Brandywine River Dams
Analysis of Chemical Contaminants in Sediments

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Executive Summary

DNREC's Watershed Approach to Toxics Assessment and Restoration (WATAR) team evaluated physical and chemical data from sediment samples collected along 22 transects behind 8 dams in the Delaware portion of the Brandywine River during the summer of 2020. The purpose of the evaluation was to assess existing conditions and to predict potential ecological and/or human health risks associated with dam modification, removal or failure. There is increasing interest in removing barriers to anadromous fish species that have historically used the non-tidal Brandywine River for spawning. In addition, the City of Wilmington utilizes the Brandywine River as a source of public drinking water.

Dam modification, removal and/or failure, in general, raises several issues of potential environmental concern, including fundamental changes to the local environment. Sediment that has collected behind dams, potentially over hundreds of years, may contain persistent, bioaccumulative, and toxic compounds such as metals, polychlorinated biphenyls (PCBs), dioxins and furans, polycyclic aromatic hydrocarbons (PAHs), pesticides, and per- and polyfluoroalkyl substances (PFAS). Removal of these contaminated sediments can be extremely expensive, yet their resuspension as a result of dam removal or failure has the potential to damage downstream water quality and threatens the health of fish and wildlife and water users (American Rivers, 2020). As the steepest river in Delaware, the Brandywine River was heavily utilized as a source of waterpower for mills during the last 300 years. It is estimated that there were as many as 100 mills on the Brandywine River at its industrial peak (Brandywine Conservancy, 2005). This report aims to characterize potential impacts to aquatic organisms and to human health as a result of the release of stored sediment behind several Brandywine River dams.

Results of assessment activities and subsequent data evaluation indicate that there are less sediments by volume behind the dams in the Brandywine River than originally expected. In addition, based upon the evaluations conducted, risk associated with dam modification, removal and/or failure is not likely to increase the risk of toxicity as compared to its current state (with dams in place). Generalized results of the toxicity assessments of particular contaminant classes are highlighted below.

- Metals were detected in all of the sediment samples analyzed as part of this study. Despite the presence of metals in the sediments, acute toxicity to aquatic life is not expected. Data suggest that there is slight potential for chronic toxicity due to divalent metals at nine out of 22 sample locations. The distribution of calculated toxicity values due to metals is relatively consistent between dams. Finally, human health risk due to the presence of metals in the sediment is not expected.
- Mercury was detected in all of the sediment samples collected during this study. Concentrations at Dam #8 appear to be greater than the other dams sampled. Neither acute nor chronic toxicity to aquatic life is expected, however. Further,

human health risk due to the presence of mercury in the sediment is not expected.

- PCBs were detected (above the analytical method detection limit) in one sediment sample associated with this study (Dam #4) and are not expected to cause toxicity to aquatic life. There appears to be potential, however, for PCBs to bioaccumulate in fish. This potential is confirmed by the presence of PCB driven fish consumption advisories in the non-tidal Brandywine River. It is concluded that low concentrations of dissolved PCBs in sediment porewater and surface water collectively contribute to some level of bioaccumulation. Therefore, any removal of PCBs from sediments would represent a net benefit to the Brandywine River ecosystem.
- Dioxins and furans were detected in all samples collected as part of this study. In relation to each other, increased concentrations of dioxin and furan toxicity equivalency quotients (TEQs) exist in samples collected from Dam #2, Dam #4, Dam #7 and Dam #8. Even so, impacts to aquatic life are not expected. Slightly elevated bioaccumulation risk is predicted from these compounds, which is verified by the presence of fish consumption advisories due in part to dioxins and furans in the non-tidal Brandywine River. Therefore, any removal of dioxins/furans from sediments would represent a net benefit to the Brandywine River ecosystem.
- Total PAHs were detected in all sediment samples collected behind the Brandywine River dams. In general, concentrations are higher at transect samples collected from Dam #4, Dam #8 and Dam #10. Toxicity to aquatic life is not expected, however. Further, impacts to human health due to PAHs in the sediment are not expected.
- Pesticides were not frequently detected in the Brandywine River sediments. In the two locations where pesticides were detected during this study (at Dam #2 and Dam #8), potential chronic toxicity to aquatic life was predicted. Acute toxicity was not predicted. Last, human health risk due to the presence of pesticides in the sediment is not expected.
- PFAS compounds were detected in all of the sediment samples for which they were analyzed. Due to the fact that Delaware/USEPA have not yet developed surface water criteria for protection of aquatic life that are exposed to this class of chemicals, no conclusions can be made about potential aquatic life toxicity. Human health risk due to the presence of PFAS compounds in the sediment is not expected.

Conclusions presented in this report only account for potential toxicity to benthic aquatic life and human health due to the presence of toxic compounds in the sediment. Assessment or consideration should be further given to impacts to aquatic life habitat that might be expected from the volume of sediment or from the geophysical characteristics of sediment released during dam modification, removal or failure. As highlighted above, data collected in this study indicate that there are areas of greater relative concentration of toxic compounds. Although increased risk of toxicity due to sediment release may not be predicted, evaluation should be made at the time of specific project planning/implementation to determine if a benefit to the ecosystem as a whole could be accomplished as a result of sediment removal activities.

1 Introduction

Dam modification, removal and/or failure, in general, raises several issues of environmental concern, including fundamental changes to the local environment. The reservoir created by the dam will be eliminated, and with it the flat-water habitat that had been created. Sediment that collects behind a dam, sometimes over hundreds of years, may contain toxic compounds such as PCBs, dioxins, and heavy metals. Removal of these contaminated materials is often extremely expensive, and the threat of re-suspending these toxic-laden sediments in the process of dam removal has the potential to damage downstream water quality and threaten the health of fish and wildlife and water users (American Rivers, 2020).

The Delaware portion of the Brandywine River contains a number of dams (Figure 1), which are not regulated under Delaware's Dam Safety Program. The Brandywine River is also a source of drinking water to the City of Wilmington, who has an intake upsteam of Dam #2. To evaluate the potential environmental risks that currently exist and that may be created by removal, modification, or failure of dams in the Delaware portion of the Brandywine River, DNREC's Watershed Approach to Toxics Assessment and Restoration (WATAR) team has evaluated chemical data from sediment samples collected from 22 transects behind 8 dams during the summer of 2020. The results of the assessment are summarized in this report.

WATAR is a cooperative approach/project team that draws on the expertise of staff primarily within, but not limited to, the Division of Watershed Stewardship (Watershed Assessment & Management Section, or WAMS) and the Division of Waste and Hazardous Substances (Remediation Section, or RS). WATAR creates a framework for assessing potential toxic impacts and implementing remediation and restoration projects in Delaware watersheds that are impacted by toxic pollutants. The long-term goals of WATAR are to return watersheds to a fishable, swimmable and potable status as quickly as possible by identifying and controlling releases of contaminants from remaining land-based sources and creating innovative strategies to mitigate legacy contamination in sediment.

This project was initiated by the desire [of Brandywine Shad 2020, a nonprofit led by the Brandywine Conservancy, the Hagley Museum & Library, and the University of Delaware] for all dams in the Brandywine River to be removed or appropriately modified to promote passage of American Shad (Alosa sapidissima) and other fish species to "pre-dam" historic spawning grounds. DNREC-WATAR's role in evaluating the potential for adverse human health or ecological effects from release of sediments during dam modification, removal or failure is critical to protecting downstream drinking water sources and existing fish habitat. Last, and given the increasing frequency of major storm and flow events in our region, characterizing potential impacts that might result from the release of sediments during a catastrophic failure of any dam in the Brandywine River is critical. This characterization will allow for proactive measures to be taken (as opposed to reactive measures) to reduce risk to aquatic life and humans, if necessary.

1.1 Brandywine River Watershed Characteristics

The Brandywine River is the steepest river in Delaware. From its sources in the Welsh Mountains of the Piedmont Province in northern Chester and Lancaster Counties, it flows south through central Chester County, Pennsylvania, and enters New Castle County, Delaware, at an elevation of about 138 feet above sea level. It continues about 12 more miles before crossing the "fall line" where the Piedmont meets the flat Atlantic Coastal Plain in the City of Wilmington (Brandywine Conservancy, 2005). The Brandywine winds through Wilmington for approximately two more river miles as a tidally influenced river before reaching its confluence with the Christina River, approximately one mile short of the Delaware River. The entire watershed measures approximately 325 square miles (208,000 acres) (Brandywine Conservancy et.al., 2018).

As the steepest river in Delaware, the Brandywine River was heavily utilized as a source of waterpower for mills in the colonial period and early America. It is estimated that there were as many as 100 mills on the Brandywine during this period (Brandywine Conservancy, 2005). Many of the mill buildings, mill races, and dams have survived. There are eleven dams and eight mill races still in existence along the Delaware portion of the Brandywine River.

1.1.1 Delaware's Brandywine River Dams

Early dams and mills date back to the late 1600s. For example, in 1682 Jacob Vandever was given permission to build a gristmill along the Brandywine in present-day Wilmington (Brandywine Conservancy, 2005). In an age of water-powered industry, Wilmington soon rose to become an important industrial force. Led by Quaker businessmen, Wilmington became a flour-milling center in the decades prior to the American Revolution, and a paper-making center afterwards. Industry along the Brandywine diversified, and by 1797, some "60-80 mills, almost all of different descriptions, such as paper, powder, tobacco, sawing, fulling, and flour" were operating along the small but powerful river, according to a French visitor (Hagley Museum, 1957). In 1802, new techniques were imported to improve the existing industry of gunpowder making, as the DuPont Company was organized in America.

There are currently nine functional dams (out of 11 total) on the Brandywine River in Delaware. Dam owner-partners include the City of Wilmington (former Dam #1 and Dam #2); the State of Delaware (Dam #3, Dam #4, Dam #5 and Dam #11); the Hagley Museum and Library (Dam #7, Dam #8, Dam #9, and Dam #10), and the DuPont Company (Dam #6). The Lower Brandywine River contains five historic districts on the National Register, one of which is also a National Historic Landmark. Five of the dams on the Lower Brandywine (Dam #7, Dam #8, Dam #9, Dam #10 and Dam #11) are considered historic. All dams are concentrated on the river between river miles 2.1 and 7.2 and are located in Delaware. The following is a brief description of the dam heights and construction:

- Former Dam 1: West Street Dam -The West Street Dam was a combination of parged stone and concrete that was approximately 2 to 4 feet high. The City of Wilmington removed the dam in 2019.
- Dam 2: Broom Street Dam -The Broom Street Dam appears to be concrete and is approximately 6 to 8 feet high. It is used to maintain a sufficient water level in the River to support raw water intake by the City of Wilmington along the eastern side of the River. In addition, a mill race on the western side of the river channels water to the City water filtration plant. This dam supports the main drinking water intakes for the City of Wilmington.
- Former Dam 3: Augustine Mill Dam - The dam is currently breached.
- Dam 4: Alapocas Run Park Dam -The Alapocas Dam appears to be double-step concrete and is approximately 7 to 9 feet high. The dam has concrete wing walls and Alapocas Run enters Brandywine River just downstream of the dam on the eastern side.
- Dam 5: Brandywine Falls Dam -The Brandywine Falls Dam appears to be a combination of stone and concrete and is approximately 6 to 8 feet high. There is a private community and millrace on the western side of the dam.
- Dam 6: DuPont Dam - The DuPont Dam, based on the general characteristics of the other dams observed, is most likely constructed of a combination of stone and concrete.
- Dam 7: Brecks Mill Dam -Brecks Mill Dam appears to be approximately 3 to 5 feet high and constructed of a combination of stone and concrete. Buildings are constructed immediately adjacent to the dam on both sides of the River.
- Dam 8: Lower Hagley Dam -The Lower Hagley Dam appears to be approximately 5 to 7 feet high and constructed of a combination of stone and concrete.
- Dam 9: Upper Hagley Dam -The Upper Hagley Dam appears to be approximately 5 to 7 feet high and constructed of a combination of stone and concrete. This dam is unusual as the western portion of the dam extends on an approximate 45-degree angle to the course of the river and then turns at the approximate midpoint to extend at a more conventional 90-degree angle to the course of the river to the eastern side. The 90-degree portion of the dam appears to be in disrepair as compared to the rest of the dam.
- Dam 10: Eluetherian Dam- The Eluetherian Dam is a unique, historic dam that is constructed with a timber spillway and was reconstructed within the past 15 years by the Hagley Museum. There is a millrace on the western side of the River and a channel on the eastern side. Flow through these structures is supported by the dam.
- Dam 11: Rockland Mills Dam- Rockland Mills Dam is located within Brandywine State Park and appears to be 4 to 5 feet high. The dam is in disrepair and is partially breached on the western side.

1.1.2 Topography

Topographically, the Brandywine River watershed is characterized by a transition from high rolling hills in the north to very flat Coastal Plain topography in the south (Brandywine Conservancy et.al., 2018). The Brandywine River defines the largest watershed within the Brandywine-Christina watershed, arising nearly sixty miles from its mouth, in the rolling farmland of northern Chester County, through the east-west limestone valley of the central Brandywine River watershed (the so-called Great Valley or Chester Valley), to the steep rocky outcrops of the fall zone in northern Delaware (Brandywine Conservancy et.al., 2018). The narrow stream valley in the lower reaches of the Brandywine provided ample hydraulic power for the mills of the early industrial period in the region (Brandywine Conservancy 2005).

1.1.3 Geology

Several significant geologic formations affect the hydrology of the Brandywine River watershed. The upper basin is underlain by metamorphic bedrock (diabase, gneiss, and marble), while the Great Valley, cutting across the central Brandywine River watershed is characterized by limestone (Brandywine Conservancy et.al., 2018). Farther downstream are hard, metamorphic formations such as Wissahickon Schists and Brandywine Blue Gneiss (also known as Wilmington Blue Rock), while throughout the basin critical aquifer recharge areas, such as the Cockeysville formation, are characterized by limestone marble bedrock (Brandywine Conservancy et.al., 2018). The Columbia and Potomac sediments of the Coastal Plain form the base for the tidal, navigable portion of the Brandywine River watershed, below former Dam #1.

1.1.4 Precipitation

Annual precipitation measured by the National Weather Service at Wilmington Airport in Delaware ranged from 24.9 inches in 1965 to 56.7 inches in 2004. Annual precipitation measured by the U.S. Geological Survey (USGS) and Chester County Water Resources Authority (CCWRA) at Brandywine River at the Chadds Ford stream gage in Pennsylvania ranged from 34.5 inches in 1965 to 69.7 inches in 1996. Precipitation tends to be higher up in the Piedmont plateau of Chester County, PA due to the orographic effect where the weather stations are situated at higher elevations than the stations in New Castle County, DE.

1.1.5 Surface Water Discharge and Peak Discharge Events

There are 11 USGS continuous stream gage stations in the Brandywine River watershed. The highest storms of record at the gage stations were Hurricane Floyd and Agnes. The Brandywine at Chadds Ford, PA station, based on 44 years of record, recorded Hurricane Floyd as the highest storm of record in September 1999 at 26,900 cubic feet per second (cfs). For the same period of record, 44 years, the Brandywine River at Wilmington, DE station recorded Hurricane Agnes (June 1972) as the highest peak discharge at 29,000 cfs.

1.1.6 Land Use Type and Population

The Brandywine River watershed is characterized by a diverse mix of land uses and cover types. The Brandywine watershed extends from the City of Wilmington in the south to the agricultural region in northern Chester County, Pennsylvania. Streams in the watershed pass through a wide mix of agricultural lands, industrialized areas, and urban and suburbanized areas, until they meet the Christina River near the Delaware River.

The Brandywine watershed is composed of roughly equal portions of three land cover types: urbanized, agricultural and natural lands (i.e. forest and wetlands). The more populous, urbanized areas surrounding the Brandywine River watershed are concentrated in Delaware, as well as the US Route 30 corridor in the Pennsylvania portion of the Brandywine River watershed (Brandywine Conservancy et.al., 2018). While most of the land area of the basin lies in Pennsylvania, Delaware has more population based on 2015 totals. Reportedly, approximately 56% of the basin's inhabitants live in Delaware, while approximately 43% reside in Pennsylvania (Brandywine Conservancy et.al., 2018).

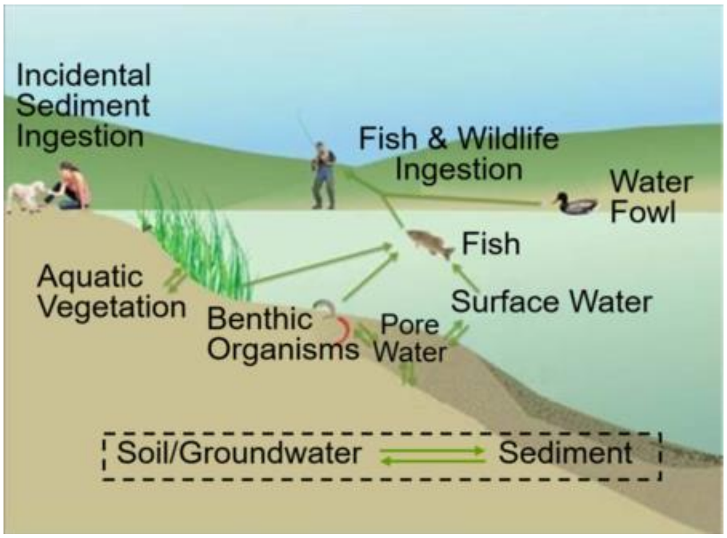
1.1.7 Cultural and Recreational Resources

The Brandywine River watershed provides numerous ecological and natural functions while also serving as a recreation destination. The watershed has a robust and growing ecotourism industry and is an important attraction for a variety of popular tourism and recreational activities in the mid-Atlantic region (such as fishing, hiking, cycling and bird watching) while the streams of the watershed provide a variety of primary and secondary recreational opportunities. The First State National Historical Park is a 1,100-acre property along the banks of the Brandywine River. The Brandywine River is truly a unique stream from an angling perspective with three distinct fisheries and over 14 target species available along its 60-mile length (Brandywine Conservancy 2005). The upper reaches of the Brandywine, particularly along the east branch, is a cold water fishery providing good habitat and conditions for freshwater trout; the middle and largest section is a warm water fishery with smallmouth bass being the most targeted species; the lower portion from the City of Wilmington to its confluence with the Christina is a tidal fishery offering anglers opportunities to catch American shad, hickory shad and striped bass. The watershed also functions as protected-species habitat for the bald eagle, brook trout (the state fish of Pennsylvania), cerulean warbler and bog turtle.

1.2 Conceptual Exposure Model

In order to understand why certain data assessment methods were applied in this evaluation, it is necessary to understand the basic pathways by which benthic aquatic life, fish, and humans, in this case, can be exposed to toxic compounds in the sediment. The figure below (ITRC, 2011) is a simple conceptual exposure model that depicts contaminant transport pathways between environmental media (soil, groundwater, sediment, porewater, and surface water) and receptors in a freshwater system like the non-tidal Brandywine River. Calculations were conducted during this evaluation to assess:

- Exposure of benthic aquatic organisms to contaminants in sediments. Specifically, exposure to the dissolved (bioavailable) portion of the contaminant in sediment porewater and/or its potential to bioaccumulate through the aquatic food chain to fish;
- Exposure of humans to contaminants through drinking surface water and eating fish from the Brandywine River; and
- Exposure of humans to contaminants through incidental sediment ingestion or inhalation under specific exposure scenarios (excavation work, recreation, and residential).



For most aquatic risk assessments, contaminant movement/transport is either directly measured, estimated using models, and/or measured as tissue concentrations within a target organism, like fish (ITRC, 2011). Although the sediment and aquatic systems are complex, reasonable estimates of potential for toxic impacts to receptors can be made.

1.3 Bioavailability

As defined by the National Research Council (NRC, 2003), "bioavailability processes" are the "…individual physical, chemical, and biological interactions that determine the exposure of plants and animals to chemicals associated with soils and sediments" More specifically, "bioavailability addresses the fact that only a fraction of a contaminant present in the environment may be taken up and subsequently result in an effect on an organism" (ITRC, 2011). Where possible, bioavailability was considered during this assessment in an attempt to model environmental conditions more accurately, and in a way that is more representative of actual conditions. This also allows for more appropriate comparisons between modeled and measured results.

2 Methods

The overall objective of the sediment sampling and analysis associated with the Brandywine River dams is to better characterize toxic contaminant levels in the sediments that are "trapped" or stored behind the dams, and to assess the potential for adverse impacts to human and ecological health should the sediment be released and/or relocated through dam modification, removal, or failure.

2.1 Field Methods

DNREC-WATAR team members conducted all field sampling alongside AquaSurvey, Inc. (ASI, contractor to Brandywine Shad 2020) in March 2020 and June 2020. ASI conducted all sediment sampling activities, while DNREC conducted all sediment sample processing for laboratory analysis by TestAmerica, Inc. (under State contract). DNREC-WATAR conducted subsequent data analysis and reporting, as well. Brandywine Dam #2, #4, #7, #8 and #11 were sampled between March 3 and 12, 2020. All sampling activities were suspended on March 13, 2020 due to initial COVID-19 restrictions. Brandywine Dam #6, #9 and #10 were sampled on June 9 and 10, 2020 while exercising all appropriate health and safety protocols related to the continued COVID-19 pandemic. Sampling behind Brandywine Dam #1 was not conducted as part of this study because the dam was successfully removed by the City of Wilmington in the fall of 2019. Sampling behind dam #3 was not conducted because it had been previously breached, and any stored sediments had already been redistributed downstream. Dam #9 and Dam #10 were only sampled on the Hagley Museum (west side) of the river due to denial of access to the east side of the river by the property owner. Although not ideal, for this assessment DNREC assumed that data received/assessed was be representative of the entire sediment wedge behind those dams. Last, sampling behind Brandywine Dam #5 was not completed due to access related issues and COVID-19 communication complications.

Sediment core samples were collected, where possible, along several transects behind each dam. If push-core sampling was not possible based upon initial probing surveys and lack of sediment thickness, then surface sediment grab samples were collected instead using a petite ponar, or by hand. After individual cores/samples from each transect were described/logged in the field, they were composited into one representative sample for each transect. As shown on referenced figures, between 2 and 5 transects were sampled at each location based upon the apparent lateral extent of the sediment wedge behind each individual dam. The probe survey conducted prior to sampling also enabled a more precise evaluation of sediment volume behind each dam.

Homogenization of samples was conducted using disposable aluminum trays and disposable plastic scoops to create a sample representative of the entire thickness of sediment stored behind each dam (as opposed to sampling discrete layers). After homogenization, sediment was transferred to laboratory supplied glass or plastic containers appropriate for desired analysis. Standard DNREC sampling protocols and procedures, including collection and analysis of field and equipment blanks, were utilized to minimize/assess the potential for cross contamination between samples.

The locations of the transects and individual samples are shown on Figures 2 through 9. Probing survey results and core depth information is summarized in ASI logs presented in Appendix A.

2.2 Laboratory Methods

The chemical parameters for the bulk sediment analysis of each sample included inorganics (metals) including mercury, polychlorinated biphenyl (PCB) homologs, chlorinated pesticides, polynuclear aromatic hydrocarbons (PAHs) including alkylated homologs, dioxins and furans, grain size, and total organic carbon (TOC). One composited transect sample per dam was also analyzed for per- and polyfluoroalkyl substances (PFAS). Table 2-1 contains a list of individual analytes and associated analytical methods. All sediment contamination results were expressed on a dry weight basis. Sample-specific detection limits varied due to matrix interferences and when non-detects were converted from wet to dry weight. Method detection limits for sediment analyses were generally less than or equal to DNREC guidelines. Grain-size analysis on the sediment samples was performed using sieves and a hydrometer. All analyses were conducted by TestAmerica, Inc. in Edison, New Jersey under the State of Delaware contract for analytical services. Laboratory analytical results for all samples are included in Appendix B.

Table 2-1. Laboratory methods for analysis of bulk sediment samples collected from behind the Brandywine River dams in March/June 2020.

Parameter	**Analytical Method**
	Solid Samples
Inorganics (Metals)	
Aluminum	6020B
Antimony	6020B
Arsenic	6020B
Barium	6020B
Beryllium	6020B
Cadmium	6020B
Calcium	6020B
Chromium	6020B
Cobalt	6020B
Copper	6020B
Iron	6020B
Lead	6020B
Magnesium	6020B
Manganese	6020B
Nickel	6020B
Potassium	6020B
Selenium	6020B
Silver	6020B
Sodium	6020B

Thallium	6020B
Vanadium	6020B
Zinc	6020B
Mercury	7471B
PCBs Homologs	
PCB Homologs	680
Organochlorine Pesticides	
Aldrin	8081A
Alpha BHC	8081A
Beta BHC	8081A
Delta BHC	8081A
Cis-Chlordane	8081A
Trans-Chlordane	8081A
Gamma BHC (Lindane)	8081A
4,4’-DDD	8081A
4,4’-DDE	8081A
4,4’-DDT	8081A
Dieldrin	8081A
Endosulfan I	8081A
Endosulfan II	8081A
Endosulfan Sulfate	8081A
Endrin and compounds	8081A
Heptachlor	8081A
Heptachlor Epoxide	8081A
Methoxychlor	8081A
Toxaphane	8081A
Polycyclic Aromatic Hydrocarbons (PAHs) + Alkylated Homologs	
1-Methylnaphthalene	8270D SIM
2-Methylnaphthalene	8270D SIM
Acenaphthene	8270D SIM
Acenaphthylene	8270D SIM
Anthracene	8270D SIM
Benzo(a)anthracene	8270D SIM
Benzo(a)pyrene	8270D SIM
Benzo(b)fluoranthene	8270D SIM
Benzo(e)pyrene	8270D SIM
Benzo(g,h,i)perylene	8270D SIM
Benzo(k)fluoranthene	8270D SIM
Chrysene	8270D SIM
C1-Chrysenes	8270D SIM
C2-Chrysenes	8270D SIM
C3-Chrysenes	8270D SIM
C4-Chrysenes	8270D SIM
Dibenz(a,h)anthracene	8270D SIM
Fluoranthene	8270D SIM

C1-Fluoranthenes/pyrene	8270D SIM
Fluorene	8270D SIM
C1-Fluorenes	8270D SIM
C2-Fluorenes	8270D SIM
C3-Fluorenes	8270D SIM
Indeno(1,2,3-cd)pyrene	8270D SIM
Naphthalene	8270D SIM
C2-Naphthalenes	8270D SIM
C3-Naphthalenes	8270D SIM
C4-Naphthalenes	8270D SIM
Perylene	8270D SIM
Phenanthrene	8270D SIM
C1-Phenanthrenes/Anthracenes	8270D SIM
C2-Phenanthrenes/Anthracenes	8270D SIM
C3-Phenanthrenes/Anthracenes	8270D SIM
C4-Phenanthrenes/Anthracenes	8270D SIM
Pyrene	8270D SIM
Dioxins and Furans	
1,2,3,4,6,7,8-HpCDD	1613B
1,2,3,4,6,7,8-HpCDF	1613B
1,2,3,4,7,8,9-HpCDF	1613B
1,2,3,4,7,8-HxCDD	1613B
1,2,3,4,7,8-HxCDF	1613B
1,2,3,6,7,8-HxCDD	1613B
1,2,3,6,7,8-HxCDF	1613B
1,2,3,7,8,9-HxCDD	1613B
1,2,3,7,8,9-HxCDF	1613B
1,2,3,7,8-PeCDD	1613B
1,2,3,7,8-PeCDF	1613B
2,3,4,6,7,8-HxCDF	1613B
2,3,4,7,8-PeCDF	1613B
2,3,7,8-TCDD	1613B
2,3,7,8-TCDF	1613B
OCDD	1613B
OCDF	1613B
Per- and Polyfluoroalkyl Substances (PFAS)	
1H,1H,2H,2H-perfluorodecanesulfonic acid (8:2)	537 (Modified)
1H,1H,2H,2H-perfluorooctanesulfonic acid (6:2)	537 (Modified)
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	537 (Modified)
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	537 (Modified)
Perfluorobutanesulfonic acid (PFBS)	537 (Modified)
Perfluorobutanoic acid (PFBA)	537 (Modified)
Perfluorodecanesulfonic acid (PFDS)	537 (Modified)

Perfluorodecanoic acid (PFDA)	537 (Modified)
Perfluorododecanoic acid (PFDoA)	537 (Modified)
Perfluoroheptanesulfonic Acid (PFHpS)	537 (Modified)
Perfluoroheptanoic acid (PFHpA)	537 (Modified)
Perfluorohexanesulfonic acid (PFHxS)	537 (Modified)
Perfluorohexanoic acid (PFHxA)	537 (Modified)
Perfluorononanoic acid (PFNA)	537 (Modified)
Perfluorooctanesulfonamide (PFOSA)	537 (Modified)
Perfluorooctanesulfonic acid (PFOS)	537 (Modified)
Perfluorooctanoic acid (PFOA)	537 (Modified)
Perfluoropentanoic acid (PFPeA)	537 (Modified)
Perfluorotetradecanoic acid (PFTeA)	537 (Modified)
Perfluorotridecanoic acid (PFTriA)	537 (Modified)
Perfluoroundecanoic acid (PFUnA)	537 (Modified)
Miscellaneous	
Grain Size	D422
Total Organic Carbon	EPA Lloyd Kahn

2.3 Sediment Volume Assessment Methods

Three different methods were used to estimate the volume of sediment stored behind the Brandywine River dams. A more detailed description of each method is described below.

2.3.1 Method 1-Wedge Estimate

Prior to conducting sampling, estimates of stored sediment were needed to determine an appropriate number of sample locations necessary to adequately characterize the volume. Method 1 used aerial imagery and manual measurement from Google Earth combined with reported dam heights. Due to the shallow depth of bedrock along the majority of Delaware's portion of the Brandywine River, rock outcrops within the river are visible through the aerial imagery. The location of each of these outcrops along the length of the Brandywine as well as the reported elevations above sea level were tracked in a Microsoft Excel spreadsheet. Those data were used to approximate the riverbed. The location of each dam along the length of the Brandywine as well as its reported height were also noted. By conservatively assuming that sediment filled the height of the dam and extended back in a flat plane to the intercepting interpreted river bottom, an estimate of sediment volume was calculated. This method was assumed to be overly conservative for use beyond that of establishing an upper limit.

2.3.2 Method 2-Transect Estimate

Method 2 utilized the data collected during sampling efforts to provide a more realistic calculation of volume. During sampling, it became apparent that the initial estimate of sediment volume did not reflect actual site conditions, likely due to the high velocity of the river and its drastic change in elevation. This is precisely the same reasons that made the installation of the dams so beneficial originally. For most of the transects sampled during this assessment, very little sediment was found in the middle of the river channel. Most of the accumulated sediment was located along the banks of the river. In fact, several composited transect samples were comprised of *only* bank sediment, as no sediment could be recovered from the central portions of the river. After plotting the locations of each probe point, the distance between each transect and the transect closest downstream was measured manually. In the case of transect one for each dam, the distance between the transect and dam was measured. The distance between transects or the transect and the dam were multiplied by the width of the river to provide an area. To be conservative, each calculated area was multiplied by only the thickest probe depth to provide a volume from each transect. The summation of each transect volume yields the estimate for the sediment volume between each dam.

2.3.3 Method 3-Thiessen Polygons, Point Estimate

Thiessen polygons break a larger area of interest into smaller polygons around individual points. The polygons identify the area that is closest to a point than the other points within the larger framework. Thiessen polygons are not uniform in size but are driven by the number and location of points within an area of interest. Utilizing the probe data collected during the sediment sampling effort, polygons were digitally generated (using ArcGIS) around each point within a defined area of interest. The Thiessen polygon method calculated an area for each probe location, which was subsequently multiplied by the sediment thickness to generate a volume of sediment for each point associated with each dam. The volume calculated at each point was then summed to obtain a further revised total volume of sediment located behind each dam. This calculated total, as well as a total with an additional 15% margin of error added, is shown in Table 3-2.

Because only half of the river could be sampled at Dam #9 and Dam #10, additional manual adjustments were necessary. The polygons generated for the mid-river sample were assigned the area between the single bank sample and the other bank. In short, too much weight was assigned for the mid-point sample. An assumption that the banks were relatively symmetrical was made. In these cases, the area of the single bank sample was doubled, while an equal area was subtracted from the falsely generous mid-point sample.

2.4 Chemical Data Assessment Methods

Results of bulk chemical analyses of sediment were used to evaluate the risk to benthic aquatic life and human health associated with potential release and redistribution of accumulated sediment from behind each dam. This was accomplished in several ways.

In general, risk to benthic aquatic life was evaluated by conducting equilibrium partitioning theory (EqP) calculations and dividing a resulting predicted porewater concentration by compound specific freshwater acute and chronic toxicity values published in the State of Delaware Surface Water Quality Standards (DNREC, 2011). In other words, results from sediment analyses were converted to an estimated dissolved concentration in the water that fills the pore space in the sediment (called sediment porewater). By assuming that the concentrations predicted in sediment porewater are in equilibrium with overlying surface water, then comparison of the estimated values to applicable water quality criteria (that were developed to protect organisms living in and on the sediment) can be made. Acute criteria are protective of short-term effects (days), and chronic criteria are protective of long-term effects (months to years, depending upon the lifespan of the organism). Therefore, the acute results are most relevant when considering sediments that will be removed (excavated) and that will have potential associated resuspension of sediments during removal activities. In addition, the acute results are relevant to evaluating initial benthic aquatic life response from dam breaching or full removal of dams and the resulting instantaneous release of sediments/porewater (i.e. increased short term exposure). Chronic results represent longer term effects and are most relevant to assessing sediments as they currently exist (in place), or after sediments have re-deposited after an initial release (via dam modification, removal or failure. Due to the lack of appreciable sediment thickness in most areas of the non-tidal Brandywine River, there are not distinct "layers" that may cause differing levels of potential risk from contaminants. As a result, the assessment of potential risk to benthic aquatic life from this assessment effectively represents both the current risk (meaning risk with sediments in place – no change), and the risk that would occur if sediment were released as a result of dam modification, removal or failure.

Another way to assess toxicity to benthic aquatic life involves determination/calculation of an organic carbon normalized concentration in the sediments that is in equilibrium with a porewater concentration equal to an aquatic life criterion. Fuchsman (2006) refers to such an organic carbon normalized sediment concentration as a Sediment Quality Benchmark (SQB). By calculating the SQB, and then calculating a carbon normalized sediment concentration for samples collected during this assessment (sediment concentration divided by the fraction of organic carbon in the sample) a direct comparison can be made between laboratory analytical results, and the calculated criterion.

Risk to human health was also evaluated using multiple approaches. First, and where applicable, bioaccumulation risk was evaluated by calculating an estimated fish tissue concentration from the estimated porewater concentration, with subsequent comparison to fish tissue screening levels. Conversely, one can use an acceptable fish tissue concentration to back calculate an equivalent porewater concentration that can be compared to porewater estimates. Another way is to calculate a bioaccumulation-based sediment quality criterion (BBSQC). Similar to an SQB for aquatic life protection, a BBSCQ represents a bulk sediment concentration that equates to an acceptable fish tissue concentration for protection of human health from adverse health effects (Greene, 1997). Each of these methods were used at different times during this assessment.

Another approach used to evaluate potential human health impacts was to compare the estimated sediment porewater concentrations to criteria published in the State of Delaware Surface Water Quality Standards (DNREC, 2011) associated with drinking water and eating fish from a body of water. This evaluation is relevant here because the Brandywine River provides a source of drinking water to the City of Wilmington. This approach was used as a screening technique, and with caution. Effective comparison of sediment porewater values to surface water quality standards assumes that concentrations of contaminants in the sediment porewater are equal to concentrations in the surface water. This is not always the case, and therefore does account for the potential for dilution from overlying surface water. Therefore, if estimated porewater concentrations are less than established criteria, one can conservatively conclude that there is no potential risk via this pathway. However, if estimated concentrations exceed the established criteria, it should not be automatically assumed that unacceptable risk exists. Instead, closer scrutiny of data and additional lines of evidence were evaluated before making any conclusions about increased risk from exposure through drinking water and eating fish from the Brandywine River.

Finally, laboratory analytical results were used to evaluate whether the sediment contains contaminant concentrations that would pose an unacceptable risk to human health if it were excavated/removed during dam removal or modification and subsequently placed into an upland (outside of the river) setting. This was accomplished by comparing analytical results to the DNREC-RS Hazardous Substance Cleanup Act (HSCA) Screening Level Table (DNREC 2013, updated February 2020), and conducting additional risk assessment with data from samples that exceeded applicable screening values.

An important concept to understand before reviewing results of this assessment is that different criteria used in this assessment were developed to protect human health to differing degrees. Specifically, criteria published in Table 2 of the DNREC Surface Water Quality Standards were developed to protect humans from carcinogenic risk at a level of "one excess cancer in a population of 1 million over a 70-year lifetime" (expressed as 1×10^{-6}). Criteria published in the DNREC HSCA Screening Level Table were developed based upon the same level of protection, however they are meant to be used for screening levels only, not cleanup standards. The Delaware Regulations Governing Hazardous Substance Cleanup (7 Del.C. Ch. 91) state that "acceptable risk" means "a probability of one additional lifetime incidence of cancer in 100,000 or less for carcinogens (expressed as 1×10^{-5}), and a hazard index of one (1) or less for non-carcinogens". Therefore, data that exceeds HSCA Screening Levels simply represent contaminants of potential concern which are further evaluated against a cumulative regulatory risk threshold (i.e. combined risk from all contaminants) equal to 1×10^{-5}. Each set of criteria used are enforceable under the regulation(s) through which they were created. Furthermore, none are necessarily "right" or "wrong" to utilize for comparing field data. What is critical, as noted, is that one understands what each set of criteria represent, and how they were intended to be applied.

Summarization of the methodologies and results of the Brandywine River sediment toxicity evaluations are included in Section 3. Spreadsheets containing calculations and more detailed assessment information are included in Appendix C.

3 Results and Discussion

3.1 Sediment Evaluation

Physical and chemical data from sediment samples collected and analyzed during this assessment were compared to appropriate guideline concentrations to determine the potential aquatic life and/or human health impacts of dam modification, removal or failure in the Brandywine River. DNREC Surface Water Quality Standards (DNREC, 2011) and DNREC-RS Screening Level Values for soil were used for data and modeled concentration estimate comparison because the assessment area is located in the State of Delaware.

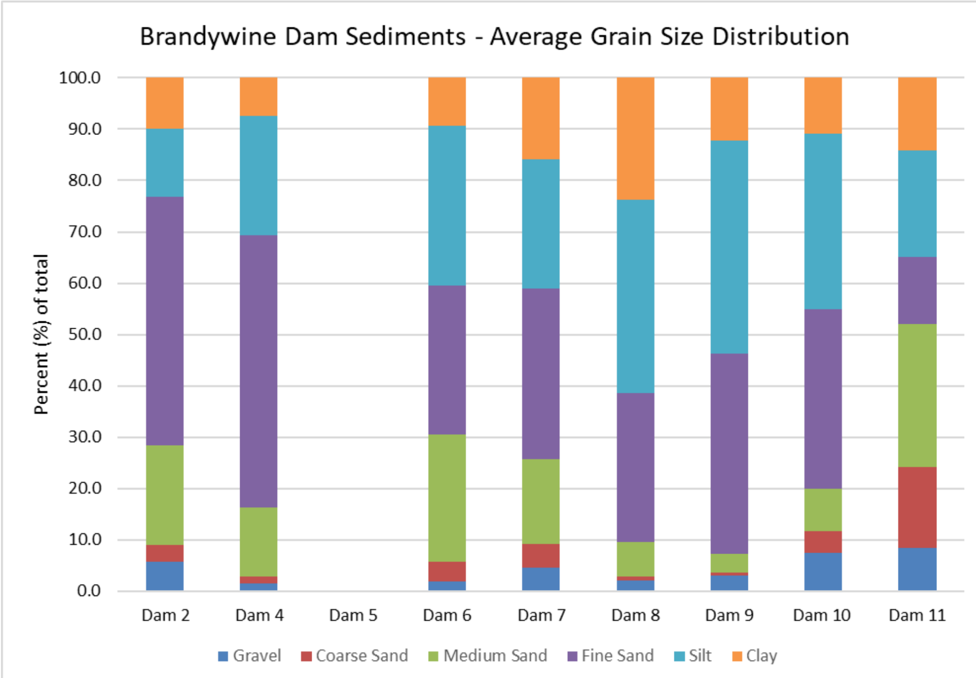
3.1.1 Grain Size Distribution & Total Organic Carbon

The grain size compositions of the Brandywine River dam composited sediment transect samples ranged from 0.3 to 14.8 percent gravel, 27.0 to 78.4 percent sand, 10.0 to 47.3 percent silt, and 6.4 to 24.2 percent clay (Table 3-1). Total organic carbon content ranged from 3,920 milligrams per kilogram (mg/kg) (0.39%) to 34,600 mg/kg (3.46%).

Table 3-1. Grain size distribution and total organic carbon content for composite sediment samples collected from the Brandywine River dams in March/June 2020.

Composite Sample	Percent Gravel	Percent Sand	Percent Silt	Percent Clay	TOC (mg/kg)
Dam 1	Dam Removed in 2019				
Dam 2 Transect 1	0.3	75.5	14.9	9.3	12,800
Dam 2 Transect 2	6.3	67.6	15.3	10.8	15,100
Dam 2 Transect 3	10.5	70.0	10.0	9.5	12,200
Dam 3	Dam Previously Failed/Breached				
Dam 4 Transect 1	1.4	59.7	32.5	6.4	16,300
Dam 4 Transect 2	0.3	52.5	30.2	17.0	25,900
Dam 4 Transect 3	3.2	71.6	19.7	5.5	19,800
Dam 4 Transect 4	1.8	78.4	15.6	4.2	11,800
Dam 4 Transect 5	0.7	77.5	18.0	3.8	12,100
Dam 5	Not Sampled	Not Sampled	Not Sampled	Not Sampled	Not Sampled
Dam 6 Transect 1	2.2	50.0	37.4	10.4	21,200
Dam 6 Transect 2	2.6	66.4	23.9	7.1	17,800
Dam 6 Transect 3	1.1	56.6	32.0	10.3	23,400
Dam 7 Transect 1	9.4	58.0	20.9	11.7	16,100
Dam 7 Transect 2	1.6	43.4	31.8	23.2	21,100
Dam 7 Transect 3	2.5	61.7	23.2	12.6	4,330
Dam 8 Transect 1	1.5	27.0	47.3	24.2	24,300
Dam 8 Transect 2	2.7	45.9	28.1	23.3	22,200
Dam 9 Transect 1	0.9	58.1	29.9	11.1	28,500
Dam 9 Transect 2	5.1	28.6	52.9	13.4	34,600
Dam 10 Transect 1	0	43.0	44.4	12.6	24,200
Dam 10 Transect 2	14.8	52.1	23.8	9.3	3,920
Dam 11 Transect 1	3.5	55.6	26.2	14.7	19,600
Dam 11 Transect 2	13.5	57.8	15.0	13.7	18,700

To look at grain size distribution a different way, average distributions of gravel, coarse sand, medium sand, fine sand, silt and clay were calculated for each dam. Those data are plotted below. Complete sieve-hydrometer results and calculations are included in the BWR_2020_Grain Size_Final spreadsheet included in Appendix C.



Higher contributions of fine-grained material (fine sand, silt and clay) are indicative of lower energy environments, where these finer/lighter particles can drop out of suspension in the surface water. On the contrary, dominance of more course particles (medium sand, coarse sand and gravel) generally indicates relatively higher energy environments that transport finer grained particles downstream. By comparison, the data presented shows that sediments behind Dam #4, Dam #8, Dam #9 and Dam #10 contain more fine-grained material than the other dams.

3.1.2 Sediment Volume Estimates

As described in Section 2, three methods were used to estimate the volume of sediment stored behind the Brandywine River dams. Results of each method of estimation are shown on Table 3-2. Method 1 (DNREC, 2019) was a highly conservative estimate that was used initially to determine an appropriate number of sampling locations/transects. Method 1 assumes that sediment has accumulated to the height of the dam and extends horizontally to the natural river bottom, forming a wedge. Method 2 used data collected during sample collection (probe data) but was still conservative in that it used the maximum thickness along each transect. Method 3 used sediment thickness at each probe point to provide a refined volume of sediment around each point of each transect.

Table 3-2. Sediment Volume Estimates behind Brandywine River dams.				
Sediment Volume Estimates and Refinements				
Dam #	**Method 1-Wedge (yd^3)**	**Method 2-Transect (yd^3)**	**Method 3-Theissen (yd^3)**	**Theissen Estimate* (yd^3)**
2	23,300	16,200	8,500	9,800
4	19,300	4,800	2,300	2,600
5	32,600	Not Sampled	Not Sampled	Not Sampled
6	16,600	4,600	1,100	1,200
7	52,200	5,500	2,600	3,000
8	28,500	16,300	7,200	8,300
9	1,900	5,300	6,500	7,500
10	7,100	2,800	1,400	1,600
11	126,000	6,300	6,500	7,500

Note: All values were rounded to the nearest 100 yd^3
* A 15% margin of safety was added to the Theissen Estimate

3.2 Sediment Contamination Evaluation

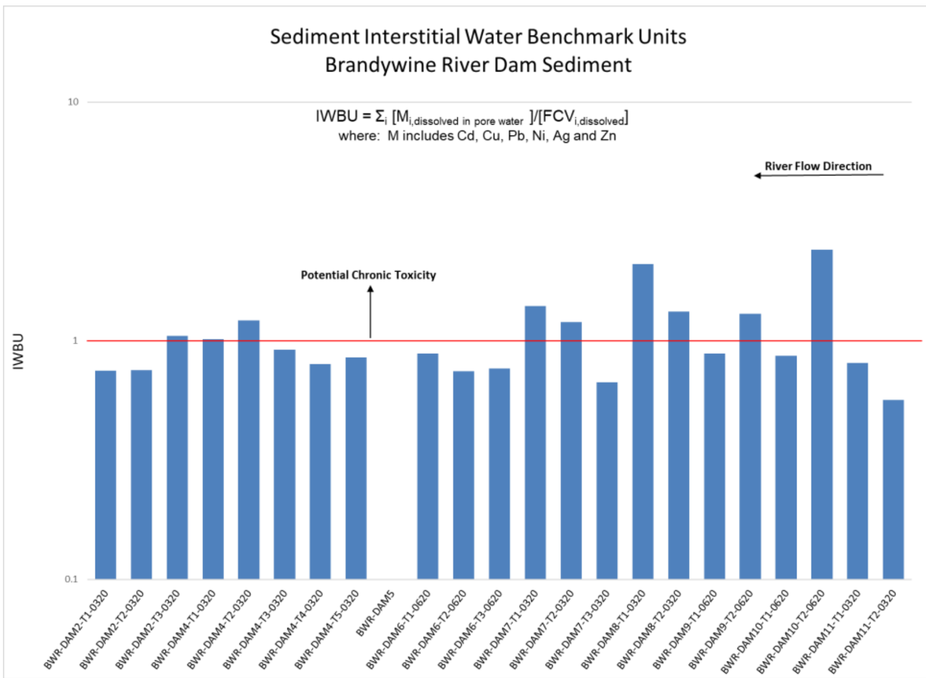
Results of the chemical analyses performed on the composited sediment samples are summarized in Table 3-3 (Inorganics), Table 3-4 (PCBs and Dioxins/Furans), Table 3-5 (SVOCs), Table 3-6 (Pesticides) and Table 3-7 (PFAS). A separate discussion about the contaminant concentrations and their associated potential toxicity to aquatic life and human health are summarized below. Additional detail regarding sediment data assessment methods and associated results are included in the assessment spreadsheets for each contaminant class that are included as Appendix C.

3.2.1 Inorganic (Metals) Assessment

Various metals were detected in all samples collected from the Brandywine River at concentrations exceeding method detection limits.

To evaluate toxicity of metals to benthic aquatic life, the total dissolved concentration of each metal in the sediment porewater was estimated by dividing the bulk metal concentration by the sediment to porewater metal partition coefficient published by the EPA (USEPA, 2005a). This concentration was further partitioned between dissolved organic carbon (DOC)-bound metal and total inorganic metal species in porewater solution, again using the mean partition coefficients published by the EPA (USEPA, 2005a). The resulting estimated dissolved total inorganic metal concentration in the porewater was then compared to freshwater acute and chronic water quality criteria for the protection of aquatic life, and criteria developed to protect human health via fish and water ingestion (DNREC, 2011). In all cases, the ratio of the estimated inorganic metal concentration in the sediment porewater to the applicable criterion was expressed as toxic units, where ratios greater than 1 suggest exposure concentrations in excess of the criterion. Finally, to evaluate the additive effect of specific divalent metals on benthic aquatic life, the chronic toxic units for cadmium, copper, lead, nickel, silver and zinc were summed to produce a so-called interstitial water benchmark unit (IWBU) as fully described in USEPA, 2005b. This same approach was also used to calculate acute toxic units for each sample. Again, the combined effect of the divalent metals cadmium, copper, lead, nickel, silver and zinc were considered. IWBU values greater than 1 indicate an increased risk of impact to benthic aquatic life. Sediments with IWBU values less than 1 are not likely to be toxic to benthic aquatic life due to the collective presence of divalent metals.

Each of the 22 composite samples from Brandywine River dam sediments had IWBU values for acute toxicity less than 1. A total of 9 composite samples collected from Brandywine River Dam sediments had a chronic IWBU value slightly greater than 1. Toxic unit results greater than 1 ranged from 1.01 at Dam 4 Transect 1 to 2.41 at Dam 10 Transect 2. As can be seen in the graph below, the potential for chronic toxicity to benthic aquatic life from metals exists at several locations. Upon closer examination of the data, IWBU exceedances are dominated by copper, cadmium and lead in all cases (Dam #2, Dam #4, Dam #7, Dam #8, Dam #9 and Dam #10).



A review of the freshwater chronic aquatic life criterion for cadmium reveals that it is very conservative and may overstate ecological risk (Greene, 2010). Assuming this is true and considering the marginal overall calculated exceedances, it becomes less likely that divalent metals are causing or will cause significant chronic toxicity, currently or if sediments were released through dam modification, removal, or failure.

Because several of the metals detected in the sediment samples were not included in the IWBU summation, a separate comparison was made of predicted dissolved inorganic concentrations of arsenic, chromium and selenium in the porewater to applicable aquatic life and human health criteria. Further, a separate comparison was made of predicted dissolved inorganic barium, beryllium, antimony and thallium to human health criteria only, as no aquatic life criteria exist for these metals. Only two sample locations had chronic toxic unit values greater than 1 for any metal (cadmium at Dam 8 Transect 1 ($T.U._c$ = 1.23), and lead at Dam 10 Transect 2 ($T.U._c$ = 1.60)). None of the individually assessed metals had acute aquatic toxic unit values in excess of 1.

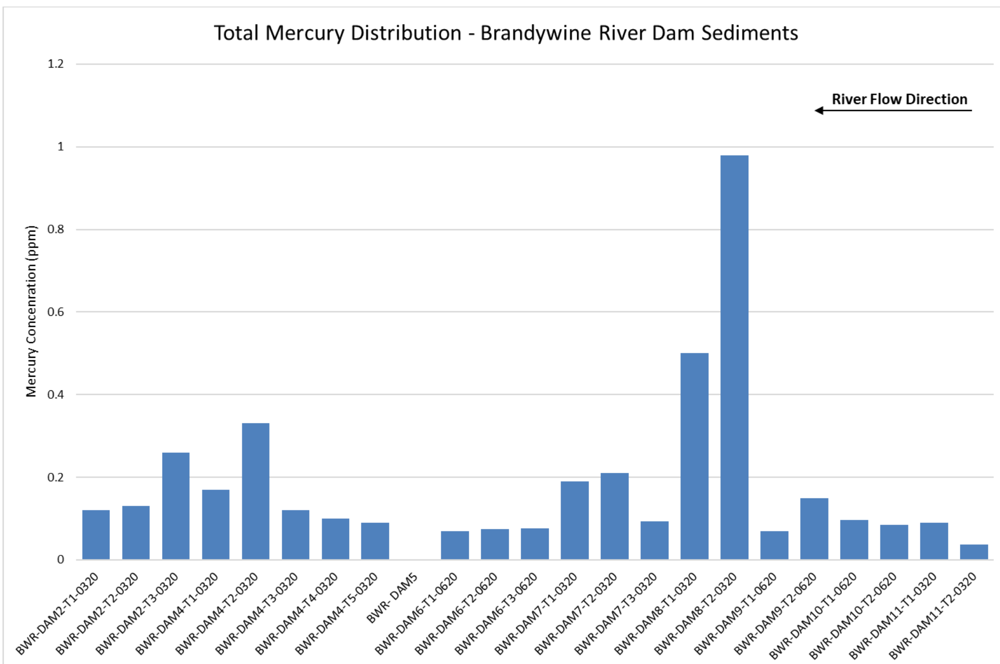
The estimated porewater concentration of arsenic exceeded the applicable human health water quality criterion (fish and water ingestion) in 15 of the 22 composite sediment samples collected during this study ($T.U._{hh}$ values ranged from 1.07 to 2.15). The calculated porewater concentration of thallium exceeded the human health criterion in all 22 composite samples collected during this study ($T.U._{hh}$ values ranged from 1.50 to 7.26). Median predicted porewater concentrations for arsenic and thallium across all sampling sites were 12.12 micrograms per liter (µg/L) and 5.13 µg/L, respectively. Each of these predicted concentrations slightly exceeds the human health criteria (set at the EPA Maximum Contaminant Level (MCL)) for drinking water and eating fish (10 µg/L for arsenic and 2 µg/L for thallium), and, as cautioned earlier, needs to be assessed more closely. The major assumption in this particular evaluation is that concentrations of metals in sediment porewater and overlying surface waters are equal. It is highly unlikely that this it truly the case, and dilution from surface water likely mitigates any potential risk. To evaluate this hypothesis, the most recent City of Wilmington Surface Water Quality Report (2019) was reviewed. The report indicates that "primary parameters," or "contaminants that are regulated by an MCL," are assessed at entry points to the municipal distribution system. This includes sampling and analysis of metals at the filter plant on the Brandywine River, just upstream of Dam #2. The most recently published data indicates that neither arsenic nor thallium were detected in the river water at detectable concentrations. As such, it is concluded that dilution is occurring, and that there is no increase in human health risk associated with arsenic or thallium.

Finally, a comparison of metals concentrations in the sediment samples to DNREC-RS Soil Screening Levels (DNREC, 2013) was conducted to evaluate whether concentrations of metals in sediment would pose a risk to human health if sediment were excavated/removed, dewatered, and deposited in an upland setting (as soil). Here, human exposure is based primarily upon incidental ingestion and inhalation. As shown in Table 3-3, thallium exceeded the RS human health soil screening level in each of the 22 composite samples. Estimated concentrations of thallium were reported for 6 of the 22 composite samples. The remainder were reported as “not detected” but at a detection limit that’s higher than the regulatory standard. Antimony exceeded its human health soil screening level in one of 22 composite samples. As discussed previously, an exceedance of soil screening levels does not indicate risk. However, it focuses the assessment of risk under specific use scenarios (and therefore specific exposure parameters) through the use of the United States Environmental Protection Agency (USEPA) supported Risk Assessment Information System (RAIS) online risk calculator. Maximum detected concentrations, and therefore the most conservative values (worst case scenario) for antimony and/or thallium, were used in the RAIS online risk calculator. Results indicated that human health risk from these compounds are not expected under the "recreator use scenario," "excavation worker scenario" or "residential use" scenario.

More detailed information regarding the approach used for this assessment and its results is included in the BWR_2020_Metals_Final spreadsheet included in Appendix C. RAIS output is included in Appendix D.

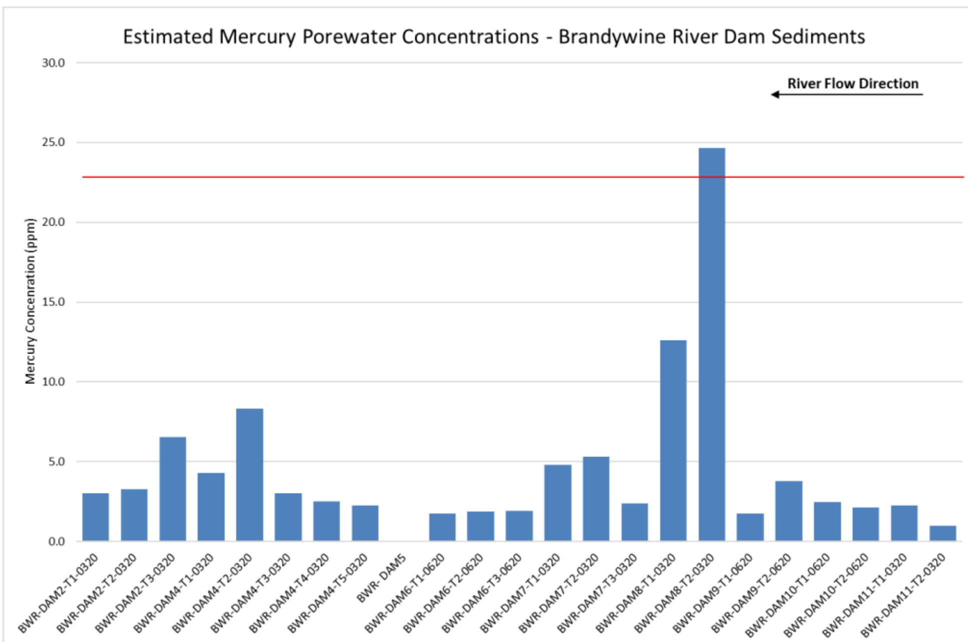
3.2.2 Mercury Assessment

Total mercury was detected in all of the sediment samples collected from the Brandywine River at concentrations exceeding method detection limits. Concentrations ranged from 0.038 milligrams per kilogram (mg/kg) at Dam 11 Transect 2 to 0.98 mg/kg at Dam 8 Transect 2. The plot below shows total mercury concentration in sediments at each sample location.



To evaluate potential toxicity of mercury to benthic aquatic life, the total dissolved concentration of mercury in the sediment porewater was estimated by dividing the bulk sediment concentration by the sediment to porewater metal partition coefficient published by the USEPA (USEPA, 2005a). The resulting dissolved total inorganic metal concentration in the pore water was then compared to applicable freshwater acute and chronic water quality criteria for the protection of aquatic life. The ratio of the estimated mercury concentration in the porewater to the applicable criterion was expressed as toxic units, where ratios greater than 1 suggest exposure concentrations in excess of the criterion. Predicted mercury concentrations in porewater did not exceed the freshwater acute or chronic criteria for protection of aquatic life. All toxic unit values were less than 1.

To assess the potential for bioaccumulation of mercury and associated human health risk at each sample location, an acceptable mercury fish tissue concentration was utilized. Delaware Surface Water Quality Standards (DNREC, 2011), Table 2, lists a methyl-mercury concentration in fish tissue of 0.3 milligrams per kilogram (mg/kg) as the safety threshold for safe human consumption (from fish and water ingestion). In order to determine whether the total mercury concentration estimated in sediment porewater could cause human health impacts through bioaccumulation, the 0.3 mg/kg fish tissue threshold concentration for methylmercury was used to back calculate a comparable total mercury porewater concentration. The conservative assumption that porewater concentrations are equal to overlying surface water concentrations was used again here. The resulting water quality target was calculated to be 23.1 nanograms per liter (ng/L), or 0.0231 µg/L, total mercury in porewater. As shown in the diagram below, the highest resulting estimated porewater concentration was 24.7 ng/L at Dam 8 Transect 2, just over the calculated criterion. All other results ranged from 0.9 ng/l to 12.5 ng/l, which is 1.8 to 25 times lower than the calculated water quality target of 23.1 ng/L for protection of human health from eating fish. As a result, and considering the conservative model assumptions, overall toxicity due to bioaccumulation of mercury is not expected. To a more direct line of evidence, the most recent fish tissue data collected (2015) indicates that mercury did not exceed regulatory thresholds in any of the 4 composite fish tissue samples collected from the non-tidal Brandywine River (Greene, 2016a).



Finally, a comparison of mercury concentrations in the sediment samples to DNREC-RS Soil Screening Levels (DNREC, 2013) was conducted to evaluate whether concentrations of mercury in sediment would pose a risk to human health if sediment were excavated/removed, dewatered, and deposited in an upland setting. Here, human exposure is based primarily upon incidental ingestion and inhalation. As shown in Table 3-3, none of the sample results for total mercury exceeded the applicable soil screening level.

More detailed information regarding the approach used for this assessment and its results is included in the BWR_2020_Mercury_Final spreadsheet included in Appendix C.

3.2.3 Polychlorinated Biphenyl (PCB) Assessment

PCBs were detected in the sediment sample at Dam 4 Transect 1 at a concentration of 69.0 micrograms per kilogram (µg/kg), or parts per billion (ppb). PCBs were not detected at concentrations exceeding the method detection limit at any other samples analyzed during this study.

The approach used to evaluate potential toxicity of PCBs in sediments to benthic aquatic organisms follows that of Fuchsman et. al. (2006), with minor modification. The aim of the approach is to determine an organic carbon normalized concentration in the sediments that is in equilibrium with a porewater concentration equal to the chronic aquatic life criterion (0.014 µg/L). Fuchsman (2006) refers to such an organic carbon normalized sediment concentration as a Sediment Quality Benchmark (SQB). If the ratio of the measured organic carbon normalized concentration in the sediment to the SQB is less than 1, then chronic aquatic life toxicity in the sediments is unlikely. Ratios greater than 1 indicate that the porewater exposure may be high enough to cause toxicity to benthic aquatic life. Utilizing the sample result at Dam 4 Transect 1, the ratio was 0.15, which is below 1, thereby indicating that benthic aquatic life toxicity due to PCBs is not expected.

Because the Brandywine River is used as a drinking water source for the City of Wilmington, the calculated dissolved porewater concentration at each location was next compared to Delaware's Water Quality Criteria for Protection of Human Heath (from fish and water ingestion) (DNERC, 2011). Under the assumption that the porewater concentration is the same as the surface water concentration, the estimated porewater concentration of 0.00212 µg/L at Dam 4 Transect 1 is approximately 30 times greater than the referenced surface water quality criterion of 0.000064 µg/L. This indicates the potential for human health impact from fish and water ingestion. For additional context, the drinking water MCL for PCBs is 0.5 µg/L (DNREC, 2011), which is more than 200 times greater than the estimated concentration of 0.00212 µg/L at Dam 4 Transect 1. Therefore, the identified risk seems to be dominated by the potential for consumption of fish that have bioaccumulated PCBs.

To further assess the potential for PCBs in the sediments to contribute to bioaccumulation, the total PCB concentrations in the samples were compared to a calculated bioaccumulation-based sediment quality criterion (BBSQC) (Greene, 1997). The BBSQC represents a bulk sediment concentration that equates to an acceptable fish tissue concentration for protection of human health from adverse health effects. The sample collected from Dam 4 Transect 1 exceeds the BBSQC of 33.2 ppb by a factor of 2.08. Because PCBs were not detected at concentrations above the method detection limit in any of the other samples, none exceeded the BBSQC.

PCBs are the primary risk driver for fish consumption advisories in Delaware (including in the non-tidal Brandywine River), and to provide additional context as to the source of PCB impacts to fish, the same calculations described above to assess potential PCB risk to aquatic life and human health were conducted utilizing laboratory results for non-detected (or 'U' qualified) data set equal to ½ the laboratory method detection limit, and equal to the method detection limit (MDL). Further, assessment data (sediment and surface water) measured in 2015 from the non-tidal Brandywine River were reviewed for comparison to estimated values. The 2015 samples were analyzed for PCBs by a more sensitive, high resolution method (USEPA Method 1668). Sediment and surface water analytical data from two non-tidal locations, Smith Bridge and the "City Dam" (Dam #2), indicated that total PCB concentrations in sediment were 9.13 and 7.21 µg/kg (ppb), respectively. By comparison, concentrations of PCBs derived in this assessment from using ½ the MDL ranged from approximately 10 µg/kg to 15 µg/kg at all locations. In addition, predicted porewater PCB concentrations utilizing ½ the MDL (mean concentration from 22 sites of 0.000506 µg/L) are similar to dissolved PCBs measured in surface water at the same two locations in 2015 (0.000734 µg/L and 0.000509 µg/L). From this, it can be concluded that results from the current (2020) assessment of PCBs utilizing ½ the MDL more closely represents actual conditions. Based upon review of the assessment, all conclusions stated above regarding potential toxicity to benthic aquatic life and comparison of data to the BBSQC are unchanged. However, instead of only one exceedance of the criterion developed to protect humans from drinking water and eating fish containing PCBs, each of the 22 estimated porewater concentrations exceeded the criterion. Further, since measured concentrations of dissolved phase PCBs in surface water in 2015 are very similar to estimated porewater concentrations calculated from this study, the assumption that porewater concentrations of PCBs are the same (generally) as surface water concentrations is verified. Finally, and as a result of all of the lines of evidence presented, it appears that relatively low concentrations of PCBs in sediment porewater are likely contributing to surface water concentrations (or vice versa) that contribute to bioaccumulation in fish. At the time of this assessment a consumption advisory was in place that recommended eating no more than six 8oz servings of fish per year from the non-tidal Brandywine River.

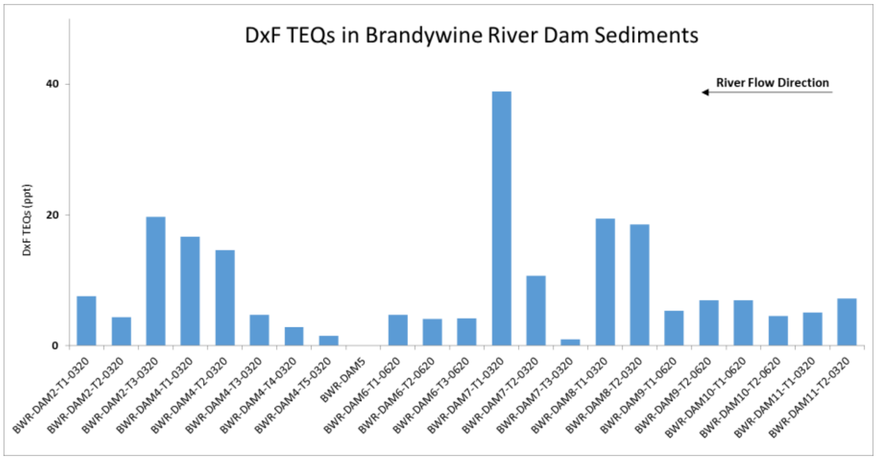
Finally, a comparison of PCB concentrations in the sediment samples to DNREC-RS Soil Screening Levels (DNREC, 2013) was conducted to evaluate whether concentrations of PCBs in sediment would pose a risk to human health if sediment were excavated/removed, dewatered, and deposited in an upland setting. Here, human exposure is based primarily upon incidental ingestion and inhalation. As shown in Table 3-4, none of the sample PCB results exceeded the applicable soil screening level (even if ½ MDL is assumed).

More detailed information regarding the approach used for this assessment and its results is included in the BWR_2020_PCB_Final spreadsheet included in Appendix C.

3.2.4 Dioxins and Furans Assessment

Dioxins and Furans were detected in all of the Brandywine River samples at concentrations exceeding method detection limits. Of the dioxin and furan compounds present, OCDD (1,2,3,4,6,7,8,9-octachlorodibenzodioxin) dominates on a weight percentage basis, a finding which is consistent with sediments throughout the region and the country (Hites, 1990; Wenning et.al., 1993; Bonn, 1998).

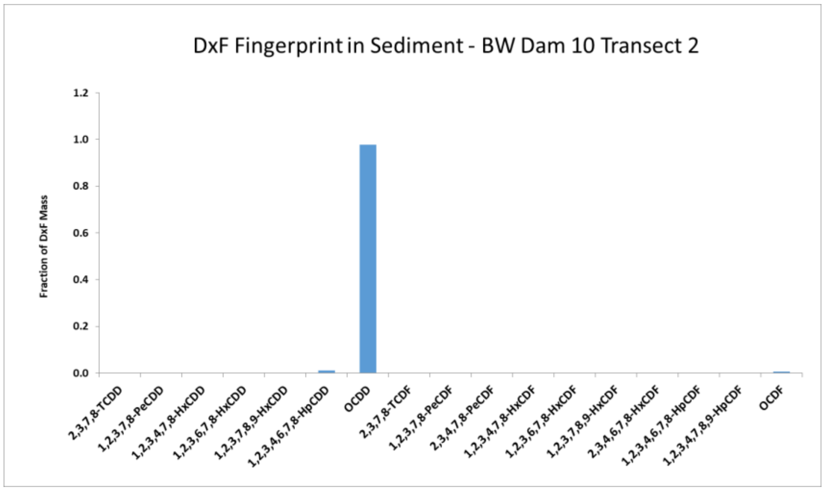
The approach used to assess potential toxicity to benthic aquatic life was to first calculate dioxin-like (2,3,7,8-TCDD) Toxicity Equivalency Quotients (TEQs) for each sample by multiplying the concentration of each dioxin and furan compound detected by its associated toxicity equivalence factor, or TEF (Van den Berg, et.al., 2006). The sum of individual TEFs for each sample is its TEQ. The diagram below shows the distribution of total dioxin and furan TEQ values across the study area.

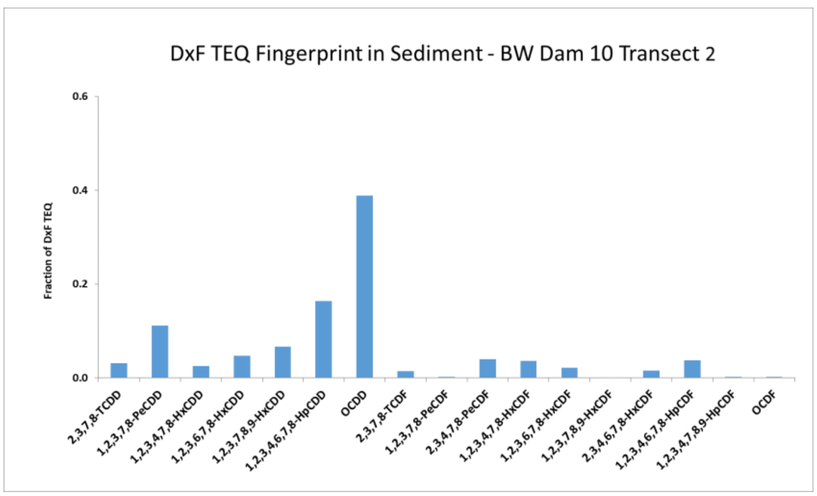


Insight into the nature and source of the dioxins and furans in each sample was deduced by calculating the weight percent contribution of each dioxin and furan compound to the total. Knowing the relative contribution of each compound in a sample is important because it provides a type of chemical fingerprint. This, in concert with other information, may in turn provide clues regarding potential sources, especially when the fingerprint is unusual or unique in some way. This fingerprinting technique was also extended to TEQs, where the fractional contribution of each dioxin and furan compound to the total TEQ in each sample was calculated and plotted.

Chemical fingerprinting indicates a highly similar profile at all 22 sediment sampling sites in the Brandywine River, with OCDD dominating the dioxin and furan mass present in the samples (contributing between 78.3% and 97.7% of the dioxin and furan mass). A similar compound, 1,2,3,4,6,7,8-HpCDD, was second most abundant, contributing between 1.2% to 2.8% of the dioxin and furan mass. The results for Brandywine River sediment samples are quite similar to the broader Christina Basin and Shellpot Creek where OCDD has been found to contribute an average of 94% of the dioxin and furan mass in surface sediments and 1,2,3,4,6,7,8-HpCDD contributed an average of 2.9% of the mass (Greene, 2009). As an aside, OCDD also dominates the dioxin and furan mass in surface water, and to a lesser degree, biota samples collected from the Christina Basin and Shellpot Creek (Greene, 2009). This common fingerprint across a fairly large area indicates a similar pathway through which OCDD enters the aquatic environment, including the Brandywine River. It is suggested here that air deposition may be the primary source. We can take some comfort in knowing that the overall emissions of dioxins and furans (including OCDD) appear to be declining over time in the U.S. (USEPA, 2006). This trend also appears to be occurring in the Christina Basin based upon dated sediment cores which show higher dioxin and furan concentrations in the past (Velinsky et.al, 2010).

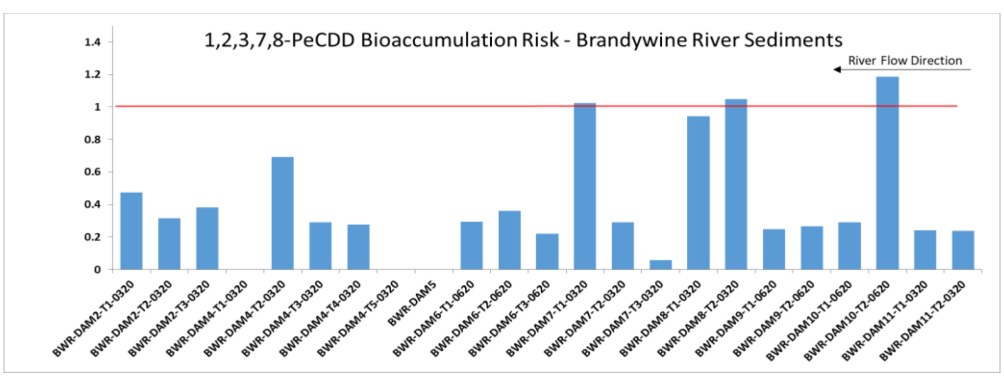
We can also take comfort in knowing that the most abundant dioxin and furan compound in the sediments, OCDD, is the least toxic among this class. Consequently, OCDD's contribution to dioxin-like TEQs is much less than its mass contribution to total dioxins and furans. This is demonstrated below for the sample collected from Dam 10 Transect 2. The maximum contribution of OCDD on a mass basis was 97.71%, while on a TEQ basis, OCDD contributed a more modest 38.8% in this same sample.





Equilibrium partitioning calculations were again performed to assess potential toxicity of dioxin and furan compound to benthic aquatic life. The overall approach mirrors the method described above for PCBs (Fuchsman et al., 2006) but was adapted here for dioxins and furans. The idea is to predict an organic carbon normalized sediment concentration in equilibrium with a porewater concentration set equal to the applicable aquatic life protection criterion. The resulting SQB is then compared to actual organic normalized field data for the contaminant of interest. The comparison is expressed as the ratio of the field data to the criterion, where the ratio for acute effects is referred to as acute toxic units ($T.U._{a}$) and the ratio for chronic effects is referred to as chronic toxic units ($T.U._{c}$). $T.U._{a}$ and $T.U._{c}$ values greater than 1 indicate that the predicted exposure concentration exceeds the acute and chronic criteria, respectively. In usual circumstances, acute and chronic aquatic life criteria would be taken from Delaware's Surface Water Quality Standards (DNREC, 2011) or from EPA's recommended water quality criteria (USEPA, 2002). Aquatic life criteria for dioxins and furans do not exist in either of those documents. However, a close examination of EPA's Ambient Water Quality Criteria for 2,3,7,8-tetrachloro-dibenzo-p-dioxin (EPA, 1984) indicates that acute values for some freshwater aquatic species are >1.0 µg/L; some chronic values are <0.01 µg/L; and the chronic value for rainbow trout is <0.001 µg/L. Although this information was insufficient to allow USEPA to develop national criteria, it does provide a rough estimate of the aquatic toxicity of the specific compound 2,3,7,8-TCDD. To that end, this analysis assumes that the acute toxicity of 2,3,7,8-TCDD to aquatic life may occur at exposure concentrations of 1 µg/L, while chronic toxicity may occur at an exposure concentration of 0.001 µg/L. Results of the assessment indicate that $T.U._a$ and $T.U._c$ values are orders of magnitude less than 1, and therefore the presence of 2,3,7,8-TCDD specifically is not expected to cause acute or chronic aquatic life toxicity to benthic organisms living in and on the Brandywine River sediments.

Another part of the assessment involved evaluating the potential for certain dioxins in the sediments to bioaccumulate in the aquatic food chain & contribute to human health impacts related to fish consumption from the Brandywine River. As previously discussed, the approach involved comparing organic carbon normalized dioxin concentrations in the sediments to a BBSQC that was back calculated from an acceptable fish tissue concentration (Greene, 1997). Again, the results are expressed as a ratio of the field concentration to the criterion with ratios greater than 1 indicating an increased likelihood of bioaccumulation in fish along with an increased risk to consumers of those fish. This part of the assessment focused on 3 particular dioxin compounds, OCDD and 1,2,3,4,6,7,8-HpCDD since they are the two most dominant dioxin and furan compounds in the Brandywine River sediments, and 1,2,3,7,8-PeCDD since it is generally the most prominent dioxin and furan compound in fish on a TEQ basis (Greene, 2008, 2009 and 2016a). The assessment for Brandywine River sediments indicates that OCDD and 1,2,3,4,6,7,8-HpCDD risk from the sediments is low and not of major concern. Risk from 1,2,3,7,8-PeCDD, however, is predicted to be slightly greater. The organic carbon normalized concentration of 1,2,3,7,8-PeCDD in the sediment is near or slightly greater than BBSQC calculated to prevent health risk to people who may consume the fish (see toxic unit plot below) at several locations, specifically at Dam 7 Transect 1 (T.U.=1.02), Dam 8 Transects 1 (T.U.=0.94) and 2 (T.U.=1.05), and Dam 10 Transect 2 (T.U.=1.19).



This finding is tempered however by the fact that the reported concentration of 1,2,3,7,8-PeCDD at 20 of the 22 sampling sites was "J-qualified", meaning that the concentration fell between the MDL and the practical quantitation limit (PQL) and hence the concentration is only an estimate at those stations. Concentrations at the other two sites were "U-qualified," meaning that concentrations were not detected at all above the MDL. This aside, it is possible that 1,2,3,7,8-PeCDD is contributing to bioaccumulation risk and therefore human health risk related to fish consumption. Understanding that direct measurements are the best way to verify predictions, comparison of dioxin and furan results from this assessment to the most recent DNREC fish contaminant monitoring program data was performed. The most recent data, collected in 2015 for fish in the non-tidal Brandywine River, indicated that dioxins and furans (as TEQs) exceed regulatory thresholds for fish consumption in 2 of 4 composite samples (Greene, 2016a). As a result, there is a fish advisory in place, which includes dioxins and furans, to deter excessive fish consumption from the non-tidal Brandywine River.

As with other contaminants in this study, the human health assessment was expanded to include the potential risk from both consuming fish and drinking water from the Brandywine River. The assessment focused on OCDD, 1,2,3,4,6,7,8-HpCDD and 1,2,3,7,8- PeCDD for the same reasons stated above. Results predicted that all 22 sample locations would exceed the surface water quality criterion of $5.0\ E^{-9}$ µg/L (ppb) for 2,3,7,8-TCDD (as TEQs). Toxic units ranged from 4.5 at Dam 7 Transect 1 to 91.6 at Dam 4, Transect 1. The conservative assumptions that predicted porewater concentrations are in equilibrium with surface water applies, and that chemical concentrations are the same in sediment porewater and overlying surface water apply here. Again, the assumption is highly unlikely. Upon review of surface water data from samples collected in the Brandywine River in 2015, it appears that measured surface water concentrations of dioxins/furans were one to two orders of magnitude less than porewater concentrations predicted in this assessment. This indicates that diffusion from the sediments into the water column is most likely occurring, and therefore dilution from overlying surface water is also occurring. In addition, comparison of predicted porewater concentrations of the selected dioxins (as TEQs) to the USEPA established drinking water Maximum Contaminant Level for dioxin (2,3,7,8 TCDD) (USEPA, 2009) indicates no exceedances. In fact, predicted concentrations are orders of magnitude less than the drinking water MCL. Therefore, the majority of the risk associated with the applicable criterion appears to be based upon the potential accumulation of dioxins/furans into the bodies of fish that are subsequently consumed by humans.

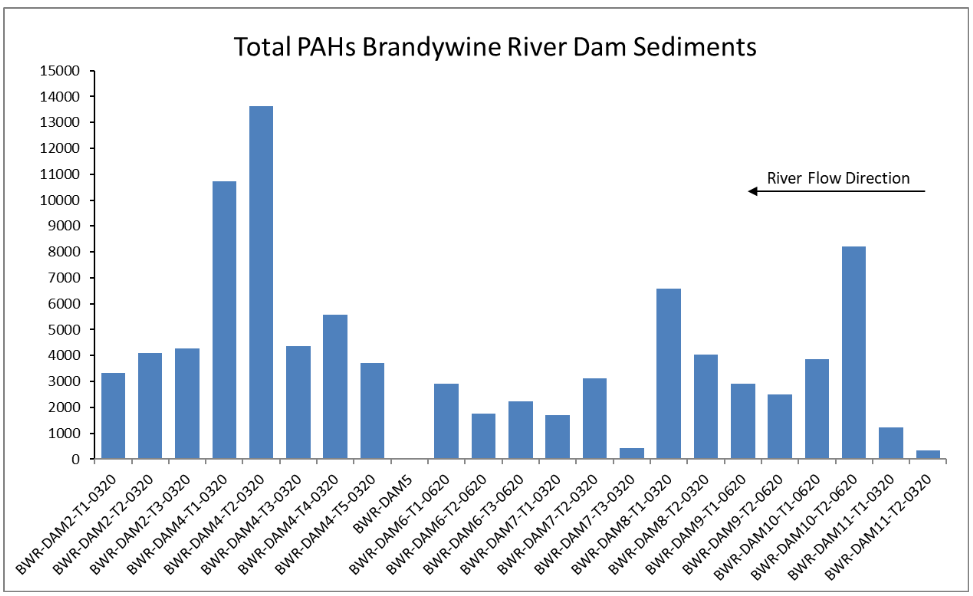
Finally, a comparison of total dioxin and furan TEQ concentrations in the sediment samples to DNREC-RS Soil Screening Levels (DNREC, 2013) was conducted to evaluate whether concentrations in sediment would pose a risk to human health if sediment were excavated/removed, dewatered, and deposited in an upland setting (data summarized in Table 3-4). Here, human exposure is based primarily upon incidental ingestion and inhalation. Total dioxin and furan TEQs ranged from 1.48 parts per trillion (ppt) at Dam 4 Transect 5, to 38.85 ppt at Dam 7 Transect 1. The screening value for 2,3,7,8-TCDD (as TEQs) is 4.8 ppt. Exceedances ranged from 5.05 ppt to 38.85 ppt and occurred at 13 of the

22 sample locations. Since the criteria used for this comparison were developed as screening levels, further evaluation is necessary to determine whether the concentrations represent a risk under HSCA regulations. Utilizing the maximum concentration detected in any sample, and therefore the most conservative value for assessment of risk, the RAIS online risk calculator indicated that an increase in human health risk from contact with sediments is not expected under the "recreator use scenario," "excavation worker scenario" or "residential use" scenario.

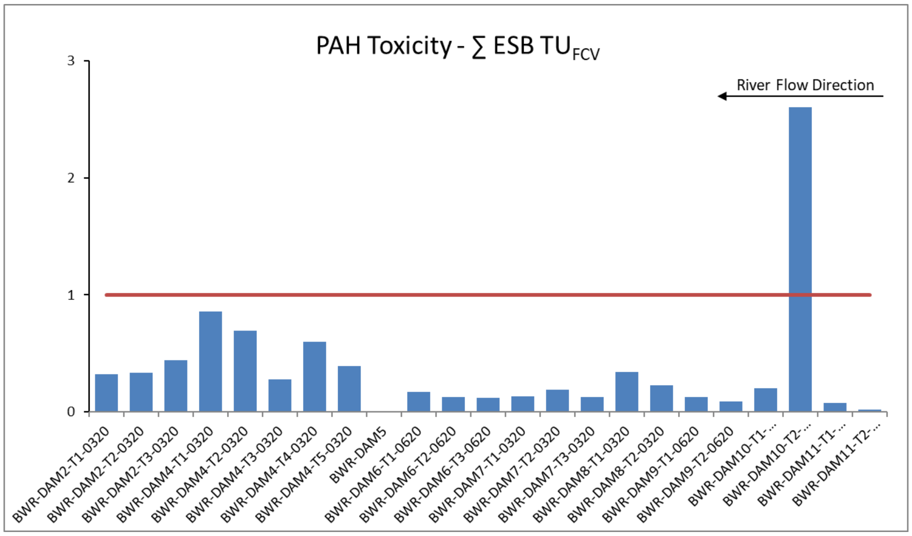
More detailed information regarding the approach used for this assessment and its results is included in the BWR_2020_DxF_Final spreadsheet, included in Appendix C. RAIS calculations are included in Appendix D.

3.2.5 Polycyclic Aromatic Hydrocarbon (PAH) Assessment

Total PAHs were detected in each of the samples collected, at concentrations between 349.3 ppb and 13,628 ppb. The plot below shows the distribution of total PAHs across the study area.



The approach used to assess potential toxicity to benthic aquatic life from PAH mixtures in sediments was to compare organic carbon normalized field data for individual parent and alkylated PAH compounds to equilibrium partitioning sediment benchmarks (ESBs) (Burgess, et. al., 2013). ESBs for (PAHs) were derived based on EqP and are expressed on an organic carbon basis. ESBs for 34 parent and alkylated PAH compounds were taken directly from Burgess et.al. (2013). As with other compounds assessed in this report, the comparisons are expressed as the ratio of the organic carbon normalized field result for each parent and alkylated PAH compound to the associated ESB for those same compounds. Per Burgess et.al. (2013), the individual ratios are summed for each sample and expressed as toxic units ($\sum$ ESB TU_{FCV}). The "FCV" subscript is an abbreviation for final chronic value, reflecting the intent of the ESB to protect benthic aquatic life against longer term chronic effects as opposed to shorter term acute effects. Toxicity units greater than 1 indicate that porewater exposure concentrations may be high enough to cause toxicity to benthic organisms. Results, shown below, indicated that the largest chronic toxicity unit value calculated was 2.60 at Dam 10 Transect 2, which is greater than 1, thereby indicating that chronic toxicity due to PAHs is possible at this location.



Porewater concentrations were estimated for additional individual PAHs for comparison to Delaware human health water quality criteria for fish and water ingestion (DNREC, 2011), since the Brandywine River is used as a drinking water source for the City of Wilmington. The method involved predicting the concentration of each PAH compound in the sediment porewater using EqP principles (Di Toro, 1991; Di Toro, 2000a; Di Toro, 2000b; USEPA, 2003). Three individual PAH compounds were estimated to be above referenced water quality criteria in Brandywine River sediments. Again, a toxic unit approach was used to determine the magnitude of any exceedance of criteria. A toxic unit greater than one indicates that toxic impacts are possible. Toxics units greater than 1 were calculated for benzo(a)anthracene at Dam #2, Dam #4 and Dam #10. Toxic unit values ranged from 1.36 at Dam 4 Transect 5 to 14.2 at Dam 2 Transect 3. In addition, toxic units greater than 1 were calculated for benzo(b)fluoranthene at Dam #2 and Dam #10. Toxic unit values ranged from 1.96 at Dam 10 Transect 2 to 2.03 at Dam 2 Transect 3. Finally, toxic units greater than 1 were calculated for benzo(a)pyrene at every dam samples except Dam #11, where the value was less than 1. Toxic unit values ranged from 1.04 at Dam 7 Transect 2 to 31.8 at Dam 2 Transect 3. The conservative assumption that predicted porewater concentrations are in equilibrium with surface water and that chemical concentrations are the same in sediment porewater and overlying surface water applies. That is highly unlikely in this case. Examining the data for benzo(a)pyrene specifically, none of the predicted porewater concentrations exceed the drinking water MCL for protection of human health (USEPA, 2009). Therefore, the majority of the risk associated with the applicable criterion (and therefore the number of exceedances of the criterion) appears more heavily based upon the potential accumulation of PAHs into the bodies of fish that are subsequently consumed by humans. Understanding that direct measurements are the best way to verify predictions, a comparison of Brandywine River PAH data in fish tissue from the most recent DNREC fish contaminant monitoring program sampling was performed. The most recent data, collected in 2015 for fish in the non-tidal Brandywine River, indicates that PAHs (specifically benzo(a)pyrene TEQs) do not exceed regulatory thresholds for fish consumption (Greene, 2016a). Therefore, although potential impacts to human health are predicted based upon the conservative approach used, direct measurement of PAHs in fish tissue as compared to health based criteria demonstrate that they are not accumulating in Brandywine River fish at concentrations that would cause impact to humans.

Finally, in order to evaluate the potential risk to humans if sediment were excavated/removed, dewatered, and deposited in an upland setting, concentrations of PAHs in sediment samples were compared to the DNREC-RS Soil Screening Value for protection of human health (DNREC, 2013). Here, human exposure is based primarily upon incidental ingestion and inhalation. As shown in Table 3-5, benzo(a)pyrene was the only compound detected at concentrations exceeding its screening level. Exceedances ranged from 260 ppb to 600 ppb (screening level is 240 ppb) and occurred at 8 of the 22 sample locations. Since the criteria used for this comparison were developed as screening levels, further evaluation is necessary to determine whether the concentrations represent a risk under HSCA regulations. Utilizing the maximum concentration detected in any sample, and therefore most conservative value for assessment of risk, the RAIS online risk calculator indicated that human health risk from contact with sediments is not expected under the "recreator use scenario," "excavation worker scenario" or "residential use" scenario.

More detailed information regarding the approach used for this assessment and its results is included in the BWR_2020_PAH_Final spreadsheet, included in Appendix C. RAIS calculations are included in Appendix D.

3.2.6 Pesticide Assessment

Two pesticides were detected in the Brandywine River dam sediment samples at concentrations that exceeded their associated laboratory method detection limit, including 4,4-DDE at Dam 8 Transect 1 (3.8 ppb) and 4,4-DDT at Dam 2 Transect 1 (4.1 ppb). Over 90% (20 out of 22 stations) of the results were 'non-detected' for all pesticides tested. And of those two stations with detections, only one individual pesticide had a reportable concentration in each sample.

The approach to assess potential toxicity to benthic aquatic life from organochlorine pesticides in sediments was to utilize EqP calculations to predict the concentration of the contaminant in the porewater. This is done by dividing the reported bulk sediment concentration of the contaminant by a calculated sediment-water partition coefficient. The resulting estimated porewater concentration is then compared to Delaware's acute and chronic aquatic life criteria (DNREC, 2011). Results of the comparisons are expressed as the ratio of the predicted exposure concentration in the sediment porewater to the applicable acute and chronic aquatic life criteria. The ratio using the acute criterion is referred to as acute toxic units ($T.U._{a}$). The ratio using the chronic criterion is referred to as chronic toxic units ($T.U._{c}$). Toxic unit values greater than 1 indicate that the predicted exposure concentration exceeds the associated criterion and that there is an increased likelihood of impact to benthic aquatic life.

Results of the comparison indicate that acute toxicity is not predicted at either of the locations where pesticides were detected. Chronic toxicity is, however, predicted at both transect locations. $T.U._{c}$ were calculated to be 3.8 for DDE at Dam 8 Transect 1 and 4.1 for DDT at Dam 2 Transect 1. It is important to recognize that the chronic aquatic life criterion of 0.001 µg/L used for DDT, DDD, and DDE is based on a methodology that USEPA no longer supports (the Tissue Residue Value approach). Although these criteria were used for this assessment, there is good reason to believe that they significantly overstate the risk of chronic toxicity to aquatic life by up to 100 times. This metric was derived by dividing the acute toxicity criterion for DDT, DDD and DDE (1.1 µg/L) by a conservative yet reasonable acute to chronic ratio of 10. This provides an alternative estimate of the chronic toxicity of DDT, DDD and DDE of 0.11 µg/L, which is 110 times greater than the outdated chronic criterion of 0.001 µg/L. Using the alternative chronic criterion, chronic toxic units fall to 0.04 at Dam 2 Transect 1 and 0.06 at Dam 8 Transect 1 (both less than 1).

Predicted porewater concentrations were also compared to Delaware human health water quality criteria for fish and water ingestion, since the Brandywine River is used as a drinking water source for the City of Wilmington (DNREC, 2011). Pesticide compounds in porewater were estimated to be above the referenced criteria. Again, a toxic unit approach was used to determine the magnitude of any exceedance of criteria. Toxics units greater than 1 were calculated for DDT at Dam 2 Transect 1 (T.U.=20.3) and for DDE at Dam 8 Transect 1 (T.U.=30.5). Note that the human health criterion for DDT and its metabolites (DDE and DDD) is the same for just fish ingestion as it is for ingestion of both fish and water. Therefore, the potential for the pesticides detected in the sediments to bioaccumulate in the aquatic food web and contribute to fish contamination in the Brandywine River was further assessed. As with some other compounds, the approach involved comparing organic carbon normalized concentrations in the sediments to a BBSQC that was back calculated from an acceptable fish tissue concentration (Greene, 1997). Again, the results are expressed as a ratio of the organic carbon normalized sediment concentration to the criterion with ratios greater than 1 indicating an increased likelihood of bioaccumulation in fish along with an increased risk to consumers of those fish. Organochlorine pesticide results from both samples were less than the calculated BBSQC (toxic units less than 1), indicating that the bioaccumulation risk is low.

Concerning the apparent potential for human health impacts from fish and water ingestion, this assessment conservatively assumes that predicted concentrations in sediment porewater are in equilibrium with surface water, and that concentrations in surface water and porewater are equal. Review of 2015 surface water data for chlorinated pesticides indicates that this assumption is unlikely. Upon review of surface water data from samples collected in the Brandywine River in 2015, it appears that measured surface water concentrations of DDT and DDE were approximately two orders of magnitude less than porewater concentrations predicted in this assessment. This indicates that diffusion from the sediments into the water column is most likely occurring, and therefore dilution from overlying surface water is also occurring. There is not currently an MCL for DDT or DDE for comparison to drinking water standards.

To validate the predicted results, pesticide data from the most recent DNREC fish contaminant monitoring program were reviewed. The most recent data, collected in 2015 from fish in the non-tidal Brandywine River, indicated that organochlorine pesticides (specifically DDT and DDE) do not exceed regulatory thresholds for fish consumption. Therefore, although potential impacts to human health are predicted based upon the conservative approach and criteria used for comparison, direct measurement of pesticides in fish tissue demonstrate that they are not accumulating in Brandywine River fish at concentrations that would cause impact to humans.

Finally, a comparison of pesticide concentrations in the sediment samples to DNREC-RS Soil Screening Levels (DNREC, 2013) was conducted to evaluate whether concentrations of DDT and DDE in sediment would pose a risk to human health if sediment were excavated/removed, dewatered, and deposited in an upland setting. Here, human exposure is based primarily upon incidental ingestion and inhalation. As shown in Table 3-6, none of the pesticide results exceeded their applicable soil screening levels.

More detailed information regarding the approach used for this assessment and its results is included in the BWR_2020_Pesticide_Final spreadsheet included in Appendix C.

3.2.7 Per- and Polyfluoroalkyl Substances (PFAS) Assessment

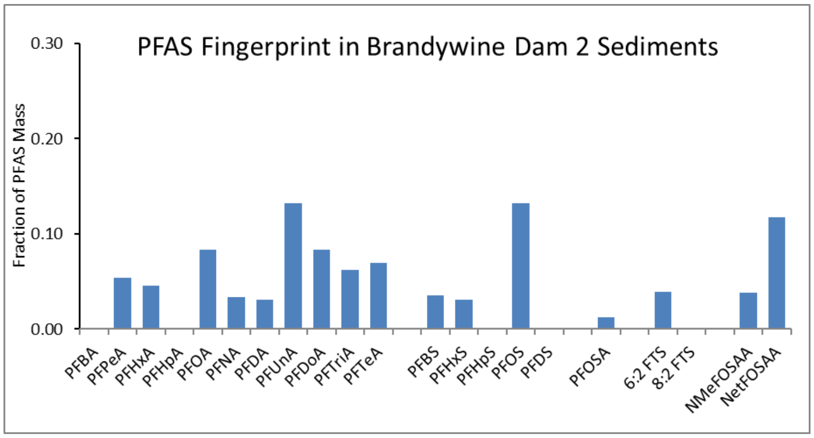
PFAS are a large and complex class of anthropogenic compounds whose prevalence in the environment are an emerging, worldwide priority in environmental and human health (ITRC, 2020). Because of this, and because such little data exists regarding PFAS in Delaware, any information related to its magnitude and distribution in the environment is valuable. DNREC viewed the Brandywine River Dam Sediment Assessment as an opportunity to collect some information. Therefore, the Transect 1 composite sample at each dam location was analyzed for PFAS compounds in addition to the others evaluated above. PFAS compounds were detected using USEPA Method 537 (Modified) at each of the transect location sampled during this assessment.

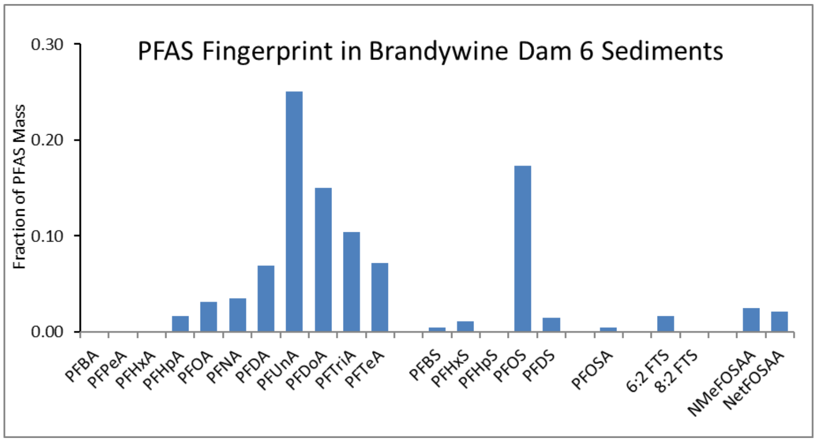
Because the science is still advancing with regards to toxic effects of PFAS compounds to both human and ecological receptors, it is difficult to put detected concentrations into the context of risk. In fact, there are currently only a few states in the country that have any specific criteria related to PFAS compounds, and analytical methods and compound lists are continuously developing. In most cases, the focus has been on human health impacts from drinking water containing PFAS, and in some cases from consuming PFAS impacted fish (fish consumption advisory levels). Peer reviewed studies indicate that exposure to perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS) over certain levels may result in adverse health effects (USEPA, 2020). Currently, EPA has established a Drinking Water Health Advisory for two PFAS compounds, PFOA and PFOS, of 70 parts per trillion (ppt), separate or combined (USEPA, 2016a & 2016b).

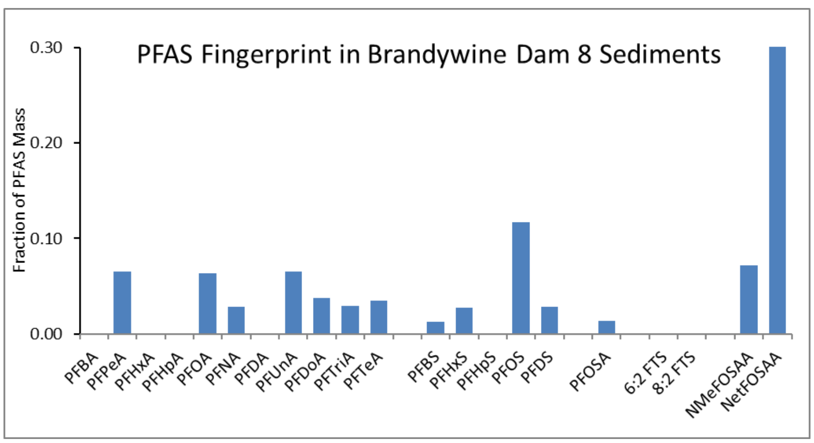
To understand whether PFAS compounds present in Brandywine River sediment samples are elevated enough to cause an impact to drinking water, data from the City of Wilmington's most recent (2019) Water Quality Report was reviewed. According to Table 3 of the report, PFBS, PFhpA, PFHxA, PFNA, PFOS and PFOA were detected at the intake upsteam of Dam #2 at concentrations ranging from 2.3 parts per trillion (ppt)(PFBS) to 8.15 ppt (PFOA). PFOS was detected in the water sample at a concentration of 3.35 ppt. Both PFOA and PFOS concentrations are below the USEPA Health Advisory Level of 70 ppt (individual or combined).

Aside from the USEPA Health Advisory Level for drinking water, the only other criteria that DNREC has established/adopted to date is for PFOA and PFOS in soil. DRNEC-RS soil screening values are generally adopted from USEPA soil screening values (DNREC, 2013), and currently include a screening value of 16 mg/kg (ppm) PFOA and 6 mg/kg (ppm) PFOS. Comparison of sediment data to these criteria are applicable if sediment is excavated/removed, dewatered, and deposited in an upland setting. As shown in Table 3-7, the concentrations of PFOA and PFOS detected in the Brandywine River dam sediments are several orders of magnitude less than the DNREC-RS human health soil Screening Levels.

In lieu of any additional human health or ecological criteria for which to compare results, the data collected from the Brandywine River dam sediments were organized and plotted based upon carbon chain length, and functional group (carboxylic acids, sulfonic acids, sulfonamides, etc.). Fingerprints, or mass contributions of each specific compound, were also calculated and plotted in a similar way to other compounds assessed during this study in order to determine if there were any trends that could be identified, and to further help understand the distribution of PFAS compounds in the environment. Several fingerprint examples are provided below to show the variation in results. No conclusions could be drawn at this time regarding trends through comparison of fingerprints.


PFAS Fingerprint in Brandywine Dam 2 Sediments
Fraction of PFAS Mass
0.30
0.20
0.10
0.00
PFBA
PFPeA
PFHxA
PFHpA
PFOA
PFNA
PFDA
PFUnA
PFDoA
PFTriA
PFTeA
PFBS
PFHxS
PFHpS
PFOS
PFDS
PFOSA
6:2 FTS
8:2 FTS
NMeFOSAA
NetFOSAA


PFAS Fingerprint in Brandywine Dam 6 Sediments
Fraction of PFAS Mass
0.30
0.20
0.10
0.00
PFBA
PFPeA
PFHxA
PFHpA
PFOA
PFNA
PFDA
PFUnA
PFDoA
PFTriA
PFTeA
PFBS
PFHxS
PFHpS
PFOS
PFDS
PFOSA
6:2 FTS
8:2 FTS
NMeFOSAA
NetFOSAA


PFAS Fingerprint in Brandywine Dam 8 Sediments
Fraction of PFAS Mass
0.30
0.20
0.10
0.00
PFBA
PFPeA
PFHxA
PFHpA
PFOA
PFNA
PFDA
PFUnA
PFDoA
PFTriA
PFTeA
PFBS
PFHxS
PFHpS
PFOS
PFDS
PFOSA
6:2 FTS
8:2 FTS
NMeFOSAA
NetFOSAA

4 Conclusions

Conclusions presented below only take potential toxicity to benthic aquatic life and human health into account. Assessment or consideration should be further given to impacts to aquatic life habitat that might be expected from the volume of sediment or from the geophysical characteristics of sediment released during dam modification, removal or failure. In addition, spatial distribution of data collected in this study indicate that there are certain areas of greater impact than others, even if toxicity is not predicted. Evaluation should be made at the time of specific project planning/implementation to determine if a benefit to the ecosystem as a whole could be accomplished as a result of sediment removal activities, and whether those activities would be cost effective. Positive results towards overall ecosystem recovery can be obtained through targeted actions.

Finally, the results provided below, with the exception of an example provided for PAHs, also do not consider the mixing of sediment from different transects at any dam location as a result of dam modification, removal or failure. This mixing would almost certainly lower the estimated overall risks (per dam location) that were identified for individual dam transects.

4.1 Sediment Volume

The sediment volumes calculated and reported in Table 3-2 do not necessarily represent the sediment load that will be mobilized through dam modification, removal or failure. Field observations and probe data collected during sampling indicated that significantly less sediment exists within the central portions of the river as compared to areas adjacent to the banks of the river. As such, the calculated sediment volumes are highly dependent upon the thickness of sediment along the banks of the Brandywine River. This is highlighted by the results for Dam #9, which has the lowest reported dam height of 2 feet. Method 1 used in the assessment, which should have resulted in a gross overestimate, resulted in a lower estimate of sediment volume than the estimates based upon field collected data. This discrepancy appears to be due to the ability to advance a probe to a depth of seven feet along the bank. The amount of sediment that will become mobilized during dam modification, removal or failure, however, will depend on the design of any modifications and/or the extent of removal or failure.

4.2 Metals

Despite the presence of metals in the samples, acute toxicity to aquatic life due to divalent metals is not expected. Data suggests that there is slight potential for chronic toxicity due to divalent metals at nine of the composited transect locations. However, as noted in the assessment summary above, the portion of the modeled risk due to cadmium may be overstated, which would make any chronic toxicity to benthic aquatic life less likely. Further, the distribution of IWBU values is relatively consistent from Dam 2 to Dam 11. Therefore, any release of sediment and associated porewater during dam modification, removal or failure is not likely to increase the risk of toxicity as compared to its current state.

In addition, although conservative assessment methods predicted the potential for human health impact due to arsenic and thallium from drinking water and eating fish from the Brandywine River, direct measurement of surface water by the City of Wilmington at the surface water intake to their water supply system verified that metals concentrations in the surface water are much less than predicted concentrations (i.e. model assumptions are false and dilution is taking place between sediment porewater and overlying surface water). Therefore, unacceptable human health risk due to metals in the sediment is not expected. As a result of the assessment conducted, and based on fate and transport considerations, the concentration of metals dissolved in the water column during dam modification, removal or failure is expected to be no greater than the dissolved concentrations in the porewater prior to any activity. Therefore, the overall effect of sediment release, planned or unplanned, is not expected to be any greater than it is currently.

Last, human health risk associated with incidental ingestion of metals in sediment from excavation work, trespassing, or residential re-use is not anticipated.

4.3 Mercury

Although mercury was detected in all of the Brandywine Dam sediment samples collected, neither acute nor chronic toxicity to benthic aquatic life was predicted.

Estimated porewater concentrations at one sample (Dam 8 Transect 2) slightly exceeded the calculated water quality target derived to protect humans from eating fish with elevated mercury concentrations. The remaining results were between 2 and 25 times lower than the calculated water quality target. As a result, and considering the conservative model assumptions, low to no overall toxicity due to bioaccumulation of mercury is expected. In addition, no fish advisories currently exist due to mercury within the non-tidal Brandywine River.

Last, human health risk associated with incidental ingestion of mercury in sediment is not anticipated.

4.4 PCBs

PCBs were detected in one sediment transect sample (Dam 4 Transect 1) at a concentration exceeding the method detection limit of EPA Method 680. Results of the assessment conducted indicate that the presence of PCBs is not expected to cause toxicity to benthic aquatic life.

Impacts to human health from PCBs are not expected from drinking Brandywine River water; however, there appears to be potential for PCBs to bioaccumulate in fish which are then consumed by humans. Review of available data verified the assumption that, at least for PCBs, estimated porewater concentrations are generally in equilibrium with and are equal to surface water concentrations. As a result, any removal of PCB mass would represent a net benefit to the system. Further, and as previously noted, PCBs are the main risk driver for fish consumption advisories in the non-tidal Brandywine River, therefore some exposure and bioaccumulation are occurring in fish. It is concluded, based upon results of this study, that there are dissolved PCBs in sediment porewater and surface water that collectively contribute to some level of bioaccumulation. Currently, a fish advisory exists in the non-tidal Brandywine River to limit human health impacts through this exposure pathway.

Based upon field observations (and probing data) at the Dam 4 Transect 1 location, there was little sediment in the central portion of the channel, and therefore sediment volume was limited to bank deposits. In addition, a Hazardous Substance Cleanup Act (HSCA) regulated Voluntary Cleanup Program site is located on the west bank of the Brandywine River at Dam 4, and PCB removal has occurred in relation to that site (see Section 4.3.1 below). The study results indicate that the presence of elevated PCB concentrations appears to be highly localized to this one location and should not contribute heavily to overall human health risk. PCBs dissolved in the water column during dam modification, removal, or failure is expected to be no greater than the dissolved concentrations in the porewater prior to dam removal, modification or failure. As a result, no increase in risk above what currently exists is expected, and institutional controls (fish advisories) are in place to limit any resulting human exposure.

Last, human health risk associated with incidental ingestion of PCBs in sediment is not anticipated.

4.4.1 Former PCB Source at Dam 4

There is a known former source of PCBs related to a HSCA site adjacent to Dam 4. The Former Wilmington Piece Dye Site/Bancroft Mills Site (DE-1304/DE-1695) is a 12-acre site that straddles Dam 4 on the west bank of the Brandywine River (also known as Rockford Falls Lower Parcel or The Falls). During a Remedial Investigation (RI) in 2016, total PCBs were reported at a concentration of 5.3 µg/kg in a sediment sample, and at a concentration of 237.6 µg/kg in the sample's duplicate (quality control sample). In addition, PCBs were detected in a soil sample collected during the RI near the location of the sediment sample and its duplicate.

A sediment removal action, overseen by DNREC-RS, took place to address the high concentration of PCBs discovered in sediment during the 2016 investigation. Very little sediment volume was found in the area and hand removal was required. A total of 5 gallons of PCB impacted sediment was removed. The overall lack of sediment in this portion of the Brandywine River was again confirmed during the 2020 sampling activities.

Subsequent evaluation of data collected in 2020 and comparison to 1997 and 2016 data indicates that there may be additional sources of PCBs. A summary of the subsequent evaluation can be found in Appendix E. More information regarding the HSCA investigation can be found through the Delaware Environmental Navigator (https://www.nav.dnrec.delaware.gov/DEN3/).

4.5 Dioxins and Furans

Dioxins and furans are present in the sediments of the Brandywine River. Of the dioxin and furan compounds present, OCDD dominates on a weight percentage basis, a finding which is consistent with sediments throughout the region and the country. OCDD is primarily derived from combustion sources, which are plentiful both near and far. Despite the presence of dioxin and furan compounds in the sediments, toxicity to benthic aquatic life is not expected, although there is uncertainty in this conclusion since aquatic toxicity information for these compounds is somewhat sparse. Review of TEQ fingerprints shows similar patterns between transect locations and dams, with a few exceptions.

With regard to potential human health impacts, the presence of certain dioxins, specifically 1,2,3,7,8-PeCDD, in the sediments of the Brandywine River poses a slightly elevated risk through the transfer of these chemicals from the sediments to fish and then to people who consume the fish at 4 of the 22 sample locations (transects). This prediction is supported by exceedances of fish tissue screening levels in samples collected from the non-tidal Brandywine River in 2015. Actual human exposure through this pathway is expected to be reduced because there is already a fish consumption advisory in place for the non-tidal Brandywine River. Risk related to human exposure via drinking water AND fish consumption was predicted based upon conservative model assumptions. However, upon further evaluation, exposure from drinking water, by itself, is not expected. Nevertheless, there are areas of the Brandywine River identified during this sediment evaluation that may contribute more to 1,2,3,7,8-PeCDD bioaccumulation in fish than other areas. Even though the potential for increased risk is relatively low at these locations, any removal of contaminant mass from the system would likely result in a net benefit from an exposure standpoint and should be considered during planning activities for dam modification or removal at those locations. However, based on fate and transport considerations, the concentration of dioxins and furans dissolved in the water column during dam modification, removal or failure is expected to be no greater than the dissolved concentrations in the porewater prior to any activity. Therefore, the overall effect of sediment release, planned or unplanned, is not expected to be any greater than it is already.

Last, human health risk associated with incidental ingestion of dioxin and furan compounds in sediment from excavation work, trespassing, or residential re-use is not anticipated.

4.6 PAHs

Overall, potential chronic toxicity to aquatic life from PAHs was observed for one sample (Dam 10 Transect 2). This assessment assumes, conservatively, that predicted concentrations in sediment porewater are in equilibrium with surface water. Further, the sediment samples collected from Dam 10 only represent the conditions on the western side of the river. Additionally, careful review of the data indicate that the composite sample collected at Dam 10 Transect 2 has the lowest reported concentration of total organic carbon of all samples collected. Organic carbon plays an important role in the bioavailability of many organic compounds, including PAHs. Note from the plots shown above that total PAH concentrations are higher at Dam 4 Transect 1 and Dam 4 Transect 2, but toxicity from PAHs is expected to be less than was predicted for Dam 10 Transect 2 (as shown by the sum of toxic units). TOC content at Dam 4 Transect 1 and Dam 4 transect 2 was measured at 1.6% and 2.6%, respectively. In contrast, the TOC content in the Dam 10 Transect 2 sample was measured at 0.4%. As an additional exercise, the TOC content was averaged between the two composited samples collected at Dam 10 to represent a mixing of the material through dam modification, removal, or failure. The same analysis was done to determine the sum of toxic units for the 34 reported PAHs (as described above) for the Dam 10 Transect 2 sample. Using an average TOC content of 1.4%, the resulting sum of toxic units was calculated to be 0.73, which is less than one. Additional sampling across the entirety of the river at Dam #10, or confirmation of TOC content would help to refine this assessment.

Potential impacts to human health from exposure to benzo(a)pyrene were predicted at almost every location sampled. Potential human health impacts were predicted from benzo(a)anthracene and benzo(b)fluoranthene at several of the locations sampled, as well. Further data analysis showed that assumptions used in the assessment of human health impacts were overly conservative. Predicted PAH concentrations in porewater were below applicable drinking water standards, and review of actual fish tissue data from samples collected in the non-tidal Brandywine River showed that bioaccumulation of PAHs is not occurring to an unacceptable degree.

As a result of the assessment conducted, and based on fate and transport considerations, the concentration of PAHs dissolved in the water column during dam modification, removal or failure is expected to be no greater than the dissolved concentrations in the porewater prior to any activity. Therefore, the overall effect of sediment release, planned or unplanned, is not expected to be any greater than it is currently.

Last, human health risk associated with incidental ingestion of PAH compounds in sediment from excavation work, trespassing, or residential re-use is not anticipated.

4.7 Pesticides

Organochlorine pesticides were not frequently detected in Brandywine River sediments. Concentrations of detected pesticides at Dam 2 Transect 1 and Dam 8 Transect 1 are not high enough to cause acute toxicity to aquatic life. However, depending on what criteria are used, there may be some chronic toxicity to benthic aquatic life at the two transect locations. Also, recall that the transect samples were collected as both horizontal and vertical composites, and that no other pesticides were detected in other transect samples. As stated above, these assessment results don't consider the mixing of sediment from different transects as a result of dam modification, removal, or failure.

Pesticide compounds in porewater were estimated to be above the referenced human health criteria at the same two locations specified above. No drinking water MCL exists for the pesticides detected, however more refined assessment and review of actual fish tissue data from samples collected in the non-tidal Brandywine River showed that bioaccumulation of pesticides is not occurring to an unacceptable degree.

As a result of the assessment conducted, and based on fate and transport considerations, the concentration of pesticides dissolved in the water column during dam modification, removal or failure is expected to be no greater than the dissolved concentrations in the porewater prior to any activity. Therefore, effects from the release of sediments through dam modification, removal or failure is not expected.

Last, human health risk associated with incidental ingestion of pesticides in sediment from excavation work, trespassing, or residential re-use is not anticipated.

4.8 PFAS

PFAS compounds were detected in all of the samples collected during this study. Due to the fact that Delaware/USEPA have not developed criteria for protection of aquatic life that are exposed to this class of chemicals, no conclusions can be made at this time.

With regards to human health, the only appropriate criteria available are for two compounds in drinking water and for two compounds in soil (PFOA and PFOS). Direct measurement of surface water by the City of Wilmington at the surface water intake to their water supply system verified that PFAS chemicals are present in the surface water. However, concentrations do not exceed the USEPA Health Advisory Level. Further, concentrations of PFOA and PFOS detected in sediment are not expected to cause human health risk associated with incidental ingestion from excavation work, trespassing, or residential re-use.

5 References

American Rivers. 2020. Frequently Asked Questions About River Restoration. Website. https://www.americanrivers.org/conservation-resources/rrformer/removing-dams-faqs/.

Bonn BA. 1998. Polychlorinated dibenzo-p-dioxin and dibenzofuran concentration profiles in sediment and fish tissue of the Williamette Basin, Oregon. Environ Sci Technol 32(6): 729-735.

Brandywine Conservancy. 2005. The Restoration of American Shad To the Brandywine River, A Feasibility Study.

Brandywine Conservancy et.al. 2018. Brandywine-Christina State of the Watershed Report.

Burgess, et.al. 2013. Mechanistic Sediment Quality Guidelines Based On Contaminant Bioavailability: Equilibrium Partitioning Sediment Benchmarks. Environ Tox Chem 32, No. 1, pp. 102-114.

Di Toro D, et.al. 1991. Technical basis for establishing sediment quality criteria for nonionic organic chemicals using equilibrium partitioning. Environ Tox Chem 10: 1541-1583.

Di Toro D, et.al. 2000a. Technical basis for narcotic chemicals and polycyclic aromatic hydrocarbon criteria. I. Water and Tissue. Environ Tox Chem 19(8): 1951-1970.

Di Toro D, et.al. 2000b. Technical basis for narcotic chemicals and polycyclic aromatic hydrocarbon criteria. II. Mixtures and sediments. Environ Tox Chem 19(8): 1971-1982.

DNREC. 2011. State of Delaware Surface Water Quality Standards. Delaware Department of Natural Resources and Environmental Control, Division of Water Resources, Watershed Assessment & Management Section, Dover, DE.

DNREC. 2013. Department of Natural Resources and Environmental Control, Division of Waste and Hazardous Substances, Remediation Section, HSCA Screening Level Table, Last updated February 2020. New Castle, DE.

DNREC. 2019. Preliminary DNREC-RS Sampling Requirements – Brandywine River Dam Removal. Internal White Paper. Delaware Department of Natural Resources and Environmental Control, Division of Waste and Hazardous Substances, Remediation Section.

Fuchsman, TR Barber, JC Lawton, and KB Leigh. 2006. An evaluation of cause-effect relationships between polychlorinated biphenyl concentrations and sediment toxicity to benthic invertebrates. Environ Tox Chem 25(10): 2601-2612.

Greene, R. 1997. Bioaccumulation-based Sediment Quality Criteria for the Protection of Human Health. Delaware Department of Natural Resources and Environmental Control, Division of Water Resources, Watershed Assessment Branch, Dover, DE.

Greene RW. 2008. Dioxins and Furans in Fish from the Delaware River (PowerPoint presentation). Delaware Department of Natural Resources and Environmental Control, Watershed Assessment Branch, Dover, DE.

Greene RW. 2009. Persistent, Bioaccumulative, and Toxic (PBT) Pollutants in Surface Water, Sediment, and Biota of the Christina Basin and Shellpot Creek Watershed, DE. Spreadsheet analysis. Delaware Department of Natural Resources and Environmental Control, Dover, DE.

Greene, R. 2010. Cadmium Freshwater Chronic Criterion Review. Spreadsheet analysis. Delaware Department of Natural Resources and Environmental Control, Dover, DE.

Greene, R. 2016a. WATAR 2015 Fish Tissue Data. Spreadsheet analysis. Delaware Department of Natural Resources and Environmental Control, Dover, DE.

Greene, R. 2016b. WATAR 2015 Sediment Data. Spreadsheet analysis. Delaware Department of Natural Resources and Environmental Control, Dover, DE.

Greene, R. 2016c. WATAR 2015 Surface Water Data. Spreadsheet analysis. Delaware Department of Natural Resources and Environmental Control, Dover, DE.

Hagley Museum, 1957; A Story of Early industry on the Brandywine, Eleutherian Mills – Hagley Foundation, Wilmington, Delaware.

Hites RA. 1990. Environmental behavior of chlorinated dioxins and furans. Acc Chem Res 23: 194-201.

ITRC, 2011. Incorporating Bioavailability Considerations into the Evaluation of Contaminated Sediment Sites. CS-1. Washington, D.C., Interstate Technology & Regulatory Council, Contaminated Sediments Team. www.itrcweb.org

ITRC, 2020. Per- and Polyfluoroalky Substances (PFAS-1). Washington, D.C. Web-Based Guidance. www.itrcweb.org

NRC. 2003. Bioavailability of Contaminants in Soils and Sediments: Processes, Tools and Applications. Committee on Bioavailability of Contaminants in Soils and Sediments. Washington, D.C., National Academies Press.

USDHSS. 2000. Toxicological Profile for Polychlorinated Biphenyls (PCBs). United Sates Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry, Division of Toxicology, Atlanta, GA, November 2000.

USEPA. 1984. Ambient Water Quality Criteria for 2,3,7,8-Tetrachloro-dibenzo-p-dioxin (EPA 440/5-84-007). U.S. Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 2002. National Recommended Water Quality Criteria: 2002 (EPA-822-R-02-047). U.S. Environmental Protection Agency, Office of Water and Office of Science and Technology, Washington, DC.

USEPA. 2003. Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures (EPA/600/R-02/013). U.S. Environmental Protection Agency.

USEPA. 2005a. Partition Coefficients for Metals in Surface Water, Soil and Waste (EPA/600/R-05/074). U.S. Environmental Protection Agency, Washington, D.C.

USEPA. 2005b. Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: Metal Mixtures (Cadmium, Copper, Lead, Nickel, Silver and Zinc), (EPA/600/R-02/011). U.S. Environmental Protection Agency, Narragansett, RI and Duluth, MN.

USEPA. 2006. An Inventory of Sources and Environmental Releases of Dioxin-Like Compounds in the United States for the Years 1987, 1995, and 2000 (EPA/600/P-03/002F). U.S. Environmental Protection Agency, Office of Research and Development, Washington, DC.

USEPA. 2008. Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: Compendium of Tier 2 Values for Nonionic Organics (EPA/600/R-02/016). U.S. Environmental Protection Agency, Narragansett, RI and Duluth, MN.

USEPA. 2009. National Primary Drinking Water Regulations (EPA 816-F-09-004). U.S. Environmental Protection Agency, Office of Ground Water and Drinking Water, Washington, DC. May 2009.

USEPA. 2016a. Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS). (EPA 822-R-16-004), USEPA Office of Water, Washington, DC, May 2016.

USEPA. 2016b. Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA). (EPA 822-R-16-005), USEPA Office of Water, Washington, DC, May 2016.

USEPA. 2020. Drinking Water Health Advisories for PFOA and PFOS. Webpage. https://www.epa.gov/ground-water-and-drinking-water/drinking-water-health-advisories-pfoa-and-pfos.

Wenning RJ, et.al. 1993. Application of pattern recognition techniques to evaluate polychlorinated dibenzo-p-dioxin and dibenzofuran distributions in surficial sediments from the Lower Passaic River and Newark Bay. Ecotox Environ Safety 25: 103-125.

Van den Berg M, et.al. 2006. The 2005 World Health Organization Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds. Toxicol Sci 93(2): 223-241.

Velinsky D, et.al. 2010. Vertical Profiles of Radioisotopes, Contaminants, Nutrients and Diatoms in Sediment Cores from the Tidal Christina Basin: A Historical Analysis. Report prepared by the Academy of Natural Sciences Philadelphia and the University of Delaware for the Delaware Department of Natural Resources and Environmental Control, Dover, DE.

TABLES

Table 3-3 Inorganic Results – Brandywine River Dam Sediments

Analyte Name	Units	Dam 2 Transect 1	Dam 2 Transect 2	Dam 2 Transect 3	Dam 4 Transect 1	Dam 4 Transect 2	Dam 4 Transect 3	Dam 4 Transect 4	Dam 4 Transect 5	DNREC Soil Screening Value (Human Health)
Aluminum	mg/kg	10,800	10,600	10,200	14,300	16,800	12,400	10,300	12,000	51,200
Antimony	mg/kg	0.37 (U)	0.36 (U)	0.34 (U)	0.47 (U)	0.43 (U)	0.51 (U)	0.41 (U)	0.44 (U)	3.1
Arsenic	mg/kg	2.4	2.2	2.9	3.4	4.2	2.2	2.1	2.7	11
Barium	mg/kg	86.1	78.4	86.8	141	152	116	94.2	109	1,500
Beryllium	mg/kg	0.45 (J)	0.32 (J)	0.46 (J)	0.58 (J)	0.77	0.45 (J)	0.42 (J)	0.50 (J)	16
Cadmium	mg/kg	0.43 (U)	0.42 (U)	0.39 (U)	0.54 (U)	0.50 (U)	0.58 (U)	0.47 (U)	0.51 (U)	7.1
Calcium	mg/kg	1,220	1,630	915	2,840	1,990	2,450	1,940	2,940	NS
Chromium	mg/kg	22.9	25.0	21.8	32.7	46.4	32.2	27.7	29.3	214
Cobalt	mg/kg	7.2	8.0	7.0	12.1	12.3	10.2	9.0	10.7	34
Copper	mg/kg	24.8	23.4	66.0	36.1	42.4	25.0	29.8	26.7	310
Iron	mg/kg	15,600	19,000	15,300	23,200	24,500	21,800	18,500	21,200	74,767
Lead	mg/kg	31.3	38.5	50.3	44.4	90.2	34.3	25.5	33.1	400
Magnesium	mg/kg	2,400	2,700	2,230	4,290	3,920	3,830	3,290	3,730	NS
Manganese	mg/kg	247	409	197	506	501	361	265	450	2,100
Nickel	mg/kg	21.1	16.4	15.5	31.6	31.6	24.2	20.3	22.3	150
Potassium	mg/kg	1,050	917	893	1,880	1,710	1,670	1,700	1,890	NS
Selenium	mg/kg	0.37 (J)	0.38 (J)	0.38 (J)	0.63 (J)	0.73 (J)	0.68 (J)	0.40 (U)	0.51 (J)	39
Silver	mg/kg	0.79 (U)	0.77 (U)	0.71 (U)	1.0 (U)	0.91 (U)	1.1 (U)	0.86 (U)	0.93 (U)	39
Sodium	mg/kg	138	151	261	181	165	212	125 (J)	159	NS
Thallium	mg/kg	0.16 (U)	0.15 (U)	0.14 (U)	0.20 (U)	**0.21 (J)**	0.22 (U)	0.17 (U)	0.19 (U)	0.078
Vanadium	mg/kg	29.7	27.6	26.6	36.7	42.4	35.1	33.3	37.5	134
Zinc	mg/kg	74.7	83.2	74.0	128	148	108	86.6	99.0	2,300
Mercury										
Mercury	mg/kg	0.12	0.13	0.26	0.17	0.33	0.12	0.10	0.089	1.1

NOTE: **Bold** values indicate sample concentration is greater than DNREC's Soil Screening Level Value for protection of human health. (U) indicates the compound was analyzed for, but not detected. (J) indicates the result is less than the RL, but greater than or equal to the MDL and the concentration is an approximate value. (NS) indicates that there is No Standard associated with the compound.

Table 3-3 Inorganic Results – Brandywine River Dam Sediments (Continued)

Analyte Name	Units	Dam 6 Transect 1	Dam 6 Transect 2	Dam 6 Transect 3	Dam 7 Transect 1	Dam 7 Transect 2	Dam 7 Transect 3	Dam 8 Transect 1	Dam 8 Transect 2	DNREC Soil Screening Value (Human Health)
Aluminum	mg/kg	14100	10900	11000	18,700	17,100	15,400	20,100	20,800	51,200
Antimony	mg/kg	0.46 (U)	0.39 (U)	0.43 (U)	0.46 (U)	**5.5**	0.41 (U)	0.55 (U)	0.51 (U)	3.1
Arsenic	mg/kg	3.2	2.4	2.3	4.6	4.1	4.7	5.4	4.7	11
Barium	mg/kg	141	104	104	151	136	54.8	183	180	1,500
Beryllium	mg/kg	0.57 (J)	0.48 (J)	0.51 (J)	0.75	0.66 (J)	0.74	0.93	0.99	16
Cadmium	mg/kg	0.52 (U)	0.45 (U)	0.49 (U)	0.52 (U)	0.56 (U)	0.47 (U)	0.67 (J)	0.59 (U)	7.1
Calcium	mg/kg	4350	6700	2130	1,500	1,460	1,310	2,150	1,700	NS
Chromium	mg/kg	34.1	29.9	29.7	42.7	41.1	36.7	46.1	50.0	214
Cobalt	mg/kg	11.1	9.5	9.7	13.1	12.8	20.6	16.8	15.9	34
Copper	mg/kg	28.0	22.5	21.9	85.0	43.9	20.9	61.0	59.2	310
Iron	mg/kg	23200	18700	18200	29,400	26,800	53,300	32,900	32,400	74,767
Lead	mg/kg	32.2	27.1	24.4	61.0	74.0	11.8	73.0	63.0	400
Magnesium	mg/kg	4010	3440	3450	4,100	4,250	2,810	5,030	4,800	NS
Manganese	mg/kg	586	455	378	324	321	501	752	538	2,100
Nickel	mg/kg	27.6	23.2	22.6	34.3	27.3	17.6	54.3	46.2	150
Potassium	mg/kg	1560	1390	1490	1,630	1,760	843	2,170	2,070	NS
Selenium	mg/kg	0.73 (J)	0.46 (J)	0.58 (J)	0.83 (J)	0.57 (J)	0.57 (J)	0.73 (J)	0.65 (J)	39
Silver	mg/kg	0.96 (U)	0.82 (U)	0.91 (U)	0.96 (U)	1.0 (U)	0.86 (U)	1.2 (U)	1.1 (U)	39
Sodium	mg/kg	130 (J)	142	173	150 (J)	144 (J)	316	109 (J)	99.8 (J)	NS
Thallium	mg/kg	0.19 (U)	0.17 (U)	0.18 (U)	**0.23 (J)**	0.21 (U)	0.17 (U)	**0.29 (J)**	**0.25 (J)**	0.078
Vanadium	mg/kg	36.6	29.0	29.8	49.0	46.5	55.7	47.9	51.8	134
Zinc	mg/kg	119	94.4	93.2	143	121	57.2	180	145	2,300
Mercury										
Mercury	mg/kg	0.07	0.075	0.076	0.19	0.21	0.094	0.50	0.98	1.1

NOTE: **Bold** values indicate sample concentration is greater than DNREC's Soil Screening Level Value for protection of human health. (U) indicates the compound was analyzed for, but not detected. (J) indicates the result is less than the RL, but greater than or equal to the MDL and the concentration is an approximate value. (NS) indicates that there is No Standard associated with the compound.

