RESPONSE TO PADEP COMMENTS
REMEDIAL INVESTIGATION REPORT ADDENDUM
AREA OF INTEREST 9

PHILADELPHIA ENERGY SOLUTIONS REFINING & MARKETING, LLC
PHILADELPHIA REFINING COMPLEX
PHILADELPHIA, PENNSYLVANIA

Prepared for:

Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
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Wilmington, Delaware 19803

Prepared by:

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Philadelphia, Pennsylvania 19103

July 7, 2017
2574602

LANGAN

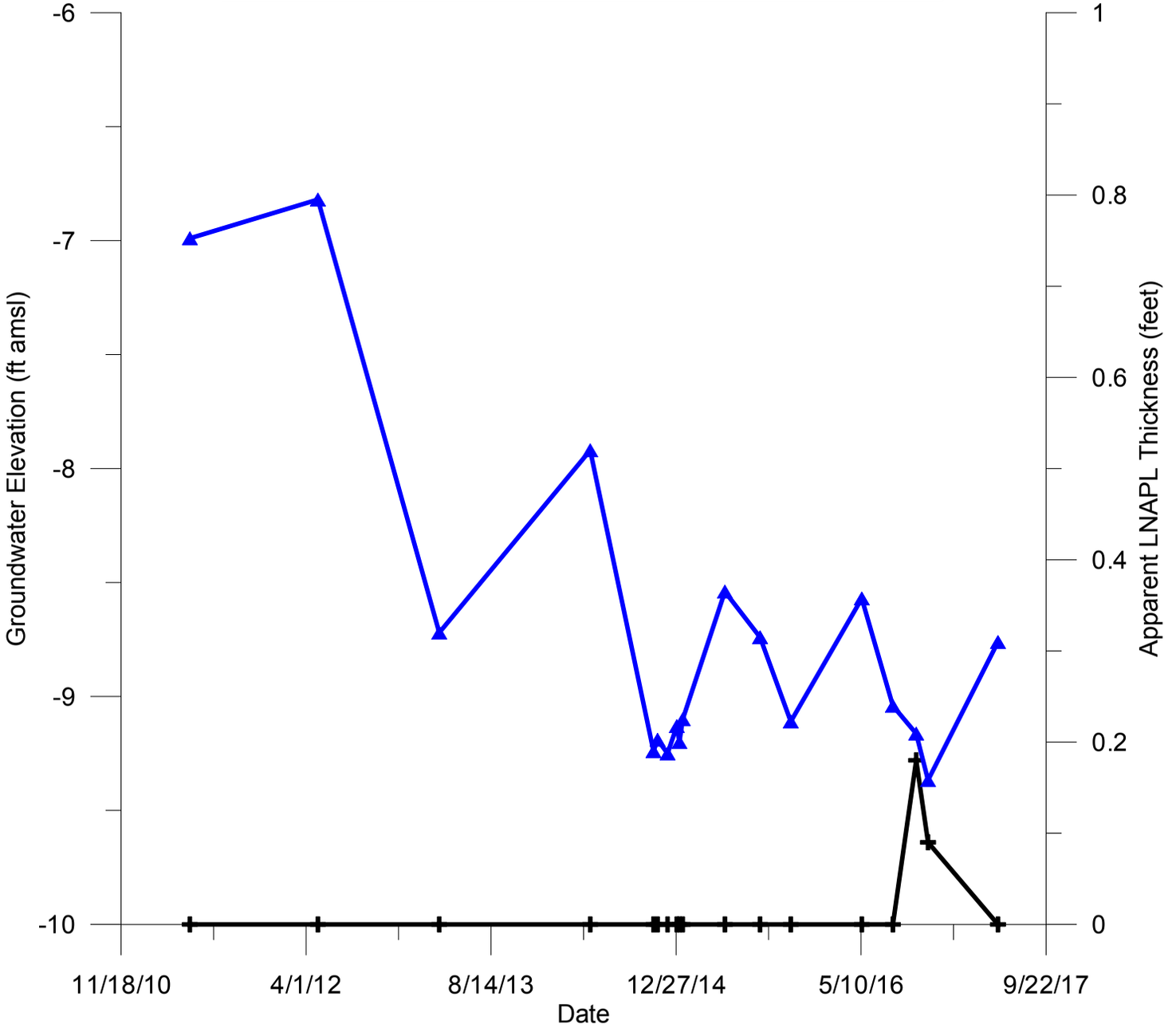
Evergreen Responses
PADEP Remedial Investigation Report (RIR) Addendum Review for AOI 9
Dated April 18, 2017

AOI 9 RIR Addendum - PADEP Comment Number (Corresponding to PADEP "Report Comments" Document Dated April 18, 2017)	Evergreen Response
Soil	
1. Page 2: Screening Rationale: Subsurface soil sample results were screened against PADEP non-residential soil direct contact MSCs. The original AOI 9 RIR was a multi-step screen including comparison to PADEP soil-to-groundwater MSCs. Why was the screening rationale changed?	The subsurface soil screening in the AOI 9 RIR Addendum (dated February 8, 2017) is the same as presented in the AOI 9 RIR (dated December 31, 2015).
2. In the 2015 sampling, Evergreen identified exceedances of direct contact MSCs for 1,2,4 TMB at 3–4 ' depth in the T-100 area. Langan's 2/8/2017 SCR/RACR indicates that no remedial action is necessary for these exceedances because PES's excavation permitting and PPE procedures would protect workers from exposures. However, the TMB direct contact standards are based on inhalation exposures for outdoor receptors (even without an excavation). A risk assessment or remedial action is required to attain the site-specific standard. A risk calculation or determination of a site-specific numerical value using EPA's current TMB RfC value (IRIS database, Sep 2016) may demonstrate acceptable risks for these concentrations.	Langan is preparing a Human Health Risk Assessment for the PES Refining Complex. Inhalation exposure to constituents in ambient air has been evaluated through collection of ambient air samples at AOI-9. The data indicate 1,2,4-TMB is present at low levels in ambient air, several orders of magnitude below applicable industrial hygiene standards.
Groundwater	
3. On 3/28/2016 DEP disapproved the 12/31/2015 RIR. The key deficiency was the lack of groundwater characterization beyond the western property boundary. Evergreen apparently attempted to install wells in the Essington Avenue right-of-way, but they were unsuccessful at obtaining access to do so. Without data on offsite groundwater elevations and plume delineation, the characterization remains incomplete. [§250.408(a), (b), and (e)]	Evergreen is in the process of attempting to obtain access to off-site areas for the purpose of installing groundwater monitoring well. Access agreements with off-site owners are nearly finalized as of the submittal date of this response to comments. The results of additional characterization completed in this area, which will include results from sampling off-site wells and evaluating potential off-site sources, will be provided in a future RIR addendum.
4. Quantitative modeling of the benzene plume (by Stantec, Appendix D) indicates a potential plume length of up to ~1700 ', which is substantially farther than the distance between the available source and calibration wells. The model may be conservative, but it implies a large and very uncertain extrapolation. In addition, no modeling was presented for MTBE, which likely extends offsite as well.	Delineation of potential off-site dissolved concentrations of COCs in groundwater is being pursued by Evergreen through installation and sampling of off-site wells. Access agreement negotiations are active. The results of additional characterization completed in this area, which will include results from sampling off-site wells, updating modeling and evaluating potential off-site sources, will be provided in a future RIR addendum.
5. Langan intends to review DEP's files for other cleanup sites on Essington Avenue, such as the Enterprise Leasing property. We suggest that these file reviews should have been performed as part of the remedial investigation. We are aware of three sites in DEP's records that may have useful information, listed below. Some selected data from the sites is being sent separately. Groundwater flow west of Essington may differ from that assumed in Stantec's modeling. Site Address Facility ID Records ID Flying Carport 7780 Essington Ave. 619338 191676 Eastwick Industrial Park 7001–7801 Essington Ave. — 22111 Enterprise Leasing Co. 7001 Essington Ave. 719112 8321	Evergreen has reviewed the PADEP provided information.
6. New monitoring wells installed near the southwestern property boundary (S-142 and S-143) show MTBE exceedances (up to 250 ug/L). Horizontal delineation of this plume is necessary. No MTBE model was presented, and current groundwater data does not appear to be sufficient to model this plume. [§250.408(a), (b), and (e)]	Offsite monitoring wells and access issues are being evaluated by Evergreen. Access agreements are almost finalized as of the submittal of these response to comments. Offsite monitoring well installation and groundwater results will be included in a future RIR addendum.
7. Langan suggested in the report that the MTBE contamination in the southwest may have originated offsite. However, groundwater flow in the unconfined aquifer and the lower aquifer is inferred to the south in this area. Contouring of lower aquifer MTBE in Figure I-6, based only on three widely separated wells, is not a reliable interpretation. No justification was provided to support the suggestion that the MTBE plume was more likely to originate offsite rather than within the SRTF.	The sub-bullet that is questioned appears in Section 6.4 on pages 26 and 27. The text of the sub-bullet states "Plume 3 was identified based on the re-classification of wells (hydrostratigraphic units) and the October 2016 limited groundwater sampling event. Plume 3 is comprised of MTBE plumes in both the unconfined and lower aquifer the southwest portion of AOI 9. The MTBE plume in the unconfined aquifer appears to be stable. The extent of the MTBE plume in the lower aquifer is not well defined and could potentially be from off-site source(s). The potential source(s) of MTBE will be evaluated during a future RIR addendum and comprehensively modeled to estimate the future extent of groundwater concentrations."
8. Pages 13–14: Langan states that MW-74D, MW-76D, and MW-106D had downhole video performed due to missing logs. EPA did not locate any further discussion of this in the RIR addendum. Is there useful information to expand upon this statement?	No, there is no additional information. This effort was conducted to establish screen lengths and elevations for monitoring wells MW-74D, MW-76D, and MW-106D. The construction information for these monitoring wells was included in Table 2.
9. It's suggested in the report that increased concentrations in S-112 and the appearance of LNAPL in S-114 and S-122 may reflect unstable conditions or new releases. However, groundwater elevations were lower than typical in the Oct 2016 gauging event, and this may have had an effect. (See #28 below.)	Based on LNAPL characterization the sample from S-114 was deemed as undegraded which indicates a newer release of product. Also, monitoring wells S-114 and S-122 have approximately 5 years of gauging data with no previous occurrence of LNAPL. Hydrographs for monitoring well S-114 and S-122 displaying groundwater elevations and apparent LNAPL thicknesses have been prepared and are attached.
10. Please provide available construction information on the Philadelphia Schuylkill West Side Interceptor combined sewer line and the Essington Avenue / Mingo storm water line, including sizes and depths. (See #24 below.)	The requested information is attached. Langan has also revised Figures 5 and 6A to include the Mingo Avenue sewers and the Philadelphia Schuylkill West Side Interceptor. Please refer to the response to Comment #24 below.
Inhalation Pathway	
11. Please document conditions at the time of air sampling, including indoor and outdoor temperatures, weather conditions (e.g., wind, precipitation, barometric pressure changes), and building characteristics (HVAC operation, ventilation, etc.).	All available information from the field sheets related to the indoor and outdoor air sampling events is attached.
12. As noted in the report, some reporting levels in the indoor air sample analyses exceeded applicable screening values. If Evergreen will be using risk-based screening values rather than occupation criteria (PELs), then those exceedances will need to be addressed.	Langan is preparing a Human Health Risk Assessment for the PES Refining Complex. Reporting limit exceedances of applicable screening values will be addressed in the HHRA. In Section 7.0 "Conclusions and Recommendations", page 30, subsection of Vapor, the first bullet states "Based on the results of the April 2016 indoor air samples collected in Buildings SR2 Corner Office and Loading Dock Office SR9, COC concentrations were below the site specific standards of 1/10th the PADEP statewide health standard or the EPA RSLs. However, some of the laboratory's reporting limits were above the applicable screening values. These buildings will be further evaluated by Evergreen as part of the Complex-wide Cleanup Plan."
13. The results of the outdoor air testing were presented in Section 4.5 and Table 8. However, there was no discussion of those results. They were not compared to occupational criteria in the table. Evergreen should interpret the results and discuss if they will be screened, used in a risk assessment, or addressed through compliance with occupational criteria.	The following language was added to Section 4.5 of the RIR: "The results of the outdoor air samples will be discussed in the Human Health Risk Assessment for the PES Refining Complex. Concentrations of constituents in outdoor air are below the applicable ACGIH TLVs and NIOSH RELs for all analytes." The revised text is attached. Table 8 has been updated with the applicable ACGIH TLVs and NIOSH RELs and is also attached.

AOI 9 RIR Addendum - PADEP Comment Number (Corresponding to PADEP "Report Comments" Document Dated April 18, 2017)	Evergreen Response
CSM and Pathways	
14. Pages 22–24: The Geology and Hydrogeology section of the CSM does not include information on the lower aquifer. The updated CSM should include this information.	Langan has added lower aquifer information to the Geology and Hydrogeology section of the CSM in both the RIR Addendum text and the Appendix I Qualitative Fate and Transport text. The revised text is attached.
15. Page 26: bullet 1: Langan states both qualitative and quantitative assessments were completed to refine the current CSM for AOI 9. This information is not included in the updated CSM in Section 6. The updated CSM should include this information.	Langan has updated and revised the CSM in both the RIR Addendum text and the Appendix I Qualitative Fate and Transport text. The revised text is attached.
16. Pages 26 and 29: AOI plumes: Confusing terminology – There appears to be differences between the use of plume and source in the RIR itself and then between the RIR and the Appendix I Qualitative Fate and Transport Assessment. Bullet 3 of page 26 says three areas have been identified as source areas for groundwater petroleum impacts. Then the second bullet of this section says Plume 2 is a historically undefined source. The next sentence then says there appears to be separate source areas associated with Plume 2. Then for comparison with the Appendix I F&T Assessment, page I-13 discusses a concentration versus time plot indicating a benzene source centered on S-112 is potentially increasing, followed next by a separate source area at S-115 with an increasing plume.	Langan has clarified the terminology in both the RIR Addendum and Qualitative F&T text. The revised text is attached.
17. Page 26: Plume 3 bullet: Page I-14 of the Appendix I F&T Assessment states the MTBE plume in the lower aquifer is potentially increasing. The updated CSM should include this information.	Third sub-bullet on page 26 of the AOI 9 RIR Addendum can be updated. The updated and revised text is attached.
18. Page 27: Potential Migration Pathways and Site Receptors does not include direct contact exposures to off-site groundwater during excavation activities, off-site groundwater users, off-site vapor intrusion, or ecological receptors in the Schuylkill River. EPA believes these should be included as potential receptors. Could VI or DC from GW in storm sewer lines be a potential pathway also?	Potential migration pathways and offsite receptors will be evaluated as part of a future RIR addendum.
19. Page 28: Soil bullet 3: The text "with regard to…the soil-to-groundwater pathway" is not followed by a conclusion or recommendation pertaining to that pathway.	The soil-to-groundwater pathway will be evaluated through analysis and characterization of the groundwater pathway.
Tables, Figures, and Appendices	
20. There are discrepancies in Table 2. For some monitoring wells the screen length equals the well completion depth. (This was pointed out in DEP's 3/10/2016 comments, corrected by Langan in the 3/22/2016 supplementary information submittal, but then repeated in the 2/8/2017 addendum.)	Langan has revised Table 2 and it is attached.
21. In Table 7, 26 ug/m3 is presented as the "RSL" for trimethylbenzenes. However, this is not EPA's published RSL, but rather a calculated value using the 2016 RfC value. EPA will presumably post a new RSL in the near future. Exceedances of vapor intrusion screening values should generally be addressed through a risk assessment.	Langan is preparing a Human Health Risk Assessment for the PES Refining Complex to address the exceedances of the vapor intrusion screening values.
22. Several screening values in Table 7 are incorrect. For example, the benzene screening value based on EPA's RSLs is 13 ug/m3, not 16 ug/m3. Screening values must be the lower of the cancer and non-cancer values. (See DEP's vapor intrusion training materials.)	Table 7 has been revised. There are no benzene exceedances of the lower RSL of 13 ug/m3. There are no changes to exceedances with the updated standards.
23. Figure 4 is titled "Interpreted Extent of Middle/Lower Clay." However, based on Langan's current interpretation and the figure legend, this map depicts the extent of the clay unit found in the Holocene alluvium, not the PRM Lower/Middle Clay.	The title of Figure 4 has been revised to "Interpreted Extent of Holocene Clay".
24. I ask that cross section B–B' (Figure 6b) include the PWD Schuylkill West Side Interceptor combined sewer line (near S-122) and the western extent be extended slightly to also show the Essington Avenue line.	Langan has also revised Figures 5 and 6A to include the Mingo Avenue sewers and the Philadelphia Schuylkill West Side Interceptor. The revised figures are attached.
25. There are discrepancies with the modified well logs for S-110 and S-123 (Appendix C) and the information in Table 2. S-110: The log text says 5 ′ of bentonite was added, but the diagram indicates 2′ of bentonite in the originally 12′ deep well. Table 2 says the screen is now 2–7′. S-123: The log indicates a 5–10′ screen, but Table 2 says 2–10′.	Langan has included a revised Table 2 as referenced in the above Response 20. We have also modified the logs for S-110 and S-123 to reflect the addition of 5' of bentonite.
26. Filling the bottom of the S-110 and S-123 screens may have only a limited effect on the hydrostratigraphic interval sampled in the well because water will continue to move through the sand packs around the screens.	Evergreen will no longer use monitoring wells S-110 and S-123 for groundwater elevations or analytical data.
27. In Appendix D it's stated that the S-117 well screen is fouled and may have poor hydraulic communication. Has Evergreen re-developed the well or considered replacing it? It is a point of compliance well, and I recommend correcting the problem so that Evergreen collects representative data from it.	Evergreen will consider re-development of S-117.
28. With the trend plots of groundwater concentration data in Appendix I (Figures I-7–12) it would also be helpful to plot hydrographs to show possible relationships with groundwater elevation changes.	Langan has added this information to Appendix I Figures I-7 through I-12.

9

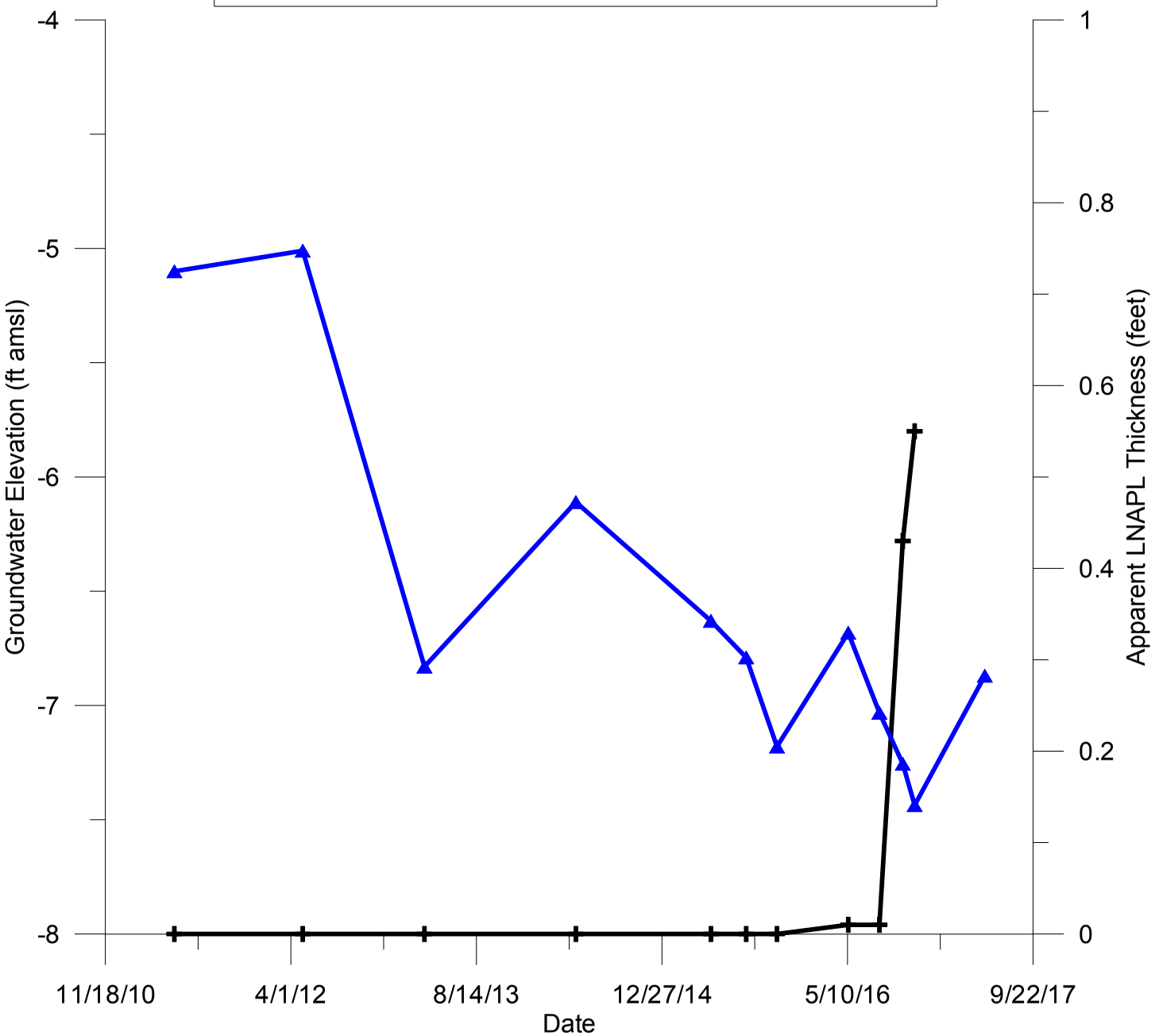
Monitoring Well S-114SRTF
Apparent LNAPL Thickness and Groundwater Elevation Trends
AOI 9 Remedial Investigation Report Addendum
PES Philadelphia Refining Complex
Philadelphia, PA



Legend
Apparent LNAPL Thickness
Groundwater Elevation

Notes:
1. Apparent LNAPL thicknesses and groundwater elevations were obtained from gauging events spanning from May 2011 through May 2017.
2. LNAPL = light non-aqueous phase liquid.
6. ft amsl = feet above mean sea level.

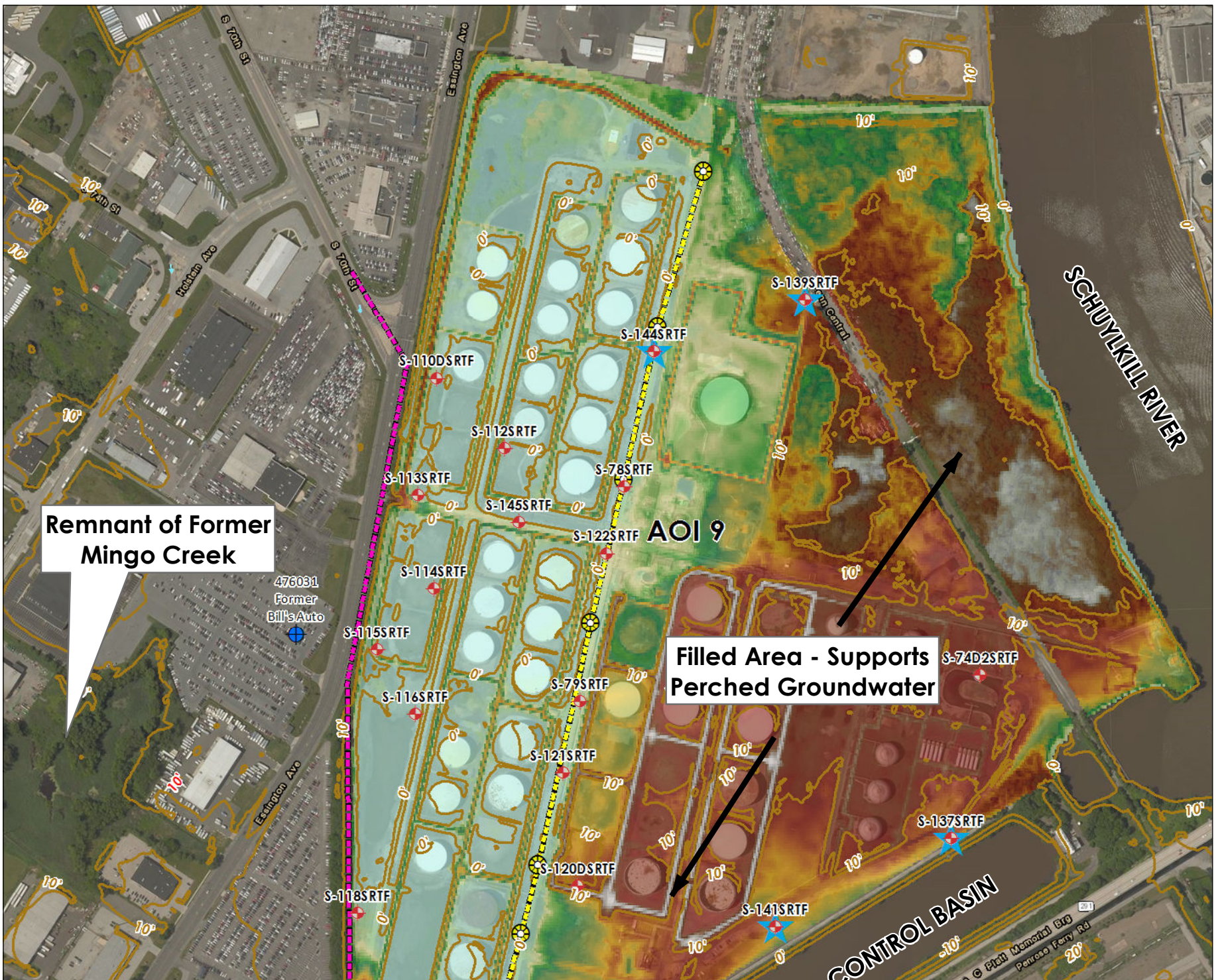
Monitoring Well S-122SRTF
Apparent LNAPL Thickness and Groundwater Elevation Trends
AOI 9 Remedial Investigation Report Addendum
PES Philadelphia Refining Complex
Philadelphia, PA

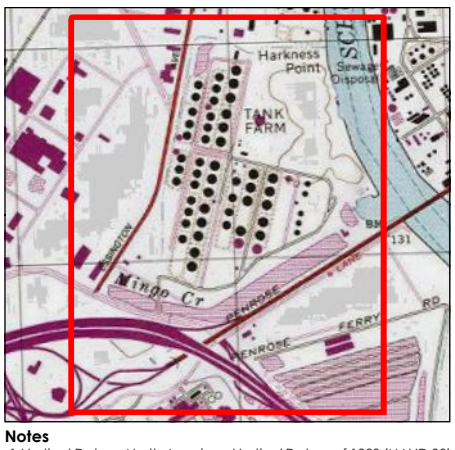


Legend
Apparent LNAPL Thickness
Groundwater Elevation

Notes:
1. Apparent LNAPL thicknesses and groundwater elevations were obtained from gauging events spanning from May 2011 through May 2017.
2. LNAPL = light non-aqueous phase liquid.
6. ft amsl = feet above mean sea level.

10





Notes

1. Vertical Datum: North American Vertical Datum of 1988 (NAVD 88)
2. Coordinate System: NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet
3. Source: Stantec
4. Service Layer Credits: Image courtesy of USGS Earthstar Geographics SIO © 2017 Microsoft Corporation
   Copyright:© 2013 National Geographic Society, i-cubed
   Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors
   c.i. = contour interval; contours obtained from the Pennsylvania Spatial Data
5. Access (PASDA)
   PaGWIS = Pennsylvania Groundwater Information System
6.

Legend

- Monitoring Well (utilized in this assessment)
- Indicates Slug Testing Was Performed
- PaGWIS Identified Offsite Monitoring Well

Approximate Sewer Location

- Mingo Avenue Sewer
- Schuylkill West Side Interceptor
- Approximate Sewer Manhole Location
- Area of Interest 9
- 2015 Topographic Contour (c.i. 10 feet)

2010 USGS National Elevation Dataset

Value

- 17.8 feet
- 0 feet

150 0 150 300 Feet

1:6,000 (At Original document size of 11x17)

N

Stantec

EVERGREEN

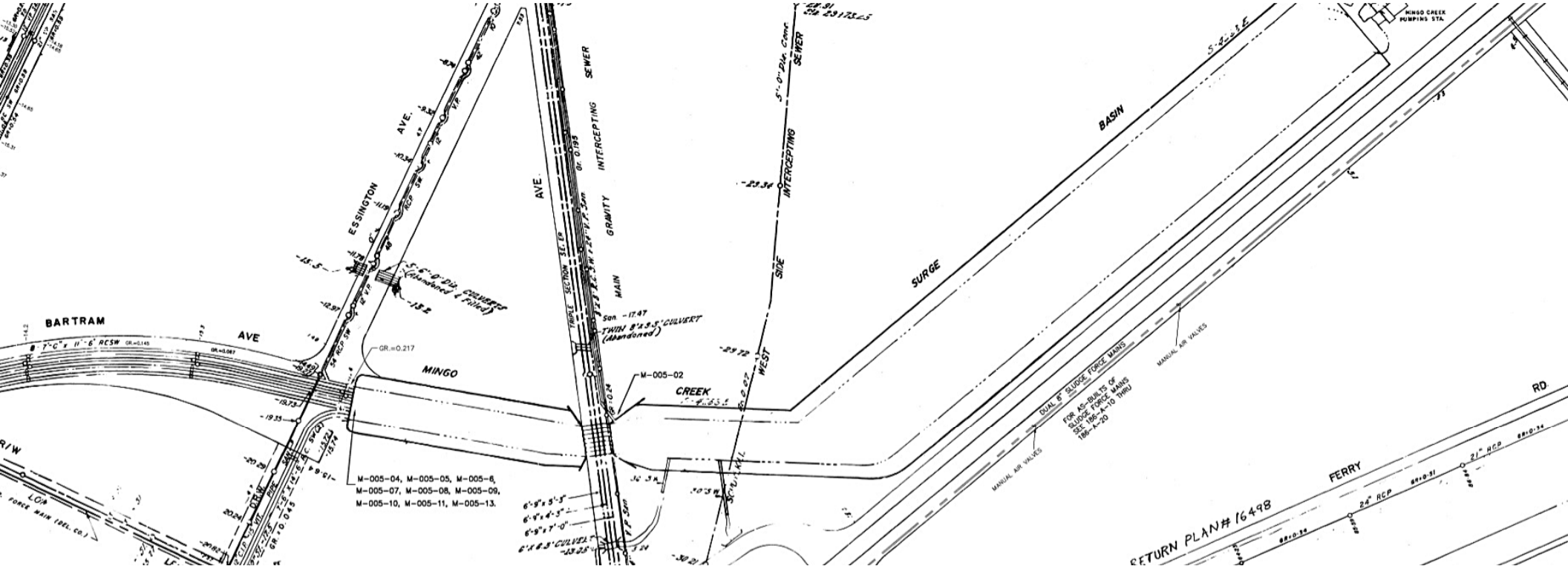
Project Location
Philadelphia Refining Complex
Schuylkill River Tank Farm

213402599
Prepared by ADK on 10/26/2016
Technical Review by JT on 12/12/2016
Independent Review by MN on 12/12/2016

Client/Project
PHILADELPHIA REFINERY OPERATIONS
A SERIES OF EVERGREEN RESOURCES GROUP, LLC
3144 PASSYUNK AVENUE
PHILADELPHIA, PA 19145

Figure No.
1

Title
AOI 9 SITE PLAN FOR QD ANALYSES

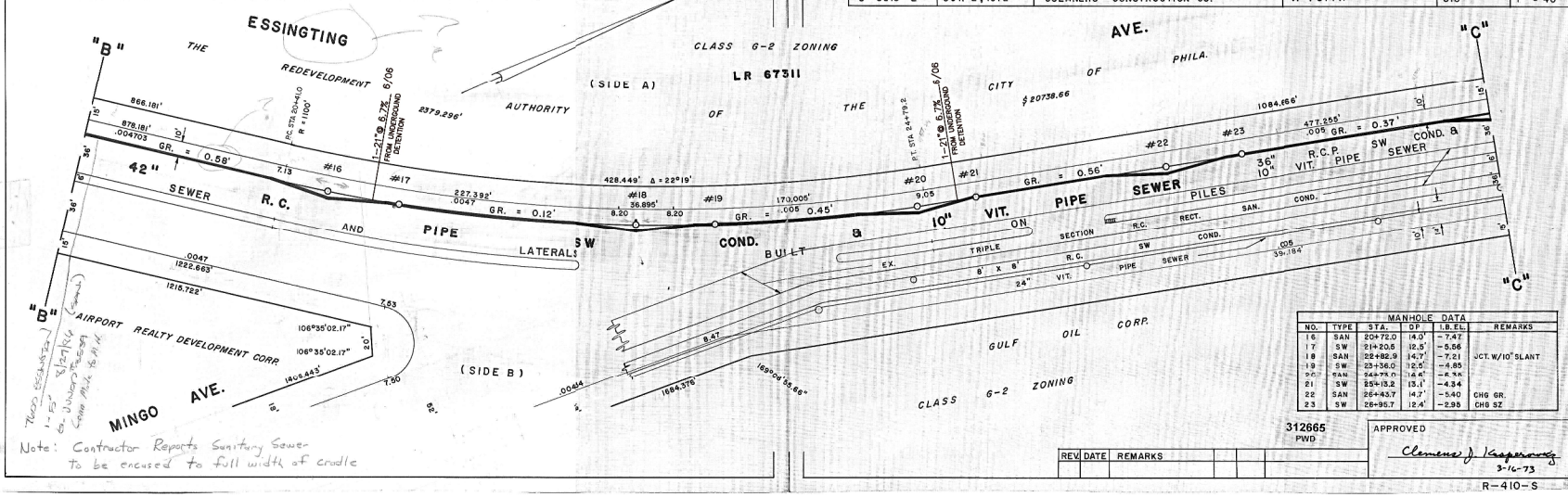

BARTRAM AVE
MINGO CREEK
ESSINGTON AVE.
AVE.
INTERCEPTING SEWER
GRAVITY MAIN
SIDE INTERCEPTING SEWER
WEST
SURGE BASIN
MINGO CREEK PUMPING STA.
FERRY RD.
RETURN PLAN# 16498
M-005-02
M-005-04, M-005-05, M-005-6, M-005-07, M-005-08, M-005-09, M-005-10, M-005-11, M-005-13.
DUAL 6" SLUDGE FORCE MAINS
FOR AS-BUILTS OF SLUDGE FORCE MAINS SEE 185-A-10 THRU 185-A-20
MANUAL AIR VALVES
MANUAL AIR VALVES
5'-0" Dia. Conc.
5'-6"x8'-0" CULVERT (Abandoned & Filled)
TWIN 8'x9'-5" CULVERT (abandoned)
24" RCP
21" RCP

ESSINGTON AVE. BARTRAM AVE. TO 70 TH ST.

SHEET	PLAT
3 OF 4	9

16026-C

WORK NO.	COMPLETION DATE	CONTRACTOR	INSPECTOR	FIELD BK. NO.	SCALE
S-3615-E	OCT. 2, 1972	COLANERO CONSTRUCTION CO.	V. FUFFA	815	1" = 40'



Note: Contractor Reports Sanitary Sewer to be encased to full width of cradle

MANHOLE DATA

NO.	TYPE	STA.	DP	I.E.EL.	REMARKS
16	SAN	20+72.0	14.0'	-7.47	
17	SW	21+20.5	12.5'	-5.56	
18	SAN	22+82.9	14.7'	-7.21	JCT. W/10" SLANT
19	SW	23+36.0	12.5'	-4.85	
20	SAN	24+73.0	14.6'	-6.34	
21	SW	25+13.2	13.1'	-4.34	
22	SAN	26+43.7	14.7'	-5.40	CHG GR.
23	SW	26+95.7	12.4'	-2.95	CHG SZ

312665
PWD

APPROVED
Clemens J. Kasperavage
3-16-73

REV.	DATE	REMARKS

R-410-S

LATERAL LOCATION (SIDE A)

STA. 0+00 = P.I. OF NW CURB LINE OF ESSINGTON AVE. & BARTRAM AVE.

