Appendix 17-B

FORMER PARCELS C AND D
WILMINGTON, DELAWARE

SIRB ID: DE-1377 (FORMERLY DE-1335 AND DE-1040)

GENERAL SITE INFORMATION

Site Name: Former Parcels C and D (Part of Justison Landing Redevelopment)

SIRB ID Number: DE-1377 (formerly DE-1335 and DE-1040)

Site Location and Description: The Justison Landing Redevelopment project consists of approximately 15 acres along the Wilmington Riverfront in New Castle County, Delaware. The Justison Landing project is bordered by West Street and the AAA building to the north, the Christina River and the Riverwalk to the east, Hollingsworth Avenue to the south, and South Madison Street to the west.

Prior to creating the Justison Landing Redevelopment Site (DE-1377), the project area included two SIRB sites; the Wilmington Public Works Yard and Redevelopment Parcels C and D. Parcels C and D Site (Parcels C and D) are located at 400 South Madison Street (DE-1040; tax parcel ID# 26-042.00-024) and 350 South Madison Street (DE-1335; tax parcel ID# 26-042.00-023) in Wilmington, Delaware. The 400 South Madison Street location is approximately four acres and was occupied by the Delaware Transit Corporation (DTC). The building was demolished in 2006 in preparation for redevelopment. The 350 South Madison Street location is approximately 1.27 acres and was vacated by Brandywine Counseling in anticipation of redevelopment. The building was demolished in 2005. The surrounding land is generally commercial and/or industrial.

Previous Site Uses: The site is located in an area of the Wilmington Riverfront that has been in continuous industrial use since the late 1700s. Review of aerial photographs and Sanborn maps of the property showed that the site was historically used for building steamships, steel manufacturing, railroad cars, boilers, and coal gas operations. These historical documents also showed that a dry dock and culvertized stream were located on the property. This stream (Shipley Run) has been covered and is now part of the City of Wilmington Combined Sewer Overflow (CSO) system. The site was previously occupied by the Harlan and Hollingsworth Corporation and Bethlehem Steel. Recently, Brandywine Counseling and Delaware Transit Corporation operated on the property. Surrounding property uses in the area during the late 1800s included a tannery, gas works, foundry, boiler works, coal yard, lumber yard, planing mill, steam saw mill and carriage factory. Industrial usage of the surrounding properties appears to have continued through at least 1992.

Site Regulatory Status: This section briefly summarizes previous investigations performed on the site through the SIRB program. A current SIRB regulatory status is also included.

Investigation or Regulatory Report	Dates	Description
Phase I Environmental Assessment Report (400 S. Madison St.)	1995	400 S. Madison St. Assessment; Environmental concerns at the site include previous industrial/commercial site usage, the historic fill placed at the site, and historic presence of dry dock and rail cars. (Tetra Tech, 1995)
Phase II Environmental Assessment Report (400 S. Madison St.)	1995	8 soil samples and 4 groundwater samples collected; Arsenic and chromium are above unrestricted use URS in soil. Arsenic above restricted use URS in soil. Methylene chloride above groundwater URS in one sample but is potentially contaminant from laboratory. (Tetra Tech, 1995)
Final Plan of Remedial Action (400 S. Madison St.)	1995	No further action necessary, except deed restriction to limit property use to commercial. (DNREC, 1995)
Remedial Investigation (Redevelopment Parcels C and D, 350 and 400 S. Madison St.)	2005	Installed 4 new monitoring wells; 46 soil samples and 4 groundwater samples collected; Benzo(a)pyrene was COC for restricted use in soil. Antimony, zinc, PCBs, and PAHs were COCs for unrestricted use in soil. Hexachlorobenzene was COC for unrestricted and restricted use at GP07. No COCs were identified in groundwater. (BrightFields, 2005)
Focused Feasibility Study (Redevelopment Parcels C and D, 350 and 400 S. Madison St.)	2/2006	4 remedial alternatives for soil and 2 remedial alternatives for groundwater were evaluated. Remedial approach chosen is to remove PCB hotspot, install vapor barriers, cap the surface, monitor groundwater, and manage soil and groundwater to minimize worker exposure. (BrightFields, 2006)
Interim Response Action Report (IRA) Soil Management Area SM5 (South) (Justison Landing Redevelopment)	4/2006	A total of 5,258.22 tons of soil were removed and disposed off-site. Confirmation samples from the bottom and sidewall indicated that PCB levels are below remediation goal of 3 mg/kg. This removal reduced the risk associated with PCBs at this location. (BrightFields, 2006)