Table 3-3 Inorganic Results – Brandywine River Dam Sediments (Continued)

Analyte Name	Units	Dam 9 Transect 1	Dam 9 Transect 2	Dam 10 Transect 1	Dam 10 Transect 2	Dam 11 Transect 1	Dam 11 Transect 2	DNREC Soil Screening Value (Human Health)
Aluminum	mg/kg	13800	20200	14900	21700	13,800	10,700	51,200
Antimony	mg/kg	0.48 (U)	0.67 (U)	0.42 (U)	0.41 (U)	0.49 (U)	0.37 (U)	3.1
Arsenic	mg/kg	2.9	5.1	3.2	4.6	2.7	1.8	11
Barium	mg/kg	136	207	147	172	96.8	92.8	1,500
Beryllium	mg/kg	0.59 (J)	0.87 (J)	0.69	0.79	0.58 (J)	0.49 (J)	16
Cadmium	mg/kg	0.55 (U)	0.77 (U)	0.48 (U)	0.47 (U)	0.56 (U)	0.43 (U)	7.1
Calcium	mg/kg	2570	4490	3090	2550	1,510	780	NS
Chromium	mg/kg	33.3	45.6	37.2	49.5	31.2	20.5	214
Cobalt	mg/kg	11.3	16.6	12.5	16.3	10.6	9.1	34
Copper	mg/kg	27.1	40.9	29.9	43.0	20.5	13.6	310
Iron	mg/kg	22600	33000	25300	30700	24,400	17,400	74,767
Lead	mg/kg	28.1	45.9	32.5	383	21.5	8.0	400
Magnesium	mg/kg	4220	5890	4710	4710	3,560	2,710	NS
Manganese	mg/kg	442	838	455	514	338	325	2,100
Nickel	mg/kg	26.9	40.8	30.3	32.8	22.3	16.6	150
Potassium	mg/kg	1790	2250	1890	1930	1,360	1,310	NS
Selenium	mg/kg	0.56 (J)	1.2 (J)	0.67 (J)	0.65 (J)	0.48 (U)	0.37 (U)	39
Silver	mg/kg	1.0 (U)	1.4 (U)	0.89 (U)	0.86 (U)	1.0 (U)	0.79 (U)	39
Sodium	mg/kg	135 (J)	200 (J)	135 (J)	152	82.6 (J)	54.3 (J)	NS
Thallium	mg/kg	0.21 (U)	0.29 (U)	**0.20 (J)**	**0.19 (J)**	0.21 (U)	0.16 (U)	0.078
Vanadium	mg/kg	36.6	50.2	39.8	60.2	38.0	25.9	134
Zinc	mg/kg	112	173	119	101	87.9	48.4	2,300
Mercury								
Mercury	mg/kg	0.069	0.15	0.097	0.084	0.090	0.038	1.1

NOTE: **Bold** values indicate sample concentration is greater than DNREC's Soil Screening Level Value for protection of human health. (U) indicates the compound was analyzed for, but not detected. (J) indicates the result is less than the RL, but greater than or equal to the MDL and the concentration is an approximate value. (NS) indicates that there is No Standard associated with the compound.

Table 3-4 PCB and Dioxin/Furan Results – Brandywine River Dam Sediments

Analyte Name	Units	Dam 2 Transect 1	Dam 2 Transect 2	Dam 2 Transect 3	Dam 4 Transect 1	Dam 4 Transect 2	Dam 4 Transect 3	Dam 4 Transect 4	Dam 4 Transect 5	DNREC Soil Screening Value (Human Health)
Polychlorinated Biphenyls (PCBs)										
Total PCBs	ug/kg	0.0 (U)	0.0 (U)	0.0 (U)	69.0	0.0 (U)	0.0 (U)	0.0 (U)	0.0 (U)	230
Dioxins and Furans										
1,2,3,4,6,7,8-HpCDD	pg/g	157 (B)	67.6 (B)	87.5 (B)	157 (B)	203 (B)	84.8 (B)	49.4 (B)	31.3 (B)	NS
1,2,3,4,6,7,8-HpCDF	pg/g	58.9 (B)	27.5 (B)	25.0 (B)	195 (B)	164 (B)	24.7 (B)	12.6 (B)	8.72 (B)	NS
1,2,3,4,7,8,9-HpCDF	pg/g	1.99 (J Z B)	2.57 (J B)	1.95 (J B)	5.04 (J B)	6.10 (B)	0.80 (J B)	0.47 (J Z B)	0.29 (J B)	NS
1,2,3,4,7,8-HxCDD	pg/g	1.52 (J)	1.07 (J)	1.08 (J)	2.59 (J)	2.97 (J)	1.17 (J)	0.68 (J)	0.34 (J Z)	NS
1,2,3,4,7,8-HxCDF	pg/g	3.53 (J B)	4.10 (J B)	10.3 (B)	57.0 (B)	10.7 (B)	2.38 (J B)	1.49 (J B)	1.18 (J B)	NS
1,2,3,6,7,8-HxCDD	pg/g	5.22 (B)	1.98 (J B)	2.38 (J B)	4.71 (J B)	7.05 (B)	2.74 (J B)	1.51 (J B)	1.05 (J B)	NS
1,2,3,6,7,8-HxCDF	pg/g	4.46 (J)	2.27 (J)	3.65 (J)	17.2	7.38	2.15 (J)	1.35 (J)	0.96 (J)	NS
1,2,3,7,8,9-HxCDD	pg/g	5.42 (B)	2.97 (J B)	3.09 (J B)	6.17 (B)	8.47 (B)	3.44 (J B)	1.99 (J B)	1.33 (J B)	NS
1,2,3,7,8,9-HxCDF	pg/g	0.058 (U)	0.18 (U)	0.40 (J B)	0.12 (U)	0.64 (U)	0.053 (U)	0.052 (U)	0.033 (U)	NS
1,2,3,7,8-PeCDD	pg/g	0.65 (J Z B)	0.51 (J Z B)	0.50 (J Z B)	2.96 (U)	1.93 (J Z B)	0.62 (J B Z)	0.35 (J Z B)	0.23 (U)	NS
1,2,3,7,8-PeCDF	pg/g	0.91 (J B)	0.65 (J Z B)	14.3 (B)	2.41 (J B)	2.67 (J B)	0.53 (J B)	0.35 (J B)	0.25 (J B)	NS
2,3,4,6,7,8-HxCDF	pg/g	1.02 (J B)	1.01 (J B)	1.26 (J B)	2.82 (J B)	2.54 (J B)	0.88 (J B)	0.61 (J B)	0.34 (J B Z)	NS
2,3,4,7,8-PeCDF	pg/g	1.01 (J B)	0.99 (J B)	12.7 (B)	5.67 (B)	2.11 (J B)	0.81 (J B)	0.63 (J Z B)	0.38 (J B)	NS
2,3,7,8-TCDD	pg/g	0.30 (J Z)	0.092 (J Z)	0.21 (J)	0.33 (U)	0.56 (J)	0.24 (J)	0.15 (J)	0.041 (J Z)	4.8
2,3,7,8-TCDF	pg/g	2.10	0.76 (J Z)	101	1.70 (Z)	4.36	1.20	0.70 (J Z)	0.70 (J)	NS
OCDD	pg/g	5920 (E B)	3470 (B)	4370 (E B)	6,660 (E B)	10,900 (E B)	3,750 (B)	2,170 (B)	1,070 (B)	NS
OCDF	pg/g	79.1 (B)	87.8 (B)	35.2 (B)	241 (B)	216 (B)	38.0 (B)	22.9 (B)	16.0 (B)	NS

NOTE: (U) indicates the compound was analyzed for but not detected. (J) indicates the result is less than the RL, but greater than or equal to the MDL and the concentration is an approximate value. (B) indicates compound was found in the blank and sample. (Z) indicates the data contains important qualifier codes, see hardcopy report and report narrative for further details. (E) indicates that the result exceeded a calibration range. (NS) indicates that there is No Standard associated with the compound.

Table 3-4 PCB and Dioxin/Furan Results – Brandywine River Dam Sediments (Continued)

Analyte Name	Units	Dam 6 Transect 1	Dam 6 Transect 2	Dam 6 Transect 3	Dam 7 Transect 1	Dam 7 Transect 2	Dam 7 Transect 3	Dam 8 Transect 1	Dam 8 Transect 2	DNREC Soil Screening Value (Human Health)
Polychlorinated Biphenyls (PCBs)										
Total PCBs	ug/kg	0.0 (U)	0.0 (U)	0.0 (U)	0.0 (U)	0.0 (U)	0.0 (U)	0.0 (U)	0.0 (U)	230
Dioxins and Furans										
1,2,3,4,6,7,8-HpCDD	pg/g	89.9	76.2	80.9	354 (B)	213 (B)	20.9 (B)	350 (B)	309 (B)	NS
1,2,3,4,6,7,8-HpCDF	pg/g	25.9 (B)	21.8 (B)	24.4 (B)	1720 (B)	120 (B)	2.86 (J B)	86.6 (B)	176 (B)	NS
1,2,3,4,7,8,9-HpCDF	pg/g	1.08 (J B)	1.08 (J B)	1 (J B)	4.99 (U)	1.23 (J B)	0.11 (J Z B)	2.82 (J B)	3.42 (J B)	NS
1,2,3,4,7,8-HxCDD	pg/g	1.29 (J)	1.63 (J)	1.23 (J)	4.52 (J)	1.76 (J)	0.24 (J Z)	5.05	4.79 (J)	NS
1,2,3,4,7,8-HxCDF	pg/g	1.89 (J)	1.33 (J Z)	1.63 (J)	19.8 (J B)	3.29 (J B)	0.20 (J B)	10.5 (B)	5.93 (B)	NS
1,2,3,6,7,8-HxCDD	pg/g	2.83 (J)	2.55 (J)	2.79 (J)	18.6 (J B)	4.50 (J Z B)	0.53 (J Z B)	11.3 (B)	12.3 (B)	NS
1,2,3,6,7,8-HxCDF	pg/g	1.21 (J)	0.94 (J)	1.03 (J)	39.0	3.92 (J)	0.24 (J)	4.26 (J)	8.55	NS
1,2,3,7,8,9-HxCDD	pg/g	3.64 (J B)	3.39 (J B)	3.21 (J B)	9.89 (J B)	5.76 (B)	1.02 (J B)	13.6 (B)	12.7 (B)	NS
1,2,3,7,8,9-HxCDF	pg/g	0.13 (U)	0.13 (U)	0.15 (U)	2.11 (U)	0.27 (U)	0.029 (U)	0.14 (U)	0.15 (U)	NS
1,2,3,7,8-PeCDD	pg/g	0.67 (J Z)	0.69 (J Z)	0.55 (J Z)	1.77 (J Z B)	0.66 (J Z B)	0.13 (J B)	2.46 (J Z B)	2.50 (J Z B)	NS
1,2,3,7,8-PeCDF	pg/g	0.42 (J)	0.24 (J Z)	0.37 (J Z)	3.11 (J B)	2.38 (J B)	0.11 (J Z B)	4.30 (J B)	3.01 (J B)	NS
2,3,4,6,7,8-HxCDF	pg/g	0.9 (J)	0.75 (J)	0.72 (J Z)	13.2 (J B)	1.11 (J B)	0.095 (J Z B)	2.47 (J B)	2.73 (J B)	NS
2,3,4,7,8-PeCDF	pg/g	0.75 (J)	0.53 (J)	0.6 (J)	6.23 (J Z B)	2.27 (J B)	0.11 (J Z B)	4.03 (J B)	3.01 (J B)	NS
2,3,7,8-TCDD	pg/g	0.21 (J)	0.2 (J)	0.15 (J Z)	0.11 (J Z)	0.11 (J Z)	0.039 (J Z)	1.24	0.72 (J)	4.8
2,3,7,8-TCDF	pg/g	0.99	0.61 (J)	0.8 (J)	3.88 (J)	8.88	0.43 (J)	16.7	7.84	NS
OCDD	pg/g	3940 (E B)	2920 (B)	3680 (E B)	10600 (B)	9500 (E B)	935 (B)	11900 (E B)	13000 (E B)	NS
OCDF	pg/g	38.3 (B)	47 (B)	37.7 (B)	653 (B)	51.2 (B)	3.91 (J B)	115 (B)	120 (B)	NS
NOTE: (U) indicates the compound was analyzed for but not detected. (J) indicates the result is less than the RL, but greater than or equal to the MDL and the concentration is an approximate value. (B) indicates compound was found in the blank and sample. (Z) indicates the data contains important qualifier codes, see hardcopy report and report narrative for further details. (E) indicates that the result exceeded a calibration range. (NS) indicates that there is No Standard associated with the compound.										

Table 3-4 PCB and Dioxin/Furan Results – Brandywine River Dam Sediments (Continued)

Analyte Name	**Units**	**Dam 9 Transect 1**	**Dam 9 Transect 2**	**Dam 10 Transect 1**	**Dam 10 Transect 2**	**Dam 11 Transect 1**	**Dam 11 Transect 2**	**DNREC Soil Screening Value (Human Health)**
Polychlorinated Biphenyls (PCBs)								
Total PCBs	ug/kg	0.0 (U)	0.0 (U)	0.0 (U)	0.0 (U)	0.0 (U)	0.0 (U)	230
Dioxins and Furans								
1,2,3,4,6,7,8-HpCDD	pg/g	103	134	156	73.8	114 (B)	239 (B)	NS
1,2,3,4,6,7,8-HpCDF	pg/g	36.4 (B)	37.3 (B)	53.1 (B)	17.0 (B)	19.7 (B)	0.64 (J B Z)	NS
1,2,3,4,7,8,9-HpCDF	pg/g	1.39 (J B)	1.75 (J B)	4.77 (J B)	0.89 (J Z B)	0.78 (J Z B)	0.051 (U)	NS
1,2,3,4,7,8-HxCDD	pg/g	1.46 (J)	2.00 (J)	1.97 (J)	1.10 (J)	1.34 (J Z)	1.44 (J)	NS
1,2,3,4,7,8-HxCDF	pg/g	2.15 (J)	2.75 (J)	3.47 (J)	1.62 (J)	1.64 (J B)	0.071 (J B Z)	NS
1,2,3,6,7,8-HxCDD	pg/g	3.09 (J)	4.21 (J)	4.91	2.09 (J)	2.85 (J B)	4.28 (J B)	NS
1,2,3,6,7,8-HxCDF	pg/g	1.26 (J)	1.50 (J Z)	1.51 (J Z)	0.94 (J)	1.47 (J Z)	0.12 (J Z)	NS
1,2,3,7,8,9-HxCDD	pg/g	3.93 (J B)	5.19 (J B)	4.90 (B)	2.99 (J B)	3.33 (J B)	4.99 (B)	NS
1,2,3,7,8,9-HxCDF	pg/g	0.17 (U)	0.22 (U)	0.44 (U)	0.070 (U)	0.15 (U)	0.023 (U)	NS
1,2,3,7,8-PeCDD	pg/g	0.76 (J Z)	0.99 (J Z)	0.76 (J Z)	0.50 (J Z)	0.51 (J Z B)	0.48 (J B)	NS
1,2,3,7,8-PeCDF	pg/g	0.45 (J Z)	0.51 (J)	0.58 (J Z)	0.32 (J Z)	0.36 (J Z B)	0.025 (J B Z)	NS
2,3,4,6,7,8-HxCDF	pg/g	0.93 (J)	1.28 (J)	1.33 (J)	0.66 (J)	0.66 (J B)	0.021 (U)	NS
2,3,4,7,8-PeCDF	pg/g	0.74 (J)	0.88 (J Z)	0.99 (J)	0.60 (J)	0.51 (J Z B)	0.010 (U)	NS
2,3,7,8-TCDD	pg/g	0.16 (J)	0.25 (J)	0.11 (J Z)	0.14 (J)	0.10 (J Z)	0.064 (J)	4.8
2,3,7,8-TCDF	pg/g	0.89 (J)	1.08 (J)	0.99	0.64 (J)	1.16 (J)	0.052 (J)	NS
OCDD	pg/g	4720 (E B)	6120 (E B)	5590 (E B)	5840 (E B)	5,600 (B)	10,600 (E B)	NS
OCDF	pg/g	46.8 (B)	56.2 (B)	156 (B)	33.4 (B)	31.9 (B)	1.03 (J B)	NS
NOTE: (U) indicates the compound was analyzed for but not detected. (J) indicates the result is less than the RL, but greater than or equal to the MDL and the concentration is an approximate value. (B) indicates compound was found in the blank and sample. (Z) indicates the data contains important qualifier codes, see hardcopy report and report narrative for further details. (E) indicates that the result exceeded a calibration range. (NS) indicates that there is No Standard associated with the compound.								

Table 3-5 PAH Results – Brandywine River Dam Sediments

Analyte Name	Units	Dam 2 Transect 1	Dam 2 Transect 2	Dam 2 Transect 3	Dam 4 Transect 1	Dam 4 Transect 2	Dam 4 Transect 3	Dam 4 Transect 4	Dam 4 Transect 5	Dam 6 Transect 1	Dam 6 Transect 2	Dam 6 Transect 3	DNREC Soil Screening Value (Human Health)
1-Methylnaphthalene	ug/kg	5.9 (J)	7.1 (J)	8.5 (J)	40	36	15	7.6 (J)	8.5 (J)	4.4 (J)	4 (J)	4.5 (J)	18,000
2-Methylnaphthalene	ug/kg	6.2 (J)	6.9 (J)	9.1 (J)	34	40	11 (J)	4.1 (J)	7.0 (J)	3.4 (J)	2.9 (J)	3 (U)	24,000
Acenaphthene	ug/kg	9.2 (J)	8.8 (J)	11	93	120	14 (J)	21	15	5 (U)	5.2 (J)	5.1 (U)	360,000
Acenaphthylene	ug/kg	15	35	37	18	44	26 (Z)	27	16	10 (J)	6.9 (J)	9 (J)	NS
Anthracene	ug/kg	32	34	46	140	260	41 (Z)	69	51	24	21	19	1,800,000
Benzo[a]anthracene	ug/kg	150	230	230	550	690 (D)	240	370	220	170	100	110	1,100
Benzo[a]pyrene	ug/kg	160 (B)	**280 (B)**	230 (B)	**580 (B)**	**590 (D)**	**290 (Z B)**	**350 (B)**	240 (B)	210	120	150	240
Benzo[b]fluoranthene	ug/kg	180 (B)	310 (B)	180 (B)	680 (B)	570 (D)	340 (Z B)	470 (B)	280 (B)	250	130	190	1,110
Benzo[e]pyrene	ug/kg	130	230	170	470	460	250 (Z)	290	190	180	110	140	NS
Benzo[g,h,i]perylene	ug/kg	93	140	110	240	190	110 (Z)	110	75	71	35	53	NS
Benzo[k]fluoranthene	ug/kg	160	300	210	650	650 (D)	330 (Z)	400	270	250	110	210	11,000
C1-Chrysenes	ug/kg	110	160	140	250	390	130	120	94	83	51	71	NS
C1-Fluoranthenes/pyrene	ug/kg	180	230	270	530	750	240	320	200	140	93	110	NS
C1-Fluorenes	ug/kg	13	11 (U)	16	28	89	15 (U)	10 (U)	11 (U)	12 (U)	11 (U)	13 (U)	NS
C1-Phenanthrenes/Anthracenes	ug/kg	140	93	160	370	630	140	120	120	68	47	47	NS
C2-Chrysenes	ug/kg	74	83	78	100	210	44	40	39	40	24	28	NS
C2-Fluorenes	ug/kg	20	15	20	39	150	15 (U)	10 (U)	11 (U)	12 (U)	11 (U)	13 (U)	NS
C2-Naphthalenes	ug/kg	36	30	40	120	200	55	36	42	24	20	22	NS
C2-Phenanthrenes/Anthracenes	ug/kg	92	80	130	200	570	92	87	88	47	33	46	NS
C3-Chrysenes	ug/kg	33	23	45	30	99	18	12	13	17	15	13 (U)	NS
C3-Fluorenes	ug/kg	36	11 (U)	36	15 (U)	180	15 (U)	10 (U)	11 (U)	12 (U)	11 (U)	13 (U)	NS
C3-Naphthalenes	ug/kg	42	24	43	77	270	35	28	31	17 (B)	14 (B)	15 (B)	NS
C3-Phenanthrenes/Anthracenes	ug/kg	61	37	88	78	330	40	34	34	24	18	25	NS
C4-Chrysenes	ug/kg	20	11 (U)	29	15 (U)	49	15	10	11 (U)	12 (U)	11 (U)	13 (U)	NS
C4-Naphthalenes	ug/kg	39	16	36	44	240	20	16	19	12 (U)	11 (U)	13 (U)	NS
C4-Phenanthrenes/Anthracenes	ug/kg	46	22	100	43	230	21	18	15	12	11 (U)	13	NS
Chrysene	ug/kg	200	320	260	740 (D)	830 (D)	340	430	270	250	150	170	110,000
Dibenz(a,h)anthracene	ug/kg	27	46	36	90	82	40	44	27	25	18	21	170
Fluoranthene	ug/kg	310	460	380	1,400 (D)	1,500 (D)	550	730 (D)	490	420	240	340	240,000
Fluorene	ug/kg	13	12	16	120	120	23	38	22	6 (U)	6.6 (J)	6.1 (U)	240,000
Indeno[1,2,3-cd]pyrene	ug/kg	89	150	110	240	220	120 (Z)	130	81	72	49	57	1,300
Naphthalene	ug/kg	14	16	19	57	59	24	12	17	8 (U)	7.3 (J)	8.1 (U)	3,800
Perylene	ug/kg	340	100	450	170	380	100 (Z)	120	64	56	38	55	NS
Phenanthrene	ug/kg	140	170	160	1,300 (D)	1,100 (D)	200	410	240	140	96	95	180,000
Pyrene	ug/kg	300	430	370	1,200 (D)	1,300 (D)	470	700 (D)	430	310	200	220	180,000

NOTE: (U) indicates the compound was analyzed for but not detected. (J) indicates the result is less than the RL, but greater than or equal to the MDL and the concentration is an approximate value. (B) indicates compound was found in the blank and sample. (D) indicates the sample results are obtained from a dilution; the surrogate or matrix spike recoveries reported are calculated from diluted samples. (Z) indicates the data contains important qualifier codes, see hardcopy report and report narrative for further details. (NS) indicates that there is No Standard associated with the compound.

Table 3-5 PAH Results – Brandywine River Dam Sediments (Continued)

Analyte Name	Units	Dam 7 Transect 1	Dam 7 Transect 2	Dam 7 Transect 3	Dam 8 Transect 1	Dam 8 Transect 2	Dam 9 Transect 1	Dam 9 Transect 2	Dam 10 Transect 1	Dam 10 Transect 2	Dam 11 Transect 1	Dam 11 Transect 2	DNREC Soil Screening Value (Human Health)
1-Methylnaphthalene	ug/kg	5.5 (J)	6.5 (J)	0.86 (J)	18	7.5	5.6 (J)	6.9 (J)	8 (J)	13	5.1	1.0	18,000
2-Methylnaphthalene	ug/kg	5.2 (J)	5.8 (J)	0.55 (J)	27	9.3	4.2 (J)	4.9 (U)	5.6 (J)	11 (J)	3.5 (J)	0.31 (J)	24,000
Acenaphthene	ug/kg	3.4 (U)	6.0 (J)	1.6 (J)	53	9.9	5.9 (U)	8.2 (U)	8.9 (J)	46	2.5 (J)	0.52 (J)	360,000
Acenaphthylene	ug/kg	16	24	1.2 (J)	35	17	13 (J)	13 (J)	16	100	5.3	0.61 (J)	NS
Anthracene	ug/kg	13	26	4.8	51	27	25	23	33	120	6.1	0.41 (J)	1,800,000
Benzo[a]anthracene	ug/kg	75	120	24	210	120	160	120	190	480	51	3.2	1,100
Benzo[a]pyrene	ug/kg	94 (B)	130 (B)	27	**280**	130	210	170	260 (Z)	600	75	4.1	240
Benzo[b]fluoranthene	ug/kg	100 (B)	120 (B)	33	250	130	290	200	330 (Z)	560	110	5.4	1,110
Benzo[e]pyrene	ug/kg	85	110	24	240	110	200	170	220 (Z)	440	79	3.5	NS
Benzo[g,h,i]perylene	ug/kg	40	43	16	140	48	66	73	100 (Z)	350	41	1.7	NS
Benzo[k]fluoranthene	ug/kg	110	140	28	250	120	270	200	320 (Z)	550 (D)	96	5.0	11,000
C1-Chrysenes	ug/kg	72	140	21	300	190	120	72	100	290	33	2.0	NS
C1-Fluoranthenes/pyrene	ug/kg	120	180	22	350	220	160	120	210	460	60	4.5	NS
C1-Fluorenes	ug/kg	11 (U)	16	2.0 (U)	35	20	15 (U)	20 (U)	13 (U)	29	4.0 (U)	2.0	NS
C1-Phenanthrenes/Anthracenes	ug/kg	58	110	9.3	240	160	63	57	94	240	33	2.1	NS
C2-Chrysenes	ug/kg	44	140	7.2	230	140	54	30	44	110	4.0 (U)	1.6	NS
C2-Fluorenes	ug/kg	13	27	2.0 (U)	75	47	15 (U)	22	13 (U)	19	4.0 (U)	0.92 (U)	NS
C2-Naphthalenes	ug/kg	25	47	3.1	120	65	23	64	35	52	17	2.7	NS
C2-Phenanthrenes/Anthracenes	ug/kg	64	130	7.9	330	210	48	48	110	150	26	4.3	NS
C3-Chrysenes	ug/kg	20	48	3.3	160	120	24	22	19	48	11	0.92 (U)	NS
C3-Fluorenes	ug/kg	11 (U)	53	2.0 (U)	110	73	15 (U)	20 (U)	13 (U)	12 (U)	4.0 (U)	0.92 (U)	NS
C3-Naphthalenes	ug/kg	28	93	4.9	190	120	17 (B)	26 (B)	27 (B)	46 (B)	13	4.0	NS
C3-Phenanthrenes/Anthracenes	ug/kg	40	110	4.7	270	210	27	26	40	64	11	2.7	NS
C4-Chrysenes	ug/kg	11 (U)	11 (U)	2.0 (U)	100	61	15 (U)	20 (U)	13 (U)	12 (U)	6.7	0.92 (U)	NS
C4-Naphthalenes	ug/kg	23	85	2.0 (U)	230	190	15 (U)	20 (U)	18	27	12	1.8	NS
C4-Phenanthrenes/Anthracenes	ug/kg	28	95	3.6	220	180	19	20	18	23	7.5	3.0	NS
Chrysene	ug/kg	110	150	30	280	160	230	210	280	570	96	4.8	110,000
Dibenz(a,h)anthracene	ug/kg	13	31	5.1	45	19	26	27	34 (Z)	130	13	0.86 (J)	170
Fluoranthene	ug/kg	150	240	51	400	240	330	310	550	790 (D)	140	5.9	240,000
Fluorene	ug/kg	5.1 (J)	15	2.3	44	20	7 (U)	9.8 (U)	14	56	4.7	0.67 (J)	240,000
Indeno[1,2,3-cd]pyrene	ug/kg	40	51	16	130	48	73	81	100 (Z)	350	41	1.8	1,300
Naphthalene	ug/kg	14	16	2.3	52	14	9.3 (U)	13 (U)	8.3 (U)	13	5.7	1.2	3,800
Perylene	ug/kg	65	260	13	440	430 (D)	64	62	76 (Z)	180	73	270 (D)	NS
Phenanthrene	ug/kg	62	130	22	250	150	130	120	190	540	44	2.5	180,000
Pyrene	ug/kg	160	210	42	420	220	270	220	410	760 (D)	110	5.1	180,000

NOTE: (U) indicates the compound was analyzed for but not detected. (J) indicates the result is less than the RL, but greater than or equal to the MDL and the concentration is an approximate value. (B) indicates compound was found in the blank and sample. (D) indicates the sample results are obtained from a dilution; the surrogate or matrix spike recoveries reported are calculated from diluted samples. (Z) indicates the data contains important qualifier codes, see hardcopy report and report narrative for further details. (NS) indicates that there is No Standard associated with the compound.

Table 3-6 Pesticide Results – Brandywine River Dam Sediments

Analyte Name	Units	Dam 2 Transect 1	Dam 2 Transect 2	Dam 2 Transect 3	Dam 4 Transect 1	Dam 4 Transect 2	Dam 4 Transect 3	Dam 4 Transect 4	Dam 4 Transect 5	DNREC Soil Screening Value (Human Health)
4,4'-DDD	ug/kg	1.9 (U)	1.8 (U)	1.8 (U)	2.5 (U)	2.1 (U)	2.5 (U)	1.8 (U)	1.9 (U)	190
4,4'-DDE	ug/kg	1.3 (U)	1.3 (U)	1.2 (U)	1.8 (U)	1.5 (U)	1.7 (U)	1.2 (U)	1.3 (U)	2,000
4,4'-DDT	ug/kg	4.1 (J)	2.0 (U)	1.9 (U)	2.7 (U)	2.3 (U)	2.7 (U)	1.9 (U)	2.0 (U)	1,900
Aldrin	ug/kg	1.7 (U)	1.6 (U)	1.6 (U)	2.3 (U)	1.9 (U)	2.2 (U)	1.6 (U)	1.7 (U)	39
alpha-BHC	ug/kg	1.1 (U)	1.1 (U)	1.1(U)	1.5 (U)	1.2 (U)	1.5 (U)	1.0 (U)	1.1 (U)	86
beta-BHC	ug/kg	1.2 (U)	1.2 (U)	1.2 (U)	1.7 (U)	1.4 (U)	1.7 (U)	1.2 (U)	1.2 (U)	300
cis-Chlordane	ug/kg	1.7 (U)	1.7 (U)	1.7 (U)	2.4 (U)	1.9 (U)	2.3 (U)	1.6 (U)	1.8 (U)	NS
delta-BHC	ug/kg	0.67 (U)	0.67 (U)	0.65 (U)	0.91 (U)	0.75 (U)	0.91 (U)	0.63 (U)	0.68 (U)	NS
Dieldrin	ug/kg	1.4 (U)	1.4 (U)	1.4 (U)	1.9 (U)	1.6 (U)	1.9 (U)	1.3 (U)	1.4 (U)	34
Endosulfan I	ug/kg	1.7 (U)	1.7 (U)	1.6 (U)	2.3 (U)	1.9 (U)	2.3 (U)	1.6 (U)	1.7 (U)	NS
Endosulfan II	ug/kg	2.8 (U)	2.8 (U)	2.7 (U)	3.8 (U)	3.2 (U)	3.8 (U)	2.6 (U)	2.9 (U)	NS
Endosulfan sulfate	ug/kg	1.4 (U)	1.4 (U)	1.3 (U)	1.9 (U)	1.5 (U)	1.9 (U)	1.3 (U)	1.4 (U)	38,000
Endrin	ug/kg	1.6 (U)	1.6 (U)	1.5 (U)	2.1 (U)	1.8 (U)	2.1 (U)	1.5 (U)	1.6 (U)	1,900
Endrin aldehyde	ug/kg	2.6 (U)	2.6 (U)	2.5 (U)	3.5 (U)	2.9 (U)	3.5 (U)	2.4 (U)	2.6 (U)	NS
Endrin ketone	ug/kg	2.1 (U)	2.1 (U)	2.0 (U)	2.9 (U)	2.4 (U)	2.9 (U)	2.0 (U)	2.2 (U)	NS
gamma-BHC (Lindane)	ug/kg	1.0 (U)	1.0 (U)	0.98 (U)	1.4 (U)	1.1 (U)	1.4 (U)	0.95 (U)	1.0 (U)	570
Heptachlor	ug/kg	1.3 (U)	1.3 (U)	1.2 (U)	1.8 (U)	1.5 (U)	1.7 (U)	1.2 (U)	1.3 (U)	130
Heptachlor epoxide	ug/kg	1.6 (U)	1.6 (U)	1.6 (U)	2.2 (U)	1.8 (U)	2.2 (U)	1.5 (U)	1.7 (U)	70
Methoxychlor	ug/kg	2.5 (U)	2.5 (U)	2.4 (U)	3.4 (U)	2.8 (U)	3.4 (U)	2.4 (U)	2.5 (U)	32,000
Toxaphene	ug/kg	40 (U)	39 (U)	38 (U)	54 (U)	44 (U)	54 (U)	37 (U)	40 (U)	490
trans-Chlordane	ug/kg	1.9 (U)	1.9 (U)	1.9 (U)	2.6 (U)	2.2 (U)	2.6 (U)	1.8 (U)	2.0 (U)	NS

NOTE: Bold values indicate sample concentration is greater than DNREC's Soil Screening Level Value for protection of human health. (U) indicates the compound was analyzed for, but not detected. (NS) indicates that there is No Standard associated with the compound.

Table 3-6 Pesticide Results – Brandywine River Dam Sediments (Continued)

Analyte Name	Units	Dam 6 Transect 1	Dam 6 Transect 2	Dam 6 Transect 3	Dam 7 Transect 1	Dam 7 Transect 2	Dam 7 Transect 3	Dam 8 Transect 1	Dam 8 Transect 2	DNREC Soil Screening Value (Human Health)
4,4'-DDD	ug/kg	2.2 (U)	1.9 (U)	2.1 (U)	1.9 (U)	1.9 (U)	1.7 (U)	2.2 (U)	2.1 (U)	190
4,4'-DDE	ug/kg	1.5 (U)	1.3 (U)	1.5 (U)	1.3 (U)	1.3 (U)	1.2 (U)	3.8 (J)	1.4 (U)	2,000
4,4'-DDT	ug/kg	2.3 (U)	2.1 (U)	2.3 (U)	2.1 (U)	2.1 (U)	1.8 (U)	2.4 (U)	2.2 (U)	1,900
Aldrin	ug/kg	1.9 (U)	1.7 (U)	1.9 (U)	1.7 (U)	1.7 (U)	1.5 (U)	2.0 (U)	1.8 (U)	39
alpha-BHC	ug/kg	1.3 (U)	1.1 (U)	1.3 (U)	1.1 (U)	1.2 (U)	1.0 (U)	1.3 (U)	1.2 (U)	86
beta-BHC	ug/kg	1.4 (U)	1.3 (U)	1.4 (U)	1.3 (U)	1.3 (U)	1.1 (U)	1.5 (U)	1.4 (U)	300
cis-Chlordane	ug/kg	2 (U)	1.8 (U)	1.9 (U)	1.8 (U)	1.8 (U)	1.6 (U)	2.1 (U)	1.9 (U)	NS
delta-BHC	ug/kg	0.77 (U)	0.69 (U)	0.75 (U)	0.69 (U)	0.70 (U)	0.60 (U)	0.81 (U)	0.74 (U)	NS
Dieldrin	ug/kg	1.6 (U)	1.5 (U)	1.6 (U)	1.5 (U)	1.5 (U)	1.3 (U)	1.7 (U)	1.6 (U)	34
Endosulfan I	ug/kg	1.9 (U)	1.7 (U)	1.9 (U)	1.7 (U)	1.7 (U)	1.5 (U)	2.0 (U)	1.9 (U)	NS
Endosulfan II	ug/kg	3.2 (U)	2.9 (U)	3.2 (U)	2.9 (U)	2.9 (U)	2.5 (U)	3.4 (U)	3.1 (U)	NS
Endosulfan sulfate	ug/kg	1.6 (U)	1.4 (U)	1.5 (U)	1.4 (U)	1.4 (U)	1.2 (U)	1.7 (U)	1.5 (U)	38,000
Endrin	ug/kg	1.8 (U)	1.6 (U)	1.8 (U)	1.6 (U)	1.6 (U)	1.4 (U)	1.9 (U)	1.7 (U)	1,900
Endrin aldehyde	ug/kg	3 (U)	2.7 (U)	2.9 (U)	2.7 (U)	2.7 (U)	2.3 (U)	3.1 (U)	2.9 (U)	NS
Endrin ketone	ug/kg	2.5 (U)	2.2 (U)	2.4 (U)	2.2 (U)	2.2 (U)	1.9 (U)	2.6 (U)	2.4 (U)	NS
gamma-BHC (Lindane)	ug/kg	1.2 (U)	1 (U)	1.1 (U)	1.0 (U)	1.1 (U)	0.91 (U)	1.2 (U)	1.1 (U)	570
Heptachlor	ug/kg	1.5 (U)	1.3 (U)	1.5 (U)	1.3 (U)	1.3 (U)	1.2 (U)	1.6 (U)	1.4 (U)	130
Heptachlor epoxide	ug/kg	1.9 (U)	1.7 (U)	1.8 (U)	1.7 (U)	1.7 (U)	1.5 (U)	2.0 (U)	1.8 (U)	70
Methoxychlor	ug/kg	2.9 (U)	2.6 (U)	2.8 (U)	2.6 (U)	2.6 (U)	2.3 (U)	3.0 (U)	2.8 (U)	32,000
Toxaphene	ug/kg	46 (U)	41 (U)	45 (U)	41 (U)	41 (U)	36 (U)	48 (U)	44 (U)	490
trans-Chlordane	ug/kg	2.2 (U)	2 (U)	2.2 (U)	2.0 (U)	2.0 (U)	1.7 (U)	2.3 (U)	2.1(U)	NS

NOTE: Bold values indicate sample concentration is greater than DNREC's Soil Screening Level Value for protection of human health. (U) indicates the compound was analyzed for, but not detected. (NS) indicates that there is No Standard associated with the compound.

Table 3-6 Pesticide Results – Brandywine River Dam Sediments (Continued)

Analyte Name	Units	Dam 9 Transect 1	Dam 9 Transect 2	Dam 10 Transect 1	Dam 10 Transect 2	Dam 11 Transect 1	Dam 11 Transect 2	DNREC Soil Screening Value (Human Health)
4,4'-DDD	ug/kg	2.4 (U)	3.4 (U)	2.2 (U)	2.1 (U)	2.1 (U)	1.6 (U)	190
4,4'-DDE	ug/kg	1.7 (U)	2.4 (U)	1.5 (U)	1.4 (U)	1.4 (U)	1.1 (U)	2,000
4,4'-DDT	ug/kg	2.6 (U)	3.7 (U)	2.4 (U)	2.2 (U)	2.2 (U)	1.7 (U)	1,900
Aldrin	ug/kg	2.1 (U)	3 (U)	2 (U)	1.8 (U)	1.8 (U)	1.4 (U)	39
alpha-BHC	ug/kg	1.4 (U)	2 (U)	1.3 (U)	1.2 (U)	1.2 (U)	0.95 (U)	86
beta-BHC	ug/kg	1.6 (U)	2.2 (U)	1.5 (U)	1.4 (U)	1.4 (U)	1.0 (U)	300
cis-Chlordane	ug/kg	2.2 (U)	3.2 (U)	2.1 (U)	1.9 (U)	1.9 (U)	1.5 (U)	NS
delta-BHC	ug/kg	0.87 (U)	1.2 (U)	0.8 (U)	0.75 (U)	0.74 (U)	0.57 (U)	NS
Dieldrin	ug/kg	1.8 (U)	2.6 (U)	1.7 (U)	1.6 (U)	1.6 (U)	1.2 (U)	34
Endosulfan I	ug/kg	2.2 (U)	3 (U)	2 (U)	1.9 (U)	1.8 (U)	1.4 (U)	NS
Endosulfan II	ug/kg	3.6 (U)	5.1 (U)	3.4 (U)	3.1 (U)	3.1 (U)	2.4 (U)	NS
Endosulfan sulfate	ug/kg	1.8 (U)	2.5 (U)	1.6 (U)	1.5 (U)	1.5 (U)	1.2 (U)	38,000
Endrin	ug/kg	2 (U)	2.9 (U)	1.9 (U)	1.7 (U)	1.7 (U)	1.3 (U)	1,900
Endrin aldehyde	ug/kg	3.3 (U)	4.7 (U)	3.1 (U)	2.9 (U)	2.9 (U)	2.2 (U)	NS
Endrin ketone	ug/kg	2.7 (U)	3.9 (U)	2.5 (U)	2.4 (U)	2.4 (U)	1.8 (U)	NS
gamma-BHC (Lindane)	ug/kg	1.3 (U)	1.9 (U)	1.2 (U)	1.1 (U)	1.1 (U)	0.86 (U)	570
Heptachlor	ug/kg	1.7 (U)	2.4 (U)	1.5 (U)	1.4 (U)	1.4 (U)	1.1 (U)	130
Heptachlor epoxide	ug/kg	2.1 (U)	3 (U)	2 (U)	1.8 (U)	1.8 (U)	1.4 (U)	70
Methoxychlor	ug/kg	3.2 (U)	4.6 (U)	3 (U)	2.8 (U)	2.8 (U)	2.1 (U)	32,000
Toxaphene	ug/kg	51 (U)	72 (U)	47 (U)	44 (U)	44 (U)	34 (U)	490
trans-Chlordane	ug/kg	2.5 (U)	3.5 (U)	2.3 (U)	2.1 (U)	2.1 (U)	1.6 (U)	NS

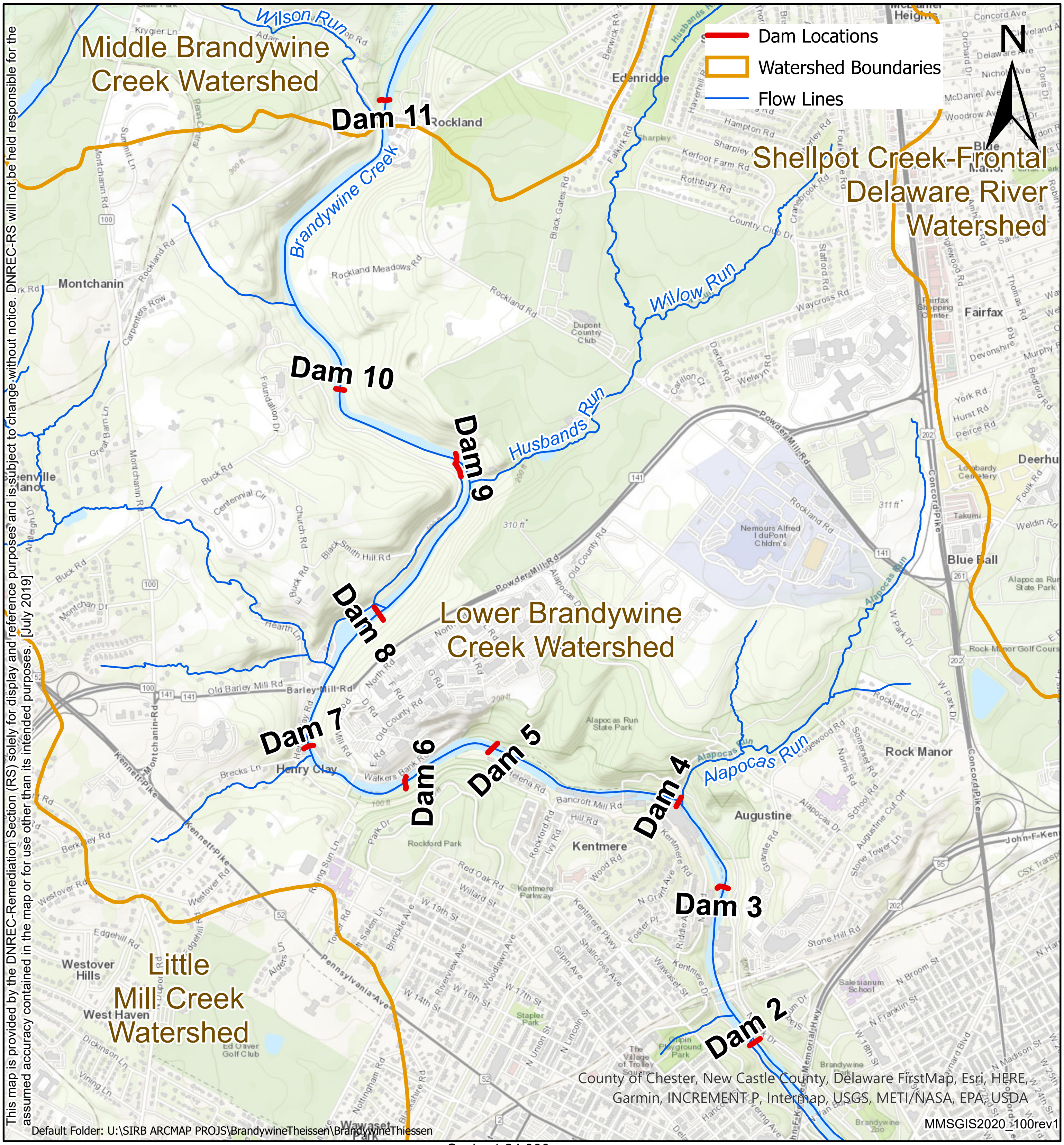
NOTE: Bold values indicate sample concentration is greater than DNREC's Soil Screening Level Value for protection of human health. (U) indicates the compound was analyzed for, but not detected. (NS) indicates that there is No Standard associated with the compound.

Table 3-7 Per- and Polyfluoroalkyl Substances (PFAS) Results – Brandywine River Dam Sediments

Analyte Name	Units	Dam 2 Transect 1	Dam 4 Transect 1	Dam 6 Transect 1	Dam 7 Transect 1	Dam 8 Transect 1	Dam 9 Transect 1	Dam 10 Transect 1	Dam 11 Transect 1	DNREC Soil Screening Value (Human Health)
1H,1H,2H,2H-perfluorodecanesulfonic acid (8:2)	ug/kg	0.046 (U Z)	0.064 (U Z)	0.053 (U)	0.047 (U Z)	0.055 (U)	0.06 (U)	0.057 (U)	0.052 (U)	NS
1H,1H,2H,2H-perfluorooctanesulfonic acid (6:2)	ug/kg	0.056 (J Z)	0.048 (U Z)	0.057 (J)	0.036 (U Z)	0.042 (U)	0.046 (U)	0.043 (U)	0.039 (U)	NS
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	ug/kg	0.17 (J Z)	0.083 (J Z)	0.073 (J B)	0.049 (J Z)	0.63 (J)	0.14 (J B)	0.093 (J B)	0.085 (J)	NS
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	ug/kg	0.055 (J Z)	0.18 (J Z)	0.086 (J)	0.056 (U Z)	0.11 (J)	0.13 (J)	0.13 (J)	0.14 (J)	NS
Perfluorobutanesulfonic acid (PFBS)	ug/kg	0.051 (J Z B)	0.031 (J Z B)	0.017 (J B)	0.039 (J Z B)	0.019 (J B)	0.018 (U)	0.019 (J B)	0.028 (J B)	NS
Perfluorobutanoic acid (PFBA)	ug/kg	0.30 (U Z)	0.42 (U Z)	0.35 (U)	0.31 (U Z)	0.36 (U)	0.4 (U)	0.37 (U)	0.34 (U)	NS
Perfluorodecanesulfonic acid (PFDS)	ug/kg	0.030 (U Z)	0.076 (J Z)	0.05 (J)	0.046 (J Z)	0.043 (J)	0.05 (J)	0.045 (J)	0.044 (J)	NS
Perfluorodecanoic acid (PFDA)	ug/kg	0.045 (J Z)	0.24 (J Z)	0.24 (J)	0.082 (J Z)	0.040 (U)	0.17 (J)	0.091 (J)	0.067 (J)	NS
Perfluorododecanoic acid (PFDoA)	ug/kg	0.12 (J Z)	0.62 (Z)	0.52 (Z)	0.18 (J Z)	0.058 (J)	0.37 (J Z)	0.35 (J Z)	0.23 (J)	NS
Perfluoroheptanesulfonic Acid (PFHpS)	ug/kg	0.024 (U Z)	0.033 (U Z)	0.027 (U)	0.025 (U Z)	0.028 (U)	0.031 (U)	0.029 (J)	0.027 (U)	NS
Perfluoroheptanoic acid (PFHpA)	ug/kg	0.037 (U Z)	0.050 (U Z)	0.059 (J)	0.044 (J Z)	0.044 (U)	0.048 (U)	0.045 (U)	0.041 (J)	NS
Perfluorohexanesulfonic acid (PFHxS)	ug/kg	0.044 (J Z B)	0.063 (J Z B)	0.038 (J B)	0.049 (J Z B)	0.042 (J B)	0.057 (J B)	0.063 (J B)	0.046 (J B)	NS
Perfluorohexanoic acid (PFHxA)	ug/kg	0.066 (J Z)	0.053 (U Z)	0.044 (U)	0.039 (J Z)	0.045 (U)	0.05 (U)	0.047 (U)	0.043 (U)	NS
Perfluorononanoic acid (PFNA)	ug/kg	0.049 (J Z)	0.11 (J Z)	0.12 (J)	0.059 (J Z)	0.043 (J)	0.082 (J)	0.043 (J)	0.053 (J)	NS
Perfluorooctanesulfonamide (PFOSA)	ug/kg	0.018 (J Z)	0.030 (J Z)	0.017 (J)	0.014 (U Z)	0.021 (J)	0.018 (J)	0.017 (U)	0.016 (U)	NS
Perfluorooctanesulfonic acid (PFOS)	ug/kg	0.19 (J Z)	0.54 (Z)	0.6	0.26 (J Z)	0.18 (J)	0.51	0.32 (J)	0.33 (J)	6,000
Perfluorooctanoic acid (PFOA)	ug/kg	0.12 (J Z B)	0.16 (J Z B)	0.11 (J B)	0.20 (J Z B)	0.098 (J B)	0.082 (J B)	0.096 (J B)	0.13 (J B)	16,000
Perfluoropentanoic acid (PFPeA)	ug/kg	0.078 (J Z)	0.072 (J Z)	0.033 (U)	0.13 (J Z)	0.10 (J)	0.037 (U)	0.035 (U)	0.056 (J)	NS
Perfluorotetradecanoic acid (PFTeA)	ug/kg	0.10 (J Z)	0.41 (J Z)	0.25 (J)	0.12 (J Z)	0.053 (J)	0.22 (J)	0.21 (J)	0.15 (J)	NS
Perfluorotridecanoic acid (PFTriA)	ug/kg	0.090 (J Z)	0.42 (J Z)	0.36	0.13 (J Z)	0.045 (J)	0.33 (J)	0.3 (J)	0.15 (J)	NS
Perfluoroundecanoic acid (PFUnA)	ug/kg	0.19 (J Z)	0.76 (Z)	0.87	0.21 (J Z)	0.10 (J)	0.84	0.55	0.33 (J)	NS

NOTE: (U) indicates the compound was analyzed for but not detected. (J) indicates the result is less than the RL, but greater than or equal to the MDL and the concentration is an approximate value. (B) indicates compound was found in the blank and sample. (Z) indicates the data contains important qualifier codes, see hardcopy report and report narrative for further details. (NS) indicates that there is No Standard associated with the compound.

FIGURES



Scale: 1:24,000
1 inch equals 2,000 feet

0 1,000 2,000 4,000 Feet

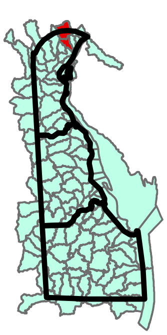
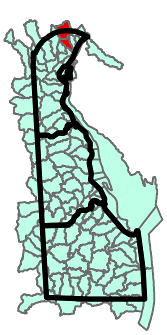


FIGURE 1
BRANDYWINE RIVER DAMS - SEDIMENT EVALUATION
MIDDLE AND LOWER BRANDYWINE CREEK WATERSHEDS
DAM LOCATION MAP
NEW CASTLE COUNTY, DELAWARE

DELAWARE DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL
DNREC - WATAR

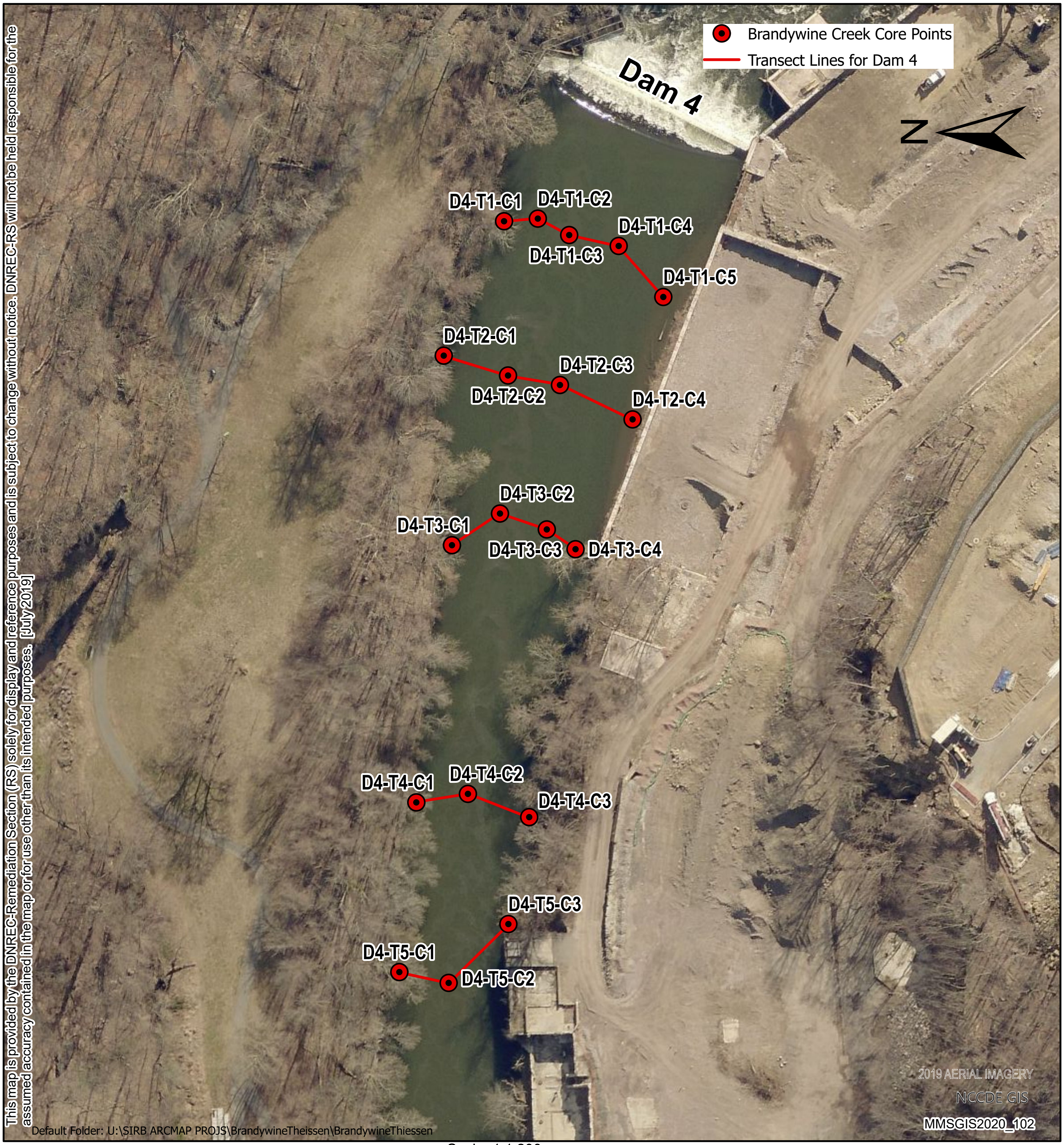


Scale: 1:1,200
1 inch equals 100 feet

Feet
0 50 100 200

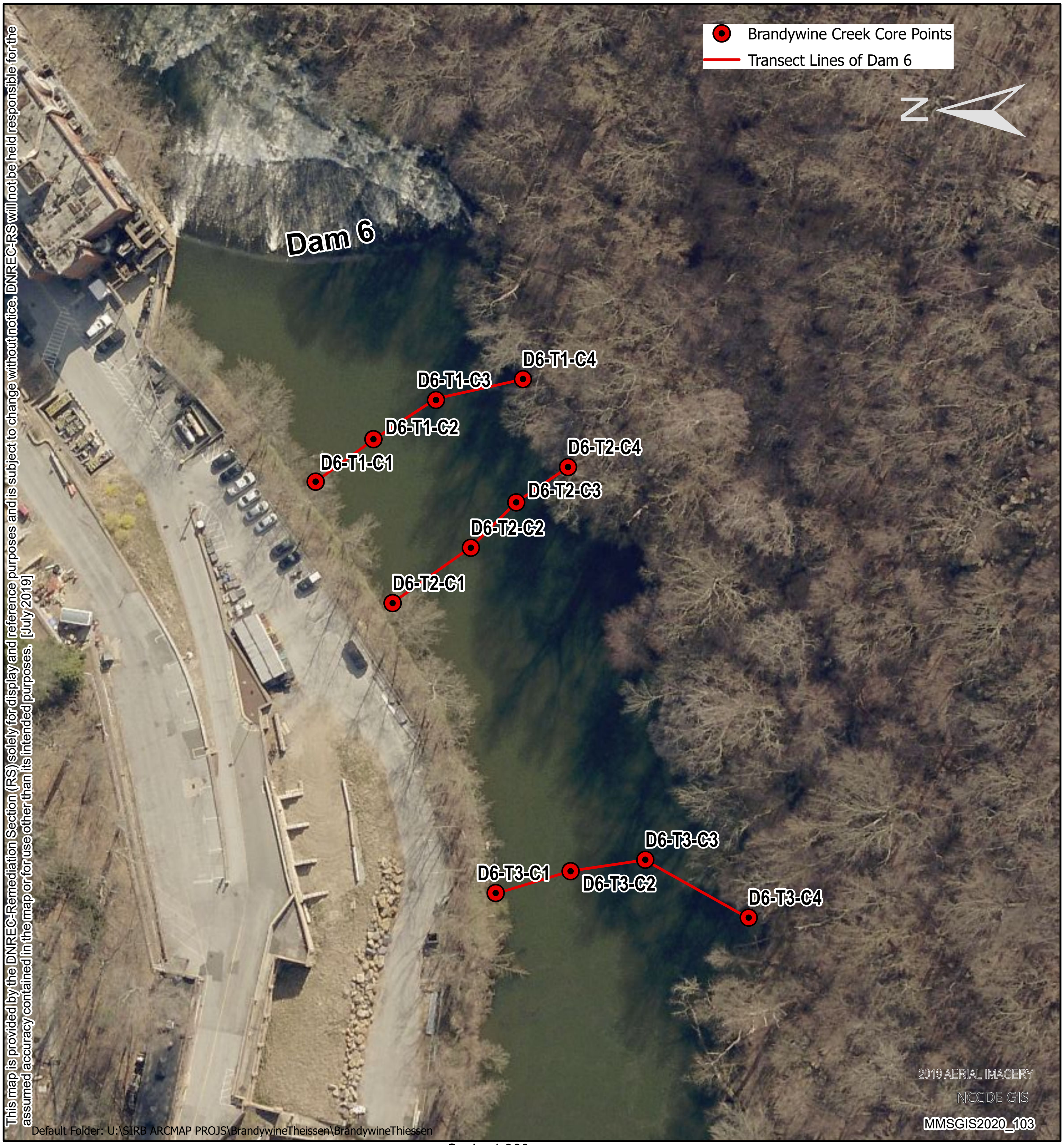
FIGURE 2
BRANDYWINE RIVER DAM 2
SAMPLE LOCATIONS AND TRANSECTS
NEW CASTLE COUNTY, DELAWARE

DELAWARE DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL
DNREC - WATAR

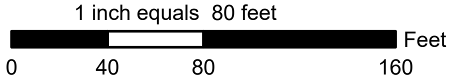


Scale: 1:1,200
1 inch equals 100 feet
0 50 100 200 Feet

FIGURE 3
BRANDYWINE RIVER DAM 4
SAMPLE LOCATIONS AND TRANSECTS
NEW CASTLE COUNTY, DELAWARE



Scale: 1:960
1 inch equals 80 feet



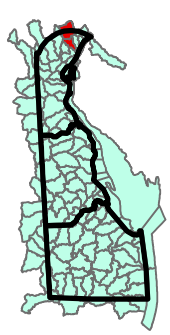
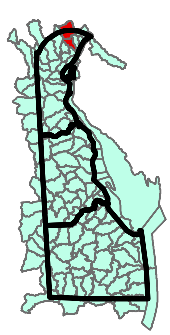


FIGURE 4
BRANDYWINE RIVER DAM 6
SAMPLE LOCATIONS AND TRANSECTS
NEW CASTLE COUNTY, DELAWARE

DELAWARE DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL
DNREC - WATAR

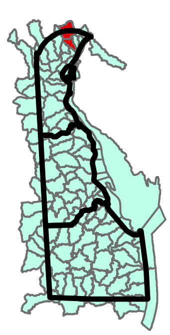


Scale: 1:720
1 inch equals 60 feet

Feet
0 30 60 120

FIGURE 5
BRANDYWINE RIVER DAM 7
SAMPLE LOCATIONS AND TRANSECTS
NEW CASTLE COUNTY, DELAWARE

DELAWARE DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL
DNREC - WATAR

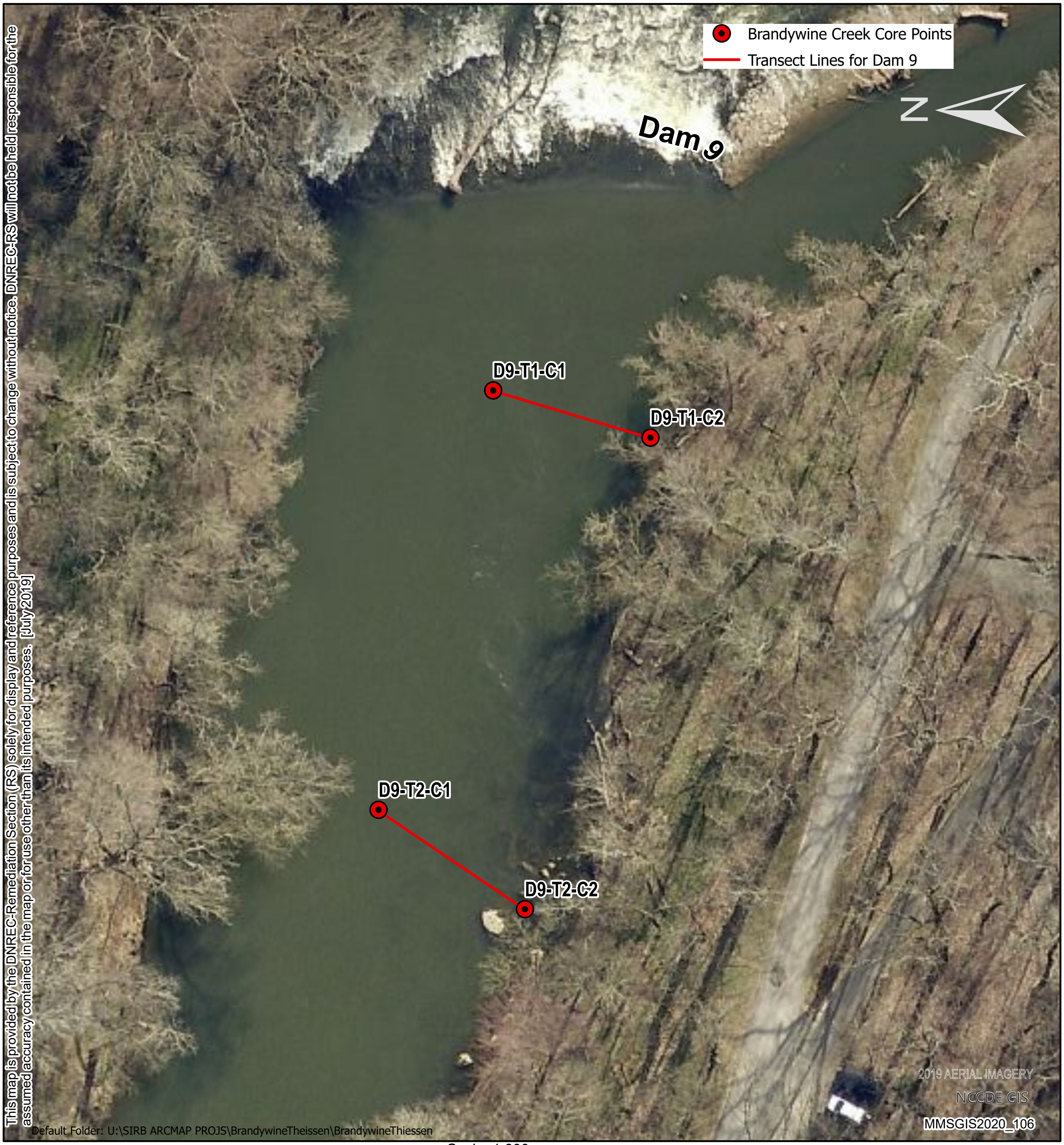


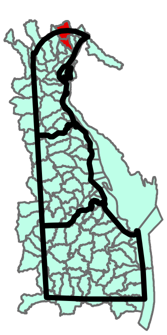
Scale: 1:600
1 inch equals 50 feet

0 25 50 100 Feet

FIGURE 6
BRANDYWINE RIVER DAM 8
SAMPLE LOCATIONS AND TRANSECTS
NEW CASTLE COUNTY, DELAWARE

DELAWARE DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL
DNREC - WATAR

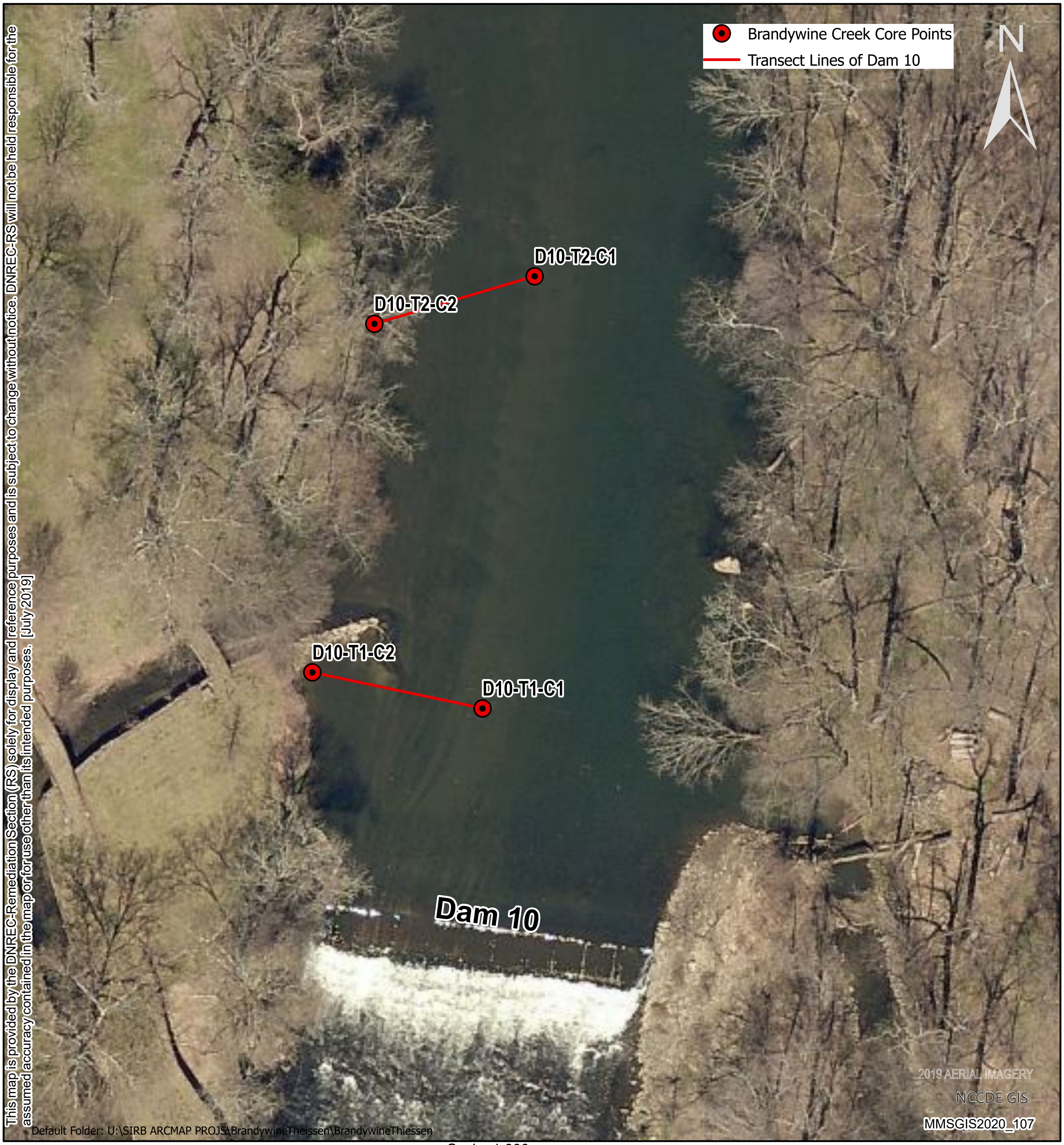


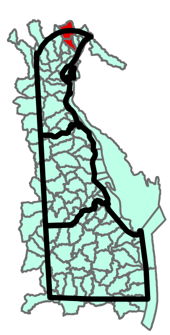


Scale: 1:600
1 inch equals 50 feet
0 25 50 100 Feet

FIGURE 7
BRANDYWINE RIVER DAM 9
SAMPLE LOCATIONS AND TRANSECTS
NEW CASTLE COUNTY, DELAWARE

DELAWARE DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL
DNREC - WATAR



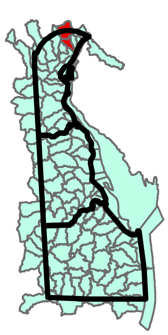


Scale: 1:600
1 inch equals 50 feet

0 25 50 100 Feet

FIGURE 8
BRANDYWINE RIVER DAM 10
SAMPLE LOCATIONS AND TRANSECTS
NEW CASTLE COUNTY, DELAWARE

DELAWARE DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL
DNREC - WATAR



Scale: 1:600
1 inch equals 50 feet

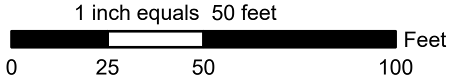


FIGURE 9
BRANDYWINE RIVER DAM 11
SAMPLE LOCATIONS AND TRANSECTS
NEW CASTLE COUNTY, DELAWARE

DELAWARE DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL
DNREC - WATAR

APPENDIX A

AQUASURVEY, INC. FIELD LOGS

AQUA SURVEY, INC.
SEDIMENT CORE LOG

Client: Kleinschmidt		Project: Brandywine Creek			Logger: WR	
Job #: 40-046	Date: 3-6-2020	Time: 0939		Crew:	CS	
Coordinates:	N 640692.64	E 617257.02		Vessel:	Jon boats	
Core # : D2-T1-C1	Zone: DE	Datum: NAD 83		Deploy:	**1**	**2**	**3**
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:		Core Penetration Length (ft.):		3.2		
Measured Water Depth [MWD] [ft.]:	2.0	Recovered Core Length (ft.):		3.1		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:		Sample Length Retained (ft.):		*		
Corrected Depth @ MLLW [ft.]:		Core Volume Retained (gal.):		*		
+ MLW Adjustment [ft.}		Collected to Project Depth:		Yes ☑ No ☐ Refusal ☑		
Corrected Depth @ MLW [ft.]:						
Required Sample Core Length [SCL] [ft.]:						

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
Bottom		

# of containers:				
Type of container:	bucket	hardliner	cup	other

Conditions:

Comments: *Core to DNREC

Core Volumes
Nominal core-barrel diameter: 3.5" .33 gal/ft EST. Volume

Liner Type: Soft

Vibracorer: Slambar

Live Organisms Present	Yes	☐	No	☐
Oil Present	Yes	☐	No	☐
Odor Present	Yes	☐	No	☐
Debris Present	Yes	☐	No	☐
Within 10% of Req'd Core Length	Yes	☐	No	☐
Photo	Yes	☐	No	☐

AQUA SURVEY, INC.
SEDIMENT CORE LOG

Client: Kleinschmidt		Project: Brandywine Creek			Logger: WR	
Job #: 40-046	Date: 3-6-2020	Time: 0939		Crew:	CS	
Coordinates:	N 640692.64	E 617257.02		Vessel:	Jon boats	
Core # : D2-T1-C1	Zone: DE Datum: NAD 83			Deploy:	1	2	3
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:		Core Penetration Length (ft.):			3.2		
Measured Water Depth [MWD] [ft.]:	2.0	Recovered Core Length (ft.):			3.1		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:		Sample Length Retained (ft.):			*		
Corrected Depth @ MLLW [ft.]:		Core Volume Retained (gal.):			*		
+ MLW Adjustment [ft.}		Collected to Project Depth:			Yes ☑ No ☐ Refusal ☑		
Corrected Depth @ MLW [ft.]:							
Required Sample Core Length [SCL] [ft.]:							

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
Bottom		

# of containers:					Core Volumes
Type of container:	bucket	hardliner	cup	other	Nominal core-barrel diameter: 3.5" .33 gal/ft EST. Volume

Conditions:

Liner Type: Soft

Comments: *Core to DNREC

Vibracorer: Slambar

Live Organisms Present	Yes	☐	No	☐
Oil Present	Yes	☐	No	☐
Odor Present	Yes	☐	No	☐
Debris Present	Yes	☐	No	☐
Within 10% of Req'd Core Length	Yes	☐	No	☐
Photo	Yes	☐	No	☐

MLW #td ver 021820

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt		Project: Brandywine Creek		Logger:	WR
Job #: 40-046	Date: 3-6-2020	Time: 0939		Crew:	CS
Coordinates:	N 640692.64	E 617257.02		Vessel:	Jon boats
Core # : D2-T1-C1	Zone: DE Datum: NAD 83			Deploy:	1 / 2 / 3

Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:		Core Penetration Length (ft.):	3.2		
Measured Water Depth [MWD] [ft.]:	2.0	Recovered Core Length (ft.):	3.1		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:		Sample Length Retained (ft.):	*		
Corrected Depth @ MLLW [ft.]:		Core Volume Retained (gal.):	*		
+ MLW Adjustment [ft.}		Collected to Project Depth:	Yes ☑ No ☐ Refusal ☑		
Corrected Depth @ MLW [ft.]:					
Required Sample Core Length [SCL] [ft.]:					

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
Bottom		

# of containers:					Core Volumes
Type of container:	bucket	hardliner	cup	other	Nominal core-barrel diameter: 3.5" .33 gal/ft EST. Volume

Conditions:

Liner Type: Soft

Comments: *Core to DNREC

Vibracorer: Slambar

Live Organisms Present	Yes ☐	No ☐
Oil Present	Yes ☐	No ☐
Odor Present	Yes ☐	No ☐
Debris Present	Yes ☐	No ☐
Within 10% of Req'd Core Length	Yes ☐	No ☐
Photo	Yes ☐	No ☐

MLW #td ver 021820

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt		Project: Brandywine Creek			Logger: WR	
Job #: 40-046	Date: 3-6-2020	Time: 0939		Crew:	CS	
Coordinates:	N 640692.64	E 617257.02		Vessel:	Jon boats	
Core # : D2-T1-C1	Zone: DE Datum: NAD 83			Deploy:	1	2	3
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:		Core Penetration Length (ft.):			3.2		
Measured Water Depth [MWD] [ft.]:	2.0	Recovered Core Length (ft.):			3.1		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:		Sample Length Retained (ft.):			*		
Corrected Depth @ MLLW [ft.]:		Core Volume Retained (gal.):			*		
+ MLW Adjustment [ft.}		Collected to Project Depth:			Yes ☑ No ☐ Refusal ☑		
Corrected Depth @ MLW [ft.]:							
Required Sample Core Length [SCL] [ft.]:							

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
Bottom		

					Core Volumes
# of containers:					Nominal core-barrel
Type of container:	bucket	hardliner	cup	other	diameter: 3.5" .33 gal/ft EST. Volume

Conditions:

Liner Type: Soft

Comments: *Core to DNREC

Vibracorer: Slambar

	Yes	No
Live Organisms Present	☐	☐
Oil Present	☐	☐
Odor Present	☐	☐
Debris Present	☐	☐
Within 10% of Req'd Core Length	☐	☐
Photo	☐	☐

MLW #td ver 021820

AQUA SURVEY, INC.
SEDIMENT CORE LOG

Client: Kleinschmidt		Project: Brandywine Creek			Logger: WR	
Job #: 40-046	Date: 3-6-2020	Time: 0939		Crew:	CS	
Coordinates:	N 640692.64	E 617257.02		Vessel:	Jon boats	
Core # : D2-T1-C1	Zone: DE Datum: NAD 83			Deploy:	1	2	3
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:		Core Penetration Length (ft.):	3.2		
Measured Water Depth [MWD] [ft.]:	2.0	Recovered Core Length (ft.):	3.1		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:		Sample Length Retained (ft.):	*		
Corrected Depth @ MLLW [ft.]:		Core Volume Retained (gal.):	*		
+ MLW Adjustment [ft.}		Collected to Project Depth:	Yes ☑ No ☐ Refusal ☑		
Corrected Depth @ MLW [ft.]:					
Required Sample Core Length [SCL] [ft.]:					

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
Bottom		

# of containers:				
Type of container:	bucket	hardliner	cup	other

Core Volumes
Nominal core-barrel diameter: 3.5" .33 gal/ft EST. Volume

Conditions:

Liner Type: Soft

Vibracorer: Slambar

Comments: *Core to DNREC

Live Organisms Present	Yes	☐	No	☐
Oil Present	Yes	☐	No	☐
Odor Present	Yes	☐	No	☐
Debris Present	Yes	☐	No	☐
Within 10% of Req'd Core Length	Yes	☐	No	☐
Photo	Yes	☐	No	☐

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt		Project: Brandywine Creek		Logger: WR	
Job #: 40-046	Date: 3-6-2020	Time: 0939		Crew: CS	
Coordinates:	N 640692.64	E 617257.02		Vessel: Jon boats	
Core # : D2-T1-C1	Zone: DE Datum: NAD 83		Deploy:	1	2	3

Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:		Core Penetration Length (ft.):	3.2		
Measured Water Depth [MWD] [ft.]:	2.0	Recovered Core Length (ft.):	3.1		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:		Sample Length Retained (ft.):	*		
Corrected Depth @ MLLW [ft.]:		Core Volume Retained (gal.):	*		
+ MLW Adjustment [ft.}:		Collected to Project Depth:	Yes ☑ No ☐ Refusal ☑		
Corrected Depth @ MLW [ft.]:					
Required Sample Core Length [SCL] [ft.]:					

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
Bottom		

# of containers:				
Type of container:	bucket	hardliner	cup	other

Core Volumes
Nominal core-barrel diameter: 3.5" .33 gal/ft EST. Volume

Conditions:

Liner Type: Soft

Comments: *Core to DNREC

Vibracorer: Slambar

	Yes	No
Live Organisms Present	☐	☐
Oil Present	☐	☐
Odor Present	☐	☐
Debris Present	☐	☐
Within 10% of Req'd Core Length	☐	☐
Photo	☐	☐

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt		Project: Brandywine Creek		Logger: WR	
Job #: 40-046	Date: 3-6-2020	Time: 0939		Crew: CS	
Coordinates:	N 640692.64	E 617257.02		Vessel: Jon boats	
Core # : D2-T1-C1	Zone: DE Datum: NAD 83		Deploy:	1	2	3

Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:		Core Penetration Length (ft.):	3.2		
Measured Water Depth [MWD] [ft.]:	2.0	Recovered Core Length (ft.):	3.1		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:		Sample Length Retained (ft.):	*		
Corrected Depth @ MLLW [ft.]:		Core Volume Retained (gal.):	*		
+ MLW Adjustment [ft.}		Collected to Project Depth:	Yes ☑ No ☐ Refusal ☑		
Corrected Depth @ MLW [ft.]:					
Required Sample Core Length [SCL] [ft.]:					

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
Bottom		

# of containers:				
Type of container:	bucket	hardliner	cup	other

Core Volumes
Nominal core-barrel diameter: 3.5" .33 gal/ft EST. Volume

Conditions:

Liner Type: Soft

Vibracorer: Slambar

Comments: *Core to DNREC

Live Organisms Present	Yes	☐	No	☐
Oil Present	Yes	☐	No	☐
Odor Present	Yes	☐	No	☐
Debris Present	Yes	☐	No	☐
Within 10% of Req'd Core Length	Yes	☐	No	☐
Photo	Yes	☐	No	☐

MLW #td ver 021820

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt		Project: Brandywine Creek			Logger: WR	
Job #: 40-046	Date: 3-6-2020	Time: 0939		Crew:	CS	
Coordinates:	N 640692.64	E 617257.02		Vessel:	Jon boats	
Core # : D2-T1-C1	Zone: DE Datum: NAD 83			Deploy:	1	2	3
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:		Core Penetration Length (ft.):			3.2		
Measured Water Depth [MWD] [ft.]:	2.0	Recovered Core Length (ft.):			3.1		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:		Sample Length Retained (ft.):			*		
Corrected Depth @ MLLW [ft.]:		Core Volume Retained (gal.):			*		
+ MLW Adjustment [ft.}		Collected to Project Depth:			Yes ✔ No ☐ Refusal ✔		
Corrected Depth @ MLW [ft.]:							
Required Sample Core Length [SCL] [ft.]:							

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
Bottom		

					Core Volumes
# of containers:					Nominal core-barrel
Type of container:	bucket	hardliner	cup	other	diameter: 3.5" .33 gal/ft EST. Volume

Conditions:

Liner Type: Soft

Comments: *Core to DNREC

Vibracorer: Slambar

Live Organisms Present	Yes	☐	No	☐
Oil Present	Yes	☐	No	☐
Odor Present	Yes	☐	No	☐
Debris Present	Yes	☐	No	☐
Within 10% of Req'd Core Length	Yes	☐	No	☐
Photo	Yes	☐	No	☐

MLW #td ver 021820

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt		Project: Brandywine Creek		Logger: WR		
Job #: 40-046	Date: 3-6-2020	Time: 0939		Crew: CS		
Coordinates:	N 640692.64	E 617257.02		Vessel: Jon boats		
Core # : D2-T1-C1	Zone: DE Datum: NAD 83			Deploy:	1	2	3

Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:		Core Penetration Length (ft.):	3.2		
Measured Water Depth [MWD] [ft.]:	2.0	Recovered Core Length (ft.):	3.1		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:		Sample Length Retained (ft.):	*		
Corrected Depth @ MLLW [ft.]:		Core Volume Retained (gal.):	*		
+ MLW Adjustment [ft.}		Collected to Project Depth:	Yes ☑ No ☐ Refusal ☑		
Corrected Depth @ MLW [ft.]:					
Required Sample Core Length [SCL] [ft.]:					

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
Bottom		

# of containers:					Core Volumes
Type of container:	bucket	hardliner	cup	other	Nominal core-barrel diameter: 3.5" .33 gal/ft EST. Volume

Conditions:

Liner Type: Soft

Comments: *Core to DNREC

Vibracorer: Slambar

Live Organisms Present	Yes	☐	No	☐
Oil Present	Yes	☐	No	☐
Odor Present	Yes	☐	No	☐
Debris Present	Yes	☐	No	☐
Within 10% of Req'd Core Length	Yes	☐	No	☐
Photo	Yes	☐	No	☐

MLW #td ver 021820

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt		Project: Brandywine Creek		Logger: WR	
Job #: 40-046	Date: 3-6-2020	Time: 0939		Crew: CS	
Coordinates:	N 640692.64	E 617257.02		Vessel: Jon boats	
Core # : D2-T1-C1	Zone: DE Datum: NAD 83			Deploy:	1 / 2 / 3

Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:		Core Penetration Length (ft.):	3.2		
Measured Water Depth [MWD] [ft.]:	2.0	Recovered Core Length (ft.):	3.1		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:		Sample Length Retained (ft.):	*		
Corrected Depth @ MLLW [ft.]:		Core Volume Retained (gal.):	*		
+ MLW Adjustment [ft.}		Collected to Project Depth:	Yes ☑ No ☐ Refusal ☑		
Corrected Depth @ MLW [ft.]:					
Required Sample Core Length [SCL] [ft.]:					

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
Bottom		

# of containers:					Core Volumes
Type of container:	bucket	hardliner	cup	other	Nominal core-barrel diameter: 3.5" .33 gal/ft EST. Volume

Conditions:

Liner Type: Soft

Comments: *Core to DNREC

Vibracorer: Slambar

Live Organisms Present	Yes	☐	No	☐
Oil Present	Yes	☐	No	☐
Odor Present	Yes	☐	No	☐
Debris Present	Yes	☐	No	☐
Within 10% of Req'd Core Length	Yes	☐	No	☐
Photo	Yes	☐	No	☐

MLW #td ver 021820

AQUA SURVEY, INC.
SEDIMENT CORE LOG

Client: Kleinschmidt		Project: Brandywine Creek		Logger: WR		
Job #: 40-046	Date: 3-6-2020	Time: 0939		Crew: CS		
Coordinates:	N 640692.64	E 617257.02		Vessel: Jon boats		
Core # : D2-T1-C1	Zone: DE Datum: NAD 83		Deploy:	1	2	3
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:		Core Penetration Length (ft.):		3.2		
Measured Water Depth [MWD] [ft.]: 2.0		Recovered Core Length (ft.):		3.1		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:		Sample Length Retained (ft.):		*		
Corrected Depth @ MLLW [ft.]:		Core Volume Retained (gal.):		*		
+ MLW Adjustment [ft.}		Collected to Project Depth:		Yes ☑ No ☐ Refusal ☑		
Corrected Depth @ MLW [ft.]:						
Required Sample Core Length [SCL] [ft.]:						

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
Bottom		

# of containers:					Core Volumes
Type of container:	bucket	hardliner	cup	other	Nominal core-barrel diameter: 3.5" .33 gal/ft EST. Volume

Conditions:

Liner Type: Soft

Comments: *Core to DNREC

Vibracorer: Slambar

Live Organisms Present	Yes	☐	No	☐
Oil Present	Yes	☐	No	☐
Odor Present	Yes	☐	No	☐
Debris Present	Yes	☐	No	☐
Within 10% of Req'd Core Length	Yes	☐	No	☐
Photo	Yes	☐	No	☐

MLW #td ver 021820

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt	Project: Brandywine Creek		Logger: WR
Job #: 40-046	Date: 3-6-2020	Time: 0939	Crew: CS
Coordinates:	N 640692.64	E 617257.02	Vessel: Jon boats
Core # : D2-T1-C1	Zone: DE Datum: NAD 83		

			Deploy:	1	2	3
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:			Core Penetration Length (ft.):	3.2		
Measured Water Depth [MWD] [ft.]:	2.0		Recovered Core Length (ft.):	3.1		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:			Sample Length Retained (ft.):	*		
Corrected Depth @ MLLW [ft.]:			Core Volume Retained (gal.):	*		
+ MLW Adjustment [ft.}			Collected to Project Depth:	Yes ☑ No ☐ Refusal ☑		
Corrected Depth @ MLW [ft.]:						
Required Sample Core Length [SCL] [ft.]:						

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
Bottom		

# of containers:				
Type of container:	bucket	hardliner	cup	other

Core Volumes
Nominal core-barrel diameter: 3.5" .33 gal/ft EST. Volume

Conditions:

Liner Type: Soft

Vibracorer: Slambar

Comments: *Core to DNREC

	Yes	No
Live Organisms Present	☐	☐
Oil Present	☐	☐
Odor Present	☐	☐
Debris Present	☐	☐
Within 10% of Req'd Core Length	☐	☐
Photo	☐	☐

MLW #td ver 021820

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt		Project: Brandywine Creek			Logger: WR		
Job #: 40-046	Date: 3-6-2020	Time: 0939		Crew:	CS		
Coordinates:	N 640692.64	E 617257.02		Vessel:	Jon boats		
Core # : D2-T1-C1	Zone: DE Datum: NAD 83			Deploy:	1	2	3
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:		Core Penetration Length (ft.):			3.2		
Measured Water Depth [MWD] [ft.]:	2.0	Recovered Core Length (ft.):			3.1		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:		Sample Length Retained (ft.):			*		
Corrected Depth @ MLLW [ft.]:		Core Volume Retained (gal.):			*		
+ MLW Adjustment [ft.}		Collected to Project Depth:			Yes ☑ No ☐ Refusal ☑		
Corrected Depth @ MLW [ft.]:							
Required Sample Core Length [SCL] [ft.]:							

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
Bottom		

# of containers:					Core Volumes
Type of container:	bucket	hardliner	cup	other	Nominal core-barrel diameter: 3.5" .33 gal/ft EST. Volume

Conditions:

Liner Type: Soft

Comments: *Core to DNREC

Vibracorer: Slambar

Live Organisms Present	Yes ☐	No ☐
Oil Present	Yes ☐	No ☐
Odor Present	Yes ☐	No ☐
Debris Present	Yes ☐	No ☐
Within 10% of Req'd Core Length	Yes ☐	No ☐
Photo	Yes ☐	No ☐

AQUA SURVEY, INC.
SEDIMENT CORE LOG

Client: Kleinschmidt		Project: Brandywine Creek			Logger: WR	
Job #: 40-046	Date: 3-6-2020	Time: 0939		Crew:	CS	
Coordinates:	N 640692.64	E 617257.02		Vessel:	Jon boats	
Core # : D2-T1-C1	Zone: DE Datum: NAD 83			Deploy:	1	2	3
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Corrected Depth @ MLLW [ft.]:		Core Volume Retained (gal.):			*		
+ MLW Adjustment [ft.}		Collected to Project Depth:			Yes ☑ No ☐ Refusal ☑		
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All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
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# of containers:				
Type of container:	bucket	hardliner	cup	other

Core Volumes
Nominal core-barrel diameter: 3.5" .33 gal/ft EST. Volume

Conditions:

Liner Type: Soft

Comments: *Core to DNREC

Vibracorer: Slambar

	Yes	No
Live Organisms Present	☐	☐
Oil Present	☐	☐
Odor Present	☐	☐
Debris Present	☐	☐
Within 10% of Req'd Core Length	☐	☐
Photo	☐	☐

MLW #td ver 021820

AQUA SURVEY, INC.
SEDIMENT CORE LOG

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Job #: 40-046	Date: 3-6-2020	Time: 0939		Crew: CS		
Coordinates:	N 640692.64	E 617257.02		Vessel: Jon boats		
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Corrected Depth @ MLW [ft.]:					
Required Sample Core Length [SCL] [ft.]:					

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
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# of containers:					
Type of container:	bucket	hardliner	cup	other	

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Liner Type: Soft

Comments: *Core to DNREC

Vibracorer: Slambar

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Oil Present	Yes ☐	No ☐
Odor Present	Yes ☐	No ☐
Debris Present	Yes ☐	No ☐
Within 10% of Req'd Core Length	Yes ☐	No ☐
Photo	Yes ☐	No ☐

MLW #td ver 021820

AQUA SURVEY, INC.

SEDIMENT CORE LOG

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Job #: 40-046	Date: 3-6-2020	Time: 0939		Crew:	CS	
Coordinates:	N 640692.64	E 617257.02		Vessel:	Jon boats	
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Sample Interval (ft.)	Sample Id #	Description
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Type of container:	bucket	hardliner	cup	other

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Comments: *Core to DNREC

Vibracorer: Slambar

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Odor Present	Yes	☐	No	☐
Debris Present	Yes	☐	No	☐
Within 10% of Req'd Core Length	Yes	☐	No	☐
Photo	Yes	☐	No	☐

MLW #td ver 021820

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt	Project: Brandywine Creek		Logger: WR
Job #: 40-046	Date: 3-6-2020	Time: 0939	Crew: CS
Coordinates:	N 640692.64	E 617257.02	Vessel: Jon boats
Core # : D2-T1-C1	Zone: DE Datum: NAD 83		

			Deploy:	1	2	3
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Corrected Depth @ MLW [ft.]:						
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All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
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# of containers:				
Type of container:	bucket	hardliner	cup	other

Core Volumes
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Liner Type: Soft

Vibracorer: Slambar

Comments: *Core to DNREC

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Oil Present	Yes ☐	No ☐
Odor Present	Yes ☐	No ☐
Debris Present	Yes ☐	No ☐
Within 10% of Req'd Core Length	Yes ☐	No ☐
Photo	Yes ☐	No ☐

MLW #td ver 021820

AQUA SURVEY, INC.
SEDIMENT CORE LOG

Client: Kleinschmidt		Project: Brandywine Creek			Logger: WR	
Job #: 40-046	Date: 3-6-2020	Time: 0939		Crew:	CS	
Coordinates:	N 640692.64	E 617257.02		Vessel:	Jon boats	
Core # : D2-T1-C1	Zone: DE	Datum: NAD 83		Deploy:	1	2	3

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Oil Present	Yes	☐	No	☐
Odor Present	Yes	☐	No	☐
Debris Present	Yes	☐	No	☐
Within 10% of Req'd Core Length	Yes	☐	No	☐
Photo	Yes	☐	No	☐

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SEDIMENT CORE LOG

Client: Kleinschmidt		Project: Brandywine Creek			Logger: WR	
Job #: 40-046	Date: 3-6-2020	Time: 0939		Crew:	CS	
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Debris Present	Yes	☐	No	☐
Within 10% of Req'd Core Length	Yes	☐	No	☐
Photo	Yes	☐	No	☐

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Within 10% of Req'd Core Length	Yes	☐	No	☐
Photo	Yes	☐	No	☐

AQUA SURVEY, INC.
SEDIMENT CORE LOG

Client: Kleinschmidt		Project: Brandywine Creek			Logger: WR	
Job #: 40-046	Date: 3-6-2020	Time: 0939	Crew:	CS		
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Vibracorer: Slambar

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Oil Present	☐	☐
Odor Present	☐	☐
Debris Present	☐	☐
Within 10% of Req'd Core Length	☐	☐
Photo	☐	☐

MLW #td ver 021820

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt		Project: Brandywine Creek			Logger: WR	
Job #: 40-046	Date: 3-6-2020	Time: 0939		Crew:	CS	
Coordinates:	N 640692.64	E 617257.02		Vessel:	Jon boats	
Core # : D2-T1-C1	Zone: DE Datum: NAD 83			Deploy:	1	2	3
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:		Core Penetration Length (ft.):	3.2		
Measured Water Depth [MWD] [ft.]:	2.0	Recovered Core Length (ft.):	3.1		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:		Sample Length Retained (ft.):	*		
Corrected Depth @ MLLW [ft.]:		Core Volume Retained (gal.):	*		
+ MLW Adjustment [ft.}:		Collected to Project Depth:	Yes ☑ No ☐ Refusal ☑		
Corrected Depth @ MLW [ft.]:					
Required Sample Core Length [SCL] [ft.]:					

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
Bottom		

# of containers:					Core Volumes
Type of container:	bucket	hardliner	cup	other	Nominal core-barrel diameter: 3.5" .33 gal/ft EST. Volume

Conditions:

Liner Type: Soft

Comments: *Core to DNREC

Vibracorer: Slambar

Live Organisms Present	Yes	☐	No	☐
Oil Present	Yes	☐	No	☐
Odor Present	Yes	☐	No	☐
Debris Present	Yes	☐	No	☐
Within 10% of Req'd Core Length	Yes	☐	No	☐
Photo	Yes	☐	No	☐

MLW #td ver 021820

AQUA SURVEY, INC.

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Client: Kleinschmidt		Project: Brandywine Creek		Logger: WR		
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Sample Interval (ft.)	Sample Id #	Description
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Photo	Yes	☐	No	☐

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Debris Present	☐	☐
Within 10% of Req'd Core Length	☐	☐
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Bottom		

	bucket	hardliner	cup	other
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Photo	☐	☐

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Photo	Yes	☐	No	☐

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Sample Interval (ft.)	Sample Id #	Description
Top		
Bottom		

# of containers:					Core Volumes Nominal core-barrel
Type of container:	bucket	hardliner	cup	other	diameter: 3.5" .33 gal/ft EST. Volume

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AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt		Project: Brandywine Creek		Logger: WR	
Job #: 40-046	Date: 3-6-2020	Time: 0939	Crew:	CS	
Coordinates:	N 640692.64	E 617257.02	Vessel:	Jon boats	
Core # : D2-T1-C1	Zone: DE Datum: NAD 83		Deploy:	1	2	3

Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:		Core Penetration Length (ft.):	3.2		
Measured Water Depth [MWD] [ft.]:	2.0	Recovered Core Length (ft.):	3.1		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:		Sample Length Retained (ft.):	*		
Corrected Depth @ MLLW [ft.]:		Core Volume Retained (gal.):	*		
+ MLW Adjustment [ft.}		Collected to Project Depth:	Yes ☑ No ☐ Refusal ☑		
Corrected Depth @ MLW [ft.]:					
Required Sample Core Length [SCL] [ft.]:					

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
Bottom		

# of containers:					Core Volumes Nominal core-barrel
Type of container:	bucket	hardliner	cup	other	diameter: 3.5" .33 gal/ft EST. Volume

Conditions:

Liner Type: Soft

Comments: *Core to DNREC

Vibracorer: Slambar

Live Organisms Present	Yes	☐	No	☐
Oil Present	Yes	☐	No	☐
Odor Present	Yes	☐	No	☐
Debris Present	Yes	☐	No	☐
Within 10% of Req'd Core Length	Yes	☐	No	☐
Photo	Yes	☐	No	☐

MLW #td ver 021820

AQUA SURVEY, INC.
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Client: Kleinschmidt		Project: Brandywine Creek			Logger: WR	
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Coordinates:	N 640692.64	E 617257.02		Vessel:	Jon boats	
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			Deploy 1	Deploy 2	Deploy 3
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Photo	Yes	☐	No	☐

MLW #td ver 021820

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt		Project: Brandywine Creek			Logger: WR	
Job #: 40-046	Date: 3-6-2020	Time: 0939		Crew:	CS	
Coordinates:	N 640692.64	E 617257.02		Vessel:	Jon boats	
Core # : D2-T1-C1	Zone: DE	Datum: NAD 83		Deploy:	1	2	3

Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:		Core Penetration Length (ft.):	3.2		
Measured Water Depth [MWD] [ft.]:	2.0	Recovered Core Length (ft.):	3.1		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:		Sample Length Retained (ft.):	*		
Corrected Depth @ MLLW [ft.]:		Core Volume Retained (gal.):	*		
+ MLW Adjustment [ft.}		Collected to Project Depth:	Yes ☑ No ☐ Refusal ☑		
Corrected Depth @ MLW [ft.]:					
Required Sample Core Length [SCL] [ft.]:					

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
Bottom		

# of containers:				
Type of container:	bucket	hardliner	cup	other

Core Volumes

Nominal core-barrel diameter: 3.5" .33 gal/ft EST. Volume

Conditions:

Liner Type: Soft

Comments: *Core to DNREC

Vibracorer: Slambar

Live Organisms Present	Yes	☐	No	☐
Oil Present	Yes	☐	No	☐
Odor Present	Yes	☐	No	☐
Debris Present	Yes	☐	No	☐
Within 10% of Req'd Core Length	Yes	☐	No	☐
Photo	Yes	☐	No	☐

AQUA SURVEY, INC.
SEDIMENT CORE LOG

Client: Kleinschmidt		Project: Brandywine Creek			Logger: WR	
Job #: 40-046	Date: 3-6-2020	Time: 0939		Crew:	CS	
Coordinates:	N 640692.64	E 617257.02		Vessel:	Jon boats	
Core # : D2-T1-C1	Zone: DE Datum: NAD 83			Deploy:	1	2	3

Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:		Core Penetration Length (ft.):	3.2		
Measured Water Depth [MWD] [ft.]:	2.0	Recovered Core Length (ft.):	3.1		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:		Sample Length Retained (ft.):	*		
Corrected Depth @ MLLW [ft.]:		Core Volume Retained (gal.):	*		
+ MLW Adjustment [ft.}		Collected to Project Depth:	Yes ☑ No ☐ Refusal ☑		
Corrected Depth @ MLW [ft.]:					
Required Sample Core Length [SCL] [ft.]:					

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
Bottom		

# of containers:					Core Volumes
Type of container:	bucket	hardliner	cup	other	Nominal core-barrel diameter: 3.5" .33 gal/ft EST. Volume

Conditions:

Liner Type: Soft

Comments: *Core to DNREC

Vibracorer: Slambar

Live Organisms Present	Yes	☐	No	☐
Oil Present	Yes	☐	No	☐
Odor Present	Yes	☐	No	☐
Debris Present	Yes	☐	No	☐
Within 10% of Req'd Core Length	Yes	☐	No	☐
Photo	Yes	☐	No	☐

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt		Project: Brandywine Creek			Logger: WR	
Job #: 40-046	Date: 3-6-2020	Time: 0939	Crew:	CS		
Coordinates:	N 640692.64	E 617257.02	Vessel:	Jon boats		
Core # : D2-T1-C1	Zone: DE Datum: NAD 83		Deploy:	1	2	3
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:		Core Penetration Length (ft.):		3.2		
Measured Water Depth [MWD] [ft.]:	2.0	Recovered Core Length (ft.):		3.1		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:		Sample Length Retained (ft.):		*		
Corrected Depth @ MLLW [ft.]:		Core Volume Retained (gal.):		*		
+ MLW Adjustment [ft.}		Collected to Project Depth:		Yes ☑	No ☐	Refusal ☑
Corrected Depth @ MLW [ft.]:						
Required Sample Core Length [SCL] [ft.]:						

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
Bottom		

# of containers:					Core Volumes Nominal core-barrel
Type of container:	bucket	hardliner	cup	other	diameter: 3.5" .33 gal/ft EST. Volume

Conditions:

Liner Type: Soft

Comments: *Core to DNREC

Vibracorer: Slambar

Live Organisms Present	Yes	☐	No	☐
Oil Present	Yes	☐	No	☐
Odor Present	Yes	☐	No	☐
Debris Present	Yes	☐	No	☐
Within 10% of Req'd Core Length	Yes	☐	No	☐
Photo	Yes	☐	No	☐

MLW #td ver 021820

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt		Project: Brandywine Creek		Logger: WR	
Job #: 40-046	Date: 3-6-2020	Time: 0939	Crew:	CS	
Coordinates:	N 640692.64	E 617257.02	Vessel:	Jon boats	
Core # : D2-T1-C1	Zone: DE Datum: NAD 83		Deploy:	1	2	3

Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:		Core Penetration Length (ft.):	3.2		
Measured Water Depth [MWD] [ft.]:	2.0	Recovered Core Length (ft.):	3.1		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:		Sample Length Retained (ft.):	*		
Corrected Depth @ MLLW [ft.]:		Core Volume Retained (gal.):	*		
+ MLW Adjustment [ft.}		Collected to Project Depth:	Yes ☑ No ☐ Refusal ☑		
Corrected Depth @ MLW [ft.]:					
Required Sample Core Length [SCL] [ft.]:					

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
Bottom		

# of containers:				
Type of container:	bucket	hardliner	cup	other

Core Volumes
Nominal core-barrel diameter: 3.5" .33 gal/ft EST. Volume

Conditions:

Liner Type: Soft

Vibracorer: Slambar

Comments: *Core to DNREC

Live Organisms Present	Yes	☐	No	☐
Oil Present	Yes	☐	No	☐
Odor Present	Yes	☐	No	☐
Debris Present	Yes	☐	No	☐
Within 10% of Req'd Core Length	Yes	☐	No	☐
Photo	Yes	☐	No	☐

MLW #td ver 021820

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt	Project: Brandywine Creek		Logger: WR
Job #: 40-046	Date: 3-6-2020	Time: 0939	Crew: CS
Coordinates:	N 640692.64	E 617257.02	Vessel: Jon boats
Core # : D2-T1-C1	Zone: DE Datum: NAD 83		Deploy:

			Deploy 1	2	3
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:		Core Penetration Length (ft.):	3.2		
Measured Water Depth [MWD] [ft.]:	2.0	Recovered Core Length (ft.):	3.1		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:		Sample Length Retained (ft.):	*		
Corrected Depth @ MLLW [ft.]:		Core Volume Retained (gal.):	*		
+ MLW Adjustment [ft.}		Collected to Project Depth:	Yes ☑ No ☐ Refusal ☑		
Corrected Depth @ MLW [ft.]:					
Required Sample Core Length [SCL] [ft.]:					

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
Bottom		

# of containers:				
Type of container:	bucket	hardliner	cup	other

Core Volumes
Nominal core-barrel diameter: 3.5" .33 gal/ft EST. Volume

Conditions:

Comments: *Core to DNREC

Liner Type: Soft

Vibracorer: Slambar

	Yes	No
Live Organisms Present	☐	☐
Oil Present	☐	☐
Odor Present	☐	☐
Debris Present	☐	☐
Within 10% of Req'd Core Length	☐	☐
Photo	☐	☐

MLW #td ver 021820

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt		Project: Brandywine Creek		Logger: WR	
Job #: 40-046	Date: 3-6-2020	Time: 0939		Crew: CS	
Coordinates:	N 640692.64	E 617257.02		Vessel: Jon boats	
Core # : D2-T1-C1	Zone: DE Datum: NAD 83		Deploy:	1	2	3

Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:		Core Penetration Length (ft.):	3.2		
Measured Water Depth [MWD] [ft.]:	2.0	Recovered Core Length (ft.):	3.1		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:		Sample Length Retained (ft.):	*		
Corrected Depth @ MLLW [ft.]:		Core Volume Retained (gal.):	*		
+ MLW Adjustment [ft.}		Collected to Project Depth:	Yes ☑ No ☐ Refusal ☑		
Corrected Depth @ MLW [ft.]:					
Required Sample Core Length [SCL] [ft.]:					

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
Bottom		

# of containers:					Core Volumes
Type of container:	bucket	hardliner	cup	other	Nominal core-barrel diameter: 3.5" .33 gal/ft EST. Volume

Conditions:

Liner Type: Soft

Comments: *Core to DNREC

Vibracorer: Slambar

Live Organisms Present	Yes	☐	No	☐
Oil Present	Yes	☐	No	☐
Odor Present	Yes	☐	No	☐
Debris Present	Yes	☐	No	☐
Within 10% of Req'd Core Length	Yes	☐	No	☐
Photo	Yes	☐	No	☐

AQUA SURVEY, INC.
SEDIMENT CORE LOG

Client: Kleinschmidt		Project: Brandywine Creek		Logger: WR	
Job #: 40-046	Date: 3-6-2020	Time: 0939	Crew:	CS	
Coordinates:	N 640692.64	E 617257.02	Vessel:	Jon boats	
Core # : D2-T1-C1	Zone: DE Datum: NAD 83		Deploy:	1	2	3

Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:		Core Penetration Length (ft.):	3.2		
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Corrected Depth @ MLLW [ft.]:		Core Volume Retained (gal.):	*		
+ MLW Adjustment [ft.}		Collected to Project Depth:	Yes ☑ No ☐ Refusal ☑		
Corrected Depth @ MLW [ft.]:					
Required Sample Core Length [SCL] [ft.]:					

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
Bottom		

# of containers:				
Type of container:	bucket	hardliner	cup	other

Core Volumes
Nominal core-barrel diameter: 3.5" .33 gal/ft EST. Volume

Conditions:

Liner Type: Soft

Comments: *Core to DNREC

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Live Organisms Present	Yes	☐	No	☐
Oil Present	Yes	☐	No	☐
Odor Present	Yes	☐	No	☐
Debris Present	Yes	☐	No	☐
Within 10% of Req'd Core Length	Yes	☐	No	☐
Photo	Yes	☐	No	☐

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt		Project: Brandywine Creek			Logger: WR	
Job #: 40-046	Date: 3-6-2020	Time: 0939		Crew:	CS	
Coordinates:	N 640692.64	E 617257.02		Vessel:	Jon boats	
Core # : D2-T1-C1	Zone: DE	Datum: NAD 83		Deploy:	1	2	3
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:		Core Penetration Length (ft.):			3.2		
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Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:		Sample Length Retained (ft.):			*		
Corrected Depth @ MLLW [ft.]:		Core Volume Retained (gal.):			*		
+ MLW Adjustment [ft.}		Collected to Project Depth:			Yes ☑ No ☐ Refusal ☑		
Corrected Depth @ MLW [ft.]:							
Required Sample Core Length [SCL] [ft.]:							

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
Bottom		

# of containers:					
Type of container:	bucket	hardliner	cup	other	

Core Volumes
Nominal core-barrel diameter: 3.5" .33 gal/ft EST. Volume

Conditions:

Liner Type: Soft

Vibracorer: Slambar

Comments: *Core to DNREC

	Yes	No
Live Organisms Present	☐	☐
Oil Present	☐	☐
Odor Present	☐	☐
Debris Present	☐	☐
Within 10% of Req'd Core Length	☐	☐
Photo	☐	☐

MLW #td ver 021820

AQUA SURVEY, INC.
SEDIMENT CORE LOG

Client: Kleinschmidt		Project: Brandywine Creek			Logger: WR	
Job #: 40-046	Date: 3-6-2020	Time: 0939		Crew:	CS	
Coordinates:	N 640692.64	E 617257.02		Vessel:	Jon boats	
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Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:		Core Penetration Length (ft.):			3.2		
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Corrected Depth @ MLLW [ft.]:		Core Volume Retained (gal.):			*		
+ MLW Adjustment [ft.}		Collected to Project Depth:			Yes ☑ No ☐ Refusal ☑		
Corrected Depth @ MLW [ft.]:							
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All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
Bottom		

# of containers:				
Type of container:	bucket	hardliner	cup	other

Core Volumes
Nominal core-barrel diameter: 3.5" .33 gal/ft EST. Volume

Conditions:

Liner Type: Soft

Vibracorer: Slambar

Comments: *Core to DNREC

Live Organisms Present	Yes	☐	No	☐
Oil Present	Yes	☐	No	☐
Odor Present	Yes	☐	No	☐
Debris Present	Yes	☐	No	☐
Within 10% of Req'd Core Length	Yes	☐	No	☐
Photo	Yes	☐	No	☐

AQUA SURVEY, INC.
SEDIMENT CORE LOG

Client: Kleinschmidt		Project: Brandywine Creek			Logger: WR	
Job #: 40-046	Date: 3-6-2020	Time: 0939		Crew:	CS	
Coordinates:	N 640692.64	E 617257.02		Vessel:	Jon boats	
Core # : D2-T1-C1	Zone: DE Datum: NAD 83			Deploy:	1	2	3
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:		Core Penetration Length (ft.):	3.2		
Measured Water Depth [MWD] [ft.]:	2.0	Recovered Core Length (ft.):	3.1		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:		Sample Length Retained (ft.):	*		
Corrected Depth @ MLLW [ft.]:		Core Volume Retained (gal.):	*		
+ MLW Adjustment [ft.}		Collected to Project Depth:	Yes ☑ No ☐ Refusal ☑		
Corrected Depth @ MLW [ft.]:					
Required Sample Core Length [SCL] [ft.]:					

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
Bottom		

# of containers:					Core Volumes
Type of container:	bucket	hardliner	cup	other	Nominal core-barrel diameter: 3.5" .33 gal/ft EST. Volume

Conditions:

Liner Type: Soft

Comments: *Core to DNREC

Vibracorer: Slambar

Live Organisms Present	Yes ☐	No ☐
Oil Present	Yes ☐	No ☐
Odor Present	Yes ☐	No ☐
Debris Present	Yes ☐	No ☐
Within 10% of Req'd Core Length	Yes ☐	No ☐
Photo	Yes ☐	No ☐

MLW #td ver 021820

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt		Project: Brandywine Creek			Logger: WR	
Job #: 40-046	Date: 3-6-2020	Time: 0939		Crew:	CS	
Coordinates:	N 640692.64	E 617257.02		Vessel:	Jon boats	
Core # : D2-T1-C1	Zone: DE Datum: NAD 83			Deploy:	1	2	3

Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:		Core Penetration Length (ft.):	3.2		
Measured Water Depth [MWD] [ft.]:	2.0	Recovered Core Length (ft.):	3.1		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:		Sample Length Retained (ft.):	*		
Corrected Depth @ MLLW [ft.]:		Core Volume Retained (gal.):	*		
+ MLW Adjustment [ft.}		Collected to Project Depth:	Yes ☑ No ☐ Refusal ☑		
Corrected Depth @ MLW [ft.]:					
Required Sample Core Length [SCL] [ft.]:					

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
Bottom		

# of containers:				
Type of container:	bucket	hardliner	cup	other

Core Volumes

Nominal core-barrel diameter: 3.5" .33 gal/ft EST. Volume

Conditions:

Liner Type: Soft

Comments: *Core to DNREC

Vibracorer: Slambar

Live Organisms Present	Yes	☐	No	☐
Oil Present	Yes	☐	No	☐
Odor Present	Yes	☐	No	☐
Debris Present	Yes	☐	No	☐
Within 10% of Req'd Core Length	Yes	☐	No	☐
Photo	Yes	☐	No	☐

MLW #td ver 021820

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt		Project: Brandywine Creek		Logger: WR		
Job #: 40-046	Date: 3-6-2020	Time: 0939		Crew: CS		
Coordinates:	N 640692.64	E 617257.02		Vessel: Jon boats		
Core # : D2-T1-C1	Zone: DE Datum: NAD 83			Deploy:	1	2	3
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:		Core Penetration Length (ft.):		3.2		
Measured Water Depth [MWD] [ft.]:	2.0	Recovered Core Length (ft.):		3.1		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:		Sample Length Retained (ft.):		*		
Corrected Depth @ MLLW [ft.]:		Core Volume Retained (gal.):		*		
+ MLW Adjustment [ft.}		Collected to Project Depth:		Yes ☑ No ☐ Refusal ☑		
Corrected Depth @ MLW [ft.]:						
Required Sample Core Length [SCL] [ft.]:						

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
Bottom		

					Core Volumes
# of containers:					Nominal core-barrel
Type of container:	bucket	hardliner	cup	other	diameter: 3.5" .33 gal/ft EST. Volume

Conditions:

Liner Type: Soft

Comments: *Core to DNREC

Vibracorer: Slambar

	Yes	No
Live Organisms Present	☐	☐
Oil Present	☐	☐
Odor Present	☐	☐
Debris Present	☐	☐
Within 10% of Req'd Core Length	☐	☐
Photo	☐	☐

MLW #td ver 021820

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt	Project: Brandywine Creek		Logger: WR
Job #: 40-046	Date: 3-6-2020	Time: 0939	Crew: CS
Coordinates:	N 640692.64	E 617257.02	Vessel: Jon boats
Core # : D2-T1-C1	Zone: DE Datum: NAD 83		Deploy: 1 / 2 / 3

Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:		Core Penetration Length (ft.):	3.2		
Measured Water Depth [MWD] [ft.]:	2.0	Recovered Core Length (ft.):	3.1		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:		Sample Length Retained (ft.):	*		
Corrected Depth @ MLLW [ft.]:		Core Volume Retained (gal.):	*		
+ MLW Adjustment [ft.}		Collected to Project Depth:	Yes ☑ No ☐ Refusal ☑		
Corrected Depth @ MLW [ft.]:					
Required Sample Core Length [SCL] [ft.]:					

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
Bottom		

# of containers:					Core Volumes
Type of container:	bucket	hardliner	cup	other	Nominal core-barrel diameter: 3.5" .33 gal/ft EST. Volume

Conditions:

Liner Type: Soft

Comments: *Core to DNREC

Vibracorer: Slambar

Live Organisms Present	Yes	☐	No	☐
Oil Present	Yes	☐	No	☐
Odor Present	Yes	☐	No	☐
Debris Present	Yes	☐	No	☐
Within 10% of Req'd Core Length	Yes	☐	No	☐
Photo	Yes	☐	No	☐

MLW #td ver 021820

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SEDIMENT CORE LOG

Client: Kleinschmidt	Project: Brandywine Creek		Logger: WR
Job #: 40-046	Date: 3-6-2020	Time: 0939	Crew: CS
Coordinates:	N 640692.64	E 617257.02	Vessel: Jon boats
Core # : D2-T1-C1	Zone: DE Datum: NAD 83		

			Deploy:	1	2	3
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:			Core Penetration Length (ft.):	3.2		
Measured Water Depth [MWD] [ft.]:	2.0		Recovered Core Length (ft.):	3.1		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:			Sample Length Retained (ft.):	*		
Corrected Depth @ MLLW [ft.]:			Core Volume Retained (gal.):	*		
+ MLW Adjustment [ft.}			Collected to Project Depth:	Yes ☑	No ☐	Refusal ☑
Corrected Depth @ MLW [ft.]:						
Required Sample Core Length [SCL] [ft.]:						

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
Bottom		

					Core Volumes
# of containers:					Nominal core-barrel
Type of container:	bucket	hardliner	cup	other	diameter: 3.5" .33 gal/ft EST. Volume

Conditions:

Liner Type: Soft

Comments: *Core to DNREC

Vibracorer: Slambar

	Yes	No
Live Organisms Present	☐	☐
Oil Present	☐	☐
Odor Present	☐	☐
Debris Present	☐	☐
Within 10% of Req'd Core Length	☐	☐
Photo	☐	☐

MLW #td ver 021820

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt		Project: Brandywine Creek		Logger:	WR	
Job #: 40-046	Date: 3-6-2020	Time: 0939		Crew:	CS	
Coordinates:	N 640692.64	E 617257.02		Vessel:	Jon boats	
Core # : D2-T1-C1	Zone: DE Datum: NAD 83			Deploy:	**1**	**2**	**3**
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:		Core Penetration Length (ft.):	3.2		
Measured Water Depth [MWD] [ft.]:	2.0	Recovered Core Length (ft.):	3.1		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:		Sample Length Retained (ft.):	*		
Corrected Depth @ MLLW [ft.]:		Core Volume Retained (gal.):	*		
+ MLW Adjustment [ft.}:		Collected to Project Depth:	Yes ✔ No ☐ Refusal ✔		
Corrected Depth @ MLW [ft.]:					
Required Sample Core Length [SCL] [ft.]:					

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
Bottom		

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Type of container:	bucket	hardliner	cup	other

Core Volumes
Nominal core-barrel diameter: 3.5" .33 gal/ft EST. Volume

Conditions:

Liner Type: Soft

Comments: *Core to DNREC

Vibracorer: Slambar

	Yes	No
Live Organisms Present	☐	☐
Oil Present	☐	☐
Odor Present	☐	☐
Debris Present	☐	☐
Within 10% of Req'd Core Length	☐	☐
Photo	☐	☐

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt		Project: Brandywine Creek		Logger: WR		
Job #: 40-046	Date: 3-6-2020	Time: 0939	Crew:	CS		
Coordinates:	N 640692.64	E 617257.02	Vessel:	Jon boats		
Core # : D2-T1-C1	Zone: DE Datum: NAD 83		Deploy:	1	2	3
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:		Core Penetration Length (ft.):		3.2		
Measured Water Depth [MWD] [ft.]:	2.0	Recovered Core Length (ft.):		3.1		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:		Sample Length Retained (ft.):		*		
Corrected Depth @ MLLW [ft.]:		Core Volume Retained (gal.):		*		
+ MLW Adjustment [ft.}		Collected to Project Depth:		Yes ☑	No ☐	Refusal ☑
Corrected Depth @ MLW [ft.]:						
Required Sample Core Length [SCL] [ft.]:						

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
Bottom		

# of containers:					Core Volumes
Type of container:	bucket	hardliner	cup	other	Nominal core-barrel diameter: 3.5" .33 gal/ft EST. Volume

Conditions:

Liner Type: Soft

Comments: *Core to DNREC

Vibracorer: Slambar

Live Organisms Present	Yes	☐	No	☐
Oil Present	Yes	☐	No	☐
Odor Present	Yes	☐	No	☐
Debris Present	Yes	☐	No	☐
Within 10% of Req'd Core Length	Yes	☐	No	☐
Photo	Yes	☐	No	☐

MLW #td ver 021820

AQUA SURVEY, INC.
SEDIMENT CORE LOG

Client: Kleinschmidt		Project: Brandywine Creek			Logger: WR	
Job #: 40-046	Date: 3-6-2020	Time: 0939		Crew:	CS	
Coordinates:	N 640692.64	E 617257.02		Vessel:	Jon boats	
Core # : D2-T1-C1	Zone: DE Datum: NAD 83			Deploy:	1	2	3

Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:		Core Penetration Length (ft.):	3.2		
Measured Water Depth [MWD] [ft.]:	2.0	Recovered Core Length (ft.):	3.1		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:		Sample Length Retained (ft.):	*		
Corrected Depth @ MLLW [ft.]:		Core Volume Retained (gal.):	*		
+ MLW Adjustment [ft.}:		Collected to Project Depth:	Yes ☑ No ☐ Refusal ☑		
Corrected Depth @ MLW [ft.]:					
Required Sample Core Length [SCL] [ft.]:					

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
Bottom		

# of containers:					Core Volumes
Type of container:	bucket	hardliner	cup	other	Nominal core-barrel diameter: 3.5" .33 gal/ft EST. Volume

Conditions:

Liner Type: Soft

Comments: *Core to DNREC

Vibracorer: Slambar

Live Organisms Present	Yes ☐	No ☐
Oil Present	Yes ☐	No ☐
Odor Present	Yes ☐	No ☐
Debris Present	Yes ☐	No ☐
Within 10% of Req'd Core Length	Yes ☐	No ☐
Photo	Yes ☐	No ☐

MLW #td ver 021820

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt		Project: Brandywine Creek			Logger: WR	
Job #: 40-046	Date: 3-6-2020	Time: 0939		Crew:	CS	
Coordinates:	N 640692.64	E 617257.02		Vessel:	Jon boats	
Core # : D2-T1-C1	Zone: DE Datum: NAD 83			Deploy:	1	2	3
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:		Core Penetration Length (ft.):			3.2		
Measured Water Depth [MWD] [ft.]:	2.0	Recovered Core Length (ft.):			3.1		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:		Sample Length Retained (ft.):			*		
Corrected Depth @ MLLW [ft.]:		Core Volume Retained (gal.):			*		
+ MLW Adjustment [ft.}		Collected to Project Depth:			Yes ✔ No ☐ Refusal ✔		
Corrected Depth @ MLW [ft.]:							
Required Sample Core Length [SCL] [ft.]:							

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
Bottom		

# of containers:					Core Volumes
Type of container:	bucket	hardliner	cup	other	Nominal core-barrel diameter: 3.5" .33 gal/ft EST. Volume

Conditions:

Liner Type: Soft

Comments: *Core to DNREC

Vibracorer: Slambar

Live Organisms Present	Yes	☐	No	☐
Oil Present	Yes	☐	No	☐
Odor Present	Yes	☐	No	☐
Debris Present	Yes	☐	No	☐
Within 10% of Req'd Core Length	Yes	☐	No	☐
Photo	Yes	☐	No	☐

MLW #td ver 021820

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt		Project: Brandywine Creek		Logger: WR		
Job #: 40-046	Date: 3-6-2020	Time: 0939		Crew: CS		
Coordinates:	N 640692.64	E 617257.02		Vessel: Jon boats		
Core # : D2-T1-C1	Zone: DE Datum: NAD 83			Deploy:	1	2	3

Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:		Core Penetration Length (ft.):	3.2		
Measured Water Depth [MWD] [ft.]:	2.0	Recovered Core Length (ft.):	3.1		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:		Sample Length Retained (ft.):	*		
Corrected Depth @ MLLW [ft.]:		Core Volume Retained (gal.):	*		
+ MLW Adjustment [ft.}		Collected to Project Depth:	Yes ☑ No ☐ Refusal ☑		
Corrected Depth @ MLW [ft.]:					
Required Sample Core Length [SCL] [ft.]:					

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
Bottom		

# of containers:					Core Volumes
Type of container:	bucket	hardliner	cup	other	Nominal core-barrel diameter: 3.5" .33 gal/ft EST. Volume

Conditions:

Liner Type: Soft

Comments: *Core to DNREC

Vibracorer: Slambar

Live Organisms Present	Yes	☐	No	☐
Oil Present	Yes	☐	No	☐
Odor Present	Yes	☐	No	☐
Debris Present	Yes	☐	No	☐
Within 10% of Req'd Core Length	Yes	☐	No	☐
Photo	Yes	☐	No	☐

MLW #td ver 021820

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt		Project: Brandywine Creek			Logger: WR	
Job #: 40-046	Date: 3-6-2020	Time: 0939		Crew:	CS	
Coordinates:	N 640692.64	E 617257.02		Vessel:	Jon boats	
Core # : D2-T1-C1	Zone: DE Datum: NAD 83			Deploy:	1	2	3
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:		Core Penetration Length (ft.):			3.2		
Measured Water Depth [MWD] [ft.]:	2.0	Recovered Core Length (ft.):			3.1		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:		Sample Length Retained (ft.):			*		
Corrected Depth @ MLLW [ft.]:		Core Volume Retained (gal.):			*		
+ MLW Adjustment [ft.}		Collected to Project Depth:			Yes ☑ No ☐ Refusal ☑		
Corrected Depth @ MLW [ft.]:							
Required Sample Core Length [SCL] [ft.]:							

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
Bottom		

# of containers:				
Type of container:	bucket	hardliner	cup	other

Core Volumes

Nominal core-barrel diameter: 3.5" .33 gal/ft EST. Volume

Conditions:

Liner Type: Soft

Comments: *Core to DNREC

Vibracorer: Slambar

Live Organisms Present	Yes	☐	No	☐
Oil Present	Yes	☐	No	☐
Odor Present	Yes	☐	No	☐
Debris Present	Yes	☐	No	☐
Within 10% of Req'd Core Length	Yes	☐	No	☐
Photo	Yes	☐	No	☐

MLW #td ver 021820

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt		Project: Brandywine Creek			Logger: WR	
Job #: 40-046	Date: 3-6-2020	Time: 0939		Crew:	CS	
Coordinates:	N 640692.64	E 617257.02		Vessel:	Jon boats	
Core # : D2-T1-C1	Zone: DE	Datum: NAD 83		Deploy:	1	2	3

Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:		Core Penetration Length (ft.):	3.2		
Measured Water Depth [MWD] [ft.]:	2.0	Recovered Core Length (ft.):	3.1		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:		Sample Length Retained (ft.):	*		
Corrected Depth @ MLLW [ft.]:		Core Volume Retained (gal.):	*		
+ MLW Adjustment [ft.}		Collected to Project Depth:	Yes ☑ No ☐ Refusal ☑		
Corrected Depth @ MLW [ft.]:					
Required Sample Core Length [SCL] [ft.]:					

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
Bottom		

# of containers:					Core Volumes
Type of container:	bucket	hardliner	cup	other	Nominal core-barrel diameter: 3.5" .33 gal/ft EST. Volume

Conditions:

Liner Type: Soft

Comments: *Core to DNREC

Vibracorer: Slambar

Live Organisms Present	Yes	☐	No	☐
Oil Present	Yes	☐	No	☐
Odor Present	Yes	☐	No	☐
Debris Present	Yes	☐	No	☐
Within 10% of Req'd Core Length	Yes	☐	No	☐
Photo	Yes	☐	No	☐

MLW #td ver 021820

AQUA SURVEY, INC.
SEDIMENT CORE LOG

Client: Kleinschmidt		Project: Brandywine Creek			Logger: WR	
Job #: 40-046	Date: 3-6-2020	Time: 0939		Crew:	CS	
Coordinates:	N 640692.64	E 617257.02		Vessel:	Jon boats	
Core # : D2-T1-C1	Zone: DE	Datum: NAD 83		Deploy:	1	2	3
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:		Core Penetration Length (ft.):			3.2		
Measured Water Depth [MWD] [ft.]:	2.0	Recovered Core Length (ft.):			3.1		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:		Sample Length Retained (ft.):			*		
Corrected Depth @ MLLW [ft.]:		Core Volume Retained (gal.):			*		
+ MLW Adjustment [ft.}		Collected to Project Depth:			Yes ☑ No ☐ Refusal ☑		
Corrected Depth @ MLW [ft.]:							
Required Sample Core Length [SCL] [ft.]:							

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
Bottom		

# of containers:					Core Volumes
Type of container:	bucket	hardliner	cup	other	Nominal core-barrel diameter: 3.5" .33 gal/ft EST. Volume

Conditions:

Liner Type: Soft

Vibracorer: Slambar

Comments: *Core to DNREC

Live Organisms Present	Yes	☐	No	☐
Oil Present	Yes	☐	No	☐
Odor Present	Yes	☐	No	☐
Debris Present	Yes	☐	No	☐
Within 10% of Req'd Core Length	Yes	☐	No	☐
Photo	Yes	☐	No	☐

MLW #td ver 021820

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt		Project: Brandywine Creek		Logger: WR		
Job #: 40-046	Date: 3-6-2020	Time: 0939	Crew:	CS		
Coordinates:	N 640692.64	E 617257.02	Vessel:	Jon boats		
Core # : D2-T1-C1	Zone: DE Datum: NAD 83		Deploy:	1	2	3
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:		Core Penetration Length (ft.):		3.2		
Measured Water Depth [MWD] [ft.]:	2.0	Recovered Core Length (ft.):		3.1		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:		Sample Length Retained (ft.):		*		
Corrected Depth @ MLLW [ft.]:		Core Volume Retained (gal.):		*		
+ MLW Adjustment [ft.}		Collected to Project Depth:		Yes ☑	No ☐	Refusal ☑
Corrected Depth @ MLW [ft.]:						
Required Sample Core Length [SCL] [ft.]:						