STA.	DIA.	TYPE	DP
13+46.8	8"	SAN	
13+46.8	15"	SW	
15+52.8	8"	SAN	
15+52.8	15"	SW	
17+63.3	8"	SAN	
17+63.3	15"	SW	
19+60.7	8"	SAN	
19+60.7	15"	SW	

SLANT LOCATION (SIDE B)

STA. 0+00 = SAN MH # 1

STA.	DIA	TYPE	REMARKS
20+42.5	8"	SAN	8' LONG
20+42.5	15"	SW	
21+37.0	8"	SAN	
21+37.0	15"	SW	

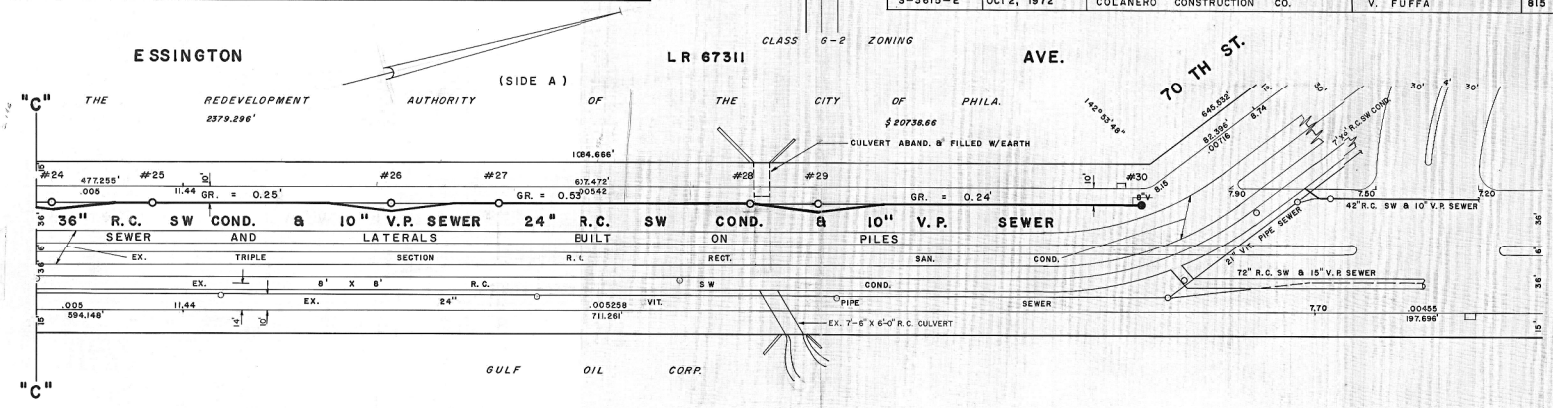
NOTE: SEE SHEET 4-OF-4 FOR SEWER ASSESSMENT DATA

ESSINGTON AVE. BARTRAM AVE. TO 70 TH ST.

SHEET	PLAT
4 OF 4	9

16026-D

WORK NO.	COMPLETION DATE	CONTRACTOR	INSPECTOR	FIELD BK. NO.	SCALE
S-3615-E	OCT 2, 1972	COLANERO CONSTRUCTION CO.	V. FUFFA	815	1"=40'



MANHOLE DATA					
NO.	TYPE	STA.	DP	I.B.EL.	REMARKS
24	SAN	28+75.5	14.7'	-4.54	
25	SW	29+38.5	13.0'	-2.58	
26	SAN	30+87.3	14.0'	-4.02	CHG GR.
27	SW	31+54.7	11.7'	-1.96	CHG SZ.
28	SW	33+14.9	10.3	-1.09	
29	SAN	33+56.9	11.6'	-2.59	
30	SPEC	35+60.8	9.8'	-2.11	

LATERAL LOCATION			
STA. 0+00 = P.I. OF NW CURB LINE OF ESSINGTON AVE. & BARTRAM AVE.			
STA.	DIA.	TYPE	DP
21+56.8	8"	SAN	
21+56.8	15"	SW	
23+58.3	8"	SAN	
23+58.3	15"	SW	
25+58.3	8"	SAN	
25+58.3	15"	SW	
27+60.8	8"	SAN	
27+60.8	15"	SW	

S-3615-E

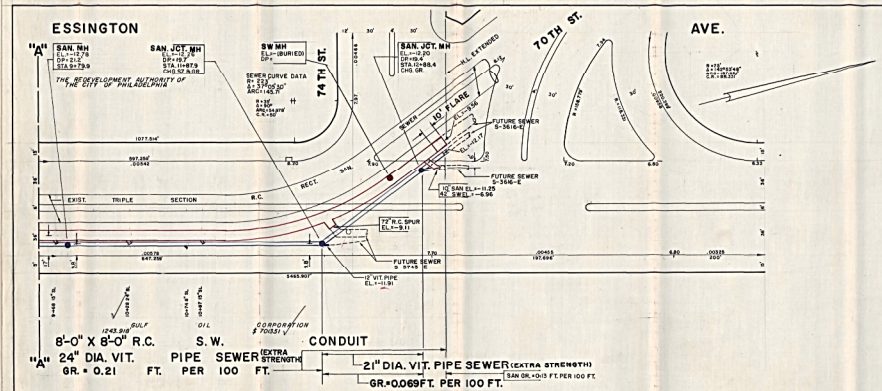
NOTE: SEWER ASSESSMENTS PAID CITY BY REDEVELOPMENT AUTHORITY ($28,151.02) AS PER CHECK No. 27147 DATED (5-14-1973) DEPT. COLLECTIONS RECEIPT No. 33-011432- (5-21-1973)

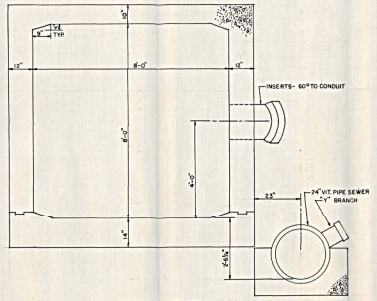
312664
PWD

REV	DATE	REMARKS

APPROVED
Clemens J. Kasperowicz
3-16-73

R-410-S





TYPICAL SECTION
8'-0"X8'-0" R.C. STORMWATER CONDUIT
SCALE 3/4"=1'-0"

SUMMARY

ITEM	QUANTITY		DESCRIPTION
1A	3687.28	CU. YDS.	EXCAVATION INCL.LTR. 4-20-67 & 6-26-67
1B	2627.50	CU. YDS.	EXCAVATION INCL. LTR. 2-21-67 & 6-26-67
2	2736.20	LIN. FT.	8'X8' R.C. SW CONDUIT INCL.LTR. 5-19-67
3	6.0	LIN.FT.	42" R.C. PIPE
4	9.0	LIN. FT.	10" V.C. PIPE IN CONCRETE
5A	2598.08	LIN. FT.	24" V.C. PIPE-EXTRA STRENGTH
5B	123.25	LIN. FT.	21" V.C. PIPE-EXTRA STRENGTH
5C	10.0	LIN. FT.	10" V.C. PIPE-EXTRA STRENGTH
6	1188.70	LIN.FT.	24" V.C. PIPE-STD. STRENGTH
7	15.0	LIN. FT.	18" V.C. PIPE-INLET CONNECTIONS
8	7		3' DIA. BRICK MANHOLES
9	13		SPEC. 4' BR. OR R.C. MANHOLES-SQUARE
10	1		SPEC. JCT MANHOLE-4' SQUARE
11A	6		4' DIA BRICK MANHOLES
11B	1		JUNCTION MANHOLE
12	100 %	COMPLETE	CONNECT 24" V.C. PIPE TO EXIST. MH
13	34.17	CU.YDS	15-1 CONCRETE INCL. LTR. 4-20-67 & 5-19-67
14	100 %	COMPLETE	CONSTRUCTION OF OUTLET WALL
15	5432.77	CU. YDS.	BROKEN STONE INCL. LTR. 3-20-67 & 4-20-67 & 5-19-67
16	261.21	SQ. YDS	STONE RIP-RAP INCL. LTR. 6-26-67
17	452.71	CU. YDS.	10" CONCRETE PAVING BASE (STATE)
18	524.40	LIN. FT.	CONCRETE MEDIAN
20B	668.88	SQ.YDS.	ASPHALT PAVING
21	100 %	COMPLETE	MAINTENANCE OF TRAFFIC
	402.58	CU.YDS	1" (1-2 SURFACE COURSE) & 7" BITUMINOUS CONCRETE COMP.I 9-1-66

CONTINGENT ITEMS

2A	14.366	MBM	SHEATHING & SHORING LTR 11-10-66
2B	20448.0	LBS	STEEL "H" BEAMS LTR 11-10-66
19	200.0	LIN.FT.	5" V.C. PIPE SUB DRAIN LTR 11-10-66, 1-19-67, 2-21-67 & 3-22-67
24	2165.0	LIN.FT.	12" SUB DRAINS LTR 12-15-66, 3-22-67, 4-20-67 & 5-19-67
4B	259.30	TONS	BASE LEVELING ASPHALTIC BINDER LTR. 11-16-66, 4-20-67, 5-19-67, 6-26-67 & 7-28-67, 12-15-66
	2424.0	LIN.FT.	8" V.C. SUB DRAIN LTR 1-18-67 & 3-22-67

TOTAL ASSESSMENT $ 19,405.11

NOTE-
ALL LOCATIONS ARE IN U. S. STANDARD

SURVEY DRAFTING RETURN PLAN SHEET 4 OF 4

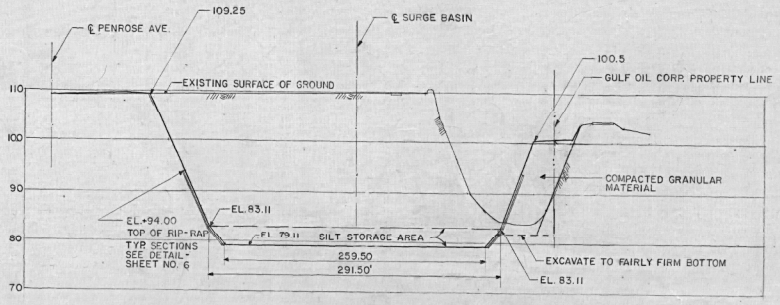
CONSTRUCTION OF SEWER IN ESSINGTON AVENUE FROM MINGO AVENUE TO 70 TH STREET

123039 PWD

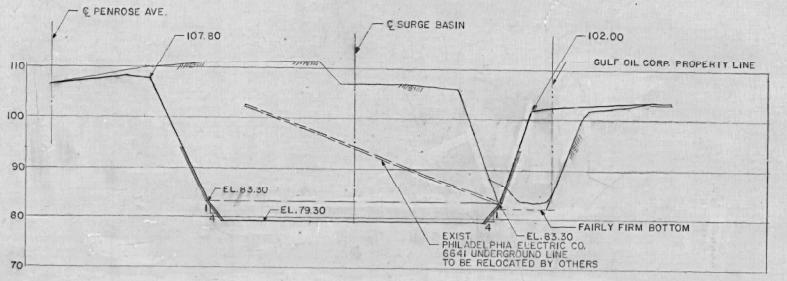
CITY OF PHILADELPHIA
WATER DEPARTMENT

CORRECT-
Walter G. Thomas
12-7-67.
CHIEF SURVEYOR

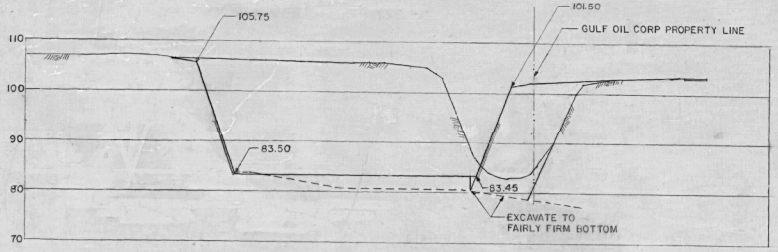
WORK NO	S-3637-E
CONTRACTOR	N.F. ACCHIONE
INSPECTOR	P. WORTMAN
DATE OF COMPLETION	AUGUST 30, 1967
SCALE	1" = 40'
FIELD BK NO	708
SURVEYED BY	RAY DOVELL
DRAWN BY	S. O. SCOTT JR.
CHECKED BY	R. J. KNOX
APPROVED BY	R. J. KNOX



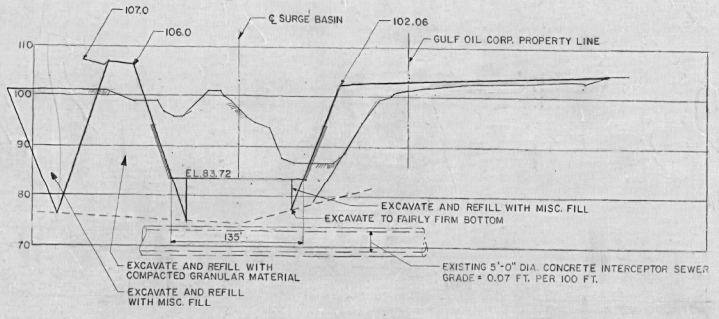
SECTION H-H
SCALE 1" = 50' HORIZ.
1" = 10' VERT.
℄ STA. 27+50



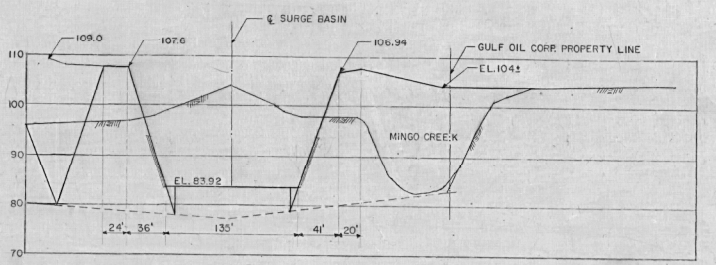
SECTION J-J
SCALE 1" = 50' HORIZ.
1" = 10' VERT.
℄ STA. 30+50



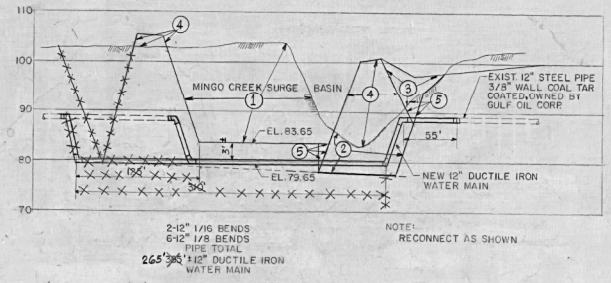
SECTION K-K
SCALE 1" = 50' HORIZ.
1" = 10' VERT.
℄ STA. 33+50



SECTION L-L
SCALE 1" = 50' HORIZ.
1" = 10' VERT.
℄ STA. 36+81



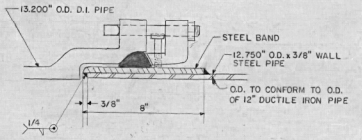
SECTION M-M
SCALE 1" = 50' HORIZ.
1" = 10' VERT.
℄ STA. 39+80



2-12" 1/16 BENDS
6-12" 1/8 BENDS
PIPE TOTAL
265'3⅝"±12" DUCTILE IRON WATER MAIN

NOTE:
RECONNECT AS SHOWN

SECTION AT 12" DIA. STEEL WATER MAIN
SCALE: 1" = 50' HORIZ.
1" = 10' VERT.
℄ STA. 35+65



TYPICAL DUCTILE IRON PIPE & STEEL PIPE CONNECTION DETAIL
NOT TO SCALE

NOTES: ELEVATIONS ARE BASED ON DATUM 100.00 FEET BELOW CITY OF PHILADELPHIA DATUM.
DISTANCES ARE IN US STD. MEASURE. 100.1968' US STD. EQUALS 100.0000' CITY OF PHILADELPHIA.
FOR ADDITIONAL NOTES, SEE SHEET NO. 1.

LEVISION block D

134443

MINGO CREEK SURGE BASIN
AND APPURTENANT WORK
CROSS SECTIONS

APPROVED _____
CHIEF, DESIGN BRANCH, ENGINEERING DIV.

CITY OF PHILADELPHIA
WATER DEPARTMENT

MS

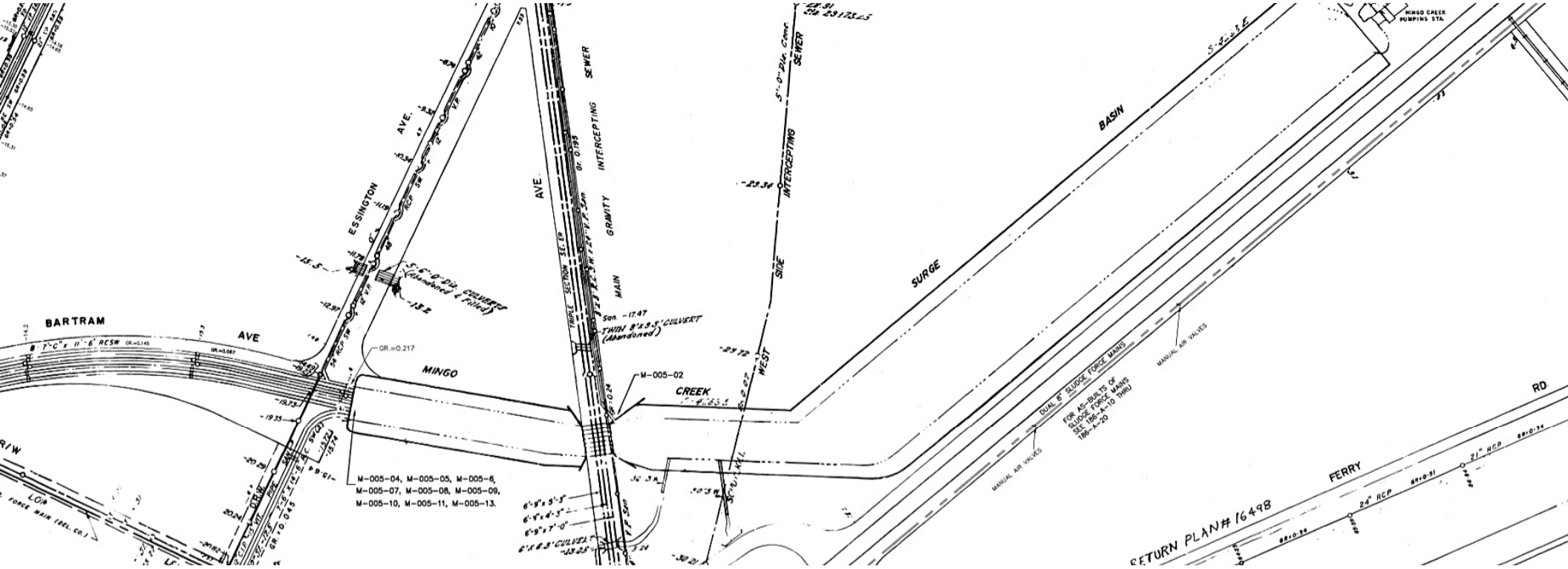
SCALE: AS NOTED

DRAWN BY	[illegible]	DATE 5/17/76
TRACED BY		DATE
CHECKED BY	J.H. MIRKIL	DATE 5-20-76
SUPERVISOR	Mario J. Siegel	5-10-76 DATE

WORK NO. S-4288-E
SHEET NO. 5 OF 16

FOR 24+80
SEE 26+25

242481


BARTRAM AVE
MINGO CREEK
ESSINGTON AVE.
AVE.
INTERCEPTING SEWER
GRAVITY MAIN
SIDE INTERCEPTING SEWER
WEST
SURGE BASIN
MINGO CREEK PUMPING STA.
FERRY RD.
RETURN PLAN# 16498
M-005-02
M-005-04, M-005-05, M-005-6, M-005-07, M-005-08, M-005-09, M-005-10, M-005-11, M-005-13.
DUAL 6" SLUDGE FORCE MAINS
FOR AS-BUILTS OF SLUDGE FORCE MAINS SEE 185-A-10 THRU 185-A-20
MANUAL AIR VALVES
MANUAL AIR VALVES
5'-0" Dia. Conc.
5'-6"x8'-0" CULVERT (Abandoned & Filled)
TWIN 8'x9'-5" CULVERT (abandoned)
24" RCP
21" RCP

11

Modified from NJDEP Indoor Air Building Survey and Sampling Form
[provided in NJDEP Vapor Intrusion Technical Guidance (Version 3.1) March 2013]

OUTDOOR AIR SURVEY and SAMPLING FORM

Preparer's name: Luke Mokrycki Date: 5-2-16

Preparer's affiliation: AQUATERRA Phone #: 610 431 5733

Site Name: Philly Refinery Case #: _____

Area and Description: AOI 9

Part I - Outside Contaminant Sources

Description of area and worker activities: Near blender unit

Stationary sources nearby (gas stations, emission stacks, etc.): blender pumps & piping

Heavy vehicular traffic nearby (or other mobile sources): N/A

Tanks or storage areas nearby: Tank 56, corrosion inhibitor tanks, various petro component tanks

Monitoring wells nearby: ~~NA~~ MW-1 SRTF

Part II – Outdoor Contaminant Sources

Identify all potential outdoor sources found around the working area, the location of the source, and whether the item was removed prior to outdoor air sampling event.

Potential Sources	Location(s)	Removed (Yes / No / NA)
Gasoline storage cans		
Gas-powered equipment		
Kerosene storage cans		
Paints / thinners / strippers		
Cleaning solvents		
Other house cleaning products		
Polishes / waxes		
Insecticides		

Potential Sources	Location(s)	Removed (Yes / No / NA)
Other:		
petrol products blending & pumping area	Vicinity of wells	N/A

Part III – Miscellaneous Items

Have any pesticides/herbicides been applied in the area? *Yes* / No

If so, when and which chemicals? _____

Has there ever been a fire in the area? *Yes / No* If yes, when? _____

Has painting or staining been done in the area in the last 6 months? *Yes* / NO

If yes, when _____ and where? _____

Part IV – Sampling Information

Sample Technician: Luke Mokrycki Phone number: (484) 832 - 7476

Sample Source: Outdoor Air / Sub-Slab / ~~Near Slab~~ Soil Gas / Exterior Soil Gas

Sampler Type: Tedlar bag / Sorbent / Stainless Steel Canister / Other (specify): _____

Analytical Method: TO-15 / TO-17 / other: _____ Cert. Laboratory: _____

Sample locations

Field ID # AOI 9-AA-16-002

Description of sample Location near MW-1 SRTF

Sample height 6'

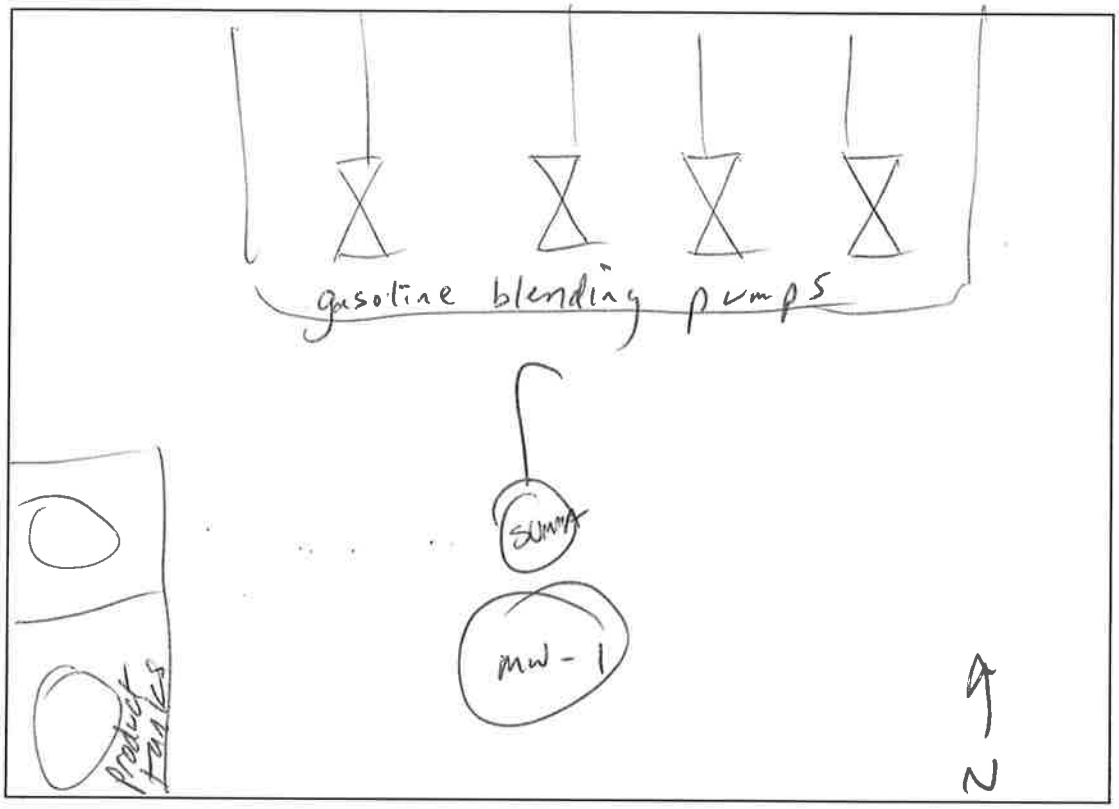
SUMA Canister Number 2060

Flow Control Number FC 0322

Starting Time and Pressure 0828 - 31 Hg 1030 - 26 Hg 1300 - 16 Hg 1600 - 5

Ending Time and Pressure - 5 Hg @ 1600

Provide Drawing of Sample Location(s)



Part V - Meteorological Conditions

Was there significant precipitation within 12 hours prior to (or during) the sampling event? *Yes / (No)*

Describe the general weather conditions: 48°F overcast ; light rain at times, winds 2-3 mph - SE

Part VI – General Observations

Provide any information that may be pertinent to the sampling event and may assist in the data interpretation process.

(NJDEP 1997; NHDES 1998; VDOH 1993; MassDEP 2002; NYSDOH 2005; CalEPA 2005)

OUTDOOR AIR SURVEY and SAMPLING FORM

Preparer's name: Luke Mokrycki Date: 5-2-16

Preparer's affiliation: AQUATERRA Phone #: 4848327476

Site Name: Philly Refinery Case #:

Area and Description: AOI 9

Part I - Outside Contaminant Sources

Description of area and worker activities: EMPTY FIELD ADJACENT TO TANKS

Stationary sources nearby (gas stations, emission stacks, etc.): N/A

Heavy vehicular traffic nearby (or other mobile sources): N/A

Tanks or storage areas nearby: 14 TK

Monitoring wells nearby: ~~NA~~ RW-A

Part II – Outdoor Contaminant Sources

Identify all potential outdoor sources found around the working area, the location of the source, and whether the item was removed prior to outdoor air sampling event.

Potential Sources	Location(s)	Removed (Yes / No / NA)
Gasoline storage cans		N/A
Gas-powered equipment		
Kerosene storage cans		
Paints / thinners / strippers		
Cleaning solvents		
Other house cleaning products		
Polishes / waxes		
Insecticides		

Potential Sources	Location(s)	Removed (Yes / No / NA)
Other:		N/A

Part III – Miscellaneous Items

Have any pesticides/herbicides been applied in the area? *Yes* / No

If so, when and which chemicals? _____

Has there ever been a fire in the area? *Yes* / *No* If yes, when? _____

Has painting or staining been done in the area in the last 6 months? *Yes* / *No*

If yes, when past week and where? 14 TK

Part IV – Sampling Information

Sample Technician: Luke Mokrycki Phone number: (484) 832 - 7476

Sample Source: (Outdoor Air) / Sub-Slab / Near Slab Soil Gas / Exterior Soil Gas

Sampler Type: Tedlar bag / Sorbent / (Stainless Steel Canister) / Other (specify): _____

Analytical Method: (TO-15) / TO-17 / other: _____ Cert. Laboratory: _____

Sample locations

Field ID # AOI 9-AA-16-003

Description of sample Location Summa deployed near RW-A manhole

Sample height 6'

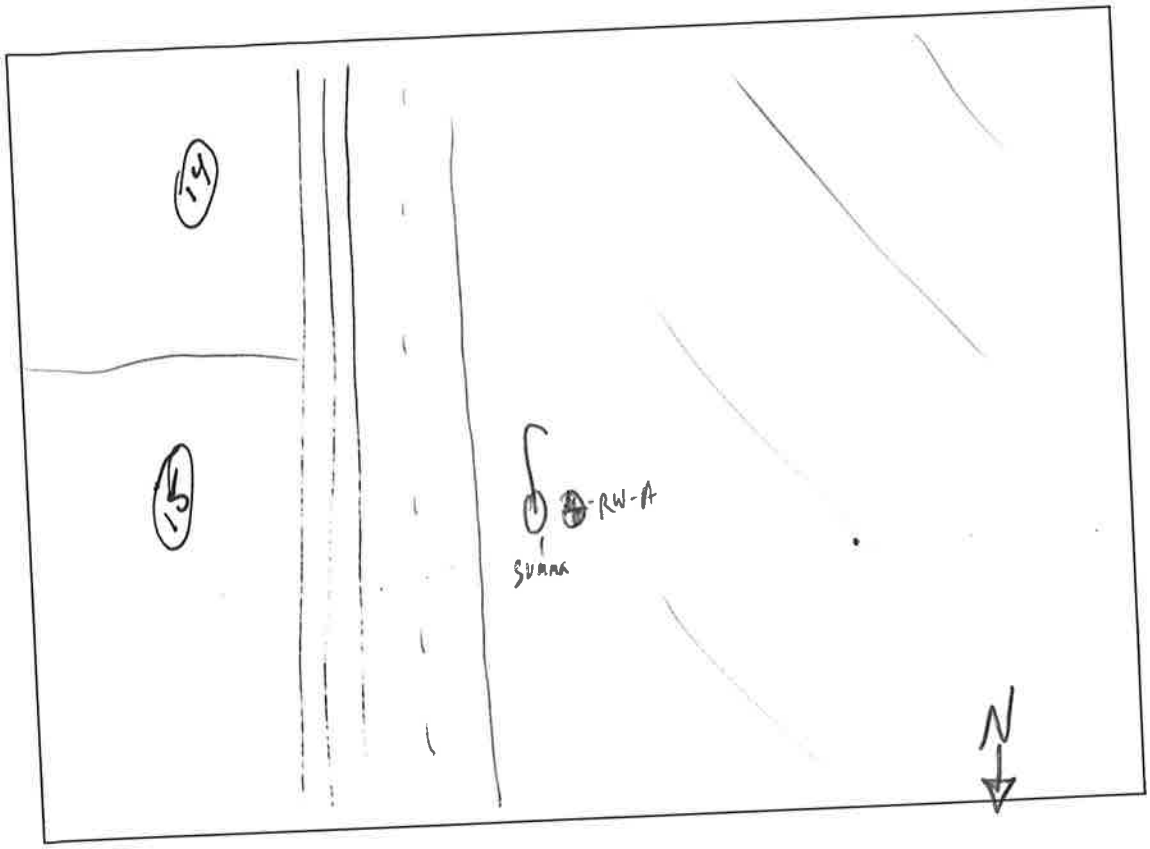
SUMA Canister Number can ID 2822 Batch 12417

Flow Control Number FC 0543

Starting Time and Pressure 0810 -32 Hg 0955 -25 Hg 1200 -18 Hg 1500 -[illegible]

Ending Time and Pressure 1630 -3Hg

Provide Drawing of Sample Location(s)



Part V - Meteorological Conditions

Was there significant precipitation within 12 hours prior to (or during) the sampling event? *Yes / No*

Describe the general weather conditions: 48°F light rain scattered overcast 2-3 mph wind to SE

Part VI – General Observations

Provide any information that may be pertinent to the sampling event and may assist in the data interpretation process.

(NJDEP 1997; NHDES 1998; VDOH 1993; MassDEP 2002; NYSDOH 2005; CalEPA 2005)

OUTDOOR AIR SURVEY and SAMPLING FORM

Preparer's name: Luke Makuchi Date: 5-2-16

Preparer's affiliation: AQUATERRA Phone #: 610 4315733

Site Name: Philly Refinery Case #:

Area and Description: AOI 9

Part I - Outside Contaminant Sources

Description of area and worker activities: Near flare (active) LPG racks

Stationary sources nearby (gas stations, emission stacks, etc.): flare, truck loading racks

Heavy vehicular traffic nearby (or other mobile sources): LPG tanker trucks, P/U truck traffic

Tanks or storage areas nearby: N/A

Monitoring wells nearby: ~~NA~~ MW-74 SRTF

Part II – Outdoor Contaminant Sources

Identify all potential outdoor sources found around the working area, the location of the source, and whether the item was removed prior to outdoor air sampling event.

Potential Sources	Location(s)	Removed (Yes / No / NA)
Gasoline storage cans		
Gas-powered equipment	generators/compressors near flare 30 yd west	
Kerosene storage cans		NO
Paints / thinners / strippers		
Cleaning solvents		
Other house cleaning products		
Polishes / waxes		
Insecticides		

Potential Sources	Location(s)	Removed (Yes / No / NA)
Other:		
active LPG truck rack	50 yd SE	NO
active flare	30 yd west	NO

Part III – Miscellaneous Items

Have any pesticides/herbicides been applied in the area? *Yes* / No

If so, when and which chemicals? _____

Has there ever been a fire in the area? *Yes / No* If yes, when? _____

Has painting or staining been done in the area in the last 6 months? *Yes / No*

If yes, when _____ and where? _____

Part IV – Sampling Information

Sample Technician: Luke Mokycki Phone number: (484) 832-7476

Sample Source: (Outdoor Air) / Sub-Slab / Near Slab Soil Gas / Exterior Soil Gas

Sampler Type: Tedlar bag / Sorbent / (Stainless Steel Canister) / Other (specify): _____

Analytical Method: (TO-15) / TO-17 / other: _____ Cert. Laboratory: _____

Sample locations

Field ID # AOE 9-AA-16-004

Description of sample Location deployed next to S-74 SRTF

Sample height 6'

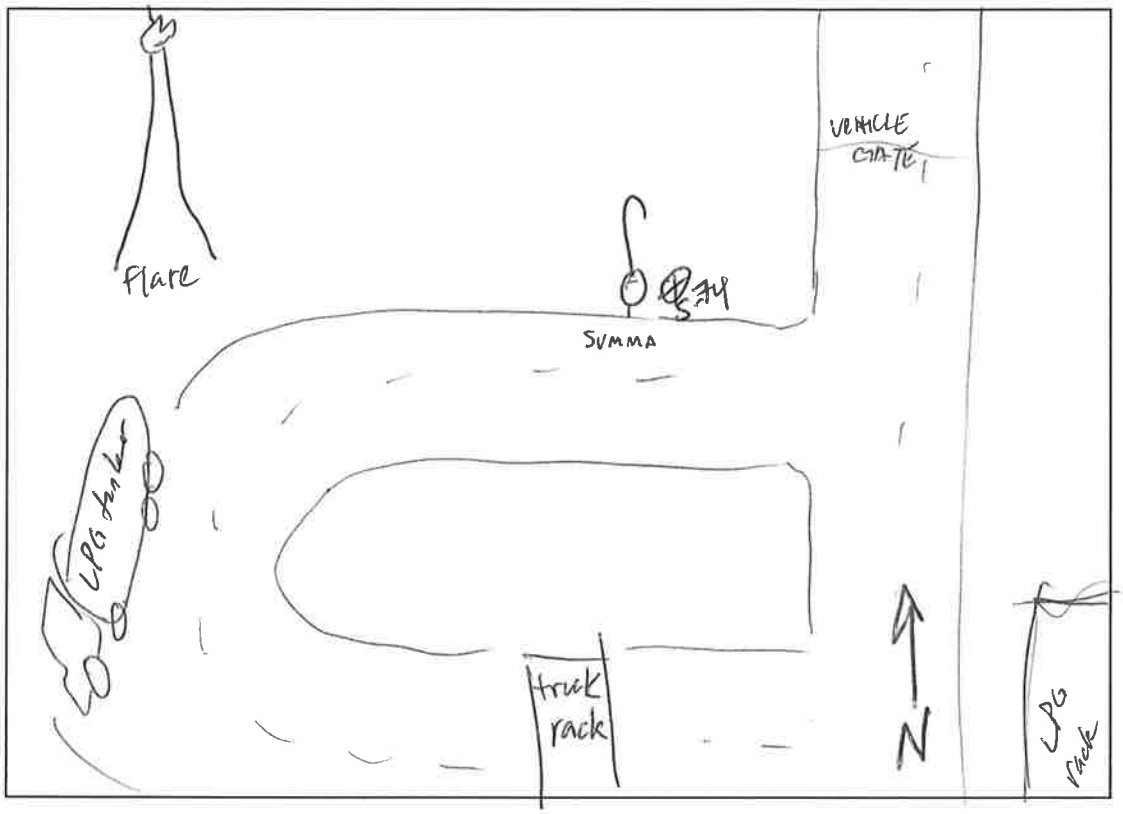
SUMA Canister Number 1069

Flow Control Number FC0307

Starting Time and Pressure 0850 -30 Hg 1100 -24 Hg 1350 -12 Hg 1615-4H

Ending Time and Pressure 1700 - 3Hg

Provide Drawing of Sample Location(s)



Part V - Meteorological Conditions

Was there significant precipitation within 12 hours prior to (or during) the sampling event? *Yes / (No)*

Describe the general weather conditions: 48°F overcast passing light rain
winds SE 2-3 mph

Part VI – General Observations

Provide any information that may be pertinent to the sampling event and may assist in the data interpretation process.

