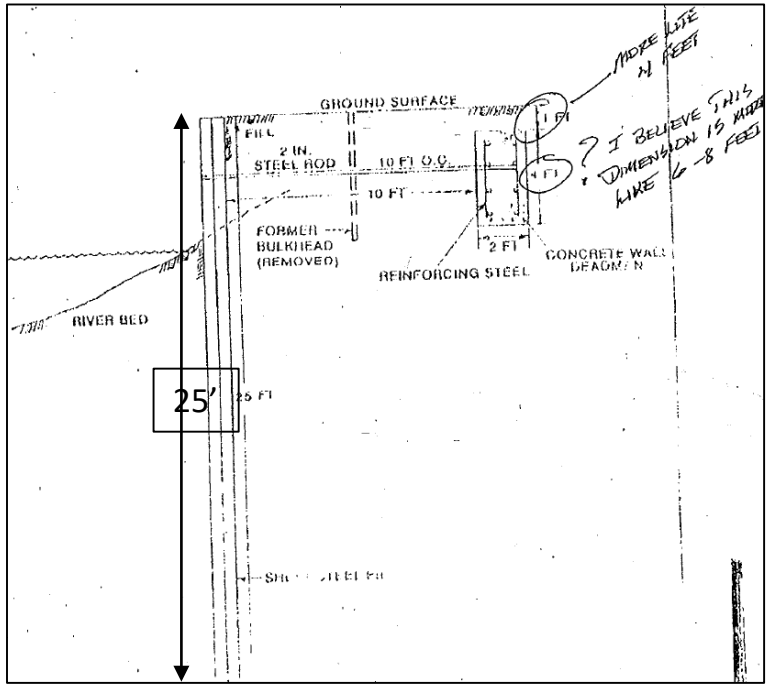
TP-5 area excavated to up to 15’ bgs





dead-man 10’ from
sheetpile and rods 10’ OC.
2’ thick, from 4’ to ~12’ BGS

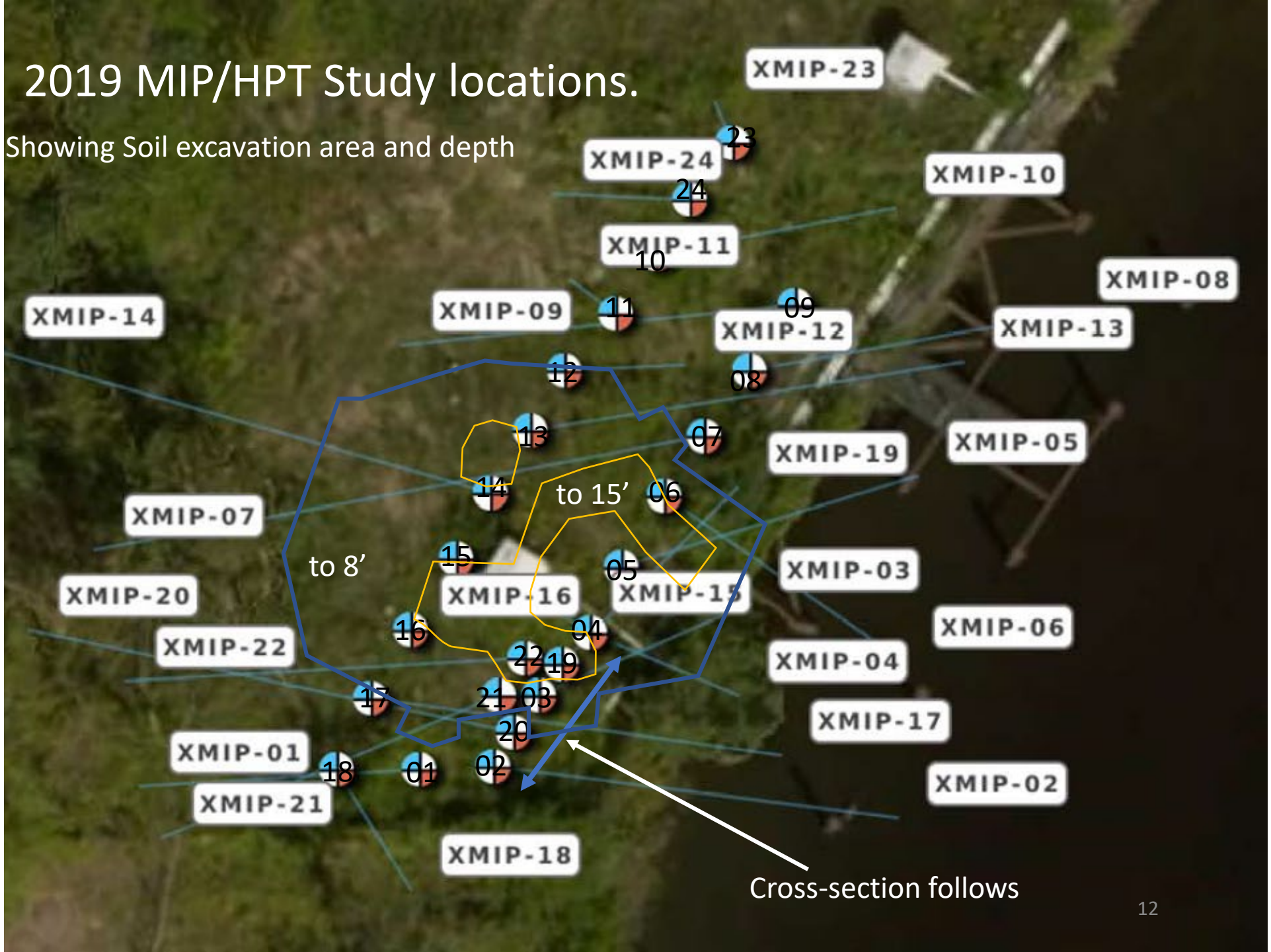
Buklhead as-built



6/2013
1995
2018
MIP/HPT transects (5' to 10' OC
10'
15'
Bulkhead (sheetpile to 25' bgs)
Area of soil impact
below water table
PCB soil excavation
2' to 15' BGS
NAPL detected
18 to 20' BGS
PRB (5' OC, screened
22 to 32' bgs)
Performance monitoring
Proposed initial PRB infrastructure

2019 MIP/HPT Study locations.

Showing Soil excavation area and depth

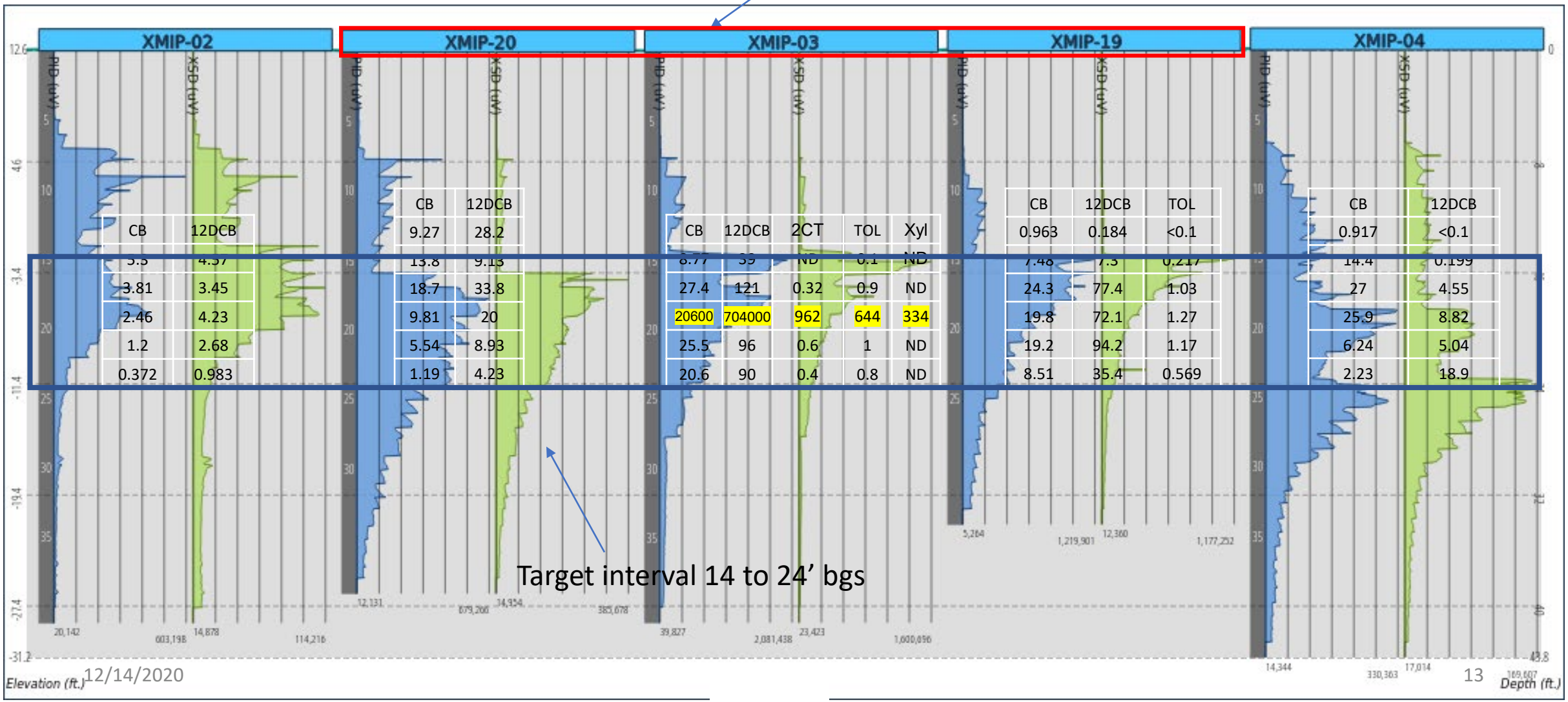


Transect MIP locations 2, 20, 3, 19 and 4

CB, 12DCB, 2CT and TOL, Xyl data [mg/L]

RCRA soil remedy, top 13 – 15’ Excavated

Chemical Mass sampling intervals and locations



XMIP-02 CB	XMIP-02 12DCB
3.3	4.37
3.81	3.45
2.46	4.23
1.2	2.68
0.372	0.983

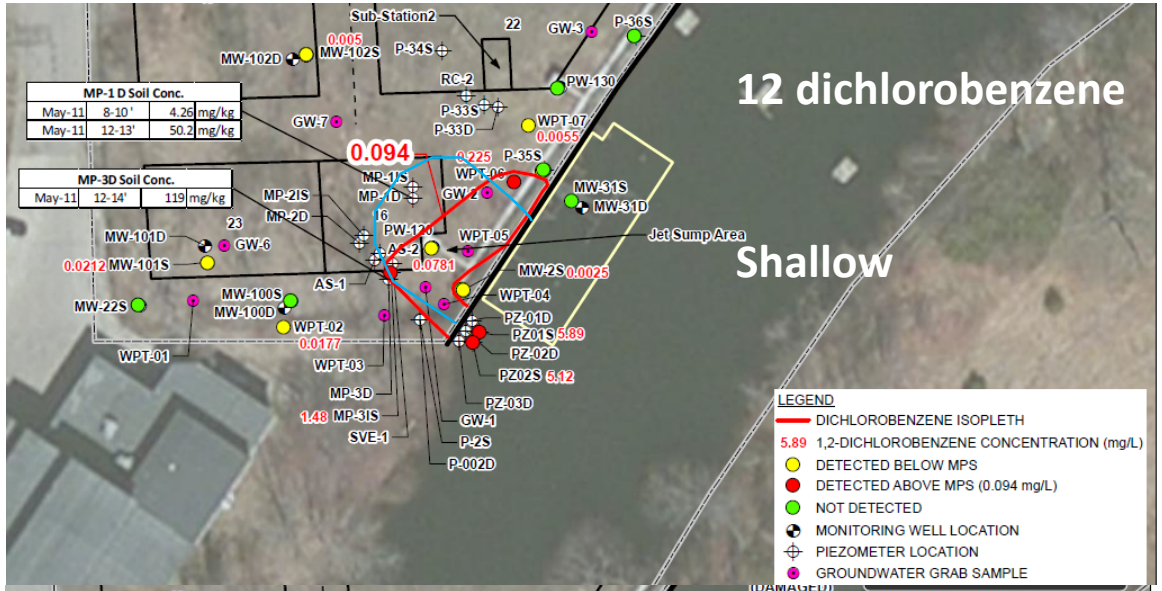
XMIP-20 CB	XMIP-20 12DCB
9.27	28.2
13.8	9.13
18.7	33.8
9.81	20
5.54	8.93
1.19	4.23