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
Bottom		

# of containers:					Core Volumes Nominal core-barrel diameter: 3.5" .33 gal/ft EST. Volume
Type of container:	bucket	hardliner	cup	other	

Conditions:

Liner Type: Soft

Comments: *Core to DNREC

Vibracorer: Slambar

Live Organisms Present	Yes	☐	No	☐
Oil Present	Yes	☐	No	☐
Odor Present	Yes	☐	No	☐
Debris Present	Yes	☐	No	☐
Within 10% of Req'd Core Length	Yes	☐	No	☐
Photo	Yes	☐	No	☐

MLW #td ver 021820

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt		Project: Brandywine Creek			Logger: WR	
Job #: 40-046	Date: 3-6-2020	Time: 0939		Crew:	CS	
Coordinates:	N 640692.64	E 617257.02		Vessel:	Jon boats	
Core # : D2-T1-C1	Zone: DE Datum: NAD 83			Deploy:	1	2	3
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:		Core Penetration Length (ft.):			3.2		
Measured Water Depth [MWD] [ft.]:	2.0	Recovered Core Length (ft.):			3.1		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:		Sample Length Retained (ft.):			*		
Corrected Depth @ MLLW [ft.]:		Core Volume Retained (gal.):			*		
+ MLW Adjustment [ft.}		Collected to Project Depth:			Yes ☑ No ☐ Refusal ☑		
Corrected Depth @ MLW [ft.]:							
Required Sample Core Length [SCL] [ft.]:							

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		
Bottom		

# of containers:					Core Volumes
Type of container:	bucket	hardliner	cup	other	Nominal core-barrel diameter: 3.5" .33 gal/ft EST. Volume

Conditions:

Liner Type: Soft

Vibracorer: Slambar

Comments: *Core to DNREC

Live Organisms Present	Yes	☐	No	☐
Oil Present	Yes	☐	No	☐
Odor Present	Yes	☐	No	☐
Debris Present	Yes	☐	No	☐
Within 10% of Req'd Core Length	Yes	☐	No	☐
Photo	Yes	☐	No	☐

MLW #td ver 021820

APPENDIX B

LABORATORY ANALYTICAL REPORTS

(Large Files - Available Separately)

APPENDIX C

TOXICITY EVALUATIONS OF BRANDYWINE RIVER SEDIMENTS

(Open and Zoom PDF Versions Digitally – Excel Versions Available Separately)

Evaluation of Grain Size Data - Brandywine River Sediment Samples

Prepared by: John Cargill, Delaware DNREC, DWS, Watershed Assessment and Management Section

August 20, 2020

TestAmerica Laboratories, Inc.
Eurofins TestAmerica, Edison

SUMMARY OF ANALYTICAL RESULTS: 460-205020-1
Job Description: WATAR (DE-1525) BRANDYWINE DAM SEDIMENTS
For:
State of Delaware
391 Lukens Drive
New Castle, Delaware 19720-2774

Client ID		DNREC SIRS	BWR-DAM2-T1-0320			BWR-DAM2-T1-0320			BWR-DAM2-T2-0320			BWR-DAM2-T2-0320		
Lab Sample ID		Screening Levels	460-205020-1			460-205020-1			460-205020-2			460-205020-2		
Sampling Date		Soils	03/06/2020 10:30:00			03/06/2020 10:30:00			03/05/2020 14:00:00			03/05/2020 14:00:00		
Matrix		Nov 2019	Soil			Soil			Soil			Soil		
Dilution Factor			1			1			1			1		
Unit		%	%			% passing			%			% passing		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY D422														
Clay	STL00587	NA	9.3			NR			10.8			NR		
Coarse Sand	STL00583	NA	0.5			NR			4.5			NR		
Fine Sand	STL00585	NA	60.7			NR			42.6			NR		
Gravel	STL00581	NA	0.3			NR			6.3			NR		
Hydrometer Reading 1 - Percent Finer	STL01284	NA	NR			20.2			NR			25.4		
Hydrometer Reading 2 - Percent Finer	STL01285	NA	NR			18.3			NR			22.5		
Hydrometer Reading 3 - Percent Finer	STL01286	NA	NR			14.7			NR			17.6		
Hydrometer Reading 4 - Percent Finer	STL01287	NA	NR			11.1			NR			13.8		
Hydrometer Reading 5 - Percent Finer	STL01288	NA	NR			9.3			NR			10.8		
Hydrometer Reading 6 - Percent Finer	STL01290	NA	NR			5.6			NR			7.0		
Hydrometer Reading 7 - Percent Finer	STL01291	NA	NR			2.9			NR			5.0		
Medium Sand	STL00584	NA	14.4			NR			20.5			NR		
Sand	STL00582	NA	75.6			NR			67.6			NR		
Sieve Size #10 - Percent Finer	STL01268	NA	NR			99.2			NR			89.2		
Sieve Size #100 - Percent Finer	STL01269	NA	NR			35.8			NR			37.6		
Sieve Size #20 - Percent Finer	STL01271	NA	NR			97.6			NR			81.8		
Sieve Size #200 - Percent Finer	STL01272	NA	NR			24.1			NR			26.1		
Sieve Size #4 - Percent Finer	STL01274	NA	NR			99.7			NR			93.7		
Sieve Size #40 - Percent Finer	STL01275	NA	NR			84.8			NR			68.7		
Sieve Size #60 - Percent Finer	STL01276	NA	NR			57.2			NR			52.3		
Sieve Size #80 - Percent Finer	STL01277	NA	NR			43.7			NR			43.3		
Sieve Size 0.375 inch - Percent Finer	STL01278	NA	NR			100.0			NR			100.0		
Sieve Size 0.75 inch - Percent Finer	STL01279	NA	NR			100.0			NR			100.0		
Sieve Size 1 inch - Percent Finer	STL01280	NA	NR			100.0			NR			100.0		
Sieve Size 1.5 inch - Percent Finer	STL01281	NA	NR			100.0			NR			100.0		
Sieve Size 2 inch - Percent Finer	STL01282	NA	NR			100.0			NR			100.0		
Sieve Size 3 inch - Percent Finer	STL01283	NA	NR			100.0			NR			100.0		
Silt	STL00586	NA	14.9			NR			15.3			NR		

Client ID	BWR-DAM2-T3-0320			BWR-DAM2-T3-0320			BWR-DAM4-T1-0320			BWR-DAM4-T1-0320		
Lab Sample ID	460-205020-3			460-205020-3			460-205020-4			460-205020-4		
Sampling Date	03/05/2020 15:30:00			03/05/2020 15:30:00			03/09/2020 13:55:00			03/09/2020 13:55:00		
Matrix	Soil			Soil			Soil			Soil		
Dilution Factor	1			1			1			1		
Unit	%			% passing			%			% passing		
	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY D422												
Clay	9.5			NR			6.4			NR		
Coarse Sand	5.0			NR			1.7			NR		
Fine Sand	41.5			NR			50.7			NR		
Gravel	10.5			NR			1.4			NR		
Hydrometer Reading 1 - Percent Finer	NR			20.9			NR			19.9		
Hydrometer Reading 2 - Percent Finer	NR			18.2			NR			18.7		
Hydrometer Reading 3 - Percent Finer	NR			14.2			NR			11.3		
Hydrometer Reading 4 - Percent Finer	NR			11.5			NR			7.6		
Hydrometer Reading 5 - Percent Finer	NR			9.5			NR			6.4		
Hydrometer Reading 6 - Percent Finer	NR			6.1			NR			3.9		
Hydrometer Reading 7 - Percent Finer	NR			4.1			NR			1.4		
Medium Sand	23.5			NR			7.3			NR		
Sand	70.0			NR			59.7			NR		
Sieve Size #10 - Percent Finer	NR			84.5			NR			96.9		
Sieve Size #100 - Percent Finer	NR			30.1			NR			56.0		
Sieve Size #20 - Percent Finer	NR			77.3			NR			95.2		
Sieve Size #200 - Percent Finer	NR			19.5			NR			38.9		
Sieve Size #4 - Percent Finer	NR			89.5			NR			98.6		
Sieve Size #40 - Percent Finer	NR			61.0			NR			89.6		
Sieve Size #60 - Percent Finer	NR			44.0			NR			75.6		
Sieve Size #80 - Percent Finer	NR			35.5			NR			64.2		
Sieve Size 0.375 inch - Percent Finer	NR			93.7			NR			100.0		
Sieve Size 0.75 inch - Percent Finer	NR			100.0			NR			100.0		
Sieve Size 1 inch - Percent Finer	NR			100.0			NR			100.0		
Sieve Size 1.5 inch - Percent Finer	NR			100.0			NR			100.0		
Sieve Size 2 inch - Percent Finer	NR			100.0			NR			100.0		
Sieve Size 3 inch - Percent Finer	NR			100.0			NR			100.0		
Silt	10.0			NR			32.5			NR		

Client ID	BWR-DAM4-T2-0320			BWR-DAM4-T2-0320			BWR-DAM4-T3-0320			BWR-DAM4-T3-0320		
Lab Sample ID	460-205020-5			460-205020-5			460-205020-6			460-205020-6		
Sampling Date	03/09/2020 11:50:00			03/09/2020 11:50:00			03/09/2020 12:35:00			03/09/2020 12:35:00		
Matrix	Soil			Soil			Soil			Soil		
Dilution Factor	1			1			1			1		
Unit	%			% passing			%			% passing		
	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY D422												
Clay	17.0			NR			5.5			NR		
Coarse Sand	1.0			NR			1.9			NR		
Fine Sand	34.7			NR			48.1			NR		
Gravel	0.3			NR			3.2			NR		
Hydrometer Reading 1 - Percent Finer	NR			26.0			NR			19.9		
Hydrometer Reading 2 - Percent Finer	NR			23.7			NR			16.3		
Hydrometer Reading 3 - Percent Finer	NR			22.6			NR			10.9		
Hydrometer Reading 4 - Percent Finer	NR			21.5			NR			8.2		
Hydrometer Reading 5 - Percent Finer	NR			17.0			NR			5.5		
Hydrometer Reading 6 - Percent Finer	NR			10.3			NR			3.7		
Hydrometer Reading 7 - Percent Finer	NR			6.9			NR			2.0		
Medium Sand	16.8			NR			21.6			NR		
Sand	52.5			NR			71.6			NR		
Sieve Size #10 - Percent Finer	NR			98.7			NR			94.9		
Sieve Size #100 - Percent Finer	NR			56.1			NR			40.0		
Sieve Size #20 - Percent Finer	NR			95.6			NR			90.7		
Sieve Size #200 - Percent Finer	NR			47.2			NR			25.2		
Sieve Size #4 - Percent Finer	NR			99.7			NR			96.8		
Sieve Size #40 - Percent Finer	NR			81.9			NR			73.3		
Sieve Size #60 - Percent Finer	NR			66.8			NR			56.1		
Sieve Size #80 - Percent Finer	NR			60.2			NR			46.4		
Sieve Size 0.375 inch - Percent Finer	NR			100.0			NR			99.1		
Sieve Size 0.75 inch - Percent Finer	NR			100.0			NR			100.0		
Sieve Size 1 inch - Percent Finer	NR			100.0			NR			100.0		
Sieve Size 1.5 inch - Percent Finer	NR			100.0			NR			100.0		
Sieve Size 2 inch - Percent Finer	NR			100.0			NR			100.0		
Sieve Size 3 inch - Percent Finer	NR			100.0			NR			100.0		
Silt	30.2			NR			19.7			NR		

Client ID	BWR-DAM4-T4-0320			BWR-DAM4-T4-0320			BWR-DAM4-T5-0320			BWR-DAM4-T5-0320		
Lab Sample ID	460-205020-7			460-205020-7			460-205020-8			460-205020-8		
Sampling Date	03/09/2020 12:55:00			03/09/2020 12:55:00			03/09/2020 13:15:00			03/09/2020 13:15:00		
Matrix	Soil			Soil			Soil			Soil		
Dilution Factor	1			1			1			1		
Unit	%			% passing			%			% passing		
	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY D422												
Clay	4.2			NR			3.8			NR		
Coarse Sand	1.3			NR			1.2			NR		
Fine Sand	64.4			NR			67.3			NR		
Gravel	1.8			NR			0.7			NR		
Hydrometer Reading 1 - Percent Finer	NR			12.4			NR			12.0		
Hydrometer Reading 2 - Percent Finer	NR			10.7			NR			10.5		
Hydrometer Reading 3 - Percent Finer	NR			7.5			NR			7.6		
Hydrometer Reading 4 - Percent Finer	NR			5.0			NR			5.3		
Hydrometer Reading 5 - Percent Finer	NR			4.2			NR			3.8		
Hydrometer Reading 6 - Percent Finer	NR			2.6			NR			3.1		
Hydrometer Reading 7 - Percent Finer	NR			1			NR			1.6		
Medium Sand	12.7			NR			9.0			NR		
Sand	78.4			NR			77.5			NR		
Sieve Size #10 - Percent Finer	NR			96.9			NR			98.1		
Sieve Size #100 - Percent Finer	NR			43.3			NR			49.6		
Sieve Size #20 - Percent Finer	NR			94.5			NR			96.3		
Sieve Size #200 - Percent Finer	NR			19.8			NR			21.8		
Sieve Size #4 - Percent Finer	NR			98.2			NR			99.3		
Sieve Size #40 - Percent Finer	NR			84.2			NR			89.1		
Sieve Size #60 - Percent Finer	NR			66.5			NR			74.9		
Sieve Size #80 - Percent Finer	NR			53.5			NR			60.8		
Sieve Size 0.375 inch - Percent Finer	NR			99.7			NR			99.8		
Sieve Size 0.75 inch - Percent Finer	NR			100.0			NR			100.0		
Sieve Size 1 inch - Percent Finer	NR			100.0			NR			100.0		
Sieve Size 1.5 inch - Percent Finer	NR			100.0			NR			100.0		
Sieve Size 2 inch - Percent Finer	NR			100.0			NR			100.0		
Sieve Size 3 inch - Percent Finer	NR			100.0			NR			100.0		
Silt	15.6			NR			18.0			NR		

Client ID	BWR-DAM7-T1-0320			BWR-DAM7-T1-0320			BWR-DAM7-T2-0320			BWR-DAM7-T2-0320		
Lab Sample ID	460-205020-11			460-205020-11			460-205020-12			460-205020-12		
Sampling Date	03/10/2020 13:15:00			03/10/2020 13:15:00			03/10/2020 11:30:00			03/10/2020 11:30:00		
Matrix	Soil			Soil			Soil			Soil		
Dilution Factor	1			1			1			1		
Unit	%			% passing			%			% passing		
	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY D422												
Clay	11.7			NR			23.2			NR		
Coarse Sand	11.0			NR			1.0			NR		
Fine Sand	29.1			NR			30.5			NR		
Gravel	9.4			NR			1.6			NR		
Hydrometer Reading 1 - Percent Finer	NR			25.6			NR			50.8		
Hydrometer Reading 2 - Percent Finer	NR			22.5			NR			44.7		
Hydrometer Reading 3 - Percent Finer	NR			17.9			NR			35.5		
Hydrometer Reading 4 - Percent Finer	NR			14.0			NR			27.8		
Hydrometer Reading 5 - Percent Finer	NR			11.7			NR			23.2		
Hydrometer Reading 6 - Percent Finer	NR			7.1			NR			14.0		
Hydrometer Reading 7 - Percent Finer	NR			4.8			NR			9.5		
Medium Sand	17.9			NR			11.9			NR		
Sand	58.0			NR			43.4			NR		
Sieve Size #10 - Percent Finer	NR			79.6			NR			97.4		
Sieve Size #100 - Percent Finer	NR			41.5			NR			63.1		
Sieve Size #20 - Percent Finer	NR			71.1			NR			95.1		
Sieve Size #200 - Percent Finer	NR			32.6			NR			55.0		
Sieve Size #4 - Percent Finer	NR			90.6			NR			98.4		
Sieve Size #40 - Percent Finer	NR			61.7			NR			85.5		
Sieve Size #60 - Percent Finer	NR			51.2			NR			74.5		
Sieve Size #80 - Percent Finer	NR			45.2			NR			68.0		
Sieve Size 0.375 inch - Percent Finer	NR			97.1			NR			100.0		
Sieve Size 0.75 inch - Percent Finer	NR			100.0			NR			100.0		
Sieve Size 1 inch - Percent Finer	NR			100.0			NR			100.0		
Sieve Size 1.5 inch - Percent Finer	NR			100.0			NR			100.0		
Sieve Size 2 inch - Percent Finer	NR			100.0			NR			100.0		
Sieve Size 3 inch - Percent Finer	NR			100.0			NR			100.0		
Silt	20.9			NR			31.8			NR		

Client ID	BWR-DAM7-T3-0320			BWR-DAM7-T3-0320			BWR-DAM8-T1-0320			BWR-DAM8-T1-0320		
Lab Sample ID	460-205020-13			460-205020-13			460-205020-14			460-205020-14		
Sampling Date	03/10/2020 12:10:00			03/10/2020 12:10:00			03/11/2020 12:15:00			03/11/2020 12:15:00		
Matrix	Soil			Soil			Soil			Soil		
Dilution Factor	1			1			1			1		
Unit	%			% passing			%			% passing		
	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY D422												
Clay	12.6			NR			24.2			NR		
Coarse Sand	2.1			NR			0.4			NR		
Fine Sand	39.9			NR			24.6			NR		
Gravel	2.5			NR			1.5			NR		
Hydrometer Reading 1 - Percent Finer	NR			29.9			NR			60.2		
Hydrometer Reading 2 - Percent Finer	NR			25.0			NR			48.2		
Hydrometer Reading 3 - Percent Finer	NR			19.5			NR			37.7		
Hydrometer Reading 4 - Percent Finer	NR			16.0			NR			28.7		
Hydrometer Reading 5 - Percent Finer	NR			12.6			NR			24.2		
Hydrometer Reading 6 - Percent Finer	NR			10.5			NR			16.7		
Hydrometer Reading 7 - Percent Finer	NR			7.0			NR			10.7		
Medium Sand	19.7			NR			2.0			NR		
Sand	61.7			NR			27.0			NR		
Sieve Size #10 - Percent Finer	NR			95.4			NR			98.1		
Sieve Size #100 - Percent Finer	NR			46.5			NR			83.2		
Sieve Size #20 - Percent Finer	NR			90.2			NR			97.3		
Sieve Size #200 - Percent Finer	NR			35.8			NR			71.5		
Sieve Size #4 - Percent Finer	NR			97.5			NR			98.5		
Sieve Size #40 - Percent Finer	NR			75.7			NR			96.1		
Sieve Size #60 - Percent Finer	NR			59.9			NR			91.5		
Sieve Size #80 - Percent Finer	NR			51.7			NR			87.3		
Sieve Size 0.375 inch - Percent Finer	NR			100.0			NR			100.0		
Sieve Size 0.75 inch - Percent Finer	NR			100.0			NR			100.0		
Sieve Size 1 inch - Percent Finer	NR			100.0			NR			100.0		
Sieve Size 1.5 inch - Percent Finer	NR			100.0			NR			100.0		
Sieve Size 2 inch - Percent Finer	NR			100.0			NR			100.0		
Sieve Size 3 inch - Percent Finer	NR			100.0			NR			100.0		
Silt	23.2			NR			47.3			NR		

Client ID	BWR-DAM8-T2-0320			BWR-DAM8-T2-0320			BWR-DAM11-T1-0320			BWR-DAM11-T1-0320		
Lab Sample ID	460-205020-15			460-205020-15			460-205020-16			460-205020-16		
Sampling Date	03/11/2020 11:45:00			03/11/2020 11:45:00			03/12/2020 12:10:00			03/12/2020 12:10:00		
Matrix	Soil			Soil			Soil			Soil		
Dilution Factor	1			1			1			1		
Unit	%			% passing			%			% passing		
	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY D422												
Clay	23.3			NR			14.7			NR		
Coarse Sand	1.3			NR			14.7			NR		
Fine Sand	33.4			NR			17.0			NR		
Gravel	2.7			NR			3.5			NR		
Hydrometer Reading 1 - Percent Finer	NR			50.6			NR			32.5		
Hydrometer Reading 2 - Percent Finer	NR			42.0			NR			27.7		
Hydrometer Reading 3 - Percent Finer	NR			36.2			NR			24.4		
Hydrometer Reading 4 - Percent Finer	NR			30.5			NR			19.6		
Hydrometer Reading 5 - Percent Finer	NR			23.3			NR			14.7		
Hydrometer Reading 6 - Percent Finer	NR			14.6			NR			9.9		
Hydrometer Reading 7 - Percent Finer	NR			8.9			NR			6.6		
Medium Sand	11.2			NR			23.9			NR		
Sand	45.9			NR			55.6			NR		
Sieve Size #10 - Percent Finer	NR			96.0			NR			81.8		
Sieve Size #100 - Percent Finer	NR			61.4			NR			47.5		
Sieve Size #20 - Percent Finer	NR			92.5			NR			66.3		
Sieve Size #200 - Percent Finer	NR			51.4			NR			40.9		
Sieve Size #4 - Percent Finer	NR			97.3			NR			96.5		
Sieve Size #40 - Percent Finer	NR			84.8			NR			57.9		
Sieve Size #60 - Percent Finer	NR			72.4			NR			53.6		
Sieve Size #80 - Percent Finer	NR			65.8			NR			50.4		
Sieve Size 0.375 inch - Percent Finer	NR			100.0			NR			100.0		
Sieve Size 0.75 inch - Percent Finer	NR			100.0			NR			100.0		
Sieve Size 1 inch - Percent Finer	NR			100.0			NR			100.0		
Sieve Size 1.5 inch - Percent Finer	NR			100.0			NR			100.0		
Sieve Size 2 inch - Percent Finer	NR			100.0			NR			100.0		
Sieve Size 3 inch - Percent Finer	NR			100.0			NR			100.0		
Silt	28.1			NR			26.2			NR		

Client ID	BWR-DAM11-T2-0320			BWR-DAM11-T2-0320			BWR-DUP1-0320			BWR-DUP1-0320		
Lab Sample ID	460-205020-17			460-205020-17			460-205020-18			460-205020-18		
Sampling Date	03/12/2020 11:20:00			03/12/2020 11:20:00			03/12/2020 00:00:00			03/12/2020 00:00:00		
Matrix	Soil			Soil			Soil			Soil		
Dilution Factor	1			1			1			1		
Unit	%			% passing			%			% passing		
	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY D422												
Clay	13.7			NR			8.0			NR		
Coarse Sand	16.6			NR			23.3			NR		
Fine Sand	9.4			NR			8.4			NR		
Gravel	13.5			NR			12.7			NR		
Hydrometer Reading 1 - Percent Finer	NR			27.4			NR			16.4		
Hydrometer Reading 2 - Percent Finer	NR			25.2			NR			14.7		
Hydrometer Reading 3 - Percent Finer	NR			22.3			NR			13.6		
Hydrometer Reading 4 - Percent Finer	NR			17.3			NR			10.8		
Hydrometer Reading 5 - Percent Finer	NR			13.7			NR			8.0		
Hydrometer Reading 6 - Percent Finer	NR			9.4			NR			5.2		
Hydrometer Reading 7 - Percent Finer	NR			6.6			NR			3.5		
Medium Sand	31.8			NR			34.7			NR		
Sand	57.8			NR			66.4			NR		
Sieve Size #10 - Percent Finer	NR			69.9			NR			64.0		
Sieve Size #100 - Percent Finer	NR			31.5			NR			22.9		
Sieve Size #20 - Percent Finer	NR			51.2			NR			45.0		
Sieve Size #200 - Percent Finer	NR			28.7			NR			20.9		
Sieve Size #4 - Percent Finer	NR			86.5			NR			87.3		
Sieve Size #40 - Percent Finer	NR			38.1			NR			29.3		
Sieve Size #60 - Percent Finer	NR			34.2			NR			25.2		
Sieve Size #80 - Percent Finer	NR			32.6			NR			23.9		
Sieve Size 0.375 inch - Percent Finer	NR			95.3			NR			98.9		
Sieve Size 0.75 inch - Percent Finer	NR			100.0			NR			100.0		
Sieve Size 1 inch - Percent Finer	NR			100.0			NR			100.0		
Sieve Size 1.5 inch - Percent Finer	NR			100.0			NR			100.0		
Sieve Size 2 inch - Percent Finer	NR			100.0			NR			100.0		
Sieve Size 3 inch - Percent Finer	NR			100.0			NR			100.0		
Silt	15.0			NR			12.9			NR		

NR: Not Analyzed

TestAmerica Laboratories, Inc.
Eurofins TestAmerica, Edison

SUMMARY OF ANALYTICAL RESULTS: 460-210989-1
Job Description: WATAR (DE-1525)
For:
State of Delaware
391 Lukens Drive
New Castle, Delaware 19720-2774

Client ID	CAS#	Results (14 sample columns)
Clay	[illegible]	[illegible]
Coarse Sand	[illegible]	[illegible]
Fine Sand	[illegible]	[illegible]
Gravel	[illegible]	[illegible]
Hydrometer Reading 1 - Percent Finer	[illegible]	[illegible]
Hydrometer Reading 2 - Percent Finer	[illegible]	[illegible]
Hydrometer Reading 3 - Percent Finer	[illegible]	[illegible]
Hydrometer Reading 4 - Percent Finer	[illegible]	[illegible]
Hydrometer Reading 5 - Percent Finer	[illegible]	[illegible]
Hydrometer Reading 6 - Percent Finer	[illegible]	[illegible]
Hydrometer Reading 7 - Percent Finer	[illegible]	[illegible]
Medium Sand	[illegible]	[illegible]
Sand	[illegible]	[illegible]
Sieve Size #10 - Percent Finer	[illegible]	[illegible]
Sieve Size #100 - Percent Finer	[illegible]	[illegible]
Sieve Size #20 - Percent Finer	[illegible]	[illegible]
Sieve Size #200 - Percent Finer	[illegible]	[illegible]
Sieve Size #4 - Percent Finer	[illegible]	[illegible]
Sieve Size #40 - Percent Finer	[illegible]	[illegible]
Sieve Size #60 - Percent Finer	[illegible]	[illegible]
Sieve Size #80 - Percent Finer	[illegible]	[illegible]
Sieve Size 0.375 inch - Percent Finer	[illegible]	[illegible]
Sieve Size 0.75 inch - Percent Finer	[illegible]	[illegible]
Sieve Size 1 inch - Percent Finer	[illegible]	[illegible]
Sieve Size 1.5 inch - Percent Finer	[illegible]	[illegible]
Sieve Size 2 inch - Percent Finer	[illegible]	[illegible]
Sieve Size 3 inch - Percent Finer	[illegible]	[illegible]
Silt	[illegible]	[illegible]

NR: Not Analyzed

Lab Contact
[illegible]
Manager of Project Management
(732)549-3900

Data Reordered and Condensed

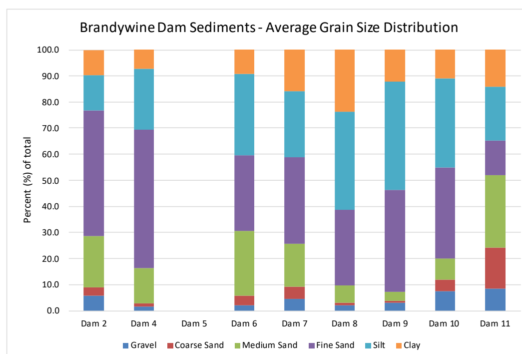
Client ID	BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-0320
Lab Sample ID	460-205020-1	460-205020-2	460-205020-3	460-205020-4	460-205020-5	460-205020-6	460-205020-7	460-205020-8
Sampling Date	03/06/2020 10:30:00	03/05/2020 14:00:00	03/05/2020 15:30:00	03/09/2020 13:55:00	03/09/2020 11:50:00	03/09/2020 12:35:00	03/09/2020 12:55:00	03/09/2020 13:15:00
Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Dilution Factor	1	1	1	1	1	1	1	1
Unit	%	%	%	%	%	%	%	%
	Result	Result	Result	Result	Result	Result	Result	Result
SOIL BY D422								
Gravel	0.3	6.3	10.5	1.4	0.3	3.2	1.8	0.7
Coarse Sand	0.5	4.5	5	1.7	1	1.9	1.3	1.2
Medium Sand	14.4	20.5	23.5	7.3	16.8	21.6	12.7	9
Fine Sand	60.7	42.6	41.5	50.7	34.7	48.1	64.4	67.3
Silt	14.9	15.3	10	32.5	30.2	19.7	15.6	18
Clay	9.3	10.8	9.5	6.4	17	5.5	4.2	3.8
Sand	75.6	67.6	70	59.7	52.5	71.6	78.4	77.5

Client ID	BWR-DAM6-T1-0620	BWR-DAM6-T2-0620	BWR-DAM6-T3-0620	BWR-DAM7-T1-0320	BWR-DAM7-T2-0320	BWR-DAM7-T3-0320
Lab Sample ID	460-210989-1	460-210989-2	460-210989-3	460-205020-11	460-205020-12	460-205020-13
Sampling Date	06/10/2020 11:15:00	06/10/2020 11:40:00	06/10/2020 12:15:00	03/10/2020 13:15:00	03/10/2020 11:30:00	03/10/2020 12:10:00
Matrix	Soil	Soil	Soil	Soil	Soil	Soil
Dilution Factor	1	1	1	1	1	1
Unit	%	%	%	%	%	%
	Result	Result	Result	Result	Result	Result
SOIL BY D422						
Gravel	2.2	2.6	1.1	9.4	1.6	2.5
Coarse Sand	3.3	7	0.8	11	1	2.1
Medium Sand	25.6	33.9	14.8	17.9	11.9	19.7
Fine Sand	21.1	25.5	41	29.1	30.5	39.9
Silt	37.4	23.9	32	20.9	31.8	23.2
Clay	10.4	7.1	10.3	11.7	23.2	12.6
Sand	50	66.4	56.6	58	43.4	61.7

Client ID	BWR-DAM8-T1-0320	BWR-DAM8-T2-0320	BWR-DAM9-T1-0620	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DAM11-T1-0320	BWR-DAM11-T2-0320
Lab Sample ID	460-205020-14	460-205020-15	460-210989-4	460-210989-5	460-210989-6	460-210989-7	460-205020-16	460-205020-17
Sampling Date	03/11/2020 12:15:00	03/11/2020 11:45:00	06/09/2020 14:15:00	06/09/2020 14:30:00	06/09/2020 11:10:00	06/09/2020 11:35:00	03/12/2020 12:10:00	03/12/2020 11:20:00
Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Dilution Factor	1	1	1	1	1	1	1	1
Unit	%	%	%	%	%	%	%	%
	Result	Result	Result	Result	Result	Result	Result	Result
SOIL BY D422								
Gravel	1.5	2.7	0.9	5.1	0	14.8	3.5	13.5
Coarse Sand	0.4	1.3	0.6	0.8	1.8	6.9	14.7	16.6
Medium Sand	2	11.2	4.4	2.6	4.2	12.2	23.9	31.8
Fine Sand	24.6	33.4	53.1	25.2	37	33	17	9.4
Silt	47.3	28.1	29.9	52.9	44.4	23.8	26.2	15
Clay	24.2	23.3	11.1	13.4	12.6	9.3	14.7	13.7
Sand	27	45.9	58.1	28.6	43	52.1	55.6	57.8

Average Percent of Grain Sizes Per Dam

	Dam 2	Dam 4	Dam 5	Dam 6	Dam 7	Dam 8	Dam 9	Dam 10	Dam 11
Gravel	5.7	1.5		2.0	4.5	2.1	3.0	7.4	8.5
Coarse Sand	3.3	1.4		3.7	4.7	0.9	0.7	4.4	15.7
Medium Sand	19.5	13.5		24.8	16.5	6.6	3.5	8.2	27.9
Fine Sand	48.3	53.0		29.2	33.2	29.0	39.2	35.0	13.2
Silt	13.4	23.2		31.1	25.3	37.7	41.4	34.1	20.6
Clay	9.9	7.4		9.3	15.8	23.8	12.3	11.0	14.2



Assessment of Sediment Metals Data for Brandywine River Dam Sediments

Prepared by: John Cargill & Dannielle Pratt, DE DNREC

Date: October 22, 2020

Methods:

The total dissolved concentration of several metals in the sediment porewater was estimated by dividing the bulk metal concentration by the sediment to porewater metal partition coefficient (K_d) as published by EPA (EPA, 2005a). This concentration was further partitioned between DOC-bound metal and total inorganic metal species in porewater solution, again using mean partition coefficients (K_{d2}) published by the EPA (EPA, 2005a). The resulting dissolved total inorganic metal concentration in the porewater was then compared to applicable water quality criteria for the protection of aquatic life (Table 1 - Delaware Surface Water Quality Standards) and human health from fish and water ingestion (Table 2 - Delaware Surface Water Quality Standards). Human health criteria are being evaluated in this study because the Brandywine River is used as a drinking water source by the City of Wilmington. For purposes of DOC-pore water partitioning, the DOC of the porewater was assumed to be 5 times greater than that of the water column (Thurman 1985; Caron and Suffet 1989; Hanchak-Kariouk et.al. 1997), where the water column DOC was assumed to average 3.5 mg/L (Cavallo, 2007). Non-detected results were assigned a value of 1/2 of the detection level.

The ratio of the inorganic metal concentration in the porewater to the applicable water quality criterion was expressed as toxic units, where ratios greater than 1 suggest exposure concentrations in excess of the criterion. In the spreadsheet tabs for each metal, $T.U._a$ values are the toxic units related to the freshwater acute water quality criteria, $T.U._c$ values are the toxic units related to the freshwater chronic water quality criteria, and $T.U._{hh}$ values are the toxic units related to the human health water quality criteria. Finally, to evaluate the additive effect of divalent metals on benthic aquatic life, the $T.U._c$ values for cadmium, copper, lead, nickel, silver and zinc were summed to produce a so-called interstitial water benchmark unit (IWBU) as fully described in EPA, 2005b. This same approach was also used to evaluate potential acute effects from divalent metals (using acute aquatic life criteria rather than the chronic criteria). As with the toxic unit approach, IWBU values greater than one (1) indicate an increased risk of impact to benthic aquatic life. Sediments with values less than 1 are not likely to be toxic to benthic aquatic life due to the presence of divalent metals.

Results:

Equilibrium Partitioning (EqP) and T.U. calculations for each metal are documented on separate tabs of this spreadsheet. The sum of the acute and chronic T.U. values and the IWBU values by metal and sample are presented on the tab named 'TU & IWBU Results'. Plots of IWBU values for each sample appear on the tabs 'IWBU Chart (Chronic) and IWBU Chart (Acute)'.

Key results of this assessment are summarized below:

1. All of the composited transect samples collected from Brandywine River Dam Sediments had calculated IWBU values for acute toxicity less than 1. However, several of the composited transect samples collected from Brandywine River Dam Sediments had calculated IWBU values for chronic toxicity slightly greater than 1. The acute results are most relevant when sediments will be removed (dredged) and that will have potential associated resuspension of sediments during removal activities. The acute results would also apply to initial benthic aquatic life response from breaching or removal of dams and the resulting instantaneous release of sediments/porewater. Chronic results represent longer term effects, are most relevant to assess sediments in place, or after sediments have re-deposited after an initial release (from dredging, removal or instantaneous release associated with dam removal or failure).

2. Although several of the metals were not included in the IWBU summation, we separately compared predicted dissolved inorganic concentrations of arsenic, chromium and selenium in the porewater to applicable aquatic life and human health criteria. Further, we separately compared predicted dissolved inorganic barium, beryllium, antimony and thallium to human health criteria only, as no aquatic life criteria exist for these metals. Only two individual composite samples had chronic toxic unit values greater than 1 (cadmium at Dam 8 Transect 1 ($T.U._c$ = 1.23), and lead at Dam 10 Transect 2 (T.U.c = 1.60)). None of the individual composite samples had acute toxic unit values in excess of 1.

3. The calculated porewater concentration of arsenic exceeded the human health criterion in 15 of the 22 composite samples collected during this study ($T.U._{hh}$ values ranged from 1.07 to 2.15). The calculated porewater concentration of thallium exceeded the human health criterion in 22 of 22 composite samples collected during this study ($T.U._{hh}$ values ranged from 1.50 to 7.26). Median predicted porewater concentrations for arsenic and thallium across all sampling sites were 12.12 ug/L and 5.13 ug/L, respectively. Each of these predicted concentrations slightly exceeds its MCL for drinking water (10 ug/L for As and 2 ug/L for Tl), and therefore, represent potential risks. However, given the conservative assumptions that accompany the assessment, it is unlikely that these are the concentrations at the drinking water intake near Dam 2.

4. A separate comparison of metals concentrations in the sediment samples to DNREC RS Soil Screening Levels was conducted to evaluate whether concentrations of metals in sediment would pose a risk to human health if sediment were dredged/removed, dewatered, and deposited in an upland setting. Thallium exceeded human health soil screening criteria in 20 of 22 composite samples. Antimony exceeded human health soil screening criteria in one of 22 composite samples. An exceedance of soil screening levels does not indicate risk. However, it focuses the assessment of risk under specific use scenarios (and therefore specific exposure parameters) with the USEPA supported Risk Assessment Information System (RAIS) online risk calculator. Utilizing the maximum concentrations, and therefore most conservative values, for antimony and/or thallium detected at each dam in the RAIS online risk calculator indicated that human health risk from these compounds are not expected under the "recreator use scenario," "excavation worker use scenario" or "residential use" scenario.

Conclusions:

1. Acute toxicity due to individual metals or from the additive effect of divalent metals is not likely based upon this assessment, and therefore short term impacts to aquatic life are not expected from any sudden release of sediments from behind the Brandywine River dams or from any sediment removal activities associated with dam modification (fish ladder construction or bypass, for example).

2. There appears to be a very slight potential for chronic toxicity to aquatic life in the sediments of the Brandywine River due to divalent metals. IWBU exceedances (values greater than 1) are dominated by copper, cadmium and lead in all cases (Dam #2, Dam #4, Dam #7, Dam #8, Dam #9 and Dam #10). A review of the freshwater chronic aquatic life criterion for cadmium reveals that it very conservative and may overstate eco risk (Greene, 2010), as well. Assuming this is true and considering the marginal overall calculated exceedances, it becomes less likely that divalent metals are causing or will cause significant chronic toxicity, currently or if released. With that in mind, this type of assessment should be considered a screening too. An IWBU greater than 1 is not proof of chronic toxicity to benthic organisms and a value less than 1 is not proof that toxicity is absent. Nevertheless, the approach has distinct advantages over the ERL/ERM approach in that it begins to address the chemical form and therefore bioavailability of the metal. Further, it compares predicted dissolved exposure concentrations to scientifically relevant and legally applicable water quality criteria for the protection of aquatic life. Last, the distribution of IWBU values is relatively consistent from Dam 2 to Dam 11. Therefore any release of sediment and associated porewater is not likely to change conditions as compared to its current state.

3. Based upon the assessment conducted, there appears to be a slight potential for human health impacts due to arsenic and thallium from drinking Brandywine River surface water and eating fish from the Brandywine River. However, this assessment conservatively assumes that the porewater is in equilibrium with the surface water, and that the concentrations of metals are equal in both. It is highly unlikely that this it truly the case, and dilution from surface water likely mitigates any potential risk. To evaluate this hypothesis, the most recent (2019) City of Wilmington Surface Water Quality Report was reviewed. The reports indicates that "primary parameters," or "contaminants that are regulated by an MCL," are assessed at entry points to the municipal distribution system. This includes sampling at the filter plant on the Brandywine River, just upstream of Dam #2. The most recently published data indicates that neither arsenic nor thallium were detected in the river water at detectable concentrations. As such, it is concluded that there is no increase in human health risk associated with arsenic or thallium related to drinking water or eating fish from the Brandywine River.

4. There appears to be no risk to human health in an upland setting associated with metals in the Brandywine River dam sediments as indicated by comparison to DNREC-RS Screening Levels, and subsequent evaluation of thallium and antimony in the RAIS risk calculator for exposure to a recreator, excavation worker, or in a residential setting.

TestAmerica Laboratories, Inc.
Eurofins TestAmerica, Edison
SUMMARY OF ANALYTICAL RESULTS: 460-205020-1
Job Description: WATAR (DE-1525) BRANDYWINE DAM SEDIMENTS
For:
State of Delaware
391 Lukens Drive
New Castle, Delaware 19720-2774

Client ID		DNREC SIRS	BWR-DAM2-T1-0320			BWR-DAM2-T2-0320			BWR-DAM2-T3-0320			BWR-DAM4-T1-0320			BWR-DAM4-T2-0320			BWR-DAM4-T3-0320			BWR-DAM4-T4-0320			BWR-DAM4-T5-0320			BWR-FIELDBLANK-0320_SOLID			BWR-DAM7-T1-0320			BWR-DAM7-T2-0320			BWR-DAM7-T3-0320			BWR-DAM8-T1-0320			BWR-DAM8-T2-0320			BWR-DAM11-T1-0320			BWR-DAM11-T2-0320			BWR-DUP1-0320		
Lab Sample ID		Screening Levels	460-205020-1			460-205020-2			460-205020-3			460-205020-4			460-205020-5			460-205020-6			460-205020-7			460-205020-8			460-205020-9			460-205020-11			460-205020-12			460-205020-13			460-205020-14			460-205020-15			460-205020-16			460-205020-17			460-205020-18		
Sampling Date		Soils	03/06/2020 10:30:00			03/05/2020 14:00:00			03/05/2020 15:30:00			03/09/2020 13:55:00			03/09/2020 11:50:00			03/09/2020 12:35:00			03/09/2020 12:55:00			03/09/2020 13:15:00			03/12/2020 12:50:00			03/10/2020 13:15:00			03/10/2020 11:30:00			03/10/2020 12:10:00			03/11/2020 12:15:00			03/11/2020 11:45:00			03/12/2020 12:10:00			03/12/2020 11:20:00			03/12/2020 00:00:00		
Matrix		Nov 2019	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
SOIL BY 6020B(MG/KG)	[illegible]																																																					
SOIL BY 7471B(MG/KG)																																																						
Mercury	7439-97-6	1.1	0.12		0.0062	0.13		0.0061	0.26		0.0060	0.17		0.0082	0.33		0.0069	0.12		0.0083	0.10		0.0060	0.089		0.0066	0.0076	J	0.0039	0.19		0.0064	0.21		0.0062	0.094		0.0059	0.50		0.0076	0.98		0.0070	0.090		0.0073	0.038		0.0056	0.030		0.0053

Highlighted Concentrations shown in bold type face exceed limits
J : Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
U : Indicates the analyte was analyzed for but not detected.

Client ID		DNREC SIRS	BWR-DAM2-T1-0320			BWR-DAM2-T2-0320			BWR-DAM2-T3-0320			BWR-DAM4-T1-0320			BWR-DAM4-T2-0320			BWR-DAM4-T3-0320			BWR-DAM4-T4-0320			BWR-DAM4-T5-0320			BWR-FIELDBLANK-0320_SOLID			BWR-DAM7-T1-0320			BWR-DAM7-T2-0320			BWR-DAM7-T3-0320			BWR-DAM8-T1-0320			BWR-DAM8-T2-0320			BWR-DAM11-T1-0320			BWR-DAM11-T2-0320			BWR-DUP1-0320		
Lab Sample ID		Screening Levels	460-205020-1			460-205020-2			460-205020-3			460-205020-4			460-205020-5			460-205020-6			460-205020-7			460-205020-8			460-205020-9			460-205020-11			460-205020-12			460-205020-13			460-205020-14			460-205020-15			460-205020-16			460-205020-17			460-205020-18		
Sampling Date		Soils	03/06/2020 10:30:00			03/05/2020 14:00:00			03/05/2020 15:30:00			03/09/2020 13:55:00			03/09/2020 11:50:00			03/09/2020 12:35:00			03/09/2020 12:55:00			03/09/2020 13:15:00			03/12/2020 12:50:00			03/10/2020 13:15:00			03/10/2020 11:30:00			03/10/2020 12:10:00			03/11/2020 12:15:00			03/11/2020 11:45:00			03/12/2020 12:10:00			03/12/2020 11:20:00			03/12/2020 00:00:00		
Matrix		Nov 2019	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY LLOYD KAHN																																																						
Total Organic Carbon (mg/kg)	7440-44-0	NA	12800		684	15100		684	12200		684	16300		684	25900		684	19800		684	11800		684	12100		684	684	U	684	16100		684	21100		684	4330		684	24300		684	22200		684	19600		684	18700		684	19000	Z	684

U : Indicates the analyte was analyzed for but not detected.
Z : Data contains important qualifier codes see hardcopy report and report narrative for further details.

Eurofins TestAmerica, Edison
Lab Job ID: 460-210989-1
Job Description: WATAR (DE-1525)
For:
State of Delaware
391 Lukens Drive
New Castle, Delaware 19720-2774

Client ID		DNREC SIRS	BWR-DAM6-T1-0620			BWR-DAM6-T2-0620			BWR-DAM6-T3-0620			BWR-DAM9-T1-0620			BWR-DAM9-T2-0620			BWR-DAM10-T1-0620			BWR-DAM10-T2-0620			BWR-DUP2-0620		
Lab Sample ID		Screening Levels	460-210989-1			460-210989-2			460-210989-3			460-210989-4			460-210989-5			460-210989-6			460-210989-7			460-210989-8		
Sampling Date		Soils	06/10/2020 11:15:00			06/10/2020 11:40:00			06/10/2020 12:15:00			06/09/2020 14:15:00			06/09/2020 14:30:00			06/09/2020 11:10:00			06/09/2020 11:35:00			06/10/2020 00:00:00		
Matrix		Feb 2020	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Unit																											
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 6020B(MG/KG)																											
Aluminum	7429-90-5	51200	14100		10.7	10900		9.1	11000		10.1	13800		11.3	20200		15.6	14900		9.9	21700		9.6	13800		10.1
Antimony	7440-36-0	3.1	0.46	U	0.46	0.39	U	0.39	0.43	U	0.43	0.48	U	0.48	0.67	U	0.67	0.42	U	0.42	0.41	U	0.41	0.43	U	0.43
Arsenic	7440-38-2	11	3.2		0.50	2.4		0.43	2.3		0.47	2.9		0.53	5.1		0.73	3.2		0.46	4.6		0.45	4.3		0.47
Barium	7440-39-3	1500	141		1.0	104		0.88	104		0.98	136		1.1	207		1.5	147		0.96	172		0.93	139		0.98
Beryllium	7440-41-7	16	0.57	J	0.25	0.48	J	0.21	0.51	J	0.24	0.59	J	0.27	0.87	J	0.37	0.69		0.23	0.79		0.23	0.86		0.24
Cadmium	7440-43-9	7.1	0.52	U	0.52	0.45	U	0.45	0.49	U	0.49	0.55	U	0.55	0.77	U	0.77	0.48	U	0.48	0.47	U	0.47	0.49	U	0.49
Calcium	7440-70-2	NA	4350		46.3	6700		39.6	2130		43.7	2570		49.0	4490		67.8	3090		42.7	2550		41.5	2480		43.7
Chromium	7440-47-3	214	34.1		0.94	29.9		0.80	29.7		0.88	33.3		0.99	45.6		1.4	37.2		0.86	49.5		0.84	38.9		0.88
Cobalt	7440-48-4	34	11.1		0.94	9.5		0.80	9.7		0.89	11.3		0.99	16.6		1.4	12.5		0.87	16.3		0.84	13.6		0.88
Copper	7440-50-8	310	28.0		0.89	22.5		0.76	21.9		0.84	27.1		0.94	40.9		1.3	29.9		0.82	43.0		0.80	30.8		0.84
Iron	7439-89-6	74767	23200		32.7	18700		28.0	18200		30.9	22600		34.6	33000		47.9	25300		30.2	30700		29.4	30200		30.9
Lead	7439-92-1	400	32.2		0.29	27.1		0.25	24.4		0.28	28.1		0.31	45.9		0.43	32.5		0.27	383		0.26	32.0		0.28
Magnesium	7439-95-4	NA	4010		43.3	3440		37.0	3450		40.9	4220		45.8	5890		63.4	4710		40.0	4710		38.9	3500		40.9
Manganese	7439-96-5	2100	586		1.9	455		1.6	378		1.8	442		2.0	838		2.8	455		1.8	514		1.7	645		1.8
Nickel	7440-02-0	150	27.6		1.0	23.2		0.87	22.6		0.96	26.9		1.1	40.8		1.5	30.3		0.94	32.8		0.91	27.5		0.96
Potassium	7440-09-7	NA	1560		56.1	1390		48.0	1490		53.0	1790		59.3	2250		82.1	1890		51.8	1930		50.3	1500		52.9
Selenium	7782-49-2	39	0.73	J	0.45	0.46	J	0.39	0.58	J	0.43	0.56	J	0.48	1.2	J	0.66	0.67	J	0.42	0.65	J	0.41	0.62	J	0.43
Silver	7440-22-4	39	0.96	U	0.96	0.82	U	0.82	0.91	U	0.91	1.0	U	1.0	1.4	U	1.4	0.89	U	0.89	0.86	U	0.86	0.91	U	0.91
Sodium	7440-23-5	NA	130	J	48.8	142		41.7	173		46.1	135	J	51.6	200	J	71.4	135	J	45.0	152		43.8	116	J	46.0
Thallium	7440-28-0	0.078	0.19	U	0.19	0.17	U	0.17	0.18	U	0.18	0.21	U	0.21	0.29	U	0.29	**0.20**	J	0.18	**0.19**	J	0.17	0.18	U	0.18
Vanadium	7440-62-2	134	36.6		0.89	29.0		0.76	29.8		0.84	36.6		0.94	50.2		1.3	39.8		0.82	60.2		0.80	39.7		0.84
Zinc	7440-66-6	2300	119		6.1	94.4		5.2	93.2		5.7	112		6.4	173		8.9	119		5.6	101		5.5	117		5.7
SOIL BY 7471B(MG/KG)																											
Mercury	7439-97-6	1.1	0.070	B	0.0072	0.075	B	0.0064	0.076	B	0.0072	0.069	B	0.0084	0.15		0.011	0.097		0.0076	0.084		0.0069	0.060		0.0066

Highlighted Concentrations shown in bold type face exceed limits
B : Compound was found in the blank and sample.
J : Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
U : Indicates the analyte was analyzed for but not detected.

Client ID		DNREC SIRS	BWR-DAM6-T1-0620			BWR-DAM6-T2-0620			BWR-DAM6-T3-0620			BWR-DAM9-T1-0620			BWR-DAM9-T2-0620			BWR-DAM10-T1-0620			BWR-DAM10-T2-0620			BWR-DUP2-0620		
Lab Sample ID		Screening Levels	460-210989-1			460-210989-2			460-210989-3			460-210989-4			460-210989-5			460-210989-6			460-210989-7			460-210989-8		
Sampling Date		Soils	06/10/2020 11:15:00			06/10/2020 11:40:00			06/10/2020 12:15:00			06/09/2020 14:15:00			06/09/2020 14:30:00			06/09/2020 11:10:00			06/09/2020 11:35:00			06/10/2020 00:00:00		
Matrix		Feb 2020	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY LLOYD KAHN																											
TOC Result 1 (mg/kg)	STL00338	NA	21200		153	17800		136	23400		150	28500		172	34600		243	24200		159	3920		148	20900		149

Copied Raw Data

[illegible]

Data with U qualiers set to 1/2 Method Detection Limit

[illegible]

Data with U qualiers set to 1/2 Method Detection Limit

[illegible]

Data with U qualified values set to 1/2 MDL

Sample ID	Conc Units	UNIT QUAL	Silver	Aluminum	Arsenic	Cadmium	Chromium	Copper	Iron	Mercury	Manganese	Nickel	Lead	Antimony	Selenium	Thallium	Zinc	Barium	Beryllium	Calcium	Cobalt	Magnesium	Potassium	Sodium	Vanadium
BWR-DAM2-T1-0320	ppm	Dry	0.395	10800	2.4	0.215	22.9	24.8	15600	NA	247	21.1	31.3	0.185	0.37	0.08	74.7	86.1	0.45	1220	7.2	2400	1050	138	29.7
BWR-DAM2-T2-0320	ppm	Dry	0.385	10600	2.2	0.21	25	23.4	19000	NA	409	16.4	38.5	0.18	0.38	0.075	83.2	78.4	0.32	1630	8	2700	917	151	27.6
BWR-DAM2-T3-0320	ppm	Dry	0.355	10200	2.9	0.195	21.8	66	15300	NA	197	15.5	50.3	0.17	0.38	0.07	74	86.6	0.46	915	7	2230	893	261	26.6
BWR-DAM4-T1-0320	ppm	Dry	0.5	14300	3.4	0.27	32.7	36.1	23200	NA	506	31.6	44.4	0.235	0.63	0.1	128	141	0.58	2840	12.1	4290	1880	181	36.7
BWR-DAM4-T2-0320	ppm	Dry	0.455	16800	4.2	0.25	46.4	42.4	24500	NA	501	31.6	90.2	0.215	0.73	0.21	148	152	0.77	1990	12.3	3920	1710	165	42.4
BWR-DAM4-T3-0320	ppm	Dry	0.55	12400	2.2	0.29	32.2	25	21800	NA	361	24.2	34.3	0.255	0.68	0.11	108	116	0.45	2450	10.2	3830	1670	212	35.1
BWR-DAM4-T4-0320	ppm	Dry	0.43	10300	2.1	0.235	27.7	29.8	18500	NA	265	20.3	25.5	0.205	0.2	0.085	86.6	94.2	0.42	1940	9	3290	1700	125	33.3
BWR-DAM4-T5-0320	ppm	Dry	0.465	12000	2.7	0.255	29.3	26.7	21200	NA	450	22.3	33.1	0.22	0.51	0.095	99	109	0.5	2940	10.7	3730	1890	159	37.5
BWR-DAM7-T1-0320	ppm	Dry	0.48	18700	4.6	0.26	42.7	85	29400	NA	324	34.3	61	0.23	0.83	0.23	143	151	0.75	1500	13.1	4100	1630	150	49
BWR-DAM7-T2-0320	ppm	Dry	0.5	17100	4.1	0.28	41.1	43.9	26800	NA	321	27.3	74	5.5	0.57	0.105	121	136	0.66	1460	12.8	4250	1760	144	46.5
BWR-DAM7-T3-0320	ppm	Dry	0.43	15400	4.7	0.235	36.7	20.9	53300	NA	501	17.6	11.8	0.205	0.57	0.085	57.2	54.8	0.74	1310	20.6	2810	843	316	55.7
BWR-DAM8-T1-0320	ppm	Dry	0.6	20100	5.4	0.67	46.1	61	32900	NA	752	54.3	73	0.275	0.73	0.29	180	183	0.93	2150	16.8	5030	2170	109	47.9
BWR-DAM8-T2-0320	ppm	Dry	0.55	20800	4.7	0.295	50	59.2	32400	NA	538	46.2	63	0.255	0.65	0.25	145	180	0.99	1700	15.9	4800	2070	99.8	51.8
BWR-DAM11-T1-0320	ppm	Dry	0.5	13800	2.7	0.28	31.2	20.5	24400	NA	338	22.3	21.5	0.245	0.24	0.105	87.9	96.8	0.58	1510	10.6	3560	1360	82.6	38
BWR-DAM11-T2-0320	ppm	Dry	0.395	10700	1.8	0.215	20.5	13.6	17400	NA	325	16.6	8	0.185	0.185	0.08	48.4	92.8	0.49	780	9.1	2710	1310	54.3	25.9
BWR-DAM6-T1-0620	ppm	Dry	0.48	14100	3.2	0.26	34.1	28	23200	NA	586	27.6	32.2	0.23	0.73	0.095	119	141	0.57	4350	11.1	4010	1560	130	36.6
BWR-DAM6-T2-0620	ppm	Dry	0.41	10900	2.4	0.225	29.9	22.5	18700	NA	455	23.2	27.1	0.195	0.46	0.085	94.4	104	0.48	6700	9.5	3440	1390	142	29
BWR-DAM6-T3-0620	ppm	Dry	0.455	11000	2.3	0.245	29.7	21.9	18200	NA	378	22.6	24.4	0.215	0.58	0.09	93.2	104	0.51	2130	9.7	3450	1490	173	29.8
BWR-DAM9-T1-0620	ppm	Dry	0.5	13800	2.9	0.275	33.3	27.1	22600	NA	442	26.9	28.1	0.24	0.56	0.105	112	136	0.59	2570	11.3	4220	1790	135	36.6
BWR-DAM9-T2-0620	ppm	Dry	0.7	20200	5.1	0.385	45.6	40.9	33000	NA	838	40.8	45.9	0.335	1.2	0.145	173	207	0.87	4490	16.6	5890	2250	200	50.2
BWR-DAM10-T1-0620	ppm	Dry	0.445	14900	3.2	0.24	37.2	29.9	25300	NA	455	30.3	32.5	0.21	0.67	0.2	119	147	0.69	3090	12.5	4710	1890	135	39.8
BWR-DAM10-T2-0620	ppm	Dry	0.43	21700	4.6	0.235	49.5	43	30700	NA	514	32.8	383	0.205	0.65	0.19	101	172	0.79	2550	16.3	4710	1930	152	60.2
BWR-DUP1-0320 (DUP of D11-T1)	ppm	Dry	0.415	5010	0.87	0.225	18	7.9	8980	NA	180	9.5	5.3	0.195	0.195	0.085	29.2	41.7	0.22	491	4.7	1350	642	41.9	12.1
BWR-DUP2-0620 (DUP of D6-T1)	ppm	Dry	0.455	13800	4.3	0.245	38.9	30.8	30200	NA	645	27.5	32	0.215	0.62	0.09	117	139	0.86	2480	13.6	3500	1500	116	39.7
BWR-FIELDBLANK-0320_SOLID	ppm	Dry	0.285	313	0.78	0.155	3.4	1.1	1830	NA	2	0.3	1.7	0.135	0.135	0.06	1.8	0.76	0.15	50.7	0.28	35.6	16.65	14.5	3
SIRS Soil Screening Value			39	51200	11	7	214	310	74767	NA	2100	150	400	3.1	39	0.078	2300	1500	16	NS	34	NS	NS	NS	134

Count = 22

	Silver	Aluminum	Arsenic	Cadmium	Chromium	Copper	Iron	Mercury	Manganese	Nickel	Lead	Antimony	Selenium	Thallium	Zinc	Barium	Beryllium	Calcium	Cobalt	Magnesium	Potassium	Sodium	Vanadium
Mean =	0.47	14572.73	3.35	0.27	34.80	35.98	24881.82	NA	441.05	27.54	56.05	0.46	0.57	0.13	108.89	125.85	0.62	2373.41	11.93	3821.82	1597.86	155.21	39.36
Median =	0.46	13950.00	3.05	0.25	33.00	28.90	23200.00	NA	446.00	25.55	33.70	0.22	0.58	0.10	104.50	126.00	0.58	2060.00	11.20	3875.00	1685.00	147.00	37.10
Min =	0.36	10200.00	1.80	0.20	20.50	13.60	15300.00	NA	197.00	15.50	8.00	0.17	0.19	0.07	48.40	54.80	0.32	780.00	7.00	2230.00	843.00	54.30	25.90
Max =	0.70	21700.00	5.40	0.67	50.00	85.00	53300.00	NA	838.00	54.30	383.00	5.50	1.20	0.29	180.00	207.00	0.99	6700.00	20.60	5890.00	2250.00	316.00	60.20
St. Error =	0.02	809.10	0.24	0.02	1.92	3.81	1789.13	NA	32.69	2.10	16.19	0.24	0.05	0.01	7.33	8.33	0.04	291.12	0.74	195.58	86.47	12.05	2.11

NA = Not Analyzed. A separate assessment of Mercury has been prepared in a separate spreadsheet.
NS = No Standard
Not assessed: Aluminum, Calcium, Cobalt, Iron, Magnesium, Manganese, Potassium, Sodium, Vanadium (compounds do not have freshwater acute or chronic criteria, or human health criteria from fish and water ingestion).

Red highlited cell exceeds DNREC Soil Screening Value for protection of human health

Acute Toxicity Units

JGC Check

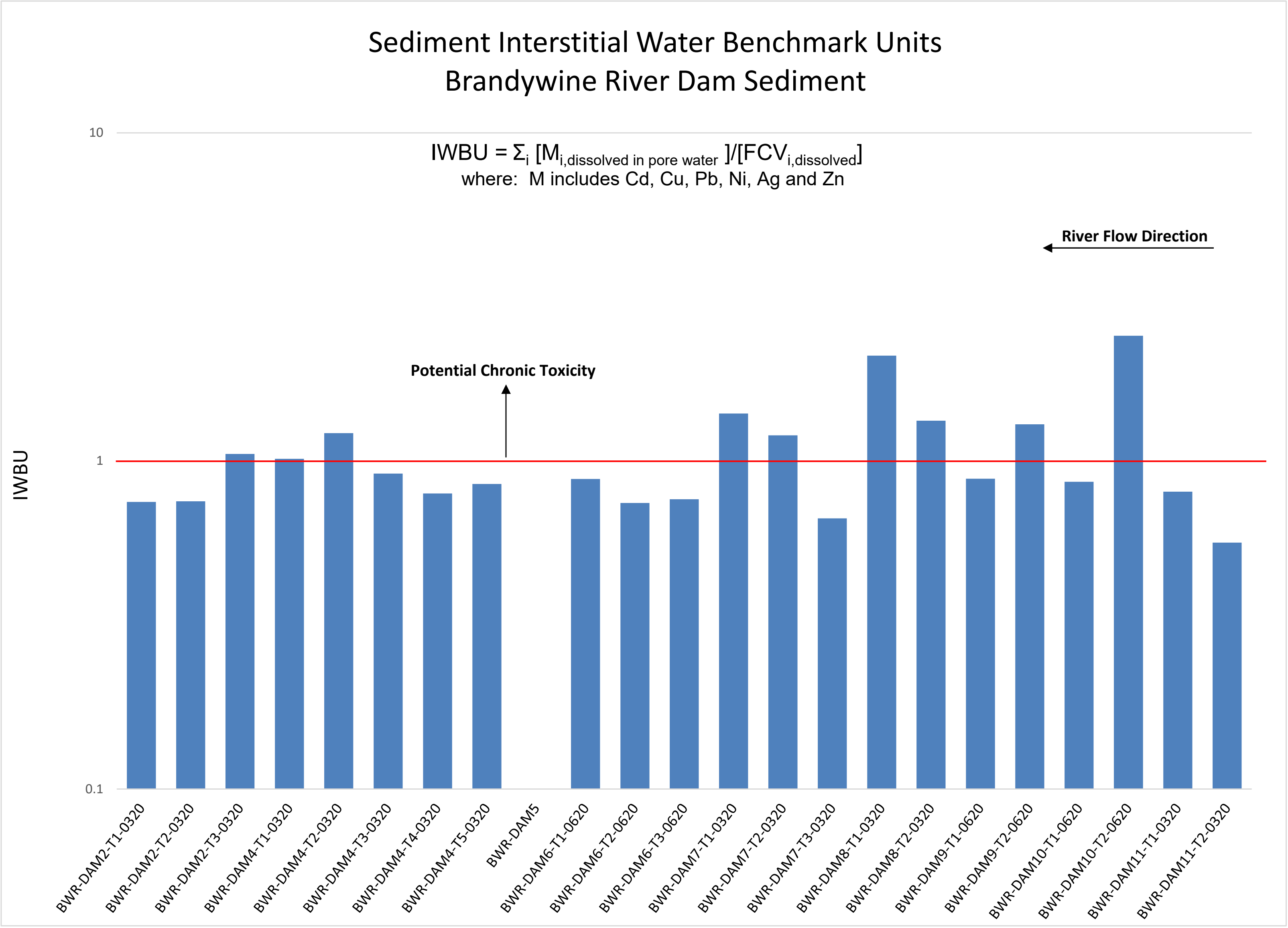
	Cadmium	Copper	Lead	Nickel	Silver	Zinc	Sum
Sample ID	T.U.$_a$	T.U.$_a$	T.U.$_a$	T.U.$_a$	T.U.$_a$	T.U.$_a$	∑ T.U.$_a$
BWR-DAM2-T1-0320	0.0482	0.1081	0.0051	0.0052	0.0307	0.0158	0.2131
BWR-DAM2-T2-0320	0.0471	0.1020	0.0063	0.0041	0.0299	0.0176	0.2069
BWR-DAM2-T3-0320	0.0437	0.2878	0.0082	0.0038	0.0276	0.0157	0.3868
BWR-DAM4-T1-0320	0.0605	0.1574	0.0072	0.0078	0.0388	0.0271	0.2989
BWR-DAM4-T2-0320	0.0560	0.1849	0.0147	0.0078	0.0353	0.0313	0.3301
BWR-DAM4-T3-0320	0.0650	0.1090	0.0056	0.0060	0.0427	0.0229	0.2512
BWR-DAM4-T4-0320	0.0527	0.1300	0.0041	0.0050	0.0334	0.0183	0.2435
BWR-DAM4-T5-0320	0.0572	0.1164	0.0054	0.0055	0.0361	0.0210	0.2416
BWR-DAM5							
BWR-DAM6-T1-0620	0.0583	0.1221	0.0052	0.0068	0.0373	0.0252	0.2549
BWR-DAM6-T2-0620	0.0504	0.0981	0.0044	0.0057	0.0318	0.0200	0.2105
BWR-DAM6-T3-0620	0.0549	0.0955	0.0040	0.0056	0.0353	0.0197	0.2150
BWR-DAM7-T1-0320	0.0583	0.3707	0.0099	0.0085	0.0373	0.0303	0.5149
BWR-DAM7-T2-0320	0.0628	0.1914	0.0120	0.0067	0.0388	0.0256	0.3374
BWR-DAM7-T3-0320	0.0527	0.0911	0.0019	0.0044	0.0334	0.0121	0.1956
BWR-DAM8-T1-0320	0.1502	0.2660	0.0119	0.0134	0.0466	0.0381	0.5262
BWR-DAM8-T2-0320	0.0661	0.2582	0.0103	0.0114	0.0427	0.0307	0.4194
BWR-DAM9-T1-0620	0.0616	0.1182	0.0046	0.0066	0.0388	0.0237	0.2536
BWR-DAM9-T2-0620	0.0863	0.1784	0.0075	0.0101	0.0544	0.0366	0.3732
BWR-DAM10-T1-0620	0.0538	0.1304	0.0053	0.0075	0.0346	0.0252	0.2567
BWR-DAM10-T2-0620	0.0527	0.1875	0.0623	0.0081	0.0334	0.0214	0.3654
BWR-DAM11-T1-0320	0.0628	0.0894	0.0035	0.0055	0.0388	0.0186	0.2186
BWR-DAM11-T2-0320	0.0482	0.0593	0.0013	0.0041	0.0307	0.0102	0.1538

	% of T.U.$_a$	% of T.U.$_a$	% of T.U.$_a$	% of T.U.$_a$	% of T.U.$_a$	% of T.U.$_a$	
Sample ID	from Cd	from Cu	from Pb	from Ni	from Ag	from Zn	
BWR-DAM2-T1-0320	22.61	50.74	2.39	2.45	14.39	7.42	100.00
BWR-DAM2-T2-0320	22.75	49.31	3.03	1.96	14.45	8.51	100.00
BWR-DAM2-T3-0320	11.30	74.42	2.12	0.99	7.13	4.05	100.00
BWR-DAM4-T1-0320	20.25	52.67	2.42	2.61	12.99	9.06	100.00
BWR-DAM4-T2-0320	16.98	56.02	4.45	2.37	10.70	9.49	100.00
BWR-DAM4-T3-0320	25.88	43.41	2.22	2.38	17.01	9.10	100.00
BWR-DAM4-T4-0320	21.63	53.37	1.70	2.06	13.71	7.53	100.00
BWR-DAM4-T5-0320	23.66	48.20	2.23	2.28	14.95	8.67	100.00
BWR-DAM5							
BWR-DAM6-T1-0620	22.86	47.90	2.06	2.68	14.62	9.88	100.00
BWR-DAM6-T2-0620	23.96	46.61	2.09	2.72	15.12	9.49	100.00
BWR-DAM6-T3-0620	25.54	44.41	1.85	2.60	16.43	9.17	100.00
BWR-DAM7-T1-0320	11.32	71.99	1.93	1.65	7.24	5.88	100.00
BWR-DAM7-T2-0320	18.60	56.74	3.57	2.00	11.51	7.59	100.00
BWR-DAM7-T3-0320	26.93	46.60	0.98	2.22	17.07	6.19	100.00
BWR-DAM8-T1-0320	28.54	50.56	2.26	2.55	8.86	7.24	100.00
BWR-DAM8-T1-0320	15.77	61.56	2.44	2.72	10.19	7.32	100.00
BWR-DAM9-T1-0620	24.31	46.61	1.80	2.62	15.31	9.35	100.00
BWR-DAM9-T2-0620	23.12	47.79	2.00	2.70	14.57	9.81	100.00
BWR-DAM10-T1-0620	20.96	50.79	2.06	2.92	13.46	9.81	100.00
BWR-DAM10-T2-0620	14.42	51.32	17.06	2.22	9.14	5.85	100.00
BWR-DAM11-T1-0320	28.71	40.90	1.60	2.52	17.76	8.51	100.00
BWR-DAM11-T2-0320	31.33	38.56	0.85	2.67	19.94	6.66	100.00

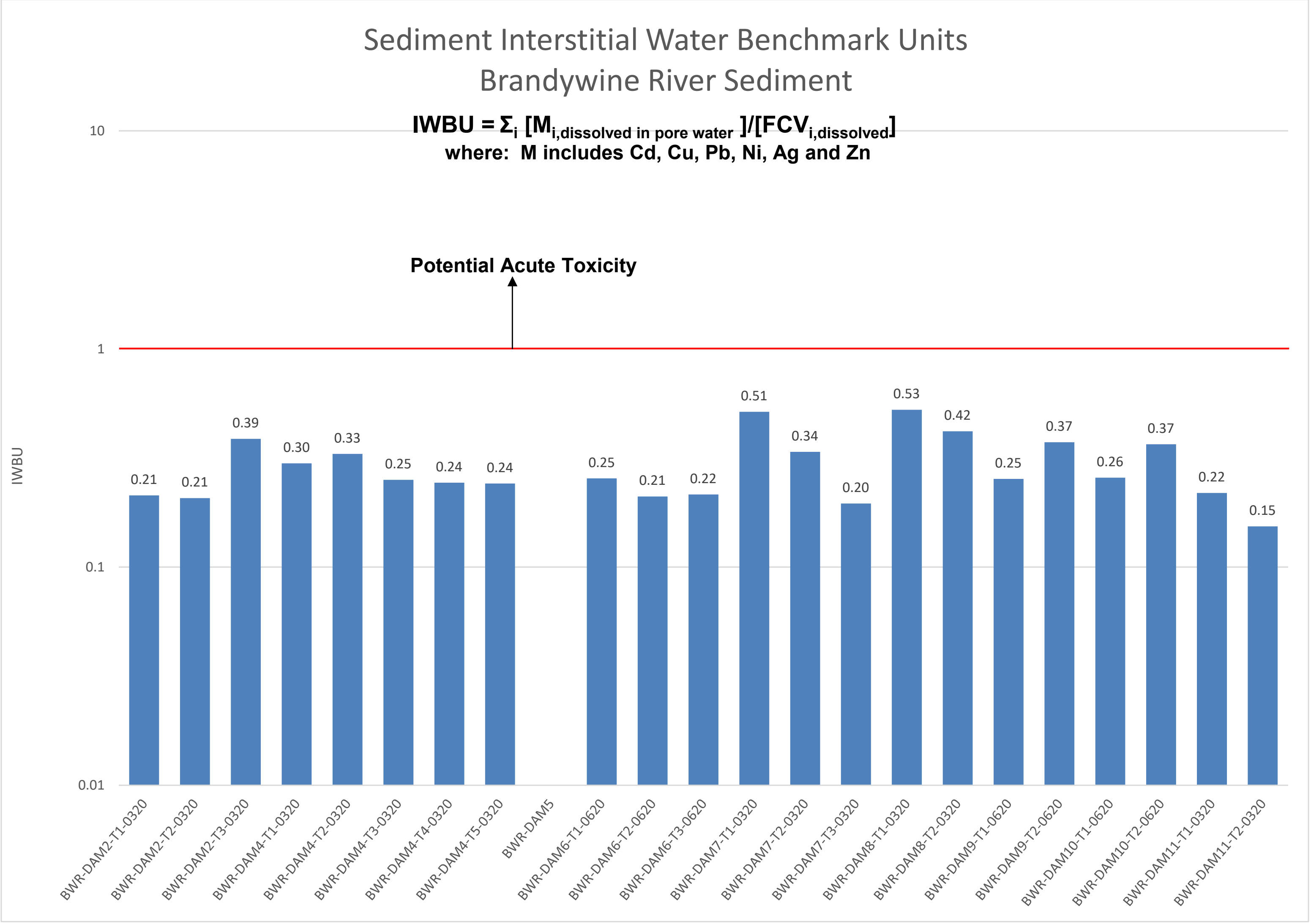
Chronic Toxicity Units and IWBUs

	Cadmium	Copper	Lead	Nickel	Silver	Zinc	Sum
Sample ID	T.U.$_c$	T.U.$_c$	T.U.$_c$	T.U.$_c$	T.U.$_c$	T.U.$_c$	IWBU all
BWR-DAM2-T1-0320	0.3945	0.1623	0.1307	0.0470	NA	0.0157	0.75
BWR-DAM2-T2-0320	0.3853	0.1531	0.1608	0.0365	NA	0.0175	0.75
BWR-DAM2-T3-0320	0.3578	0.4319	0.2101	0.0345	NA	0.0155	1.05
BWR-DAM4-T1-0320	0.4954	0.2362	0.1854	0.0703	NA	0.0269	1.01
BWR-DAM4-T2-0320	0.4587	0.2775	0.3767	0.0703	NA	0.0311	1.21
BWR-DAM4-T3-0320	0.5321	0.1636	0.1432	0.0539	NA	0.0227	0.92
BWR-DAM4-T4-0320	0.4312	0.1950	0.1065	0.0452	NA	0.0182	0.80
BWR-DAM4-T5-0320	0.4679	0.1747	0.1382	0.0496	NA	0.0208	0.85
BWR-DAM5							
BWR-DAM6-T1-0620	0.4770	0.1832	0.1345	0.0614	NA	0.0250	0.88
BWR-DAM6-T2-0620	0.4128	0.1472	0.1132	0.0516	NA	0.0198	0.74
BWR-DAM6-T3-0620	0.4495	0.1433	0.1019	0.0503	NA	0.0196	0.76
BWR-DAM7-T1-0320	0.4770	0.5562	0.2547	0.0763	NA	0.0300	1.39
BWR-DAM7-T2-0320	0.5137	0.2873	0.3090	0.0608	NA	0.0254	1.20
BWR-DAM7-T3-0320	0.4312	0.1368	0.0493	0.0392	NA	0.0120	0.67
BWR-DAM8-T1-0320	1.2293	0.3992	0.3049	0.1208	NA	0.0378	2.09
BWR-DAM8-T2-0320	0.5413	0.3874	0.2631	0.1028	NA	0.0304	1.33
BWR-DAM9-T1-0620	0.5046	0.1773	0.1173	0.0599	NA	0.0235	0.88
BWR-DAM9-T2-0620	0.7064	0.2676	0.1917	0.0908	NA	0.0363	1.29
BWR-DAM10-T1-0620	0.4403	0.1957	0.1357	0.0674	NA	0.0250	0.86
BWR-DAM10-T2-0620	0.4312	0.2814	1.5994	0.0730	NA	0.0212	2.41
BWR-DAM11-T1-0320	0.5137	0.1342	0.0898	0.0496	NA	0.0185	0.81
BWR-DAM11-T2-0320	0.3945	0.0890	0.0334	0.0369	NA	0.0102	0.56

	% of IWBU	% of IWBU	% of IWBU	% of IWBU	% of IWBU	% of IWBU	
Sample ID	from Cd	from Cu	from Pb	from Ni	from Ag	from Zn	
BWR-DAM2-T1-0320	52.59	21.64	17.43	6.26	0.00	2.09	100.00
BWR-DAM2-T2-0320	51.16	20.33	21.35	4.85	0.00	2.32	100.00
BWR-DAM2-T3-0320	34.08	41.14	20.01	3.29	0.00	1.48	100.00
BWR-DAM4-T1-0320	48.84	23.29	18.28	6.93	0.00	2.65	100.00
BWR-DAM4-T2-0320	37.78	22.85	31.02	5.79	0.00	2.56	100.00
BWR-DAM4-T3-0320	58.12	17.87	15.65	5.88	0.00	2.48	100.00
BWR-DAM4-T4-0320	54.17	24.50	13.38	5.68	0.00	2.28	100.00
BWR-DAM4-T5-0320	54.96	20.53	16.24	5.83	0.00	2.44	100.00
BWR-DAM5							
BWR-DAM6-T1-0620	54.14	20.79	15.26	6.97	0.00	2.83	100.00
BWR-DAM6-T2-0620	55.44	19.77	15.20	6.93	0.00	2.66	100.00
BWR-DAM6-T3-0620	58.79	18.74	13.33	6.58	0.00	2.56	100.00
BWR-DAM7-T1-0320	34.21	39.89	18.27	5.47	0.00	2.15	100.00
BWR-DAM7-T2-0320	42.95	24.02	25.83	5.08	0.00	2.12	100.00
BWR-DAM7-T3-0320	64.51	20.46	7.37	5.86	0.00	1.80	100.00
BWR-DAM8-T1-0320	58.76	19.08	14.57	5.78	0.00	1.81	100.00
BWR-DAM8-T2-0320	40.85	29.24	19.86	7.76	0.00	2.30	100.00
BWR-DAM9-T1-0620	57.17	20.09	13.30	6.78	0.00	2.66	100.00
BWR-DAM9-T2-0620	54.64	20.70	14.83	7.02	0.00	2.81	100.00
BWR-DAM10-T1-0620	50.96	22.64	15.71	7.80	0.00	2.89	100.00
BWR-DAM10-T2-0620	17.92	11.69	66.47	3.03	0.00	0.88	100.00
BWR-DAM11-T1-0320	63.76	16.65	11.14	6.16	0.00	2.29	100.00
BWR-DAM11-T2-0320	69.94	15.78	5.92	6.55	0.00	1.80	100.00



Sediment Interstitial Water Benchmark Units
Brandywine River Dam Sediment
IWBU = Σi [Mi,dissolved in pore water]/[FCVi,dissolved]
where: M includes Cd, Cu, Pb, Ni, Ag and Zn
River Flow Direction
Potential Chronic Toxicity
IWBU
10
1
0.1
BWR-DAM2-T1-0320
BWR-DAM2-T2-0320
BWR-DAM2-T3-0320
BWR-DAM4-T1-0320
BWR-DAM4-T2-0320
BWR-DAM4-T3-0320
BWR-DAM4-T4-0320
BWR-DAM4-T5-0320
BWR-DAM5
BWR-DAM6-T1-0620
BWR-DAM6-T2-0620
BWR-DAM6-T3-0620
BWR-DAM7-T1-0320
BWR-DAM7-T2-0320
BWR-DAM7-T3-0320
BWR-DAM8-T1-0320
BWR-DAM8-T2-0320
BWR-DAM9-T1-0620
BWR-DAM9-T2-0620
BWR-DAM10-T1-0620
BWR-DAM10-T2-0620
BWR-DAM11-T1-0320
BWR-DAM11-T2-0320



Sediment Interstitial Water Benchmark Units
Brandywine River Sediment
IWBU = Σi [Mi,dissolved in pore water]/[FCVi,dissolved]
where: M includes Cd, Cu, Pb, Ni, Ag and Zn
Potential Acute Toxicity
IWBU
10
1
0.1
0.01
0.21
0.21
0.39
0.30
0.33
0.25
0.24
0.24
0.25
0.21
0.22
0.51
0.34
0.20
0.53
0.42
0.25
0.37
0.26
0.37
0.22
0.15
BWR-DAM2-T1-0320
BWR-DAM2-T2-0320
BWR-DAM2-T3-0320
BWR-DAM4-T1-0320
BWR-DAM4-T2-0320
BWR-DAM4-T3-0320
BWR-DAM4-T4-0320
BWR-DAM4-T5-0320
BWR-DAM5
BWR-DAM6-T1-0620
BWR-DAM6-T2-0620
BWR-DAM6-T3-0620
BWR-DAM7-T1-0320
BWR-DAM7-T2-0320
BWR-DAM7-T3-0320
BWR-DAM8-T1-0320
BWR-DAM8-T2-0320
BWR-DAM9-T1-0620
BWR-DAM9-T2-0620
BWR-DAM10-T1-0620
BWR-DAM10-T2-0620
BWR-DAM11-T1-0320
BWR-DAM11-T2-0320

Barium Calculations

Sample ID	Barium	TOC_{sed}	log K_{d1}	$C_{d,pw}$	$C_{d,pw}$	log K_{d2}	DOC Water Column	DOC Pore Water	$C_{d,pw,inorg}$	$C_{d,pw,DOC\ bound}$	f_{inorg}	$f_{DOC\ bound}$	Salinity	Fresh or	Hardness	Acute Fresh	Chronic Fresh	HH WQC F&W	$T.U._{hh}$
	(mg/kg dw)	(%)	(L/kg)- mean value EPA doc	(mg/L)	(ug/L)	(L/kg oc)	(mg/L)	(mg/L)	(ug/L)	(ug/L)	(%)	(%)	(ppt)	Marine?	(mg/L $CaCO_3$)	(ug/L)	(ug/L)	(ug/L)	
Value References	Lab Data	Lab Data	EPA 2005a			EPA 2005a	Summary	Summary					SWQS		Assumption	SWQS	SWQS	SWQS	
BWR-DAM2-T1-0320	86.1	1.28	2.5	0.27	272.27	3.6	3.5	17.5	254.54	17.73	93.49	6.51	1	F	100			2000	0.127269
BWR-DAM2-T2-0320	78.4	1.51	2.5	0.25	247.92	3.6	3.5	17.5	231.78	16.15	93.49	6.51	1	F	100			2000	0.115888
BWR-DAM2-T3-0320	86.6	1.22	2.5	0.27	273.85	3.6	3.5	17.5	256.02	17.84	93.49	6.51	1	F	100	No aquatic life criteria for barium		2000	0.128008
BWR-DAM4-T1-0320	141	1.63	2.5	0.45	445.88	3.6	3.5	17.5	416.84	29.04	93.49	6.51	1	F	100			2000	0.20842
BWR-DAM4-T2-0320	152	2.59	2.5	0.48	480.67	3.6	3.5	17.5	449.36	31.31	93.49	6.51	1	F	100			2000	0.22468
BWR-DAM4-T3-0320	116	1.98	2.5	0.37	366.82	3.6	3.5	17.5	342.93	23.89	93.49	6.51	1	F	100			2000	0.171466
BWR-DAM4-T4-0320	94.2	1.18	2.5	0.30	297.89	3.6	3.5	17.5	278.48	19.40	93.49	6.51	1	F	100			2000	0.139242
BWR-DAM4-T5-0320	109	1.21	2.5	0.34	344.69	3.6	3.5	17.5	322.24	22.45	93.49	6.51	1	F	100			2000	0.161119
BWR-DAM7-T1-0320	151	1.61	2.5	0.48	477.50	3.6	3.5	17.5	446.40	31.10	93.49	6.51	1	F	100			2000	0.223202
BWR-DAM7-T2-0320	136	2.11	2.5	0.43	430.07	3.6	3.5	17.5	402.06	28.01	93.49	6.51	1	F	100			2000	0.201029
BWR-DAM7-T3-0320	54.8	0.433	2.5	0.17	173.29	3.6	3.5	17.5	162.01	11.29	93.49	6.51	1	F	100			2000	0.081003
BWR-DAM8-T1-0320	183	2.43	2.5	0.58	578.70	3.6	3.5	17.5	541.01	37.69	93.49	6.51	1	F	100			2000	0.270503
BWR-DAM8-T2-0320	180	2.22	2.5	0.57	569.21	3.6	3.5	17.5	532.14	37.07	93.49	6.51	1	F	100			2000	0.266068
BWR-DAM11-T1-0320	96.8	1.96	2.5	0.31	306.11	3.6	3.5	17.5	286.17	19.94	93.49	6.51	1	F	100			2000	0.143086
BWR-DAM11-T2-0320	92.8	1.87	2.5	0.29	293.46	3.6	3.5	17.5	274.35	19.11	93.49	6.51	1	F	100			2000	0.137173
BWR-DUP1-0320	41.7	1.9	2.5	0.13	131.87	3.6	3.5	17.5	123.28	8.59	93.49	6.51	1	F	100			2000	0.061639
BWR-FIELDBLANK-0320_SOLID	0.76	0.0684	2.5	0.00	2.40	3.6	3.5	17.5	2.25	0.16	93.49	6.51	1	F	100			2000	0.001123
BWR-DAM6-T1-0620	141	2.12	2.5	0.45	445.88	3.6	3.5	17.5	416.84	29.04	93.49	6.51	1	F	100			2000	0.20842
BWR-DAM6-T2-0620	104	1.78	2.5	0.33	328.88	3.6	3.5	17.5	307.46	21.42	93.49	6.51	1	F	100			2000	0.153728
BWR-DAM6-T3-0620	104	2.34	2.5	0.33	328.88	3.6	3.5	17.5	307.46	21.42	93.49	6.51	1	F	100			2000	0.153728
BWR-DAM9-T1-0620	136	2.85	2.5	0.43	430.07	3.6	3.5	17.5	402.06	28.01	93.49	6.51	1	F	100			2000	0.201029
BWR-DAM9-T2-0620	207	3.46	2.5	0.65	654.59	3.6	3.5	17.5	611.96	42.63	93.49	6.51	1	F	100			2000	0.305979
BWR-DAM10-T1-0620	147	2.42	2.5	0.46	464.85	3.6	3.5	17.5	434.58	30.28	93.49	6.51	1	F	100			2000	0.217289
BWR-DAM10-T2-0620	172	0.392	2.5	0.54	543.91	3.6	3.5	17.5	508.49	35.43	93.49	6.51	1	F	100			2000	0.254243
BWR-DAM5	Not Sampled																		
BWR-DUP2-0620	139	2.09	2.5	0.44	439.56	3.6	3.5	17.5	410.93	28.63	93.49	6.51	1	F	100			2000	0.205464

Beryllium Calculations

Sample ID	Beryllium	TOC_{sed}	log K_{d1}	$C_{d,pw}$	$C_{d,pw}$	log K_{d2}	DOC Water Column	DOC Pore Water	$C_{d,pw,inorg}$	$C_{d,pw,DOC\ bound}$	f_{inorg}	$f_{DOC\ bound}$	Salinity	Fresh or	Hardness	Acute Fresh	Chronic Fresh	HH WQC F&W	$T.U._{hh}$
	(mg/kg dw)	(%)	(L/kg)	(mg/L)	(ug/L)	(L/kg oc)	(mg/L)	(mg/L)	(ug/L)	(ug/L)	(%)	(%)	(ppt)	Marine?	(mg/L $CaCO_3$)	(ug/L)	(ug/L)	(ug/L)	
Value References	Lab Data	Lab Data	EPA 2005a			EPA 2005a	Summary	Summary					SWQS		Assumption	SWQS	SWQS	SWQS	
BWR-DAM2-T1-0320	0.45	1.28	2.8	7.13E-04	7.13E-01	2.1	3.5	17.5	7.12E-01	1.57E-03	99.78	0.22	1	F	100			4	0.18
BWR-DAM2-T2-0320	0.32	1.51	2.8	5.07E-04	5.07E-01	2.1	3.5	17.5	5.06E-01	1.11E-03	99.78	0.22	1	F	100			4	0.13
BWR-DAM2-T3-0320	0.46	1.22	2.8	7.29E-04	7.29E-01	2.1	3.5	17.5	7.27E-01	1.60E-03	99.78	0.22	1	F	100	No aquatic life criteria for beryllium		4	0.18
BWR-DAM4-T1-0320	0.58	1.63	2.8	9.19E-04	9.19E-01	2.1	3.5	17.5	9.17E-01	2.02E-03	99.78	0.22	1	F	100			4	0.23
BWR-DAM4-T2-0320	0.77	2.59	2.8	1.22E-03	1.22E+00	2.1	3.5	17.5	1.22E+00	2.68E-03	99.78	0.22	1	F	100			4	0.30
BWR-DAM4-T3-0320	0.45	1.98	2.8	7.13E-04	7.13E-01	2.1	3.5	17.5	7.12E-01	1.57E-03	99.78	0.22	1	F	100			4	0.18
BWR-DAM4-T4-0320	0.42	1.18	2.8	6.66E-04	6.66E-01	2.1	3.5	17.5	6.64E-01	1.46E-03	99.78	0.22	1	F	100			4	0.17
BWR-DAM4-T5-0320	0.5	1.21	2.8	7.92E-04	7.92E-01	2.1	3.5	17.5	7.91E-01	1.74E-03	99.78	0.22	1	F	100			4	0.20
BWR-DAM7-T1-0320	0.75	1.61	2.8	1.19E-03	1.19E+00	2.1	3.5	17.5	1.19E+00	2.61E-03	99.78	0.22	1	F	100			4	0.30
BWR-DAM7-T2-0320	0.66	2.11	2.8	1.05E-03	1.05E+00	2.1	3.5	17.5	1.04E+00	2.30E-03	99.78	0.22	1	F	100			4	0.26
BWR-DAM7-T3-0320	0.74	0.433	2.8	1.17E-03	1.17E+00	2.1	3.5	17.5	1.17E+00	2.58E-03	99.78	0.22	1	F	100			4	0.29
BWR-DAM8-T1-0320	0.93	2.43	2.8	1.47E-03	1.47E+00	2.1	3.5	17.5	1.47E+00	3.24E-03	99.78	0.22	1	F	100			4	0.37
BWR-DAM8-T2-0320	0.99	2.22	2.8	1.57E-03	1.57E+00	2.1	3.5	17.5	1.57E+00	3.45E-03	99.78	0.22	1	F	100			4	0.39
BWR-DAM11-T1-0320	0.58	1.96	2.8	9.19E-04	9.19E-01	2.1	3.5	17.5	9.17E-01	2.02E-03	99.78	0.22	1	F	100			4	0.23
BWR-DAM11-T2-0320	0.49	1.87	2.8	7.77E-04	7.77E-01	2.1	3.5	17.5	7.75E-01	1.71E-03	99.78	0.22	1	F	100			4	0.19
BWR-DUP1-0320	0.22	1.9	2.8	3.49E-04	3.49E-01	2.1	3.5	17.5	3.48E-01	7.66E-04	99.78	0.22	1	F	100			4	0.09
BWR-FIELDBLANK-0320_SOLID	0.15	0.0684	2.8	2.38E-04	2.38E-01	2.1	3.5	17.5	2.37E-01	5.23E-04	99.78	0.22	1	F	100			4	0.06
BWR-DAM6-T1-0620	0.57	2.12	2.8	9.03E-04	9.03E-01	2.1	3.5	17.5	9.01E-01	1.99E-03	99.78	0.22	1	F	100			4	0.23
BWR-DAM6-T2-0620	0.48	1.78	2.8	7.61E-04	7.61E-01	2.1	3.5	17.5	7.59E-01	1.67E-03	99.78	0.22	1	F	100			4	0.19
BWR-DAM6-T3-0620	0.51	2.34	2.8	8.08E-04	8.08E-01	2.1	3.5	17.5	8.07E-01	1.78E-03	99.78	0.22	1	F	100			4	0.20
BWR-DAM9-T1-0620	0.59	2.85	2.8	9.35E-04	9.35E-01	2.1	3.5	17.5	9.33E-01	2.06E-03	99.78	0.22	1	F	100			4	0.23
BWR-DAM9-T2-0620	0.87	3.46	2.8	1.38E-03	1.38E+00	2.1	3.5	17.5	1.38E+00	3.03E-03	99.78	0.22	1	F	100			4	0.34
BWR-DAM10-T1-0620	0.69	2.42	2.8	1.09E-03	1.09E+00	2.1	3.5	17.5	1.09E+00	2.40E-03	99.78	0.22	1	F	100			4	0.27
BWR-DAM10-T2-0620	0.79	0.392	2.8	1.25E-03	1.25E+00	2.1	3.5	17.5	1.25E+00	2.75E-03	99.78	0.22	1	F	100			4	0.31
BWR-DAM5	Not Sampled																		
BWR-DUP2-0620	0.86	2.09	2.8	1.36E-03	1.36E+00	2.1	3.5	17.5	1.36E+00	3.00E-03	99.78	0.22	1	F	100			4	0.34

Antimony Calculations

Sample ID	Antimony	TOC_{sed}	log K_{d1}	$C_{d,pw}$	$C_{d,pw}$	log K_{d2}	DOC Water Column	DOC Pore Water	$C_{d,pw,inorg}$	$C_{d,pw,DOC\ bound}$	f_{inorg}	$f_{DOC\ bound}$	Salinity	Fresh or	Hardness	Acute Fresh	Chronic Fresh	HH WQC F&W	$T.U._{hh}$
	(mg/kg dw)	(%)	(L/kg)	(mg/L)	(ug/L)	(L/kg oc)	(mg/L)	(mg/L)	(ug/L)	(ug/L)	(%)	(%)	(ppt)	Marine?	(mg/L $CaCO_3$)	(ug/L)	(ug/L)	(ug/L)	
Value References	Lab Data	Lab Data	EPA 2005a			EPA 2005a	Summary	Summary					SWQS		Assumption	SWQS	SWQS	SWQS	
BWR-DAM2-T1-0320	0.185	1.28	3.6	4.65E-05	4.65E-02	2.0	3.5	17.5	4.64E-02	8.12E-05	99.83	0.17	1	F	100			6	0.008
BWR-DAM2-T2-0320	0.18	1.51	3.6	4.52E-05	4.52E-02	2.0	3.5	17.5	4.51E-02	7.90E-05	99.83	0.17	1	F	100			6	0.008
BWR-DAM2-T3-0320	0.17	1.22	3.6	4.27E-05	4.27E-02	2.0	3.5	17.5	4.26E-02	7.46E-05	99.83	0.17	1	F	100	No aquatic life criteria for antimony.		6	0.007
BWR-DAM4-T1-0320	0.235	1.63	3.6	5.90E-05	5.90E-02	2.0	3.5	17.5	5.89E-02	1.03E-04	99.83	0.17	1	F	100			6	0.010
BWR-DAM4-T2-0320	0.215	2.59	3.6	5.40E-05	5.40E-02	2.0	3.5	17.5	5.39E-02	9.43E-05	99.83	0.17	1	F	100			6	0.009
BWR-DAM4-T3-0320	0.255	1.98	3.6	6.41E-05	6.41E-02	2.0	3.5	17.5	6.39E-02	1.12E-04	99.83	0.17	1	F	100			6	0.011
BWR-DAM4-T4-0320	0.205	1.18	3.6	5.15E-05	5.15E-02	2.0	3.5	17.5	5.14E-02	9.00E-05	99.83	0.17	1	F	100			6	0.009
BWR-DAM4-T5-0320	0.22	1.21	3.6	5.53E-05	5.53E-02	2.0	3.5	17.5	5.52E-02	9.65E-05	99.83	0.17	1	F	100			6	0.009
BWR-DAM7-T1-0320	0.23	1.61	3.6	5.78E-05	5.78E-02	2.0	3.5	17.5	5.77E-02	1.01E-04	99.83	0.17	1	F	100			6	0.010
BWR-DAM7-T2-0320	5.5	2.11	3.6	1.38E-03	1.38E+00	2.0	3.5	17.5	1.38E+00	2.41E-03	99.83	0.17	1	F	100			6	0.230
BWR-DAM7-T3-0320	0.205	0.433	3.6	5.15E-05	5.15E-02	2.0	3.5	17.5	5.14E-02	9.00E-05	99.83	0.17	1	F	100			6	0.009
BWR-DAM8-T1-0320	0.275	2.43	3.6	6.91E-05	6.91E-02	2.0	3.5	17.5	6.90E-02	1.21E-04	99.83	0.17	1	F	100			6	0.011
BWR-DAM8-T2-0320	0.255	2.22	3.6	6.41E-05	6.41E-02	2.0	3.5	17.5	6.39E-02	1.12E-04	99.83	0.17	1	F	100			6	0.011
BWR-DAM11-T1-0320	0.245	1.96	3.6	6.15E-05	6.15E-02	2.0	3.5	17.5	6.14E-02	1.08E-04	99.83	0.17	1	F	100			6	0.010
BWR-DAM11-T2-0320	0.185	1.87	3.6	4.65E-05	4.65E-02	2.0	3.5	17.5	4.64E-02	8.12E-05	99.83	0.17	1	F	100			6	0.008
BWR-DUP1-0320	0.195	1.9	3.6	4.90E-05	4.90E-02	2.0	3.5	17.5	4.89E-02	8.56E-05	99.83	0.17	1	F	100			6	0.008
BWR-FIELDBLANK-0320_SOLID	0.135	0.0684	3.6	3.39E-05	3.39E-02	2.0	3.5	17.5	3.39E-02	5.92E-05	99.83	0.17	1	F	100			6	0.006
BWR-DAM6-T1-0620	0.23	2.12	3.6	5.78E-05	5.78E-02	2.0	3.5	17.5	5.77E-02	1.01E-04	99.83	0.17	1	F	100			6	0.010
BWR-DAM6-T2-0620	0.195	1.78	3.6	4.90E-05	4.90E-02	2.0	3.5	17.5	4.89E-02	8.56E-05	99.83	0.17	1	F	100			6	0.008
BWR-DAM6-T3-0620	0.215	2.34	3.6	5.40E-05	5.40E-02	2.0	3.5	17.5	5.39E-02	9.43E-05	99.83	0.17	1	F	100			6	0.009
BWR-DAM9-T1-0620	0.24	2.85	3.6	6.03E-05	6.03E-02	2.0	3.5	17.5	6.02E-02	1.05E-04	99.83	0.17	1	F	100			6	0.010
BWR-DAM9-T2-0620	0.335	3.46	3.6	8.41E-05	8.41E-02	2.0	3.5	17.5	8.40E-02	1.47E-04	99.83	0.17	1	F	100			6	0.014
BWR-DAM10-T1-0620	0.21	2.42	3.6	5.27E-05	5.27E-02	2.0	3.5	17.5	5.27E-02	9.22E-05	99.83	0.17	1	F	100			6	0.009
BWR-DAM10-T2-0620	0.205	0.392	3.6	5.15E-05	5.15E-02	2.0	3.5	17.5	5.14E-02	9.00E-05	99.83	0.17	1	F	100			6	0.009
BWR-DAM5	Not Sampled																		
BWR-DUP2-0620	0.215	2.09	3.6	5.40E-05	5.40E-02	2.0	3.5	17.5	5.39E-02	9.43E-05	99.83	0.17	1	F	100			6	0.009

1/2 Detection Limit

Thallium Calculations

Sample ID	Thallium	TOC_{sed}	log K_{d1}	$C_{d,pw}$	$C_{d,pw}$	log K_{d2}	DOC Water Column	DOC Pore Water	$C_{d,pw,inorg}$	$C_{d,pw,DOC\ bound}$	f_{inorg}	$f_{DOC\ bound}$	Salinity	Fresh or	Hardness	Acute Fresh	Chronic Fresh	HH WQC F&W	$T.U._{hh}$
	(mg/kg dw)	(%)	(L/kg)	(mg/L)	(ug/L)	(L/kg oc)	(mg/L)	(mg/L)	(ug/L)	(ug/L)	(%)	(%)	(ppt)	Marine?	(mg/L $CaCO_3$)	(ug/L)	(ug/L)	(ug/L)	
Value References	Lab Data	Lab Data	EPA 2005a			EPA 2005a	Summary	Summary					SWQS		Assumption	SWQS	SWQS	SWQS	
BWR-DAM2-T1-0320	0.08	1.28	1.3	4.01E-03	4.01E+00	1.6	3.5	17.5	4.01E+00	2.79E-03	99.93	0.07	1	F	100			2	2.003
BWR-DAM2-T2-0320	0.075	1.51	1.3	3.76E-03	3.76E+00	1.6	3.5	17.5	3.76E+00	2.62E-03	99.93	0.07	1	F	100			2	1.878
BWR-DAM2-T3-0320	0.07	1.22	1.3	3.51E-03	3.51E+00	1.6	3.5	17.5	3.51E+00	2.44E-03	99.93	0.07	1	F	100	No aquatic life criteria for thallium.		2	1.753
BWR-DAM4-T1-0320	0.1	1.63	1.3	5.01E-03	5.01E+00	1.6	3.5	17.5	5.01E+00	3.49E-03	99.93	0.07	1	F	100			2	2.504
BWR-DAM4-T2-0320	0.21	2.59	1.3	1.05E-02	1.05E+01	1.6	3.5	17.5	1.05E+01	7.33E-03	99.93	0.07	1	F	100			2	5.259
BWR-DAM4-T3-0320	0.11	1.98	1.3	5.51E-03	5.51E+00	1.6	3.5	17.5	5.51E+00	3.84E-03	99.93	0.07	1	F	100			2	2.755
BWR-DAM4-T4-0320	0.085	1.18	1.3	4.26E-03	4.26E+00	1.6	3.5	17.5	4.26E+00	2.97E-03	99.93	0.07	1	F	100			2	2.129
BWR-DAM4-T5-0320	0.095	1.21	1.3	4.76E-03	4.76E+00	1.6	3.5	17.5	4.76E+00	3.31E-03	99.93	0.07	1	F	100			2	2.379
BWR-DAM7-T1-0320	0.23	1.61	1.3	1.15E-02	1.15E+01	1.6	3.5	17.5	1.15E+01	8.03E-03	99.93	0.07	1	F	100			2	5.760
BWR-DAM7-T2-0320	0.105	2.11	1.3	5.26E-03	5.26E+00	1.6	3.5	17.5	5.26E+00	3.66E-03	99.93	0.07	1	F	100			2	2.629
BWR-DAM7-T3-0320	0.085	0.433	1.3	4.26E-03	4.26E+00	1.6	3.5	17.5	4.26E+00	2.97E-03	99.93	0.07	1	F	100			2	2.129
BWR-DAM8-T1-0320	0.29	2.43	1.3	1.45E-02	1.45E+01	1.6	3.5	17.5	1.45E+01	1.01E-02	99.93	0.07	1	F	100			2	7.262
BWR-DAM8-T2-0320	0.25	2.22	1.3	1.25E-02	1.25E+01	1.6	3.5	17.5	1.25E+01	8.72E-03	99.93	0.07	1	F	100			2	6.260
BWR-DAM11-T1-0320	0.105	1.96	1.3	5.26E-03	5.26E+00	1.6	3.5	17.5	5.26E+00	3.66E-03	99.93	0.07	1	F	100			2	2.629
BWR-DAM11-T2-0320	0.08	1.87	1.3	4.01E-03	4.01E+00	1.6	3.5	17.5	4.01E+00	2.79E-03	99.93	0.07	1	F	100			2	2.003
BWR-DUP1-0320	0.085	1.9	1.3	4.26E-03	4.26E+00	1.6	3.5	17.5	4.26E+00	2.97E-03	99.93	0.07	1	F	100			2	2.129
BWR-FIELDBLANK-0320_SOLID	0.06	0.0684	1.3	3.01E-03	3.01E+00	1.6	3.5	17.5	3.01E+00	2.09E-03	99.93	0.07	1	F	100			2	1.503
BWR-DAM6-T1-0620	0.095	2.12	1.3	4.76E-03	4.76E+00	1.6	3.5	17.5	4.76E+00	3.31E-03	99.93	0.07	1	F	100			2	2.379
BWR-DAM6-T2-0620	0.085	1.78	1.3	4.26E-03	4.26E+00	1.6	3.5	17.5	4.26E+00	2.97E-03	99.93	0.07	1	F	100			2	2.129
BWR-DAM6-T3-0620	0.09	2.34	1.3	4.51E-03	4.51E+00	1.6	3.5	17.5	4.51E+00	3.14E-03	99.93	0.07	1	F	100			2	2.254
BWR-DAM9-T1-0620	0.105	2.85	1.3	5.26E-03	5.26E+00	1.6	3.5	17.5	5.26E+00	3.66E-03	99.93	0.07	1	F	100			2	2.629
BWR-DAM9-T2-0620	0.145	3.46	1.3	7.27E-03	7.27E+00	1.6	3.5	17.5	7.26E+00	5.06E-03	99.93	0.07	1	F	100			2	3.631
BWR-DAM10-T1-0620	0.2	2.42	1.3	1.00E-02	1.00E+01	1.6	3.5	17.5	1.00E+01	6.98E-03	99.93	0.07	1	F	100			2	5.008
BWR-DAM10-T2-0620	0.19	0.392	1.3	9.52E-03	9.52E+00	1.6	3.5	17.5	9.52E+00	6.63E-03	99.93	0.07	1	F	100			2	4.758
BWR-DAM5	Not Sampled																		
BWR-DUP2-0620	0.09	2.09	1.3	4.51E-03	4.51E+00	1.6	3.5	17.5	4.51E+00	3.14E-03	99.93	0.07	1	F	100			2	2.254

1/2 Detection Limit

4.006706447
3.756287294
3.505868141
5.008383058
10.51760442
5.509221364
4.257125599
4.757963905
11.51928103
5.258802211
4.257125599
14.52431087
12.52095765
5.258802211
4.006706447
4.757963905
4.257125599
4.507544752
5.258802211
7.262155434
10.01676612
9.515927811

Predicted Porewater Conc

Summary Statistics	
Mean	6.5564287
Standard Err	0.6991568
Median	5.1335926
Mode	4.2571256
Standard Dev	3.2793359
Sample Varia	10.754044
Kurtosis	0.2137706
Skewness	1.2157722
Range	11.018443
Minimum	3.5058681
Maximum	14.524311
Sum	144.24143
Count	22
	0

Silver Calculations

Sample ID	Silver	TOC_{sed}	log K_{d1}	$C_{d,pw}$	$C_{d,pw}$	log K_{d2}	DOC Water Column	DOC Pore Water	$C_{d,pw,inorg}$	$C_{d,pw,DOC\ bound}$	f_{inorg}	$f_{DOC\ bound}$	Salinity	Fresh or	Hardness	Acute Fresh	Chronic Fresh	HH WQC F&W	$T.U._a$	$T.U._c$	ACR Fresh	$T.U._{hh}$
	(mg/kg dw)	(%)	(L/kg)	(mg/L)	(ug/L)	(L/kg oc)	(mg/L)	(mg/L)	(ug/L)	(ug/L)	(%)	(%)	(ppt)	Marine?	(mg/L $CaCO_3$)	(ug/L)	(ug/L)	(ug/L)				
Value References	Lab Data	Lab Data	EPA 2005a			EPA 2005a	Summary	Summary					SWQS		Assumption	SWQS	SWQS	SWQS				
BWR-DAM2-T1-0320	0.395	1.28	3.6	9.92E-05	9.92E-02	2.5	3.5	17.5	9.87E-02	5.46E-04	99.45	0.55	1	F	100	3.22	NS	170	0.0307	NA	NA	0.0006
BWR-DAM2-T2-0320	0.385	1.51	3.6	9.67E-05	9.67E-02	2.5	3.5	17.5	9.62E-02	5.32E-04	99.45	0.55	1	F	100	3.22	NS	170	0.0299	NA	NA	0.0006
BWR-DAM2-T3-0320	0.355	1.22	3.6	8.92E-05	8.92E-02	2.5	3.5	17.5	8.87E-02	4.91E-04	99.45	0.55	1	F	100	3.22	NS	170	0.0276	NA	NA	0.0005
BWR-DAM4-T1-0320	0.5	1.63	3.6	1.26E-04	1.26E-01	2.5	3.5	17.5	1.25E-01	6.91E-04	99.45	0.55	1	F	100	3.22	NS	170	0.0388	NA	NA	0.0007
BWR-DAM4-T2-0320	0.455	2.59	3.6	1.14E-04	1.14E-01	2.5	3.5	17.5	1.14E-01	6.29E-04	99.45	0.55	1	F	100	3.22	NS	170	0.0353	NA	NA	0.0007
BWR-DAM4-T3-0320	0.55	1.98	3.6	1.38E-04	1.38E-01	2.5	3.5	17.5	1.37E-01	7.60E-04	99.45	0.55	1	F	100	3.22	NS	170	0.0427	NA	NA	0.0008
BWR-DAM4-T4-0320	0.43	1.18	3.6	1.08E-04	1.08E-01	2.5	3.5	17.5	1.07E-01	5.94E-04	99.45	0.55	1	F	100	3.22	NS	170	0.0334	NA	NA	0.0006
BWR-DAM4-T5-0320	0.465	1.21	3.6	1.17E-04	1.17E-01	2.5	3.5	17.5	1.16E-01	6.43E-04	99.45	0.55	1	F	100	3.22	NS	170	0.0361	NA	NA	0.0007
BWR-DAM7-T1-0320	0.48	1.61	3.6	1.21E-04	1.21E-01	2.5	3.5	17.5	1.20E-01	6.64E-04	99.45	0.55	1	F	100	3.22	NS	170	0.0373	NA	NA	0.0007
BWR-DAM7-T2-0320	0.5	2.11	3.6	1.26E-04	1.26E-01	2.5	3.5	17.5	1.25E-01	6.91E-04	99.45	0.55	1	F	100	3.22	NS	170	0.0388	NA	NA	0.0007
BWR-DAM7-T3-0320	0.43	0.433	3.6	1.08E-04	1.08E-01	2.5	3.5	17.5	1.07E-01	5.94E-04	99.45	0.55	1	F	100	3.22	NS	170	0.0334	NA	NA	0.0006
BWR-DAM8-T1-0320	0.6	2.43	3.6	1.51E-04	1.51E-01	2.5	3.5	17.5	1.50E-01	8.29E-04	99.45	0.55	1	F	100	3.22	NS	170	0.0466	NA	NA	0.0009
BWR-DAM8-T2-0320	0.55	2.22	3.6	1.38E-04	1.38E-01	2.5	3.5	17.5	1.37E-01	7.60E-04	99.45	0.55	1	F	100	3.22	NS	170	0.0427	NA	NA	0.0008
BWR-DAM11-T1-0320	0.5	1.96	3.6	1.26E-04	1.26E-01	2.5	3.5	17.5	1.25E-01	6.91E-04	99.45	0.55	1	F	100	3.22	NS	170	0.0388	NA	NA	0.0007
BWR-DAM11-T2-0320	0.395	1.87	3.6	9.92E-05	9.92E-02	2.5	3.5	17.5	9.87E-02	5.46E-04	99.45	0.55	1	F	100	3.22	NS	170	0.0307	NA	NA	0.0006
BWR-DUP1-0320	0.415	1.9	3.6	1.04E-04	1.04E-01	2.5	3.5	17.5	1.04E-01	5.74E-04	99.45	0.55	1	F	100	3.22	NS	170	0.0322	NA	NA	0.0006
BWR-FIELDBLANK-0320_SOLID	0.285	0.0684	3.6	7.16E-05	7.16E-02	2.5	3.5	17.5	7.12E-02	3.94E-04	99.45	0.55	1	F	100	3.22	NS	170	0.0221	NA	NA	0.0004
BWR-DAM6-T1-0620	0.48	2.12	3.6	1.21E-04	1.21E-01	2.5	3.5	17.5	1.20E-01	6.64E-04	99.45	0.55	1	F	100	3.22	NS	170	0.0373	NA	NA	0.0007
BWR-DAM6-T2-0620	0.41	1.78	3.6	1.03E-04	1.03E-01	2.5	3.5	17.5	1.02E-01	5.67E-04	99.45	0.55	1	F	100	3.22	NS	170	0.0318	NA	NA	0.0006
BWR-DAM6-T3-0620	0.455	2.34	3.6	1.14E-04	1.14E-01	2.5	3.5	17.5	1.14E-01	6.29E-04	99.45	0.55	1	F	100	3.22	NS	170	0.0353	NA	NA	0.0007
BWR-DAM9-T1-0620	0.5	2.85	3.6	1.26E-04	1.26E-01	2.5	3.5	17.5	1.25E-01	6.91E-04	99.45	0.55	1	F	100	3.22	NS	170	0.0388	NA	NA	0.0007
BWR-DAM9-T2-0620	0.7	3.46	3.6	1.76E-04	1.76E-01	2.5	3.5	17.5	1.75E-01	9.68E-04	99.45	0.55	1	F	100	3.22	NS	170	0.0544	NA	NA	0.0010
BWR-DAM10-T1-0620	0.445	2.42	3.6	1.12E-04	1.12E-01	2.5	3.5	17.5	1.11E-01	6.15E-04	99.45	0.55	1	F	100	3.22	NS	170	0.0346	NA	NA	0.0007
BWR-DAM10-T2-0620	0.43	0.392	3.6	1.08E-04	1.08E-01	2.5	3.5	17.5	1.07E-01	5.94E-04	99.45	0.55	1	F	100	3.22	NS	170	0.0334	NA	NA	0.0006
BWR-DAM5	Not Sampled																					
BWR-DUP2-0620	0.455	2.09	3.6	1.14E-04	1.14E-01	2.5	3.5	17.5	1.14E-01	6.29E-04	99.45	0.55	1	F	100	3.22	NS	170	0.0353	NA	NA	0.0007

1/2 Detection Limit

Arsenic Calculations

Sample ID	Arsenic	TOC_{sed}	log K_{d1}	$C_{d,pw}$	$C_{d,pw}$	log K_{d2}	DOC Water Column	DOC Pore Water	$C_{d,pw,inorg}$	$C_{d,pw,DOC\ bound}$	f_{inorg}	$f_{DOC\ bound}$	Salinity	Fresh or	Hardness	Acute Fresh	Chronic Fresh	HH WQC F&W	$T.U._a$	$T.U._c$	ACR Fresh	$T.U._{hh}$
	(mg/kg dw)	(%)	(L/kg)	(mg/L)	(ug/L)	(L/kg oc)	(mg/L)	(mg/L)	(ug/L)	(ug/L)	(%)	(%)	(ppt)	Marine?	(mg/L $CaCO_3$)	(ug/L)	(ug/L)	ug/L				
Value References	Lab Data	Lab Data	EPA 2005a			EPA 2005a	Summary	Summary					SWQS		Assumption	SWQS	SWQS	SWQS				
BWR-DAM2-T1-0320	2.4	1.28	2.4	9.55E-03	9.55E+00	2.0	3.5	17.5	9.54	1.67E-02	99.83	0.17	1	F	100	340	150	10	0.0281	0.06	2.27	0.95
BWR-DAM2-T2-0320	2.2	1.51	2.4	8.76E-03	8.76E+00	2.0	3.5	17.5	8.74	1.53E-02	99.83	0.17	1	F	100	340	150	10	0.0257	0.06	2.27	0.87
BWR-DAM2-T3-0320	2.9	1.22	2.4	1.15E-02	1.15E+01	2.0	3.5	17.5	11.52	2.02E-02	99.83	0.17	1	F	100	340	150	10	0.0339	0.08	2.27	1.15
BWR-DAM4-T1-0320	3.4	1.63	2.4	1.35E-02	1.35E+01	2.0	3.5	17.5	13.51	2.36E-02	99.83	0.17	1	F	100	340	150	10	0.0397	0.09	2.27	1.35
BWR-DAM4-T2-0320	4.2	2.59	2.4	1.67E-02	1.67E+01	2.0	3.5	17.5	16.69	2.92E-02	99.83	0.17	1	F	100	340	150	10	0.0491	0.11	2.27	1.67
BWR-DAM4-T3-0320	2.2	1.98	2.4	8.76E-03	8.76E+00	2.0	3.5	17.5	8.74	1.53E-02	99.83	0.17	1	F	100	340	150	10	0.0257	0.06	2.27	0.87
BWR-DAM4-T4-0320	2.1	1.18	2.4	8.36E-03	8.36E+00	2.0	3.5	17.5	8.35	1.46E-02	99.83	0.17	1	F	100	340	150	10	0.0245	0.06	2.27	0.83
BWR-DAM4-T5-0320	2.7	1.21	2.4	1.07E-02	1.07E+01	2.0	3.5	17.5	10.73	1.88E-02	99.83	0.17	1	F	100	340	150	10	0.0316	0.07	2.27	1.07
BWR-DAM7-T1-0320	4.6	1.61	2.4	1.83E-02	1.83E+01	2.0	3.5	17.5	18.28	3.20E-02	99.83	0.17	1	F	100	340	150	10	0.0538	0.12	2.27	1.83
BWR-DAM7-T2-0320	4.1	2.11	2.4	1.63E-02	1.63E+01	2.0	3.5	17.5	16.29	2.85E-02	99.83	0.17	1	F	100	340	150	10	0.0479	0.11	2.27	1.63
BWR-DAM7-T3-0320	4.7	0.433	2.4	1.87E-02	1.87E+01	2.0	3.5	17.5	18.68	3.27E-02	99.83	0.17	1	F	100	340	150	10	0.0549	0.12	2.27	1.87
BWR-DAM8-T1-0320	5.4	2.43	2.4	2.15E-02	2.15E+01	2.0	3.5	17.5	21.46	3.76E-02	99.83	0.17	1	F	100	340	150	10	0.0631	0.14	2.27	2.15
BWR-DAM8-T2-0320	4.7	2.22	2.4	1.87E-02	1.87E+01	2.0	3.5	17.5	18.68	3.27E-02	99.83	0.17	1	F	100	340	150	10	0.0549	0.12	2.27	1.87
BWR-DAM11-T1-0320	2.7	1.96	2.4	1.07E-02	1.07E+01	2.0	3.5	17.5	10.73	1.88E-02	99.83	0.17	1	F	100	340	150	10	0.0316	0.07	2.27	1.07
BWR-DAM11-T2-0320	1.8	1.87	2.4	7.17E-03	7.17E+00	2.0	3.5	17.5	7.15	1.25E-02	99.83	0.17	1	F	100	340	150	10	0.0210	0.05	2.27	0.72
BWR-DUP1-0320	0.87	1.9	2.4	3.46E-03	3.46E+00	2.0	3.5	17.5	3.46	6.05E-03	99.83	0.17	1	F	100	340	150	10	0.0102	0.02	2.27	0.35
BWR-FIELDBLANK-0320_SOLID	0.78	0.0684	2.4	3.11E-03	3.11E+00	2.0	3.5	17.5	3.10	5.42E-03	99.83	0.17	1	F	100	340	150	10	0.0091	0.02	2.27	0.31
BWR-DAM6-T1-0620	3.2	2.12	2.4	1.27E-02	1.27E+01	2.0	3.5	17.5	12.72	2.23E-02	99.83	0.17	1	F	100	340	150	10	0.0374	0.08	2.27	1.27
BWR-DAM6-T2-0620	2.4	1.78	2.4	9.55E-03	9.55E+00	2.0	3.5	17.5	9.54	1.67E-02	99.83	0.17	1	F	100	340	150	10	0.0281	0.06	2.27	0.95
BWR-DAM6-T3-0620	2.3	2.34	2.4	9.16E-03	9.16E+00	2.0	3.5	17.5	9.14	1.60E-02	99.83	0.17	1	F	100	340	150	10	0.0269	0.06	2.27	0.91
BWR-DAM9-T1-0620	2.9	2.85	2.4	1.15E-02	1.15E+01	2.0	3.5	17.5	11.52	2.02E-02	99.83	0.17	1	F	100	340	150	10	0.0339	0.08	2.27	1.15
BWR-DAM9-T2-0620	5.1	3.46	2.4	2.03E-02	2.03E+01	2.0	3.5	17.5	20.27	3.55E-02	99.83	0.17	1	F	100	340	150	10	0.0596	0.14	2.27	2.03
BWR-DAM10-T1-0620	3.2	2.42	2.4	1.27E-02	1.27E+01	2.0	3.5	17.5	12.72	2.23E-02	99.83	0.17	1	F	100	340	150	10	0.0374	0.08	2.27	1.27
BWR-DAM10-T2-0620	4.6	0.392	2.4	1.83E-02	1.83E+01	2.0	3.5	17.5	18.28	3.20E-02	99.83	0.17	1	F	100	340	150	10	0.0538	0.12	2.27	1.83
BWR-DAM5	Not Sampled																					
BWR-DUP2-0620	4.3	2.09	2.4	1.71E-02	1.71E+01	2.0	3.5	17.5	17.09	2.99E-02	99.83	0.17	1	F	100	340	150	10	0.0503	0.11	2.27	1.71

9.537880802
8.743057402
11.5249393
13.5119978
16.6912914
8.743057402
8.345645702
10.7301159
18.2809382
16.2938797
18.6783499
21.4602318
18.6783499
10.7301159
7.153410601
12.7171744
9.537880802
9.140469102
11.5249393
20.2679967
12.7171744
18.2809382

Predicted Porewater Conc.