(NJDEP 1997; NHDES 1998; VDOH 1993; MassDEP 2002; NYSDOH 2005; CalEPA 2005)

Modified from NJDEP Indoor Air Building Survey and Sampling Form
[provided in NJDEP Vapor Intrusion Technical Guidance (Version 3.1) March 2013]

OUTDOOR AIR SURVEY and SAMPLING FORM

Preparer's name: Luke Mokycki Date: 5-2-16

Preparer's affiliation: AQUA TERRA Phone #: 610 431 5733

Site Name: Philly Refinery Case #:

Area and Description: AOI 9

Part I - Outside Contaminant Sources

Description of area and worker activities: Near blender

Stationary sources nearby (gas stations, emission stacks, etc.): blender pumps

Heavy vehicular traffic nearby (or other mobile sources):

Tanks or storage areas nearby: 56 tk, corrosion inhibitor tanks, Future Component tks

Monitoring wells nearby: ~~NA~~ WPB-5

Part II – Outdoor Contaminant Sources

Identify all potential outdoor sources found around the working area, the location of the source, and whether the item was removed prior to outdoor air sampling event.

Potential Sources	Location(s)	Removed (Yes / No / NA)
Gasoline storage cans		
Gas-powered equipment		
Kerosene storage cans		
Paints / thinners / strippers		
Cleaning solvents		
Other house cleaning products		
Polishes / waxes		
Insecticides		

Potential Sources	Location(s)	Removed (Yes / No / NA)
Other:		
gasoline & petrol product tanks / & blending pumps and equipment	In vicinity of WPB-5?	NO

Part III – Miscellaneous Items

Have any pesticides/herbicides been applied in the area? *Yes* / No

If so, when and which chemicals? _____

Has there ever been a fire in the area? *Yes / No* If yes, when? _____

Has painting or staining been done in the area in the last 6 months? *Yes / No*

If yes, when _____ and where? _____

Part IV – Sampling Information

Sample Technician: Luke Mokrycki Phone number: (484) 832-7476

Sample Source: Outdoor Air / Sub-Slab / Near Slab Soil Gas / Exterior Soil Gas

Sampler Type: Tedlar bag / Sorbent / Stainless Steel Canister / Other (specify): _____

Analytical Method: TO-15 / TO-17 / other: _____ Cert. Laboratory: _____

Sample locations

Field ID # AOT 9-AA-16-005

Description of sample Location deployed on location of WPB-5

Sample height 6'

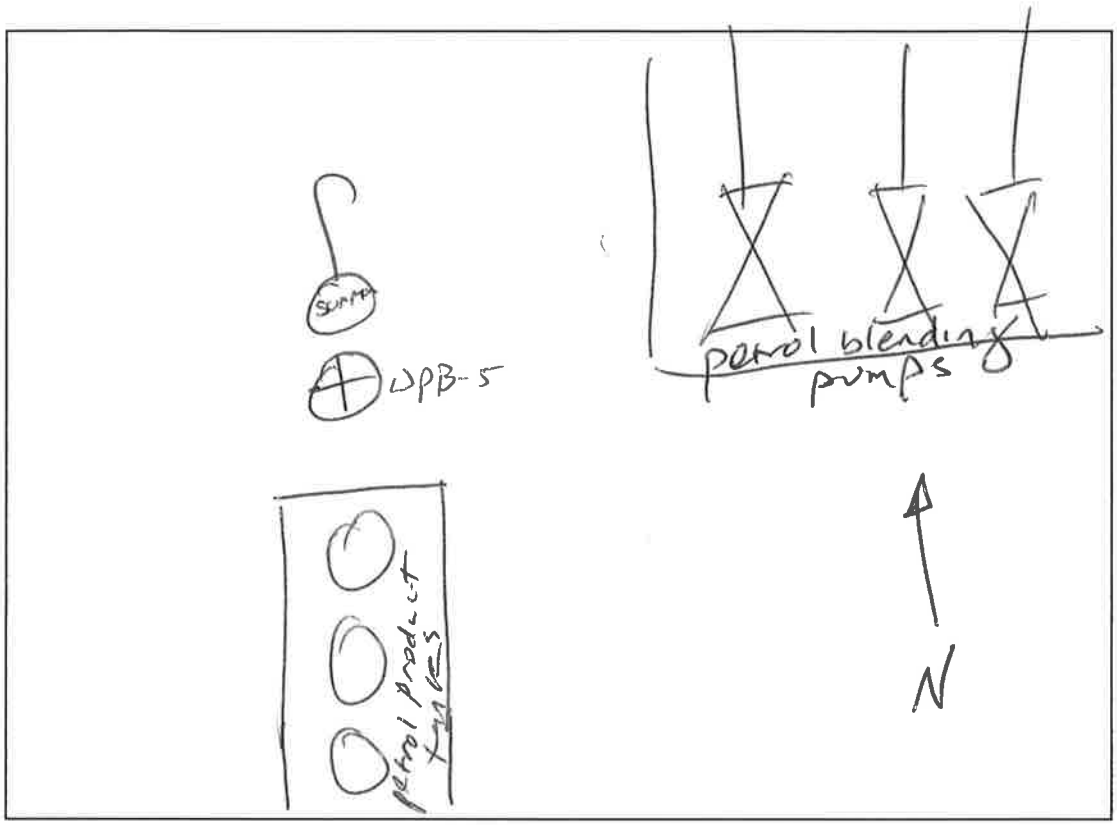
SUMA Canister Number 2092

Flow Control Number ~~FC0090~~ FC00210

Starting Time and Pressure 0830 -31 Hg 1035 -26 Hg 1300 -16 Hg 1600 -6Hg

Ending Time and Pressure 1635 -4Hg

Provide Drawing of Sample Location(s)



Part V - Meteorological Conditions

Was there significant precipitation within 12 hours prior to (or during) the sampling event? *Yes / No*

Describe the general weather conditions: 78°F overcast passing light rain w/ ~~strong~~ winds 2-3 mph — SE

Part VI – General Observations

Provide any information that may be pertinent to the sampling event and may assist in the data interpretation process.

(NJDEP 1997; NHDES 1998; VDOH 1993; MassDEP 2002; NYSDOH 2005; CalEPA 2005)

Air Sampling Locations and Field Conditions
October 2012
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

AOI	Sample No.	Location/Description	Sample Date	Start Time	Temperature (degrees F) at Start	Barometric Pressure (inHg) at Start	Weather Conditions at Start	End Time	Temperature (degrees F) at End	Barometric Pressure (inHg) at End	Weather Conditions at End	Sample Duration (hr:min)	Canister ID	Regulator ID	Pre-Sample Pressure, (PSI)	Post-Sample Pressure, (PSI)
AOI 5	1	B&S Office	10/24/2012	10:35	60.8	30.14	Haze, no precipitation, wind 5.8 to 9.2 mph	14:35	71.6	30.08	Partly Cloudy, no precipitation, wind 4.6 to 6.9 mph	4:00	AC01003	FCA00317	29.5	8.0
AOI 5	2	B&S Office (outside)	10/24/2012	10:37	60.8	30.14	Haze, no precipitation, wind 5.8 to 9.2 mph	14:39	71.6	30.08	Partly Cloudy, no precipitation, wind 4.6 to 6.9 mph	4:02	AC00760	FCA00595	29.5	13.0
AOI 6	3	24 Gate Building (1st floor)	10/24/2012	10:50	60.8	30.14	Haze, no precipitation, wind 5.8 to 9.2 mph	14:50	71.6	30.08	Partly Cloudy, no precipitation, wind 4.6 to 6.9 mph	4:00	AC01853	FCA00134	29.5	7.0
AOI 6	4	24 Gate Building (2nd floor)	10/24/2012	10:52	60.8	30.14	Haze, no precipitation, wind 5.8 to 9.2 mph	14:52	71.6	30.08	Partly Cloudy, no precipitation, wind 4.6 to 6.9 mph	4:00	AC01010	FCA00188	29.6	7.3
AOI 6	5	GP Training Building (1st floor vending area)	10/24/2012	11:07	63.0	30.14	Haze, no precipitation, wind 5.8 to 9.2 mph	15:07	72.0	30.08	Partly Cloudy, no precipitation, wind 4.6 to 6.9 mph	4:00	AC01928	FCA00161	29.5	9.0
AOI 6	6	GP Training Building (1st floor west)	10/24/2012	11:10	63.0	30.14	Haze, no precipitation, wind 5.8 to 9.2 mph	15:10	72.0	30.08	Partly Cloudy, no precipitation, wind 4.6 to 6.9 mph	4:00	AC01669	FCA00564	29.5	9.0
AOI 6	7	GP Training Building (3rd floor gym)	10/24/2012	11:12	63.0	30.14	Haze, no precipitation, wind 5.8 to 9.2 mph	15:13	72.0	30.08	Partly Cloudy, no precipitation, wind 4.6 to 6.9 mph	4:01	AC00641	FCA00023	29.5	6.5
AOI 6	8	GP Training Building (basement)	10/24/2012	11:16	63.0	30.14	Haze, no precipitation, wind 5.8 to 9.2 mph	15:16	72.0	30.08	Partly Cloudy, no precipitation, wind 4.6 to 6.9 mph	4:00	AC00747	FCA00604	29.5	7.5
AO 6	9	GP Main Office Building (basement west)	10/24/2012	12:26	64.0	30.13	Haze, no precipitation, wind 5.8 to 9.2 mph	16:26	73.0	30.07	Partly Cloudy, no precipitation, wind 4.6 to 6.9 mph	4:00	AC01113	FCA00575	29.5	7.0
AOI 6	10	GP Main Office Building (basement center)	10/24/2012	12:31	64.0	30.13	Haze, no precipitation, wind 5.8 to 9.2 mph	16:31	73.0	30.07	Partly Cloudy, no precipitation, wind 4.6 to 6.9 mph	4:00	AC01436	FCA00521	29.4	10.0
AOI 6	11	GP Main Office Building (basement east)	10/24/2012	12:33	64.0	30.13	Haze, no precipitation, wind 5.8 to 9.2 mph	16:33	73.0	30.07	Partly Cloudy, no precipitation, wind 4.6 to 6.9 mph	4:00	AC01376	FCA00349	29.4	8.0
AOI 6	12	GP Main Office Building (1st floor entrance)	10/24/2012	12:36	64.0	30.13	Haze, no precipitation, wind 5.8 to 9.2 mph	16:37	73.0	30.07	Partly Cloudy, no precipitation, wind 4.6 to 6.9 mph	4:01	AC00672	FCA00198	29.4	4.8
AOI 6	13	GP Main Office Building (1st floor west)	10/24/2012	12:40	64.0	30.13	Haze, no precipitation, wind 5.8 to 9.2 mph	16:40	73.0	30.07	Partly Cloudy, no precipitation, wind 4.6 to 6.9 mph	4:00	AC01145	FCA00374	29.4	6.5
AOI 6	14	GP Main Office Building (2nd floor west)	10/24/2012	12:44	64.0	30.13	Haze, no precipitation, wind 5.8 to 9.2 mph	16:44	73.0	30.07	Partly Cloudy, no precipitation, wind 4.6 to 6.9 mph	4:00	AC00782	FCA00298	29.6	0.0
AOI 6	15	GP Main Office Building (2nd floor east)	10/24/2012	12:48	64.0	30.13	Haze, no precipitation, wind 5.8 to 9.2 mph	16:48	73.0	30.07	Partly Cloudy, no precipitation, wind 4.6 to 6.9 mph	4:00	AC00475	FCA00402	29.5	3.5
AOI 6	16	GP Main Office Building (outside west)	10/24/2012	12:54	66.9	30.12	Haze, no precipitation, wind 5.8 to 9.2 mph	16:54	73.0	30.08	Partly Cloudy, no precipitation, wind 4.6 to 6.9 mph	4:00	AC01263	FCA00516	29.4	9.5
AOI 7	17	440 Building (2nd floor Room 221, inspection)	10/24/2012	13:10	66.9	30.12	Haze, no precipitation, wind 5.8 to 9.2 mph	17:10	73.0	30.08	Partly Cloudy, no precipitation, wind 4.6 to 6.9 mph	4:00	AC01215	FCA00365	29.5	8.0
AOI 7	18	440 Building (2nd floor meeting room)	10/24/2012	13:13	66.9	30.12	Haze, no precipitation, wind 5.8 to 9.2 mph	17:13	73.0	30.08	Partly Cloudy, no precipitation, wind 4.6 to 6.9 mph	4:00	AC01670	FCA00319	29.6	5.5
AOI 4	19	15 Pump House (inside)	10/24/2012	13:27	66.9	30.12	Haze, no precipitation, wind 5.8 to 9.2 mph	17:27	73.0	30.08	Partly Cloudy, no precipitation, wind 4.6 to 6.9 mph	4:00	AC01930	FCA00016	29.5	7.0
AOI 4	20	15 Pump House (under roof w/ pump equipment, approximately 8-10' below grade)	10/24/2012	13:30	66.9	30.12	Haze, no precipitation, wind 5.8 to 9.2 mph	17:30	73.0	30.08	Partly Cloudy, no precipitation, wind 4.6 to 6.9 mph	4:00	AC01420	FCA00397	29.5	6.3
AOI 4	21	15 Pump House (outside, at grade)	10/24/2012	13:35	66.9	30.12	Haze, no precipitation, wind 5.8 to 9.2 mph	17:35	73.0	30.08	Partly Cloudy, no precipitation, wind 4.6 to 6.9 mph	4:00	AC01464	FCA00034	29.5	3.0
AOI 8	22	North Yard Scale House (inside)	10/24/2012	13:51	66.9	30.12	Haze, no precipitation, wind 5.8 to 9.2 mph	17:51	73.0	30.08	Partly Cloudy, no precipitation, wind 4.6 to 6.9 mph	4:00	AC00590	FCA00168	29.8	7.8
AOI 8	23	North Yard Scale House (outside)	10/25/2012	8:17	59.0	30.23	Overcast, no precipitation, wind 5.8 to 6.9 mph	12:17	62.6	30.24	Overcast, no precipitation, wind 3.5 mph	4:00	AC01664	FCA00422	29.0	11.0
	24	"Trip blank," regulator attached, unopened	10/24/2012	---	---	---	---	---	---	---	---	---	AC01830	FCA00480	29.4	29.4
	25	"Trip blank," regulator attached, unopened	10/25/2012	---	---	---	---	---	---	---	---	---	AC01093	FCA00058	29.5	29.5
AOI 9	26	SRTF Propane Loading (inside)	10/25/2012	8:59	60.1	30.25	Overcast, no precipitation, wind 5.8 to 6.9 mph	12:59	63.0	30.24	Overcast, no precipitation, wind 3.5 mph	4:00	AC00540	FCA00482	29.3	8.5
AOI 9	27	SRTF Main Pump House (inside)	10/25/2012	9:07	60.1	30.25	Overcast, no precipitation, wind 5.8 to 6.9 mph	13:08	63.0	30.24	Overcast, no precipitation, wind 3.5 mph	4:01	AC01810	FCA00609	29.4	8.0
AOI 9	28	SRTF Main Pump House (outside)	10/25/2012	9:10	60.1	30.25	Overcast, no precipitation, wind 5.8 to 6.9 mph	13:10	63.0	30.24	Overcast, no precipitation, wind 3.5 mph	4:00	AC01350	FCA00454	29.5	5.0
AOI 2	29	PB Main Office Building, (safety office)	10/25/2012	8:23	60.8	30.24	Overcast, no precipitation, wind 5.8 to 6.9 mph	12:23	62.6	30.24	Overcast, no precipitation, wind 3.5 mph	4:00	AC00716	FCA00239	29.5	0.0
AOI 2	30	PB Main Office Building, (medical area)	10/25/2012	8:29	60.8	30.24	Overcast, no precipitation, wind 5.8 to 6.9 mph	12:29	62.6	30.24	Overcast, no precipitation, wind 3.5 mph	4:00	AC00501	FCA00015	29.5	6.0
AOI 2	31	PB Main Office Building, (1st floor lobby)	10/25/2012	8:34	60.8	30.24	Overcast, no precipitation, wind 5.8 to 6.9 mph	12:34	62.6	30.24	Overcast, no precipitation, wind 3.5 mph	4:00	AC00765	FCA00303	29.5	5.8
AOI 2	32	PB Main Office Building,(1st floor east wing)	10/25/2012	8:37	60.8	30.24	Overcast, no precipitation, wind 5.8 to 6.9 mph	12:37	62.6	30.24	Overcast, no precipitation, wind 3.5 mph	4:00	AC01403	FCA00432	29.5	10.0
AOI 2	33	PB Main Office Building, (1st floor west wing)	10/25/2012	8:41	60.8	30.24	Overcast, no precipitation, wind 5.8 to 6.9 mph	12:41	62.6	30.24	Overcast, no precipitation, wind 3.5 mph	4:00	AC01573	FCA00449	29.5	3.0
AOI 2	34	PB Main Office Building, (2nd floor west wing)	10/25/2012	8:44	60.8	30.24	Overcast, no precipitation, wind 5.8 to 6.9 mph	12:44	62.6	30.24	Overcast, no precipitation, wind 3.5 mph	4:00	AC00947	FCA00632	29.5	5.0
AOI 2	35	PB Main Office Building, (2nd floor center file room)	10/25/2012	8:48	60.8	30.24	Overcast, no precipitation, wind 5.8 to 6.9 mph	12:48	62.6	30.24	Overcast, no precipitation, wind 3.5 mph	4:00	AC00033	FCA00473	29.5	4.0
AOI 2	36	PB Main Office Building, (2nd floor east conference room)	10/25/2012	8:51	60.8	30.24	Overcast, no precipitation, wind 5.8 to 6.9 mph	12:51	62.6	30.24	Overcast, no precipitation, wind 3.5 mph	4:00	AC01790	FCA00538	29.5	3.5
AOI 2	37	PB Lab (west lab)	10/25/2012	9:00	60.1	30.25	Overcast, no precipitation, wind 5.8 to 6.9 mph	13:00	63.0	30.24	Overcast, no precipitation, wind 3.5 mph	4:00	AC01886	FCA00274	29.5	5.0
AOI 2	38	PB Lab (2nd floor office)	10/25/2012	9:08	60.1	30.25	Overcast, no precipitation, wind 5.8 to 6.9 mph	13:08	63.0	30.24	Overcast, no precipitation, wind 3.5 mph	4:00	AC01487	FCA00418	29.5	4.5
AOI 2	39	PB Refinery Hall (2nd floor conference room)	10/25/2012	9:40	60.1	30.25	Overcast, no precipitation, wind 5.8 to 6.9 mph	13:40	63.0	30.24	Overcast, no precipitation, wind 3.5 mph	4:00	AC01115	FCA00563	29.6	6.5
AOI 2	40	PB Refinery Hall (2nd floor east wing)	10/25/2012	9:43	60.1	30.25	Overcast, no precipitation, wind 5.8 to 6.9 mph	13:43	63.0	30.24	Overcast, no precipitation, wind 3.5 mph	4:00	AC01243	FCA00603	29.4	2.0
AOI 2	41	PB Maintenance Shop (break room)	10/25/2012	9:51	60.1	30.25	Overcast, no precipitation, wind 5.8 to 6.9 mph	13:51	63.0	30.24	Overcast, no precipitation, wind 3.5 mph	4:00	AC01218	FCA00405	29.6	9.0
AOI 2	42	PB Maintenance Shop (office)	10/25/2012	9:55	61.0	30.25	Overcast, no precipitation, wind 5.8 to 6.9 mph	13:55	64.0	30.23	Overcast, no precipitation, wind 3.5 mph	4:00	AC01179	FCA00040	29.6	4.8
AOI 2	43	PB buildings (adjacent gate area)	10/25/2012	10:00	61.0	30.25	Overcast, no precipitation, wind 5.8 to 6.9 mph	14:00	64.0	30.23	Overcast, no precipitation, wind 3.5 mph	4:00	AC00870	FCA00215	29.5	6.0
	44	"Trip blank," regulator attached, unopened	10/25/2012	---	---	---	---	---	---	---	---	---	AC00993	FCA00619	29.5	29.5

Notes:

AOI = Area of Inerest
F = Fahrenheit
inHg = inches of merucry
PSI = pounds per square inch
mph = miles per hour

Stantec

Indoor Air Sampling Field Data Sheet
(Form SP-28)

A) General Information

Sample Identification Number: IA-AOI9-SR2
Site Address: 3144 W. Passyunk, Phila, PA
Sample Canister Location: SR2 Corner Office

Sample Date: 4.5.16 Sampler: Rich Burns
Sample Time: Start: 0809 Stop: 1609
Shipping Date: 3.31.16

Canister Type: 400 mL – 1.0 L Summa Canister/6 L Summa Canister/Other (specify):

Canister Serial No.: 1203
Flow Controller Serial No.: 710568

Were "Instructions to Occupants Building" followed?
☐ Yes ☐ No

B) Sampling Information

	Start		Stop	
	Ambient	Interior	Ambient	Interior
Temperature	~32°F	59	~34°F	60
Barometric Pressure	30.46			

	Start	Stop
Canister Pressure Gauge Reading:	-30	-8
Time:	0809	1609
PID Reading:		
Basement Depth (ft below grade):	—	
Window Marked:	Yes/No	

Was there significant precipitation (e.g., >1/2-inch rain) within 24 hours prior to (or during) the sampling event?
☐ Yes ☐ No

Describe the general weather conditions:
Cold, ~32°F, overcast, Snow flurries

Indoor Air Sampling Field Data Sheet
(Form SP-28)

A) General Information

Sample Identification Number: IA-AOI9-010000R

Site Address: 3144 W. Passyunk Ave, Phila, PA

Sample Canister Location: _____

Sample Date: 4.5.16 Sampler: Rica Burns

Sample Time: Start: 0823 Stop: _____

Shipping Date: _____

Canister Type: 400 mL – 1.0 L Summa Canister/6 L Summa Canister/Other (specify):

_____

Canister Serial No.: 1285

Flow Controller Serial No.: _____

Were "Instructions to Occupants Building" followed?
☐ Yes ☐ No

B) Sampling Information

	Start		Stop	
	Ambient	Interior	Ambient	Interior
Temperature	~32°F	—	~34°F	—
Barometric Pressure	_____		_____	

	Start	Stop
Canister Pressure Gauge Reading:	-30	0
Time:	0823	_____
PID Reading:	_____	_____
Basement Depth (ft below grade):	—	
Window Marked:	Yes/No	

Was there significant precipitation (e.g., >1/2-inch rain) within 24 hours prior to (or during) the sampling event?
☐ Yes ☑ No

Describe the general weather conditions: Overcast, windy/gusty

Indoor Air Sampling Field Data Sheet
(Form SP-28)

A) General Information

Sample Identification Number: IA-AOI9-SR9
Site Address: 3144 W. Passyunk Ave, Phila, PA
Sample Canister Location: Loading Dock office SR9

Sample Date: 4.5.16 Sampler: Rich Burn
Sample Time: Start: 0843 Stop: 1615
Shipping Date: 3.31.16

Canister Type: 400 mL – 1.0 L Summa Canister/6 L Summa Canister/Other (specify):

Canister Serial No.: 1282
Flow Controller Serial No.: 252285

Were "Instructions to Occupants Building" followed?
❑ Yes ❑ No

B) Sampling Information

	Start		Stop	
	Ambient	Interior	Ambient	Interior
Temperature	~32°F	70°	~34°F	70°
Barometric Pressure	30.48			

	Start	Stop
Canister Pressure Gauge Reading:	-29	8
Time:	0843	1615
PID Reading:		
Basement Depth (ft below grade):	—	
Window Marked:	Yes/No	

Was there significant precipitation (e.g., >1/2-inch rain) within 24 hours prior to (or during) the sampling event?
❑ Yes ❑ No

Describe the general weather conditions:
Cold, ~32°F, partly cloudy, windy, gusty

Indoor Air Sampling Field Data Sheet
(Form SP-28)

A) General Information

Sample Identification Number: IA-A019-SR9-Dup
Site Address: 3144 W. Passyunk Ave Phila, PA
Sample Canister Location: Loading Dock office SR9

Sample Date: 4-5-16 Sampler: Rich Burns
Sample Time: Start: 0843 Stop: 1615
Shipping Date: 3.31.16

Canister Type: 400 mL – 1.0 L Summa Canister/6 L Summa Canister/Other (specify):

Canister Serial No.: 1263
Flow Controller Serial No.: 336758

Were "Instructions to Occupants Building" followed?
☐ Yes ☐ No

B) Sampling Information

	Start		Stop	
	Ambient	Interior	Ambient	Interior
Temperature	~32°F	70°	~34°F	70°
Barometric Pressure				

	Start	Stop
Canister Pressure Gauge Reading:	-30	-6
Time:	0843	1615
PID Reading:		
Basement Depth (ft below grade):	—	
Window Marked:	Yes/No	

Was there significant precipitation (e.g., >1/2-inch rain) within 24 hours prior to (or during) the sampling event?
☐ Yes ☑ No

Describe the general weather conditions:
Overcast, partly cloudy, windy, gusty

'84-BB
'78-MB

PH

Item #5

New Jersey Department of Environmental Protection

INDOOR AIR BUILDING SURVEY and SAMPLING FORM

Preparer's name: V. Miller Date: 3/12/15

Preparer's affiliation: Langan Phone #: _____

Part I - Occupants

Building Address: Pump House - AOI 9

Property Contact: _____ Owner / Renter / other: _____

Contact's Phone: home ( )_____ work ( )_____ cell ( )_____

# of Building occupants: Children under age 13 0 Children age 13-18 0 Adults 3-5

Part II – Building Characteristics

Building type: residential / multi-family residential / office / strip mall / commercial / (industrial)

Describe building: office/pump house Year constructed: ~1950s

Sensitive population: day care / nursing home / hospital / school / other (specify): NA

Number of floors below grade: 1 (full basement / crawl space / slab on grade)

Number of floors at or above grade: 1

Depth of basement below grade surface: ~30 ft. Basement size: _____ ft²

Basement floor construction: (concrete) / dirt / floating / stone / other (specify): _____

Foundation walls: (poured concrete) / (cinder blocks) / stone / other (specify) cinder blocks above poured concrete

Basement sump present? (Yes) / No Sump pump? Yes / No Water in sump? Yes / No

Type of heating system (circle all that apply): 2→ one in motor room 1 in pump room

hot air circulation	hot air radiation	wood	(steam radiation)
(heat pump)	hot water radiation	kerosene heater	electric baseboard

other (specify): _____

Type of ventilation system (circle all that apply):

(central air conditioning)	mechanical fans	bathroom ventilation fans
individual air conditioning units	kitchen range hood fan	outside air intake

other (specify): _____

Type of fuel utilized (circle all that apply):

Natural gas / (electric) / fuel oil / wood / coal / solar / kerosene

Are the basement walls or floor sealed with waterproof paint or epoxy coatings? Yes / (No)

Is there a whole house fan? *Yes / (No)*

Septic system? *Yes / Yes (but not used) / (No)*

Irrigation/private well? *Yes / Yes (but not used) / (No)*

Type of ground cover outside of building: grass / concrete / (asphalt) / other (specify) _____

Existing subsurface depressurization (radon) system in place? *Yes / (No)* *active / passive*

Sub-slab vapor/moisture barrier in place? *Yes / (No)*
Type of barrier: _____

Part III - Outside Contaminant Sources

NJDEP contaminated site (1000-ft. radius): _____

Other stationary sources nearby (gas stations, emission stacks, etc.): _____

Heavy vehicular traffic nearby (or other mobile sources): _____

Part IV – Indoor Contaminant Sources

Identify all potential indoor sources found in the building (including attached garages), the location of the source (floor and room), and whether the item was removed from the building 48 hours prior to indoor air sampling event. Any ventilation implemented after removal of the items should be completed at least 24 hours prior to the commencement of the indoor air sampling event.

Potential Sources	Location(s)	Removed (Yes / No / NA)
Gasoline storage cans		
Gas-powered equipment		
Kerosene storage cans		
Paints / thinners / strippers		
Cleaning solvents	Laundary detergent ~10gal	N
~~Oven cleaners~~	general cleaning supplies <1gal	N
Carpet / upholstery cleaners		
Other house cleaning products		
Moth balls		
Polishes / waxes		
Insecticides		
Furniture / floor polish		
Nail polish / polish remover		
Hairspray		
Cologne / perfume		
Air fresheners		
Fuel tank (inside building)		NA
Wood stove or fireplace		NA
New furniture / upholstery		
New carpeting / flooring		NA
Hobbies - glues, paints, etc.		

PH

Part V – Miscellaneous Items

Do any occupants of the building smoke? *Yes* / (*No*) How often? _____

Last time someone smoked in the building? _____ hours / *days* *ago*

Does the building have an attached garage directly connected to living space? *Yes* / (*No*)

If so, is a car usually parked in the garage? *Yes* / *No*

Are gas-powered equipment or cans of gasoline/fuels stored in the garage? *Yes* / *No*

Do the occupants of the building have their clothes dry cleaned? *Yes* (*No*)

If yes, how often? weekly / monthly / 3-4 times a year

Do any of the occupants use solvents in work? (*Yes*) / *No*

If yes, what types of solvents are used? General cleaning supplies

If yes, are their clothes washed at work? (*Yes*) / *No* Washer dryer present

Have any pesticides/herbicides been applied around the building or in the yard? *Yes* / (*No*)

If so, when and which chemicals? _____

Has there ever been a fire in the building? *Yes* / (*No*) If yes, when? _____

Has painting or staining been done in the building in the last 6 months? (*Yes*) / *No*

If yes, when Fall 2014 → late November and where? _____
Paint, new floor, windows ceiling

Part VI – Sampling Information

Sample Technician: V. Miller Phone number: ( ) _____ - _____

Sample Source: (Indoor Air) / Sub-Slab / Near Slab Soil Gas / Ambient Air

Sampler Type: Stainless Steel Canister / Other (specify): SUMA

Analytical Method: LL TO-15 Certified Laboratory: PACE

Sample locations (floor, room):

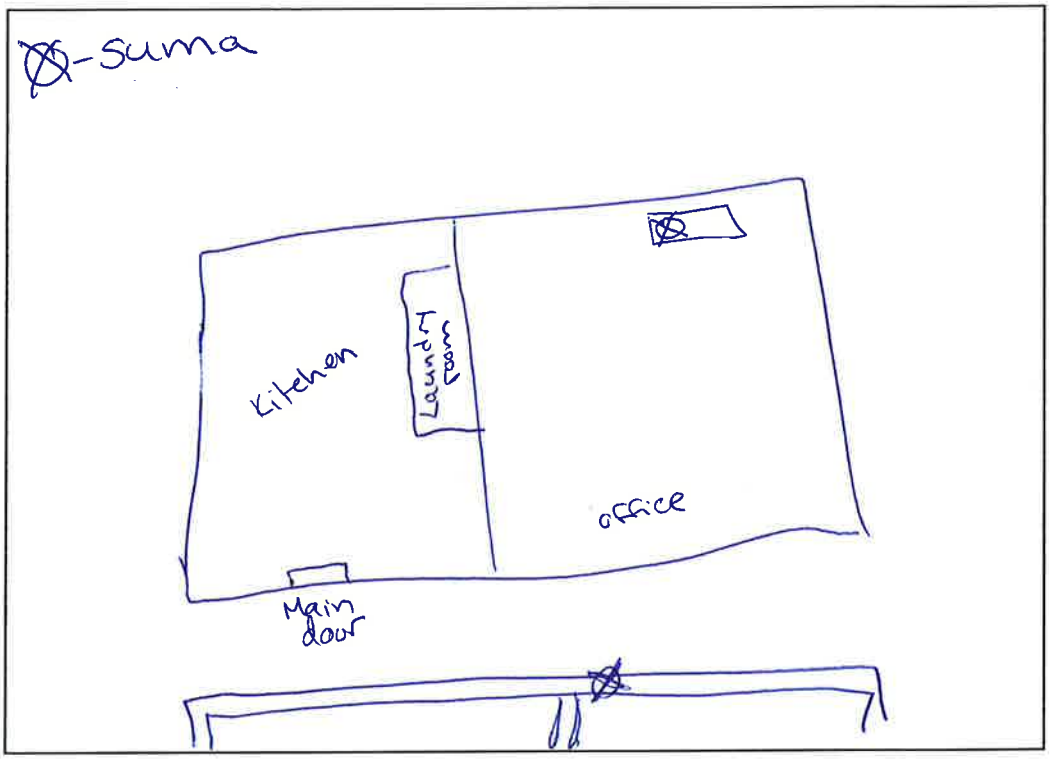
Field ID # PH-1-031215- 1st floor Field ID # _____ - _____

Field ID # PH-BG-031215 - Ambient Field ID # _____ - _____

Were "Instructions for Occupants" followed? *Yes* / *No*

If not, describe modifications: _____

Provide Drawing of Sample Location(s) in and outside Building



Part VII - Meteorological Conditions

Was there significant precipitation within 12 hours prior to (or during) the sampling event? *Yes* / (No)

Describe the general weather conditions: Sunny ~50°F. Recent snow melt. Windy

Part VIII – General Observations

Provide any information that may be pertinent to the sampling event and may assist in the data interpretation process.

PH
Basement

Item #5

New Jersey Department of Environmental Protection

INDOOR AIR BUILDING SURVEY
and SAMPLING FORM

Preparer's name: V. Miller Date: 3/12/15

Preparer's affiliation: Langan Phone #: _____

Part I - Occupants

Building Address: Pump House - AOI9

Property Contact: _____ Owner / Renter / other: _____

Contact's Phone: home ( )_____ work ( )_____ cell ( )_____

# of Building occupants: Children under age 13 _____ Children age 13-18 _____ Adults ~~_____~~ NA

Part II – Building Characteristics

Building type: residential / multi-family residential / office / strip mall / commercial / industrial

Describe building: Basement → Engine room pump room Year constructed: _____

Sensitive population: day care / nursing home / hospital / school / other (specify): N/A

Number of floors below grade: 1 (full basement / crawl space / slab on grade)

Number of floors at or above grade: 1

Depth of basement below grade surface: _____ ft. Basement size: _____ ft^2

Basement floor construction: concrete / dirt / floating / stone / other (specify): _____

Foundation walls: ~~poured concrete~~ / cinder blocks / stone / other (specify) Cinder block over concrete

Basement sump present? *Yes* / *No* Sump pump? *Yes* / *No* Water in sump? *Yes* / *No* → floor drains

one in each room

Type of heating system (circle all that apply):

hot air circulation	hot air radiation	wood	~~steam radiation~~
~~heat pump~~	hot water radiation	kerosene heater	electric baseboard
other (specify): _____			

Type of ventilation system (~~circle all~~ that apply):

~~central air conditioning~~	mechanical fans	bathroom ventilation fans
individual air conditioning units	kitchen range hood fan	outside air intake
other (specify): _____		

Type of fuel utilized (circle all that apply):

Natural gas / electric / fuel oil / wood / coal / solar / kerosene

Are the basement walls or floor sealed with waterproof paint or epoxy coatings? *Yes* / *No*

Some cracks present. Staining in areas of floor evidence of spills (adsorbent on floor

Is there a whole house fan? *Yes / (No)*

Septic system? *Yes / Yes (but not used) / (No)*

Irrigation/private well? *Yes / Yes (but not used) / (No)*

Type of ground cover outside of building: grass / concrete / asphalt / other (specify) _____

Existing subsurface depressurization (radon) system in place? *Yes / No* *active / passive*

Sub-slab vapor/moisture barrier in place? *Yes / (No)*
Type of barrier: _____

Part III - Outside Contaminant Sources

NJDEP contaminated site (1000-ft. radius): _____

Other stationary sources nearby (gas stations, emission stacks, etc.): _____

Heavy vehicular traffic nearby (or other mobile sources): _____

Part IV – Indoor Contaminant Sources

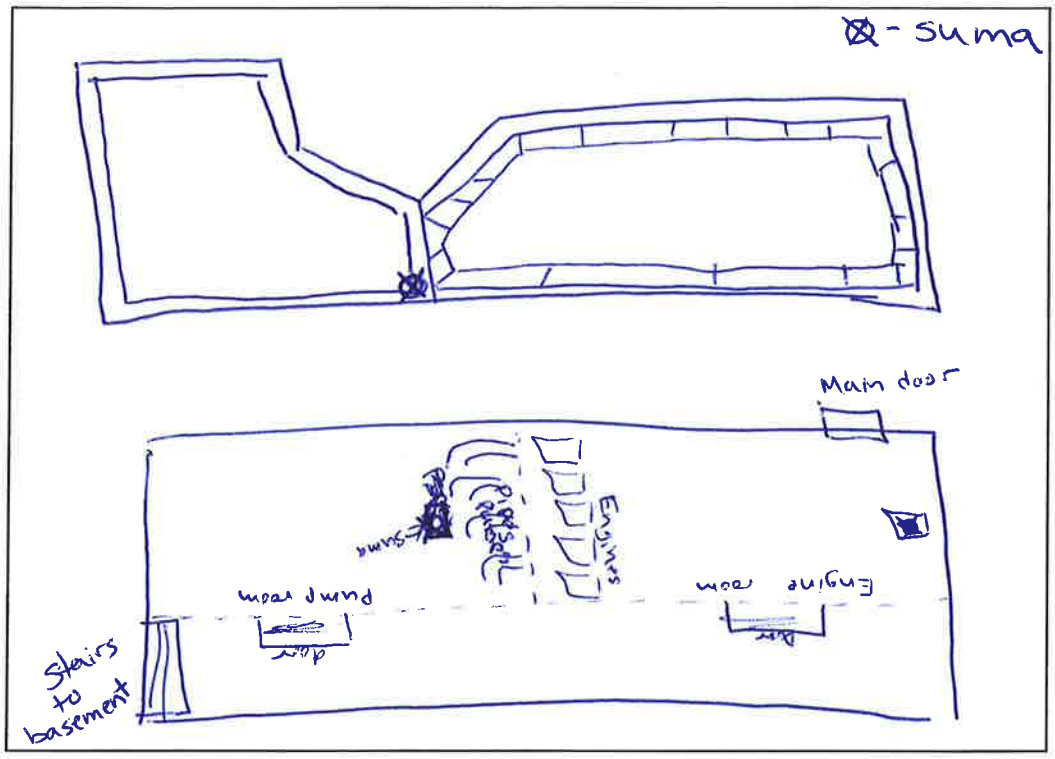
Identify all potential indoor sources found in the building (including attached garages), the location of the source (floor and room), and whether the item was removed from the building 48 hours prior to indoor air sampling event. Any ventilation implemented after removal of the items should be completed at least 24 hours prior to the commencement of the indoor air sampling event.