Final Plan of Remedial Action (Justison Landing Redevelopment)	4/2006	DNREC- published a plan to remove hotspots, place barrier cap on surface, install vapor barriers beneath buildings, groundwater monitoring, institutional controls, and management during construction. (DNREC, 2006)
Parcel 2 Remedial Action Completion Report	4/2008	This report presents a synopsis of all remedial activities associated with the redevelopment and construction of Parcel 2. (BrightFields, 2008)
Certificate of Completion of Remedy (Parcel 2 of Justison Landing Redevelopment)	4/2008	Issued to document completion of remedial actions at Parcel 2 (Formerly a portion of 400 S. Madison St.). (DNREC, 2008)

Current Regulatory Status:

The former Parcels C and D Site includes a portion of the new Justison Street and Parcels 2 and 5 of the Justison Redevelopment Project. Parcel 2 is completed and a Certificate of Remedy (COCR) was issued in April 2008 by DNREC. Justison Street has been completed and redevelopment of Parcel 5 has not yet begun. The PCB hot spot removal required by the Final Plan of Remedial Action has been completed and approved by DNREC. Operations and Maintenance (O&M) inspections for Parcel 2 are expected to begin in the fourth quarter of 2008.

SUMMARY OF SITE PCB INFORMATION

Site Investigation PCB Findings:

During the Remedial Investigation completed in December 2005 by BrightFields, concentrations of total PCBs in the soil were detected at concentrations as high as 11.9 mg/kg (BrightFields 2005). Most of the concentrations observed were found at depths between 0.5 to 2 feet below ground surface. Aroclors that were found included 1254, 1260, and 1268. As part of the Final Plan of Remedial Action for the site, a hot spot removal was completed to reduce the risk associated with PCBs. In March 2006 approximately 5,260 tons of PCB impacted soil were removed from the SM-5 South hot spot area. During the removal action confirmation samples were collected to demonstrate that the remedial action goal of 3 mg/kg of total PCB concentration was met. PCB concentrations remaining on site are all below 3 mg/kg and are discussed in more detail below.

In addition to the removal action that was completed, two feet of clean fill was emplaced across the site from approximately the western edge of Justison Street east to the Riverwalk. This was taken into account when discussing the overland transport calculations. Remaining historical surface samples that fell within these portions of the site were adjusted to account for the two feet of clean fill. For the purpose of this evaluation, these samples are no longer considered surficial samples, but are instead considered subsurface non-saturated samples.

PCBs (Aroclor-1254) are present in surface soil at one location, GP23-S001 (1.5 to 2 feet bgs) at a concentration of 0.36 mg/kg, which is below the restricted use URS value for human health, but above the un-restricted use URS value for human health (0.3 mg/kg).

PCBs are present in the subsurface soil non-saturated zone at concentrations above the unrestricted URS value, but below the restricted URS value at multiple sample locations. PCBs were detected in three distinct locations (GP02, GP13, and B6) in the subsurface saturated zone.

Due to the fact that there was only one detection in the surface soil and three detections in the subsurface soil, the maximum detected values were used in all of the calculations instead of calculating the 95% UCL of the mean across the site.

There were no PCBs detected in groundwater but, as stated above, there are PCBs in the subsurface that are in contact with the groundwater (saturated soil). The maximum saturated soil detection of 0.38 mg/kg was evaluated using the equilibrium partitioning equation to approximate maximum groundwater concentrations shown in Table B.

Concentrations of PCBs Remaining on Site			
Sample Matrix	**Corresponding Figure**	**Analytical Methods**	**Range of Total PCBs**
Surface Soil	Figure 2	Method 8082	Not detected to 0.36 mg/kg
Subsurface Soil (unsaturated)	Figure 3	Method 8082	Not detected to 2.42 mg/kg
Subsurface Soil (saturated)	Figure 4	Method 8082	Not detected to 0.38 mg/kg
Groundwater	Figure 5	Method 8082	Not detected

A summary of all samples collected for PCBs are presented in the attached Tables 1 through 3.

Acreage where PCBs detected:

Estimated surface soil area impacted by PCBs is 0.11 acres in the vicinity of GP23 (Figure 2).

Estimated sub-surface unsaturated soil area impacted by PCBs is 2.87 acres (Figure 3).