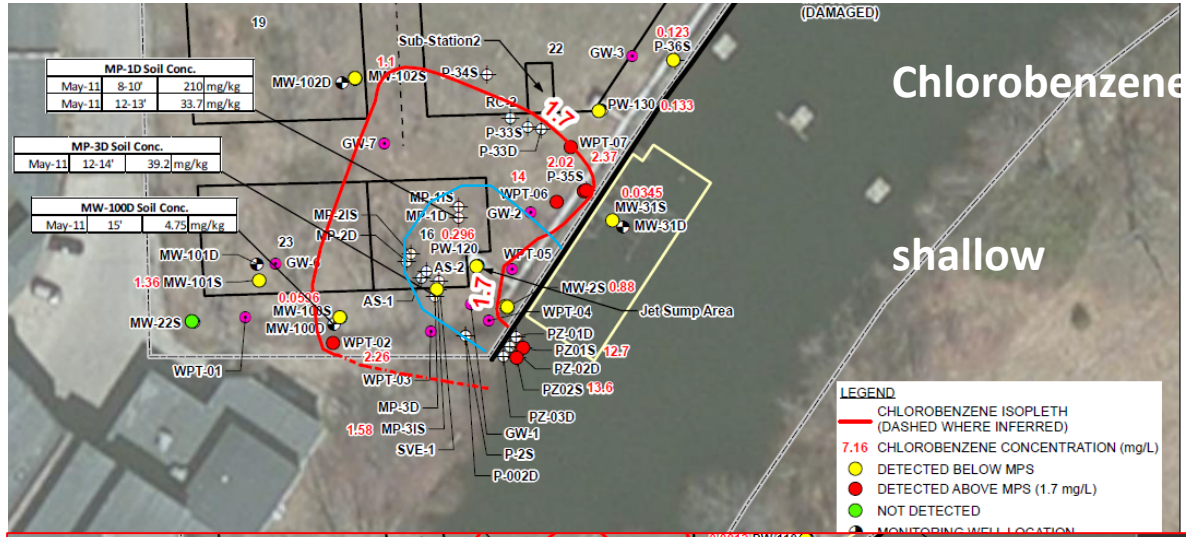
XMIP-03 CB	XMIP-03 12DCB	XMIP-03 2CT	XMIP-03 TOL	XMIP-03 Xyl
8.77	39	ND	0.1	ND
27.4	121	0.32	0.9	ND
20600	704000	962	644	334
25.5	96	0.6	1	ND
20.6	90	0.4	0.8	ND

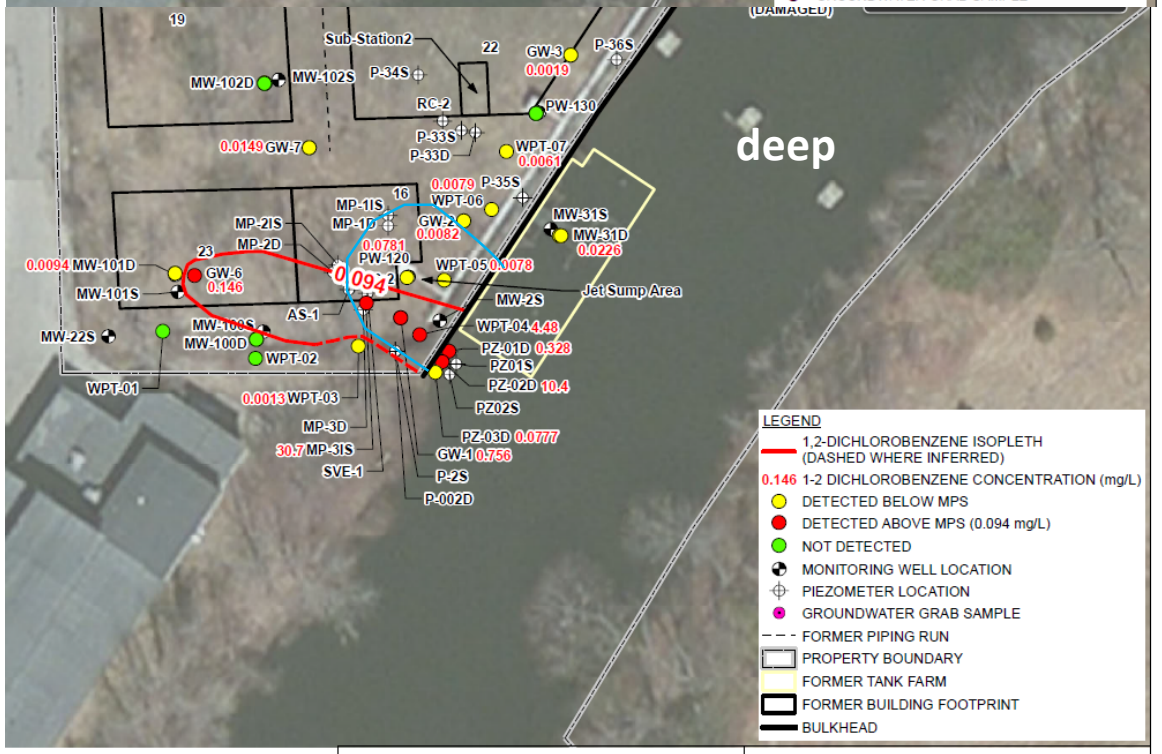
XMIP-19 CB	XMIP-19 12DCB	XMIP-19 TOL
0.963	0.184	<0.1
7.48	7.3	0.217
24.3	77.4	1.03
19.8	72.1	1.27
19.2	94.2	1.17
8.51	35.4	0.569

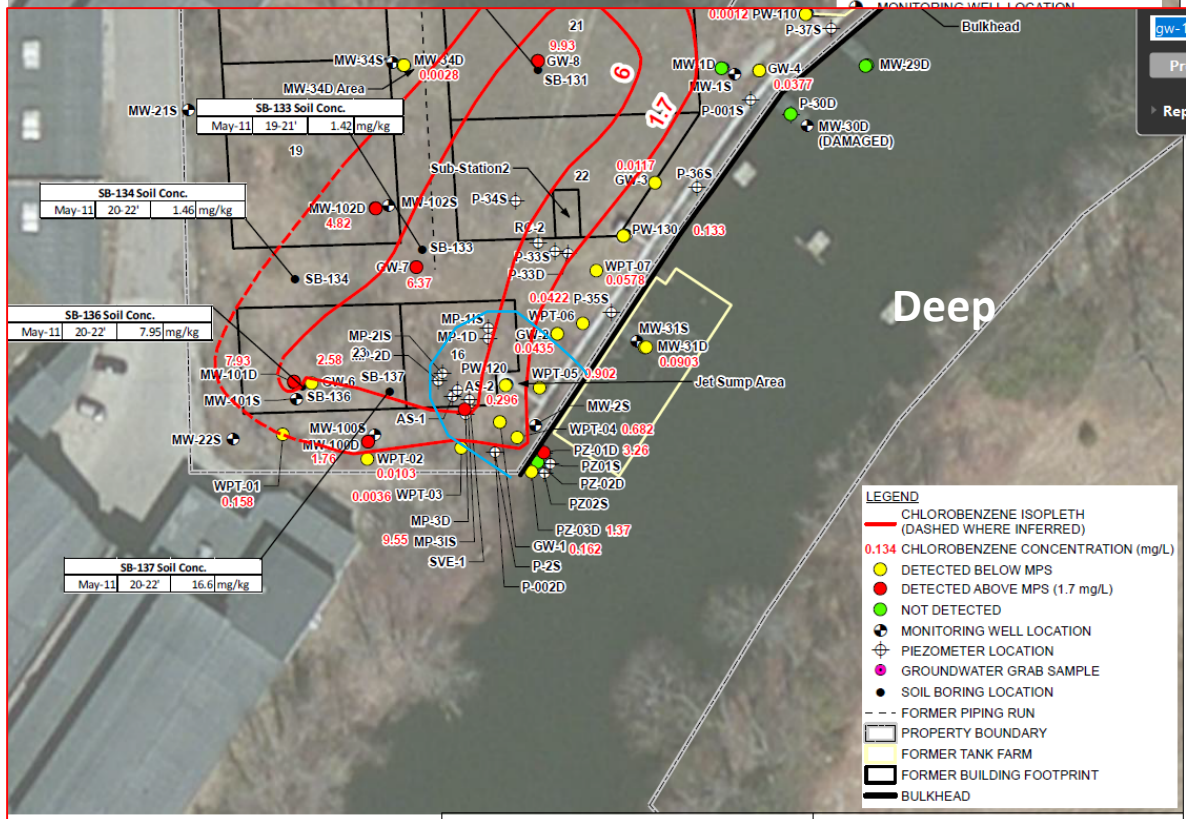
XMIP-04 CB	XMIP-04 12DCB
0.917	<0.1
14.4	0.199
27	4.55
25.9	8.82
6.24	5.04
2.23	18.9

