ONSITE SOIL REUSE PLAN

Prepared by:

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2574601

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1.0 INTRODUCTION

The PES Facility (facility) is located in Philadelphia, Pennsylvania. The facility was formerly owned by Sunoco, Inc. (R&M), and is currently owned by Philadelphia Energy Solutions Refining and Marketing LLC (PES). Site remediation is ongoing as part of a planned approach in accordance with the 2012 Consent Order and Agreement by and among the PADEP, Sunoco, and PES. The facility has operated and is planned to continue operating as a refinery. The refinery was officially entered into the One Cleanup Program in November 2011. The One Cleanup Program and the 2012 Consent Order and Agreement by and among the PADEP, Sunoco, and PES will serve as the basis of remedial activities at the refinery.

Routinely, construction and maintenance activities are completed at the facility which involves intrusion below ground surface. Because of the history of the facility, various concentrations of Chemicals of Concern (COC) in soil can be planned for during excavations. The COC list utilized for the facility is included as Attachment A. The site has developed a Sitewide Approach Workplan that assumes a non-residential site use, no on-site groundwater use and engineering controls to prevent off-site impacted groundwater migration. This process assumes that the Site Specific Standard will be established for soils at the PES Facility either under the pathway elimination option or via a calculated value in the Act 2 Reports being submitted in accordance with Sunoco's Sitewide Approach Workplan (2011).

2.0 SOIL MANAGEMENT PROCESS

The process described below will be followed whenever soils are excavated at the facility. Figure 1 presents the soil management plan flow chart. As soils are excavated at each project area they will be segregated into Non-Heavily Impacted Soils or Heavily Impacted Soils based on visual observations. For purposes of soil placement, the facility is being divided into four areas. Area 1 is defined as an area in which soil placed has the potential to impact surface water. Area 2 is defined as an area in which soil placed does not have the potential to impact surface water; Area 3 is an area with potential impact to surface water in the vicinity of Mingo Creek. The fourth area is AOI 10, no soils are to be placed in AOI 10 without the appropriate ecological evaluation. Soils are also not to be placed in the stormwater management feature in AOI 3. Figure 2 presents these areas on the facility property.

2.1 Non-Heavily Impacted Soils

Non-Heavily Impacted Soils are defined as soil that does not appear to be impacted with non aqueous phase liquid (NAPL) and/or does not appear to contain waste. Prior to sampling, soil identified as Non-Heavily Impacted may be returned back into the same hole from which it came, as it reasonably has the same chemical characteristics as undisturbed soils in the same immediate area. If, as a result of the type of construction or maintenance activity, not all of the soil fits back into the same excavated hole, then the excess soil may now be considered for potential on-site reuse. If sufficient analytical data is available, there may be instances when Non-Heavily Impacted Soils may be moved directly from one project area to another project area at the facility without being transported to a staging area, as long as the proper sampling and documentation is completed. If soils are to be placed within 100 feet of a current or identified future occupied building that does not already have vapor mitigation measures in place (e.g. the building is not under positive pressure or have an installed vapor mitigation system) then a vapor evaluation will be conducted or vapor mitigation measures will be employed and approved by the PADEP.

Non-Heavily Impacted Soils that have COC detections below the PADEP residential Statewide Health Standards (SHS) Medium Specific Concentrations (MSCs) or the Clean Fill Standards (whichever is appropriate) can be used anywhere in Area 1, 2 or 3 without restriction. Non-Heavily Impacted Soils that have COC detections below the PADEP non-residential SHSMSCs, Table 1, can be used anywhere on the facility, with the exception of AOI 10 and the stormwater management feature in AOI 3, as long as soil origin and placement is documented as non-residential soils. These soils may be re-used within the boundaries of the facility in accordance with Section 902(b) of the Act 2 (35 P.S. section 6026.902). Table 1 will be updated if the PADEP non-residential SHSMSCs are updated by the PADEP.

Non-Heavily Impacted Soils that have detections above the soil to groundwater SHS but below the direct contact SHS can be placed in any areas of the facility with no potential impact to surface water (Area 2) on Figure 2. Non-heavily impacted soils that exceed the soil to groundwater MSC (but are below the direct contact MSC) that are to be placed in areas with potential impact to surface water (Area 1) on Figure 2 will need to undergo the Synthetic Precipitation Leaching Procedure (SPLP) analysis. The results of the SPLP analysis will be compared to the calculated surface water screening criteria summarized on Table 2 and as detailed in Attachment B. The Chapter 93 Water Quality Standards used in calculating the values on Table 2 are presented in Appendix B. If the Chapter 93 criteria are updated then the values on Table 2 will be re-calculated accordingly. If soils are below the calculated surface water criteria then they can be placed in Area 1 & 2 at the facility as shown on Figure 2. If soils are above the calculated surface water criteria (but below the non-residential direct contact MSC) then the soils can only be placed in areas without potential impact to surface water (Area 2) on Figure 2 or placed in areas with potential impact to surface water with the appropriate surface water mitigation measures, as approved by the PADEP under the Act 2 Program. Soils can only be placed in Area 3 if they meet the non-residential MSCs summarized on Table 1.

If soils are above the Soil to Groundwater and Direct Contact MSCs then they can only be placed on-site if a Site Specific Standard is calculated and cumulative risk is evaluated and approved by the PADEP before the soil is placed as part of the Act 2 Program. Soils above the SSS may also be remediated to an acceptable level for onsite use, an engineering control can be installed or the soils can transported offsite for proper disposal. If any of these options are selected they are to be approved by the PADEP under the Act 2 Program.

Depending on the circumstances, excess soil may be moved to another project area at the facility or transported to a predetermined staging area for temporary stockpiling. Non-Heavily Impacted Soils with concentrations greater than the values on Table 1 will stay at the staging area for no more than one year.

2.2 Heavily Impacted Soils

Heavily Impacted Soils are defined as soil containing obvious waste material or NAPL. This soil will be characterized to determine if the soil is a hazardous or non-hazardous waste and disposed of or remediated accordingly.

Soil that appears to be Heavily Impacted will be transported to the pre-designated soil staging area for temporary stockpiling only in Area 2. Soils in this area will not be stored more than 90 days in the staging area from the date of generation unless determined and/or treated to non-hazardous status. Soil handling in this area will follow an approved E&S plan for the soil staging area. This E&S plan will be developed for specific soil management projects at the facility. The piles will be sampled and appropriately managed as hazardous or non-hazardous waste within the applicable waste regulations. Non-hazardous waste may be stored on site for one year from date of generation.

3.0 IDENTIFICATION OF REUSABLE SOILS

This section describes the sampling protocols for soils to be potentially re-used at the facility.

