Geosyntec consultants

7 Graphics Drive
Suite 106
Ewing, NJ 08628
PH 609.895.1400
www.geosyntec.com

Memorandum

Date: June 22, 2017

To: Jill McKenzie, New Jersey Department of Environmental Protection

Betsy Donovan, United States Environmental Protection Agency

From: Julianna Connolly

John Persico

Subject: Development and Use of Alternative Remediation Standards
Rolling Knolls Landfill Superfund Site
Chatham, New Jersey

On behalf of Chevron Environmental Management Company for itself and on behalf of Kewanee Industries, Alcatel-Lucent USA Inc., and Novartis Pharmaceuticals Corporation (collectively, the "Group"), Geosyntec Consultants (Geosyntec) has prepared this memorandum describing the development and use of Alternative Remediation Standards (ARS) for soil at the Rolling Knolls Landfill Superfund Site located in the Township of Chatham, Morris County, New Jersey (the "Site").

The New Jersey Soil Remediation Standards (N.J.A.C. 7:26D; New Jersey Department of Environmental Protection [NJDEP], 2012a) are based on either residential exposure (assume 350 days of exposure per year) or non-residential exposure which assumes 225 days of exposure per year. Under NJDEP's regulations, an ARS for soil may be based on an alternative land use planned for the site (N.J.A.C. 7:26D-7.3(b)(3)). NJDEP specifically allows an ARS for "recreational uses" which are site-specific uses that do not reflect either a residential or non-residential land use scenario (N.J.A.C. 7:26D, Appendix 4). At this Site, there is no anticipated future use (i.e., the Site will remain vacant and dedicated to preservation/conservation purposes). The Site is inaccessible because there is access only through one road (Britten Road) and much of the perimeter of the landfill is surrounded by the wilderness portions of the Great Swamp National Wildlife Refuge (GSNWR), which further limits access to the landfill. The only potential human receptors at the Site will be trespassers. Accordingly, the exposure scenarios to develop the soil remediation standards for residential and non-residential uses set forth in N.J.A.C. 7:26D are not appropriate for the anticipated future use and potential exposures at this Site. In addition, to the extent an

ARS is employed, institutional controls (deed notice or other means) and engineering controls (fence and signs) will be used to ensure that access to the Site is restricted and that the Site remains dedicated to preservation/conservation purposes.

NJDEP regulation allows for development of site-specific ARS in the situations applicable here (NJDEP, 2012b). The following sections describe the development of Site-specific ARS for soil for a trespasser exposure scenario at the Rolling Knolls Site.

BACKGROUND INFORMATION

Site Features

The Site features are shown on Figure 1. The Site is a former municipal landfill in use from the 1930s to 1968. It consists of approximately 140 acres of landfill, with an adjacent 30-acre area west of the landfill that has debris scattered on the surface, but no buried waste (known as the Surface Debris Area). Most of the landfill and the Surface Debris Area are privately owned. Approximately 35 acres of the landfill are on the GSNWR.

Current Uses

Two landscaping companies rent areas on the landfill and the Surface Debris Area for equipment storage and maintenance. A small building known as the Hunt Club is located on the Surface Debris Area and is used infrequently for social gatherings. Hunters formerly used the landfill from time to time but are no longer observed.

Anticipated Future Use

With the GSNWR located both on and adjacent to the Site, maintenance of the Site in an undeveloped condition provides a buffer between the developed areas of Chatham Township and the GSNWR. The presence of wetlands, the flood hazard area and habitat for state- and federally-listed endangered species severely limits Site use. Accordingly, the environmental characteristics and associated regulatory restrictions and other impediments to development (TRC, 2017) make open space/preservation the likely anticipated future use of the Site. The GSNWR is already preserved and the private landowner of the other portion of the landfill appears willing to institute engineering and institutional controls to restrict use of and access to the Site.

Site Investigations

Soil data were obtained during several sampling events at the Site since 2006. The results of this soil sampling are presented and compared to the Residential Direct Contact Soil Remediation Standards (RDCSRS) and Nonresidential Soil Remediation Standards (NRDCSRS) in the *Remedial Investigation Report* (Geosyntec, 2017).

DEVELOPMENT OF ALTERNATIVE REMEDIATION STANDARDS

Under NJDEP regulation, an ARS may be based on an alternative land use planned for the site (e.g., recreational purposes), which is defined as any site-specific use that does not reflect either a residential or non-residential land use scenario, and should incorporate the amount of time that people are likely to spend at a site given that site-specific use (N.J.A.C. 7:26D-7.3(b)(3) and Appendix 4). The plans for the Site are to discontinue the current Site activities (landscaper storage areas, hunting to the extent it continues) and restrict use of the Site using both institutional controls (deed notice or other means) and engineering controls (fence and signs). Despite fencing and signage, individuals may trespass at the Site and contact surficial soil; accordingly, for the purpose of calculating Site-specific ARS the exposure scenario is based upon a trespasser.

ARS were calculated for those constituents identified at concentrations above the NJDEP NRDCSRS in soil at the landfill portion of the Site. With the exception of lead and arsenic, Geosyntec used Equations 3 and 4 in Appendix 2 of N.J.A.C. 7:26D (these are equivalent to Equations 5 and 6 in the *Ingestion-Dermal Exposure Pathway Soil Remediation Standards Basis and Background* Document (NJDEP, 2008)) to calculate ARS associated with the ingestion and dermal absorption of carcinogenic and non-carcinogenic, respectively, contaminants in soil for a trespasser exposure scenario.

Equation 3:

Combined Ingestion and Dermal Absorption Exposure to Carcinogenic Contaminants in Soil Non-Residential Outdoor Worker Scenario

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Source: USEPA. 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Final.

$$\text{Remediation Standard} = \frac{TR * BW * AT * 365\, d/yr}{(EF * ED * 10^{-6}\, kg/mg)((SF_o * IR) * (SF_{ABS} * AF * ABS_d * SA * EV))}$$

(mg/kg)

Equation 4:

Combined Ingestion and Dermal Absorption Exposure to Noncarcinogenic Contaminants in Soil Non-Residential Outdoor Worker Scenario

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Source: USEPA. 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Final.

$$\text{Remediation Standard} = \frac{THQ * BW * AT * 365\, d/yr}{(EF * ED * 10^{-6}\, kg/mg)\left[\left(\frac{1}{RfD_o} * IR\right) + \left(\frac{1}{RfD_{ABS}} * AF * ABS_d * SA * EV\right)\right]}$$

(mg/kg)

Of the eleven exposure factors used in these equations, the Group proposes to use eight that are consistent with NJDEP default values, one (exposure frequency) that is Site specific, and two (exposure duration and skin-soil adherence factor) that are drawn from the USEPA-approved BHHRA. Table 1 presents the exposure factors used in these equations to calculate the Site-specific ARS.

Exposure Frequency and Duration

There is no established exposure frequency for trespassers on properties to be preserved and where access is restricted. Rather, ARS may be based on site-specific land use scenarios that affect the amount of time that people are likely to spend at a site. See N.J.A.C. 7:26D, Appendix 4. Accordingly, a reasonable and conservative exposure frequency for trespassers was assumed to be three (3) days per week in the summer months and two (2) days per week in the spring and fall months (or 84 days per year). We understand that this exposure frequency has been used to develop ARS for sites that will have passive recreational use (e.g., walking or hiking).[1] Given that access to the Site will be restricted and the planned institutional and engineering controls, the use of this exposure frequency here is especially conservative.

For exposure duration, the receptor is assumed to be 6 to 17 years of age (total of 12 years) as stated for an adolescent trespasser at the landfill in the BHHRA.

Skin-Soil Adherence Factor

The skin-soil adherence factor (0.07 mg/cm^2-event) used to calculate the ARS was included in the BHHRA and is the USEPA's recommended value for an adult resident. This value is based on the 50th percentile weighted adherence factor for gardeners, which is the activity determined by USEPA to represent a reasonable, high-end activity (USEPA, 2004). Again, this is a conservative value since gardening is not an activity that will occur on the landfill.

Proposed Site-Specific ARS

The proposed Site-specific ARS for those constituents that were identified in soil at concentrations above the NRDCSRS are provided in Table 2. These ARS were developed as described above, with the exception of carcinogenic PAHs, lead, and arsenic, as described below.

Carcinogenic PAHs

In addition to an alternative land use planned for a site, new chemical toxicity data is another basis to propose an ARS. N.J.A.C. 7:26D-7.3(b)(1). USEPA updated toxicity

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[1] See e.g., https://www.epa.gov/sites/production/files/2017-01/documents/plks_cms_draftwkpl.pdf

information for benzo(a)pyrene in January 2017[2]. These updated toxicity values, specifically the updated cancer slope factor, were used to calculate Site-specific ARS for benzo(a)pyrene and the other carcinogenic PAHs. The cancer slope factor used to calculate the New Jersey Soil Remediation Standards was 7.3, and the current cancer slope factor used to calculate the Site-specific ARS is 1. It is important to note that the USEPA 2017 Toxicological Profile update also evaluates benzo(a)pyrene as a non-carcinogen; however, carcinogenic effects remain the driving endpoint.

Lead

The ARS for lead was calculated using the USEPA Adult Lead Model with an exposure frequency of 84 days per year and the geometric standard deviation for baseline blood lead concentration and baseline blood lead concentrations from the National Health and Nutrition Examination Survey (NHANES) III (1999-2004) for a probability of fetal blood lead concentration exceeding the target blood lead concentration of 10 micrograms per deciliter (µg/L) of 5%.

Arsenic

The ARS for arsenic is set to the NJDEP direct contact soil remediation standard of 19 mg/kg, which is based on natural background. This is equivalent to the RDCSRS and the NRDCSRS.

COMPLIANCE ATTAINMENT USING SPATIALLY WEIGHTED AVERAGING

Surface soil was evaluated for compliance with the ARS through the use of spatially weighted averaging (SWA) in general conformance with the procedures contained in the NJDEP Site Remediation Program *Technical Guidance for the Attainment of Remediation Standards and Site-Specific Criteria, Version 1.0*, dated 24 September 2012 (Attainment Guidance).

The area to be evaluated was divided into individual areas of influence around each soil sample point, known as Thiessen polygons, using locations of soil samples collected from the 0 to 1 foot below ground surface depth interval. Thiessen polygon boundaries are defined by the area that is closest to each point relative to other points and are mathematically defined by the perpendicular bisectors of the lines between points. The

[2] https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=136

calculations to establish these boundaries were performed using the ArcGIS Thiessen Polygon tool. The result of the Thiessen polygon calculation is shown in Figure 2. Generally, the polygon sizes and locations were consistent for each of the constituents evaluated because samples for these constituents were collected from the same locations.

To calculate an average concentration for each constituent that is protective of human health and evaluate if that concentration is no greater than the ARS, the Site was divided into separate areas, known as Functional Areas (FA), within which the SWA calculations were applied. In a meeting with the NJDEP on 10 May 2017, the concept of using two FAs was proposed for the Site, which consisted of the proposed area to be capped and the remainder (i.e. uncapped) area. The NJDEP recommended that the size of the FAs be decreased, thereby increasing the number of FAs, from that which was conceptually proposed. The NJDEP also indicated that in developing FAs it would be necessary to independently address areas of greater potential exposures as well as areas of higher constituent concentrations. Here, the constituents are widespread and their distribution does not suggest a point source or discrete spill or release. The concept of a FA is designed to limit the "dilution" of a high source area concentration by lower concentrations in exterior areas far from the source. At Rolling Knolls, where there is no source area or specific discharge and the contamination is randomly distributed, there is no justification for having more than the two FAs that were initially proposed. Nonetheless, to address the NJDEP request, the Site was divided into five FAs.

The FAs used for calculation of the SWA for each constituent include:

- FA 1 – proposed capped area in the northern portion of the landfill;
- FA 2 – landfill on private property;
- FA 3 – eastern area of landfill on GSNWR;
- FA 4 – southern area of landfill on GSNWR; and
- FA 5 – Surface Debris Area, west of the landfill.