From SRI









12/14/2020

0 25 50 Feet

FORMER CIBA-GEIGY
CRANSTON, RI
60297249.1200

DEEP MONITORING WELLS (>20 FT BGS)
1,2-DICHLOROBENZENE
SUPPLEMENTAL RI

DATE: 05/20/2014 | DRWN: J.E.B. | FIGURE 4-2

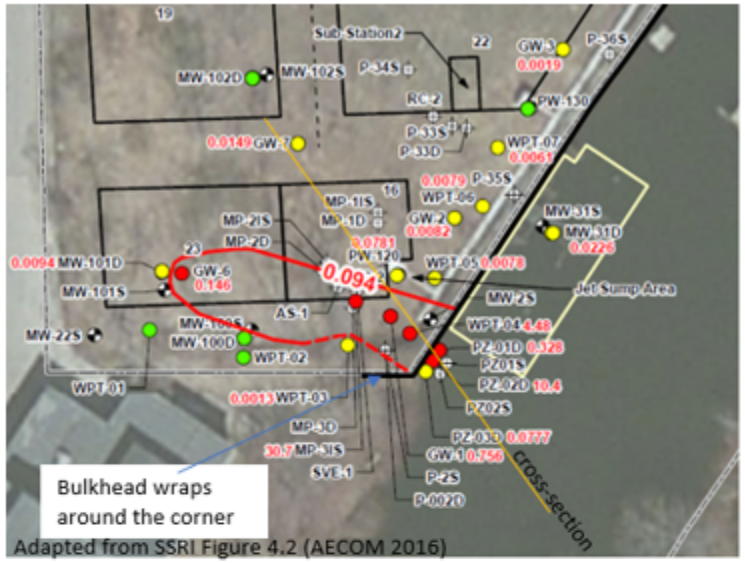
AECOM

0 25 50 Feet

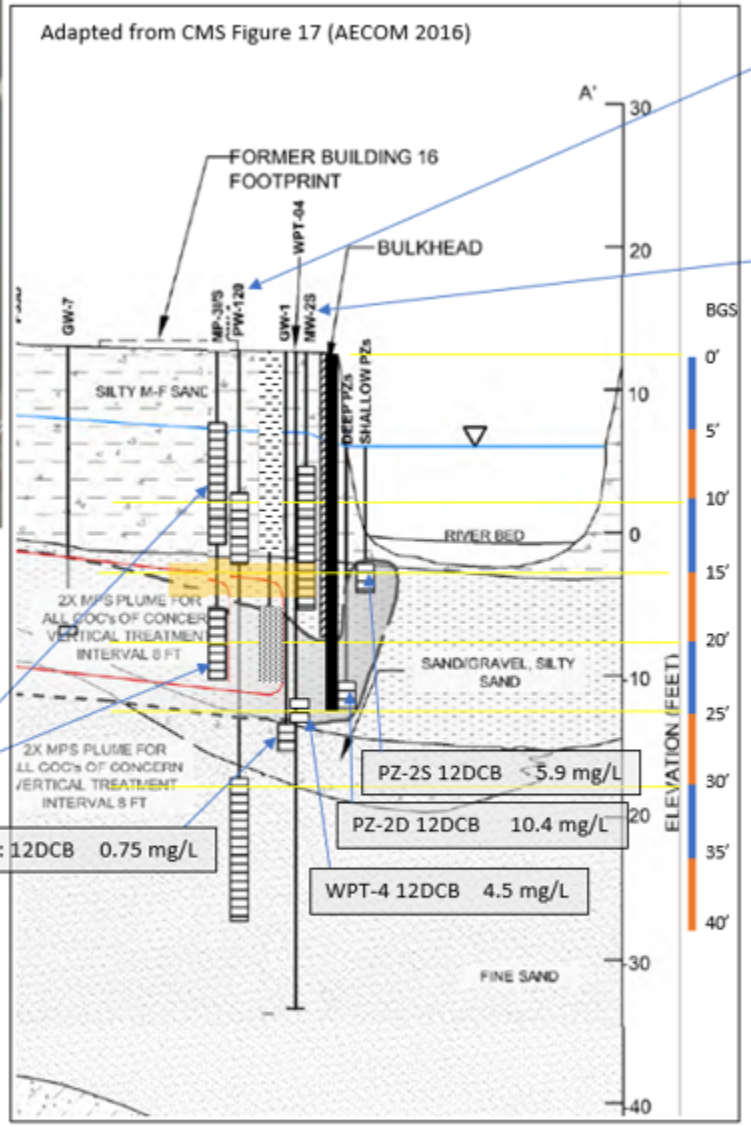
FORMER CIBA-GEIGY
CRANSTON, RI
60297249.1200

DEEP MONITORING WELLS (>20 FT BGS)
CHLOROBENZENE
SUPPLEMENTAL RI

DATE: 08/01/2014 | DRWN: J.E.B. | FIGURE 4-1



Granular layer over silty clay



SSRI (AECOM, 2016)

PW-120	6/2012 [ppb]
CB	296
12DCB	78
2CT	5.6
Tol	ND
Xyl	ND

MW-2S	7/2013 [ug/L]
CB	502
12DCB	2.4
2CT	2.6
Tol	16
Xyl	ND
Total PCB	0.46

MP-3s: 12DCB 1.5 mg/L
MP-3I: 12DCB 30.7 mg/L

GW-1: 12DCB 0.75 mg/L

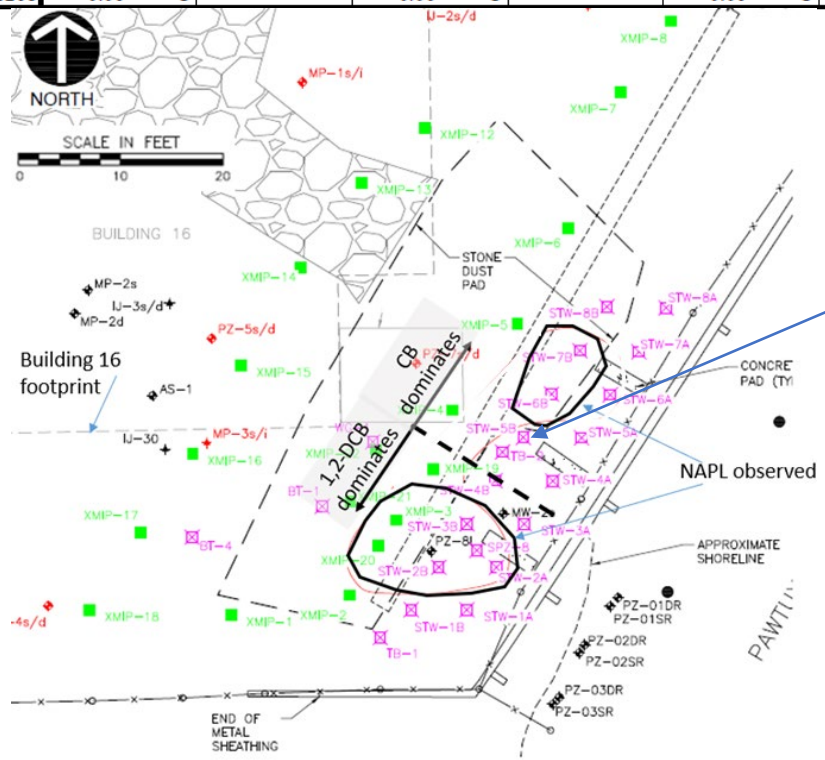
PZ-2S 12DCB 5.9 mg/L

PZ-2D 12DCB 10.4 mg/L

WPT-4 12DCB 4.5 mg/L

CSM cross-section adapted from CMS Figure 17 (AECOM 2016b). Graphic shows dissolved phase 12DCB migration from the apparent source area (jet sump) towards the river (discharging groundwater). The presence of the bulkhead deflects groundwater vertically to >25' bgs before it discharges to the river hydrological system.

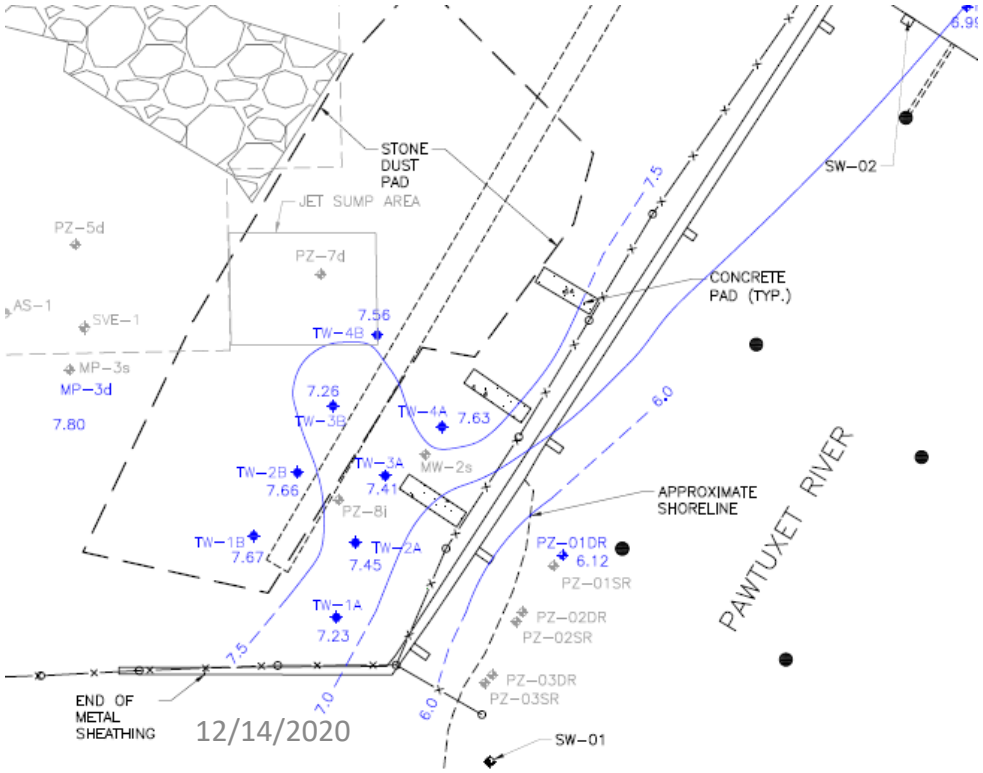
Sample Name	STW-1A	STW-1A	STW-1B	STW-1B	STW-3A	STW-3A	STW-4A	STW-4B	STW-5A	STW-5B	STW-6A	STW-7A	STW-8A
Sample Depth (feet)	15-17	20-25	15-17	20-25	15-17	19-20	16-18	15-17	14-16	14-16	14-16	14-16	14-16
Sample Date	08/30/2019	08/30/2019	08/30/2019	08/30/2019	09/03/2019	09/03/2019	09/03/2019	09/03/2019	09/03/2019	09/03/2019	09/03/2019	09/04/2019	09/04/2019
PID Reading (ppmv):	0.9	0.0	1.4	0.0	6.9	12.1	23.7	14.2	50.3	151	10.4	NT	21.1
Laboratory Sample ID:	19I0275-01	19I0275-02	19I0275-03	19I0275-04	19I0275-05	19I0275-06	19I0275-09	19I0275-11	19I0275-10	19I0275-08	19I0275-07	19I0275-12	19I0275-13
VOCs (mg/kg)													
1,2-Dichlorobenzene	0.0415 J	0.0492 J	0.245	0.0723 J	0.100 J	12.6	3.66	0.286	11.1	47.2	0.535	1.88	0.422
2-Chlorotoluene	0.159 U	0.182 U	0.0237 J	0.185 U	0.0197 J	0.021 J	0.264	0.644	5.74	3.14	0.53	0.115 U	0.130 U
Chlorobenzene	0.872	0.182 U	2.43	0.386	2.39	24.4	6.68	11.7	61.5	83.6	24.2	2.84	2.67
Toluene	0.159 U	0.182 U	0.0947 J	0.0334 J	0.064 J	0.175 U	0.086 J	0.144 U	0.0445 J	0.249	0.138 U	0.315	0.229
Xylene O	0.159 U	0.182 U	0.158 U	0.185 U	0.164 U	0.0246 J	0.0422 J	0.0231 J	0.164 J	0.136 J	0.176	0.559	0.155
Xylene P,M	0.319 U	0.365 U	0.0331 J	0.371 U	0.328 U	0.351 U	0.0688 J	0.289 U	0.556 U	0.105 J	0.242 J	1.06	0.307
Total Xylene	0.319 U	0.365 U	0.0331 J	0.371 U	0.328 U	0.0246 J	0.0688 J	0.0231 J	0.164 J	0.241 J	0.418 J	1.619	0.462
PCBs (mg/kg)													
Aroclor 1016	0.06 U	-	0.06 U	-	0.06 U	-	0.06 U	0.06 U	0.07 U	12.60 U	0.06 U	0.05 U	0.06 U
Aroclor 1221	0.06 U	-	0.06 U	-	0.06 U	-	0.06 U	0.06 U	0.07 U	12.60 U	0.06 U	0.05 U	0.06 U
Aroclor 1232	0.06 U	-	0.06 U	-	0.06 U	-	0.06 U	0.06 U	0.07 U	12.60 U	0.06 U	0.05 U	0.06 U
Aroclor 1242	0.06 U	-	0.06 U	-	0.06 U	-	0.06 U	0.06 U	0.07 U	12.60 U	1.8 U	1.7	0.06 U
Aroclor 1248	0.06 U	-	1.6	-	0.4	-	0.6	3.8	0.8	203	0.06	0.05 U	3.4
Aroclor 1254	0.06 U	-	0.06 U	-	0.06 U	-	0.06 U	0.06 U	0.07 U	12.60 U	0.06 U	0.05 U	0.06 U
Aroclor 1260	0.06 U	-	0.06 U	-	0.06 U	-	0.06 U	0.06 U	0.07 U	12.60 U	0.06 U	0.05 U	0.06 U
Aroclor 1262	0.06 U	-	0.06 U	-	0.06 U	-	0.06 U	0.06 U	0.07 U	12.60 U	0.06 U	0.05 U	0.06 U
Aroclor 1268	0.06 U	-	0.06 U	-	0.06 U	-	0.06 U	0.06 U	0.07 U	12.60 U	0.06 U	0.05 U	0.06 U



Pre-PRB well borings.