Potential Sources	Location(s) (may be TURBO oil?)	Removed (Yes / No / NA)	
Gasoline storage cans	3 - lubricant(?) cans <2 gal	N	Engine room
Gas-powered equipment	7 - engines / turbines / motors	N	
~~Kerosene storage cans~~ Oil	5gal bucket TURBO gas turbine oil (~3gal)	N	
Paints / thinners / strippers			
Cleaning solvents			
Oven cleaners			
Carpet / upholstery cleaners			
Other house cleaning products			
Moth balls			
Polishes / waxes			
Insecticides			
Furniture / floor polish			
Nail polish / polish remover			
Hairspray			
Cologne / perfume			
Air fresheners	1 spray can deodorizer	N	→ Pump room
Fuel tank (inside building)		NA	
Wood stove or fireplace		NA	
New furniture / upholstery			
New carpeting / flooring		NA	
Hobbies - glues, paints, etc.			

Pump room
TURBO gas turbine oil - 5gal bucket (~3gal Full) N
1 <1gal storage can (turbine oil?) N
unlabeled storage ~6 gal. waste oil? N
1 Container (<5gal) ~~TCE~~ TPE Solvent N

PH Basement

Provide Drawing of Sample Location(s) in and outside Building — Basement View



Part VII - Meteorological Conditions

Was there significant precipitation within 12 hours prior to (or during) the sampling event? *Yes* / *No*

Describe the general weather conditions: Sunny 150° F. Recent Snow melt. Windy

Part VIII – General Observations

Provide any information that may be pertinent to the sampling event and may assist in the data interpretation process.

Part V – Miscellaneous Items

Do any occupants of the building smoke? *Yes* / (*No*) How often? _____

Last time someone smoked in the building? _____ hours / *days* *ago*

Does the building have an attached garage directly connected to living space? *Yes* / (*No*)

If so, is a car usually parked in the garage? *Yes / No*

Are gas-powered equipment or cans of gasoline/fuels stored in the garage? *Yes / No*

Do the occupants of the building have their clothes dry cleaned? *Yes* / (*No*)

If yes, how often? weekly / monthly / 3-4 times a year

Do any of the occupants use solvents in work? (*Yes*) / ~~(*No*)~~ VM

If yes, what types of solvents are used? general cleaning only. maintenance occasionally may use solvent for parts cleaning.

If yes, are their clothes washed at work? *Yes / No*

Have any pesticides/herbicides been applied around the building or in the yard? *Yes* / (*No*)

If so, when and which chemicals? _____

Has there ever been a fire in the building? *Yes* / (*No*) If yes, when? _____

Has painting or staining been done in the building in the last 6 months? *Yes* / (*No*)

If yes, when _____ and where? Not in basement

Part VI – Sampling Information

Sample Technician: V. Miller Phone number: ( ) _____ - _____

Sample Source: (Indoor Air) / Sub-Slab / Near Slab Soil Gas / Ambient Air

Sampler Type: Stainless Steel Canister / Other (specify): SUMA

Analytical Method: LL TO-15 Certified Laboratory: PACE

Sample locations (floor, room):

Field ID # PH-2-031215 : pump room Field ID # _____ - _____

Field ID # PH-3-031215: engine room Field ID # _____ - _____

Were "Instructions for Occupants" followed? *Yes / No*

If not, describe modifications: _____

MB

Item #5

New Jersey Department of Environmental Protection

INDOOR AIR BUILDING SURVEY and SAMPLING FORM

Preparer's name: V. Miller Date: 3/12/15

Preparer's affiliation: Langan Phone #: _____

Part I - Occupants

Building Address: Maintenance Building - AOI 9

Property Contact: _____ Owner / Renter / other: _____

Contact's Phone: home ( )_____ work ( )_____ cell ( )_____

# of Building occupants: Children under age 13 _____ Children age 13-18 _____ Adults 1-4

Part II – Building Characteristics

Building type: residential / multi-family residential / (office) / strip mall / commercial / industrial

Describe building: office / maintenance Year constructed: ~1978

Sensitive population: day care / nursing home / hospital / school / other (specify): NA

Number of floors below grade: NA (full basement / crawl space / slab on grade)

Number of floors at or above grade: 1

Depth of basement below grade surface: NA ft. Basement size: _____ ft^2

Basement floor construction: concrete / dirt / floating / stone / other (specify): N/A

Foundation walls: poured concrete / (cinder blocks) / stone / other (specify) _____

Basement sump present? *Yes* / (*No*) Sump pump? *Yes* / (*No*) Water in sump? *Yes* / (*No*)

Type of heating system (circle all that apply):

(hot air circulation) hot air radiation wood (steam radiation)

heat pump hot water radiation kerosene heater electric baseboard

other (specify): ~~N/A~~ ~~May be steam? VM~~

Type of ventilation system (circle all that apply):

central air conditioning mechanical fans bathroom ventilation fans

~~individual air conditioning units~~ kitchen range hood fan outside air intake

other (specify): _____

Type of fuel utilized (circle all that apply):

Natural gas / (electric) / fuel oil / wood / coal / solar / kerosene

Are the basement walls or floor sealed with waterproof paint or epoxy coatings? *Yes* / (*No*)

Is there a whole house fan? *Yes* / (No)

Septic system? *Yes / Yes (but not used)* (No) Sewer

Irrigation/private well? *Yes / Yes (but not used)* / (No)

Type of ground cover outside of building: grass / concrete / asphalt / other (specify) Gravel parking lot

Existing subsurface depressurization (radon) system in place? *Yes* / (No) *active / passive*

Sub-slab vapor/moisture barrier in place? *Yes* / (No)

Type of barrier: _____

Part III - Outside Contaminant Sources

NJDEP contaminated site (1000-ft. radius): _____

Other stationary sources nearby (gas stations, emission stacks, etc.): _____

Heavy vehicular traffic nearby (or other mobile sources): _____

Part IV – Indoor Contaminant Sources

Identify all potential indoor sources found in the building (including attached garages), the location of the source (floor and room), and whether the item was removed from the building 48 hours prior to indoor air sampling event. Any ventilation implemented after removal of the items should be completed at least 24 hours prior to the commencement of the indoor air sampling event.

Potential Sources	Location(s)	Removed (Yes / No / NA)
Gasoline storage cans		
Gas-powered equipment		
Kerosene storage cans		
Paints / thinners / strippers	~~open wood~~ wm can of paint <1gal	N
Cleaning solvents	general spray cleaners <1gt	N
~~Oven cleaners~~	dish soap/orange solvent 1gt	N
~~Carpet / upholstery cleaners~~	laundry detergent <5gal, bleach-1gt	N
Other house cleaning products		
Moth balls		
Polishes / waxes	Floor finish <1gal	N
Insecticides	tick repellent 6oz spray	N
Furniture / floor polish		
Nail polish / polish remover		
Hairspray		
Cologne / perfume		
Air fresheners		
Fuel tank (inside building)		NA
Wood stove or fireplace		NA
New furniture / upholstery		
New carpeting / flooring		NA
Hobbies - glues, paints, etc.		
Anti-Seize lubricant	~~4oz~~ wm <1lb.	N

MB

Part V – Miscellaneous Items

Do any occupants of the building smoke? *Yes* / (No) How often? _____

Last time someone smoked in the building? _____ hours / *days* *ago*

Does the building have an attached garage directly connected to living space? *Yes* / (No)

If so, is a car usually parked in the garage? *Yes* / *No*

Are gas-powered equipment or cans of gasoline/fuels stored in the garage? *Yes* / *No*

Do the occupants of the building have their clothes dry cleaned? *Yes* / *No*

If yes, how often? weekly / monthly / 3-4 times a year NA

Do any of the occupants use solvents in work? *Yes* / (No)

If yes, what types of solvents are used? _____

If yes, are their clothes washed at work? (Yes) / *No* laundry room / bathroom

Have any pesticides/herbicides been applied around the building or in the yard? *Yes* / (No)

If so, when and which chemicals? _____

Has there ever been a fire in the building? *Yes* / (No) If yes, when? _____

Has painting or staining been done in the building in the last 6 months? *Yes* / (No)

If yes, when _____ and where? _____

Part VI – Sampling Information

Sample Technician: V. Miller Phone number: ( ) _____ - _____

Sample Source: (Indoor Air) / Sub-Slab / Near Slab Soil Gas / Ambient Air

Sampler Type: Stainless Steel Canister / Other (specify): SUMA

Analytical Method: LL TO-15 Certified Laboratory: Pace

Sample locations (floor, room):

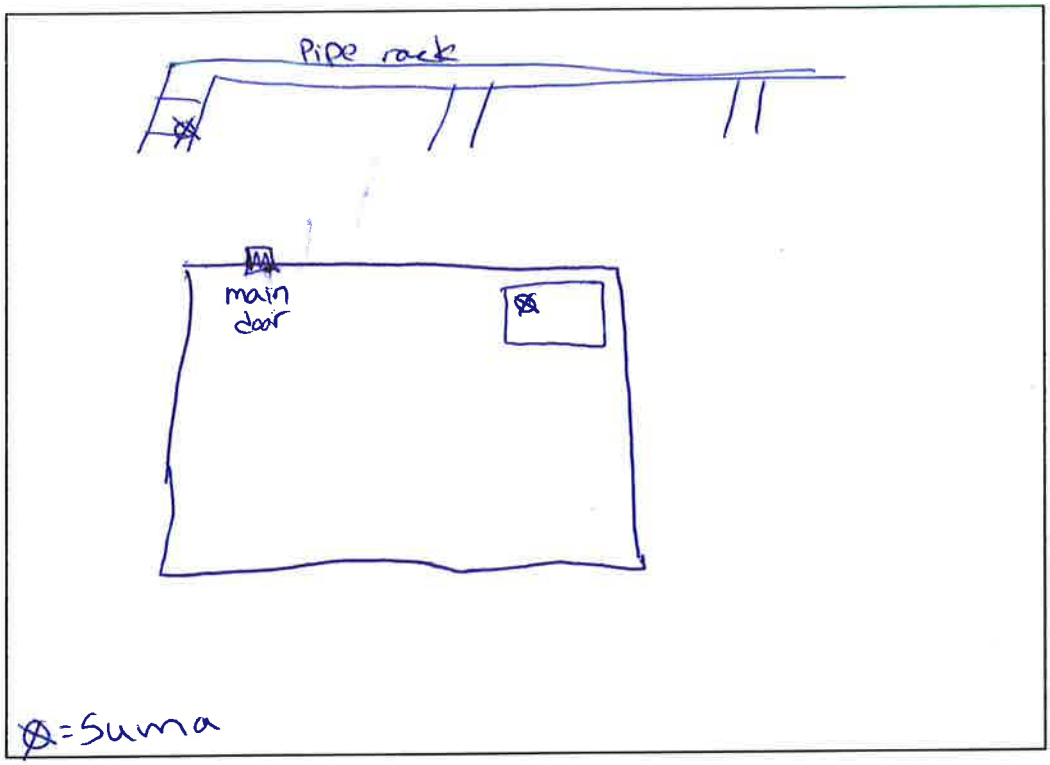
Field ID # MB - 031215 desk Field ID # ____ - _____

Field ID # MB-BG-031215 Ambient Field ID # ____ - _____

Were "Instructions for Occupants" followed? *Yes* / *No*

If not, describe modifications: _____

Provide Drawing of Sample Location(s) in and outside Building



Part VII - Meteorological Conditions

Was there significant precipitation within 12 hours prior to (or during) the sampling event? *Yes* / (No)

Describe the general weather conditions: Sunny ~50°F · Recent snow melt. Windy

Part VIII – General Observations

Provide any information that may be pertinent to the sampling event and may assist in the data interpretation process.

BB

Item #5

New Jersey Department of Environmental Protection

INDOOR AIR BUILDING SURVEY and SAMPLING FORM

Preparer's name: V. Miller Date: 3/12/15

Preparer's affiliation: Langan Phone #: _____

Part I - Occupants

Building Address: Blending Building - A019

Property Contact: _____ Owner / Renter / other: _____

Contact's Phone: home ( )_____ work ( )_____ cell ( )_____

# of Building occupants: Children under age 13 ____ Children age 13-18 _____ Adults 1-3

Part II – Building Characteristics

Building type: residential / multi-family residential / (office) / strip mall / commercial / (industrial)

Describe building: blending buildin Year constructed: ~1984

Sensitive population: day care / nursing home / hospital / school / other (specify): N/A

Number of floors below grade: NA (full basement / crawl space / slab on grade)

Number of floors at or above grade: 1

Depth of basement below grade surface: NA ft. Basement size: _____ ft^2

Basement floor construction: concrete / dirt / floating / stone / other (specify): NA

Foundation walls: poured concrete / (cinder blocks) / stone / other (specify) _____

Basement sump present? *Yes / No* Sump pump? (*Yes*) / *No* Water in sump? *Yes / No*

Type of heating system (circle all that apply):

hot air circulation | hot air radiation | wood | (steam radiation)
(heat pump) | hot water radiation | kerosene heater | electric baseboard
other (specify): _____

Type of ventilation system (circle all that apply):

(central air conditioning) | mechanical fans | bathroom ventilation fans
individual air conditioning units | kitchen range hood fan | outside air intake
other (specify): _____

Type of fuel utilized (circle all that apply):

Natural gas / (electric) / fuel oil / wood / coal / solar / kerosene

Are the basement walls or floor sealed with waterproof paint or epoxy coatings? *Yes / No*

NA

Is there a whole house fan? *Yes / (No)*

Septic system? *Yes / Yes (but not used) / (No)* — Sewer

Irrigation/private well? *Yes / Yes (but not used) / (No)*

Type of ground cover outside of building: grass / concrete / (asphalt) / other (specify) _____

Existing subsurface depressurization (radon) system in place? *Yes / (No)* *active / passive*

Sub-slab vapor/moisture barrier in place? *Yes / (No)*

Type of barrier: _____

Part III - Outside Contaminant Sources

NJDEP contaminated site (1000-ft. radius): _____

Other stationary sources nearby (gas stations, emission stacks, etc.): _____

Heavy vehicular traffic nearby (or other mobile sources): No

Part IV – Indoor Contaminant Sources

Identify all potential indoor sources found in the building (including attached garages), the location of the source (floor and room), and whether the item was removed from the building 48 hours prior to indoor air sampling event. Any ventilation implemented after removal of the items should be completed at least 24 hours prior to the commencement of the indoor air sampling event.

Potential Sources	Location(s)	Removed (Yes / No / NA)
Gasoline storage cans		
Gas-powered equipment		
Kerosene storage cans		
Paints / thinners / strippers		
Cleaning solvents	<2 qts spray cleaners - general	N
~~Oven cleaners~~ rm	Bathroom cleaner - 1qt general	N
Carpet / upholstery cleaners		
Other house cleaning products		
Moth balls		
Polishes / waxes		
Insecticides		
Furniture / floor polish		
Nail polish / polish remover		
Hairspray		
Cologne / perfume		
Air fresheners	Storage shelf - febreeze <1pt.	N
Fuel tank (inside building)		NA
Wood stove or fireplace		NA
New furniture / upholstery		
New carpeting / flooring		NA
Hobbies - glues, paints, etc.		

BB

Part V – Miscellaneous Items

Do any occupants of the building smoke? *Yes* / (No) How often? _____

Last time someone smoked in the building? _____ hours / *days* *ago*

Does the building have an attached garage directly connected to living space? *Yes* / (No) ← Engine room in back. NO

If so, is a car usually parked in the garage? *Yes* / *No* ← fuel storage lines come in to engine Room from outside

Are gas-powered equipment or cans of gasoline/fuels stored in the garage? (Yes) / *No*

Do the occupants of the building have their clothes dry cleaned? *Yes* / *No* N/A

If yes, how often? weekly / monthly / 3-4 times a year

Do any of the occupants use solvents in work? *Yes* / *No*

If yes, what types of solvents are used? Maintenace in 1/week

If yes, are their clothes washed at work? *Yes* / (No)

Have any pesticides/herbicides been applied around the building or in the yard? *Yes* / (No)

If so, when and which chemicals? _____

Has there ever been a fire in the building? *Yes* / *No* NA If yes, when? _____

Has painting or staining been done in the building in the last 6 months? *Yes* / (No)

If yes, when _____ and where? _____

Part VI – Sampling Information

Sample Technician: V. Miller Phone number: ( ) _____ - _____

Sample Source: (Indoor Air) / Sub-Slab / Near Slab Soil Gas / Ambient Air

Sampler Type: Stainless Steel Canister / Other (specify): Suma

Analytical Method: LL TO-15 Certified Laboratory: Pace

Sample locations (floor, room):

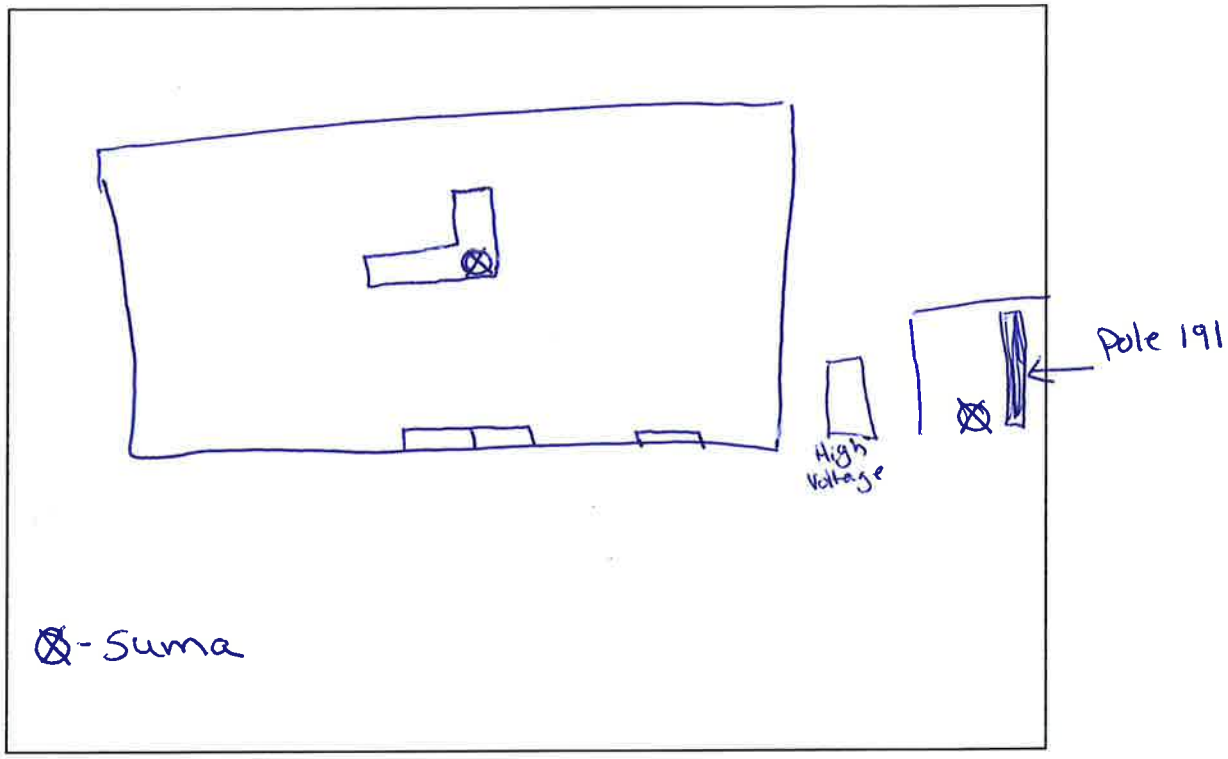
Field ID # BB - 031215 → desk Field ID # ____ - _____

Field ID # BB-BG-031215 → Ambient Field ID # ____ - _____

Were "Instructions for Occupants" followed? *Yes* / *No*

If not, describe modifications: _____

Provide Drawing of Sample Location(s) in and outside Building



Part VII - Meteorological Conditions

Was there significant precipitation within 12 hours prior to (or during) the sampling event? *Yes* / (*No*)

Describe the general weather conditions: Sunny ~50°C. Recent Snow melt. Windy

Part VIII – General Observations

Provide any information that may be pertinent to the sampling event and may assist in the data interpretation process.

Summary

New Jersey Department of Environmental Protection

INDOOR AIR BUILDING SURVEY and SAMPLING FORM

Preparer's name: V. Miller Date: 8/5/15

Preparer's affiliation: Langan Phone #: _____

Site Name: _____ Case #: _____

Part I - Occupants

Building Address: Pump House - A019

Property Contact: _____ Owner / Renter / other: _____

Contact's Phone: home ( )_____ work ( )_____ cell ( )_____

# of Building occupants: Children under age 13 _____ Children age 13-18 _____ Adults 3-5

Part II – Building Characteristics

Building type: residential / multi-family residential / office / strip mall / commercial / ~~industrial~~

Describe building: office (1st floor) / pump house Year constructed: ~1950s

Sensitive population: day care / nursing home / hospital / school / other (specify): NA

Number of floors below grade: 1 (full basement / crawl space / slab on grade)

Number of floors at or above grade: 1

Depth of basement below grade surface: ~30 ft. Basement size: _____ ft^2

Basement floor construction: concrete / dirt / floating / stone / other (specify): _____

Foundation walls: ~~poured concrete~~ / ~~cinder blocks~~ / stone / other (specify) Cinder blocks on poured Concrete

Basement sump present? *Yes* / *No* Sump pump? *Yes* / *No* Water in sump? *Yes* / *No*

Type of heating system (circle all that apply): one in meter room, one in pump room

hot air circulation	hot air radiation	wood	~~steam radiation~~
~~heat pump~~	hot water radiation	kerosene heater	electric baseboard

other (specify): _____

Type of ventilation system (circle all that apply):

~~central air conditioning~~	mechanical fans	bathroom ventilation fans individual air
conditioning units	kitchen range hood fan	outside air intake

other (specify): _____

Type of fuel utilized (circle all that apply):

Natural gas / ~~electric~~ / fuel oil / wood / coal / solar / kerosene

Are the basement walls or floor sealed with waterproof paint or epoxy coatings? *Yes* / *No*

Is there a whole house fan? *Yes* / *No*

Septic system? *Yes* / *Yes (but not used)* / *No* sewer

Irrigation/private well? *Yes* / *Yes (but not used)* / *No*

Type of ground cover outside of building: grass / concrete / asphalt / other (specify) _____

Existing subsurface depressurization (radon) system in place? *Yes* / *No* *active / passive*

Sub-slab vapor/moisture barrier in place? *Yes* / *No*
Type of barrier: _____

Part III - Outside Contaminant Sources

NJDEP contaminated site (1000-ft. radius): _____

Other stationary sources nearby (gas stations, emission stacks, etc.): _____

Heavy vehicular traffic nearby (or other mobile sources): _____

Part IV – Indoor Contaminant Sources

Same as 3/12/15

Identify all potential indoor sources found in the building (including attached garages), the location of the source (floor and room), and whether the item was removed from the building 48 hours prior to indoor air sampling event. Any ventilation implemented after removal of the items should be completed at least 24 hours prior to the commencement of the indoor air sampling event.

no changes to use

Potential Sources	**Location(s)**	**Removed** (Yes / No / NA)
Gasoline storage cans		
Gas-powered equipment		
Kerosene storage cans		
Paints / thinners / strippers		
Cleaning solvents		
Oven cleaners		
Carpet / upholstery cleaners		
Other house cleaning products		
Moth balls		
Polishes / waxes		
Insecticides		
Furniture / floor polish		
Nail polish / polish remover		
Hairspray		
Cologne / perfume		
Air fresheners		
Fuel tank (inside building)		NA
Wood stove or fireplace		NA
New furniture / upholstery		
New carpeting / flooring		NA
Hobbies - glues, paints, etc.		

Part V – Miscellaneous Items

Do any occupants of the building smoke? *Yes* / (No) How often? _____

Last time someone smoked in the building? _____ hours / *days* *ago*

Does the building have an attached garage directly connected to living space? *Yes* / (No)

If so, is a car usually parked in the garage? *Yes* / *No*

Are gas-powered equipment or cans of gasoline/fuels stored in the garage? *Yes* / *No*

Do the occupants of the building have their clothes dry cleaned? *Yes* / (No)

If yes, how often? weekly / monthly / 3-4 times a year

Do any of the occupants use solvents in work? (Yes) / *No*

If yes, what types of solvents are used? General cleaning supplies

If yes, are their clothes washed at work? (Yes) / *No* washer/dryer in bathroom

Have any pesticides/herbicides been applied around the building or in the yard? *Yes* / (No)

If so, when and which chemicals? _____

Has there ever been a fire in the building? *Yes* / (No) If yes, when? _____

Has painting or staining been done in the building in the last 6 months? *Yes* / (No)

If yes, when _____ and where? _____

Renovated Fall 2014

Part VI – Sampling Information

Sample Technician: V. Miller Phone number: ( ) _____ - _____

Sample Source: (Indoor Air) / Sub-Slab / Near Slab Soil Gas / Exterior Soil Gas

Sampler Type: Tedlar bag / Sorbent / (Stainless Steel Canister) / Other (specify): SUMA

Analytical Method: (TO-15) / TO-17 / other: _____ Cert. Laboratory: _____

Sample locations (floor, room):

Field ID # PH - 1_080515 + DUP-001-080515 Field ID # ____ - _____

Field ID # PH - BG-080515 Field ID # ____ - _____

Were "Instructions for Occupants" followed? *Yes* / *No*

If not, describe modifications: _____

Provide Drawing of Sample Location(s) in Building

Same locations as 3/12/15

Part VII - Meteorological Conditions

Was there significant precipitation within 12 hours prior to (or during) the sampling event? *Yes / No*

Describe the general weather conditions: partly cloudy. ~80°F. Low humidity.

Part VIII – General Observations

Provide any information that may be pertinent to the sampling event and may assist in the data interpretation process.

(NJDEP 1997; NHDES 1998; VDOH 1993; MassDEP 2002; NYSDOH 2005; CalEPA 2005)

New Jersey Department of Environmental Protection

INDOOR AIR BUILDING SURVEY and SAMPLING FORM

Preparer's name: V. Miller Date: 8/5/15

Preparer's affiliation: Langan Phone #: _____

Site Name: _____ Case #: _____

Part I - Occupants

Building Address: Pump House A019

Property Contact: _____ Owner / Renter / other: _____

Contact's Phone: home ( )_____ work ( )_____ cell ( )_____

# of Building occupants: Children under age 13 _____ Children age 13-18 _____ Adults NA

Part II – Building Characteristics

Building type: residential / multi-family residential / office / strip mall / commercial / (industrial)

Describe building: Basement → Engine/motor room pump room Year constructed: ~1950

Sensitive population: day care / nursing home / hospital / school / other (specify): NA

Number of floors below grade: 1 (full basement / crawl space / (slab on grade))

Number of floors at or above grade: 1

Depth of basement below grade surface: _____ ft. Basement size: _____ ft^2

Basement floor construction: (concrete) / dirt / floating / stone / other (specify): _____

Foundation walls: (poured concrete) / (cinder blocks) / stone / other (specify) cinder block over concrete floor

Basement sump present? *Yes* / *No* Sump pump? *Yes* / *No* Water in sump? *Yes* / *No*

one in each room

Type of heating system (circle all that apply):

hot air circulation	hot air radiation	wood	(steam radiation)
(heat pump)	hot water radiation	kerosene heater	electric baseboard

other (specify): _____

Type of ventilation system (circle all that apply):

(central air conditioning)	mechanical fans	bathroom ventilation fans individual air
conditioning units	kitchen range hood fan	outside air intake

other (specify): _____

Type of fuel utilized (circle all that apply):

Natural gas / (electric) / fuel oil / wood / coal / solar / kerosene

Are the basement walls or floor sealed with waterproof paint or epoxy coatings? *Yes* / (*No*)

Some cracks present. Staining in areas of floor evidence of spills (adsorbent on floor). (Same as 3/12/15)

Is there a whole house fan? *Yes / No*

Septic system? *Yes / Yes (but not used) / No*

Irrigation/private well? *Yes / Yes (but not used) / No*

Type of ground cover outside of building: grass / concrete / asphalt / other (specify) _____

Existing subsurface depressurization (radon) system in place? *Yes / No* *active / passive*

Sub-slab vapor/moisture barrier in place? *Yes / No*
Type of barrier: _____

Part III - Outside Contaminant Sources

NJDEP contaminated site (1000-ft. radius): _____

Other stationary sources nearby (gas stations, emission stacks, etc.): _____

Heavy vehicular traffic nearby (or other mobile sources): _____

Part IV – Indoor Contaminant Sources

Same as 3/12/15 No changes

Identify all potential indoor sources found in the building (including attached garages), the location of the source (floor and room), and whether the item was removed from the building 48 hours prior to indoor air sampling event. Any ventilation implemented after removal of the items should be completed at least 24 hours prior to the commencement of the indoor air sampling event.

to pumproom or engine room

Potential Sources	Location(s)	Removed (Yes / No / NA)
Gasoline storage cans		
Gas-powered equipment		
Kerosene storage cans		
Paints / thinners / strippers		
Cleaning solvents		
Oven cleaners		
Carpet / upholstery cleaners		
Other house cleaning products		
Moth balls		
Polishes / waxes		
Insecticides		
Furniture / floor polish		
Nail polish / polish remover		
Hairspray		
Cologne / perfume		
Air fresheners		
Fuel tank (inside building)		NA
Wood stove or fireplace		NA
New furniture / upholstery		
New carpeting / flooring		NA
Hobbies - glues, paints, etc.		

Part V – Miscellaneous Items

Do any occupants of the building smoke? *Yes* / (*No*) How often? _____

Last time someone smoked in the building? _____ hours / *days* *ago*

Does the building have an attached garage directly connected to living space? *Yes* / (*No*)

If so, is a car usually parked in the garage? *Yes* / *No*

Are gas-powered equipment or cans of gasoline/fuels stored in the garage? *Yes* / *No*

Do the occupants of the building have their clothes dry cleaned? *Yes* / (*No*)

If yes, how often? weekly / monthly / 3-4 times a year

Do any of the occupants use solvents in work? (*Yes*) / *No*

If yes, what types of solvents are used? General cleaning. Maintenance occasionally may use solvents for parts cleaning

If yes, are their clothes washed at work? *Yes* / *No*

Have any pesticides/herbicides been applied around the building or in the yard? *Yes* / (*No*)

If so, when and which chemicals? _____

Has there ever been a fire in the building? *Yes* / *No* If yes, when? _____

Has painting or staining been done in the building in the last 6 months? *Yes* / (*No*)

If yes, when _____ and where? _____

Part VI – Sampling Information

Sample Technician: V Miller Phone number: ( ) _____ - _____

Sample Source: (Indoor Air) / Sub-Slab / Near Slab Soil Gas / Exterior Soil Gas

Sampler Type: Tedlar bag / Sorbent / ~~Stainless Steel Canister~~ / Other (specify): SUMA

Analytical Method: (TO-15) / TO-17 / other: _____ Cert. Laboratory: _____

Sample locations (floor, room):

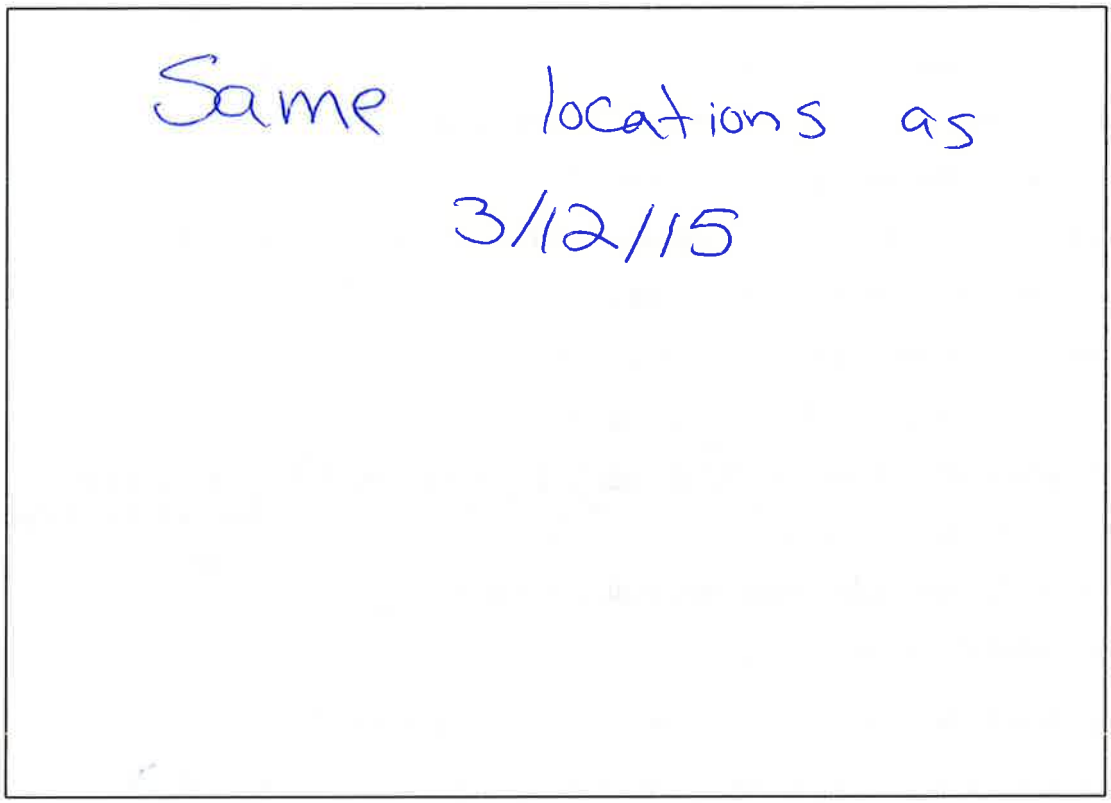
Field ID # PH - 2-080515- pump room Field ID # _____ - _____

Field ID # PH - 3-080515 - motor room Field ID # _____ - _____

Were "Instructions for Occupants" followed? *Yes* / *No*

If not, describe modifications: _____

Provide Drawing of Sample Location(s) in Building



Part VII - Meteorological Conditions

Was there significant precipitation within 12 hours prior to (or during) the sampling event? *Yes / No*

Describe the general weather conditions: Partly Cloudy. ~50°F. low humidity.

Part VIII – General Observations

Provide any information that may be pertinent to the sampling event and may assist in the data interpretation process.

Pump room floor appeared wet, likely ~~from~~ um from storm water.