These FAs were drawn in ArcGIS and the Theissen polygons were then "clipped" to the FA boundaries using the ArcGIS Intersect tool (Figure 2).

The area of each polygon within each FA was calculated using the ArcGIS attribute table which was then exported to Microsoft Excel. For each constituent, the concentration of a sample was multiplied by the area of the associated polygon within a FA. Each of these

weighted concentrations was summed and the total divided by the area of the FA. This SWA was compared to the applicable ARS.

When comparing the SWA to the ARS, the SWA was rounded to the least number of significant digits. For example, a SWA calculated to be 3.1 mg/kg for PCBs would be rounded to 3 mg/kg as the ARS only has one significant digit for PCBs.

FA 1 is the area proposed to be capped based on previous discussions with USEPA. Therefore, SWA calculations were not performed on this FA as the extent of remediation had already been defined. For the remainder of the FAs, Geosyntec compared the SWAs for lead, benzo(a)pyrene, and total PCBs to the ARS. The results of the above described SWA calculations are contained in Appendix 1. Based on the SWA results, the average concentrations of lead, benzo(a)pyrene, and total PCBs in FAs 2 through 5 are less than their respective ARS. Therefore, remediation is not required for soil other than in FA 1.

CONCLUSIONS

The ARS shown in Table 2 are proposed for soil at the Rolling Knolls Site. These are based on no future use at the Site, with appropriate institutional and engineering controls, so that the only human exposure scenario is trespassers. In addition, new chemical toxicity data was used to calculate the ARS for benzo(a)pyrene and other PAHs.

The Site was divided into five FAs to evaluate whether soil concentrations met the ARS. It is anticipated that FA 1 will be capped so no other evaluation of this area was needed. SWA was used to compare the average soil concentrations in FAs 2 through 5 to the ARS. The average concentrations for lead, benzo(a)pyrene, and total PCBs in these FAs were below the applicable ARS. Therefore, no further remediation beyond that anticipated in FA 1 is needed.

A Feasibility Study Report will be developed that evaluates Remedial Alternatives that are based on these results.

REFERENCES

CDM Federal Programs Corporation. 2014. *Baseline Human Health Risk Assessment, Rolling Knolls Landfill Superfund Site, Chatham, New Jersey*. June.

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NJDEP, 2012a. *N.J.A.C. 7:26D Remediation Standards*. Statutory authority N.J.S.A. 13:1D-1 et seq., 58:10-23.11a et seq., 58:10A-1 et seq. and 58:10B-1 et seq. May 7.

NJDEP, 2012b. *Technical Guidance for the Attainment of Remediation Standards and Site-Specific Criteria*. September 24.

NJDEP, 2008. *Development of Alternative Remediation Standards for the Ingestion-Dermal Pathway Guidance Document*. June 2

TRC. 2017. *Reuse Assessment Report, Rolling Knolls Landfill Superfund Site, Chatham, New Jersey*. February.

United States Environmental Protection Agency. 2004. *Risk Assessment Guidance for Superfund (RAGS), Volume I, Human Health Evaluation Manual, Part E, Supplemental Guidance for Dermal Risk Assessment. EPA/540/R-99/005.* Office of Superfund Remediation and Technology Innovation, Washington, D.C., July, 181 pp.

United States Environmental Protection Agency, 2003. *Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil*, EPA-540-R-03-001. Technical Review Workgroup for Lead, December 1996 (Revised January 2003), 62 pp.

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Site Plan created from Arcadis CAD drawings received December 2015.
Aerial imagery accessed via ArcGIS Online and provided by the United States Department of Agriculture on 9 December 2016.
Image is dated 31 July 2015.

400 200 0 400 Feet

Legend

- Monitoring Well Location
- Staff Gauge Location
- Non-Potable Supply Well
- Edge of landfilled wastes (dashed where approximate)
- Great Swamp National Wildlife Refuge property boundary
- Areas where surface water flow does not exhibit typical bed and bank morphology
- Waste and debris observed on ground surface but not observed or anticipated below ground surface
- Off-site shooting range
- Open water

Site Plan

ROLLING KNOLLS LANDFILL SUPERFUND SITE
CHATHAM, NEW JERSEY

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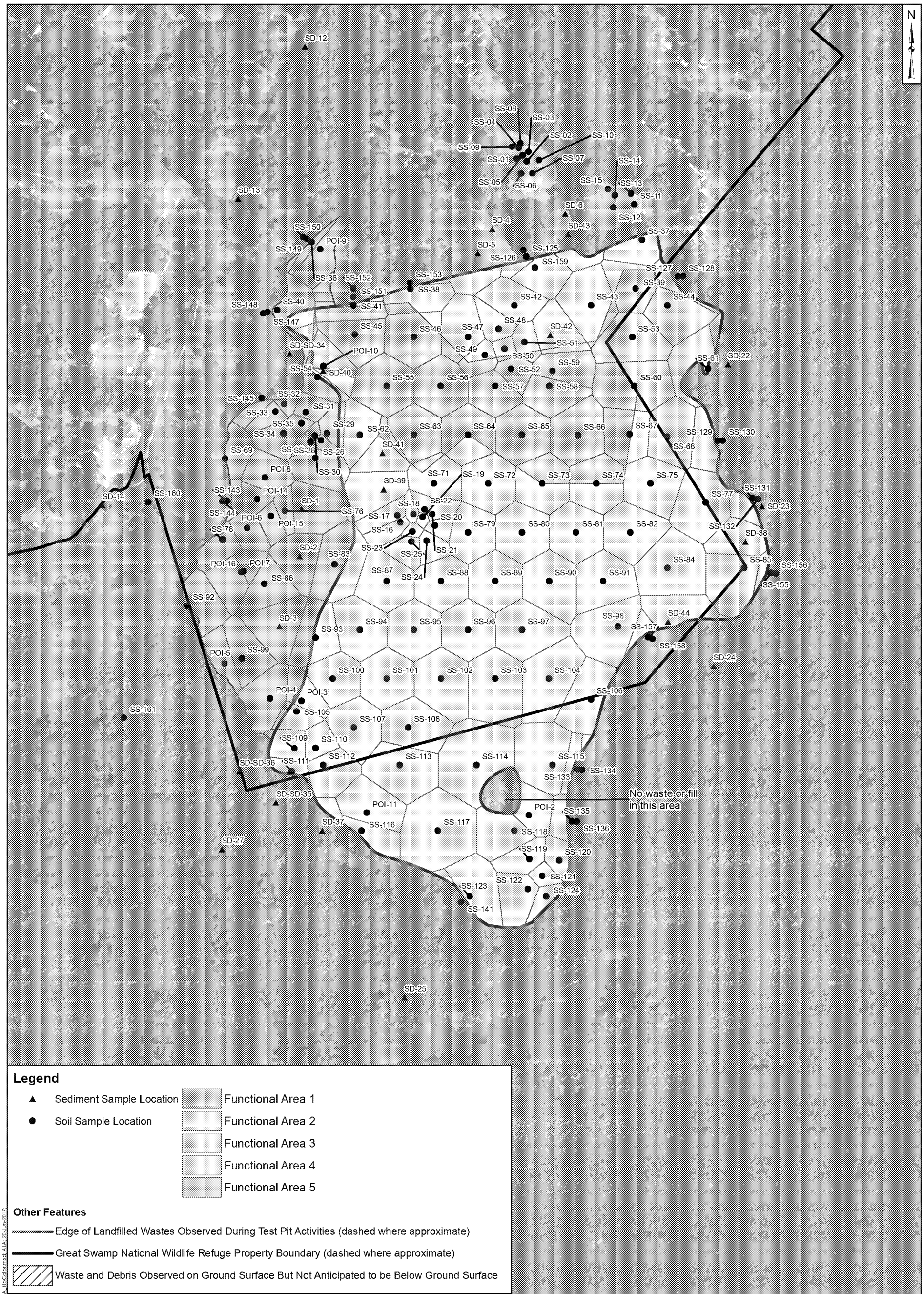
Figure 1

\\columbia-01\data\GIS\Rolling Knolls\Report 1\Figure 2_Site Plan.mxd



Legend

- ▲ Sediment Sample Location
- ● Soil Sample Location

- Functional Area 1
- Functional Area 2
- Functional Area 3
- Functional Area 4
- Functional Area 5

Other Features

- Edge of Landfilled Wastes Observed During Test Pit Activities (dashed where approximate)
- Great Swamp National Wildlife Refuge Property Boundary (dashed where approximate)
- Waste and Debris Observed on Ground Surface But Not Anticipated to be Below Ground Surface

Notes:
ppm - parts per million

PCB - Polychlorinated biphenyl

DARS - Draft Alternative Remediation Standard

Where non-detected, PCBs concentrations are assumed to equal half the detection limit.

Results of certain sediment samples are included where those sediment samples were obtained to help in delineation of constituents in soil.

Contour lines created using Natural Neighbor method. This method selected because it is the best fit model for a real world representation of the sample data.

Aerial imagery accessed via ArcGIS Online and provided by the United States Department of Agriculture on 20 Jun 2017. Image is dated 31 July 2015.

500 250 0 500 Feet

Spatially Weighted Averaging
Five Functional Area Analysis
Rolling Knolls Landfill Superfund Site
Chatham, New Jersey

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Figure 2

P:\GIS\Rolling Knolls\Report 1\PCBs Concentrations Contour Map Draft Thiessen_5FA_NoColor.mxd; AJA; 20-Jun-2017;

TABLE 1
Exposure Assumptions
Rolling Knolls Landfill Superfund Site
Chatham, New Jersey

Exposure Assumptions	NJDEP Abbreviation	Site-Specific Trespasser Exposure Scenario	Units (Note 1)	Reference (Note 2)
Target Cancer Risk	TR	1E-06	unitless	
Target Hazard Quotient	THQ	1	unitless	
Body Weight	BW	48	kg	USEPA, 2011
Averaging Time (cancer)	AT	70	yr	USEPA 1989
Averaging Time (non-cancer)	AT	12	yr	USEPA 1989
Exposure Frequency	EF	84	days/yr	Note 3
Soil Ingestion Rate	IR	100	mg/day	USEPA 1991
Skin-Soil Adherence Factor	AF	0.07	mg/cm^2-event	USEPA 2004
Skin Surface Exposed	SA	4373	cm^2	USEPA 2004
Event Frequency	EV	1	event/day	USEPA 2004
Exposure Duration	ED	12	yr	Note 4

Notes:

1. yr = year, mg = milligram, cm^2 = square centimeter, kg = kilogram.
2. The site-specific exposure scenario assumptions (other than exposure frequency) are from Table 4.1 Reasonable Maximum Exposure for an adolescent trespasser at the landfill in the Revised Baseline Human Health Risk Assessment (BHHRA) prepared by CDM Smith dated June 2014. As further detailed in this table and the BHHRA, other than the exposure frequency, the values used are default values provided by the USEPA.
3. The exposure frequency assumption is based on a recreational trespasser use of the Site. As a result, it was assumed potential receptors would visit the Site three (3) days per week in the summer months and two (2) days per week in the spring and fall months (or 84 days per year).
4. The receptor is assumed to be 6 to 17 years of age (total of 12 years) as stated for an adolescent trespasser at the landfill (BHHRA).

References:

United States Environmental Protection Agency. 1989. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual, Part A. EPA/540/1-89-002. Office of Emergency and Remedial Response, Washington, D.C., December, 287 pp.

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United States Environmental Protection Agency. 2004a. Risk Assessment Guidance for Superfund (RAGS), Volume I, Human Health Evaluation Manual, Part E, Supplemental Guidance for Dermal Risk Assessment. EPA/540/R-99/005. Office of Superfund Remediation and Technology Innovation, Washington, D.C., July, 181 pp.