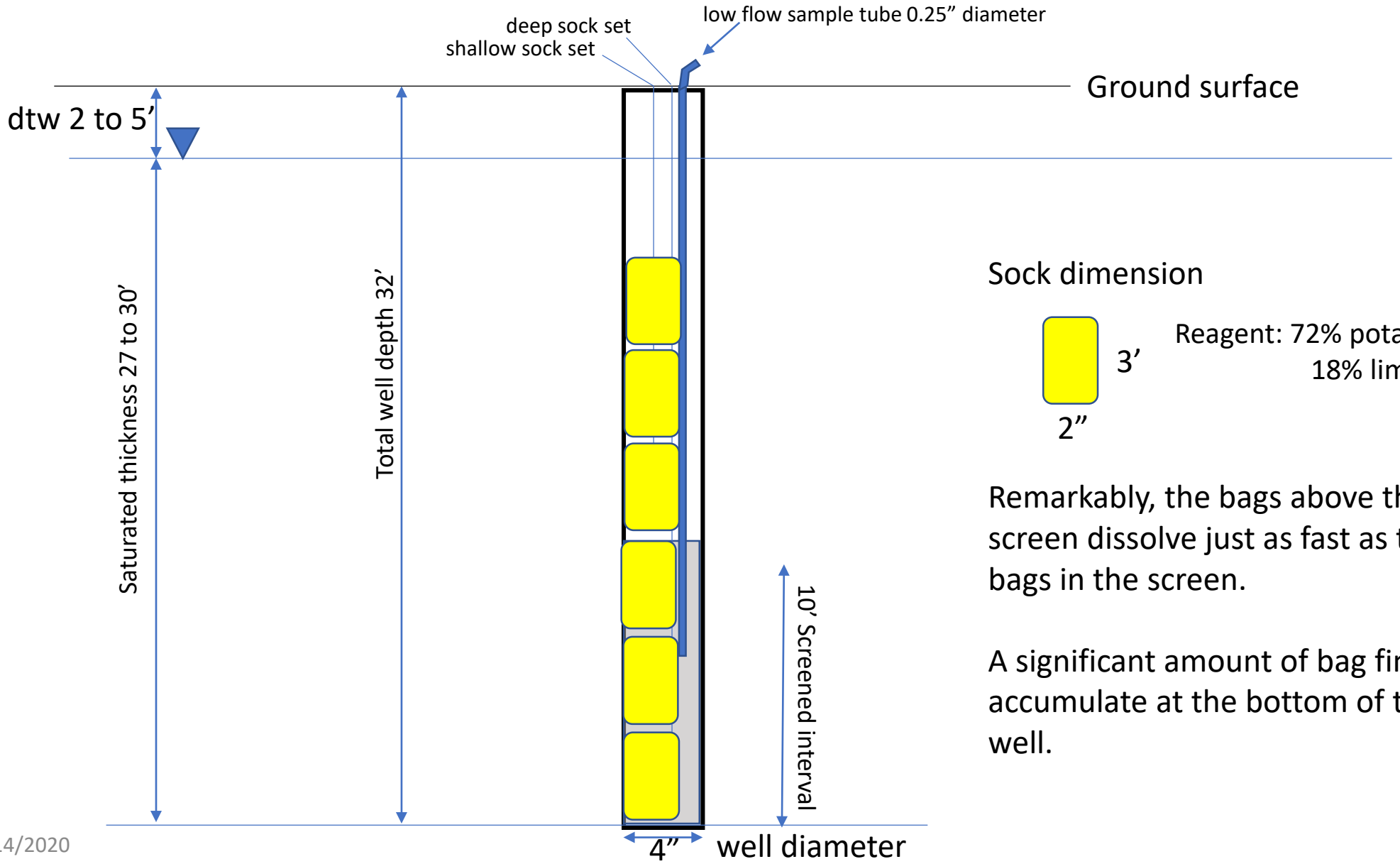
Install 8 PRB wells (TW-series) (22 to 32’ bgs)
Install upland monitoring well PZ-8i (22 – 32’ bgs)
Install river piezometers
shallow (7 – 9’ bsb)
deep(11 – 13’ bsb)

	TW-1A	TW-2A	TW-3A	TW-4A	TW-1B	TW-2B	TW-3B	TW-4B	PZ-8i
1,2-DCB	3.5	**1,260**	42.8	5.0	65.3	NS	**3,280**	35.9	**2,290**
CB	49.9	274	572	6.7	92.3	NS	796	35.7	314
2-CT	< 1.0	2.1	<1.0	<1.0	<1.0	NS	5.7	<1.0	6.8
Tol	<1.0	5.7	73.6	<1.0	1.5	NS	37.7	<1.0	13.5
Xyl	<3.0	<3.3	11.4	<3.0	<3.0	NS	7.4	<3.0	3.6
PCBs	<0.09	<0.09	<0.09	<0.09	<0.09	NS	<0.10	<0.09	**2.72**
pH	6.80	10.06	7.88	6.95	7.44	NS	7.42	6.64	6.76
Sulfate	16.8	34.0	18.8	8.7	7.9	NS	24.0	6.6	22.0
DO	0.14	0.36	0.08	0.19	0.13	NS	0.90	0.24	0.14
ORP	-14.8	-239.5	-151.5	-87.5	-104.9	NS	-147.6	-109.6	-97.6



	PZ-01SR	PZ-02SR	PZ-03SR	PZ-01DR	PZ-02DR	PZ-03DR
1,2-DCB	**336**	**98**	**656**	**4,480**	<1.0	28.2
CB	**9,070**	**4,680**	**2,380**	233	26.3	559
2-CT	60.5	34.2	7.7	6.4	<1.0	9.2
Tol	37.5	8.6	1.2	3.5	<1.0	1.5
Xyl	45.7	14.3	<3.4	9.5	<2.0	4.6
PCBs	**1.84**	**1.81**	**1.0**	<0.1	0.16	0.41
pH	6.85	7.14	6.83	6.99	6.85	7.14
Sulfate	36.5	37.5	<5.0	<5.0	26.4	13.0
DO	0.40	0.33	0.39	0.31	1.22	0.37
ORP	183.4	145.9	154.7	135.3	195.8	161.9

Hang socks on 2 separate tethers w/ 3 socks per tether.



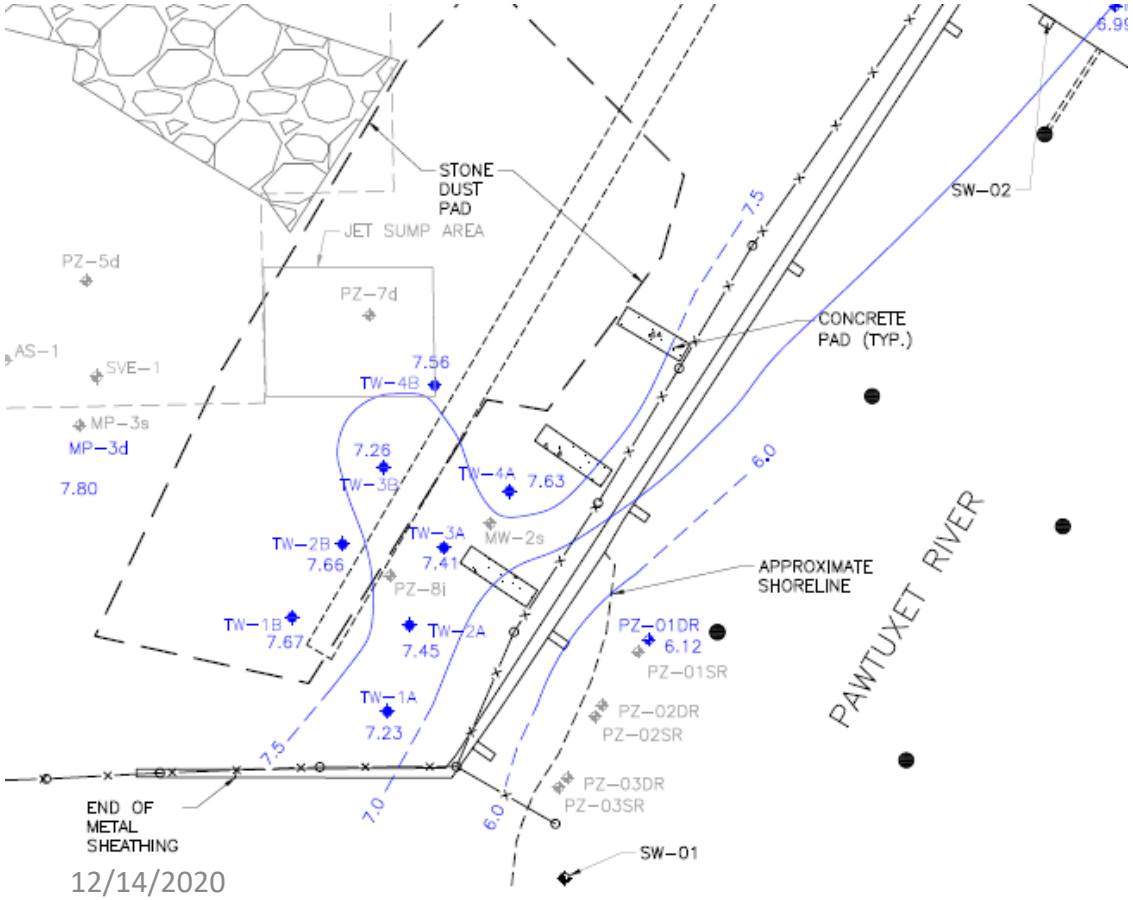
Sock dimension

Reagent: 72% potassium persulfate
18% lime

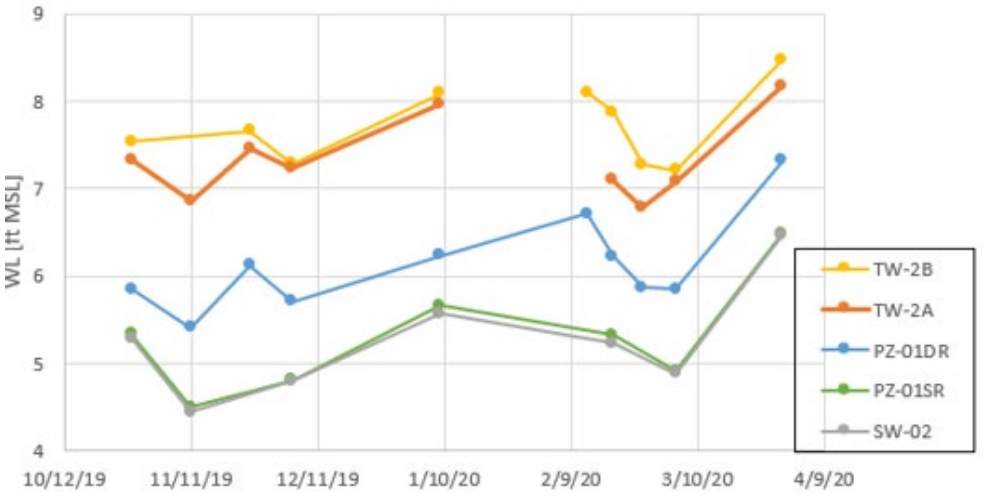
Remarkably, the bags above the screen dissolve just as fast as the bags in the screen.