Summary Statistics	
Mean	13.331356
Standard Err	0.9452075
Median	12.121057
Mode	9.5378808
Standard Dev	4.4334159
Sample Varia	19.655177
Kurtosis	-1.2628277
Skewness	0.4207533
Range	14.306821
Minimum	7.1534106
Maximum	21.460232
Sum	293.28983
Count	22
	0

Cadmium Calculations

Sample ID	Cadmium	TOC_{sed}	log K_{d1}	$C_{d,pw}$	$C_{d,pw}$	log K_{d2}	DOC Water Column	DOC Pore Water	$C_{d,pw,inorg}$	$C_{d,pw,DOC\ bound}$	f_{inorg}	$f_{DOC\ bound}$	Salinity	Fresh or	Hardness	Acute Fresh	Chronic Fresh	HH WQC F&W	$T.U._a$	$T.U._c$	ACR Fresh	$T.U._{hh}$
	(mg/kg dw)	(%)	(L/kg)	(mg/L)	(ug/L)	(L/kg oc)	(mg/L)	(mg/L)	(ug/L)	(ug/L)	(%)	(%)	(ppt)	Marine?	(mg/L $CaCO_3$)	(ug/L)	(ug/L)	(ug/L)				
Value References	Lab Data	Lab Data	EPA 2005a			EPA 2005a	Summary	Summary					SWQS		Assumption	SWQS	SWQS	SWQS				
BWR-DAM2-T1-0320	0.215	1.28	3.3	1.08E-04	1.08E-01	3.8	3.5	17.5	9.70E-02	1.07E-02	90.06	9.94	1	F	100	2.01	0.25	5.00	0.0482	0.39	8.19	0.02
BWR-DAM2-T2-0320	0.21	1.51	3.3	1.05E-04	1.05E-01	3.8	3.5	17.5	9.48E-02	1.05E-02	90.06	9.94	1	F	100	2.01	0.25	5.00	0.0471	0.39	8.19	0.02
BWR-DAM2-T3-0320	0.195	1.22	3.3	9.77E-05	9.77E-02	3.8	3.5	17.5	8.80E-02	9.72E-03	90.06	9.94	1	F	100	2.01	0.25	5.00	0.0437	0.36	8.19	0.02
BWR-DAM4-T1-0320	0.27	1.63	3.3	1.35E-04	1.35E-01	3.8	3.5	17.5	1.22E-01	1.35E-02	90.06	9.94	1	F	100	2.01	0.25	5.00	0.0605	0.50	8.19	0.02
BWR-DAM4-T2-0320	0.25	2.59	3.3	1.25E-04	1.25E-01	3.8	3.5	17.5	1.13E-01	1.25E-02	90.06	9.94	1	F	100	2.01	0.25	5.00	0.0560	0.46	8.19	0.02
BWR-DAM4-T3-0320	0.29	1.98	3.3	1.45E-04	1.45E-01	3.8	3.5	17.5	1.31E-01	1.45E-02	90.06	9.94	1	F	100	2.01	0.25	5.00	0.0650	0.53	8.19	0.03
BWR-DAM4-T4-0320	0.235	1.18	3.3	1.18E-04	1.18E-01	3.8	3.5	17.5	1.06E-01	1.17E-02	90.06	9.94	1	F	100	2.01	0.25	5.00	0.0527	0.43	8.19	0.02
BWR-DAM4-T5-0320	0.255	1.21	3.3	1.28E-04	1.28E-01	3.8	3.5	17.5	1.15E-01	1.27E-02	90.06	9.94	1	F	100	2.01	0.25	5.00	0.0572	0.47	8.19	0.02
BWR-DAM7-T1-0320	0.26	1.61	3.3	1.30E-04	1.30E-01	3.8	3.5	17.5	1.17E-01	1.30E-02	90.06	9.94	1	F	100	2.01	0.25	5.00	0.0583	0.48	8.19	0.02
BWR-DAM7-T2-0320	0.28	2.11	3.3	1.40E-04	1.40E-01	3.8	3.5	17.5	1.26E-01	1.40E-02	90.06	9.94	1	F	100	2.01	0.25	5.00	0.0628	0.51	8.19	0.03
BWR-DAM7-T3-0320	0.235	0.433	3.3	1.18E-04	1.18E-01	3.8	3.5	17.5	1.06E-01	1.17E-02	90.06	9.94	1	F	100	2.01	0.25	5.00	0.0527	0.43	8.19	0.02
BWR-DAM8-T1-0320	0.67	2.43	3.3	3.36E-04	3.36E-01	3.8	3.5	17.5	3.02E-01	3.34E-02	90.06	9.94	1	F	100	2.01	0.25	5.00	0.1502	1.23	8.19	0.06
BWR-DAM8-T2-0320	0.295	2.22	3.3	1.48E-04	1.48E-01	3.8	3.5	17.5	1.33E-01	1.47E-02	90.06	9.94	1	F	100	2.01	0.25	5.00	0.0661	0.54	8.19	0.03
BWR-DAM11-T1-0320	0.28	1.96	3.3	1.40E-04	1.40E-01	3.8	3.5	17.5	1.26E-01	1.40E-02	90.06	9.94	1	F	100	2.01	0.25	5.00	0.0628	0.51	8.19	0.03
BWR-DAM11-T2-0320	0.215	1.87	3.3	1.08E-04	1.08E-01	3.8	3.5	17.5	9.70E-02	1.07E-02	90.06	9.94	1	F	100	2.01	0.25	5.00	0.0482	0.39	8.19	0.02
BWR-DUP1-0320	0.225	1.9	3.3	1.13E-04	1.13E-01	3.8	3.5	17.5	1.02E-01	1.12E-02	90.06	9.94	1	F	100	2.01	0.25	5.00	0.0504	0.41	8.19	0.02
BWR-FIELDBLANK-0320_SOLID	0.155	0.0684	3.3	7.77E-05	7.77E-02	3.8	3.5	17.5	7.00E-02	7.72E-03	90.06	9.94	1	F	100	2.01	0.25	5.00	0.0347	0.28	8.19	0.01
BWR-DAM6-T1-0620	0.26	2.12	3.3	1.30E-04	1.30E-01	3.8	3.5	17.5	1.17E-01	1.30E-02	90.06	9.94	1	F	100	2.01	0.25	5.00	0.0583	0.48	8.19	0.02
BWR-DAM6-T2-0620	0.225	1.78	3.3	1.13E-04	1.13E-01	3.8	3.5	17.5	1.02E-01	1.12E-02	90.06	9.94	1	F	100	2.01	0.25	5.00	0.0504	0.41	8.19	0.02
BWR-DAM6-T3-0620	0.245	2.34	3.3	1.23E-04	1.23E-01	3.8	3.5	17.5	1.11E-01	1.22E-02	90.06	9.94	1	F	100	2.01	0.25	5.00	0.0549	0.45	8.19	0.02
BWR-DAM9-T1-0620	0.275	2.85	3.3	1.38E-04	1.38E-01	3.8	3.5	17.5	1.24E-01	1.37E-02	90.06	9.94	1	F	100	2.01	0.25	5.00	0.0616	0.50	8.19	0.02
BWR-DAM9-T2-0620	0.385	3.46	3.3	1.93E-04	1.93E-01	3.8	3.5	17.5	1.74E-01	1.92E-02	90.06	9.94	1	F	100	2.01	0.25	5.00	0.0863	0.71	8.19	0.03
BWR-DAM10-T1-0620	0.24	2.42	3.3	1.20E-04	1.20E-01	3.8	3.5	17.5	1.08E-01	1.20E-02	90.06	9.94	1	F	100	2.01	0.25	5.00	0.0538	0.44	8.19	0.02
BWR-DAM10-T2-0620	0.235	0.392	3.3	1.18E-04	1.18E-01	3.8	3.5	17.5	1.06E-01	1.17E-02	90.06	9.94	1	F	100	2.01	0.25	5.00	0.0527	0.43	8.19	0.02
BWR-DAM5	Not Sampled																					
BWR-DUP2-0620	0.245	2.09	3.3	1.23E-04	1.23E-01	3.8	3.5	17.5	1.11E-01	1.22E-02	90.06	9.94	1	F	100	2.01	0.25	5.00	0.0549	0.45	8.19	0.02

1/2 Detection Limit

Chromium Calculations

Sample ID	Chromium	TOC_{sed}	log K_{d1}	$C_{d,pw}$	$C_{d,pw}$	log K_{d2}	DOC Water Column	DOC Pore Water	$C_{d,pw,inorg}$	$C_{d,pw,DOC\ bound}$	f_{inorg}	$f_{DOC\ bound}$	Salinity	Fresh or	Hardness	Acute Fresh	Chronic Fresh	HH WQC F&W	$T.U._a$	$T.U._c$	ACR Fresh	$T.U._{hh}$
	(mg/kg dw)	(%)	(L/kg)	(mg/L)	(ug/L)	(L/kg oc)	(mg/L)	(mg/L)	(ug/L)	(ug/L)	(%)	(%)	(ppt)	Marine?	(mg/L $CaCO_3$)	(ug/L)	(ug/L)	(ug/L)				
Value References	Lab Data	Lab Data	EPA 2005a			EPA 2005a	Summary	Summary					SWQS		Assumption	SWQS	SWQS	SWQS				
BWR-DAM2-T1-0320	22.9	1.28	4.9	2.88E-04	2.88E-01	1.1	3.5	17.5	2.88E-01	6.35E-05	99.98	0.02	1	F	100	16	11	100	0.0180	0.03	1.45	0.0029
BWR-DAM2-T2-0320	25	1.51	4.9	3.15E-04	3.15E-01	1.1	3.5	17.5	3.15E-01	6.93E-05	99.98	0.02	1	F	100	16	11	100	0.0197	0.03	1.45	0.0031
BWR-DAM2-T3-0320	21.8	1.22	4.9	2.74E-04	2.74E-01	1.1	3.5	17.5	2.74E-01	6.05E-05	99.98	0.02	1	F	100	16	11	100	0.0171	0.02	1.45	0.0027
BWR-DAM4-T1-0320	32.7	1.63	4.9	4.12E-04	4.12E-01	1.1	3.5	17.5	4.12E-01	9.07E-05	99.98	0.02	1	F	100	16	11	100	0.0257	0.04	1.45	0.0041
BWR-DAM4-T2-0320	46.4	2.59	4.9	5.84E-04	5.84E-01	1.1	3.5	17.5	5.84E-01	1.29E-04	99.98	0.02	1	F	100	16	11	100	0.0365	0.05	1.45	0.0058
BWR-DAM4-T3-0320	32.2	1.98	4.9	4.05E-04	4.05E-01	1.1	3.5	17.5	4.05E-01	8.93E-05	99.98	0.02	1	F	100	16	11	100	0.0253	0.04	1.45	0.0041
BWR-DAM4-T4-0320	27.7	1.18	4.9	3.49E-04	3.49E-01	1.1	3.5	17.5	3.49E-01	7.68E-05	99.98	0.02	1	F	100	16	11	100	0.0218	0.03	1.45	0.0035
BWR-DAM4-T5-0320	29.3	1.21	4.9	3.69E-04	3.69E-01	1.1	3.5	17.5	3.69E-01	8.12E-05	99.98	0.02	1	F	100	16	11	100	0.0230	0.03	1.45	0.0037
BWR-DAM7-T1-0320	42.7	1.61	4.9	5.38E-04	5.38E-01	1.1	3.5	17.5	5.37E-01	1.18E-04	99.98	0.02	1	F	100	16	11	100	0.0336	0.05	1.45	0.0054
BWR-DAM7-T2-0320	41.1	2.11	4.9	5.17E-04	5.17E-01	1.1	3.5	17.5	5.17E-01	1.14E-04	99.98	0.02	1	F	100	16	11	100	0.0323	0.05	1.45	0.0052
BWR-DAM7-T3-0320	36.7	0.433	4.9	4.62E-04	4.62E-01	1.1	3.5	17.5	4.62E-01	1.02E-04	99.98	0.02	1	F	100	16	11	100	0.0289	0.04	1.45	0.0046
BWR-DAM8-T1-0320	46.1	2.43	4.9	5.80E-04	5.80E-01	1.1	3.5	17.5	5.80E-01	1.28E-04	99.98	0.02	1	F	100	16	11	100	0.0363	0.05	1.45	0.0058
BWR-DAM8-T2-0320	50	2.22	4.9	6.29E-04	6.29E-01	1.1	3.5	17.5	6.29E-01	1.39E-04	99.98	0.02	1	F	100	16	11	100	0.0393	0.06	1.45	0.0063
BWR-DAM11-T1-0320	31.2	1.96	4.9	3.93E-04	3.93E-01	1.1	3.5	17.5	3.93E-01	8.65E-05	99.98	0.02	1	F	100	16	11	100	0.0245	0.04	1.45	0.0039
BWR-DAM11-T2-0320	20.5	1.87	4.9	2.58E-04	2.58E-01	1.1	3.5	17.5	2.58E-01	5.68E-05	99.98	0.02	1	F	100	16	11	100	0.0161	0.02	1.45	0.0026
BWR-DUP1-0320	18	1.9	4.9	2.27E-04	2.27E-01	1.1	3.5	17.5	2.27E-01	4.99E-05	99.98	0.02	1	F	100	16	11	100	0.0142	0.02	1.45	0.0023
BWR-FIELDBLANK-0320_SOLID	3.4	0.0684	4.9	4.28E-05	4.28E-02	1.1	3.5	17.5	4.28E-02	9.43E-06	99.98	0.02	1	F	100	16	11	100	0.0027	0.00	1.45	0.0004
BWR-DAM6-T1-0620	34.1	2.12	4.9	4.29E-04	4.29E-01	1.1	3.5	17.5	4.29E-01	9.46E-05	99.98	0.02	1	F	100	16	11	100	0.0268	0.04	1.45	0.0043
BWR-DAM6-T2-0620	29.9	1.78	4.9	3.76E-04	3.76E-01	1.1	3.5	17.5	3.76E-01	8.29E-05	99.98	0.02	1	F	100	16	11	100	0.0235	0.03	1.45	0.0038
BWR-DAM6-T3-0620	29.7	2.34	4.9	3.74E-04	3.74E-01	1.1	3.5	17.5	3.74E-01	8.24E-05	99.98	0.02	1	F	100	16	11	100	0.0234	0.03	1.45	0.0037
BWR-DAM9-T1-0620	33.3	2.85	4.9	4.19E-04	4.19E-01	1.1	3.5	17.5	4.19E-01	9.23E-05	99.98	0.02	1	F	100	16	11	100	0.0262	0.04	1.45	0.0042
BWR-DAM9-T2-0620	45.6	3.46	4.9	5.74E-04	5.74E-01	1.1	3.5	17.5	5.74E-01	1.26E-04	99.98	0.02	1	F	100	16	11	100	0.0359	0.05	1.45	0.0057
BWR-DAM10-T1-0620	37.2	2.42	4.9	4.68E-04	4.68E-01	1.1	3.5	17.5	4.68E-01	1.03E-04	99.98	0.02	1	F	100	16	11	100	0.0293	0.04	1.45	0.0047
BWR-DAM10-T2-0620	49.5	0.392	4.9	6.23E-04	6.23E-01	1.1	3.5	17.5	6.23E-01	1.37E-04	99.98	0.02	1	F	100	16	11	100	0.0389	0.06	1.45	0.0062
BWR-DAM5	Not Sampled																					
BWR-DUP2-0620	38.9	2.09	4.9	4.90E-04	4.90E-01	1.1	3.5	17.5	4.90E-01	1.08E-04	99.98	0.02	1	F	100	16	11	100	0.0306	0.04	1.45	0.0049

Copper Calculations

Sample ID	Copper	TOC_{sed}	log K_{d1}	$C_{d,pw}$	$C_{d,pw}$	log K_{d2}	DOC Water Column	DOC Pore Water	$C_{d,pw,inorg}$	$C_{d,pw,DOC\ bound}$	f_{inorg}	$f_{DOC\ bound}$	Salinity	Fresh or	Hardness	Acute Fresh	Chronic Fresh	HH WQC F&W	$T.U._a$	$T.U._c$	ACR Fresh	$T.U._{hh}$
	(mg/kg dw)	(%)	(L/kg)	(mg/L)	(ug/L)	(L/kg oc)	(mg/L)	(mg/L)	(ug/L)	(ug/L)	(%)	(%)	(ppt)	Marine?	(mg/L $CaCO_3$)	(ug/L)	(ug/L)	(ug/L)				
Value References	Lab Data	Lab Data	EPA 2005a			EPA 2005a	Summary	Summary					SWQS		Assumption	SWQS	SWQS	SWQS				
BWR-DAM2-T1-0320	24.8	1.28	3.5	7.84E-03	7.84E+00	5.4	3.5	17.5	1.45E+00	6.39E+00	18.53	81.47	1	F	100	13.4	9.0	1300	0.1081	0.16	1.50	0.0011
BWR-DAM2-T2-0320	23.4	1.51	3.5	7.40E-03	7.40E+00	5.4	3.5	17.5	1.37E+00	6.03E+00	18.53	81.47	1	F	100	13.4	9.0	1300	0.1020	0.15	1.50	0.0011
BWR-DAM2-T3-0320	66	1.22	3.5	2.09E-02	2.09E+01	5.4	3.5	17.5	3.87E+00	1.70E+01	18.53	81.47	1	F	100	13.4	9.0	1300	0.2878	0.43	1.50	0.0030
BWR-DAM4-T1-0320	36.1	1.63	3.5	1.14E-02	1.14E+01	5.4	3.5	17.5	2.12E+00	9.30E+00	18.53	81.47	1	F	100	13.4	9.0	1300	0.1574	0.24	1.50	0.0016
BWR-DAM4-T2-0320	42.4	2.59	3.5	1.34E-02	1.34E+01	5.4	3.5	17.5	2.48E+00	1.09E+01	18.53	81.47	1	F	100	13.4	9.0	1300	0.1849	0.28	1.50	0.0019
BWR-DAM4-T3-0320	25	1.98	3.5	7.91E-03	7.91E+00	5.4	3.5	17.5	1.47E+00	6.44E+00	18.53	81.47	1	F	100	13.4	9.0	1300	0.1090	0.16	1.50	0.0011
BWR-DAM4-T4-0320	29.8	1.18	3.5	9.42E-03	9.42E+00	5.4	3.5	17.5	1.75E+00	7.68E+00	18.53	81.47	1	F	100	13.4	9.0	1300	0.1300	0.20	1.50	0.0013
BWR-DAM4-T5-0320	26.7	1.21	3.5	8.44E-03	8.44E+00	5.4	3.5	17.5	1.56E+00	6.88E+00	18.53	81.47	1	F	100	13.4	9.0	1300	0.1164	0.17	1.50	0.0012
BWR-DAM7-T1-0320	85	1.61	3.5	2.69E-02	2.69E+01	5.4	3.5	17.5	4.98E+00	2.19E+01	18.53	81.47	1	F	100	13.4	9.0	1300	0.3707	0.56	1.50	0.0038
BWR-DAM7-T2-0320	43.9	2.11	3.5	1.39E-02	1.39E+01	5.4	3.5	17.5	2.57E+00	1.13E+01	18.53	81.47	1	F	100	13.4	9.0	1300	0.1914	0.29	1.50	0.0020
BWR-DAM7-T3-0320	20.9	0.433	3.5	6.61E-03	6.61E+00	5.4	3.5	17.5	1.22E+00	5.38E+00	18.53	81.47	1	F	100	13.4	9.0	1300	0.0911	0.14	1.50	0.0009
BWR-DAM8-T1-0320	61	2.43	3.5	1.93E-02	1.93E+01	5.4	3.5	17.5	3.57E+00	1.57E+01	18.53	81.47	1	F	100	13.4	9.0	1300	0.2660	0.40	1.50	0.0027
BWR-DAM8-T2-0320	59.2	2.22	3.5	1.87E-02	1.87E+01	5.4	3.5	17.5	3.47E+00	1.53E+01	18.53	81.47	1	F	100	13.4	9.0	1300	0.2582	0.39	1.50	0.0027
BWR-DAM11-T1-0320	20.5	1.96	3.5	6.48E-03	6.48E+00	5.4	3.5	17.5	1.20E+00	5.28E+00	18.53	81.47	1	F	100	13.4	9.0	1300	0.0894	0.13	1.50	0.0009
BWR-DAM11-T2-0320	13.6	1.87	3.5	4.30E-03	4.30E+00	5.4	3.5	17.5	7.97E-01	3.50E+00	18.53	81.47	1	F	100	13.4	9.0	1300	0.0593	0.09	1.50	0.0006
BWR-DUP1-0320	7.9	1.9	3.5	2.50E-03	2.50E+00	5.4	3.5	17.5	4.63E-01	2.04E+00	18.53	81.47	1	F	100	13.4	9.0	1300	0.0345	0.05	1.50	0.0004
BWR-FIELDBLANK-0320_SOLID	1.1	0.0684	3.5	3.48E-04	3.48E-01	5.4	3.5	17.5	6.45E-02	2.83E-01	18.53	81.47	1	F	100	13.4	9.0	1300	0.0048	0.01	1.50	0.0000
BWR-DAM6-T1-0620	28	2.12	3.5	8.85E-03	8.85E+00	5.4	3.5	17.5	1.64E+00	7.21E+00	18.53	81.47	1	F	100	13.4	9.0	1300	0.1221	0.18	1.50	0.0013
BWR-DAM6-T2-0620	22.5	1.78	3.5	7.12E-03	7.12E+00	5.4	3.5	17.5	1.32E+00	5.80E+00	18.53	81.47	1	F	100	13.4	9.0	1300	0.0981	0.15	1.50	0.0010
BWR-DAM6-T3-0620	21.9	2.34	3.5	6.93E-03	6.93E+00	5.4	3.5	17.5	1.28E+00	5.64E+00	18.53	81.47	1	F	100	13.4	9.0	1300	0.0955	0.14	1.50	0.0010
BWR-DAM9-T1-0620	27.1	2.85	3.5	8.57E-03	8.57E+00	5.4	3.5	17.5	1.59E+00	6.98E+00	18.53	81.47	1	F	100	13.4	9.0	1300	0.1182	0.18	1.50	0.0012
BWR-DAM9-T2-0620	40.9	3.46	3.5	1.29E-02	1.29E+01	5.4	3.5	17.5	2.40E+00	1.05E+01	18.53	81.47	1	F	100	13.4	9.0	1300	0.1784	0.27	1.50	0.0018
BWR-DAM10-T1-0620	29.9	2.42	3.5	9.46E-03	9.46E+00	5.4	3.5	17.5	1.75E+00	7.70E+00	18.53	81.47	1	F	100	13.4	9.0	1300	0.1304	0.20	1.50	0.0013
BWR-DAM10-T2-0620	43	0.392	3.5	1.36E-02	1.36E+01	5.4	3.5	17.5	2.52E+00	1.11E+01	18.53	81.47	1	F	100	13.4	9.0	1300	0.1875	0.28	1.50	0.0019
BWR-DAM5	Not Sampled																					
BWR-DUP2-0620	30.8	2.09	3.5	9.74E-03	9.74E+00	5.4	3.5	17.5	1.81E+00	7.93E+00	18.53	81.47	1	F	100	13.4	9.0	1300	0.1343	0.20	1.50	0.0014

Nickel Calculations

Sample ID	Nickel	TOC_{sed}	log K_{d1}	$C_{d,pw}$	$C_{d,pw}$	log K_{d2}	DOC Water Column	DOC Pore Water	$C_{d,pw,inorg}$	$C_{d,pw,DOC\ bound}$	f_{inorg}	$f_{DOC\ bound}$	Salinity	Fresh or	Hardness	Acute Fresh	Chronic Fresh	HH WQC F&W	T.U.$_a$	T.U.$_c$	ACR Fresh	T.U.$_{hh}$
	(mg/kg dw)	(%)	(L/kg)	(mg/L)	(ug/L)	(L/kg oc)	(mg/L)	(mg/L)	(ug/L)	(ug/L)	(%)	(%)	(ppt)	Marine?	(mg/L $CaCO_3$)	(ug/L)	(ug/L)	(ug/L)				
Value References	Lab Data	Lab Data	EPA 2005a			EPA 2005a	Summary	Summary					SWQS		Assumption	SWQS	SWQS	SWQS				
BWR-DAM2-T1-0320	21.1	1.28	3.9	2.66E-03	2.66E+00	3.7	3.5	17.5	2.44E+00	2.14E-01	91.94	8.06	1	F	100	468.2	52.0	100	0.0052	0.05	9.00	0.0244
BWR-DAM2-T2-0320	16.4	1.51	3.9	2.06E-03	2.06E+00	3.7	3.5	17.5	1.90E+00	1.66E-01	91.94	8.06	1	F	100	468.2	52.0	100	0.0041	0.04	9.00	0.0190
BWR-DAM2-T3-0320	15.5	1.22	3.9	1.95E-03	1.95E+00	3.7	3.5	17.5	1.79E+00	1.57E-01	91.94	8.06	1	F	100	468.2	52.0	100	0.0038	0.03	9.00	0.0179
BWR-DAM4-T1-0320	31.6	1.63	3.9	3.98E-03	3.98E+00	3.7	3.5	17.5	3.66E+00	3.21E-01	91.94	8.06	1	F	100	468.2	52.0	100	0.0078	0.07	9.00	0.0366
BWR-DAM4-T2-0320	31.6	2.59	3.9	3.98E-03	3.98E+00	3.7	3.5	17.5	3.66E+00	3.21E-01	91.94	8.06	1	F	100	468.2	52.0	100	0.0078	0.07	9.00	0.0366
BWR-DAM4-T3-0320	24.2	1.98	3.9	3.05E-03	3.05E+00	3.7	3.5	17.5	2.80E+00	2.46E-01	91.94	8.06	1	F	100	468.2	52.0	100	0.0060	0.05	9.00	0.0280
BWR-DAM4-T4-0320	20.3	1.18	3.9	2.56E-03	2.56E+00	3.7	3.5	17.5	2.35E+00	2.06E-01	91.94	8.06	1	F	100	468.2	52.0	100	0.0050	0.05	9.00	0.0235
BWR-DAM4-T5-0320	22.3	1.21	3.9	2.81E-03	2.81E+00	3.7	3.5	17.5	2.58E+00	2.26E-01	91.94	8.06	1	F	100	468.2	52.0	100	0.0055	0.05	9.00	0.0258
BWR-DAM7-T1-0320	34.3	1.61	3.9	4.32E-03	4.32E+00	3.7	3.5	17.5	3.97E+00	3.48E-01	91.94	8.06	1	F	100	468.2	52.0	100	0.0085	0.08	9.00	0.0397
BWR-DAM7-T2-0320	27.3	2.11	3.9	3.44E-03	3.44E+00	3.7	3.5	17.5	3.16E+00	2.77E-01	91.94	8.06	1	F	100	468.2	52.0	100	0.0067	0.06	9.00	0.0316
BWR-DAM7-T3-0320	17.6	0.433	3.9	2.22E-03	2.22E+00	3.7	3.5	17.5	2.04E+00	1.79E-01	91.94	8.06	1	F	100	468.2	52.0	100	0.0044	0.04	9.00	0.0204
BWR-DAM8-T1-0320	54.3	2.43	3.9	6.84E-03	6.84E+00	3.7	3.5	17.5	6.28E+00	5.51E-01	91.94	8.06	1	F	100	468.2	52.0	100	0.0134	0.12	9.00	0.0628
BWR-DAM8-T2-0320	46.2	2.22	3.9	5.82E-03	5.82E+00	3.7	3.5	17.5	5.35E+00	4.69E-01	91.94	8.06	1	F	100	468.2	52.0	100	0.0114	0.10	9.00	0.0535
BWR-DAM11-T1-0320	22.3	1.96	3.9	2.81E-03	2.81E+00	3.7	3.5	17.5	2.58E+00	2.26E-01	91.94	8.06	1	F	100	468.2	52.0	100	0.0055	0.05	9.00	0.0258
BWR-DAM11-T2-0320	16.6	1.87	3.9	2.09E-03	2.09E+00	3.7	3.5	17.5	1.92E+00	1.69E-01	91.94	8.06	1	F	100	468.2	52.0	100	0.0041	0.04	9.00	0.0192
BWR-DUP1-0320	9.5	1.9	3.9	1.20E-03	1.20E+00	3.7	3.5	17.5	1.10E+00	9.64E-02	91.94	8.06	1	F	100	468.2	52.0	100	0.0023	0.02	9.00	0.0110
BWR-FIELDBLANK-0320_SOLID	0.3	0.0684	3.9	3.78E-05	3.78E-02	3.7	3.5	17.5	3.47E-02	3.05E-03	91.94	8.06	1	F	100	468.2	52.0	100	0.0001	0.00	9.00	0.0003
BWR-DAM6-T1-0620	27.6	2.12	3.9	3.47E-03	3.47E+00	3.7	3.5	17.5	3.19E+00	2.80E-01	91.94	8.06	1	F	100	468.2	52.0	100	0.0068	0.06	9.00	0.0319
BWR-DAM6-T2-0620	23.2	1.78	3.9	2.92E-03	2.92E+00	3.7	3.5	17.5	2.69E+00	2.36E-01	91.94	8.06	1	F	100	468.2	52.0	100	0.0057	0.05	9.00	0.0269
BWR-DAM6-T3-0620	22.6	2.34	3.9	2.85E-03	2.85E+00	3.7	3.5	17.5	2.62E+00	2.29E-01	91.94	8.06	1	F	100	468.2	52.0	100	0.0056	0.05	9.00	0.0262
BWR-DAM9-T1-0620	26.9	2.85	3.9	3.39E-03	3.39E+00	3.7	3.5	17.5	3.11E+00	2.73E-01	91.94	8.06	1	F	100	468.2	52.0	100	0.0066	0.06	9.00	0.0311
BWR-DAM9-T2-0620	40.8	3.46	3.9	5.14E-03	5.14E+00	3.7	3.5	17.5	4.72E+00	4.14E-01	91.94	8.06	1	F	100	468.2	52.0	100	0.0101	0.09	9.00	0.0472
BWR-DAM10-T1-0620	30.3	2.42	3.9	3.81E-03	3.81E+00	3.7	3.5	17.5	3.51E+00	3.08E-01	91.94	8.06	1	F	100	468.2	52.0	100	0.0075	0.07	9.00	0.0351
BWR-DAM10-T2-0620	32.8	0.392	3.9	4.13E-03	4.13E+00	3.7	3.5	17.5	3.80E+00	3.33E-01	91.94	8.06	1	F	100	468.2	52.0	100	0.0081	0.07	9.00	0.0380
BWR-DAM5	Not Sampled																					
BWR-DUP2-0620	27.5	2.09	3.9	3.46E-03	3.46E+00	3.7	3.5	17.5	3.18E+00	2.79E-01	91.94	8.06	1	F	100	468.2	52.0	100	0.0068	0.06	9.00	0.0318

Lead Calculations

Sample ID	Lead	TOC_{sed}	log K_{d1}	$C_{d,pw}$	$C_{d,pw}$	log K_{d2}	DOC Water Column	DOC Pore Water	$C_{d,pw,inorg}$	$C_{d,pw,DOC\ bound}$	f_{inorg}	$f_{DOC\ bound}$	Salinity	Fresh or	Hardness	Acute Fresh	Chronic Fresh	HH WQC F&W	$T.U._a$	$T.U._c$	ACR Fresh	$T.U._{hh}$
	(mg/kg dw)	(%)	(L/kg)	(mg/L)	(ug/L)	(L/kg oc)	(mg/L)	(mg/L)	(ug/L)	(ug/L)	(%)	(%)	(ppt)	Marine?	(mg/L $CaCO_3$)	(ug/L)	(ug/L)	(ug/L)				
Value References	Lab Data	Lab Data	EPA 2005a			EPA 2005a	Summary	Summary					SWQS		Assumption	SWQS	SWQS	SWQS				
BWR-DAM2-T1-0320	31.3	1.28	4.6	7.86E-04	7.86E-01	4.9	3.5	17.5	3.29E-01	4.57E-01	41.84	58.16	1	F	100	64.6	2.5	15	0.0051	0.13	25.66	0.0219
BWR-DAM2-T2-0320	38.5	1.51	4.6	9.67E-04	9.67E-01	4.9	3.5	17.5	4.05E-01	5.62E-01	41.84	58.16	1	F	100	64.6	2.5	15	0.0063	0.16	25.66	0.0270
BWR-DAM2-T3-0320	50.3	1.22	4.6	1.26E-03	1.26E+00	4.9	3.5	17.5	5.29E-01	7.35E-01	41.84	58.16	1	F	100	64.6	2.5	15	0.0082	0.21	25.66	0.0352
BWR-DAM4-T1-0320	44.4	1.63	4.6	1.12E-03	1.12E+00	4.9	3.5	17.5	4.67E-01	6.49E-01	41.84	58.16	1	F	100	64.6	2.5	15	0.0072	0.19	25.66	0.0311
BWR-DAM4-T2-0320	90.2	2.59	4.6	2.27E-03	2.27E+00	4.9	3.5	17.5	9.48E-01	1.32E+00	41.84	58.16	1	F	100	64.6	2.5	15	0.0147	0.38	25.66	0.0632
BWR-DAM4-T3-0320	34.3	1.98	4.6	8.62E-04	8.62E-01	4.9	3.5	17.5	3.60E-01	5.01E-01	41.84	58.16	1	F	100	64.6	2.5	15	0.0056	0.14	25.66	0.0240
BWR-DAM4-T4-0320	25.5	1.18	4.6	6.41E-04	6.41E-01	4.9	3.5	17.5	2.68E-01	3.73E-01	41.84	58.16	1	F	100	64.6	2.5	15	0.0041	0.11	25.66	0.0179
BWR-DAM4-T5-0320	33.1	1.21	4.6	8.31E-04	8.31E-01	4.9	3.5	17.5	3.48E-01	4.84E-01	41.84	58.16	1	F	100	64.6	2.5	15	0.0054	0.14	25.66	0.0232
BWR-DAM7-T1-0320	61	1.61	4.6	1.53E-03	1.53E+00	4.9	3.5	17.5	6.41E-01	8.91E-01	41.84	58.16	1	F	100	64.6	2.5	15	0.0099	0.25	25.66	0.0427
BWR-DAM7-T2-0320	74	2.11	4.6	1.86E-03	1.86E+00	4.9	3.5	17.5	7.78E-01	1.08E+00	41.84	58.16	1	F	100	64.6	2.5	15	0.0120	0.31	25.66	0.0518
BWR-DAM7-T3-0320	11.8	0.433	4.6	2.96E-04	2.96E-01	4.9	3.5	17.5	1.24E-01	1.72E-01	41.84	58.16	1	F	100	64.6	2.5	15	0.0019	0.05	25.66	0.0083
BWR-DAM8-T1-0320	73	2.43	4.6	1.83E-03	1.83E+00	4.9	3.5	17.5	7.67E-01	1.07E+00	41.84	58.16	1	F	100	64.6	2.5	15	0.0119	0.30	25.66	0.0511
BWR-DAM8-T2-0320	63	2.22	4.6	1.58E-03	1.58E+00	4.9	3.5	17.5	6.62E-01	9.20E-01	41.84	58.16	1	F	100	64.6	2.5	15	0.0103	0.26	25.66	0.0441
BWR-DAM11-T1-0320	21.5	1.96	4.6	5.40E-04	5.40E-01	4.9	3.5	17.5	2.26E-01	3.14E-01	41.84	58.16	1	F	100	64.6	2.5	15	0.0035	0.09	25.66	0.0151
BWR-DAM11-T2-0320	8	1.87	4.6	2.01E-04	2.01E-01	4.9	3.5	17.5	8.41E-02	1.17E-01	41.84	58.16	1	F	100	64.6	2.5	15	0.0013	0.03	25.66	0.0056
BWR-DUP1-0320	5.3	1.9	4.6	1.33E-04	1.33E-01	4.9	3.5	17.5	5.57E-02	7.74E-02	41.84	58.16	1	F	100	64.6	2.5	15	0.0009	0.02	25.66	0.0037
BWR-FIELDBLANK-0320_SOLID	1.7	0.0684	4.6	4.27E-05	4.27E-02	4.9	3.5	17.5	1.79E-02	2.48E-02	41.84	58.16	1	F	100	64.6	2.5	15	0.0003	0.01	25.66	0.0012
BWR-DAM6-T1-0620	32.2	2.12	4.6	8.09E-04	8.09E-01	4.9	3.5	17.5	3.38E-01	4.70E-01	41.84	58.16	1	F	100	64.6	2.5	15	0.0052	0.13	25.66	0.0226
BWR-DAM6-T2-0620	27.1	1.78	4.6	6.81E-04	6.81E-01	4.9	3.5	17.5	2.85E-01	3.96E-01	41.84	58.16	1	F	100	64.6	2.5	15	0.0044	0.11	25.66	0.0190
BWR-DAM6-T3-0620	24.4	2.34	4.6	6.13E-04	6.13E-01	4.9	3.5	17.5	2.56E-01	3.56E-01	41.84	58.16	1	F	100	64.6	2.5	15	0.0040	0.10	25.66	0.0171
BWR-DAM9-T1-0620	28.1	2.85	4.6	7.06E-04	7.06E-01	4.9	3.5	17.5	2.95E-01	4.11E-01	41.84	58.16	1	F	100	64.6	2.5	15	0.0046	0.12	25.66	0.0197
BWR-DAM9-T2-0620	45.9	3.46	4.6	1.15E-03	1.15E+00	4.9	3.5	17.5	4.82E-01	6.71E-01	41.84	58.16	1	F	100	64.6	2.5	15	0.0075	0.19	25.66	0.0322
BWR-DAM10-T1-0620	32.5	2.42	4.6	8.16E-04	8.16E-01	4.9	3.5	17.5	3.42E-01	4.75E-01	41.84	58.16	1	F	100	64.6	2.5	15	0.0053	0.14	25.66	0.0228
BWR-DAM10-T2-0620	383	0.392	4.6	9.62E-03	9.62E+00	4.9	3.5	17.5	4.03E+00	5.60E+00	41.84	58.16	1	F	100	64.6	2.5	15	0.0623	1.60	25.66	0.2683
BWR-DAM5	Not Sampled																					
BWR-DUP2-0620	32	2.09	4.6	8.04E-04	8.04E-01	4.9	3.5	17.5	3.36E-01	4.67E-01	41.84	58.16	1	F	100	64.6	2.5	15	0.0052	0.13	25.66	0.0224

Selenium Calculations

Sample ID	Selenium	TOC_{sed}	log K_{d1}	$C_{d,pw}$	$C_{d,pw}$	log K_{d2}	DOC Water Column	DOC Pore Water	$C_{d,pw,inorg}$	$C_{d,pw,DOC\ bound}$	f_{inorg}	$f_{DOC\ bound}$	Salinity	Fresh or	Hardness	Acute Fresh	Chronic Fresh	HH WQC F&W	$T.U._{a}$	$T.U._{c}$	ACR Fresh	$T.U._{hh}$
	(mg/kg dw)	(%)	(L/kg)	(mg/L)	(ug/L)	(L/kg oc)	(mg/L)	(mg/L)	(ug/L)	(ug/L)	(%)	(%)	(ppt)	Marine?	(mg/L $CaCO_3$)	(ug/L)	(ug/L)	(ug/L)				
Value References	Lab Data	Lab Data	EPA 2005a			EPA 2005a	Summary	Summary					SWQS		Assumption	SWQS	SWQS	SWQS				
BWR-DAM2-T1-0320	0.37	1.28	3.6	9.29E-05	9.29E-02	2	3.5	17.5	9.28E-02	1.62E-04	99.83	0.17	1	F	100	20	5	50	0.0046	0.02	4.00	0.0019
BWR-DAM2-T2-0320	0.38	1.51	3.6	9.55E-05	9.55E-02	2	3.5	17.5	9.53E-02	1.67E-04	99.83	0.17	1	F	100	20	5	50	0.0048	0.02	4.00	0.0019
BWR-DAM2-T3-0320	0.38	1.22	3.6	9.55E-05	9.55E-02	2	3.5	17.5	9.53E-02	1.67E-04	99.83	0.17	1	F	100	20	5	50	0.0048	0.02	4.00	0.0019
BWR-DAM4-T1-0320	0.63	1.63	3.6	1.58E-04	1.58E-01	2	3.5	17.5	1.58E-01	2.76E-04	99.83	0.17	1	F	100	20	5	50	0.0079	0.03	4.00	0.0032
BWR-DAM4-T2-0320	0.73	2.59	3.6	1.83E-04	1.83E-01	2	3.5	17.5	1.83E-01	3.20E-04	99.83	0.17	1	F	100	20	5	50	0.0092	0.04	4.00	0.0037
BWR-DAM4-T3-0320	0.68	1.98	3.6	1.71E-04	1.71E-01	2	3.5	17.5	1.71E-01	2.98E-04	99.83	0.17	1	F	100	20	5	50	0.0085	0.03	4.00	0.0034
BWR-DAM4-T4-0320	0.2	1.18	3.6	5.02E-05	5.02E-02	2	3.5	17.5	5.01E-02	8.78E-05	99.83	0.17	1	F	100	20	5	50	0.0025	0.01	4.00	0.0010
BWR-DAM4-T5-0320	0.51	1.21	3.6	1.28E-04	1.28E-01	2	3.5	17.5	1.28E-01	2.24E-04	99.83	0.17	1	F	100	20	5	50	0.0064	0.03	4.00	0.0026
BWR-DAM7-T1-0320	0.83	1.61	3.6	2.08E-04	2.08E-01	2	3.5	17.5	2.08E-01	3.64E-04	99.83	0.17	1	F	100	20	5	50	0.0104	0.04	4.00	0.0042
BWR-DAM7-T2-0320	0.57	2.11	3.6	1.43E-04	1.43E-01	2	3.5	17.5	1.43E-01	2.50E-04	99.83	0.17	1	F	100	20	5	50	0.0071	0.03	4.00	0.0029
BWR-DAM7-T3-0320	0.57	0.433	3.6	1.43E-04	1.43E-01	2	3.5	17.5	1.43E-01	2.50E-04	99.83	0.17	1	F	100	20	5	50	0.0071	0.03	4.00	0.0029
BWR-DAM8-T1-0320	0.73	2.43	3.6	1.83E-04	1.83E-01	2	3.5	17.5	1.83E-01	3.20E-04	99.83	0.17	1	F	100	20	5	50	0.0092	0.04	4.00	0.0037
BWR-DAM8-T2-0320	0.65	2.22	3.6	1.63E-04	1.63E-01	2	3.5	17.5	1.63E-01	2.85E-04	99.83	0.17	1	F	100	20	5	50	0.0081	0.03	4.00	0.0033
BWR-DAM11-T1-0320	0.24	1.96	3.6	6.03E-05	6.03E-02	2	3.5	17.5	6.02E-02	1.05E-04	99.83	0.17	1	F	100	20	5	50	0.0030	0.01	4.00	0.0012
BWR-DAM11-T2-0320	0.185	1.87	3.6	4.65E-05	4.65E-02	2	3.5	17.5	4.64E-02	8.12E-05	99.83	0.17	1	F	100	20	5	50	0.0023	0.01	4.00	0.0009
BWR-DUP1-0320	0.195	1.9	3.6	4.90E-05	4.90E-02	2	3.5	17.5	4.89E-02	8.56E-05	99.83	0.17	1	F	100	20	5	50	0.0024	0.01	4.00	0.0010
BWR-FIELDBLANK-0320_SOLID	0.135	0.0684	3.6	3.39E-05	3.39E-02	2	3.5	17.5	3.39E-02	5.92E-05	99.83	0.17	1	F	100	20	5	50	0.0017	0.01	4.00	0.0007
BWR-DAM6-T1-0620	0.73	2.12	3.6	1.83E-04	1.83E-01	2	3.5	17.5	1.83E-01	3.20E-04	99.83	0.17	1	F	100	20	5	50	0.0092	0.04	4.00	0.0037
BWR-DAM6-T2-0620	0.46	1.78	3.6	1.16E-04	1.16E-01	2	3.5	17.5	1.15E-01	2.02E-04	99.83	0.17	1	F	100	20	5	50	0.0058	0.02	4.00	0.0023
BWR-DAM6-T3-0620	0.58	2.34	3.6	1.46E-04	1.46E-01	2	3.5	17.5	1.45E-01	2.55E-04	99.83	0.17	1	F	100	20	5	50	0.0073	0.03	4.00	0.0029
BWR-DAM9-T1-0620	0.56	2.85	3.6	1.41E-04	1.41E-01	2	3.5	17.5	1.40E-01	2.46E-04	99.83	0.17	1	F	100	20	5	50	0.0070	0.03	4.00	0.0028
BWR-DAM9-T2-0620	1.2	3.46	3.6	3.01E-04	3.01E-01	2	3.5	17.5	3.01E-01	5.27E-04	99.83	0.17	1	F	100	20	5	50	0.0150	0.06	4.00	0.0060
BWR-DAM10-T1-0620	0.67	2.42	3.6	1.68E-04	1.68E-01	2	3.5	17.5	1.68E-01	2.94E-04	99.83	0.17	1	F	100	20	5	50	0.0084	0.03	4.00	0.0034
BWR-DAM10-T2-0620	0.65	0.392	3.6	1.63E-04	1.63E-01	2	3.5	17.5	1.63E-01	2.85E-04	99.83	0.17	1	F	100	20	5	50	0.0081	0.03	4.00	0.0033
BWR-DAM5	Not Sampled																					
BWR-DUP2-0620	0.62	2.09	3.6	1.56E-04	1.56E-01	2	3.5	17.5	1.55E-01	2.72E-04	99.83	0.17	1	F	100	20	5	50	0.0078	0.03	4.00	0.0031

1/2 Detection Limit

Zinc Calculations

Sample ID	Zinc	TOC_{sed}	log K_{d1}	$C_{d,pw}$	$C_{d,pw}$	log K_{d2}	DOC Water Column	DOC Pore Water	$C_{d,pw,inorg}$	$C_{d,pw,DOC\ bound}$	f_{inorg}	$f_{DOC\ bound}$	Salinity	Fresh or	Hardness	Acute Fresh	Chronic Fresh	HH WQC F&W	$T.U._a$	$T.U._c$	ACR Fresh	$T.U._{hh}$
	(mg/kg dw)	(%)	(L/kg)	(mg/L)	(ug/L)	(L/kg oc)	(mg/L)	(mg/L)	(ug/L)	(ug/L)	(%)	(%)	(ppt)	Marine?	(mg/L $CaCO_3$)	(ug/L)	(ug/L)	(ug/L)				
Value References	Lab Data	Lab Data	EPA 2005a			EPA 2005a	Summary	Summary					SWQS		Assumption	SWQS	SWQS	SWQS				
BWR-DAM2-T1-0320	74.7	1.28	4.1	5.93E-03	5.93E+00	5.1	3.5	17.5	1.85E+00	4.08E+00	31.22	68.78	1	F	100	117.2	118.1	7400	0.0158	0.0157	0.99	0.0003
BWR-DAM2-T2-0320	83.2	1.51	4.1	6.61E-03	6.61E+00	5.1	3.5	17.5	2.06E+00	4.55E+00	31.22	68.78	1	F	100	117.2	118.1	7400	0.0176	0.0175	0.99	0.0003
BWR-DAM2-T3-0320	74	1.22	4.1	5.88E-03	5.88E+00	5.1	3.5	17.5	1.84E+00	4.04E+00	31.22	68.78	1	F	100	117.2	118.1	7400	0.0157	0.0155	0.99	0.0002
BWR-DAM4-T1-0320	128	1.63	4.1	1.02E-02	1.02E+01	5.1	3.5	17.5	3.17E+00	6.99E+00	31.22	68.78	1	F	100	117.2	118.1	7400	0.0271	0.0269	0.99	0.0004
BWR-DAM4-T2-0320	148	2.59	4.1	1.18E-02	1.18E+01	5.1	3.5	17.5	3.67E+00	8.09E+00	31.22	68.78	1	F	100	117.2	118.1	7400	0.0313	0.0311	0.99	0.0005
BWR-DAM4-T3-0320	108	1.98	4.1	8.58E-03	8.58E+00	5.1	3.5	17.5	2.68E+00	5.90E+00	31.22	68.78	1	F	100	117.2	118.1	7400	0.0229	0.0227	0.99	0.0004
BWR-DAM4-T4-0320	86.6	1.18	4.1	6.88E-03	6.88E+00	5.1	3.5	17.5	2.15E+00	4.73E+00	31.22	68.78	1	F	100	117.2	118.1	7400	0.0183	0.0182	0.99	0.0003
BWR-DAM4-T5-0320	99	1.21	4.1	7.86E-03	7.86E+00	5.1	3.5	17.5	2.46E+00	5.41E+00	31.22	68.78	1	F	100	117.2	118.1	7400	0.0210	0.0208	0.99	0.0003
BWR-DAM7-T1-0320	143	1.61	4.1	1.14E-02	1.14E+01	5.1	3.5	17.5	3.55E+00	7.81E+00	31.22	68.78	1	F	100	117.2	118.1	7400	0.0303	0.0300	0.99	0.0005
BWR-DAM7-T2-0320	121	2.11	4.1	9.61E-03	9.61E+00	5.1	3.5	17.5	3.00E+00	6.61E+00	31.22	68.78	1	F	100	117.2	118.1	7400	0.0256	0.0254	0.99	0.0004
BWR-DAM7-T3-0320	57.2	0.433	4.1	4.54E-03	4.54E+00	5.1	3.5	17.5	1.42E+00	3.13E+00	31.22	68.78	1	F	100	117.2	118.1	7400	0.0121	0.0120	0.99	0.0002
BWR-DAM8-T1-0320	180	2.43	4.1	1.43E-02	1.43E+01	5.1	3.5	17.5	4.46E+00	9.83E+00	31.22	68.78	1	F	100	117.2	118.1	7400	0.0381	0.0378	0.99	0.0006
BWR-DAM8-T2-0320	145	2.22	4.1	1.15E-02	1.15E+01	5.1	3.5	17.5	3.60E+00	7.92E+00	31.22	68.78	1	F	100	117.2	118.1	7400	0.0307	0.0304	0.99	0.0005
BWR-DAM11-T1-0320	87.9	1.96	4.1	6.98E-03	6.98E+00	5.1	3.5	17.5	2.18E+00	4.80E+00	31.22	68.78	1	F	100	117.2	118.1	7400	0.0186	0.0185	0.99	0.0003
BWR-DAM11-T2-0320	48.4	1.87	4.1	3.84E-03	3.84E+00	5.1	3.5	17.5	1.20E+00	2.64E+00	31.22	68.78	1	F	100	117.2	118.1	7400	0.0102	0.0102	0.99	0.0002
BWR-DUP1-0320	29.2	1.9	4.1	2.32E-03	2.32E+00	5.1	3.5	17.5	7.24E-01	1.60E+00	31.22	68.78	1	F	100	117.2	118.1	7400	0.0062	0.0061	0.99	0.0001
BWR-FIELDBLANK-0320_SOLID	1.8	0.0684	4.1	1.43E-04	1.43E-01	5.1	3.5	17.5	4.46E-02	9.83E-02	31.22	68.78	1	F	100	117.2	118.1	7400	0.0004	0.0004	0.99	0.0000
BWR-DAM6-T1-0620	119	2.12	4.1	9.45E-03	9.45E+00	5.1	3.5	17.5	2.95E+00	6.50E+00	31.22	68.78	1	F	100	117.2	118.1	7400	0.0252	0.0250	0.99	0.0004
BWR-DAM6-T2-0620	94.4	1.78	4.1	7.50E-03	7.50E+00	5.1	3.5	17.5	2.34E+00	5.16E+00	31.22	68.78	1	F	100	117.2	118.1	7400	0.0200	0.0198	0.99	0.0003
BWR-DAM6-T3-0620	93.2	2.34	4.1	7.40E-03	7.40E+00	5.1	3.5	17.5	2.31E+00	5.09E+00	31.22	68.78	1	F	100	117.2	118.1	7400	0.0197	0.0196	0.99	0.0003
BWR-DAM9-T1-0620	112	2.85	4.1	8.90E-03	8.90E+00	5.1	3.5	17.5	2.78E+00	6.12E+00	31.22	68.78	1	F	100	117.2	118.1	7400	0.0237	0.0235	0.99	0.0004
BWR-DAM9-T2-0620	173	3.46	4.1	1.37E-02	1.37E+01	5.1	3.5	17.5	4.29E+00	9.45E+00	31.22	68.78	1	F	100	117.2	118.1	7400	0.0366	0.0363	0.99	0.0006
BWR-DAM10-T1-0620	119	2.42	4.1	9.45E-03	9.45E+00	5.1	3.5	17.5	2.95E+00	6.50E+00	31.22	68.78	1	F	100	117.2	118.1	7400	0.0252	0.0250	0.99	0.0004
BWR-DAM10-T2-0620	101	0.392	4.1	8.02E-03	8.02E+00	5.1	3.5	17.5	2.50E+00	5.52E+00	31.22	68.78	1	F	100	117.2	118.1	7400	0.0214	0.0212	0.99	0.0003
BWR-DAM5	Not Sampled																					
BWR-DUP2-0620	117	2.09	4.1	9.29E-03	9.29E+00	5.1	3.5	17.5	2.90E+00	6.39E+00	31.22	68.78	1	F	100	117.2	118.1	7400	0.0248	0.0246	0.99	0.0004

References

Caron, G. and I.H. Suffet, Binding of Nonpolar Pollutants to Dissolved Organic Carbon, in Aquatic Humic Substances Influence on Fate and Treatment of Pollutants, I.H. Suffet and P. MacCarthy, Editors. 1989, American Chemical Society: Washington, DC. p. 117-130.

Cavallo, G. Analysis of Boat Run Data for TSS, PC total and DOC from 2004 through March 2007. Power Point presentation dated July 31, 2007. Delaware River Basin Commission, West Trenton, NJ.

DiToro, DM, JA McGrath, DJ Hansen, WJ Berry, PR Paquin, R Mathew, KB Wu, and RC Santore. 2005 Predicting sediment metal toxicity using a sediment biotic ligand model: methodology and initial applicati Environ. Toxicol. Chem. 24(10): 2410-2427

DNREC. 2013. Department of Natural Resources and Environmental Control, Division of Waste and Hazardous Substance Remediation Section, HSCA Screening Level Table, Last updated February 2020. New Castle, DE.

EPA. 2005a. Partition Coefficients for Metals in Surface Water, Soil, and Waste (EPA/600/R-05/074). U.S. Environmental Protection Agency, Washington, DC.

EPA. 2005b. Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: Metal Mixtures (Cadmium, Copper, Lead, Nickel, Silver and Zinc), (EPA/600/R-02/011). U.S. Environmental Protection Agency, Narragansett, RI and Duluth, MN.

Greene, R. 2010. Cadmium Freshwater Chronic Criterion Review. Spreadsheet analysis. Delaware Department of Natural Resources and Environmental Control, Dover, DE.

Hunchak-Kariouk, K., L. Schweitzer, and I.H. Suffet, Partitioning of 2,2',4,4'-Tetrachlorobiphenyl by the Dissolved Organic Matter in Oxic and Anoxic Porewaters. Environ. Sci. Technol., 1997. 31(3): p. 639-645.

Thurman, E.M. 1985. Organic Geochemistry of Natural Waters. Kluwer Academic Publishers Group, Boston, MA.

Assessment of Mercury in Brandywine River Sediment Samples
Prepared by: John Cargill & Dannielle Pratt, Delaware DNREC
October 22, 2020

Methods:

To evaluate toxicity to benthic organisms, the total dissolved concentration of mercury in the sediment pore water was estimated by dividing the bulk sediment concentration by the sediment to porewater metal partition coefficient published by the EPA (USEPA, 2005a). The resulting dissolved total inorganic metal concentration in the pore water was then compared to applicable freshwater acute and chronic water quality criteria for the protection of aquatic life. The ratio of the estimated mercury concentration in the porewater to the applicable criterion was expressed as toxic units, where ratios greater than 1 suggest exposure concentrations in excess of the criterion.

To assess the potential for bioaccumulation and associated human health risk at each sample location, fish tissue concentrations were predicted from the estimated porewater concentrations. Delaware Surface Water Quality Standards (DNREC 2004), Table 2, lists a methyl-mercury concentration in fish tissue of 0.3 milligrams per kilogram (mg/kg) as the safety threshold for human consumption. In order to determine whether the total mercury concentration estimated in porewater could cause human health impacts through bioaccumulation, the 0.3 mg/kg fish tissue threshold concentration for methyl-mercury was used to back calculate a comparable total mercury porewater concentration. The conservative assumption that porewater concentrations are equal to surface water concentrations was used again here. The resulting water quality target was calculated to be 23.1 nanograms per liter (ng/L), or 0.0231 micrograms per liter (ug/L), total mercury in porewater.

In order to evaluate the potential risk to human health in an upland setting, the total mercury concentration in sediment samples was compared to the DNREC-RS Soil Screening Level (DNREC, 2013).

Results:

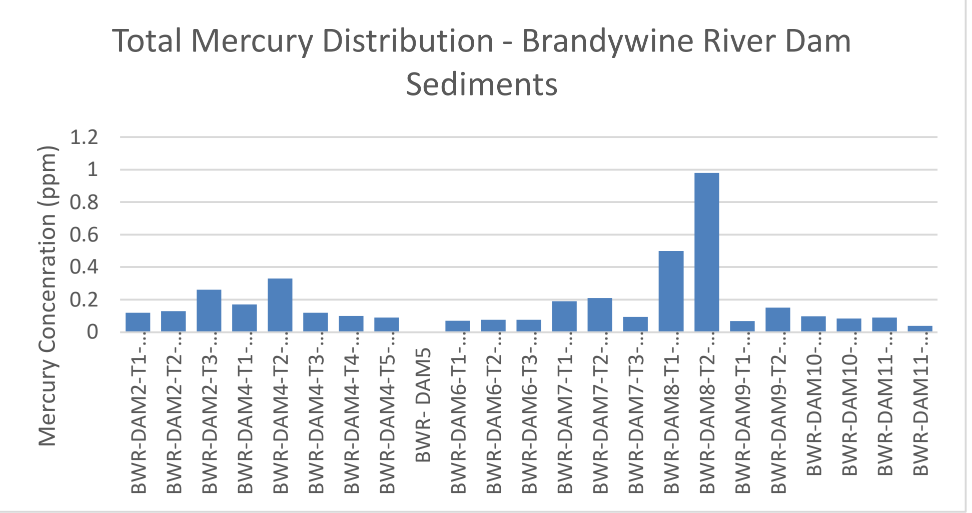
1. Predicted mercury concentrations in porewater did not exceed the freshwarer acute or chronic criteria for protection of aquatic life. All toxic unit values were less than 1.

2. Assuming that the mercury concentration in sediment porewater is equal to the mercury concentration in surface water, then the highest resulting water concentration is estimated to be 24.7 ng/L at Dam 8 Transect 2, just over the calculated criterion. All other results ranged from 0.9 ng/l to 12.5 ng/l, which is 1.8 to 25 times lower than the calculated water quality target of 23.1 ng/L for protection of human health from eating fish. As a result, toxicity due to bioaccumulation is not expected. In addition, no fish advisories currently exist due to mercury within the tidal or non-tidal Brandywine River.

3. There were no exceedances of the total mercury screening levels established for protection of human health.

Conclusions:

1. Mercury is not expected to be a concern for aquatic life or human heath related to dam failure, removal or modification. However there does appear to be a higher concentration of mercury behind dam 8 than any other dam sampled (see figure below).



TestAmerica Laboratories, Inc.
Eurofins TestAmerica, Edison

SUMMARY OF ANALYTICAL RESULTS: 460-205020-1
Job Description: WATAR (DE-1525) BRANDYWINE DAM SEDIMENTS
For:
State of Delaware
391 Lukens Drive
New Castle, Delaware 19720-2774

Client ID		DNREC SIRS	BWR-DAM2-T1-0320			BWR-DAM2-T2-0320			BWR-DAM2-T3-0320			BWR-DAM4-T1-0320			BWR-DAM4-T2-0320			BWR-DAM4-T3-0320		
Lab Sample ID		Screening Levels	460-205020-1			460-205020-2			460-205020-3			460-205020-4			460-205020-5			460-205020-6		
Sampling Date		Soils	03/06/2020 10:30:00			03/05/2020 14:00:00			03/05/2020 15:30:00			03/09/2020 13:55:00			03/09/2020 11:50:00			03/09/2020 12:35:00		
Matrix		Nov 2019	Soil			Soil			Soil			Soil			Soil			Soil		
Unit																				
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 7471B(MG/KG)																				
Mercury	7439-97-6	1.1	0.12		0.0062	0.13		0.0061	0.26		0.0060	0.17		0.0082	0.33		0.0069	0.12		0.0083

Client ID	BWR-DAM4-T4-0320			BWR-DAM4-T5-0320			BWR-FIELDBLANK-0320_SOLID			BWR-DAM7-T1-0320			BWR-DAM7-T2-0320			BWR-DAM7-T3-0320		
Lab Sample ID	460-205020-7			460-205020-8			460-205020-9			460-205020-11			460-205020-12			460-205020-13		
Sampling Date	03/09/2020 12:55:00			03/09/2020 13:15:00			03/12/2020 12:50:00			03/10/2020 13:15:00			03/10/2020 11:30:00			03/10/2020 12:10:00		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil		
Unit																		
	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 7471B(MG/KG)																		
Mercury	0.10		0.0060	0.089		0.0066	0.0076	J	0.0039	0.19		0.0064	0.21		0.0062	0.094		0.0059

Client ID	BWR-DAM8-T1-0320			BWR-DAM8-T2-0320			BWR-DAM11-T1-0320			BWR-DAM11-T2-0320			BWR-DUP1-0320		
Lab Sample ID	460-205020-14			460-205020-15			460-205020-16			460-205020-17			460-205020-18		
Sampling Date	03/11/2020 12:15:00			03/11/2020 11:45:00			03/12/2020 12:10:00			03/12/2020 11:20:00			03/12/2020 00:00:00		
Matrix	Soil			Soil			Soil			Soil			Soil		
Unit															
	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 7471B(MG/KG)															
Mercury	0.50		0.0076	0.98		0.0070	0.090		0.0073	0.038		0.0056	0.030		0.0053

TestAmerica Laboratories, Inc.
Eurofins TestAmerica, Edison

Lab Job ID: 460-210989-1
Job Description: WATAR (DE-1525)
For:
State of Delaware
391 Lukens Drive
New Castle, Delaware 19720-2774

Client ID		DNREC SIRS	BWR-DAM6-T1-0620			BWR-DAM6-T2-0620			BWR-DAM6-T3-0620			BWR-DAM9-T1-0620			BWR-DAM9-T2-0620			BWR-DAM10-T1-0620			BWR-DAM10-T2-0620			BWR-DUP2-0620		
Lab Sample ID		Screening Levels	460-210989-1			460-210989-2			460-210989-3			460-210989-4			460-210989-5			460-210989-6			460-210989-7			460-210989-8		
Sampling Date		Soils	06/10/2020 11:15:00			06/10/2020 11:40:00			06/10/2020 12:15:00			06/09/2020 14:15:00			06/09/2020 14:30:00			06/09/2020 11:10:00			06/09/2020 11:35:00			06/10/2020 00:00:00		
Matrix		Feb 2020	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Unit																										
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 7471B(MG/KG)																										
Mercury	7439-97-6	1.1	0.070	B	0.0072	0.075	B	0.0064	0.076	B	0.0072	0.069	B	0.0084	0.15		0.011	0.097		0.0076	0.084		0.0069	0.060		0.0066

Highlighted Concentrations shown in bold type face exceed limits
B : Compound was found in the blank and sample.
J : Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
U : Indicates the analyte was analyzed for but not detected.

Predicted Dissolved Mercury Concentration in Brandywine River Sediment Porewater

Mercury (Hg) in Brandywine River Sediments

Parameter	Units	Symbol	BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-0320	BWR- DAM5
Metal Conc. in Sediment (dry weight basis) =	mg/kg dry sediment	r_2 =	0.12	0.13	0.26	0.17	0.33	0.12	0.1	0.089	NS
Log Partition Coefficient for Sediment/Pore Water =	L solution/kg sediment	log K_d =	4.90	4.90	4.90	4.90	4.90	4.90	4.90	4.90	NS
Dissolved Concentration in Wet Sediment =	mg/L wet sediment	$C_d = r_2/K_d$ =	1.51E-06	1.64E-06	3.27E-06	2.14E-06	4.15E-06	1.51E-06	1.26E-06	1.12E-06	NS
Sediment Porosity =	L pore water/L wet sediment	phi =	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	NS
Dissolved Metal Conc. in Sediment Pore Water =	mg/L	$C_{d,pw} = C_d$/phi =	0.00000302	0.00000327	0.00000655	0.00000428	0.00000831	0.00000302	0.00000252	0.00000224	NS
Dissolved Metal Conc. in Sediment Pore Water =	ug/L		0.003021	0.003273	0.006546	0.004280	0.008309	0.003021	0.002518	0.002241	NS
Dissolved Metal Conc. in Sediment Pore Water =	ng/L		3.021421	3.273206	6.546412	4.280346	8.308908	3.021421	2.517851	2.240887	NS
Estimated Hardness =	mg/L as $CaCO_3$	[Hd] =	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	NS
Freshwater Acute Criterion (dissolved basis) =	ug/L	Acute Fresh =	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	NS
Freshwater Chronic Criterion (dissolved basis) =	ug/L	Chronic Fresh =	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	NS
Acute Toxicity Units for Sediment Pore Water =		$T.U._a$ =	0.0022	0.0023	0.0047	0.0031	0.0059	0.0022	0.0018	0.0016	NS
Chronic Toxicity Units for Sediment Pore Water =		$T.U._c$ =	0.004	0.004	0.009	0.006	0.011	0.004	0.003	0.003	NS
DNREC-RS HH Soil Screening Level =	mg/kg	SL =	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	

Parameter	Units	Symbol	BWR-DAM6-T1-0620	BWR-DAM6-T2-0620	BWR-DAM6-T3-0620	BWR-DAM7-T1-0320	BWR-DAM7-T2-0320	BWR-DAM7-T3-0320	BWR-DAM8-T1-0320	BWR-DAM8-T2-0320	BWR-DAM9-T1-0620
Metal Conc. in Sediment (dry weight basis) =	mg/kg dry sediment	r_2 =	0.07	0.075	0.076	0.19	0.21	0.094	0.5	0.98	0.069
Log Partition Coefficient for Sediment/Pore Water =	L solution/kg sediment	log K_d =	4.90	4.90	4.90	4.90	4.90	4.90	4.90	4.90	4.90
Dissolved Concentration in Wet Sediment =	mg/L wet sediment	$C_d = r_2/K_d$ =	8.81E-07	9.44E-07	9.57E-07	2.39E-06	2.64E-06	1.18E-06	6.29E-06	1.23E-05	8.69E-07
Sediment Porosity =	L pore water/L wet sediment	phi =	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Dissolved Metal Conc. in Sediment Pore Water =	mg/L	$C_{d,pw} = C_d$/phi =	0.00000176	0.00000189	0.00000191	0.00000478	0.00000529	0.00000237	0.00001259	0.00002467	0.00000174
Dissolved Metal Conc. in Sediment Pore Water =	ug/L		0.001762	0.001888	0.001914	0.004784	0.005287	0.002367	0.012589	0.024675	0.001737
Dissolved Metal Conc. in Sediment Pore Water =	ng/L		1.762496	1.888388	1.913567	4.783917	5.287487	2.366780	12.589254	24.674938	1.737317
Estimated Hardness =	mg/L as $CaCO_3$	[Hd] =	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Freshwater Acute Criterion (dissolved basis) =	ug/L	Acute Fresh =	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Freshwater Chronic Criterion (dissolved basis) =	ug/L	Chronic Fresh =	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77
Acute Toxicity Units for Sediment Pore Water =		$T.U._a$ =	1.26E-03	1.35E-03	1.37E-03	0.0034	0.0038	0.0017	0.0090	0.0176	1.24E-03
Chronic Toxicity Units for Sediment Pore Water =		$T.U._c$ =	2.29E-03	2.45E-03	2.49E-03	0.006	0.007	0.003	0.016	0.032	2.26E-03
DNREC-RS HH Soil Screening Level =	mg/kg	SL =	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1

Parameter	Units	Symbol	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DAM11-T1-0320	BWR-DAM11-T2-0320	BWR-DUP1-0320 (D11-T1)	BWR-DUP2-0620 (D6-T1)	BWR-FIELDBLANK-0320_SOLID	
Metal Conc. in Sediment (dry weight basis) =	mg/kg dry sediment	r_2 =	0.15	0.097	0.084	0.09	0.038	0.03	0.06	0.0076	
Log Partition Coefficient for Sediment/Pore Water =	L solution/kg sediment	log K_d =	4.90	4.90	4.90	4.90	4.90	4.90	4.90	4.90	from EPA 2005a
Dissolved Concentration in Wet Sediment =	mg/L wet sediment	$C_d = r_2/K_d$ =	1.89E-06	1.22E-06	1.06E-06	1.13E-06	4.78E-07	3.78E-07	7.55E-07	9.57E-08	
Sediment Porosity =	L pore water/L wet sediment	phi =	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	estimate based upon grain size data
Dissolved Metal Conc. in Sediment Pore Water =	mg/L	$C_{d,pw} = C_d$/phi =	0.00000378	0.00000244	0.00000211	0.00000227	0.00000096	0.00000076	0.00000151	0.00000019	
Dissolved Metal Conc. in Sediment Pore Water =	ug/L		0.003777	0.002442	0.002115	0.002266	0.000957	0.000755	0.001511	0.000191	
Dissolved Metal Conc. in Sediment Pore Water =	ng/L		3.776776	2.442315	2.114995	2.266066	0.956783	0.755355	1.510710	0.191357	
Estimated Hardness =	mg/L as $CaCO_3$	[Hd] =	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	assumption
Freshwater Acute Criterion (dissolved basis) =	ug/L	Acute Fresh =	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	from DNREC 2004
Freshwater Chronic Criterion (dissolved basis) =	ug/L	Chronic Fresh =	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	from DNREC 2004
Acute Toxicity Units for Sediment Pore Water =		$T.U._a$ =	2.70E-03	1.74E-03	1.51E-03	0.0016	0.0007	0.0005	1.08E-03	1.37E-04	
Chronic Toxicity Units for Sediment Pore Water =		$T.U._c$ =	4.90E-03	3.17E-03	2.75E-03	2.94E-03	1.24E-03	9.81E-04	1.96E-03	2.49E-04	
DNREC-RS HH Soil Screening Level =	mg/kg	SL =	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	from DNREC 2013

Red highlited cell exceeds DNREC Soil Screening Value for protection of human health

Risk to aquatic life from Mercury is not apparent based upon average concentrations predicted in sediment porewater, under the conservative assumption that porewater concentrations are equal to surface water quality concentrations. Mercury does however, bioaccumulate in fish and other aquatic life. Therefore an evaluation of predicted fish tissue concentrations is appropriate for evaluating protection of human health if fish were consumed from the Brandywine River.

Delaware Surface Water Quality Standards, Table 2, lists a MethylMercury concentration in fish tissue of 0.3 milligrams per kilogram as the safety threshold. Eating fish with a MethylMurcuy concentration above 0.3 mg/kg may be harmful to human health. In order to assess whether the total mecury porewater/surface water concentration calculated above could cause human health impacts through biaccumulation, the 0.3 mg/kg fish tissue threshold concentration for methylmercury must be used to back calculate a comparable total mercury surface water concentration. That assessment is shown below.

Site Specific Mercury Water Quality Criteria

	Hg (II)	
A. Aquatic Life		
DE Freshwater Acute Aquatic Life Criterion (1)	1400	ng/L or pptr
DE Freshwater Chronic Aquatic Life Criterion (1)	770	ng/L or pptr
DE Marine Acute Aquatic Life Criterion (1)	1800	ng/L or pptr
DE Marine Chronic Aquatic Life Criterion (1)	940	ng/L or pptr
B. Human Health		
DE Fresh and Marine Human Health Criterion (1)	0.3	ug/g methylmercury in fish
Unofficial 'Equivalent' Water Quality Target (2)	23.1	ng/L total mercury in water

1. State of Delaware Surface Water Quality Standards (DNREC, 2004)
2. Calculated as: $[(RfD\text{-}RSC)xBW)]/[(FIxBAF)_{TL3}+(FIXBAF)_{TL4}]/f_d$ where:

RfD = Reference Dose for methylmercury based on noncancer human health effects =	1.0E-04	mg MeHg/kg body weight-d
RSC = Relative source contribution to account for MeHg exposure from sources other than freshwater/estuarine fish, (note: >99.9% from ocean fish) =	2.7E-05	mg MeHg/kg body weight-d
BW = Human Body Weight =	70	kilograms body weight
FI_{TL3} = Fish consumption rate for trophic level 3 fish = (17.5 g/d)/2 =	0.00875	kilograms of fish/day
FI_{TL4} = Fish consumption rate for trophic level 4 fish = (17.5 g/d)/2 =	0.00875	kilograms of fish/day
BAF_{TL3} = Bioaccumulation Factor for trophic level 3 fish =	6.8E+05	L/kg fish
BAF_{TL4} = Bioaccumulation Factor for trophic level 4 fish =	2.7E+06	L/kg fish
f_d = Fraction of total Hg that is dissolved MeHg =	0.00749	unitless decimal fraction

Information Sources for Rough Draft Revised Criterion Calcs:

RfD taken from: IRIS database at www.epa.gov/IRIS

RSC taken from: U.S. EPA, 2001. Water quality criterion for the protection of human health: Methymercury (EPA-823-R-01-001). Office of Water, Washington, DC.

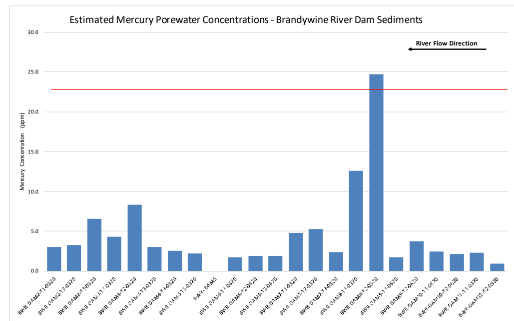
BW taken from: U.S. EPA, 1997. Exposure Factors Handbook (EPA/600/P-95/002Fa). Office of Research and Development, Washington, DC.

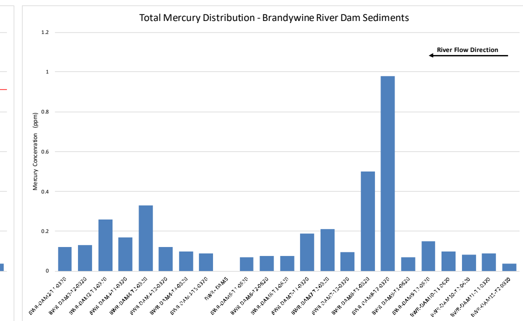
FI_{TL3} and FI_{TL4} taken from: KCA, 1994. Fish Consumption Patterns of Delaware Fishermen and Their Households. Report prepared for DE DNREC, Division of Water Resources, Dover, DE.

BAF_{TL3} and BAF_{TL4} taken from: U.S. EPA, 2002. Draft Guidance for Implementing the January 2001 Methylmercury Water Quality Criterion, Office of Science and Technology, Washington, DC.

f_d: calculated from Mason et al 2014

Note: The BAF values are generic defaults recommended in a draft EPA guidance document. As such, they are subject to change. In fact, EPA recommends in this same guidance document that, ideally, BAFs and f_d values be developed from site-specific studies.





Assuming that the mercury concentration in sediment porewater is equal to the mercury concentration in surface water, then the highest resulting water concentration is estimated to be 24.7 ng/L at Dam 8 Transect 2, just over the calculated criterion.
All other results ranged from 0.9 ng/l to 12.5 ng/l, which is 1.8 to 25 times lower than the calculated water quality target of 23.1 ng/L for protection of human health from eating fish. No fish advisories currently exist due to mercury exist for

References

DNREC. 2004. State of Delaware Surface Water Quality Standards as Amended June 2011. Delaware Department of Natural Resources and Environmental Control, Division of Water Resources, Watershed Assessment Branch, Dover, DE.

DNREC. 2013. Department of Natural Resources and Environmental Control, Division of Waste and Hazardous Substances, Remediation Section, HSCA Screening Level Table, Last updated February 2020. New Castle, DE.

EPA. 2005a. Partition Coefficients for Metals in Surface Water, Soil, and Waste (EPA/600/R-05/074). U.S. Environmental Protection Agency, Washington, DC.

Mason R, Balcom P, Gosnell K, Ortiz V, Dimento B, Schartup A. 2014. Sources and Biogeochenical Cycling of Methylmercury and Mercury in the Sub-Tidal Reaches of the Delaware River Estuary. Report prepared by University of Connecticut Department of Marine Sciences, Groton, CT for the Delaware department of Natural Resources and Environmental Control, Dover, De.

Assessment of Sediment PCB Data for the Brandywine River

Prepared by: John Cargill & Dannielle Pratt, DNREC, WHS, Remediation Section
Date: October 22, 2020

Findings:

1. Total PCBs were detected in one (1) of 22 samples collected (BRW_DAM 4_T1_0320) at a concentration of 69 micrograms per kilogram (ug/kg or ppb). PCBs were not detected in any of the other sediment samples utilizing EPA Method 680 (Homolog method).

2. Despite the presence of PCBs in the Dam 4 Transect 1 sample, toxicity to aquatic life due to PCBs is not expected. The approach used to evaluate potential toxicity of PCBs to benthic organisms followed that of Fuchsman et.al. (2006), with minor modification. The aim of the approach is to determine an organic carbon normalized concentration in the sediments in equilibrium with a porewater concentration equal to a chronic aquatic life criterion. Fuchsman (2006) refers to such an organic carbon normalized sediment concentration as a Sediment Quality Benchmark (SQB). If the ratio of the measured organic carbon normalized concentration in the sediment to the SQB is less than 1, then chronic aquatic life toxicity in the sediments is unlikely. Ratios greater than 1 indicate that the porewater exposure may be high enough to cause toxicity to benthic organisms. This would provide an indication that the narrative criteria within Section 4 of Delaware's Surface Water Quality Standards (e.g., sections 4.5.9.2.1 and 4.5.9.2.2) are not being met, with the understanding that sediments and their associated porewaters are an integral part of Delaware's surface water environment. For this particular dataset, however, the largest (and only) chronic toxicity unit value was 0.15, which is well below 1, thereby indicating that aquatic toxicity due to PCBs is not expected. Note that the NOAA ERL and ERM bulk sediment quality guidelines (Long, 1995), were not used in this assessment, nor were the so-called 'consensus-based sediment effect concentrations for PCBs (MacDonald et.al. (2000). Further, the logistic regression approach proposed by Field, et.al. (2002) was not used. All of these approaches suffer by not accounting for bioavailability and not being cause-and-effect' based. In contrast, the approach used in this assessment accounts for bioavailability by predicting dissolved phase concentrations using equilibrium partitioning. Further, the approach used here considers the 'cause-and-effect' of PCB through the use of Delaware's applicable chronic criterion for the protection of aquatic life (DNREC, 2004). Note that Fuchsman (2006) derived a different criterion for chronic toxicity using available acute toxicity data and an acute to chronic ratio. So, specification of the chronic aquatic life criterion is the key difference between the approach used in this assessment vs. that advanced by Fuchsman (2006).

3. Because the Brandywine River is used as a drinking water source for the City of Wilmington, the estimated dissolved porewater concentration was compared to Delaware's Water Quality Criteria for Protection of Human Heath (Human Carcinogens - Fish and Water Ingestion). The criteria were developed to protect humans from drinking water and eating fish from a body of water that contains the contaminant. Under the assumption that the porewater concentration is in equilibrium with, and is the same concentration as the surface water, the estimated porewater concentration of 0.00212 ug/L at Dam 4 Transect 1 is approximately 30 times greater than the referenced criterion of 0.000064 ug/L, thus indicating the potential for human health impact from fish and water ingestion. For additional context, the drinking water MCL for PCBs is 0.5 ug/L, which is more than 200 times greater than the estimated concentration of 0.00212 ug/L at Dam 4 Transect 1. Therefore the identified potential risk seems to be dominated by consumption of fish that have bioaccumulated PCBs. PCBs are the primary risk driver for fish consumption advisories in Delaware, including in the non-tidal Brandywine River.

4. To further assess the potential for PCBs in the sediments to contribute to bioaccumulation, the total PCB concentrations in the samples were compared to a calculated bioaccumulation-based sediment quality criterion (BBSQC) (Greene, 1997a). The BBSQC represents a bulk sediment concentration that equates to an acceptable fish tissue concentration for protection of human health from adverse health effects. The sample collected from Dam 4 Transect 1 exceeds the BBSQC of 33.2 ppb by a factor of 2.08. Because PCBs were not detected at concentrations above the method detection limit in any of the other samples, none exceeded the BBSQC.

5. PCBs are the primary risk driver for fish consumption advisories in Delaware, and to provide additional context as to the source of PCB impacts to fish, the same calculations described above to assess potential PCB risk to aquatic life and human health were conducted utilizing non-detected (or 'U' qualified) laboratory results equal to ½ the laboratory method detection limit, and equal to the method detection limit. Further, assessment data (sediment and surface water) measured in 2015 from the non-tidal Brandywine River were reviewed for comparison to estimated values. Sediment and surface water analytical data from two non-tidal locations, Smith Bridge and the "City Dam", indicated that total PCB concentrations in sediment were 9.13 and 7.21 ug/kg, respectively. By comparison, concentrations of PCBs derived using ½ the MDL ranged from approximately 10 ug/kg to 15 ug/kg at all locations sampled in 2020. In addition, predicted porewater PCB concentrations utilizing ½ the MDL (average concentration from 22 sites of 0.000506 ug/L) are similar to dissolved PCBs measures in surface water at the same two locations in 2015 (0.000734 ug/L and 0.000509 ug/L). From this, it can be concluded that results from the current (2020) assessment of PCBs utilizing ½ the MDL more closely represents actual conditions. Based upon review of the assessment, all conclusions stated above regarding potential toxicity to benthic aquatic life and comparison of data to the BBSQC are unchanged. However, instead of only one exceedance of the criterion developed to protect humans from drinking water and eating fish containing PCBs, each of the 22 estimated porewater concentrations exceeded the criterion. Further, since measured concentrations of dissolved phase PCBs in surface water in 2015 are very similar to estimated porewater concentrations calculated from this study, the assumption that porewater concentrations of PCBs are the same (generally) as surface water concentrations is verified. Finally, and as a result of all of the lines of evidence presented, it appears that relatively low concentrations of PCBs in sediments are likely contributing to surface water concentrations (or vice versa) that contribute to bioaccumulation in fish. At the time of this assessment a consumption advisory of no more than six 8oz servings of fish per year from the Brandywine River has been established.

6. Finally, in order to evaluate the potential risk to humans from handling of the sediment (e.g. excavation work) or after potential upland disposal/application (incidental ingestion/inhalation), the total PCB concentrations in sediment samples compared to the DNREC-RS Soil Screening Value for protection of human health (DNREC, 2013). As shown in Tables 3-3, none of the sample PCB results exceeded the applicable soil screening level (even if ½ MDL is used).

Conclusion:

Based on fate and transport considerations, the concentration of PCBs dissolved in the water column during dam removal, modification or failure is expected to be no greater than the dissolved concentrations in the porewater prior to dam removal, modification or failure. Since aquatic life toxicity is not expected from the porewater prior to any activities, aquatic toxicity is therefore not expected in the water column during or after activities.

There appears to be potential human health risk related to PCBs at all sample locations, especially at the Dam 4 Transect 1 location, primarily due to consumption of fish that have bioaccumulated PCBs and not from drinking water containing PCBs (the drinking water MCL for PCBs is 0.5 ug/L, well above the estimated (2020) and measured (2015) concentrations). Review of data has verified the assumption that, at least for PCBs, porewater concentrations are in equilibrium with and generally equal to surface water concentrations, therefore any removal of PCB mass would represent a net benefit to the system. However, as stated above, an increase in PCB risk to benthic aquatic life (or human health from fish consumption) associated with dam removal, modification or failure is not expected.

Based upon field observations (and probing data), sediment volume is limited to bank deposits at Dam 4 Transect 1, as there was little sediment in the central portion of the channel. In addition, a Hazardous Substance Cleanup Act (HSCA) regulated Voluntary Cleanup Program site is located on the west bank of the Brandywine River at Dam 4.

Supporting Calculations, Charts, and References Calculations which support the above findings appear within this spreadsheet. References cited appear on the last tab of this spreadsheet.

TestAmerica Laboratories, Inc.
Eurofins TestAmerica, Edison
SUMMARY OF ANALYTICAL RESULTS: 460-205020-1
Job Description: WATAR (DE-1525) BRANDYWINE DAM SEDIMENTS
For:
State of Delaware
391 Lukens Drive
New Castle, Delaware 19720-2774

Client ID	DNREC SIRS		BWR-DAM2-T1-0320			BWR-DAM2-T2-0320			BWR-DAM2-T3-0320			BWR-DAM4-T1-0320			BWR-DAM4-T2-0320			BWR-DAM4-T3-0320		
Lab Sample ID	Screening Levels		460-205020-1			460-205020-2			460-205020-3			460-205020-4			460-205020-5			460-205020-6		
Sampling Date		Soils	03/06/2020 10:30:00			03/05/2020 14:00:00			03/05/2020 15:30:00			03/09/2020 13:55:00			03/09/2020 11:50:00			03/09/2020 12:35:00		
Matrix		Nov 2019	Soil			Soil			Soil			Soil			Soil			Soil		
Dilution Factor			1			1			1			1			1			1		
Unit		ug/kg	ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 680																				
DCB Decachlorobiphenyl	2051-24-3	NA	3.3	U	3.3	3.3	U	3.3	3.2	U Z	3.2	4.5	U	4.5	3.7	U	3.7	4.5	U	4.5
Dichlorobiphenyl	25512-42-9	NA	0.90	U	0.90	0.89	U	0.89	0.87	U	0.87	1.2	U	1.2	1.0	U	1.0	1.2	U	1.2
Heptachlorobiphenyl	28655-71-2	NA	2.8	U	2.8	2.8	U	2.8	2.7	U	2.7	3.8	U	3.8	3.1	U	3.1	3.8	U	3.8
Hexachlorobiphenyl	26601-64-9	NA	1.9	U	1.9	1.8	U	1.8	1.8	U	1.8	15		2.5	2.1	U	2.1	2.5	U	2.5
Monochlorobiphenyl	27323-18-8	NA	0.84	U	0.84	0.83	U	0.83	0.81	U	0.81	1.1	U	1.1	0.94	U	0.94	1.1	U	1.1
Nonachlorobiphenyl	53742-07-7	NA	6.4	U	6.4	6.4	U	6.4	6.2	U	6.2	8.7	U	8.7	7.2	U	7.2	8.7	U	8.7
Octachlorobiphenyl	55722-26-4	NA	2.6	U	2.6	2.5	U	2.5	2.5	U	2.5	3.5	U	3.5	2.9	U	2.9	3.5	U	3.5
Pentachlorobiphenyl	25429-29-2	NA	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	49		2.4	1.9	U	1.9	2.3	U	2.3
Tetrachlorobiphenyl	26914-33-0	NA	2.2	U	2.2	2.1	U	2.1	2.1	U	2.1	5.0	J	3.0	2.4	U	2.4	2.9	U	2.9
Trichlorobiphenyl	25323-68-6	NA	0.84	U	0.84	0.83	U	0.83	0.81	U	0.81	1.1	U	1.1	0.94	U	0.94	1.1	U	1.1
Total Conc		NA	0.0			0.0			0.0			69.0			0.0			0.0		

Client ID	DNREC SIRS		BWR-DAM4-T4-0320			BWR-DAM4-T5-0320			BWR-FIELDBLANK-0320_SOLID			BWR-DAM7-T1-0320			BWR-DAM7-T2-0320			BWR-DAM7-T3-0320		
Lab Sample ID	Screening Levels		460-205020-7			460-205020-8			460-205020-9			460-205020-11			460-205020-12			460-205020-13		
Sampling Date		Soils	03/09/2020 12:55:00			03/09/2020 13:15:00			03/12/2020 12:50:00			03/10/2020 13:15:00			03/10/2020 11:30:00			03/10/2020 12:10:00		
Matrix		Nov 2019	Soil			Soil			Soil			Soil			Soil			Soil		
Dilution Factor			1			1			1			1			1			1		
Unit		ug/kg	ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 680																				
DCB Decachlorobiphenyl	2051-24-3	NA	3.1	U	3.1	3.4	U	3.4	2.0	U	2.0	3.4	U	3.4	3.4	U	3.4	3.0	U	3.0
Dichlorobiphenyl	25512-42-9	NA	0.85	U	0.85	0.91	U	0.91	0.55	U	0.55	0.92	U	0.92	0.93	U	0.93	0.81	U	0.81
Heptachlorobiphenyl	28655-71-2	NA	2.6	U	2.6	2.8	U	2.8	1.7	U	1.7	2.9	U	2.9	2.9	U	2.9	2.5	U	2.5
Hexachlorobiphenyl	26601-64-9	NA	1.7	U	1.7	1.9	U	1.9	1.1	U	1.1	1.9	U	1.9	1.9	U	1.9	1.7	U	1.7
Monochlorobiphenyl	27323-18-8	NA	0.79	U	0.79	0.85	U	0.85	0.51	U	0.51	0.86	U	0.86	0.87	U	0.87	0.75	U	0.75
Nonachlorobiphenyl	53742-07-7	NA	6.0	U	6.0	6.5	U	6.5	3.9	U	3.9	6.6	U	6.6	6.6	U	6.6	5.8	U	5.8
Octachlorobiphenyl	55722-26-4	NA	2.4	U	2.4	2.6	U	2.6	1.6	U	1.6	2.6	U	2.6	2.7	U	2.7	2.3	U	2.3
Pentachlorobiphenyl	25429-29-2	NA	1.6	U	1.6	1.8	U	1.8	1.1	U	1.1	1.8	U	1.8	1.8	U	1.8	1.6	U	1.6
Tetrachlorobiphenyl	26914-33-0	NA	2.0	U	2.0	2.2	U	2.2	1.3	U	1.3	2.2	U	2.2	2.2	U	2.2	1.9	U	1.9
Trichlorobiphenyl	25323-68-6	NA	0.79	U	0.79	0.85	U	0.85	0.51	U	0.51	0.86	U	0.86	0.87	U	0.87	0.75	U	0.75
Total Conc		NA	0.0			0.0			0.0			0.0			0.0			0.0		

Client ID	DNREC SIRS		BWR-DAM8-T1-0320			BWR-DAM8-T2-0320			BWR-DAM11-T1-0320			BWR-DAM11-T2-0320			BWR-DUP1-0320		
Lab Sample ID	Screening Levels		460-205020-14			460-205020-15			460-205020-16			460-205020-17			460-205020-18		
Sampling Date		Soils	03/11/2020 12:15:00			03/11/2020 11:45:00			03/12/2020 12:10:00			03/12/2020 11:20:00			03/12/2020 00:00:00		
Matrix		Nov 2019	Soil			Soil			Soil			Soil			Soil		
Dilution Factor			1			1			1			1			1		
Unit		ug/kg	ug/kg			ug/kg			ug/kg			ug/kg			ug/kg		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 680																	
DCB Decachlorobiphenyl	2051-24-3	NA	4.0	U	4.0	3.7	U	3.7	3.7	U	3.7	2.8	U	2.8	2.9	U	2.9
Dichlorobiphenyl	25512-42-9	NA	1.1	U	1.1	1.0	U	1.0	1.0	U	1.0	0.77	U	0.77	0.79	U	0.79
Heptachlorobiphenyl	28655-71-2	NA	3.3	U	3.3	3.1	U	3.1	3.1	U	3.1	2.4	U	2.4	2.5	U	2.5
Hexachlorobiphenyl	26601-64-9	NA	2.2	U	2.2	2.1	U	2.1	2.1	U	2.1	1.6	U	1.6	1.6	U	1.6
Monochlorobiphenyl	27323-18-8	NA	1.0	U	1.0	0.93	U	0.93	0.93	U	0.93	0.71	U	0.71	0.74	U	0.74
Nonachlorobiphenyl	53742-07-7	NA	7.7	U	7.7	7.1	U	7.1	7.1	U	7.1	5.5	U	5.5	5.7	U	5.7
Octachlorobiphenyl	55722-26-4	NA	3.1	U	3.1	2.8	U	2.8	2.8	U	2.8	2.2	U	2.2	2.3	U	2.3
Pentachlorobiphenyl	25429-29-2	NA	2.1	U	2.1	1.9	U	1.9	1.9	U	1.9	1.5	U	1.5	1.5	U	1.5
Tetrachlorobiphenyl	26914-33-0	NA	2.6	U	2.6	2.4	U	2.4	2.4	U	2.4	1.8	U	1.8	1.9	U	1.9
Trichlorobiphenyl	25323-68-6	NA	1.0	U	1.0	0.93	U	0.93	0.93	U	0.93	0.71	U	0.71	0.74	U	0.74
Total Conc		NA	0.0			0.0			0.0			0.0			0.0		

Client ID	DNREC SIRS		BWR-DAM2-T1-0320			BWR-DAM2-T2-0320			BWR-DAM2-T3-0320			BWR-DAM4-T1-0320			BWR-DAM4-T2-0320			BWR-DAM4-T3-0320		
Lab Sample ID	Screening Levels		460-205020-1			460-205020-2			460-205020-3			460-205020-4			460-205020-5			460-205020-6		
Sampling Date		Soils	03/06/2020 10:30:00			03/05/2020 14:00:00			03/05/2020 15:30:00			03/09/2020 13:55:00			03/09/2020 11:50:00			03/09/2020 12:35:00		
Matrix		Nov 2019	Soil			Soil			Soil			Soil			Soil			Soil		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY LLOYD KAHN																				
Total Organic Carbon (mg/kg)	7440-44-0	NA	12800		684	15100		684	12200		684	16300		684	25900		684	19800		684

Client ID	DNREC SIRS		BWR-DAM4-T4-0320			BWR-DAM4-T5-0320			BWR-FIELDBLANK-0320_SOLID			BWR-DAM7-T1-0320			BWR-DAM7-T2-0320			BWR-DAM7-T3-0320		
Lab Sample ID	Screening Levels		460-205020-7			460-205020-8			460-205020-9			460-205020-11			460-205020-12			460-205020-13		
Sampling Date		Soils	03/09/2020 12:55:00			03/09/2020 13:15:00			03/12/2020 12:50:00			03/10/2020 13:15:00			03/10/2020 11:30:00			03/10/2020 12:10:00		
Matrix		Nov 2019	Soil			Soil			Soil			Soil			Soil			Soil		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY LLOYD KAHN																				
Total Organic Carbon (mg/kg)	7440-44-0	NA	11800		684	12100		684	684	U	684	16100		684	21100		684	4330		684

Client ID	DNREC SIRS		BWR-DAM8-T1-0320			BWR-DAM8-T2-0320			BWR-DAM11-T1-0320			BWR-DAM11-T2-0320			BWR-DUP1-0320		
Lab Sample ID	Screening Levels		460-205020-14			460-205020-15			460-205020-16			460-205020-17			460-205020-18		
Sampling Date		Soils	03/11/2020 12:15:00			03/11/2020 11:45:00			03/12/2020 12:10:00			03/12/2020 11:20:00			03/12/2020 00:00:00		
Matrix		Nov 2019	Soil			Soil			Soil			Soil			Soil		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY LLOYD KAHN																	
Total Organic Carbon (mg/kg)	7440-44-0	NA	24300		684	22200		684	19600		684	18700		684	19000	Z	684

TestAmerica Laboratories, Inc.
Eurofins TestAmerica, Edison
Lab Job ID: 460-210989-1
Job Description: WATAR (DE-1525)
For:
State of Delaware
391 Lukens Drive
New Castle, Delaware 19720-2774

Client ID	DNREC SIRS		BWR-DAM6-T1-0620			BWR-DAM6-T2-0620			BWR-DAM6-T3-0620			BWR-DAM9-T1-0620		
Lab Sample ID	Screening Levels		460-210989-1			460-210989-2			460-210989-3			460-210989-4		
Sampling Date		Soils	06/10/2020 11:15:00			06/10/2020 11:40:00			06/10/2020 12:15:00			06/09/2020 14:15:00		
Matrix		Feb 2020	Soil			Soil			Soil			Soil		
Dilution Factor			1			1			1			1		
Unit		mg/kg	mg/kg			mg/kg			mg/kg			mg/kg		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 680														
DCB Decachlorobiphenyl	2051-24-3	NA	0.0038	U	0.0038	0.0034	U	0.0034	0.0037	U	0.0037	0.0043	U	0.0043
Dichlorobiphenyl	25512-42-9	NA	0.001	U	0.001	0.00092	U	0.00092	0.001	U	0.001	0.0012	U	0.0012
Heptachlorobiphenyl	28655-71-2	NA	0.0032	U	0.0032	0.0029	U	0.0029	0.0031	U	0.0031	0.0036	U	0.0036
Hexachlorobiphenyl	26601-64-9	NA	0.0021	U	0.0021	0.0019	U	0.0019	0.0021	U	0.0021	0.0024	U	0.0024
Monochlorobiphenyl	27323-18-8	NA	0.00096	U	0.00096	0.00086	U	0.00086	0.00094	U	0.00094	0.0011	U	0.0011
Nonachlorobiphenyl	53742-07-7	NA	0.0074	U	0.0074	0.0066	U	0.0066	0.0072	U	0.0072	0.0083	U	0.0083
Octachlorobiphenyl	55722-26-4	NA	0.003	U	0.003	0.0026	U	0.0026	0.0029	U	0.0029	0.0033	U	0.0033
Pentachlorobiphenyl	25429-29-2	NA	0.002	U	0.002	0.0018	U	0.0018	0.0019	U	0.0019	0.0022	U	0.0022
Tetrachlorobiphenyl	26914-33-0	NA	0.0025	U	0.0025	0.0022	U	0.0022	0.0024	U	0.0024	0.0028	U	0.0028
Trichlorobiphenyl	25323-68-6	NA	0.00097	U	0.00097	0.00086	U	0.00086	0.00094	U	0.00094	0.0011	U	0.0011
Total Conc		NA	0			0			0			0		

Client ID	DNREC SIRS		BWR-DAM9-T2-0620			BWR-DAM10-T1-0620			BWR-DAM10-T2-0620			BWR-DUP2-0620		
Lab Sample ID	Screening Levels		460-210989-5			460-210989-6			460-210989-7			460-210989-8		
Sampling Date		Soils	06/09/2020 14:30:00			06/09/2020 11:10:00			06/09/2020 11:35:00			06/10/2020 00:00:00		
Matrix		Feb 2020	Soil			Soil			Soil			Soil		
Dilution Factor			1			1			1			1		
Unit		mg/kg	mg/kg			mg/kg			mg/kg			mg/kg		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 680														
DCB Decachlorobiphenyl	2051-24-3	NA	0.0061	U	0.0061	0.004	U	0.004	0.0037	U	0.0037	0.0037	U	0.0037
Dichlorobiphenyl	25512-42-9	NA	0.0016	U	0.0016	0.0011	U	0.0011	0.001	U	0.001	0.001	U	0.001
Heptachlorobiphenyl	28655-71-2	NA	0.0051	U	0.0051	0.0033	U	0.0033	0.0031	U	0.0031	0.0031	U	0.0031
Hexachlorobiphenyl	26601-64-9	NA	0.0034	U	0.0034	0.0022	U	0.0022	0.0021	U	0.0021	0.0021	U	0.0021
Monochlorobiphenyl	27323-18-8	NA	0.0015	U	0.0015	0.001	U	0.001	0.00093	U	0.00093	0.00094	U	0.00094
Nonachlorobiphenyl	53742-07-7	NA	0.012	U	0.012	0.0077	U	0.0077	0.0071	U	0.0071	0.0072	U	0.0072
Octachlorobiphenyl	55722-26-4	NA	0.0047	U	0.0047	0.0031	U	0.0031	0.0028	U	0.0028	0.0029	U	0.0029
Pentachlorobiphenyl	25429-29-2	NA	0.0032	U	0.0032	0.0021	U	0.0021	0.0019	U	0.0019	0.0019	U	0.0019
Tetrachlorobiphenyl	26914-33-0	NA	0.004	U	0.004	0.0026	U	0.0026	0.0024	U	0.0024	0.0024	U	0.0024
Trichlorobiphenyl	25323-68-6	NA	0.0015	U	0.0015	0.001	U	0.001	0.00093	U	0.00093	0.00094	U	0.00094
Total Conc		NA	0			0			0			0		

Client ID	DNREC SIRS		BWR-DAM6-T1-0620			BWR-DAM6-T2-0620			BWR-DAM6-T3-0620			BWR-DAM9-T1-0620		
Lab Sample ID	Screening Levels		460-210989-1			460-210989-2			460-210989-3			460-210989-4		
Sampling Date		Soils	06/10/2020 11:15:00			06/10/2020 11:40:00			06/10/2020 12:15:00			06/09/2020 14:15:00		
Matrix		Feb 2020	Soil			Soil			Soil			Soil		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY LLOYD KAHN														
TOC Result 1 (mg/kg)	STL00338	NA	21200		153	17800		136	23400		150	28500		172

Client ID	DNREC SIRS		BWR-DAM9-T2-0620			BWR-DAM10-T1-0620			BWR-DAM10-T2-0620			BWR-DUP2-0620		
Lab Sample ID	Screening Levels		460-210989-5			460-210989-6			460-210989-7			460-210989-8		
Sampling Date		Soils	06/09/2020 14:30:00			06/09/2020 11:10:00			06/09/2020 11:35:00			06/10/2020 00:00:00		
Matrix		Feb 2020	Soil			Soil			Soil			Soil		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY LLOYD KAHN														
TOC Result 1 (mg/kg)	STL00338	NA	34600		243	24200		159	3920		148	20900		149

Lab Data

Client ID		DNREC SIRS	BWR-DAM2-T1-0320			BWR-DAM2-T2-0320			BWR-DAM2-T3-0320			BWR-DAM4-T1-0320			BWR-DAM4-T2-0320			BWR-DAM4-T3-0320		
Lab Sample ID		Screening Levels	460-205020-1			460-205020-2			460-205020-3			460-205020-4			460-205020-5			460-205020-6		
Sampling Date		Soils	03/06/2020 10:30:00			03/05/2020 14:00:00			03/05/2020 15:30:00			03/09/2020 13:55:00			03/09/2020 11:50:00			03/09/2020 12:35:00		
Matrix		Nov 2019	Soil			Soil			Soil			Soil			Soil			Soil		
Dilution Factor			1			1			1			1			1			1		
Unit		ug/kg	ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 680																				
DCB Decachlorobiphenyl	2051-24-3	NA	3.3	U	3.3	3.3	U	3.3	3.2	U Z	3.2	4.5	U	4.5	3.7	U	3.7	4.5	U	4.5
Dichlorobiphenyl	25512-42-9	NA	0.9	U	0.9	0.89	U	0.89	0.87	U	0.87	1.2	U	1.2	1	U	1	1.2	U	1.2
Heptachlorobiphenyl	28655-71-2	NA	2.8	U	2.8	2.8	U	2.8	2.7	U	2.7	3.8	U	3.8	3.1	U	3.1	3.8	U	3.8
Hexachlorobiphenyl	26601-64-9	NA	1.9	U	1.9	1.8	U	1.8	1.8	U	1.8	15		2.5	2.1	U	2.1	2.5	U	2.5
Monochlorobiphenyl	27323-18-8	NA	0.84	U	0.84	0.83	U	0.83	0.81	U	0.81	1.1	U	1.1	0.94	U	0.94	1.1	U	1.1
Nonachlorobiphenyl	53742-07-7	NA	6.4	U	6.4	6.4	U	6.4	6.2	U	6.2	8.7	U	8.7	7.2	U	7.2	8.7	U	8.7
Octachlorobiphenyl	55722-26-4	NA	2.6	U	2.6	2.5	U	2.5	2.5	U	2.5	3.5	U	3.5	2.9	U	2.9	3.5	U	3.5
Pentachlorobiphenyl	25429-29-2	NA	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	49		2.4	1.9	U	1.9	2.3	U	2.3
Tetrachlorobiphenyl	26914-33-0	NA	2.2	U	2.2	2.1	U	2.1	2.1	U	2.1	5	J	3	2.4	U	2.4	2.9	U	2.9
Trichlorobiphenyl	25323-68-6	NA	0.84	U	0.84	0.83	U	0.83	0.81	U	0.81	1.1	U	1.1	0.94	U	0.94	1.1	U	1.1
Total Conc		NA	0			0			0			69			0			0		

Client ID		DNREC SIRS	BWR-DAM4-T4-0320			BWR-DAM4-T5-0320			BWR-DAM7-T1-0320			BWR-DAM7-T2-0320			BWR-DAM7-T3-0320			BWR-DAM8-T1-0320		
Lab Sample ID		Screening Levels	460-205020-7			460-205020-8			460-205020-11			460-205020-12			460-205020-13			460-205020-14		
Sampling Date		Soils	03/09/2020 12:55:00			03/09/2020 13:15:00			03/10/2020 13:15:00			03/10/2020 11:30:00			03/10/2020 12:10:00			03/11/2020 12:15:00		
Matrix		Nov 2019	Soil			Soil			Soil			Soil			Soil			Soil		
Dilution Factor			1			1			1			1			1			1		
Unit		ug/kg	ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 680																				
DCB Decachlorobiphenyl	2051-24-3	NA	3.1	U	3.1	3.4	U	3.4	3.4	U	3.4	3.4	U	3.4	3	U	3	4	U	4
Dichlorobiphenyl	25512-42-9	NA	0.85	U	0.85	0.91	U	0.91	0.92	U	0.92	0.93	U	0.93	0.81	U	0.81	1.1	U	1.1
Heptachlorobiphenyl	28655-71-2	NA	2.6	U	2.6	2.8	U	2.8	2.9	U	2.9	2.9	U	2.9	2.5	U	2.5	3.3	U	3.3
Hexachlorobiphenyl	26601-64-9	NA	1.7	U	1.7	1.9	U	1.9	1.9	U	1.9	1.9	U	1.9	1.7	U	1.7	2.2	U	2.2
Monochlorobiphenyl	27323-18-8	NA	0.79	U	0.79	0.85	U	0.85	0.86	U	0.86	0.87	U	0.87	0.75	U	0.75	1	U	1
Nonachlorobiphenyl	53742-07-7	NA	6	U	6	6.5	U	6.5	6.6	U	6.6	6.6	U	6.6	5.8	U	5.8	7.7	U	7.7
Octachlorobiphenyl	55722-26-4	NA	2.4	U	2.4	2.6	U	2.6	2.6	U	2.6	2.7	U	2.7	2.3	U	2.3	3.1	U	3.1
Pentachlorobiphenyl	25429-29-2	NA	1.6	U	1.6	1.8	U	1.8	1.8	U	1.8	1.8	U	1.8	1.6	U	1.6	2.1	U	2.1
Tetrachlorobiphenyl	26914-33-0	NA	2	U	2	2.2	U	2.2	2.2	U	2.2	2.2	U	2.2	1.9	U	1.9	2.6	U	2.6
Trichlorobiphenyl	25323-68-6	NA	0.79	U	0.79	0.85	U	0.85	0.86	U	0.86	0.87	U	0.87	0.75	U	0.75	1	U	1
Total Conc		NA	0			0			0			0			0			0		

Client ID		DNREC SIRS	BWR-DAM8-T2-0320			BWR-DAM11-T1-0320			BWR-DAM11-T2-0320			BWR-DUP1-0320			BWR-FIELDBLANK-0320_SOLID			BWR-DAM6-T1-0620		
Lab Sample ID		Screening Levels	460-205020-15			460-205020-16			460-205020-17			460-205020-18			460-205020-9			460-210989-1		
Sampling Date		Soils	03/11/2020 11:45:00			03/12/2020 12:10:00			03/12/2020 11:20:00			03/12/2020 00:00:00			03/12/2020 12:50:00			06/10/2020 11:15:00		
Matrix		Nov 2019	Soil			Soil			Soil			Soil			Soil			Soil		
Dilution Factor			1			1			1			1			1			1		
Unit		ug/kg	ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			mg/kg		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 680																				
DCB Decachlorobiphenyl	2051-24-3	NA	3.7	U	3.7	3.7	U	3.7	2.8	U	2.8	2.9	U	2.9	2	U	2	0.0038	U	0.0038
Dichlorobiphenyl	25512-42-9	NA	1	U	1	1	U	1	0.77	U	0.77	0.79	U	0.79	0.55	U	0.55	0.001	U	0.001
Heptachlorobiphenyl	28655-71-2	NA	3.1	U	3.1	3.1	U	3.1	2.4	U	2.4	2.5	U	2.5	1.7	U	1.7	0.0032	U	0.0032
Hexachlorobiphenyl	26601-64-9	NA	2.1	U	2.1	2.1	U	2.1	1.6	U	1.6	1.6	U	1.6	1.1	U	1.1	0.0021	U	0.0021
Monochlorobiphenyl	27323-18-8	NA	0.93	U	0.93	0.93	U	0.93	0.71	U	0.71	0.74	U	0.74	0.51	U	0.51	0.00096	U	0.00096
Nonachlorobiphenyl	53742-07-7	NA	7.1	U	7.1	7.1	U	7.1	5.5	U	5.5	5.7	U	5.7	3.9	U	3.9	0.0074	U	0.0074
Octachlorobiphenyl	55722-26-4	NA	2.8	U	2.8	2.8	U	2.8	2.2	U	2.2	2.3	U	2.3	1.6	U	1.6	0.003	U	0.003
Pentachlorobiphenyl	25429-29-2	NA	1.9	U	1.9	1.9	U	1.9	1.5	U	1.5	1.5	U	1.5	1.1	U	1.1	0.002	U	0.002
Tetrachlorobiphenyl	26914-33-0	NA	2.4	U	2.4	2.4	U	2.4	1.8	U	1.8	1.9	U	1.9	1.3	U	1.3	0.0025	U	0.0025
Trichlorobiphenyl	25323-68-6	NA	0.93	U	0.93	0.93	U	0.93	0.71	U	0.71	0.74	U	0.74	0.51	U	0.51	0.00097	U	0.00097
Total Conc		NA	0			0			0			0			0			0		

Client ID		DNREC SIRS	BWR-DAM6-T2-0620			BWR-DAM6-T3-0620			BWR-DAM9-T1-0620			BWR-DAM9-T2-0620			BWR-DAM10-T1-0620			BWR-DAM10-T2-0620			BWR- Dam5	BWR-DUP2-0620		
Lab Sample ID		Screening Levels	460-210989-2			460-210989-3			460-210989-4			460-210989-5			460-210989-6			460-210989-7				460-210989-8		
Sampling Date		Soils	06/10/2020 11:40:00			06/10/2020 12:15:00			06/09/2020 14:15:00			06/09/2020 14:30:00			06/09/2020 11:10:00			06/09/2020 11:35:00				06/10/2020 00:00:00		
Matrix		Nov 2019	Soil			Soil			Soil			Soil			Soil			Soil				Soil		
Dilution Factor			1			1			1			1			1			1				1		
Unit		ug/kg	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg				mg/kg		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL		Result	Q	MDL
SOIL BY 680																								
DCB Decachlorobiphenyl	2051-24-3	NA	0.0034	U	0.0034	0.0037	U	0.0037	0.0043	U	0.0043	0.0061	U	0.0061	0.004	U	0.004	0.0037	U	0.0037		0.0037	U	0.0037
Dichlorobiphenyl	25512-42-9	NA	0.00092	U	0.00092	0.001	U	0.001	0.0012	U	0.0012	0.0016	U	0.0016	0.0011	U	0.0011	0.001	U	0.001		0.001	U	0.001
Heptachlorobiphenyl	28655-71-2	NA	0.0029	U	0.0029	0.0031	U	0.0031	0.0036	U	0.0036	0.0051	U	0.0051	0.0033	U	0.0033	0.0031	U	0.0031		0.0031	U	0.0031
Hexachlorobiphenyl	26601-64-9	NA	0.0019	U	0.0019	0.0021	U	0.0021	0.0024	U	0.0024	0.0034	U	0.0034	0.0022	U	0.0022	0.0021	U	0.0021		0.0021	U	0.0021
Monochlorobiphenyl	27323-18-8	NA	0.00086	U	0.00086	0.00094	U	0.00094	0.0011	U	0.0011	0.0015	U	0.0015	0.001	U	0.001	0.00093	U	0.00093		0.00094	U	0.00094
Nonachlorobiphenyl	53742-07-7	NA	0.0066	U	0.0066	0.0072	U	0.0072	0.0083	U	0.0083	0.012	U	0.012	0.0077	U	0.0077	0.0071	U	0.0071		0.0072	U	0.0072
Octachlorobiphenyl	55722-26-4	NA	0.0026	U	0.0026	0.0029	U	0.0029	0.0033	U	0.0033	0.0047	U	0.0047	0.0031	U	0.0031	0.0028	U	0.0028		0.0029	U	0.0029
Pentachlorobiphenyl	25429-29-2	NA	0.0018	U	0.0018	0.0019	U	0.0019	0.0022	U	0.0022	0.0032	U	0.0032	0.0021	U	0.0021	0.0019	U	0.0019		0.0019	U	0.0019
Tetrachlorobiphenyl	26914-33-0	NA	0.0022	U	0.0022	0.0024	U	0.0024	0.0028	U	0.0028	0.004	U	0.004	0.0026	U	0.0026	0.0024	U	0.0024		0.0024	U	0.0024
Trichlorobiphenyl	25323-68-6	NA	0.00086	U	0.00086	0.00094	U	0.00094	0.0011	U	0.0011	0.0015	U	0.0015	0.001	U	0.001	0.00093	U	0.00093		0.00094	U	0.00094
Total Conc		NA	0			0			0			0			0			0				0		

Data with U qualified values set to zero

Client ID		DNREC SIRS	BWR-DAM2-T1-0320			BWR-DAM2-T2-0320			BWR-DAM2-T3-0320			BWR-DAM4-T1-0320			BWR-DAM4-T2-0320			BWR-DAM4-T3-0320		
Lab Sample ID		Screening Levels	460-205020-1			460-205020-2			460-205020-3			460-205020-4			460-205020-5			460-205020-6		
Sampling Date		Soils	03/06/2020 10:30:00			03/05/2020 14:00:00			03/05/2020 15:30:00			03/09/2020 13:55:00			03/09/2020 11:50:00			03/09/2020 12:35:00		
Matrix		Nov 2019	Soil			Soil			Soil			Soil			Soil			Soil		
Dilution Factor			1			1			1			1			1			1		
Unit		ug/kg	ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 680																				
DCB Decachlorobiphenyl	2051-24-3	NA	0	U	3.3	0	U	3.3	0	U Z	3.2	0	U	4.5	0	U	3.7	0	U	4.5
Dichlorobiphenyl	25512-42-9	NA	0	U	0.9	0	U	0.89	0	U	0.87	0	U	1.2	0	U	1	0	U	1.2
Heptachlorobiphenyl	28655-71-2	NA	0	U	2.8	0	U	2.8	0	U	2.7	0	U	3.8	0	U	3.1	0	U	3.8
Hexachlorobiphenyl	26601-64-9	NA	0	U	1.9	0	U	1.8	0	U	1.8	15		2.5	0	U	2.1	0	U	2.5
Monochlorobiphenyl	27323-18-8	NA	0	U	0.84	0	U	0.83	0	U	0.81	0	U	1.1	0	U	0.94	0	U	1.1
Nonachlorobiphenyl	53742-07-7	NA	0	U	6.4	0	U	6.4	0	U	6.2	0	U	8.7	0	U	7.2	0	U	8.7
Octachlorobiphenyl	55722-26-4	NA	0	U	2.6	0	U	2.5	0	U	2.5	0	U	3.5	0	U	2.9	0	U	3.5
Pentachlorobiphenyl	25429-29-2	NA	0	U	1.7	0	U	1.7	0	U	1.7	49		2.4	0	U	1.9	0	U	2.3
Tetrachlorobiphenyl	26914-33-0	NA	0	U	2.2	0	U	2.1	0	U	2.1	5	J	3	0	U	2.4	0	U	2.9
Trichlorobiphenyl	25323-68-6	NA	0	U	0.84	0	U	0.83	0	U	0.81	0	U	1.1	0	U	0.94	0	U	1.1
Total Conc		NA	**0**			**0**			**0**			**69**			**0**			**0**		

Client ID		DNREC SIRS	BWR-DAM4-T4-0320			BWR-DAM4-T5-0320			BWR-DAM7-T1-0320			BWR-DAM7-T2-0320			BWR-DAM7-T3-0320			BWR-DAM8-T1-0320		
Lab Sample ID		Screening Levels	460-205020-7			460-205020-8			460-205020-11			460-205020-12			460-205020-13			460-205020-14		
Sampling Date		Soils	03/09/2020 12:55:00			03/09/2020 13:15:00			03/10/2020 13:15:00			03/10/2020 11:30:00			03/10/2020 12:10:00			03/11/2020 12:15:00		
Matrix		Nov 2019	Soil			Soil			Soil			Soil			Soil			Soil		
Dilution Factor			1			1			1			1			1			1		
Unit		ug/kg	ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 680																				
DCB Decachlorobiphenyl	2051-24-3	NA	0	U	3.1	0	U	3.4	0	U	3.4	0	U	3.4	0	U	3	0	U	4
Dichlorobiphenyl	25512-42-9	NA	0	U	0.85	0	U	0.91	0	U	0.92	0	U	0.93	0	U	0.81	0	U	1.1
Heptachlorobiphenyl	28655-71-2	NA	0	U	2.6	0	U	2.8	0	U	2.9	0	U	2.9	0	U	2.5	0	U	3.3
Hexachlorobiphenyl	26601-64-9	NA	0	U	1.7	0	U	1.9	0	U	1.9	0	U	1.9	0	U	1.7	0	U	2.2
Monochlorobiphenyl	27323-18-8	NA	0	U	0.79	0	U	0.85	0	U	0.86	0	U	0.87	0	U	0.75	0	U	1
Nonachlorobiphenyl	53742-07-7	NA	0	U	6	0	U	6.5	0	U	6.6	0	U	6.6	0	U	5.8	0	U	7.7
Octachlorobiphenyl	55722-26-4	NA	0	U	2.4	0	U	2.6	0	U	2.6	0	U	2.7	0	U	2.3	0	U	3.1
Pentachlorobiphenyl	25429-29-2	NA	0	U	1.6	0	U	1.8	0	U	1.8	0	U	1.8	0	U	1.6	0	U	2.1
Tetrachlorobiphenyl	26914-33-0	NA	0	U	2	0	U	2.2	0	U	2.2	0	U	2.2	0	U	1.9	0	U	2.6
Trichlorobiphenyl	25323-68-6	NA	0	U	0.79	0	U	0.85	0	U	0.86	0	U	0.87	0	U	0.75	0	U	1
Total Conc		NA	**0**			**0**			**0**			**0**			**0**			**0**		

Client ID		DNREC SIRS	BWR-DAM8-T2-0320			BWR-DAM11-T1-0320			BWR-DAM11-T2-0320			BWR-DUP1-0320			BWR-FIELDBLANK-0320_SOLID			BWR-DAM6-T1-0620		
Lab Sample ID		Screening Levels	460-205020-15			460-205020-16			460-205020-17			460-205020-18			460-205020-9			460-210989-1		
Sampling Date		Soils	03/11/2020 11:45:00			03/12/2020 12:10:00			03/12/2020 11:20:00			03/12/2020 00:00:00			03/12/2020 12:50:00			06/10/2020 11:15:00		
Matrix		Nov 2019	Soil			Soil			Soil			Soil			Soil			Soil		
Dilution Factor			1			1			1			1			1			1		
Unit		ug/kg	ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			**mg/kg**		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 680																				
DCB Decachlorobiphenyl	2051-24-3	NA	0	U	3.7	0	U	3.7	0	U	2.8	0	U	2.9	0	U	2	0	U	0.0038
Dichlorobiphenyl	25512-42-9	NA	0	U	1	0	U	1	0	U	0.77	0	U	0.79	0	U	0.55	0	U	0.001
Heptachlorobiphenyl	28655-71-2	NA	0	U	3.1	0	U	3.1	0	U	2.4	0	U	2.5	0	U	1.7	0	U	0.0032
Hexachlorobiphenyl	26601-64-9	NA	0	U	2.1	0	U	2.1	0	U	1.6	0	U	1.6	0	U	1.1	0	U	0.0021
Monochlorobiphenyl	27323-18-8	NA	0	U	0.93	0	U	0.93	0	U	0.71	0	U	0.74	0	U	0.51	0	U	0.00096
Nonachlorobiphenyl	53742-07-7	NA	0	U	7.1	0	U	7.1	0	U	5.5	0	U	5.7	0	U	3.9	0	U	0.0074
Octachlorobiphenyl	55722-26-4	NA	0	U	2.8	0	U	2.8	0	U	2.2	0	U	2.3	0	U	1.6	0	U	0.003
Pentachlorobiphenyl	25429-29-2	NA	0	U	1.9	0	U	1.9	0	U	1.5	0	U	1.5	0	U	1.1	0	U	0.002
Tetrachlorobiphenyl	26914-33-0	NA	0	U	2.4	0	U	2.4	0	U	1.8	0	U	1.9	0	U	1.3	0	U	0.0025
Trichlorobiphenyl	25323-68-6	NA	0	U	0.93	0	U	0.93	0	U	0.71	0	U	0.74	0	U	0.51	0	U	0.00097
Total Conc		NA	**0**			**0**			**0**			**0**			**0**			0		

Client ID		DNREC SIRS	BWR-DAM6-T2-0620			BWR-DAM6-T3-0620			BWR-DAM9-T1-0620			BWR-DAM9-T2-0620			BWR-DAM10-T1-0620			BWR-DAM10-T2-0620			BWR- Dam5	BWR-DUP2-0620		
Lab Sample ID		Screening Levels	460-210989-2			460-210989-3			460-210989-4			460-210989-5			460-210989-6			460-210989-7				460-210989-8		
Sampling Date		Soils	06/10/2020 11:40:00			06/10/2020 12:15:00			06/09/2020 14:15:00			06/09/2020 14:30:00			06/09/2020 11:10:00			06/09/2020 11:35:00				06/10/2020 00:00:00		
Matrix		Nov 2019	Soil			Soil			Soil			Soil			Soil			Soil				Soil		
Dilution Factor			1			1			1			1			1			1				1		
Unit		ug/kg	**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**				mg/kg		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL		Result	Q	MDL
SOIL BY 680																								
DCB Decachlorobiphenyl	2051-24-3	NA	0	U	0.0034	0	U	0.0037	0	U	0.0043	0	U	0.0061	0	U	0.004	0	U	0.0037	0	0	U	0.0037
Dichlorobiphenyl	25512-42-9	NA	0	U	0.00092	0	U	0.001	0	U	0.0012	0	U	0.0016	0	U	0.0011	0	U	0.001	0	0	U	0.001
Heptachlorobiphenyl	28655-71-2	NA	0	U	0.0029	0	U	0.0031	0	U	0.0036	0	U	0.0051	0	U	0.0033	0	U	0.0031	0	0	U	0.0031
Hexachlorobiphenyl	26601-64-9	NA	0	U	0.0019	0	U	0.0021	0	U	0.0024	0	U	0.0034	0	U	0.0022	0	U	0.0021	0	0	U	0.0021
Monochlorobiphenyl	27323-18-8	NA	0	U	0.00086	0	U	0.00094	0	U	0.0011	0	U	0.0015	0	U	0.001	0	U	0.00093	0	0	U	0.00094
Nonachlorobiphenyl	53742-07-7	NA	0	U	0.0066	0	U	0.0072	0	U	0.0083	0	U	0.012	0	U	0.0077	0	U	0.0071	0	0	U	0.0072
Octachlorobiphenyl	55722-26-4	NA	0	U	0.0026	0	U	0.0029	0	U	0.0033	0	U	0.0047	0	U	0.0031	0	U	0.0028	0	0	U	0.0029
Pentachlorobiphenyl	25429-29-2	NA	0	U	0.0018	0	U	0.0019	0	U	0.0022	0	U	0.0032	0	U	0.0021	0	U	0.0019	0	0	U	0.0019
Tetrachlorobiphenyl	26914-33-0	NA	0	U	0.0022	0	U	0.0024	0	U	0.0028	0	U	0.004	0	U	0.0026	0	U	0.0024	0	0	U	0.0024
Trichlorobiphenyl	25323-68-6	NA	0	U	0.00086	0	U	0.00094	0	U	0.0011	0	U	0.0015	0	U	0.001	0	U	0.00093	0	0	U	0.00094
Total Conc		NA	0			0			0			0			0			0				0		

Data with U qualified values set to 1/2 MDL

Client ID		DNREC SIRS	BWR-DAM2-T1-0320			BWR-DAM2-T2-0320			BWR-DAM2-T3-0320			BWR-DAM4-T1-0320			BWR-DAM4-T2-0320			BWR-DAM4-T3-0320		
Lab Sample ID		Screening Levels	460-205020-1			460-205020-2			460-205020-3			460-205020-4			460-205020-5			460-205020-6		
Sampling Date		Soils	03/06/2020 10:30:00			03/05/2020 14:00:00			03/05/2020 15:30:00			03/09/2020 13:55:00			03/09/2020 11:50:00			03/09/2020 12:35:00		
Matrix		Nov 2019	Soil			Soil			Soil			Soil			Soil			Soil		
Dilution Factor			1			1			1			1			1			1		
Unit		ug/kg	ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 680																				
DCB Decachlorobiphenyl	2051-24-3	NA	1.65	U	3.3	1.65	U	3.3	1.6	U Z	3.2	2.25	U	4.5	1.85	U	3.7	2.25	U	4.5
Dichlorobiphenyl	25512-42-9	NA	0.45	U	0.9	0.445	U	0.89	0.435	U	0.87	0.6	U	1.2	0.5	U	1	0.6	U	1.2
Heptachlorobiphenyl	28655-71-2	NA	1.4	U	2.8	1.4	U	2.8	1.35	U	2.7	1.9	U	3.8	1.55	U	3.1	1.9	U	3.8
Hexachlorobiphenyl	26601-64-9	NA	0.95	U	1.9	0.9	U	1.8	0.9	U	1.8	15		2.5	1.05	U	2.1	1.25	U	2.5
Monochlorobiphenyl	27323-18-8	NA	0.42	U	0.84	0.415	U	0.83	0.405	U	0.81	0.55	U	1.1	0.47	U	0.94	0.55	U	1.1
Nonachlorobiphenyl	53742-07-7	NA	3.2	U	6.4	3.2	U	6.4	3.1	U	6.2	4.35	U	8.7	3.6	U	7.2	4.35	U	8.7
Octachlorobiphenyl	55722-26-4	NA	1.3	U	2.6	1.25	U	2.5	1.25	U	2.5	1.75	U	3.5	1.45	U	2.9	1.75	U	3.5
Pentachlorobiphenyl	25429-29-2	NA	0.85	U	1.7	0.85	U	1.7	0.85	U	1.7	49		2.4	0.95	U	1.9	1.15	U	2.3
Tetrachlorobiphenyl	26914-33-0	NA	1.1	U	2.2	1.05	U	2.1	1.05	U	2.1	5	J	3	1.2	U	2.4	1.45	U	2.9
Trichlorobiphenyl	25323-68-6	NA	0.42	U	0.84	0.415	U	0.83	0.405	U	0.81	0.55	U	1.1	0.47	U	0.94	0.55	U	1.1
Total Conc		NA	**11.74**			**11.575**			**11.345**			**80.95**			**13.09**			**15.8**		

Client ID		DNREC SIRS	BWR-DAM4-T4-0320			BWR-DAM4-T5-0320			BWR-DAM7-T1-0320			BWR-DAM7-T2-0320			BWR-DAM7-T3-0320			BWR-DAM8-T1-0320		
Lab Sample ID		Screening Levels	460-205020-7			460-205020-8			460-205020-11			460-205020-12			460-205020-13			460-205020-14		
Sampling Date		Soils	03/09/2020 12:55:00			03/09/2020 13:15:00			03/10/2020 13:15:00			03/10/2020 11:30:00			03/10/2020 12:10:00			03/11/2020 12:15:00		
Matrix		Nov 2019	Soil			Soil			Soil			Soil			Soil			Soil		
Dilution Factor			1			1			1			1			1			1		
Unit		ug/kg	ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 680																				
DCB Decachlorobiphenyl	2051-24-3	NA	1.55	U	3.1	1.7	U	3.4	1.7	U	3.4	1.7	U	3.4	1.5	U	3	2	U	4
Dichlorobiphenyl	25512-42-9	NA	0.425	U	0.85	0.455	U	0.91	0.46	U	0.92	0.465	U	0.93	0.405	U	0.81	0.55	U	1.1
Heptachlorobiphenyl	28655-71-2	NA	1.3	U	2.6	1.4	U	2.8	1.45	U	2.9	1.45	U	2.9	1.25	U	2.5	1.65	U	3.3
Hexachlorobiphenyl	26601-64-9	NA	0.85	U	1.7	0.95	U	1.9	0.95	U	1.9	0.95	U	1.9	0.85	U	1.7	1.1	U	2.2
Monochlorobiphenyl	27323-18-8	NA	0.395	U	0.79	0.425	U	0.85	0.43	U	0.86	0.435	U	0.87	0.375	U	0.75	0.5	U	1
Nonachlorobiphenyl	53742-07-7	NA	3	U	6	3.25	U	6.5	3.3	U	6.6	3.3	U	6.6	2.9	U	5.8	3.85	U	7.7
Octachlorobiphenyl	55722-26-4	NA	1.2	U	2.4	1.3	U	2.6	1.3	U	2.6	1.35	U	2.7	1.15	U	2.3	1.55	U	3.1
Pentachlorobiphenyl	25429-29-2	NA	0.8	U	1.6	0.9	U	1.8	0.9	U	1.8	0.9	U	1.8	0.8	U	1.6	1.05	U	2.1
Tetrachlorobiphenyl	26914-33-0	NA	1	U	2	1.1	U	2.2	1.1	U	2.2	1.1	U	2.2	0.95	U	1.9	1.3	U	2.6
Trichlorobiphenyl	25323-68-6	NA	0.395	U	0.79	0.425	U	0.85	0.43	U	0.86	0.435	U	0.87	0.375	U	0.75	0.5	U	1
Total Conc		NA	**10.915**			**11.905**			**12.02**			**12.085**			**10.555**			**14.05**		

Client ID		DNREC SIRS	BWR-DAM8-T2-0320			BWR-DAM11-T1-0320			BWR-DAM11-T2-0320			BWR-DUP1-0320			BWR-FIELDBLANK-0320_SOLID			BWR-DAM6-T1-0620		
Lab Sample ID		Screening Levels	460-205020-15			460-205020-16			460-205020-17			460-205020-18			460-205020-9			460-210989-1		
Sampling Date		Soils	03/11/2020 11:45:00			03/12/2020 12:10:00			03/12/2020 11:20:00			03/12/2020 00:00:00			03/12/2020 12:50:00			06/10/2020 11:15:00		
Matrix		Nov 2019	Soil			Soil			Soil			Soil			Soil			Soil		
Dilution Factor			1			1			1			1			1			1		
Unit		ug/kg	ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			mg/kg		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 680																				
DCB Decachlorobiphenyl	2051-24-3	NA	1.85	U	3.7	1.85	U	3.7	1.4	U	2.8	1.45	U	2.9	1	U	2	1.9	U	3.8
Dichlorobiphenyl	25512-42-9	NA	0.5	U	1	0.5	U	1	0.385	U	0.77	0.395	U	0.79	0.275	U	0.55	0.5	U	1
Heptachlorobiphenyl	28655-71-2	NA	1.55	U	3.1	1.55	U	3.1	1.2	U	2.4	1.25	U	2.5	0.85	U	1.7	1.6	U	3.2
Hexachlorobiphenyl	26601-64-9	NA	1.05	U	2.1	1.05	U	2.1	0.8	U	1.6	0.8	U	1.6	0.55	U	1.1	1.05	U	2.1
Monochlorobiphenyl	27323-18-8	NA	0.465	U	0.93	0.465	U	0.93	0.355	U	0.71	0.37	U	0.74	0.255	U	0.51	0.48	U	0.96
Nonachlorobiphenyl	53742-07-7	NA	3.55	U	7.1	3.55	U	7.1	2.75	U	5.5	2.85	U	5.7	1.95	U	3.9	3.7	U	7.4
Octachlorobiphenyl	55722-26-4	NA	1.4	U	2.8	1.4	U	2.8	1.1	U	2.2	1.15	U	2.3	0.8	U	1.6	1.5	U	3
Pentachlorobiphenyl	25429-29-2	NA	0.95	U	1.9	0.95	U	1.9	0.75	U	1.5	0.75	U	1.5	0.55	U	1.1	1	U	2
Tetrachlorobiphenyl	26914-33-0	NA	1.2	U	2.4	1.2	U	2.4	0.9	U	1.8	0.95	U	1.9	0.65	U	1.3	1.25	U	2.5
Trichlorobiphenyl	25323-68-6	NA	0.465	U	0.93	0.465	U	0.93	0.355	U	0.71	0.37	U	0.74	0.255	U	0.51	4.85	U	9.7
Total Conc		NA	**15.8**			**12.98**			**9.995**			**10.335**			**7.135**			**17.83**		

Client ID		DNREC SIRS	BWR-DAM6-T2-0620			BWR-DAM6-T3-0620			BWR-DAM9-T1-0620			BWR-DAM9-T2-0620			BWR-DAM10-T1-0620			BWR-DAM10-T2-0620			BWR- Dam5	BWR-DUP2-0620		
Lab Sample ID		Screening Levels	460-210989-2			460-210989-3			460-210989-4			460-210989-5			460-210989-6			460-210989-7				460-210989-8		
Sampling Date		Soils	06/10/2020 11:40:00			06/10/2020 12:15:00			06/09/2020 14:15:00			06/09/2020 14:30:00			06/09/2020 11:10:00			06/09/2020 11:35:00				06/10/2020 00:00:00		
Matrix		Nov 2019	Soil			Soil			Soil			Soil			Soil			Soil				Soil		
Dilution Factor			1			1			1			1			1			1				1		
Unit		ug/kg	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg				mg/kg		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL		Result	Q	MDL
SOIL BY 680																								
DCB Decachlorobiphenyl	2051-24-3	NA	1.7	U	3.4	1.85	U	3.7	2.15	U	4.3	3.05	U	6.1	2	U	4	1.85	U	3.7		1.85	U	3.7
Dichlorobiphenyl	25512-42-9	NA	0.46	U	0.92	0.5	U	1	0.6	U	1.2	0.8	U	1.6	0.55	U	1.1	0.5	U	1		0.5	U	1
Heptachlorobiphenyl	28655-71-2	NA	1.45	U	2.9	1.55	U	3.1	1.8	U	3.6	2.55	U	5.1	1.65	U	3.3	1.55	U	3.1		1.55	U	3.1
Hexachlorobiphenyl	26601-64-9	NA	0.95	U	1.9	1.05	U	2.1	1.2	U	2.4	1.7	U	3.4	1.1	U	2.2	1.05	U	2.1		1.05	U	2.1
Monochlorobiphenyl	27323-18-8	NA	0.43	U	0.86	0.47	U	0.94	0.55	U	1.1	0.75	U	1.5	0.5	U	1	0.465	U	0.93		0.47	U	0.94
Nonachlorobiphenyl	53742-07-7	NA	3.3	U	6.6	3.6	U	7.2	4.15	U	8.3	6	U	12	3.85	U	7.7	3.55	U	7.1		3.6	U	7.2
Octachlorobiphenyl	55722-26-4	NA	1.3	U	2.6	1.45	U	2.9	1.65	U	3.3	2.35	U	4.7	1.55	U	3.1	1.4	U	2.8		1.45	U	2.9
Pentachlorobiphenyl	25429-29-2	NA	0.9	U	1.8	0.95	U	1.9	1.1	U	2.2	1.6	U	3.2	1.05	U	2.1	0.95	U	1.9		0.95	U	1.9
Tetrachlorobiphenyl	26914-33-0	NA	1.1	U	2.2	1.2	U	2.4	1.4	U	2.8	2	U	4	1.3	U	2.6	1.2	U	2.4		1.2	U	2.4
Trichlorobiphenyl	25323-68-6	NA	0.43	U	0.86	0.47	U	0.94	0.55	U	1.1	0.75	U	1.5	0.5	U	1	0.465	U	0.93		0.47	U	0.94
Total Conc		NA	**12.02**			**13.09**			**15.15**			**21.55**			**14.05**			**12.98**				**13.09**		

Data with U qualified values set to MDL

Client ID		DNREC SIRS	BWR-DAM2-T1-0320			BWR-DAM2-T2-0320			BWR-DAM2-T3-0320			BWR-DAM4-T1-0320			BWR-DAM4-T2-0320			BWR-DAM4-T3-0320		
Lab Sample ID		Screening Levels	460-205020-1			460-205020-2			460-205020-3			460-205020-4			460-205020-5			460-205020-6		
Sampling Date		Soils	03/06/2020 10:30:00			03/05/2020 14:00:00			03/05/2020 15:30:00			03/09/2020 13:55:00			03/09/2020 11:50:00			03/09/2020 12:35:00		
Matrix		Nov 2019	Soil			Soil			Soil			Soil			Soil			Soil		
Dilution Factor			1			1			1			1			1			1		
Unit		ug/kg	ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 680																				
DCB Decachlorobiphenyl	2051-24-3	NA	3.3	U	3.3	3.3	U	3.3	3.2	U Z	3.2	4.5	U	4.5	3.7	U	3.7	4.5	U	4.5
Dichlorobiphenyl	25512-42-9	NA	0.9	U	0.9	0.89	U	0.89	0.87	U	0.87	1.2	U	1.2	1	U	1	1.2	U	1.2
Heptachlorobiphenyl	28655-71-2	NA	2.8	U	2.8	2.8	U	2.8	2.7	U	2.7	3.8	U	3.8	3.1	U	3.1	3.8	U	3.8
Hexachlorobiphenyl	26601-64-9	NA	1.9	U	1.9	1.8	U	1.8	1.8	U	1.8	15		2.5	2.1	U	2.1	2.5	U	2.5
Monochlorobiphenyl	27323-18-8	NA	0.84	U	0.84	0.83	U	0.83	0.81	U	0.81	1.1	U	1.1	0.94	U	0.94	1.1	U	1.1
Nonachlorobiphenyl	53742-07-7	NA	6.4	U	6.4	6.4	U	6.4	6.2	U	6.2	8.7	U	8.7	7.2	U	7.2	8.7	U	8.7
Octachlorobiphenyl	55722-26-4	NA	2.6	U	2.6	2.5	U	2.5	2.5	U	2.5	3.5	U	3.5	2.9	U	2.9	3.5	U	3.5
Pentachlorobiphenyl	25429-29-2	NA	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	49		2.4	1.9	U	1.9	2.3	U	2.3
Tetrachlorobiphenyl	26914-33-0	NA	2.2	U	2.2	2.1	U	2.1	2.1	U	2.1	5	J	3	2.4	U	2.4	2.9	U	2.9
Trichlorobiphenyl	25323-68-6	NA	0.84	U	0.84	0.83	U	0.83	0.81	U	0.81	1.1	U	1.1	0.94	U	0.94	1.1	U	1.1
Total Conc		NA	**23.48**			**23.15**			**22.69**			**92.9**			**26.18**			**31.6**		