TABLE 2
Proposed Alternative Remediation Standards
Rolling Knolls Landfill Superfund Site
Chatham, New Jersey

Constituent of Potential Concern	NJDEP Ingestion-Dermal Unrestricted (Residential) Standard	NJDEP Ingestion-Dermal Restricted (Outdoor Worker) Standard	Site-Specific Ingestion-Dermal (Trespasser) Carcinogen Concentration	Site-Specific Ingestion-Dermal (Trespasser) Non-Carcinogen Concentration	Proposed Alternative Remediation Standard (ARS)
Volatile Organic Compounds					
Benzene	3	14	53	8,343	53
Chloroform	780	11,000		20,857	21,000
Trichloroethene	21	100	392		390
Total xylenes	12,000	170,000		312,857	310,000
Semi-Volatile Organic Compounds					
Benzo(a)anthracene	0.6	2	87		87
Benzo(a)pyrene	0.06	0.2	8.7	448	9
Benzo(b)fluoranthene	0.6	2	87		87
Benzo(k)fluoranthene	6	23	870		870
Bis(2-ethyl hexyl) phthalate	35	140	670	31,938	670
Chrysene	62	230	8,703		8,700
Dibenz(a,h)anthracene	0.06	0.2	8.7		9
Indeno(1,2,3-cd)pyrene	0.6	2	87		87
Pesticides					
Aldrin	0.04	0.2	0.7	63	1
alpha-BHC	0.1	0.5	1.9		2
alpha-Chlordane	0.2	1	4.7	929	5
gamma-Chlordane	0.2	1	4.7	929	5
Dieldrin	0.04	0.2	0.8	104	0.8
Heptachlor	0.1	0.7	2.7	1,043	3
Heptachlor epoxide	0.07	0.3	1.3	27	1.3
Polychlorinated Biphenyls					
Aroclor	0.2	1	4.7		5
Inorganics					
Aluminum	78,000	1,100,000		2,085,714	2,100,000
Antimony	31	450		834	834
Arsenic	19	19	7	573	19
Barium	16,000	230,000		417,143	420,000
Cadmium	78	1,100		1,858	1,900
Cobalt	1,600	23,000		41,714	42,000
Copper	3,100	45,000		83,429	83,000
Cyanide	1,600	23,000		41,714	42,000
Lead	400	800			3,200
Manganese	11,000	160,000		292,000	290,000
Mercury	23	340		626	630
Nickel	1,600	23,000		41,714	42,000
Silver	390	5,700		10,429	10,400
Thallium	5	79		146	146
Vanadium	78	1,100		2,086	2,100
Zinc	23,000	340,000		625,714	630,000

Notes:

1. Site-specific carcinogenic and non-carcinogenic concentrations were calculated using the exposure assumptions presented in Table 1 and the following equations from NJDEP Ingestion-Dermal Exposure Pathway Soil Remediation Standards Basis and Background dated June 2008:

Equation 1: $SF_{ABS} = SF_o / ABS_{GI}$,

where SF_{ABS} = dermally adjusted slope factor, SF_o = oral slope factor, and ABS_{GI} = gastrointestinal absorption factor.

Equation 2: $RfD_{ABS} = RfD_o * ABS_{GI}$,

where RfD_{ABS} = dermally adjusted reference dose, RfD_o = oral reference dose, and ABS_{GI} = gastrointestinal absorption factor.

Equation 5: Remediation Standard = (TR * BW * AT * 365 d/yr) / ((EF * ED * 0.000001) * ((SF $_o$ * IR) + (SF_{ABS} * AF * ABS_d * SA * EV))),

where TR = target cancer risk, BW = body weight, AT = averaging time, EF = exposure frequency, ED = exposure duration, IR = soil ingestion rate, AF = skin-soil adherence factor, ABS $_d$ = dermal absorption fraction, SA = skin surface exposed, and EV = event frequency.

Equation 6: Remediation Standard = (THQ * BW * AT * 365 d/yr) / ((EF * ED * 0.000001) * ((1 / RfD $_o$ * IR) + (1 / RfD_{ABS} * AF * ABS_d * SA * EV))),

where THQ = target hazard quotient.

2. Alternative Remediation Standards (ARS) were calculated for constituents identified in the Revised Baseline Human Health Risk Assessment prepared by CDM Smith dated June 2014 as constituents of potential concern in soil at the landfill portion of the Site.

3. The NJDEP Ingestion-Dermal Standards for Unrestricted (Residential) and Restricted (Outdoor Worker) are from Tables 1A and 1B, respectively, of N.J.A.C. 7:26D Remediation Standards (NJDEP, Last Amended May 2012).

4. ARS are the lower of the carcinogenic and non-carcinogenic values rounded to two significant figures or one significant figure if the value is less than 10, except for lead and arsenic.

5. The ARS for lead was calculated using the United States Environmental Protection Agency (USEPA) Adult Lead Model with an exposure frequency of 84 days per year and the geometric standard deviation for baseline blood lead concentration and baseline blood lead concentrations from the National Health and Nutrition Examination Survey (NHANES) III (1999-2004) for a probability of fetal blood lead concentration exceeding the target blood lead concentration of 10 micrograms per deciliter (µg/L) of 5%.

6. The ARS for arsenic is set to the NJDEP direct contact soil remediation standard of 19 mg/kg, which is based on natural background.

7. All concentrations are in milligrams/ kilogram (mg/kg).

Appendix 1 - Comparison of Spatially Weighted Averages to Proposed ARS for Surface Soil
Rolling Knolls Landfill Superfund Site
Chatham Township, New Jersey

Constituent of Concern	Functional Area	Spatially Weighted Average (mg/kg)	Alternative Remediation Standard (mg/kg)	Remediation Area	Notes
PCB	FA1	21	5	1084559	FA 1 is the area proposed to be capped.
Lead	FA1	2507	3200	NA	No additional remediatition required Lead or BaP
BaP	FA1	4.4	9.0	NA	for FA 1
			Total	**1084559 SF**	
				24.9 Acres	
PCB	FA2	4.3	5	0	
Lead	FA2	1917	3200	0	
BaP	FA2	0.97	9	0	
			Total	**0 SF**	
				0.0 Acres	
PCB	FA3	3.5	5	0	
Lead	FA3	934.4	3200	0	
BaP	FA3	0.2	9	0	
			Total	**0 SF**	
				0.0 Acres	
PCB	FA4	2.9	5	0	
Lead	FA4	1865.9	3200	0	
BaP	FA4	0.6	9	0	
			Total	**0 SF**	
				0.0 Acres	
PCB	FA5	0.5	5	0	
Lead	FA5	714.7	3200	0	
BaP	FA5	2.0	9	0	
			Total	**0 SF**	
				0.0 Acres	

Total area to be remediated **1,084,559 SF**
24.9 Acres

Note:
Calculated spatially weighted averages were subjected to rounding
in accordance with procedure allowed by NJDEP

PCB Spatially Weighted Averaging Calculations											
Sample Location	Parameter	Concentration (mg/kg)	Functional Area ID	Polygon Areas (SF)	Weighted Concentration (Concentration X Polygon Area)	Sum of Weighted Concentrations	Sum of Polygon Areas (SF)	Spatially Weighted Average (mg/kg)	Maximum Concentration (mg/kg)	Original Value (mg/kg)	Replacement Order
SS-75	Total PCBs	4.17	FA1	712.4	2970.9						
SS-74	Total PCBs	0.21	FA1	36722.9	7711.8						
SS-73	Total PCBs	4.49	FA1	30739.1	138018.4						
SS-72	Total PCBs	7.07	FA1	49.9	353.0						
SS-71	Total PCBs	1.1	FA1	6653.4	7318.7						
SS-67	Total PCBs	1.32	FA1	39351.0	51943.3						
SS-66	Total PCBs	78.1	FA1	82930.5	6476871.9						
SS-65	Total PCBs	3.68	FA1	75706.0	278598.2						
SS-64	Total PCBs	3.99	FA1	52601.3	209879.3						
SS-63	Total PCBs	13.9	FA1	64617.2	898179.7						
SS-60	Total PCBs	6	FA1	47024.9	282149.6						
SS-59	Total PCBs	10	FA1	50202.3	502022.8						
SS-58	Total PCBs	126	FA1	52681.0	6637811.1						
SS-57	Total PCBs	12.5	FA1	49767.0	622087.5						
SS-56	Total PCBs	11.4	FA1	73732.7	840552.6						
SS-53	Total PCBs	10.9	FA1	20312.7	221408.0						
SS-52	Total PCBs	15.4	FA1	24815.5	382159.1						
SS-51	Total PCBs	5.45	FA1	4642.6	25302.0						
SS-50	Total PCBs	3.4	FA1	1926.2	6548.9						
SS-49	Total PCBs	5.6	FA1	13733.8	76909.4						
SS-47	Total PCBs	5.35	FA1	8219.4	43973.7						
SS-46	Total PCBs	32	FA1	69747.8	2231930.4						
SS-43	Total PCBs	0.19	FA1	8141.1	1546.8						
SD-42	Total PCBs	0.166	FA1	8064.4	1338.7						
SS-62	Total PCBs	0.14	FA1	2593.5	363.1						
SS-55	Total PCBs	3.54	FA1	82766.9	292994.9						
SS-45	Total PCBs	0.16	FA1	63062.3	10090.0						
SS-41	Total PCBs	0.02	FA1	28292.6	565.9						
SS-40	Total PCBs	1.56	FA1	722.4	1127.0						
SD-SD-34	Total PCBs	0.1085	FA1	1488.2	161.5						
SD-41	Total PCBs	0.354	FA1	7511.0	2658.9						
SD-40	Total PCBs	0.283	FA1	4642.4	1313.8						
POI-10	Total PCBs	91.6	FA1	28526.9	2613068.4						
SS-39	Total PCBs	12.3	FA1	33128.2	407476.9						
SS-38	Total PCBs	0.03	FA1	8493.7	254.8						
SS-127	Total PCBs	0.0078	FA1	235.8	1.8	23277662.8	1084559.1	21.5			
SS-82	Total PCBs	3.1	FA2	80097.0	248300.8				91.60		
SS-112	Total PCBs	0.03	FA2	17788.1	533.6						
SS-111	Total PCBs	0.64	FA2	14461.3	9255.2						
SS-110	Total PCBs	1.28	FA2	26240.8	33588.2						
SS-109	Total PCBs	0.09	FA2	28603.2	2574.3						
SS-114	Total PCBs	1.17	FA2	9665.1	11308.2						
SS-113	Total PCBs	2.29	FA2	7120.1	16305.0						
SS-98	Total PCBs	7.51	FA2	92515.8	694793.9						
SS-97	Total PCBs	15.7	FA2	88331.8	1386809.0						
SS-96	Total PCBs	2	FA2	75023.0	150046.1						
SS-95	Total PCBs	2.46	FA2	75022.5	184555.4						
SS-91	Total PCBs	4.58	FA2	81513.4	373331.1						
SS-90	Total PCBs	29	FA2	85355.8	2475317.1						
SS-89	Total PCBs	0.28	FA2	75005.8	21001.6						
SS-88	Total PCBs	7.29	FA2	68325.4	498092.2						
SS-85	Total PCBs	3.74	FA2	36244.0	135552.5						
SS-84	Total PCBs	10.6	FA2	106522.9	1129142.3						
SS-81	Total PCBs	7.8	FA2	75004.3	585033.2						
SS-80	Total PCBs	0.4	FA2	75016.2	30006.5						
SS-79	Total PCBs	4	FA2	61652.1	246608.5						
SS-77	Total PCBs	2.16	FA2	55824.5	120580.9						
SS-75	Total PCBs	4.17	FA2	77572.2	323476.3						
SS-74	Total PCBs	0.21	FA2	37709.2	7918.9						
SS-73	Total PCBs	4.49	FA2	44343.9	199104.0						
SS-72	Total PCBs	7.07	FA2	75041.2	530541.6						
SS-71	Total PCBs	1.1	FA2	49997.3	54997.1						
SS-68	Total PCBs	4.99	FA2	23865.4	119088.5						
SS-67	Total PCBs	1.32	FA2	25225.2	33297.2						
SS-65	Total PCBs	3.68	FA2	67.8	249.5						
SS-64	Total PCBs	3.99	FA2	22399.6	89374.3						
SS-63	Total PCBs	13.9	FA2	134.4	1868.1						
SS-60	Total PCBs	6	FA2	3829.9	22979.4						
SS-51	Total PCBs	5.45	FA2	18925.0	103141.4						
SS-50	Total PCBs	3.4	FA2	10531.9	35808.4						
SS-49	Total PCBs	5.6	FA2	12270.6	68715.1						
SS-48	Total PCBs	4.4	FA2	28436.4	125120.2						
SS-47	Total PCBs	5.35	FA2	55269.0	295689.2						
SS-46	Total PCBs	32	FA2	7768.0	248577.3						
SS-43	Total PCBs	0.19	FA2	79878.1	15176.8						
SS-42	Total PCBs	1.84	FA2	55500.3	102120.5						
SS-25	Total PCBs	0.015	FA2	25567.7	383.5						
SS-24	Total PCBs	4.7	FA2	21260.6	99924.7						
SS-23	Total PCBs	0.43	FA2	6400.4	2752.2						
SS-22	Total PCBs	0.71	FA2	9363.3	6648.0						
SS-21	Total PCBs	0.73	FA2	14282.7	10426.4						
SS-20	Total PCBs	0.02	FA2	13338.6	266.8						
SS-19	Total PCBs	2.8	FA2	3991.9	11177.4						
SS-18	Total PCBs	0.04	FA2	9180.4	367.2						
SS-16	Total PCBs	0.02	FA2	20374.5	407.5						