3.1 Sampling Protocol

Soils stockpiled in the soil staging area may or may not be sampled (as described below). If soil sampling has been completed as part of site characterization activities prior to excavation, these data may be used as an indicator of soil quality.

Once soils are transported to the staging area, samples for volatile and semi-volatile organic analyses will be taken from a minimum of 18-24 inches below the surface of the stockpile. Metals samples will be collected using laboratory cleaned stainless steel trowels or augers from a depth of at least 6 inches below the surface of the stockpile.

For soil stockpiles up to 1,000 cubic yards, eight grab samples will be collected for soil analysis. Two grab samples will be collected for VOA analysis based on PID or visual observations. After the VOA samples are secured, the eight samples will be combined into 2 composite samples for SVOA and metals analysis. For soil stockpiles greater than 1,000 cubic yards but less than 3,000 cubic yards, twelve grab samples will be collected and three of these grab samples will be analyzed for VOA based on PID or visual observations. After the VOA samples are secured, the twelve grab samples will be combined into 3 composite samples for SVOA and metals analysis. All samples will be transferred to laboratory supplied containers and preserved as appropriate for the analyses to be performed. If SPLP samples are to be collected, they are to be collected at a frequency of 2 samples per 1000 cubic yards, 3 samples are to be collected for piles between 1000 and 3000 cubic yards.

All analyses will be performed using appropriate EPA methods, within the recommended QA/QC parameters. Once a stockpile has been sampled, no additional soil or material will be added to the pile. In addition, soil piles from different portions of the facility or stockpiles with different chemicals of concern will not be combined if the COC concentrations are above the SHS.

3.2 Chemicals of Concern (COC)

COCs for the facility are presented in Attachment A.

4.0 DOCUMENTATION OF SOIL REUSE STAGING AND PLACEMENT

All soils excavated at the facility will be subject to the following documentation practices. An ongoing log will be maintained to track the soil origin and reuse. The information will include, at a minimum:

- Unique pile identifier code;
- Date and location of original excavation;
- Estimated volume;
- Placement depth, thickness, and aerial extent;
- Date of placement; and
- Lab data identifying measured levels of COCs will be retained onsite indefinitely.

TABLES

Table 1
PADEP Non-Residental Used Aquifer Surface Soil MSC
PES Facility
Philadelphia, Pennsylvania

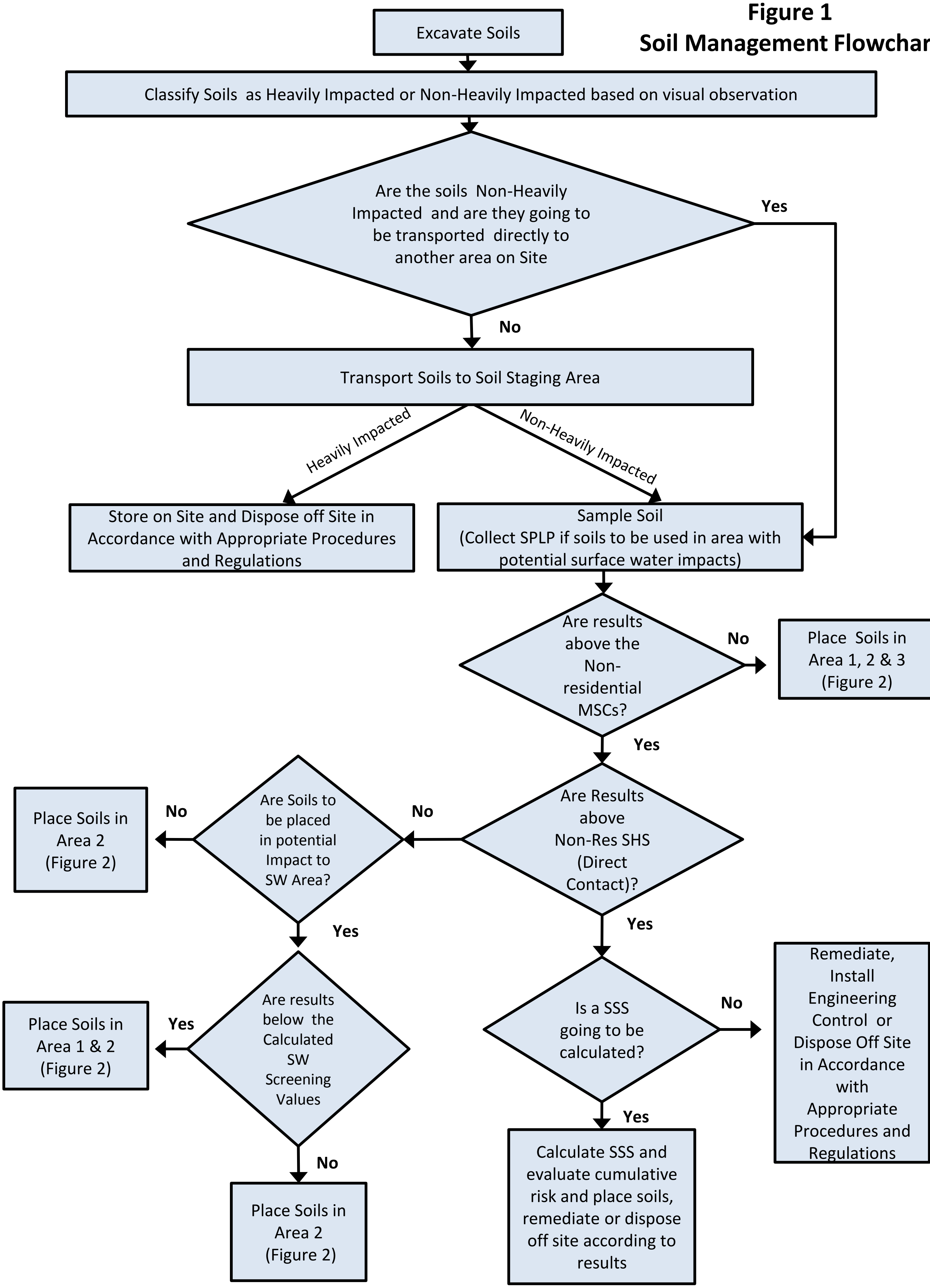
COC	CAS No.	PADEP Non-Residential Used Aquifer Saturated Soil MSC (0-2 ft bgs)
		mg/kg
Benzene	71-43-2	0.5
1,2-Dichloroethane	107-06-2	0.5
Ethylbenzene	100-41-4	70
Toluene	108-88-3	100
Anthracene	120-12-7	35
Benzo(a)anthracene	56-55-3	32
Benzo(a)pyrene	50-32-8	4.6
Chrysene	218-01-9	23
Fluorene	86-73-7	380
Naphthalene	91-20-3	10
Phenanthrene	85-01-8	1000
Pyrene	129-00-0	220
Xylenes (total)	1330-20-7	1000
Methyl tertiary butyl ether	1634-04-4	2
Cumene	98-82-8	350
1,2,4-Trimethylbenzene	95-63-6	6.2
1,3,5-Trimethylbenzene	108-67-8	5.3
Benzo(b)fluoranthene	205-99-2	17
Benzo (g,h,i) perylene	191-24-2	18
Ethylene dibromide	106-93-4	0.005
Lead (total)	7439-92-1	45