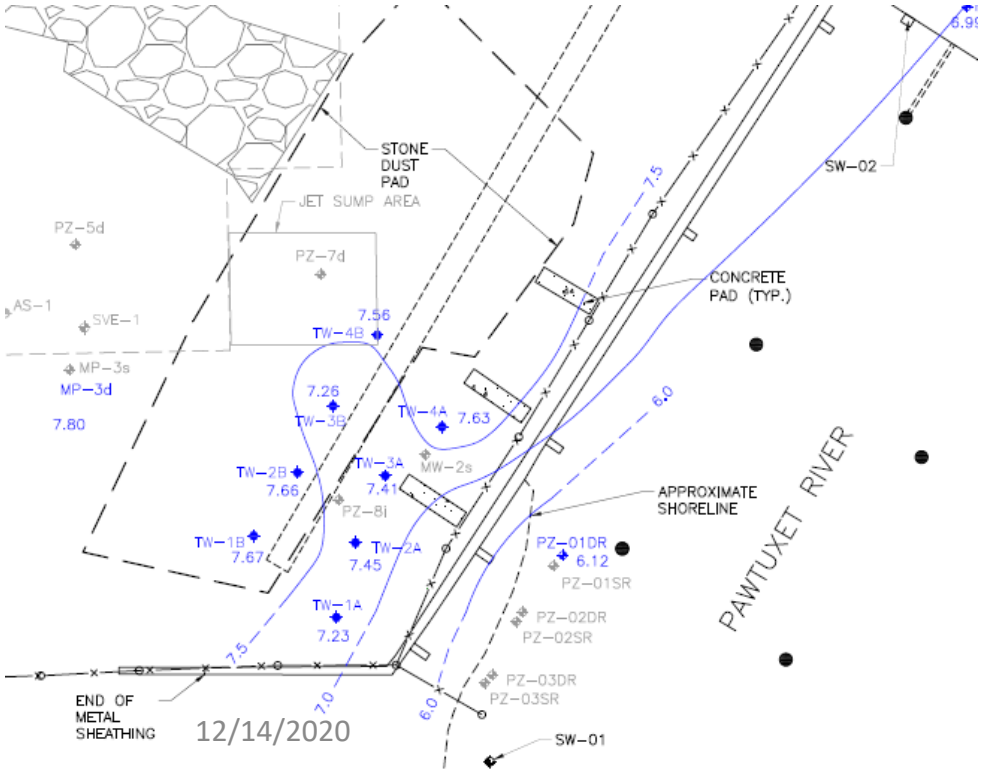
A significant amount of bag fines accumulate at the bottom of the well.

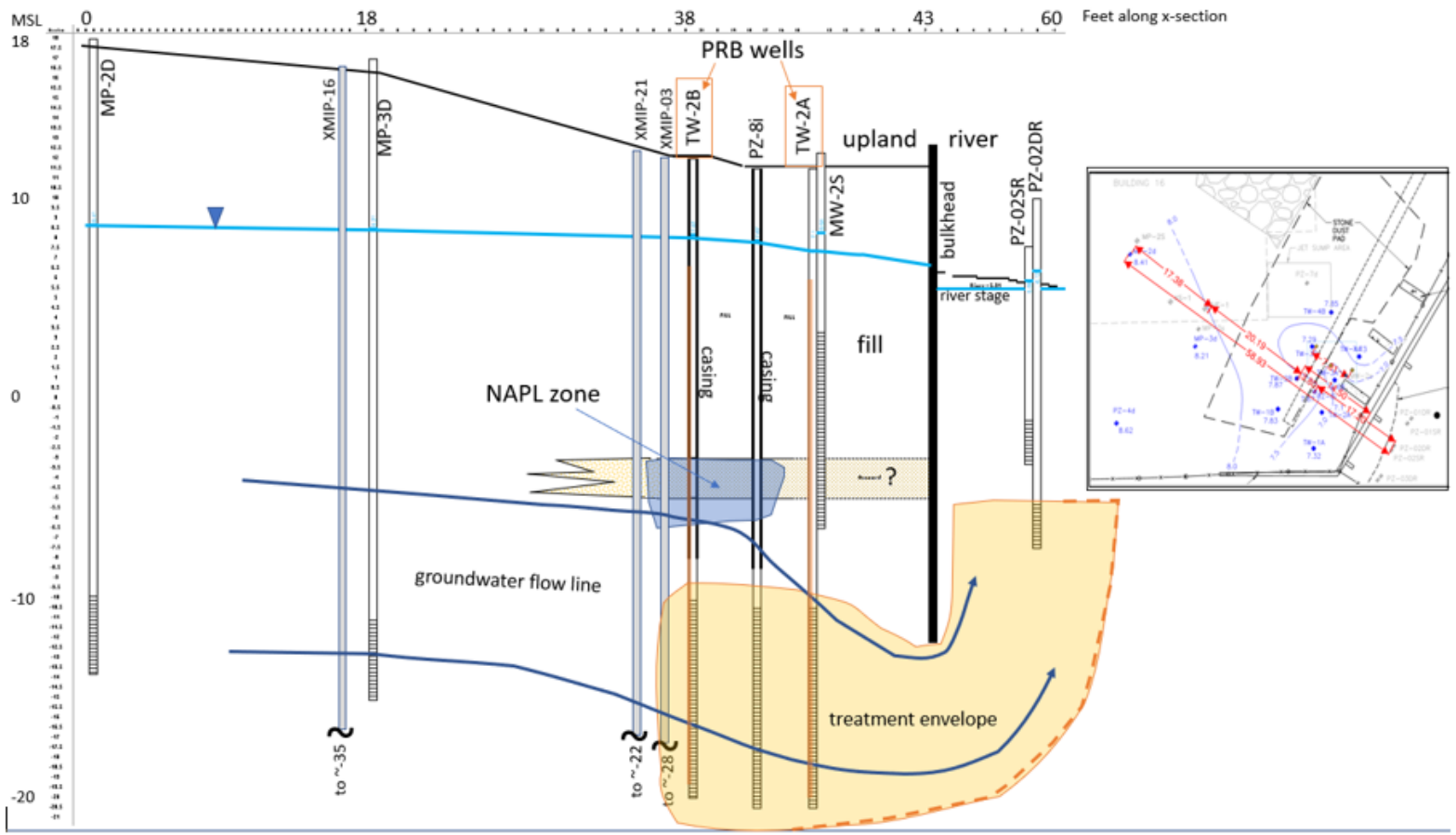
- Performance monitoring plan



	TW-1A	TW-1B	TW-2A	TW-2B	TW-3A	TW-3B	TW-4A	TW-4B	PZ-8i	PZ-01DR	PZ-01SR	PZ-02DR	PZ-02SR	PZ-03DR	PZ-03SR	SW-01	SW-02
Week 1 (October 7, 2019)																	
Persulfate	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
pH	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sulfate									X	X	X	X	X	X	X	X	X
Week 2 (October 14, 2019)																	
Persulfate	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
pH	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sulfate									X	X	X	X	X	X	X	X	X
Week 4 (October 28, 2019)																	
VOCs									X	X	X	X	X	X	X		
PCBs									X	X	X	X	X	X	X		
Persulfate	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
pH	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sulfate									X	X	X	X	X	X	X	X	X
Week 6 (November 11, 2019)																	
Persulfate	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
pH	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sulfate									X	X	X	X	X	X	X	X	X
Week 9 (December 5, 2019)																	
Persulfate	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
pH	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sulfate									X	X	X	X	X	X	X	X	X
Week 12 (January 9, 2020)																	
VOCs									X	X	X	X	X	X	X		
PCBs									X	X	X	X	X	X	X		
Persulfate	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
pH	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sulfate										X	X	X	X	X	X	X	X
Week 18 (February 19, 2020)																	
VOCs																	
PCBs																	
Persulfate	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
pH	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sulfate	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Week 24 (March 30, 2020)																	
VOCs									X	X	X	X	X	X	X		
PCBs									X	X	X	X	X	X	X		
Persulfate	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
pH	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sulfate									X	X	X	X	X	X	X	X	X
Week 48																	
VOCs									X	X	X	X	X	X	X		
PCBs									X	X	X	X	X	X	X		
Persulfate	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
pH	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sulfate									X	X	X	X	X	X	X	X	X







Cross section through the PRB showing MIP locations, well placements, NAPL zone, water levels (2/19/20 event) and implied flow lines and treatment envelope. The hydraulic gradient between TW-2A and PZ-02DR is ~0.04.