Client ID		DNREC SIRS	BWR-DAM4-T4-0320			BWR-DAM4-T5-0320			BWR-DAM7-T1-0320			BWR-DAM7-T2-0320			BWR-DAM7-T3-0320			BWR-DAM8-T1-0320		
Lab Sample ID		Screening Levels	460-205020-7			460-205020-8			460-205020-11			460-205020-12			460-205020-13			460-205020-14		
Sampling Date		Soils	03/09/2020 12:55:00			03/09/2020 13:15:00			03/10/2020 13:15:00			03/10/2020 11:30:00			03/10/2020 12:10:00			03/11/2020 12:15:00		
Matrix		Nov 2019	Soil			Soil			Soil			Soil			Soil			Soil		
Dilution Factor			1			1			1			1			1			1		
Unit		ug/kg	ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 680																				
DCB Decachlorobiphenyl	2051-24-3	NA	3.1	U	3.1	3.4	U	3.4	3.4	U	3.4	3.4	U	3.4	3	U	3	4	U	4
Dichlorobiphenyl	25512-42-9	NA	0.85	U	0.85	0.91	U	0.91	0.92	U	0.92	0.93	U	0.93	0.81	U	0.81	1.1	U	1.1
Heptachlorobiphenyl	28655-71-2	NA	2.6	U	2.6	2.8	U	2.8	2.9	U	2.9	2.9	U	2.9	2.5	U	2.5	3.3	U	3.3
Hexachlorobiphenyl	26601-64-9	NA	1.7	U	1.7	1.9	U	1.9	1.9	U	1.9	1.9	U	1.9	1.7	U	1.7	2.2	U	2.2
Monochlorobiphenyl	27323-18-8	NA	0.79	U	0.79	0.85	U	0.85	0.86	U	0.86	0.87	U	0.87	0.75	U	0.75	1	U	1
Nonachlorobiphenyl	53742-07-7	NA	6	U	6	6.5	U	6.5	6.6	U	6.6	6.6	U	6.6	5.8	U	5.8	7.7	U	7.7
Octachlorobiphenyl	55722-26-4	NA	2.4	U	2.4	2.6	U	2.6	2.6	U	2.6	2.7	U	2.7	2.3	U	2.3	3.1	U	3.1
Pentachlorobiphenyl	25429-29-2	NA	1.6	U	1.6	1.8	U	1.8	1.8	U	1.8	1.8	U	1.8	1.6	U	1.6	2.1	U	2.1
Tetrachlorobiphenyl	26914-33-0	NA	2	U	2	2.2	U	2.2	2.2	U	2.2	2.2	U	2.2	1.9	U	1.9	2.6	U	2.6
Trichlorobiphenyl	25323-68-6	NA	0.79	U	0.79	0.85	U	0.85	0.86	U	0.86	0.87	U	0.87	0.75	U	0.75	1	U	1
Total Conc		NA	**21.83**			**23.81**			**24.04**			**24.17**			**21.11**			**28.1**		

Client ID		DNREC SIRS	BWR-DAM8-T2-0320			BWR-DAM11-T1-0320			BWR-DAM11-T2-0320			BWR-DUP1-0320			BWR-FIELDBLANK-0320_SOLID			BWR-DAM6-T1-0620		
Lab Sample ID		Screening Levels	460-205020-15			460-205020-16			460-205020-17			460-205020-18			460-205020-9			460-210989-1		
Sampling Date		Soils	03/11/2020 11:45:00			03/12/2020 12:10:00			03/12/2020 11:20:00			03/12/2020 00:00:00			03/12/2020 12:50:00			06/10/2020 11:15:00		
Matrix		Nov 2019	Soil			Soil			Soil			Soil			Soil			Soil		
Dilution Factor			1			1			1			1			1			1		
Unit		ug/kg	ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			mg/kg		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 680																				
DCB Decachlorobiphenyl	2051-24-3	NA	3.7	U	3.7	3.7	U	3.7	2.8	U	2.8	2.9	U	2.9	2	U	2	3.8	U	3.8
Dichlorobiphenyl	25512-42-9	NA	1	U	1	1	U	1	0.77	U	0.77	0.79	U	0.79	0.55	U	0.55	1	U	1
Heptachlorobiphenyl	28655-71-2	NA	3.1	U	3.1	3.1	U	3.1	2.4	U	2.4	2.5	U	2.5	1.7	U	1.7	3.2	U	3.2
Hexachlorobiphenyl	26601-64-9	NA	2.1	U	2.1	2.1	U	2.1	1.6	U	1.6	1.6	U	1.6	1.1	U	1.1	2.1	U	2.1
Monochlorobiphenyl	27323-18-8	NA	0.93	U	0.93	0.93	U	0.93	0.71	U	0.71	0.74	U	0.74	0.51	U	0.51	0.96	U	0.96
Nonachlorobiphenyl	53742-07-7	NA	7.1	U	7.1	7.1	U	7.1	5.5	U	5.5	5.7	U	5.7	3.9	U	3.9	7.4	U	7.4
Octachlorobiphenyl	55722-26-4	NA	2.8	U	2.8	2.8	U	2.8	2.2	U	2.2	2.3	U	2.3	1.6	U	1.6	3	U	3
Pentachlorobiphenyl	25429-29-2	NA	1.9	U	1.9	1.9	U	1.9	1.5	U	1.5	1.5	U	1.5	1.1	U	1.1	2	U	2
Tetrachlorobiphenyl	26914-33-0	NA	2.4	U	2.4	2.4	U	2.4	1.8	U	1.8	1.9	U	1.9	1.3	U	1.3	2.5	U	2.5
Trichlorobiphenyl	25323-68-6	NA	0.93	U	0.93	0.93	U	0.93	0.71	U	0.71	0.74	U	0.74	0.51	U	0.51	9.7	U	9.7
Total Conc		NA	**25.96**			**25.96**			**19.99**			**20.67**			**14.27**			**35.66**		

Client ID		DNREC SIRS	BWR-DAM6-T2-0620			BWR-DAM6-T3-0620			BWR-DAM9-T1-0620			BWR-DAM9-T2-0620			BWR-DAM10-T1-0620			BWR-DAM10-T2-0620			BWR- Dam5	BWR-DUP2-0620		
Lab Sample ID		Screening Levels	460-210989-2			460-210989-3			460-210989-4			460-210989-5			460-210989-6			460-210989-7				460-210989-8		
Sampling Date		Soils	06/10/2020 11:40:00			06/10/2020 12:15:00			06/09/2020 14:15:00			06/09/2020 14:30:00			06/09/2020 11:10:00			06/09/2020 11:35:00				06/10/2020 00:00:00		
Matrix		Nov 2019	Soil			Soil			Soil			Soil			Soil			Soil				Soil		
Dilution Factor			1			1			1			1			1			1				1		
Unit		ug/kg	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg				mg/kg		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL		Result	Q	MDL
SOIL BY 680																								
DCB Decachlorobiphenyl	2051-24-3	NA	3.4	U	3.4	3.7	U	3.7	3.7	U	3.7	6.1	U	6.1	4	U	4	3.7	U	3.7		3.7	U	3.7
Dichlorobiphenyl	25512-42-9	NA	0.92	U	0.92	1	U	1	1	U	1	1.6	U	1.6	1.1	U	1.1	1	U	1		1	U	1
Heptachlorobiphenyl	28655-71-2	NA	2.9	U	2.9	3.1	U	3.1	3.1	U	3.1	5.1	U	5.1	3.3	U	3.3	3.1	U	3.1		3.1	U	3.1
Hexachlorobiphenyl	26601-64-9	NA	1.9	U	1.9	2.1	U	2.1	2.1	U	2.1	3.4	U	3.4	2.2	U	2.2	2.1	U	2.1		2.1	U	2.1
Monochlorobiphenyl	27323-18-8	NA	0.86	U	0.86	0.94	U	0.94	0.94	U	0.94	1.5	U	1.5	1	U	1	0.93	U	0.93		0.94	U	0.94
Nonachlorobiphenyl	53742-07-7	NA	6.6	U	6.6	7.2	U	7.2	7.2	U	7.2	12	U	12	7.7	U	7.7	7.1	U	7.1		7.2	U	7.2
Octachlorobiphenyl	55722-26-4	NA	2.6	U	2.6	2.9	U	2.9	2.9	U	2.9	4.7	U	4.7	3.1	U	3.1	2.8	U	2.8		2.9	U	2.9
Pentachlorobiphenyl	25429-29-2	NA	1.8	U	1.8	1.9	U	1.9	1.9	U	1.9	3.2	U	3.2	2.1	U	2.1	1.9	U	1.9		1.9	U	1.9
Tetrachlorobiphenyl	26914-33-0	NA	2.2	U	2.2	2.4	U	2.4	2.4	U	2.4	4	U	4	2.6	U	2.6	2.4	U	2.4		2.4	U	2.4
Trichlorobiphenyl	25323-68-6	NA	0.86	U	0.86	0.94	U	0.94	0.94	U	0.94	1.5	U	1.5	1	U	1	0.93	U	0.93		0.94	U	0.94
Total Conc		NA	**24.04**			**26.18**			**26.18**			**43.1**			**28.1**			**25.96**				**26.18**		

DUP 1 = Dam 11 Transect 1
DUP 2 = Dam 6 Transect 1

Assessment of Data With 'U' Qualified Values Set To Zero

ANALYTE	UNITS	BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-0320	BWR-DAM7-T1-0320	BWR-DAM7-T2-0320	BWR-DAM7-T3-0320	BWR-DAM8-T1-0320	BWR-DAM8-T2-0320	BWR-DAM11-T1-0320	BWR-DAM11-T2-0320	BWR-DUP1-0320	BWR-FIELDBLANK-0320_SOLID	BWR-DAM6-T1-0620	BWR-DAM6-T2-0620	BWR-DAM6-T3-0620	BWR-DAM9-T1-0620	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DUP2-0620
Total PCB	ug/Kg	0	0	0	69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOC (f_{oc})	kg oc/kg sed	0.01280	0.01510	0.01220	0.0163	0.0259	0.0198	0.0118	0.0121	0.0161	0.0211	0.0211	0.0243	0.0222	0.0196	0.0187	0.019	0.000684	0.0212	0.0178	0.0234	0.0285	0.0346	0.0242	0.00392	0.0209
Total PCB	ug/kg oc	0.00	0.00	0.00	4233.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total PCB	ug/g oc	0.00	0.00	0.00	4.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Octanol-Water Partition Coefficient

		log K_{ow}	$K_{ow/oc}$	
Log K_{ow}	L/Kg	6.3	1995262.315	Greene, 2010

$K_{oc} = K_d/F_{oc}$

therefore: $K_d = K_{oc} * F_{oc}$ where $K_{oc} = K_{ow}$

$K_d = C_{sed}/C_{diss}$

therefore: $C_{diss} = C_{sed}/K_d$

Calculation of Dissolved Porewater Concentration

	BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-0320	BWR-DAM7-T1-0320	BWR-DAM7-T2-0320	BWR-DAM7-T3-0320	BWR-DAM8-T1-0320	BWR-DAM8-T2-0320	BWR-DAM11-T1-0320	BWR-DAM11-T2-0320	BWR-DUP1-0320	BWR-FIELDBLANK-0320_SOLID	BWR-DAM6-T1-0620	BWR-DAM6-T2-0620	BWR-DAM6-T3-0620	BWR-DAM9-T1-0620	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DUP2-0620
Dissolved Porewater Concentration (ug/L)	0.00E+00	0.00E+00	0.00E+00	2.12E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Avg Porewater Conc. = 0.000096436

Delaware Organic Carbon Normalized Sediment Quality Benchmark (SQB) to Protect Aquatic Life from PCBs

SQB (ug PCB/g o.c.) = CCC (ug/L) x K_{oc} (L/kg) x (1 kg/1000 g), where:

Freshwater Chronic Criterion = 0.014 ug/L DNREC, 2011

	BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-0320	BWR-DAM7-T1-0320	BWR-DAM7-T2-0320	BWR-DAM7-T3-0320	BWR-DAM8-T1-0320	BWR-DAM8-T2-0320	BWR-DAM11-T1-0320	BWR-DAM11-T2-0320	BWR-DUP1-0320	BWR-FIELDBLANK-0320_SOLID	BWR-DAM6-T1-0620	BWR-DAM6-T2-0620	BWR-DAM6-T3-0620	BWR-DAM9-T1-0620	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DUP2-0620
SQB Freshwater (ug PCB/g oc)	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93

Comparison of SQB to Measured Total PCB

	BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-0320	BWR-DAM7-T1-0320	BWR-DAM7-T2-0320	BWR-DAM7-T3-0320	BWR-DAM8-T1-0320	BWR-DAM8-T2-0320	BWR-DAM11-T1-0320	BWR-DAM11-T2-0320	BWR-DUP1-0320	BWR-FIELDBLANK-0320_SOLID	BWR-DAM6-T1-0620	BWR-DAM6-T2-0620	BWR-DAM6-T3-0620	BWR-DAM9-T1-0620	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DUP2-0620
Measured Total PCB (ug PCB/g oc)	0.00	0.00	0.00	4.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ratio Measured PCB to SQB Freshwater	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

PCB Bioaccumulation-Based Sediment Quality Guideline (BBSQG) for Human Health Protection

BBSQG = 33.2 ug/Kg Greene, 1997 (avg. TOC used in calculation 2.5%)

Comparison of BBSQG to Measured Total PCB

	BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-0320	BWR-DAM7-T1-0320	BWR-DAM7-T2-0320	BWR-DAM7-T3-0320	BWR-DAM8-T1-0320	BWR-DAM8-T2-0320	BWR-DAM11-T1-0320	BWR-DAM11-T2-0320	BWR-DUP1-0320	BWR-FIELDBLANK-0320_SOLID	BWR-DAM6-T1-0620	BWR-DAM6-T2-0620	BWR-DAM6-T3-0620	BWR-DAM9-T1-0620	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DUP2-0620
Measured Total PCB (ug/Kg)	0.00	0.00	0.00	69.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ratio Measured PCB to BBSQG	0.00	0.00	0.00	2.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Dup1 = D11 T1
Dup2 = D6 T1

Exceeds Fish and Water Ingestion criterion for Human Carcinogens (0.000064 ug/L)
Exceeds MCL, SQB or BBSQC

Assessment of Data With 'U' Qualified Values Set To 1/2 MDL

ANALYTE	UNITS	BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-0320	BWR-DAM7-T1-0320	BWR-DAM7-T2-0320	BWR-DAM7-T3-0320	BWR-DAM8-T1-0320	BWR-DAM8-T2-0320	BWR-DAM11-T1-0320	BWR-DAM11-T2-0320	BWR-DUP1-0320	BWR-FIELDBLANK-0320_SOLID	BWR-DAM6-T1-0620	BWR-DAM6-T2-0620	BWR-DAM6-T3-0620	BWR-DAM9-T1-0620	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DUP2-0620
Total PCB	ug/Kg	11.74	11.575	11.345	80.95	13.09	15.8	10.915	11.905	12.02	12.085	10.555	14.05	15.8	12.98	9.995	10.335	7.135	17.83	12.02	13.09	15.15	21.55	14.05	12.98	13.09
TOC (f_{oc})	kg oc/kg sed	0.01280	0.01510	0.01220	0.0163	0.0259	0.0198	0.0118	0.0121	0.0161	0.0211	0.0211	0.0243	0.0222	0.0196	0.0187	0.019	0.000684	0.0212	0.0178	0.0234	0.0285	0.0346	0.0242	0.00392	0.0209
Total PCB	ug/kg oc	917.19	766.56	929.92	4966.26	505.41	797.98	925.00	983.88	746.58	572.75	500.24	578.19	711.71	662.24	534.49	543.95	10431.29	841.04	675.28	559.40	531.58	622.83	580.58	3311.22	626.32
Total PCB	ug/g oc	0.92	0.77	0.93	4.97	0.51	0.80	0.93	0.98	0.75	0.57	0.50	0.58	0.71	0.66	0.53	0.54	10.43	0.84	0.68	0.56	0.53	0.62	0.58	3.31	0.63

Octanol-Water Partition Coefficient

		log K_{ow}	$K_{ow/oc}$	
Log K_{ow}	L/Kg	6.3	1995262.315	Greene, 2010

$K_{oc} = K_d/F_{oc}$

therefore: $K_d = K_{oc} * F_{oc}$ where $K_{oc} = K_{ow}$

$K_d = C_{sed}/C_{diss}$

therefore: $C_{diss} = C_{sed}/K_d$

Calculation of Dissolved Porewater Concentration

	BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-0320	BWR-DAM7-T1-0320	BWR-DAM7-T2-0320	BWR-DAM7-T3-0320	BWR-DAM8-T1-0320	BWR-DAM8-T2-0320	BWR-DAM11-T1-0320	BWR-DAM11-T2-0320	BWR-DUP1-0320	BWR-FIELDBLANK-0320_SOLID	BWR-DAM6-T1-0620	BWR-DAM6-T2-0620	BWR-DAM6-T3-0620	BWR-DAM9-T1-0620	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DUP2-0620
Dissolved Porewater Concentration (ug/L)	4.60E-04	3.84E-04	4.66E-04	2.49E-03	2.53E-04	4.00E-04	4.64E-04	4.93E-04	3.74E-04	2.87E-04	2.51E-04	2.90E-04	3.57E-04	3.32E-04	2.68E-04	2.73E-04	5.23E-03	4.22E-04	3.38E-04	2.80E-04	2.66E-04	3.12E-04	2.91E-04	1.66E-03	3.14E-04

Avg Porewater Conc. = 0.000506207
Median Porewater Conc. = 0.000347571

Delaware Organic Carbon Normalized Sediment Quality Benchmark (SQB) to Protect Aquatic Life from PCBs

SQB (ug PCB/g o.c.) = CCC (ug/L) x K_{oc} (L/kg) x (1 kg/1000 g), where:

CCC Freshwater = 0.014 ug/L DNREC, 2011

	BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-0320	BWR-DAM7-T1-0320	BWR-DAM7-T2-0320	BWR-DAM7-T3-0320	BWR-DAM8-T1-0320	BWR-DAM8-T2-0320	BWR-DAM11-T1-0320	BWR-DAM11-T2-0320	BWR-DUP1-0320	BWR-FIELDBLANK-0320_SOLID	BWR-DAM6-T1-0620	BWR-DAM6-T2-0620	BWR-DAM6-T3-0620	BWR-DAM9-T1-0620	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DUP2-0620
SQB Freshwater (ug PCB/g oc)	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93

Comparison of SQB to Measured Total PCB

	BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-0320	BWR-DAM7-T1-0320	BWR-DAM7-T2-0320	BWR-DAM7-T3-0320	BWR-DAM8-T1-0320	BWR-DAM8-T2-0320	BWR-DAM11-T1-0320	BWR-DAM11-T2-0320	BWR-DUP1-0320	BWR-FIELDBLANK-0320_SOLID	BWR-DAM6-T1-0620	BWR-DAM6-T2-0620	BWR-DAM6-T3-0620	BWR-DAM9-T1-0620	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DUP2-0620
Measured Total PCB (ug PCB/g oc)	0.92	0.77	0.93	4.97	0.51	0.80	0.93	0.98	0.75	0.57	0.50	0.58	0.71	0.66	0.53	0.54	10.43	0.84	0.68	0.56	0.53	0.62	0.58	3.31	0.63
Ratio Measured PCB to SQB Freshwater	0.03	0.03	0.03	0.18	0.02	0.03	0.03	0.04	0.03	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.37	0.03	0.02	0.02	0.02	0.02	0.02	0.12	0.02

PCB Bioaccumulation-Based Sediment Quality Criterion (BBSQC) for Human Health Protection

BBSQG = 33.2 ug/Kg Greene, 1997 (avg. TOC used in calculation 2.5%)

Comparison of BBSQG to Measured Total PCB

	BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-0320	BWR-DAM7-T1-0320	BWR-DAM7-T2-0320	BWR-DAM7-T3-0320	BWR-DAM8-T1-0320	BWR-DAM8-T2-0320	BWR-DAM11-T1-0320	BWR-DAM11-T2-0320	BWR-DUP1-0320	BWR-FIELDBLANK-0320_SOLID	BWR-DAM6-T1-0620	BWR-DAM6-T2-0620	BWR-DAM6-T3-0620	BWR-DAM9-T1-0620	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DUP2-0620
Measured Total PCB (ug/Kg)	11.74	11.58	11.35	80.95	13.09	15.80	10.92	11.91	12.02	12.09	10.56	14.05	15.80	12.98	10.00	10.34	7.14	17.83	12.02	13.09	15.15	21.55	14.05	12.98	13.09
Ratio Measured PCB to BBSQG	0.35	0.35	0.34	2.44	0.39	0.48	0.33	0.36	0.36	0.36	0.32	0.42	0.48	0.39	0.30	0.31	0.21	0.54	0.36	0.39	0.46	0.65	0.42	0.39	0.39

Dup1 = D11 T1
Dup2 = D6 T1

Exceeds Fish and Water Ingestion criterion for Human Carcinogens (0.000064 ug/L)
Exceeds MCL, SQB or BBSQC

Assessment of Data With 'U' Qualified Values Set To MDL

ANALYTE	UNITS	BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-0320	BWR-DAM7-T1-0320	BWR-DAM7-T2-0320	BWR-DAM7-T3-0320	BWR-DAM8-T1-0320
Total PCB	ug/Kg	23.48	23.15	22.69	92.9	26.18	31.6	21.83	23.81	24.04	24.17	21.11	28.1
TOC (f_{oc})	kg oc/kg sed	0.01280	0.01510	0.01220	0.0163	0.0259	0.0198	0.0118	0.0121	0.0161	0.0211	0.0211	0.0243
Total PCB	ug/kg oc	1834.38	1533.11	1859.84	5699.39	1010.81	1595.96	1850.00	1967.77	1493.17	1145.50	1000.47	1156.38
Total PCB	ug/g oc	1.83	1.53	1.86	5.70	1.01	1.60	1.85	1.97	1.49	1.15	1.00	1.16

ANALYTE	UNITS	BWR-DAM8-T2-0320	BWR-DAM11-T1-0320	BWR-DAM11-T2-0320	BWR-DUP1-0320	BWR-FIELDBLANK-0320_SOLID	BWR-DAM6-T1-0620	BWR-DAM6-T2-0620	BWR-DAM6-T3-0620	BWR-DAM9-T1-0620	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DUP2-0620
Total PCB	ug/Kg	25.96	25.96	19.99	20.67	14.27	35.66	24.04	26.18	26.18	43.1	28.1	25.96	26.18
TOC (f_{oc})	kg oc/kg sed	0.0222	0.0196	0.0187	0.019	0.000684	0.0212	0.0178	0.0234	0.0285	0.0346	0.0242	0.00392	0.0209
Total PCB	ug/kg oc	1169.37	1324.49	1068.98	1087.89	20862.57	1682.08	1350.56	1118.80	918.60	1245.66	1161.16	6622.45	1252.63
Total PCB	ug/g oc	1.17	1.32	1.07	1.09	20.86	1.68	1.35	1.12	0.92	1.25	1.16	6.62	1.25

Octanol-Water Partition Coefficient

		log K_{ow}	$K_{ow/oc}$		therefore:	$K_{oc} = K_d/F_{oc}$	
Log K_{ow}	L/Kg	6.3	1995262.315	Greene, 2010		$K_d = K_{oc} * F_{oc}$	where $K_{oc} = K_{ow}$
						$K_d = C_{sed}/C_{diss}$	
					therefore:	$C_{diss} = C_{sed}/K_d$	

Calculation of Dissolved Porewater Concentration

	BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-0320	BWR-DAM7-T1-0320	BWR-DAM7-T2-0320	BWR-DAM7-T3-0320	BWR-DAM8-T1-0320
Dissolved Porewater Concentration (ug/L)	9.19E-04	7.68E-04	9.32E-04	2.86E-03	5.07E-04	8.00E-04	9.27E-04	9.86E-04	7.48E-04	5.74E-04	5.01E-04	5.80E-04

	BWR-DAM8-T2-0320	BWR-DAM11-T1-0320	BWR-DAM11-T2-0320	BWR-DUP1-0320	BWR-FIELDBLANK-0320_SOLID	BWR-DAM6-T1-0620	BWR-DAM6-T2-0620	BWR-DAM6-T3-0620	BWR-DAM9-T1-0620	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DUP2-0620	
Dissolved Porewater Concentration (ug/L)	5.86E-04	6.64E-04	5.36E-04	5.45E-04	1.05E-02	8.43E-04	6.77E-04	5.61E-04	4.60E-04	6.24E-04	5.82E-04	3.32E-03	6.28E-04	0.000906896

Delaware Organic Carbon Normalized Sediment Quality Benchmark (SQB) to Protect Aquatic Life from PCBs

SQB (ug PCB/g o.c.) = CCC (ug/L) x K_{oc} (L/kg) x (1 kg/1000 g), where:

CCC Freshwater = 0.014 ug/L DNREC, 2011

	BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-0320	BWR-DAM7-T1-0320	BWR-DAM7-T2-0320	BWR-DAM7-T3-0320	BWR-DAM8-T1-0320
SQB Freshwater (ug PCB/g oc)	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93

	BWR-DAM8-T2-0320	BWR-DAM11-T1-0320	BWR-DAM11-T2-0320	BWR-DUP1-0320	BWR-FIELDBLANK-0320_SOLID	BWR-DAM6-T1-0620	BWR-DAM6-T2-0620	BWR-DAM6-T3-0620	BWR-DAM9-T1-0620	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DUP2-0620
SQB Freshwater (ug PCB/g oc)	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93	27.93

Comparison of SQB to Measured Total PCB

	BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-0320	BWR-DAM7-T1-0320	BWR-DAM7-T2-0320	BWR-DAM7-T3-0320	BWR-DAM8-T1-0320
Measured Total PCB (ug PCB/g oc)	1.83	1.53	1.86	5.70	1.01	1.60	1.85	1.97	1.49	1.15	1.00	1.16
Ratio Measured PCB to SQB Freshwater	0.07	0.05	0.07	0.20	0.04	0.06	0.07	0.07	0.05	0.04	0.04	0.04

	BWR-DAM8-T2-0320	BWR-DAM11-T1-0320	BWR-DAM11-T2-0320	BWR-DUP1-0320	BWR-FIELDBLANK-0320_SOLID	BWR-DAM6-T1-0620	BWR-DAM6-T2-0620	BWR-DAM6-T3-0620	BWR-DAM9-T1-0620	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DUP2-0620
Measured Total PCB (ug PCB/g oc)	1.17	1.32	1.07	1.09	20.86	1.68	1.35	1.12	0.92	1.25	1.16	6.62	1.25
Ratio Measured PCB to SQB Freshwater	0.04	0.05	0.04	0.04	0.75	0.06	0.05	0.04	0.03	0.04	0.04	0.24	0.04

PCB Bioaccumulation-Based Sediment Quality Guideline (BBSQG) for Human Health Protection

BBSQG = 33.2 ug/Kg Greene, 1997 (avg. TOC used in calculation 2.5%)

Comparison of BBSQG to Measured Total PCB

	BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-0320	BWR-DAM7-T1-0320	BWR-DAM7-T2-0320	BWR-DAM7-T3-0320	BWR-DAM8-T1-0320
Measured Total PCB (ug/Kg)	23.48	23.15	22.69	92.90	26.18	31.60	21.83	23.81	24.04	24.17	21.11	28.10
Ratio Measured PCB to BBSQG	0.71	0.70	0.68	2.80	0.79	0.95	0.66	0.72	0.72	0.73	0.64	0.85

	BWR-DAM8-T2-0320	BWR-DAM11-T1-0320	BWR-DAM11-T2-0320	BWR-DUP1-0320	BWR-FIELDBLANK-0320_SOLID	BWR-DAM6-T1-0620	BWR-DAM6-T2-0620	BWR-DAM6-T3-0620	BWR-DAM9-T1-0620	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DUP2-0620
Measured Total PCB (ug/Kg)	25.96	25.96	19.99	20.67	14.27	35.66	24.04	26.18	26.18	43.10	28.10	25.96	26.18
Ratio Measured PCB to BBSQG	0.78	0.78	0.60	0.62	0.43	1.07	0.72	0.79	0.79	1.30	0.85	0.78	0.79

Dup1 = D11 T1
Dup2 = D6 T1

Exceeds Fish and Water Ingestion criterion for Human Carcinogens (0.000064 ug/L)
Exceeds MCL, SQB or BBSQC

References

DiToro D, et.al. 1991. Technical basis for establishing sediment quality criteria for nonionic organic chemicals using equilibrium partitioning. Environ Tox Chem 10: 1541-1583.

DNREC. 2004. State of Delaware Surface Water Quality Standards as Amended July 11, 2004. Delaware Department of Natural Resources and Environmental Control, Division of Water Resources, Watershed Assessment Branch, Dover, DE.

DNREC. 2013. Department of Natural Resources and Environmental Control, Division of Waste and Hazardous Substances, Remediation Section, HSCA Screening Level Table, Last updated February 2020. New Castle, DE.

Field, LJ, DD MacDonald, SB Norton, CG Ingersoll, CG Severn, D Smorong, and R Lindskoog. 2002. Predicting amphipod toxicity from sediment chemistry using logistic regression models. Environ Tox Chem 21(9): 1993-2005.

Fuchsman, TR Barber, JC Lawton, and KB Leigh. 2006. An evaluation of cause-effect relationships between polychlorinated biphenyl concentrations and sediment toxicity to benthic invertebrates. Environ Tox Chem 25(10): 2601-2612.

Greene, R. 1997. Bioaccumulation-based Sediment Quality Criteria for the Protection of Human Health. Delaware Department of Natural Resources and Environmental Control, Division of Water Resources, Watershed Assessment Branch, Dover, DE.

Greene, 2010. Assessment of PCBs in Sediments of the Delaware Estuary. Spreadsheet analysis. Delaware Department of Natural Resources and Environmental Control, Division of Water Resources, Watershed Assessment Branch, Dover, DE.

Long, ER, DD MacDonald, SL Smith, and FD Calder. 1995. Incidence of adverse biological effects within ranges of chemical concentrations in marine and estuarine sediments. Environ Manag 19(1): 81-97.

MacDonald, DD, LM DiPinto, J Field, CG Ingersoll, ER Long, and RC Swartz. 2000. Development and evaluation of consensus-based sediment effect concnetrations for polychlorinated biphenyls. Environ Tox Chem 19(5): 1403-1413.

Evaluation of Dioxins/Furans in Brandywine River Sediment Samples
Prepared by: John Cargill & Dannielle Pratt, DE DNREC
October 22, 2020

Data Assessment Methods:

The approach used to assess potential toxicity to benthic organisms was to first calculate toxicity equivalents (TEQs) for each sample by multiplying the concentration of each dioxin and furan compound by its associated toxicity equivalence factor (Van den Berg, et.al., 2006). Insight into the nature and source of the dioxins and furans in each sample was deduced by calculating the weight percent contribution of each dioxin and furan compound to the total. Based on mass conservation, the sum of the weight fractions must equal 1. Knowing the relative contribution of each compound in a sample is important because it provides a type of chemical fingerprint. This, in concert with other information, may in turn provide clues regarding potential sources, especially when the fingerprint is unusual or unique in some way. This fingerprinting technique was also extended to TEQs, where the fractional contribution of each dioxin and furan compound to the total TEQ in each sample was calculated and plotted.

Equilibrium partitioning (EqP) calculations were performed to assess potential toxicity to benthic organisms. The overall approach mirrors the method recommended by Fuchsman et al. (2006). That method was developed for PCBs but was adapted here for dioxins and furans. The idea is to use EqP to predict an organic carbon normalized sediment concentration in equilibrium with a porewater concentration set equal to the applicable aquatic life protection criterion. The resulting sediment quality criterion (here termed a Sediment Quality Benchmark, or SQB) is then compared to actual organic normalized field data for the contaminant of interest. The comparison is expressed as the ratio of the field data to the criterion, where the ratio for acute effects is referred to as acute toxic units or $T.U._a$ for short and the ratio for chronic effects is referred to as chronic toxic units or simply $T.U._c$. $T.U._a$ and $T.U._c$ values greater than 1 indicate that the predicted exposure concentration exceeds the acute and chronic criteria, respectively. In usual circumstances, acute and chronic aquatic life criteria would be taken from Delaware's Surface Water Quality Standards (DNREC, 2004) or from EPA's recommended water quality criteria (EPA, 2002). Aquatic life criteria for dioxins and furans do not exist in either of those documents. However, a close examination of EPA's Ambient Water Quality Criteria for 2,3,7,8-tetrachloro-dibenzo-p-dioxin (EPA, 1984) indicates that acute values for some freshwater aquatic species are >1.0 ug/L; some chronic values are <0.01 ug/L; and the chronic value for rainbow trout is <0.001 ug/L. Although this information was insufficient to allow EPA to develop national criteria, it does provide a rough estimate of the aquatic toxicity of the specific compound 2,3,7,8-TCDD. To that end, this analysis assumes that the acute toxicity of 2,3,7,8-TCDD to aquatic life may occur at exposure concentrations of 1 ug/L, while chronic toxicity may occur at an exposure concentration of 0.001 ug/L. Full details of the approach used to evaluate the potential aquatic life impacts associated with 2,3,7,8-TCDD in the Brandywine River sediments can be found on the tab 'Sed Aquatic Tox 'Calcs'.

Another part of the assessment involved evaluating the potential for certain dioxins in the sediments to bioaccumulate in the aquatic food chain & contribute to fish contamination in the Brandywine River. The approach involved comparing organic carbon normalized dioxin concentrations in the sediments to a bioaccumulation-based sediment quality benchmark (BBSQB) back calculated from an acceptable fish tissue concentration and a site specific biota to sediment accumulation factor (BSAF). Again, the results are expressed as a ratio of the field concentration to the benchmark with ratios greater than 1 indicating an increased likelihood of bioaccumulation in fish along with an increased risk to consumers of those fish.

Next, porewater concentrations were estimated for certain dioxins (the same as assessed for bioaccumulation risk) for comparison to Delaware human health water quality criteria for fish and water ingestion, since the Brandywine River is also used as a drinking water source for the City of Wilmington. Since the criterion is expressed as TEQ's, the estimated porewater concentrations calculated were multiplied by their respective TEFs, then summed, prior to comparison to the criterion.

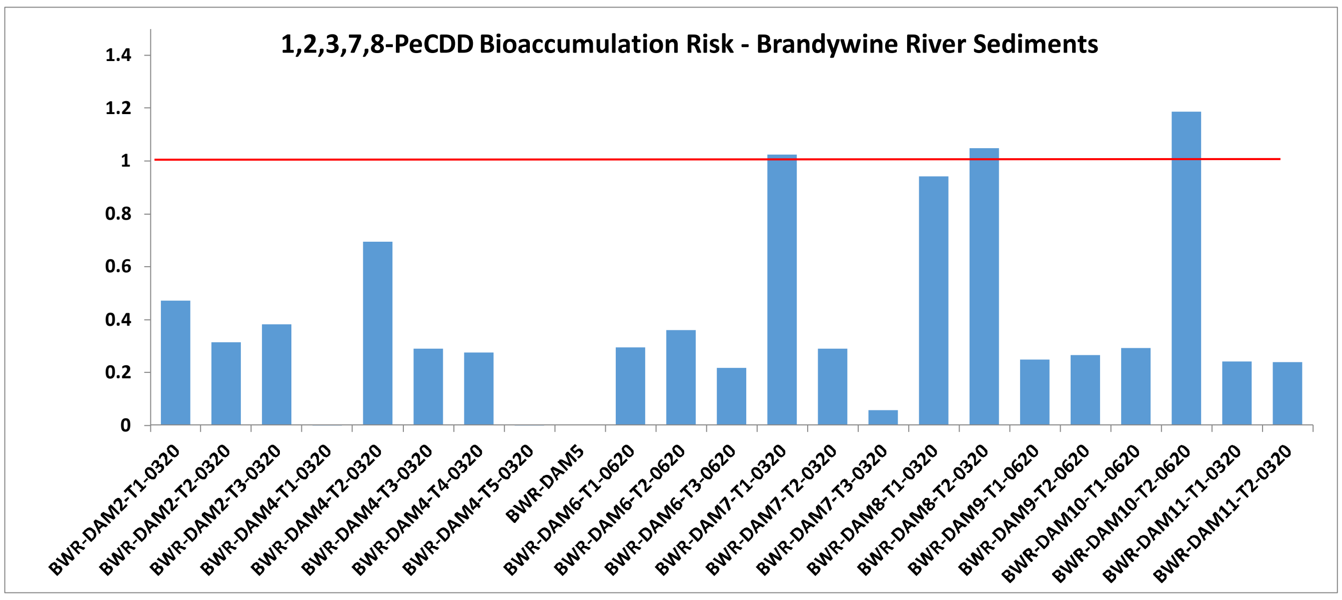
Last, bulk sediment concentrations were directly compared to DNREC RS Soil Screening Values to determine whether risk was likely from any potential excavation and upland disposal of sediments.

Results:

1. Chemical fingerprinting indicates a highly similar profile at all 22 sediment sampling sites in the Brandywine River, with OCDD dominating the dioxin and furan mass present in the samples (contributing between 78.3% and 97.7% of the dioxin and furan mass). A similar compound, 1,2,3,4,6,7,8-HpCDD, was second most abundant, contributing between 1.2% to 2.8% of the dioxin and furan mass. The dominance of OCDD in aquatic sediments of BWR is not unusual or unique compared to findings elsewhere, for instance the Great Lakes (Hites, 1990), the lower Passaic River and Newark Bay (Wenning et.al., 1993), and the Willamette Basin in Oregon (Bonn, 1998). Furthermore, the results for BWC are quite similar to the broader Christina Basin and Shellpot Creek in which OCDD was found to contribute an average of 94% (S.E. = 0.9%) of the dioxin and furan mass in surface sediments and 1,2,3,4,6,7,8-HpCDD contributed an average of 2.9% (S.E. = 0.3%) of the mass (Greene, 2009a). As an aside, OCDD also dominates the dioxin and furan mass in surface water, and to a lesser degree, biota samples collected from the Christina and Shellpot (Greene, 2009a). This common fingerprint across a fairly large area indicates a similar pathway through which OCDD enters the aquatic environment, including the BWR. It is suggested here that the primary pathway may be wet and dry deposition of fine particulate matter in the atmosphere that contains sorbed OCDD. In other words, air deposition may be the primary source. For this to be true, there must be sources of OCDD to the air to begin with. Alternatively or in addition, other compounds present in the atmosphere may be converted to OCDD, which then reaches the surface during wet and dry deposition. Based upon over 2 decades of research, it is known that OCDDs (and other dioxin and furan compounds) are released to the atmosphere from stationary and mobile sources. Among the noteworthy sources with a dominant OCDD fingerprint are: diesel truck exhaust; automobiles that burn unleaded gasoline; coal and oil-fired electrical generating facilities; industrial wood-fired boilers; municipal waste combusters; portland cement kilns; crematoria and forest fires (EPA, 2006). Recent work also indicates that OCDD is the dominant 2,3,7,8-substituted dioxin and furan compound in stack gases from the coking industry (Liu et.al., 2009). In addition to these direct sources to the atmosphere, Baker and Hites (2000) suggested that OCDD is produced in large quantities in the atmosphere through the photochemical reaction of pentachlorophenol (PCP). Although most uses of PCP have been banned in the U.S., it continues to be used to treat telephone poles and railroad ties. Because PCP has a fairly high vapor pressure, volatilization from preserved wood is likely. This provides an ongoing precursor for possible OCDD formation in the atmosphere. In addition to these direct and indirect sources of OCDD to the atmosphere (which later find their way to the land and water), it was also recently reported that OCDD is a dominant dioxin and furan compound in several current use and obsolete/banned pesticides (Holt, et.al, 2010). Hence, to the extent that OCDD may be present in current use pesticides (e.g., 2,4,-D) as well as in pesticides that have been banned but that continue to linger in the environment (e.g., Chlordane), then OCDD may have entered and continue to enter the surface water environment through pesticide usage. Although we cannot discount this possibility, it is far more likely that the number and variety of combustion sources mentioned above largely serve to explain the ubiquitous OCDD signature in the BWR sediments and beyond. We can take some comfort in knowing that the overall emissions of dioxins and furans (including OCDD) appear to be declining over time in the U.S. (EPA, 2006) and abroad (Alcock and Jones, 1996; Hites, 2011). This trend also appears to be occurring in the Christina Basin based upon dated sediment cores which show higher dioxin and furan concentrations in the past (Velinsky et.al, 2010). We can also take comfort in knowing that the most abundant dioxin and furan compound in the sediments, OCDD, is the least potent among this class. Consequently, OCDD's contribution to dioxin-like TEQs is much less than its mass contribution to total dioxins and furans. This is demonstrated by comparing the dioxin and furan fingerprint for each sample to its associated TEQ fingerprint (see tab named "Fingerprint Plots"). For example, the maximum contribution of OCDD on a mass basis was 97.71% at Dam 10 Transect 2. On a TEQ basis, OCDD contributed a more modest 38.8% in this same sample.

2. Comparing the bulk sediment concentration of 2,3,7,8-TCDD to DNREC-RS Screening Levels for protection of ecological receptors (taken from EPA Region III BTAG Screening Benchmarks) indicates that one of the 22 sediment samples collected during this study slightly exceeded the criterion (see "Summary Calculations" tab). However, utilizing EqP methods describes above that consider bioavailability of contaminants, the presence of 2,3,7,8-TCDD specifically is not expected to cause acute or chronic aquatic life toxicity to benthic organisms living in and on the Brandywine River sediments (see "Sed Aquatic Tox Calcs" tab).

3. An important pathway for human exposure to dioxin and furan compounds considered in this assessment is uptake by fish from the sediments and then consumption of those fish by recreational anglers. The human health assessment focused on 3 particular dioxin compounds, OCDD and 1,2,3,4,6,7,8-HpCDD since they are the two most dominant dioxin and furan compounds in the Brandywine River sediments, and 1,2,3,7,8- PeCDD since it is generally the most prominent dioxin and furan compound in fish on a TEQ basis (Greene, 2008, 2009c and 2016a). This approach is considered sufficient for this screening level assessment. The assessment for Brandywine River sediments indicates that OCDD and 1,2,3,4,6,7,8-HpCDD transfer from the sediments to the fish and subsequent risk to people who may consume the fish is low and not of major concern. Risk from 1,2,3,7,8-PeCDD is predicted to be slightly greater, however. The organic carbon normalized concentration of 1,2,3,7,8-PeCDD in the sediment is near or slightly greater than criteria calculated to prevent health risk to people who may consume the fish (see plot below) at several locations, specifically at Dam 7 Transect 1, Dam 8 Transects 1 and 2, and Dam 10 Transect 2. This finding is tempered however by the fact that the reported concentration of 1,2,3,7,8-PeCDD at 20 of the 22 sampling sites was "J-qualified", meaning that the concentration fell between the MDL and the PQL and hence the concentration is only an estimate at those stations. Concentrations at the other two sites were "U-qualified," meaning that concentrations were not detected at all. The finding is further tempered by the fact that there's already a fish advisory in place, which includes dioxins and furans, for the non-tidal Brandywine River to deter fish consumption. These issues aside, the presence of 1,2,3,7,8-PeCDD in the sediments of Brandywine River is not the primary driver for fish contamination and human health risk in this system. The primary risk driver is PCBs (Greene 2016a).



4. The human health assessment was expanded to include the potential risk from both consuming fish and drinking water from the Brandywine River. The assessment focused on OCDD, 1,2,3,4,6,7,8-HpCDD and 1,2,3,7,8- PeCDD for the same reasons stated above. Results predict that all 22 sample locations would exceed the surface water criterion criterion of 5.0 E^{-9} micrograms per liter for 2,3,7,8-TCDD (as TEQ). Toxic units ranged from 4.5 at Dam 7 Transect 1 to 91.6 at Dam 4, Transect 1. The conservative assumption that predicted porewater concentrations are in equilibrium with surface water applies, and that chemical concentrations are the same in sediment porwater as they are in overlying surface water applies here. This is highly unlikely. Multiple lines of evidence should be used to assess overall potential for impact, too, in addition to predictions. Looking at filtered surface water data from samples collected in the Brandywine river in 2015, it appears that measured surface water concentrations of dioxins/furans are one to two orders of magnitude less than porewater concentrations predicted in this assessment. This indicates that diffusion from the sediments into the water column is occurring, and therefore dilution from overlying surface water is also occurring. In addition, comparison of predicted porewater concentrations of selected dioxins (as TEQs) to the EPA established drinking water Maximum Contaminant Level for 2,3,7,8 TCDD indicates no exceedances. In fact, predicted concentrations are orders of magnitude less than the drinking water MCL. Therefore the majority of the risk associated with the applicable criterion (and therefore the number of exceedances of the criterion) is largely based upon the potential accumulation of dioxins/furans into the bodies of fish that are subsequently consumed by humans, which has been shown to be relatively low. Understanding that direct measurements are the best way to verify predictions, comparison of dioxin and furan data from the most recent DNREC fish contaminant monitoring program was performed. The most recent data, collected in 2015 for fish in the non-tidal Brandywine River, indicates that dioxins and furans (as TEQs) exceed regulatory thresholds for fish consumption in 2 of 4 samples. Specifically, four composite fish tissue samples were analyzed in 2015 for dioxins/furans, along with other bioaccumulative compounds. Samples locations ranged from between Dam 2 and the state line at Smith Bridge. White sucker and smallmouth bass composite sample results indicated that 2,3,7,8-TCDD TEQs (which incorporate OCDD, 1,2,3,4,6,7,8-HpCDD and 1,2,3,7,8-PeCDD) ranged from 0.15 ppt to 0.71 ppt. The applicable fish tissue screening level is 0.035 ppt.

5. The concentration of total dioxin and furan TEQs in bulk sediment was compared to the DNREC-RS Soil Screening Value (for 2,3,7,8-TCDD) for protection of human health to evaluate whether concentrations of individual compounds in sediment would pose a risk to human health if sediment were dredged/removed, dewatered, and deposited in an upland setting. Total dioxin and furan TEQs ranged from 1.48 parts per trillion (ppt) at Dam 4 Transect 5, to 38.85 ppt at Dam 7 Transect 1. The screening value for 2,3,7,8-TCDD (as TEQs) is 4.8 ppt. Exceedances ranged from 5.05 ppt to 38.85 ppt and occurred at 13 of the 22 sample locations. Since the criteria used for this comparison were developed as screening levels, further evaluation is necessary to determine whether the concentrations represent a risk under HSCA guidelines. Utilizing the maximum concentration detected in any sample, and therefore the most conservative value for assessment of risk, the RAIS online risk calculator indicated that human health risk from contact with sediments is not expected under the "recreator use scenario," "excavation worker use scenario" or "residential use" scenario.

Conclusions:

In summary, dioxins and furans are present in the sediments of the Brandywine River. Of the dioxin and furan compounds present, OCDD dominates on a weight percentage basis, a finding which is consistent with sediments throughout the region and the country. OCDD is primarily derived from combustion sources, which are plentiful both near and far. OCDD can also be produced in the atmosphere when the wood preservative PCP reacts with sunlight. Further, OCDD is also an impurity in certain current use and past use pesticides. Despite the presence of dioxin and furan compounds in the sediments of the Brandywine River, toxicity to benthic aquatic life is not expected, although there is uncertainty in this conclusion since aquatic toxicity information for these compounds is somewhat sparse. Review of TEQ fingerprints shows similar patterns between transect locations and dams, with a few exceptions.

With regard to potential human health impacts, the presence of certain dioxins, specifically 1,2,3,7,8-PeCDD, in the sediments of the Brandywine River poses a slightly elevated risk through the transfer of these chemicals from the sediments to fish and then to people who consume the fish at 3 of the 22 sample locations (transects). This prediction is supported by exceedances of fish tissue screening levels in samples collected from the non-tidal

TestAmerica Laboratories, Inc.
Eurofins TestAmerica, Edison
SUMMARY OF ANALYTICAL RESULTS: 460-205020-1
Job Description: WATAR (DE-1525) BRANDYWINE DAM SEDIMENTS
For:
State of Delaware
391 Lukens Drive
New Castle, Delaware 19720-2774

Client ID		DNREC SIRS	BWR-DAM2-T1-0320			BWR-DAM2-T2-0320			BWR-DAM2-T3-0320			BWR-DAM4-T1-0320			BWR-DAM4-T2-0320			BWR-DAM4-T3-0320		
Lab Sample ID		Screening Levels	460-205020-1			460-205020-2			460-205020-3			460-205020-4			460-205020-5			460-205020-6		
Sampling Date		Soils	03/06/2020 10:30:00			03/05/2020 14:00:00			03/05/2020 15:30:00			03/09/2020 13:55:00			03/09/2020 11:50:00			03/09/2020 12:35:00		
Matrix		Nov 2019	Soil			Soil			Soil			Soil			Soil			Soil		
Dilution Factor			1			1			1			1			1			1		
Unit		pg/g	pg/g			pg/g			pg/g			pg/g			pg/g			pg/g		
	CAS#		Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL
SOIL BY 1613B																				
1,2,3,4,6,7,8-HpCDD	35822-46-9	NA	157	B	4.96	67.6	B	4.88	87.5	B	4.91	157	B	5.36	203	B	4.83	84.8	B	5.32
1,2,3,4,6,7,8-HpCDF	67562-39-4	NA	58.9	B	4.96	27.5	B	4.88	25.0	B	4.91	195	B	5.36	164	B	4.83	24.7	B	5.32
1,2,3,4,7,8,9-HpCDF	55673-89-7	NA	1.99	J Z B	4.96	2.57	J B	4.88	1.95	J B	4.91	5.04	J B	5.36	6.10	B	4.83	0.80	J B	5.32
1,2,3,4,7,8-HxCDD	39227-28-6	NA	1.52	J	4.96	1.07	J	4.88	1.08	J	4.91	2.59	J	5.36	2.97	J	4.83	1.17	J	5.32
1,2,3,4,7,8-HxCDF	70648-26-9	NA	3.53	J B	4.96	4.10	J B	4.88	10.3	B	4.91	57.0	B	5.36	10.7	B	4.83	2.38	J B	5.32
1,2,3,6,7,8-HxCDD	57653-85-7	NA	5.22	B	4.96	1.98	J B	4.88	2.38	J B	4.91	4.71	J B	5.36	7.05	B	4.83	2.74	J B	5.32
1,2,3,6,7,8-HxCDF	57117-44-9	NA	4.46	J	4.96	2.27	J	4.88	3.65	J	4.91	17.2		5.36	7.38		4.83	2.15	J	5.32
1,2,3,7,8,9-HxCDD	19408-74-3	NA	5.42	B	4.96	2.97	J B	4.88	3.09	J B	4.91	6.17	B	5.36	8.47	B	4.83	3.44	J B	5.32
1,2,3,7,8,9-HxCDF	72918-21-9	NA	0.058	U	4.96	0.18	U	4.88	0.40	J B	4.91	0.12	U	5.36	0.64	U	4.83	0.053	U	5.32
1,2,3,7,8-PeCDD	40321-76-4	NA	0.65	J Z B	4.96	0.51	J Z B	4.88	0.50	J Z B	4.91	2.96	U	5.36	1.93	J Z B	4.83	0.62	J B Z	5.32
1,2,3,7,8-PeCDF	57117-41-6	NA	0.91	J B	4.96	0.65	J Z B	4.88	14.3	B	4.91	2.41	J B	5.36	2.67	J B	4.83	0.53	J B	5.32
2,3,4,6,7,8-HxCDF	60851-34-5	NA	1.02	J B	4.96	1.01	J B	4.88	1.26	J B	4.91	2.82	J B	5.36	2.54	J B	4.83	0.88	J B	5.32
2,3,4,7,8-PeCDF	57117-31-4	NA	1.01	J B	4.96	0.99	J B	4.88	12.7	B	4.91	5.67	B	5.36	2.11	J B	4.83	0.81	J B	5.32
2,3,7,8-TCDD	1746-01-6	NA	0.30	J Z	0.99	0.092	J Z	0.98	0.21	J	0.98	0.33	U	1.07	0.56	J	0.97	0.24	J	1.06
2,3,7,8-TCDF	51207-31-9	NA	2.10		0.99	0.76	J Z	0.98	101		0.98	1.70	Z	1.07	4.36		0.97	1.20		1.06
OCDD	3268-87-9	NA	5920	E B	9.92	3470	B	9.76	4370	E B	9.82	6660	E B	10.7	10900	E B	9.66	3750	B	10.6
OCDF	39001-02-0	NA	79.1	B	9.92	87.8	B	9.76	35.2	B	9.82	241	B	10.7	216	B	9.66	38.0	B	10.6

Client ID	BWR-DAM4-T4-0320			BWR-DAM4-T5-0320			WR-FIELDBLANK-0320_SOLID			BWR-DAM7-T1-0320			BWR-DAM7-T2-0320			BWR-DAM7-T3-0320		
Lab Sample ID	460-205020-7			460-205020-8			460-205020-9			460-205020-11			460-205020-12			460-205020-13		
Sampling Date	03/09/2020 12:55:00			03/09/2020 13:15:00			03/12/2020 12:50:00			03/10/2020 13:15:00			03/10/2020 11:30:00			03/10/2020 12:10:00		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil		
Dilution Factor	1			1			1			5			1			1		
Unit	pg/g			pg/g			pg/g			pg/g			pg/g			pg/g		
	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL
SOIL BY 1613B																		
1,2,3,4,6,7,8-HpCDD	49.4	B	4.95	31.3	B	4.85	1.57	J B	4.93	354	B	24.1	213	B	4.82	20.9	B	4.88
1,2,3,4,6,7,8-HpCDF	12.6	B	4.95	8.72	B	4.85	0.050	J B Z	4.93	1720	B	24.1	120	B	4.82	2.86	J B	4.88
1,2,3,4,7,8,9-HpCDF	0.47	J Z B	4.95	0.29	J B	4.85	0.034	J B Z	4.93	4.99	U	24.1	1.23	J B	4.82	0.11	J Z B	4.88
1,2,3,4,7,8-HxCDD	0.68	J	4.95	0.34	J Z	4.85	0.081	J Z	4.93	4.52	J	24.1	1.76	J	4.82	0.24	J Z	4.88
1,2,3,4,7,8-HxCDF	1.49	J B	4.95	1.18	J B	4.85	0.010	U	4.93	19.8	J B	24.1	3.29	J B	4.82	0.20	J B	4.88
1,2,3,6,7,8-HxCDD	1.51	J B	4.95	1.05	J B	4.85	0.048	J B Z	4.93	18.6	J B	24.1	4.50	J Z B	4.82	0.53	J Z B	4.88
1,2,3,6,7,8-HxCDF	1.35	J	4.95	0.96	J	4.85	0.010	U	4.93	39.0		24.1	3.92	J	4.82	0.24	J	4.88
1,2,3,7,8,9-HxCDD	1.99	J B	4.95	1.33	J B	4.85	0.18	J B Z	4.93	9.89	J B	24.1	5.76	B	4.82	1.02	J B	4.88
1,2,3,7,8,9-HxCDF	0.052	U	4.95	0.033	U	4.85	0.013	U	4.93	2.11	U	24.1	0.27	U	4.82	0.029	U	4.88
1,2,3,7,8-PeCDD	0.35	J Z B	4.95	0.23	U	4.85	0.050	J B	4.93	1.77	J Z B	24.1	0.66	J Z B	4.82	0.13	J B	4.88
1,2,3,7,8-PeCDF	0.35	J B	4.95	0.25	J B	4.85	0.016	U	4.93	3.11	J B	24.1	2.38	J B	4.82	0.11	J Z B	4.88
2,3,4,6,7,8-HxCDF	0.61	J B	4.95	0.34	J B Z	4.85	0.020	J B Z	4.93	13.2	J B	24.1	1.11	J B	4.82	0.095	J Z B	4.88
2,3,4,7,8-PeCDF	0.63	J Z B	4.95	0.38	J B	4.85	0.014	U	4.93	6.23	J Z B	24.1	2.27	J B	4.82	0.11	J Z B	4.88
2,3,7,8-TCDD	0.15	J	0.99	0.041	J Z	0.97	0.0087	U	0.99	0.11	J Z	4.81	0.11	J Z	0.96	0.039	J Z	0.98
2,3,7,8-TCDF	0.70	J Z	0.99	0.70	J	0.97	0.0088	U	0.99	3.88	J	4.81	8.88		0.96	0.43	J	0.98
OCDD	2170	B	9.89	1070	B	9.71	43.9	B	9.86	10600	B	48.1	9500	E B	9.64	935	B	9.76
OCDF	22.9	B	9.89	16.0	B	9.71	0.098	J B Z	9.86	653	B	48.1	51.2	B	9.64	3.91	J B	9.76

Client ID	BWR-DAM8-T1-0320			BWR-DAM8-T2-0320			BWR-DAM11-T1-0320			BWR-DAM11-T2-0320			BWR-DUP1-0320		
Lab Sample ID	460-205020-14			460-205020-15			460-205020-16			460-205020-17			460-205020-18		
Sampling Date	03/11/2020 12:15:00			03/11/2020 11:45:00			03/12/2020 12:10:00			03/12/2020 11:20:00			03/12/2020 00:00:00		
Matrix	Soil			Soil			Soil			Soil			Soil		
Dilution Factor	1			1			2			1			1		
Unit	pg/g			pg/g			pg/g			pg/g			pg/g		
	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL
SOIL BY 1613B															
1,2,3,4,6,7,8-HpCDD	350	B	4.85	309	B	4.97	114	B	9.53	239	B	4.88	144	B	4.80
1,2,3,4,6,7,8-HpCDF	86.6	B	4.85	176	B	4.97	19.7	B	9.53	0.64	J B Z	4.88	0.97	J B	4.80
1,2,3,4,7,8,9-HpCDF	2.82	J B	4.85	3.42	J B	4.97	0.78	J Z B	9.53	0.051	U	4.88	0.12	J B	4.80
1,2,3,4,7,8-HxCDD	5.05		4.85	4.79	J	4.97	1.34	J Z	9.53	1.44	J	4.88	0.74	J Z	4.80
1,2,3,4,7,8-HxCDF	10.5	B	4.85	5.93	B	4.97	1.64	J B	9.53	0.071	J B Z	4.88	0.12	J B Z	4.80
1,2,3,6,7,8-HxCDD	11.3	B	4.85	12.3	B	4.97	2.85	J B	9.53	4.28	J B	4.88	2.67	J B	4.80
1,2,3,6,7,8-HxCDF	4.26	J	4.85	8.55		4.97	1.47	J Z	9.53	0.12	J Z	4.88	0.17	J	4.80
1,2,3,7,8,9-HxCDD	13.6	B	4.85	12.7	B	4.97	3.33	J B	9.53	4.99	B	4.88	3.35	J B	4.80
1,2,3,7,8,9-HxCDF	0.14	U	4.85	0.15	U	4.97	0.15	U	9.53	0.023	U	4.88	0.031	U	4.80
1,2,3,7,8-PeCDD	2.46	J Z B	4.85	2.50	J Z B	4.97	0.51	J Z B	9.53	0.48	J B	4.88	0.31	J B Z	4.80
1,2,3,7,8-PeCDF	4.30	J B	4.85	3.01	J B	4.97	0.36	J Z B	9.53	0.025	J B Z	4.88	0.090	J B Z	4.80
2,3,4,6,7,8-HxCDF	2.47	J B	4.85	2.73	J B	4.97	0.66	J B	9.53	0.021	U	4.88	0.067	J B Z	4.80
2,3,4,7,8-PeCDF	4.03	J B	4.85	3.01	J B	4.97	0.51	J Z B	9.53	0.010	U	4.88	0.068	J B	4.80
2,3,7,8-TCDD	1.24		0.97	0.72	J	0.99	0.10	J Z	1.91	0.064	J	0.98	0.019	J Z	0.96
2,3,7,8-TCDF	16.7		0.97	7.84		0.99	1.16	J	1.91	0.052	J	0.98	0.26	J Z	0.96
OCDD	11900	E B	9.71	13000	E B	9.93	5600	B	19.1	10600	E B	9.76	5380	E B	9.61
OCDF	115	B	9.71	120	B	9.93	31.9	B	19.1	1.03	J B	9.76	2.10	J B	9.61

B : Compound was found in the blank and sample.
E : Result exceeded calibration range.
J : Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
U : Indicates the analyte was analyzed for but not detected.
Z : Data contains important qualifier codes see hardcopy report and report narrative for further details.

Client ID		DNREC SIRS	BWR-DAM2-T1-0320			BWR-DAM2-T2-0320			BWR-DAM2-T3-0320			BWR-DAM4-T1-0320			BWR-DAM4-T2-0320			BWR-DAM4-T3-0320			BWR-DAM4-T4-0320			BWR-DAM4-T5-0320		
Lab Sample ID		Screening Levels	460-205020-1			460-205020-2			460-205020-3			460-205020-4			460-205020-5			460-205020-6			460-205020-7			460-205020-8		
Sampling Date		Soils	03/06/2020 10:30:00			03/05/2020 14:00:00			03/05/2020 15:30:00			03/09/2020 13:55:00			03/09/2020 11:50:00			03/09/2020 12:35:00			03/09/2020 12:55:00			03/09/2020 13:15:00		
Matrix		Nov 2019	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY LLOYD KAHN																										
Total Organic Carbon (mg/kg)	7440-44-0	NA	12800		684	15100		684	12200		684	16300		684	25900		684	19800		684	11800		684	12100		684

Client ID	BWR-FIELDBLANK-0320_SOLID			BWR-DAM7-T1-0320			BWR-DAM7-T2-0320			BWR-DAM7-T3-0320			BWR-DAM8-T1-0320			BWR-DAM8-T2-0320			BWR-DAM11-T1-0320			BWR-DAM11-T2-0320			BWR-DUP1-0320		
Lab Sample ID	460-205020-9			460-205020-11			460-205020-12			460-205020-13			460-205020-14			460-205020-15			460-205020-16			460-205020-17			460-205020-18		
Sampling Date	03/12/2020 12:50:00			03/10/2020 13:15:00			03/10/2020 11:30:00			03/10/2020 12:10:00			03/11/2020 12:15:00			03/11/2020 11:45:00			03/12/2020 12:10:00			03/12/2020 11:20:00			03/12/2020 00:00:00		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY LLOYD KAHN																											
Total Organic Carbon (mg/kg)	684	U	684	16100		684	21100		684	4330		684	24300		684	22200		684	19600		684	18700		684	19000	Z	684

TestAmerica Laboratories, Inc.
Eurofins TestAmerica, Edison

Lab Job ID: 460-210989-1
Job Description: WATAR (DE-1525)
For:
State of Delaware
391 Lukens Drive
New Castle, Delaware 19720-2774

Client ID		DNREC SIRS	BWR-DAM6-T1-0620			BWR-DAM6-T2-0620			BWR-DAM6-T3-0620			BWR-DAM9-T1-0620			BWR-DAM9-T2-0620			BWR-DAM10-T1-0620			BWR-DAM10-T2-0620			BWR-DUP2-0620		
Lab Sample ID		Screening Levels	460-210989-1			460-210989-2			460-210989-3			460-210989-4			460-210989-5			460-210989-6			460-210989-7			460-210989-8		
Sampling Date		Soils	06/10/2020 11:15:00			06/10/2020 11:40:00			06/10/2020 12:15:00			06/09/2020 14:15:00			06/09/2020 14:30:00			06/09/2020 11:10:00			06/09/2020 11:35:00			06/10/2020 00:00:00		
Matrix		Feb 2020	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Dilution Factor			1			1			1			1			1			1			1			1		
Unit		pg/g	pg/g			pg/g			pg/g			pg/g			pg/g			pg/g			pg/g			pg/g		
	CAS#		Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL
SOIL BY 1613B																										
1,2,3,4,6,7,8-HpCDD	35822-46-9	NA	89.9		4.52	76.2		4.09	80.9		4.47	103		5.24	134		7.21	156		4.85	73.8		4.52	88.4		4.55
1,2,3,4,6,7,8-HpCDF	67562-39-4	NA	25.9	B	4.52	21.8	B	4.09	24.4	B	4.47	36.4	B	5.24	37.3	B	7.21	53.1	B	4.85	17.0	B	4.52	25.2	B	4.55
1,2,3,4,7,8,9-HpCDF	55673-89-7	NA	1.08	J B	4.52	1.08	J B	4.09	1.00	J B	4.47	1.39	J B	5.24	1.75	J B	7.21	4.77	J B	4.85	0.89	J Z B	4.52	1.08	J B	4.55
1,2,3,4,7,8-HxCDD	39227-28-6	NA	1.29	J	4.52	1.63	J	4.09	1.23	J	4.47	1.46	J	5.24	2.00	J	7.21	1.97	J	4.85	1.10	J	4.52	1.37	J	4.55
1,2,3,4,7,8-HxCDF	70648-26-9	NA	1.89	J	4.52	1.33	J Z	4.09	1.63	J	4.47	2.15	J	5.24	2.75	J	7.21	3.47	J	4.85	1.62	J	4.52	2.02	J	4.55
1,2,3,6,7,8-HxCDD	57653-85-7	NA	2.83	J	4.52	2.55	J	4.09	2.79	J	4.47	3.09	J	5.24	4.21	J	7.21	4.91		4.85	2.09	J	4.52	2.95	J	4.55
1,2,3,6,7,8-HxCDF	57117-44-9	NA	1.21	J	4.52	0.94	J	4.09	1.03	J	4.47	1.26	J	5.24	1.50	J Z	7.21	1.51	J Z	4.85	0.94	J	4.52	1.21	J	4.55
1,2,3,7,8,9-HxCDD	19408-74-3	NA	3.64	J B	4.52	3.39	J B	4.09	3.21	J B	4.47	3.93	J B	5.24	5.19	J B	7.21	4.90	B	4.85	2.99	J B	4.52	3.33	J Z B	4.55
1,2,3,7,8,9-HxCDF	72918-21-9	NA	0.13	U	4.52	0.13	U	4.09	0.15	U	4.47	0.17	U	5.24	0.22	U	7.21	0.44	U	4.85	0.070	U	4.52	0.15	U	4.55
1,2,3,7,8-PeCDD	40321-76-4	NA	0.67	J Z	4.52	0.69	J Z	4.09	0.55	J Z	4.47	0.76	J Z	5.24	0.99	J Z	7.21	0.76	J Z	4.85	0.50	J Z	4.52	0.60	J Z	4.55
1,2,3,7,8-PeCDF	57117-41-6	NA	0.42	J	4.52	0.24	J Z	4.09	0.37	J Z	4.47	0.45	J Z	5.24	0.51	J	7.21	0.58	J Z	4.85	0.32	J Z	4.52	0.45	J	4.55
2,3,4,6,7,8-HxCDF	60851-34-5	NA	0.90	J	4.52	0.75	J	4.09	0.72	J Z	4.47	0.93	J	5.24	1.28	J	7.21	1.33	J	4.85	0.66	J	4.52	0.81	J Z	4.55
2,3,4,7,8-PeCDF	57117-31-4	NA	0.75	J	4.52	0.53	J	4.09	0.60	J	4.47	0.74	J	5.24	0.88	J Z	7.21	0.99	J	4.85	0.60	J	4.52	0.68	J	4.55
2,3,7,8-TCDD	1746-01-6	NA	0.21	J	0.90	0.20	J	0.82	0.15	J Z	0.89	0.16	J	1.05	0.25	J	1.44	0.11	J Z	0.97	0.14	J	0.90	0.11	J Z	0.91
2,3,7,8-TCDF	51207-31-9	NA	0.99		0.90	0.61	J	0.82	0.80	J	0.89	0.89	J	1.05	1.08	J	1.44	0.99		0.97	0.64	J	0.90	0.81	J	0.91
OCDD	3268-87-9	NA	3940	E B	9.04	2920	B	8.18	3680	E B	8.94	4720	E B	10.5	6120	E B	14.4	5590	E B	9.70	5840	E B	9.05	3810	E B	9.11
OCDF	39001-02-0	NA	38.3	B	9.04	47.0	B	8.18	37.7	B	8.94	46.8	B	10.5	56.2	B	14.4	156	B	9.70	33.4	B	9.05	36.4	B	9.11

B : Compound was found in the blank and sample.
E : Result exceeded calibration range.
J : Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
U : Indicates the analyte was analyzed for but not detected.
Z : Data contains important qualifier codes see hardcopy report and report narrative for further details.

Client ID		DNREC SIRS	BWR-DAM6-T1-0620			BWR-DAM6-T2-0620			BWR-DAM6-T3-0620			BWR-DAM9-T1-0620			BWR-DAM9-T2-0620			BWR-DAM10-T1-0620			BWR-DAM10-T2-0620			BWR-DUP2-0620		
Lab Sample ID		Screening Levels	460-210989-1			460-210989-2			460-210989-3			460-210989-4			460-210989-5			460-210989-6			460-210989-7			460-210989-8		
Sampling Date		Soils	06/10/2020 11:15:00			06/10/2020 11:40:00			06/10/2020 12:15:00			06/09/2020 14:15:00			06/09/2020 14:30:00			06/09/2020 11:10:00			06/09/2020 11:35:00			06/10/2020 00:00:00		
Matrix		Feb 2020	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY LLOYD KAHN																										
TOC Result 1 (mg/kg)	STL00338	NA	21200		153	17800		136	23400		150	28500		172	34600		243	24200		159	3920		148	20900		149

Data Re-ordered by Dam #

Client ID	BWR-DAM2-T1-0320			BWR-DAM2-T2-0320			BWR-DAM2-T3-0320			BWR-DAM4-T1-0320			BWR-DAM4-T2-0320		
Lab Sample ID	460-205020-1			460-205020-2			460-205020-3			460-205020-4			460-205020-5		
Sampling Date	03/06/2020 10:30:00			03/05/2020 14:00:00			03/05/2020 15:30:00			03/09/2020 13:55:00			03/09/2020 11:50:00		
Matrix	Soil			Soil			Soil			Soil			Soil		
Dilution Factor	1			1			1			1			1		
Unit	pg/g			pg/g			pg/g			pg/g			pg/g		
	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL
SOIL BY 1613B															
1,2,3,4,6,7,8-HpCDD	157	B	4.96	67.6	B	4.88	87.5	B	4.91	157	B	5.36	203	B	4.83
1,2,3,4,6,7,8-HpCDF	58.9	B	4.96	27.5	B	4.88	25.0	B	4.91	195	B	5.36	164	B	4.83
1,2,3,4,7,8,9-HpCDF	1.99	J Z B	4.96	2.57	J B	4.88	1.95	J B	4.91	5.04	J B	5.36	6.10	B	4.83
1,2,3,4,7,8-HxCDD	1.52	J	4.96	1.07	J	4.88	1.08	J	4.91	2.59	J	5.36	2.97	J	4.83
1,2,3,4,7,8-HxCDF	3.53	J B	4.96	4.10	J B	4.88	10.3	B	4.91	57.0	B	5.36	10.7	B	4.83
1,2,3,6,7,8-HxCDD	5.22	B	4.96	1.98	J B	4.88	2.38	J B	4.91	4.71	J B	5.36	7.05	B	4.83
1,2,3,6,7,8-HxCDF	4.46	J	4.96	2.27	J	4.88	3.65	J	4.91	17.2		5.36	7.38		4.83
1,2,3,7,8,9-HxCDD	5.42	B	4.96	2.97	J B	4.88	3.09	J B	4.91	6.17	B	5.36	8.47	B	4.83
1,2,3,7,8,9-HxCDF	0.058	U	4.96	0.18	U	4.88	0.40	J B	4.91	0.12	U	5.36	0.64	U	4.83
1,2,3,7,8-PeCDD	0.65	J Z B	4.96	0.51	J Z B	4.88	0.50	J Z B	4.91	2.96	U	5.36	1.93	J Z B	4.83
1,2,3,7,8-PeCDF	0.91	J B	4.96	0.65	J Z B	4.88	14.3	B	4.91	2.41	J B	5.36	2.67	J B	4.83
2,3,4,6,7,8-HxCDF	1.02	J B	4.96	1.01	J B	4.88	1.26	J B	4.91	2.82	J B	5.36	2.54	J B	4.83
2,3,4,7,8-PeCDF	1.01	J B	4.96	0.99	J B	4.88	12.7	B	4.91	5.67	B	5.36	2.11	J B	4.83
2,3,7,8-TCDD	0.30	J Z	0.99	0.092	J Z	0.98	0.21	J	0.98	0.33	U	1.07	0.56	J	0.97
2,3,7,8-TCDF	2.10		0.99	0.76	J Z	0.98	101		0.98	1.70	Z	1.07	4.36		0.97
OCDD	5920	E B	9.92	3470	B	9.76	4370	E B	9.82	6660	E B	10.7	10900	E B	9.66
OCDF	79.1	B	9.92	87.8	B	9.76	35.2	B	9.82	241	B	10.7	216	B	9.66

Client ID	BWR-DAM4-T3-0320			BWR-DAM4-T4-0320			BWR-DAM4-T5-0320			BWR-DAM6-T1-0620			BWR-DAM6-T2-0620		
Lab Sample ID	460-205020-6			460-205020-7			460-205020-8			460-210989-1			460-210989-2		
Sampling Date	03/09/2020 12:35:00			03/09/2020 12:55:00			03/09/2020 13:15:00			06/10/2020 11:15:00			06/10/2020 11:40:00		
Matrix	Soil			Soil			Soil			Soil			Soil		
Dilution Factor	1			1			1			1			1		
Unit	pg/g			pg/g			pg/g			pg/g			pg/g		
	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL
SOIL BY 1613B															
1,2,3,4,6,7,8-HpCDD	84.8	B	5.32	49.4	B	4.95	31.3	B	4.85	89.9		4.52	76.2		4.09
1,2,3,4,6,7,8-HpCDF	24.7	B	5.32	12.6	B	4.95	8.72	B	4.85	25.9	B	4.52	21.8	B	4.09
1,2,3,4,7,8,9-HpCDF	0.80	J B	5.32	0.47	J Z B	4.95	0.29	J B	4.85	1.08	J B	4.52	1.08	J B	4.09
1,2,3,4,7,8-HxCDD	1.17	J	5.32	0.68	J	4.95	0.34	J Z	4.85	1.29	J	4.52	1.63	J	4.09
1,2,3,4,7,8-HxCDF	2.38	J B	5.32	1.49	J B	4.95	1.18	J B	4.85	1.89	J	4.52	1.33	J Z	4.09
1,2,3,6,7,8-HxCDD	2.74	J B	5.32	1.51	J B	4.95	1.05	J B	4.85	2.83	J	4.52	2.55	J	4.09
1,2,3,6,7,8-HxCDF	2.15	J	5.32	1.35	J	4.95	0.96	J	4.85	1.21	J	4.52	0.94	J	4.09
1,2,3,7,8,9-HxCDD	3.44	J B	5.32	1.99	J B	4.95	1.33	J B	4.85	3.64	J B	4.52	3.39	J B	4.09
1,2,3,7,8,9-HxCDF	0.053	U	5.32	0.052	U	4.95	0.033	U	4.85	0.13	U	4.52	0.13	U	4.09
1,2,3,7,8-PeCDD	0.62	J B Z	5.32	0.35	J Z B	4.95	0.23	U	4.85	0.67	J Z	4.52	0.69	J Z	4.09
1,2,3,7,8-PeCDF	0.53	J B	5.32	0.35	J B	4.95	0.25	J B	4.85	0.42	J	4.52	0.24	J Z	4.09
2,3,4,6,7,8-HxCDF	0.88	J B	5.32	0.61	J B	4.95	0.34	J B Z	4.85	0.90	J	4.52	0.75	J	4.09
2,3,4,7,8-PeCDF	0.81	J B	5.32	0.63	J Z B	4.95	0.38	J B	4.85	0.75	J	4.52	0.53	J	4.09
2,3,7,8-TCDD	0.24	J	1.06	0.15	J	0.99	0.041	J Z	0.97	0.21	J	0.90	0.20	J	0.82
2,3,7,8-TCDF	1.20		1.06	0.70	J Z	0.99	0.70	J	0.97	0.99		0.90	0.61	J	0.82
OCDD	3750	B	10.6	2170	B	9.89	1070	B	9.71	3940	E B	9.04	2920	B	8.18
OCDF	38.0	B	10.6	22.9	B	9.89	16.0	B	9.71	38.3	B	9.04	47.0	B	8.18

Client ID	BWR-DAM6-T3-0620			BWR-DAM7-T1-0320			BWR-DAM7-T2-0320			BWR-DAM7-T3-0320			BWR-DAM8-T1-0320		
Lab Sample ID	460-210989-3			460-205020-11			460-205020-12			460-205020-13			460-205020-14		
Sampling Date	06/10/2020 12:15:00			03/10/2020 13:15:00			03/10/2020 11:30:00			03/10/2020 12:10:00			03/11/2020 12:15:00		
Matrix	Soil			Soil			Soil			Soil			Soil		
Dilution Factor	1			5			1			1			1		
Unit	pg/g			pg/g			pg/g			pg/g			pg/g		
	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL
SOIL BY 1613B															
1,2,3,4,6,7,8-HpCDD	80.9		4.47	354	B	24.1	213	B	4.82	20.9	B	4.88	350	B	4.85
1,2,3,4,6,7,8-HpCDF	24.4	B	4.47	1720	B	24.1	120	B	4.82	2.86	J B	4.88	86.6	B	4.85
1,2,3,4,7,8,9-HpCDF	1.00	J B	4.47	4.99	U	24.1	1.23	J B	4.82	0.11	J Z B	4.88	2.82	J B	4.85
1,2,3,4,7,8-HxCDD	1.23	J	4.47	4.52	J	24.1	1.76	J	4.82	0.24	J Z	4.88	5.05		4.85
1,2,3,4,7,8-HxCDF	1.63	J	4.47	19.8	J B	24.1	3.29	J B	4.82	0.20	J B	4.88	10.5	B	4.85
1,2,3,6,7,8-HxCDD	2.79	J	4.47	18.6	J B	24.1	4.50	J Z B	4.82	0.53	J Z B	4.88	11.3	B	4.85
1,2,3,6,7,8-HxCDF	1.03	J	4.47	39.0		24.1	3.92	J	4.82	0.24	J	4.88	4.26	J	4.85
1,2,3,7,8,9-HxCDD	3.21	J B	4.47	9.89	J B	24.1	5.76	B	4.82	1.02	J B	4.88	13.6	B	4.85
1,2,3,7,8,9-HxCDF	0.15	U	4.47	2.11	U	24.1	0.27	U	4.82	0.029	U	4.88	0.14	U	4.85
1,2,3,7,8-PeCDD	0.55	J Z	4.47	1.77	J Z B	24.1	0.66	J Z B	4.82	0.13	J B	4.88	2.46	J Z B	4.85
1,2,3,7,8-PeCDF	0.37	J Z	4.47	3.11	J B	24.1	2.38	J B	4.82	0.11	J Z B	4.88	4.30	J B	4.85
2,3,4,6,7,8-HxCDF	0.72	J Z	4.47	13.2	J B	24.1	1.11	J B	4.82	0.095	J Z B	4.88	2.47	J B	4.85
2,3,4,7,8-PeCDF	0.60	J	4.47	6.23	J Z B	24.1	2.27	J B	4.82	0.11	J Z B	4.88	4.03	J B	4.85
2,3,7,8-TCDD	0.15	J Z	0.89	0.11	J Z	4.81	0.11	J Z	0.96	0.039	J Z	0.98	1.24		0.97
2,3,7,8-TCDF	0.80	J	0.89	3.88	J	4.81	8.88		0.96	0.43	J	0.98	16.7		0.97
OCDD	3680	E B	8.94	10600	B	48.1	9500	E B	9.64	935	B	9.76	11900	E B	9.71
OCDF	37.7	B	8.94	653	B	48.1	51.2	B	9.64	3.91	J B	9.76	115	B	9.71

Client ID	BWR-DAM8-T2-0320			BWR-DAM9-T1-0620			BWR-DAM9-T2-0620			BWR-DAM10-T1-0620			BWR-DAM10-T2-0620		
Lab Sample ID	460-205020-15			460-210989-4			460-210989-5			460-210989-6			460-210989-7		
Sampling Date	03/11/2020 11:45:00			06/09/2020 14:15:00			06/09/2020 14:30:00			06/09/2020 11:10:00			06/09/2020 11:35:00		
Matrix	Soil			Soil			Soil			Soil			Soil		
Dilution Factor	1			1			1			1			1		
Unit	pg/g			pg/g			pg/g			pg/g			pg/g		
	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL
SOIL BY 1613B															
1,2,3,4,6,7,8-HpCDD	309	B	4.97	103		5.24	134		7.21	156		4.85	73.8		4.52
1,2,3,4,6,7,8-HpCDF	176	B	4.97	36.4	B	5.24	37.3	B	7.21	53.1	B	4.85	17.0	B	4.52
1,2,3,4,7,8,9-HpCDF	3.42	J B	4.97	1.39	J B	5.24	1.75	J B	7.21	4.77	J B	4.85	0.89	J Z B	4.52
1,2,3,4,7,8-HxCDD	4.79	J	4.97	1.46	J	5.24	2.00	J	7.21	1.97	J	4.85	1.10	J	4.52
1,2,3,4,7,8-HxCDF	5.93	B	4.97	2.15	J	5.24	2.75	J	7.21	3.47	J	4.85	1.62	J	4.52
1,2,3,6,7,8-HxCDD	12.3	B	4.97	3.09	J	5.24	4.21	J	7.21	4.91		4.85	2.09	J	4.52
1,2,3,6,7,8-HxCDF	8.55		4.97	1.26	J	5.24	1.50	J Z	7.21	1.51	J Z	4.85	0.94	J	4.52
1,2,3,7,8,9-HxCDD	12.7	B	4.97	3.93	J B	5.24	5.19	J B	7.21	4.90	B	4.85	2.99	J B	4.52
1,2,3,7,8,9-HxCDF	0.15	U	4.97	0.17	U	5.24	0.22	U	7.21	0.44	U	4.85	0.070	U	4.52
1,2,3,7,8-PeCDD	2.50	J Z B	4.97	0.76	J Z	5.24	0.99	J Z	7.21	0.76	J Z	4.85	0.50	J Z	4.52
1,2,3,7,8-PeCDF	3.01	J B	4.97	0.45	J Z	5.24	0.51	J	7.21	0.58	J Z	4.85	0.32	J Z	4.52
2,3,4,6,7,8-HxCDF	2.73	J B	4.97	0.93	J	5.24	1.28	J	7.21	1.33	J	4.85	0.66	J	4.52
2,3,4,7,8-PeCDF	3.01	J B	4.97	0.74	J	5.24	0.88	J Z	7.21	0.99	J	4.85	0.60	J	4.52
2,3,7,8-TCDD	0.72	J	0.99	0.16	J	1.05	0.25	J	1.44	0.11	J Z	0.97	0.14	J	0.90
2,3,7,8-TCDF	7.84		0.99	0.89	J	1.05	1.08	J	1.44	0.99		0.97	0.64	J	0.90
OCDD	13000	E B	9.93	4720	E B	10.5	6120	E B	14.4	5590	E B	9.70	5840	E B	9.05
OCDF	120	B	9.93	46.8	B	10.5	56.2	B	14.4	156	B	9.70	33.4	B	9.05

							D11T1			D6T1					
Client ID	BWR-DAM11-T1-0320			BWR-DAM11-T2-0320			BWR-DUP1-0320			BWR-DUP2-0620			BWR-FIELDBLANK-0320_SOLID		
Lab Sample ID	460-205020-16			460-205020-17			460-205020-18			460-210989-8			460-205020-9		
Sampling Date	03/12/2020 12:10:00			03/12/2020 11:20:00			03/12/2020 00:00:00			06/10/2020 00:00:00			03/12/2020 12:50:00		
Matrix	Soil			Soil			Soil			Soil			Soil		
Dilution Factor	2			1			1			1			1		
Unit	pg/g			pg/g			pg/g			pg/g			pg/g		
	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL
SOIL BY 1613B															
1,2,3,4,6,7,8-HpCDD	114	B	9.53	239	B	4.88	144	B	4.80	88.4		4.55	1.57	J B	4.93
1,2,3,4,6,7,8-HpCDF	19.7	B	9.53	0.64	J B Z	4.88	0.97	J B	4.80	25.2	B	4.55	0.050	J B Z	4.93
1,2,3,4,7,8,9-HpCDF	0.78	J Z B	9.53	0.051	U	4.88	0.12	J B	4.80	1.08	J B	4.55	0.034	J B Z	4.93
1,2,3,4,7,8-HxCDD	1.34	J Z	9.53	1.44	J	4.88	0.74	J Z	4.80	1.37	J	4.55	0.081	J Z	4.93
1,2,3,4,7,8-HxCDF	1.64	J B	9.53	0.071	J B Z	4.88	0.12	J B Z	4.80	2.02	J	4.55	0.010	U	4.93
1,2,3,6,7,8-HxCDD	2.85	J B	9.53	4.28	J B	4.88	2.67	J B	4.80	2.95	J	4.55	0.048	J B Z	4.93
1,2,3,6,7,8-HxCDF	1.47	J Z	9.53	0.12	J Z	4.88	0.17	J	4.80	1.21	J	4.55	0.010	U	4.93
1,2,3,7,8,9-HxCDD	3.33	J B	9.53	4.99	B	4.88	3.35	J B	4.80	3.33	J Z B	4.55	0.18	J B Z	4.93
1,2,3,7,8,9-HxCDF	0.15	U	9.53	0.023	U	4.88	0.031	U	4.80	0.15	U	4.55	0.013	U	4.93
1,2,3,7,8-PeCDD	0.51	J Z B	9.53	0.48	J B	4.88	0.31	J B Z	4.80	0.60	J Z	4.55	0.050	J B	4.93
1,2,3,7,8-PeCDF	0.36	J Z B	9.53	0.025	J B Z	4.88	0.090	J B Z	4.80	0.45	J	4.55	0.016	U	4.93
2,3,4,6,7,8-HxCDF	0.66	J B	9.53	0.021	U	4.88	0.067	J B Z	4.80	0.81	J Z	4.55	0.020	J B Z	4.93
2,3,4,7,8-PeCDF	0.51	J Z B	9.53	0.010	U	4.88	0.068	J B	4.80	0.68	J	4.55	0.014	U	4.93
2,3,7,8-TCDD	0.10	J Z	1.91	0.064	J	0.98	0.019	J Z	0.96	0.11	J Z	0.91	0.0087	U	0.99
2,3,7,8-TCDF	1.16	J	1.91	0.052	J	0.98	0.26	J Z	0.96	0.81	J	0.91	0.0088	U	0.99
OCDD	5600	B	19.1	10600	E B	9.76	5380	E B	9.61	3810	E B	9.11	43.9	B	9.86
OCDF	31.9	B	19.1	1.03	J B	9.76	2.10	J B	9.61	36.4	B	9.11	0.098	J B Z	9.86

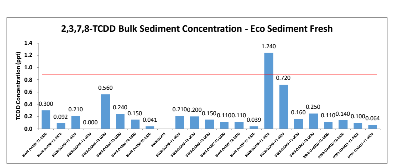
Results with 'U' Qualified Values Set to Zero

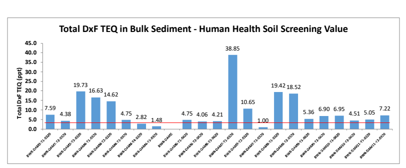
Fingerprints for Dioxin & Furan Compounds (U values set to zero)

TEQ Calculations using WHO 2005 TEFs and ND=0

TEQ Fingerprint for Dioxins and Furans

SAMPLE NAME	2,3,7,8-TCDD (ppt)	Total DxF TEQs (ppt)
BWR-DAM2-T1-0320	0.300	7.59
BWR-DAM2-T2-0320	0.092	4.38
BWR-DAM2-T3-0320	0.210	19.73
BWR-DAM4-T1-0320	0.000	16.63
BWR-DAM4-T2-0320	0.560	14.62
BWR-DAM4-T3-0320	0.240	4.75
BWR-DAM4-T4-0320	0.150	2.82
BWR-DAM4-T5-0320	0.041	1.48
BWR-DAM5		
BWR-DAM6-T1-0620	0.210	4.75
BWR-DAM6-T2-0620	0.200	4.06
BWR-DAM6-T3-0620	0.150	4.21
BWR-DAM7-T1-0320	0.110	38.85
BWR-DAM7-T2-0320	0.110	10.65
BWR-DAM7-T3-0320	0.039	1.00
BWR-DAM8-T1-0320	1.240	19.42
BWR-DAM8-T2-0320	0.720	18.52
BWR-DAM9-T1-0620	0.160	5.36
BWR-DAM9-T2-0620	0.250	6.90
BWR-DAM10-T1-0620	0.110	6.95
BWR-DAM10-T2-0620	0.140	4.51
BWR-DAM11-T1-0320	0.100	5.05
BWR-DAM11-T2-0320	0.064	7.22





2,3,7,8 TCDD - Screening Values	(mg/kg or ppm)	(ug/kg or ppb)	(ng/kg or ppt)
HH - Soil	0.0000048	4.80E-03	4.80E+00
Eco - Surface Soil	0.000003	3.00E-03	3.00E+00
Eco - Sediment Fresh	0.00000085	8.50E-04	8.50E-01

Total DxF TEQs	
Mean	9.521167364
Standard Error	1.871437746
Median	6.13405
Mode	#N/A
Standard Deviation	8.777821096
Sample Variance	77.05014319
Kurtosis	4.916089925
Skewness	2.016122178
Range	37.846027
Minimum	1.001173
Maximum	38.8472
Sum	209.465682
Count	22

0.00

TEQ Calculations using WHO 2005 TEFs and ND=0

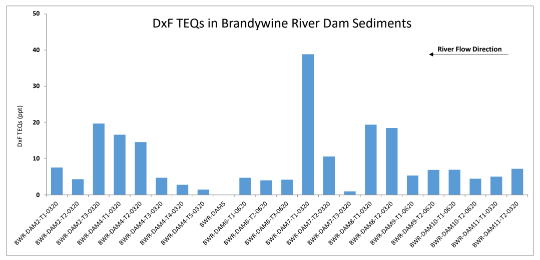
Client ID	BWR-DAM2-T1-0320			BWR-DAM2-T2-0320			BWR-DAM2-T3-0320			BWR-DAM4-T1-0320			BWR-DAM4-T2-0320			BWR-DAM4-T3-0320		
Lab Sample ID	460-205020-1			460-205020-2			460-205020-3			460-205020-4			460-205020-5			460-205020-6		
Sampling Date	03/06/2020 10:30:00			03/05/2020 14:00:00			03/05/2020 15:30:00			03/09/2020 13:55:00			03/09/2020 11:50:00			03/09/2020 12:35:00		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil		
Dilution Factor	1			1			1			1			1			1		
Unit	pg/g			pg/g			pg/g			pg/g			pg/g			pg/g		
	TEF	Result	TEQ (pg/g	TEF	Result	TEQ (pg/g	TEF	Result	TEQ (pg/g)	TEF	Result	TEQ (pg/g)	TEF	Result	TEQ (pg/g)	TEF	Result	TEQ (pg/g)
1,2,3,4,6,7,8-HpCDD	0.01	157	1.57	0.01	67.6	0.676	0.01	87.5	0.875	0.01	157	1.57	0.01	203	2.03	0.01	84.8	0.848
1,2,3,4,6,7,8-HpCDF	0.01	58.9	0.589	0.01	27.5	0.275	0.01	25	0.25	0.01	195	1.95	0.01	164	1.64	0.01	24.7	0.247
1,2,3,4,7,8,9-HpCDF	0.01	1.99	0.0199	0.01	2.57	0.0257	0.01	1.95	0.0195	0.01	5.04	0.0504	0.01	6.1	0.061	0.01	0.8	0.008
1,2,3,4,7,8-HxCDD	0.1	1.52	0.152	0.1	1.07	0.107	0.1	1.08	0.108	0.1	2.59	0.259	0.1	2.97	0.297	0.1	1.17	0.117
1,2,3,4,7,8-HxCDF	0.1	3.53	0.353	0.1	4.1	0.41	0.1	10.3	1.03	0.1	57	5.7	0.1	10.7	1.07	0.1	2.38	0.238
1,2,3,6,7,8-HxCDD	0.1	5.22	0.522	0.1	1.98	0.198	0.1	2.38	0.238	0.1	4.71	0.471	0.1	7.05	0.705	0.1	2.74	0.274
1,2,3,6,7,8-HxCDF	0.1	4.46	0.446	0.1	2.27	0.227	0.1	3.65	0.365	0.1	17.2	1.72	0.1	7.38	0.738	0.1	2.15	0.215
1,2,3,7,8,9-HxCDD	0.1	5.42	0.542	0.1	2.97	0.297	0.1	3.09	0.309	0.1	6.17	0.617	0.1	8.47	0.847	0.1	3.44	0.344
1,2,3,7,8,9-HxCDF	0.1	0	0	0.1	0	0	0.1	0.4	0.04	0.1	0	0	0.1	0	0	0.1	0	0
1,2,3,7,8-PeCDD	1	0.65	0.65	1	0.51	0.51	1	0.5	0.5	1	0	0	1	1.93	1.93	1	0.62	0.62
1,2,3,7,8-PeCDF	0.03	0.91	0.0273	0.03	0.65	0.0195	0.03	14.3	0.429	0.03	2.41	0.0723	0.03	2.67	0.0801	0.03	0.53	0.0159
2,3,4,6,7,8-HxCDF	0.1	1.02	0.102	0.1	1.01	0.101	0.1	1.26	0.126	0.1	2.82	0.282	0.1	2.54	0.254	0.1	0.88	0.088
2,3,4,7,8-PeCDF	0.3	1.01	0.303	0.3	0.99	0.297	0.3	12.7	3.81	0.3	5.67	1.701	0.3	2.11	0.633	0.3	0.81	0.243
2,3,7,8-TCDD	1	0.3	0.3	1	0.092	0.092	1	0.21	0.21	1	0	0	1	0.56	0.56	1	0.24	0.24
2,3,7,8-TCDF	0.1	2.1	0.21	0.1	0.76	0.076	0.1	101	10.1	0.1	1.7	0.17	0.1	4.36	0.436	0.1	1.2	0.12
OCDD	0.0003	5920	1.776	0.0003	3470	1.041	0.0003	4370	1.311	0.0003	6660	1.998	0.0003	10900	3.27	0.0003	3750	1.125
OCDF	0.0003	79.1	0.02373	0.0003	87.8	0.02634	0.0003	35.2	0.01056	0.0003	241	0.0723	0.0003	216	0.0648	0.0003	38	0.0114
Total DxF TEQ (pg/g) =			7.58593			4.37854			19.73106			16.633			14.6159			4.7543

Client ID	BWR-DAM4-T4-0320			BWR-DAM4-T5-0320			BWR-DAM6-T1-0620			BWR-DAM6-T2-0620			BWR-DAM6-T3-0620			BWR-DAM7-T1-0320		
Lab Sample ID	460-205020-7			460-205020-8			460-210989-1			460-210989-2			460-210989-3			460-205020-11		
Sampling Date	03/09/2020 12:55:00			03/09/2020 13:15:00			06/10/2020 11:15:00			06/10/2020 11:40:00			06/10/2020 12:15:00			03/10/2020 13:15:00		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil		
Dilution Factor	1			1			1			1			1			5		
Unit	pg/g			pg/g			pg/g			pg/g			pg/g			pg/g		
	TEF	Result	TEQ (pg/g)	TEF	Result	TEQ (pg/g)	TEF	Result	TEQ (pg/g)	TEF	Result	TEQ (pg/g)	TEF	Result	TEQ (pg/g)	TEF	Result	TEQ (pg/g)
1,2,3,4,6,7,8-HpCDD	0.01	49.4	0.494	0.01	31.3	0.313	0.01	89.9	0.899	0.01	76.2	0.762	0.01	80.9	0.809	0.01	354	3.54
1,2,3,4,6,7,8-HpCDF	0.01	12.6	0.126	0.01	8.72	0.0872	0.01	25.9	0.259	0.01	21.8	0.218	0.01	24.4	0.244	0.01	1720	17.2
1,2,3,4,7,8,9-HpCDF	0.01	0.47	0.0047	0.01	0.29	0.0029	0.01	1.08	0.0108	0.01	1.08	0.0108	0.01	1	0.01	0.01	0	0
1,2,3,4,7,8-HxCDD	0.1	0.68	0.068	0.1	0.34	0.034	0.1	1.29	0.129	0.1	1.63	0.163	0.1	1.23	0.123	0.1	4.52	0.452
1,2,3,4,7,8-HxCDF	0.1	1.49	0.149	0.1	1.18	0.118	0.1	1.89	0.189	0.1	1.33	0.133	0.1	1.63	0.163	0.1	19.8	1.98
1,2,3,6,7,8-HxCDD	0.1	1.51	0.151	0.1	1.05	0.105	0.1	2.83	0.283	0.1	2.55	0.255	0.1	2.79	0.279	0.1	18.6	1.86
1,2,3,6,7,8-HxCDF	0.1	1.35	0.135	0.1	0.96	0.096	0.1	1.21	0.121	0.1	0.94	0.094	0.1	1.03	0.103	0.1	39	3.9
1,2,3,7,8,9-HxCDD	0.1	1.99	0.199	0.1	1.33	0.133	0.1	3.64	0.364	0.1	3.39	0.339	0.1	3.21	0.321	0.1	9.89	0.989
1,2,3,7,8,9-HxCDF	0.1	0	0	0.1	0	0	0.1	0	0	0.1	0	0	0.1	0	0	0.1	0	0
1,2,3,7,8-PeCDD	1	0.35	0.35	1	0	0	1	0.67	0.67	1	0.69	0.69	1	0.55	0.55	1	1.77	1.77
1,2,3,7,8-PeCDF	0.03	0.35	0.0105	0.03	0.25	0.0075	0.03	0.42	0.0126	0.03	0.24	0.0072	0.03	0.37	0.0111	0.03	3.11	0.0933
2,3,4,6,7,8-HxCDF	0.1	0.61	0.061	0.1	0.34	0.034	0.1	0.9	0.09	0.1	0.75	0.075	0.1	0.72	0.072	0.1	13.2	1.32
2,3,4,7,8-PeCDF	0.3	0.63	0.189	0.3	0.38	0.114	0.3	0.75	0.225	0.3	0.53	0.159	0.3	0.6	0.18	0.3	6.23	1.869
2,3,7,8-TCDD	1	0.15	0.15	1	0.041	0.041	1	0.21	0.21	1	0.2	0.2	1	0.15	0.15	1	0.11	0.11
2,3,7,8-TCDF	0.1	0.7	0.07	0.1	0.7	0.07	0.1	0.99	0.099	0.1	0.61	0.061	0.1	0.8	0.08	0.1	3.88	0.388
OCDD	0.0003	2170	0.651	0.0003	1070	0.321	0.0003	3940	1.182	0.0003	2920	0.876	0.0003	3680	1.104	0.0003	10600	3.18
OCDF	0.0003	22.9	0.00687	0.0003	16	0.0048	0.0003	38.3	0.01149	0.0003	47	0.0141	0.0003	37.7	0.01131	0.0003	653	0.1959
Total DxF TEQ (pg/g) =			2.81507			1.4814			4.75489			4.0571			4.21041			38.8472

Client ID	BWR-DAM7-T2-0320			BWR-DAM7-T3-0320			BWR-DAM8-T1-0320			BWR-DAM8-T2-0320			BWR-DAM9-T1-0620			BWR-DAM9-T2-0620		
Lab Sample ID	460-205020-12			460-205020-13			460-205020-14			460-205020-15			460-210989-4			460-210989-5		
Sampling Date	03/10/2020 11:30:00			03/10/2020 12:10:00			03/11/2020 12:15:00			03/11/2020 11:45:00			06/09/2020 14:15:00			06/09/2020 14:30:00		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil		
Dilution Factor	1			1			1			1			1			1		
Unit	pg/g			pg/g			pg/g			pg/g			pg/g			pg/g		
	TEF	Result	TEQ (pg/g)	TEF	Result	TEQ (pg/g)	TEF	Result	TEQ (pg/g)	TEF	Result	TEQ (pg/g)	TEF	Result	TEQ (pg/g)	TEF	Result	TEQ (pg/g)
1,2,3,4,6,7,8-HpCDD	0.01	213	2.13	0.01	20.9	0.209	0.01	350	3.5	0.01	309	3.09	0.01	103	1.03	0.01	134	1.34
1,2,3,4,6,7,8-HpCDF	0.01	120	1.2	0.01	2.86	0.0286	0.01	86.6	0.866	0.01	176	1.76	0.01	36.4	0.364	0.01	37.3	0.373
1,2,3,4,7,8,9-HpCDF	0.01	1.23	0.0123	0.01	0.11	0.0011	0.01	2.82	0.0282	0.01	3.42	0.0342	0.01	1.39	0.0139	0.01	1.75	0.0175
1,2,3,4,7,8-HxCDD	0.1	1.76	0.176	0.1	0.24	0.024	0.1	5.05	0.505	0.1	4.79	0.479	0.1	1.46	0.146	0.1	2	0.2
1,2,3,4,7,8-HxCDF	0.1	3.29	0.329	0.1	0.2	0.02	0.1	10.5	1.05	0.1	5.93	0.593	0.1	2.15	0.215	0.1	2.75	0.275
1,2,3,6,7,8-HxCDD	0.1	4.5	0.45	0.1	0.53	0.053	0.1	11.3	1.13	0.1	12.3	1.23	0.1	3.09	0.309	0.1	4.21	0.421
1,2,3,6,7,8-HxCDF	0.1	3.92	0.392	0.1	0.24	0.024	0.1	4.26	0.426	0.1	8.55	0.855	0.1	1.26	0.126	0.1	1.5	0.15
1,2,3,7,8,9-HxCDD	0.1	5.76	0.576	0.1	1.02	0.102	0.1	13.6	1.36	0.1	12.7	1.27	0.1	3.93	0.393	0.1	5.19	0.519
1,2,3,7,8,9-HxCDF	0.1	0	0	0.1	0	0	0.1	0	0	0.1	0	0	0.1	0	0	0.1	0	0
1,2,3,7,8-PeCDD	1	0.66	0.66	1	0.13	0.13	1	2.46	2.46	1	2.5	2.5	1	0.76	0.76	1	0.99	0.99
1,2,3,7,8-PeCDF	0.03	2.38	0.0714	0.03	0.11	0.0033	0.03	4.3	0.129	0.03	3.01	0.0903	0.03	0.45	0.0135	0.03	0.51	0.0153
2,3,4,6,7,8-HxCDF	0.1	1.11	0.111	0.1	0.095	0.0095	0.1	2.47	0.247	0.1	2.73	0.273	0.1	0.93	0.093	0.1	1.28	0.128
2,3,4,7,8-PeCDF	0.3	2.27	0.681	0.3	0.11	0.033	0.3	4.03	1.209	0.3	3.01	0.903	0.3	0.74	0.222	0.3	0.88	0.264
2,3,7,8-TCDD	1	0.11	0.11	1	0.039	0.039	1	1.24	1.24	1	0.72	0.72	1	0.16	0.16	1	0.25	0.25
2,3,7,8-TCDF	0.1	8.88	0.888	0.1	0.43	0.043	0.1	16.7	1.67	0.1	7.84	0.784	0.1	0.89	0.089	0.1	1.08	0.108
OCDD	0.0003	9500	2.85	0.0003	935	0.2805	0.0003	11900	3.57	0.0003	13000	3.9	0.0003	4720	1.416	0.0003	6120	1.836
OCDF	0.0003	51.2	0.01536	0.0003	3.91	0.001173	0.0003	115	0.0345	0.0003	120	0.036	0.0003	46.8	0.01404	0.0003	56.2	0.01686
Total DxF TEQ (pg/g) =			10.65206			1.001173			19.4247			18.5175			5.36444			6.90366

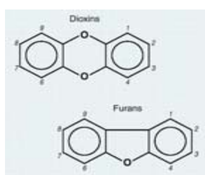
Client ID	BWR-DAM10-T1-0620			BWR-DAM10-T2-0620			BWR-DAM11-T1-0320			BWR-DAM11-T2-0320			BWR-DUP1-0320			BWR-DUP2-0620			BWR-FIELDBLANK-0320_SOLID		
Lab Sample ID	460-210989-6			460-210989-7			460-205020-16			460-205020-17			460-205020-18			460-210989-8			460-205020-9		
Sampling Date	06/09/2020 11:10:00			06/09/2020 11:35:00			03/12/2020 12:10:00			03/12/2020 11:20:00			03/12/2020 00:00:00			06/10/2020 00:00:00			03/12/2020 12:50:00		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Dilution Factor	1			1			2			1			1			1			1		
Unit	pg/g			pg/g			pg/g			pg/g			pg/g			pg/g			pg/g		
	TEF	Result	TEQ (pg/g)	TEF	Result	TEQ (pg/g)	TEF	Result	TEQ (pg/g)	TEF	Result	TEQ (pg/g)	TEF	Result	TEQ (pg/g)	TEF	Result	TEQ (pg/g)	TEF	Result	TEQ (pg/g)
1,2,3,4,6,7,8-HpCDD	0.01	156	1.56	0.01	73.8	0.738	0.01	114	1.14	0.01	239	2.39	0.01	144	1.44	0.01	88.4	0.884	0.01	1.57	0.0157
1,2,3,4,6,7,8-HpCDF	0.01	53.1	0.531	0.01	17	0.17	0.01	19.7	0.197	0.01	0.64	0.0064	0.01	0.97	0.0097	0.01	25.2	0.252	0.01	0.05	0.0005
1,2,3,4,7,8,9-HpCDF	0.01	4.77	0.0477	0.01	0.89	0.0089	0.01	0.78	0.0078	0.01	0	0	0.01	0.12	0.0012	0.01	1.08	0.0108	0.01	0.034	0.00034
1,2,3,4,7,8-HxCDD	0.1	1.97	0.197	0.1	1.1	0.11	0.1	1.34	0.134	0.1	1.44	0.144	0.1	0.74	0.074	0.1	1.37	0.137	0.1	0.081	0.0081
1,2,3,4,7,8-HxCDF	0.1	3.47	0.347	0.1	1.62	0.162	0.1	1.64	0.164	0.1	0.071	0.0071	0.1	0.12	0.012	0.1	2.02	0.202	0.1	0	0
1,2,3,6,7,8-HxCDD	0.1	4.91	0.491	0.1	2.09	0.209	0.1	2.85	0.285	0.1	4.28	0.428	0.1	2.67	0.267	0.1	2.95	0.295	0.1	0.048	0.0048
1,2,3,6,7,8-HxCDF	0.1	1.51	0.151	0.1	0.94	0.094	0.1	1.47	0.147	0.1	0.12	0.012	0.1	0.17	0.017	0.1	1.21	0.121	0.1	0	0
1,2,3,7,8,9-HxCDD	0.1	4.9	0.49	0.1	2.99	0.299	0.1	3.33	0.333	0.1	4.99	0.499	0.1	3.35	0.335	0.1	3.33	0.333	0.1	0.18	0.018
1,2,3,7,8,9-HxCDF	0.1	0	0	0.1	0	0	0.1	0	0	0.1	0	0	0.1	0	0	0.1	0	0	0.1	0	0
1,2,3,7,8-PeCDD	1	0.76	0.76	1	0.5	0.5	1	0.51	0.51	1	0.48	0.48	1	0.31	0.31	1	0.6	0.6	1	0.05	0.05
1,2,3,7,8-PeCDF	0.03	0.58	0.0174	0.03	0.32	0.0096	0.03	0.36	0.0108	0.03	0.025	0.00075	0.03	0.09	0.0027	0.03	0.45	0.0135	0.03	0	0
2,3,4,6,7,8-HxCDF	0.1	1.33	0.133	0.1	0.66	0.066	0.1	0.66	0.066	0.1	0	0	0.1	0.067	0.0067	0.1	0.81	0.081	0.1	0.02	0.002
2,3,4,7,8-PeCDF	0.3	0.99	0.297	0.3	0.6	0.18	0.3	0.51	0.153	0.3	0	0	0.3	0.068	0.0204	0.3	0.68	0.204	0.3	0	0
2,3,7,8-TCDD	1	0.11	0.11	1	0.14	0.14	1	0.1	0.1	1	0.064	0.064	1	0.019	0.019	1	0.11	0.11	1	0	0
2,3,7,8-TCDF	0.1	0.99	0.099	0.1	0.64	0.064	0.1	1.16	0.116	0.1	0.052	0.0052	0.1	0.26	0.026	0.1	0.81	0.081	0.1	0	0
OCDD	0.0003	5590	1.677	0.0003	5840	1.752	0.0003	5600	1.68	0.0003	10600	3.18	0.0003	5380	1.614	0.0003	3810	1.143	0.0003	43.9	0.01317
OCDF	0.0003	156	0.0468	0.0003	33.4	0.01002	0.0003	31.9	0.00957	0.0003	1.03	0.000309	0.0003	2.1	0.00063	0.0003	36.4	0.01092	0.0003	0.098	0.0000294
Total DxF TEQ (pg/g) =			6.9549			4.51252			5.05317			7.216759			4.15533			4.47822			0.1126394

Sample ID	DxF TEQs (pg/g)
BWR-DAM2-T1-0320	7.58593
BWR-DAM2-T2-0320	4.37854
BWR-DAM2-T3-0320	19.73106
BWR-DAM4-T1-0320	16.633
BWR-DAM4-T2-0320	14.6159
BWR-DAM4-T3-0320	4.7543
BWR-DAM4-T4-0320	2.81507
BWR-DAM4-T5-0320	1.4814
BWR-DAM5	0
BWR-DAM6-T1-0620	4.75489
BWR-DAM6-T2-0620	4.0571
BWR-DAM6-T3-0620	4.21041
BWR-DAM7-T1-0320	38.8472
BWR-DAM7-T2-0320	10.65206
BWR-DAM7-T3-0320	1.001173
BWR-DAM8-T1-0320	19.4247
BWR-DAM8-T2-0320	18.5175
BWR-DAM9-T1-0620	5.36444
BWR-DAM9-T2-0620	6.90366
BWR-DAM10-T1-0620	6.9549
BWR-DAM10-T2-0620	4.51252
BWR-DAM11-T1-0320	5.05317
BWR-DAM11-T2-0320	7.216759



Toxicity Equivalency Factors (TEFs) for Dioxins and Furans

Chlorinated Dibenzo-p-Dioxins	WHO 2005 TEF
2,3,7,8-TCDD	1
1,2,3,7,8-PeCDD	1
1,2,3,4,7,8-HxCDD	0.1
1,2,3,6,7,8-HxCDD	0.1
1,2,3,7,8,9-HxCDD	0.1
1,2,3,4,6,7,8-HpCDD	0.01
OCDD	0.0003
Chlorinated Dibenzo-p-Furans	
2,3,7,8-TCDF	0.1
1,2,3,7,8-PeCDF	0.03
2,3,4,7,8-PeCDF	0.3
1,2,3,4,7,8-HxCDF	0.1
1,2,3,6,7,8-HxCDF	0.1
1,2,3,7,8,9-HxCDF	0.1
2,3,4,6,7,8-HxCDF	0.1
1,2,3,4,6,7,8-HpCDF	0.01
1,2,3,4,7,8,9-HpCDF	0.01
OCDF	0.0003



TEFs taken from Van den Berg et.al. (2006)

Fingerprints for Dioxin & Furan Compounds (U values set to zero) - Compounds Reordered

Client ID	BWR-DAM2-T1-0320		BWR-DAM2-T2-0320		BWR-DAM2-T3-0320		BWR-DAM4-T1-0320		BWR-DAM4-T2-0320	
Lab Sample ID	460-205020-1		460-205020-2		460-205020-3		460-205020-4		460-205020-5	
Sampling Date	03/06/2020 10:30:00		03/05/2020 14:00:00		03/05/2020 15:30:00		03/09/2020 13:55:00		03/09/2020 11:50:00	
Matrix	Soil		Soil		Soil		Soil		Soil	
Dilution Factor	1		1		1		1		1	
Unit	pg/g		pg/g		pg/g		pg/g		pg/g	
DIOXIN-1613B-SOIL	Result	% of Total	Result	% of Total	Result	% of Total	Result	% of Total	Result	% of Total
2,3,7,8-TCDD	4.80528E-05	0.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,7,8-PeCDD	0.000104114	0.01%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,4,7,8-HxCDD	0.000243468	0.02%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,6,7,8-HxCDD	0.000836119	0.08%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,7,8,9-HxCDD	0.000868154	0.09%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,4,6,7,8-HpCDD	0.025147642	2.51%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
OCDD	0.948242308	94.82%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2,3,7,8-TCDF	0.00033637	0.03%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,7,8-PeCDF	0.00014576	0.01%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2,3,4,7,8-PeCDF	0.000161778	0.02%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,4,7,8-HxCDF	0.000585422	0.06%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,6,7,8-HxCDF	0.000714385	0.07%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,7,8,9-HxCDF	0	0.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2,3,4,6,7,8-HxCDF	0.00016336	0.02%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,4,6,7,8-HpCDF	0.00943437	0.94%	0.007489368	0.75%	0.005352723	0.54%	0.02650065	2.65%	0.014211636	1.42%
1,2,3,4,7,8,9-HpCDF	0.00031875	0.03%	0.000699915	0.07%	0.000417512	0.04%	0.00068494	0.07%	0.000528604	0.05%
OCDF	0.012669927	1.27%	0.023911509	2.39%	0.007536634	0.75%	0.032752086	3.28%	0.018717764	1.87%

Client ID	BWR-DAM4-T3-0320		BWR-DAM4-T4-0320		BWR-DAM4-T5-0320		BWR-DAM6-T1-0620		BWR-DAM6-T2-0620	
Lab Sample ID	460-205020-6		460-205020-7		460-205020-8		460-210989-1		460-210989-2	
Sampling Date	03/09/2020 12:35:00		03/09/2020 12:55:00		03/09/2020 13:15:00		06/10/2020 11:15:00		06/10/2020 11:40:00	
Matrix	Soil		Soil		Soil		Soil		Soil	
Dilution Factor	1		1		1		1		1	
Unit	pg/g		pg/g		pg/g		pg/g		pg/g	
DIOXIN-1613B-SOIL	Result	% of Total	Result	% of Total	Result	% of Total	Result	% of Total	Result	% of Total
2,3,7,8-TCDD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,7,8-PeCDD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,4,7,8-HxCDD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,6,7,8-HxCDD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,7,8,9-HxCDD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,4,6,7,8-HpCDD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
OCDD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2,3,7,8-TCDF	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,7,8-PeCDF	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2,3,4,7,8-PeCDF	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,4,7,8-HxCDF	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,6,7,8-HxCDF	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,7,8,9-HxCDF	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2,3,4,6,7,8-HxCDF	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,4,6,7,8-HpCDF	0.006309938	0.63%	0.005562472	0.56%	0.00769719	0.77%	0.0063	0.63%	0.00708	0.71%
1,2,3,4,7,8,9-HpCDF	0.00020437	0.02%	0.000207489	0.02%	0.000255985	0.03%	0.00026	0.03%	0.00035	0.04%
OCDF	0.009707597	0.97%	0.010109572	1.01%	0.014123284	1.41%	0.00932	0.93%	0.01526	1.53%

Client ID	BWR-DAM6-T3-0620		BWR-DAM7-T1-0320		BWR-DAM7-T2-0320		BWR-DAM7-T3-0320		BWR-DAM8-T1-0320	
Lab Sample ID	460-210989-3		460-205020-11		460-205020-12		460-205020-13		460-205020-14	
Sampling Date	06/10/2020 12:15:00		03/10/2020 13:15:00		03/10/2020 11:30:00		03/10/2020 12:10:00		03/11/2020 12:15:00	
Matrix	Soil		Soil		Soil		Soil		Soil	
Dilution Factor	1		5		1		1		1	
Unit	pg/g		pg/g		pg/g		pg/g		pg/g	
DIOXIN-1613B-SOIL	Result	% of Total	Result	% of Total	Result	% of Total	Result	% of Total	Result	% of Total
2,3,7,8-TCDD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,7,8-PeCDD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,4,7,8-HxCDD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,6,7,8-HxCDD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,7,8,9-HxCDD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,4,6,7,8-HpCDD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
OCDD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2,3,7,8-TCDF	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,7,8-PeCDF	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2,3,4,7,8-PeCDF	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,4,7,8-HxCDF	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,6,7,8-HxCDF	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,7,8,9-HxCDF	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2,3,4,6,7,8-HxCDF	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,4,6,7,8-HpCDF	0.00636	0.64%	0.12791	12.79%	0.0121	1.21%	0.00296	0.30%	0.00691	0.69%
1,2,3,4,7,8,9-HpCDF	0.00026	0.03%	0	0.00%	0.00012	0.01%	0.00011	0.01%	0.00023	0.02%
OCDF	0.00983	0.98%	0.04856	4.86%	0.00516	0.52%	0.00405	0.40%	0.00918	0.92%

Client ID	BWR-DAM8-T2-0320		BWR-DAM9-T1-0620		BWR-DAM9-T2-0620		BWR-DAM10-T1-0620		BWR-DAM10-T2-0620	
Lab Sample ID	460-205020-15		460-210989-4		460-210989-5		460-210989-6		460-210989-7	
Sampling Date	03/11/2020 11:45:00		06/09/2020 14:15:00		06/09/2020 14:30:00		06/09/2020 11:10:00		06/09/2020 11:35:00	
Matrix	Soil		Soil		Soil		Soil		Soil	
Dilution Factor	1		1		1		1		1	
Unit	pg/g		pg/g		pg/g		pg/g		pg/g	
DIOXIN-1613B-SOIL	Result	% of Total	Result	% of Total	Result	% of Total	Result	% of Total	Result	% of Total
2,3,7,8-TCDD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,7,8-PeCDD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,4,7,8-HxCDD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,6,7,8-HxCDD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,7,8,9-HxCDD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,4,6,7,8-HpCDD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
OCDD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2,3,7,8-TCDF	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,7,8-PeCDF	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2,3,4,7,8-PeCDF	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,4,7,8-HxCDF	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,6,7,8-HxCDF	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,7,8,9-HxCDF	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2,3,4,6,7,8-HxCDF	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,4,6,7,8-HpCDF	0.01287	1.29%	0.00739	0.74%	0.00586	0.59%	0.00888	0.89%	0.00284	0.28%
1,2,3,4,7,8,9-HpCDF	0.00025	0.03%	0.00028	0.03%	0.00027	0.03%	0.0008	0.08%	0.00015	0.01%
OCDF	0.00878	0.88%	0.00951	0.95%	0.00882	0.88%	0.02608	2.61%	0.00559	0.56%

Client ID	BWR-DAM11-T1-0320		BWR-DAM11-T2-0320		BWR-DUP1-0320		BWR-DUP2-0620		BWR-FIELDBLANK-0320_SOLID	
Lab Sample ID	460-205020-16		460-205020-17		460-205020-18		460-210989-8		460-205020-9	
Sampling Date	03/12/2020 12:10:00		03/12/2020 11:20:00		03/12/2020 00:00:00		06/10/2020 00:00:00		03/12/2020 12:50:00	
Matrix	Soil		Soil		Soil		Soil		Soil	
Dilution Factor	2		1		1		1		1	
Unit	pg/g		pg/g		pg/g		pg/g		pg/g	
DIOXIN-1613B-SOIL	Result	% of Total	Result	% of Total	Result	% of Total	Result	% of Total	Result	% of Total
2,3,7,8-TCDD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,7,8-PeCDD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,4,7,8-HxCDD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,6,7,8-HxCDD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,7,8,9-HxCDD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,4,6,7,8-HpCDD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
OCDD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2,3,7,8-TCDF	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,7,8-PeCDF	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2,3,4,7,8-PeCDF	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,4,7,8-HxCDF	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,6,7,8-HxCDF	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,7,8,9-HxCDF	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2,3,4,6,7,8-HxCDF	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,2,3,4,6,7,8-HpCDF	0.00341	0.34%	5.9E-05	0.01%	0.00018	0.02%	0.00634	0.63%	0.00109	0.11%
1,2,3,4,7,8,9-HpCDF	0.00013	0.01%	0	0.00%	2.2E-05	0.00%	0.00027	0.03%	0.00074	0.07%
OCDF	0.00552	0.55%	9.5E-05	0.01%	0.00038	0.04%	0.00916	0.92%	0.00213	0.21%

TEQ Fingerprint for Dioxins and Furan Compounds - Compounds Reordered

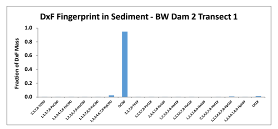
Client ID	BWR-DAM2-T1-0320		BWR-DAM2-T2-0320		BWR-DAM2-T3-0320		BWR-DAM4-T1-0320		BWR-DAM4-T2-0320	
Lab Sample ID	460-205020-1		460-205020-2		460-205020-3		460-205020-4		460-205020-5	
Sampling Date	03/06/2020 10:30:00		03/05/2020 14:00:00		03/05/2020 15:30:00		03/09/2020 13:55:00		03/09/2020 11:50:00	
Matrix	Soil		Soil		Soil		Soil		Soil	
Dilution Factor	1		1		1		1		1	
Unit	Decimal		Decimal		Decimal		Decimal		Decimal	
DIOXIN-1613B-SOIL	Result	% of Total	Result	% of Total	Result	% of Total	Result	% of Total	Result	% of Total
2,3,7,8-TCDD	0.039546898	3.95%	0.02101157	2.10%	0.010643118	1.06%	0	0.00%	0.038314438	3.83%
1,2,3,7,8-PeCDD	0.085684946	8.57%	0.116477182	11.65%	0.025340757	2.53%	0	0.00%	0.132047975	13.20%
1,2,3,4,7,8-HxCDD	0.020037095	2.00%	0.02443737	2.44%	0.005473604	0.55%	0.015571454	1.56%	0.020320336	2.03%
1,2,3,6,7,8-HxCDD	0.068811603	6.88%	0.045220553	4.52%	0.0120622	1.21%	0.028317201	2.83%	0.048235141	4.82%
1,2,3,7,8,9-HxCDD	0.071448062	7.14%	0.067830829	6.78%	0.015660588	1.57%	0.037094932	3.71%	0.057950588	5.80%
1,2,3,4,6,7,8-HpCDD	0.2069621	20.70%	0.154389363	15.44%	0.044346325	4.43%	0.094390669	9.44%	0.138889839	13.89%
OCDD	0.234117636	23.41%	0.237750483	23.78%	0.066443465	6.64%	0.120122648	12.01%	0.223728953	22.37%
2,3,7,8-TCDF	0.027682829	2.77%	0.017357384	1.74%	0.511883295	51.19%	0.010220646	1.02%	0.029830527	2.98%
1,2,3,7,8-PeCDF	0.003598768	0.36%	0.004453539	0.45%	0.02174237	2.17%	0.00434678	0.43%	0.005480333	0.55%
2,3,4,7,8-PeCDF	0.039942367	3.99%	0.067830829	6.78%	0.19309657	19.31%	0.102266578	10.23%	0.043308999	4.33%
1,2,3,4,7,8-HxCDF	0.046533517	4.65%	0.093638519	9.36%	0.05220196	5.22%	0.342692238	34.27%	0.073207945	7.32%
1,2,3,6,7,8-HxCDF	0.058793055	5.88%	0.051843765	5.18%	0.018498753	1.85%	0.103408886	10.34%	0.050492956	5.05%
1,2,3,7,8,9-HxCDF	0	0.00%	0	0.00%	0.002027261	0.20%	0	0.00%	0	0.00%
2,3,4,6,7,8-HxCDF	0.013445945	1.34%	0.02306705	2.31%	0.006385871	0.64%	0.016954248	1.70%	0.017378335	1.74%
1,2,3,4,6,7,8-HpCDF	0.077643743	7.76%	0.062806324	6.28%	0.012670379	1.27%	0.117236818	11.72%	0.11220657	11.22%
1,2,3,4,7,8,9-HpCDF	0.002623278	0.26%	0.005869536	0.59%	0.00098829	0.10%	0.003030121	0.30%	0.004173537	0.42%
OCDF	0.00312816	0.31%	0.006015704	0.60%	0.000535197	0.05%	0.00434678	0.43%	0.004433528	0.44%

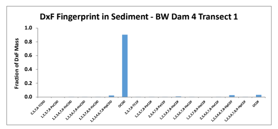
Client ID	BWR-DAM4-T3-0320		BWR-DAM4-T4-0320		BWR-DAM4-T5-0320		BWR-DAM6-T1-0620		BWR-DAM6-T2-0620	
Lab Sample ID	460-205020-6		460-205020-7		460-205020-8		460-210989-1		460-210989-2	
Sampling Date	03/09/2020 12:35:00		03/09/2020 12:55:00		03/09/2020 13:15:00		06/10/2020 11:15:00		06/10/2020 11:40:00	
Matrix	Soil		Soil		Soil		Soil		Soil	
Dilution Factor	1		1		1		1		1	
Unit	Decimal		Decimal		Decimal		Decimal		Decimal	
DIOXIN-1613B-SOIL	Result	% of Total	Result	% of Total	Result	% of Total	Result	% of Total	Result	% of Total
2,3,7,8-TCDD	0.050480618	5.05%	0.053284643	5.33%	0.027676522	2.77%	0.04417	4.42%	0.0493	4.93%
1,2,3,7,8-PeCDD	0.130408262	13.04%	0.124330834	12.43%	0	0.00%	0.14091	14.09%	0.17007	17.01%
1,2,3,4,7,8-HxCDD	0.024609301	2.46%	0.024155705	2.42%	0.022951262	2.30%	0.02713	2.71%	0.04018	4.02%
1,2,3,6,7,8-HxCDD	0.057632038	5.76%	0.053639874	5.36%	0.070878898	7.09%	0.05952	5.95%	0.06285	6.29%
1,2,3,7,8,9-HxCDD	0.072355552	7.24%	0.07069096	7.07%	0.089779938	8.98%	0.07655	7.66%	0.08356	8.36%
1,2,3,4,6,7,8-HpCDD	0.178364849	17.84%	0.175484091	17.55%	0.211286621	21.13%	0.18907	18.91%	0.18782	18.78%
OCDD	0.236627895	23.66%	0.231255351	23.13%	0.216686918	21.67%	0.24859	24.86%	0.21592	21.59%
2,3,7,8-TCDF	0.025240309	2.52%	0.024866167	2.49%	0.047252599	4.73%	0.02082	2.08%	0.01504	1.50%
1,2,3,7,8-PeCDF	0.003344341	0.33%	0.003729925	0.37%	0.005062778	0.51%	0.00265	0.26%	0.00177	0.18%
2,3,4,7,8-PeCDF	0.051111625	5.11%	0.06713865	6.71%	0.076954232	7.70%	0.04732	4.73%	0.03919	3.92%
1,2,3,4,7,8-HxCDF	0.050059946	5.01%	0.052929412	5.29%	0.079654381	7.97%	0.03975	3.97%	0.03278	3.28%
1,2,3,6,7,8-HxCDF	0.04522222	4.52%	0.047956179	4.80%	0.064803564	6.48%	0.02545	2.54%	0.02317	2.32%
1,2,3,7,8,9-HxCDF	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
2,3,4,6,7,8-HxCDF	0.01850956	1.85%	0.021669088	2.17%	0.022951262	2.30%	0.01893	1.89%	0.01849	1.85%
1,2,3,4,6,7,8-HpCDF	0.051952969	5.20%	0.0447591	4.48%	0.058863237	5.89%	0.05447	5.45%	0.05373	5.37%
1,2,3,4,7,8,9-HpCDF	0.001682687	0.17%	0.001669585	0.17%	0.001957608	0.20%	0.00227	0.23%	0.00266	0.27%
OCDF	0.002397829	0.24%	0.002440437	0.24%	0.003240178	0.32%	0.00242	0.24%	0.00348	0.35%

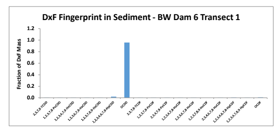
Client ID	BWR-DAM6-T3-0620		BWR-DAM7-T1-0320		BWR-DAM7-T2-0320		BWR-DAM7-T3-0320		BWR-DAM8-T1-0320	
Lab Sample ID	460-210989-3		460-205020-11		460-205020-12		460-205020-13		460-205020-14	
Sampling Date	06/10/2020 12:15:00		03/10/2020 13:15:00		03/10/2020 11:30:00		03/10/2020 12:10:00		03/11/2020 12:15:00	
Matrix	Soil		Soil		Soil		Soil		Soil	
Dilution Factor	1		5		1		1		1	
Unit	Decimal		Decimal		Decimal		Decimal		Decimal	
DIOXIN-1613B-SOIL	Result	% of Total	Result	% of Total	Result	% of Total	Result	% of Total	Result	% of Total
2,3,7,8-TCDD	0.03563	3.56%	0.00283	0.28%	0.01033	1.03%	0.03895	3.90%	0.06384	6.38%
1,2,3,7,8-PeCDD	0.13063	13.06%	0.04556	4.56%	0.06196	6.20%	0.12985	12.98%	0.12664	12.66%
1,2,3,4,7,8-HxCDD	0.02921	2.92%	0.01164	1.16%	0.01652	1.65%	0.02397	2.40%	0.026	2.60%
1,2,3,6,7,8-HxCDD	0.06626	6.63%	0.04788	4.79%	0.04225	4.22%	0.05294	5.29%	0.05817	5.82%
1,2,3,7,8,9-HxCDD	0.07624	7.62%	0.02546	2.55%	0.05407	5.41%	0.10188	10.19%	0.07001	7.00%
1,2,3,4,6,7,8-HpCDD	0.19214	19.21%	0.09113	9.11%	0.19996	20.00%	0.20876	20.88%	0.18018	18.02%
OCDD	0.26221	26.22%	0.08186	8.19%	0.26755	26.76%	0.28017	28.02%	0.18379	18.38%
2,3,7,8-TCDF	0.019	1.90%	0.00999	1.00%	0.08336	8.34%	0.04295	4.29%	0.08597	8.60%
1,2,3,7,8-PeCDF	0.00264	0.26%	0.0024	0.24%	0.0067	0.67%	0.0033	0.33%	0.00664	0.66%
2,3,4,7,8-PeCDF	0.04275	4.28%	0.04811	4.81%	0.06393	6.39%	0.03296	3.30%	0.06224	6.22%
1,2,3,4,7,8-HxCDF	0.03871	3.87%	0.05097	5.10%	0.03089	3.09%	0.01998	2.00%	0.05405	5.41%
1,2,3,6,7,8-HxCDF	0.02446	2.45%	0.10039	10.04%	0.0368	3.68%	0.02397	2.40%	0.02193	2.19%
1,2,3,7,8,9-HxCDF	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
2,3,4,6,7,8-HxCDF	0.0171	1.71%	0.03398	3.40%	0.01042	1.04%	0.00949	0.95%	0.01272	1.27%
1,2,3,4,6,7,8-HpCDF	0.05795	5.80%	0.44276	44.28%	0.11265	11.27%	0.02857	2.86%	0.04458	4.46%
1,2,3,4,7,8,9-HpCDF	0.00238	0.24%	0	0.00%	0.00115	0.12%	0.0011	0.11%	0.00145	0.15%
OCDF	0.00269	0.27%	0.00504	0.50%	0.00144	0.14%	0.00117	0.12%	0.00178	0.18%

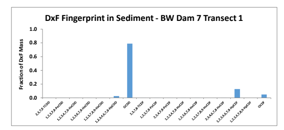
Client ID	BWR-DAM8-T2-0320		BWR-DAM9-T1-0620		BWR-DAM9-T2-0620		BWR-DAM10-T1-0620		BWR-DAM10-T2-0620	
Lab Sample ID	460-205020-15		460-210989-4		460-210989-5		460-210989-6		460-210989-7	
Sampling Date	03/11/2020 11:45:00		06/09/2020 14:15:00		06/09/2020 14:30:00		06/09/2020 11:10:00		06/09/2020 11:35:00	
Matrix	Soil		Soil		Soil		Soil		Soil	
Dilution Factor	1		1		1		1		1	
Unit	Decimal		Decimal		Decimal		Decimal		Decimal	
DIOXIN-1613B-SOIL	Result	% of Total	Result	% of Total	Result	% of Total	Result	% of Total	Result	% of Total
2,3,7,8-TCDD	0.03888	3.89%	0.02983	2.98%	0.03621	3.62%	0.01582	1.58%	0.03102	3.10%
1,2,3,7,8-PeCDD	0.13501	13.50%	0.14167	14.17%	0.1434	14.34%	0.10928	10.93%	0.1108	11.08%
1,2,3,4,7,8-HxCDD	0.02587	2.59%	0.02722	2.72%	0.02897	2.90%	0.02833	2.83%	0.02438	2.44%
1,2,3,6,7,8-HxCDD	0.06642	6.64%	0.0576	5.76%	0.06098	6.10%	0.0706	7.06%	0.04632	4.63%
1,2,3,7,8,9-HxCDD	0.06858	6.86%	0.07326	7.33%	0.07518	7.52%	0.07045	7.05%	0.06626	6.63%
1,2,3,4,6,7,8-HpCDD	0.16687	16.69%	0.19201	19.20%	0.1941	19.41%	0.2243	22.43%	0.16354	16.35%
OCDD	0.21061	21.06%	0.26396	26.40%	0.26595	26.59%	0.24112	24.11%	0.38825	38.83%
2,3,7,8-TCDF	0.04234	4.23%	0.01659	1.66%	0.01564	1.56%	0.01423	1.42%	0.01418	1.42%
1,2,3,7,8-PeCDF	0.00488	0.49%	0.00252	0.25%	0.00222	0.22%	0.0025	0.25%	0.00213	0.21%
2,3,4,7,8-PeCDF	0.04876	4.88%	0.04138	4.14%	0.03824	3.82%	0.0427	4.27%	0.03989	3.99%
1,2,3,4,7,8-HxCDF	0.03202	3.20%	0.04008	4.01%	0.03983	3.98%	0.04989	4.99%	0.0359	3.59%
1,2,3,6,7,8-HxCDF	0.04617	4.62%	0.02349	2.35%	0.02173	2.17%	0.02171	2.17%	0.02083	2.08%
1,2,3,7,8,9-HxCDF	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
2,3,4,6,7,8-HxCDF	0.01474	1.47%	0.01734	1.73%	0.01854	1.85%	0.01912	1.91%	0.01463	1.46%
1,2,3,4,6,7,8-HpCDF	0.09505	9.50%	0.06785	6.79%	0.05403	5.40%	0.07635	7.63%	0.03767	3.77%
1,2,3,4,7,8,9-HpCDF	0.00185	0.18%	0.00259	0.26%	0.00253	0.25%	0.00686	0.69%	0.00197	0.20%
OCDF	0.00194	0.19%	0.00262	0.26%	0.00244	0.24%	0.00673	0.67%	0.00222	0.22%

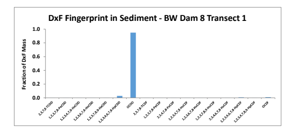
Client ID	BWR-DAM11-T1-0320		BWR-DAM11-T2-0320		BWR-DUP1-0320		BWR-DUP2-0620		BWR-FIELDBLANK-0320_SOLID	
Lab Sample ID	460-205020-16		460-205020-17		460-205020-18		460-210989-8		460-205020-9	
Sampling Date	03/12/2020 12:10:00		03/12/2020 11:20:00		03/12/2020 00:00:00		06/10/2020 00:00:00		03/12/2020 12:50:00	
Matrix	Soil		Soil		Soil		Soil		Soil	
Dilution Factor	2		1		1		1		1	
Unit	Decimal		Decimal		Decimal		Decimal		Decimal	
DIOXIN-1613B-SOIL	Result	% of Total	Result	% of Total	Result	% of Total	Result	% of Total	Result	% of Total
2,3,7,8-TCDD	0.01979	1.98%	0.00887	0.89%	0.00457	0.46%	0.02456	2.46%	0	0.00%
1,2,3,7,8-PeCDD	0.10093	10.09%	0.06651	6.65%	0.0746	7.46%	0.13398	13.40%	0.44389	44.39%
1,2,3,4,7,8-HxCDD	0.02652	2.65%	0.01995	2.00%	0.01781	1.78%	0.03059	3.06%	0.07191	7.19%
1,2,3,6,7,8-HxCDD	0.0564	5.64%	0.05931	5.93%	0.06425	6.43%	0.06587	6.59%	0.04261	4.26%
1,2,3,7,8,9-HxCDD	0.0659	6.59%	0.06914	6.91%	0.08062	8.06%	0.07436	7.44%	0.1598	15.98%
1,2,3,4,6,7,8-HpCDD	0.2256	22.56%	0.33117	33.12%	0.34654	34.65%	0.1974	19.74%	0.13938	13.94%
OCDD	0.33246	33.25%	0.44064	44.06%	0.38842	38.84%	0.25524	25.52%	0.11692	11.69%
2,3,7,8-TCDF	0.02296	2.30%	0.00072	0.07%	0.00626	0.63%	0.01809	1.81%	0	0.00%
1,2,3,7,8-PeCDF	0.00214	0.21%	0.0001	0.01%	0.00065	0.06%	0.00301	0.30%	0	0.00%
2,3,4,7,8-PeCDF	0.03028	3.03%	0	0.00%	0.00491	0.49%	0.04555	4.56%	0	0.00%
1,2,3,4,7,8-HxCDF	0.03245	3.25%	0.00098	0.10%	0.00289	0.29%	0.04511	4.51%	0	0.00%
1,2,3,6,7,8-HxCDF	0.02909	2.91%	0.00166	0.17%	0.00409	0.41%	0.02702	2.70%	0	0.00%
1,2,3,7,8,9-HxCDF	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
2,3,4,6,7,8-HxCDF	0.01306	1.31%	0	0.00%	0.00161	0.16%	0.01809	1.81%	0.01776	1.78%
1,2,3,4,6,7,8-HpCDF	0.03899	3.90%	0.00089	0.09%	0.00233	0.23%	0.05627	5.63%	0.00444	0.44%
1,2,3,4,7,8,9-HpCDF	0.00154	0.15%	0	0.00%	0.00029	0.03%	0.00241	0.24%	0.00302	0.30%
OCDF	0.00189	0.19%	4.3E-05	0.00%	0.00015	0.02%	0.00244	0.24%	0.00026	0.03%

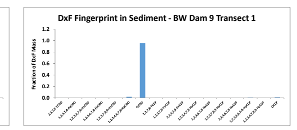


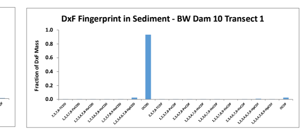


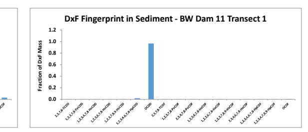


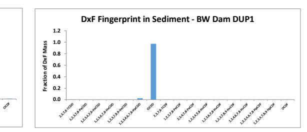


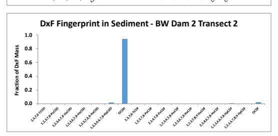


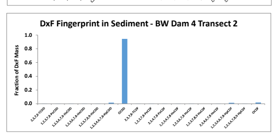


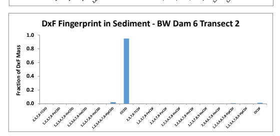


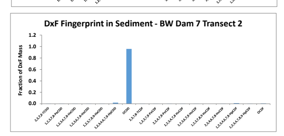


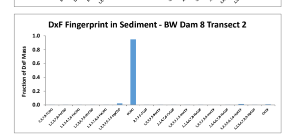


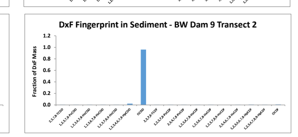


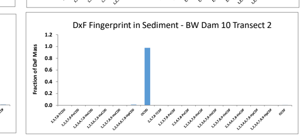


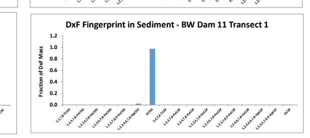


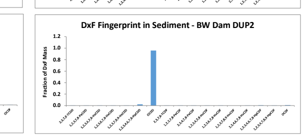


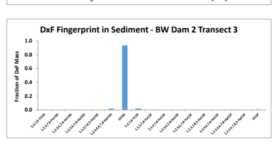


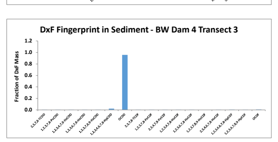


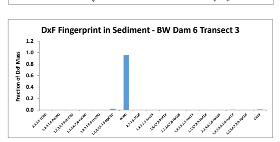


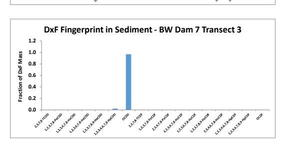


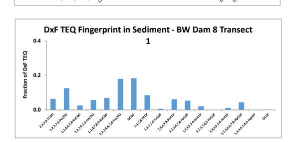


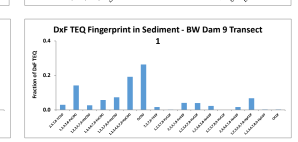


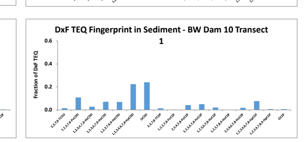


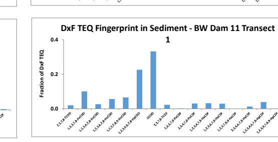


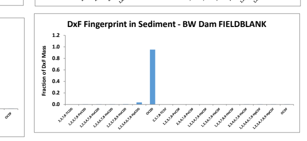


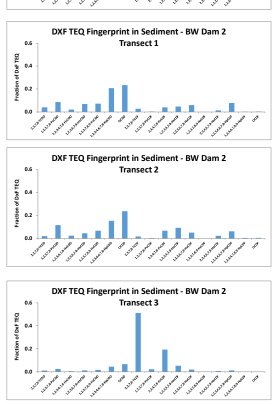


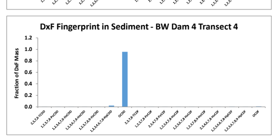


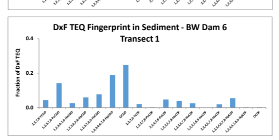


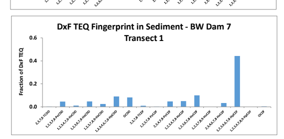


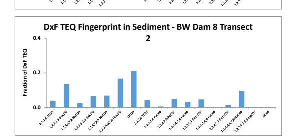


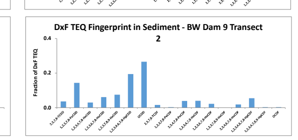


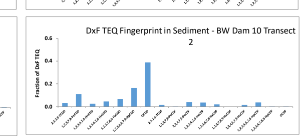


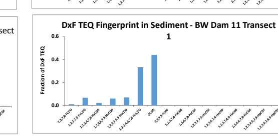


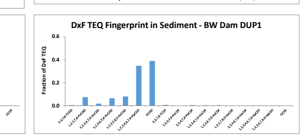


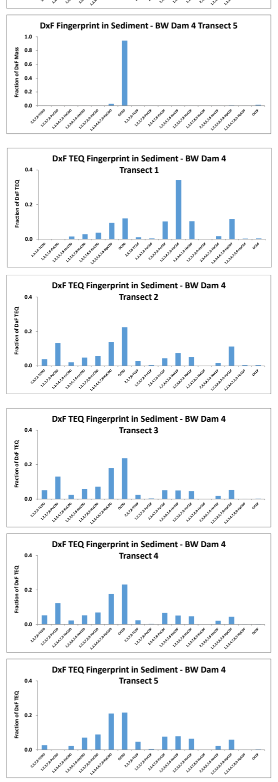


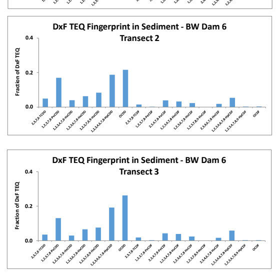


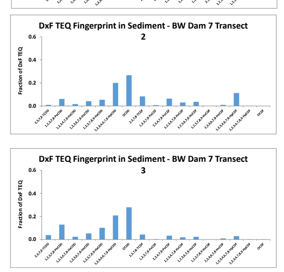


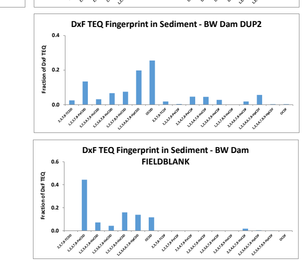












Potential Toxicity to Benthic Aquatic Life Due to 2,3,7,8-TCDD in Sediment Pore Water

The calculations below follow the general approach presented in Fuchsman et al. (2006).