PCB Spatially Weighted Averaging Calculations											
Sample Location	Parameter	Concentration (mg/kg)	Functional Area ID	Polygon Areas (SF)	Weighted Concentration (Concentration X Polygon Area)	Sum of Weighted Concentrations	Sum of Polygon Areas (SF)	Spatially Weighted Average (mg/kg)	Maximum Concentration (mg/kg)	Original Value (mg/kg)	Replacement Order
SS-158	Total PCBs	0.24	FA2	379.9	91.2						
SS-157	Total PCBs	0.4	FA2	13152.4	5261.0						
SS-108	Total PCBs	0.48	FA2	72160.8	34637.2						
SS-106	Total PCBs	0.86	FA2	39348.1	33839.4						
SS-104	Total PCBs	5.57	FA2	93494.7	520765.6						
SS-103	Total PCBs	5.55	FA2	101098.3	561095.5						
SS-102	Total PCBs	4.22	FA2	89329.7	376971.3						
SD-44	Total PCBs	0.432	FA2	51536.5	22263.8						
SD-42	Total PCBs	0.166	FA2	45856.5	7612.2						
SD-38	Total PCBs	0.65	FA2	15423.8	10025.5						
SS-94	Total PCBs	5.03	FA2	76226.4	383418.8						
SS-93	Total PCBs	0.02	FA2	33808.9	676.2						
SS-87	Total PCBs	8.7	FA2	75544.8	657240.2						
SS-83	Total PCBs	0.015	FA2	36698.7	550.5						
SS-62	Total PCBs	0.14	FA2	50303.2	7042.5						
SS-54	Total PCBs	0.03	FA2	5541.8	166.3						
SS-41	Total PCBs	0.02	FA2	4182.9	83.7						
SS-40	Total PCBs	1.56	FA2	11355.7	17714.9						
SS-29	Total PCBs	0.015	FA2	7436.7	111.6						
SS-28	Total PCBs	0.015	FA2	875.0	13.1						
SS-26	Total PCBs	0.015	FA2	5649.2	84.7						
SS-17	Total PCBs	0.11	FA2	25681.5	2825.0						
SS-107	Total PCBs	0.32	FA2	71272.6	22807.2						
SS-105	Total PCBs	9.31	FA2	21324.6	198532.3						
SS-101	Total PCBs	7.3	FA2	75028.8	547710.5						
SS-100	Total PCBs	4.06	FA2	60359.0	245057.4						
SD-SD-34	Total PCBs	0.1085	FA2	6357.9	689.8						
SD-41	Total PCBs	0.354	FA2	35461.0	12553.2						
SD-40	Total PCBs	0.283	FA2	12839.2	3633.5						
SD-39	Total PCBs	0.046	FA2	63770.2	2933.4						
POI-3	Total PCBs	0.64	FA2	21800.5	13952.3						
POI-10	Total PCBs	91.6	FA2	121.5	11128.8						
SS-151	Total PCBs	0.0046	FA2	1761.0	8.1						
SS-39	Total PCBs	12.3	FA2	18004.0	221449.3						
SS-38	Total PCBs	0.03	FA2	39990.5	1199.7						
SS-37	Total PCBs	0.04	FA2	37759.8	1510.4						
SS-159	Total PCBs	0.01	FA2	46474.1	464.7						
SS-153	Total PCBs	0.0093	FA2	2713.1	25.2						
SS-127	Total PCBs	0.0078	FA2	3813.5	29.7						
SS-125	Total PCBs	0.26	FA2	8893.7	2312.4						
SD-5	Total PCBs	0.095	FA2	25816.8	2452.6						
SD-43	Total PCBs	0.085	FA2	18234.1	1549.9	14794823.5	3414739.8	4.3			
SS-85	Total PCBs	3.74	FA3	43221.2	161647.3				12.30		
SS-77	Total PCBs	2.16	FA3	36654.8	79174.4						
SS-75	Total PCBs	4.17	FA3	1.0	4.1						
SS-68	Total PCBs	4.99	FA3	52754.2	263243.4						
SS-67	Total PCBs	1.32	FA3	19.6	25.9						
SS-61	Total PCBs	0.025	FA3	51379.3	1284.5						
SS-60	Total PCBs	6	FA3	50262.9	301577.6						
SS-53	Total PCBs	10.9	FA3	63203.5	688918.4						
SS-44	Total PCBs	1.83	FA3	69314.4	126845.3						
SS-155	Total PCBs	0.24	FA3	9232.5	2215.8						
SS-131	Total PCBs	0.72	FA3	14885.8	10717.8						
SS-129	Total PCBs	0.015	FA3	37722.0	565.8						
SD-44	Total PCBs	0.432	FA3	4608.4	1990.8						
SD-38	Total PCBs	0.65	FA3	34511.8	22432.7						
SD-24	Total PCBs	0.18	FA3	1591.5	286.5						
SD-23	Total PCBs	0.08	FA3	5350.9	428.1						
SD-22	Total PCBs	0.041	FA3	7655.5	313.9						
SS-39	Total PCBs	12.3	FA3	9177.7	112885.8						
SS-128	Total PCBs	0.006	FA3	4487.6	26.9						
SS-127	Total PCBs	0.0078	FA3	10003.6	78.0	1774663.0	506038.3	3.5			
SS-124	Total PCBs	1.48	FA4	18126.0	26826.5						
SS-116	Total PCBs	0.02	FA4	35153.8	703.1						
SS-112	Total PCBs	0.03	FA4	36133.6	1084.0						
SS-111	Total PCBs	0.64	FA4	1309.9	838.3						
SD-37	Total PCBs	0.013	FA4	10278.9	133.6						
POI-11	Total PCBs	0.025	FA4	68148.8	1703.7						
SS-141	Total PCBs	0.04	FA4	5009.8	200.4						
SS-135	Total PCBs	0.32	FA4	20977.9	6712.9						
SS-134	Total PCBs	0.27	FA4	2934.9	792.4						
SS-133	Total PCBs	0.21	FA4	16897.8	3548.5						
SS-123	Total PCBs	3.15	FA4	69468.6	218826.0						
SS-122	Total PCBs	1.28	FA4	49397.0	63228.2						
SS-121	Total PCBs	8.6	FA4	14081.7	121102.5						
SS-120	Total PCBs	3.4	FA4	24077.5	81863.4						
SS-119	Total PCBs	2.3	FA4	35820.4	82386.8						
SS-118	Total PCBs	23	FA4	59287.0	1363600.1						
SS-117	Total PCBs	2.66	FA4	142943.9	380230.8						
SS-115	Total PCBs	0.78	FA4	94876.8	74003.9						
SS-114	Total PCBs	1.17	FA4	125574.4	146922.1						
SS-113	Total PCBs	2.29	FA4	86880.3	198955.8						
POI-2	Total PCBs	2.18	FA4	41505.8	90482.6						
SS-108	Total PCBs	0.48	FA4	9054.8	4346.3						
SS-106	Total PCBs	0.86	FA4	37475.7	32229.1						

PEB Spatially Weighted Averaging Calculations											
Sample Location	Parameter	Concentration (mg/kg)	Functional Area ID	Polygon Areas (SF)	Weighted Concentration (Concentration X Polygon Area)	Sum of Weighted Concentrations	Sum of Polygon Areas (SF)	Spatially Weighted Average (mg/kg)	Maximum Concentration (mg/kg)	Original Value (mg/kg)	Replacement Order
SS-104	Total PCBs	5.57	FA4	11914.7	66364.7						
SS-103	Total PCBs	5.55	FA4	5009.6	27803.5						
SS-107	Total PCBs	0.32	FA4	971.5	310.9	2995200.2	1023311.0	2.9			
SS-109	Total PCBs	0.09	FA5	2012.7	181.1						
SS-99	Total PCBs	0.08	FA5	56433.5	4514.7						
SS-93	Total PCBs	0.02	FA5	34548.7	691.0						
SS-92	Total PCBs	0.055	FA5	50489.4	2776.9						
SS-86	Total PCBs	0.03	FA5	53132.7	1594.0						
SS-83	Total PCBs	0.015	FA5	57302.9	859.5						
SS-78	Total PCBs	0.02	FA5	34123.6	682.5						
SS-76	Total PCBs	0.02	FA5	19160.2	383.2						
SS-69	Total PCBs	0.035	FA5	32534.0	1138.7						
SS-54	Total PCBs	0.03	FA5	20738.9	622.2						
SS-41	Total PCBs	0.02	FA5	3007.5	60.2						
SS-40	Total PCBs	1.56	FA5	33304.9	51955.6						
SS-35	Total PCBs	0.015	FA5	9703.3	145.5						
SS-34	Total PCBs	0.015	FA5	34242.2	513.6						
SS-33	Total PCBs	0.015	FA5	17933.2	269.0						
SS-32	Total PCBs	0.015	FA5	9478.8	142.2						
SS-31	Total PCBs	0.015	FA5	21298.1	319.5						
SS-30	Total PCBs	0.015	FA5	4941.5	74.1						
SS-29	Total PCBs	0.015	FA5	16658.9	249.9						
SS-28	Total PCBs	0.015	FA5	7297.7	109.5						
SS-27	Total PCBs	0.015	FA5	10010.6	150.2						
SS-26	Total PCBs	0.015	FA5	46538.3	698.1						
SS-17	Total PCBs	0.11	FA5	10.1	1.1						
SS-147	Total PCBs	0.065	FA5	15.8	1.0						
SS-145	Total PCBs	0.02	FA5	13515.7	270.3						
SS-143	Total PCBs	0.02	FA5	11590.6	231.8						
SS-105	Total PCBs	9.31	FA5	4934.3	45938.0						
SS-100	Total PCBs	4.06	FA5	794.4	3225.4						
SD-SD-34	Total PCBs	0.1085	FA5	7350.6	797.5						
SD-39	Total PCBs	0.046	FA5	4609.4	212.0						
SD-3	Total PCBs	0.75	FA5	70122.3	52591.8						
SD-2	Total PCBs	0.175	FA5	59664.5	10441.3						
SD-1	Total PCBs	0.55	FA5	64555.7	35505.6						
POI-8	Total PCBs	0.11	FA5	44498.6	4894.8						
POI-7	Total PCBs	0.02	FA5	18508.2	370.2						
POI-6	Total PCBs	0.16	FA5	30696.9	4911.5						
POI-5	Total PCBs	0.03	FA5	33527.7	1005.8						
POI-4	Total PCBs	0.445	FA5	62704.4	27903.5						
POI-3	Total PCBs	0.64	FA5	13332.6	8532.8						
POI-16	Total PCBs	0.015	FA5	41283.3	619.2						
POI-15	Total PCBs	0.015	FA5	20766.5	311.5						
POI-14	Total PCBs	0.04	FA5	20378.3	815.1						
POI-10	Total PCBs	91.6	FA5	1858.3	170222.9						
SS-36	Total PCBs	2.06	FA5	11764.1	24234.1						
SS-152	Total PCBs	0.02	FA5	5986.6	119.7						
SS-151	Total PCBs	0.0046	FA5	4668.1	21.5						
SS-150	Total PCBs	0.02	FA5	2525.3	50.5						
SS-149	Total PCBs	0.01	FA5	140.6	1.4						
POI-9	Total PCBs	1.97	FA5	45042.6	88733.8	550095.5	1169737.0	0.5			