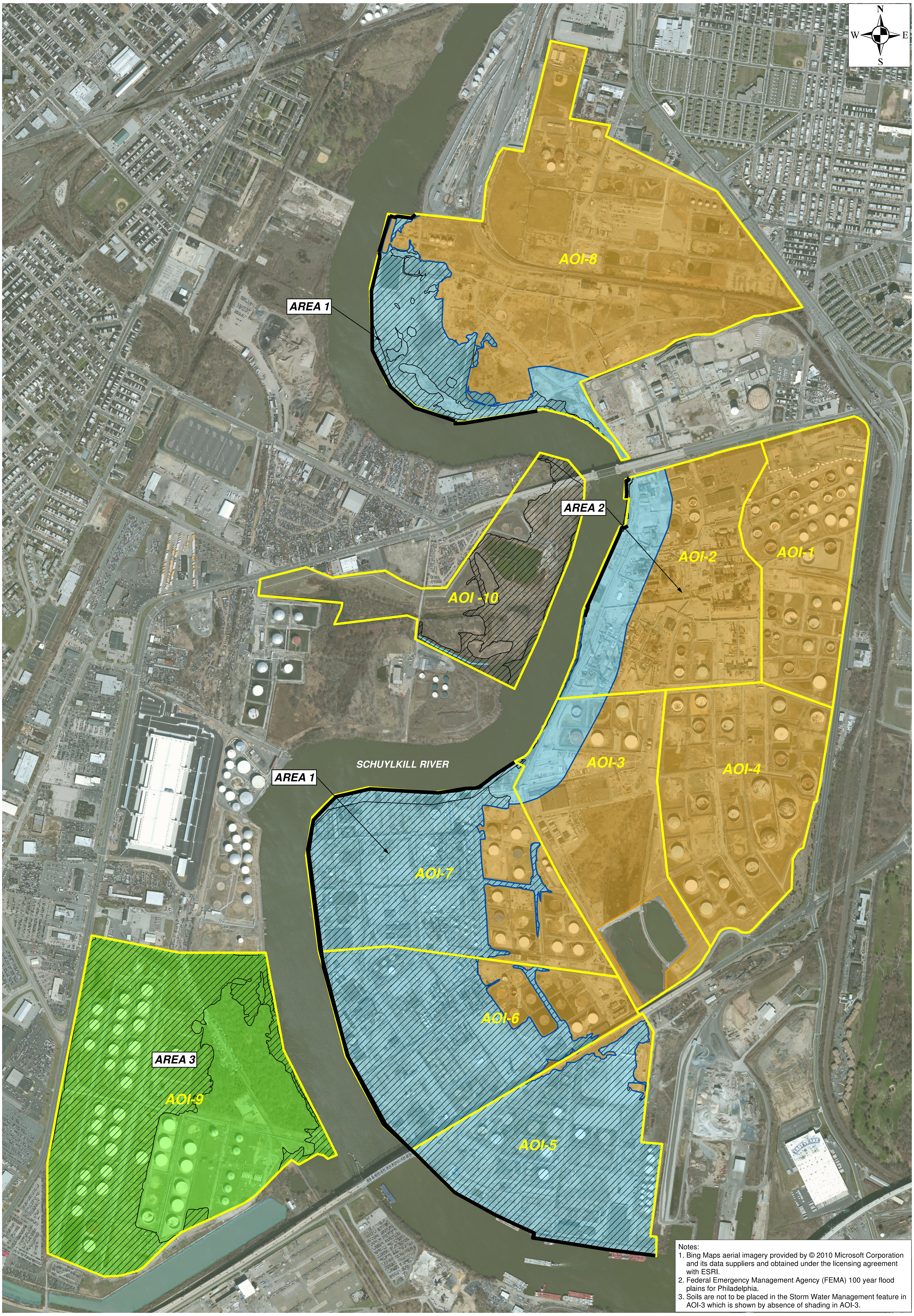
Table 2
Calculated Surface Water Screening Values
PES Facility
Philadelphia, Pennsylvania

COC	CAS No.	Soil Reuse Area #1		Soil Reuse Area #2	Soil Reuse Area #3
		PADEP Direct Contact MSC for Non-Residential Soil (0-2 ft bgs)	Most Stringent Wasteload Allocation	PADEP Direct Contact MSC for Non-Residential Soil (0-2 ft bgs)	Compare Soil Results to PADEP Non-Residential Used Aquifer Saturated Soil MSC (0-2 ft bgs)
		mg/kg	ug/l	mg/kg	mg/kg
Benzene	71-43-2	290	14,012	290	0.5
1,2-Dichloroethane	107-06-2	86	4,437	86	0.5
Ethylbenzene	100-41-4	10,000	423,730	10,000	70
Toluene	108-88-3	10,000	248,393	10,000	100
Anthracene	120-12-7	190,000	8,350,000	190,000	35
Benzo(a)anthracene	56-55-3	110	44	110	32
Benzo(a)pyrene	50-32-8	11	44	11	4.6
Chrysene	218-01-9	11,000	44	11,000	23
Fluorene	86-73-7	110,000	1,100,000	110,000	380
Naphthalene	91-20-3	56,000	20,455	56,000	10
Phenanthrene	85-01-8	190,000	731	190,000	1,000
Pyrene	129-00-0	84,000	835,293	84,000	220
Xylenes (total)	1330-20-7	8,000	160,725	8,000	1,000
Methyl tertiary butyl ether	1634-04-4	3,200	22,060,000	3,200	2
Cumene	98-82-8	10,000	380	10,000	350
1,2,4-Trimethylbenzene	95-63-6	560	4,822	560	6.2
1,3,5-Trimethylbenzene	108-67-8	480	10,374	480	5.3
Benzo(b)fluoranthene	205-99-2	110	1,325	110	17
Benzo (g,h,i) perylene	191-24-2	170,000	1,116	170,000	18
Ethylene dibromide	106-93-4	3.70	N/A	3.70	0.005
Lead (total)	7439-92-1	1,000	3,674	1,000	45