(NJDEP 1997; NHDES 1998; VDOH 1993; MassDEP 2002; NYSDOH 2005; CalEPA 2005)

New Jersey Department of Environmental Protection

INDOOR AIR BUILDING SURVEY and SAMPLING FORM

Preparer's name: V. Miller Date: 8/5/15

Preparer's affiliation: Langan Phone #: _____

Site Name: Maintenance Building ~~Case #~~: A019

Part I - Occupants

Building Address: _____

Property Contact: _____ Owner / Renter / other: _____

Contact's Phone: home ( )_____ work ( )_____ cell ( )_____

# of Building occupants: Children under age 13 _____ Children age 13-18 _____ Adults 1-4

Part II – Building Characteristics

Building type: residential / multi-family residential / (office) / strip mall / commercial / industrial

Describe building: office / maintenance Year constructed: ~1978

Sensitive population: day care / nursing home / hospital / school / other (specify): NA

Number of floors below grade: NA (full basement / crawl space / slab on grade)

Number of floors at or above grade: 1

Depth of basement below grade surface: NA ft. Basement size: _____ ft^2

Basement floor construction: concrete / dirt / floating / stone / other (specify): NA

Foundation walls: poured concrete / (cinder blocks) / stone / other (specify) _____

Basement sump present? *Yes* / (*No*) Sump pump? *Yes* / (*No*) Water in sump? *Yes* / *No*

Type of heating system (circle all that apply):

(hot air circulation)	hot air radiation	wood	(steam radiation)
heat pump	hot water radiation	kerosene heater	electric baseboard
other (specify): _____			

Type of ventilation system (circle all that apply):

central air conditioning	mechanical fans	bathroom ventilation fans individual air
(conditioning units)	kitchen range hood fan	outside air intake
other (specify): _____		

Type of fuel utilized (circle all that apply):

Natural gas / (electric) / fuel oil / wood / coal / solar / kerosene

Are the basement walls or floor sealed with waterproof paint or epoxy coatings? *Yes* / *No*

NA

Is there a whole house fan? *Yes* / (*No*)

Septic system? *Yes* / *Yes (but not used)* / (*No*) Sewer

Irrigation/private well? *Yes* / *Yes (but not used)* / (*No*)

Type of ground cover outside of building: grass / concrete / asphalt / other (specify) gravel parking lot

Existing subsurface depressurization (radon) system in place? *Yes* / (*No*) *active / passive*

Sub-slab vapor/moisture barrier in place? *Yes* / (*No*)
Type of barrier: _____

Part III - Outside Contaminant Sources

NJDEP contaminated site (1000-ft. radius): _____

Other stationary sources nearby (gas stations, emission stacks, etc.): _____

Heavy vehicular traffic nearby (or other mobile sources): NA

Part IV – Indoor Contaminant Sources

→ Same as 3/12/15

Identify all potential indoor sources found in the building (including attached garages), the location of the source (floor and room), and whether the item was removed from the building 48 hours prior to indoor air sampling event. Any ventilation implemented after removal of the items should be completed at least 24 hours prior to the commencement of the indoor air sampling event.

No change in use

Potential Sources	Location(s)	Removed (Yes / No / NA)
Gasoline storage cans		
Gas-powered equipment		
Kerosene storage cans		
Paints / thinners / strippers		
Cleaning solvents		
Oven cleaners		
Carpet / upholstery cleaners		
Other house cleaning products		
Moth balls		
Polishes / waxes		
Insecticides		
Furniture / floor polish		
Nail polish / polish remover		
Hairspray		
Cologne / perfume		
Air fresheners		
Fuel tank (inside building)		NA
Wood stove or fireplace		NA
New furniture / upholstery		
New carpeting / flooring		NA
Hobbies - glues, paints, etc.		

Part V – Miscellaneous Items

Do any occupants of the building smoke? *Yes / (No)* How often? _____

Last time someone smoked in the building? _____ hours / *days* *ago*

Does the building have an attached garage directly connected to living space? *Yes / (No)*

If so, is a car usually parked in the garage? *Yes / No*

Are gas-powered equipment or cans of gasoline/fuels stored in the garage? *Yes / No*

Do the occupants of the building have their clothes dry cleaned? *Yes / No* NA

If yes, how often? weekly / monthly / 3-4 times a year

Do any of the occupants use solvents in work? *Yes / No*

If yes, what types of solvents are used? _____

If yes, are their clothes washed at work? *(Yes) / No* laundry room / bathroom

Have any pesticides/herbicides been applied around the building or in the yard? *Yes / No*

If so, when and which chemicals? _____

Has there ever been a fire in the building? *Yes / (No)* If yes, when? _____

Has painting or staining been done in the building in the last 6 months? *Yes / (No)*

If yes, when _____ and where? _____

Part VI – Sampling Information

Sample Technician: V. Miller Phone number: ( ) _____ - _____

Sample Source: (Indoor Air) / Sub-Slab / Near Slab Soil Gas / Exterior Soil Gas

Sampler Type: Tedlar bag / Sorbent / (Stainless Steel Canister) / Other (specify): SUMA

Analytical Method: (TO-15) / TO-17 / other: _____ Cert. Laboratory: PACE

Sample locations (floor, room):

Field ID # MB - 080515 - desk Field ID # _____ - _____

Field ID # MB - BG - 080515 ambient Field ID # _____ - _____

Were "Instructions for Occupants" followed? *Yes / No*

If not, describe modifications: _____

Provide Drawing of Sample Location(s) in Building

Same as 3/12/15

Part VII - Meteorological Conditions

Was there significant precipitation within 12 hours prior to (or during) the sampling event? *Yes* / *No*

Describe the general weather conditions: Partly Cloudy ~50° low humidity.

Part VIII – General Observations

Provide any information that may be pertinent to the sampling event and may assist in the data interpretation process.

(NJDEP 1997; NHDES 1998; VDOH 1993; MassDEP 2002; NYSDOH 2005; CalEPA 2005)

New Jersey Department of Environmental Protection

INDOOR AIR BUILDING SURVEY and SAMPLING FORM

Preparer's name: V. Miller Date: 8/5/15

Preparer's affiliation: Langan Phone #: _____

Site Name: Blending Building ~~Case #:~~ A019

Part I - Occupants

Building Address: _____

Property Contact: _____ Owner / Renter / other: _____

Contact's Phone: home ( )_____ work ( )_____ cell ( )_____

# of Building occupants: Children under age 13 ____ Children age 13-18 _____ Adults ____

Part II – Building Characteristics

Building type: residential / multi-family residential / (office) / strip mall / commercial / (industrial)

Describe building: blending building Year constructed: ~1984

Sensitive population: day care / nursing home / hospital / school / other (specify): NA

Number of floors below grade: NA (full basement / crawl space / slab on grade)

Number of floors at or above grade: 1

Depth of basement below grade surface: NA ft. Basement size: _____ ft^2

Basement floor construction: concrete / dirt / floating / stone / other (specify): NA

Foundation walls: poured concrete / (cinder blocks) / stone / other (specify) _____

Basement sump present? *Yes / No* Sump pump? *Yes / No* Water in sump? *Yes / No*

Type of heating system (circle all that apply):

hot air circulation	hot air radiation	wood	(steam radiation)
(heat pump)	hot water radiation	kerosene heater	electric baseboard

other (specify): _____

Type of ventilation system (circle all that apply):

(central air conditioning)	mechanical fans	bathroom ventilation fans individual air
conditioning units	kitchen range hood fan	outside air intake

other (specify): _____

Type of fuel utilized (circle all that apply):

Natural gas / (electric) / fuel oil / wood / coal / solar / kerosene

Are the basement walls or floor sealed with waterproof paint or epoxy coatings? *Yes / No* NA

Is there a whole house fan? *Yes* / *No*

Septic system? *Yes* / *Yes (but not used)* / *No* - Sewer

Irrigation/private well? *Yes* / *Yes (but not used)* / *No*

Type of ground cover outside of building: grass / concrete / asphalt / other (specify) _____

Existing subsurface depressurization (radon) system in place? *Yes* / *No* *active / passive*

Sub-slab vapor/moisture barrier in place? *Yes* / *No*
Type of barrier: _____

Part III - Outside Contaminant Sources

NJDEP contaminated site (1000-ft. radius): _____

Other stationary sources nearby (gas stations, emission stacks, etc.): _____

Heavy vehicular traffic nearby (or other mobile sources): Na

Part IV – Indoor Contaminant Sources → Same as 3/12/15 description

Identify all potential indoor sources found in the building (including attached garages), the location of the source (floor and room), and whether the item was removed from the building 48 hours prior to indoor air sampling event. Any ventilation implemented after removal of the items should be completed at least 24 hours prior to the commencement of the indoor air sampling event.

Potential Sources	Location(s)	Removed (Yes / No / NA)
Gasoline storage cans		
Gas-powered equipment		
Kerosene storage cans		
Paints / thinners / strippers		
Cleaning solvents		
Oven cleaners		
Carpet / upholstery cleaners		
Other house cleaning products		
Moth balls		
Polishes / waxes		
Insecticides		
Furniture / floor polish		
Nail polish / polish remover		
Hairspray		
Cologne / perfume		
Air fresheners		
Fuel tank (inside building)		NA
Wood stove or fireplace		NA
New furniture / upholstery		
New carpeting / flooring		NA
Hobbies - glues, paints, etc.		

Part V – Miscellaneous Items

Do any occupants of the building smoke? *Yes* / (No) How often? _____

Last time someone smoked in the building? _____ hours / *days* *ago*

Does the building have an attached garage directly connected to living space? *Yes* / (No) Engine room in back. No fuel storage lines enter engine room from outside

If so, is a car usually parked in the garage? *Yes* / *No*

Are gas-powered equipment or cans of gasoline/fuels stored in the garage? (Yes) / *No*

Do the occupants of the building have their clothes dry cleaned? *Yes* / *No* NA

If yes, how often? weekly / monthly / 3-4 times a year

Do any of the occupants use solvents in work? *Yes* / *No*

If yes, what types of solvents are used? maintenance/cleaning 1/week

If yes, are their clothes washed at work? *Yes* / (No)

Have any pesticides/herbicides been applied around the building or in the yard? *Yes* / (No)

If so, when and which chemicals? _____

Has there ever been a fire in the building? *Yes* / *No* If yes, when? _____

Has painting or staining been done in the building in the last 6 months? *Yes* / *No*

If yes, when _____ and where? _____

Part VI – Sampling Information

Sample Technician: V. Miller Phone number: ( ) _____ - _____

Sample Source: (Indoor Air) / Sub-Slab / Near Slab Soil Gas / Exterior Soil Gas

Sampler Type: Tedlar bag / Sorbent / (Stainless Steel Canister) / Other (specify): SUMA

Analytical Method: (TO-15) / TO-17 / other: _____ Cert. Laboratory: PACE

Sample locations (floor, room):

Field ID # BB - 080515 → desk Field ID # _____ - _____

Field ID # BB - BG - 080515 Field ID # _____ - _____

Were "Instructions for Occupants" followed? *Yes* / *No*

If not, describe modifications: _____

Provide Drawing of Sample Location(s) in Building

Same locations as 3/12/15

Part VII - Meteorological Conditions

Was there significant precipitation within 12 hours prior to (or during) the sampling event? *Yes* / (*No*)

Describe the general weather conditions: Partly cloudy. ~80° Low humidity.

Part VIII – General Observations

Provide any information that may be pertinent to the sampling event and may assist in the data interpretation process.

Air conditioning running on high.

(NJDEP 1997; NHDES 1998; VDOH 1993; MassDEP 2002; NYSDOH 2005; CalEPA 2005)

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4.5 Outdoor Worker Air Sampling Results

Aquaterra collected four outdoor worker ambient air samples in 2016 from select locations from within AOI 9 based upon PADEP vapor intrusion guidance documents. The air sample results are provided in Table 8 and outdoor worker ambient air sample locations are displayed in Figure 18. The results of the outdoor air samples will be discussed in the Human Health Risk Assessment for the PES Refining Complex. Concentrations of constituents in outdoor air are below the applicable ACGIH TLVs and NIOSH RELs for all analytes.

Table 8
Summary of Outdoor Worker Air Quality Analytical Results
AOI 9 Remedial Investigation Report Addendum
PES Philadelphia Refining Complex
Philadelphia, Pennsylvania

Analyte	CAS Number	NIOSH RELs	ACGIH TLVs	Location	AOI9-AA-16-002					AOI9-AA-16-003					AOI9-AA-16-004					AOI9-AA-16-005				
				Sample	AOI9-AA-16-002-20160502					AOI9-AA-16-003-20160502					AOI9-AA-16-004-20160502					AOI9-AA-16-005-20160502				
				Date	5/2/2016					5/2/2016					5/2/2016					5/2/2016				
				Collected By	Aquaterra					Aquaterra					Aquaterra					Aquaterra				
				Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
1,2,4-Trimethylbenzene	95-63-6	125,000	123,000	ug/m3	15.5		0.19	3.7	1.49	13.9		0.18	3.6	1.44	6.9		0.18	3.6	1.44	11.9		0.18	3.6	1.44
1,2-Dibromoethane (EDB)	106-93-4	346	NS	ug/m3	ND	U	1.2	2.3	1.49	ND	U	1.1	2.2	1.44	ND	U	1.1	2.2	1.44	ND	U	1.1	2.2	1.44
1,2-Dichloroethane (EDC)	107-06-2	4,000	40,500	ug/m3	ND	U	0.31	0.61	1.49	ND	U	0.3	0.59	1.44	ND	U	0.3	0.59	1.44	ND	U	0.3	0.59	1.44
1,3,5-Trimethylbenzene	108-67-8	125,000	123,000	ug/m3	5.1		0.27	1.5	1.49	4		0.26	1.4	1.44	2.2		0.26	1.4	1.44	4		0.26	1.4	1.44
Benzene	71-43-2	319	1,600	ug/m3	61.2		0.18	0.97	1.49	1.6		0.18	0.94	1.44	0.73	J	0.18	0.94	1.44	21.5		0.18	0.94	1.44
Ethylbenzene	100-41-4	435,000	86,800	ug/m3	14		0.63	3.3	1.49	2.9	J	0.61	3.2	1.44	1.9	J	0.61	3.2	1.44	9.4		0.61	3.2	1.44
Isopropylbenzene (Cumene)	98-82-8	245,000	246,000	ug/m3	2.2	J	0.21	3.7	1.49	1.1	J	0.2	3.6	1.44	ND	U	0.2	3.6	1.44	ND	U	0.2	3.6	1.44
Methyl Tertiary Butyl Ether	1634-04-4	NS	180,000	ug/m3	ND	U	0.45	5.5	1.49	ND	U	0.44	5.3	1.44	ND	U	0.44	5.3	1.44	ND	U	0.44	5.3	1.44
Naphthalene	91-20-3	50,000	52,000	ug/m3	5.7	J	0.45	7.9	1.49	3	J	0.44	7.7	1.44	3.2	J	0.44	7.7	1.44	3.8	J	0.44	7.7	1.44
Toluene	108-88-3	375,000	75,400	ug/m3	162		0.23	1.1	1.49	10.5		0.22	1.1	1.44	6.4		0.22	1.1	1.44	86.4		0.22	1.1	1.44
Xylenes (Total)	1330-20-7	435,000	434,000	ug/m3	70.4		1.2	2.6	1.49	12.1		1.1	2.5	1.44	4.9		1.1	2.5	1.44	48.4		1.1	2.5	1.44

Note:
CAS - Chemical Abstrct Number
ug/m3 - Micrograms per cubic meter
Q - Qualifier
MDL - Method detection limit
RL - Reporting limit
DF - Dilution factor
ND - Not detected
NIOSH RELs - National Institute for Occupational Safety and Health Recommended Exposure Limits.
ACGIH TLVs - American Conference of Governmental Industrial Hygienists Threshold Limit Value.
NIOSH RELs and ACGIH TLVs from GHD's Air Data Evaluation Letter (Reference No. 11109626), November 9, 2016

Qualifiers:
U - Compound analyzed but not detected
J- Estimated Value. Result between method detection and reporting limits

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6.0 CONCEPTUAL SITE MODEL

A preliminary conceptual site model (CSM) for the facility, including AOI 9, was presented in the CCR. The CSM for AOI 9 was later refined as part of the 2009 AOI 9 SCR and the 2015 AOI 9 RIR. Data collected from site characterization activities completed since the submittal of the 2015 AOI 9 RIR were used to further refine the CSM. The updated CSM for AOI 9 is described in the following sections.

6.1 Geology and Hydrogeology

The following describes geologic and hydrogeologic conditions in AOI 9:

- Anthropogenic Fill is present throughout most of AOI 9 with thicknesses up to 21 feet. Fill is thickest in the east and gradually thins to the west.
- The Holocene Alluvium is present throughout most of AOI 9 ranging in thickness from 0 feet up to approximately 22 feet. Based on the available stratigraphic data, the Holocene Alluvium appears to be stratified with layers of silt and sands, and less permeable clay.
- The Trenton Gravel is laterally continuous throughout AOI 9, and generally ranges from approximately 20 to 30 feet thick with a greatest thickness of approximately 58 feet observed at monitoring well S-144SRTF
- The Upper Sand does not appear to be continuous throughout AOI 9, and most likely occurs as thin discontinuous lenses overlying the Middle Clay, where present.
- The Middle Clay is discontinuous throughout AOI 9. Where present, the Middle Clay is thickest in the south based on monitoring wells S-138SRTF and S-143SRTF (up to 8 feet thick in S-143SRTF).
- The Middle Sand is discontinuous throughout AOI 9, and has a similar extent as the overlying Middle Clay; progressively pinching out to the northwest in the direction of the Fall Line. The Middle Sand ranges in thickness from zero feet to approximately 15 feet.
- The Lower Clay appears to be discontinuous but where present ranges in thickness up to approximately 8.5 feet.
- The Lower Sand is located approximately 59 to 70 feet bgs and ranges in thickness between 29 to 45 feet. Beneath the Lower Sand is the Wissahickon Schist bedrock.

- The depth to weathered bedrock beneath AOI 9 was encountered from approximately 99 to 117 feet bgs.
- The hydrogeologic framework for AOI 9 consists of four layers. Layer 1 is a perched aquifer supported by the thick anthropogenic fill deposits overlying the Holocene Clay in the eastern portion of the AOI. Layer 2 is the unconfined aquifer, which consists of the combined Holocene Alluvium, Trenton Gravel, and Upper Sand (where present). Layer 3 is the discontinuous Middle Clay confining unit. Layer 4 is the Middle Sand, Lower Clay, and Lower Sand (lower aquifer) which is a semi-confined.
- Groundwater recharge of the perched aquifer occurs at the potentiometric high centered on S-74SRTF. From this high point, perched groundwater flows radially outward and eventually converges on at the center of AOI 9 towards the hole in the Holocene clay.
- Perched groundwater recharges the unconfined aquifer at the western extent of the perched aquifer and preferentially where the Holocene clay is absent in the center of AOI9.
- The groundwater elevations in the unconfined aquifer throughout most of AOI 9 generally range from -8 to -10 NAVD 88. These low water table elevations throughout the majority of AOI 9 are most likely a result of pumping in Mingo Creek basin.
- It appears that the potentiometric surface for the unconfined aquifer is representative of differential draw down throughout AOI 9 because of the pumping in Mingo Creek basin.
- Unconfined aquifer groundwater in the northern third of AOI 9 generally flows to the south.
- Unconfined groundwater in the central portion of the site flows radially outward from a potentiometric high point centered on S-74D2.
- Groundwater in the lower aquifer generally flows to the south towards the Delaware River. The observed flow patterns generally correspond to the flow direction indicated by the 1995-1996 potentiometric surface for the lower sand as modeled (last simulated time step) and observed by Schreffler (Schreffler, 2001).

6.2 Compounds of Concern

The following summarizes relevant information concerning COCs by media in AOI 9:

Soil

- Benzene, 1,2,4-TMB, 1,3,5-TMB, ethyl benzene, naphthalene, benzo(a)pyrene, benzo(b)flouranthene, toluene, and lead are the only COCs in surface soil that were reported above the PADEP non-residential soil MSCs. The site COC benzo(b)flouranthene was added to this list since the submittal of the 2015 AOI 9 RIR. These compounds have been delineated where soil boring results were above the soil direct contact MSC or the SSS for lead.
- Lead, 1,2,4-TMB, 1,3,5-TMB, ethyl benzene, total xylenes, naphthalene, toluene, and benzene are the only COCs in subsurface soil that were reported above the PADEP non-residential soil MSC or direct contact MSC. No additional site COCs were identified in subsurface soil since the submittal of the 2015 AOI 9 RIR.

Groundwater

- Benzene, 1,2,4-TMB, EDB, ethylbenzene, MTBE, naphthalene, and lead, 1,2,4-TMB, ethyl benzene, EDB, MTBE, and naphthalene are the COCs in perched groundwater that were above their respective PADEP non-residential groundwater MSCs.
- All of the site COCs in unconfined aquifer, except for cumene, were above their respective PADEP non-residential groundwater MSCs.
- Benzene and MTBE are the only COCs in the lower aquifer that were above their respective PADEP non-residential groundwater MSC.

Indoor Air

- No COCs in indoor air were detected above the site specific standards of $1/10^{th}$ the PADEP statewide health standard and the EPA RSLs (cancer risk $10^{—5}$ and 10^{-6} at a hazard quotient of 0.1) during the 2016 indoor air sampling event.

6.3 LNAPL Distribution and LNAPL Mobility

The following summarizes relevant information concerning LNAPL distribution in AOI 9:

- MW-1SRTF, MW-2SRTF, and MW-3SRTF in AOI 9 contain measurable LNAPL classified as light distillate. MW-2SRTF and MW-3SRTF are monitoring wells in the area of the Blending Building, near MW-1SRTF. The occurrence of LNAPL in

MW-1SRTF correlates with the COC concentrations that exceeded MSCs in unconfined groundwater in this area. Based on the presence of LNAPL in monitoring wells MW-1SRTF, MW-2SRTF, and MW3-SRTF and the occurrence of LNAPL in MW-1SRTF over time, continued monitoring will be performed to assess the localized LNAPL plume; mobility of the plume is not apparent beyond this localized area.

- S-114SRTF and S-122SRTF in AOI 9 contain measurable LNAPL classified as mixes of light/middle distillates. Both wells are located in the central portion of AOI 9 and have only recently been found to contain measurable thicknesses of LNAPL. The occurrence of LNAPL in S-114SRTF and S-122SRTF correlates with the COC concentrations that exceeded MSCs in unconfined groundwater in the areas of the wells. Based on the presence of LNAPL in monitoring wells surrounding MW-1SRTF, continued monitoring of LNAPL in the blending area will be continued to assess if the LNAPL is stable and immobile. The newly identified LNAPL in monitoring wells S-114SRTF and S-122SRTF will also be monitored to evaluate their mobility.

6.4 Fate and Transport of COCs

- No fate and transport modeling was completed for the soil analytical results. The soil-to-groundwater pathway is evaluated through groundwater data.
- Both qualitative and quantitative (Appendix D) assessments were completed to assess the potential fate and transport of dissolved petroleum impacts and refine the current CSM for AOI 9.
- For the AOI 9 CSM plume stability assessment, benzene and MTBE, the most mobile of the COCs, were the focus of the qualitative fate and transport evaluation. The plume stability assessments for these compounds indicate that their plumes are either decreasing or stable, with the exception of the benzene plume at S-112SRTF. See Appendix I.
- Three dissolved phase petroleum plume areas have been identified in AOI 9.
    - Plume 1 is related to residual LNAPL in soil near several historical recovery wells in the Blending Area located near the southern property boundary. Based on the limited extent of Plume 1, limited LNAPL mobility, and the presence of an underlying clay aquitard (Holocene clay),

contamination from this area is unlikely to migrate any further to reach any potential receptors.

- Plume 2 is generally located in the west-central portion of AOI 9. The dissolved phase petroleum impacts in this area do not appear to be related to a single "source area", but are more likely a result of isolated dissolved phase plumes that have co-mingled over time. For the purpose of the qualitative fate and transport assessment, four major plumes have been identified in this area:
    - A larger benzene plume centered around monitoring well S-112SRTF;
    - A smaller benzene plume centered around monitoring well S-115SRTF;
    - A larger MTBE plume centered around monitoring well S-144SRTF; and
    - A smaller MTBE plume centered around monitoring well S-115DSRTF.

  Isolated LNAPL plumes identified at monitoring wells S-114SRTF and S-122SRTF may be contributing dissolved phase petroleum impacts to this area. Recent benzene results (October 2016) from S-112SRTF indicate the source area of the larger benzene plume may be increasing. However, downgradient wells within this plume show stable concentration trends. Based on the groundwater flow direction maps and isoconcentration maps for benzene and MTBE, portions of the dissolved plumes may have migrated to the west beyond the AOI 9 property boundary. A quantitative assessment of the potential off-site transport of benzene from Plume 2 is provided in Appendix D. A bulleted summary of the quantitative fate and transport analysis of the benzene from Plume 2 is provided below
    - The Quick Domenico (QD) groundwater fate and transport model was used to predict the downgradient extent that benzene could potentially migrate past the western boundary of AOI 9.

- Constant source and steady state scenarios were simulated for observed benzene concentrations at monitoring wells S-112SRTF and S-115SRTF.
- The QD model at S-112SRTF was calibrated to benzene concentrations observed at the downgadient (southwest) monitoring well S-113SRTF by varying the decay constant (degradation coefficient).
- There is currently no calibration monitoring point downgradient of S-115SRTF. Therefore, the QD model at S-115SRTF could not be calibrated, and a conservative value for the decay constant of 0.001 day^{-1} was utilized for the plume extent estimate for this well.
- The QD models for S-112SRTF and S-115SRTF predicted benzene plume lengths of approximately 900 feet and 1,750 feet, respectively.
- The QD estimated plume lengths indicate the benzene from Plume 2 would extend onto adjacent properties to the west of the AOI 9 boundary.

- Plume 3 was identified based on the re-classification of wells (hydrostratigraphic units) and the October 2016 limited groundwater sampling event. Plume 3 is comprised of MTBE plumes in both the unconfined and lower aquifers in the southwest portion of AOI 9. The MTBE plume in the unconfined aquifer appears to be stable. The extent of the MTBE plume in the lower aquifer is not well defined and could potentially be from off-site source(s). Based on the MTBE concentration trends observed during limited sampling events at monitoring well S-118DSRTF, the MTBE plume in the lower aquifer is potentially increasing. The potential source(s) of MTBE will be evaluated during the Complex-wide Cleanup Plan activities and comprehensively modeled to estimate the future extent of groundwater concentrations.

6.5 Potential Migration Pathways and Site Receptors

The following summarizes potential migration pathways and site receptors for AOI 9.

- AOI 9 is situated within a fenced and secured area to prevent unauthorized access.

- The potential direct contact pathway to soil greater than two feet is deemed incomplete based on PES's on-site work permit and PPE procedures, which limit exposure to soil encountered in excavations.
- The potential direct contact pathway to groundwater is deemed incomplete based on PES's on-site work permit and PPE procedures, which limit exposure to groundwater that may be encountered in excavations.
- COC concentrations in potential indoor air receptors are not above the site specific standards of 1/10th the PADEP statewide health standard or the EPA RSLs during the 2016 indoor air sampling event.
- Based on the results from the Stantec quantitative F&T assessment for provided in Appendix D, groundwater with dissolved phase COCs above the MSCs have the potential to extend beyond the western boundary of AOI 9 and the Complex. The results of this evaluation were utilized to assess potential offsite VI concern.
- LNAPL is contained within the boundaries of AOI 9. The potential direct contact pathway to LNAPL is deemed incomplete based on PES's on-site permit and PPE procedures, which prevent exposure to LNAPL that may be encountered in excavations.
- The areas with surface soil concentrations above COC direct contact MSCs and lead above the SSS will be remediated by Evergreen to eliminate the potential exposure pathway. The remediation activities will be discussed in a separate Complex-Wide Cleanup Plan.

APPENDIX I
Qualitative Fate & Transport Assessment
Remedial Investigation Report Addendum– AOI 9
Philadelphia Energy Solutions Refining & Marketing, LLC
Philadelphia Refining Complex
Philadelphia, Pennsylvania

Introduction

In September 2015, representatives from Evergreen's team, the Pennsylvania Department of Environmental Protection Agency (PADEP) and the United States Environmental Protection Agency (EPA) met to discuss the fate and transport (F&T) approach for the Complex. It was agreed upon during the meeting that AOI Remedial Investigation Reports (RIRs) would provide a qualitative F&T assessment and that a Complex-wide groundwater flow and transport model would be presented for the Complex as part of a separate report. The Complex-wide model will provide a quantitative F&T assessment for the Complex utilizing a Complex-wide numerical groundwater flow and contaminant transport model currently being developed by Stantec and other consultants on behalf of Evergreen.

This appendix contains the qualitative assessment for the AOI 9 RIR Addendum. The assessment includes information regarding the following conditions in AOI 9:

- Geologic framework;
- Hydrogeologic conditions;
- Hydrologic conditions;
- Anthropogenic features (such as the adjacent Mingo Creek Flood Control System);
- Constituent of concern (COC) plume stability; and
- Potential receptors.

The purpose of this assessment is to qualitatively evaluate the potential fate and transport of dissolved petroleum impacts and refine the current conceptual site model (CSM) for AOI 9.

Framework Summary

General Geologic Framework

The Complex lies within the up-dip limits of the Atlantic Coastal Plain, generally within two miles of the "Fall Line," where crystalline bedrock of the Appalachian foothills intersects the ground surface (outcrops). The Atlantic Coastal Plain is a physiographic province that is defined as having relatively flat topography and as being underlain by a characteristic wedge of

unconsolidated sediments that thicken in a southeasterly direction, away from sediment source areas in the Appalachian Mountains. These sediments were deposited atop a sloping bedrock surface in complex fluvial, estuarine, and marginal marine environments along the passive Atlantic margin. Overall, subsidence of the Piedmont land surface in conjunction with cyclical sea-level fluctuations have been the primary controlling mechanisms driving periods of deposition, non-deposition and erosion in the Atlantic Coastal Plain (Trapp and Meisler, 1992). In general, the resulting sedimentary record in the vicinity of the Complex is complicated, largely incomplete, and under-represented by only Cretaceous and Quaternary deposits, separated by a regional disconformity. A general summary of those deposits that are identified in AOI 9 is presented below.

Anthropogenic Fill

Throughout most of the Complex the surface is covered by anthropogenic fill. These materials are heterogeneous and have been described on borehole logs as a mixture of compacted soil and anthropogenic debris, including sand, clay, silt, gravel, cinders, concrete, asphalt, crushed stone, ash, glass, brick fragments, and wood.

Quaternary Deposits

A recent (Holocene) alluvium deposit is present throughout most of the Complex beneath the anthropogenic fill. The Holocene alluvium generally consists of predominantly gray, muddy deposits with occasional sandy, gravelly, and organic-rich lenses. These sediments were deposited in dynamic floodplain, channel, and marsh environments through the Holocene. The Trenton Gravel is present throughout most of the Complex beneath the Holocene alluvium. The Trenton Gravel is of Pleistocene Age and is a very heterogeneous unit comprised of a predominant brown to gray sand, gravel and minor amounts of clay (Owens and Minard, 1979).

Cretaceous Deposits

The Cretaceous deposits are configured in a southeasterly-thickening wedge, overlain by the much younger Quaternary deposits, and underlain by the Wissahickon Formation. The wedge is made up of a series of vertically alternating aquifers and confining units called the Potomac-Raritan-Magothy (PRM) aquifer system. Each of the geological units of the PRM progressively pinches-out to the northwest. The PRM aquifer system consists of six units:

- Upper Clay unit;
- Upper Sand unit;
- Middle Clay unit;
- Middle Sand unit;
- Lower Clay unit, and
- Lower Sand unit.

AOI 9-Specific Geological Framework

In AOI 9, surface materials consist of anthropogenic fill and Holocene alluvium with a combined thickness ranging from approximately 2 to 32 feet. Based on the available stratigraphic data, the Holocene alluvium appears to be stratified with layers of silt and sands, and less permeable clay. Two fairly extensive clay layers (upper and lower) were identified within the Holocene alluvium. It appears these clay layers are important hydrogeologic features within AOI 9 and influence recharge to the unconfined aquifer. Therefore, the clay layers were mapped separately from other Holocene alluvium deposits. In the eastern portion of AOI 9, the Holocene clay deposits are thickest, gradually thin to the west, and are absent near the center of AOI 9. Geologic cross-sections of AOI 9 are provided as Figures 6a and 6b in the RIR Addendum.

Beneath the fill and Holocene alluvium is the Trenton Gravel which is older Pleistocene age alluvium. The Trenton Gravel generally ranges from approximately 20 to 30 feet thick throughout AOI 9, with a greatest thickness of 58 feet observed at monitoring well S-144SRTF (displayed in Figure 6a of the RIR Addendum). Below the Trenton Gravel are units of the PRM aquifer system. The shallowest PRM unit present in AOI 9 is the Upper Sand unit (the Upper Clay is not present in AOI 9). The Upper Sand does not appear to be continuous throughout AOI 9, and most likely occurs as thin discontinuous lenses overlying the Middle Clay, where present. The Middle Clay is discontinuous throughout AOI 9. Where present, the Middle Clay is thickest in the south based on monitoring wells S-138SRTF and S-143SRTF (up to 8 feet thick in S-143SRTF). It is assumed the Middle Sand has a similar extent as the overlying Middle Clay, and progressively pinches out to the northwest in the direction of the Fall Line. The Middle Sand ranges in thickness from zero feet to approximately 15 feet and overlies the Lower Clay. The Lower Clay appears to be discontinuous but where present ranges in thickness up to 8.5 feet. The Lower Sand is located approximately 59 to 70 feet below ground surface (bgs) and ranges in thickness between approximately 29 to 45 feet. Beneath the Lower

Sand is the Wissahickon Schist bedrock. The weathered zone of the Wissahickon Schist was encountered approximately 99 to 117 feet bgs.

General Hydrogeologic Framework

The hydrogeologic frame work is defined by grouping geologic units that are laterally extensive and have similar hydrogeologic properties. The generalized hydrostratigraphy of the Complex consists of seven layers (Schreffler, 2001, Sloto 2012):

- Layer 1: Combined anthropogenic fill, Holocene alluvium and Trenton Gravel;
- Layer 2: Upper Clay unit of the PRM (not present in AOI 9);
- Layer 3: Upper Sand unit of the PRM;
- Layer 4: Middle Clay unit of the PRM;
- Layer 5: Middle Sand unit of the PRM;
- Layer 6: Lower Clay unit of the PRM; and
- Layer 7: Lower Sand unit of the PRM.

AOI-9-Specific Hydrogeologic Framework

In the eastern half of AOI 9, significant anthropogenic fill thickness underlain by thick Holocene clay deposits supports a perched aquifer. Generally, within AOI 9 saturated conditions within the anthropogenic fill only exist in areas of perched groundwater. The unconfined aquifer consists of the combined Holocene Alluvium, Trenton Gravel, and Upper Sand (where present). Beneath the unconfined aquifer the Middle Clay, Middle Sand, Lower Clay, and Lower Sand are present as discontinuous units. Therefore, the Middle Sand, Lower Clay, and Lower Sand comprise the lower aquifer. The lower aquifer is a semi-confined aquifer. The lower aquifer lies above the Wissahickon Schist bedrock.

The groundwater elevations in the unconfined aquifer throughout most of AOI 9 generally range from -8 to -10 feet North American Vertical Datum of 1998 (NAVD 88). These low water table elevations throughout the majority of AOI 9 are most likely a result of pumping in Mingo Creek Flood Control basin (Mingo Creek basin). According to the City of Philadelphia Water Department (PWD), pumping from the Mingo Creek basin occurs approximately every 1 to 3 days depending on water level conditions. Large-capacity pumps are programmed to control the basin's water surface elevation between approximately -10.5 and -11 feet NAVD 88. Water-level data (data logger) of the unconfined aquifer collected by Stantec, and presented in

Appendix D of the RIR Addendum, supports the connection between the Mingo Creek basin and the unconfined aquifer beneath AOI 9.

The head differences measured in October 2016 between paired monitoring wells in the unconfined and lower aquifer (S-74D2SRTF/S-7D1SRTF, S-118SRTF/S-118DSRTF S-137SRTF/S-138SRTF, and S-142SRTF/S-143SRTF) ranged between zero (S-118SRTF/S-118DSRTF) to 4.28 (S-74D2SRTF/S-74D1SRTF). The observed head differences correspond to a downward vertical hydraulic gradient of 0.067 feet per feet (ft/ft) near the potentiometric high point of the unconfined aquifer (S-74D2SRTF/S-74D1SRTF) and transition to an upward vertical hydraulic gradient of 0.016 ft/ft (S-142SRTF/S-143SRTF) near Mingo Creek basin. The upward vertical hydraulic gradients observed are most likely attributable to the artificial lowering of the unconfined aquifer potentiometric surface due to the pumping in Mingo Creek basin.

AOI-9 Groundwater Flow Patterns

Interpreted groundwater flow patterns and hydraulic gradients in perched aquifer, unconfined aquifer, and lower aquifer within AOI 9 are depicted on groundwater elevation/potentiometric maps constructed using groundwater gauging data collected in May 2016, August 2016, and October 2016 (Figures 7 through 15 of the AOI 9 RIR Addendum).