Note

Alternative Remediation Standard 5 mg/kg
84 Days

Lead Spatially Weighted Averaging Calculation												
Sample Location	Parameter	Concentration (mg/kg)	Detection Limit	Detection Limit*1/2	Functional Area ID	Polygon Area (m2)	Weighted Concentration (Concentration * Polygon Area)	Sum of Weighted Concentrations	Sum of Polygon Areas (m2)	Spatially Weighted Average (mg/kg)	Maximum Concentration (mg/kg)	Original Value (mg/kg)	Replacement Order
SS-53	Lead	1110	8	4	FA1	20324.7	22560434.2						
SS-45	Lead	161	0.39	0.195	FA1	63230.2	10180066.1						
SS-71	Lead	1070	4.6	2.3	FA1	6653.4	7119100.0						
SS-75	Lead	1360	11.1	5.55	FA1	712.4	968917.5						
SS-74	Lead	49.6	0.42	0.21	FA1	36722.9	1821455.1						
SS-73	Lead	1880	10.1	5.05	FA1	30739.1	57789438.6						
SS-72	Lead	1750	12.8	6.4	FA1	49.9	87373.9						
SS-67	Lead	1580	4.7	2.35	FA1	39351.0	62174510.4						
SS-66	Lead	2100	5	2.5	FA1	82930.5	174154046.0						
SS-65	Lead	1560	0.78	0.39	FA1	75706.0	118101399.2						
SS-60	Lead	974	6.7	3.35	FA1	47024.9	45802290.0						
SS-59	Lead	1250	0.68	0.34	FA1	57294.4	71618047.1						
SS-58	Lead	927	5.5	2.75	FA1	52681.0	48835324.6						
SS-57	Lead	795	0.6	0.3	FA1	49767.0	39564767.5						
SS-52	Lead	2850	4.9	2.45	FA1	24815.5	70724245.9						
SS-51	Lead	2200	7.8	3.9	FA1	4942.4	10873294.9						
SS-50	Lead	673	0.83	0.415	FA1	1926.2	1296301.5						
SS-49	Lead	1010	4.5	2.25	FA1	13733.8	13871168.3						
SS-43	Lead	55.1	0.51	0.255	FA1	8801.4	484958.3						
SS-39	Lead	1050	7.5	3.75	FA1	32489.0	34113470.4						
SD-52	Lead	108	0.81	0.405	FA1	875.0	94502.4						
SS-64	Lead	1930	6.7	3.35	FA1	52601.3	101520575.3						
SS-63	Lead	2020	5.2	2.6	FA1	69938.0	141274754.8						
SS-62	Lead	37.4	0.42	0.21	FA1	4783.8	178912.6						
SS-56	Lead	2060	1.2	0.6	FA1	73732.7	151889322.3						
SS-55	Lead	16500	63	31.5	FA1	83246.4	1373566292.3						
SS-47	Lead	7140	14.1	7.05	FA1	8219.4	58686342.7						
SS-46	Lead	665	0.72	0.36	FA1	69747.8	46382303.8						
SS-41	Lead	42.3	0.51	0.255	FA1	28292.6	1202435.5						
SS-40	Lead	825	4	2	FA1	894.5	737944.0						
SS-38	Lead	86.8	0.48	0.24	FA1	8493.7	737249.8						
POI-10	Lead	1510	1.1	0.55	FA1	34258.2	51729922.4	2720141167.4	1084979.3	2507.1			
SS-91	Lead	452	1.2	0.6	FA2	81513.4	36844034.2				13800.00		
SS-87	Lead	1640	4.6	2.3	FA2	75544.8	123893551.6						
SS-106	Lead	205	0.86	0.43	FA2	39348.1	8066365.9						
SS-114	Lead	2540	5.6	2.8	FA2	9665.1	24549357.8						
SS-113	Lead	2280	5.1	2.55	FA2	7120.1	16233798.6						
SS-112	Lead	22.7	0.39	0.195	FA2	17788.1	403788.8						
SS-111	Lead	663	2.9	1.45	FA2	13821.5	9163625.7						
SS-110	Lead	313	0.59	0.295	FA2	26240.8	8213367.5						
SS-109	Lead	43.6	0.63	0.315	FA2	28381.6	1237438.6						
SS-108	Lead	6270	3.6	1.8	FA2	72160.8	452448006.4						
SS-107	Lead	792	2	1	FA2	71272.6	56447930.7						
SS-105	Lead	1070	8	4	FA2	21324.2	22816886.8						
SD-62	Lead	162	0.61	0.305	FA2	204.7	33169.0						
SD-61	Lead	204	0.26	0.13	FA2	657.1	134044.4						
POI-3	Lead	1720	4.3	2.15	FA2	21800.5	37496784.2						
SS-96	Lead	2700	5.4	2.7	FA2	75023.0	202562229.5						
SS-95	Lead	1550	6	3	FA2	75022.5	116284875.8						
SS-94	Lead	1400	5.2	2.6	FA2	76226.4	106716964.4						
SS-93	Lead	22	0.46	0.23	FA2	33808.9	743796.8						
SS-88	Lead	1630	5.1	2.55	FA2	68325.4	111370409.5						
SS-83	Lead	14.9	0.36	0.18	FA2	36698.7	546810.7						
SS-79	Lead	1900	5.1	2.55	FA2	61652.1	117139020.7						
SS-71	Lead	1070	4.6	2.3	FA2	55469.5	59352369.3						
SS-26	Lead	72.7	0	0	FA2	10947.2	795861.9						
SS-25	Lead	48	0	0	FA2	25567.7	1227249.6						
SS-24	Lead	2430	0	0	FA2	21260.6	51663170.2						
SS-23	Lead	337	0	0	FA2	6400.4	2156930.3						
SS-22	Lead	329	0	0	FA2	9363.3	3080538.6						
SS-21	Lead	476	0	0	FA2	14282.7	6798568.8						
SS-20	Lead	175	0	0	FA2	13338.6	2334249.3						
SS-19	Lead	1090	0	0	FA2	3991.9	4351200.4						
SS-18	Lead	422	0	0	FA2	9987.3	4214633.1						
SS-17	Lead	901	0	0	FA2	71225.4	64174071.9						
SS-16	Lead	91.8	0	0	FA2	20374.5	1870376.3						
SS-102	Lead	1870	5.8	2.9	FA2	89329.7	167046511.8						
SS-101	Lead	1380	5.9	2.95	FA2	75028.8	103539797.8						
SS-100	Lead	2650	6.2	3.1	FA2	60359.0	159951273.4						
SBA01	Lead	722	0.53	0.265	FA2	996.7	719639.1						
SS-98	Lead	2710	7.2	3.6	FA2	93348.9	252975420.5						
SS-97	Lead	1430	12.6	6.3	FA2	88331.8	126314453.1						
SS-90	Lead	1540	9.6	4.8	FA2	85355.8	131447871.3						
SS-89	Lead	55	0.43	0.215	FA2	75005.8	4125318.2						
SS-84	Lead	4510	8.3	4.15	FA2	126205.6	569187164.1						
SS-82	Lead	4010	4.7	2.35	FA2	80097.0	321189113.3						
SS-81	Lead	2290	12.8	6.4	FA2	75004.3	171759738.3						
SS-80	Lead	2490	3.8	1.9	FA2	75016.2	186790415.7						
SS-77	Lead	141	2	1	FA2	55811.7	7869455.7						
SS-75	Lead	1360	11.1	5.55	FA2	77572.2	105498254.4						
SS-74	Lead	49.6	0.42	0.21	FA2	37709.2	1870374.3						
SS-73	Lead	1880	10.1	5.05	FA2	44343.9	83366472.3						
SS-72	Lead	1750	12.8	6.4	FA2	75041.2	131322180.9						
SS-158	Lead	70.9	0.18	0.09	FA2	16700.0	1184030.3						
SS-157	Lead	93	0.25	0.125	FA2	21881.9	2035012.4						
SS-104	Lead	528	0.85	0.425	FA2	93494.7	49365214.3						
SS-103	Lead	13800	52.7	26.35	FA2	101098.3	1395156367.6						
SD-56	Lead	74.4	0.25	0.125	FA2	4432.0	329738.7						
SS-85	Lead	2360	10.1	5.05	FA2	37773.8	89146260.7						
SBA07	Lead	1580	0.58	0.29	FA2	15445.9	24404571.4						
SS-68	Lead	1320	3.2	1.6	FA2	23865.4	31502381.3						
SS-67	Lead	1580	4.7	2.35	FA2	25225.2	39855776.9						
SS-65	Lead	1560	0.78	0.39	FA2	67.8	105780.1						
SS-60	Lead	974	6.7	3.35	FA2	3829.9	3730329.5						
SS-59	Lead	1250	0.68	0.34	FA2	6678.8	8348361.9						