FIGURES

Figure 1
Soil Management Flowchart





Legend

Areas of Interest (AOIs)

AOI-1: Belmont Terminal/No.1 Tank Farm/No.2 Tank Farm
AOI-2: Point Breeze Processing Area
AOI-3: Impoundment Area
AOI-4: No. 4 Tank Farm Area
AOI-5: Girard Point South Tank Field Area
AOI-6: Girard Point Chemical Processing Area
AOI-7: Girard Point Fuels Processing Area
AOI-8: Point Breeze Process Area North Yard
AOI-9: Schuylkill River Tank Farm
AOI -10: Point Breeze Processing Area West Yard

Bulkhead

Area 1 - Area with potential surface water impact as defined by 100 year floodplain and 500 feet from shore without bulkhead

Area 2 - Area with no potential surface water impact

Area 3 - Area with potential surface water impacts as defined by 100 year floodplain and in vicinity of Mingo Creek

AOI-10 Area not to be filled without completion of appropriate ecological evaluation

100 Year Flood Plain

Areas of Interest

Figure 2: Soil Management Plan
PES Philadelphia Refinery
Philadelphia, Pennsylvania

Philadelphia Refinery
3144 Passyunk Avenue
Philadelphia, PA.
19145

0 500 1,000 Feet

SCALE: 1" = 500'
DATE: January 16, 2013
DRN. BY: MH
CKD. BY: PT
JOB#: 2574601

ATTACHMENT A

Attachment A
Constituents of Concern
Onsite Soil Reuse Plan
PES Facility
Philadelphia, Pennsylvania

METALS	CAS No.
Lead (dissolved)	7439-92-1

VOCs	CAS No.
1,2-Dichloroethane	107-06-2
1,2,4-Trimethylbenzene	95-63-6
1,3,5-Trimethylbenzene	108-67-8
Benzene	71-43-2
Cumene	98-82-8
Ethylbenzene	100-41-4
Methyl tertiary butyl ether	1634-04-4
Toluene	108-88-3
Xylenes (total)	1330-20-7
Ethylene dibromide	106-93-4

SVOCs/ PAHs	CAS No.
Anthracene	120-12-7
Benzo(a)anthracene	56-55-3
Benzo(g,h,i)perylene	191-24-2
Benzo(a)pyrene	50-32-8
Benzo(b)fluoranthene	205-99-2
Chrysene	218-01-9
Fluorene	86-73-7
Naphthalene	91-20-3
Phenanthrene	85-01-8
Pyrene	129-00-0

Notes:
1. Constituents are from Pennsylvania Corrective Action Process (CAP) Regulation Amendments effective December 1, 2001; provided in Chapter VI, Section E (pgs. 29-30) of PADEP Document, *Closure Requirements for Underground Storage Tank Systems,* effective April 1, 1998 and the March 18, 2008 revised PADEP Petroleum Short List.

ATTACHMENT B

Attachment B
Onsite Soil Reuse Plan
PES Facility
Philadelphia, Pennsylvania

This attachment presents the process detailing how the Calculated Surface Water Screening Values on Table 2 were calculated for the PES Facility. These calculations were completed by dividing Area 1 (the area of potential surface water impacts) into 3 areas based on ground water flow direction as shown on Figure B-1. The results of the SPLP analysis would be compared to the calculated surface water screening values on Table 2.

The acceptable surface water screening values were derived for each COC using the PADEP's PENTOXSD computer program for organics and the PADEP mixing model equation for inorganics (Technical Guidance Manual, Section IV, page 20) for the North Yard, Point Breeze and Girard Point as shown on Figure B-1 and summarized on Tables 1- 8. The most conservative value calculated for each COC across these areas were then used to populate Table 2. The following summarizes some of the key assumptions of these calculations:

- Only 10% of the reported flow in the Schuylkill River was used in the river to calculate the surface water screening values.
- The total shoreline was used for each area and if a bulkhead was present along a shoreline the hydraulic conductivity for that portion of the shoreline was reduced accordingly.
- A representative hydraulic gradient was calculated for each area based on site specific data.
- The assumed depth to which soils would be placed was 15 feet.
- The Chapter 93 surface water criteria were used in the calculations unless they were not available for a COC. In those instances an EPA Region 3 BTAG or an EPA Region 5 ESL screening criteria were used in the calculations.