As defined above, the perched aquifer is locally present in the eastern half of AOI 9 where significant fill deposits are underlain by thick Holocene clay strata. Several monitoring wells are screened within this perched aquifer. Based on the groundwater elevations as shown in Figures 7 through 9 of the RIR Addendum, the following observations can be made regarding the perched aquifer:

- Groundwater recharge of the perched aquifer occurs at the potentiometric high centered on S-74SRTF. From this high point, perched groundwater flows radially outward and eventually converges on at the center of AOI 9 towards the hole in the Holocene clay under a typical hydraulic gradient of 0.006 ft/ft.

- Perched groundwater recharges the unconfined aquifer at the western extent of the perched aquifer and preferentially where the Holocene clay is missing in the center of AOI 9.

As defined above, the unconfined aquifer is the combined Holocene alluvium/Trenton Gravel which makes up the water table aquifer. Based on the groundwater elevations within the unconfined aquifer as shown in Figures 10 through 12 of the RIR Addendum, the following observations can be made regarding the unconfined aquifer:

- Groundwater in the northern third of AOI 9 generally flows to the south under a typical gradient of 0.009 ft/ft.

- Groundwater flow in the central portion of the site flows radially outward from potentiometric high point centered on S-74D2 under a typical gradient of 0.002 ft/ft.

- It appears that the groundwater contours for the unconfined aquifer displayed on Figures 10 through 12 of the RIR Addendum are representative of differential draw down throughout AOI 9 because of the pumping in Mingo Creek basin. One or more of the following hydrogeologic and anthropogenic conditions may be causing the observed inconsistent drawdown pattern:
    - More permeable aquifer material on the western side of AOI 9 when compared to the east;
    - Groundwater infiltration into the Mingo Avenue sewer which drains into Mingo basin; and/or
    - Perched groundwater recharging the unconfined aquifer along the western edge of the perched aquifer.

As defined above, within AOI 9, the lower aquifer is the combined Middle and Lower Sand, which is a semi-confined aquifer. Based on the groundwater elevations within the lower aquifer as shown in Figures 13 through 15 of the RIR Addendum, the following observations can be made regarding the lower aquifer:

- Groundwater in the lower aquifer generally flows to the south towards the Delaware River under a typical gradient of 0.0004 ft/ft.

- The groundwater contours for the lower aquifer displayed on Figures 13 through 15 of RIR Addendum generally correspond to the flow direction of the 1995-1996

potentiometric surface for the lower sand as modeled (last simulated time step) and observed by Schreffler (Schreffler, 2001).

Aquifer Properties

Hydraulic Conductivity

As reported in Appendix D of the AOI 9 RIR Addendum, Stantec performed slug tests on five monitoring wells at AOI 9 in October 2016, including wells S-137SRTF, S-139SRTF, S-141SRTF, S-142SRTF, and S-144SRTF. Details of the slug test methods and aquifer test analyses are provided in Appendix D. The following unconfined aquifer hydraulic conductivity values were estimated for the tested wells:

- S-137SRTF: 271 feet per day (ft/d);
- S-139SRTF: 125 ft/d;
- S-141SRTF: 130 ft/d;
- S-142SRTF: 35 ft/d; and
- S-144SRTF: 237 ft/d.

A geometric mean of the test results was calculated to be 130 ft/d. In general, this hydraulic conductivity value fits the range of previous testing results for the Complex (Stantec, 2016) and for the nearby Enterprise Avenue Landfill site Pleistocene-age sand and gravel unit (Scheinfeld and Davenger, 2006). The site-specific hydraulic conductivities from AOI-9 were incorporated into Stantec's Predictive Analysis of the Potential Fate-and-Transport of Plume 2 Benzene Using Quick Domenico – Area of Interest 9 (Appendix D of the AOI 9 RIR Addendum) and may be incorporated into the future Complex-wide numerical groundwater flow and contaminant transport model.

Published hydraulic conductivity estimates for the lower aquifer range between 123 to 152 ft/d with a mean of 135 ft/d (Paulachok, 1991). In the calibrated groundwater flow model created by the United States Geologic Survey (USGS) (Schreffler, 2001), the lower aquifer has a hydraulic conductivity of 164 ft/day.

Porosity

In 2015, two soil samples of the Trenton Gravel within AOI 9 were collected to determine soil properties of the unconfined aquifer (refer to Appendix J in the RIR). Soil sample AOI-9-S-110DSRTF was collected at a depth of approximately 10 to 12 feet bgs. A deeper soil sample,

AOI-9-S-118DSRTF, was collected at a depth of approximately 42 to 44 feet bgs. The soil sample collected from S-110DSRTF, described as sand and gravel, had a total porosity of 0.281 and an effective porosity of 0.225. The soil sample collected from S-118DSRTF, also described as sand and gravel, had a total porosity of 0.355 and an effective porosity of 0.282. The average total and effective porosities of the two samples are 0.32 and 0.25, respectively. In the calibrated groundwater flow model created by the USGS (Schreffler, 2001), a porosity of 0.3 was used for the unconfined aquifer and the lower aquifer, which is similar to the geotechnical soil analysis results.

Groundwater Seepage Velocities

Groundwater seepage velocity (seepage velocity) is an estimate of the rate of groundwater movement through the pores in a geologic material. Seepage velocity does not take into account processes such as dispersion, sorption or biotransformation, which can significantly affect the migration of dissolved constituent relative to groundwater. The calculation of seepage velocity also assumes homogenous aquifer conditions and a uniform hydraulic gradient. The seepage velocity equation is:

$$V_x = \frac{K \times i}{n_e}$$

Where:

V_x = seepage velocity (Length/Time);
K = hydraulic conductivity (Length/Time);
i = hydraulic gradient (unitless); and
n_e = effective porosity (unitless).

For the unconfined aquifer with K = 130 feet/day, i = 0.002 and n_e = 0.25, the seepage velocity is 1 ft/d or 365 feet per year (ft/yr). For the lower aquifer with a K = 164 feet/day, i = 0.0004 and n_e = 0.3, the seepage velocity is 0.2 ft/d or 73 ft/yr. These seepage velocities are conservative and do not incorporate a retardation factor.

Hydrology

Topography and Drainage

Based on a LiDAR dataset from January, 2010, AOI 9 ground surface elevations range from approximately two feet NAVD 88 at the northwest corner of the property to approximately 16 feet NAVD 88 at the eastern side (see Figure I-7 of the RIR). The vegetated area located between the former railroad right-of-way and the Schuylkill River is topographically higher and is covered with trees. The ground surface in the western and southern portions of the AOI is generally flat and is broken up by tank containment berms ranging in height from approximately 2 to 10 feet.

Rainfall

Average yearly precipitation at Philadelphia International Airport, located about one mile southwest of AOI 9, is 41.45 inches (www.usclimatedata.com). A significant portion of precipitation does not reach the water table due to several processes. In AOI 9, some of the precipitation becomes runoff that is redirected by impermeable surfaces such as roadways and above ground storage tanks (see Figure I-8 of the RIR) and is intercepted by storm water control facilities. Some precipitation likely returns to the atmosphere through evapotranspiration by vegetation, where present.

Surface Water Bodies

Existing surface water bodies in the vicinity of AOI 9 include the Schuylkill River to the east, (Figure I-9 of the RIR), the Mingo Creek Flood Control Basin to the south and an area of standing water surrounded by vegetation in the northwest corner of the property. Based on a review of available historical maps and photos, several small tributaries to the Schuylkill River and Mingo Creek were once present within AOI 9. In 1908, AOI 9 consisted of alluvium and marsh with the eastern extent often submerged as categorized and depicted by the USGS in Figure I-10 in the RIR.

The major surface water body near AOI 9 is the Schuylkill River. The USGS river-gauging station located at the Fairmount Dam, several miles upriver from AOI 9, recorded a mean surface water discharge rate of 2,773 cubic feet per second (cfs) between 1932 and 2005. The lowest elevation of the Schuylkill riverbed near AOI 9 is approximately 45 feet below mean sea level where the bottom has been dredged. The average stage of the Schuylkill River at AOI 9 is approximately 0.5 feet NAVD 88 (Schreffler, 2001).

Dames and Moore (2001) indicated that the Mingo Creek basin is approximately 25 feet deep, however siltation and shoaling for the basin have likely occurred since it was originally excavated and/or last dredged. Scheinfield and Davenger (2006) noted that within the shallow aquifer near the Philadelphia International Airport, groundwater flow was to the north-northwest toward Mingo Creek basin because of dewatering operations conducted by the PWD. As documented by Stantec (Appendix D) and stated above, the PWD indicated pumping from the Mingo Creek basin occurs approximately every 1 to 3 days depending on water level conditions. Large-capacity pumps are programmed to control the basin's water surface elevation between -10.5 and -11 feet NAVD 88. The pumps have the capacity to transfer water from the Mingo Creek basin to the Schuylkill River at up to 53,000 gallons per minute (gpm). PWD has indicated that pumping the basin water level down from an elevation of -10.5 feet to -11 NAVD 88 requires approximately 1 hour of runtime, and that the span volume of the basin between those controlled elevations is approximately 3 million gallons of water. Stantec's water level data indicating the connection between Mingo Creek basin and the unconfined aquifer is provided in Appendix D in the RIR Addendum.

Anthropogenic Site Features

Three groundwater recovery wells, RW-A, RW-B and RW-B5, are located in AOI 9 (Figure I-11 of the RIR). Since 2004, these recovery wells have not been in service due to low recovery of light non-aqueous phase liquid (LNAPL); however it possible that drawdown associated with the operation of remediation wells at nearby sites could have influenced historic water levels beneath AOI 9 (Scheinfeld and Davenger, 2006).

A set of floodgates control direct communication of surface water between the Mingo Creek Flood Control Basin and the Schuylkill River. As documented in Appendix D, it is reasonable to assume the low water table elevations present throughout much of AOI 9 are the result of pumping from Mingo Creek basin.

Constituents of Concern, Groundwater Plumes, and Plume Stability

Consistent with the F&T analysis in the RIR, delineated areas where COC concentrations in groundwater are above their respective medium-specific concentrations (MSCs) have been grouped into three primary dissolved phase petroleum plume areas described below:

- The Blending Area Plume (Plume 1) is located in the vicinity of well MW-1SRTF (Figure I-1). Since active recovery of LNAPL ceased in 2004, MW-1SRTF was the only well in AOI 9 where measureable LNAPL was identified. However, during the October 2016 gauging event, LNAPL was identified in MW-2SRTF and MW-3SRTF, which are immediately adjacent to MW-1SRTF. Refinement of the hydrogeologic framework shows that Plume 1 is constrained to the perched aquifer.

- During the October 2016 gauging, measurable LNAPL was also observed in monitoring wells S-114SRTF and S-122SRTF, which are located in the West Plume Area (Plume 2). Refinement of the hydrogeologic framework shows that Plume 2 is located in the unconfined aquifer.

- Based on the November 2016 limited groundwater sampling event, two additional groundwater plumes were identified which include unconfined aquifer and lower aquifer methyl tertiary butyl ether (MTBE) plumes located in the southern portion in AOI 9 near Mingo Creek basin. These plumes are collectively referred to as Plume 3.

1,2,4-trimethylbenzene (1,2,4-TMB), 1,2-dibromoethane (EDB), 1,3,5-trimethylbenzene (1,3,5-TMB), benzene, ethylbenzene, MTBE, toluene, xylenes (total), benzo(a)pyrene, benzo(g,h,i)perylene, naphthalene, and lead are the COCs in the perched aquifer that were detected above their respective PADEP non-residential groundwater MSCs. All of the AOI 9 COCs, except cumene, were detected in the unconfined aquifer above their respective PADEP non-residential groundwater MSCs. MTBE is the only COC that has been detected above the PADEP non-residential groundwater MSCs in monitoring wells screened in the lower aquifer. For the AOI 9 CSM plume assessments, groundwater concentration trends for benzene and MTBE, the most mobile of the COCs, were the focus.

Plume Stability Assessment

The persistence of a dissolved plumes was assessed by plotting COC concentration versus time from wells located in Plumes 1 and 2 in the RIR. With sufficient analytical data, a decreasing COC concentration trend in a well can be interpreted as the presence of a shrinking plume with respect to that COC at that location. Similarly, an increasing trend can be interpreted as an expanding plume area (USEPA, 2002). No significant changes in groundwater concentration can be interpreted as a stable-plume. Using multiple wells in a single plume, the

overall stability of the plume can be assessed. Trend graphs for select wells within Plumes 2 and 3 were updated with the groundwater results from the limited groundwater sampling in November 2016.

Plume stability at AOI 9 was also evaluated by generating isoconcentration maps that depict the horizontal distribution of benzene and MTBE in the perched, unconfined and lower aquifers based on the November 2016 groundwater results. Over time, a reduction, redistribution of mass, and/or a decrease in extent can indicate plume attenuation. Conclusions drawn regarding overall plume stability in AOI 9 are preliminary and qualitative. Refer to Appendix D of the RIR Addendum for a quantitative assessment of the potential fate and transport of benzene from Plume 2.

The qualitative plume stability assessment in AOI 9 is described below.

Plume 1

Groundwater concentration trend graphs for benzene and MTBE at monitoring well MW-2SRTF and well WPB-5 screened in the perched aquifer within Plume 1 were created using analytical results from 2009 and 2015 (Figures I-13 and I-14 in the RIR). The concentration trends of these wells indicated the dissolved phase COCs in Plume 1 are decreasing. As stated above, measurable LNAPL was observed in MW-2SRTF and MW-3SRTF during the October 2016 gauging event. This increase in LNAPL extent indicates the potential for slight LNAPL mobility. However, based on minimal LNAPL thickness measured, ranging from 0.11 to 0.63 feet, and the dissolved phase COC distribution, significant mobility of this LNAPL plume is unlikely.

Groundwater isoconcentration maps for benzene and MTBE in the perched, unconfined and lower aquifers were created using analytical results from the limited groundwater sampling in November 2016 (Figures I-2 through I-6). Interpreting the isoconcentration maps for November 2016 and the previous isoconcentration maps from the RIR, the following summaries can be made for Plume 1:

- A groundwater sample was collected from beneath the LNAPL in MW-1SRTF during the November 2016 sampling.
- Benzene and MTBE concentrations detected at MW-1SRTF in November 2016 were 4,980 µg/l and 269 µg/l, respectively, confirming MW-1SRTF is a source area for Plume 1.

- The horizontal extent of benzene has not changed significantly, therefore, the benzene plume in Plume 1 is stable.
- Both the horizontal extent of MTBE and MTBE concentrations have decreased over time which suggests the MTBE plume in Plume 1 is decreasing.
- COC concentrations in the perched, unconfined, and lower aquifer monitoring wells surrounding Plume 1 indicate this plume is vertically constrained to the perched aquifer by the Holocene clay and horizontally limited to the Blending Area.

Plume 2

Plume 2 is generally located in the west-central portion of AOI 9. The dissolved phase petroleum impacts in this area do not appear to be related to a single "source area", but are more likely a result of isolated dissolved phase plumes that have co-mingled over time. For the purpose of the qualitative fate and transport assessment, four major plumes have been identified in this area:

- A larger benzene plume centered around well S-112SRTF;
- A smaller benzene plume centered around monitoring well S-115SRTF;
- A larger MTBE plume centered around monitoring well S-144SRTF; and
- A smaller MTBE plume centered around monitoring well S-115DSRTF.

To evaluate plume stability in Plume 2, benzene and MTBE concentrations versus time were plotted for wells S-112SRTF, S-113SRTF, S-115SRTF, S-110DSRTF, and S-115DSRTF (Figures I-7 through I-11). Recent benzene results (October 2016) from S-112SRTF indicate the source area of the larger benzene plume may be increasing. However, downgradient from S-112SRTF at S-113SRTF, benzene concentrations exhibit fluctuations, but appear to be stable. Benzene concentrations trends at S-115SRTF indicate the smaller benzene plume is decreasing. However, to be conservative in estimating the potential future extent of benzene emanating from S-115SRTF, a continuous benzene source has been assumed (Appendix D of the RIR Addendum).

Based on the limited groundwater sampling event in November 2016, the highest concentration of MTBE within Plume 2 was detected at S-144SRTF. This monitoring well was installed in September 2016; therefore, this well has only been sampled once. To evaluate the stability of the MTBE in Plume 2, concentration trend graphs were created for downgradient monitoring wells S-112SRTF, S-110DSRTF, and S-115DSTRF. With the exception of S-

112SRTF, which exhibits increasing MTBE concentrations, these wells indicate the MTBE plume is stable.

Groundwater isoconcentration maps for benzene and MTBE in the perched, unconfined and lower aquifers were created using analytical results from the limited groundwater sampling in November 2016 sampling events (Figures I-2 through I-6). Interpreting the isoconcentration maps for November 2016, the following summaries can be made for Plume 2:

- Isolated LNAPL plumes identified at monitoring wells S-114SRTF and S-122SRTF may be contributing dissolved phase petroleum impacts to this area.
- Based on the groundwater flow direction maps and isoconcentration maps for benzene and MTBE, portions of the dissolved plumes may have migrated to the west beyond the AOI 9 property boundary.

To evaluate the potential off-site transport of Plume 2, Stantec performed a quantitative fate and transport assessment of benzene from Plume 2 (Appendix D of the RIR Addendum). Based on Stantec's quantitative assessment, dissolved concentrations of benzene in groundwater above the MSC may extend beyond the western boundary of AOI 9.

Plume 3

To evaluate plume stability in Plume 3, MTBE concentrations versus time were plotted for wells S-118DSRTF and S-120DSRTF (Figures I-12 through I-13). Concentrations versus time plots for these wells indicate the MTBE plume is stable in the unconfined aquifer (S-120D) and potentially increasing in the lower aquifer (S-118D).

Groundwater isoconcentration maps illustrating MTBE concentrations in the perched, unconfined and lower aquifers were created using analytical results from the limited groundwater sampling in November 2016 sampling events (Figures I-2 through I-6). Interpreting the isoconcentration maps, the following summaries can be made for Plume 3:

- MTBE is present in both aquifers in this area. Evergreen will continue to evaluate head potentials, water levels, and COC trends in support of the anticipated numerical modeling.
- The MTBE plume in the unconfined aquifer appears to be stable; however, the extent of the MTBE plume in the lower aquifer is not well defined and is potentially from off-site

sources. The source of the MTBE plumes in both aquifers will be evaluated during the Complex-wide Cleanup Plan, and incorporated in the anticipated numerical modeling.

Potential Receptors

Potential human health and ecological receptors to COCs in groundwater in AOI 9 include:

- Workers in occupied buildings that are not under positive pressure (from vapor intrusion into indoor air);
- Offsite users of groundwater;
- Offsite workers in occupied buildings that are not under positive pressure (from vapor intrusion into indoor air); and
- Ecological receptors in Mingo Creek and the Schuylkill River.

Qualitative Fate and Transport Assessment Summary

- Perched groundwater flows radially outward from a potentiometric high point in the east and eventually converges at the center of AOI 9 towards the hole in the Holocene clay. Perched groundwater recharges the unconfined aquifer at the western extent of the perched aquifer, and preferentially where the Holocene clay is absent in the center of AOI 9. The potentiometric surface of the unconfined aquifer is believed to be artificially lowered by the pumping in Mingo Creek basin. Due to the pumping in Mingo Creek basin, recharge of perched groundwater at the center of the AOI, possible groundwater infiltration into Mingo Avenue Sewer, and the presence of heterogeneous aquifer material, groundwater flow conditions in the unconfined aquifer are transient, and subject to differential drawdown throughout AOI 9.

- Groundwater in the lower aquifer generally flows to the south.

- All AOI 9 COCs, except for cumene, were detected in groundwater in the November 2016 limited groundwater sampling at concentrations above their respective used-aquifer, non-residential groundwater MSCs.

- Three dissolved phase petroleum plume areas have been identified with regard to COC exceedances of PADEP groundwater non-residential MSCs.

- Plume 1 is related to residual LNAPL in soil near several historical recovery wells in the Blending Area located near the southern property boundary. Based on the limited LNAPL mobility and presence of an underlying clay aquitard (Holocene clay), contamination from this area is unlikely to migrate any further to reach any potential receptors.

- Plume 2 is generally located in the west-central portion of AOI 9. The dissolved phase petroleum impacts in this area do not appear to be related to a single "source area", but are more likely a result of isolated dissolved phase plumes that have co-mingled over time. For the purpose of the qualitative fate and transport assessment, four major plumes have been identified in this area:

    - A larger benzene plume centered around well S-112SRTF;
    - A smaller benzene plume centered around monitoring well S-115SRTF;
    - A larger MTBE plume centered around monitoring well S-144SRTF; and
    - A smaller MTBE plume centered around monitoring well S-115DSRTF.

  Isolated LNAPL plumes identified at monitoring wells S-114SRTF and S-122SRTF may be contributing dissolved phase petroleum impacts to this area. Recent benzene results (October 2016) from S-112SRTF indicate the source area of the larger benzene plume may be increasing. However, downgradient wells within this plume show stable concentration trends. Based on the groundwater flow direction maps and isoconcentration maps for benzene and MTBE, portions of the dissolved plumes may have migrated to the west beyond the AOI 9 property boundary. A quantitative assessment of the potential off-site transport of benzene from Plume 2 is provided in Appendix D.
- Plume 3 is comprised of MTBE plumes in both the unconfined and lower aquifers in the southwest portion of AOI 9. The MTBE plume in the unconfined aquifer appears to be stable. The extent of the MTBE plume in the lower aquifer is not well defined and could potentially be from off-site source(s). Based on the MTBE concentration trends observed during limited sampling events at monitoring well S-118DSRTF, the MTBE plume in the lower aquifer is potentially increasing. The potential source(s) of MTBE will be evaluated during the Complex-wide Cleanup Plan activities and comprehensively modeled to estimate the future extent of groundwater concentrations.

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Table 2
Existing Well Summary
AOI 9 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Well ID	Former Well ID[2]	AOI #	Northing	Easting	Well Type[3]	Well Classification (Shallow, Intermediate, Deep)	Soil Boring Log Available (Y/N)	Construction Detail Available (Y/N)	Date of Well Completion	Well Construction Details[1]							
										Well Completion Depth (ft. bgs)	Well Diameter (in)	Top of Inner Casing Elevation (ft. msl) (NAVD88)	Ground Surface Elevation[1] (ft.) (NAVD88)	Top of Screen Elevation (ft) (NAVD88)	Bottom of Screen Elevation (ft) (NAVD88)	Depth to Screen (ft. bgs)	Screen Length (ft.)
AOI - 9 (Schuylkill River Tank Farm)																	
S-27 SRTF	S-27	9	--	--	Monitoring Well	Shallow/Intermediate	--	--	--	--	--	--	--	--	--	--	--
S-74 SRTF	S-74	9	216177.890	2679161.000	Monitoring Well	Shallow/Intermediate	Y	Y	2/21/86	14	4	14.54	11.99	7.99	-2.01	4	10
S-74D1 SRTF	--	9	216087.004	2679175.318	Monitoring Well	Deep	--	--	--	86.6[6]	4[6]	12.582	10.851	--	--	--	--
S-74D2 SRTF	--	9	216095.384	2679122.082	Monitoring Well	Deep	Y	Y	7/14/09	42	4	13.281	10.669	-21.331	-31.331	32	10
S-75 SRTF	S-75	9	215842.410	2678408.230	Monitoring Well	Shallow/Intermediate	Y	Y	2/21/86	15.5	4	11.53	11.05	5.55	-4.45	5.5	10
S-76 SRTF	S-76	9	216803.700	2678250.170	Monitoring Well	Shallow/Intermediate/Deep	Y	Y	2/21/86	14	4	6.96	6.64	2.64	-7.36	4	10
S-76D SRTF	--	9	216806.470	2678240.930	Monitoring Well	Deep	--	--	--	83.5[6]	2[6]	8.63	6.51	--	--	--	--
S-77 SRTF	S-77	9	217723.800	2678019.110	Monitoring Well	Shallow/Intermediate/Deep	Y	Y	2/20/86	15	4	4.35	3.45	-1.55	-11.55	5	10
S-78 SRTF	S-78	9	216834.250	2677723.940	Monitoring Well	Shallow/Intermediate/Deep	Y	Y	2/21/86	14	4	1.5	0.64	-3.36	-13.36	4	10
S-79 SRTF	S-79	9	215991.820	2677551.200	Monitoring Well	Shallow/Intermediate/Deep	Y	Y	2/21/86	14.5	4	1.84	1.69	-2.81	-12.81	4.5	10
S-80 SRTF	S-80	9	215206.980	2677375.750	Monitoring Well	Shallow/Intermediate/Deep	Y	Y	2/21/86	15	4	2.57	1.04	-3.71	-13.71	4.75	10
S-81 SRTF	S-81	9	216805.680	2677041.990	Monitoring Well	Shallow/Intermediate/Deep	Y	Y	2/21/86	13.25	4	1.46	-0.59	-3.84	-13.84	3.25	10
S-82 SRTF	S-82	9	217918.130	2677316.360	Monitoring Well	Shallow/Intermediate/Deep	Y	Y	2/25/86	13	4	1.11	-0.07	-3.07	-13.07	3	10
S-83 SRTF	S-83	9	218241.390	2677509.710	Monitoring Well	Shallow/Intermediate/Deep	Y	Y	2/22/86	13	4	2.38	1.27	-1.73	-11.73	3	10
S-109 SRTF	--	9	217894.451	2677084.468	Monitoring Well	Shallow/Intermediate	Y	Y	7/1/09	12	2	2.353	0.241	-1.759	-11.759	2	10
S-110 SRTF	--	9	217259.253	2676977.149	Monitoring Well	Shallow/Intermediate/Deep	Y	Y	6/22/09	7*	4	3.494	0.941	-1.059	--	2	5*
S-114 SRTF	--	9	216434.573	2676977.571	Monitoring Well	Shallow/Intermediate/Deep	Y	Y	6/30/09	15	4	2.159	-0.441	-5.441	-15.441	5	10
S-122 SRTF	--	9	216572.738	2677653.397	Monitoring Well	Shallow/Intermediate/Deep	Y	Y	7/1/09	15	4	2.420	1.041	-1.959	-13.959	3	12
S-129 SRTF	--	9	216640.251	2678837.061	Monitoring Well	Shallow/Intermediate/Deep	Y	Y	6/24/09	15	4	11.346	8.399	3.399	-6.601	5	10
S-104 SRTF	S-104	9	--	--	Monitoring Well	Shallow/Intermediate	Y	Y	10/3/86	15	4	11.97	15.05	10.05	0.05	5	10
S-105 SRTF	S-105	9	215474.480	2676792.830	Monitoring Well	Shallow/Intermediate	Y	Y	10/7/86	12.5	4	1.95	-1.21	-3.71	-13.71	2.5	10
S-106 SRTF	S-106	9	214765.250	2677605.420	Monitoring Well	Shallow/Intermediate	Y	Y	10/2/86	13	4	10.02	7.17	4.17	-5.83	3	10
S-106D SRTF	--	9	214778.370	2677609.520	Monitoring Well	Deep	--	--	--	91[6]	2[6]	9.46	7.37	--	--	--	--
S-107 SRTF	S-107	9	--	--	Monitoring Well	Shallow/Intermediate	Y	Y	11/10/94	15	4	14.48	11.31	6.31	-3.69	5	10
S-108 SRTF	--	9	218321.234	2677666.572	Monitoring Well	Shallow/Intermediate	Y	Y	6/17/09	12	4	4.313	1.066	-0.934	-10.934	2	10
S-110D SRTF	--	9	217259.296	2676986.318	Monitoring Well	Deep	Y	Y	6/23/15	60	4	2.670	0.319	-39.681	-59.681	40	20
S-111 SRTF	--	9	217432.087	2677273.189	Monitoring Well	Shallow/Intermediate/Deep	Y	Y	6/23/09	15	4	0.776	1.355	-3.645	-13.645	5	10
S-112 SRTF	--	9	216983.650	2677255.771	Monitoring Well	Shallow/Intermediate/Deep	Y	Y	6/22/09	12	4	1.515	-1.407	-3.407	-13.407	2	10
S-113 SRTF	--	9	216800.094	2676914.895	Monitoring Well	Shallow/Intermediate/Deep	Y	Y	6/19/09	15	4	3.020	0.433	-4.567	-14.567	5	10
S-115 SRTF	--	9	216194.161	2676754.377	Monitoring Well	Shallow/Intermediate/Deep	Y	Y	6/4/09	15	4	2.748	0.200	-4.8	-14.8	5	10
S-115D SRTF	--	9	216206.278	2676754.860	Monitoring Well	Deep	Y	Y	6/12/15	58	4	2.416	-0.300	-38.2995	-58.2995	38	20
S-116 SRTF	--	9	215941.827	2676903.275	Monitoring Well	Shallow/Intermediate/Deep	Y	Y	6/4/09	15	4	0.866	-1.682	-6.682	-16.682	5	10
S-117 SRTF	--	9	215734.945	2676674.754	Monitoring Well	Shallow/Intermediate	Y	Y	6/3/09	15	4	2.873	0.523	-4.477	-14.477	5	10
S-118 SRTF	--	9	215161.136	2676677.720	Monitoring Well	Shallow/Intermediate	Y	Y	6/3/09	15	4	3.632	1.022	-3.978	-13.978	5	10
S-118D SRTF	--	9	215159.799	2676690.243	Monitoring Well	Deep	Y	Y	6/19/15	79.5	4	3.006	0.659	-58.8413	-78.8413	59.5	20
S-119 SRTF	--	9	214808.507	2676922.941	Monitoring Well	Shallow/Intermediate	Y	Y	6/11/09	12	4	2.355	-0.619	-1.619	-12.619	1	11
S-120 SRTF	--	9	215265.133	2677550.794	Monitoring Well	Shallow/Intermediate	Y	Y	6/5/09	15	4	12.068	9.457	4.457	-5.543	5	10
S-120D SRTF	--	9	215267.387	2677542.246	Monitoring Well	Deep	Y	Y	6/12/09	35	4	12.366	9.350	-15.65	-25.65	25	10
S-121 SRTF	--	9	215710.024	2677485.962	Monitoring Well	Shallow/Intermediate	Y	Y	6/24/09	15	4	1.009	1.463	-3.537	-13.537	5	10
S-123 SRTF	--	9	216789.990	2677861.259	Monitoring Well	Shallow/Intermediate/Deep	Y	Y	6/29/09	10*	4	2.420	2.944	-2.056	--	5	5*
S-124 SRTF	--	9	216398.433	2677901.078	Monitoring Well	Shallow/Intermediate/Deep	Y	Y	6/11/09	12	4	7.876	4.938	2.938	-7.062	2	10
S-125 SRTF	--	9	216114.464	2677820.289	Monitoring Well	Shallow/Intermediate/Deep	Y	Y	6/30/09	12	4	7.181	4.626	2.626	-7.374	2	10
S-126 SRTF	--	9	215066.858	2677909.915	Monitoring Well	Shallow/Intermediate/Deep	Y	Y	6/4/09	15	4	11.829	9.210	4.21	-5.79	5	10
S-127 SRTF	--	9	215607.335	2678537.389	Monitoring Well	Shallow/Intermediate/Deep	Y	Y	6/10/09	15	4	12.128	9.541	6.541	-5.459	3	12
S-128 SRTF	--	9	216040.095	2678633.585	Monitoring Well	Shallow/Intermediate/Deep	Y	Y	6/10/09	15	4	13.314	10.341	7.341	-4.659	3	12
S-130 SRTF	--	9	215534.299	2678986.149	Monitoring Well	Shallow/Intermediate/Deep	Y	Y	6/29/09	12	4	11.413	8.539	6.539	-3.461	2	10
S-131 SRTF	--	9	215919.278	2679372.329	Monitoring Well	Shallow/Intermediate/Deep	Y	Y	7/20/09	16	4	8.805	6.468	0.468	-9.532	6	10
S-132 SRTF	--	9	216093.960	2679907.044	Monitoring Well	Shallow/Intermediate/Deep	Y	Y	6/25/09	12	4	8.703	5.969	3.969	-6.031	2	10
S-133 SRTF	--	9	218139.769	2678047.078	Monitoring Well	Shallow/Intermediate/Deep	Y	Y	6/8/09	15	4	4.677	2.058	-2.942	-12.942	5	10
S-134 SRTF	--	9	217578.495	2678432.568	Monitoring Well	Shallow/Intermediate/Deep	Y	Y	6/18/09	15	4	10.335	10.676	5.676	-4.324	5	10
S-135 SRTF	--	9	216461.823	2676810.093	Monitoring Well	Shallow	Y	Y	6/16/15	20	4	2.178	-0.589	-5.5886	-20.5886	5	15
S-136 SRTF	--	9	218406.192	2677243.791	Monitoring Well	Shallow	Y	Y	7/27/15	15	2	4.951	1.549	0.5489	-13.4511	1	14
MW-1 SRTF	MW-1	9	215031.720	2677759.010	Monitoring Well	Shallow/Intermediate	--	--	--	16.6[6]	4[6]	10.08	8.1	--	--	--	--
MW-2 SRTF	MW-2	9	215020.030	2677732.090	Monitoring Well	Shallow/Intermediate	--	--	--	12[6]	4[6]	7.33	7.71	--	--	--	--
MW-3 SRTF	MW-3	9	215010.900	2677753.470	Monitoring Well	Shallow/Intermediate	--	--	--	--	--	9.88	7.22	--	--	--	--
RW-A	--	9	215502.450	2676803.040	Recovery Well - Inactive	Shallow/Intermediate				11.6[6]	6[6]	-1.87	-1.42				
RW-B	--	9	215039.530	2677745.510	Recovery Well - Active	Shallow/Intermediate	--	--	--	12.6[6]	6[6]	7.4	7.78	--	--	--	--
RW-B5	--	9	215112.490	2677731.800	Recovery Well - Inactive	Shallow/Intermediate	--	--	--	13.6[6]	4[6]	7.84	8.52	--	--	--	--
WP-1	--	9	--	--	Monitoring Well Point Location	Shallow/Intermediate	Y	Y	6/9/92	15	4	5.79	--	--	--	4	10
WP-10	--	9	215290.938	2682063.085	Monitoring Well Point Location	Shallow/Intermediate	Y	Y	6/9/92	15	2	10.16	--	--	--	5	10
WP-2	--	9	--	--	Monitoring Well Point Location	Shallow/Intermediate	Y	Y	6/9/92	15	4	5.83	--	--	--	5	10
WP-3	--	9	--	--	Monitoring Well Point Location	Shallow/Intermediate	Y	Y	6/3/92	15	2	5.16	--	--	--	3	11
WP-4	--	9	--	--	Monitoring Well Point Location	Shallow/Intermediate	Y	Y	6/3/92	13	2	--	--	--	--	2	10
WP-5	--	9	--	--	Monitoring Well Point Location	Shallow/Intermediate	Y	Y	6/3/92	15	2	--	--	--	--	5	9
WP-6	--	9	--	--	Monitoring Well Point Location	Shallow/Intermediate	Y	Y	5/28/92	15	2	--	--	--	--	5	9
WP-7	--	9	--	--	Monitoring Well Point Location	Shallow/Intermediate	Y	Y	6/3/92	15	2	--	--	--	--	5	10
WP-8	--	9	215136.674	2682440.816	Monitoring Well Point Location	Shallow/Intermediate	Y	Y	6/9/92	15	2	6.99	--	--	--	5	10
WP-9	--	9	215223.177	2682225.999	Monitoring Well Point Location	Shallow/Intermediate	Y	Y	6/3/92	15	2	8.57	--	--	--	5	10
WPA-1	--	9	215456.360	2676796.560	Monitoring Well Point Location	Shallow/Intermediate	Y	Y	2/16/93	12	2	2.73	-1.03	-2.53	-12.53	1.5	10
WPA-2	--	9	215475.790	2676772.670	Monitoring Well Point Location	Shallow/Intermediate	Y	Y	2/16/93	12	2	2.69	-1.93	-3.43	-13.43	1.5	10
WPA-3	--	9	215490.960	2676782.800	Monitoring Well Point Location	Shallow/Intermediate	Y	Y	2/16/93	12	2	3.25	-1.94	-3.44	-13.44	1.5	10
WPA-5	--	9	215578.500	2676815.810	Monitoring Well Point Location	Shallow/Intermediate	Y	Y	2/16/93	12	2	2.48	-1.67	-2.67	-12.67	1	10
WPB-1	--	9	--	--	Monitoring Well Point Location	Shallow/Intermediate	Y	Y	2/17/93	10.5	2	13.61	--	--	--	0.5	10
WPB-2	--	9	215057.330	2677705.610	Monitoring Well Point Location	Shallow/Intermediate	Y	Y	2/17/93	12	2	11.3	7.91	5.91	-4.09	2	10
WPB-3	--	9	214997.260	2677732.580	Monitoring Well Point Location	Shallow/Intermediate	Y	Y	2/17/93	12	2	7.16	7.35	5.35	-4.65	2	10
WPB-4	--	9	214999.490	2677774.580	Monitoring Well Point Location	Shallow/Intermediate	Y	Y	2/18/93	12	2	12.9	7.51	5.51	-4.49	2	10
WPB-5	--	9	215114.050	2677727.880	Monitoring Well Point Location	Shallow/Intermediate	Y	Y	2/22/93	12	2	12.32	8.23	6.23	-63.77	2	70
WPB-6	--	9	--	--	Monitoring Well Point Location	--	--	--	--	--	--	--	11.81	--	--	--	--
WPB-7	--	9	--	--	Monitoring Well Point Location	--	--	--	--	--	--	--	11.52	--	--	--	--

-- Data could not be located or determined based on available reports

Abandoned/destroyed wells.