Lead Spatially Weighted Averaging Calculations													
Sample Location	Parameter	Concentration (mg/kg)	Detection Limit	Detection Limit*1/2	Functional Area ID	Polygon Area (SF)	Weighted Concentration (Concentration * Polygon Area)	Sum of Weighted Concentrations	Sum of Polygon Areas (SF)	Spatially Weighted Average (mg/kg)	Maximum Concentration (mg/kg)	Digital Value (mg/kg)	Replacement Order
SS-51	Lead	2200	7.8	3.9	FA2	37632.1	82790528.3						
SS-50	Lead	673	0.83	0.415	FA2	10531.9	7087954.2						
SS-49	Lead	1010	4.5	2.25	FA2	12270.6	12393264.2						
SS-48	Lead	1300	5.7	2.85	FA2	28446.1	36979956.7						
SS-43	Lead	55.1	0.51	0.255	FA2	100904.1	5559814.1						
SS-42	Lead	441	0.45	0.225	FA2	74402.1	32811314.7						
SS-39	Lead	1050	7.5	3.75	FA2	16993.4	17843097.9						
SS-37	Lead	50.7	0.35	0.175	FA2	31446.6	1594343.3						
SS-159	Lead	13.9	0.19	0.095	FA2	55098.0	765862.3						
SS-127	Lead	42.6	0.22	0.11	FA2	204.2	8699.4						
SS-126	Lead	13.9	0.24	0.12	FA2	656.6	9126.2						
SS-125	Lead	59.1	0.21	0.105	FA2	11934.6	705334.8						
SD-52	Lead	108	0.81	0.405	FA2	12764.7	1378585.4						
SBA05	Lead	7.1	0.31	0.155	FA2	1850.5	13138.6						
SS-64	Lead	1930	6.7	3.35	FA2	22399.6	43231174.7						
SS-63	Lead	2020	5.2	2.6	FA2	11188.3	22600389.7						
SS-62	Lead	37.4	0.42	0.21	FA2	80362.8	3005569.0						
SS-54	Lead	53.9	0.42	0.21	FA2	11899.5	641383.7						
SS-47	Lead	7140	14.1	7.05	FA2	58222.9	415711195.1						
SS-46	Lead	665	0.72	0.36	FA2	7768.0	5165746.2						
SS-41	Lead	42.5	0.51	0.255	FA2	4182.9	177772.5						
SS-40	Lead	825	4	2	FA2	15058.3	12423129.5						
SS-38	Lead	86.8	0.48	0.24	FA2	42512.9	3690121.2						
SS-29	Lead	31.1	0	0	FA2	7436.7	231282.2						
SS-28	Lead	5	0	0	FA2	875.0	4374.8						
SS-153	Lead	86.5	0.17	0.085	FA2	5817.3	503196.9						
SS-151	Lead	44.8	0.23	0.115	FA2	1761.0	78893.3						
POI-10	Lead	1510	1.1	0.55	FA2	8838.0	13345339.6	6546253544.9	3414319.6	1917.3			
SS-53	Lead	1110	8	4	FA3	63203.5	70155908.8						
SD-54	Lead	117	0.19	0.095	FA3	12983.1	1519021.4						
SS-77	Lead	141	2	1	FA3	32939.8	4644513.9						
SS-75	Lead	1360	11.1	5.55	FA3	1.0	1348.3						
SD-56	Lead	74.4	0.25	0.125	FA3	2580.7	192002.4						
SS-85	Lead	2360	10.1	5.05	FA3	46852.1	110571044.7						
SS-155	Lead	94.8	0.21	0.105	FA3	9237.8	875739.5						
SS-132	Lead	208	0.17	0.085	FA3	33.0	6853.9						
SS-131	Lead	123	0.23	0.115	FA3	3591.1	441710.6						
SBA07	Lead	1580	0.58	0.29	FA3	29508.6	46623614.8						
SBA06	Lead	364	0.51	0.255	FA3	25314.0	9214292.4						
SS-68	Lead	1320	3.2	1.6	FA3	48001.5	63361937.0						
SS-67	Lead	1580	4.7	2.35	FA3	19.6	30977.5						
SS-61	Lead	23.9	0.54	0.27	FA3	46126.5	1102423.9						
SS-60	Lead	974	6.7	3.35	FA3	50262.4	48955605.0						
SS-44	Lead	1580	2.5	1.25	FA3	66085.3	104414772.8						
SS-39	Lead	1050	7.5	3.75	FA3	9177.7	9636595.9						
SS-175	Lead	26.7	0.27	0.135	FA3	15094.7	403028.5						
SS-129	Lead	5.9	0.22	0.11	FA3	31807.0	187661.3						
SS-128	Lead	15.5	0.2	0.1	FA3	3005.5	46584.9						
SS-127	Lead	42.6	0.22	0.11	FA3	9672.1	412033.0						
SD-53	Lead	70.6	0.25	0.125	FA3	209.8	14814.6						
SD-52	Lead	108	0.81	0.405	FA3	331.5	35796.6	472848281.7	506038.3	934.4			
POI-11	Lead	116	0.46	0.23	FA4	68146.1	7904952.8						
SD-59	Lead	181	0.25	0.125	FA4	16047.7	2904638.1						
SS-135	Lead	174	0.21	0.105	FA4	20977.9	3650160.4						
SS-134	Lead	88.2	0.18	0.09	FA4	2907.4	256430.8						
SS-133	Lead	202	0.24	0.12	FA4	16897.8	3413360.9						
SS-124	Lead	473	4.4	2.2	FA4	17135.1	8104923.4						
SS-122	Lead	1270	5.3	2.65	FA4	38720.8	49175372.9						
SS-121	Lead	1340	5.7	2.85	FA4	14081.7	18869453.0						
SS-120	Lead	1310	6.1	3.05	FA4	24077.5	31541483.8						
SS-119	Lead	1070	5.9	2.95	FA4	35820.4	38327782.1						
SS-118	Lead	2560	12.2	6.1	FA4	59287.0	151774620.3						
SS-115	Lead	6170	8.8	4.4	FA4	94876.8	585389647.5						
SS-106	Lead	205	0.86	0.43	FA4	37371.6	7661186.0						
SD-57	Lead	82.8	0.24	0.12	FA4	131.6	10892.6						
POI-2	Lead	1490	5.6	2.8	FA4	41505.8	61843640.9						
SS-141	Lead	44.1	0.24	0.12	FA4	4495.1	198232.7						
SS-123	Lead	1370	11.4	5.7	FA4	57603.8	78917228.0						
SS-117	Lead	1420	5.2	2.6	FA4	142943.9	202980358.2						
SS-116	Lead	34.6	0.44	0.22	FA4	35154.3	1216340.3						
SS-114	Lead	2540	5.6	2.8	FA4	125574.4	318959005.3						
SS-113	Lead	2280	5.1	2.55	FA4	86880.3	198086990.5						
SS-112	Lead	22.7	0.39	0.195	FA4	36127.7	820099.0						
SS-111	Lead	663	2.9	1.45	FA4	1309.9	868448.6						
SS-108	Lead	6270	3.6	1.8	FA4	9054.8	56773878.1						
SS-107	Lead	792	2	1	FA4	971.5	769412.0						
SD-60	Lead	158	1.5	0.75	FA4	7998.9	1263819.9						
SBA09	Lead	223	0.31	0.155	FA4	10286.9	2293989.4						
SS-104	Lead	528	0.85	0.425	FA4	11914.7	6290947.9						
SS-103	Lead	13800	52.7	26.35	FA4	5009.6	69132965.6	1909400261.2	1023311.0	1865.9			
SD-64	Lead	219	0.39	0.195	FA5	12084.4	2646483.5						
SS-105	Lead	1070	8	4	FA5	4542.7	4860734.3						
SD-62	Lead	162	0.61	0.305	FA5	13626.2	2207445.9						
POI-4	Lead	70.4	0.5	0.25	FA5	47173.7	3321030.1						
POI-3	Lead	1720	4.3	2.15	FA5	13332.6	22932031.8						
SS-99	Lead	54.9	0.35	0.175	FA5	53438.7	2933786.0						
SS-92	Lead	102	0.95	0.475	FA5	39648.7	4044170.9						
SS-78	Lead	20.9	0.48	0.24	FA5	33157.6	692993.8						
SS-69	Lead	84.8	0.73	0.365	FA5	32309.1	2739812.5						
SS-170	Lead	240	0.58	0.29	FA5	552.1	132501.1						
SS-143	Lead	262	0.18	0.09	FA5	11263.4	2951022.7						
SD-63	Lead	60.6	0.51	0.255	FA5	12423.9	752886.2						
POI-5	Lead	436	0.59	0.295	FA5	28427.0	12394154.7						
POI-16	Lead	33.6	0.28	0.14	FA5	41005.6	1377786.6						
SS-93	Lead	22	0.46	0.23	FA5	34550.3	760105.9						

Lead Spatially Weighted Averaging Calculation													
Sample Location	Parameter	Concentration (mg/kg)	Detection Limit	Detection Limit*1/2	Functional Area ID	Polygon Area (SF)	Weighted Concentration (Concentration * Polygon Area)	Sum of Weighted Concentrations	Sum of Polygon Areas (SF)	Spatially Weighted Average (mg/kg)	Maximum Concentration (mg/kg)	Original Value (mg/kg)	Replacement Order
SS-86	Lead	58.6	0.83	0.415	FAS	53101.2	3111732.8						
SS-83	Lead	14.9	0.36	0.18	FAS	57506.9	856853.1						
SS-76	Lead	24.7	0.55	0.275	FAS	19149.8	473000.7						
SS-26	Lead	72.7	0	0	FAS	46884.1	3408473.9						
SS-17	Lead	901	0	0	FAS	1014.8	914305.0						
SS-100	Lead	2650	6.2	3.1	FAS	794.4	2105226.1						
SBA04	Lead	218	0.25	0.125	FAS	70125.0	15287249.4						
SBA02	Lead	76.6	0.39	0.195	FAS	59671.5	4570834.1						
SBA01	Lead	722	0.53	0.265	FAS	67624.4	48824792.7						
POI-8	Lead	550	0.5	0.25	FAS	44497.0	24473355.3						
POI-7	Lead	60.8	0.53	0.265	FAS	18507.9	1125282.4						
POI-6	Lead	2570	4.3	2.15	FAS	30696.4	78889660.3						
POI-15	Lead	17.3	0.34	0.17	FAS	20766.1	359253.6						
POI-14	Lead	9210	44.3	22.15	FAS	20378.3	187684062.2						
SS-54	Lead	53.9	0.42	0.21	FAS	20860.2	1124363.0						
SS-41	Lead	42.5	0.51	0.255	FAS	3007.5	127819.0						
SS-40	Lead	825	4	2	FAS	26572.2	21922068.1						
SS-36	Lead	2910	7.2	3.6	FAS	10492.1	30531963.5						
SS-35	Lead	36.2	0	0	FAS	9703.3	351258.8						
SS-34	Lead	51.2	0	0	FAS	34242.2	1753198.8						
SS-33	Lead	27.4	0	0	FAS	17933.2	491370.1						
SS-32	Lead	63.3	0	0	FAS	9478.8	600007.1						
SS-31	Lead	19.8	0	0	FAS	21298.1	421702.4						
SS-30	Lead	3.5	0	0	FAS	4941.5	17295.2						
SS-29	Lead	31.1	0	0	FAS	16658.9	518090.4						
SS-28	Lead	5	0	0	FAS	7297.7	36488.7						
SS-27	Lead	121	0	0	FAS	10010.6	1211287.9						
SS-152	Lead	61.8	0.25	0.125	FAS	1692.1	104572.7						
SS-151	Lead	44.8	0.23	0.115	FAS	4668.1	209132.7						
SS-150	Lead	92.5	0.46	0.23	FAS	1336.4	123616.8						
SS-149	Lead	83.4	0.54	0.27	FAS	140.6	11727.9						
SS-147	Lead	136	0.13	0.065	FAS	15.8	2155.6						
SS-145	Lead	343	0.47	0.235	FAS	13515.7	4635888.8						
SD-69	Lead	65.6	0.58	0.29	FAS	5767.8	378369.1						
SD-65	Lead	107	0.48	0.24	FAS	14018.2	1499944.3						
POI-9	Lead	7900	5.8	2.9	FAS	40817.8	322460734.3						
POI-10	Lead	1510	1.1	0.55	FAS	7014.4	10591714.1	835955796.6	1169737.0	714.7			