Estimated sub-surface saturated soil area impacted by PCBs is 0.51 acres (Figure 4).

PCB Remediation Status:

PCB remediation was completed in March 2006 and approved by DNREC in January 2007. The eastern portion of the site has been redeveloped into buildings, paved roadways and minimal vegetation. The western portion of the site is occupied by construction trailers and parking as of June 30, 2008. A total of approximately 5,260 tons of soil were removed and disposed off-site and replaced with clean imported fill. Confirmation samples from the bottom and sidewalls indicated that PCB levels were reduced to below the remediation goal of 3 mg/kg. The area that was excavated is shown on the attached figures.

PCB MASS LOADING SUMMARY

The PCB mass loading rate to surface water via overland flow and via groundwater transport were estimated for Parcels C&D. A summary of the results is included below and the details of the calculations are included as attachments to this Appendix.

OVERLAND FLOW:

Overland flow has been determined on this site by using the Revised Universal Soil Loss Equation (RUSLE). The RUSLE predicts the long term average annual rate of erosion on an area based on rainfall patterns, soil type, topography, cover/canopy factors and support management practices. These specific factors are site specific and rely on local information of the site. A breakdown of the individual factors is presented below with a brief explanation of their choice.

Ground Cover and Canopy:

A site inspection was performed on June 30, 2008 to estimate the current site ground cover and canopy. The eastern portion of the site has been redeveloped into buildings, paved roadways, and minimal vegetation. The western portion of the site is occupied by construction trailers and parking. The cover/management factor (C) assigned by the USGS RUSLE2 model at the associated flow path is 0.0138, which corresponds to at least 75% groundcover of tall weeds or short brush; with the cover at the surface being grass, grass-like plants, decaying compacted duff, or litter at least 2 inches deep.

Site Sediment and Erosion Control Practices:

Silt fence encompasses the area in the vicinity of GP23, but is no longer preventing sediment from dispersing from the area because it is not being properly maintained in this area.

Input Factors and Results:

A breakdown of the individual factors is presented below with a brief explanation of their choice.

RUSLE Factors	Values Provided	Explanation of Selection
E = rainfall/erodibility index (10^2 m-tonne-cm/ha-hr)	170	An appropriate value for R for the site was determined from plots of Rainfall patterns for the Eastern U.S. (Wischmeier and Smith, 1978).

RUSLE Factors	Values Provided	Explanation of Selection
K = soil erodibility (0.01 tonf acre hr/acre ft-ton in)	0.424	The soil erodibility factor was chosen based on the information provided by the boring log for GP23 in BrightFields 2005 Remedial Investigation Report (Redevelopment of Parcels C & D).
ls = topographic factor (dimensionless)	0.698	The slope length was estimated to 5.3 feet, which is the distance between the hot spot surface location and storm water discharge point along the overland flow path. The elevation change from the hot spot location to the discharge point was estimated at 0.4 feet. These factors were used to calculate a slope of 7.5 %.
C = cover/management factor (dimensionless)	0.0138	The cover/management factor C assigned to the site and associated flow path was 0.0138, which corresponds to at least 75% groundcover of tall weeds or short brush; with the cover at the surface being grass, grass-like plants, decaying compacted duff, or litter at least 2 inches deep.
P = support practice factor (dimensionless)	1.0	Silt fencing was instituted in the vicinity of the hot spot location, but is no longer preventing sediment from dispersing from the area because of physical damage.

The average annual erosion rate is based on the windows based RUSLE2 program (RUSLE2 License, version 2006-Jul-24).

The total PCB loading via overland flow is 0.03 grams per year. Please see attached table for specific variables.

Uncertainty Analysis Associated with Overland Flow:

Specific Areas and Degree of Uncertainty for Parcels C & D

	Samples Per Acre (site)	Chemical Data Quality*	Topography	Soil Type	Site Coverage	Map Quality	Distance to Discharge Points
Site Specific Information	0.4	Method 8082	Estimated based off of a visual inspection.	Detailed logs that are located within the area of concern	Based on a thorough site assessment.	Scaled Map	5 feet
Degree of Uncertainty	High	Low to Moderate	High	Low	Low	Moderate to High	Low

* Primary analysis used in the historical samples

Areas of uncertainty for Parcels C&D include the following: spot elevations were collected prior

to the majority of redevelopment activities. Since then, portions of the site have been filled with two feet of clean fill and large areas of impervious surfaces (i.e. buildings, parking garages, roadways, hardscaping, etc.) have been constructed. Certain areas of the property were originally not noted as filled with clean fill, but upon inspection the areas were clearly filled with some amount of surficial material. These areas were noted and the figures were changed based on the evaluation of the site conditions. Based on this evaluation the overall level of uncertainty associated with PCB mass loading from Parcels C&D site is **Low to Moderate**.