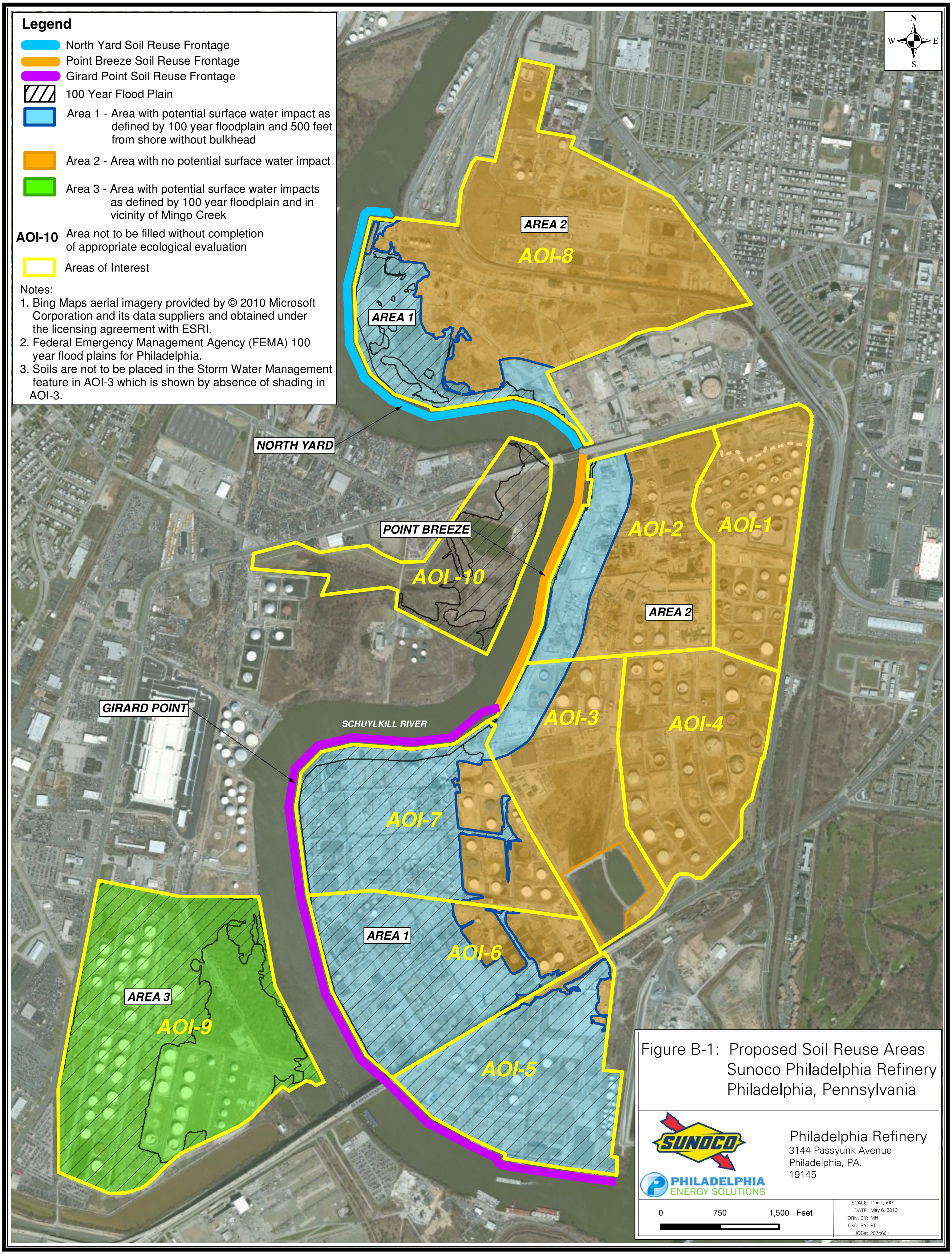


Figure B-1: Proposed Soil Reuse Areas
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Path: \\langan.com\data\DT\data6\2574601\ArcGIS\MapDocuments\Soil_Management\Figure X - Soil Resuse Areas_rev5-6-13.mxd

Attachment B
Table 1
Historical Highest Groundwater Elevations Along Schuylkill River
PES Facility
Philadelphia, Pennsylvania

Soil Reuse Area	AOI	Well ID	Highest Historical Groundwater Elevation	Grade	Minimum Historical Depth to Water
			feet mean sea level		feet below grade
North Yard	AOI 8	N-72	6.35	9.45	3.10
		N-133	5.98	7.19	1.21
		PZ-506	5.49	8.77	3.28
		N-64	5.31	8.99	3.68
		MW-6	1.19	8.99	7.80
Point Breeze	AOI 2	S-154	4.01	10.14	6.13
		S-336	2.64	9.16	6.52
		S-246A	2.40	9.37	6.97
	AOI 3	S-280	1.22	23.73	22.51
		S-66	4.11	25.75	21.64
Girard Point	AOI 5	A-22	3.85	7.76	3.91
		SW-1	3.55	7.19	3.64
		A-48	2.67	4.63	1.96
		A-9	3.03	5.95	2.92
		A-142	2.96	6.14	3.19
	AOI 6	B-158	6.30	8.66	2.36
		URS-5	3.07	5.86	2.79
		URS-1	4.63	5.86	1.23
		B-164	5.15	5.86	0.71
		B-130	5.32	8.11	2.79
	AOI 7	C-129	3.97	7.20	3.23
		C-145	3.27	7.36	4.09
		C-107	6.46	7.78	1.32
		C-105	6.51	6.60	0.09
		C-140	6.00	7.99	1.99

Attachment B
Table 2
PENTOXSD Input Data
North Yard - AOI 8
PES Facility
Philadelphia, Pennsylvania

Parameter	Unit	Value	Source
River Mile Index (**at discharge point**)	mile	3.5	Estimated from site GIS - approximate middle of AOI 8 shoreline reach
River Stage Elevation (**at discharge point**)	ft	1.00	Estmated using data from WRIR 01-4218
Drainage Area	mi^2	1,906.00	Estimated based on distance upstream from mouth of river.
$Q_{7\text{-}10}$ Stream Flow	ft^3/s	10.2	10% of Observed value (per PADEP); value from USGS Penrose Ave reference gauge
$Q_{7\text{-}10}$ Reach Width	ft	calculated by PENTOXSD	calculated by PENTOXSD
$Q_{7\text{-}10}$ Reach Depth	ft	calculated by PENTOXSD	calculated by PENTOXSD
Q_h Stream Flow	ft^3/s	81.10	10% of Observed value (per PADEP); value from USGS Penrose Ave reference gauge
Q_h Reach Width	ft	calculated by PENTOXSD	calculated by PENTOXSD
Q_h Reach Depth	ft	calculated by PENTOXSD	calculated by PENTOXSD
River Mile Index (**at confluence**)	mile	0.001	Estimated from site GIS
River Stage Elevation (**at confluence**)	ft	0.50	Average tidal
Drainage Area	mi^2	1,912.00	PA Gazzetteer of Streams
$Q_{7\text{-}10}$ Stream Flow	ft^3/s	10.2	10% of Observed value (per PADEP); value from USGS Penrose Ave reference gauge
$Q_{7\text{-}10}$ Reach Width	ft	calculated by PENTOXSD	calculated by PENTOXSD
$Q_{7\text{-}10}$ Reach Depth	ft	calculated by PENTOXSD	calculated by PENTOXSD
Q_h Stream Flow	ft^3/s	81.10	10% of Observed value (per PADEP); value from USGS Penrose Ave reference gauge
Q_h Reach Width	ft	calculated by PENTOXSD	calculated by PENTOXSD
Q_h Reach Depth	ft	calculated by PENTOXSD	calculated by PENTOXSD
Diffuse Groundwater Flow Through Bulkhead	million gallons per day	0.00079	Calculated
Hydraulic Conductivity (K)	ft/d	0.2830	Estimated for wooden bulkhead
Hydraulic Gradient (i)	ft/ft	0.0063	Site specific data
Length of Shoreline	ft	4,300.0	Estimated from site GIS
Reused Soil Saturated Thickness	ft	13.8	Estimated from observed groundwater depths and maximum resued soil emplacement depth.
Diffuse Groundwater Flow Through Alluvium/Fill	million gallons per day	0.00115	Calculated
Hydraulic Conductivity (K)	ft/d	4.6400	Estimated for wooden bulkhead
Hydraulic Gradient (i)	ft/ft	0.0020	Site specific data
Length of Shoreline		1,200.0	Estimated from site GIS
Reused Soil Saturated Thickness	ft^2	13.8	Estimated from observed groundwater depths and maximum resued soil emplacement depth.
Total Diffuse Groundwater Flow	million gallons per day	0.00194	Calculated