Note

Alternative Remediaton Standard 3200 mg/kg
84 Days

Benzo(a)pyrene Spatially Weighted Averaging Calculations													
Sample Location	Parameter	Concentration (mg/kg)	Detection Limit	Detection Limit X 0.5	Functional Area ID	Polygon Areas (ft²)	Weighted Concentration (Concentration X Polygon Area)	Sum of Weighted Concentrations	Sum of Polygon Areas (ft²)	Spatially Weighted Average (mg/kg)	Maximum Concentration (mg/kg)	Original Value (mg/kg)	Replacement Order
SS-75	Benzo(a) pyrene	0.005	0.01	0.005	FA1	712.4	3.6						
SS-74	Benzo(a) pyrene	2.7	0.01	0.005	FA1	36722.9	99151.8						
SS-73	Benzo(a) pyrene	0.24	0.01	0.005	FA1	30739.1	7377.4						
SS-72	Benzo(a) pyrene	0.09	0.00073	0.000365	FA1	49.9	4.5						
SS-71	Benzo(a) pyrene	0.11	0.01	0.005	FA1	6653.4	731.9						
SS-67	Benzo(a) pyrene	0.53	0.01	0.005	FA1	39351.0	20856.0						
SS-66	Benzo(a) pyrene	1	0.01	0.005	FA1	82930.5	82930.5						
SS-65	Benzo(a) pyrene	51	0.01	0.005	FA1	75706.0	3861007.3						
SS-64	Benzo(a) pyrene	0.73	0.01	0.005	FA1	52601.3	38399.0						
SS-63	Benzo(a) pyrene	0.26	0.01	0.005	FA1	64617.2	16800.5						
SS-60	Benzo(a) pyrene	0.14	0.01	0.005	FA1	47024.9	6583.5						
SS-59	Benzo(a) pyrene	0.68	0.01	0.005	FA1	50202.3	34137.6						
SS-58	Benzo(a) pyrene	0.15	0.01	0.005	FA1	52681.0	7902.2						
SS-57	Benzo(a) pyrene	2.9	0.01	0.005	FA1	49767.0	144324.3						
SS-56	Benzo(a) pyrene	0.14	0.01	0.005	FA1	73732.7	10322.6						
SS-53	Benzo(a) pyrene	0.79	0.01	0.005	FA1	20312.7	16047.0						
SS-52	Benzo(a) pyrene	3.8	0.01	0.005	FA1	24815.5	94299.0						
SS-51	Benzo(a) pyrene	0.58	0.01	0.005	FA1	4642.6	2692.7						
SS-50	Benzo(a) pyrene	0.11	0.01	0.005	FA1	1926.2	211.9						
SS-49	Benzo(a) pyrene	2.3	0.01	0.005	FA1	13733.8	31587.8						
SS-47	Benzo(a) pyrene	0.79	0.01	0.005	FA1	8219.4	6493.3						
SS-46	Benzo(a) pyrene	0.77	0.01	0.005	FA1	69747.8	53705.8						
SS-43	Benzo(a) pyrene	0.08	0.01	0.005	FA1	8141.1	651.3						
SD-42	Benzo(a) pyrene	0.008	0	0	FA1	8064.4	64.5						
SS-62	Benzo(a) pyrene	0.04	0.01	0.005	FA1	2593.5	103.7						
SS-55	Benzo(a) pyrene	0.44	0.01	0.005	FA1	82766.9	36417.4						
SS-45	Benzo(a) pyrene	1.2	0.01	0.005	FA1	63062.3	75674.7						
SS-41	Benzo(a) pyrene	0.3	0.01	0.005	FA1	28292.6	8487.8						
SS-40	Benzo(a) pyrene	0.75	0.01	0.005	FA1	722.4	541.8						
SD-SD-34	Benzo(a) pyrene	0.23	0	0	FA1	1488.2	342.3						
SD-41	Benzo(a) pyrene	0.05	0	0	FA1	7511.0	375.5						
SD-40	Benzo(a) pyrene	0.41	0	0	FA1	4642.4	1903.4						
POI-10	Benzo(a) pyrene	0.15	0.01	0.005	FA1	28526.9	4279.0						
SS-39	Benzo(a) pyrene	0.87	0.01	0.005	FA1	33128.2	28821.5						
SS-38	Benzo(a) pyrene	7.9	0.01	0.005	FA1	8493.7	67099.9						
SS-127	Benzo(a) pyrene	0.01	0.00082	0.00041	FA1	235.8	2.4	4760335.3	1084559.1	4.4			
SS-82	Benzo(a) pyrene	0.15	0.01	0.005	FA2	80097.0	12014.6				51.0		
SS-112	Benzo(a) pyrene	0.0047	0.01	0.005	FA2	17788.1	83.6						
SS-111	Benzo(a) pyrene	0.07	0.01	0.005	FA2	27655.3	1935.9						
SS-110	Benzo(a) pyrene	0.93	0.01	0.005	FA2	34996.7	32547.0						
SS-114	Benzo(a) pyrene	0.04	0.01	0.005	FA2	9665.1	386.6						
SS-113	Benzo(a) pyrene	0.07	0.01	0.005	FA2	7120.1	498.4						
SS-98	Benzo(a) pyrene	0.13	0.01	0.005	FA2	92515.8	12027.1						
SS-97	Benzo(a) pyrene	0.31	0.01	0.005	FA2	88331.8	27382.9						
SS-96	Benzo(a) pyrene	0.17	0.01	0.005	FA2	75023.0	12753.9						
SS-95	Benzo(a) pyrene	0.4	0.01	0.005	FA2	75022.5	30009.0						
SS-91	Benzo(a) pyrene	0.62	0.01	0.005	FA2	81513.4	50538.3						
SS-90	Benzo(a) pyrene	0.49	0.01	0.005	FA2	85355.8	41824.3						
SS-89	Benzo(a) pyrene	0.05	0.01	0.005	FA2	75005.8	3750.3						
SS-88	Benzo(a) pyrene	2.3	0.01	0.005	FA2	68325.4	157148.4						
SS-85	Benzo(a) pyrene	0.12	0.01	0.005	FA2	36244.0	4349.3						
SS-84	Benzo(a) pyrene	0.6	0.01	0.005	FA2	106522.9	63913.7						
SS-81	Benzo(a) pyrene	0.18	0.01	0.005	FA2	75004.3	13500.8						
SS-80	Benzo(a) pyrene	11	0.01	0.005	FA2	75016.2	825178.5						
SS-79	Benzo(a) pyrene	0.13	0.01	0.005	FA2	61652.1	8014.8						
SS-77	Benzo(a) pyrene	0.03	0.01	0.005	FA2	55824.5	1674.7						
SS-75	Benzo(a) pyrene	0.005	0.01	0.005	FA2	77572.2	387.9						
SS-74	Benzo(a) pyrene	2.7	0.01	0.005	FA2	37709.2	101814.7						
SS-73	Benzo(a) pyrene	0.24	0.01	0.005	FA2	44343.9	10642.5						
SS-72	Benzo(a) pyrene	0.09	0.00073	0.000365	FA2	75041.2	6753.7						
SS-71	Benzo(a) pyrene	0.11	0.01	0.005	FA2	49997.3	5499.7						
SS-68	Benzo(a) pyrene	0.44	0.01	0.005	FA2	23865.4	10500.8						
SS-67	Benzo(a) pyrene	0.53	0.01	0.005	FA2	25225.2	13369.3						
SS-65	Benzo(a) pyrene	51	0.01	0.005	FA2	67.8	3458.2						
SS-64	Benzo(a) pyrene	0.73	0.01	0.005	FA2	22399.6	16351.7						
SS-63	Benzo(a) pyrene	0.26	0.01	0.005	FA2	134.4	34.9						
SS-60	Benzo(a) pyrene	0.14	0.01	0.005	FA2	3829.9	536.2						
SS-51	Benzo(a) pyrene	0.58	0.01	0.005	FA2	18925.0	10976.5						
SS-50	Benzo(a) pyrene	0.11	0.01	0.005	FA2	10531.9	1158.5						
SS-49	Benzo(a) pyrene	2.3	0.01	0.005	FA2	12270.6	28222.3						
SS-48	Benzo(a) pyrene	0.27	0.01	0.005	FA2	28436.4	7677.8						
SS-47	Benzo(a) pyrene	0.79	0.01	0.005	FA2	55269.0	43662.5						
SS-46	Benzo(a) pyrene	0.77	0.01	0.005	FA2	7768.0	5981.4						
SS-43	Benzo(a) pyrene	0.08	0.01	0.005	FA2	79878.1	6390.2						
SS-42	Benzo(a) pyrene	0.12	0.01	0.005	FA2	55500.3	6660.0						
SS-25	Benzo(a) pyrene	0.25	0	0	FA2	25567.7	6391.9						
SS-24	Benzo(a) pyrene	0.65	0	0	FA2	21260.6	13819.4						
SS-23	Benzo(a) pyrene	0.81	0	0	FA2	6400.4	5184.3						
SS-22	Benzo(a) pyrene	3.1	0	0	FA2	9363.3	29026.4						
SS-21	Benzo(a) pyrene	4.3	0	0	FA2	14282.7	61415.6						
SS-20	Benzo(a) pyrene	2.4	0	0	FA2	13338.6	32012.6						
SS-19	Benzo(a) pyrene	2.9	0	0	FA2	3991.9	11576.6						
SS-18	Benzo(a) pyrene	0.83	0	0	FA2	9180.4	7619.7						
SS-16	Benzo(a) pyrene	1.1	0	0	FA2	20374.5	22411.9						
SS-158	Benzo(a) pyrene	0.11	0.0059	0.00295	FA2	379.9	41.8						
SS-157	Benzo(a) pyrene	0.12	0.0069	0.00345	FA2	13152.4	1578.3						
SS-108	Benzo(a) pyrene	6.9	0.01	0.005	FA2	72160.8	497909.3						
SS-106	Benzo(a) pyrene	0.07	0.01	0.005	FA2	39348.1	2754.4						
SS-104	Benzo(a) pyrene	0.005	0.01	0.005	FA2	93494.7	467.5						
SS-103	Benzo(a) pyrene	0.07	0.01	0.005	FA2	101098.3	7076.9						
SS-102	Benzo(a) pyrene	0.16	0.01	0.005	FA2	89329.7	14292.7						
SD-44	Benzo(a) pyrene	0.012	0	0	FA2	51536.5	618.4						