GROUNDWATER DISCHARGE ANALYSIS

Groundwater discharge is based on the hydraulic conductivity of the soil, the groundwater gradient, and the cross-sectional area of the aquifer. A breakdown of the individual factors used in the Darcy equation is presented below.

Because PCBs were detected in saturated soil, but not in groundwater, the calculated concentration of PCBs in pore water, based on partitioning, was used to calculate the mass loading.

Two areas of concern were originally identified through the site assessment. Upon a further evaluation the site was spilt into three zones identified in Figure 7 of this appendix. The area in the northwestern portion of the site was spilt into two areas. The area identified in this evaluation as "Area C" was evaluated separately because of the distinguishable differences in concentrations isolated to the northwestern edge surrounding sample location B-5/GP13.

Input Factors:

A breakdown of the individual factors is presented below with a brief explanation of their choice.

Area A: Vicinity of boring GP02

Groundwater Transport Factors	Value Used		Justification/Derivation of Value Used
	min	max	
K = Hydraulic Conductivity (ft/day)	0.28	14.2	Drilling logs from Geoprobe® borings and well boreholes for the Parcels C and D RI were used to evaluate the lithology beneath the site. An examination of the drilling logs shows that the groundwater being monitored is within a moderately coarse-grained fill unit that overlies the marsh deposit clay. The fill unit ranges in composition from fine to coarse-grained sand to silt, with some areas of gravel and is primarily a silty sand. The hydraulic conductivity for silty sand ranges from approximately 1×10^{-4} to 5×10^{-3} cm/sec (Cernica, 1995).

Groundwater Transport Factors	Value Used		Justification/Derivation of Value Used
	min	max	
I = Horizontal Groundwater Gradient	0.010	0.017	In November 2004, February and April, 2005, BrightFields measured depth to groundwater in all four of the Parcels C and D wells and also in all accessible wells on the adjacent former Wilmington Public Works Yard. This data was used to assess the groundwater flow direction and horizontal gradient at the site.
Saturated Thickness (ft)	6.5	6.5	Based on the borings logs, the saturated zone above the marsh deposits is between 0.3 and 11 feet thick. The saturated thickness averaged 5.25 feet and had a 95% UCL of the mean thickness of 6.5 feet.
Lateral Discharge Distance (ft)	105	105	The lateral discharge distance was chosen to be equal to the length of the PCB impacted area measured perpendicular to the Christina River.
A= Cross-Sectional Area (ft2)	683	683	Calculated from the saturated thickness and lateral discharge distance.
Groundwater PCB Concentration (µg/L)	0.04	0.22	The maximum concentration observed in the saturated subsurface soil (0.200 mg/kg) was used to determine the estimated concentration in groundwater.
Distance to Discharge point (ft)	Directly adjacent		Approximate distance from property boundary to closest surface water location.

The PCB loading via groundwater discharge for Area A is between 0.004 to 1.6 grams per year. Please see attached tables for specific variables.

Area B: Vicinity of boring B-6

Groundwater Transport Factors	Value Used		Justification/Derivation of Value Used
	min	max	
K = Hydraulic Conductivity (ft/day)	0.28	14.2	Drilling logs from Geoprobe® borings and well boreholes for the Parcels C and D RI were used to evaluate the lithology beneath the site. An examination of the drilling logs shows that the groundwater being monitored is within a moderately coarse-grained fill unit that overlies the marsh deposit clay. The fill unit ranges in composition from fine to coarse-grained sand to silt, with some areas of gravel and is primarily a silty sand. The hydraulic conductivity for silty sand ranges from approximately 1×10^{-4} to 5×10^{-3} cm/sec (Cernica, 1995).
I = Horizontal Groundwater Gradient	0.010	0.017	In November 2004, February and April, 2005, BrightFields measured depth to groundwater in all four of the Parcels C and D wells and also in all accessible wells on the adjacent former Wilmington Public Works Yard. This data was used to assess the groundwater flow direction and horizontal gradient at the site.
Saturated Thickness (ft)	6.5	6.5	Based on the borings logs, the saturated zone above the marsh deposits is between 0.3 and 11 feet thick. The saturated thickness averaged 5.25 feet and had a 95% UCL of the mean thickness of 6.5 feet.
Lateral Discharge Distance (ft)	70	70	The lateral discharge distance was chosen to be equal to the length of the PCB impacted area measured perpendicular to the Christina River.