NOTES:

AOI - Area of Interest
ft. - feet
bgs - below ground surface
in. - inches
msl - elevation relative to mean sea level

1. Well construction details were taken directly from well boring logs provided by Handex, Secor, Aquaterra or collected from available historic reports. Where no well boring logs exist, no well construction or lithologic data is listed
2. Former well IDs were derived from handwritten notes on the logs themselves or the referenced report
3. Well type was chosen based on the formation in which the well was screened. Shallow = screened in Fill/Alluvium; Intermediate = screened in Trenton Gravel; Deep = screened in Farrington Sand
4. Wells unable to be located.
5. Wells damaged.
6. Well completion depth and well diameter obtained from Aquaterras August 2009 gauging event

* Total depth and screen length reflect changes due to the addition of 5-feet of bentonite to monitoring wells S-110 and S-123 in September 2016.

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Table 7
Summary of Indoor Air Quality Analytical Results
AOI 9 Remedial Investigations Report Addendum
Philadelphia Energy Solutions Refining Complex
Philadelphia, Pennsylvania

Analyte	CAS Number	PADEP VI	1/10th PADEP VI	OSHA PEL TWA	EPA RSL Cancer Risk = 10^{-5} HQ = 0.1	EPA RSL Cancer Risk = 10^{-6} HQ = 0.1	NIOSH RELs	ACGIH TLVs	Location	Outdoor					SR2 Corner Office					Loading Dock Office SR9					Loading Dock Office SR9				
									Sample	AOI9-AA-16-001					AOI9-AI-16-001					AOI9-AI-16-002					AOI9-AI-16-002-DUP				
									Date	4/5/2016					4/5/2016					4/5/2016					4/5/2016				
									Collected By	GHD					GHD					GHD					GHD				
									Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
1,2,4-Trimethylbenzene	95-63-6	31	3.1	NS	3.1	3.1	125,000	123,000	ug/m3	1	J	0.98	***4.9***	1	1.2	J	0.98	***4.9***	1	ND	U	0.98	***4.9***	1	ND	U	0.98	***4.9***	1
1,2-Dibromoethane	106-93-4	0.2	0.02	153,700	0.2	0.02	346	NS	ug/m3	ND	U	***1.5***	***7.7***	1	ND	U	***1.5***	***7.7***	1	ND	U	***1.5***	***7.7***	1	ND	U	***1.5***	***7.7***	1
1,2-Dichloroethane	107-06-2	4.7	0.47	202,400	3.1	0.47	4,000	40,500	ug/m3	ND	U	***0.81***	***4***	1	ND	U	***0.81***	***4***	1	ND	U	***0.81***	***4***	1	ND	U	***0.81***	***4***	1
1,3,5-Trimethylbenzene	108-67-8	31	3.1	NS	NS	NS	125,000	123,000	ug/m3	ND	U	0.98	***4.9***	1	ND	U	0.98	***4.9***	1	ND	U	0.98	***4.9***	1	ND	U	0.98	***4.9***	1
Benzene	71-43-2	16	1.6	3,190	13	1.6	319	1,600	ug/m3	1.8	J	0.64	***3.2***	1	1.3	J	0.64	***3.2***	1	0.71	J	0.64	***3.2***	1	0.64	J	0.64	***3.2***	1
Ethylbenzene	100-41-4	49	4.9	435,000	49	4.9	435,000	86,800	ug/m3	ND	U	0.87	4.3	1	2.9	J	0.87	4.3	1	ND	U	0.87	4.3	1	1.5	J	0.87	4.3	1
Isopropylbenzene (Cumene)	98-82-8	1,800	180	245,000	180	180	245,000	246,000	ug/m3	ND	U	0.98	4.9	1	ND	U	0.98	4.9	1	ND	U	0.98	4.9	1	ND	U	0.98	4.9	1
Methyl Tert-Butyl Ether	1634-04-4	470	47	NS	470	47	NS	180,000	ug/m3	ND	U	0.72	3.6	1	ND	U	0.72	3.6	1	ND	U	0.72	3.6	1	ND	U	0.72	3.6	1
Naphthalene	91-20-3	3.6	0.36	50,000	1.3	0.36	50,000	52,000	ug/m3	ND	U	***2.6***	***5.2***	1	ND	U	***2.6***	***5.2***	1	ND	U	***2.6***	***5.2***	1	ND	U	***2.6***	***5.2***	1
Toluene	108-88-3	22,000	2200	754,000	2,200	2,200	375,000	75,400	ug/m3	3.3	J	0.75	3.8	1	4.1		0.75	3.8	1	0.88	J	0.75	3.8	1	0.88	J	0.75	3.8	1
Total Xylenes	1330-20-7	440	44	435,000	44	44	435,000	434,000	ug/m3	3.5	J	0.87	4.3	1	14.5		0.87	4.3	1	1.1	J	0.87	4.3	1	7	J	0.87	4.3	1

Note:
PADEP VI- Pennsylvania Department of Environmental Protection Vapor intrusion Screening Value. Indoor Air Statewide Health Standard Non-Residential Vapor Intrusion Screening Level (November 2016).
OSHA PEL TWA - Occupational Safety and Health Administration Time-Weighted Average Permissible Exposure Limit .
EPA RSL - United States Environmental Protection Agency Industrial Regional Screening Level.
HQ - Hazard Quotient
NIOSH RELs - National Institute for Occupational Safety and Health Recommended Exposure Limits.
ACGIH TLVs - American Conference of Governmental Industrial Hygienists Threshold Limit Value.
The RSL for 1,2,4 and 1,3,5- trimethylbenzene were calculated using the September 2016 final IRIS RfC.
OSHA PELs, NIOSH RELs, and ACGIH TLVs from GHD's Air Data Evaluation Letter (Reference No. 11109626), November 9, 2016.
CAS - Chemical Abstract Registry Number
ug/m3 - Micrograms per cubic meter
Q - Qualifier
MDL - Method detection limit
RL - Reporting limit
DF - Dilution factor
ND - Not detected
NS - No standard
NA - Not analyzed

Qualifiers:
U - Compound analyzed but not detected
D- Diluted Sample
J - Compound detected below below the reporting limit (the value given is an estimate).

Exceedances:
10 - Result exceeds PA VI
10 - Result exceeds 1/10th PA VI
10 - Result exceeds OSHA PEL TWA
10 - Result exceeds EPA RSL (HQ = 0.1, Target Cancer Risk = 10^{-5})
10 - Result exceeds EPA RSL (HQ = 0.1, Target Cancer Risk = 10^{-6})
10 - Result exceeds NIOSH REL
10 - Result exceeds ACGIH TLVs
15 - MDL exceeds standard

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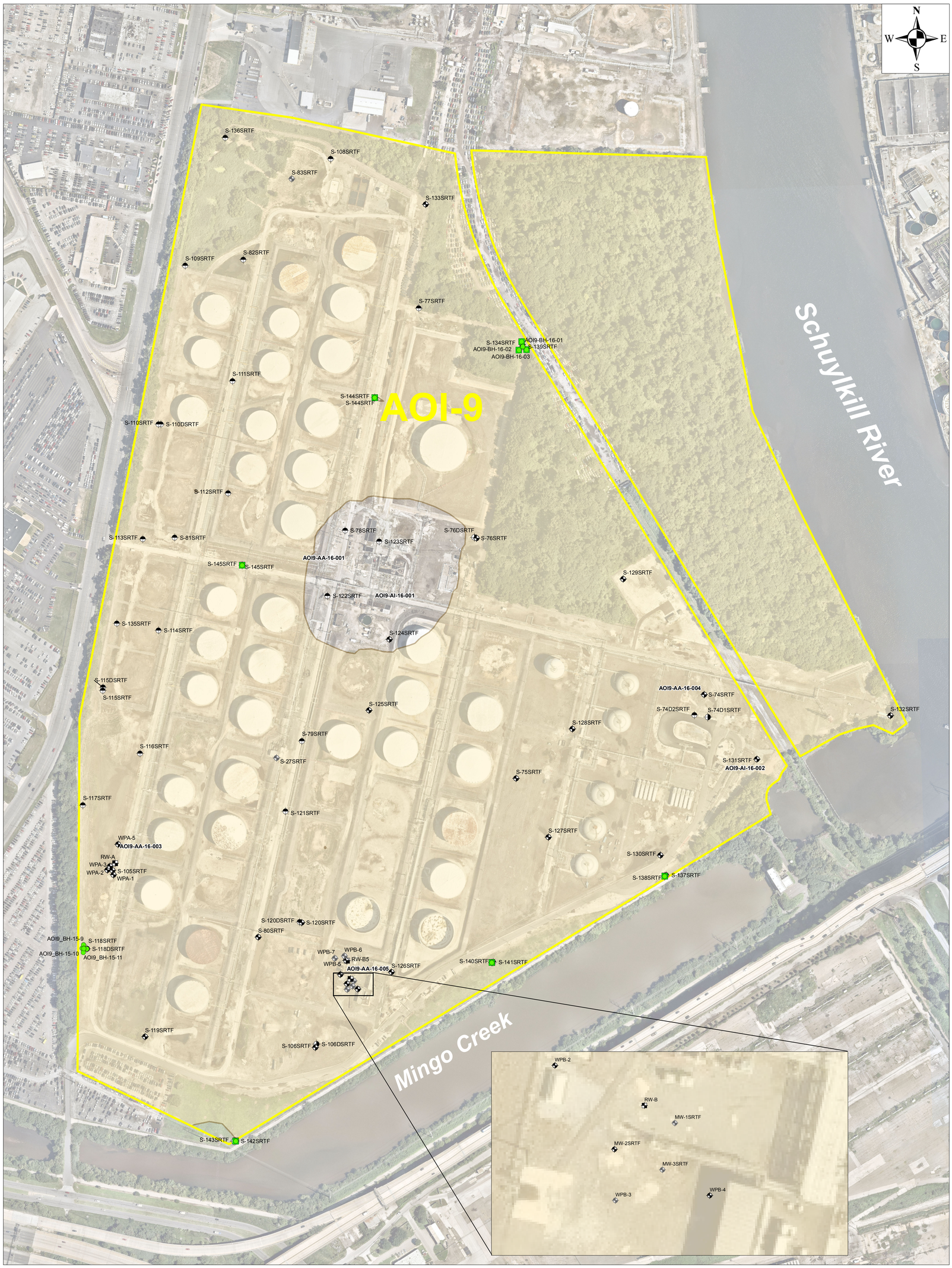

Legend

- Surface Soil Boring Location
- Subsurface Soil Boring Location
- Well Abandoned/Destroyed/Unable to Locate
- Perched Aquifer Monitoring Well
- Unconfined Aquifer Monitoring Well
- Lower Aquifer Monitoring Well
- Perched Aquifer Recovery Well
- AOI-9 SRTF Boundary
- Holocene Clay Layer Extent

Notes:
1. Aerial imagery provided by Nearmap.com, dated 7/29/2015.

Figure 4: Interpreted Extent of Holocene Clay
AOI-9 Remedial Investigation Report Addendum
PES Philadelphia Refining Complex
Philadelphia, Pennsylvania

Evergreen Resources Management Operations
2 Righter Parkway, Suite 200
Wilmington, DE 19803

0 90 180 360 Feet

SCALE: 1" = 180'
DATE: December 28, 2015
DRN. BY: MH
CKD. BY: KM
JOB#: 257402

Path: \\langan.com\data\DYL\data0\257460\1\ArcGIS\MapDocuments\AOI 9 RIR Addendum 2016\Figure 4 - Interpreted Extent of Middele\Lower Clay_012517.mxd Date: 5/1/2017 User: edieck Time: 10:31:21 AM

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Legend

- Well Abandoned/Destroyed/Unable to Locate
- Perched Aquifer Monitoring Well
- Unconfined Aquifer Monitoring Well
- Lower Aquifer Monitoring Well
- Perched Aquifer Recovery Well
- Approximate Sewer Manhole Location
- Mingo Avenue Sewers
- Schuylkill West Side Interceptor Sewer
- A-A' Cross Section Location
- B-B' Cross Section Location
- AOI-9 SRTF Boundary
- Holocene Clay Layer Extent

Notes:
1. Aerial imagery provided by Nearmap.com, dated 7/29/2015.
2. Sewers may continue beyond extent shown on this figure.

Figure 5: Geologic Cross Section Location Plan
AOI-9 Remedial Investigation Report Addendum
PES Philadelphia Refining Complex
Philadelphia, Pennsylvania

Evergreen Resources Management Operations
2 Righter Parkway, Suite 200
Wilmington, DE 19803

0 180 360 Feet

SCALE: 1" = 180'
DATE: January 25, 2017
DRN. BY: MH
CKD. BY: KM
JOB #: 2574602

Path: \\angan.com\data\DYL\data6\2574601A\rcGIS\MapDocuments\AOI 9 RIR Addendum 2016\Figure 5 - Geologic Cross Section Location Plan_062217.mxd Date: 6/22/2017 User: MMking Time: 3:37:44 PM

W — E

APPROXIMATE LOCATION OF MINGO AVENUE SEWERS (see notes 5 and 6)

TRIPLE SANITARY SEWER DIMENSIONS
6'9" W X 5'3" D
6'9" W X 4'3" D
6'9" W X 7'0" D

STORMWATER SEWER DIMENSIONS
8'0" W X 8'0" D

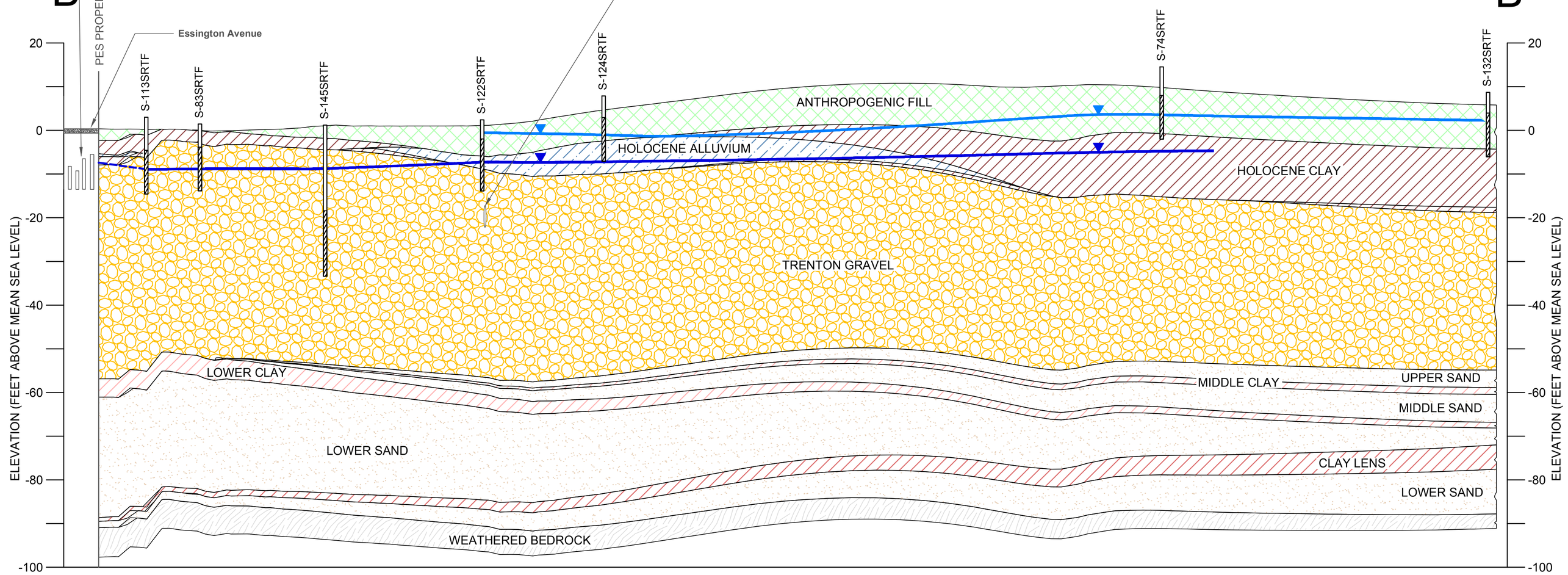
APPROXIMATE DEPTH FROM GRADE - 13.5 FEET

APPROXIMATE LOCATION OF SCHUYLKILL WEST SIDE INTERCEPTOR SEWER (see note 7)

DIMENSIONS: 5 FOOT DIAMETER PIPE
APPROXIMATE DEPTH FROM GRADE - 28 FEET

LEGEND:

- FILL
- HOLOCENE CLAY
- HOLOCENE ALLUVIUM
- GRAVEL
- SAND
- CLAY
- CLAY LENS
- WEATHERED BEDROCK
- PERCHED AQUIFER GROUNDWATER SURFACE
- UNCONFINED AQUIFER GROUNDWATER SURFACE (DASHED WHERE INFERRED)
- S-80SRTF — LOCATION ID
- WELL CASING/BOREHOLE
- WELL SCREEN
- SCHUYLKILL WEST SIDE INTERCEPTOR SEWER
- MINGO AVENUE SEWER



NOTES:

1. GEOLOGIC CROSS-SECTION WAS CREATED FROM THE 3D GEOLOGIC MODEL OF AOI 9, WHICH WAS GENERATED IN EARTH VOLUMETRIC STUDIO (EVS) SOFTWARE.
2. THE PERCHED AQUIFER AND UNCONFINED AQUIFER GROUNDWATER SURFACES WERE INTERPOLATED IN EVS USING THE GROUNDWATER ELEVATION DATA COLLECTED DURING THE OCTOBER 2016 GAUGING EVENT BY LANGAN.
3. ALL REFERENCED FIGURES PROVIDED BY PA DESIGN ONE CALL OR DIRECTLY FROM PHILADELPHIA WATER DEPARTMENT (PWD).
4. DEPTHS OF SEWERS ARE ASSUMED.
5. ASSUMED THE TRIPLE SANITARY SEWER IS AT THE SAME DEPTH BELOW GRADE AS THE STORWATER SEWER WITH THE SAME CONDUIT WALL THICKNESS.
6. REFERENCES FOR MINGO AVE SEWER:
SEWER PLAN PROVIDED BY PHILADELPHIA WATER DEPARTMENT (PWD)- NO DATE OR TITLE BLOCK PROVIDED ON FIGURE
ESSINGTON AVE BARTRAM AVE TO 70TH STREET. MARCH 15, 1973. SHEETS 3 AND 4 OF 4
CONSTRUCTION OF SEWER IN ESSINGTON AVENUE FROM MINGO AVENUE TO 70TH STREET. CITY OF PHILADELPHIA WATER DEPARTMENT (PWD). DECEMBER 7. 1963.
7. REFERENCES FOR SCHUYLKILL WEST SIDE INTERCEPTOR SEWER:
SEWER PLAN PROVIDED BY PHILADELPHIA WATER DEPARTMENT (PWD)- NO DATE OR TITLE BLOCK PROVIDED ON FIGURE
MINGO CREEK SURGE BASIN AND APPURTENANT WORK CROSS SECTIONS. CITY OF PHILADELPHIA WATER DEPARTMENT (PWD). MAY 10, 1976.
8. APPROXIMATE DEPTH OF SCHUYLKILL WEST SIDE INTERCEPTOR SEWER BASED ON ESTIMATION OF PIPE SLOPE AT THIS LOCATION.

150 0 75 150
SCALE IN FEET

15 0 7.5 15
SCALE IN FEET

Evergreen Resources Management Operations
2 Righter Parkway, Suite 200
Wilmington, DE 19803

Project
AOI-9 REMEDIAL INVESTIGATION REPORT ADDENDUM
PES PHILADELPHIA REFINING COMPLEX
PHILADELPHIA COUNTY PENNSYLVANIA

Drawing Title
GEOLOGIC CROSS SECTION B-B'

Project No. 2574601	Drawing No. 6b
Date 1/24/2017	
Scale 1"=150' HOR. 1"=15' VER.	
Drawn By MMK / Checked By ED	
Submission Date 1/24/2017	

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MONITORING WELL LOG: S-110SRTF

PROJECT:	Sunoco - Philadelphia Refinery	DRILLING CO.:	Total Quality Drilling
SITE LOCATION:	AOI-9 - SRTF	DRILLING METHOD:	6" Hollow Stem Auger
JOB NO.:		SAMPLING METHOD:	Split Spoon Sampling
LOGGED BY:	Shaun Sykes	SCREEN/RISER DIAMETER:	4"
DATES DRILLED:	6/22/2009	WELLBORE DIAMETER:	6"
TOTAL DEPTH:	12'	ELEVATION:	-

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0	0.0		Fill, orange-brown sandy silt, slightly moist, no odor	Sample taken from 1-2' on 6/1/2009	2' PVC Riser	
	0.5		Orange-brown silty sand, slightly moist, no odor			
-5				Cleared to 10', backfilled with sand		
			5-feet of bentonite was added to monitoring well S-110SRTF in September 2016 to adjust depth to bottom and screen length. Well now screened from 2'-7'.			
-10	1.7		Wet, coarse sand and mixed gravels (brown/tan), no odor		10' PVC Screen	
	1.5		Same as above			

MONITORING WELL LOG: S-123SRTF

PROJECT:	Sunoco - Philadelphia Refinery	DRILLING CO.:	Total Quality Drilling
SITE LOCATION:	AOI-9 - SRTF	DRILLING METHOD:	6" Hollow Stem Auger
JOB NO.:		SAMPLING METHOD:	Split Spoon Sampling
LOGGED BY:	Shaun Sykes	SCREEN/RISER DIAMETER:	4"
DATES DRILLED:	6/29/2009	WELLBORE DIAMETER:	6"
TOTAL DEPTH:	15'	ELEVATION:	-

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0			Asphalt & gravel, fill	No 2' sample - Asphalt	5' PVC Riser	
-5				Cleared to 10', backfilled with sand		
-10	550		Medium brown, fine sandy clay, wet, strong odor		10' PVC Screen	
	1120		Medium brown, fine sand and clay, wet, strong odor			
	987		Same as above			
	801		Same as above			
	302		Medium brown, mixed sands, trace clay, wet, odors			
-15			Same as above			

5-feet of bentonite was added to monitoring well S-123SRTF in September 2016 to adjust depth to bottom and screen length. Well now screened from 5'-10'.

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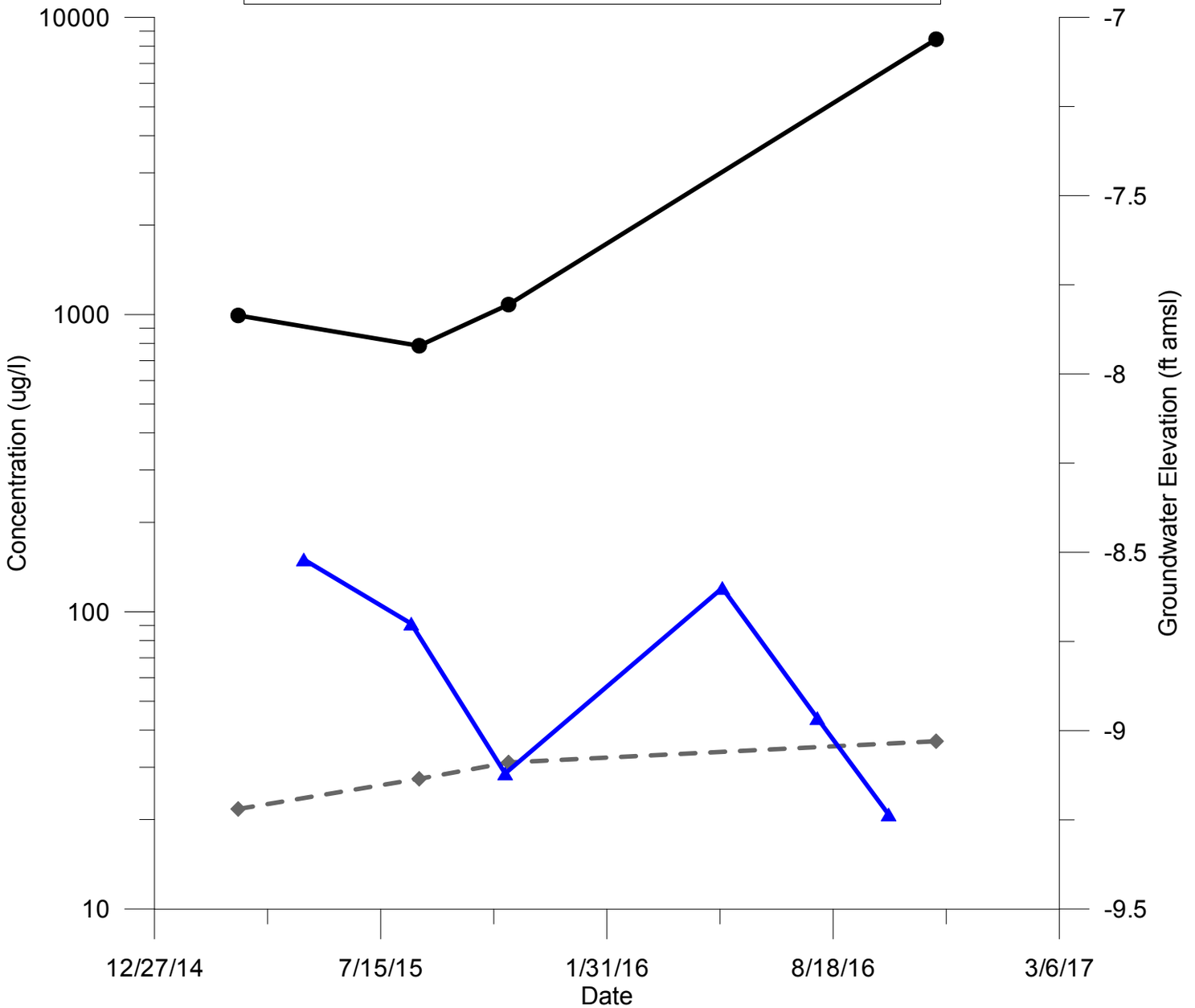
Trend Graphs

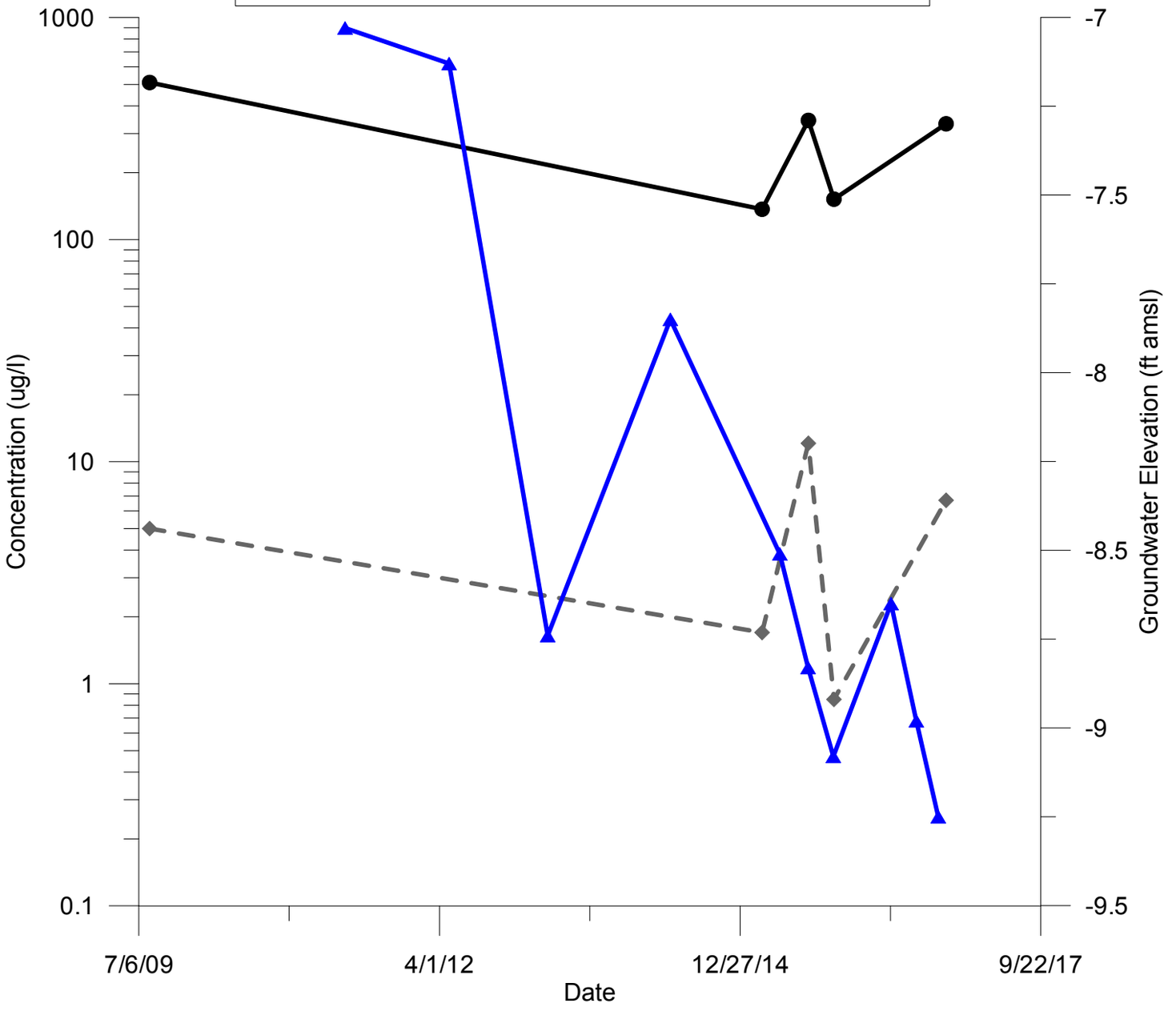
Figure I-7
Plume 2
Benzene and MTBE Concentration Trends at Well S-112SRTF
AOI 9 Remedial Investigation Report Addendum
PES Philadelphia Refining Complex
Philadelphia, PA



Legend
Benzene
MTBE
Groundwater Elevation

Notes:
1. Analytical data was obtained from March 2015, August 2015, November 2015, and November 2016 sampling events.
2. ug/l = microgram per liter.
3. MTBE = methyl tertiary butyl ether.
4. Concentrations are displayed on a log-10 scale.
5. Groundwater elevations were obtained from May 2015, August 2015, November 2015, May 2016, August 2016, and October 2016 gauging events.
6. ft amsl = feet above mean sea level.

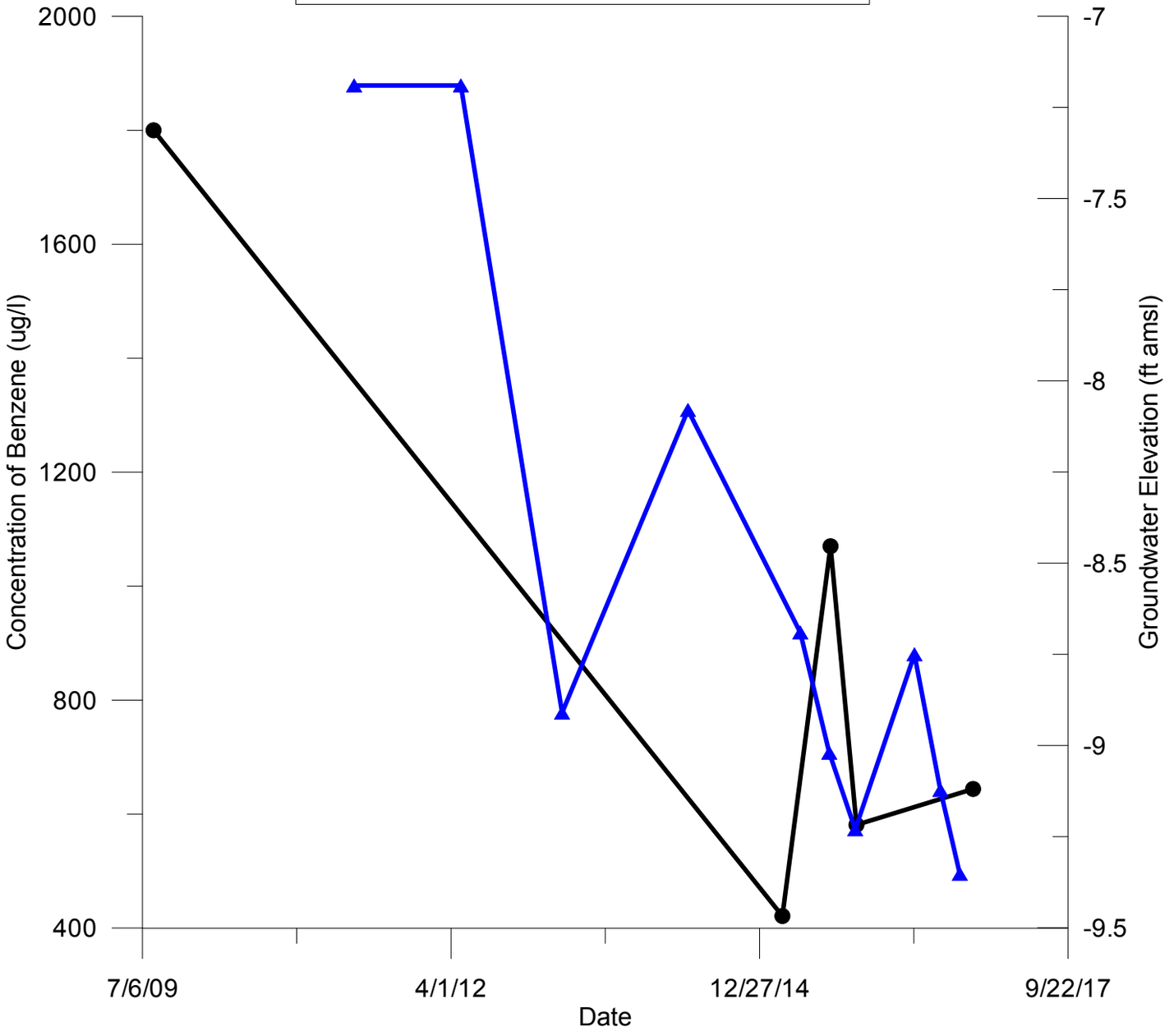
Figure I-8
Plume 2
Benzene and MTBE Concentration Trends at Well S-113SRTF
AOI 9 Remedial Investigation Report Addendum
PES Philadelphia Refining Complex
Philadelphia, PA



Legend
- Benzene
- MTBE
- Groundwater Elevation

Notes:
1. Analytical data was obtained from August 2009, March 2015, August 2015, November 2015, and November 2016 sampling events.
2. ug/l = microgram per liter.
3. MTBE = methyl tertiary butyl ether.
4. Concentrations are displayed on a log-10 scale.
5. Groundwater elevations were obtained from May 2011, May 2012, March 2013, May 2014, May 2015, August 2015, November 2015, May 2016, August 2016, and October 2016 gauging events.
6. ft amsl = feet above mean sea level.