Sample-Specific Organic Carbon Normalized Sediment Quality Benchmark (SQB) to Protect Aquatic Life from 2,3,7,8-TCDD

SQB (ng TCDD/g o.c.) = Tox Value (ug/L) x K_{oc} (L/kg o.c.) x (1000/1000), where:

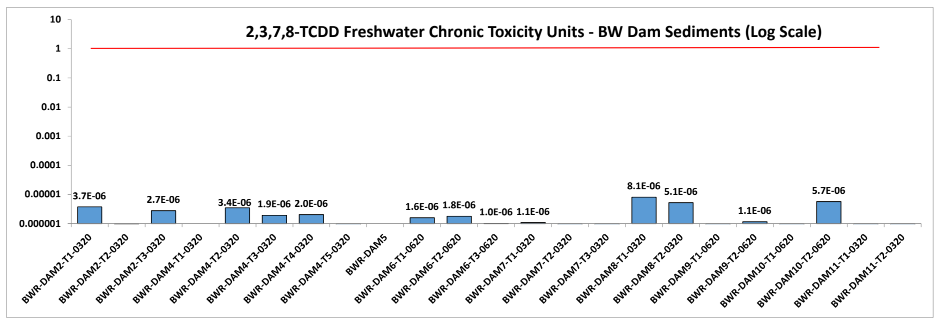
Freshwater Acute Value =	1	ug/L	EPA (1984)
Freshwater Chronic Value =	0.001	ug/L	EPA (1984)
log $K_{ow\text{-}TCDD}$ =	6.80	L/kg octanol	Mackay et al (1992)
log $K_{oc\text{-}TCDD}$ =	6.80	L/kg oc	
SQB Freshwater Acute =	6,309,573	(ng TCDD/g oc)	
SQB Freshwater Chronic =	6309.6	(ng TCDD/g oc)	

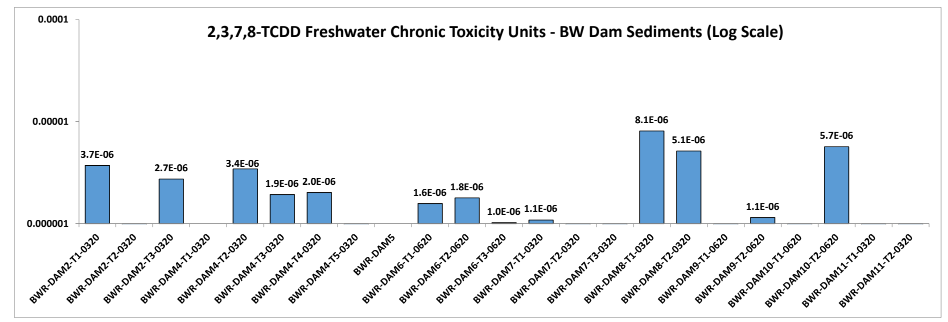
Comparison of SQB to OC Normalized Sediment Concentrations

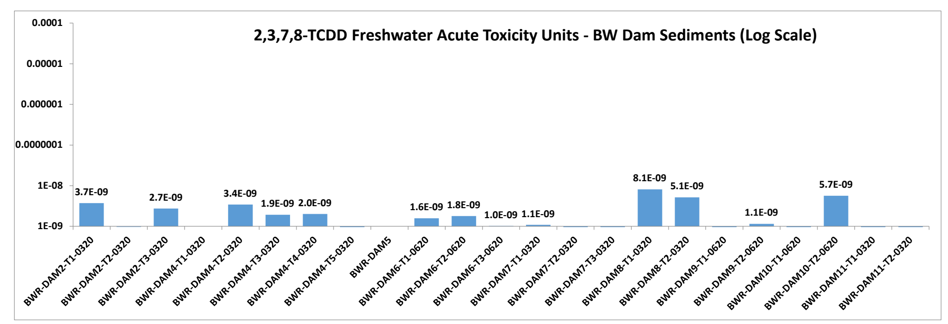
		BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-0320
Measured 2,3,7,8-TCDD	(pg/g)	0.300	0.092	0.210	0.000	0.560	0.240	0.150	0.041
Measured TOC	(g o.c./g)	0.01280	0.01510	0.01220	0.0163	0.0259	0.0198	0.0118	0.0121
oc-normalized 2,3,7,8-TCDD	(ng TCDD/g oc)	0.0234375	0.006092715	0.017213115	0	0.021621622	0.012121212	0.012711864	0.00338843
oc-norm 2,3,7,8-TCDD/SQB Fresh Acute (T.U.a)		3.71459E-09	9.6563E-10	2.72809E-09	0	3.4268E-09	1.92108E-09	2.01469E-09	5.3703E-10
oc-norm 2,3,7,8-TCDD/SQB Fresh Chronic (T.U.c)		3.71459E-06	9.6563E-07	2.72809E-06	0	3.4268E-06	1.92108E-06	2.01469E-06	5.3703E-07

		BWR-DAM5	BWR-DAM6-T1-0620	BWR-DAM6-T2-0620	BWR-DAM6-T3-0620	BWR-DAM7-T1-0320	BWR-DAM7-T2-0320	BWR-DAM7-T3-0320	BWR-DAM8-T1-0320
Measured 2,3,7,8-TCDD	(pg/g)		0.210	0.200	0.150	0.110	0.110	0.039	1.240
Measured TOC	(g o.c./g)		0.0212	0.0178	0.0234	0.0161	0.0211	0.0211	0.0243
oc-normalized 2,3,7,8-TCDD	(ng TCDD/g oc)		0.00990566	0.011235955	0.006410256	0.006832298	0.00521327	0.001848341	0.051028807
oc-norm 2,3,7,8-TCDD/SQB Fresh Acute (T.U.a)			1.56994E-09	1.78078E-09	1.01596E-09	1.08285E-09	8.26248E-10	2.92942E-10	8.08752E-09
oc-norm 2,3,7,8-TCDD/SQB Fresh Chronic (T.U.c)			1.56994E-06	1.78078E-06	1.01596E-06	1.08285E-06	8.26248E-07	2.92942E-07	8.08752E-06

		BWR-DAM8-T2-0320	BWR-DAM9-T1-0620	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DAM11-T1-0320	BWR-DAM11-T2-0320
Measured 2,3,7,8-TCDD	(pg/g)	0.720	0.160	0.250	0.110	0.140	0.100	0.064
Measured TOC	(g o.c./g)	0.0222	0.0285	0.0346	0.0242	0.00392	0.0196	0.0187
oc-normalized 2,3,7,8-TCDD	(ng TCDD/g oc)	0.032432432	0.005614035	0.007225434	0.004545455	0.035714286	0.005102041	0.00342246
oc-norm 2,3,7,8-TCDD/SQB Fresh Acute (T.U.a)		5.14019E-09	8.89765E-10	1.14515E-09	7.20406E-10	5.66033E-09	8.08619E-10	5.42423E-10
oc-norm 2,3,7,8-TCDD/SQB Fresh Chronic (T.U.c)		5.14019E-06	8.89765E-07	1.14515E-06	7.20406E-07	5.66033E-06	8.08619E-07	5.42423E-07







Organic Carbon Normalized Bioaccumulation-Based Sediment Quality Criterion (BBSQC) for the Protection of Human Health
OCDD, PeCDD and HpCDD

Equations used to calculated the BBSQB were adapted from Greene (1997b

This part of the assessment considers 3 specific dioxin and furan compounds: OCDD because it is the most abundant dioxin and furan compounc the sediment samples; and 1,2,3,7,8-PeCDD and 1,2,3,4,6,7,8-HpCDD because they, along with OCDD, represent the greatest TEQ load to BWR fish. This approac is considered sufficient for this screening level assessment. Results will be hedged with the knowledge that not all dioxin and furan compounds are considere

The approach involves calculating an organic carbon normalized concentration of OCDD and 1,2,3,7,8-PeCDD in the sediments based upon a biota sediment accumulation factor (BSAF) for these 3 compounds and an acceptable concentration in edible fish flesh. The resulting oc-normalized sedim concentrations serve as a bioaccumulation-based sediment quality benchmarks (BB SQB) or criteria against which the actual field data can be comparec The results of the comparison are expressed as the ratio of the oc-normalized field data to the oc-normalized BB SQB. Ratios greater than 1 indica increased risk and ratios less than 1 imply lower (de minimus) risk. For purposes of this analysis, acceptable concentrations of 1,2,3,7,8-PeCD OCDD, and 1,2,3,4,6,7,8-HpCDD in fish are defined as concentrations that keep human health risk low (i.e., lifetime cancer risk < 10-5) even if someone were t consume an average of 17.5 grams of fish per day from the waterway. This is equivalent to 4.3 ounces per week, or roughly 1 serving per week. This is no dou a conservative assumption for the Brandywine River: BWR does not support a major recreational fishery; access to BWR is limited in many area and there's already a fish consumption advisory in place for the non-tidal BWR that discourages consuming large quantities of fish caught from that waterbc

Calculation of the BBSQB

Variable	Abbreviation	Value	Units	Comment
Risk Level	RL	0.00001	unitless	Consistent with DE HSCA & DE fish advisory progran
Human Body Weight	BW	70	kg	EPA guidance
Lifetime Duration	LT	75	yr	EPA guidance
Exposure Duratior	ED	30	yr	EPA guidance; used only in Consuption Advisory risk assessme
Fish Consumption Rate	CR	0.0175	kg/day	KCA (1994) & EPA (2002)
GI Adsorption Factor	AF	1	unitless	
Reduction for Trimming/Cooking	RF	0	%	
Cancer Potency TCDD	q_1^*	1.56E+05	$(mg/kg\text{-}d)^{-1}$	EPA (2000)
Toxicity Equivalency Factor for 1,2,3,4,6,7,8-HpCDD	TEF	1.00E-02	(mg/kg-d)	Van den Berg et.al. (2006)
Toxicity Equivalency Factor for 1,2,3,7,8-PeCDD	TEF	1	(mg/kg-d)	Van den Berg et.al. (2006)
Toxicity Equivalency Factor for OCDD	TEF	0.0003	(mg/kg-d)	Van den Berg et.al. (2006)
Lipid Fraction of Fish Fillet	l_f	0.0255	kg lipid/kg fillet	Greene (2016a,b); median for White Sucker and Smallmouth Bass among 4 sites - calculation below
Biota to Sediment Accumulation Factor for 1,2,3,4,6,7,8-HpCDD	BSAF	0.00772	kg lipid/kg o.c.	Greene (2016a,b); median for White Sucker and Smallmouth Bass among 4 sites - calculation belo
Biota to Sediment Accumulation Factor for 1,2,3,7,8-PeCDD	BSAF	0.234	kg lipid/kg o.c.	Greene (2016a,b); median for White Sucker and Smallmouth Bass among 4 sites - calculation belo
Biota to Sediment Accumulation Factor for OCDD	BSAF	0.00099	kg lipid/kg o.c.	Greene (2016a,b); median for White Sucker and Smallmouth Bass among 4 sites - calculation belo
BBSQB for 1,2,3,4,6,7,8-HpCDD	BBSQB	3.26E-01	mg/kg o.c.	Same as ug/g o.c.
BBSQB for 1,2,3,7,8-PeCDD	BBSQB	1.07E-04	mg/kg o.c.	Same as ug/g o.c.
BBSQB for OCDD	BBSQB	84.6	mg/kg o.c.	Same as ug/g o.c.

Note that the BBSQBs will be 10 times more stringent if a 10^{-6} cancer isk is used in the calculations.

Next we compare the organic carbon normalized concentrations of 1,2,3,7,8-PeCDD, 1,2,3,4,6,7,8-HpCDD and OCDD from BWR to the above benchmarks. The comparison is expressed as the ratio between the observed concentration to the SC Therefore, ratios greater than 1 indicate exceedance of the benchmark and an increased likelihood of a bioaccumulation proble

Comparison of SQB to OC Normalized Sediment Concentrations

		BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-0320	BWR-DAM5	BWR-DAM6-T1-0620	BWR-DAM6-T2-0620	BWR-DAM6-T3-0620	BWR-DAM7-T1-0320	BWR-DAM7-T2-0320	BWR-DAM7-T3-0320	BWR-DAM8-T1-0320	BWR-DAM8-T2-0320	BWR-DAM9-T1-0620	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DAM11-T1-0320	BWR-DAM11-T2-0320
Measured 1,2,3,4,6,7,8-HpCDD	(pg/g)	157	67.6	87.5	157	203	84.8	49.4	31.3		89.9	76.2	80.9	354	213	20.9	350	309	103	134	156	73.8	114	239
Measured 1,2,3,7,8-PeCDD	(pg/g)	0.65	0.51	0.5	0	1.93	0.62	0.35	0		0.67	0.69	0.55	1.77	0.66	0.13	2.46	2.5	0.76	0.99	0.76	0.5	0.51	0.48
Measured OCDD	(pg/g)	5920	3470	4370	6660	10900	3750	2170	1070		3940	2920	3680	10600	9500	935	11900	13000	4720	6120	5590	5840	5600	10600
Measured TOC	(g o.c./g sed)	0.01280	0.01510	0.01220	0.0163	0.0259	0.0198	0.0118	0.0121		0.0212	0.0178	0.0234	0.0161	0.0211	0.0211	0.0243	0.0222	0.0285	0.0346	0.0242	0.00392	0.0196	0.0187
oc-normalized 1,2,3,4,6,7,8-HpCDD	(ng HpCDD/g oc)	12.266	4.477	7.172	9.632	7.838	4.283	4.186	2.587		4.241	4.281	3.457	21.988	10.095	0.991	14.403	13.919	3.614	3.873	6.446	18.827	5.816	12.781
oc-normalized 1,2,3,7,8-PeCDD	(ng PeCDD/g oc)	0.051	0.034	0.041	0.000	0.075	0.031	0.030	0.000		0.032	0.039	0.024	0.110	0.031	0.006	0.101	0.113	0.027	0.029	0.031	0.128	0.026	0.026
oc-normalized OCDD	(ng OCDD/g oc)	462.500	229.801	358.197	408.589	420.849	189.394	183.898	88.430		185.849	164.045	157.265	658.385	450.237	44.313	489.712	585.586	165.614	176.879	230.992	1489.796	285.714	566.845
BBSQB for 1,2,3,4,6,7,8-HpCDD	(ng HpCDD/g oc)	325.58	325.58	325.58	325.58	325.58	325.58	325.58	325.58		325.58	325.58	325.58	325.58	325.58	325.58	325.58	325.58	325.58	325.58	325.58	325.58	325.58	325.58
BBSQB for 1,2,3,7,8-PeCDD	(ng PeCDD/g oc)	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11		0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
BBSQB for OCDD	(ng OCDD/g oc)	84641	84641	84641	84641	84641	84641	84641	84641		84641	84641	84641	84641	84641	84641	84641	84641	84641	84641	84641	84641	84641	84641
Ratio to BBSQB for 1,2,3,4,6,7,8-HpCDD		0.038	0.014	0.022	0.030	0.024	0.013	0.013	0.008		0.013	0.013	0.011	0.068	0.031	0.003	0.044	0.043	0.011	0.012	0.020	0.058	0.018	0.039
Ratio to BBSQB for 1,2,3,7,8-PeCDD		0.473	0.314	0.381	0.000	0.694	0.291	0.276	0.000		0.294	0.361	0.219	1.023	0.291	0.057	0.942	1.048	0.248	0.266	0.292	1.187	0.242	0.239
Ratio to BBSQB for OCDD		0.005	0.003	0.004	0.005	0.005	0.002	0.002	0.001		0.002	0.002	0.002	0.008	0.005	0.001	0.006	0.007	0.002	0.002	0.003	0.018	0.003	0.007

Sample Name	% Lipid	kg lipid/kg fillet	OCDD BSAF (kg lipid/kg o.c.)	PeCDD BSAF (kg lipid/kg o.c.)	HpCDD BSAF (kg lipid/kg o.c.)
BRSmithBr-FISH-1015	3.09	0.0309	0.00053	5.42218	0.00686
BRRocklandRd-FISH-1015	4.25	0.0425	0.00096	0.00687	0.00858
BRRocklandRd-SMB-1015	1.36	0.0136	0.00102	0.01994	0.01124
BR95CityDam-FISH-1015	2.01	0.0201	0.00123	0.44828	0.00541

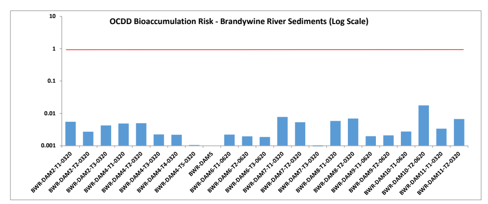
Sample Name	OCDD Tissue Conc. (ng/g)	PeCDD Tissue Conc. (ng/g)	HpCDD Tissue Conc. (ng/g)	OCDD Sediment Conc. (ng/g)	PeCDD Sediment Conc. (ng/g)	HpCDD Sediment Conc. (ng/g)	%TOC	%Lipid	Lipid Normalized OCDD Tissue Conc. (ng/g)	OC Normalized OCDD Sediment Conc. (ng/g)	Lipid Normalized PeDD Tissue Conc. (ng/g)	OC Normalized PeCDD Sediment Conc. (ng/g)	Lipid Normalized HpCDD Tissue Conc. (ng/g)	OC Normalized HpCDD Sediment Conc. (ng/g)	OCDD BSAF (kg/kg)	PeCDD BSAF (kg/kg)	HpCDD BSAF (kg/kg)
BRSmithBr-1015	0.00173	0.00194	0.000444	4.82	0.000528	0.0955	4.56	3.09	0.06	105.70	0.06	0.01	0.01	2.09	0.00053	5.42218	0.00686
BRRocklandRd-1015	0.0019	0.000237	0.000501	0.138	0.00241	0.00408	0.297	4.25	0.04	46.46	0.01	0.81	0.01	1.37	0.00096	0.00687	0.00858
BRRocklandRd-1015 (SMB)	0.000647	0.00022	0.00021	0.138	0.00241	0.00408	0.297	1.36	0.05	46.46	0.02	0.81	0.02	1.37	0.00102	0.01994	0.01124
BR95CityDam1015	0.0014	0.000345	0.000389	0.403	0.000273	0.0255	0.713	2.01	0.07	56.52	0.02	0.04	0.02	3.58	0.00123	0.44828	0.00541

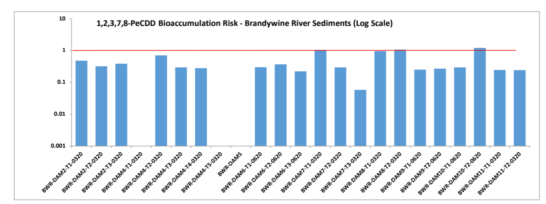
1/2 Method Detection Limit

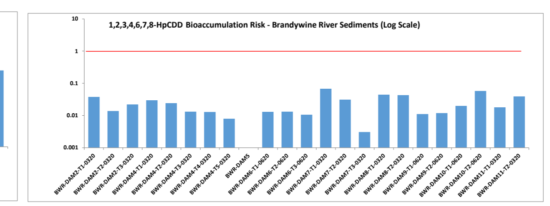
Summary Statistics - Non-Tidal Brandywine

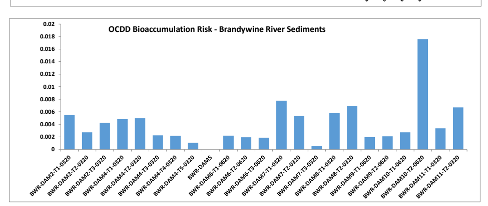
	Lipid Content (kg/kg)	OCDD BSAF	PeCDD BSAF	HpCDD BSAF
Mean	0.0268	0.00094	1.47432	0.00802
Standard Error	0.0063	0.00015	1.31994	0.00125
Median	0.0255	0.00099	0.23411	0.00772
Mode	#N/A	#N/A	#N/A	#N/A
Standard Deviation	0.0127	0.00030	2.63989	0.00251
Sample Variance	0.0002	0.00000	6.96901	0.00001
Kurtosis	-1.4413	1.96192	3.87336	-0.34300
Skewness	0.4493	-1.06743	1.96454	0.59625
Range	0.0289	0.00070	5.41531	0.00583
Minimum	0.0136	0.00053	0.00687	0.00541
Maximum	0.0425	0.00123	5.42218	0.01124
Sum	0.1071	0.00375	5.89727	0.03209
Count	4	4	4	4

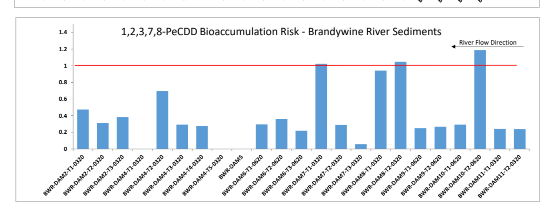
BSAFs were calculated from 2015 WATAR Dataset for non-tidal Brandywine sampling stations.
BSAF = Lipid Normalized Fish Tissue Concentration / Organic Carbon Normalized Sediment Concentratio

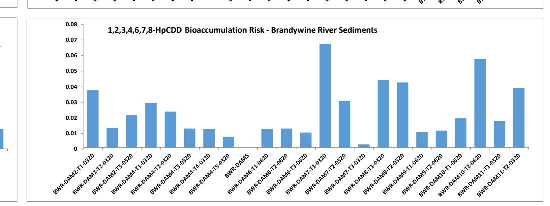












	BRSmithBr-FISH-1015	BRRocklandRd-FISH-1015	BR95CityDam-FISH-1015
% of PeCDD in 2015 Fish Tissue TEQ Fingerprint	0.00%	37.50%	48.78%
% of HpCDD in 2015 Fish Tissue TEQ Fingerprint	0.00%	0.79%	0.55%
% of OCDD in 2015 Fish Tissue TEQ Fingerprint	0.17%	0.09%	0.06%

Assessment of Potential Toxicity to Human Health due to Dioxin and Furan TEQs from Drinking Water and Eating Fish From the Brandywine River

To assess this endpoint, porewater concentrations of PeCDD, HpCDD and OCDD will be estimated because they represent the greatest TEQ load to BWR fish. Those estimated concentrations will then be multiplied by their respective TEF, to give an estimated TEQ in sediment porewater, which in turn can compared to applicable water quality criteria.

Predicted Pore Water Concentration of PeCdd in Brandywine River Samples

Parameter	Symbol / Units	BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-0320	BWR-DAM6-T1-0620	BWR-DAM6-T2-0620	BWR-DAM6-T3-0620	BWR-DAM7-T1-0320	BWR-DAM7-T2-0320	BWR-DAM7-T3-0320	BWR-DAM8-T1-0320	BWR-DAM8-T2-0320	BWR-DAM9-T1-0620	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DAM11-T1-0320	BWR-DAM11-T2-0320	Reference
Log 1,2,3,7,8-PeCDD Octanol Water Partition Coefficient =	$\log K_{ow}$ = (mg chem/L octanol)/(mg chem/L water)	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	EPA 2004
1,2,3,7,8-PeCDD Octanol Water Partition Coefficient =	K_{ow} = (mg chem/L octanol)/(mg chem/L water)	3.16E+07	3.16E+07	3.16E+07	3.16E+07	3.16E+07	3.16E+07	3.16E+07	3.16E+07	3.16E+07	3.16E+07	3.16E+07	3.16E+07	3.16E+07	3.16E+07	3.16E+07	3.16E+07	3.16E+07	3.16E+07	3.16E+07	3.16E+07	3.16E+07	3.16E+07	
Organic Carbon - Water Partition Coefficient =	K_{oc} = (mg chem/kg org. carbon)/(mg chem/L water)	5.01E+05	5.01E+05	5.01E+05	5.01E+05	5.01E+05	5.01E+05	5.01E+05	5.01E+05	5.01E+05	5.01E+05	5.01E+05	5.01E+05	5.01E+05	5.01E+05	5.01E+05	5.01E+05	5.01E+05	5.01E+05	5.01E+05	5.01E+05	5.01E+05	5.01E+05	Schwarzenbach, et.al., 2003
Fraction of Organic Carbon in Sediment =	f_{oc} = TOC/100 = (kg org. carbon/kg sediment)	0.0128	0.0151	0.0122	0.0163	0.0259	0.0198	0.0118	0.0121	0.0212	0.0178	0.0234	0.0161	0.0211	0.0211	0.0243	0.0222	0.0285	0.0346	0.0242	0.00392	0.0196	0.0187	
Sediment - Water Partition Coefficient =	$K_d = f_{oc}K_{oc}$ = (L water/kg sediment)	6.41E+03	7.57E+03	6.11E+03	8.17E+03	1.30E+04	9.92E+03	5.91E+03	6.06E+03	1.06E+04	8.92E+03	1.17E+04	8.07E+03	1.06E+04	1.06E+04	1.22E+04	1.11E+04	1.43E+04	1.73E+04	1.21E+04	1.96E+03	9.82E+03	9.37E+03	DiToro, et.al., 1991
1,2,3,7,8-PeCDD in Sediment =	C_s = (ug chem/kg sed = ppb)	0.00065	0.00051	0.0005	0.00296	0.00193	0.00062	0.00035	0.00023	0.00067	0.00069	0.00055	0.00177	0.00066	0.00013	0.00246	0.0025	0.00076	0.00099	0.00076	0.0005	0.00051	0.00048	
Estimated Pore Water Concentration =	$C_d = C_s/K_d$ = (ug chem/L water = ppb)	1.01E-07	6.74E-08	8.18E-08	3.62E-07	1.49E-07	6.25E-08	5.92E-08	3.79E-08	6.31E-08	7.73E-08	4.69E-08	2.19E-07	6.24E-08	1.23E-08	2.02E-07	2.25E-07	5.32E-08	5.71E-08	6.27E-08	2.54E-07	5.16E-08	5.15E-08	DiToro, et.al., 1991
1,2,3,7,8-PeCDD TEF	1	1.01E-07	6.74E-08	8.18E-08	3.62E-07	1.49E-07	6.25E-08	5.92E-08	3.79E-08	6.31E-08	7.73E-08	4.69E-08	2.19E-07	6.24E-08	1.23E-08	2.02E-07	2.25E-07	5.32E-08	5.71E-08	6.27E-08	2.54E-07	5.16E-08	5.15E-08	Van den Berg et.al. (2006)

Predicted Pore Water Concentration of 1,2,3,4,6,7,8 HpCDD in Brandywine River Samples

Parameter	Symbol / Units	BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-0320	BWR-DAM6-T1-0620	BWR-DAM6-T2-0620	BWR-DAM6-T3-0620	BWR-DAM7-T1-0320	BWR-DAM7-T2-0320	BWR-DAM7-T3-0320	BWR-DAM8-T1-0320	BWR-DAM8-T2-0320	BWR-DAM9-T1-0620	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DAM11-T1-0320	BWR-DAM11-T2-0320	Reference
Log 1,2,3,4,7,8-HpCDD Octanol Water Partition Coefficient =	$\log K_{ow}$ = (mg chem/L octanol)/(mg chem/L water)	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	EPA 2004
1,2,3,4,7,8-HpCDD Octanol Water Partition Coefficient =	K_{ow} = (mg chem/L octanol)/(mg chem/L water)	1.58E+08	1.58E+08	1.58E+08	1.58E+08	1.58E+08	1.58E+08	1.58E+08	1.58E+08	1.58E+08	1.58E+08	1.58E+08	1.58E+08	1.58E+08	1.58E+08	1.58E+08	1.58E+08	1.58E+08	1.58E+08	1.58E+08	1.58E+08	1.58E+08	1.58E+08	
Organic Carbon - Water Partition Coefficient =	K_{oc} = (mg chem/kg org. carbon)/(mg chem/L water)	1.65E+06	1.65E+06	1.65E+06	1.65E+06	1.65E+06	1.65E+06	1.65E+06	1.65E+06	1.65E+06	1.65E+06	1.65E+06	1.65E+06	1.65E+06	1.65E+06	1.65E+06	1.65E+06	1.65E+06	1.65E+06	1.65E+06	1.65E+06	1.65E+06	1.65E+06	Schwarzenbach, et.al., 2003
Fraction of Organic Carbon in Sediment =	f_{oc} = TOC/100 = (kg org. carbon/kg sediment)	0.0128	0.0151	0.0122	0.0163	0.0259	0.0198	0.0118	0.0121	0.0212	0.0178	0.0234	0.0161	0.0211	0.0211	0.0243	0.0222	0.0285	0.0346	0.0242	0.00392	0.0196	0.0187	
Sediment - Water Partition Coefficient =	$K_d = f_{oc}K_{oc}$ = (L water/kg sediment)	2.11E+04	2.49E+04	2.02E+04	2.69E+04	4.28E+04	3.27E+04	1.95E+04	2.00E+04	3.50E+04	2.94E+04	3.87E+04	2.66E+04	3.49E+04	3.49E+04	4.01E+04	3.67E+04	4.71E+04	5.72E+04	4.00E+04	6.48E+03	3.24E+04	3.09E+04	DiToro, et.al., 1991
1,2,3,4,7,8-HpCDD in Sediment =	C_s = (ug chem/kg sed = ppb)	0.157	0.0676	0.0875	0.157	0.203	0.0848	0.0494	0.0313	0.0899	0.0762	0.0809	0.354	0.213	0.0209	0.35	0.309	0.103	0.134	0.156	0.0738	0.114	0.239	
Estimated Pore Water Concentration =	$C_d = C_s/K_d$ = (ug chem/L water = ppb)	7.42E-06	2.71E-06	4.34E-06	5.83E-06	4.74E-06	2.59E-06	2.53E-06	1.57E-06	2.57E-06	2.59E-06	2.09E-06	1.33E-05	6.11E-06	6.00E-07	8.72E-06	8.43E-06	2.19E-06	2.34E-06	3.90E-06	1.14E-05	3.52E-06	7.74E-06	DiToro, et.al., 1991
1,2,3,4,6,7,8-HpCDD TEF	0.01	7.42E-08	2.71E-08	4.34E-08	5.83E-08	4.74E-08	2.59E-08	2.53E-08	1.57E-08	2.57E-08	2.59E-08	2.09E-08	1.33E-07	6.11E-08	6.00E-09	8.72E-08	8.43E-08	2.19E-08	2.34E-08	3.90E-08	1.14E-07	3.52E-08	7.74E-08	Van den Berg et.al. (2006)

Predicted Pore Water Concentration of OCDD in Brandywine River Samples

Parameter	Symbol / Units	BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-0320	BWR-DAM6-T1-0620	BWR-DAM6-T2-0620	BWR-DAM6-T3-0620	BWR-DAM7-T1-0320	BWR-DAM7-T2-0320	BWR-DAM7-T3-0320	BWR-DAM8-T1-0320	BWR-DAM8-T2-0320	BWR-DAM9-T1-0620	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DAM11-T1-0320	BWR-DAM11-T2-0320	Reference
Log OCDD Octanol Water Partition Coefficient =	$\log K_{ow}$ = (mg chem/L octanol)/(mg chem/L water)	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	EPA 2004
OCDD Octanol Water Partition Coefficient =	K_{ow} = (mg chem/L octanol)/(mg chem/L water)	3.98E+08	3.98E+08	3.98E+08	3.98E+08	3.98E+08	3.98E+08	3.98E+08	3.98E+08	3.98E+08	3.98E+08	3.98E+08	3.98E+08	3.98E+08	3.98E+08	3.98E+08	3.98E+08	3.98E+08	3.98E+08	3.98E+08	3.98E+08	3.98E+08	3.98E+08	
Organic Carbon - Water Partition Coefficient =	K_{oc} = (mg chem/kg org. carbon)/(mg chem/L water)	3.27E+06	3.27E+06	3.27E+06	3.27E+06	3.27E+06	3.27E+06	3.27E+06	3.27E+06	3.27E+06	3.27E+06	3.27E+06	3.27E+06	3.27E+06	3.27E+06	3.27E+06	3.27E+06	3.27E+06	3.27E+06	3.27E+06	3.27E+06	3.27E+06	3.27E+06	Schwarzenbach, et.al., 2003
Fraction of Organic Carbon in Sediment =	f_{oc} = TOC/100 = (kg org. carbon/kg sediment)	0.0128	0.0151	0.0122	0.0163	0.0259	0.0198	0.0118	0.0121	0.0212	0.0178	0.0234	0.0161	0.0211	0.0211	0.0243	0.0222	0.0285	0.0346	0.0242	0.00392	0.0196	0.0187	
Sediment - Water Partition Coefficient =	$K_d = f_{oc}K_{oc}$ = (L water/kg sediment)	4.18E+04	4.93E+04	3.98E+04	5.32E+04	8.46E+04	6.47E+04	3.85E+04	3.95E+04	6.92E+04	5.81E+04	7.64E+04	5.26E+04	6.89E+04	6.89E+04	7.94E+04	7.25E+04	9.31E+04	1.13E+05	7.90E+04	1.28E+04	6.40E+04	6.11E+04	DiToro, et.al., 1991
OCDD in Sediment =	C_s = (ug chem/kg sed = ppb)	5.92	3.47	4.37	6.66	10.9	3.75	2.17	1.07	3.94	2.92	3.68	10.6	9.5	0.935	11.9	13	4.72	6.12	5.59	5.84	5.6	10.6	
Estimated Pore Water Concentration =	$C_d = C_s/K_d$ = (ug chem/L water = ppb)	1.42E-04	7.04E-05	1.10E-04	1.25E-04	1.29E-04	5.80E-05	5.63E-05	2.71E-05	5.69E-05	5.02E-05	4.82E-05	2.02E-04	1.38E-04	1.36E-05	1.50E-04	1.79E-04	5.07E-05	5.42E-05	7.07E-05	4.56E-04	8.75E-05	1.74E-04	DiToro, et.al., 1991
OCDD TEF	0.0003	4.25E-08	2.11E-08	3.29E-08	3.75E-08	3.87E-08	1.74E-08	1.69E-08	8.12E-09	1.71E-08	1.51E-08	1.44E-08	6.05E-08	4.14E-08	4.07E-09	4.50E-08	5.38E-08	1.52E-08	1.62E-08	2.12E-08	1.37E-07	2.62E-08	5.21E-08	Van den Berg et.al. (2006)

	Units	BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-0320	BWR-DAM6-T1-0620	BWR-DAM6-T2-0620	BWR-DAM6-T3-0620	BWR-DAM7-T1-0320	BWR-DAM7-T2-0320	BWR-DAM7-T3-0320	BWR-DAM8-T1-0320	BWR-DAM8-T2-0320	BWR-DAM9-T1-0620	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DAM11-T1-0320	BWR-DAM11-T2-0320
Sum of TEFs for PeCDD, HpCDD and OCDD	(ug chem/L water = ppb)	2.18E-07	1.16E-07	1.58E-07	4.58E-07	2.35E-07	1.06E-07	1.01E-07	6.17E-08	1.06E-07	1.18E-07	8.23E-08	4.13E-07	1.65E-07	2.24E-08	3.34E-07	3.63E-07	9.03E-08	9.68E-08	1.23E-07	5.05E-07	1.13E-07	1.81E-07
Human Health Criterion (Fish & Water Ingestion)	(ug chem/L water = ppb)	0.000000005	0.000000005	0.000000005	0.000000005	0.000000005	0.000000005	0.000000005	0.000000005	0.000000005	0.000000005	0.000000005	0.000000005	0.000000005	0.000000005	0.000000005	0.000000005	0.000000005	0.000000005	0.000000005	0.000000005	0.000000005	0.000000005
Human Health Toxic Units ($T.U._{hh}$)		43.6	23.1	31.6	91.6	47.0	21.2	20.3	12.3	21.2	23.7	16.5	82.6	33.0	4.5	66.8	72.5	18.1	19.4	24.6	101.1	22.7	36.1
Drinking Water MCL	(ug TCDD/L water = ppb)	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Ratio of predicted concentration to MCL		7.2685166E-06	3.8532993E-06	5.2697482E-06	1.5272274E-05	7.8262037E-06	3.5267047E-06	3.3805481E-06	2.0569450E-06	3.5266529E-06	3.9442486E-06	2.7423872E-06	1.3764442E-05	5.4959064E-06	7.4532136E-07	1.1138764E-05	1.2091329E-05	3.0099117E-06	3.2260529E-06	4.0967251E-06	1.6843782E-05	3.7790514E-06	6.0217379E-06

	BRSmithBr-FISH-1015	BR95CityDam-FISH-1015	Max Predicted Porewater
PeCDD in 2015 Surface Water Samples (ug chem/L water = ppb)	ND	ND	3.98E+08
HpCDD in 2015 Surface Water Samples (ug chem/L water = ppb)	1.39E-06	1.07E-06	1.33E-05
OCDD in 2015 Surface Water Samples (ug chem/L water = ppb)	3.16E-05	2.71E-05	4.56E-04

Ratio of SW Measurement to Porewater Estimate - Using Highest Predicted Concentration Between All Stations

Ratio PeCDD in Surface Water/Estimated Porewater	ND in Surface Water	ND in Surface Water
Ratio HpCDD in Surface Water/Estimated Porewater	1.04E-01	8.04E-02
Ratio OCDD in Surface Water/Estimated Porewater	6.93E-02	5.94E-02

Results greater than 1 indicate that surface water concentrations are higher than predicted porewater concentrations. Results less than one indicate that predicted porewater concentrations are higher than measured surface water cocentrations.

References

Alcock RE and Jones KC. 1996. Dioxins in the environment: A review of trend data. Environ Sci Technol 30(11): 3133-3143

Baker JI and Hites RA. 2000. Is combustion the major source of polychlorinated dibenzo-p-dioxins and dibenzofurans to the environment? A massbalance investigation. Environ Sci Technol 34(14): 2879-2886.

Bonn BA. 1998. Polychlorinated dibenzo-p-dioxin and dibenzofuran concentration profiles in sediment and fish tissue of the Williamette Basin, Oregon. Environ Sci Technol 32(6): 729-735.

DiToro D, et.al. 1991. Technical basis for establishing sediment quality criteria for nonionic organic chemicals using equilibrium partitioning. Environ Tox Chem 10: 1541-1583.

DNREC. 2004. State of Delaware Surface Water Quality Standards as Amended July 11, 2004. Delaware Department of Natural Resources and Environmental Control, Division of Water Resources, Watershed Assessment Branch, Dover, DE.

DNREC. 2013. Department of Natural Resources and Environmental Control, Division of Waste and Hazardous Substances, Remediation Section, HSCA Screening Level Table, Last updated February 2020. New Castle, DE.

EPA. 1984. Ambient Water Quality Criteria for 2,3,7,8-Tetrachloro-dibenzo-p-dioxin (EPA 440/5-84-007). U.S. Environmental Protection Agency, Office of Water, Washington, DC.

EPA. 2000. Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories, Volume 1 Fish Sampling and Analysis, Third Edition (EPA 823-B-00-007). U.S. Environmental Protection Agency, Office of Water, Washington, DC.

EPA. 2002. National Recommended Water Quality Criteria: 2002 (EPA-822-R-02-047). U.S. Environmental Protection Agency, Office of Water and Office of Science and Technology, Washington, DC.

EPA. 2004. Exposure and Human Health Reassessment of 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD) and Related Compounds. National Academy Sciences (External Review Draft) (EPA/600/P-00/001).

EPA. 2006. An Inventory of Sources and Environmental Releases of Dioxin-Like Compounds in the United States for the Years 1987, 1995, and 2000 (EPA/600/P-03/002F). U.S. Environmental Protection Agency, Office of Research and Development, Washington, DC.

Fuchsman PC, TR Barber, JC Lawton, and KB Leigh. 2006. An evaluation of cause-effect relationships between polychlorinated biphenyl concentrations and sediment toxicity to benthic invertebrates. Environ Tox Chem 25(10): 2601-2612.

Greene RW. 1997a. Summary of Dioxin, Furan and Coplanar PCB Toxicity Equivalents (TEQs) in Delaware Aqueous Sediments. Delaware Department of Natural Resources and Environmental Control, Watershed Assessment Branch, Dover, DE.

Greene RW. 1997b. Bioaccumulation-based Sediment Quality Criteria for the Protection of Human Health. Delaware Department of Natural Resources and Environmental Control, Division of Water Resources, Watershed Assessment Branch, Dover, DE.

Greene RW. 2008. Dioxins and Furans in Fish from the Delaware River (Powerpoint presentation). Delaware Department of Natural Resources and Environmental Control, Watershed Assessment Branch, Dover, DE.

Greene RW. 2009a. Persistent, Bioaccumulative, and Toxic (PBT) Pollutants in Surface Water, Sediment, and Biota of the Christina Basin and Shellpot Creek Watershed, DE (Powerpoint presentation). Delaware Department of Natural Resources and Environmental Control, Dover, DE.

Greene RW. 2009b. The Chemical, Physical and Biological Fate of Polychlorinated Biphenyls in the Tidal Christina Basin. A doctoral dissertation submitted to the University of Delaware Department of Civil Engineering, Newark, DE.

Greene RW. 2009c. Persistent, Bioaccumulative, and Toxic (PBT) Pollutants in Surface Water, Sediment, and Biota of the Christina Basin and Shellpot Creek Watershed, DE. Spreadsheet analysis. Delaware Department of Natural Resources and Environmental Control, Dover, DE.

Greene, R. 2016a. WATAR 2015 Fish Tissue Data. Spreadsheet analysis. Delaware Department of Natural Resources and Environmental Control, Dover, DE.

Greene, R. 2016b. WATAR 2015 Sediment Data. Spreadsheet analysis. Delaware Department of Natural Resources and Environmental Control, Dover, DE.

Hites RA. 1990. Environmental behavior of chlorinated dioxins and furans. Acc Chem Res 23: 194-201.

Hites RA. 2011. Dioxins: An overview and history. Environ Sci Technol 45(1): 16-20.

Holt E, Weber R, Stevenson G, and Gaus C. 2010. Polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/Fs) impurities in pesticides: A neglected source of contemporary relevance. Environ Sci Technol 44(14): 5409-5415.

KCA Research Division, David C. Cox & Associates. 1994. Fish Consumption Patterns of Delaware Recreational Fishermen and Their Households. Prepared for the State of Delaware, Department of Natural Resources and Environmental Control, Dover, DE.

Liu G, et.al. 2009. Atmospheric emission of PCDD/Fs, PCBs, hexachlorobenzene, and pentachlorobenzene from the coking industry. Environ Sci Technol 43(24): 9196-9201.

Mackay D, Shiu WY, Ma KC. 1992. Illustrated Handbook of Physical-Chemical Properties and Environmental Fate for Organic Chemicals, Vol I - Monoaromatic Hydrocarbons, Chlorobenzenes, and PCBs. Lewis, Boca Raton, FL.

Schwarzenbach R, P Gschwend, and D Imboden. 2003. Environmental Organic Chemistry, Second Edition. John Wiley & Sons, Inc., New York, NY.

Velinsky D, et.al. 2010. Vertical Profiles of Radioisotopes, Contaminants, Nutrients and Diatoms in Sediment Cores from the Tidal Christina Basin: A Historical Analysis. Report prepared by the Academy of Natural Sciences Philadelphia and the University of Delaware for the Delaware Department of Natural Resources and Environmental Control, Dover, DE.

Van den Berg M, et.al. 2006. The 2005 World Health Organization Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds. Toxicol Sci 93(2): 223-241.

Wenning RJ, et.al. 1993. Application of pattern recognition techniques to evaluate polychlorinated dibenzo-p-dioxin and dibenzofuran distributions in surficial sediments from the Lower Passaic River and Newark Bay. Ecotox Environ Safety 25: 103-125.

Evaluation of PAHs in Brandywine River Sediment Samples

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October 22, 2020

Methods:

The approach used to assess potential toxicity to benthic organisms from PAH mixtures in sediments is to compare organic carbon normalized field data for individual parent and alkylated PAH compounds to equilibrium partitioning sediment benchmarks (ESBs). ESBs for polycyclic aromatic hydrocarbons (PAHs) are based on equilibrium partitioning theory (EqP), are also expressed on an organic carbon basis, and recognize that the primary mode of toxicity for PAH compounds is type I narcosis. ESBs for 34 parent and alkylated PAH compounds were taken directly from Burgess et.al. (2013). Those ESBs appear on the ESB Comparison tab along with comparisons to the organic carbon normalized field data. The comparisons are expressed as the ratio of the organic carbon normalized field result for each parent and alkylated PAH compound to the associated ESB for those same compounds. Per Burgess et.al. (2013), the individual ratios are summed for each sample and expressed in toxic units ($\sum$ ESB TU_{FCV}). The "FCV" subscript is an abbreviation for final chronic value, reflecting the intent of the ESB to protect benthic aquatic life against longer term chronic effects as opposed to shorter term acute effects.

To evaluate the reported PAHs that did not have corresponding ESBs in Burgess et. al. 2013 (1-methylnaphthalene and 2-methylnaphthalenethe), the method involved first estimating the porewater concentration of the contaminant at each sample location. Second, a compound specific narcosis-based Secondary Chronic Value (SCV) was calculated for comparison to the porewater concentration as described by the USEPA (EPA, 2008), again expressed as toxic units.

Porewater concentrations were estimated for additional individual PAHs for comparison to Delaware human health water quality criteria for fish and water ingestion, since the Brandywine River is used as a drinking water source for the City of Wilmington (see spreadsheet tabs for Select PAH - HH).   The method involved predicting the concentration of each select PAH compound in the sediment porewater using EqP (Di Toro, 1991; Di Toro, 2000a; Di Toro, 2000b; EPA, 2003).

Bulk sediment concentrations were directly compared to DNREC RS Soil Screening Values to determine whether risk was likely from the potential excavation and upland disposal of sediments.

Results:

1. Total PAHs were detected in each of the samples collected, at concentrations between 349.3 ppb to 13,628 ppb.

2. Chronic toxicity to benthic aquatic life due to PAHs in the Dam 10 Transect 2 sample is possible. The method used to evaluate chronic toxicity of the PAHs to benthic organisms is describe above. Toxicity units greater than 1 indicate that porewater exposure concentrations may be high enough to cause toxicity to benthic organisms. This would provide an indication that the narrative criteria within Section 4 of Delaware's Surface Water Quality Standards (e.g., sections 4.5.9.2.1 and 4.5.9.2.2) are not being met, with the understanding that sediments and their associated pore waters are an integral part of Delaware's surface water environment. For these particular samples the largest chronic toxicity unit value was 2.60 at Dam 10 Transect 2, which is greater than 1, thereby indicating that chronic toxicity due to PAHs is possible at this location. Note that the approach used in this assessment accounts for bioavailability by predicting dissolved phase concentrations using equilibrium partitioning. Further, the 'cause-and-effect' of each PAH compound is considered through narcosis theory.

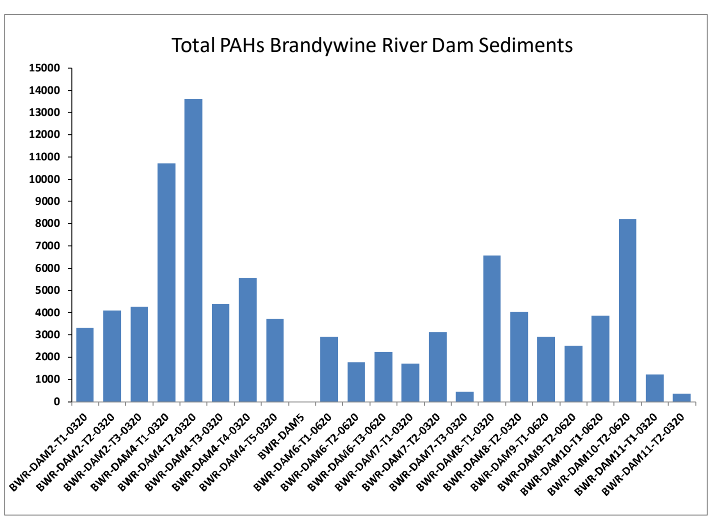
3. Based on fate and transport considerations, the concentration of specific PAH compounds dissolved in the water column during dam removal/modification/failure is expected to be no greater than the dissolved concentrations in the porewater prior to any activity. Since the potential for chronic toxicity to aquatic life from dissolved phase PAHs exists from one of the locations sampled prior to excavation, potential chronic toxicity is therefore possible during dam removal/modification/failure due to dissolved phase PAH compounds at this location. The possibility of a toxic impact in the water column can be minimized by using techniques that release as little sediment to the water column as possible.

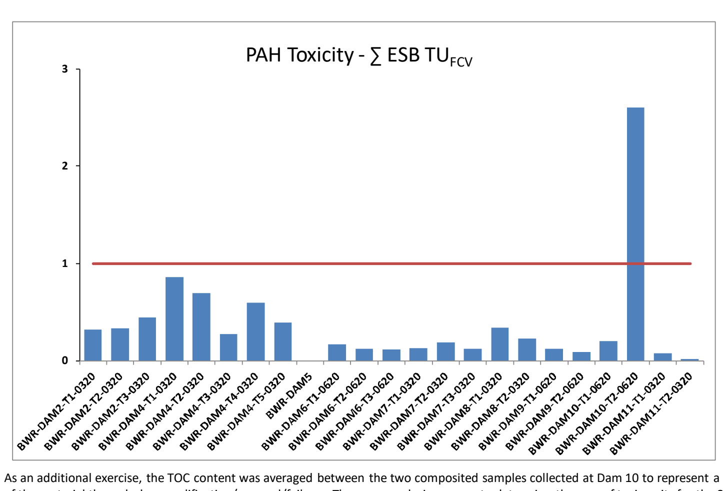
4. Three individual PAH compounds were estimated to be above DNREC Water Quality Standards for protection of human health from the consumption of fish and water. Again, a toxic unit approach was used to determine the magnitude of any exceedance of criteria. A toxic unit greater than one indicates that toxic impacts are possible. Toxics units greater than 1 were calculated for benzo(a)anthracene at Dam #2, Dam #4 and Dam #10. Toxic unit values ranged from 1.36 at Dam 4 Transect 5 to 14.2 at Dam 2 Transect 3. In addition, toxic units greater than 1 were calculated for benzo(b)fluoranthene at Dam #2 and Dam #10. Toxic unit values ranged from 1.96 at Dam 10 Transect 2 to 2.03 at Dam 2 Transect 3. Finally, toxic units greater than 1 were calculated for benzo(a)pyrene at every dam samples except Dam #11. Toxic unit values ranged from 1.04 at Dam 7 Transect 2 to 31.8 at Dam 2 Transect 3.

5. The concentration of individual PAHS in sediment was compared to the DNREC-RS Soil Screening Value for protection of human health to evaluate whether concentrations of individual compounds in sediment would pose a risk to human health if sediment were dredged/removed, dewatered, and deposited in an upland setting. Benzo(a)pyrene was the only compound detected at concentrations exceeding its screening level. Exceedances ranged from 260 ppb to 600 ppb (screening level is 240 ppb) and occurred at 8 of the 22 sample locations. Utilizing the maximum concentration detected in any sample, and therefore most conservative value for benzo(a)pyrene, the RAIS online risk calculator indicated that human health risk is not expected under the "recreator use scenario," "excavation worker use scenario" or "residential use" scenario.

Conclusions:

Overall, potential chronic toxicity to aquatic life from PAHs was observed for one sample (Dam 10 Transect 2). This assessment assumes, conservatively, that predicted concentrations in sediment porewater are in equilibrium with surface water. Further, the sediment samples collected from Dam 10 only represent the conditions on the western side of the River. Additionally, careful review of the data indicate that the composite sample collected at Dam 10 Transect 2 has the lowest concentration of total organic carbon of all samples collected. Organic carbon plays an important role in the bioavailability of many organic compounds, including PAHs. Note from the plots below that total PAH concentrations are higher at Dam 4 Transect 1 and Dam 4 Transect 2, but toxicity from PAHs is expected to be less than was predicted for Dam 10 Transect 2 (as shown by the sum of toxic units). TOC content at Dam 4 Transect 1 and Dam 4 transect 2 was measured at 1.6% and 2.6%, respectively. In contrast, the TOC content in the Dam 10 Transect 2 sample was measured at 0.4%.





As an additional exercise, the TOC content was averaged between the two composited samples collected at Dam 10 to represent a mixing of the material through dam modification/removal/failure. The same analysis was run to determine the sum of toxic units for the 34 reported PAHs (as described above) for the Dam 10 Transect 2 sample. Using an average TOC content of 1.4%, the resulting sum of toxic units was calculated to be 0.73, which is less than one.   Additional sampling across the entirety of the river, or confirmation of TOC content would help to refine this assessment.

Potential impacts to human health from benzo(a)pyrene were predicted at almost every location sampled. Potential human health impacts were predicted from benzo(a)anthracene and benzo(b)fluoranthene at few of the locations sampled, too. The conservative assumption that predicted porewater concentrations are in equilibrium with surface water applies, and also assumes that chemical concentrations are the same in sediment porewater as they are in overlying surface water.   This is highly unlikely. Further, and as shown through the example above, the averaging of TOC across multiple sample transects for each dam will have an effect on the predicted porewater concentrations, and therefore the predicted toxicity. Those additional assessments were not completed in this spreadsheet, but would be simple to do. Multiple lines of evidence should be used to assess overall potential for impact, too, in addition to predictions. Looking at the data for benzo(a)pyrene specifically, none of the predicted porewater concentrations exceed the drinking water MCL for protection of human health. Therefore the majority of the risk associated with the applicable criterion (and therefore the number of exceedances of the criterion) is based upon the potential accumulation of PAHs into the bodies of fish that are subsequently consumed by humans. Understanding that direct measurements are the best way to verify predictions, comparison of PAH data from the most recent DNREC fish contaminant monitoring program was performed.   The most recent data, collected in 2015 for fish in the non-tidal Brandywine River, indicates that PAHs (specifically benzo(a)pyrene TEQs) do not exceed regulatory thresholds for fish consumption. Specifically, four composite fish tissue samples were analyzed in 2015 for PAHs, along with other bioaccumulative compounds. Samples locations ranged from between Dam 2 and the state line at Smith Bridge. White sucker and smallmouth bass composite sample results indicated that benzo(a)pyrene TEQs (which also incorporate benzo(a)anthracene and benzo(b)fluoranthene) ranged from 0.01 ppb to 0.24 ppb. The DNREC Screening Value for benzo(a)pyrene TEQs in fish tissue is 54 ppb.   Therefore, although potential impacts to human health are predicted based upon the conservative mathematical approach used, direct measurement of PAHs in fish tissue as compared to health based criteria demonstrate that they are not accumulating in Brandywine River fish at concentrations that would cause impact to either themselves, or humans.

Supporting Calculations, Charts, and References Calculations which support the above findings appear within this spreadsheet. References cited appear on the last tab of this spreadsheet.

TestAmerica Laboratories, Inc.
Eurofins TestAmerica, Edison
SUMMARY OF ANALYTICAL RESULTS: 460-205020-1
Job Description: WATAR (DE-1525) BRANDYWINE DAM SEDIMENTS
For:
State of Delaware
391 Lukens Drive
New Castle, Delaware 19720-2774

Client ID		DNREC SIRS	BWR-DAM2-T1-0320			BWR-DAM2-T2-0320			BWR-DAM2-T3-0320			BWR-DAM4-T1-0320			BWR-DAM4-T1-0320			BWR-DAM4-T2-0320			BWR-DAM4-T2-0320		
Lab Sample ID		Screening Levels	460-205020-1			460-205020-2			460-205020-3			460-205020-4			460-205020-4			460-205020-5			460-205020-5		
Sampling Date		Soils	03/06/2020 10:30:00			03/05/2020 14:00:00			03/09/2020 10:30:00			03/09/2020 13:55:00			03/09/2020 13:55:00			03/09/2020 11:50:00			03/09/2020 11:50:00		
Matrix		Nov 2019	Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Dilution Factor			10			10			10			10			33.3			10			50		
Unit		ug/kg	ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 8270D SIM																							
1-Methylnaphthalene	90-12-0	18000	5.9	J	2	7.1	J	1.9	8.5	J	1.9	40		2.7	NR			36		2.2	NR		
2-Methylnaphthalene	91-57-6	24000	6.2	J	2.8	6.9	J	2.8	9.1	J	2.7	34		3.8	NR			40		3.1	NR		
Acenaphthene	83-32-9	360000	9.2	J	3.3	8.8	J	3.2	11		3.2	93		4.5	NR			120		3.7	NR		
Acenaphthylene	208-96-8	NA	15		2.1	35		2.1	37		2	18		2.9	NR			44		2.4	NR		
Anthracene	120-12-7	1800000	32		1.8	34		1.8	46		1.7	140		2.5	NR			260		2	NR		
Benzo[a]anthracene	56-55-3	1100	150		3.6	230		3.6	230		3.5	550		4.9	NR			NR			690	D	20
Benzo[a]pyrene	50-32-8	240	160	B	1.8	280	B	1.8	230	B	1.7	580	B	2.5	NR			NR			590	D	10
Benzo[b]fluoranthene	205-99-2	1110	180	B	2.3	310	B	2.3	180	B	2.2	680	B	3.1	NR			NR			570	D	13
Benzo[e]pyrene	192-97-2	NA	130		2.3	230		2.3	170		2.2	470		3.1	NR			460		2.6	NR		
Benzo[g,h,i]perylene	191-24-2	NA	93		4.6	140		4.5	110		4.4	240		6.3	NR			190		5.1	NR		
Benzo[k]fluoranthene	207-08-9	11000	160		2	300		1.9	210		1.9	650		2.7	NR			NR			650	D	11
C1-Chrysenes	STL00905	NA	110		11	160		11	140		11	250		15	NR			390		12	NR		
C1-Fluoranthenes/pyrene	STL00912	NA	180		11	230		11	270		11	530		15	NR			750		12	NR		
C1-Fluorenes	STL00913	NA	13		11	11	U	11	16		11	28		15	NR			89		12	NR		
C1-Phenanthrenes/Anthracenes	STL00901	NA	140		11	93		11	160		11	370		15	NR			630		12	NR		
C2-Chrysenes	STL00906	NA	74		11	83		11	78		11	100		15	NR			210		12	NR		
C2-Fluorenes	STL00914	NA	20		11	15		11	20		11	39		15	NR			150		12	NR		
C2-Naphthalenes	STL00917	NA	36		11	30		11	40		11	120		15	NR			200		12	NR		
C2-Phenanthrenes/Anthracenes	STL00902	NA	92		11	80		11	130		11	200		15	NR			570		12	NR		
C3-Chrysenes	STL00907	NA	33		11	23		11	45		11	30		15	NR			99		12	NR		
C3-Fluorenes	STL00915	NA	36		11	11	U	11	36		11	15	U	15	NR			180		12	NR		
C3-Naphthalenes	STL00918	NA	42		11	24		11	43		11	77		15	NR			270		12	NR		
C3-Phenanthrenes/Anthracenes	STL00903	NA	61		11	37		11	88		11	78		15	NR			330		12	NR		
C4-Chrysenes	STL00908	NA	20		11	11	U	11	29		11	15	U	15	NR			49		12	NR		
C4-Naphthalenes	STL00919	NA	39		11	16		11	36		11	44		15	NR			240		12	NR		
C4-Phenanthrenes/Anthracenes	STL00904	NA	46		11	22		11	100		11	43		15	NR			230		12	NR		
Chrysene	218-01-9	110000	200		4.6	320		4.5	260		4.4	NR			740	D	21	NR			830	D	26
Dibenz(a,h)anthracene	53-70-3	170	27		2	46		1.9	36		1.9	90		2.7	NR			82		2.2	NR		
Fluoranthene	206-44-0	240000	310		3.6	460		3.6	380		3.5	NR			1400	D	16	NR			1500	D	20
Fluorene	86-73-7	240000	13		2	12		1.9	16		1.9	120		2.7	NR			120		2.2	NR		
Indeno[1,2,3-cd]pyrene	193-39-5	1300	89		2	150		1.9	110		1.9	240		2.7	NR			220		2.2	NR		
Naphthalene	91-20-3	3800	14		5.1	16		5	19		4.9	57		7	NR			59		5.7	NR		
Perylene	198-55-0	NA	340		4.6	100		4.5	450		4.4	170		6.3	NR			380		5.1	NR		
Phenanthrene	85-01-8	180000	140		4.9	170		4.9	160		4.7	NR			1300	D	22	NR			1100	D	27
Pyrene	129-00-0	180000	300		4.3	430		4.2	370		4.1	NR			1200	D	19	NR			1300	D	24
Total Conc		NA	3316.3			4098.8			4273.6			6081			4640			6398			7230		

Client ID		DNREC SIRS	BWR-DAM4-T3-0320			BWR-DAM4-T4-0320			BWR-DAM4-T4-0320			BWR-DAM4-T5-0320			BWR-FIELDBLANK-0320_SOLID			BWR-DAM7-T1-0320			BWR-DAM7-T2-0320			BWR-DAM7-T3-0320		
Lab Sample ID		Screening Levels	460-205020-6			460-205020-7			460-205020-7			460-205020-8			460-205020-9			460-205020-11			460-205020-12			460-205020-13		
Sampling Date		Soils	03/09/2020 12:35:00			03/09/2020 12:55:00			03/09/2020 12:55:00			03/09/2020 13:15:00			03/12/2020 12:50:00			03/10/2020 13:15:00			03/10/2020 11:30:00			03/10/2020 12:10:00		
Matrix		Nov 2019	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Dilution Factor			10			10			25			10			1			10			10			2		
Unit		ug/kg	ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 8270D SIM																										
1-Methylnaphthalene	90-12-0	18000	15		2.6	7.6	J	1.9	NR			8.5	J	2	0.12	U	0.12	5.5	J	2	6.5	J	2	0.86	J	0.36
2-Methylnaphthalene	91-57-6	24000	11	J	3.7	4.1	J	2.6	NR			7	J	2.8	0.17	U	0.17	5.2	J	2.9	5.8	J	2.9	0.55	J	0.5
Acenaphthene	83-32-9	360000	14	J	4.4	21		3.1	NR			15		3.3	0.2	U	0.2	3.4	U	3.4	6	J	3.4	1.6	J	0.59
Acenaphthylene	208-96-8	NA	26	Z	2.8	27		2	NR			16		2.1	0.13	U	0.13	16		2.2	24		2.2	1.2	J	0.39
Anthracene	120-12-7	1800000	41	Z	2.4	69		1.7	NR			51		1.8	0.11	U	0.11	13		1.9	26		1.9	4.8		0.33
Benzo[a]anthracene	56-55-3	1100	240		4.8	370		3.4	NR			220		3.6	0.22	U	0.22	75		3.7	120		3.7	24		0.65
Benzo[a]pyrene	50-32-8	240	290	Z B	2.4	350	B	1.7	NR			240	B	1.8	0.34	J B	0.11	94	B	1.9	130	B	1.9	27		0.33
Benzo[b]fluoranthene	205-99-2	1110	340	Z B	3.1	470	B	2.2	NR			280	B	2.3	0.35	J B	0.14	100	B	2.4	120	B	2.4	33		0.41
Benzo[e]pyrene	192-97-2	NA	250	Z	3.1	290		2.2	NR			190		2.3	0.14	U	0.14	85		2.4	110		2.4	24		0.41
Benzo[g,h,i]perylene	191-24-2	NA	110	Z	6.1	110		4.3	NR			75		4.6	0.28	U	0.28	40		4.7	43		4.7	16		0.83
Benzo[k]fluoranthene	207-08-9	11000	330	Z	2.6	400		1.9	NR			270		2	0.12	U	0.12	110		2	140		2	28		0.36
C1-Chrysenes	STL00905	NA	130		15	120		10	NR			94		11	0.68	U	0.68	72		11	140		11	21		2
C1-Fluoranthenes/pyrene	STL00912	NA	240		15	320		10	NR			200		11	0.68	U	0.68	120		11	180		11	22		2
C1-Fluorenes	STL00913	NA	15	U	15	10		10	NR			11	U	11	0.68	U	0.68	11	U	11	16		11	2	U	2
C1-Phenanthrenes/Anthracenes	STL00901	NA	140		15	120		10	NR			120		11	0.68	U	0.68	58		11	110		11	9.3		2
C2-Chrysenes	STL00906	NA	44		15	40		10	NR			39		11	0.68	U	0.68	44		11	140		11	7.2		2
C2-Fluorenes	STL00914	NA	15	U	15	10	U	10	NR			11	U	11	0.68	U	0.68	13		11	27		11	2	U	2
C2-Naphthalenes	STL00917	NA	55		15	36		10	NR			42		11	0.68	U	0.68	25		11	47		11	3.1		2
C2-Phenanthrenes/Anthracenes	STL00902	NA	92		15	87		10	NR			88		11	0.68	U	0.68	64		11	130		11	7.9		2
C3-Chrysenes	STL00907	NA	18		15	12		10	NR			13		11	0.68	U	0.68	20		11	48		11	3.3		2
C3-Fluorenes	STL00915	NA	15	U	15	10	U	10	NR			11	U	11	0.68	U	0.68	11	U	11	53		11	2	U	2
C3-Naphthalenes	STL00918	NA	35		15	28		10	NR			31		11	0.68	U	0.68	28		11	93		11	4.9		2
C3-Phenanthrenes/Anthracenes	STL00903	NA	40		15	34		10	NR			34		11	0.68	U	0.68	40		11	110		11	4.7		2
C4-Chrysenes	STL00908	NA	15	U	15	10	U	10	NR			11	U	11	0.68	U	0.68	11	U	11	11	U	11	2	U	2
C4-Naphthalenes	STL00919	NA	20		15	16		10	NR			19		11	0.68	U	0.68	23		11	85		11	2	U	2
C4-Phenanthrenes/Anthracenes	STL00904	NA	21		15	18		10	NR			15		11	0.68	U	0.68	28		11	95		11	3.6		2
Chrysene	218-01-9	110000	340		6.1	430		4.3	NR			270		4.6	0.28	U	0.28	110		4.7	150		4.7	30		0.83
Dibenz(a,h)anthracene	53-70-3	170	40	Z	2.6	44		1.9	NR			27		2	0.12	U	0.12	13		2	31		2	5.1		0.36
Fluoranthene	206-44-0	240000	550		4.8	NR			730	D	8.5	490		3.6	0.22	U	0.22	150		3.7	240		3.7	51		0.65
Fluorene	86-73-7	240000	23		2.6	38		1.9	NR			22		2	0.12	U	0.12	5.1	J	2	15		2	2.3		0.36
Indeno[1,2,3-cd]pyrene	193-39-5	1300	120	Z	2.6	130		1.9	NR			81		2	0.12	U	0.12	40		2	51		2	16		0.36
Naphthalene	91-20-3	3800	24		6.8	12		4.8	NR			17		5.1	0.69		0.31	14		5.2	16		5.2	2.3		0.92
Perylene	198-55-0	NA	100	Z	6.1	120		4.3	NR			64		4.6	0.28	U	0.28	65		4.7	260		4.7	13		0.83
Phenanthrene	85-01-8	180000	200		6.6	410		4.7	NR			240		5	0.3	U	0.3	62		5.1	130		5.1	22		0.89
Pyrene	129-00-0	180000	470		5.7	NR			700	D	10	430		4.3	0.26	U	0.26	160		4.4	210		4.4	42		0.77
Total Conc		NA	4369			4143.7			1430			3708.5			1.38			1697.8			3108.3			431.71		

Client ID		DNREC SIRS	BWR-DAM8-T1-0320			BWR-DAM8-T2-0320			BWR-DAM8-T2-0320			BWR-DAM11-T1-0320			BWR-DAM11-T2-0320			BWR-DAM11-T2-0320			BWR-DUP1-0320			BWR-DUP1-0320		
Lab Sample ID		Screening Levels	460-205020-14			460-205020-15			460-205020-15			460-205020-16			460-205020-17			460-205020-17			460-205020-18			460-205020-18		
Sampling Date		Soils	03/11/2020 12:15:00			03/11/2020 11:45:00			03/11/2020 11:45:00			03/12/2020 12:10:00			03/12/2020 11:20:00			03/12/2020 11:20:00			03/12/2020 00:00:00			03/12/2020 00:00:00		
Matrix		Nov 2019	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Dilution Factor			10			10			5			3.333			1			10			1			10		
Unit		ug/kg	ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 8270D SIM																										
1-Methylnaphthalene	90-12-0	18000	18		2.4	NR			7.5		1.1	5.1		0.72	1		0.17	NR			1.1		0.17	NR		
2-Methylnaphthalene	91-57-6	24000	27		3.3	NR			9.3		1.5	3.5	J	1	0.31	J	0.23	NR			0.26	J	0.25	NR		
Acenaphthene	83-32-9	360000	53		3.9	NR			9.9		1.8	2.5	J	1.2	0.52	J	0.28	NR			0.35	J	0.29	NR		
Acenaphthylene	208-96-8	NA	35		2.5	NR			17		1.2	5.3		0.78	0.61	J	0.18	NR			0.33	J	0.19	NR		
Anthracene	120-12-7	1800000	51		2.2	NR			27		0.99	6.1		0.66	0.41	J	0.15	NR			0.28	J	0.16	NR		
Benzo[a]anthracene	56-55-3	1100	210		4.3	NR			120		2	51		1.3	3.2		0.3	NR			1.7		0.32	NR		
Benzo[a]pyrene	50-32-8	240	280		2.2	NR			130		0.99	75		0.66	4.1		0.15	NR			2.6		0.16	NR		
Benzo[b]fluoranthene	205-99-2	1110	250		2.7	NR			130		1.3	110		0.84	5.4		0.19	NR			3.4		0.2	NR		
Benzo[e]pyrene	192-97-2	NA	240		2.7	NR			110		1.3	79		0.84	3.5		0.19	NR			2.1		0.2	NR		
Benzo[g,h,i]perylene	191-24-2	NA	140		5.5	NR			48		2.5	41		1.7	1.7		0.39	NR			0.94	J	0.4	NR		
Benzo[k]fluoranthene	207-08-9	11000	250		2.4	NR			120		1.1	96		0.72	5		0.17	NR			2.7		0.17	NR		
C1-Chrysenes	STL00905	NA	300		13	NR			190		6	33		4	2		0.92	NR			2.4		0.97	NR		
C1-Fluoranthenes/pyrene	STL00912	NA	350		13	NR			220		6	60		4	4.5		0.92	NR			3.3		0.97	NR		
C1-Fluorenes	STL00913	NA	35		13	NR			20		6	4	U	4	2		0.92	NR			0.97	U	0.97	NR		
C1-Phenanthrenes/Anthracenes	STL00901	NA	240		13	NR			160		6	33		4	2.1		0.92	NR			1.5		0.97	NR		
C2-Chrysenes	STL00906	NA	230		13	NR			140		6	4	U	4	1.6		0.92	NR			1.4		0.97	NR		
C2-Fluorenes	STL00914	NA	75		13	NR			47		6	4	U	4	0.92	U	0.92	NR			0.97	U	0.97	NR		
C2-Naphthalenes	STL00917	NA	120		13	NR			65		6	17		4	2.7		0.92	NR			2.3		0.97	NR		
C2-Phenanthrenes/Anthracenes	STL00902	NA	330		13	NR			210		6	26		4	4.3		0.92	NR			6.2		0.97	NR		
C3-Chrysenes	STL00907	NA	160		13	NR			120		6	11		4	0.92	U	0.92	NR			1		0.97	NR		
C3-Fluorenes	STL00915	NA	110		13	NR			73		6	4	U	4	0.92	U	0.92	NR			0.97	U	0.97	NR		
C3-Naphthalenes	STL00918	NA	190		13	NR			120		6	13		4	4		0.92	NR			3.6		0.97	NR		
C3-Phenanthrenes/Anthracenes	STL00903	NA	270		13	NR			210		6	11		4	2.7		0.92	NR			2.5		0.97	NR		
C4-Chrysenes	STL00908	NA	100		13	NR			61		6	6.7		4	0.92	U	0.92	NR			1		0.97	NR		
C4-Naphthalenes	STL00919	NA	230		13	NR			190		6	12		4	1.8		0.92	NR			1.6		0.97	NR		
C4-Phenanthrenes/Anthracenes	STL00904	NA	220		13	NR			180		6	7.5		4	3		0.92	NR			2.8		0.97	NR		
Chrysene	218-01-9	110000	280		5.5	NR			160		2.5	96		1.7	4.8		0.39	NR			2.6		0.4	NR		
Dibenz(a,h)anthracene	53-70-3	170	45		2.4	NR			19		1.1	13		0.72	0.86	J	0.17	NR			0.52	J	0.17	NR		
Fluoranthene	206-44-0	240000	400		4.3	NR			240		2	140		1.3	5.9		0.3	NR			3.4		0.32	NR		
Fluorene	86-73-7	240000	44		2.4	NR			20		1.1	4.7		0.72	0.67	J	0.17	NR			0.56	J	0.17	NR		
Indeno[1,2,3-cd]pyrene	193-39-5	1300	130		2.4	NR			48		1.1	41		0.72	1.8		0.17	NR			1		0.17	NR		
Naphthalene	91-20-3	3800	52		6.1	NR			14		2.8	5.7		1.9	1.2		0.43	NR			1.1		0.45	NR		
Perylene	198-55-0	NA	440		5.5	430	D	5	NR			73		1.7	NR			270	D	3.9	NR			260	D	4
Phenanthrene	85-01-8	180000	250		5.9	NR			150		2.7	44		1.8	2.5		0.41	NR			1.5		0.43	NR		
Pyrene	129-00-0	180000	420		5.1	NR			220		2.3	110		1.6	5.1		0.36	NR			3.2		0.37	NR		
Total Conc		NA	6575			430			3605.7			1232.1			79.28			270			59.24			260		

* LCS or LCSD is outside acceptance limits.
^ Instrument related QC is outside acceptance limits.
B Compound was found in the blank and sample.
F1 MS and/or MSD Recovery is outside acceptance limits.
J Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
U Indicates the analyte was analyzed for but not detected.

Client ID		DNREC SIRS	BWR-DAM2-T1-0320			BWR-DAM2-T2-0320			BWR-DAM2-T3-0320			BWR-DAM4-T1-0320			BWR-DAM4-T2-0320			BWR-DAM4-T3-0320			BWR-DAM4-T4-0320			BWR-DAM4-T5-0320			BWR-FIELDBLANK-0320_SOLID			BWR-DAM7-T1-0320			BWR-DAM7-T2-0320			BWR-DAM7-T3-0320			BWR-DAM8-T1-0320			BWR-DAM8-T2-0320			BWR-DAM11-T1-0320			BWR-DAM11-T2-0320			BWR-DUP1-0320		
Lab Sample ID		Screening Levels	460-205020-1			460-205020-2			460-205020-3			460-205020-4			460-205020-5			460-205020-6			460-205020-7			460-205020-8			460-205020-9			460-205020-11			460-205020-12			460-205020-13			460-205020-14			460-205020-15			460-205020-16			460-205020-17			460-205020-18		
Sampling Date		Soils	03/06/2020 10:30:00			03/05/2020 14:00:00			03/09/2020 10:30:00			03/09/2020 13:55:00			03/09/2020 11:50:00			03/09/2020 12:35:00			03/09/2020 12:55:00			03/09/2020 13:15:00			03/12/2020 12:50:00			03/10/2020 13:15:00			03/10/2020 11:30:00			03/10/2020 12:10:00			03/11/2020 12:15:00			03/11/2020 11:45:00			03/12/2020 12:10:00			03/12/2020 11:20:00			03/12/2020 00:00:00		
Matrix		Nov 2019	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY LLOYD KAHN																																																						
Total Organic Carbon (mg/kg)	7440-44-0	NA	12800		684	15100		684	12200		684	16300		684	25900		684	19800		684	11800		684	12100		684	684	U	684	16100		684	21100		684	4330		684	24300		684	22200		684	19600		684	18700		684	19000	Z	684

TestAmerica Laboratories, Inc.
Eurofins TestAmerica, Edison
Lab Job ID: 460-210989-1
Job Description: WATAR (DE-1525)
For
State of Delaware
391 Lukens Drive
New Castle, Delaware 19720-2774

Client ID		DNREC SIRS	BWR-DAM6-T1-0620			BWR-DAM6-T2-0620			BWR-DAM6-T3-0620			BWR-DAM9-T1-0620			BWR-DAM9-T2-0620			BWR-DAM10-T1-0620			BWR-DAM10-T1-0620			BWR-DAM10-T2-0620			BWR-DAM10-T2-0620			BWR-DUP2-0620		
Lab Sample ID		Screening Levels	460-210989-1			460-210989-2			460-210989-3			460-210989-4			460-210989-5			460-210989-6			460-210989-6			460-210989-7			460-210989-7			460-210989-8		
Sampling Date		Soils	06/10/2020 11:15:00			06/10/2020 11:40:00			06/10/2020 12:15:00			06/09/2020 14:15:00			06/09/2020 14:30:00			06/09/2020 11:10:00			06/09/2020 11:10:00			06/09/2020 11:35:00			06/09/2020 11:35:00			06/10/2020 00:00:00		
Matrix		Feb 2020	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Dilution Factor			10			10			10			10			10			10			10			10			20			5		
Unit		mg/kg	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Secondary	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 8270D SIM																																
1-Methylnaphthalene	90-12-0	18	0.0044	J	0.0026	0.004	J	0.0023	0.0045	J	0.0026	0.0056	J	0.003	0.0069	J	0.0043	0.008	J	0.0027	0.0069	J	0.0027	0.013		0.0026	NR			0.0029	J	0.0013
2-Methylnaphthalene	91-57-6	24	0.0034	J	0.003	0.0029	J	0.0026	0.003	U	0.003	0.0042	J	0.0035	0.0049	U	0.0049	0.0056	J	0.0031	0.0047	J	0.0031	0.011	J	0.003	NR			0.0022	J	0.0015
Acenaphthene	83-32-9	360	0.005	U	0.005	0.0052	J	0.0045	0.0051	U	0.0051	0.0059	U	0.0059	0.0082	U	0.0082	0.0089	J	0.0052	0.0097	J	0.0052	0.046		0.005	NR			0.0025	U	0.0025
Acenaphthylene	208-96-8	NA	0.010	J	0.0034	0.0069	J	0.003	0.009	J	0.0034	0.013	J	0.0039	0.013	J	0.0055	0.016		0.0035	0.015		0.0035	0.10		0.0033	NR			0.0061	J	0.0017
Anthracene	120-12-7	1800	0.024		0.0045	0.021		0.004	0.019		0.0045	0.025		0.0052	0.023		0.0073	0.033		0.0047	0.037		0.0047	0.12		0.0044	NR			0.014		0.0022
Benzo[a]anthracene	56-55-3	1.1	0.17		0.0049	0.10		0.0043	0.11		0.0049	0.16		0.0056	0.12		0.0079	0.19		0.005	0.20	Z	0.005	0.48		0.0048	NR			0.080		0.0024
Benzo[a]pyrene	50-32-8	0.24	0.21		0.0049	0.12		0.0043	0.15		0.0049	0.21		0.0056	0.17		0.0079	0.26	Z	0.005	0.21	Z	0.005	0.60		0.0048	NR			0.12		0.0024
Benzo[b]fluoranthene	205-99-2	1.11	0.25		0.0076	0.13		0.0068	0.19		0.0078	0.29		0.0089	0.20		0.013	0.33	Z	0.008	0.35	Z	0.008	0.56		0.0076	NR			0.15		0.0038
Benzo[e]pyrene	192-97-2	NA	0.18		0.0067	0.11		0.0059	0.14		0.0068	0.20		0.0078	0.17		0.011	0.22	Z	0.007	0.20	Z	0.007	0.44		0.0067	NR			0.11		0.0033
Benzo[g,h,i]perylene	191-24-2	NA	0.071		0.0052	0.035		0.0046	0.053		0.0053	0.066		0.0061	0.073		0.0085	0.10	Z	0.0054	0.072	Z	0.0054	0.35		0.0052	NR			0.045		0.0026
Benzo[k]fluoranthene	207-08-9	11	0.25		0.006	0.11		0.0053	0.21		0.0061	0.27		0.007	0.20		0.0098	0.32	Z	0.0062	0.31	Z	0.0062	NR			0.55	D	0.012	0.15		0.0029
C1-Chrysenes	STL00905	NA	0.083		0.012	0.051		0.011	0.071		0.013	0.12		0.015	0.072		0.020	0.10		0.013	0.10	Z	0.013	0.29		0.012	NR			0.048		0.0062
C1-Fluoranthenes/pyrene	STL00912	NA	0.14		0.012	0.093		0.011	0.11		0.013	0.16		0.015	0.12		0.020	0.21		0.013	0.27	Z	0.013	0.46		0.012	NR			0.082		0.0062
C1-Fluorenes	STL00913	NA	0.012	U	0.012	0.011	U	0.011	0.013	U	0.013	0.015	U	0.015	0.020	U	0.020	0.013	U	0.013	0.013	U	0.013	0.029		0.012	NR			0.0062	U	0.0062
C1-Phenanthrenes/Anthracenes	STL00901	NA	0.068		0.012	0.047		0.011	0.047		0.013	0.063		0.015	0.057		0.020	0.094		0.013	0.091		0.013	0.24		0.012	NR			0.033		0.0062
C2-Chrysenes	STL00906	NA	0.040		0.012	0.024		0.011	0.028		0.013	0.054		0.015	0.030		0.020	0.044		0.013	0.047	Z	0.013	0.11		0.012	NR			0.021		0.0062
C2-Fluorenes	STL00914	NA	0.012	U	0.012	0.011	U	0.011	0.013	U	0.013	0.015	U	0.015	0.022		0.020	0.013	U	0.013	0.013	U	0.013	0.019		0.012	NR			0.0062	U	0.0062
C2-Naphthalenes	STL00917	NA	0.024		0.012	0.020		0.011	0.022		0.013	0.023		0.015	0.064		0.020	0.035		0.013	0.038		0.013	0.052		0.012	NR			0.017		0.0062
C2-Phenanthrenes/Anthracenes	STL00902	NA	0.047		0.012	0.033		0.011	0.046		0.013	0.048		0.015	0.048		0.020	0.11		0.013	0.073		0.013	0.15		0.012	NR			0.025		0.0062
C3-Chrysenes	STL00907	NA	0.017		0.012	0.015		0.011	0.013	U	0.013	0.024		0.015	0.022		0.020	0.019		0.013	0.018	Z	0.013	0.048		0.012	NR			0.013		0.0062
C3-Fluorenes	STL00915	NA	0.012	U	0.012	0.011	U	0.011	0.013	U	0.013	0.015	U	0.015	0.020	U	0.020	0.013	U	0.013	0.041		0.013	0.012	U	0.012	NR			0.0062	U	0.0062
C3-Naphthalenes	STL00918	NA	0.017	B	0.012	0.014	B	0.011	0.015	B	0.013	0.017	B	0.015	0.026	B	0.020	0.027	B	0.013	0.026	B	0.013	0.046	B	0.012	NR			0.011	B	0.0062
C3-Phenanthrenes/Anthracenes	STL00903	NA	0.024		0.012	0.018		0.011	0.025		0.013	0.027		0.015	0.026		0.020	0.040		0.013	0.033		0.013	0.064		0.012	NR			0.016		0.0062
C4-Chrysenes	STL00908	NA	0.012	U	0.012	0.011	U	0.011	0.013	U	0.013	0.015	U	0.015	0.020	U	0.020	0.013	U	0.013	0.013	U Z	0.013	0.012	U	0.012	NR			0.0062	U	0.0062
C4-Naphthalenes	STL00919	NA	0.012	U	0.012	0.011	U	0.011	0.013	U	0.013	0.015	U	0.015	0.020	U	0.020	0.018		0.013	0.017		0.013	0.027		0.012	NR			0.0072		0.0062
C4-Phenanthrenes/Anthracenes	STL00904	NA	0.012		0.012	0.011	U	0.011	0.013		0.013	0.019		0.015	0.020		0.020	0.018		0.013	0.016		0.013	0.023		0.012	NR			0.0078		0.0062
Chrysene	218-01-9	110	0.25		0.0078	0.15		0.0069	0.17		0.0079	0.23		0.0091	0.21		0.013	0.28		0.0082	0.27	Z	0.0082	0.57		0.0078	NR			0.12		0.0039
Dibenz(a,h)anthracene	53-70-3	0.17	0.025		0.0024	0.018		0.0021	0.021		0.0025	0.026		0.0028	0.027		0.004	0.034	Z	0.0025	0.024	Z	0.0025	0.13		0.0024	NR			0.017		0.0012
Fluoranthene	206-44-0	240	0.42		0.0047	0.24		0.0041	0.34		0.0047	0.33		0.0054	0.31		0.0076	0.55		0.0049	0.45		0.0049	NR			0.79	D	0.0093	0.19		0.0023
Fluorene	86-73-7	240	0.006	U	0.006	0.0066	J	0.0053	0.0061	U	0.0061	0.007	U	0.007	0.0098	U	0.0098	0.014		0.0062	0.014		0.0062	0.056		0.0059	NR			0.0038	J	0.0029
Indeno[1,2,3-cd]pyrene	193-39-5	1.3	0.072		0.0037	0.049		0.0033	0.057		0.0038	0.073		0.0043	0.081		0.0061	0.10	Z	0.0039	0.074	Z	0.0039	0.35		0.0037	NR			0.049		0.0018
Naphthalene	91-20-3	3.8	0.008	U	0.008	0.0073	J	0.0071	0.0081	U	0.0081	0.0093	U	0.0093	0.013	U	0.013	0.0083	U	0.0083	0.0083	U	0.0083	0.013		0.008	NR			0.004	U	0.004
Perylene	198-55-0	NA	0.056		0.0054	0.038		0.0048	0.055		0.0055	0.064		0.0063	0.062		0.0089	0.076	Z	0.0056	0.063	Z	0.0056	0.18		0.0054	NR			0.042		0.0027
Phenanthrene	85-01-8	180	0.14		0.0075	0.096		0.0066	0.095		0.0076	0.13		0.0087	0.12		0.012	0.19		0.0078	0.20		0.0078	0.54		0.0074	NR			0.067		0.0037
Pyrene	129-00-0	180	0.31		0.0043	0.20		0.0038	0.22		0.0044	0.27		0.005	0.22		0.007	0.41		0.0045	0.54	Z	0.0045	NR			0.76	D	0.0085	0.19		0.0021
Total Conc		NA	2.9178			1.7649			2.2205			2.9218			2.5129			3.8605			3.8203			6.117			2.1			1.64		

Conversion of 460-210989-1 to ug/kg

Client ID		DNREC SIRS	BWR-DAM6-T1-0620			BWR-DAM6-T2-0620			BWR-DAM6-T3-0620			BWR-DAM9-T1-0620			BWR-DAM9-T2-0620			BWR-DAM10-T1-0620			BWR-DAM10-T1-0620			BWR-DAM10-T2-0620			BWR-DAM10-T2-0620			BWR-DUP2-0620		
Lab Sample ID		Screening Levels	460-210989-1			460-210989-2			460-210989-3			460-210989-4			460-210989-5			460-210989-6			460-210989-6			460-210989-7			460-210989-7			460-210989-8		
Sampling Date		Soils	06/10/2020 11:15:00			06/10/2020 11:40:00			06/10/2020 12:15:00			06/09/2020 14:15:00			06/09/2020 14:30:00			06/09/2020 11:10:00			06/09/2020 11:10:00			06/09/2020 11:35:00			06/09/2020 11:35:00			06/10/2020 00:00:00		
Matrix		Feb 2020	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Dilution Factor			10			10			10			10			10			10			10			10			20			5		
Unit		mg/kg	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Secondary	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 8270D SIM																																
1-Methylnaphthalene	90-12-0	18	4.4	J	2.6	4	J	2.3	4.5	J	2.6	5.6	J	3	6.9	J	4.3	8	J	2.7	6.9	J	2.7	13		2.6	NR			2.9	J	1.3
2-Methylnaphthalene	91-57-6	24	3.4	J	3	2.9	J	2.6	3	U	3	4.2	J	3.5	4.9	U	4.9	5.6	J	3.1	4.7	J	3.1	11	J	3	NR			2.2	J	1.5
Acenaphthene	83-32-9	360	5	U	5	5.2	J	4.5	5.1	U	5.1	5.9	U	5.9	8.2	U	8.2	8.9	J	5.2	9.7	J	5.2	46		5	NR			2.5	U	2.5
Acenaphthylene	208-96-8	NA	10	J	3.4	6.9	J	3	9	J	3.4	13	J	3.9	13	J	5.5	16		3.5	15		3.5	100		3.3	NR			6.1	J	1.7
Anthracene	120-12-7	1800	24		4.5	21		4	19		4.5	25		5.2	23		7.3	33		4.7	37		4.7	120		4.4	NR			14		2.2
Benzo[a]anthracene	56-55-3	1.1	170		4.9	100		4.3	110		4.9	160		5.6	120		7.9	190		5	200	Z	5	480		4.8	NR			80		2.4
Benzo[a]pyrene	50-32-8	0.24	210		4.9	120		4.3	150		4.9	210		5.6	170		7.9	260	Z	5	210	Z	5	600		4.8	NR			120		2.4
Benzo[b]fluoranthene	205-99-2	1.11	250		7.6	130		6.8	190		7.8	290		8.9	200		13	330	Z	8	350	Z	8	560		7.6	NR			150		3.8
Benzo[e]pyrene	192-97-2	NA	180		6.7	110		5.9	140		6.8	200		7.8	170		11	220	Z	7	200	Z	7	440		6.7	NR			110		3.3
Benzo[g,h,i]perylene	191-24-2	NA	71		5.2	35		4.6	53		5.3	66		6.1	73		8.5	100	Z	5.4	72	Z	5.4	350		5.2	NR			45		2.6
Benzo[k]fluoranthene	207-08-9	11	250		6	110		5.3	210		6.1	270		7	200		9.8	320	Z	6.2	310	Z	6.2	NR			550	D	12	150		2.9
C1-Chrysenes	STL00905	NA	83		12	51		11	71		13	120		15	72		20	100		13	100	Z	13	290		12	NR			48		6.2
C1-Fluoranthenes/pyrene	STL00912	NA	140		12	93		11	110		13	160		15	120		20	210		13	270	Z	13	460		12	NR			82		6.2
C1-Fluorenes	STL00913	NA	12	U	12	11	U	11	13	U	13	15	U	15	20	U	20	13	U	13	13	U	13	29		12	NR			6.2	U	6.2
C1-Phenanthrenes/Anthracenes	STL00901	NA	68		12	47		11	47		13	63		15	57		20	94		13	91		13	240		12	NR			33		6.2
C2-Chrysenes	STL00906	NA	40		12	24		11	28		13	54		15	30		20	44		13	47	Z	13	110		12	NR			21		6.2
C2-Fluorenes	STL00914	NA	12	U	12	11	U	11	13	U	13	15	U	15	22		20	13	U	13	13	U	13	19		12	NR			6.2	U	6.2
C2-Naphthalenes	STL00917	NA	24		12	20		11	22		13	23		15	64		20	35		13	38		13	52		12	NR			17		6.2
C2-Phenanthrenes/Anthracenes	STL00902	NA	47		12	33		11	46		13	48		15	48		20	110		13	73		13	150		12	NR			25		6.2
C3-Chrysenes	STL00907	NA	17		12	15		11	13	U	13	24		15	22		20	19		13	18	Z	13	48		12	NR			13		6.2
C3-Fluorenes	STL00915	NA	12	U	12	11	U	11	13	U	13	15	U	15	20	U	20	13	U	13	41		13	12	U	12	NR			6.2	U	6.2
C3-Naphthalenes	STL00918	NA	17	B	12	14	B	11	15	B	13	17	B	15	26	B	20	27	B	13	26	B	13	46	B	12	NR			11	B	6.2
C3-Phenanthrenes/Anthracenes	STL00903	NA	24		12	18		11	25		13	27		15	26		20	40		13	33		13	64		12	NR			16		6.2
C4-Chrysenes	STL00908	NA	12	U	12	11	U	11	13	U	13	15	U	15	20	U	20	13	U	13	13	U Z	13	12	U	12	NR			6.2	U	6.2
C4-Naphthalenes	STL00919	NA	12	U	12	11	U	11	13	U	13	15	U	15	20	U	20	18		13	17		13	27		12	NR			7.2		6.2
C4-Phenanthrenes/Anthracenes	STL00904	NA	12		12	11	U	11	13		13	19		15	20		20	18		13	16		13	23		12	NR			7.8		6.2
Chrysene	218-01-9	110	250		7.8	150		6.9	170		7.9	230		9.1	210		13	280		8.2	270	Z	8.2	570		7.8	NR			120		3.9
Dibenz(a,h)anthracene	53-70-3	0.17	25		2.4	18		2.1	21		2.5	26		2.8	27		4	34	Z	2.5	24	Z	2.5	130		2.4	NR			17		1.2
Fluoranthene	206-44-0	240	420		4.7	240		4.1	340		4.7	330		5.4	310		7.6	550		4.9	450		4.9	NR			790	D	9.3	190		2.3
Fluorene	86-73-7	240	6	U	6	6.6	J	5.3	6.1	U	6.1	7	U	7	9.8	U	9.8	14		6.2	14		6.2	56		5.9	NR			3.8	J	2.9
Indeno[1,2,3-cd]pyrene	193-39-5	1.3	72		3.7	49		3.3	57		3.8	73		4.3	81		6.1	100	Z	3.9	74	Z	3.9	350		3.7	NR			49		1.8
Naphthalene	91-20-3	3.8	8	U	8	7.3	J	7.1	8.1	U	8.1	9.3	U	9.3	13	U	13	8.3	U	8.3	8.3	U	8.3	13		8	NR			4	U	4
Perylene	198-55-0	NA	56		5.4	38		4.8	55		5.5	64		6.3	62		8.9	76	Z	5.6	63	Z	5.6	180		5.4	NR			42		2.7
Phenanthrene	85-01-8	180	140		7.5	96		6.6	95		7.6	130		8.7	120		12	190		7.8	200		7.8	540		7.4	NR			67		3.7
Pyrene	129-00-0	180	310		4.3	200		3.8	220		4.4	270		5	220		7	410		4.5	540	Z	4.5	NR			760	D	8.5	190		2.1
Total Conc		NA	2917.8			1764.9			2220.5			2921.8			2512.9			3860.5			3820.3			6117			2100			1640		

Client ID		DNREC SIRS	BWR-DAM6-T1-0620			BWR-DAM6-T2-0620			BWR-DAM6-T3-0620			BWR-DAM9-T1-0620			BWR-DAM9-T2-0620			BWR-DAM10-T1-0620			BWR-DAM10-T2-0620			BWR-DUP2-0620		
Lab Sample ID		Screening Levels	460-210989-1			460-210989-2			460-210989-3			460-210989-4			460-210989-5			460-210989-6			460-210989-7			460-210989-8		
Sampling Date		Soils	06/10/2020 11:15:00			06/10/2020 11:40:00			06/10/2020 12:15:00			06/09/2020 14:15:00			06/09/2020 14:30:00			06/09/2020 11:10:00			06/09/2020 11:35:00			06/10/2020 00:00:00		
Matrix		Feb 2020	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY LLOYD KAHN																										
TOC Result 1 (mg/kg)	STL00338	NA	21200		153	17800		136	23400		150	28500		172	34600		243	24200		159	3920		148	20900		149

ANALYTE	UNITS	Sample ID	Sample ID	Sample ID	Sample ID	Sample ID	Sample ID	Sample ID	Sample ID	Sample ID	Sample ID	Sample ID	Sample ID	Sample ID	Sample ID	Sample ID	Sample ID	Sample ID	Sample ID	Sample ID	Sample ID	Sample ID	Sample ID	Sample ID	Sample ID	Sample ID
		BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-0320	BWR-FIELDBLANK-0320_SOLID	BWR-DAM7-T1-0320	BWR-DAM7-T2-0320	BWR-DAM7-T3-0320	BWR-DAM8-T1-0320	BWR-DAM8-T2-0320	BWR-DAM11-T1-0320	BWR-DAM11-T2-0320	BWR-DUP1-0320	BWR-DAM6-T1-0620	BWR-DAM6-T2-0620	BWR-DAM6-T3-0620	BWR-DAM9-T1-0620	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DUP2-0620
TOC	mg/Kg	12800.0	15100.0	12200.0	16300.0	25900.0	19800.0	11800.0	12100.0	684.0	16100.0	21100.0	4330.0	24300.0	22200.0	19600.0	18700.0	19000.0	21200.0	17800.0	23400.0	28500.0	34600.0	24200.0	3920.0	20900.0
TOC	%	1.3	1.5	1.2	1.6	2.6	2.0	1.2	1.2	0.1	1.6	2.1	0.4	2.4	2.2	2.0	1.9	1.9	2.1	1.8	2.3	2.9	3.5	2.4	0.4	2.1
TOC	kg OC/kg sed	0.01280	0.01510	0.01220	0.01630	0.02590	0.01980	0.01180	0.01210	0.00068	0.01610	0.02110	0.00433	0.02430	0.02220	0.01960	0.01870	0.01900	0.02120	0.01780	0.02340	0.02850	0.03460	0.02420	0.00392	0.02090

Notes:
TOC - Total Organic Carbon

A list of sediment quality guidelines (SQGs) was recently published by Burgess et al 2013. These equilibrium partitioning (EqP) based guidelines are called equilibrium partitioning sediment benchmarks (ESBs). Carbon normalized sediment concentrations less than or equal to the ESB values are not expected to result in adverse effects while concentrations in excess of the ESB values may result in adverse effects to benthic organisms.