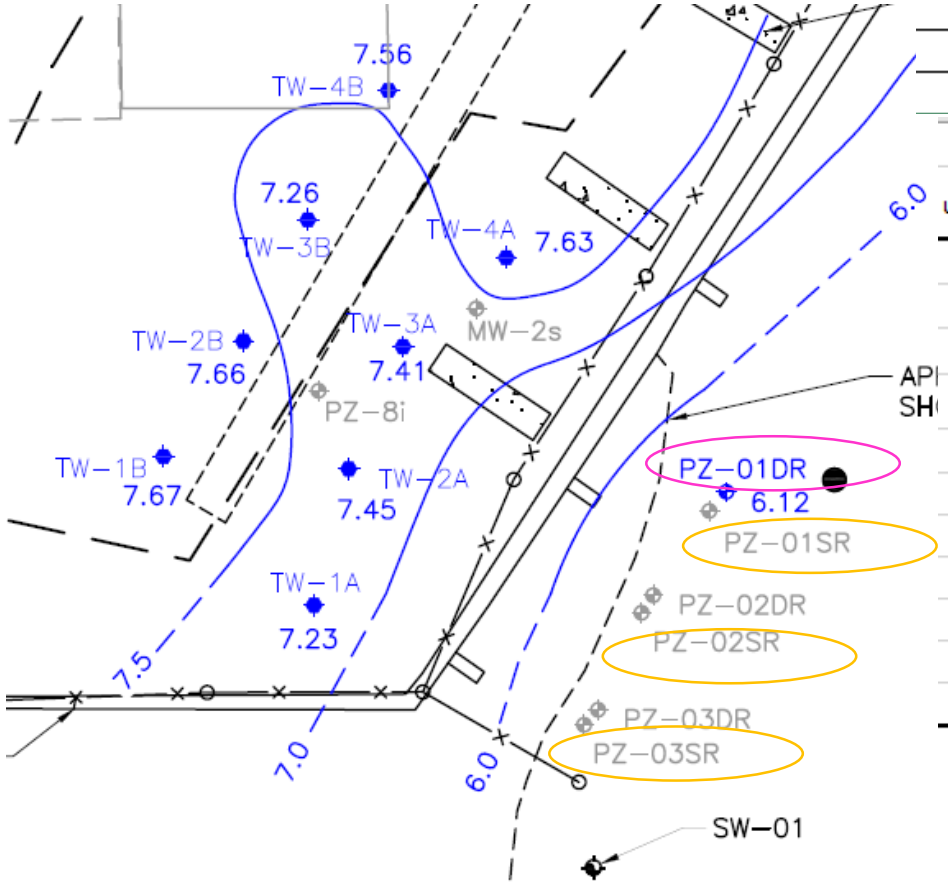
River Piezometer Monitoring

Shallow composition (CB and PCB)

- Consistent with known river sediment impacts

Deep composition (DCB)

- Consistent with GW discharge

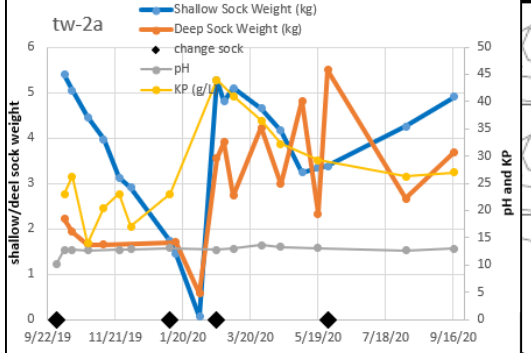


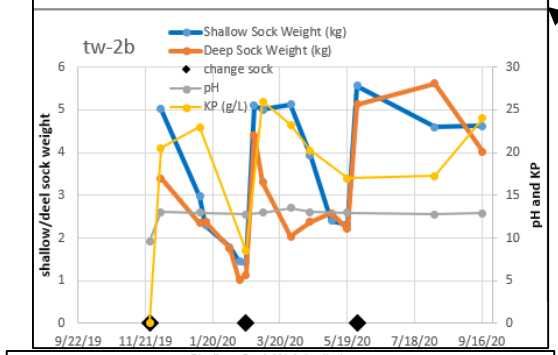
	PZ-01SR				PZ-02SR				PZ-03SR			
COC [ug/L]	10/16/19 (baseline)	10/28/19	1/9/20	3/30/20	10/16/19 (baseline)	10/28/19	1/9/20	3/30/20	10/16/19 (baseline)	10/28/19	1/9/20	3/30/20
1,2-DCB	**336**	7.4	**428**	**690**	**98**	27.8	83	82	**656**	**322**	**204**	**308**
CB	**9,070**	220	**3,520**	**5,050**	**4,680**	254	**1,900**	**2,160**	**2,380**	673	523	884
2-CT	60.5	2.5	23.7	25.5	34.2	2.3	7.6	2.7	7.7	2.1	< 1	< 1
Tol	37.5	1.4	2.9	1.3	8.6	1.3	1.5	1	1.2	1.3	< 1	1
Xyl	45.7	<3	7.9	7	14.3	<3	<4	2	<3.4	< 3	<3	< 2
PCB	**1.84**	<0.09	0.38	0.5	**1.81**	**8.77**	**4.34**	0.18	**1**	<0.09	**0.97**	<0.09
Persulfate	0	0	0	0	0	0	0	0	0	0	0	0
Sulfate	36.5	25.9	12.9	20.8	37.5	34	17.1	21.1	<5.0	<5.0	<5.0	6.5
pH	6.85	6.78	7.37	6.75	7.14	6.81	6.71	6.46	6.83	6.88	6.57	6.65
DO	0.4	0.24	9.43	2.69	0.33	1.61	10.86	2.90	0.39	0.12	10.55	3.28
ORP	183.4	-306	12.3	-41.4	145.9	-192	33	-40.4	154.7	-388.5	21.3	-101.2

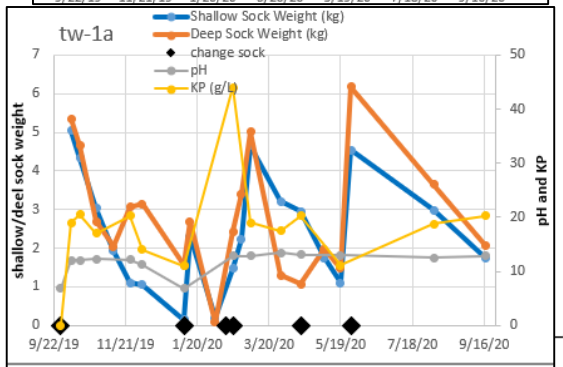
	PZ-01DR				PZ-02DR				PZ-03DR			
ug/L	10/16/19 (baseline)	10/28/19	1/9/20	3/30/20	10/16/19 (baseline)	10/28/19	1/9/20	3/30/20	10/16/19 (baseline)	10/28/19	1/9/20	3/30/20
1,2-DCB	**4,480**	**4,510**	**4,580**	**5,240**	<1	2.4	<1	<1	28.2	12.9	26.9	18.2
CB	233	57.9	36.4	50	26.3	38.4	11.3	3.2	559	144	219	250
2-CT	6.4	1.1	<1	< 1	<1	1.3	<1	<1	9.2	3.2	<1	<1
Tol	3.5	2.1	1.4	1.6	<1	1.4	<1	<1	1.5	<1.0	<1	<1
Xyl	9.5	5.1	4.5	4.65	<2	<3	<3	<2	4.6	<3	<3	2
PCB	<0.10	< 0.11	<0.11	<0.11	0.16	0.23	< 0.11	< 0.11	0.41	<0.10	0.18	<0.09
KP	0	0	0	0	0	0	0	0	0	0	0	0
Sulfate	<5.0	5.2	<5.0	<5.0	26.4	26.3	< 5.0	< 5.0	13	15.4	<5.0	<5.0
pH	6.99	6.96	8.52	7.54	6.85	7.35	7.59	9.60	7.14	7.01	6.43	6.55
DO	0.31	0.03	9.67	1.07	1.22	0.02	9.4	1.16	0.37	0.03	10.16	1.93
ORP	135.3	-450.3	-26.9	-196.7	195.8	-503.2	24.1	-97.3	161.9	-472.2	10.9	-69.4

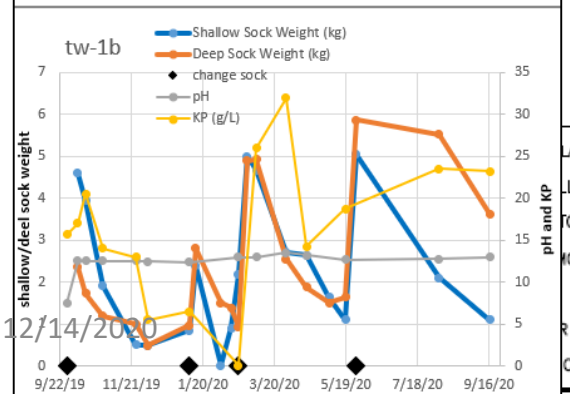
PRB WELL PARASMETERS w/ TIME

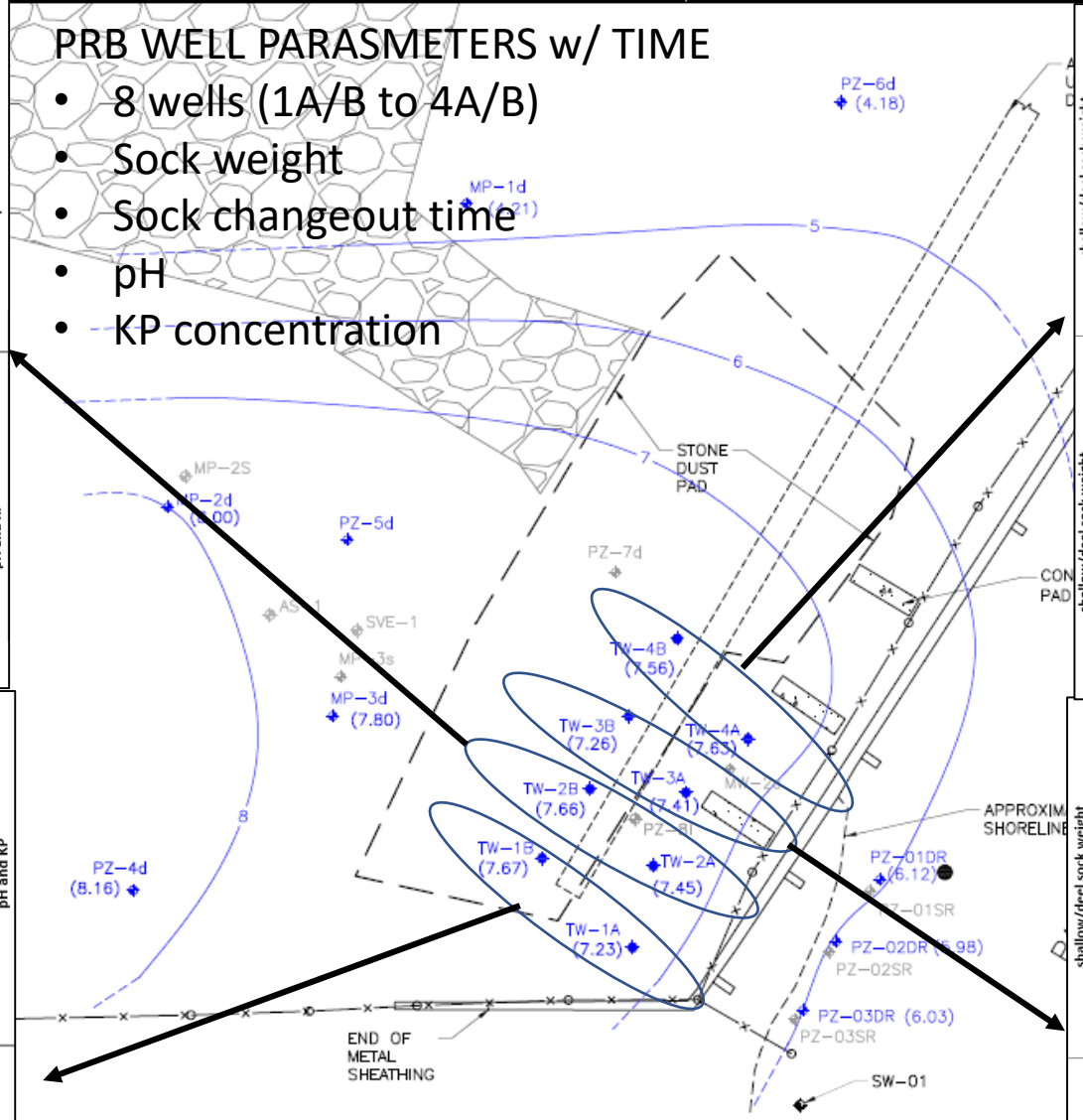
- 8 wells (1A/B to 4A/B)
- Sock weight
- Sock changeout time
- pH
- KP concentration