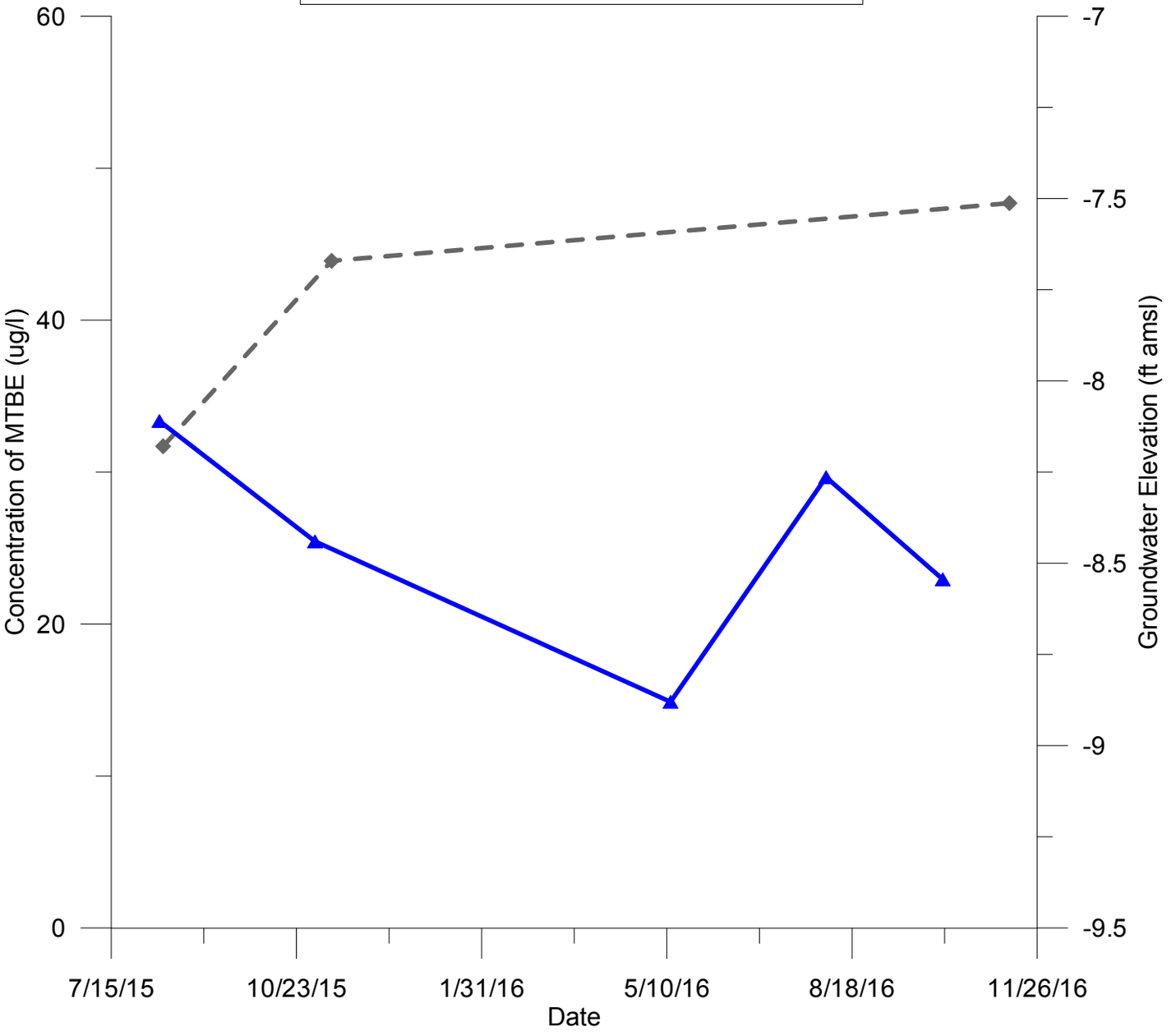
Figure I-9
Plume 2
Benzene Concentration Trend at Well S-115SRTF
AOI 9 Remedial Investigation Report Addendum
PES Philadelphia Refining Complex
Philadelphia, PA



Legend
Benzene
Groundwater Elevation

Notes:
1. Analytical data was obtained from August 2009, March 2015, August 2015, November 2015, and November 2016 sampling events.
2. ug/l = microgram per liter.
3. Groundwater elevations were obtained from May 2011, May 2012, March 2013, May 2014, May 2015, August 2015, November 2015, May 2016, August 2016, and October 2016 gauging events.
4. ft amsl = feet above mean sea level.

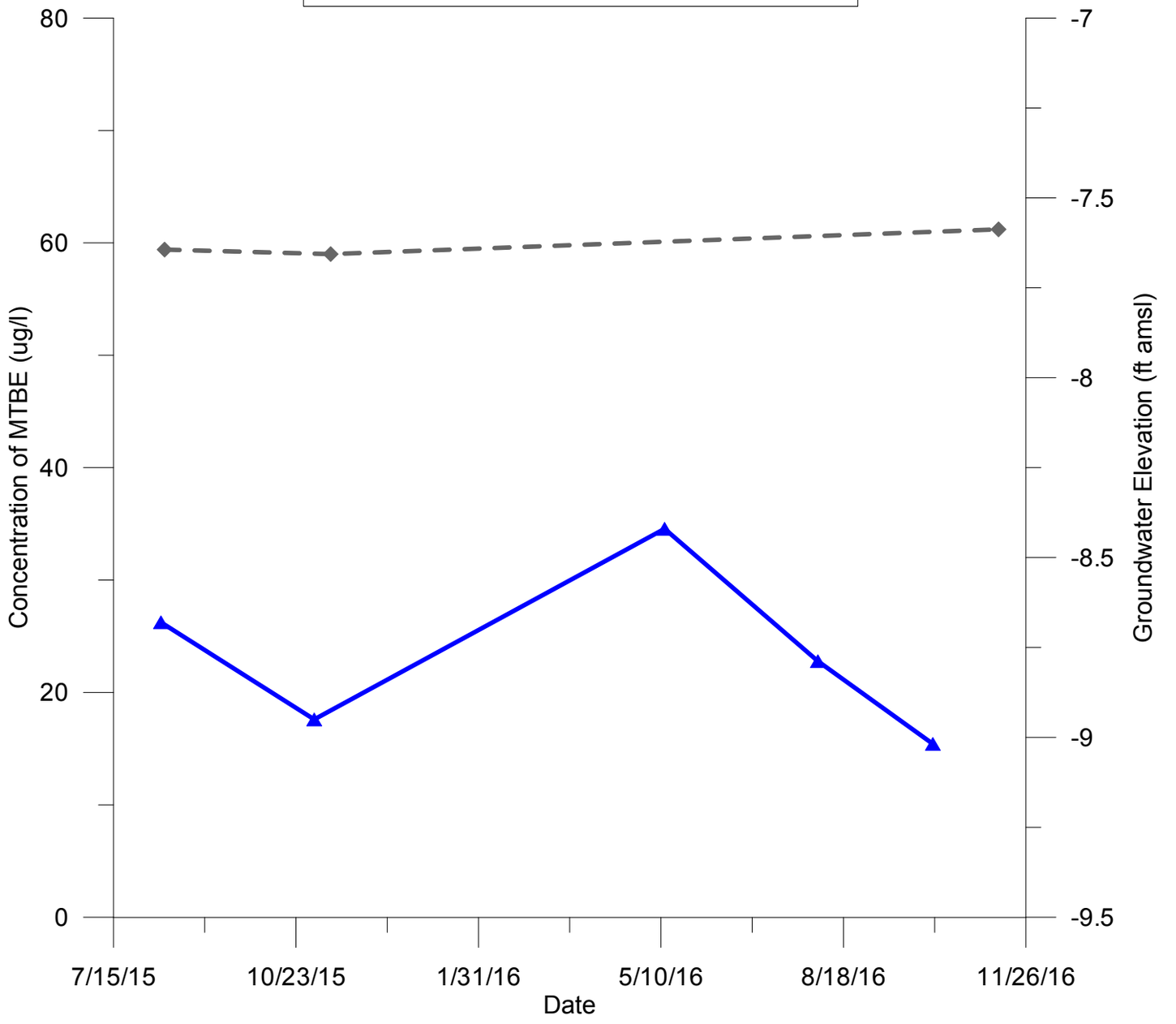
Figure I-10
Plume 2
MTBE Concentration Trend at Well S-110DSRTF
AOI 9 Remedial Investigation Report Addendum
PES Philadelphia Refining Complex
Philadelphia, PA



Legend
MTBE
Groundwater Elevation

Notes:
1. Analytical data was obtained from August 2015, November 2015,and November 2016 sampling events.
2. ug/l = microgram per liter.
3. MTBE = methyl tertiary butyl ether.
4. Groundwater elevations were obtained from August 2015, November 2015, May 2016, August 2016, and October 2016 gauging events.
5. ft amsl = feet above mean sea level.

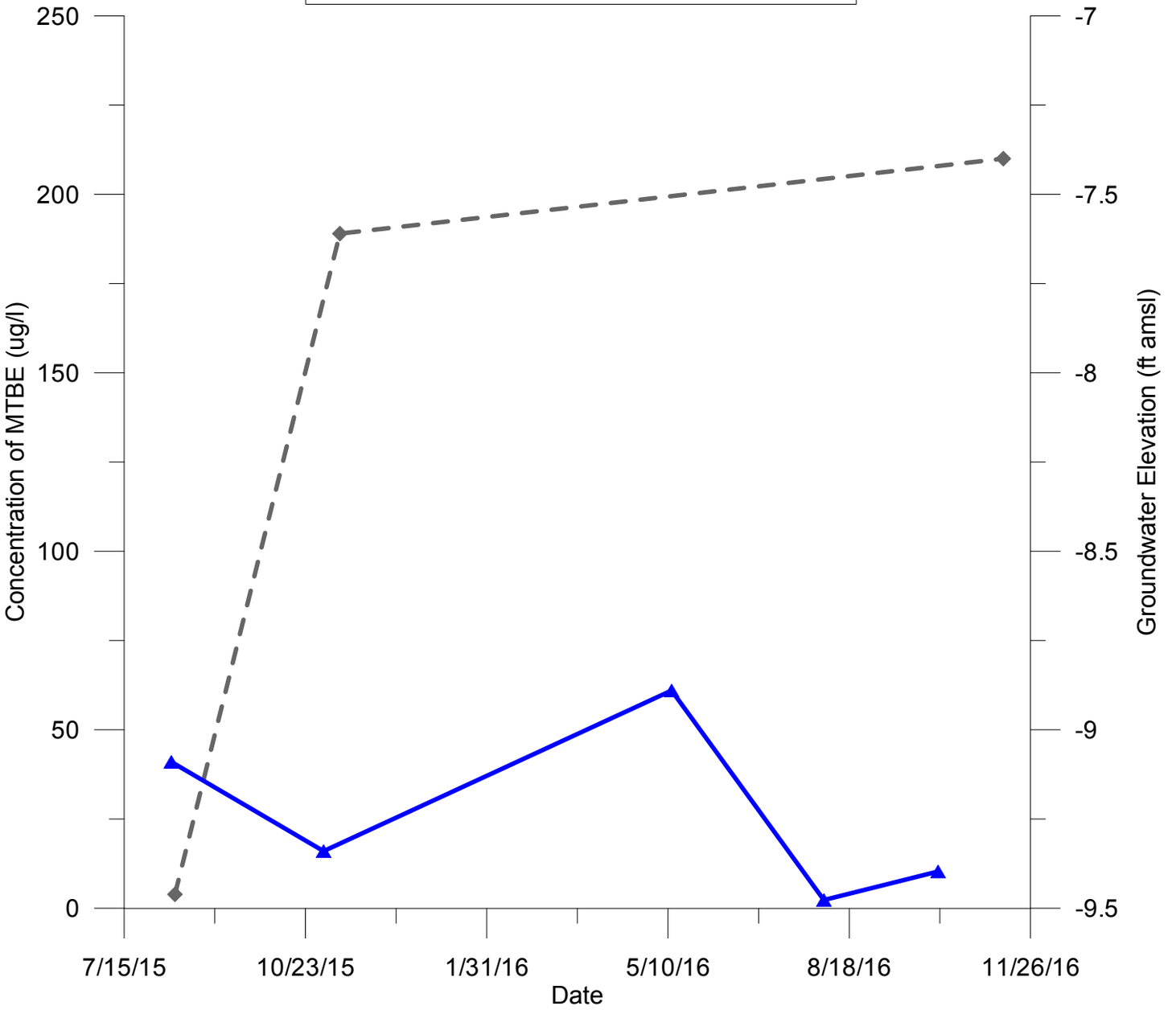
Figure I-11
Plume 2
MTBE Concentration Trend at Well S-115DSRTF
AOI 9 Remedial Investigation Report Addendum
PES Philadelphia Refining Complex
Philadelphia, PA



Legend
MTBE
Groundwater Elevation

Notes:
1. Analytical data was obtained from August 2015, November 2015,and November 2016 sampling events.
2. ug/l = microgram per liter.
3. MTBE = methyl tertiary butyl ether.
4. Groundwater elevations were obtained from August 2015, November 2015, May 2016, August 2016, and October 2016 gauging events.
5. ft amsl = feet above mean sea level.

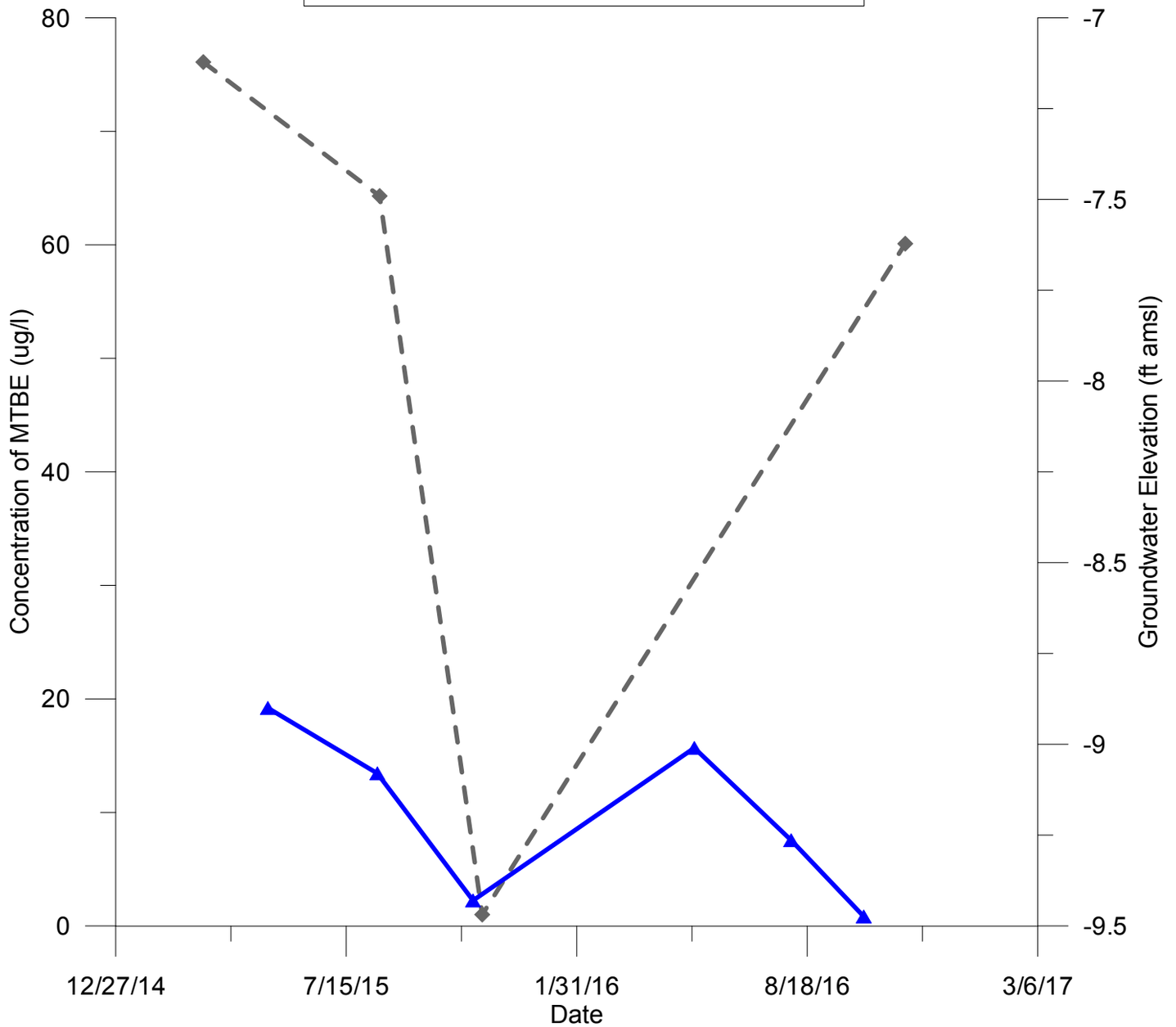
Figure I-12
Plume 3
MTBE Concentration Trend at Well S-118DSRTF
AOI 9 Remedial Investigation Report Addendum
PES Philadelphia Refining Complex
Philadelphia, PA



Legend
MTBE
Groundwater Elevation

Notes:
1. Analytical data was obtained from August 2015, November 2015,and November 2016 sampling events.
2. ug/l = microgram per liter.
3. MTBE = methyl tertiary butyl ether.
4. Groundwater elevations were obtained from August 2015, November 2015, May 2016, August 2016, and October 2016 gauging events.
5. ft amsl = feet above mean sea level.

Figure I-13
Plume 3
MTBE Concentration Trend at Well S-120DSRTF
AOI 9 Remedial Investigation Report Addendum
PES Philadelphia Refining Complex
Philadelphia, PA



Legend
MTBE
Groundwater Elevation

Notes:
1. Analytical data was obtained from March 2015, August 2015, November 2015, and November 2016 sampling events.
2. ug/l = microgram per liter.
3. MTBE = methyl tertiary butyl ether.
4. Groundwater elevations were obtained from May 2015, August 2015, November 2015, May 2016, August 2016, and October 2016 gauging events.
5. ft amsl = feet above mean sea level.

Data Validation

LANGAN

Technical Memorandum

300 Kimball Drive Parsippany, NJ 07054 T: 973.560.4900 F: 973.560.4901

To: Valentina Miller, Staff Engineer

From: Kevin Nelson, Staff Chemist

Date: May 18, 2017

Re: Data Usability Assessment
PES Philadelphia Refinery, AOI-9 Soil
3144 Passyunk Avenue, Philadelphia, Pennsylvania
Langan Project No.: 2574601

This memorandum presents the findings of an analytical data validation of ten percent of the data generated from the analysis of twenty-one soil samples collected on August 25 and 26 and September 9, 2016 by Aquaterra at the PES Philadelphia site. The samples were analyzed by Pace Analytical Laboratories, Inc. located in Greensburg, Pennsylvania (PADEP registration #68-00282) for volatile organic compounds (VOCs), metals, semi-volatile organic compounds (SVOCs) and percent moisture using the analytical methods specified below:

- 1,2-Dibromoethane (EDB) and 1,2-Dibromo-3-chloropropane (DBCP) by USEPA Method 8011, *EDB and DBCP by Microextraction and Gas Chromatography*
- VOCs by USEPA Method 8260B, *VOCs by Gas-Chromatography/Mass-Spectrometry (GC/MS)*
- SVOCs by USEPA Method 8270 by SIM, *SVOCs by GC/MS*
- Dissolved Lead (Pb) by USEPA Method 6010B, *Inductively Coupled Plasma-Atomic Emission Spectrometry*
- Percent Moisture (%M) by ASTM D2974-87, *Standard Test Method for Moisture, Ash and Organic Matter of Peat and Other Organic Soils*

Table 1, below, summarizes the laboratory and client sample identification numbers, sample collection dates, and analytical parameters subject to review from the data package selected to meet the ten percent review criteria.

TABLE 1: SAMPLE SUMMARY

SDG	*Lab Sample ID*	*Client Sample ID*	*Sample Date*	*Analytical Parameters*
30194418	30194418001	S-142SRTF_1.5-2_082616	8/26/16	VOCs, SVOCs, Lead, %M

SDG	Lab Sample ID	Client Sample ID	Sample Date	Analytical Parameters
30194418	30194418002	S-142SRTF_4.5-5_082616	8/26/16	VOCs, SVOCs, Lead, %M
30194418	30194418003	S-144SRTF_1.5-2_082616	8/26/16	VOCs, SVOCs, Lead, %M
30194418	30194418004	S-144SRTF_7-7.5_082616	8/26/16	VOCs, SVOCs, Lead, %M
30194418	30194418005	DUP-001	8/26/16	VOCs, SVOCs, Lead, %M
30194418	30194418006	S-145SRTF_1.5-2_082616	8/26/16	VOCs, SVOCs, Lead, %M
30194418	30194418007	S-145SRTF_7.5-8_082616	8/26/16	VOCs, SVOCs, Lead, %M
30194418	30194418008	FB-001	8/26/16	VOCs, SVOCs, Lead
30194418	30194418009	TRIP BLANK	8/26/16	VOCs, SVOCs

Validation Overview

The acceptable ranges of accuracy are method and matrix specific and are defined within the published analytical test methods specified in the section above. In addition to the published methodologies, the following USEPA guidance documents were also used to review the laboratory data:

- National Functional Guidelines for Superfund Organic Methods Data Review (January 2017, EPA-540-R-2017-002)
- National Functional Guidelines for Inorganic Superfund Methods Data Review (January 2017, EPA-540-R-2017-001)

This data usability assessment was performed in accordance with the specifics of the analytical methods. This review includes reconstruction of the analytical data to verify that data are easily traceable and sufficiently complete to permit logical reconstruction by a qualified individual other than the originator. Items subject to review in this memorandum include holding times, sample preservation, laboratory blanks, laboratory control samples, system monitoring compounds, matrix spike/spike duplicate recoveries, laboratory duplicates, trip blanks, field blanks, field duplicates and overall system performance.

As a result of the review process, the following qualifiers may be assigned to the data in accordance with the USEPA's guidelines and best professional judgment:

R – The sample results are unusable due to the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.

J – The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample.

UJ – The analyte was not detected at a level greater than or equal to the reporting limit (RL); however, the reported RL is approximate and may be inaccurate or imprecise.

U – The analyte was analyzed for, but was not detected at a level greater than or equal to the level of the RL or the sample concentration for results impacted by blank contamination.

NJ – The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.

If any validation qualifiers are assigned these qualifiers should supersede any laboratory-applied qualifiers. Data that is not qualified as a result of this data validation is considered acceptable on the basis of the items specified for review. Data that is qualified as "R" are not sufficiently valid and technically supportable to be used for data interpretation. Data that is otherwise qualified due to minor data quality anomalies are usable, as qualified.

VALIDATOR-APPLIED QUALIFICATION

Client Sample ID	*Analysis*	*Analyte*	*CAS #*	*Validator Qualifier*
DUP-001	SVOCs	Benzo(a)pyrene	50-32-8	UJ
DUP-001	SVOCs	Benzo(b)fluoranthene	205-99-2	UJ
DUP-001	SVOCs	Benzo(g,h,i)perylene	191-24-2	UJ
DUP-001	SVOCs	Phenanthrene	85-01-8	J
S145SRTF_1.5-2_082616	SVOCs	Benzo(a)pyrene	50-32-8	UJ
S145SRTF_1.5-2_082616	SVOCs	Benzo(b)fluoranthene	205-99-2	UJ
S145SRTF_1.5-2_082616	SVOCs	Benzo(g,h,i)perylene	191-24-2	UJ

MAJOR DEFICIENCIES:

Major deficiencies include those that grossly impact data quality and necessitate the rejection of results. No major deficiencies were identified.

MINOR DEFICIENCIES:

Minor deficiencies include anomalies that directly impact data quality but do not result in unusable data. The section below describes the minor deficiencies that were identified.

SVOCs by USEPA Method 8270 by SIM:

- The internal standards naphthalene-d8 and phenanthrene-d10 were recovered below the lower control limit in sample 30194418005 (48.2% and 48.9%, respectively). The associated results are qualified as "J" or "UJ" based on potential high bias.
- The internal standard perylene-d12 was recovered below the lower control limit in sample 30194418006 (47.1%). The associated results are qualified as "J" or "UJ" based on potential high bias.
- The internal standards naphthalene-d8 and perylene-12 were recovered below the lower control limit in sample 30194418006 (45.1% and 45.2%). The associated results are qualified as "J" or "UJ" based on potential high bias.
- The internal standard perylene-d12 was recovered below the lower control limit in sample 30194418005 (45.5%). The associated results are qualified as "J" or "UJ" based on potential high bias.

OTHER DEFICIENCIES:

Other deficiencies include anomalies that do not directly impact data quality. The section below describes the other deficiencies that were identified.

VOCs by USEPA Method 8260B:

- The trip blank displayed a positive detection for 1,2,4-trimethylbenzene at a concentration of 1.2 µg/L. The associated results were either non-detect or greater than ten times the blank contamination. No qualification is necessary.

SVOCs by USEPA Method 8270 by SIM

- The internal standard naphthalene-d8 was recovered below the lower control limit in sample 30194418004 (49.9%). The sample was reanalyzed and the internal standards met the method performance criteria; no qualification is necessary.

Metals by USEPA Method 6010B:

- The MS recovery for matrix spike sample 1137923 exhibited a percent recovery below the lower control limit for lead (68%). The sample used for the MS did not originate from the site; no qualification is necessary.
- The duplicate for laboratory duplicate 1137922 exhibited a relative percent difference greater than the control limit for lead (22%). The sample used as the duplicate did not originate from the site; no qualification is necessary.
- The MS/MSD 1136692/1136693 exhibited percent recoveries and RPDs outside the acceptable control limits. The parent sample did not originate from the site; no qualification is necessary.
- The serial dilution 1138528SD exhibited a percent difference greater than the control limit for lead (13.4%). The parent sample did not originate from the site; no qualification is necessary.

COMMENTS:

On the basis of this evaluation, the laboratory appears to have followed the specified analytical methods with the exception of errors discussed above. If a given fraction is not mentioned above, that means that all specified criteria were met for that parameter. All laboratory data packages met the method requirements and all sample holding times were met.

The field duplicate DUP-001 and parent sample S-144SRTF_7-7.5_082616 met the method performance criteria.

All data are considered usable. In addition, completeness, defined as the percentage of analytical results that are judged to be valid, is 100%.

Signed,

Kevin Nelson
Staff Chemist

LANGAN

300 Kimball Drive Parsippany, NJ 07054 T: 973.560.4900 F: 973.560.4901

Technical Memorandum

To: Valentina Miller, Staff Engineer

From: Kevin Nelson, Staff Chemist

Date: May 18, 2017

Re: Data Usability Assessment
PES Philadelphia Refinery, AOI-9 Groundwater
3144 Passyunk Avenue, Philadelphia, Pennsylvania
Langan Project No.: 2574601

This memorandum presents the findings of an analytical data validation of ten percent of the data generated from the analysis of thirty-five groundwater samples collected on November 8 through 11, 2016 by Aquaterra at the PES Philadelphia site. The samples were analyzed by Pace Analytical Laboratories, Inc. located in Greensburg, Pennsylvania (PADEP registration #68-00282) for volatile organic compounds (VOCs), metals, and semi-volatile organic compounds (SVOCs) using the analytical methods specified below:

- 1,2-Dibromoethane (EDB) and 1,2-Dibromo-3-chloropropane (DBCP) by USEPA Method 8011, *EDB and DBCP by Microextraction and Gas Chromatography*
- VOCs by USEPA Method 8260B, *VOCs by Gas-Chromatography/Mass-Spectrometry (GC/MS)*
- SVOCs by USEPA Method 8270 by SIM, *SVOCs by GC/MS*
- Dissolved Lead (Pb) by USEPA Method 6010B, *Inductively Coupled Plasma-Atomic Emission Spectrometry*

Table 1, below, summarizes the laboratory and client sample identification numbers, sample collection dates, and analytical parameters subject to review from the data package selected to meet the ten percent review criteria.

TABLE 1: SAMPLE SUMMARY

SDG	*Lab Sample ID*	*Client Sample ID*	*Sample Date*	*Analytical Parameters*
30202105	30202105001	S-143SRTF-20161108-WG	11/8/16	VOCs, SVOCs, Pb
30202105	30202105002	S-138SRTF-20161108-WG	11/8/16	VOCs, SVOCs, Pb
30202105	30202105003	AOI9-EQUIPMENTBLANK-20161108	11/8/16	VOCs, SVOCs, Pb
30202105	30202105004	AOI9-FIELDBLANK-20161108	11/8/16	VOCs, SVOCs, Pb

SDG	Lab Sample ID	Client Sample ID	Sample Date	Analytical Parameters
30202105	30202105005	S-106DSRTF-20161108-WG	11/8/16	VOCs, SVOCs, Pb
30202105	30202105006	S-120DSRTF-20161109-WG	11/9/16	VOCs, SVOCs, Pb
30202105	30202105007	S118DSRTF-20161109-WG	11/9/16	VOCs, SVOCs, Pb
30202105	30202105008	S-115DSRTF-20161109-WG	11/9/16	VOCs, SVOCs, Pb
30202105	30202105009	S144SRTF-20161109-WG	11/9/16	VOCs, SVOCs, Pb
30202105	30202105010	S-110DSRTF-20161109-WG	11/9/16	VOCs, SVOCs, Pb
30202105	30202105011	AOI90EQUIPMENTBLANK-20161109	11/9/16	VOCs, SVOCs, Pb
30202105	30202105012	AOI9-FIELDBLANK-20161109	11/9/16	VOCs, SVOCs, Pb

Validation Overview

The acceptable ranges of accuracy are method and matrix specific and are defined within the published analytical test methods specified in the section above. In addition to the published methodologies, the following USEPA guidance documents were also used to review the laboratory data:

- National Functional Guidelines for Superfund Organic Methods Data Review (January 2017, EPA-540-R-2017-002)
- National Functional Guidelines for Inorganic Superfund Methods Data Review (January 2017, EPA-540-R-2017-001)

This data usability assessment was performed in accordance with the specifics of the analytical methods. This review includes reconstruction of the analytical data to verify that data are easily traceable and sufficiently complete to permit logical reconstruction by a qualified individual other than the originator. Items subject to review in this memorandum include holding times, sample preservation, laboratory blanks, laboratory control samples, system monitoring compounds, matrix spike/spike duplicate recoveries, laboratory duplicates, equipment blanks, field blanks and overall system performance.

As a result of the review process, the following qualifiers may be assigned to the data in accordance with the USEPA's guidelines and best professional judgment:

R – The sample results are unusable due to the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.

J – The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample.

UJ – The analyte was not detected at a level greater than or equal to the reporting limit (RL); however, the reported RL is approximate and may be inaccurate or imprecise.

U – The analyte was analyzed for, but was not detected at a level greater than or equal to the level of the RL or the sample concentration for results impacted by blank contamination.

NJ – The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.

If any validation qualifiers are assigned these qualifiers should supersede any laboratory-applied qualifiers. Data that is not qualified as a result of this data validation is considered acceptable on the basis of the items specified for review. Data that is qualified as "R" are not sufficiently valid and technically supportable to be used for data interpretation. Data that is otherwise qualified due to minor data quality anomalies are usable, as qualified.

VALIDATOR-APPLIED QUALIFICATION

Client Sample ID	*Analysis*	*Analyte*	*CAS #*	*Validator Qualifier*
S-143SRTF-20161108-WG	VOCs	EDB	106-93-4	UJ
S-138SRTF-20161108-WG	VOCs	EDB	106-93-4	UJ
AOI9-EQUIPMENTBLANK-20161108	VOCs	EDB	106-93-4	UJ
AOI9-FIELDBLANK-20161108	VOCs	EDB	106-93-4	UJ
S-106DSRTF-20161108-WG	VOCs	EDB	106-93-4	UJ
S-120DSRTF-20161109-WG	VOCs	EDB	106-93-4	UJ
S118DSRTF-20161109-WG	VOCs	EDB	106-93-4	UJ
S-115DSRTF-20161109-WG	VOCs	EDB	106-93-4	UJ
S144SRTF-20161109-WG	VOCs	EDB	106-93-4	UJ
S-110DSRTF-20161109-WG	VOCs	EDB	106-93-4	UJ
AOI90EQUIPMENTBLANK-20161109	VOCs	EDB	106-93-4	UJ
AOI9-FIELDBLANK-20161109	VOCs	EDB	106-93-4	UJ
S-143SRTF-20161108-WG	SVOCs	Naphthalene	91-20-3	U (0.10)
S-138SRTF-20161108-WG	SVOCs	Naphthalene	91-20-3	U (0.12)
AOI9-EQUIPMENTBLANK-20161108	SVOCs	Naphthalene	91-20-3	U (0.10)

Client Sample ID	*Analysis*	*Analyte*	*CAS #*	*Validator Qualifier*
AOI9-FIELDBLANK-20161108	SVOCs	Naphthalene	91-20-3	U (0.10)
S-106DSRTF-20161108-WG	SVOCs	Naphthalene	91-20-3	U (0.10)
S118DSRTF-20161109-WG	SVOCs	Naphthalene	91-20-3	U (0.10)
S-115DSRTF-20161109-WG	SVOCs	Naphthalene	91-20-3	U (0.10)
S144SRTF-20161109-WG	SVOCs	Naphthalene	91-20-3	U (0.10)
S-110DSRTF-20161109-WG	SVOCs	Naphthalene	91-20-3	U (0.10)
AOI90EQUIPMENTBLANK-20161109	SVOCs	Naphthalene	91-20-3	U (0.10)
AOI9-FIELDBLANK-20161109	SVOCs	Naphthalene	91-20-3	U (0.10)
S-115DSRTF-20161109-WG	SVOCs	Anthracene	120-12-7	J
S-115DSRTF-20161109-WG	SVOCs	Benzo(a)anthracene	56-55-3	UJ
S-115DSRTF-20161109-WG	SVOCs	Benzo(a)pyrene	50-32-8	UJ
S-115DSRTF-20161109-WG	SVOCs	Benzo(b)fluoranthene	205-99-2	UJ
S-115DSRTF-20161109-WG	SVOCs	Benzo(g,h,i)perylene	191-24-2	UJ
S-115DSRTF-20161109-WG	SVOCs	Chrysene	218-01-9	UJ
S-115DSRTF-20161109-WG	SVOCs	Fluorene	86-73-7	UJ
S-115DSRTF-20161109-WG	SVOCs	Phenanthrene	85-01-8	UJ
S-115DSRTF-20161109-WG	SVOCs	Pyrene	129-00-0	UJ

MAJOR DEFICIENCIES:

Major deficiencies include those that grossly impact data quality and necessitate the rejection of results. No major deficiencies were identified.

MINOR DEFICIENCIES:

Minor deficiencies include anomalies that directly impact data quality but do not result in unusable data. The section below describes the minor deficiencies that were identified.

EDB and DBCP by USEPA Method 8011:

- The CCV analyzed on 11/16/16 at 21:34 exhibited a low RRF for 1,2-dibromoethane (0.00674). The associated results in samples 30202105001 through 30202105006 are qualified as "UJ" based on potential indeterminate bias.
- The CCV analyzed on 11/17/16 at 1:44 exhibited a low RRF for 1,2-dibromoethane (0.00697). The associated results in samples 30202105001 through 30202105012 are qualified as "UJ" based on potential indeterminate bias.
- The CCV analyzed on 11/17/16 at 5:54 exhibited a low RRF for 1,2-dibromoethane (0.006971). The associated results in samples 30202105006 through 30202105012 are qualified as "UJ" based on potential indeterminate bias.

SVOCs by USEPA Method 8270 by SIM:

- The method blank for batch 240304 displayed a positive detection for naphthalene at a concentration of 0.040 µg/L. The associated positive detections less than the reporting limit in samples 30202105001 through 30202105012 are qualified as "U" based on potential high bias.
- The surrogate terphenyl-d14 was recovered below the lower control limit (i.e. 58%) in sample 30202105008 (48%). The associated results are qualified as "J" or "UJ" based on potential low bias.

OTHER DEFICIENCIES:

Other deficiencies include anomalies that do not directly impact data quality. The section below describes the other deficiencies that were identified.

EDB and DBCP by USEPA Method 8011:

- The initial calibration verification (ICV) analyzed on 11/15/16 at 22:01 exhibited a percent difference greater than the control limit for 1,2-dibromoethane (-42.9103%). The same ICV also exhibited a low RRF for the same compound (0.003996). This calibration is not associated with any investigative samples; no qualification is necessary.
- The CCV analyzed on 11/15/2016 at 22:01 exhibited %Ds greater than the control limit for 1,2-dibromoethane (-42.9%) and 1,2-dibromo-3-chloropropane (-46.6%). The same CCV also exhibited low RRFs and EDB and DBCP (0.00400 and 0.00374, respectfully).

This calibration is not associated with any investigative samples; no qualification is necessary.

SVOCs by USEPA Method 8270 by SIM:

- The equipment blank collected on 11/8/2016 displayed a positive detection for naphthalene at a concentration of 0.047 µg/L. This positive detection is also present in the method blank; this result has been qualified as "U".
- The field blank collected on 11/8/2016 displayed a positive detection for naphthalene at a concentration of 0.045 µg/L. This positive detection is also present in the method blank; this result has been qualified as "U".
- The equipment blank collected on 11/9/2016 displayed a positive detection for naphthalene at a concentration of 0.040 µg/L. This positive detection is also present in the method blank; this result has been qualified as "U".
- The field blank collected on 11/9/2016 displayed a positive detection for naphthalene at a concentration of 0.041 µg/L. This positive detection is also present in the method blank; this result has been qualified as "U".

Metals by USEPA Method 6010B:

- The field blank taken on 11/8/2016 displayed a positive detection for dissolved lead at a concentration of 80.2 µg/L. The associated results are all non-detections; no qualification is necessary.

COMMENTS:

On the basis of this evaluation, the laboratory appears to have followed the specified analytical methods with the exception of errors discussed above. If a given fraction is not mentioned above, that means that all specified criteria were met for that parameter. All laboratory data packages met the method requirements and all sample holding times were met.

All data are considered usable. In addition, completeness, defined as the percentage of analytical results that are judged to be valid, is 100%.

Signed,

Kevin Nelson
Staff Chemist