Results with 'U' qualified values set to Zero

Bulk Conc. (ug/kg)	BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-0320	BWR-DAM7-T1-0320	BWR-DAM7-T2-0320	BWR-DAM7-T3-0320	BWR-DAM8-T1-0320
1-Methylnaphthalene	5.9 J	7.1 J	8.5 J	40	36	15	7.6 J	8.5 J	5.5 J	6.5 J	0.86 J	18
2-Methylnaphthalene	6.2 J	6.9 J	9.1 J	34	40	11 J	4.1 J	7 J	5.2 J	5.8 J	0.55 J	27
Acenaphthene	9.2 J	8.8 J	11	93	120	14 J	21	15	0 U	6 J	1.6 J	53
Acenaphthylene	15	35	37	18	44	26 Z	27	16	16	24	1.2 J	35
Anthracene	32	34	46	140	260	41 Z	69	51	13	26	4.8	51
Benzo[a]anthracene	150	230	230	550	690 D	240	370	220	75	120	24	210
Benzo[a]pyrene	160 B	280 B	230 B	580 B	590 D	290 Z B	350 B	240 B	94 B	130 B	27	280
Benzo[b]fluoranthene	180 B	310 B	180 B	680 B	570 D	340 Z B	470 B	280 B	100 B	120 B	33	250
Benzo[e]pyrene	130	230	170	470	460	250 Z	290	190	85	110	24	240
Benzo[g,h,i]perylene	93	140	110	240	190	110 Z	110	75	40	43	16	140
Benzo[k]fluoranthene	160	300	210	650	650 D	330 Z	400	270	110	140	28	250
C1-Chrysenes	110	160	140	250	390	130	120	94	72	140	21	300
C1-Fluoranthenes/pyrene	180	230	270	530	750	240	320	200	120	180	22	350
C1-Fluorenes	13	0 U	16	28	89	0 U	10	0 U	0 U	16	0 U	35
C1-Phenanthrenes/Anthracenes	140	93	160	370	630	140	120	120	58	110	9.3	240
C2-Chrysenes	74	83	78	100	210	44	40	39	44	140	7.2	230
C2-Fluorenes	20	15	20	39	150	0 U	0 U	0 U	13	27	0 U	75
C2-Naphthalenes	36	30	40	120	200	55	36	42	25	47	3.1	120
C2-Phenanthrenes/Anthracenes	92	80	130	200	570	92	87	88	64	130	7.9	330
C3-Chrysenes	33	23	45	30	99	18	12	13	20	48	3.3	160
C3-Fluorenes	36	0 U	36	0 U	180	0 U	0 U	0 U	0 U	53	0 U	110
C3-Naphthalenes	42	24	43	77	270	35	28	31	28	93	4.9	190
C3-Phenanthrenes/Anthracenes	61	37	88	78	330	40	34	34	40	110	4.7	270
C4-Chrysenes	20	0 U	29	0 U	49	0 U	0 U	0 U	0 U	0 U	0 U	100
C4-Naphthalenes	39	16	36	44	240	20	16	19	23	85	0 U	230
C4-Phenanthrenes/Anthracenes	46	22	100	43	230	21	18	15	28	95	3.6	220
Chrysene	200	320	260	740 D	830 D	340	430	270	110	150	30	280
Dibenz(a,h)anthracene	27	46	36	90	82	40 Z	44	27	13	31	5.1	45
Fluoranthene	310	460	380	1400 D	1500 D	550	730 D	490	150	240	51	400
Fluorene	13	12	16	120	120	23	38	22	5.1 J	15	2.3	44
Indeno[1,2,3-cd]pyrene	89	150	110	240	220	120 Z	130	81	40	51	16	130
Naphthalene	14	16	19	57	59	24	12	17	14	16	2.3	52
Perylene	340	100	450	170	380	100 Z	120	64	65	260	13	440
Phenanthrene	140	170	160	1300 D	1100 D	200	410	240	62	130	22	250
Pyrene	300	430	370	1200 D	1300 D	470	700 D	430	160	210	42	420
Total PAH	3316.3	4098.8	4273.6	10721.0	13628.0	4369.0	5573.7	3708.5	1697.8	3108.3	431.7	6575.0
Total Organic Carbon (kg oc/kg sed)	0.01280	0.01510	0.01220	0.0163	0.0259	0.0198	0.0118	0.0121	0.0161	0.0211	0.00433	0.0243

Bulk Conc. (ug/kg)	BWR-DAM8-T2-0320	BWR-DAM11-T1-0320	BWR-DAM11-T2-0320	BWR-DUP1-0320	BWR-FIELDBLANK-0320_SOLID	BWR-DAM6-T1-0620	BWR-DAM6-T2-0620	BWR-DAM6-T3-0620	BWR-DAM9-T1-0620	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DUP2-0620
1-Methylnaphthalene	7.5	5.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2-Methylnaphthalene	9.3	3.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Acenaphthene	9.9	2.5 J	0.52 J	0.35 J	0 U	0 U	5.2 J	0 U	0 U	0 U	9.7 J	46	0 U
Acenaphthylene	17	5.3	0.61 J	0.33 J	0 U	10 J	6.9 J	9 J	13 J	13	15	100	6.1 J
Anthracene	27	6.1	0.41 J	0.28 J	0 U	24	21	19	25	23	37	120	14
Benzo[a]anthracene	120	51	3.2	1.7	0 U	170	100	110	160	120	200	480	80
Benzo[a]pyrene	130	75	4.1	2.6	0.34 J B	210	120	150	210	170	210 Z	600	120
Benzo[b]fluoranthene	130	110	5.4	3.4	0.35 J B	250	130	190	290	200	350 Z	560	150
Benzo[e]pyrene	110	79	3.5	2.1	0 U	180	110	140	200	170	200 Z	440	110
Benzo[g,h,i]perylene	48	41	1.7	0.94 J	0 U	71	35	53	66	73	72 Z	350	45
Benzo[k]fluoranthene	120	96	5	2.7	0 U	250	110	210	270	200	310 Z	550 D	150
C1-Chrysenes	190	33	2	2.4	0 U	83	51	71	120	72	100 Z	290	48
C1-Fluoranthenes/pyrene	220	60	4.5	3.3	0 U	140	93	110	160	120	270 Z	460	82
C1-Fluorenes	20	0 U	2	0 U	0 U	0 U	0 U	0 U	0 U	0 U	13	29	0 U
C1-Phenanthrenes/Anthracenes	160	33	2.1	1.5	0 U	68	47	47	63	57	91	240	33
C2-Chrysenes	140	0 U	1.6	1.4	0 U	40	24	28	54	30	47	110	21
C2-Fluorenes	47	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	22	13	19	0 U
C2-Naphthalenes	65	17	2.7	2.3	0 U	24	20	22	23	64	38	52	17
C2-Phenanthrenes/Anthracenes	210	26	4.3	6.2	0 U	47	33	46	48	48	73	150	25
C3-Chrysenes	120	11	0 U	1	0 U	17	15	0 U	24	22	18 Z	48	13
C3-Fluorenes	73	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	41	0 U	0 U
C3-Naphthalenes	120	13	4	3.6	0 U	17 B	14	15 B	17 B	26 B	26 B	46 B	11 B
C3-Phenanthrenes/Anthracenes	210	11	2.7	2.5	0 U	24	18	25	27	26	33	64	16
C4-Chrysenes	61	6.7	0 U	1	0 U	0 U	0 U	0 U	0 U	0 U	13 Z	0 U	0 U
C4-Naphthalenes	190	12	1.8	1.6	0 U	0 U	0 U	0 U	0 U	0 U	17	27	7.2
C4-Phenanthrenes/Anthracenes	180	7.5	3	2.8	0 U	12	0 U	0 U	19	20	16	23	7.8
Chrysene	160	96	4.8	2.6	0 U	250	150	170	230	210	270 Z	570	120
Dibenz(a,h)anthracene	19	13	0.86 J	0.52 J	0 U	25	18	21	26	27	24 Z	130	17
Fluoranthene	240	140	5.9	3.4	0 U	420	240	340	330	310	450	790 D	190
Fluorene	20	4.7	0.67 J	0.56 J	0 U	0 U	6.6 J	0 U	0 U	0 U	14	56	3.8 J
Indeno[1,2,3-cd]pyrene	48	41	1.8	1	0 U	72	49	57	73	81	74 Z	350	49
Naphthalene	14	5.7	1.2	1.1	0.69	0 U	7.3 J	0 U	0 U	0 U	8.3	13	0 U
Perylene	430 D	73	270 D	260 D	0 U	56	38	55	64	62	63 Z	180	42
Phenanthrene	150	44	2.5	1.5	0 U	140	96	95	130	120	200	540	67
Pyrene	220	110	5.1	3.2	0 U	310	200	220	270	220	540 Z	760 D	190
Total PAH	4035.7	1232.1	349.3	319.2	1.4	2917.8	1764.9	2220.5	2921.8	2512.9	3867.6	8217.0	1640.0
Total Organic Carbon (kg oc/kg sed)	0.0222	0.0196	0.0187	0.019	0.000684	0.0212	0.0178	0.0234	0.0285	0.0346	0.0242	0.00392	0.0209

Average Dam 10 TOC = 0.01406

Organic Carbon Normalized Concentration (ug sed/g oc)

	BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-0320	BWR-DAM7-T1-0320	BWR-DAM7-T2-0320	BWR-DAM7-T3-0320	BWR-DAM8-T1-0320
1-Methylnaphthalene	0.4609	0.4702	0.6967	2.4540	1.3900	0.7576	0.6441	0.7025	0.3416	0.3081	0.1986	0.7407
2-Methylnaphthalene	0.4844	0.4570	0.7459	2.0859	1.5444	0.5556	0.3475	0.5785	0.3230	0.2749	0.1270	1.1111
Acenaphthene	0.7188	0.5828	0.9016	5.7055	4.6332	0.7071	1.7797	1.2397	0.0000	0.2844	0.3695	2.1811
Acenaphthylene	1.1719	2.3179	3.0328	1.1043	1.6988	1.3131	2.2881	1.3223	0.9938	1.1374	0.2771	1.4403
Anthracene	2.5000	2.2517	3.7705	8.5890	10.0386	2.0707	5.8475	4.2149	0.8075	1.2322	1.1085	2.0988
Benzo[a]anthracene	11.7188	15.2318	18.8525	33.7423	26.6409	12.1212	31.3559	18.1818	4.6584	5.6872	5.5427	8.6420
Benzo[a]pyrene	12.5000	18.5430	18.8525	35.5828	22.7799	14.6465	29.6610	19.8347	5.8385	6.1611	6.2356	11.5226
Benzo[b]fluoranthene	14.0625	20.5298	14.7541	41.7178	22.0077	17.1717	39.8305	23.1405	6.2112	5.6872	7.6212	10.2881
Benzo[e]pyrene	10.1563	15.2318	13.9344	28.8344	17.7606	12.6263	24.5763	15.7025	5.2795	5.2133	5.5427	9.8765
Benzo[g,h,i]perylene	7.2656	9.2715	9.0164	14.7239	7.3359	5.5556	9.3220	6.1983	2.4845	2.0379	3.6952	5.7613
Benzo[k]fluoranthene	12.5000	19.8675	17.2131	39.8773	25.0965	16.6667	33.8983	22.3140	6.8323	6.6351	6.4665	10.2881
C1-Chrysenes	8.5938	10.5960	11.4754	15.3374	15.0579	6.5657	10.1695	7.7686	4.4720	6.6351	4.8499	12.3457
C1-Fluoranthenes/pyrene	14.0625	15.2318	22.1311	32.5153	28.9575	12.1212	27.1186	16.5289	7.4534	8.5308	5.0808	14.4033
C1-Fluorenes	1.0156	0.0000	1.3115	1.7178	3.4363	0.0000	0.8475	0.0000	0.0000	0.7583	0.0000	1.4403
C1-Phenanthrenes/Anthracenes	10.9375	6.1589	13.1148	22.6994	24.3243	7.0707	10.1695	9.9174	3.6025	5.2133	2.1478	9.8765
C2-Chrysenes	5.7813	5.4967	6.3934	6.1350	8.1081	2.2222	3.3898	3.2231	2.7329	6.6351	1.6628	9.4650
C2-Fluorenes	1.5625	0.9934	1.6393	2.3926	5.7915	0.0000	0.0000	0.0000	0.8075	1.2796	0.0000	3.0864
C2-Naphthalenes	2.8125	1.9868	3.2787	7.3620	7.7220	2.7778	3.0508	3.4711	1.5528	2.2275	0.7159	4.9383
C2-Phenanthrenes/Anthracenes	7.1875	5.2980	10.6557	12.2699	22.0077	4.6465	7.3729	7.2727	3.9752	6.1611	1.8245	13.5802
C3-Chrysenes	2.5781	1.5232	3.6885	1.8405	3.8224	0.9091	1.0169	1.0744	1.2422	2.2749	0.7621	6.5844
C3-Fluorenes	2.8125	0.0000	2.9508	0.0000	6.9498	0.0000	0.0000	0.0000	0.0000	2.5118	0.0000	4.5267
C3-Naphthalenes	3.2813	1.5894	3.5246	4.7239	10.4247	1.7677	2.3729	2.5620	1.7391	4.4076	1.1316	7.8189
C3-Phenanthrenes/Anthracenes	4.7656	2.4503	7.2131	4.7853	12.7413	2.0202	2.8814	2.8099	2.4845	5.2133	1.0855	11.1111
C4-Chrysenes	1.5625	0.0000	2.3770	0.0000	1.8919	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	4.1152
C4-Naphthalenes	3.0469	1.0596	2.9508	2.6994	9.2664	1.0101	1.3559	1.5702	1.4286	4.0284	0.0000	9.4650
C4-Phenanthrenes/Anthracenes	3.5938	1.4570	8.1967	2.6380	8.8803	1.0606	1.5254	1.2397	1.7391	4.5024	0.8314	9.0535
Chrysene	15.6250	21.1921	21.3115	45.3988	32.0463	17.1717	36.4407	22.3140	6.8323	7.1090	6.9284	11.5226
Dibenz(a,h)anthracene	2.1094	3.0464	2.9508	5.5215	3.1660	2.0202	3.7288	2.2314	0.8075	1.4692	1.1778	1.8519
Fluoranthene	24.2188	30.4636	31.1475	85.8896	57.9151	27.7778	61.8644	40.4959	9.3168	11.3744	11.7783	16.4609
Fluorene	1.0156	0.7947	1.3115	7.3620	4.6332	1.1616	3.2203	1.8182	0.3168	0.7109	0.5312	1.8107
Indeno[1,2,3-cd]pyrene	6.9531	9.9338	9.0164	14.7239	8.4942	6.0606	11.0169	6.6942	2.4845	2.4171	3.6952	5.3498
Naphthalene	1.0938	1.0596	1.5574	3.4969	2.2780	1.2121	1.0169	1.4050	0.8696	0.7583	0.5312	2.1399
Perylene	26.5625	6.6225	36.8852	10.4294	14.6718	5.0505	10.1695	5.2893	4.0373	12.3223	3.0023	18.1070
Phenanthrene	10.9375	11.2583	13.1148	79.7546	42.4710	10.1010	34.7458	19.8347	3.8509	6.1611	5.0808	10.2881
Pyrene	23.4375	28.4768	30.3279	73.6196	50.1931	23.7374	59.3220	35.5372	9.9379	9.9526	9.6998	17.2840

	BWR-DAM8-T2-0320	BWR-DAM11-T1-0320	BWR-DAM11-T2-0320	BWR-DUP1-0320	BWR-FIELDBLANK-0320_SOLID	BWR-DAM6-T1-0620	BWR-DAM6-T2-0620	BWR-DAM6-T3-0620	BWR-DAM9-T1-0620	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DUP2-0620
1-Methylnaphthalene	0.3378	0.2602	0.0535	0.0579	0.0000	0.2075	0.2247	0.1923	0.1965	0.1994	0.2851	3.3163	0.1388
2-Methylnaphthalene	0.4189	0.1786	0.0166	0.0137	0.0000	0.1604	0.1629	0.0000	0.1474	0.0000	0.1942	2.8061	0.1053
Acenaphthene	0.4459	0.1276	0.0278	0.0184	0.0000	0.0000	0.2921	0.0000	0.0000	0.0000	0.4008	11.7347	0.0000
Acenaphthylene	0.7658	0.2704	0.0326	0.0174	0.0000	0.4717	0.3876	0.3846	0.4561	0.3757	0.6198	25.5102	0.2919
Anthracene	1.2162	0.3112	0.0219	0.0147	0.0000	1.1321	1.1798	0.8120	0.8772	0.6647	1.5289	30.6122	0.6699
Benzo[a]anthracene	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Benzo[a]pyrene	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Benzo[b]fluoranthene	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Benzo[e]pyrene	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Benzo[g,h,i]perylene	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Benzo[k]fluoranthene	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
C1-Chrysenes	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
C1-Fluoranthenes/pyrene	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
C1-Fluorenes	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
C1-Phenanthrenes/Anthracenes	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
C2-Chrysenes	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
C2-Fluorenes	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
C2-Naphthalenes	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
C2-Phenanthrenes/Anthracenes	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
C3-Chrysenes	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
C3-Fluorenes	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
C3-Naphthalenes	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
C3-Phenanthrenes/Anthracenes	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
C4-Chrysenes	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
C4-Naphthalenes	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
C4-Phenanthrenes/Anthracenes	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Chrysene	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Dibenz(a,h)anthracene	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fluoranthene	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fluorene	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Indeno[1,2,3-cd]pyrene	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Naphthalene	0.6306	0.2908	0.0642	0.0579	1.0088	0.0000	0.4101	0.0000	0.0000	0.0000	0.3430	3.3163	0.0000
Perylene	19.3694	3.7245	14.4385	13.6842	0.0000	2.6415	2.1348	2.3504	2.2456	1.7919	2.6033	45.9184	2.0096
Phenanthrene	6.7568	2.2449	0.1337	0.0789	0.0000	6.6038	5.3933	4.0598	4.5614	3.4682	8.2645	137.7551	3.2057
Pyrene	9.9099	5.6122	0.2727	0.1684	0.0000	14.6226	11.2360	9.4017	9.4737	6.3584	22.3140	193.8776	9.0909

Narcosis ESB from Burgess, et al. (ug sed/g oc)

NA	1-Methylnaphthalene
NA	2-Methylnaphthalene
491	Acenaphthene
452	Acenaphthylene
594	Anthracene
841	Benzo[a]anthracene
965	Benzo[a]pyrene
979	Benzo[b]fluoranthene
967	Benzo[e]pyrene
1095	Benzo[g,h,i]perylene
981	Benzo[k]fluoranthene
929	C1-Chrysenes
770	C1-Fluoranthenes/pyrene
611	C1-Fluorenes
670	C1-Phenanthrenes/Anthracenes
1008	C2-Chrysenes
686	C2-Fluorenes
510	C2-Naphthalenes
746	C2-Phenanthrenes/Anthracenes
1112	C3-Chrysenes
769	C3-Fluorenes
581	C3-Naphthalenes
829	C3-Phenanthrenes/Anthracenes
1214	C4-Chrysenes
657	C4-Naphthalenes
913	C4-Phenanthrenes/Anthracenes
844	Chrysene
1123	Dibenz(a,h)anthracene
707	Fluoranthene
538	Fluorene
1115	Indeno[1,2,3-cd]pyrene
385	Naphthalene
967	Perylene
596	Phenanthrene
697	Pyrene

Comparison of Carbon Normalized Concentration to ESB

	BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-0320	BWR-DAM7-T1-0320	BWR-DAM7-T2-0320	BWR-DAM7-T3-0320	BWR-DAM8-T1-0320
1-Methylnaphthalene	0.000332692	0.000339377	0.00502875	0.001771	0.001003	0.000547	0.000465	0.000507	0.0002466	0.000222	0.000143	0.000535
2-Methylnaphthalene	0.00034994	0.000330129	0.005388812	0.001507	0.001116	0.000401	0.000251	0.000418	0.0002333	0.000199	9.18E-05	0.000803
Acenaphthene	0.0014638	0.0011869	0.0018363	0.0116202	0.0094363	0.0014401	0.0036246	0.0025248	0.0000000	0.0005791	0.0007526	0.0044421
Acenaphthylene	0.0025926	0.0051281	0.0067097	0.0024431	0.0037585	0.0029052	0.0050622	0.0029255	0.0021986	0.0025165	0.0006131	0.0031866
Anthracene	0.0042088	0.0037907	0.0063476	0.0144595	0.0169000	0.0034860	0.0098442	0.0070958	0.0013593	0.0020745	0.0018662	0.0035333
Benzo[a]anthracene	0.0139343	0.0181115	0.0224167	0.0401217	0.0316777	0.0144129	0.0372841	0.0216193	0.0055391	0.0067624	0.0065906	0.0102758
Benzo[a]pyrene	0.0129534	0.0192156	0.0195362	0.0368734	0.0236061	0.0151777	0.0307368	0.0205541	0.0060503	0.0063846	0.0064617	0.0119406
Benzo[b]fluoranthene	0.0143641	0.0209702	0.0150706	0.0426127	0.0224798	0.0175401	0.0406849	0.0236369	0.0063444	0.0058092	0.0077847	0.0105087
Benzo[e]pyrene	0.0105028	0.0157516	0.0144100	0.0298184	0.0183667	0.0130571	0.0254150	0.0162383	0.0054597	0.0053912	0.0057319	0.0102136
Benzo[g,h,i]perylene	0.0066353	0.0084671	0.0082341	0.0134465	0.0066995	0.0050736	0.0085133	0.0056606	0.0022689	0.0018611	0.0033746	0.0052615
Benzo[k]fluoranthene	0.0127421	0.0202523	0.0175465	0.0406496	0.0255826	0.0169895	0.0345548	0.0227462	0.0069646	0.0067636	0.0065918	0.0104873
C1-Chrysenes	0.0092505	0.0114058	0.0123524	0.0165096	0.0162087	0.0070674	0.0109467	0.0083623	0.0048138	0.0071422	0.0052205	0.0132892
C1-Fluoranthenes/pyrene	0.0182630	0.0197815	0.0287418	0.0422277	0.0376072	0.0157418	0.0352190	0.0214661	0.0096798	0.0110790	0.0065985	0.0187056
C1-Fluorenes	0.0016622	0.0000000	0.0021464	0.0028114	0.0056240	0.0000000	0.0013870	0.0000000	0.0000000	0.0012411	0.0000000	0.0023573
C1-Phenanthrenes/Anthracenes	0.0163246	0.0091924	0.0195743	0.0338797	0.0363050	0.0105533	0.0151783	0.0148020	0.0053768	0.0077810	0.0032057	0.0147411
C2-Chrysenes	0.0057354	0.0054531	0.0063427	0.0060863	0.0080438	0.0022046	0.0033629	0.0031976	0.0027112	0.0065824	0.0016496	0.0093899
C2-Fluorenes	0.0022777	0.0014481	0.0023897	0.0034878	0.0084424	0.0000000	0.0000000	0.0000000	0.0011770	0.0018653	0.0000000	0.0044992
C2-Naphthalenes	0.0055147	0.0038956	0.0064288	0.0144352	0.0151412	0.0054466	0.0059821	0.0068060	0.0030447	0.0043676	0.0014038	0.0096829
C2-Phenanthrenes/Anthracenes	0.0096347	0.0071019	0.0142838	0.0164476	0.0295010	0.0062285	0.0098832	0.0097490	0.0053286	0.0082589	0.0024457	0.0182041
C3-Chrysenes	0.0023185	0.0013698	0.0033170	0.0016551	0.0034374	0.0008175	0.0009145	0.0009662	0.0011171	0.0020458	0.0006854	0.0059212
C3-Fluorenes	0.0036573	0.0000000	0.0038372	0.0000000	0.0090375	0.0000000	0.0000000	0.0000000	0.0000000	0.0032664	0.0000000	0.0058865
C3-Naphthalenes	0.0056476	0.0027356	0.0060664	0.0081307	0.0179427	0.0030425	0.0040841	0.0044096	0.0029933	0.0075862	0.0019477	0.0134577
C3-Phenanthrenes/Anthracenes	0.0057486	0.0029558	0.0087010	0.0057723	0.0153695	0.0024369	0.0034757	0.0033895	0.0029970	0.0062886	0.0013093	0.0134030
C4-Chrysenes	0.0012871	0.0000000	0.0019580	0.0000000	0.0015584	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0033898
C4-Naphthalenes	0.0046376	0.0016128	0.0044914	0.0041087	0.0141041	0.0015374	0.0020638	0.0023900	0.0021744	0.0061316	0.0000000	0.0144064
C4-Phenanthrenes/Anthracenes	0.0039362	0.0015958	0.0089778	0.0028894	0.0097265	0.0011617	0.0016708	0.0013578	0.0019049	0.0049314	0.0009106	0.0099162
Chrysene	0.0185130	0.0251091	0.0252506	0.0537900	0.0379696	0.0203456	0.0431762	0.0264384	0.0080951	0.0084230	0.0082090	0.0136524
Dibenz(a,h)anthracene	0.0018783	0.0027127	0.0026276	0.0049167	0.0028193	0.0017989	0.0033204	0.0019870	0.0007190	0.0013083	0.0010488	0.0016490
Fluoranthene	0.0342557	0.0430885	0.0440559	0.1214845	0.0819166	0.0392896	0.0875027	0.0572785	0.0131779	0.0160883	0.0166595	0.0232828
Fluorene	0.0018878	0.0014771	0.0024377	0.0136839	0.0086119	0.0021591	0.0059858	0.0033795	0.0005888	0.0013214	0.0009873	0.0033656
Indeno[1,2,3-cd]pyrene	0.0062360	0.0089092	0.0080865	0.0132053	0.0076181	0.0054355	0.0098807	0.0060038	0.0022282	0.0021678	0.0033140	0.0047980
Naphthalene	0.0028409	0.0027522	0.0040451	0.0090829	0.0059169	0.0031484	0.0026414	0.0036492	0.0022586	0.0019696	0.0013797	0.0055582
Perylene	0.0274690	0.0068485	0.0381440	0.0107854	0.0151725	0.0052229	0.0105165	0.0054698	0.0041750	0.0127428	0.0031048	0.0187249
Phenanthrene	0.0183515	0.0188897	0.0220046	0.1338164	0.0712601	0.0169480	0.0582983	0.0332797	0.0064613	0.0103375	0.0085249	0.0172619
Pyrene	0.0336263	0.0408563	0.0435120	0.1056236	0.0720130	0.0340565	0.0851105	0.0509859	0.0142581	0.0142792	0.0139165	0.0247976
Sum of Toxic Units	0.3210341	0.3327351	0.4422981	0.8601538	0.6919735	0.2756731	0.5970365	0.3892944	0.1319457	0.1857682	0.1225238	0.3415275

	BWR-DAM8-T2-0320	BWR-DAM11-T1-0320	BWR-DAM11-T2-0320	BWR-DUP1-0320	BWR-FIELDBLANK-0320_SOLID	BWR-DAM6-T1-0620	BWR-DAM6-T2-0620	BWR-DAM6-T3-0620	BWR-DAM9-T1-0620	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DUP2-0620
1-Methylnaphthalene	0.000244	0.000188	3.86E-05	4.18E-05	0.000126627	0.000149802	0.000162196	0.0001388	0.0001418	0.0001439	0.000205795	0.0023936	0.00010015
2-Methylnaphthalene	0.000303	0.000129	1.2E-05	9.89E-06	0.000179558	0.0001159	0.000117704	0	0.0001065	0	0.000140312	0.0020273	7.6048E-05
Acenaphthene	0.0009082	0.0002598	0.0000566	0.0000375	0.0000000	0.0000000	0.0005950	0.0000000	0.0000000	0.0000000	0.0008163	0.0238996	0.0000000
Acenaphthylene	0.0016942	0.0005982	0.0000722	0.0000384	0.0000000	0.0010436	0.0008576	0.0008509	0.0010092	0.0008312	0.0013713	0.0564385	0.0006457
Anthracene	0.0020475	0.0005239	0.0000369	0.0000248	0.0000000	0.0019059	0.0019862	0.0013669	0.0014768	0.0011191	0.0025739	0.0515358	0.0011277
Benzo[a]anthracene	0.0064274	0.0030940	0.0002035	0.0001064	0.0000000	0.0095349	0.0066801	0.0055896	0.0066754	0.0041239	0.0098269	0.1455993	0.0045514
Benzo[a]pyrene	0.0060682	0.0039653	0.0002272	0.0001418	0.0005151	0.0102649	0.0069861	0.0066428	0.0076357	0.0050915	0.0089924	0.1586127	0.0059499
Benzo[b]fluoranthene	0.0059815	0.0057326	0.0002950	0.0001828	0.0005227	0.0120454	0.0074600	0.0082938	0.0103937	0.0059043	0.0147730	0.1459215	0.0073310
Benzo[e]pyrene	0.0051240	0.0041682	0.0001936	0.0001143	0.0000000	0.0087803	0.0063907	0.0061871	0.0072570	0.0050810	0.0085465	0.1160754	0.0054428
Benzo[g,h,i]perylene	0.0019746	0.0019104	0.0000830	0.0000452	0.0000000	0.0030585	0.0017957	0.0020685	0.0021149	0.0019268	0.0027171	0.0815395	0.0019663
Benzo[k]fluoranthene	0.0055101	0.0049928	0.0002726	0.0001449	0.0000000	0.0120208	0.0062995	0.0091482	0.0096572	0.0058923	0.0130580	0.1430236	0.0073160
C1-Chrysenes	0.0092127	0.0018124	0.0001151	0.0001360	0.0000000	0.0042143	0.0030841	0.0032661	0.0045323	0.0022400	0.0044480	0.0796336	0.0024722
C1-Fluoranthenes/pyrene	0.0128700	0.0039756	0.0003125	0.0002256	0.0000000	0.0085763	0.0067853	0.0061050	0.0072910	0.0045042	0.0144896	0.1523986	0.0050954
C1-Fluorenes	0.0014745	0.0000000	0.0001750	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0008792	0.0121080	0.0000000
C1-Phenanthrenes/Anthracenes	0.0107570	0.0025129	0.0001676	0.0001178	0.0000000	0.0047874	0.0039410	0.0029978	0.0032993	0.0024588	0.0056124	0.0913798	0.0023566
C2-Chrysenes	0.0062563	0.0000000	0.0000849	0.0000731	0.0000000	0.0018718	0.0013376	0.0011871	0.0018797	0.0008602	0.0019267	0.0278385	0.0009968
C2-Fluorenes	0.0030862	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0009269	0.0007831	0.0070655	0.0000000
C2-Naphthalenes	0.0057410	0.0017007	0.0002831	0.0002374	0.0000000	0.0022198	0.0022031	0.0018435	0.0015824	0.0036269	0.0030789	0.0260104	0.0015949
C2-Phenanthrenes/Anthracenes	0.0126802	0.0017782	0.0003082	0.0004374	0.0000000	0.0029718	0.0024852	0.0026351	0.0022577	0.0018596	0.0040436	0.0512940	0.0016034
C3-Chrysenes	0.0048610	0.0005047	0.0000000	0.0000473	0.0000000	0.0007211	0.0007578	0.0000000	0.0007573	0.0005718	0.0006689	0.0110116	0.0005594
C3-Fluorenes	0.0042761	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0022031	0.0000000	0.0000000
C3-Naphthalenes	0.0093036	0.0011416	0.0003682	0.0003261	0.0000000	0.0013802	0.0013537	0.0011033	0.0010267	0.0012934	0.0018492	0.0201974	0.0009059
C3-Phenanthrenes/Anthracenes	0.0114107	0.0006770	0.0001742	0.0001587	0.0000000	0.0013656	0.0012198	0.0012888	0.0011428	0.0009064	0.0016449	0.0196942	0.0009235
C4-Chrysenes	0.0022634	0.0002816	0.0000000	0.0000434	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0004425	0.0000000	0.0000000
C4-Naphthalenes	0.0130267	0.0009319	0.0001465	0.0001282	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0010692	0.0104836	0.0005243
C4-Phenanthrenes/Anthracenes	0.0088807	0.0004191	0.0001757	0.0001614	0.0000000	0.0006200	0.0000000	0.0006085	0.0007302	0.0006331	0.0007242	0.0064264	0.0004088
Chrysene	0.0085393	0.0058033	0.0003041	0.0001621	0.0000000	0.0139721	0.0099846	0.0086078	0.0095618	0.0071912	0.0132192	0.1722846	0.0068029
Dibenz(a,h)anthracene	0.0007621	0.0005906	0.0000410	0.0000244	0.0000000	0.0010501	0.0009005	0.0007991	0.0008124	0.0006949	0.0008831	0.0295310	0.0007243
Fluoranthene	0.0152911	0.0101031	0.0004463	0.0002531	0.0000000	0.0280217	0.0190709	0.0205515	0.0163776	0.0126726	0.0263013	0.2850504	0.0128584
Fluorene	0.0016745	0.0004457	0.0000666	0.0000548	0.0000000	0.0000000	0.0006892	0.0000000	0.0000000	0.0000000	0.0010753	0.0265534	0.0003380
Indeno[1,2,3-cd]pyrene	0.0019392	0.0018761	0.0000863	0.0000472	0.0000000	0.0030459	0.0024689	0.0021847	0.0022972	0.0020996	0.0027425	0.0800769	0.0021027
Naphthalene	0.0016380	0.0007554	0.0001667	0.0001504	0.0026202	0.0000000	0.0010652	0.0000000	0.0000000	0.0000000	0.0008908	0.0086138	0.0000000
Perylene	0.0200304	0.0038516	0.0149312	0.0141512	0.0000000	0.0027317	0.0022077	0.0024306	0.0023222	0.0018531	0.0026921	0.0474854	0.0020781
Phenanthrene	0.0113368	0.0037666	0.0002243	0.0001325	0.0000000	0.0110802	0.0090491	0.0068118	0.0076534	0.0058191	0.0138665	0.2311327	0.0053788
Pyrene	0.0142179	0.0080520	0.0003913	0.0002416	0.0000000	0.0209794	0.0161205	0.0134888	0.0135921	0.0091225	0.0320144	0.2781600	0.0130429
Sum of Toxic Units	0.2278117	0.0765420	0.0204599	0.0181974	0.0039641	0.1685293	0.1240550	0.1161961	0.1235840	0.0894483	0.2005708	2.6014965	0.0952743

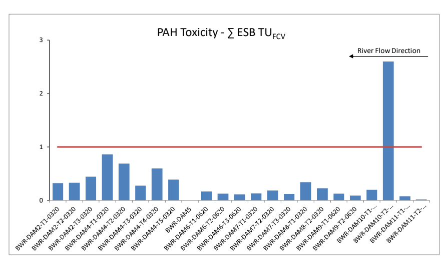
Toxic Units Greater Than 1

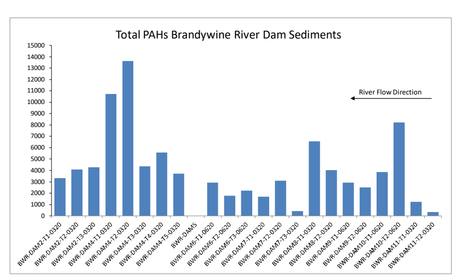
Avg Dam 10 TU = 1.40103

Summary Data - Reordered For Plot

Sample ID	$\sum$ ESB TU_{FCV}		Total PAHs (ppb)
BWR-DAM2-T1-0320	0.32	1	3316.3
BWR-DAM2-T2-0320	0.33	1	4098.8
BWR-DAM2-T3-0320	0.44	1	4273.6
BWR-DAM4-T1-0320	0.86	1	10721
BWR-DAM4-T2-0320	0.69	1	13628
BWR-DAM4-T3-0320	0.28	1	4369
BWR-DAM4-T4-0320	0.60	1	5573.7
BWR-DAM4-T5-0320	0.39	1	3708.5
BWR-DAM5	0.00	1	0
BWR-DAM6-T1-0620	0.17	1	2917.8
BWR-DAM6-T2-0620	0.12	1	1764.9
BWR-DAM6-T3-0620	0.12	1	2220.5
BWR-DAM7-T1-0320	0.13	1	1697.8
BWR-DAM7-T2-0320	0.19	1	3108.3
BWR-DAM7-T3-0320	0.12	1	431.71
BWR-DAM8-T1-0320	0.34	1	6575
BWR-DAM8-T2-0320	0.23	1	4035.7
BWR-DAM9-T1-0620	0.12	1	2921.8
BWR-DAM9-T2-0620	0.09	1	2512.9
BWR-DAM10-T1-0620	0.20	1	3867.6
BWR-DAM10-T2-0620	2.60	1	8217
BWR-DAM11-T1-0320	0.08	1	1232.1
BWR-DAM11-T2-0320	0.02	1	349.3

Column1	
Mean	3980.056
Standard Error	680.1356
Median	3316.3
Mode	#N/A
Standard Deviation	3261.816
Sample Variance	10639442
Kurtosis	2.776822
Skewness	1.56503
Range	13628
Minimum	0
Maximum	13628
Sum	91541.29
Count	23
	0





Dam 10 Transect 2 TU using average TOC

	Bulk Concentration	Avg OC Normalized Conc.	ESB Comparison
1-Methylnaphthalene	[illegible]	[illegible]	[illegible]
2-Methylnaphthalene	[illegible]	[illegible]	[illegible]
Acenaphthene	[illegible]	[illegible]	[illegible]
Acenaphthylene	[illegible]	[illegible]	[illegible]
Anthracene	[illegible]	[illegible]	[illegible]
Benzo[a]anthracene	[illegible]	[illegible]	[illegible]
Benzo[a]pyrene	[illegible]	[illegible]	[illegible]
Benzo[b]fluoranthene	[illegible]	[illegible]	[illegible]
Benzo[e]pyrene	[illegible]	[illegible]	[illegible]
Benzo[g,h,i]perylene	[illegible]	[illegible]	[illegible]
Benzo[k]fluoranthene	[illegible]	[illegible]	[illegible]
C1-Chrysenes	[illegible]	[illegible]	[illegible]
C1-Fluoranthenes/pyrene	[illegible]	[illegible]	[illegible]
C1-Fluorenes	[illegible]	[illegible]	[illegible]
C1-Phenanthrenes/Anthracenes	[illegible]	[illegible]	[illegible]
C2-Chrysenes	[illegible]	[illegible]	[illegible]
C2-Fluorenes	[illegible]	[illegible]	[illegible]
C2-Naphthalenes	[illegible]	[illegible]	[illegible]
C2-Phenanthrenes/Anthracenes	[illegible]	[illegible]	[illegible]
C3-Chrysenes	[illegible]	[illegible]	[illegible]
C3-Fluorenes	[illegible]	[illegible]	[illegible]
C3-Naphthalenes	[illegible]	[illegible]	[illegible]
C3-Phenanthrenes/Anthracenes	[illegible]	[illegible]	[illegible]
C4-Chrysenes	[illegible]	[illegible]	[illegible]
C4-Naphthalenes	[illegible]	[illegible]	[illegible]
C4-Phenanthrenes/Anthracenes	[illegible]	[illegible]	[illegible]
Chrysene	[illegible]	[illegible]	[illegible]
Dibenz(a,h)anthracene	[illegible]	[illegible]	[illegible]
Fluoranthene	[illegible]	[illegible]	[illegible]
Fluorene	[illegible]	[illegible]	[illegible]
Indeno[1,2,3-cd]pyrene	[illegible]	[illegible]	[illegible]
Naphthalene	[illegible]	[illegible]	[illegible]
Perylene	[illegible]	[illegible]	[illegible]
Phenanthrene	[illegible]	[illegible]	[illegible]
Pyrene	[illegible]	[illegible]	[illegible]
		Sum of Toxic Units	**0.7284969**

Some data input derived from EPA 2013 EPI Suite Program (ECOSAR Module)

Client Sample ID	**Brandywine River**		
Collection Date	**March-20**		
TOC	Variable	kg OC/kg sed	field measured
Critical Value for 50% Mortality	35.3	umol/g octanol	from USEPA 2008
Acute-to-Chronic Ratio	5.09		from USEPA 2008
Final Chronic Value	6.94	umol/g octanol	

BWR-DAM2-T1-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
1-Methylnaphthalene	0.01280	90-12-0	142.2	3.87	3.80	81.60	5.9	0.0723	2.58E+04	N	0.0015	217.32	0.000333

T.U.c = 0.0003
Acute to Chronic 5.09
T.U.a = 0.0001

BWR-DAM2-T2-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
1-Methylnaphthalene	0.01510	90-12-0	142.2	3.87	3.80	96.26	7.1	0.0738	2.58E+04	N	0.0015	217.32	0.000339

T.U.c = 0.000339
Acute to Chronic 5.09
T.U.a = 0.000067

BWR-DAM2-T3-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
1-Methylnaphthalene	0.00122	90-12-0	142.2	3.87	3.80	7.78	8.5	1.0929	2.58E+04	N	0.0015	217.32	0.005029

T.U.c = 0.005029
Acute to Chronic 5.09
T.U.a = 0.000988

BWR-DAM4-T1-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
1-Methylnaphthalene	0.0163	90-12-0	142.2	3.87	3.80	103.91	40	0.3849	2.58E+04	N	0.0015	217.32	0.001771

T.U.c = 0.001771
Acute to Chronic 5.09
T.U.a = 0.000348

BWR-DAM4-T2-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
1-Methylnaphthalene	0.0259	90-12-0	142.2	3.87	3.80	165.12	36	0.2180	2.58E+04	N	0.0015	217.32	0.001003

T.U.c = 0.001003
Acute to Chronic 5.09
T.U.a = 0.000197

BWR-DAM4-T3-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
1-Methylnaphthalene	0.0198	90-12-0	142.2	3.87	3.80	126.23	15	0.1188	2.58E+04	N	0.0015	217.32	0.000547

T.U.c = 0.000547
Acute to Chronic 5.09
T.U.a = 0.000107

BWR-DAM4-T4-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
1-Methylnaphthalene	0.0118	90-12-0	142.2	3.87	3.80	75.23	7.6	0.1010	2.58E+04	N	0.0015	217.32	0.000465

T.U.c = 0.000465
Acute to Chronic 5.09
T.U.a = 0.000091

BWR-DAM4-T5-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
1-Methylnaphthalene	0.0121	90-12-0	142.2	3.87	3.80	77.14	8.5	0.1102	2.58E+04	N	0.0015	217.32	0.000507

T.U.c = 0.000507
Acute to Chronic 5.09
T.U.a = 0.000100

BWR-DAM7-T1-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
1-Methylnaphthalene	0.0161	90-12-0	142.2	3.87	3.80	102.64	5.5	0.0536	2.58E+04	N	0.0015	217.32	0.000247

T.U.c = 0.000247
Acute to Chronic 5.09
T.U.a = 0.000048

BWR-DAM7-T2-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
1-Methylnaphthalene	0.0211	90-12-0	142.2	3.87	3.80	134.52	6.5	0.0483	2.58E+04	N	0.0015	217.32	0.000222

T.U.c = 0.000222
Acute to Chronic 5.09
T.U.a = 0.000044

BWR-DAM7-T3-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
1-Methylnaphthalene	0.00433	90-12-0	142.2	3.87	3.80	27.60	0.86	0.0312	2.58E+04	N	0.0015	217.32	0.000143

T.U.c = 0.000143
Acute to Chronic 5.09
T.U.a = 0.000028

BWR-DAM8-T1-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
1-Methylnaphthalene	0.0243	90-12-0	142.2	3.87	3.80	154.92	18	0.1162	2.58E+04	N	0.0015	217.32	0.000535

T.U.c = 0.000535
Acute to Chronic 5.09
T.U.a = 0.000105

BWR-DAM8-T2-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
1-Methylnaphthalene	0.0222	90-12-0	142.2	3.87	3.80	141.53	7.5	0.0530	2.58E+04	N	0.0015	217.32	0.000244

T.U.c = 0.000244
Acute to Chronic 5.09
T.U.a = 0.000048

BWR-DAM11-T1-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
1-Methylnaphthalene	0.0196	90-12-0	142.2	3.87	3.80	124.95	5.1	0.0408	2.58E+04	N	0.0015	217.32	0.000188

T.U.c = 0.000188
Acute to Chronic 5.09
T.U.a = 0.000037

BWR-DAM11-T2-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
1-Methylnaphthalene	0.0187	90-12-0	142.2	3.87	3.80	119.22	1	0.0084	2.58E+04	N	0.0015	217.32	0.000039

T.U.c = 0.000039
Acute to Chronic 5.09
T.U.a = 0.000008

BWR-DUP1-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
1-Methylnaphthalene	0.019	90-12-0	142.2	3.87	3.80	121.13	1.1	0.0091	2.58E+04	N	0.0015	217.32	0.000042

T.U.c = 0.000042
Acute to Chronic 5.09
T.U.a = 0.000008

BWR-FIELDBLANK-0320_SOLID

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
1-Methylnaphthalene	0.000684	90-12-0	142.2	3.87	3.80	4.36	0.12	0.0275	2.58E+04	N	0.0015	217.32	0.000127

T.U.c = 0.000127
Acute to Chronic 5.09
T.U.a = 0.000025

BWR-DAM6-T1-0620

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
1-Methylnaphthalene	0.0212	90-12-0	142.2	3.87	3.80	135.15	4.4	0.0326	2.58E+04	N	0.0015	217.32	0.000150

T.U.c = 0.000150
Acute to Chronic 5.09
T.U.a = 0.000029

BWR-DAM6-T2-0620

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
1-Methylnaphthalene	0.0178	90-12-0	142.2	3.87	3.80	113.48	4	0.0352	2.58E+04	N	0.0015	217.32	0.000162

T.U.c = 0.000162
Acute to Chronic 5.09
T.U.a = 0.000032

BWR-DAM6-T3-0620

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
1-Methylnaphthalene	0.0234	90-12-0	142.2	3.87	3.80	149.18	4.5	0.0302	2.58E+04	N	0.0015	217.32	0.000139

T.U.c = 0.000139
Acute to Chronic 5.09
T.U.a = 0.000027

BWR-DAM9-T1-0620

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
1-Methylnaphthalene	0.0285	90-12-0	142.2	3.87	3.80	181.69	5.6	0.0308	2.58E+04	N	0.0015	217.32	0.000142

T.U.c = 0.000142
Acute to Chronic 5.09
T.U.a = 0.000028

BWR-DAM9-T2-0620

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
1-Methylnaphthalene	0.0346	90-12-0	142.2	3.87	3.80	220.58	6.9	0.0313	2.58E+04	N	0.0015	217.32	0.000144

T.U.c = 0.000144
Acute to Chronic 5.09
T.U.a = 0.000028

BWR-DAM10-T1-0620

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
1-Methylnaphthalene	0.0242	90-12-0	142.2	3.87	3.80	154.28	6.9	0.0447	2.58E+04	N	0.0015	217.32	0.000206

T.U.c = 0.000206
Acute to Chronic 5.09
T.U.a = 0.000040

BWR-DAM10-T2-0620

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
1-Methylnaphthalene	0.00392	90-12-0	142.2	3.87	3.80	24.99	13	0.5202	2.58E+04	N	0.0015	217.32	0.002394

T.U.c = 0.002394
Acute to Chronic 5.09
T.U.a = 0.000470

BWR-DUP2-0620

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
1-Methylnaphthalene	0.0209	90-12-0	142.2	3.87	3.80	133.24	2.9	0.0218	2.58E+04	N	0.0015	217.32	0.000100

T.U.c = 0.000100
Acute to Chronic 5.09
T.U.a = 0.000020

Client Sample ID	**Brandywine River**		
Collection Date	**March-20**		
TOC	Variable	kg OC/kg sed	field measured
Critical Value for 50% Mortality	35.3	umol/g octanol	from USEPA 2008
Acute-to-Chronic Ratio	5.09		from USEPA 2008
Final Chronic Value	6.94	umol/g octanol	

BWR-DAM2-T1-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
2-Methylnaphthalene	0.01280	91-57-6	142.19	3.86	3.79	79.78	6.2	0.0777	2.46E+04	N	0.0016	222.09	0.0003

T.U.c = 0.0003
Acute to Chronic Rati 5.09
T.U.a = 0.0001

BWR-DAM2-T2-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
2-Methylnaphthalene	0.0151	91-57-6	142.19	3.86	3.79	94.11	6.9	0.0733	2.46E+04	N	0.0016	222.09	0.0003

T.U.c = 0.000330
Acute to Chronic Rati 5.09
T.U.a = 0.000065

BWR-DAM2-T3-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
2-Methylnaphthalene	0.00122	91-57-6	142.19	3.86	3.79	7.60	9.1	1.1968	2.46E+04	N	0.0016	222.09	0.0054

T.U.c = 0.0054
Acute to Chronic Rati 5.09
T.U.a = 0.0011

BWR-DAM4-T1-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
2-Methylnaphthalene	0.0163	91-57-6	142.19	3.86	3.79	101.59	34	0.3347	2.46E+04	N	0.0016	222.09	0.0015

T.U.c = 0.0015
Acute to Chronic Rati 5.09
T.U.a = 0.0003

BWR-DAM4-T2-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
2-Methylnaphthalene	0.0259	91-57-6	142.19	3.86	3.79	161.42	40	0.2478	2.46E+04	N	0.0016	222.09	0.0011

T.U.c = 0.0011
Acute to Chronic Rati 5.09
T.U.a = 0.0002

BWR-DAM4-T3-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
2-Methylnaphthalene	0.0198	91-57-6	142.19	3.86	3.79	123.40	11	0.0891	2.46E+04	N	0.0016	222.09	0.0004

T.U.c = 0.0004
Acute to Chronic Rati 5.09
T.U.a = 0.0001

BWR-DAM4-T4-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
2-Methylnaphthalene	0.0118	91-57-6	142.19	3.86	3.79	73.54	4.1	0.0557	2.46E+04	N	0.0016	222.09	0.0003

T.U.c = 0.0003
Acute to Chronic Rati 5.09
T.U.a = 4.93E-05

BWR-DAM4-T5-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
2-Methylnaphthalene	0.0121	91-57-6	142.19	3.86	3.79	75.41	7	0.0928	2.46E+04	N	0.0016	222.09	0.0004

T.U.c = 0.0004
Acute to Chronic Rati 5.09
T.U.a = 0.0001

BWR-DAM7-T1-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
2-Methylnaphthalene	0.0161	91-57-6	142.19	3.86	3.79	100.34	5.2	0.0518	2.46E+04	N	0.0016	222.09	0.0002

T.U.c = 0.0002
Acute to Chronic Rati 5.09
T.U.a = 4.58E-05

BWR-DAM7-T2-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
2-Methylnaphthalene	0.0211	91-57-6	142.19	3.86	3.79	131.51	5.8	0.0441	2.46E+04	N	0.0016	222.09	0.0002

T.U.c = 0.0002
Acute to Chronic Rati 5.09
T.U.a = 3.90E-05

BWR-DAM7-T3-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
2-Methylnaphthalene	0.00433	91-57-6	142.19	3.86	3.79	26.99	0.55	0.0204	2.46E+04	N	0.0016	222.09	0.0001

T.U.c = 0.0001
Acute to Chronic Rati 5.09
T.U.a = 1.80E-05

BWR-DAM8-T1-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
2-Methylnaphthalene	0.0243	91-57-6	142.19	3.86	3.79	151.45	27	0.1783	2.46E+04	N	0.0016	222.09	0.0008

T.U.c = 0.0008
Acute to Chronic Rati 5.09
T.U.a = 0.0002

BWR-DAM8-T2-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
2-Methylnaphthalene	0.0222	91-57-6	142.19	3.86	3.79	138.36	9.3	0.0672	2.46E+04	N	0.0016	222.09	0.0003

T.U.c = 0.0003
Acute to Chronic Rati 5.09
T.U.a = 0.0001

BWR-DAM11-T1-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
2-Methylnaphthalene	0.0196	91-57-6	142.19	3.86	3.79	122.16	3.5	0.0287	2.46E+04	N	0.0016	222.09	0.0001

T.U.c = 0.0001
Acute to Chronic Rati 5.09
T.U.a = 2.53E-05

BWR-DAM11-T2-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
2-Methylnaphthalene	0.0187	91-57-6	142.19	3.86	3.79	116.55	0.31	0.0027	2.46E+04	N	0.0016	222.09	1.20E-05

T.U.c = 1.20E-05
Acute to Chronic Rati 5.09
T.U.a = 2.35E-06

BWR-DUP1-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
2-Methylnaphthalene	0.019	91-57-6	142.19	3.86	3.79	118.42	0.26	0.0022	2.46E+04	N	0.0016	222.09	9.89E-06

T.U.c = 9.89E-06
Acute to Chronic Rati 5.09
T.U.a = 0.0000

BWR-FIELDBLANK-0320_SOLID

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
2-Methylnaphthalene	0.000684	91-57-6	142.19	3.86	3.79	4.26	0.17	0.0399	2.46E+04	N	0.0016	222.09	0.0002

T.U.c = 0.0002
Acute to Chronic Rati 5.09
T.U.a = 0.0000

BWR-DAM6-T1-0620

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
2-Methylnaphthalene	0.0212	91-57-6	142.19	3.86	3.79	132.13	3.4	0.0257	2.46E+04	N	0.0016	222.09	0.0001

T.U.c = 0.0001
Acute to Chronic Rati 5.09
T.U.a = 2.28E-05

BWR-DAM6-T2-0620

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
2-Methylnaphthalene	0.0178	91-57-6	142.19	3.86	3.79	110.94	2.9	0.0261	2.46E+04	N	0.0016	222.09	0.0001

T.U.c = 0.0001
Acute to Chronic Rati 5.09
T.U.a = 2.31E-05

BWR-DAM6-T3-0620

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
2-Methylnaphthalene	0.0234	91-57-6	142.19	3.86	3.79	145.84	0	0.0000	2.46E+04	N	0.0016	222.09	0.0000

T.U.c = 0.0000
Acute to Chronic Rati 5.09
T.U.a = 0.00E+00

BWR-DAM9-T1-0620

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
2-Methylnaphthalene	0.0285	91-57-6	142.19	3.86	3.79	177.63	4.2	0.0236	2.46E+04	N	0.0016	222.09	1.06E-04

T.U.c = 1.06E-04
Acute to Chronic Rati 5.09
T.U.a = 0.0000

BWR-DAM9-T2-0620

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
2-Methylnaphthalene	0.0346	91-57-6	142.19	3.86	3.79	215.64	0	0.0000	2.46E+04	N	0.0016	222.09	0.0000

T.U.c = 0.0000
Acute to Chronic Rati 5.09
T.U.a = 0.0000

BWR-DAM10-T1-0620

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
2-Methylnaphthalene	0.0242	91-57-6	142.19	3.86	3.79	150.83	4.7	0.0312	2.46E+04	N	0.0016	222.09	1.40E-04

T.U.c = 1.40E-04
Acute to Chronic Rati 5.09
T.U.a = 0.0000

BWR-DAM10-T2-0620

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
2-Methylnaphthalene	0.00392	91-57-6	142.19	3.86	3.79	24.43	11	0.4502	2.46E+04	N	0.0016	222.09	0.0020

T.U.c = 0.0020
Acute to Chronic Rati 5.09
T.U.a = 0.0004

BWR-DUP2-0620

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Solubility (ug/L)	Cd > Solub (Y/N)	Narcosis SCV (mmol/L)	Narcosis SCV (ug/L)	Sediment T.U.C (Cd/FCV)
2-Methylnaphthalene	0.0209	91-57-6	142.19	3.86	3.79	130.26	2.2	0.0169	2.46E+04	N	0.0016	222.09	7.60E-05

T.U.c = 7.60E-05
Acute to Chronic Rati 5.09
T.U.a = 0.0000

Predicted Porewater Conentrations for Select PAHs

BWR-DAM2-T1-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Fish & Water Ingestion Syst. Tox. HH Criterion ug/L water	Fish & Water Ingestion Human Carcinogen HH Criterion ug/L water	T.U.
Acenaphthene	0.01280	83329	154.21	3.77	3.71	65.07	9.2	0.1414	670	NA	0.00021101
Anthracene	0.01280	120127	178.12	4.48	4.40	324.59	32	0.0986	8300	NA	1.1878E-05
Benzo(a)anthracene	0.01280	56553	228.29	5.64	5.54	4483.43	150	0.0335	NA	0.038	0.8804358
Benzo(a)pyrene	0.01280	50328	252.31	6.30	6.19	19970.55	160	0.0080	0.2	0.0038	2.108368
Benzo(b)flouranthene	0.01280	205992	252.3	6.39	6.28	24482.74	180	0.0074	NA	0.038	0.19347682
Dibenz(a,h)anthracene	0.01280	53703	278.4	7.10	6.98	122120.89	27	0.0002	NA	0.0038	0.05818221
Fluoranthene	0.01280	206440	202.26	5.13	5.04	1413.45	310	0.2193	130	NA	0.00168709
Fluorene	0.01280	86737	166.22	3.96	3.89	100.04	13	0.1299	1108	NA	0.00011728
Indeno[1,2,3-cd]pyrene	0.01280	193395	276.3	6.91	6.79	79436.48	89	0.0011	NA	0.038	0.029484
Pyrene	0.01280	129000	202.26	5.04	4.95	1152.95	300	0.2602	830	NA	0.0003135

BWR-DAM2-T2-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Fish & Water Ingestion Syst. Tox. HH Criterion ug/L water	Fish & Water Ingestion Human Carcinogen HH Criterion ug/L water	T.U.
Acenaphthene	0.0151	83329	154.21	3.77	3.71	76.77	8.8	0.1146	670	NA	0.0001711
Anthracene	0.0151	120127	178.12	4.48	4.40	382.91	34	0.0888	8300	NA	1.0698E-05
Benzo(a)anthracene	0.0151	56553	228.29	5.64	5.54	5289.04	230	0.0435	NA	0.038	1.14437218
Benzo(a)pyrene	0.0151	50328	252.31	6.30	6.19	23559.01	280	0.0119	0.2	0.0038	3.12764525
Benzo(b)flouranthene	0.0151	205992	252.3	6.39	6.28	28881.98	310	0.0107	NA	0.038	0.28245622
Dibenz(a,h)anthracene	0.0151	53703	278.4	7.10	6.98	144064.49	46	0.0003	NA	0.0038	0.0840267
Fluoranthene	0.0151	206440	202.26	5.13	5.04	1667.43	460	0.2759	130	NA	0.00212211
Fluorene	0.0151	86737	166.22	3.96	3.89	118.01	12	0.1017	1108	NA	9.1771E-05
Indeno[1,2,3-cd]pyrene	0.0151	193395	276.3	6.91	6.79	93710.22	150	0.0016	NA	0.038	0.04212314
Pyrene	0.0151	129000	202.26	5.04	4.95	1360.12	430	0.3161	830	NA	0.0003809

BWR-DAM2-T3-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Fish & Water Ingestion Syst. Tox. HH Criterion ug/L water	Fish & Water Ingestion Human Carcinogen HH Criterion ug/L water	T.U.
Acenaphthene	0.00122	83329	154.21	3.77	3.71	6.20	11	1.7735	670	NA	0.00264709
Anthracene	0.00122	120127	178.12	4.48	4.40	30.94	46	1.4869	8300	NA	0.00017914
Benzo(a)anthracene	0.00122	56553	228.29	5.64	5.54	427.33	230	0.5382	NA	0.038	14.1639508
Benzo(a)pyrene	0.00122	50328	252.31	6.30	6.19	1903.44	230	0.1208	0.2	0.0038	31.7983371
Benzo(b)flouranthene	0.00122	205992	252.3	6.39	6.28	2333.51	180	0.0771	NA	0.038	2.02992073
Dibenz(a,h)anthracene	0.00122	53703	278.4	7.10	6.98	11639.65	36	0.0031	NA	0.0038	0.81391504
Fluoranthene	0.00122	206440	202.26	5.13	5.04	134.72	380	2.8207	130	NA	0.02169754
Fluorene	0.00122	86737	166.22	3.96	3.89	9.53	16	1.6780	1108	NA	0.00151447
Indeno[1,2,3-cd]pyrene	0.00122	193395	276.3	6.91	6.79	7571.29	110	0.0145	NA	0.038	0.38233078
Pyrene	0.00122	129000	202.26	5.04	4.95	109.89	370	3.3670	830	NA	0.00405662

Predicted Porewater Conentrations for Select PAHs

BWR-DAM4-T1-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Fish & Water Ingestion Syst. Tox. HH Criterion ug/L water	Fish & Water Ingestion Human Carcinogen HH Criterion ug/L water	T.U.
Acenaphthene	0.0163	83329	154.21	3.77	3.71	82.87	93	1.1223	670	NA	0.001675
Anthracene	0.0163	120127	178.12	4.48	4.40	413.34	140	0.3387	8300	NA	4.08E-05
Benzo(a)anthracene	0.0163	56553	228.29	5.64	5.54	5709.36	550	0.0963	NA	0.038	2.535079
Benzo(a)pyrene	0.0163	50328	252.31	6.30	6.19	25431.24	580	0.0228	0.2	0.0038	6.001735
Benzo(b)flouranthene	0.0163	205992	252.3	6.39	6.28	31177.24	680	0.0218	NA	0.038	0.573968
Dibenz(a,h)anthracene	0.0163	53703	278.4	7.10	6.98	155513.32	90	0.0006	NA	0.0038	0.152297
Fluoranthene	0.0163	206440	202.26	5.13	5.04	1799.94	1400	0.7778	130	NA	0.005983
Fluorene	0.0163	86737	166.22	3.96	3.89	127.39	120	0.9420	1108	NA	0.00085
Indeno[1,2,3-cd]pyrene	0.0163	193395	276.3	6.91	6.79	101157.39	240	0.0024	NA	0.038	0.062435
Pyrene	0.0163	129000	202.26	5.04	4.95	1468.21	12000	8.1732	830	NA	0.009847

BWR-DAM4-T2-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Fish & Water Ingestion Syst. Tox. HH Criterion ug/L water	Fish & Water Ingestion Human Carcinogen HH Criterion ug/L water	T.U.
Acenaphthene	0.0259	83329	154.21	3.77	3.71	131.67	120	0.9114	670	NA	0.00136
Anthracene	0.0259	120127	178.12	4.48	4.40	656.78	260	0.3959	8300	NA	4.77E-05
Benzo(a)anthracene	0.0259	56553	228.29	5.64	5.54	9071.93	690	0.0761	NA	0.038	2.001547
Benzo(a)pyrene	0.0259	50328	252.31	6.30	6.19	40409.15	590	0.0146	0.2	0.0038	3.842277
Benzo(b)flouranthene	0.0259	205992	252.3	6.39	6.28	49539.29	570	0.0115	NA	0.038	0.30279
Dibenz(a,h)anthracene	0.0259	53703	278.4	7.10	6.98	247103.99	82	0.0003	NA	0.0038	0.087327
Fluoranthene	0.0259	206440	202.26	5.13	5.04	2860.02	1500	0.5245	130	NA	0.004034
Fluorene	0.0259	86737	166.22	3.96	3.89	202.42	120	0.5928	1108	NA	0.000535
Indeno[1,2,3-cd]pyrene	0.0259	193395	276.3	6.91	6.79	160734.74	220	0.0014	NA	0.038	0.036019
Pyrene	0.0259	129000	202.26	5.04	4.95	2332.92	1300	0.5572	830	NA	0.000671

BWR-DAM4-T3-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Fish & Water Ingestion Syst. Tox. HH Criterion ug/L water	Fish & Water Ingestion Human Carcinogen HH Criterion ug/L water	T.U.
Acenaphthene	0.0198	83329	154.21	3.77	3.71	100.66	14	0.1391	670	NA	0.000208
Anthracene	0.0198	120127	178.12	4.48	4.40	502.09	41	0.0817	8300	NA	9.84E-06
Benzo(a)anthracene	0.0198	56553	228.29	5.64	5.54	6935.30	240	0.0346	NA	0.038	0.910673
Benzo(a)pyrene	0.0198	50328	252.31	6.30	6.19	30891.94	290	0.0094	0.2	0.0038	2.470411
Benzo(b)flouranthene	0.0198	205992	252.3	6.39	6.28	37871.73	340	0.0090	NA	0.038	0.236255
Dibenz(a,h)anthracene	0.0198	53703	278.4	7.10	6.98	188905.76	40	0.0002	NA	0.0038	0.055723
Fluoranthene	0.0198	206440	202.26	5.13	5.04	2186.43	550	0.2516	130	NA	0.001935
Fluorene	0.0198	86737	166.22	3.96	3.89	154.75	23	0.1486	1108	NA	0.000134
Indeno[1,2,3-cd]pyrene	0.0198	193395	276.3	6.91	6.79	122878.30	120	0.0010	NA	0.038	0.025699
Pyrene	0.0198	129000	202.26	5.04	4.95	1783.47	470	0.2635	830	NA	0.000318

BWR-DAM4-T4-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Fish & Water Ingestion Syst. Tox. HH Criterion ug/L water	Fish & Water Ingestion Human Carcinogen HH Criterion ug/L water	T.U.
Acenaphthene	0.0118	83329	154.21	3.77	3.71	59.99	21	0.3501	670	NA	0.000522
Anthracene	0.0118	120127	178.12	4.48	4.40	299.23	69	0.2306	8300	NA	2.78E-05
Benzo(a)anthracene	0.0118	56553	228.29	5.64	5.54	4133.16	370	0.0895	NA	0.038	2.355788
Benzo(a)pyrene	0.0118	50328	252.31	6.30	6.19	18410.35	350	0.0190	0.2	0.0038	5.002907
Benzo(b)flouranthene	0.0118	205992	252.3	6.39	6.28	22570.02	470	0.0208	NA	0.038	0.548002
Dibenz(a,h)anthracene	0.0118	53703	278.4	7.10	6.98	112580.20	44	0.0004	NA	0.0038	0.102851
Fluoranthene	0.0118	206440	202.26	5.13	5.04	1303.02	730	0.5602	130	NA	0.00431
Fluorene	0.0118	86737	166.22	3.96	3.89	92.22	38	0.4120	1108	NA	0.000372
Indeno[1,2,3-cd]pyrene	0.0118	193395	276.3	6.91	6.79	73230.50	130	0.0018	NA	0.038	0.046716
Pyrene	0.0118	129000	202.26	5.04	4.95	1062.87	700	0.6586	830	NA	0.000793

BWR-DAM4-T5-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Fish & Water Ingestion Syst. Tox. HH Criterion ug/L water	Fish & Water Ingestion Human Carcinogen HH Criterion ug/L water	T.U.
Acenaphthene	0.0121	83329	154.21	3.77	3.71	61.51	15	0.2438	670	NA	0.000364
Anthracene	0.0121	120127	178.12	4.48	4.40	306.84	51	0.1662	8300	NA	2E-05
Benzo(a)anthracene	0.0121	56553	228.29	5.64	5.54	4238.24	220	0.0519	NA	0.038	1.366009
Benzo(a)pyrene	0.0121	50328	252.31	6.30	6.19	18878.41	240	0.0127	0.2	0.0038	3.34551
Benzo(b)flouranthene	0.0121	205992	252.3	6.39	6.28	23143.84	280	0.0121	NA	0.038	0.318375
Dibenz(a,h)anthracene	0.0121	53703	278.4	7.10	6.98	115442.41	27	0.0002	NA	0.0038	0.061548
Fluoranthene	0.0121	206440	202.26	5.13	5.04	1336.15	490	0.3667	130	NA	0.002821
Fluorene	0.0121	86737	166.22	3.96	3.89	94.57	22	0.2326	1108	NA	0.00021
Indeno[1,2,3-cd]pyrene	0.0121	193395	276.3	6.91	6.79	75092.29	81	0.0011	NA	0.038	0.028386
Pyrene	0.0121	129000	202.26	5.04	4.95	1089.90	430	0.3945	830	NA	0.000475

Predicted Porewater Conentrations for Select PAHs

BWR-DAM6-T1-0620

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Fish & Water Ingestion Syst. Tox. HH Criterion ug/L water	Fish & Water Ingestion Human Carcinogen HH Criterion ug/L water	T.U.
Acenaphthene	0.0212	83329	154.21	3.77	3.71	107.78	5	0.0464	670	NA	6.92E-05
Anthracene	0.0212	120127	178.12	4.48	4.40	537.60	24	0.0446	8300	NA	5.38E-06
Benzo(a)anthracene	0.0212	56553	228.29	5.64	5.54	7425.67	170	0.0229	NA	0.038	0.602462
Benzo(a)pyrene	0.0212	50328	252.31	6.30	6.19	33076.22	210	0.0063	0.2	0.0038	1.670782
Benzo(b)flouranthene	0.0212	205992	252.3	6.39	6.28	40549.53	250	0.0062	NA	0.038	0.162245
Dibenz(a,h)anthracene	0.0212	53703	278.4	7.10	6.98	202262.73	25	0.0001	NA	0.0038	0.032527
Fluoranthene	0.0212	206440	202.26	5.13	5.04	2341.02	420	0.1794	130	NA	0.00138
Fluorene	0.0212	86737	166.22	3.96	3.89	165.69	6	0.0362	1108	NA	3.27E-05
Indeno[1,2,3-cd]pyrene	0.0212	193395	276.3	6.91	6.79	131566.66	72	0.0005	NA	0.038	0.014401
Pyrene	0.0212	129000	202.26	5.04	4.95	1909.57	310	0.1623	830	NA	0.000196

BWR-DAM6-T2-0620

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Fish & Water Ingestion Syst. Tox. HH Criterion ug/L water	Fish & Water Ingestion Human Carcinogen HH Criterion ug/L water	T.U.
Acenaphthene	0.0178	83329	154.21	3.77	3.71	90.49	5.2	0.0575	670	NA	8.58E-05
Anthracene	0.0178	120127	178.12	4.48	4.40	451.38	21	0.0465	8300	NA	5.61E-06
Benzo(a)anthracene	0.0178	56553	228.29	5.64	5.54	6234.76	100	0.0160	NA	0.038	0.422082
Benzo(a)pyrene	0.0178	50328	252.31	6.30	6.19	27771.54	120	0.0043	0.2	0.0038	1.137097
Benzo(b)flouranthene	0.0178	205992	252.3	6.39	6.28	34046.31	130	0.0038	NA	0.038	0.100482
Dibenz(a,h)anthracene	0.0178	53703	278.4	7.10	6.98	169824.37	18	0.0001	NA	0.0038	0.027893
Fluoranthene	0.0178	206440	202.26	5.13	5.04	1965.58	240	0.1221	130	NA	0.000939
Fluorene	0.0178	86737	166.22	3.96	3.89	139.12	6.6	0.0474	1108	NA	4.28E-05
Indeno[1,2,3-cd]pyrene	0.0178	193395	276.3	6.91	6.79	110466.35	49	0.0004	NA	0.038	0.011673
Pyrene	0.0178	129000	202.26	5.04	4.95	1603.32	200	0.1247	830	NA	0.00015

BWR-DAM6-T3-0620

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Fish & Water Ingestion Syst. Tox. HH Criterion ug/L water	Fish & Water Ingestion Human Carcinogen HH Criterion ug/L water	T.U.
Acenaphthene	0.0234	83329	154.21	3.77	3.71	118.96	5.1	0.0429	670	NA	6.4E-05
Anthracene	0.0234	120127	178.12	4.48	4.40	593.38	19	0.0320	8300	NA	3.86E-06
Benzo(a)anthracene	0.0234	56553	228.29	5.64	5.54	8196.26	110	0.0134	NA	0.038	0.353178
Benzo(a)pyrene	0.0234	50328	252.31	6.30	6.19	36508.66	150	0.0041	0.2	0.0038	1.081214
Benzo(b)flouranthene	0.0234	205992	252.3	6.39	6.28	44757.50	190	0.0042	NA	0.038	0.111713
Dibenz(a,h)anthracene	0.0234	53703	278.4	7.10	6.98	223252.26	21	0.0001	NA	0.0038	0.024754
Fluoranthene	0.0234	206440	202.26	5.13	5.04	2583.96	340	0.1316	130	NA	0.001012
Fluorene	0.0234	86737	166.22	3.96	3.89	182.88	6.1	0.0334	1108	NA	3.01E-05
Indeno[1,2,3-cd]pyrene	0.0234	193395	276.3	6.91	6.79	145219.81	57	0.0004	NA	0.038	0.010329
Pyrene	0.0234	129000	202.26	5.04	4.95	2107.73	220	0.1044	830	NA	0.000126

Predicted Porewater Conentrations for Select PAHs

BWR-DAM7-T1-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Fish & Water Ingestion Syst. Tox. HH Criterion ug/L water	Fish & Water Ingestion Human Carcinogen HH Criterion ug/L water	T.U.
Acenaphthene	0.0161	83329	154.21	3.77	3.71	81.85	3.4	0.0415	670	NA	6.2E-05
Anthracene	0.0161	120127	178.12	4.48	4.40	408.27	13	0.0318	8300	NA	3.84E-06
Benzo(a)anthracene	0.0161	56553	228.29	5.64	5.54	5639.31	75	0.0133	NA	0.038	0.349987
Benzo(a)pyrene	0.0161	50328	252.31	6.30	6.19	25119.20	94	0.0037	0.2	0.0038	0.984778
Benzo(b)flouranthene	0.0161	205992	252.3	6.39	6.28	30794.69	100	0.0032	NA	0.038	0.085456
Dibenz(a,h)anthracene	0.0161	53703	278.4	7.10	6.98	153605.19	13	0.0001	NA	0.0038	0.022272
Fluoranthene	0.0161	206440	202.26	5.13	5.04	1777.85	150	0.0844	130	NA	0.000649
Fluorene	0.0161	86737	166.22	3.96	3.89	125.83	5.1	0.0405	1108	NA	3.66E-05
Indeno[1,2,3-cd]pyrene	0.0161	193395	276.3	6.91	6.79	99916.19	40	0.0004	NA	0.038	0.010535
Pyrene	0.0161	129000	202.26	5.04	4.95	1450.19	160	0.1103	830	NA	0.000133

BWR-DAM7-T2-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Fish & Water Ingestion Syst. Tox. HH Criterion ug/L water	Fish & Water Ingestion Human Carcinogen HH Criterion ug/L water	T.U.
Acenaphthene	0.0211	83329	154.21	3.77	3.71	107.27	6	0.0559	670	NA	8.35E-05
Anthracene	0.0211	120127	178.12	4.48	4.40	535.06	26	0.0486	8300	NA	5.85E-06
Benzo(a)anthracene	0.0211	56553	228.29	5.64	5.54	7390.65	120	0.0162	NA	0.038	0.427283
Benzo(a)pyrene	0.0211	50328	252.31	6.30	6.19	32920.20	130	0.0039	0.2	0.0038	1.039196
Benzo(b)flouranthene	0.0211	205992	252.3	6.39	6.28	40358.26	120	0.0030	NA	0.038	0.078247
Dibenz(a,h)anthracene	0.0211	53703	278.4	7.10	6.98	201308.66	31	0.0002	NA	0.0038	0.040524
Fluoranthene	0.0211	206440	202.26	5.13	5.04	2329.98	240	0.1030	130	NA	0.000792
Fluorene	0.0211	86737	166.22	3.96	3.89	164.91	15	0.0910	1108	NA	8.21E-05
Indeno[1,2,3-cd]pyrene	0.0211	193395	276.3	6.91	6.79	130946.07	51	0.0004	NA	0.038	0.010249
Pyrene	0.0211	129000	202.26	5.04	4.95	1900.56	210	0.1105	830	NA	0.000133

BWR-DAM7-T3-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Fish & Water Ingestion Syst. Tox. HH Criterion ug/L water	Fish & Water Ingestion Human Carcinogen HH Criterion ug/L water	T.U.
Acenaphthene	0.00433	83329	154.21	3.77	3.71	22.01	1.6	0.0727	670	NA	0.000108
Anthracene	0.00433	120127	178.12	4.48	4.40	109.80	4.8	0.0437	8300	NA	5.27E-06
Benzo(a)anthracene	0.00433	56553	228.29	5.64	5.54	1516.66	24	0.0158	NA	0.038	0.416428
Benzo(a)pyrene	0.00433	50328	252.31	6.30	6.19	6755.66	27	0.0040	0.2	0.0038	1.051749
Benzo(b)flouranthene	0.00433	205992	252.3	6.39	6.28	8282.05	33	0.0040	NA	0.038	0.104856
Dibenz(a,h)anthracene	0.00433	53703	278.4	7.10	6.98	41311.21	5.1	0.0001	NA	0.0038	0.032488
Fluoranthene	0.00433	206440	202.26	5.13	5.04	478.14	51	0.1067	130	NA	0.00082
Fluorene	0.00433	86737	166.22	3.96	3.89	33.84	2.3	0.0680	1108	NA	6.13E-05
Indeno[1,2,3-cd]pyrene	0.00433	193395	276.3	6.91	6.79	26871.87	16	0.0006	NA	0.038	0.015669
Pyrene	0.00433	129000	202.26	5.04	4.95	390.02	42	0.1077	830	NA	0.00013

Predicted Porewater Conentrations for Select PAHs

BWR-DAM8-T1-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Fish & Water Ingestion Syst. Tox. HH Criterion ug/L water	Fish & Water Ingestion Human Carcinogen HH Criterion ug/L water	T.U.
Acenaphthene	0.0243	83329	154.21	3.77	3.71	123.54	53	0.4290	670	NA	0.00064
Anthracene	0.0243	120127	178.12	4.48	4.40	616.21	51	0.0828	8300	NA	9.97E-06
Benzo(a)anthracene	0.0243	56553	228.29	5.64	5.54	8511.50	210	0.0247	NA	0.038	0.649276
Benzo(a)pyrene	0.0243	50328	252.31	6.30	6.19	37912.84	280	0.0074	0.2	0.0038	1.943516
Benzo(b)flouranthene	0.0243	205992	252.3	6.39	6.28	46478.95	250	0.0054	NA	0.038	0.141547
Dibenz(a,h)anthracene	0.0243	53703	278.4	7.10	6.98	231838.88	45	0.0002	NA	0.0038	0.051079
Fluoranthene	0.0243	206440	202.26	5.13	5.04	2683.34	400	0.1491	130	NA	0.001147
Fluorene	0.0243	86737	166.22	3.96	3.89	189.92	44	0.2317	1108	NA	0.000209
Indeno[1,2,3-cd]pyrene	0.0243	193395	276.3	6.91	6.79	150805.18	130	0.0009	NA	0.038	0.022685
Pyrene	0.0243	129000	202.26	5.04	4.95	2188.80	420	0.1919	830	NA	0.000231

BWR-DAM8-T2-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Fish & Water Ingestion Syst. Tox. HH Criterion ug/L water	Fish & Water Ingestion Human Carcinogen HH Criterion ug/L water	T.U.
Acenaphthene	0.0222	83329	154.21	3.77	3.71	112.86	9.9	0.0877	670	NA	0.000131
Anthracene	0.0222	120127	178.12	4.48	4.40	562.95	27	0.0480	8300	NA	5.78E-06
Benzo(a)anthracene	0.0222	56553	228.29	5.64	5.54	7775.94	120	0.0154	NA	0.038	0.406111
Benzo(a)pyrene	0.0222	50328	252.31	6.30	6.19	34636.42	130	0.0038	0.2	0.0038	0.987704
Benzo(b)flouranthene	0.0222	205992	252.3	6.39	6.28	42462.25	130	0.0031	NA	0.038	0.080567
Dibenz(a,h)anthracene	0.0222	53703	278.4	7.10	6.98	211803.42	19	0.0001	NA	0.0038	0.023607
Fluoranthene	0.0222	206440	202.26	5.13	5.04	2451.45	240	0.0979	130	NA	0.000753
Fluorene	0.0222	86737	166.22	3.96	3.89	173.51	20	0.1153	1108	NA	0.000104
Indeno[1,2,3-cd]pyrene	0.0222	193395	276.3	6.91	6.79	137772.64	48	0.0003	NA	0.038	0.009168
Pyrene	0.0222	129000	202.26	5.04	4.95	1999.65	220	0.1100	830	NA	0.000133

Predicted Porewater Conentrations for Select PAHs

BWR-DAM9-T1-0620

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Fish & Water Ingestion Syst. Tox. HH Criterion ug/L water	Fish & Water Ingestion Human Carcinogen HH Criterion ug/L water	T.U.
Acenaphthene	0.0285	83329	154.21	3.77	3.71	144.89	5.9	0.0407	670	NA	6.08E-05
Anthracene	0.0285	120127	178.12	4.48	4.40	722.71	25	0.0346	8300	NA	4.17E-06
Benzo(a)anthracene	0.0285	56553	228.29	5.64	5.54	9982.63	160	0.0160	NA	0.038	0.421785
Benzo(a)pyrene	0.0285	50328	252.31	6.30	6.19	44465.67	210	0.0047	0.2	0.0038	1.242827
Benzo(b)flouranthene	0.0285	205992	252.3	6.39	6.28	54512.34	290	0.0053	NA	0.038	0.139997
Dibenz(a,h)anthracene	0.0285	53703	278.4	7.10	6.98	271909.80	26	0.0001	NA	0.0038	0.025163
Fluoranthene	0.0285	206440	202.26	5.13	5.04	3147.13	330	0.1049	130	NA	0.000807
Fluorene	0.0285	86737	166.22	3.96	3.89	222.74	7	0.0314	1108	NA	2.84E-05
Indeno[1,2,3-cd]pyrene	0.0285	193395	276.3	6.91	6.79	176870.28	73	0.0004	NA	0.038	0.010861
Pyrene	0.0285	129000	202.26	5.04	4.95	2567.11	270	0.1052	830	NA	0.000127

BWR-DAM9-T2-0620

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Fish & Water Ingestion Syst. Tox. HH Criterion ug/L water	Fish & Water Ingestion Human Carcinogen HH Criterion ug/L water	T.U.
Acenaphthene	0.0346	83329	154.21	3.77	3.71	175.90	8.2	0.0466	670	NA	6.96E-05
Anthracene	0.0346	120127	178.12	4.48	4.40	877.40	23	0.0262	8300	NA	3.16E-06
Benzo(a)anthracene	0.0346	56553	228.29	5.64	5.54	12119.26	120	0.0099	NA	0.038	0.260568
Benzo(a)pyrene	0.0346	50328	252.31	6.30	6.19	53982.89	170	0.0031	0.2	0.0038	0.828723
Benzo(b)flouranthene	0.0346	205992	252.3	6.39	6.28	66179.90	200	0.0030	NA	0.038	0.079528
Dibenz(a,h)anthracene	0.0346	53703	278.4	7.10	6.98	330108.04	27	0.0001	NA	0.0038	0.021524
Fluoranthene	0.0346	206440	202.26	5.13	5.04	3820.73	310	0.0811	130	NA	0.000624
Fluorene	0.0346	86737	166.22	3.96	3.89	270.42	9.8	0.0362	1108	NA	3.27E-05
Indeno[1,2,3-cd]pyrene	0.0346	193395	276.3	6.91	6.79	214726.72	81	0.0004	NA	0.038	0.009927
Pyrene	0.0346	129000	202.26	5.04	4.95	3116.56	220	0.0706	830	NA	8.5E-05

Predicted Porewater Conentrations for Select PAHs

BWR-DAM10-T1-0620

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Fish & Water Ingestion Syst. Tox. HH Criterion ug/L water	Fish & Water Ingestion Human Carcinogen HH Criterion ug/L water	T.U.
Acenaphthene	0.0242	83329	154.21	3.77	3.71	123.03	9.7	0.0788	670	NA	0.000118
Anthracene	0.0242	120127	178.12	4.48	4.40	613.67	37	0.0603	8300	NA	7.26E-06
Benzo(a)anthracene	0.0242	56553	228.29	5.64	5.54	8476.48	200	0.0236	NA	0.038	0.620913
Benzo(a)pyrene	0.0242	50328	252.31	6.30	6.19	37756.82	260	0.0069	0.2	0.0038	1.812151
Benzo(b)flouranthene	0.0242	205992	252.3	6.39	6.28	46287.67	350	0.0076	NA	0.038	0.198984
Dibenz(a,h)anthracene	0.0242	53703	278.4	7.10	6.98	230884.81	34	0.0001	NA	0.0038	0.038753
Fluoranthene	0.0242	206440	202.26	5.13	5.04	2672.30	550	0.2058	130	NA	0.001583
Fluorene	0.0242	86737	166.22	3.96	3.89	189.14	14	0.0740	1108	NA	6.68E-05
Indeno[1,2,3-cd]pyrene	0.0242	193395	276.3	6.91	6.79	150184.59	100	0.0007	NA	0.038	0.017522
Pyrene	0.0242	129000	202.26	5.04	4.95	2179.79	540	0.2477	830	NA	0.000298

BWR-DAM10-T2-0620

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Fish & Water Ingestion Syst. Tox. HH Criterion ug/L water	Fish & Water Ingestion Human Carcinogen HH Criterion ug/L water	T.U.
Acenaphthene	0.00392	83329	154.21	3.77	3.71	19.93	46	2.3082	670	NA	0.003445
Anthracene	0.00392	120127	178.12	4.48	4.40	99.40	120	1.2072	8300	NA	0.000145
Benzo(a)anthracene	0.00392	56553	228.29	5.64	5.54	1373.05	480	0.3496	NA	0.038	9.199656
Benzo(a)pyrene	0.00392	50328	252.31	6.30	6.19	6115.98	600	0.0981	0.2	0.0038	25.81675
Benzo(b)flouranthene	0.00392	205992	252.3	6.39	6.28	7497.84	560	0.0747	NA	0.038	1.965479
Dibenz(a,h)anthracene	0.00392	53703	278.4	7.10	6.98	37399.52	130	0.0035	NA	0.0038	0.914732
Fluoranthene	0.00392	206440	202.26	5.13	5.04	432.87	790	1.8250	130	NA	0.014039
Fluorene	0.00392	86737	166.22	3.96	3.89	30.64	56	1.8279	1108	NA	0.00165
Indeno[1,2,3-cd]pyrene	0.00392	193395	276.3	6.91	6.79	24327.42	350	0.0144	NA	0.038	0.378607
Pyrene	0.00392	129000	202.26	5.04	4.95	353.09	760	2.1524	830	NA	0.002593

Predicted Porewater Conentrations for Select PAHs

BWR-DAM11-T1-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Fish & Water Ingestion Syst. Tox. HH Criterion ug/L water	Fish & Water Ingestion Human Carcinogen HH Criterion ug/L water	T.U.
Acenaphthene	0.0196	83329	154.21	3.77	3.71	99.64	2.5	0.0251	670	NA	3.74E-05
Anthracene	0.0196	120127	178.12	4.48	4.40	497.02	6.1	0.0123	8300	NA	1.48E-06
Benzo(a)anthracene	0.0196	56553	228.29	5.64	5.54	6865.25	51	0.0074	NA	0.038	0.195493
Benzo(a)pyrene	0.0196	50328	252.31	6.30	6.19	30579.90	75	0.0025	0.2	0.0038	0.645419
Benzo(b)flouranthene	0.0196	205992	252.3	6.39	6.28	37489.19	110	0.0029	NA	0.038	0.077215
Dibenz(a,h)anthracene	0.0196	53703	278.4	7.10	6.98	186997.62	13	0.0001	NA	0.0038	0.018295
Fluoranthene	0.0196	206440	202.26	5.13	5.04	2164.34	140	0.0647	130	NA	0.000498
Fluorene	0.0196	86737	166.22	3.96	3.89	153.18	4.7	0.0307	1108	NA	2.77E-05
Indeno[1,2,3-cd]pyrene	0.0196	193395	276.3	6.91	6.79	121637.10	41	0.0003	NA	0.038	0.00887
Pyrene	0.0196	129000	202.26	5.04	4.95	1765.45	110	0.0623	830	NA	7.51E-05

BWR-DAM11-T2-0320

Compound	TOC	CAS #	MW (g/mol)	log Kow	log Koc (L/Kg oc)	Part. Coeff., Kd (L water/Kg sed)	Sed. Conc., C_S (ug chem/kg sed)	Pore Water Conc., C_d (ug/L water)	Fish & Water Ingestion Syst. Tox. HH Criterion ug/L water	Fish & Water Ingestion Human Carcinogen HH Criterion ug/L water	T.U.
Acenaphthene	0.0187	83329	154.21	3.77	3.71	95.07	0.52	0.0055	670	NA	8.16E-06
Anthracene	0.0187	120127	178.12	4.48	4.40	474.20	0.41	0.0009	8300	NA	1.04E-07
Benzo(a)anthracene	0.0187	56553	228.29	5.64	5.54	6550.00	3.2	0.0005	NA	0.038	0.012857
Benzo(a)pyrene	0.0187	50328	252.31	6.30	6.19	29175.72	4.1	0.0001	0.2	0.0038	0.036981
Benzo(b)flouranthene	0.0187	205992	252.3	6.39	6.28	35767.75	5.4	0.0002	NA	0.038	0.003973
Dibenz(a,h)anthracene	0.0187	53703	278.4	7.10	6.98	178410.99	0.86	0.0000	NA	0.0038	0.001269
Fluoranthene	0.0187	206440	202.26	5.13	5.04	2064.96	5.9	0.0029	130	NA	2.2E-05
Fluorene	0.0187	86737	166.22	3.96	3.89	146.15	0.67	0.0046	1108	NA	4.14E-06
Indeno[1,2,3-cd]pyrene	0.0187	193395	276.3	6.91	6.79	116051.73	1.8	0.0000	NA	0.038	0.000408
Pyrene	0.0187	129000	202.26	5.04	4.95	1684.39	5.1	0.0030	830	NA	3.65E-06

Molecular Weight, Octanol Water Partition Coefficient, and Aqueous Solubility

Based on compilation and analysis in:

Greene, R. 2006. Excel Spreadsheet titled, "Solubility of PAHs". State of Delaware Department of Natural Resources and Environmental Control, Division of Water Resources, Watershed Assessment Branch, Dover, DE.

The values presented in the table below are used to estimate acute and chronic toxicity values for individual PAH compounds or alkyl groups and to check whether predicted pore water concentrations exceed their associated aqueous solubility. If solubility is exceeded, then the solubility is substituted for the exposure concentration in calculating toxicity units.

Compound	CAS	MW (g/mol)	log Kow	Solub (L, 25° C) (ug/L)	Solub (L, 25° C) (mol/L)
Naphthalene	91203	128.17	3.28	105,292	8.22E-04
C1-Naphthalenes		142.2	3.92	31,622	2.22E-04
C2-Naphthalenes		156.23	4.15	16,973	1.09E-04
C3-Naphthalenes		170.25	4.59	6,554	3.85E-05
C4-Naphthalenes		184.28	4.93	2,666	1.45E-05
Benzothiophene	95158	134.11	3.03	84,479	6.30E-04
C1-Benzothiophenes		148.23	3.52	37,602	2.54E-04
C2-Benzothiophenes		162.25	4.07	9,559	5.89E-05
C3-Benzothiophenes		176.28	4.58	3,529	2.00E-05
Biphenyl	92524	154.2	4.01	14,273	9.26E-05
Acenaphthylene	208968	152.2	3.47	64,896	4.26E-04
Acenaphthene	83329	154.21	3.77	22,178	1.44E-04
Dibenzofuran	132649	168.19	3.79	15,933	9.47E-05
Fluorene	86737	166.22	3.96	12,842	7.73E-05
C1-Fluorenes		180.25	4.52	4,966	2.76E-05
C2-Fluorenes		194.27	4.82	2,221	1.14E-05
C3-Fluorenes		208.3	5.29	901	4.33E-06
Carbazole	86748	167.21	3.20	86,864	5.19E-04
Anthracene	120127	178.12	4.48	2,436	1.37E-05
Phenanthrene	85018	178.23	4.52	4,368	2.45E-05
C1-Phenanthrene/Anthracenes		192.26	4.95	1,970	1.02E-05
C2-Phenanthrene/Anthracenes		206.29	5.44	790	3.83E-06
C3-Phenanthrene/Anthracenes		220.31	5.68	575	2.61E-06
C4-Phenanthrene/Anthracenes		234.3	6.16	283	1.21E-06
Dibenzothiophene	132650	184.3	4.48	1,650	8.95E-06
C1-Dibenzothiophenes		198.28	4.99	645	3.25E-06
C2-Dibenzothiophenes		212.31	5.45	257	1.21E-06
C3-Dibenzothiophenes		226.3	5.94	101	4.46E-07
Fluoranthene	206440	202.26	5.13	1,235	6.11E-06
Pyrene	129000	202.26	5.04	1,046	5.17E-06
C1-Fluoranthenes/Pyrenes		216.28	5.52	716	3.31E-06
C2-Fluoranthenes/Pyrenes		230.3	5.93	257	1.12E-06
C3-Fluoranthenes/Pyrenes		244.3	6.36	139	5.70E-07
Benzo(a)anthracene	56553	228.29	5.64	215	9.42E-07
Chrysene	218019	228.29	5.68	145	6.34E-07
C1-Chrysenes		242.32	6.18	179	7.37E-07
C2-Chrysenes		256.34	6.40	210	8.17E-07
C3-Chrysenes		270.36	6.81	254	9.40E-07
C4-Chrysenes		284.38	7.17	306	1.08E-06
Benzo(b)fluoranthene	205992	252.3	6.39	228	9.03E-07
Benzo(k)fluoranthene	207089	252.3	6.32	141	5.57E-07
Benzo(e)pyrene	192972	252.3	6.33	91	3.59E-07
Benzo(a)pyrene	50328	252.31	6.30	121	4.78E-07
Perylene	191242	252.31	6.33	44	1.74E-07
Indeno(1,2,3-cd)pyrene	193395	276.3	6.91	247	8.95E-07
Dibenz(a,h)anthracene	53703	278.4	7.10	59	2.10E-07
Benzo(ghi)perylene	191242	276.3	6.79	193	6.99E-07

References

Burgess RM, Berry WJ, Mount DR, Di Toro DM. 2013. Mechanistic sediment quality guidelines based on contaminant bioavailability: equilibrium partitioning sediment benchmarks. Environ Toxicol Chem 32(1): 103-114

Di Toro D, et.al. 1991. Technical basis for establishing sediment quality criteria for nonionic organic chemicals using equilibrium partitioning. Environ Tox Chem 10: 1541-1583.

Di Toro D, et.al. 2000a. Technical basis for narcotic chemcials and polycyclic aromatic hydrocarbon criteria. I. Water and Tissue. Environ Tox Chem 19(8): 1951-1970.

Di Toro D, et.al. 2000b. Technical basis for narcotic chemcials and polycyclic aromatic hydrocarbon criteria. II. Mixtures and sediments. Environ Tox Chem 19(8): 1971-1982.

DNREC. 2004. State of Delaware Surface Water Quality Standards as Amended June 1, 2011. Delaware Department of Natural Resources and Environmental Control, Division of Water Resources, Division of Watershed Stewardship, Dover, DE.

DNREC. 2013. Department of Natural Resources and Environmental Control, Division of Waste and Hazardous Substances, Remediation Section, HSCA Screening Level Table, Last updated February 2020. New Castle, DE.

Equation came from EPA/600/R-02/016, March (equation 2-2)

Parameters came from EPA's EpiSuite ECOSAR Module

EPA. 2003. Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures (EPA/600/R-02/013). U.S. Environmental Protection Agency.

USEPA. 2008. Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: Compendium of Tier 2 Values for Nonionic Organics (EPA/600/R-02/016). U.S. Environmental Protection Agency, Narragansett, RI and Duluth, MN.

Assessment of Organochlorine Pesticide Data for Sediments in Brandywine River

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Date: October 22, 2020

Methods:

The approach to assess potential toxicity to benthic organisms from organochlorine pesticides in sediments is to perform Equilibrium partitioning (EqP) calculations. EqP involves predicting the concentration of the contaminant in the porewater by dividing the reported bulk sediment concentration of the contaminant by a sediment-water partition coefficient. To assess potential toxicity to benthic organisms, the resulting estimated porewater concentration is compared to Delaware's acute and chronic aquatic life criteria. Results of the comparisons are expressed as the ratio of the predicted exposure concentration in the sediment pore water to the applicable acute and chronic aquatic life criteria. The ratio using the acute criterion is referred to as acute toxic units or $T.U._a$. The ratio using the chronic criterion is referred to as chronic toxic units or $T.U._c$. Toxic unit values greater than 1 indicate that the predicted exposure concentration exceeds the associated criterion and that there's an increased likelihood of impact to benthic aquatic life.

Predicted porewater concentrations were also compared to Delaware human health water quality criteria for fish and water ingestion, since the Brandywine River is used as a drinking water source for the City of Wilmington.

The final step in the assessment involved evaluating the potential for the pesticides detected in the sediments to bioaccumulate in the aquatic food web and contribute to fish contamination in the Brandywine River. The approach involved comparing organic carbon normalized concentrations in the sediments to a bioaccumulation-based sediment quality benchmark (BBSQB) back calculated from an acceptable fish tissue concentration and a biota to sediment accumulation factor (BSAF). Full details of the approach are presented on the tab 'HH Tox Calcs'. Again, the results are expressed as a ratio of the organic carbon normalized sediment concentration to the benchmark with ratios greater than 1 indicating an increased likelihood of bioaccumulation in fish along with an increased risk to consumers of those fish.

Findings:

1. Two pesticides were detected in the Brandywine River Sediment samples at concentrations that exceeded their associated laboratory method detection limit, including 4,4-DDE at Dam 8 Transect 1 (3.8 ppb) and 4,4-DDT at Dam 2 Transect 1 (4.1 ppb). Over 90% (20 out of 22 stations) of the results were 'non-detected' for all pesticides tested. And of those two stations with detections, only one pesticide had a reportable concentration.

2. After completing EqP calculations, acute toxicity is not predicted at either of the dam transect locations. Chronic toxicity is, however, predicted at both transect locations based upon the ratio of expected porewater concentrations to freshwater chronic aquatic life criteria. Chronic toxic units were calculated to be 3.8 for DDE at Dam 8 Transect 1 and 4.1 for DDT at Dam 2 Transect 1. It is important to recognize that the chronic aquatic life criterion of 0.001 ug/L used for DDT, DDD, and DDE is based on a methodology (the so-called Tissue Residue Value approach) that EPA no longer supports. EPA has not updated these criteria based upon current scientific procedures and so these criteria remain on the books 40 years after they were published in 1980. Although these criteria were used for this assessment, there is good reason to believe that they significantly overstate the risk of chronic toxicity to aquatic life by up to 100 times. This metric was derived by dividing the acute toxicity criterion for DDT, DDD and DDE (1.1 ug/L) by a conservative yet reasonable acute to chronic ratio of 10. This provides an alternative estimate of the chronic toxicity of DDT, DDD and DDE of 0.11 ug/L, which is 110 times greater than the outdated chronic criterion of 0.001 ug/L. Using the alternative chronic criteria , chronic toxic units fall to 0.04 at Dam 2 Transect 1 and 0.06 at Dam 8 Transect 1 (both less than 1).

3. Based on fate and transport considerations, the concentration of DDT and DDE dissolved in the water column during dam removal/modification/failure is expected to be no greater than the dissolved concentrations in the porewater prior to any activity. Since there appears to be a slight to no potential for chronic toxicity to aquatic life from DDT or DDE in porewater (based upon which criteria are used), there is slight to no potential for toxicity due to these compounds during dam removal/modification/failure at those locations.

4. Pesticide compounds in porewater were estimated to be above DNREC Water Quality Standards for protection of human health from the consumption of fish and water. Again, a toxic unit approach was used to determine the magnitude of any exceedance of criteria. A toxic unit greater than one indicates that toxic impacts are possible. Toxics units greater than 1 were calculated for DDT at Dam 2 Transect 1 (T.U.=20.3) and for DDE at Dam 8 Transect 1 (T.U.=30.5). Note that the human health criterion for DDT and its metabolites is that same for just fish ingestion as it is for ingestion of both fish and water.

5. More detailed assessment of potential bioaccumulation and associated health risk from consumption of fish containing DDT and DDE as described above (see HH Tox Calcs) indicates that the risk is very low. Organochlorine pesticide results from both samples were less than the calculated BBSQB.

6. The concentration of individual organochlorine pesticides in sediment was compared to the DNREC-RS Soil Screening Value for protection of human health to evaluate whether concentrations of individual compounds in sediment might pose a risk to human health if sediment were dredged/removed, dewatered, and deposited in an upland setting. There were no exceedances of soil screening levels.

Conclusions:

In summary, organochlorine pesticides were not frequently detected Brandywine River Sediments. Concentrations of detected pesticides at Dam 2 Transect 1 and Dam 8 Transect 1 are not high enough to cause acute toxicity to aquatic life. However, depending on what criteria are used, there may be some chronic toxicity to benthic aquatic life at the two transect locations. Keep in mind that multiple composite transect samples were collected at each dam. These results don't consider the mixing of sediment from different transects as a result of dam removal/modification/failure.

Concerning the apparent potential for human health impacts from fish and water ingestion, this assessment conservatively assumes that predicted concentrations in sediment porewater are in equilibrium with surface water, and that concentrations in surface water and porewater are equal. Review of 2015 surface water data for chlorinated pesticides indicates that this is assumption is unlikely. Upon review of surface water data from samples collected in the Brandywine River in 2015, it appears that measured surface water concentrations of DDT and DDE were approximately two orders of magnitude less than porewater concentrations predicted in this assessment. This indicates that diffusion from the sediments into the water column is most likely occurring, and therefore dilution from overlying surface water is also occurring. There is not currently an MCL for DDT or DDE for comparison to drinking water standards.

Understanding that direct measurements are the best way to verify predictions, comparison of organochlorine pesticide data from the most recent DNREC fish contaminant monitoring program was performed. The most recent data, collected in 2015 for fish in the non-tidal Brandywine River, indicates that organochlorine pesticides (specifically DDT and DDE) do not exceed regulatory thresholds for fish consumption. Specifically, four composite fish tissue samples were analyzed in 2015 for pesticides, along with other bioaccumulative compounds. Samples locations ranged from between Dam 2 and the state line at Smith Bridge. White sucker and smallmouth bass composite sample results indicated that Total DDT+DDD+DDE (DDx) in fish tissue ranged from 9.7 ppb to 46.0 ppb. The DNREC Screening Value for DDT and metabolites in fish tissue is 159 ppb. Therefore, although potential impacts to human health are predicted based upon the conservative mathematical approach used, direct measurement of pesticides in fish tissue as compared to health based criteria demonstrate that they are not accumulating in Brandywine River fish at concentrations that would cause impact to either themselves, or humans.

Further, recall that the samples were collected as both horizontal and vertical composites, and that no other pesticides were detected in other transect samples. As stated above, these assessment results don't consider the mixing of sediment from different transects as a result of dam removal/modification/failure.

Supporting Calculations, Charts, and References Calculations which support the above findings appear within this spreadsheet. References cited appear on the last tab of this spreadsheet.

TestAmerica Laboratories, Inc.
Eurofins TestAmerica, Edison

SUMMARY OF ANALYTICAL RESULTS: 460-205020-1
Job Description: WATAR (DE-1525) BRANDYWINE DAM SEDIMENTS
For:
State of Delaware
391 Lukens Drive
New Castle, Delaware 19720-2774

Client ID		DNREC SIRS			BWR-DAM2-T1-0320			BWR-DAM2-T2-0320			BWR-DAM2-T3-0320			BWR-DAM4-T1-0320			BWR-DAM4-T2-0320			BWR-DAM4-T3-0320			BWR-DAM4-T4-0320			BWR-DAM4-T5-0320			BWR-FIELDBLANK-0320_SOLID
Lab Sample ID		Screening Levels			460-205020-1			460-205020-2			460-205020-3			460-205020-4			460-205020-5			460-205020-6			460-205020-7			460-205020-8			460-205020-9
Sampling Date		Soils			03/06/2020 10:30:00			03/05/2020 14:00:00			03/05/2020 15:30:00			03/09/2020 13:55:00			03/09/2020 11:50:00			03/09/2020 12:35:00			03/09/2020 12:55:00			03/09/2020 13:15:00			03/12/2020 12:50:00
Matrix		Nov 2019			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil
Dilution Factor					1			1			1			1			1			1			1			1			1
Unit		ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 8081A																													
4,4'-DDD	72-54-8	190	1.9	U	1.9	1.8	U	1.8	1.8	U	1.8	2.5	U	2.5	2.1	U	2.1	2.5	U	2.5	1.8	U	1.8	1.9	U	1.9	1.1	U	1.1
4,4'-DDE	72-55-9	2000	1.3	U	1.3	1.3	U	1.3	1.2	U	1.2	1.8	U	1.8	1.5	U	1.5	1.7	U	1.7	1.2	U	1.2	1.3	U	1.3	0.79	U	0.79
4,4'-DDT	50-29-3	1900	4.1	J	2.0	2.0	U	2.0	1.9	U	1.9	2.7	U	2.7	2.3	U	2.3	2.7	U	2.7	1.9	U	1.9	2.0	U	2.0	1.2	U	1.2
Aldrin	09-00-2	39	1.7	U	1.7	1.6	U	1.6	1.6	U	1.6	2.3	U	2.3	1.9	U	1.9	2.2	U	2.2	1.6	U	1.6	1.7	U	1.7	1.0	U	1.0
alpha-BHC	19-84-6	86	1.1	U	1.1	1.1	U	1.1	1.1	U	1.1	1.5	U	1.5	1.2	U	1.2	1.5	U	1.5	1.0	U	1.0	1.1	U	1.1	0.68	U	0.68
beta-BHC	19-85-7	300	1.2	U	1.2	1.2	U	1.2	1.2	U	1.2	1.7	U	1.7	1.4	U	1.4	1.7	U	1.7	1.2	U	1.2	1.2	U	1.2	0.75	U	0.75
cis-Chlordane	03-71-9	NA	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	2.4	U	2.4	1.9	U	1.9	2.3	U	2.3	1.6	U	1.6	1.8	U	1.8	1.1	U	1.1
delta-BHC	19-86-8	NA	0.67	U	0.67	0.67	U	0.67	0.65	U	0.65	0.91	U	0.91	0.75	U	0.75	0.91	U	0.91	0.63	U	0.63	0.68	U	0.68	0.41	U	0.41
Dieldrin	60-57-1	34	1.4	U	1.4	1.4	U	1.4	1.4	U	1.4	1.9	U	1.9	1.6	U	1.6	1.9	U	1.9	1.3	U	1.3	1.4	U	1.4	0.87	U	0.87
Endosulfan I	59-98-8	NA	1.7	U	1.7	1.7	U	1.7	1.6	U	1.6	2.3	U	2.3	1.9	U	1.9	2.3	U	2.3	1.6	U	1.6	1.7	U	1.7	1.0	U	1.0
Endosulfan II	13-65-9	NA	2.8	U	2.8	2.8	U	2.8	2.7	U	2.7	3.8	U	3.8	3.2	U	3.2	3.8	U	3.8	2.6	U	2.6	2.9	U	2.9	1.7	U	1.7
Endosulfan sulfate	31-07-8	38000	1.4	U	1.4	1.4	U	1.4	1.3	U	1.3	1.9	U	1.9	1.5	U	1.5	1.9	U	1.9	1.3	U	1.3	1.4	U	1.4	0.84	U	0.84
Endrin	72-20-8	1900	1.6	U	1.6	1.6	U	1.6	1.5	U	1.5	2.1	U	2.1	1.8	U	1.8	2.1	U	2.1	1.5	U	1.5	1.6	U	1.6	0.96	U	0.96
Endrin aldehyde	21-93-4	NA	2.6	U	2.6	2.6	U	2.6	2.5	U	2.5	3.5	U	3.5	2.9	U	2.9	3.5	U	3.5	2.4	U	2.4	2.6	U	2.6	1.6	U	1.6
Endrin ketone	94-70-5	NA	2.1	U	2.1	2.1	U	2.1	2.0	U	2.0	2.9	U	2.9	2.4	U	2.4	2.9	U	2.9	2.0	U	2.0	2.2	U	2.2	1.3	U	1.3
gamma-BHC (Lindane)	58-89-9	570	1.0	U	1.0	1.0	U	1.0	0.98	U	0.98	1.4	U	1.4	1.1	U	1.1	1.4	U	1.4	0.95	U	0.95	1.0	U	1.0	0.62	U	0.62
Heptachlor	76-44-8	130	1.3	U	1.3	1.3	U	1.3	1.2	U	1.2	1.8	U	1.8	1.5	U	1.5	1.7	U	1.7	1.2	U	1.2	1.3	U	1.3	0.79	U	0.79
Heptachlor epoxide	24-57-3	70	1.6	U	1.6	1.6	U	1.6	1.6	U	1.6	2.2	U	2.2	1.8	U	1.8	2.2	U	2.2	1.5	U	1.5	1.7	U	1.7	1.0	U	1.0
Methoxychlor	72-43-5	32000	2.5	U	2.5	2.5	U	2.5	2.4	U	2.4	3.4	U	3.4	2.8	U	2.8	3.4	U	3.4	2.4	U	2.4	2.5	U	2.5	1.5	U	1.5
Toxaphene	01-35-2	#VALUE!	40	U	40	39	U	39	38	U	38	54	U	54	44	U	44	54	U	54	37	U	37	40	U	40	24	U	24
trans-Chlordane	03-74-2	NA	1.9	U	1.9	1.9	U	1.9	1.9	U	1.9	2.6	U	2.6	2.2	U	2.2	2.6	U	2.6	1.8	U	1.8	2.0	U	2.0	1.2	U	1.2

Client ID			BWR-DAM7-T1-0320			BWR-DAM7-T2-0320			BWR-DAM7-T3-0320			BWR-DAM8-T1-0320			BWR-DAM8-T2-0320			BWR-DAM11-T1-0320			BWR-DAM11-T2-0320			BWR-DUP1-0320
Lab Sample ID			460-205020-11			460-205020-12			460-205020-13			460-205020-14			460-205020-15			460-205020-16			460-205020-17			460-205020-18
Sampling Date			03/10/2020 13:15:00			03/10/2020 11:30:00			03/10/2020 12:10:00			03/11/2020 12:15:00			03/11/2020 11:45:00			03/12/2020 12:10:00			03/12/2020 11:20:00			03/12/2020 00:00:00
Matrix			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil
Dilution Factor			1			1			1			1			1			1			1			1
Unit			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg
	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 8081A																								
4,4'-DDD	1.9	U	1.9	1.9	U	1.9	1.7	U	1.7	2.2	U	2.2	2.1	U	2.1	2.1	U	2.1	1.6	U	1.6	1.6	U	1.6
4,4'-DDE	1.3	U	1.3	1.3	U	1.3	1.2	U	1.2	3.8	J	1.6	1.4	U	1.4	1.4	U	1.4	1.1	U	1.1	1.1	U	1.1
4,4'-DDT	2.1	U	2.1	2.1	U	2.1	1.8	U	1.8	2.4	U	2.4	2.2	U	2.2	2.2	U	2.2	1.7	U	1.7	1.8	U	1.8
Aldrin	1.7	U	1.7	1.7	U	1.7	1.5	U	1.5	2.0	U	2.0	1.8	U	1.8	1.8	U	1.8	1.4	U	1.4	1.5	U	1.5
alpha-BHC	1.1	U	1.1	1.2	U	1.2	1.0	U	1.0	1.3	U	1.3	1.2	U	1.2	1.2	U	1.2	0.95	U	0.95	0.98	U	0.98
beta-BHC	1.3	U	1.3	1.3	U	1.3	1.1	U	1.1	1.5	U	1.5	1.4	U	1.4	1.4	U	1.4	1.0	U	1.0	1.1	U	1.1
cis-Chlordane	1.8	U	1.8	1.8	U	1.8	1.6	U	1.6	2.1	U	2.1	1.9	U	1.9	1.9	U	1.9	1.5	U	1.5	1.5	U	1.5
delta-BHC	0.69	U	0.69	0.70	U	0.70	0.60	U	0.60	0.81	U	0.81	0.74	U	0.74	0.74	U	0.74	0.57	U	0.57	0.59	U	0.59
Dieldrin	1.5	U	1.5	1.5	U	1.5	1.3	U	1.3	1.7	U	1.7	1.6	U	1.6	1.6	U	1.6	1.2	U	1.2	1.3	U	1.3
Endosulfan I	1.7	U	1.7	1.7	U	1.7	1.5	U	1.5	2.0	U	2.0	1.9	U	1.9	1.8	U	1.8	1.4	U	1.4	1.5	U	1.5
Endosulfan II	2.9	U	2.9	2.9	U	2.9	2.5	U	2.5	3.4	U	3.4	3.1	U	3.1	3.1	U	3.1	2.4	U	2.4	2.5	U	2.5
Endosulfan sulfate	1.4	U	1.4	1.4	U	1.4	1.2	U	1.2	1.7	U	1.7	1.5	U	1.5	1.5	U	1.5	1.2	U	1.2	1.2	U	1.2
Endrin	1.6	U	1.6	1.6	U	1.6	1.4	U	1.4	1.9	U	1.9	1.7	U	1.7	1.7	U	1.7	1.3	U	1.3	1.4	U	1.4
Endrin aldehyde	2.7	U	2.7	2.7	U	2.7	2.3	U	2.3	3.1	U	3.1	2.9	U	2.9	2.9	U	2.9	2.2	U	2.2	2.3	U	2.3
Endrin ketone	2.2	U	2.2	2.2	U	2.2	1.9	U	1.9	2.6	U	2.6	2.4	U	2.4	2.4	U	2.4	1.8	U	1.8	1.9	U	1.9
gamma-BHC (Lindane)	1.0	U	1.0	1.1	U	1.1	0.91	U	0.91	1.2	U	1.2	1.1	U	1.1	1.1	U	1.1	0.86	U	0.86	0.90	U	0.90
Heptachlor	1.3	U	1.3	1.3	U	1.3	1.2	U	1.2	1.6	U	1.6	1.4	U	1.4	1.4	U	1.4	1.1	U	1.1	1.1	U	1.1
Heptachlor epoxide	1.7	U	1.7	1.7	U	1.7	1.5	U	1.5	2.0	U	2.0	1.8	U	1.8	1.8	U	1.8	1.4	U	1.4	1.4	U	1.4
Methoxychlor	2.6	U	2.6	2.6	U	2.6	2.3	U	2.3	3.0	U	3.0	2.8	U	2.8	2.8	U	2.8	2.1	U	2.1	2.2	U	2.2
Toxaphene	41	U	41	41	U	41	36	U	36	48	U	48	44	U	44	44	U	44	34	U	34	35	U	35
trans-Chlordane	2.0	U	2.0	2.0	U	2.0	1.7	U	1.7	2.3	U	2.3	2.1	U	2.1	2.1	U	2.1	1.6	U	1.6	1.7	U	1.7

Client ID		DNREC SIRS			BWR-DAM2-T1-0320			BWR-DAM2-T2-0320			BWR-DAM2-T3-0320			BWR-DAM4-T1-0320			BWR-DAM4-T2-0320			BWR-DAM4-T3-0320			BWR-DAM4-T4-0320			BWR-DAM4-T5-0320			BWR-FIELDBLANK-0320_SOLID
Lab Sample ID		Screening Levels			460-205020-1			460-205020-2			460-205020-3			460-205020-4			460-205020-5			460-205020-6			460-205020-7			460-205020-8			460-205020-9
Sampling Date		Soils			03/06/2020 10:30:00			03/05/2020 14:00:00			03/05/2020 15:30:00			03/09/2020 13:55:00			03/09/2020 11:50:00			03/09/2020 12:35:00			03/09/2020 12:55:00			03/09/2020 13:15:00			03/12/2020 12:50:00
Matrix		Nov 2019			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY LLOYD KAHN																													
Total Organic Carbon (mg/kg)	40-44-0	NA	12800		684	15100		684	12200		684	16300		684	25900		684	19800		684	11800		684	12100		684	684	U	684

Client ID			BWR-DAM7-T1-0320			BWR-DAM7-T2-0320			BWR-DAM7-T3-0320			BWR-DAM8-T1-0320			BWR-DAM8-T2-0320			BWR-DAM11-T1-0320			BWR-DAM11-T2-0320			BWR-DUP1-0320
Lab Sample ID			460-205020-11			460-205020-12			460-205020-13			460-205020-14			460-205020-15			460-205020-16			460-205020-17			460-205020-18
Sampling Date			03/10/2020 13:15:00			03/10/2020 11:30:00			03/10/2020 12:10:00			03/11/2020 12:15:00			03/11/2020 11:45:00			03/12/2020 12:10:00			03/12/2020 11:20:00			03/12/2020 00:00:00
Matrix			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil
	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY LLOYD KAHN																								
Total Organic Carbon (mg/kg)	16100		684	21100		684	4330		684	24300		684	22200		684	19600		684	18700		684	19000	Z	684

TestAmerica Laboratories, Inc.
Eurofins TestAmerica, Edison

Lab Job ID: 460-210989-1
Job Description: WATAR (DE-1525)
For:
State of Delaware
391 Lukens Drive
New Castle, Delaware 19720-2774

Client ID		DNREC SIRS			BWR-DAM6-T1-0620			BWR-DAM6-T2-0620			BWR-DAM6-T3-0620			BWR-DAM9-T1-0620			BWR-DAM9-T2-0620			BWR-DAM10-T1-0620			BWR-DAM10-T2-0620			BWR-DUP2-0620
Lab Sample ID		Screening Levels			460-210989-1			460-210989-2			460-210989-3			460-210989-4			460-210989-5			460-210989-6			460-210989-7			460-210989-8
Sampling Date		Soils			06/10/2020 11:15:00			06/10/2020 11:40:00			06/10/2020 12:15:00			06/09/2020 14:15:00			06/09/2020 14:30:00			06/09/2020 11:10:00			06/09/2020 11:35:00			06/10/2020 00:00:00
Matrix		Feb 2020			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil
Dilution Factor					1			1			1			1			1			1			1			1
Unit		mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 8081A																										
4,4'-DDD	72-54-8	0.19	0.0022	U	0.0022	0.0019	U	0.0019	0.0021	U	0.0021	0.0024	U	0.0024	0.0034	U	0.0034	0.0022	U	0.0022	0.0021	U	0.0021	0.0021	U	0.0021
4,4'-DDE	72-55-9	2	0.0015	U	0.0015	0.0013	U	0.0013	0.0015	U	0.0015	0.0017	U	0.0017	0.0024	U	0.0024	0.0015	U	0.0015	0.0014	U	0.0014	0.0015	U	0.0015
4,4'-DDT	50-29-3	1.9	0.0023	U	0.0023	0.0021	U	0.0021	0.0023	U	0.0023	0.0026	U	0.0026	0.0037	U	0.0037	0.0024	U	0.0024	0.0022	U	0.0022	0.0023	U	0.0023
Aldrin	09-00-2	0.039	0.0019	U	0.0019	0.0017	U	0.0017	0.0019	U	0.0019	0.0021	U	0.0021	0.0030	U	0.0030	0.0020	U	0.0020	0.0018	U	0.0018	0.0019	U	0.0019
alpha-BHC	19-84-6	0.086	0.0013	U	0.0013	0.0011	U	0.0011	0.0013	U	0.0013	0.0014	U	0.0014	0.0020	U	0.0020	0.0013	U	0.0013	0.0012	U	0.0012	0.0012	U	0.0012
beta-BHC	19-85-7	0.3	0.0014	U	0.0014	0.0013	U	0.0013	0.0014	U	0.0014	0.0016	U	0.0016	0.0022	U	0.0022	0.0015	U	0.0015	0.0014	U	0.0014	0.0014	U	0.0014
cis-Chlordane	03-71-9	NA	0.0020	U	0.0020	0.0018	U	0.0018	0.0019	U	0.0019	0.0022	U	0.0022	0.0032	U	0.0032	0.0021	U	0.0021	0.0019	U	0.0019	0.0019	U	0.0019
delta-BHC	19-86-8	NA	0.00077	U	0.00077	0.00069	U	0.00069	0.00075	U	0.00075	0.00087	U	0.00087	0.0012	U	0.0012	0.00080	U	0.00080	0.00075	U	0.00075	0.00075	U	0.00075
Dieldrin	60-57-1	0.034	0.0016	U	0.0016	0.0015	U	0.0015	0.0016	U	0.0016	0.0018	U	0.0018	0.0026	U	0.0026	0.0017	U	0.0017	0.0016	U	0.0016	0.0016	U	0.0016
Endosulfan I	59-98-8	NA	0.0019	U	0.0019	0.0017	U	0.0017	0.0019	U	0.0019	0.0022	U	0.0022	0.0030	U	0.0030	0.0020	U	0.0020	0.0019	U	0.0019	0.0019	U	0.0019
Endosulfan II	13-65-9	NA	0.0032	U	0.0032	0.0029	U	0.0029	0.0032	U	0.0032	0.0036	U	0.0036	0.0051	U	0.0051	0.0034	U	0.0034	0.0031	U	0.0031	0.0032	U	0.0032
Endosulfan sulfate	31-07-8	38	0.0016	U	0.0016	0.0014	U	0.0014	0.0015	U	0.0015	0.0018	U	0.0018	0.0025	U	0.0025	0.0016	U	0.0016	0.0015	U	0.0015	0.0015	U	0.0015
Endrin	72-20-8	1.9	0.0018	U	0.0018	0.0016	U	0.0016	0.0018	U	0.0018	0.0020	U	0.0020	0.0029	U	0.0029	0.0019	U	0.0019	0.0017	U	0.0017	0.0018	U	0.0018
Endrin aldehyde	21-93-4	NA	0.0030	U	0.0030	0.0027	U	0.0027	0.0029	U	0.0029	0.0033	U	0.0033	0.0047	U	0.0047	0.0031	U	0.0031	0.0029	U	0.0029	0.0029	U	0.0029
Endrin ketone	94-70-5	NA	0.0025	U	0.0025	0.0022	U	0.0022	0.0024	U	0.0024	0.0027	U	0.0027	0.0039	U	0.0039	0.0025	U	0.0025	0.0024	U	0.0024	0.0024	U	0.0024
gamma-BHC (Lindane)	58-89-9	0.57	0.0012	U	0.0012	0.0010	U	0.0010	0.0011	U	0.0011	0.0013	U	0.0013	0.0019	U	0.0019	0.0012	U	0.0012	0.0011	U	0.0011	0.0011	U	0.0011
Heptachlor	76-44-8	0.13	0.0015	U	0.0015	0.0013	U	0.0013	0.0015	U	0.0015	0.0017	U	0.0017	0.0024	U	0.0024	0.0015	U	0.0015	0.0014	U	0.0014	0.0015	U	0.0015
Heptachlor epoxide	24-57-3	0.07	0.0019	U	0.0019	0.0017	U	0.0017	0.0018	U	0.0018	0.0021	U	0.0021	0.0030	U	0.0030	0.0020	U	0.0020	0.0018	U	0.0018	0.0018	U	0.0018
Methoxychlor	72-43-5	32	0.0029	U	0.0029	0.0026	U	0.0026	0.0028	U	0.0028	0.0032	U	0.0032	0.0046	U	0.0046	0.0030	U	0.0030	0.0028	U	0.0028	0.0028	U	0.0028
Toxaphene	01-35-2	See Reg	0.046	U	0.046	0.041	U	0.041	0.045	U	0.045	0.051	U	0.051	0.072	U	0.072	0.047	U	0.047	0.044	U	0.044	0.044	U	0.044
trans-Chlordane	03-74-2	NA	0.0022	U	0.0022	0.0020	U	0.0020	0.0022	U	0.0022	0.0025	U	0.0025	0.0035	U	0.0035	0.0023	U	0.0023	0.0021	U	0.0021	0.0022	U	0.0022

Client ID		DNREC SIRS			BWR-DAM6-T1-0620			BWR-DAM6-T2-0620			BWR-DAM6-T3-0620			BWR-DAM9-T1-0620			BWR-DAM9-T2-0620			BWR-DAM10-T1-0620			BWR-DAM10-T2-0620			BWR-DUP2-0620
Lab Sample ID		Screening Levels			460-210989-1			460-210989-2			460-210989-3			460-210989-4			460-210989-5			460-210989-6			460-210989-7			460-210989-8
Sampling Date		Soils			06/10/2020 11:15:00			06/10/2020 11:40:00			06/10/2020 12:15:00			06/09/2020 14:15:00			06/09/2020 14:30:00			06/09/2020 11:10:00			06/09/2020 11:35:00			06/10/2020 00:00:00
Matrix		Feb 2020			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY LLOYD KAHN																										
TOC Result 1 (mg/kg)	L00338	NA	21200		153	17800		136	23400		150	28500		172	34600		243	24200		159	3920		148	20900		149

Data Conversion to ug/kg

Client ID		DNREC SIRS			BWR-DAM6-T1-0620			BWR-DAM6-T2-0620			BWR-DAM6-T3-0620			BWR-DAM9-T1-0620			BWR-DAM9-T2-0620			BWR-DAM10-T1-0620			BWR-DAM10-T2-0620			BWR-DUP2-0620
Lab Sample ID		Screening Levels			460-210989-1			460-210989-2			460-210989-3			460-210989-4			460-210989-5			460-210989-6			460-210989-7			460-210989-8
Sampling Date		Soils			06/10/2020 11:15:00			06/10/2020 11:40:00			06/10/2020 12:15:00			06/09/2020 14:15:00			06/09/2020 14:30:00			06/09/2020 11:10:00			06/09/2020 11:35:00			06/10/2020 00:00:00
Matrix		Feb 2020			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil
Dilution Factor					1			1			1			1			1			1			1			1
Unit		ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 8081A																										
4,4'-DDD	72-54-8	190	2.2	U	2.2	1.9	U	1.9	2.1	U	2.1	2.4	U	2.4	3.4	U	3.4	2.2	U	2.2	2.1	U	2.1	2.1	U	2.1
4,4'-DDE	72-55-9	2000	1.5	U	1.5	1.3	U	1.3	1.5	U	1.5	1.7	U	1.7	2.4	U	2.4	1.5	U	1.5	1.4	U	1.4	1.5	U	1.5
4,4'-DDT	50-29-3	1900	2.3	U	2.3	2.1	U	2.1	2.3	U	2.3	2.6	U	2.6	3.7	U	3.7	2.4	U	2.4	2.2	U	2.2	2.3	U	2.3
Aldrin	09-00-2	39	1.9	U	1.9	1.7	U	1.7	1.9	U	1.9	2.1	U	2.1	3	U	3	2	U	2	1.8	U	1.8	1.9	U	1.9
alpha-BHC	19-84-6	86	1.3	U	1.3	1.1	U	1.1	1.3	U	1.3	1.4	U	1.4	2	U	2	1.3	U	1.3	1.2	U	1.2	1.2	U	1.2
beta-BHC	19-85-7	300	1.4	U	1.4	1.3	U	1.3	1.4	U	1.4	1.6	U	1.6	2.2	U	2.2	1.5	U	1.5	1.4	U	1.4	1.4	U	1.4
cis-Chlordane	03-71-9		2	U	2	1.8	U	1.8	1.9	U	1.9	2.2	U	2.2	3.2	U	3.2	2.1	U	2.1	1.9	U	1.9	1.9	U	1.9
delta-BHC	19-86-8		0.77	U	0.77	0.69	U	0.69	0.75	U	0.75	0.87	U	0.87	1.2	U	1.2	0.8	U	0.8	0.75	U	0.75	0.75	U	0.75
Dieldrin	60-57-1	34	1.6	U	1.6	1.5	U	1.5	1.6	U	1.6	1.8	U	1.8	2.6	U	2.6	1.7	U	1.7	1.6	U	1.6	1.6	U	1.6
Endosulfan I	59-98-8		1.9	U	1.9	1.7	U	1.7	1.9	U	1.9	2.2	U	2.2	3	U	3	2	U	2	1.9	U	1.9	1.9	U	1.9
Endosulfan II	13-65-9		3.2	U	3.2	2.9	U	2.9	3.2	U	3.2	3.6	U	3.6	5.1	U	5.1	3.4	U	3.4	3.1	U	3.1	3.2	U	3.2
Endosulfan sulfate	31-07-8	38000	1.6	U	1.6	1.4	U	1.4	1.5	U	1.5	1.8	U	1.8	2.5	U	2.5	1.6	U	1.6	1.5	U	1.5	1.5	U	1.5
Endrin	72-20-8	1900	1.8	U	1.8	1.6	U	1.6	1.8	U	1.8	2	U	2	2.9	U	2.9	1.9	U	1.9	1.7	U	1.7	1.8	U	1.8
Endrin aldehyde	21-93-4		3	U	3	2.7	U	2.7	2.9	U	2.9	3.3	U	3.3	4.7	U	4.7	3.1	U	3.1	2.9	U	2.9	2.9	U	2.9
Endrin ketone	94-70-5		2.5	U	2.5	2.2	U	2.2	2.4	U	2.4	2.7	U	2.7	3.9	U	3.9	2.5	U	2.5	2.4	U	2.4	2.4	U	2.4
gamma-BHC (Lindane)	58-89-9	570	1.2	U	1.2	1	U	1	1.1	U	1.1	1.3	U	1.3	1.9	U	1.9	1.2	U	1.2	1.1	U	1.1	1.1	U	1.1
Heptachlor	76-44-8	130	1.5	U	1.5	1.3	U	1.3	1.5	U	1.5	1.7	U	1.7	2.4	U	2.4	1.5	U	1.5	1.4	U	1.4	1.5	U	1.5
Heptachlor epoxide	24-57-3	70	1.9	U	1.9	1.7	U	1.7	1.8	U	1.8	2.1	U	2.1	3	U	3	2	U	2	1.8	U	1.8	1.8	U	1.8
Methoxychlor	72-43-5	32000	2.9	U	2.9	2.6	U	2.6	2.8	U	2.8	3.2	U	3.2	4.6	U	4.6	3	U	3	2.8	U	2.8	2.8	U	2.8
Toxaphene	01-35-2	490	46	U	46	41	U	41	45	U	45	51	U	51	72	U	72	47	U	47	44	U	44	44	U	44
trans-Chlordane	03-74-2		2.2	U	2.2	2	U	2	2.2	U	2.2	2.5	U	2.5	3.5	U	3.5	2.3	U	2.3	2.1	U	2.1	2.2	U	2.2

Client ID		DNREC SIRS	BWR-DAM2-T1-0320			BWR-DAM2-T2-0320			BWR-DAM2-T3-0320			BWR-DAM4-T1-0320			BWR-DAM4-T2-0320			BWR-DAM4-T3-0320			BWR-DAM4-T4-0320			BWR-DAM4-T5-0320			BWR-DAM7-T1-0320		
Lab Sample ID		Screening Levels	460-205020-1			460-205020-2			460-205020-3			460-205020-4			460-205020-5			460-205020-6			460-205020-7			460-205020-8			460-205020-11		
Sampling Date		Soils	03/06/2020 10:30:00			03/05/2020 14:00:00			03/05/2020 15:30:00			03/09/2020 13:55:00			03/09/2020 11:50:00			03/09/2020 12:35:00			03/09/2020 12:55:00			03/09/2020 13:15:00			03/10/2020 13:15:00		
Matrix		Feb-20	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Dilution Factor			1			1			1			1			1			1			1			1			1		
Unit		ug/kg	ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 8081A																													
4,4'-DDD	72-54-8	190	1.9	U	1.9	1.8	U	1.8	1.8	U	1.8	2.5	U	2.5	2.1	U	2.1	2.5	U	2.5	1.8	U	1.8	1.9	U	1.9	1.9	U	1.9
4,4'-DDE	72-55-9	2000	1.3	U	1.3	1.3	U	1.3	1.2	U	1.2	1.8	U	1.8	1.5	U	1.5	1.7	U	1.7	1.2	U	1.2	1.3	U	1.3	1.3	U	1.3
4,4'-DDT	50-29-3	1900	4.1	J	2	2	U	2	1.9	U	1.9	2.7	U	2.7	2.3	U	2.3	2.7	U	2.7	1.9	U	1.9	2	U	2	2.1	U	2.1
Aldrin	309-00-2	39	1.7	U	1.7	1.6	U	1.6	1.6	U	1.6	2.3	U	2.3	1.9	U	1.9	2.2	U	2.2	1.6	U	1.6	1.7	U	1.7	1.7	U	1.7
alpha-BHC	319-84-6	86	1.1	U	1.1	1.1	U	1.1	1.1	U	1.1	1.5	U	1.5	1.2	U	1.2	1.5	U	1.5	1	U	1	1.1	U	1.1	1.1	U	1.1
beta-BHC	319-85-7	300	1.2	U	1.2	1.2	U	1.2	1.2	U	1.2	1.7	U	1.7	1.4	U	1.4	1.7	U	1.7	1.2	U	1.2	1.2	U	1.2	1.3	U	1.3
cis-Chlordane	5103-71-9	NA	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	2.4	U	2.4	1.9	U	1.9	2.3	U	2.3	1.6	U	1.6	1.8	U	1.8	1.8	U	1.8
delta-BHC	319-86-8	NA	0.67	U	0.67	0.67	U	0.67	0.65	U	0.65	0.91	U	0.91	0.75	U	0.75	0.91	U	0.91	0.63	U	0.63	0.68	U	0.68	0.69	U	0.69
Dieldrin	60-57-1	34	1.4	U	1.4	1.4	U	1.4	1.4	U	1.4	1.9	U	1.9	1.6	U	1.6	1.9	U	1.9	1.3	U	1.3	1.4	U	1.4	1.5	U	1.5
Endosulfan I	959-98-8	NA	1.7	U	1.7	1.7	U	1.7	1.6	U	1.6	2.3	U	2.3	1.9	U	1.9	2.3	U	2.3	1.6	U	1.6	1.7	U	1.7	1.7	U	1.7
Endosulfan II	33213-65-	NA	2.8	U	2.8	2.8	U	2.8	2.7	U	2.7	3.8	U	3.8	3.2	U	3.2	3.8	U	3.8	2.6	U	2.6	2.9	U	2.9	2.9	U	2.9
Endosulfan sulfate	1031-07-8	38000	1.4	U	1.4	1.4	U	1.4	1.3	U	1.3	1.9	U	1.9	1.5	U	1.5	1.9	U	1.9	1.3	U	1.3	1.4	U	1.4	1.4	U	1.4
Endrin	72-20-8	1900	1.6	U	1.6	1.6	U	1.6	1.5	U	1.5	2.1	U	2.1	1.8	U	1.8	2.1	U	2.1	1.5	U	1.5	1.6	U	1.6	1.6	U	1.6
Endrin aldehyde	7421-93-4	NA	2.6	U	2.6	2.6	U	2.6	2.5	U	2.5	3.5	U	3.5	2.9	U	2.9	3.5	U	3.5	2.4	U	2.4	2.6	U	2.6	2.7	U	2.7
Endrin ketone	53494-70-	NA	2.1	U	2.1	2.1	U	2.1	2	U	2	2.9	U	2.9	2.4	U	2.4	2.9	U	2.9	2	U	2	2.2	U	2.2	2.2	U	2.2
gamma-BHC (Lindane)	58-89-9	570	1	U	1	1	U	1	0.98	U	0.98	1.4	U	1.4	1.1	U	1.1	1.4	U	1.4	0.95	U	0.95	1	U	1	1	U	1
Heptachlor	76-44-8	130	1.3	U	1.3	1.3	U	1.3	1.2	U	1.2	1.8	U	1.8	1.5	U	1.5	1.7	U	1.7	1.2	U	1.2	1.3	U	1.3	1.3	U	1.3
Heptachlor epoxide	1024-57-3	70	1.6	U	1.6	1.6	U	1.6	1.6	U	1.6	2.2	U	2.2	1.8	U	1.8	2.2	U	2.2	1.5	U	1.5	1.7	U	1.7	1.7	U	1.7
Methoxychlor	72-43-5	32000	2.5	U	2.5	2.5	U	2.5	2.4	U	2.4	3.4	U	3.4	2.8	U	2.8	3.4	U	3.4	2.4	U	2.4	2.5	U	2.5	2.6	U	2.6
Toxaphene	8001-35-2	490	40	U	40	39	U	39	38	U	38	54	U	54	44	U	44	54	U	54	37	U	37	40	U	40	41	U	41
trans-Chlordane	5103-74-2	NA	1.9	U	1.9	1.9	U	1.9	1.9	U	1.9	2.6	U	2.6	2.2	U	2.2	2.6	U	2.6	1.8	U	1.8	2	U	2	2	U	2

Client ID		DNREC SIRS	BWR-DAM7-T2-0320			BWR-DAM7-T3-0320			BWR-DAM8-T1-0320			BWR-DAM8-T2-0320			BWR-DAM11-T1-0320			BWR-DAM11-T2-0320			BWR-DUP1-0320			BWR-FIELDBLANK-0320_SOLID		
Lab Sample ID		Screening Levels	460-205020-12			460-205020-13			460-205020-14			460-205020-15			460-205020-16			460-205020-17			460-205020-18			460-205020-9		
Sampling Date		Soils	03/10/2020 11:30:00			03/10/2020 12:10:00			03/11/2020 12:15:00			03/11/2020 11:45:00			03/12/2020 12:10:00			03/12/2020 11:20:00			03/12/2020 00:00:00			03/12/2020 12:50:00		
Matrix		Feb-20	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Dilution Factor			1			1			1			1			1			1			1			1		
Unit		ug/kg	ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 8081A																										
4,4'-DDD	72-54-8	190	1.9	U	1.9	1.7	U	1.7	2.2	U	2.2	2.1	U	2.1	2.1	U	2.1	1.6	U	1.6	1.6	U	1.6	1.1	U	1.1
4,4'-DDE	72-55-9	2000	1.3	U	1.3	1.2	U	1.2	3.8	J	1.6	1.4	U	1.4	1.4	U	1.4	1.1	U	1.1	1.1	U	1.1	0.79	U	0.79
4,4'-DDT	50-29-3	1900	2.1	U	2.1	1.8	U	1.8	2.4	U	2.4	2.2	U	2.2	2.2	U	2.2	1.7	U	1.7	1.8	U	1.8	1.2	U	1.2
Aldrin	309-00-2	39	1.7	U	1.7	1.5	U	1.5	2	U	2	1.8	U	1.8	1.8	U	1.8	1.4	U	1.4	1.5	U	1.5	1	U	1
alpha-BHC	319-84-6	86	1.2	U	1.2	1	U	1	1.3	U	1.3	1.2	U	1.2	1.2	U	1.2	0.95	U	0.95	0.98	U	0.98	0.68	U	0.68
beta-BHC	319-85-7	300	1.3	U	1.3	1.1	U	1.1	1.5	U	1.5	1.4	U	1.4	1.4	U	1.4	1	U	1	1.1	U	1.1	0.75	U	0.75
cis-Chlordane	5103-71-9	NA	1.8	U	1.8	1.6	U	1.6	2.1	U	2.1	1.9	U	1.9	1.9	U	1.9	1.5	U	1.5	1.5	U	1.5	1.1	U	1.1
delta-BHC	319-86-8	NA	0.7	U	0.7	0.6	U	0.6	0.81	U	0.81	0.74	U	0.74	0.74	U	0.74	0.57	U	0.57	0.59	U	0.59	0.41	U	0.41
Dieldrin	60-57-1	34	1.5	U	1.5	1.3	U	1.3	1.7	U	1.7	1.6	U	1.6	1.6	U	1.6	1.2	U	1.2	1.3	U	1.3	0.87	U	0.87
Endosulfan I	959-98-8	NA	1.7	U	1.7	1.5	U	1.5	2	U	2	1.9	U	1.9	1.8	U	1.8	1.4	U	1.4	1.5	U	1.5	1	U	1
Endosulfan II	33213-65-	NA	2.9	U	2.9	2.5	U	2.5	3.4	U	3.4	3.1	U	3.1	3.1	U	3.1	2.4	U	2.4	2.5	U	2.5	1.7	U	1.7
Endosulfan sulfate	1031-07-8	38000	1.4	U	1.4	1.2	U	1.2	1.7	U	1.7	1.5	U	1.5	1.5	U	1.5	1.2	U	1.2	1.2	U	1.2	0.84	U	0.84
Endrin	72-20-8	1900	1.6	U	1.6	1.4	U	1.4	1.9	U	1.9	1.7	U	1.7	1.7	U	1.7	1.3	U	1.3	1.4	U	1.4	0.96	U	0.96
Endrin aldehyde	7421-93-4	NA	2.7	U	2.7	2.3	U	2.3	3.1	U	3.1	2.9	U	2.9	2.9	U	2.9	2.2	U	2.2	2.3	U	2.3	1.6	U	1.6
Endrin ketone	53494-70-	NA	2.2	U	2.2	1.9	U	1.9	2.6	U	2.6	2.4	U	2.4	2.4	U	2.4	1.8	U	1.8	1.9	U	1.9	1.3	U	1.3
gamma-BHC (Lindane)	58-89-9	570	1.1	U	1.1	0.91	U	0.91	1.2	U	1.2	1.1	U	1.1	1.1	U	1.1	0.86	U	0.86	0.9	U	0.9	0.62	U	0.62
Heptachlor	76-44-8	130	1.3	U	1.3	1.2	U	1.2	1.6	U	1.6	1.4	U	1.4	1.4	U	1.4	1.1	U	1.1	1.1	U	1.1	0.79	U	0.79
Heptachlor epoxide	1024-57-3	70	1.7	U	1.7	1.5	U	1.5	2	U	2	1.8	U	1.8	1.8	U	1.8	1.4	U	1.4	1.4	U	1.4	1	U	1
Methoxychlor	72-43-5	32000	2.6	U	2.6	2.3	U	2.3	3	U	3	2.8	U	2.8	2.8	U	2.8	2.1	U	2.1	2.2	U	2.2	1.5	U	1.5
Toxaphene	8001-35-2	490	41	U	41	36	U	36	48	U	48	44	U	44	44	U	44	34	U	34	35	U	35	24	U	24
trans-Chlordane	5103-74-2	NA	2	U	2	1.7	U	1.7	2.3	U	2.3	2.1	U	2.1	2.1	U	2.1	1.6	U	1.6	1.7	U	1.7	1.2	U	1.2

Client ID		DNREC SIRS	BWR-DAM6-T1-0620			BWR-DAM6-T2-0620			BWR-DAM6-T3-0620			BWR-DAM9-T1-0620			BWR-DAM9-T2-0620			BWR-DAM10-T1-0620			BWR-DAM10-T2-0620			BWR-DUP2-0620		
Lab Sample ID		Screening Levels	460-210989-1			460-210989-2			460-210989-3			460-210989-4			460-210989-5			460-210989-6			460-210989-7			460-210989-8		
Sampling Date		Soils	06/10/2020 11:15:00			06/10/2020 11:40:00			06/10/2020 12:15:00			06/09/2020 14:15:00			06/09/2020 14:30:00			06/09/2020 11:10:00			06/09/2020 11:35:00			06/10/2020 00:00:00		
Matrix		Feb-20	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Dilution Factor			1			1			1			1			1			1			1			1		
Unit		ug/kg	ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 8081A																										
4,4'-DDD	72-54-8	190	2.2	U	2.2	1.9	U	1.9	2.1	U	2.1	2.4	U	2.4	3.4	U	3.4	2.2	U	2.2	2.1	U	2.1	2.1	U	2.1
4,4'-DDE	72-55-9	2000	1.5	U	1.5	1.3	U	1.3	1.5	U	1.5	1.7	U	1.7	2.4	U	2.4	1.5	U	1.5	1.4	U	1.4	1.5	U	1.5
4,4'-DDT	50-29-3	1900	2.3	U	2.3	2.1	U	2.1	2.3	U	2.3	2.6	U	2.6	3.7	U	3.7	2.4	U	2.4	2.2	U	2.2	2.3	U	2.3
Aldrin	309-00-2	39	1.9	U	1.9	1.7	U	1.7	1.9	U	1.9	2.1	U	2.1	3	U	3	2	U	2	1.8	U	1.8	1.9	U	1.9
alpha-BHC	319-84-6	86	1.3	U	1.3	1.1	U	1.1	1.3	U	1.3	1.4	U	1.4	2	U	2	1.3	U	1.3	1.2	U	1.2	1.2	U	1.2
beta-BHC	319-85-7	300	1.4	U	1.4	1.3	U	1.3	1.4	U	1.4	1.6	U	1.6	2.2	U	2.2	1.5	U	1.5	1.4	U	1.4	1.4	U	1.4
cis-Chlordane	5103-71-9	NA	2	U	2	1.8	U	1.8	1.9	U	1.9	2.2	U	2.2	3.2	U	3.2	2.1	U	2.1	1.9	U	1.9	1.9	U	1.9
delta-BHC	319-86-8	NA	0.77	U	0.77	0.69	U	0.69	0.75	U	0.75	0.87	U	0.87	1.2	U	1.2	0.8	U	0.8	0.75	U	0.75	0.75	U	0.75
Dieldrin	60-57-1	34	1.6	U	1.6	1.5	U	1.5	1.6	U	1.6	1.8	U	1.8	2.6	U	2.6	1.7	U	1.7	1.6	U	1.6	1.6	U	1.6
Endosulfan I	959-98-8	NA	1.9	U	1.9	1.7	U	1.7	1.9	U	1.9	2.2	U	2.2	3	U	3	2	U	2	1.9	U	1.9	1.9	U	1.9
Endosulfan II	33213-65-	NA	3.2	U	3.2	2.9	U	2.9	3.2	U	3.2	3.6	U	3.6	5.1	U	5.1	3.4	U	3.4	3.1	U	3.1	3.2	U	3.2
Endosulfan sulfate	1031-07-8	38000	1.6	U	1.6	1.4	U	1.4	1.5	U	1.5	1.8	U	1.8	2.5	U	2.5	1.6	U	1.6	1.5	U	1.5	1.5	U	1.5
Endrin	72-20-8	1900	1.8	U	1.8	1.6	U	1.6	1.8	U	1.8	2	U	2	2.9	U	2.9	1.9	U	1.9	1.7	U	1.7	1.8	U	1.8
Endrin aldehyde	7421-93-4	NA	3	U	3	2.7	U	2.7	2.9	U	2.9	3.3	U	3.3	4.7	U	4.7	3.1	U	3.1	2.9	U	2.9	2.9	U	2.9
Endrin ketone	53494-70-	NA	2.5	U	2.5	2.2	U	2.2	2.4	U	2.4	2.7	U	2.7	3.9	U	3.9	2.5	U	2.5	2.4	U	2.4	2.4	U	2.4
gamma-BHC (Lindane)	58-89-9	570	1.2	U	1.2	1	U	1	1.1	U	1.1	1.3	U	1.3	1.9	U	1.9	1.2	U	1.2	1.1	U	1.1	1.1	U	1.1
Heptachlor	76-44-8	130	1.5	U	1.5	1.3	U	1.3	1.5	U	1.5	1.7	U	1.7	2.4	U	2.4	1.5	U	1.5	1.4	U	1.4	1.5	U	1.5
Heptachlor epoxide	1024-57-3	70	1.9	U	1.9	1.7	U	1.7	1.8	U	1.8	2.1	U	2.1	3	U	3	2	U	2	1.8	U	1.8	1.8	U	1.8
Methoxychlor	72-43-5	32000	2.9	U	2.9	2.6	U	2.6	2.8	U	2.8	3.2	U	3.2	4.6	U	4.6	3	U	3	2.8	U	2.8	2.8	U	2.8
Toxaphene	8001-35-2	490	46	U	46	41	U	41	45	U	45	51	U	51	72	U	72	47	U	47	44	U	44	44	U	44
trans-Chlordane	5103-74-2	NA	2.2	U	2.2	2	U	2	2.2	U	2.2	2.5	U	2.5	3.5	U	3.5	2.3	U	2.3	2.1	U	2.1	2.2	U	2.2