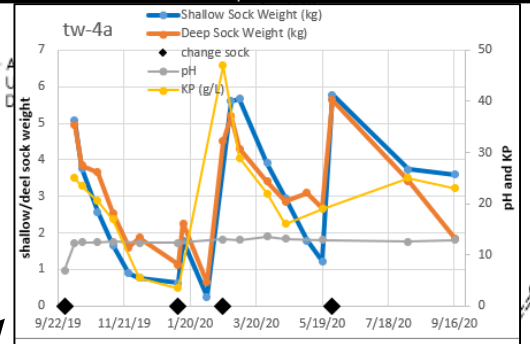


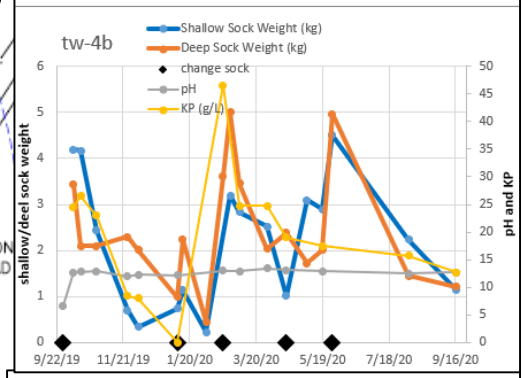


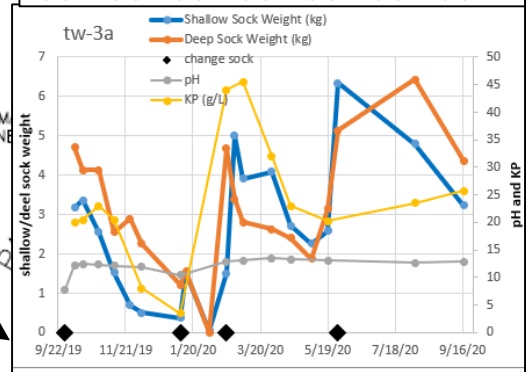


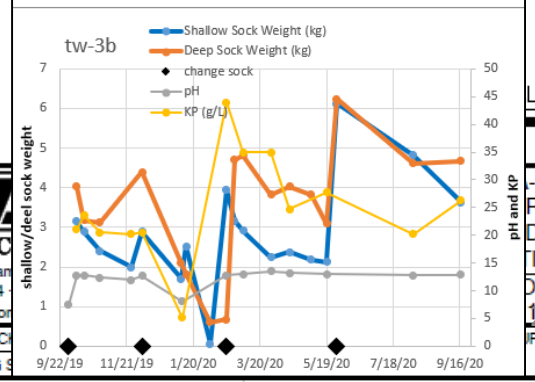












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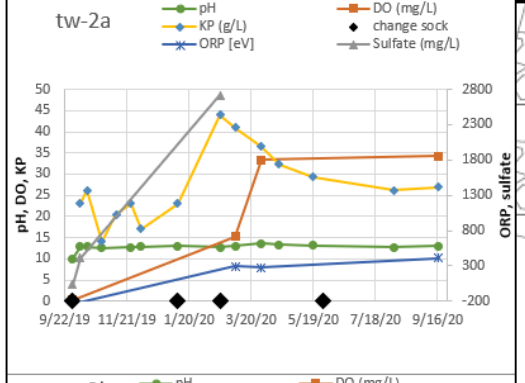
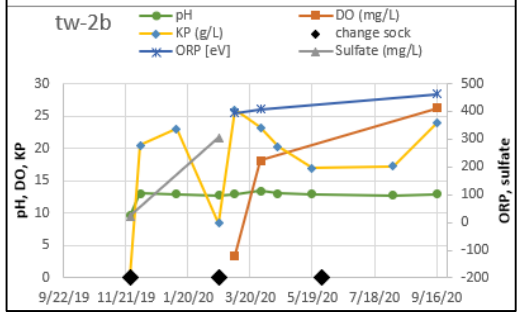
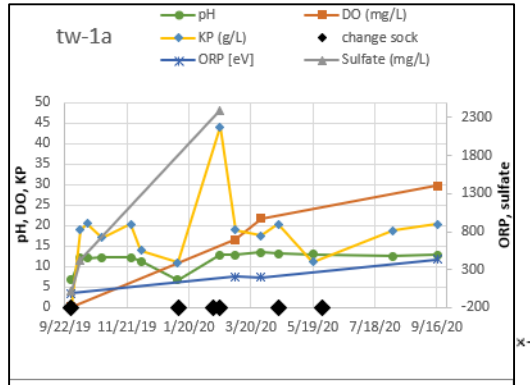
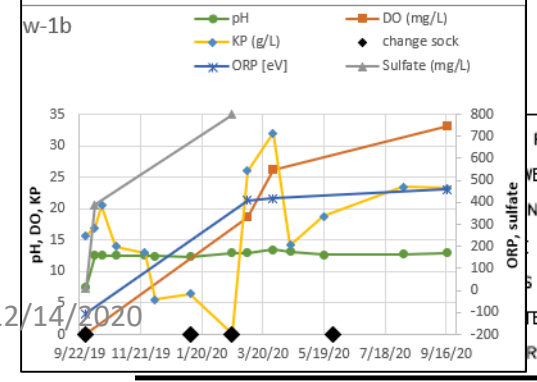
PRB WELL PARASMETERS w/ TIME

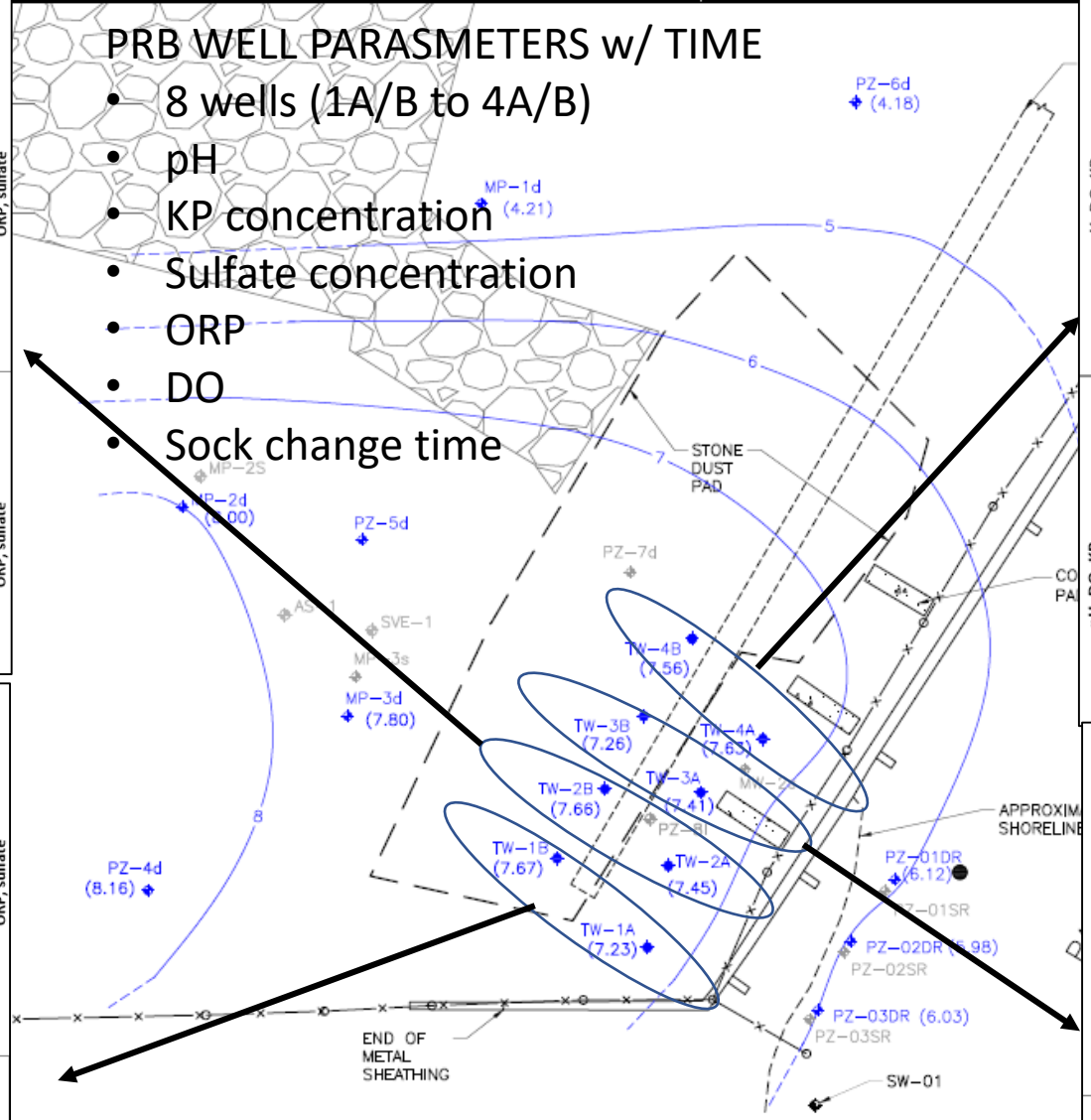
- 8 wells (1A/B to 4A/B)
- pH
- KP concentration
- Sulfate concentration
- ORP
- DO
- Sock change time