Benzo(a)pyrene Spatially Weighted Averaging Calculations													
Sample Location	Parameter	Concentration (mg/kg)	Detection Limit	Detection Limit x 0.5	Functional Area ID	Polygon Area (ft²)	Weighted Concentration (Concentration x Polygon Area)	Sum of Weighted Concentrations	Sum of Polygon Areas (ft²)	Spatially Weighted Average (mg/kg)	Maximum Concentration (mg/kg)	Original Value (mg/kg)	Replacement Order
SD-42	Benzo(a) pyrene	0.008	0	0	FA2	45856.5	366.9						
SD-38	Benzo(a) pyrene	0.065	0	0	FA2	15423.8	1002.5						
SS-94	Benzo(a) pyrene	0.22	0.01	0.005	FA2	76226.4	16769.8						
SS-93	Benzo(a) pyrene	0.005	0.01	0.005	FA2	33808.9	169.0						
SS-87	Benzo(a) pyrene	0.4	0.01	0.005	FA2	75544.8	30217.9						
SS-83	Benzo(a) pyrene	0.005	0.01	0.005	FA2	36698.7	183.5						
SS-62	Benzo(a) pyrene	0.04	0.01	0.005	FA2	50303.2	2012.1						
SS-54	Benzo(a) pyrene	0.28	0.01	0.005	FA2	5541.8	1551.7						
SS-41	Benzo(a) pyrene	0.3	0.01	0.005	FA2	4182.9	1254.9						
SS-40	Benzo(a) pyrene	0.75	0.01	0.005	FA2	11355.7	8516.8						
SS-29	Benzo(a) pyrene	0.12	0	0	FA2	7436.7	892.4						
SS-28	Benzo(a) pyrene	0.15	0	0	FA2	875.0	131.2						
SS-26	Benzo(a) pyrene	0.29	0	0	FA2	5649.2	1638.3						
SS-17	Benzo(a) pyrene	1.4	0	0	FA2	25681.5	35954.1						
SS-107	Benzo(a) pyrene	7	0.01	0.005	FA2	71272.6	498908.5						
SS-105	Benzo(a) pyrene	0.16	0.01	0.005	FA2	27977.9	4476.5						
SS-101	Benzo(a) pyrene	0.5	0.01	0.005	FA2	75028.8	37514.4						
SS-100	Benzo(a) pyrene	0.14	0.01	0.005	FA2	60359.0	8450.3						
SD-SD-34	Benzo(a) pyrene	0.23	0	0	FA2	6357.9	1462.3						
SD-41	Benzo(a) pyrene	0.05	0	0	FA2	35461.0	1773.0						
SD-40	Benzo(a) pyrene	0.41	0	0	FA2	12839.2	5264.1						
SD-39	Benzo(a) pyrene	0.225	0	0	FA2	63770.2	14348.3						
POI-3	Benzo(a) pyrene	0.36	0.01	0.005	FA2	21800.5	7848.2						
POI-10	Benzo(a) pyrene	0.15	0.01	0.005	FA2	121.5	18.2						
SS-151	Benzo(a) pyrene	0.3	0.01	0.005	FA2	1761.0	528.3						
SS-39	Benzo(a) pyrene	0.87	0.01	0.005	FA2	18004.0	15663.5						
SS-38	Benzo(a) pyrene	7.9	0.01	0.005	FA2	39990.5	315924.6						
SS-37	Benzo(a) pyrene	0.06	0.01	0.005	FA2	37759.8	2265.6						
SS-159	Benzo(a) pyrene	0.00042	0.00084	0.00042	FA2	46474.1	19.5						
SS-153	Benzo(a) pyrene	0.01	0.00075	0.000375	FA2	2713.1	27.1						
SS-127	Benzo(a) pyrene	0.01	0.00082	0.00041	FA2	3813.5	38.1						
SS-125	Benzo(a) pyrene	0.01	0.00087	0.000435	FA2	8893.7	88.9						
SD-5	Benzo(a) pyrene	0.17	0	0	FA2	25816.8	4388.9						
SD-43	Benzo(a) pyrene	0.0235	0	0	FA2	18234.1	428.5	3313906.7	3414739.8	1.0			
SS-85	Benzo(a) pyrene	0.12	0.01	0.005	FA3	43221.2	5186.5						
SS-77	Benzo(a) pyrene	0.03	0.01	0.005	FA3	36654.8	1099.6						
SS-75	Benzo(a) pyrene	0.005	0.01	0.005	FA3	1.0	0.0						
SS-68	Benzo(a) pyrene	0.44	0.01	0.005	FA3	52754.2	23211.8						
SS-67	Benzo(a) pyrene	0.53	0.01	0.005	FA3	19.6	10.4						
SS-61	Benzo(a) pyrene	0.02	0.01	0.005	FA3	51379.3	1027.6						
SS-60	Benzo(a) pyrene	0.14	0.01	0.005	FA3	50262.9	7036.8						
SS-53	Benzo(a) pyrene	0.79	0.01	0.005	FA3	63203.5	49930.8						
SS-44	Benzo(a) pyrene	0.005	0.01	0.005	FA3	69314.4	346.6						
SS-155	Benzo(a) pyrene	0.08	0.005	0.0025	FA3	9232.5	738.6						
SS-131	Benzo(a) pyrene	0.13	0.0058	0.0029	FA3	14885.8	1935.2						
SS-129	Benzo(a) pyrene	0.0088	0.00074	0.00037	FA3	37722.0	332.0						
SD-44	Benzo(a) pyrene	0.012	0	0	FA3	4608.4	55.3						
SD-38	Benzo(a) pyrene	0.065	0	0	FA3	34511.8	2243.3						
SD-24	Benzo(a) pyrene	0.12	0	0	FA3	1591.5	191.0						
SD-23	Benzo(a) pyrene	0.085	0	0	FA3	5350.9	454.8						
SD-22	Benzo(a) pyrene	0.6	0	0	FA3	7655.5	4593.3						
SS-39	Benzo(a) pyrene	0.87	0.01	0.005	FA3	9177.7	7984.6						
SS-128	Benzo(a) pyrene	0.01	0.00082	0.00041	FA3	4487.6	44.9						
SS-127	Benzo(a) pyrene	0.01	0.00082	0.00041	FA3	10003.6	100.0	106523.1	506038.3	0.2			
SS-124	Benzo(a) pyrene	0.14	0.01	0.005	FA4	18126.0	2537.6						
SS-116	Benzo(a) pyrene	0.02	0.01	0.005	FA4	35153.8	703.1						
SS-112	Benzo(a) pyrene	0.0047	0.01	0.005	FA4	36133.6	169.8						
SS-111	Benzo(a) pyrene	0.07	0.01	0.005	FA4	1309.9	91.7						
SD-37	Benzo(a) pyrene	0.0365	0	0	FA4	10278.9	375.2						
POI-11	Benzo(a) pyrene	0.33	0.01	0.005	FA4	68148.8	22489.1						
SS-141	Benzo(a) pyrene	0.02	0.0014	0.0007	FA4	5009.8	100.2						
SS-135	Benzo(a) pyrene	0.19	0.0074	0.0037	FA4	20977.9	3985.8						
SS-134	Benzo(a) pyrene	0.2	0.0075	0.00375	FA4	2934.9	587.0						
SS-133	Benzo(a) pyrene	0.19	0.01	0.005	FA4	16897.8	3210.6						
SS-123	Benzo(a) pyrene	0.16	0.01	0.005	FA4	69468.6	11115.0						
SS-122	Benzo(a) pyrene	0.08	0.01	0.005	FA4	49397.0	3951.8						
SS-121	Benzo(a) pyrene	0.11	0.01	0.005	FA4	14081.7	1549.0						
SS-120	Benzo(a) pyrene	0.46	0.01	0.005	FA4	24077.5	11075.6						
SS-119	Benzo(a) pyrene	1.7	0.01	0.005	FA4	35820.4	60894.6						
SS-118	Benzo(a) pyrene	0.4	0.01	0.005	FA4	59287.0	23714.8						
SS-117	Benzo(a) pyrene	0.56	0.01	0.005	FA4	142943.9	80048.6						
SS-115	Benzo(a) pyrene	2.8	0.01	0.005	FA4	94876.8	265654.9						
SS-114	Benzo(a) pyrene	0.04	0.01	0.005	FA4	125574.4	5023.0						
SS-113	Benzo(a) pyrene	0.07	0.01	0.005	FA4	86880.3	6081.6						
POI-2	Benzo(a) pyrene	0.41	0.01	0.005	FA4	41505.8	17017.4						
SS-108	Benzo(a) pyrene	6.9	0.01	0.005	FA4	9054.8	62478.4						
SS-106	Benzo(a) pyrene	0.07	0.01	0.005	FA4	37475.7	2623.3						
SS-104	Benzo(a) pyrene	0.005	0.01	0.005	FA4	11914.7	59.6						
SS-103	Benzo(a) pyrene	0.07	0.01	0.005	FA4	5009.6	350.7						
SS-107	Benzo(a) pyrene	7	0.01	0.005	FA4	971.5	6800.4	592688.7	1023311.0	0.6			
SS-99	Benzo(a) pyrene	0.02	0.01	0.005	FA5	56433.5	1128.7				33.0		
SS-93	Benzo(a) pyrene	0.005	0.01	0.005	FA5	34548.7	172.7						
SS-92	Benzo(a) pyrene	0.14	0.01	0.005	FA5	50489.4	7068.5						
SS-86	Benzo(a) pyrene	0.06	0.01	0.005	FA5	53132.7	3188.0						
SS-83	Benzo(a) pyrene	0.005	0.01	0.005	FA5	57302.9	286.5						
SS-78	Benzo(a) pyrene	0.02	0.01	0.005	FA5	34123.6	682.5						
SS-76	Benzo(a) pyrene	0.01	0.01	0.005	FA5	19160.2	191.6						
SS-69	Benzo(a) pyrene	0.09	0.01	0.005	FA5	32534.0	2928.1						
SS-54	Benzo(a) pyrene	0.28	0.01	0.005	FA5	20738.9	5806.9						
SS-41	Benzo(a) pyrene	0.3	0.01	0.005	FA5	3007.5	902.3						
SS-40	Benzo(a) pyrene	0.75	0.01	0.005	FA5	33304.9	24978.7						
SS-35	Benzo(a) pyrene	0.29	0	0	FA5	9703.3	2814.0						

Benzo(a)pyrene Spatially Weighted Averaging Calculations													
Sample Location	Parameter	Concentration (mg/kg)	Detection Limit	Detection Limit X 0.5	Functional Area ID	Polygon Area (ft²)	Weighted Concentration (Concentration X Polygon Area)	Sum of Weighted Concentrations	Sum of Polygon Areas (ft²)	Spatially Weighted Average (mg/kg)	Maximum Concentration (mg/kg)	Original Value (mg/kg)	Replacement Order
SS-34	Benzo(a) pyrene	0.03	0	0	FA5	34242.2	1027.3						
SS-33	Benzo(a) pyrene	0.39	0	0	FA5	17933.2	6994.0						
SS-32	Benzo(a) pyrene	1.7	0	0	FA5	9478.8	16113.9						
SS-31	Benzo(a) pyrene	0.02	0	0	FA5	21298.1	426.0						
SS-30	Benzo(a) pyrene	0.09	0	0	FA5	4941.5	444.7						
SS-29	Benzo(a) pyrene	0.12	0	0	FA5	16658.9	1999.1						
SS-28	Benzo(a) pyrene	0.15	0	0	FA5	7297.7	1094.7						
SS-27	Benzo(a) pyrene	0.06	0	0	FA5	10010.6	600.6						
SS-26	Benzo(a) pyrene	0.29	0	0	FA5	46538.3	13496.1						
SS-17	Benzo(a) pyrene	1.4	0	0	FA5	10.1	14.2						
SS-147	Benzo(a) pyrene	0.8	0.02	0.01	FA5	15.8	12.7						
SS-145	Benzo(a) pyrene	0.14	0.0056	0.0028	FA5	13515.7	1892.2						
SS-143	Benzo(a) pyrene	0.28	0.01	0.005	FA5	11590.6	3245.4						
SS-105	Benzo(a) pyrene	0.16	0.01	0.005	FA5	6241.5	998.6						
SS-100	Benzo(a) pyrene	0.14	0.01	0.005	FA5	794.4	111.2						
SD-SD-34	Benzo(a) pyrene	0.23	0	0	FA5	7350.6	1690.6						
SD-39	Benzo(a) pyrene	0.225	0	0	FA5	4609.4	1037.1						
SD-3	Benzo(a) pyrene	3.85	0	0	FA5	70122.3	269971.0						
SD-2	Benzo(a) pyrene	3.3	0	0	FA5	59664.5	196893.0						
SD-1	Benzo(a) pyrene	2.85	0	0	FA5	64555.7	183983.7						
POI-8	Benzo(a) pyrene	0.2	0.01	0.005	FA5	44498.6	8899.7						
POI-7	Benzo(a) pyrene	0.005	0.01	0.005	FA5	18508.2	92.5						
POI-6	Benzo(a) pyrene	0.33	0.01	0.005	FA5	30696.9	10130.0						
POI-5	Benzo(a) pyrene	0.03	0.01	0.005	FA5	33527.7	1005.8						
POI-4	Benzo(a) pyrene	0.04	0.01	0.005	FA5	63409.8	2536.4						
POI-3	Benzo(a) pyrene	0.36	0.01	0.005	FA5	13332.6	4799.7						
POI-16	Benzo(a) pyrene	0.2	0.01	0.005	FA5	41283.3	8256.7						
POI-15	Benzo(a) pyrene	0.0065	0.01	0.005	FA5	20766.5	135.0						
POI-14	Benzo(a) pyrene	0.04	0.01	0.005	FA5	20378.3	815.1						
POI-10	Benzo(a) pyrene	0.15	0.01	0.005	FA5	1858.3	278.7						
SS-36	Benzo(a) pyrene	2.3	0.01	0.005	FA5	11764.1	27057.5						
SS-152	Benzo(a) pyrene	0.79	0.04	0.02	FA5	5986.6	4729.4						
SS-151	Benzo(a) pyrene	0.3	0.01	0.005	FA5	4668.1	1400.4						
SS-150	Benzo(a) pyrene	0.4	0.01	0.005	FA5	2525.3	1010.1						
SS-149	Benzo(a) pyrene	0.32	0.01	0.005	FA5	140.6	45.0						
POI-9	Benzo(a) pyrene	33	0.01	0.005	FA5	45042.6	1486404.3	2309790.8	1169737.0	2.0			

Note

Alternative Remediation Standard 9 mg/kg
84 Days