Attachment B
Table 3
PENTOXSD Input Data
Point Breeze- AOI 2 and 3
PES Facility
Philadelphia, Pennsylvania

Parameter	Unit	Value	Source
River Mile Index (**at discharge point**)	mile	2.8	Estimated from site GIS - boundary between AOI 2 and AOI 3
River Stage Elevation (**at discharge point**)	ft	1.00	Average stage from WRIR 01-4218
Drainage Area	mi^2	1,907.50	Estimated based on distance upstream from mouth of river.
$Q_{7\text{-}10}$ Stream Flow	ft^3/s	10.2	10% of Observed value (per PADEP); value from USGS Penrose Ave reference gauge
$Q_{7\text{-}10}$ Reach Width	ft	calculated by PENTOXSD	calculated by PENTOXSD
$Q_{7\text{-}10}$ Reach Depth	ft	calculated by PENTOXSD	calculated by PENTOXSD
Q_h Stream Flow	ft^3/s	81.10	10% of Observed value (per PADEP); value from USGS Penrose Ave reference gauge
Q_h Reach Width	ft	calculated by PENTOXSD	calculated by PENTOXSD
Q_h Reach Depth	ft	calculated by PENTOXSD	calculated by PENTOXSD
River Mile Index (**at confluence**)	mile	0.001	Estimated from site GIS
River Stage Elevation (**at confluence**)	ft	0.50	Average tidal
Drainage Area	mi^2	1,912.00	PA Gazzetteer of Streams
$Q_{7\text{-}10}$ Stream Flow	ft^3/s	10.2	10% of Observed value (per PADEP); value from USGS Penrose Ave reference gauge
$Q_{7\text{-}10}$ Reach Width	ft	calculated by PENTOXSD	calculated by PENTOXSD
$Q_{7\text{-}10}$ Reach Depth	ft	calculated by PENTOXSD	calculated by PENTOXSD
Q_h Stream Flow	ft^3/s	81.10	10% of Observed value (per PADEP); value from USGS Penrose Ave reference gauge
Q_h Reach Width	ft	calculated by PENTOXSD	calculated by PENTOXSD
Q_h Reach Depth	ft	calculated by PENTOXSD	calculated by PENTOXSD
Diffuse Groundwater Flow Through Bulkhead	million gallons per day	0.00002	Calculated
Hydraulic Conductivity (K)	ft/d	0.0283	Estimated for partial steel bulkhead
Hydraulic Gradient (i)	ft/ft	0.0091	Site specific data
Length of Shoreline	ft	1,205.0	Estimated from site GIS
Reused Soil Saturated Thickness	ft	8.87	Estimated from observed groundwater depths and maximum resued soil emplacement depth.
Diffuse Groundwater Flow Through Alluvium/Fill	million gallons per day	0.00447	Calculated
Hydraulic Conductivity (K)	ft/d	4.6400	Estimated for partial steel bulkhead
Hydraulic Gradient (i)	ft/ft	0.0091	Site specific data
Length of Shoreline		1,595.0	Estimated from site GIS
Reused Soil Saturated Thickness	ft^2	8.87	Estimated from observed groundwater depths and maximum resued soil emplacement depth.
Total Diffuse Groundwater Flow	million gallons per day	0.00449	Calculated

Attachment B
Table 4
PENTOXSD Input Data
Girard Point-AOI 5,6 and7
PES Facility
Philadelphia, Pennsylvania

Parameter	Unit	Value	Source
River Mile Index (**at discharge point**)	mile	1.3	Estimated from site GIS - RMI at Penrose Avenue
River Stage Elevation (**at discharge point**)	ft	0.75	Average river stage near the property from WRIR 01-4218
Drainage Area	mi^2	1,910.00	Estimated based on distance upstream from mouth of river.
$Q_{7\text{-}10}$ Stream Flow	ft^3/s	10.2	10% of Observed value (per PADEP); value from USGS Penrose Ave reference gauge
$Q_{7\text{-}10}$ Reach Width	ft	calculated by PENTOXSD	calculated by PENTOXSD
$Q_{7\text{-}10}$ Reach Depth	ft	calculated by PENTOXSD	calculated by PENTOXSD
Q_h Stream Flow	ft^3/s	81.10	10% of Observed value (per PADEP); value from USGS Penrose Ave reference gauge
Q_h Reach Width	ft	calculated by PENTOXSD	calculated by PENTOXSD
Q_h Reach Depth	ft	calculated by PENTOXSD	calculated by PENTOXSD
River Mile Index (**at confluence**)	mile	0.001	Estimated from site GIS
River Stage Elevation (**at confluence**)	ft	0.50	Average tidal
Drainage Area	mi^2	1,912.00	PA Gazzetteer of Streams
$Q_{7\text{-}10}$ Stream Flow	ft^3/s	10.2	10% of Observed value (per PADEP); value from USGS Penrose Ave reference gauge
$Q_{7\text{-}10}$ Reach Width	ft	calculated by PENTOXSD	calculated by PENTOXSD
$Q_{7\text{-}10}$ Reach Depth	ft	calculated by PENTOXSD	calculated by PENTOXSD
Q_h Stream Flow	ft^3/s	81.1	10% of Observed value (per PADEP); value from USGS Penrose Ave reference gauge
Q_h Reach Width	ft	calculated by PENTOXSD	calculated by PENTOXSD
Q_h Reach Depth	ft	calculated by PENTOXSD	calculated by PENTOXSD
Diffuse Groundwater Flow Through Bulkhead	million gallons per day	0.00022	Calculated
Hydraulic Conductivity (K)	ft/d	0.0283	Estimated for steel bulkhead
Hydraulic Gradient (i)	ft/ft	0.0070	Site specific data
Length of Shoreline	ft	10,000.0	Estimated from site GIS
Reused Soil Saturated Thickness	ft	14.9	Estimated from observed groundwater and maximum soil emplacement depths
Total Diffuse Groundwater Flow	million gallons per day	0.00022	Calculated

Attachment B
Table 5
Wasteload Allocation for Lead in North Yard - AOI 8
PES Facility
Philadelphia, Pennsylvania