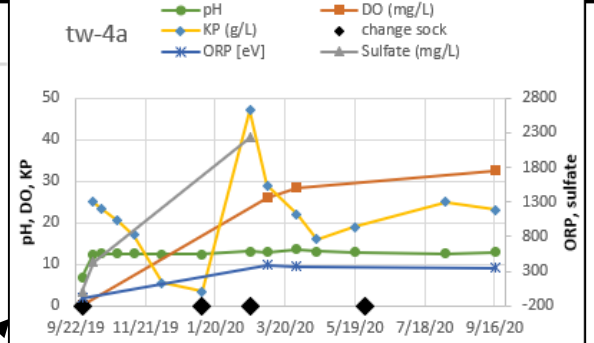


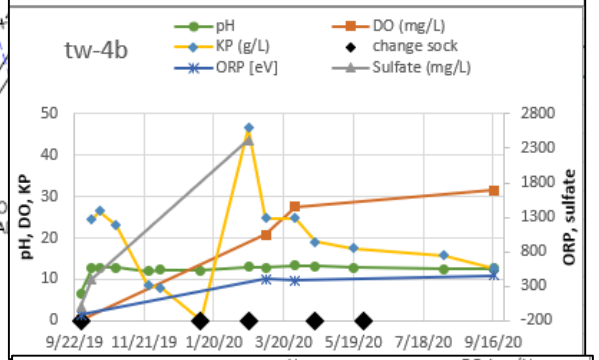


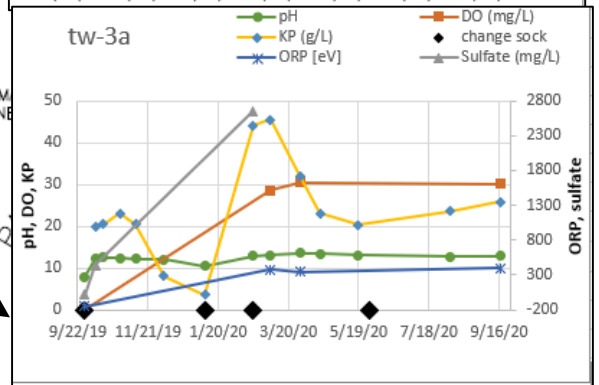


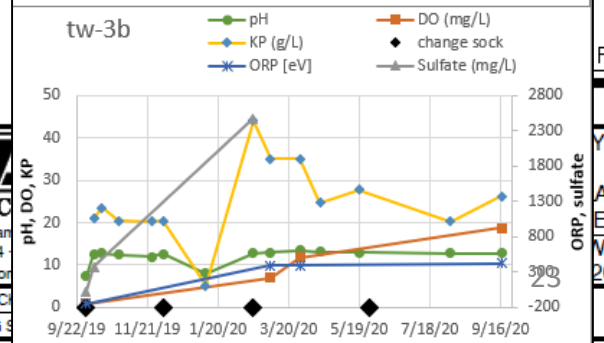












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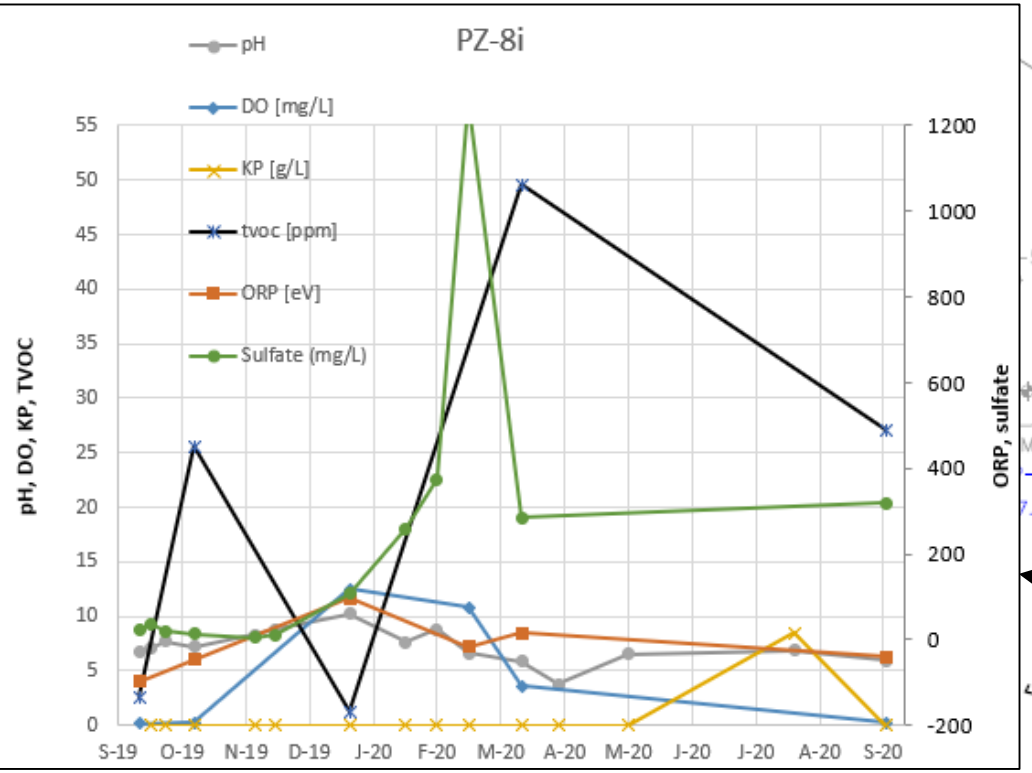
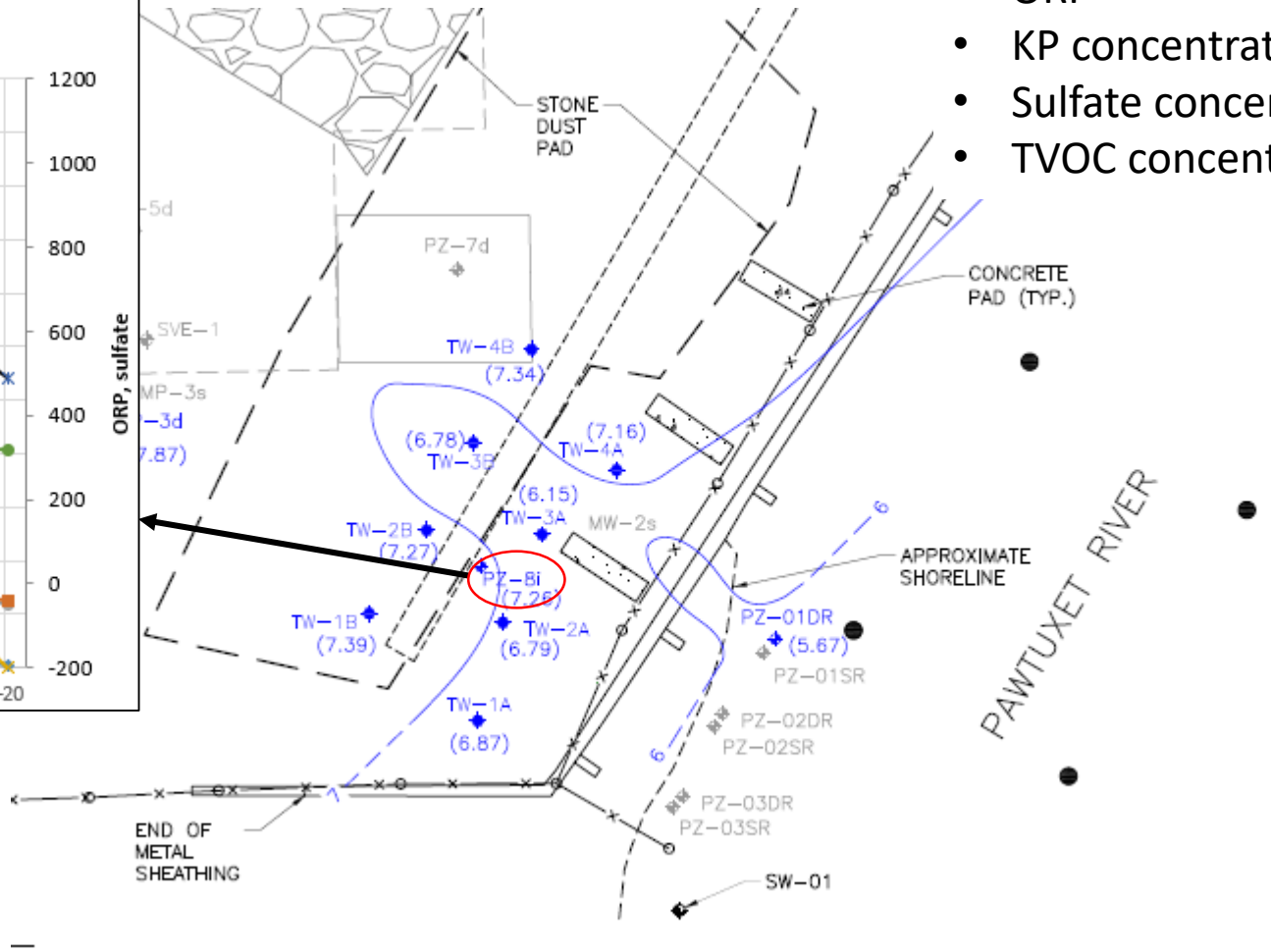
PRB PERFORMANCE MW (8i)

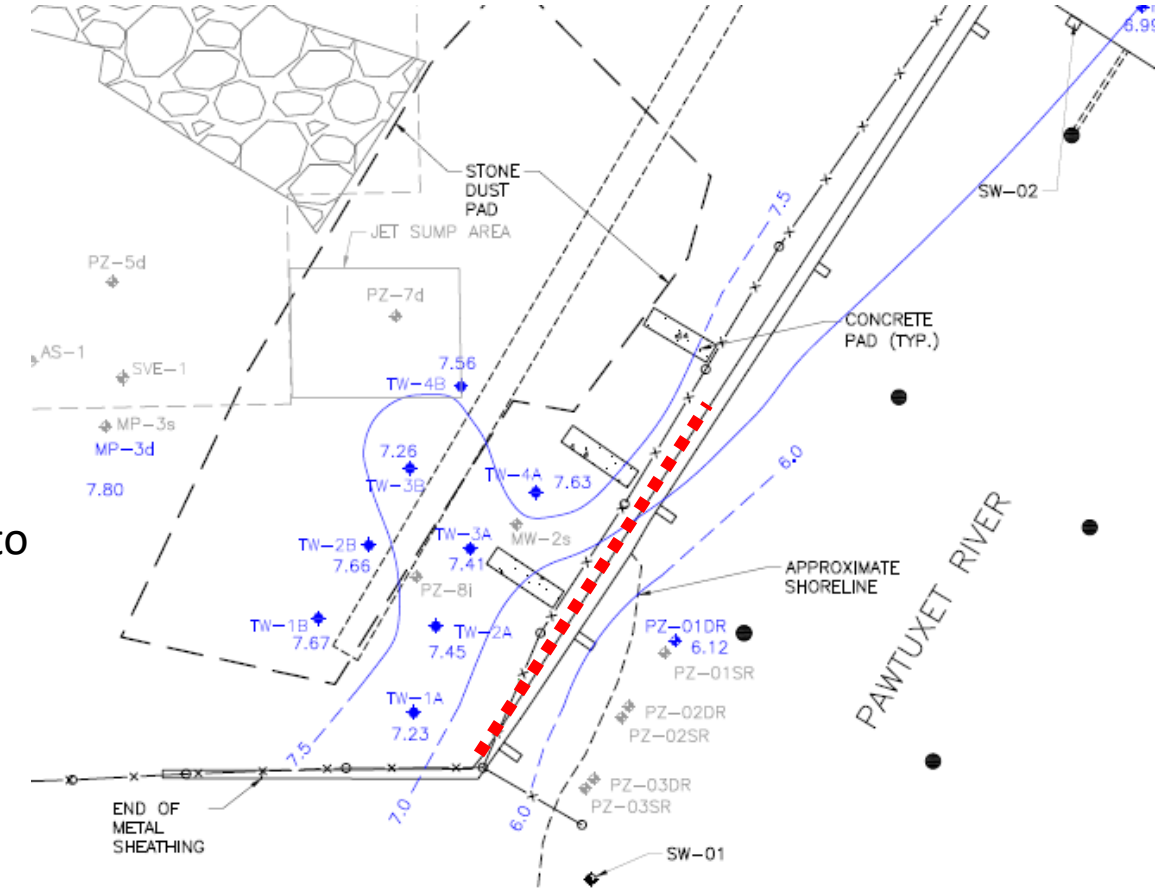
- pH
- DO
- ORP
- KP concentration
- Sulfate concentration
- TVOC concentration





Summary

- RCRA Closure CD TBC
- Soil: EPA review of Closure and M&M plan
- PRB installed 9/30/19
- DNAPL (DCB and CB w/ PCB) detected in granular layer 18 to 20’ bgs.
- Remedy monitored for 1 year.
- AAKP is dissolving and disassociating.
- No indication of significant reagent transport away from PRB wells.
- River-side impact appears to be from 2 sources: shallow associated with known surface discharge, deep from GW discharge.
- Data gaps: resolve mass flux flow path to river to refine treatment area and monitoring of same.

Recommendations

- Continue maintaining PRB
- Field work
  - Hydraulics of PRB wells (slug tests)
  - Profile study
    - Adjacent to sheetpile from 20 to 35’
  - Based on result:
    - Install MWs on upland side, adjacent to and spanning across the depth of the sheet-pile bulkhead.
    - Extend river PZ transect further downgradient.