Groundwater Transport Factors	Value Used		Justification/Derivation of Value Used
	min	max	
A= Cross-Sectional Area (ft2)	455	455	Calculated from the saturated thickness and lateral discharge distance.
Groundwater PCB Concentration (µg/L)	0.003	0.01	The maximum concentration observed in the saturated subsurface soil (0.012 mg/kg) was used to determine the estimated concentration in groundwater.
Distance to Discharge point (ft)	290 feet		Approximate distance from property boundary to closest surface water location.

The PCB loading via groundwater discharge for Area B is between 0.0002 to 0.1 grams per year. Please see attached tables for specific variables.

Area C: Vicinity of boring B-5/GP13

Groundwater Transport Factors	Value Used		Justification/Derivation of Value Used
	min	max	
K = Hydraulic Conductivity (ft/day)	0.28	14.2	Drilling logs from Geoprobe® borings and well boreholes for the Parcels C and D RI were used to evaluate the lithology beneath the site. An examination of the drilling logs shows that the groundwater being monitored is within a moderately coarse-grained fill unit that overlies the marsh deposit clay. The fill unit ranges in composition from fine to coarse-grained sand to silt, with some areas of gravel and is primarily a silty sand. The hydraulic conductivity for silty sand ranges from approximately 1×10^{-4} to 5×10^{-3} cm/sec (Cernica, 1995).
I = Horizontal Groundwater Gradient	0.010	0.017	In November 2004, February and April, 2005, BrightFields measured depth to groundwater in all four of the Parcels C and D wells and also in all accessible wells on the adjacent former Wilmington Public Works Yard. This data was used to assess the groundwater flow direction and horizontal gradient at the site.
Saturated Thickness (ft)	6.5	6.5	Based on the borings logs, the saturated zone above the marsh deposits is between 0.3 and 11 feet thick. The saturated thickness averaged 5.25 feet and had a 95% UCL of the mean thickness of 6.5 feet.
Lateral Discharge Distance (ft)	60	60	The lateral discharge distance was chosen to be equal to the length of the PCB impacted area measured perpendicular to the Christina River.
A= Cross-Sectional Area (ft2)	390	390	Calculated from the saturated thickness and lateral discharge distance.
Groundwater PCB Concentration (µg/L)	0.08	0.42	The maximum concentration observed in the saturated subsurface soil (0.38 mg/kg) was used to determine the estimated concentration in groundwater.
Distance to Discharge point (ft)	290		Approximate distance from property boundary to closest surface water location.

The PCB loading via groundwater discharge for Area C is between 0.005 to 1.8 grams per year. Please see attached tables for specific variables.

Mass Loading Via Groundwater Transport Result:

The groundwater discharge is 120 to 46,000 L/day (attached Table A). The maximum detected soil concentrations from each sub-area were used to calculate the groundwater concentrations for the loading estimate. The estimated minimum and maximum contaminant mass loading contributions are shown in the Table C in the groundwater transport calculations attachment. As previously described, these calculations are highly conservative (protective), and they overestimate the actual mass loading because they assume that there are no contaminant losses due to degradation, dispersion, sorption, volatilization, etc.

The total PCB loading via groundwater discharge is between 0.009 and 3.5 grams per year (attached Table C).

Uncertainty Analysis Associated with Groundwater Transport:

Specific Areas and Degree of Uncertainty for the Justison Landing Former Parcels C & D

	Groundwater PCB Concentration	Hydraulic Conductivity	Horizontal Groundwater Gradient	Saturated Thickness	Lateral Discharge Distance	Distance to Discharge point
Site Specific Information	Partitioning based on maximum concentration observed in saturated soil	Based on detailed site logs.	Based on wells and measurements collected adjacent to the site.	Few good quality logs.	Groundwater gradient defined and multiple number of samples collected onsite.	Directly adjacent to 290 feet
Degree of Uncertainty	Moderate - High	Moderate to High	Moderate to High	Moderate	Moderate	Moderate

Based on this evaluation the overall uncertainty associated with the Justison Landing Parcels C &D site is **moderate to high.**

Work Cited

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