Parameter	Unit	Value	Source
Hydraulic Conductivity (K)	ft/d	0.2830	Estimated for wooden bulkhead
Hydraulic Gradient (i)	ft/ft	0.0063	Site specific data
Length of Shoreline	ft	4,300	Estimated from site GIS
Reused Soil Saturated Thickness	ft	13.8	Estimated from observed groundwater depths and maximum reused soil emplacement depth.
Diffuse Groundwater Flow Through Bulkhead	ft^3/d	105.80	Calculated
Hydraulic Conductivity (K)	ft/d	4.64	Site specific aquifer tesing of alluvium/fill
Hydraulic Gradient (i)	ft/ft	0.0020	Site specific data
Length of Shoreline	ft	1,200	Estimated from site GIS
Reused Soil Saturated Thickness	ft	13.8	Estimated from observed groundwater depths and maximum reused soil emplacement depth.
Diffuse Groundwater Flow Through Alluvium/Fill	ft^3/d	153.68	Calculated
Total Diffuse Groundwater Flow	ft^3/day	**259.47**	Calculated
WQC	ug/l	65	PA Chapter 93.8
Background Concentration	ug/l	0.0	Assumed to be zero
Partial Mixing Factor	unitless	1.0	Not used, therefore set to a value of 1
Surface Water Flow	ft^3/d	881280	10% of Observed value (per PADEP); value from USGS Penrose Ave reference gauge
Groundwater Flow	ft^3/d	259.47	Calculated above
Lead Acute Fish Criterion Wasteload Allocation	ug/l	**220,832**	Calculated
WQC	ug/l	2.5	PA Chapter 93.8
Background Concentration	ug/l	0.0	Assumed to be zero
Partial Mixing Factor	unitless	1.0	Not used, therefore set to a value of 1
Surface Water Flow	ft^3/d	881280	10% of Observed value (per PADEP); value from USGS Penrose Ave reference gauge
Groundwater Flow	ft^3/d	259.47	Calculated above
Lead Chronic Fish Criterion Wasteload Allocation	ug/l	**8,494**	Calculated

NOTES:
Wasteload allocation calculated from equation in ACT 2 Guidance, Section IV, page 20.
WLA = Wasteload Allocation
WQC = Water Quality Criteria
ug/l = microgram per liter

Attachment B
Table 6
Wasteload Allocation for Lead in Point Breeze - AOI 2 and 3
PES Facility
Philadelphia, Pennsylvania

Parameter	Unit	Value	Source
Hydraulic Conductivity (K)	ft/d	0.0283	Estimated for partial steel bulkhead
Hydraulic Gradient (i)	ft/ft	0.0091	Site specific data
Length of Shoreline	ft	1,205	Estimated from site GIS
Reused Soil Saturated Thickness	ft	8.9	Estimated from observed groundwater depths and maximum reused soil emplacement depth.
Diffuse Groundwater Flow Through Bulkhead	ft^3/d	2.75	Calculated
Hydraulic Conductivity (K)	ft/d	4.64	Site specific aquifer tesing of alluvium/fill
Hydraulic Gradient (i)	ft/ft	0.0091	From previous AOI 2 PENTOXSD analysis
Length of Shoreline	ft	1,595	Estimated from site GIS
Reused Soil Saturated Thickness	ft	8.9	Estimated from observed groundwater depths and maximum reused soil emplacement depth.
Diffuse Groundwater Flow Through Alluvium/Fill	ft^3/d	597.37	Calculated
Total Diffuse Groundwater Flow	ft^3/day	**600.12**	Calculated
WQC	ug/l	65	PA Chapter 93.8
Background Concentration	ug/l	0.0	Assumed to be zero
Partial Mixing Factor	unitless	1.0	Not used, therefore set to a value of 1
Surface Water Flow	ft^3/d	881280	10% of Observed value (per PADEP); value from USGS Penrose Ave reference gauge
Groundwater Flow	ft^3/d	600.12	Calculated above
Lead Acute Fish Criterion Wasteload Allocation	ug/l	**95,517**	Calculated
WQC	ug/l	2.5	PA Chapter 93.8
Background Concentration	ug/l	0.0	Assumed to be zero
Partial Mixing Factor	unitless	1.0	Not used, therefore set to a value of 1
Surface Water Flow	ft^3/d	881280	10% of Observed value (per PADEP); value from USGS Penrose Ave reference gauge
Groundwater Flow	ft^3/d	600.12	Calculated above
Lead Chronic Fish Criterion Wasteload Allocation	ug/l	**3,674**	Calculated

NOTES:
Wasteload allocation calculated from equation in ACT 2 Guidance, Section IV, page 20.
WLA = Wasteload Allocation
WQC = Water Quality Criteria
ug/l = microgram per liter

Attachment B
Table 7
Wasteload Allocation for Lead in Girard Point - AOI ,6 and 7
PES Facility
Philadelphia, Pennsylvania

Parameter	Unit	Value	Source
Hydraulic Conductivity (K)	ft/d	0.0283	Estimated for steel bulkhead
Hydraulic Gradient (i)	ft/ft	0.0070	Site specific data
Length of Shoreline	ft	10,000	Estimated from site GIS
Reused Soil Saturated Thickness	ft	14.9	Site specific data
Diffuse Groundwater Flow Through Bulkhead	ft^3/d	29.54	Calculated
Hydraulic Conductivity (K)	ft/d	NA	NA
Hydraulic Gradient (i)	ft/ft	NA	NA
Length of Shoreline	ft	NA	NA
Reused Soil Saturated Thickness	ft	NA	NA
Diffuse Groundwater Flow Through Alluvium/Fill	ft^3/d	NA	NA
Total Diffuse Groundwater Flow	ft^3/day	**29.54**	Calculated
WQC	ug/l	65	PA Chapter 93.8
Background Concentration	ug/l	0.0	Assumed to be zero
Partial Mixing Factor	unitless	1.0	Not used, therefore set to a value of 1
Surface Water Flow	ft^3/d	881280	10% of Observed value (per PADEP); value from USGS Penrose Ave reference gauge
Groundwater Flow	ft^3/d	29.54	Calculated above
Lead Acute Fish Criterion Wasteload Allocation	ug/l	**1,939,455**	Calculated
WQC	ug/l	2.5	PA Chapter 93.8
Background Concentration	ug/l	0.0	Assumed to be zero
Partial Mixing Factor	unitless	1.0	Not used, therefore set to a value of 1
Surface Water Flow	ft^3/d	881280	10% of Observed value (per PADEP); value from USGS Penrose Ave reference gauge
Groundwater Flow	ft^3/d	29.54	Calculated above
Lead Chronic Fish Criterion Wasteload Allocation	ug/l	**74,594**	Calculated

NOTES:
Wasteload allocation calculated from equation in ACT 2 Guidance, Section IV, page 20.
WLA = Wasteload Allocation
WQC = Water Quality Criteria
ug/l = microgram per liter

Attachment B
Table 8
Soil Reuse Area Wasteload Allocation Results
PES Facility
Philadelphia, Pennsylvania

COC	CAS No.	North Yard - AOI 8				Point Breeze - AOI 2and 3				Girard Point AOI 5, 6 and 7			
		AFC	CFC	THH	CRL	AFC	CFC	THH	CRL	AFC	CFC	THH	CRL
		ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
Benzene	71-43-2	203,456	285,674	NA	32,428	93,513	130,829	NA	14,012	1,930,000	2,710,000	NA	285,951
1,2-Dichloroethane	107-06-2	4,770,000	6,810,000	NA	10,269	2,190,000	3,110,000	NA	4,437	45,270,000	64,800,000	NA	90,551
Ethylbenzene	100-41-4	922,305	1,270,000	1,160,000	NA	423,730	583,698	533,380	NA	8,750,000	12,120,000	11,080,000	NA
Toluene	108-88-3	540,662	725,173	2,850,000	NA	248,393	332.104.3	1,300,000	NA	5,130,000	6,890,000	27,170,000	NA
Anthracene	120-12-7	NA	NA	18,230,000	NA	NA	NA	8,350,000	NA	NA	NA	173,520,000	NA
Benzo(a)anthracene	56-55-3	159	220	NA	103	73	101	NA	44	1,509	2,091	NA	906
Benzo(a)pyrene	50-32-8	NA	NA	NA	103	NA	NA	NA	44	NA	NA	NA	906
Chrysene	218-01-9	NA	NA	NA	103	NA	NA	NA	44	NA	NA	NA	906
Fluorene	86-73-7	NA	NA	2,410,000	NA	NA	NA	1,100,000	NA	NA	NA	22,990,000	NA
Naphthalene	91-20-3	44,525	94,492	NA	NA	20,455	43,274	NA	NA	422,581	898,975	NA	NA
Phenanthrene	85-01-8	1,590	2,197	NA	NA	731	1,006	NA	NA	15,092	20,906	NA	NA
Pyrene	129-00-0	NA	NA	1,820,000	NA	NA	NA	835,293	NA	NA	NA	17,350,000	NA
Xylenes (total)	1330-20-7	349,840	461,473	153,820,000	NA	160,725	211,339	70,440,000	NA	3,320,000	4,390,000	1,463,440,000	NA
Methyl tertiary butyl ether	1634-04-4	48,020,000	112,070,000	NA	NA	22,060,000	51,320,000	NA	NA	455,780,000	1,066,220,000	NA	NA
Cumene	98-82-8	827	5,713	NA	NA	380	2,617	NA	NA	7,848	54,357	NA	NA
1,2,4-Trimethylbenzene	95-63-6	10,495	72,517	NA	NA	4,822	33,210	NA	NA	99,608	689,911	NA	NA
1,3,5-Trimethylbenzene	108-67-8	22,581	156,022	NA	NA	10,374	71,453	NA	NA	214,309	1,480,000	NA	NA
Benzo(b)fluoranthene	205-99-2	2,885	19,931	NA	NA	1,325	9,128	NA	NA	27,377	189,621	NA	NA
Benzo (g,h,i) perylene	191-24-2	2,430	16,789	NA	NA	1,116	7,689	NA	NA	23,061	159,725	NA	NA
Ethylene dibromide	106-93-4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead (total)	7439-92-1	220,832	8,494	NA	NA	95,517	3,674	NA	NA	1,939,455	74,594	NA	NA

NOTES:
PA Chapter 93 AFC = Acute Fish Criterion
PA Chapter 93 CFC = Chronic Fish Criterion
PA Chapter 93 THH = Target Human Health
PA Chapter 93 CRL = Cancer Risk Level
NA - No surface water quality standard available.
Surface Water Quality Criteria for Cumene, 1,2,4-Trimethylbenzene and 1,3,5-Trimethylbenzene from EPA Region 3 Biological Technical Assistance Group Freshwater Screening Benchmarks.
Surface Water Quality Criteria for Benzo(b)fluoranthene and Benzo (g,h,i) perylene from USEPA R5 ESL Surface Water Screening Benchmarks.
A saftey factor of 0.1 was applied to the soil reuse area wasteload allocation results in Point Breeze AOI 2 and 3 based on the AFC for naphalene.

Attachment B
Table 9
Soil Reuse Area
Surface Water Quality Criteria for Toxic Substances
PES Facility
Philadelphia, Pennsylvania

COC	CAS No.	AFC	CFC	THH	CRL
		ug/l	ug/l	ug/l	ug/l
Benzene	71-43-2	640.00	130.00	NA	1.20
1,2-Dichloroethane	107-06-2	15,000.00	3,100.00	NA	0.38
Ethylbenzene	100-41-4	2,900.00	580.00	530.00	NA
Toluene	108-88-3	1,700.00	330.00	1,300.00	NA
Anthracene	120-12-7	NA	NA	8,300.00	NA
Benzo(a)anthracene	56-55-3	0.50	0.10	NA	0.004
Benzo(a)pyrene	50-32-8	NA	NA	NA	0.004
Chrysene	218-01-9	NA	NA	NA	0.004
Fluorene	86-73-7	NA	NA	1,100.00	NA
Naphthalene	91-20-3	140.00	43.00	NA	NA
Phenanthrene	85-01-8	5.00	1.00	NA	NA
Pyrene	129-00-0	NA	NA	830.00	NA
Xylenes (total)	1330-20-7	1,100.00	210.00	70,000.00	NA
Methyl tertiary butyl ether	1634-04-4	151,000.00	51,000.00	NA	NA
Cumene (1)	98-82-8	2.60	2.60	NA	NA
1,2,4-Trimethylbenzene (1)	95-63-6	33.00	33.00	NA	NA
1,3,5-Trimethylbenzene (1)	108-67-8	71.00	71.00	NA	NA
Benzo(b)fluoranthene (2)	205-99-2	9.07	9.07	NA	NA
Benzo (g,h,i) perylene (2)	191-24-2	7.64	7.64	NA	NA
Ethylene dibromide	106-93-4	NA	NA	NA	NA
Lead (total)	7439-92-1	65.00	2.50	NA	NA

NOTES:
AFC: Acute Fish Criterion
CFC: Chronic Fish Criterion
THH: Target Human Health
CRL: Cancer Risk Level
NA: No surface water quality standard available.
Surface water quality criteria from PA Code Chapter 93.8c., Table 5: Water Qualtiy Criteria for Toxic Substances, unless otherwise noted.
(1): Surface Water Quality Criteria from EPA Region 3 Biological Technical Assistance Group Freshwater Screening Benchmarks.
(2): Surface Water Quality Criteria from USEPA R5 Ecological Screening Level (ESL) Surface Water Screening Benchmarks.