Concentrations with "U" Qualified Results Set to Zero

Value Detected

Client ID		DNREC SIRS	BWR-DAM2-T1-0320			BWR-DAM2-T2-0320			BWR-DAM2-T3-0320			BWR-DAM4-T1-0320			BWR-DAM4-T2-0320			BWR-DAM4-T3-0320			BWR-DAM4-T4-0320			BWR-DAM4-T5-0320			BWR-DAM7-T1-0320		
Lab Sample ID		Screening Levels	460-205020-1			460-205020-2			460-205020-3			460-205020-4			460-205020-5			460-205020-6			460-205020-7			460-205020-8			460-205020-11		
Sampling Date		Soils	03/06/2020 10:30:00			03/05/2020 14:00:00			03/05/2020 15:30:00			03/09/2020 13:55:00			03/09/2020 11:50:00			03/09/2020 12:35:00			03/09/2020 12:55:00			03/09/2020 13:15:00			03/10/2020 13:15:00		
Matrix		Feb-20	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Dilution Factor			1			1			1			1			1			1			1			1			1		
Unit		ug/kg	ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 8081A																													
4,4'-DDD	72-54-8	190	0	U	1.9	0	U	1.8	0	U	1.8	0	U	2.5	0	U	2.1	0	U	2.5	0	U	1.8	0	U	1.9	0	U	1.9
4,4'-DDE	72-55-9	2000	0	U	1.3	0	U	1.3	0	U	1.2	0	U	1.8	0	U	1.5	0	U	1.7	0	U	1.2	0	U	1.3	0	U	1.3
4,4'-DDT	50-29-3	1900	4.1	J	2	0	U	2	0	U	1.9	0	U	2.7	0	U	2.3	0	U	2.7	0	U	1.9	0	U	2	0	U	2.1
Aldrin	309-00-2	39	0	U	1.7	0	U	1.6	0	U	1.6	0	U	2.3	0	U	1.9	0	U	2.2	0	U	1.6	0	U	1.7	0	U	1.7
alpha-BHC	319-84-6	86	0	U	1.1	0	U	1.1	0	U	1.1	0	U	1.5	0	U	1.2	0	U	1.5	0	U	1	0	U	1.1	0	U	1.1
beta-BHC	319-85-7	300	0	U	1.2	0	U	1.2	0	U	1.2	0	U	1.7	0	U	1.4	0	U	1.7	0	U	1.2	0	U	1.2	0	U	1.3
cis-Chlordane	5103-71-9	NA	0	U	1.7	0	U	1.7	0	U	1.7	0	U	2.4	0	U	1.9	0	U	2.3	0	U	1.6	0	U	1.8	0	U	1.8
delta-BHC	319-86-8	NA	0	U	0.67	0	U	0.67	0	U	0.65	0	U	0.91	0	U	0.75	0	U	0.91	0	U	0.63	0	U	0.68	0	U	0.69
Dieldrin	60-57-1	34	0	U	1.4	0	U	1.4	0	U	1.4	0	U	1.9	0	U	1.6	0	U	1.9	0	U	1.3	0	U	1.4	0	U	1.5
Endosulfan I	959-98-8	NA	0	U	1.7	0	U	1.7	0	U	1.6	0	U	2.3	0	U	1.9	0	U	2.3	0	U	1.6	0	U	1.7	0	U	1.7
Endosulfan II	33213-65-	NA	0	U	2.8	0	U	2.8	0	U	2.7	0	U	3.8	0	U	3.2	0	U	3.8	0	U	2.6	0	U	2.9	0	U	2.9
Endosulfan sulfate	1031-07-8	38000	0	U	1.4	0	U	1.4	0	U	1.3	0	U	1.9	0	U	1.5	0	U	1.9	0	U	1.3	0	U	1.4	0	U	1.4
Endrin	72-20-8	1900	0	U	1.6	0	U	1.6	0	U	1.5	0	U	2.1	0	U	1.8	0	U	2.1	0	U	1.5	0	U	1.6	0	U	1.6
Endrin aldehyde	7421-93-4	NA	0	U	2.6	0	U	2.6	0	U	2.5	0	U	3.5	0	U	2.9	0	U	3.5	0	U	2.4	0	U	2.6	0	U	2.7
Endrin ketone	53494-70-	NA	0	U	2.1	0	U	2.1	0	U	2	0	U	2.9	0	U	2.4	0	U	2.9	0	U	2	0	U	2.2	0	U	2.2
gamma-BHC (Lindane)	58-89-9	570	0	U	1	0	U	1	0	U	0.98	0	U	1.4	0	U	1.1	0	U	1.4	0	U	0.95	0	U	1	0	U	1
Heptachlor	76-44-8	130	0	U	1.3	0	U	1.3	0	U	1.2	0	U	1.8	0	U	1.5	0	U	1.7	0	U	1.2	0	U	1.3	0	U	1.3
Heptachlor epoxide	1024-57-3	70	0	U	1.6	0	U	1.6	0	U	1.6	0	U	2.2	0	U	1.8	0	U	2.2	0	U	1.5	0	U	1.7	0	U	1.7
Methoxychlor	72-43-5	32000	0	U	2.5	0	U	2.5	0	U	2.4	0	U	3.4	0	U	2.8	0	U	3.4	0	U	2.4	0	U	2.5	0	U	2.6
Toxaphene	8001-35-2	490	0	U	40	0	U	39	0	U	38	0	U	54	0	U	44	0	U	54	0	U	37	0	U	40	0	U	41
trans-Chlordane	5103-74-2	NA	0	U	1.9	0	U	1.9	0	U	1.9	0	U	2.6	0	U	2.2	0	U	2.6	0	U	1.8	0	U	2	0	U	2
Total Chlordane			0			0			0			0			0			0			0			0			0		

Client ID		DNREC SIRS	BWR-DAM7-T2-0320			BWR-DAM7-T3-0320			BWR-DAM8-T1-0320			BWR-DAM8-T2-0320			BWR-DAM11-T1-0320			BWR-DAM11-T2-0320			BWR-DUP1-0320			BWR-FIELDBLANK-0320_SOLID		
Lab Sample ID		Screening Levels	460-205020-12			460-205020-13			460-205020-14			460-205020-15			460-205020-16			460-205020-17			460-205020-18			460-205020-9		
Sampling Date		Soils	03/10/2020 11:30:00			03/10/2020 12:10:00			03/11/2020 12:15:00			03/11/2020 11:45:00			03/12/2020 12:10:00			03/12/2020 11:20:00			03/12/2020 00:00:00			03/12/2020 12:50:00		
Matrix		Feb-20	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Dilution Factor			1			1			1			1			1			1			1			1		
Unit		ug/kg	ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 8081A																										
4,4'-DDD	72-54-8	190	0	U	1.9	0	U	1.7	0	U	2.2	0	U	2.1	0	U	2.1	0	U	1.6	0	U	1.6	0	U	1.1
4,4'-DDE	72-55-9	2000	0	U	1.3	0	U	1.2	3.8	J	1.6	0	U	1.4	0	U	1.4	0	U	1.1	0	U	1.1	0	U	0.79
4,4'-DDT	50-29-3	1900	0	U	2.1	0	U	1.8	0	U	2.4	0	U	2.2	0	U	2.2	0	U	1.7	0	U	1.8	0	U	1.2
Aldrin	309-00-2	39	0	U	1.7	0	U	1.5	0	U	2	0	U	1.8	0	U	1.8	0	U	1.4	0	U	1.5	0	U	1
alpha-BHC	319-84-6	86	0	U	1.2	0	U	1	0	U	1.3	0	U	1.2	0	U	1.2	0	U	0.95	0	U	0.98	0	U	0.68
beta-BHC	319-85-7	300	0	U	1.3	0	U	1.1	0	U	1.5	0	U	1.4	0	U	1.4	0	U	1	0	U	1.1	0	U	0.75
cis-Chlordane	5103-71-9	NA	0	U	1.8	0	U	1.6	0	U	2.1	0	U	1.9	0	U	1.9	0	U	1.5	0	U	1.5	0	U	1.1
delta-BHC	319-86-8	NA	0	U	0.7	0	U	0.6	0	U	0.81	0	U	0.74	0	U	0.74	0	U	0.57	0	U	0.59	0	U	0.41
Dieldrin	60-57-1	34	0	U	1.5	0	U	1.3	0	U	1.7	0	U	1.6	0	U	1.6	0	U	1.2	0	U	1.3	0	U	0.87
Endosulfan I	959-98-8	NA	0	U	1.7	0	U	1.5	0	U	2	0	U	1.9	0	U	1.8	0	U	1.4	0	U	1.5	0	U	1
Endosulfan II	33213-65-	NA	0	U	2.9	0	U	2.5	0	U	3.4	0	U	3.1	0	U	3.1	0	U	2.4	0	U	2.5	0	U	1.7
Endosulfan sulfate	1031-07-8	38000	0	U	1.4	0	U	1.2	0	U	1.7	0	U	1.5	0	U	1.5	0	U	1.2	0	U	1.2	0	U	0.84
Endrin	72-20-8	1900	0	U	1.6	0	U	1.4	0	U	1.9	0	U	1.7	0	U	1.7	0	U	1.3	0	U	1.4	0	U	0.96
Endrin aldehyde	7421-93-4	NA	0	U	2.7	0	U	2.3	0	U	3.1	0	U	2.9	0	U	2.9	0	U	2.2	0	U	2.3	0	U	1.6
Endrin ketone	53494-70-	NA	0	U	2.2	0	U	1.9	0	U	2.6	0	U	2.4	0	U	2.4	0	U	1.8	0	U	1.9	0	U	1.3
gamma-BHC (Lindane)	58-89-9	570	0	U	1.1	0	U	0.91	0	U	1.2	0	U	1.1	0	U	1.1	0	U	0.86	0	U	0.9	0	U	0.62
Heptachlor	76-44-8	130	0	U	1.3	0	U	1.2	0	U	1.6	0	U	1.4	0	U	1.4	0	U	1.1	0	U	1.1	0	U	0.79
Heptachlor epoxide	1024-57-3	70	0	U	1.7	0	U	1.5	0	U	2	0	U	1.8	0	U	1.8	0	U	1.4	0	U	1.4	0	U	1
Methoxychlor	72-43-5	32000	0	U	2.6	0	U	2.3	0	U	3	0	U	2.8	0	U	2.8	0	U	2.1	0	U	2.2	0	U	1.5
Toxaphene	8001-35-2	490	0	U	41	0	U	36	0	U	48	0	U	44	0	U	44	0	U	34	0	U	35	0	U	24
trans-Chlordane	5103-74-2	NA	0	U	2	0	U	1.7	0	U	2.3	0	U	2.1	0	U	2.1	0	U	1.6	0	U	1.7	0	U	1.2
Total Chlordane			0			0			0			0			0			0			0			0		

Client ID		DNREC SIRS	BWR-DAM6-T1-0620			BWR-DAM6-T2-0620			BWR-DAM6-T3-0620			BWR-DAM9-T1-0620			BWR-DAM9-T2-0620			BWR-DAM10-T1-0620			BWR-DAM10-T2-0620			BWR-DUP2-0620		
Lab Sample ID		Screening Levels	460-210989-1			460-210989-2			460-210989-3			460-210989-4			460-210989-5			460-210989-6			460-210989-7			460-210989-8		
Sampling Date		Soils	06/10/2020 11:15:00			06/10/2020 11:40:00			06/10/2020 12:15:00			06/09/2020 14:15:00			06/09/2020 14:30:00			06/09/2020 11:10:00			06/09/2020 11:35:00			06/10/2020 00:00:00		
Matrix		Feb-20	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Dilution Factor			1			1			1			1			1			1			1			1		
Unit		ug/kg	ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 8081A																										
4,4'-DDD	72-54-8	190	0	U	2.2	0	U	1.9	0	U	2.1	0	U	2.4	0	U	3.4	0	U	2.2	0	U	2.1	0	U	2.1
4,4'-DDE	72-55-9	2000	0	U	1.5	0	U	1.3	0	U	1.5	0	U	1.7	0	U	2.4	0	U	1.5	0	U	1.4	0	U	1.5
4,4'-DDT	50-29-3	1900	0	U	2.3	0	U	2.1	0	U	2.3	0	U	2.6	0	U	3.7	0	U	2.4	0	U	2.2	0	U	2.3
Aldrin	309-00-2	39	0	U	1.9	0	U	1.7	0	U	1.9	0	U	2.1	0	U	3	0	U	2	0	U	1.8	0	U	1.9
alpha-BHC	319-84-6	86	0	U	1.3	0	U	1.1	0	U	1.3	0	U	1.4	0	U	2	0	U	1.3	0	U	1.2	0	U	1.2
beta-BHC	319-85-7	300	0	U	1.4	0	U	1.3	0	U	1.4	0	U	1.6	0	U	2.2	0	U	1.5	0	U	1.4	0	U	1.4
cis-Chlordane	5103-71-9	NA	0	U	2	0	U	1.8	0	U	1.9	0	U	2.2	0	U	3.2	0	U	2.1	0	U	1.9	0	U	1.9
delta-BHC	319-86-8	NA	0	U	0.77	0	U	0.69	0	U	0.75	0	U	0.87	0	U	1.2	0	U	0.8	0	U	0.75	0	U	0.75
Dieldrin	60-57-1	34	0	U	1.6	0	U	1.5	0	U	1.6	0	U	1.8	0	U	2.6	0	U	1.7	0	U	1.6	0	U	1.6
Endosulfan I	959-98-8	NA	0	U	1.9	0	U	1.7	0	U	1.9	0	U	2.2	0	U	3	0	U	2	0	U	1.9	0	U	1.9
Endosulfan II	33213-65-	NA	0	U	3.2	0	U	2.9	0	U	3.2	0	U	3.6	0	U	5.1	0	U	3.4	0	U	3.1	0	U	3.2
Endosulfan sulfate	1031-07-8	38000	0	U	1.6	0	U	1.4	0	U	1.5	0	U	1.8	0	U	2.5	0	U	1.6	0	U	1.5	0	U	1.5
Endrin	72-20-8	1900	0	U	1.8	0	U	1.6	0	U	1.8	0	U	2	0	U	2.9	0	U	1.9	0	U	1.7	0	U	1.8
Endrin aldehyde	7421-93-4	NA	0	U	3	0	U	2.7	0	U	2.9	0	U	3.3	0	U	4.7	0	U	3.1	0	U	2.9	0	U	2.9
Endrin ketone	53494-70-	NA	0	U	2.5	0	U	2.2	0	U	2.4	0	U	2.7	0	U	3.9	0	U	2.5	0	U	2.4	0	U	2.4
gamma-BHC (Lindane)	58-89-9	570	0	U	1.2	0	U	1	0	U	1.1	0	U	1.3	0	U	1.9	0	U	1.2	0	U	1.1	0	U	1.1
Heptachlor	76-44-8	130	0	U	1.5	0	U	1.3	0	U	1.5	0	U	1.7	0	U	2.4	0	U	1.5	0	U	1.4	0	U	1.5
Heptachlor epoxide	1024-57-3	70	0	U	1.9	0	U	1.7	0	U	1.8	0	U	2.1	0	U	3	0	U	2	0	U	1.8	0	U	1.8
Methoxychlor	72-43-5	32000	0	U	2.9	0	U	2.6	0	U	2.8	0	U	3.2	0	U	4.6	0	U	3	0	U	2.8	0	U	2.8
Toxaphene	8001-35-2	490	0	U	46	0	U	41	0	U	45	0	U	51	0	U	72	0	U	47	0	U	44	0	U	44
trans-Chlordane	5103-74-2	NA	0	U	2.2	0	U	2	0	U	2.2	0	U	2.5	0	U	3.5	0	U	2.3	0	U	2.1	0	U	2.2
Total Chlordane			0			0			0			0			0			0			0			0		

Assessment of Potential Toxicity to Benthic Aquatic Life due to Organochlorine Pesticides and Human Health from Drinking Water and Eating Fish From the Brandywine River

Predicted Pore Water Concentration of 4,4'-DDD in Brandywine River Samples

Parameter	Symbol	Units	BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-0320	BWR-DAM7-T1-0320	BWR-DAM7-T2-0320	BWR-DAM7-T3-0320	BWR-DAM8-T1-0320	BWR-DAM8-T2-0320	BWR-DAM11-T1-0320	BWR-DAM11-T2-0320	BWR-DUP1-0320	BWR-FIELDBLANK-0320_SOLID	BWR-DAM6-T1-0620	BWR-DAM6-T2-0620	BWR-DAM6-T3-0620	BWR-DAM9-T1-0620	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DUP2-0620	Reference
Log 4,4'-DDD Octanol Water Partition Coefficient =	$\log K_{ow}$ =	(mg chem/L octanol)/(mg chem/L water)	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	SPARC, 2006
4,4'-DDD Octanol Water Partition Coefficient =	K_{ow} =	(mg chem/L octanol)/(mg chem/L water)	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	
Organic Carbon - Water Partition Coefficient =	K_{oc} =	(mg chem/kg org. carbon)/(mg chem/L water)	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	Schwarzenbach, et.al., 2003
Fraction of Organic Carbon in Sediment =	f_{oc} = TOC/100 =	(kg org. carbon/kg sediment)	0.0128	0.0151	0.0122	0.0163	0.0259	0.0198	0.0118	0.0121	0.0161	0.0211	0.0043	0.0243	0.0222	0.0196	0.0187	0.019	0.000684	0.0212	0.0178	0.0234	0.0285	0.0346	0.0242	0.00392	0.0209	
Sediment - Water Partition Coefficient =	$K_d = f_{oc}K_{oc}$ =	(L water/kg sediment)	2.12E+02	2.51E+02	2.02E+02	2.71E+02	4.30E+02	3.29E+02	1.96E+02	2.01E+02	2.67E+02	3.50E+02	7.14E+01	4.03E+02	3.68E+02	3.25E+02	3.10E+02	3.15E+02	1.14E+01	3.52E+02	2.95E+02	3.88E+02	4.73E+02	5.74E+02	4.02E+02	6.51E+01	3.47E+02	DiToro, et.al., 1991
4,4'-DDD Concentration in Surface Sediment =	C_s =	(ug chem/kg sed = ppb)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pore Water Concentration =	$C_d = C_s/K_d$ =	(ug chem/L water = ppb)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	DiToro, et.al., 1991
Fresh Acute Criterion =	CMC =	(ug chem/L water = ppb)	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	DNREC, 2004
Fresh Chronic Criterion =	CCC =	(ug chem/L water = ppb)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	DNREC, 2004
	TU_a =		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
	TU_c =		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

Predicted Pore Water Concentration of 4,4'-DDE in Brandywine River Samples

Parameter	Symbol	Units	BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-0320	BWR-DAM7-T1-0320	BWR-DAM7-T2-0320	BWR-DAM7-T3-0320	BWR-DAM8-T1-0320	BWR-DAM8-T2-0320	BWR-DAM11-T1-0320	BWR-DAM11-T2-0320	BWR-DUP1-0320	BWR-FIELDBLANK-0320_SOLID	BWR-DAM6-T1-0620	BWR-DAM6-T2-0620	BWR-DAM6-T3-0620	BWR-DAM9-T1-0620	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DUP2-0620	Reference
Log 4,4'-DDE Octanol Water Partition Coefficient =	$\log K_{ow}$ =	(mg chem/L octanol)/(mg chem/L water)	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	SPARC, 2006
4,4'-DDE Octanol Water Partition Coefficient =	K_{ow} =	(mg chem/L octanol)/(mg chem/L water)	5.01E+05	5.01E+05	5.01E+05	5.01E+05	5.01E+05	5.01E+05	5.01E+05	5.01E+05	5.01E+05	5.01E+05	5.01E+05	5.01E+05	5.01E+05	5.01E+05	5.01E+05	5.01E+05	5.01E+05	5.01E+05	5.01E+05	5.01E+05	5.01E+05	5.01E+05	5.01E+05	5.01E+05	5.01E+05	
Organic Carbon - Water Partition Coefficient =	K_{oc} =	(mg chem/kg org. carbon)/(mg chem/L water)	2.33E+04	2.33E+04	2.33E+04	2.33E+04	2.33E+04	2.33E+04	2.33E+04	2.33E+04	2.33E+04	2.33E+04	2.33E+04	2.33E+04	2.33E+04	2.33E+04	2.33E+04	2.33E+04	2.33E+04	2.33E+04	2.33E+04	2.33E+04	2.33E+04	2.33E+04	2.33E+04	2.33E+04	2.33E+04	Schwarzenbach, et.al., 2003
Fraction of Organic Carbon in Sediment =	f_{oc} = TOC/100 =	(kg org. carbon/kg sediment)	0.0128	0.0151	0.0122	0.0163	0.0259	0.0198	0.0118	0.0121	0.0161	0.0211	0.0043	0.0243	0.0222	0.0196	0.0187	0.019	0.000684	0.0212	0.0178	0.0234	0.0285	0.0346	0.0242	0.00392	0.0209	
Sediment - Water Partition Coefficient =	$K_d = f_{oc}K_{oc}$ =	(L water/kg sediment)	2.99E+02	3.52E+02	2.85E+02	3.80E+02	6.04E+02	4.62E+02	2.75E+02	2.82E+02	3.76E+02	4.92E+02	1.00E+02	5.67E+02	5.18E+02	4.57E+02	4.36E+02	4.43E+02	1.60E+01	4.95E+02	4.15E+02	5.46E+02	6.65E+02	8.07E+02	5.65E+02	9.15E+01	4.88E+02	DiToro, et.al., 1991
4,4'-DDE Concentration in Surface Sediment =	C_s =	(ug chem/kg sed = ppb)	0	0	0	0	0	0	0	0	0	0	0	3.8	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pore Water Concentration =	$C_d = C_s/K_d$ =	(ug chem/L water = ppb)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.70E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	DiToro, et.al., 1991
Fresh Acute Criterion =	CMC =	(ug chem/L water = ppb)	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	DNREC, 2004
Fresh Chronic Criterion =	CCC =	(ug chem/L water = ppb)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	DNREC, 2004
Human Health Criterion (Fish & Water Ingestion)		(ug chem/L water = ppb)	0.00022	0.00022	0.00022	0.00022	0.00022	0.00022	0.00022	0.00022	0.00022	0.00022	0.00022	0.00022	0.00022	0.00022	0.00022	0.00022	0.00022	0.00022	0.00022	0.00022	0.00022	0.00022	0.00022	0.00022	0.00022	
	TU_a =		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.09E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
	TU_c =		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	TU_{hh} =													30.46														

Detected Value

Predicted Pore Water Concentration of 4,4'-DDT in Brandywine River Samples

Parameter	Symbol	Units	BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-0320	BWR-DAM7-T1-0320	BWR-DAM7-T2-0320	BWR-DAM7-T3-0320	BWR-DAM8-T1-0320	BWR-DAM8-T2-0320	BWR-DAM11-T1-0320	BWR-DAM11-T2-0320	BWR-DUP1-0320	BWR-FIELDBLANK-0320_SOLID	BWR-DAM6-T1-0620	BWR-DAM6-T2-0620	BWR-DAM6-T3-0620	BWR-DAM9-T1-0620	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DUP2-0620	Reference
Log 4,4'-DDT Octanol Water Partition Coefficient =	$\log K_{ow}$ =	(mg chem/L octanol)/(mg chem/L water)	6.36	6.36	6.36	6.36	6.36	6.36	6.36	6.36	6.36	6.36	6.36	6.36	6.36	6.36	6.36	6.36	6.36	6.36	6.36	6.36	6.36	6.36	6.36	6.36	6.36	SPARC, 2006
4,4'-DDT Octanol Water Partition Coefficient =	K_{ow} =	(mg chem/L octanol)/(mg chem/L water)	2.29E+06	2.29E+06	2.29E+06	2.29E+06	2.29E+06	2.29E+06	2.29E+06	2.29E+06	2.29E+06	2.29E+06	2.29E+06	2.29E+06	2.29E+06	2.29E+06	2.29E+06	2.29E+06	2.29E+06	2.29E+06	2.29E+06	2.29E+06	2.29E+06	2.29E+06	2.29E+06	2.29E+06	2.29E+06	
Organic Carbon - Water Partition Coefficient =	K_{oc} =	(mg chem/kg org. carbon)/(mg chem/L water)	7.18E+04	7.18E+04	7.18E+04	7.18E+04	7.18E+04	7.18E+04	7.18E+04	7.18E+04	7.18E+04	7.18E+04	7.18E+04	7.18E+04	7.18E+04	7.18E+04	7.18E+04	7.18E+04	7.18E+04	7.18E+04	7.18E+04	7.18E+04	7.18E+04	7.18E+04	7.18E+04	7.18E+04	7.18E+04	Schwarzenbach, et.al., 2003
Fraction of Organic Carbon in Sediment =	f_{oc} = TOC/100 =	(kg org. carbon/kg sediment)	0.0128	0.0151	0.0122	0.0163	0.0259	0.0198	0.0118	0.0121	0.0161	0.0211	0.0043	0.0243	0.0222	0.0196	0.0187	0.019	0.000684	0.0212	0.0178	0.0234	0.0285	0.0346	0.0242	0.00392	0.0209	
Sediment - Water Partition Coefficient =	$K_d = f_{oc}K_{oc}$ =	(L water/kg sediment)	9.20E+02	1.08E+03	8.77E+02	1.17E+03	1.86E+03	1.42E+03	8.48E+02	8.69E+02	1.16E+03	1.52E+03	3.09E+02	1.75E+03	1.59E+03	1.41E+03	1.34E+03	1.37E+03	4.91E+01	1.52E+03	1.28E+03	1.68E+03	2.05E+03	2.49E+03	1.74E+03	2.82E+02	1.50E+03	DiToro, et.al., 1991
4,4'-DDT Concentration in Surface Sediment =	C_s =	(ug chem/kg sed = ppb)	4.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pore Water Concentration =	$C_d = C_s/K_d$ =	(ug chem/L water = ppb)	4.46E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	DiToro, et.al., 1991
Fresh Acute Criterion =	CMC =	(ug chem/L water = ppb)	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	DNREC, 2004
Fresh Chronic Criterion =	CCC =	(ug chem/L water = ppb)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	DNREC, 2004
Human Health Criterion (Fish & Water Ingestion)		(ug chem/L water = ppb)	0.00022	0.00022	0.00022	0.00022	0.00022	0.00022	0.00022	0.00022	0.00022	0.00022	0.00022	0.00022	0.00022	0.00022	0.00022	0.00022	0.00022	0.00022	0.00022	0.00022	0.00022	0.00022	0.00022	0.00022	0.00022	
	TU_a =		4.05E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
	TU_c =		4.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	TU_{hh} =		20.27																									

Detected Value

Predicted Pore Water Concentration of Aldrin in Brandywine River Samples

Parameter	Symbol	Units	BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-0320	BWR-DAM7-T1-0320	BWR-DAM7-T2-0320	BWR-DAM7-T3-0320	BWR-DAM8-T1-0320	BWR-DAM8-T2-0320	BWR-DAM11-T1-0320	BWR-DAM11-T2-0320	BWR-DUP1-0320	BWR-FIELDBLANK-0320_SOLID	BWR-DAM6-T1-0620	BWR-DAM6-T2-0620	BWR-DAM6-T3-0620	BWR-DAM9-T1-0620	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DUP2-0620	Reference
Log Aldrin Octanol Water Partition Coefficient =	$\log K_{ow}$ =	(mg chem/L octanol)/(mg chem/L water)	5.52	5.52	5.52	5.52	5.52	5.52	5.52	5.52	5.52	5.52	5.52	5.52	5.52	5.52	5.52	5.52	5.52	5.52	5.52	5.52	5.52	5.52	5.52	5.52	5.52	Montgomery, 2000
Aldrin Octanol Water Partition Coefficient =	K_{ow} =	(mg chem/L octanol)/(mg chem/L water)	3.31E+05	3.31E+05	3.31E+05	3.31E+05	3.31E+05	3.31E+05	3.31E+05	3.31E+05	3.31E+05	3.31E+05	3.31E+05	3.31E+05	3.31E+05	3.31E+05	3.31E+05	3.31E+05	3.31E+05	3.31E+05	3.31E+05	3.31E+05	3.31E+05	3.31E+05	3.31E+05	3.31E+05	3.31E+05	
Organic Carbon - Water Partition Coefficient =	K_{oc} =	(mg chem/kg org. carbon)/(mg chem/L water)	1.72E+04	1.72E+04	1.72E+04	1.72E+04	1.72E+04	1.72E+04	1.72E+04	1.72E+04	1.72E+04	1.72E+04	1.72E+04	1.72E+04	1.72E+04	1.72E+04	1.72E+04	1.72E+04	1.72E+04	1.72E+04	1.72E+04	1.72E+04	1.72E+04	1.72E+04	1.72E+04	1.72E+04	1.72E+04	Schwarzenbach, et.al., 2003
Fraction of Organic Carbon in Sediment =	f_{oc} = TOC/100 =	(kg org. carbon/kg sediment)	0.0128	0.0151	0.0122	0.0163	0.0259	0.0198	0.0118	0.0121	0.0161	0.0211	0.0043	0.0243	0.0222	0.0196	0.0187	0.019	0.000684	0.0212	0.0178	0.0234	0.0285	0.0346	0.0242	0.00392	0.0209	
Sediment - Water Partition Coefficient =	$K_d = f_{oc}K_{oc}$ =	(L water/kg sediment)	2.20E+02	2.59E+02	2.09E+02	2.80E+02	4.45E+02	3.40E+02	2.03E+02	2.08E+02	2.76E+02	3.62E+02	7.38E+01	4.17E+02	3.81E+02	3.37E+02	3.21E+02	3.26E+02	1.17E+01	3.64E+02	3.06E+02	4.02E+02	4.89E+02	5.94E+02	4.16E+02	6.73E+01	3.59E+02	DiToro, et.al., 1991
Aldrin Concentration in Surface Sediment =	C_s =	(ug chem/kg sed = ppb)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pore Water Concentration =	$C_d = C_s/K_d$ =	(ug chem/L water = ppb)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	DiToro, et.al., 1991
Fresh Acute Criterion =	CMC =	(ug chem/L water = ppb)	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	DNREC, 2004
Fresh Chronic Criterion =	CCC =	(ug chem/L water = ppb)	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	DNREC, 2004
	TU_a =		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	TU_c =		na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	

Predicted Pore Water Concentration of Chlordane in Brandywine River Samples

Parameter	Symbol	Units	BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-0320	BWR-DAM7-T1-0320	BWR-DAM7-T2-0320	BWR-DAM7-T3-0320	BWR-DAM8-T1-0320	BWR-DAM8-T2-0320	BWR-DAM11-T1-0320	BWR-DAM11-T2-0320	BWR-DUP1-0320	BWR-FIELDBLANK-0320_SOLID	BWR-DAM6-T1-0620	BWR-DAM6-T2-0620	BWR-DAM6-T3-0620	BWR-DAM9-T1-0620	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DUP2-0620	Reference
Log Chlordane Octanol Water Partition Coefficient =	$\log K_{ow}$ =	(mg chem/L octanol)/(mg chem/L water)	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	Montgomery, 2000
Chlordane Octanol Water Partition Coefficient =	K_{ow} =	(mg chem/L octanol)/(mg chem/L water)	1.00E+06	1.00E+06	1.00E+06	1.00E+06	1.00E+06	1.00E+06	1.00E+06	1.00E+06	1.00E+06	1.00E+06	1.00E+06	1.00E+06	1.00E+06	1.00E+06	1.00E+06	1.00E+06	1.00E+06	1.00E+06	1.00E+06	1.00E+06	1.00E+06	1.00E+06	1.00E+06	1.00E+06	1.00E+06	
Organic Carbon - Water Partition Coefficient =	K_{oc} =	(mg chem/kg org. carbon)/(mg chem/L water)	3.89E+04	3.89E+04	3.89E+04	3.89E+04	3.89E+04	3.89E+04	3.89E+04	3.89E+04	3.89E+04	3.89E+04	3.89E+04	3.89E+04	3.89E+04	3.89E+04	3.89E+04	3.89E+04	3.89E+04	3.89E+04	3.89E+04	3.89E+04	3.89E+04	3.89E+04	3.89E+04	3.89E+04	3.89E+04	Schwarzenbach, et.al., 2003
Fraction of Organic Carbon in Sediment =	f_{oc} = TOC/100 =	(kg org. carbon/kg sediment)	0.0128	0.0151	0.0122	0.0163	0.0259	0.0198	0.0118	0.0121	0.0161	0.0211	0.0043	0.0243	0.0222	0.0196	0.0187	0.019	0.000684	0.0212	0.0178	0.0234	0.0285	0.0346	0.0242	0.00392	0.0209	
Sediment - Water Partition Coefficient =	$K_d = f_{oc}K_{oc}$ =	(L water/kg sediment)	4.98E+02	5.87E+02	4.75E+02	6.34E+02	1.01E+03	7.70E+02	4.59E+02	4.71E+02	6.26E+02	8.21E+02	1.67E+02	9.45E+02	8.64E+02	7.63E+02	7.28E+02	7.39E+02	2.66E+01	8.25E+02	6.93E+02	9.10E+02	1.11E+03	1.35E+03	9.41E+02	1.53E+02	8.13E+02	DiToro, et.al., 1991
Chlordane Concentration in Surface Sediment =	C_s =	(ug chem/kg sed = ppb)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pore Water Concentration =	$C_d = C_s/K_d$ =	(ug chem/L water = ppb)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	DiToro, et.al., 1991
Fresh Acute Criterion =	CMC =	(ug chem/L water = ppb)	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	DNREC, 2004
Fresh Chronic Criterion =	CCC =	(ug chem/L water = ppb)	0.0043	0.0043	0.0043	0.0043	0.0043	0.0043	0.0043	0.0043	0.0043	0.0043	0.0043	0.0043	0.0043	0.0043	0.0043	0.0043	0.0043	0.0043	0.0043	0.0043	0.0043	0.0043	0.0043	0.0043	0.0043	DNREC, 2004
	TU_a =		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
	TU_c =		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

Predicted Pore Water Concentration of Dieldrin in Brandywine River Samples

Parameter	Symbol	Units	BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-0320	BWR-DAM7-T1-0320	BWR-DAM7-T2-0320	BWR-DAM7-T3-0320	BWR-DAM8-T1-0320	BWR-DAM8-T2-0320	BWR-DAM11-T1-0320	BWR-DAM11-T2-0320	BWR-DUP1-0320	BWR-FIELDBLANK-0320_SOLID	BWR-DAM6-T1-0620	BWR-DAM6-T2-0620	BWR-DAM6-T3-0620	BWR-DAM9-T1-0620	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DUP2-0620	Reference
Log Dieldrin Octanol Water Partition Coefficient =	$\log K_{ow}$ =	(mg chem/L octanol)/(mg chem/L water)	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	Montgomery, 2000
Dieldrin Octanol Water Partition Coefficient =	K_{ow} =	(mg chem/L octanol)/(mg chem/L water)	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	
Organic Carbon - Water Partition Coefficient =	K_{oc} =	(mg chem/kg org. carbon)/(mg chem/L water)	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	Schwarzenbach, et.al., 2003
Fraction of Organic Carbon in Sediment =	f_{oc} = TOC/100 =	(kg org. carbon/kg sediment)	0.0128	0.0151	0.0122	0.0163	0.0259	0.0198	0.0118	0.0121	0.0161	0.0211	0.0043	0.0243	0.0222	0.0196	0.0187	0.019	0.000684	0.0212	0.0178	0.0234	0.0285	0.0346	0.0242	0.00392	0.0209	
Sediment - Water Partition Coefficient =	$K_d = f_{oc}K_{oc}$ =	(L water/kg sediment)	1.19E+02	1.40E+02	1.13E+02	1.52E+02	2.41E+02	1.84E+02	1.10E+02	1.13E+02	1.50E+02	1.96E+02	4.00E+01	2.26E+02	2.06E+02	1.82E+02	1.74E+02	1.77E+02	6.36E+00	1.97E+02	1.66E+02	2.18E+02	2.65E+02	3.22E+02	2.25E+02	3.64E+01	1.94E+02	DiToro, et.al., 1991
Dieldrin Concentration in Surface Sediment =	C_s =	(ug chem/kg sed = ppb)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pore Water Concentration =	$C_d = C_s/K_d$ =	(ug chem/L water = ppb)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	DiToro, et.al., 1991
Fresh Acute Criterion =	CMC =	(ug chem/L water = ppb)	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	DNREC, 2004
Fresh Chronic Criterion =	CCC =	(ug chem/L water = ppb)	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	DNREC, 2004
	TU_a =		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	TU_c =		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

Predicted Pore Water Concentration of Endosulfan I in Brandywine River Samples

Parameter	Symbol	Units	BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-0320	BWR-DAM7-T1-0320	BWR-DAM7-T2-0320	BWR-DAM7-T3-0320	BWR-DAM8-T1-0320	BWR-DAM8-T2-0320	BWR-DAM11-T1-0320	BWR-DAM11-T2-0320	BWR-DUP1-0320	BWR-FIELDBLANK-0320_SOLID	BWR-DAM6-T1-0620	BWR-DAM6-T2-0620	BWR-DAM6-T3-0620	BWR-DAM9-T1-0620	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DUP2-0620	Reference
Log Endosulfan I Octanol Water Partition Coefficient =	$\log K_{ow}$ =	(mg chem/L octanol)/(mg chem/L water)	3.55	3.55	3.55	3.55	3.55	3.55	3.55	3.55	3.55	3.55	3.55	3.55	3.55	3.55	3.55	3.55	3.55	3.55	3.55	3.55	3.55	3.55	3.55	3.55	3.55	Montgomery, 2000
Endosulfan I Epoxide Octanol Water Partition Coefficient =	K_{ow} =	(mg chem/L octanol)/(mg chem/L water)	3.55E+03	3.55E+03	3.55E+03	3.55E+03	3.55E+03	3.55E+03	3.55E+03	3.55E+03	3.55E+03	3.55E+03	3.55E+03	3.55E+03	3.55E+03	3.55E+03	3.55E+03	3.55E+03	3.55E+03	3.55E+03	3.55E+03	3.55E+03	3.55E+03	3.55E+03	3.55E+03	3.55E+03	3.55E+03	
Organic Carbon - Water Partition Coefficient =	K_{oc} =	(mg chem/kg org. carbon)/(mg chem/L water)	5.98E+02	5.98E+02	5.98E+02	5.98E+02	5.98E+02	5.98E+02	5.98E+02	5.98E+02	5.98E+02	5.98E+02	5.98E+02	5.98E+02	5.98E+02	5.98E+02	5.98E+02	5.98E+02	5.98E+02	5.98E+02	5.98E+02	5.98E+02	5.98E+02	5.98E+02	5.98E+02	5.98E+02	5.98E+02	Schwarzenbach, et.al., 2003
Fraction of Organic Carbon in Sediment =	f_{oc} = TOC/100 =	(kg org. carbon/kg sediment)	0.0128	0.0151	0.0122	0.0163	0.0259	0.0198	0.0118	0.0121	0.0161	0.0211	0.0043	0.0243	0.0222	0.0196	0.0187	0.019	0.000684	0.0212	0.0178	0.0234	0.0285	0.0346	0.0242	0.00392	0.0209	
Sediment - Water Partition Coefficient =	$K_d = f_{oc}K_{oc}$ =	(L water/kg sediment)	7.66E+00	9.04E+00	7.30E+00	9.75E+00	1.55E+01	1.18E+01	7.06E+00	7.24E+00	9.63E+00	1.26E+01	2.57E+00	1.45E+01	1.33E+01	1.17E+01	1.12E+01	1.14E+01	4.09E-01	1.27E+01	1.07E+01	1.40E+01	1.71E+01	2.07E+01	1.45E+01	2.35E+00	1.25E+01	DiToro, et.al., 1991
Endosulfan I Concentration in Surface Sediment =	C_s =	(ug chem/kg sed = ppb)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pore Water Concentration =	$C_d = C_s/K_d$ =	(ug chem/L water = ppb)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	DiToro, et.al., 1991
Fresh Acute Criterion =	CMC =	(ug chem/L water = ppb)	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	DNREC, 2004
Fresh Chronic Criterion =	CCC =	(ug chem/L water = ppb)	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	DNREC, 2004
	TU_a =		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	TU_c =		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

Predicted Pore Water Concentration of Endosulfan II in Mirror Lake Samples

Parameter	Symbol	Units	BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-0320	BWR-DAM7-T1-0320	BWR-DAM7-T2-0320	BWR-DAM7-T3-0320	BWR-DAM8-T1-0320	BWR-DAM8-T2-0320	BWR-DAM11-T1-0320	BWR-DAM11-T2-0320	BWR-DUP1-0320	BWR-FIELDBLANK-0320_SOLID	BWR-DAM6-T1-0620	BWR-DAM6-T2-0620	BWR-DAM6-T3-0620	BWR-DAM9-T1-0620	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DUP2-0620	Reference
Log Endosulfan II Octanol Water Partition Coefficient =	$\log K_{ow}$ =	(mg chem/L octanol)/(mg chem/L water)	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62	Montgomery, 2000
Endosulfan II Epoxide Octanol Water Partition Coefficient =	K_{ow} =	(mg chem/L octanol)/(mg chem/L water)	4.17E+03	4.17E+03	4.17E+03	4.17E+03	4.17E+03	4.17E+03	4.17E+03	4.17E+03	4.17E+03	4.17E+03	4.17E+03	4.17E+03	4.17E+03	4.17E+03	4.17E+03	4.17E+03	4.17E+03	4.17E+03	4.17E+03	4.17E+03	4.17E+03	4.17E+03	4.17E+03	4.17E+03	4.17E+03	
Organic Carbon - Water Partition Coefficient =	K_{oc} =	(mg chem/kg org. carbon)/(mg chem/L water)	6.74E+02	6.74E+02	6.74E+02	6.74E+02	6.74E+02	6.74E+02	6.74E+02	6.74E+02	6.74E+02	6.74E+02	6.74E+02	6.74E+02	6.74E+02	6.74E+02	6.74E+02	6.74E+02	6.74E+02	6.74E+02	6.74E+02	6.74E+02	6.74E+02	6.74E+02	6.74E+02	6.74E+02	6.74E+02	Schwarzenbach, et.al., 2003
Fraction of Organic Carbon in Sediment =	f_{oc} = TOC/100 =	(kg org. carbon/kg sediment)	0.0128	0.0151	0.0122	0.0163	0.0259	0.0198	0.0118	0.0121	0.0161	0.0211	0.0043	0.0243	0.0222	0.0196	0.0187	0.019	0.000684	0.0212	0.0178	0.0234	0.0285	0.0346	0.0242	0.00392	0.0209	
Sediment - Water Partition Coefficient =	$K_d = f_{oc}K_{oc}$ =	(L water/kg sediment)	8.63E+00	1.02E+01	8.23E+00	1.10E+01	1.75E+01	1.33E+01	7.96E+00	8.16E+00	1.08E+01	1.42E+01	2.90E+00	1.64E+01	1.50E+01	1.32E+01	1.26E+01	1.28E+01	4.61E-01	1.43E+01	1.20E+01	1.58E+01	1.92E+01	2.33E+01	1.63E+01	2.64E+00	1.41E+01	DiToro, et.al., 1991
Endosulfan II Concentration in Surface Sediment =	C_s =	(ug chem/kg sed = ppb)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pore Water Concentration =	$C_d = C_s/K_d$ =	(ug chem/L water = ppb)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	DiToro, et.al., 1991
Fresh Acute Criterion =	CMC =	(ug chem/L water = ppb)	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	DNREC, 2004
Fresh Chronic Criterion =	CCC =	(ug chem/L water = ppb)	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	DNREC, 2004
	TU_a =		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	TU_c =		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

Predicted Pore Water Concentration of Endrin in Brandywine River Samples

Parameter	Symbol	Units	BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-0320	BWR-DAM7-T1-0320	BWR-DAM7-T2-0320	BWR-DAM7-T3-0320	BWR-DAM8-T1-0320	BWR-DAM8-T2-0320	BWR-DAM11-T1-0320	BWR-DAM11-T2-0320	BWR-DUP1-0320	BWR-FIELDBLANK-0320_SOLID	BWR-DAM6-T1-0620	BWR-DAM6-T2-0620	BWR-DAM6-T3-0620	BWR-DAM9-T1-0620	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DUP2-0620	Reference
Log Endrin Octanol Water Partition Coefficient =	$\log K_{ow}$ =	(mg chem/L octanol)/(mg chem/L water)	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	Montgomery, 2000
Endrin Octanol Water Partition Coefficient =	K_{ow} =	(mg chem/L octanol)/(mg chem/L water)	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	1.45E+05	
Organic Carbon - Water Partition Coefficient =	K_{oc} =	(mg chem/kg org. carbon)/(mg chem/L water)	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	9.30E+03	Schwarzenbach, et.al., 2003
Fraction of Organic Carbon in Sediment =	f_{oc} = TOC/100 =	(kg org. carbon/kg sediment)	0.0128	0.0151	0.0122	0.0163	0.0259	0.0198	0.0118	0.0121	0.0161	0.0211	0.0043	0.0243	0.0222	0.0196	0.0187	0.019	0.000684	0.0212	0.0178	0.0234	0.0285	0.0346	0.0242	0.00392	0.0209	
Sediment - Water Partition Coefficient =	$K_d = f_{oc}K_{oc}$ =	(L water/kg sediment)	1.19E+02	1.40E+02	1.13E+02	1.52E+02	2.41E+02	1.84E+02	1.10E+02	1.13E+02	1.50E+02	1.96E+02	4.00E+01	2.26E+02	2.06E+02	1.82E+02	1.74E+02	1.77E+02	6.36E+00	1.97E+02	1.66E+02	2.18E+02	2.65E+02	3.22E+02	2.25E+02	3.64E+01	1.94E+02	DiToro, et.al., 1991
Endrin Concentration in Surface Sediment =	C_s =	(ug chem/kg sed = ppb)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pore Water Concentration =	$C_d = C_s/K_d$ =	(ug chem/L water = ppb)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	DiToro, et.al., 1991
Fresh Acute Criterion =	CMC =	(ug chem/L water = ppb)	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	DNREC, 2004
Fresh Chronic Criterion =	CCC =	(ug chem/L water = ppb)	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	DNREC, 2004
	TU_a =		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	TU_c =		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

Predicted Pore Water Concentration of Heptachlor in Brandywine River Samples

Parameter	Symbol	Units	BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-0320	BWR-DAM7-T1-0320	BWR-DAM7-T2-0320	BWR-DAM7-T3-0320	BWR-DAM8-T1-0320	BWR-DAM8-T2-0320	BWR-DAM11-T1-0320	BWR-DAM11-T2-0320	BWR-DUP1-0320	BWR-FIELDBLANK-0320_SOLID	BWR-DAM6-T1-0620	BWR-DAM6-T2-0620	BWR-DAM6-T3-0620	BWR-DAM9-T1-0620	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DUP2-0620	Reference
Log Heptachlor Octanol Water Partition Coefficient =	$\log K_{ow}$ =	(mg chem/L octanol)/(mg chem/L water)	5.44	5.44	5.44	5.44	5.44	5.44	5.44	5.44	5.44	5.44	5.44	5.44	5.44	5.44	5.44	5.44	5.44	5.44	5.44	5.44	5.44	5.44	5.44	5.44	5.44	Montgomery, 2000
Heptachlor Octanol Water Partition Coefficient =	K_{ow} =	(mg chem/L octanol)/(mg chem/L water)	2.75E+05	2.75E+05	2.75E+05	2.75E+05	2.75E+05	2.75E+05	2.75E+05	2.75E+05	2.75E+05	2.75E+05	2.75E+05	2.75E+05	2.75E+05	2.75E+05	2.75E+05	2.75E+05	2.75E+05	2.75E+05	2.75E+05	2.75E+05	2.75E+05	2.75E+05	2.75E+05	2.75E+05	2.75E+05	
Organic Carbon - Water Partition Coefficient =	K_{oc} =	(mg chem/kg org. carbon)/(mg chem/L water)	1.50E+04	1.50E+04	1.50E+04	1.50E+04	1.50E+04	1.50E+04	1.50E+04	1.50E+04	1.50E+04	1.50E+04	1.50E+04	1.50E+04	1.50E+04	1.50E+04	1.50E+04	1.50E+04	1.50E+04	1.50E+04	1.50E+04	1.50E+04	1.50E+04	1.50E+04	1.50E+04	1.50E+04	1.50E+04	Schwarzenbach, et.al., 2003
Fraction of Organic Carbon in Sediment =	f_{oc} = TOC/100 =	(kg org. carbon/kg sediment)	0.0128	0.0151	0.0122	0.0163	0.0259	0.0198	0.0118	0.0121	0.0161	0.0211	0.0043	0.0243	0.0222	0.0196	0.0187	0.019	0.000684	0.0212	0.0178	0.0234	0.0285	0.0346	0.0242	0.00392	0.0209	
Sediment - Water Partition Coefficient =	$K_d = f_{oc}K_{oc}$ =	(L water/kg sediment)	1.92E+02	2.26E+02	1.83E+02	2.44E+02	3.88E+02	2.97E+02	1.77E+02	1.81E+02	2.41E+02	3.16E+02	6.44E+01	3.64E+02	3.33E+02	2.94E+02	2.80E+02	2.85E+02	1.02E+01	3.18E+02	2.67E+02	3.51E+02	4.27E+02	5.18E+02	3.63E+02	5.87E+01	3.13E+02	DiToro, et.al., 1991

Heptachlor Concentration in Surface Sediment =	C_s =	(ug chem/kg sed = ppb)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pore Water Concentration =	$C_d = C_s/K_d$ =	(ug chem/L water = ppb)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	DiToro, et.al., 1991
Fresh Acute Criterion =	CMC =	(ug chem/L water = ppb)	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	DNREC, 2004
Fresh Chronic Criterion =	CCC =	(ug chem/L water = ppb)	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	DNREC, 2004
	$T.U_a$ =		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	$T.U_c$ =		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

Predicted Pore Water Concentration of Methoxychlor in Brandywine River Samples

Parameter	Symbol	Units	BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-0320	BWR-DAM7-T1-0320	BWR-DAM7-T2-0320	BWR-DAM7-T3-0320	BWR-DAM8-T1-0320	BWR-DAM8-T2-0320	BWR-DAM11-T1-0320	BWR-DAM11-T2-0320	BWR-DUP1-0320	BWR-FIELDBLANK-0320_SOLID	BWR-DAM6-T1-0620	BWR-DAM6-T2-0620	BWR-DAM6-T3-0620	BWR-DAM9-T1-0620	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DUP2-0620	Reference
Log Methoxychlor Octanol Water Partition Coefficient =	$\log K_{ow}$ =	(mg chem/L octanol)/(mg chem/L water)	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	Montgomery, 2000
Methoxychlor Octanol Water Partition Coefficient =	K_{ow} =	(mg chem/L octanol)/(mg chem/L water)	2.00E+04	2.00E+04	2.00E+04	2.00E+04	2.00E+04	2.00E+04	2.00E+04	2.00E+04	2.00E+04	2.00E+04	2.00E+04	2.00E+04	2.00E+04	2.00E+04	2.00E+04	2.00E+04	2.00E+04	2.00E+04	2.00E+04	2.00E+04	2.00E+04	2.00E+04	2.00E+04	2.00E+04	2.00E+04	
Organic Carbon - Water Partition Coefficient =	K_{oc} =	(mg chem/kg org. carbon)/(mg chem/L water)	2.15E+03	2.15E+03	2.15E+03	2.15E+03	2.15E+03	2.15E+03	2.15E+03	2.15E+03	2.15E+03	2.15E+03	2.15E+03	2.15E+03	2.15E+03	2.15E+03	2.15E+03	2.15E+03	2.15E+03	2.15E+03	2.15E+03	2.15E+03	2.15E+03	2.15E+03	2.15E+03	2.15E+03	2.15E+03	Schwarzenbach, et.al., 2003
Fraction of Organic Carbon in Sediment =	f_{oc} = TOC/100 =	(kg org. carbon/kg sediment)	0.0128	0.0151	0.0122	0.0163	0.0259	0.0198	0.0118	0.0121	0.0161	0.0211	0.0043	0.0243	0.0222	0.0196	0.0187	0.019	0.000684	0.0212	0.0178	0.0234	0.0285	0.0346	0.0242	0.00392	0.0209	
Sediment - Water Partition Coefficient =	$K_d = f_{oc}K_{oc}$ =	(L water/kg sediment)	2.75E+01	3.24E+01	2.62E+01	3.50E+01	5.56E+01	4.25E+01	2.53E+01	2.60E+01	3.46E+01	4.53E+01	9.24E+00	5.22E+01	4.77E+01	4.21E+01	4.02E+01	4.08E+01	1.47E+00	4.55E+01	3.82E+01	5.03E+01	6.12E+01	7.43E+01	5.20E+01	8.42E+00	4.49E+01	DiToro, et.al., 1991
Methoxychlor Concentration in Surface Sediment =	C_s =	(ug chem/kg sed = ppb)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pore Water Concentration =	$C_d = C_s/K_d$ =	(ug chem/L water = ppb)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	DiToro, et.al., 1991
Fresh Acute Criterion =	CMC =	(ug chem/L water = ppb)	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	DNREC, 2004
Fresh Chronic Criterion =	CCC =	(ug chem/L water = ppb)	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	DNREC, 2004
	$T.U_a$ =		na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	
	$T.U_c$ =		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

Predicted Pore Water Concentration of Toxaphene in Brandywine River Samples

Parameter	Symbol	Units	BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-0320	BWR-DAM7-T1-0320	BWR-DAM7-T2-0320	BWR-DAM7-T3-0320	BWR-DAM8-T1-0320	BWR-DAM8-T2-0320	BWR-DAM11-T1-0320	BWR-DAM11-T2-0320	BWR-DUP1-0320	BWR-FIELDBLANK-0320_SOLID	BWR-DAM6-T1-0620	BWR-DAM6-T2-0620	BWR-DAM6-T3-0620	BWR-DAM9-T1-0620	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DUP2-0620	Reference
Log Toxaphene Octanol Water Partition Coefficient =	$\log K_{ow}$ =	(mg chem/L octanol)/(mg chem/L water)	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	Montgomery, 2000
Toxaphene Octanol Water Partition Coefficient =	K_{ow} =	(mg chem/L octanol)/(mg chem/L water)	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	3.16E+05	
Organic Carbon - Water Partition Coefficient =	K_{oc} =	(mg chem/kg org. carbon)/(mg chem/L water)	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	1.66E+04	Schwarzenbach, et.al., 2003
Fraction of Organic Carbon in Sediment =	f_{oc} = TOC/100 =	(kg org. carbon/kg sediment)	0.0128	0.0151	0.0122	0.0163	0.0259	0.0198	0.0118	0.0121	0.0161	0.0211	0.0043	0.0243	0.0222	0.0196	0.0187	0.019	0.000684	0.0212	0.0178	0.0234	0.0285	0.0346	0.0242	0.00392	0.0209	
Sediment - Water Partition Coefficient =	$K_d = f_{oc}K_{oc}$ =	(L water/kg sediment)	2.12E+02	2.51E+02	2.02E+02	2.71E+02	4.30E+02	3.29E+02	1.96E+02	2.01E+02	2.67E+02	3.50E+02	7.14E+01	4.03E+02	3.68E+02	3.25E+02	3.10E+02	3.15E+02	1.14E+01	3.52E+02	2.95E+02	3.88E+02	4.73E+02	5.74E+02	4.02E+02	6.51E+01	3.47E+02	DiToro, et.al., 1991
Toxaphene Concentration in Surface Sediment =	C_s =	(ug chem/kg sed = ppb)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pore Water Concentration =	$C_d = C_s/K_d$ =	(ug chem/L water = ppb)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	DiToro, et.al., 1991
Fresh Acute Criterion =	CMC =	(ug chem/L water = ppb)	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	DNREC, 2004
Fresh Chronic Criterion =	CCC =	(ug chem/L water = ppb)	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	DNREC, 2004
	$T.U_a$ =		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	$T.U_c$ =		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

Predicted Pore Water Concentration of Endosulfan Sulfate in Brandywine River Samples

Parameter	Symbol	Units	BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-0320	BWR-DAM7-T1-0320	BWR-DAM7-T2-0320	BWR-DAM7-T3-0320	BWR-DAM8-T1-0320	BWR-DAM8-T2-0320	BWR-DAM11-T1-0320	BWR-DAM11-T2-0320	BWR-DUP1-0320	BWR-FIELDBLANK-0320_SOLID	BWR-DAM6-T1-0620	BWR-DAM6-T2-0620	BWR-DAM6-T3-0620	BWR-DAM9-T1-0620	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DUP2-0620	Reference
Log Endosulfan Sulfate Octanol Water Partition Coefficient =	$\log K_{ow}$ =	(mg chem/L octanol)/(mg chem/L water)	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	Montgomery, 2000
Endosulfan Sulfate Octanol Water Partition Coefficient =	K_{ow} =	(mg chem/L octanol)/(mg chem/L water)	4.57E+03	4.57E+03	4.57E+03	4.57E+03	4.57E+03	4.57E+03	4.57E+03	4.57E+03	4.57E+03	4.57E+03	4.57E+03	4.57E+03	4.57E+03	4.57E+03	4.57E+03	4.57E+03	4.57E+03	4.57E+03	4.57E+03	4.57E+03	4.57E+03	4.57E+03	4.57E+03	4.57E+03	4.57E+03	
Organic Carbon - Water Partition Coefficient =	K_{oc} =	(mg chem/kg org. carbon)/(mg chem/L water)	7.22E+02	7.22E+02	7.22E+02	7.22E+02	7.22E+02	7.22E+02	7.22E+02	7.22E+02	7.22E+02	7.22E+02	7.22E+02	7.22E+02	7.22E+02	7.22E+02	7.22E+02	7.22E+02	7.22E+02	7.22E+02	7.22E+02	7.22E+02	7.22E+02	7.22E+02	7.22E+02	7.22E+02	7.22E+02	Schwarzenbach, et.al., 2003
Fraction of Organic Carbon in Sediment =	f_{oc} = TOC/100 =	(kg org. carbon/kg sediment)	0.0128	0.0151	0.0122	0.0163	0.0259	0.0198	0.0118	0.0121	0.0161	0.0211	0.0043	0.0243	0.0222	0.0196	0.0187	0.019	0.000684	0.0212	0.0178	0.0234	0.0285	0.0346	0.0242	0.00392	0.0209	
Sediment - Water Partition Coefficient =	$K_d = f_{oc}K_{oc}$ =	(L water/kg sediment)	9.24E+00	1.09E+01	8.81E+00	1.18E+01	1.87E+01	1.43E+01	8.52E+00	8.73E+00	1.16E+01	1.52E+01	3.10E+00	1.75E+01	1.60E+01	1.41E+01	1.35E+01	1.37E+01	4.94E-01	1.53E+01	1.28E+01	1.69E+01	2.06E+01	2.50E+01	1.75E+01	2.83E+00	1.51E+01	DiToro, et.al., 1991
Endosulfan Sulfate Concentration in Surface Sediment =	C_s =	(ug chem/kg sed = ppb)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pore Water Concentration =	$C_d = C_s/K_d$ =	(ug chem/L water = ppb)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	DiToro, et.al., 1991
Fresh Acute Criterion =	CMC =	(ug chem/L water = ppb)	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	DNREC, 2004
Fresh Chronic Criterion =	CCC =	(ug chem/L water = ppb)	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	DNREC, 2004
	$T.U_a$ =		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	$T.U_c$ =		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

Delaware does not have an aquatic life criterion for heptachlor epoxide.

II. Human Health Assessment (considers sediment to biota partitioning and consumption of fish by human receptors)

DDXs bioaccumulate in aquatic foodchains. DDXs in sediments can enter the foodchain when they partition into aquatic life that live in or on the sediments. Once DDXs have been incorporated into the benthic aquatic life, they can then be transferred up through the foodchain through predator-prey interactions. Increases in concentration from lower trophic levels to higher trophic levels is referred to as biomagnification. Ultimately, humans can be exposed to these contaminants through ingestion of contaminated fish flesh. The most direct approach to assess this risk is to collect and analyze fish samples from the location of interest. An alternative approach is to derive a bioaccumulation-based sediment quality value that if not exceeded, should not result in unacceptable accumulation in the foodchain and elevated health risks to indivuals who consume fish from the waterway. The technical approach to derive bioaccumulation-based sediment quality values is described elsewhere (Greene, 1997a). Using the approach described in Greene 1997a, a bioaccumulation-based sediment quality criterion (BBSQC) for DDT and a few other pesticides have been derived:

DDT	47.7 ppb
Chlordane	20.2 ppb
Dieldrin	4.3 ppb

Organic Carbon Normalized Bioaccumulation-Based Sediment Quality Criterion (BBSQC) for the Protection of Human Health from Organochlorine Pesticides

Equations used to calculated the BBSQC were adapted from Greene (1997)

The approach involves calculating an organic carbon normalized contaminant concentration in the sediments (a SQC) based upon a biota to sediment accumulation factor (BSAF) and an acceptable concentration in edible fish flesh. For purposes of this analysis, an acceptable concentration of contaminant in fish is defined as a concentration that keeps human health risk low (lifetime cancer risk < 10^{-5} and non-cancer hazard index < 1) even if someone were to consume an average of 17.5 grams of fish per day from the waterway. This is equivalent to 4.3 ounces per week.

BB SQBs for each of the organochlorine pesticides detected in the sediments of the Brandywine River are calculated below and then compared to the field data.

4,4'-DDE

Variable	Abbreviation	Value	Units	Comment
Risk Level	RL	0.00001	unitless	Consistent with DE HSCA & DE fish advisory program
Hazard Index	HI	1	unitless	Consistent with DE HSCA & DE fish advisory program
Human Body Weight	BW	70	kg	EPA guidance
Lifetime Duration	LT	75	yr	EPA guidance; used only in CA risk assessment
Exposure Duration	ED	30	yr	EPA guidance; used only in CA risk assessment
Fish Consumption Rate	CR	0.0175	kg/day	KCA (1994) & EPA (2002)
GI Adsorption Factor	AF	1	unitless	
Reduction for Trimming/Cooking	RF	0	%	
Cancer Potency	q_1^*	0.34	$(mg/kg\text{-}d)^{-1}$	EPA IRIS
Reference Dose	RfD	no data	(mg/kg-d)	EPA IRIS
Lipid Fraction of Fish Fillet	l_f	0.0255	kg lipid/kg fillet	Greene (2016a,b); median for White Sucker and Smallmouth Bass among 4 sites - calculation below
Biota to Sediment Accumulation Factor	BSAF	7.0165	kg lipid/kg o.c.	Greene (2016a,b); median for White Sucker and Smallmouth Bass among 4 sites - calculation below
BBSQC using cancer endpoint	$BBSQB_{CA}$	1.64	mg DDE/kg o.c.	Same as ug DDE/g o.c.
BBSQC using non-cancer endpoint	$BBSQB_{non\text{-}CA}$		mg DDE/kg o.c.	Same as ug DDE/g o.c.

Next we compare the organic carbon normalized DDE concentrations from Brandywine River sediments to the above benchmarks. The comparison is expressed as the ratio between the observed concentration to the SQC. Therefore, ratios greater than 1 indicate exceedance of the benchmark and an increased likelihood of a bioaccumulation problem.

Comparison of BBSQC to Measured Total 4,4-DDE Concentration

	BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-032	BWR-DAM7-T1-0320	BWR-DAM7-T2-032	BWR-DAM7-T3-0320	BWR-DAM8-T1-0320
Measured 4,4,-DDE in Sed (ug chem/kg sed)	0	0	0	0	0	0	0	0	0	0	0	3.8
Fraction organic carbon (kg oc/kg sed)	0.0128	0.0151	0.0122	0.0163	0.0259	0.0198	0.0118	0.0121	0.0161	0.0211	0.0043	0.0243
OC Normalized Conc in Sed (ug chem/kg oc)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	156.38
OC Normalized Conc in Sed (mg chem/kg oc)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16
Ratio of measured to BBSQC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10
Ratio of measured to $BBSQC_{-CA}$	na	na	na	na	na	na	na	na	na	na	na	na

	BWR-DAM8-T2-0320	BWR-DAM11-T1-0320	BWR-DAM11-T2-032	BWR-DUP1-0320	BWR-FIELDBLANK-0320_SOLID	BWR-DAM6-T1-0620	BWR-DAM6-T2-062	BWR-DAM6-T3-0620	BWR-DAM9-T1-062	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DUP2-0620
Measured 4,4,-DDE in Sed (ug chem/kg sed)	0	0	0	0	0	0	0	0	0	0	0	0	0
Fraction organic carbon (kg oc/kg sed)	0.0222	0.0196	0.0187	0.019	0.000684	0.0212	0.0178	0.0234	0.0285	0.0346	0.0242	0.00392	0.0209
OC Normalized Conc in Sed (ug chem/kg oc)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OC Normalized Conc in Sed (mg chem/kg oc)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ratio of measured to BBSQC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ratio of measured to $BBSQC_{-CA}$	na	na	na	na	na	na	na	na	na	na	na	na	na

4,4'-DDT

Variable	Abbreviation	Value	Units	Comment
Risk Level	RL	0.00001	unitless	Consistent with DE HSCA & DE fish advisory program
Hazard Index	HI	1	unitless	Consistent with DE HSCA & DE fish advisory program
Human Body Weight	BW	70	kg	EPA guidance
Lifetime Duration	LT	75	yr	EPA guidance; used only in CA risk assessment
Exposure Duration	ED	30	yr	EPA guidance; used only in CA risk assessment
Fish Consumption Rate	CR	0.0175	kg/day	KCA (1994) & EPA (2002)
GI Adsorption Factor	AF	1	unitless	
Reduction for Trimming/Cooking	RF	0	%	
Cancer Potency	q_1^*	0.34	$(mg/kg\text{-}d)^{-1}$	EPA IRIS
Reference Dose	RfD	5.00E-04	(mg/kg-d)	EPA IRIS
Lipid Fraction of Fish Fillet	l_f	0.0255	kg lipid/kg fillet	Greene (2015); median for White Sucker and Smallmouth Bass among 4 sites - calculation below
Biota to Sediment Accumulation Factor	BSAF	1.5816	kg lipid/kg o.c.	Greene (2015); median for White Sucker and Smallmouth Bass among 4 sites - calculation below
BBSQB using cancer endpoint	HH SQB_{CA}	7.29	mg DDT/kg o.c.	Same as ug DDT/g o.c.
BBSQB using non-cancer endpoint	HH $SQB_{non\text{-}CA}$	49.59	mg DDT/kg o.c.	Same as ug DDT/g o.c.

Next we compare the organic carbon normalized DDT concentrations from Brandywine River Sediments to the above benchmarks. The comparison is expressed as the ratio between the observed concentration to the SQC. Therefore, ratios greater than 1 indicate exceedance of the benchmark and an increased likelihood of a bioaccumulation problem.

Comparison of BBSQC to Measured Total 4,4-DDT Concentration

	BWR-DAM2-T1-0320	BWR-DAM2-T2-0320	BWR-DAM2-T3-0320	BWR-DAM4-T1-0320	BWR-DAM4-T2-0320	BWR-DAM4-T3-0320	BWR-DAM4-T4-0320	BWR-DAM4-T5-032	BWR-DAM7-T1-0320	BWR-DAM7-T2-032	BWR-DAM7-T3-0320	BWR-DAM8-T1-0320
Measured 4,4,-DDT in Sed (ug chem/kg sed)	4.1	0	0	0	0	0	0	0	0	0	0	0
Fraction organic carbon (kg oc/kg sed)	0.0128	0.0151	0.0122	0.0163	0.0259	0.0198	0.0118	0.0121	0.0161	0.0211	0.0043	0.0243
OC Normalized Conc in Sed (ug chem/kg oc)	320.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OC Normalized Conc in Sed (mg chem/kg oc)	0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ratio of measured to $BBSQC_{CA}$	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ratio of measured to $BBSQC_{non\text{-}CA}$	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

	BWR-DAM8-T2-0320	BWR-DAM11-T1-0320	BWR-DAM11-T2-032	BWR-DUP1-0320	BWR-FIELDBLANK-0320_SOLID	BWR-DAM6-T1-0620	BWR-DAM6-T2-062	BWR-DAM6-T3-0620	BWR-DAM9-T1-062	BWR-DAM9-T2-0620	BWR-DAM10-T1-0620	BWR-DAM10-T2-0620	BWR-DUP2-0620
Measured 4,4,-DDT in Sed (ug chem/kg sed)	0	0	0	0	0	0	0	0	0	0	0	0	0
Fraction organic carbon (kg oc/kg sed)	0.0222	0.0196	0.0187	0.019	0.000684	0.0212	0.0178	0.0234	0.0285	0.0346	0.0242	0.00392	0.0209
OC Normalized Conc in Sed (ug chem/kg oc)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OC Normalized Conc in Sed (mg chem/kg oc)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ratio of measured to $BBSQC_{CA}$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ratio of measured to $BBSQC_{non\text{-}CA}$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Sample Name	% Lipid	kg lipid/kg fillet	DDE BSAF (kg lipid/kg o.c.)	DDT BSAF (kg lipid/kg o.c.)
BRSmithBr-FISH-1015	3.09	0.0309	11.48	13.83
BRRocklandRd-FISH-1015	4.25	0.0425	1.34	0.70
BRRocklandRd-SMB-1015	1.36	0.0136	2.56	0.58
BR95CityDam-FISH-1015	2.01	0.0201	16.18	2.46

Summary Statistics - Non-Tidal Brandywine

	Lipid Content (kg/kg)	DDE BSAF	DDT BSAF
Mean	0.0268	7.8887	4.3912
Standard Error	0.0063	3.5708	3.1743
Median	0.0255	7.0165	1.5816
Mode	#N/A	#N/A	#N/A
Standard Deviation	0.0127	7.1416	6.3486
Sample Variance	0.0002	51.0019	40.3047
Kurtosis	-1.4413	-3.8299	3.6041
Skewness	0.4493	0.3369	1.8940
Range	0.0289	14.8428	13.2507
Minimum	0.0136	1.3394	0.5755
Maximum	0.0425	16.1822	13.8262
Sum	0.1071	31.5546	17.5649
Count	4	4	4

BSAFs were calculated from 2015 WATAR Dataset for non-tidal Brandywine sampling stations.
BSAF = Lipid Normalized Fish Tissue Concentration / Organic Carbon Normalized Sediment Concentration.

Sample Name	DDT Tissue Conc. (ng/g)	DDE Tissue Conc. (ng/g)	DDT Sediment Conc. (ng/g)	DDE Sediment Conc. (ng/g)	%TOC	%Lipid	Lipid Normalized DDE Tissue Conc. (ng/g)	OC Normalized DDE Sediment Conc. (ng/g)	Lipid Normalized DDT Tissue Conc. (ng/g)	OC Normalized DDT Sediment Conc. (ng/g)	DDE BSAF (kg/kg)	DDT BSAF (kg/kg)
BRSmithBr-1015	2.97	8.4	0.317	1.08	4.56	3.09	271.84	23.68	96.12	6.95	11.48	13.83
BRRocklandRd-1015	4.27	11.5	0.425	0.6	0.297	4.25	270.59	202.02	100.47	143.10	1.34	0.70
BRRocklandRd-1015 (SMB)	1.12	7.02	0.425	0.6	0.297	1.36	516.18	202.02	82.35	143.10	2.56	0.58
BR95CityDam1015	5.03	32.8	0.725	0.719	0.713	2.01	1631.84	100.84	250.25	101.68	16.18	2.46

1/2 Method Detection Limit

References

DiToro D, et.al. 1991. Technical basis for establishing sediment quality criteria for nonionic organic chemicals using equilibrium partitioning. Environ Tox Chem 10: 1541-1583.

DNREC. 2004. State of Delaware Surface Water Quality Standards as Amended June 1, 2011. Delaware Department of Natural Resources and Environmental Control, Division of Water Resources, Watershed Assessment & Management Branch, Dover, DE.

DNREC. 2013. Department of Natural Resources and Environmental Control, Division of Waste and Hazardous Substances, Remediation Section, HSCA Screening Level Table, Last updated February 2020. New Castle, DE.

Greene, R. 1997. Bioaccumulation-based Sediment Quality Criteria for the Protection of Human Health. Delaware Department of Natural Resources and Environmental Control, Division of Water Resources, Watershed Assessment Branch, Dover, DE.

Greene, R. 2016a. WATAR 2015 Fish Tissue Data. Spreadsheet analysis. Delaware Department of Natural Resources and Environmental Control, Dover, DE.

Greene, R. 2016b. WATAR 2015 Sediment Data. Spreadsheet analysis. Delaware Department of Natural Resources and Environmental Control, Dover, DE.

EPA. 2002. National Recommended Water Quality Criteria: 2002 (EPA-822-R-02-047). U.S. Environmental Protection Agency, Office of Water and Office of Science and Technology, Washington, DC.

EPA. 2011. Integrated Risk Information System (IRIS). Accessed on-line 2/11/2011 at www.epa.gov/IRIS. U.S. Environmental Protection Agency, Washington, DC.

Greene R. 1997. Bioaccumulation-based Sediment Quality Criteria for the Protection of Human Health. Delaware Department of Natural Resources and Environmental Control, Division of Water Resources, Watershed Assessment Branch, Dover, DE.

KCA Research Division, David C. Cox & Associates. 1994. Fish Consumption Patterns of Delaware Recreational Fishermen and Their Households. Prepared for the State of Delaware, Department of Natural Resources and Environmental Control, Dover, DE.

Schwarzenbach R, P Gschwend, and D Imboden. 2003. Environmental Organic Chemistry, Second Edition. John Wiley & Sons, Inc., New York, NY.

SPARC. 2006. SPARC Performs Automated Reasoning in Chemistry On-Line Calculator (http://ibmlc2.chem.uga.edu/sparc), January 2006 Release.

Assessment of PFAS in Brandywine River Sediment Samples
Prepared by: John Cargill, Delaware DNREC
October 22, 2020

Methods:

Because the science is still advancing with regards to toxic effects of PFAS compounds to both human and ecological health, it is difficult to put detected concentrations into context. In fact, there are currently only a few states in the country that have any specific criteria related to PFAS compounds, and analytical methods and compound lists are continuously developing. In most cases, the focus has been on human health impacts from drinking water containing PFAS, and in some cases from consuming PFAS impacted fish (fish consumption advisory levels). EPA has established a Drinking Water Health Advisory for two PFAS compounds, PFOA and PFOS, of 70 parts per trillion (ppt).

Peer reviewed studies indicate that exposure to PFOA and PFOS over certain levels may result in adverse health effects, including developmental effects to fetuses during pregnancy or to breastfed infants (e.g., low birth weight, accelerated puberty, skeletal variations), cancer (e.g., testicular, kidney), liver effects (e.g., tissue damage), immune effects (e.g., antibody production and immunity), thyroid effects and other effects (e.g., cholesterol changes) (USEPA, 2020).

PFAS analysis was conducted during this assessment because the opportunity to collect information in the Brandywine River was there, and the costs were not excessive. Because PFAS is such an important emerging contaminant throughout the country, and because such little data exists, any information related to its magnitude and distribution in the environment is valuable. Only the Transect 1 composite sample at each dam location was analyzed for PFAS.

Results:

Aside from the USEPA Health Advisory Level for drinking water, the only other criteria that DNREC has established/adopted to date is for PFOA and PFOS in soil. DRNEC-RS soil screening values are generally adopted from USEPA soil screening values (DNREC 2013), and currently include a screening value of 16 mg/kg (ppm) PFOA and 6 mg/kg (ppm) PFOS. Comparison of sediment data to these criteria are applicable if sediment is excavated, dewatered and moved to an upland location. Further, an exceedance of DNREC-RS screening criteria simply mean that the soil containing the contaminant should undergo further use specific risk assessment. The concentrations of PFOA and PFOS detected in the Brandywine Dam sediments are several orders of magnitude less than the DNREC-RS human health soil Screening Levels.

In lieu of any additional human health or ecological criteria to compare results, the data were organized and plotted based upon carbon chain length, and functional group (carboxylic acids, sulfonic acids, sulfonamides, etc.), in order to determine if there were any trends that could be identified, and to further help understand the distribution of PFAS compounds in the environment.

Conclusions:

Human health impacts are not expected from PFOA or PFOS if the sediments were removed and transported to an upland location. Information regarding other PFAS compounds in soil is not yet available. In addition, the potential for ecological impacts from detected concentrations cannot be made at this time.

To understand whether PFAS compounds present in sediment samples are high enough to cause an impact to drinking water, data from the City of Wilmington Water Quality Report from 2019 was reviewed (http://www.ccrwilmingtonde.com/2019_City_of_Wilmington_Water_Quality_Report.pdf). According to Table 3 of the report, PFBS, PFhpA, PFHxA, PFNA, PFOS and PFOA were detected in drinking water at concentrations ranging from 2.3 parts per trillion (ppt)(PFBS) to 8.15 ppt (PFOA). PFOS was detected in the water sample at a concentration of 3.35 ppt. Both PFOA and PFOS concentrations are below the USEPA Health Advisory Level of 70 ppt (individual or combined).

TestAmerica Laboratories, Inc.

Eurofins TestAmerica, Edison

SUMMARY OF ANALYTICAL RESULTS: 460-205020-1

Job Description: WATAR (DE-1525) BRANDYWINE DAM SEDIMENTS

For:

State of Delaware

391 Lukens Drive

New Castle, Delaware 19720-2774

Client ID		DNREC SIRS	BWR-DAM2-T1-0320			BWR-DAM4-T1-0320			BWR-DAM7-T1-0320			BWR-DAM8-T1-0320			BWR-DAM11-T1-0320			BWR-DUP1-0320		
Lab Sample ID		Screening Levels	460-205020-1			460-205020-4			460-205020-11			460-205020-14			460-205020-16			460-205020-18		
Sampling Date		Soils	03/06/2020 10:30:00			03/09/2020 13:55:00			03/10/2020 13:15:00			03/11/2020 12:15:00			03/12/2020 12:10:00			03/12/2020 00:00:00		
Matrix		Nov 2019	Soil			Soil			Soil			Soil			Soil			Soil		
Dilution Factor			1			1			1			1			1			1		
Unit		ug/kg	ug/kg			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 537 (MODIFIED)																				
1H,1H,2H,2H-perfluorodecanesulfonic acid (8:2)	39108-34-4	NA	0.046	U Z	0.046	0.064	U Z	0.064	0.047	U Z	0.047	0.055	U	0.055	0.052	U	0.052	0.040	U	0.040
1H,1H,2H,2H-perfluorooctanesulfonic acid (6:2)	27619-97-2	NA	0.056	J Z	0.035	0.048	U Z	0.048	0.036	U Z	0.036	0.042	U	0.042	0.039	U	0.039	0.030	U	0.030
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	2991-50-6	NA	0.17	J Z	0.048	0.083	J Z	0.066	0.049	J Z	0.049	0.63	J	0.057	0.085	J	0.054	0.041	U	0.041
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	2355-31-9	NA	0.055	J Z	0.054	0.18	J Z	0.075	0.056	U Z	0.056	0.11	J	0.064	0.14	J	0.061	0.089	J	0.047
Perfluorobutanesulfonic acid (PFBS)	375-73-5	NA	0.051	J Z B	0.014	0.031	J Z B	0.019	0.039	J Z B	0.014	0.019	J B	0.017	0.028	J B	0.016	0.017	J B	0.012
Perfluorobutanoic acid (PFBA)	375-22-4	NA	0.30	U Z	0.30	0.42	U Z	0.42	0.31	U Z	0.31	0.36	U	0.36	0.34	U	0.34	0.26	U	0.26
Perfluorodecanesulfonic acid (PFDS)	335-77-3	NA	0.030	U Z	0.030	0.076	J Z	0.042	0.046	J Z	0.031	0.043	J	0.036	0.044	J	0.034	0.026	U	0.026
Perfluorodecanoic acid (PFDA)	335-76-2	NA	0.045	J Z	0.034	0.24	J Z	0.046	0.082	J Z	0.034	0.040	U	0.040	0.067	J	0.038	0.063	J	0.029
Perfluorododecanoic acid (PFDoA)	307-55-1	NA	0.12	J Z	0.024	0.62	Z	0.033	0.18	J Z	0.025	0.058	J	0.028	0.23	J	0.027	0.18	J	0.021
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	NA	0.024	U Z	0.024	0.033	U Z	0.033	0.025	U Z	0.025	0.028	U	0.028	0.027	U	0.027	0.021	U	0.021
Perfluoroheptanoic acid (PFHpA)	375-85-9	NA	0.037	U Z	0.037	0.050	U Z	0.050	0.044	J Z	0.038	0.044	U	0.044	0.041	J	0.041	0.032	U	0.032
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	NA	0.044	J Z B	0.024	0.063	J Z B	0.033	0.049	J Z B	0.025	0.042	J B	0.028	0.046	J B	0.027	0.041	J B	0.021
Perfluorohexanoic acid (PFHxA)	307-24-4	NA	0.066	J Z	0.038	0.053	U Z	0.053	0.039	J Z	0.039	0.045	U	0.045	0.043	U	0.043	0.033	U	0.033
Perfluorononanoic acid (PFNA)	375-95-1	NA	0.049	J Z	0.032	0.11	J Z	0.044	0.059	J Z	0.033	0.043	J	0.038	0.053	J	0.036	0.046	J	0.028
Perfluorooctanesulfonamide (PFOSA)	754-91-6	NA	0.018	J Z	0.014	0.030	J Z	0.019	0.014	U Z	0.014	0.021	J	0.017	0.016	U	0.016	0.012	U	0.012
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	6000	0.19	J Z	0.11	0.54	Z	0.15	0.26	J Z	0.11	0.18	J	0.13	0.33	J	0.12	0.23	J	0.092
Perfluorooctanoic acid (PFOA)	335-67-1	16000	0.12	J Z B	0.022	0.16	J Z B	0.031	0.20	J Z B	0.023	0.098	J B	0.027	0.13	J B	0.025	0.12	J B	0.019
Perfluoropentanoic acid (PFPeA)	2706-90-3	NA	0.078	J Z	0.029	0.072	J Z	0.039	0.13	J Z	0.029	0.10	J	0.034	0.056	J	0.032	0.084	J	0.025
Perfluorotetradecanoic acid (PFTeA)	376-06-7	NA	0.10	J Z	0.030	0.41	J Z	0.042	0.12	J Z	0.031	0.053	J	0.036	0.15	J	0.034	0.11	J	0.026
Perfluorotridecanoic acid (PFTriA)	72629-94-8	NA	0.090	J Z	0.021	0.42	J Z	0.028	0.13	J Z	0.021	0.045	J	0.025	0.15	J	0.023	0.16	J	0.018
Perfluoroundecanoic acid (PFUnA)	2058-94-8	NA	0.19	J Z	0.038	0.76	Z	0.053	0.21	J Z	0.039	0.10	J	0.045	0.33	J	0.043	0.23	J	0.033

B : Compound was found in the blank and sample.
J : Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
U : Indicates the analyte was analyzed for but not detected.
Z : Data contains important qualifier codes see hardcopy report and report narrative for further details.

TestAmerica Laboratories, Inc.

Eurofins TestAmerica, Edison

SUMMARY OF ANALYTICAL RESULTS: 460-205020-1

Job Description: WATAR (DE-1525) BRANDYWINE DAM SEDIMENTS

For:

State of Delaware

391 Lukens Drive

New Castle, Delaware 19720-2774

Client ID		DNREC SIRS	BWR-FBGLOVE-0320			BWR-FBLINER-0320		
Lab Sample ID		Screening Levels	460-205020-19			460-205020-20		
Sampling Date		GW Ingestion	03/12/2020 12:40:00			03/12/2020 12:45:00		
Matrix		Nov 2019	Water			Water		
Dilution Factor			1			1		
Unit		ng/l	ng/l			ng/l		
	CAS#		Result	Q	MDL	Result	Q	MDL
WATER BY 537 (MODIFIED)								
1H,1H,2H,2H-perfluorodecanesulfonic acid (8:2)	39108-34-4	NA	2.62	U	2.62	2.48	U	2.48
1H,1H,2H,2H-perfluorooctanesulfonic acid (6:2)	27619-97-2	NA	4.96	U	4.96	4.70	U	4.70
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	2991-50-6	NA	1.35	U	1.35	1.28	U	1.28
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	2355-31-9	NA	1.53	U	1.53	1.45	U	1.45
Perfluorobutanesulfonic acid (PFBS)	375-73-5	NA	0.44	U	0.44	0.42	U	0.42
Perfluorobutanoic acid (PFBA)	375-22-4	NA	0.90	U	0.90	0.85	U	0.85
Perfluorodecanesulfonic acid (PFDS)	335-77-3	NA	0.81	U	0.81	0.77	U	0.77
Perfluorodecanoic acid (PFDA)	335-76-2	NA	0.69	U	0.69	0.66	U	0.66
Perfluorododecanoic acid (PFDoA)	307-55-1	NA	0.53	U	0.53	0.50	U	0.50
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	NA	0.86	U	0.86	0.81	U	0.81
Perfluoroheptanoic acid (PFHpA)	375-85-9	NA	0.82	U	0.82	0.78	U	0.78
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	NA	0.72	U	0.72	0.68	U	0.68
Perfluorohexanoic acid (PFHxA)	307-24-4	NA	0.69	U	0.69	0.65	U	0.65
Perfluorononanoic acid (PFNA)	375-95-1	NA	0.24	U	0.24	0.23	U	0.23
Perfluorooctanesulfonamide (PFOSA)	754-91-6	NA	9.02	U	9.02	8.54	U	8.54
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	NA	0.55	U	0.55	0.52	U	0.52
Perfluorooctanoic acid (PFOA)	335-67-1	NA	0.73	U	0.73	0.69	U	0.69
Perfluoropentanoic acid (PFPeA)	2706-90-3	NA	0.57	U	0.57	0.54	U	0.54
Perfluorotetradecanoic acid (PFTeA)	376-06-7	NA	0.83	U	0.83	0.79	U	0.79
Perfluorotridecanoic acid (PFTriA)	72629-94-8	NA	0.54	U	0.54	0.51	U	0.51
Perfluoroundecanoic acid (PFUnA)	2058-94-8	NA	0.70	U	0.70	0.67	U	0.67

U : Indicates the analyte was analyzed for but not detected.

TestAmerica Laboratories, Inc.

Eurofins TestAmerica, Edison

Lab Job ID: 460-210989-1

Client ID		DNREC SIRS	BWR-DAM6-T1-0620			BWR-DAM9-T1-0620			BWR-DAM10-T1-0620			BWR-DUP2-0620		
Lab Sample ID		Screening Levels	460-210989-1			460-210989-4			460-210989-6			460-210989-8		
Sampling Date		Soils	06/10/2020 11:15:00			06/09/2020 14:15:00			06/09/2020 11:10:00			06/10/2020 00:00:00		
Matrix		Feb 2020	Soil			Soil			Soil			Soil		
Dilution Factor			1			1			1			1		
Unit		mg/kg	mg/kg			mg/kg			mg/kg			mg/kg		
	CAS#		Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 537 (MODIFIED)														
1H,1H,2H,2H-perfluorodecanesulfonic acid (8:2)	39108-34-4	NA	0.000053	U	0.000053	0.00006	U	0.00006	0.000057	U	0.000057	0.000053	U	0.000053
1H,1H,2H,2H-perfluorooctanesulfonic acid (6:2)	27619-97-2	NA	0.000057	J	0.00004	0.000046	U	0.000046	0.000043	U	0.000043	0.000093	J	0.00004
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	2991-50-6	NA	0.000073	J B	0.000055	0.00014	J B	0.000062	0.000093	J B	0.000059	0.00010	J B	0.000055
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	2355-31-9	NA	0.000086	J	0.000062	0.00013	J	0.000071	0.00013	J	0.000067	0.00012	J	0.000062
Perfluorobutanesulfonic acid (PFBS)	375-73-5	NA	0.000017	J B	0.000016	0.000018	U	0.000018	0.000019	J B	0.000017	0.000016	J B	0.000016
Perfluorobutanoic acid (PFBA)	375-22-4	NA	0.00035	U	0.00035	0.00040	U	0.00040	0.00037	U	0.00037	0.00035	U	0.00035
Perfluorodecanesulfonic acid (PFDS)	335-77-3	NA	0.00005	J	0.000035	0.00005	J	0.00004	0.000045	J	0.000037	0.000039	J	0.000035
Perfluorodecanoic acid (PFDA)	335-76-2	NA	0.00024	J	0.000038	0.00017	J	0.000044	0.000091	J	0.000041	0.00020	J	0.000038
Perfluorododecanoic acid (PFDoA)	307-55-1	NA	0.00052	Z	0.000027	0.00037	J Z	0.000031	0.00035	J Z	0.000029	0.00043	Z	0.000027
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	NA	0.000027	U	0.000027	0.000031	U	0.000031	0.000029	J	0.000029	0.000027	U	0.000027
Perfluoroheptanoic acid (PFHpA)	375-85-9	NA	0.000059	J	0.000042	0.000048	U	0.000048	0.000045	U	0.000045	0.000066	J	0.000042
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	NA	0.000038	J B	0.000027	0.000057	J B	0.000031	0.000063	J B	0.000029	0.000067	J B	0.000027
Perfluorohexanoic acid (PFHxA)	307-24-4	NA	0.000044	U	0.000044	0.00005	U	0.00005	0.000047	U	0.000047	0.000044	U	0.000044
Perfluorononanoic acid (PFNA)	375-95-1	NA	0.00012	J	0.000036	0.000082	J	0.000042	0.000043	J	0.000039	0.00012	J	0.000036
Perfluorooctanesulfonamide (PFOSA)	754-91-6	NA	0.000017	J	0.000016	0.000018	J	0.000018	0.000017	U	0.000017	0.000024	J	0.000016
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	6	0.00060		0.00012	0.00051		0.00014	0.00032	J	0.00013	0.00051		0.00012
Perfluorooctanoic acid (PFOA)	335-67-1	16	0.00011	J B	0.000026	0.000082	J B	0.000029	0.000096	J B	0.000027	0.00012	J B	0.000026
Perfluoropentanoic acid (PFPeA)	2706-90-3	NA	0.000033	U	0.000033	0.000037	U	0.000037	0.000035	U	0.000035	0.000033	U	0.000033
Perfluorotetradecanoic acid (PFTeA)	376-06-7	NA	0.00025	J	0.000035	0.00022	J	0.00004	0.00021	J	0.000037	0.00022	J	0.000035
Perfluorotridecanoic acid (PFTriA)	72629-94-8	NA	0.00036		0.000024	0.00033	J	0.000027	0.00030	J	0.000025	0.00033	J	0.000024
Perfluoroundecanoic acid (PFUnA)	2058-94-8	NA	0.00087		0.000044	0.00084		0.00005	0.00055		0.000047	0.00070		0.000044

B : Compound was found in the blank and sample.
J : Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
U : Indicates the analyte was analyzed for but not detected.
Z : Data contains important qualifier codes see hardcopy report and report narrative for further details.

Data Reordered by Dam #

Client ID	BWR-DAM2-T1-0320			BWR-DAM4-T1-0320			BWR-DAM6-T1-0620			BWR-DAM7-T1-0320			BWR-DAM8-T1-0320		
Lab Sample ID			460-205020-1			460-205020-4			460-210989-1			460-205020-11			460-205020-14
Sampling Date			03/06/2020 10:30:00			03/09/2020 13:55:00			06/10/2020 11:15:00			03/10/2020 13:15:00			03/11/2020 12:15:00
Matrix			Soil			Soil			Soil			Soil			Soil
Dilution Factor			1			1			1			1			1
Unit			ug/kg			ug/kg			mg/kg			ug/kg			ug/kg
	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 537 (MODIFIED)															
1H,1H,2H,2H-perfluorodecanesulfonic acid (8:2)	0.046	U Z	0.046	0.064	U Z	0.064	0.000053	U	0.000053	0.047	U Z	0.047	0.055	U	0.055
1H,1H,2H,2H-perfluorooctanesulfonic acid (6:2)	0.056	J Z	0.035	0.048	U Z	0.048	0.000057	J	0.00004	0.036	U Z	0.036	0.042	U	0.042
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	0.17	J Z	0.048	0.083	J Z	0.066	0.000073	J B	0.000055	0.049	J Z	0.049	0.63	J	0.057
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	0.055	J Z	0.054	0.18	J Z	0.075	0.000086	J	0.000062	0.056	U Z	0.056	0.11	J	0.064
Perfluorobutanesulfonic acid (PFBS)	0.051	J Z B	0.014	0.031	J Z B	0.019	0.000017	J B	0.000016	0.039	J Z B	0.014	0.019	J B	0.017
Perfluorobutanoic acid (PFBA)	0.30	U Z	0.30	0.42	U Z	0.42	0.00035	U	0.00035	0.31	U Z	0.31	0.36	U	0.36
Perfluorodecanesulfonic acid (PFDS)	0.030	U Z	0.030	0.076	J Z	0.042	0.00005	J	0.000035	0.046	J Z	0.031	0.043	J	0.036
Perfluorodecanoic acid (PFDA)	0.045	J Z	0.034	0.24	J Z	0.046	0.00024	J	0.000038	0.082	J Z	0.034	0.040	U	0.040
Perfluorododecanoic acid (PFDoA)	0.12	J Z	0.024	0.62	Z	0.033	0.00052	Z	0.000027	0.18	J Z	0.025	0.058	J	0.028
Perfluoroheptanesulfonic Acid (PFHpS)	0.024	U Z	0.024	0.033	U Z	0.033	0.000027	U	0.000027	0.025	U Z	0.025	0.028	U	0.028
Perfluoroheptanoic acid (PFHpA)	0.037	U Z	0.037	0.050	U Z	0.050	0.000059	J	0.000042	0.044	J Z	0.038	0.044	U	0.044
Perfluorohexanesulfonic acid (PFHxS)	0.044	J Z B	0.024	0.063	J Z B	0.033	0.000038	J B	0.000027	0.049	J Z B	0.025	0.042	J B	0.028
Perfluorohexanoic acid (PFHxA)	0.066	J Z	0.038	0.053	U Z	0.053	0.000044	U	0.000044	0.039	J Z	0.039	0.045	U	0.045
Perfluorononanoic acid (PFNA)	0.049	J Z	0.032	0.11	J Z	0.044	0.00012	J	0.000036	0.059	J Z	0.033	0.043	J	0.038
Perfluorooctanesulfonamide (PFOSA)	0.018	J Z	0.014	0.030	J Z	0.019	0.000017	J	0.000016	0.014	U Z	0.014	0.021	J	0.017
Perfluorooctanesulfonic acid (PFOS)	0.19	J Z	0.11	0.54	Z	0.15	0.00060		0.00012	0.26	J Z	0.11	0.18	J	0.13
Perfluorooctanoic acid (PFOA)	0.12	J Z B	0.022	0.16	J Z B	0.031	0.00011	J B	0.000026	0.20	J Z B	0.023	0.098	J B	0.027
Perfluoropentanoic acid (PFPeA)	0.078	J Z	0.029	0.072	J Z	0.039	0.000033	U	0.000033	0.13	J Z	0.029	0.10	J	0.034
Perfluorotetradecanoic acid (PFTeA)	0.10	J Z	0.030	0.41	J Z	0.042	0.00025	J	0.000035	0.12	J Z	0.031	0.053	J	0.036
Perfluorotridecanoic acid (PFTriA)	0.090	J Z	0.021	0.42	J Z	0.028	0.00036		0.000024	0.13	J Z	0.021	0.045	J	0.025
Perfluoroundecanoic acid (PFUnA)	0.19	J Z	0.038	0.76	Z	0.053	0.00087		0.000044	0.21	J Z	0.039	0.10	J	0.045

Client ID	BWR-DAM9-T1-0620			BWR-DAM10-T1-0620			BWR-DAM11-T1-0320			BWR-DUP1-0320			BWR-DUP2-0620		
Lab Sample ID			460-210989-4			460-210989-6			460-205020-16			460-205020-18			460-210989-8
Sampling Date			06/09/2020 14:15:00			06/09/2020 11:10:00			03/12/2020 12:10:00			03/12/2020 00:00:00			06/10/2020 00:00:00
Matrix			Soil			Soil			Soil			Soil			Soil
Dilution Factor			1			1			1			1			1
Unit			mg/kg			mg/kg			ug/kg			ug/kg			mg/kg
	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 537 (MODIFIED)															
1H,1H,2H,2H-perfluorodecanesulfonic acid (8:2)	0.00006	U	0.00006	0.000057	U	0.000057	0.052	U	0.052	0.040	U	0.040	0.000053	U	0.000053
1H,1H,2H,2H-perfluorooctanesulfonic acid (6:2)	0.000046	U	0.000046	0.000043	U	0.000043	0.039	U	0.039	0.030	U	0.030	0.000093	J	0.00004
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	0.00014	J B	0.000062	0.000093	J B	0.000059	0.085	J	0.054	0.041	U	0.041	0.00010	J B	0.000055
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	0.00013	J	0.000071	0.00013	J	0.000067	0.14	J	0.061	0.089	J	0.047	0.00012	J	0.000062
Perfluorobutanesulfonic acid (PFBS)	0.000018	U	0.000018	0.000019	J B	0.000017	0.028	J B	0.016	0.017	J B	0.012	0.000016	J B	0.000016
Perfluorobutanoic acid (PFBA)	0.00040	U	0.00040	0.00037	U	0.00037	0.34	U	0.34	0.26	U	0.26	0.00035	U	0.00035
Perfluorodecanesulfonic acid (PFDS)	0.00005	J	0.00004	0.000045	J	0.000037	0.044	J	0.034	0.026	U	0.026	0.000039	J	0.000035
Perfluorodecanoic acid (PFDA)	0.00017	J	0.000044	0.000091	J	0.000041	0.067	J	0.038	0.063	J	0.029	0.00020	J	0.000038
Perfluorododecanoic acid (PFDoA)	0.00037	J Z	0.000031	0.00035	J Z	0.000029	0.23	J	0.027	0.18	J	0.021	0.00043	Z	0.000027
Perfluoroheptanesulfonic Acid (PFHpS)	0.000031	U	0.000031	0.000029	J	0.000029	0.027	U	0.027	0.021	U	0.021	0.000027	U	0.000027
Perfluoroheptanoic acid (PFHpA)	0.000048	U	0.000048	0.000045	U	0.000045	0.041	J	0.041	0.032	U	0.032	0.000066	J	0.000042
Perfluorohexanesulfonic acid (PFHxS)	0.000057	J B	0.000031	0.000063	J B	0.000029	0.046	J B	0.027	0.041	J B	0.021	0.000067	J B	0.000027
Perfluorohexanoic acid (PFHxA)	0.00005	U	0.00005	0.000047	U	0.000047	0.043	U	0.043	0.033	U	0.033	0.000044	U	0.000044
Perfluorononanoic acid (PFNA)	0.000082	J	0.000042	0.000043	J	0.000039	0.053	J	0.036	0.046	J	0.028	0.00012	J	0.000036
Perfluorooctanesulfonamide (PFOSA)	0.000018	J	0.000018	0.000017	U	0.000017	0.016	U	0.016	0.012	U	0.012	0.000024	J	0.000016
Perfluorooctanesulfonic acid (PFOS)	0.00051		0.00014	0.00032	J	0.00013	0.33	J	0.12	0.23	J	0.092	0.00051		0.00012
Perfluorooctanoic acid (PFOA)	0.000082	J B	0.000029	0.000096	J B	0.000027	0.13	J B	0.025	0.12	J B	0.019	0.00012	J B	0.000026
Perfluoropentanoic acid (PFPeA)	0.000037	U	0.000037	0.000035	U	0.000035	0.056	J	0.032	0.084	J	0.025	0.000033	U	0.000033
Perfluorotetradecanoic acid (PFTeA)	0.00022	J	0.00004	0.00021	J	0.000037	0.15	J	0.034	0.11	J	0.026	0.00022	J	0.000035
Perfluorotridecanoic acid (PFTriA)	0.00033	J	0.000027	0.00030	J	0.000025	0.15	J	0.023	0.16	J	0.018	0.00033	J	0.000024
Perfluoroundecanoic acid (PFUnA)	0.00084		0.00005	0.00055		0.000047	0.33	J	0.043	0.23	J	0.033	0.00070		0.000044

B : Compound was found in the blank and sample.
J : Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
U : Indicates the analyte was analyzed for but not detected.
Z : Data contains important qualifier codes see hardcopy report and report narrative for further details.

Results with 'U' Qualified Valeus Set to Zero and All Results Converted ug/kg

Client ID	BWR-DAM2-T1-0320			BWR-DAM4-T1-0320			BWR-DAM6-T1-0620			BWR-DAM7-T1-0320			BWR-DAM8-T1-0320		
Lab Sample ID			460-205020-1			460-205020-4			460-210989-1			460-205020-11			460-205020-14
Sampling Date			03/06/2020 10:30:00			03/09/2020 13:55:00			06/10/2020 11:15:00			03/10/2020 13:15:00			03/11/2020 12:15:00
Matrix			Soil			Soil			Soil			Soil			Soil
Dilution Factor			1			1			1			1			1
Unit			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg
	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 537 (MODIFIED)															
1H,1H,2H,2H-perfluorodecanesulfonic acid (8:2)	0	U Z	0.046	0	U Z	0.064	0	U	0	0	U Z	0.047	0	U	0.055
1H,1H,2H,2H-perfluorooctanesulfonic acid (6:2)	0.056	J Z	0.035	0	U Z	0.048	0.057	J	0.04	0	U Z	0.036	0	U	0.042
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	0.17	J Z	0.048	0.083	J Z	0.066	0.073	J B	0.055	0.049	J Z	0.049	0.63	J	0.057
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	0.055	J Z	0.054	0.18	J Z	0.075	0.086	J	0.062	0	U Z	0.056	0.11	J	0.064
Perfluorobutanesulfonic acid (PFBS)	0.051	J Z B	0.014	0.031	J Z B	0.019	0.017	J B	0.016	0.039	J Z B	0.014	0.019	J B	0.017
Perfluorobutanoic acid (PFBA)	0	U Z	0.3	0	U Z	0.42	0	U	0.35	0	U Z	0.31	0	U	0.36
Perfluorodecanesulfonic acid (PFDS)	0	U Z	0.03	0.076	J Z	0.042	0.05	J	0.035	0.046	J Z	0.031	0.043	J	0.036
Perfluorodecanoic acid (PFDA)	0.045	J Z	0.034	0.24	J Z	0.046	0.24	J	0.038	0.082	J Z	0.034	0	U	0.04
Perfluorododecanoic acid (PFDoA)	0.12	J Z	0.024	0.62	Z	0.033	0.52	Z	0.027	0.18	J Z	0.025	0.058	J	0.028
Perfluoroheptanesulfonic Acid (PFHpS)	0	U Z	0.024	0	U Z	0.033	0	U	0.027	0	U Z	0.025	0	U	0.028
Perfluoroheptanoic acid (PFHpA)	0	U Z	0.037	0	U Z	0.05	0.059	J	0.042	0.044	J Z	0.038	0	U	0.044
Perfluorohexanesulfonic acid (PFHxS)	0.044	J Z B	0.024	0.063	J Z B	0.033	0.038	J B	0.027	0.049	J Z B	0.025	0.042	J B	0.028
Perfluorohexanoic acid (PFHxA)	0.066	J Z	0.038	0	U Z	0.053	0	U	0.044	0.039	J Z	0.039	0	U	0.045
Perfluorononanoic acid (PFNA)	0.049	J Z	0.032	0.11	J Z	0.044	0.12	J	0.036	0.059	J Z	0.033	0.043	J	0.038
Perfluorooctanesulfonamide (PFOSA)	0.018	J Z	0.014	0.03	J Z	0.019	0.017	J	0.016	0	U Z	0.014	0.021	J	0.017
Perfluorooctanesulfonic acid (PFOS)	0.19	J Z	0.11	0.54	Z	0.15	0.6		0.12	0.26	J Z	0.11	0.18	J	0.13
Perfluorooctanoic acid (PFOA)	0.12	J Z B	0.022	0.16	J Z B	0.031	0.11	J B	0.026	0.2	J Z B	0.023	0.098	J B	0.027
Perfluoropentanoic acid (PFPeA)	0.078	J Z	0.029	0.072	J Z	0.039	0	U	0.033	0.13	J Z	0.029	0.1	J	0.034
Perfluorotetradecanoic acid (PFTeA)	0.1	J Z	0.03	0.41	J Z	0.042	0.25	J	0.035	0.12	J Z	0.031	0.053	J	0.036
Perfluorotridecanoic acid (PFTriA)	0.09	J Z	0.021	0.42	J Z	0.028	0.36		0.024	0.13	J Z	0.021	0.045	J	0.025
Perfluoroundecanoic acid (PFUnA)	0.19	J Z	0.038	0.76	Z	0.053	0.87		0.044	0.21	J Z	0.039	0.1	J	0.045

Client ID	BWR-DAM9-T1-0620			BWR-DAM10-T1-0620			BWR-DAM11-T1-0320			BWR-DUP1-0320			BWR-DUP2-0620		
Lab Sample ID			460-210989-4			460-210989-6			460-205020-16			460-205020-18			460-210989-8
Sampling Date			06/09/2020 14:15:00			06/09/2020 11:10:00			03/12/2020 12:10:00			03/12/2020 00:00:00			06/10/2020 00:00:00
Matrix			Soil			Soil			Soil			Soil			Soil
Dilution Factor			1			1			1			1			1
Unit			mg/kg			mg/kg			ug/kg			ug/kg			mg/kg
	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 537 (MODIFIED)															
1H,1H,2H,2H-perfluorodecanesulfonic acid (8:2)	0	U	0	0	U	0	0	U	0.052	0	U	0.04	0	U	0
1H,1H,2H,2H-perfluorooctanesulfonic acid (6:2)	0	U	0.046	0	U	0.043	0	U	0.039	0	U	0.03	0.093	J	0.04
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	0.14	J B	0.062	0.093	J B	0.059	0.085	J	0.054	0	U	0.041	0.1	J B	0.055
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	0.13	J	0.071	0.13	J	0.067	0.14	J	0.061	0.089	J	0.047	0.12	J	0.062
Perfluorobutanesulfonic acid (PFBS)	0	U	0.018	0.019	J B	0.017	0.028	J B	0.016	0.017	J B	0.012	0.016	J B	0.016
Perfluorobutanoic acid (PFBA)	0	U	0.4	0	U	0.37	0	U	0.34	0	U	0.26	0	U	0.35
Perfluorodecanesulfonic acid (PFDS)	0.05	J	0.04	0.045	J	0.037	0.044	J	0.034	0	U	0.026	0.039	J	0.035
Perfluorodecanoic acid (PFDA)	0.17	J	0.044	0.091	J	0.041	0.067	J	0.038	0.063	J	0.029	0.2	J	0.038
Perfluorododecanoic acid (PFDoA)	0.37	J Z	0.031	0.35	J Z	0.029	0.23	J	0.027	0.18	J	0.021	0.43	Z	0.027
Perfluoroheptanesulfonic Acid (PFHpS)	0	U	0.031	0.029	J	0.029	0	U	0.027	0	U	0.021	0	U	0.027
Perfluoroheptanoic acid (PFHpA)	0	U	0.048	0	U	0.045	0.041	J	0.041	0	U	0.032	0.066	J	0.042
Perfluorohexanesulfonic acid (PFHxS)	0.057	J B	0.031	0.063	J B	0.029	0.046	J B	0.027	0.041	J B	0.021	0.067	J B	0.027
Perfluorohexanoic acid (PFHxA)	0	U	0.05	0	U	0.047	0	U	0.043	0	U	0.033	0	U	0.044
Perfluorononanoic acid (PFNA)	0.082	J	0.042	0.043	J	0.039	0.053	J	0.036	0.046	J	0.028	0.12	J	0.036
Perfluorooctanesulfonamide (PFOSA)	0.018	J	0.018	0	U	0.017	0	U	0.016	0	U	0.012	0.024	J	0.016
Perfluorooctanesulfonic acid (PFOS)	0.51		0.14	0.32	J	0.13	0.33	J	0.12	0.23	J	0.092	0.51		0.12
Perfluorooctanoic acid (PFOA)	0.082	J B	0.029	0.096	J B	0.027	0.13	J B	0.025	0.12	J B	0.019	0.12	J B	0.026
Perfluoropentanoic acid (PFPeA)	0	U	0.037	0	U	0.035	0.056	J	0.032	0.084	J	0.025	0	U	0.033
Perfluorotetradecanoic acid (PFTeA)	0.22	J	0.04	0.21	J	0.037	0.15	J	0.034	0.11	J	0.026	0.22	J	0.035
Perfluorotridecanoic acid (PFTriA)	0.33	J	0.027	0.3	J	0.025	0.15	J	0.023	0.16	J	0.018	0.33	J	0.024
Perfluoroundecanoic acid (PFUnA)	0.84		0.05	0.55		0.047	0.33	J	0.043	0.23	J	0.033	0.7		0.044

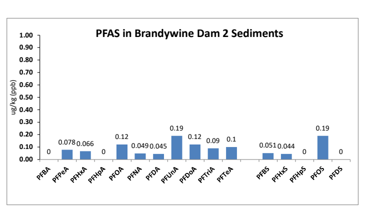
Results Reordered by Carbon Chain Length and Functional Group

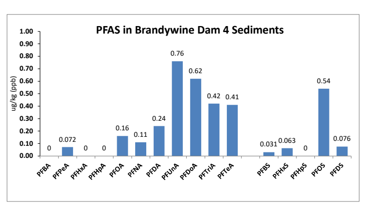
Client ID	BWR-DAM2-T1-0320			BWR-DAM4-T1-0320			BWR-DAM6-T1-0620			BWR-DAM7-T1-0320			BWR-DAM8-T1-0320		
Lab Sample ID			460-205020-1			460-205020-4			460-210989-1			460-205020-11			460-205020-14
Sampling Date			03/06/2020 10:30:00			03/09/2020 13:55:00			06/10/2020 11:15:00			03/10/2020 13:15:00			03/11/2020 12:15:00
Matrix			Soil			Soil			Soil			Soil			Soil
Dilution Factor			1			1			1			1			1
Unit			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg
	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 537 (MODIFIED)															
Perluoroalkylcarboxylic Acids (PFCAs)															
Perfluorobutanoic acid (PFBA)	0 U Z		0.3	0 U Z		0.42	0 U		0.35	0 U Z		0.31	0 U		0.36
Perfluoropentanoic acid (PFPeA)	0.078 J Z		0.029	0.072 J Z		0.039	0 U		0.033	0.13 J Z		0.029	0.1 J		0.034
Perfluorohexanoic acid (PFHxA)	0.066 J Z		0.038	0 U Z		0.053	0 U		0.044	0.039 J Z		0.039	0 U		0.045
Perfluoroheptanoic acid (PFHpA)	0 U Z		0.037	0 U Z		0.05	0.059 J		0.042	0.044 J Z		0.038	0 U		0.044
Perfluorooctanoic acid (PFOA)	0.12 J Z B		0.022	0.16 J Z B		0.031	0.11 J B		0.026	0.2 J Z B		0.023	0.098 J B		0.027
Perfluorononanoic acid (PFNA)	0.049 J Z		0.032	0.11 J Z		0.044	0.12 J		0.036	0.059 J Z		0.033	0.043 J		0.038
Perfluorodecanoic acid (PFDA)	0.045 J Z		0.034	0.24 J Z		0.046	0.24 J		0.038	0.082 J Z		0.034	0 U		0.04
Perfluoroundecanoic acid (PFUnA)	0.19 J Z		0.038	0.76 Z		0.053	0.87		0.044	0.21 J Z		0.039	0.1 J		0.045
Perfluorododecanoic acid (PFDoA)	0.12 J Z		0.024	0.62 Z		0.033	0.52 Z		0.027	0.18 J Z		0.025	0.058 J		0.028
Perfluorotridecanoic acid (PFTriA)	0.09 J Z		0.021	0.42 J Z		0.028	0.36		0.024	0.13 J Z		0.021	0.045 J		0.025
Perfluorotetradecanoic acid (PFTeA)	0.1 J Z		0.03	0.41 J Z		0.042	0.25 J		0.035	0.12 J Z		0.031	0.053 J		0.036
Perluoroalkylsulfonic Acids (PFSAs)															
Perfluorobutanesulfonic acid (PFBS)	0.051 J Z B		0.014	0.031 J Z B		0.019	0.017 J B		0.016	0.039 J Z B		0.014	0.019 J B		0.017
Perfluorohexanesulfonic acid (PFHxS)	0.044 J Z B		0.024	0.063 J Z B		0.033	0.038 J B		0.027	0.049 J Z B		0.025	0.042 J B		0.028
Perfluoroheptanesulfonic Acid (PFHpS)	0 U Z		0.024	0 U Z		0.033	0 U		0.027	0 U Z		0.025	0 U		0.028
Perfluorooctanesulfonic acid (PFOS)	0.19 J Z		0.11	0.54 Z		0.15	0.6		0.12	0.26 J Z		0.11	0.18 J		0.13
Perfluorodecanesulfonic acid (PFDS)	0 U Z		0.03	0.076 J Z		0.042	0.05 J		0.035	0.046 J Z		0.031	0.043 J		0.036
Perfluorooctanesulfonamides (FOSAs)															
Perfluorooctanesulfonamide (PFOSA)	0.018 J Z		0.014	0.03 J Z		0.019	0.017 J		0.016	0 U Z		0.014	0.021 J		0.017
Telomer Sulfonic Acids															
1H,1H,2H,2H-perfluorooctanesulfonic acid (6:2)	0.056 J Z		0.035	0 U Z		0.048	0.057 J		0.04	0 U Z		0.036	0 U		0.042
1H,1H,2H,2H-perfluorodecanesulfonic acid (8:2)	0 U Z		0.046	0 U Z		0.064	0 U		0	0 U Z		0.047	0 U		0.055
Perfluorooctanesulfonamidoacedic acids (FOSAAs)															
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	0.055 J Z		0.054	0.18 J Z		0.075	0.086 J		0.062	0 U Z		0.056	0.11 J		0.064
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	0.17 J Z		0.048	0.083 J Z		0.066	0.073 J B		0.055	0.049 J Z		0.049	0.63 J		0.057

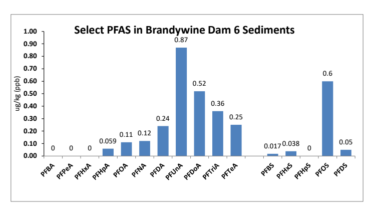
Client ID	BWR-DAM9-T1-0620			BWR-DAM10-T1-0620			BWR-DAM11-T1-0320			BWR-DUP1-0320			BWR-DUP2-0620		
Lab Sample ID			460-210989-4			460-210989-6			460-205020-16			460-205020-18			460-210989-8
Sampling Date			06/09/2020 14:15:00			06/09/2020 11:10:00			03/12/2020 12:10:00			03/12/2020 00:00:00			06/10/2020 00:00:00
Matrix			Soil			Soil			Soil			Soil			Soil
Dilution Factor			1			1			1			1			1
Unit			ug/kg			ug/kg			ug/kg			ug/kg			ug/kg
	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 537 (MODIFIED)															
Perluoroalkylcarboxylic Acids (PFCAs)															
Perfluorobutanoic acid (PFBA)	0 U		0.4	0 U		0.37	0 U		0.34	0 U		0.26	0 U		0.35
Perfluoropentanoic acid (PFPeA)	0 U		0.037	0 U		0.035	0.056 J		0.032	0.084 J		0.025	0 U		0.033
Perfluorohexanoic acid (PFHxA)	0 U		0.05	0 U		0.047	0 U		0.043	0 U		0.033	0 U		0.044
Perfluoroheptanoic acid (PFHpA)	0 U		0.048	0 U		0.045	0.041 J		0.041	0 U		0.032	0.066 J		0.042
Perfluorooctanoic acid (PFOA)	0.082 J B		0.029	0.096 J B		0.027	0.13 J B		0.025	0.12 J B		0.019	0.12 J B		0.026
Perfluorononanoic acid (PFNA)	0.082 J		0.042	0.043 J		0.039	0.053 J		0.036	0.046 J		0.028	0.12 J		0.036
Perfluorodecanoic acid (PFDA)	0.17 J		0.044	0.091 J		0.041	0.067 J		0.038	0.063 J		0.029	0.2 J		0.038
Perfluoroundecanoic acid (PFUnA)	0.84		0.05	0.55		0.047	0.33 J		0.043	0.23 J		0.033	0.7		0.044
Perfluorododecanoic acid (PFDoA)	0.37 J Z		0.031	0.35 J Z		0.029	0.23 J		0.027	0.18 J		0.021	0.43 Z		0.027
Perfluorotridecanoic acid (PFTriA)	0.33 J		0.027	0.3 J		0.025	0.15 J		0.023	0.16 J		0.018	0.33 J		0.024
Perfluorotetradecanoic acid (PFTeA)	0.22 J		0.04	0.21 J		0.037	0.15 J		0.034	0.11 J		0.026	0.22 J		0.035
Perluoroalkylsulfonic Acids (PFSAs)															
Perfluorobutanesulfonic acid (PFBS)	0 U		0.018	0.019 J B		0.017	0.028 J B		0.016	0.017 J B		0.012	0.016 J B		0.016
Perfluorohexanesulfonic acid (PFHxS)	0.057 J B		0.031	0.063 J B		0.029	0.046 J B		0.027	0.041 J B		0.021	0.067 J B		0.027
Perfluoroheptanesulfonic Acid (PFHpS)	0 U		0.031	0.029 J		0.029	0 U		0.027	0 U		0.021	0 U		0.027
Perfluorooctanesulfonic acid (PFOS)	0.51		0.14	0.32 J		0.13	0.33 J		0.12	0.23 J		0.092	0.51		0.12
Perfluorodecanesulfonic acid (PFDS)	0.05 J		0.04	0.045 J		0.037	0.044 J		0.034	0 U		0.026	0.039 J		0.035
Perfluorooctanesulfonamides (FOSAs)															
Perfluorooctanesulfonamide (PFOSA)	0.018 J		0.018	0 U		0.017	0 U		0.016	0 U		0.012	0.024 J		0.016
Telomer Sulfonic Acids															
1H,1H,2H,2H-perfluorooctanesulfonic acid (6:2)	0 U		0.046	0 U		0.043	0 U		0.039	0 U		0.03	0.093 J		0.04
1H,1H,2H,2H-perfluorodecanesulfonic acid (8:2)	0 U		0	0 U		0	0 U		0.052	0 U		0.04	0 U		0
Perfluorooctanesulfonamidoacedic acids (FOSAAs)															
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	0.13 J		0.071	0.13 J		0.067	0.14 J		0.061	0.089 J		0.047	0.12 J		0.062
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	0.14 J B		0.062	0.093 J B		0.059	0.085 J		0.054	0 U		0.041	0.1 J B		0.055

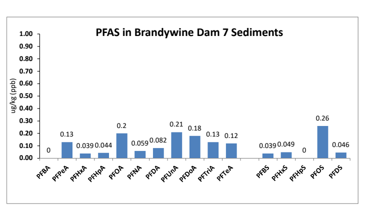
	DAM2	DAM4	DAM6	DAM7	DAM8	DAM9	DAM10	DAM11	DUP1	DUP2
Total PFCAs (ppb)	0.858	2.792	2.529	1.194	0.497	2.094	1.64	1.207	0.993 (DUP to D11T1)	2.186 (DUP to D6T1)
Total PFSAs (ppb)	0.285	0.71	0.705	0.394	0.284	0.617	0.476	0.448	0.288	0.632
Total FOSAs (ppb)	0.018	0.03	0.017	0	0.021	0.018	0	0	0	0.024
Total Telomer Sulfonic Acids (ppb)	0.056	0	0.057	0	0	0	0	0	0	0.093
Total FOSAAs (ppb)	0.225	0.263	0.159	0.049	0.74	0.27	0.223	0.225	0.089	0.22
Total PFOA (ppb)	0.12	0.16	0.11	0.2	0.098	0.082	0.096	0.13	0.12	0.12
Total PFOS (ppb)	0.19	0.54	0.6	0.26	0.18	0.51	0.32	0.33	0.23	0.51

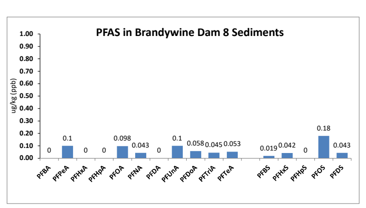
Carbon Chain Length	Abbreviation	Perluoroalkylcarboxylic Acids (PFCAs)
4	PFBA	Perfluorobutanoic acid (PFBA)
5	PFPeA	Perfluoropentanoic acid (PFPeA)
6	PFHxA	Perfluorohexanoic acid (PFHxA)
7	PFHpA	Perfluoroheptanoic acid (PFHpA)
8	PFOA	Perfluorooctanoic acid (PFOA)
9	PFNA	Perfluorononanoic acid (PFNA)
10	PFDA	Perfluorodecanoic acid (PFDA)
11	PFUnA	Perfluoroundecanoic acid (PFUnA)
12	PFDoA	Perfluorododecanoic acid (PFDoA)
13	PFTriA	Perfluorotridecanoic acid (PFTriA)
14	PFTeA	Perfluorotetradecanoic acid (PFTeA)
		Perluoroalkylsulfonic Acids (PFSAs)
4	PFBS	Perfluorobutanesulfonic acid (PFBS)
6	PFHxS	Perfluorohexanesulfonic acid (PFHxS)
7	PFHpS	Perfluoroheptanesulfonic Acid (PFHpS)
8	PFOS	Perfluorooctanesulfonic acid (PFOS)
10	PFDS	Perfluorodecanesulfonic acid (PFDS)
		Perfluorooctanesulfonamides (FOSAs)
8	PFOSA	Perfluorooctanesulfonamide (PFOSA)
		Telomer Sulfonic Acids
8	6:2 FTS	1H,1H,2H,2H-Perfluorooctanesulfonic acid (6:2 FTS)
10	8:2 FTS	1H,1H,2H,2H-Perfluorodecanesulfonic acid (8:2 FTS)
		Perfluorooctanesulfonamidoacedic acids (FOSAAs)
8	NMeFOSAA	N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)
8	NetFOSAA	N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)

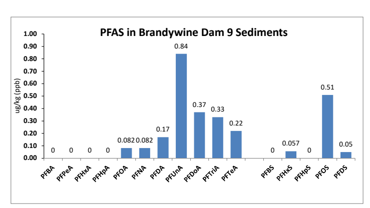


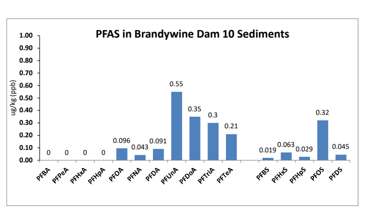


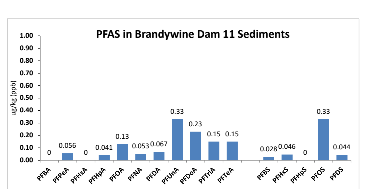












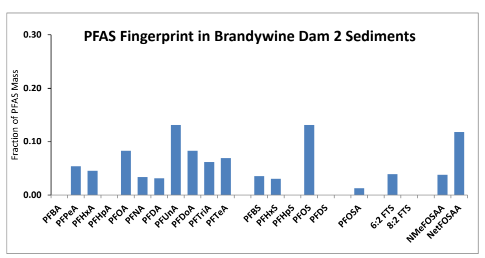
Results Reordered by Carbon Chain Length and Functional Group

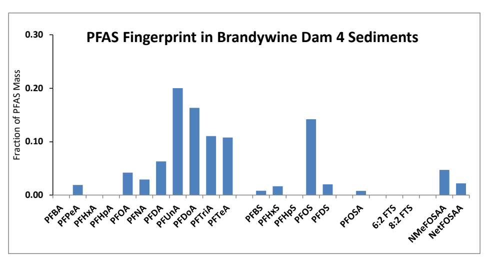
Client ID	BWR-DAM2-T1-0320			BWR-DAM4-T1-0320			BWR-DAM6-T1-0620			BWR-DAM7-T1-0320			BWR-DAM8-T1-0320		
Lab Sample ID	460-205020-1			460-205020-4			460-210989-1			460-205020-11			460-205020-14		
Sampling Date	03/06/2020 10:30:00			03/09/2020 13:55:00			06/10/2020 11:15:00			03/10/2020 13:15:00			03/11/2020 12:15:00		
Matrix	Soil			Soil			Soil			Soil			Soil		
Dilution Factor	1			1			1			1			1		
Unit	ug/kg			ug/kg			ug/kg			ug/kg			ug/kg		
	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 537 (MODIFIED)															
Perluoroalkylcarboxylic Acids (PFCAs)															
Perfluorobutanoic acid (PFBA)	0	U Z	0.3	0	U Z	0.42	0	U	0.35	0	U Z	0.31	0	U	0.36
Perfluoropentanoic acid (PFPeA)	0.078	J Z	0.029	0.072	J Z	0.039	0	U	0.033	0.13	J Z	0.029	0.1	J	0.034
Perfluorohexanoic acid (PFHxA)	0.066	J Z	0.038	0	U Z	0.053	0	U	0.044	0.039	J Z	0.039	0	U	0.045
Perfluoroheptanoic acid (PFHpA)	0	U Z	0.037	0	U Z	0.05	0.059	J	0.042	0.044	J Z	0.038	0	U	0.044
Perfluorooctanoic acid (PFOA)	0.12	J Z B	0.022	0.16	J Z B	0.031	0.11	J B	0.026	0.2	J Z B	0.023	0.098	J B	0.027
Perfluorononanoic acid (PFNA)	0.049	J Z	0.032	0.11	J Z	0.044	0.12	J	0.036	0.059	J Z	0.033	0.043	J	0.038
Perfluorodecanoic acid (PFDA)	0.045	J Z	0.034	0.24	J Z	0.046	0.24	J	0.038	0.082	J Z	0.034	0	U	0.04
Perfluoroundecanoic acid (PFUnA)	0.19	J Z	0.038	0.76	Z	0.053	0.87		0.044	0.21	J Z	0.039	0.1	J	0.045
Perfluorododecanoic acid (PFDoA)	0.12	J Z	0.024	0.62	Z	0.033	0.52	Z	0.027	0.18	J Z	0.025	0.058	J	0.028
Perfluorotridecanoic acid (PFTriA)	0.09	J Z	0.021	0.42	J Z	0.028	0.36		0.024	0.13	J Z	0.021	0.045	J	0.025
Perfluorotetradecanoic acid (PFTeA)	0.1	J Z	0.03	0.41	J Z	0.042	0.25	J	0.035	0.12	J Z	0.031	0.053	J	0.036
Perluoroalkylsulfonic Acids (PFSAs)															
Perfluorobutanesulfonic acid (PFBS)	0.051	J Z B	0.014	0.031	J Z B	0.019	0.017	J B	0.016	0.039	J Z B	0.014	0.019	J B	0.017
Perfluorohexanesulfonic acid (PFHxS)	0.044	J Z B	0.024	0.063	J Z B	0.033	0.038	J B	0.027	0.049	J Z B	0.025	0.042	J B	0.028
Perfluoroheptanesulfonic Acid (PFHpS)	0	U Z	0.024	0	U Z	0.033	0	U	0.027	0	U Z	0.025	0	U	0.028
Perfluorooctanesulfonic acid (PFOS)	0.19	J Z	0.11	0.54	Z	0.15	0.6		0.12	0.26	J Z	0.11	0.18	J	0.13
Perfluorodecanesulfonic acid (PFDS)	0	U Z	0.03	0.076	J Z	0.042	0.05	J	0.035	0.046	J Z	0.031	0.043	J	0.036
Perfluorooctanesulfonamides (FOSAs)															
Perfluorooctanesulfonamide (PFOSA)	0.018	J Z	0.014	0.03	J Z	0.019	0.017	J	0.016	0	U Z	0.014	0.021	J	0.017
Telomer Sulfonic Acids															
1H,1H,2H,2H-perfluorooctanesulfonic acid (6:2)	0.056	J Z	0.035	0	U Z	0.048	0.057	J	0.04	0	U Z	0.036	0	U	0.042
1H,1H,2H,2H-perfluorodecanesulfonic acid (8:2)	0	U Z	0.046	0	U Z	0.064	0	U	0	0	U Z	0.047	0	U	0.055
Perfluorooctanesulfonamidoacedic acids (FOSAAs)															
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	0.055	J Z	0.054	0.18	J Z	0.075	0.086	J	0.062	0	U Z	0.056	0.11	J	0.064
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	0.17	J Z	0.048	0.083	J Z	0.066	0.073	J B	0.055	0.049	J Z	0.049	0.63	J	0.057
Sum PFAS	1.442			3.795			3.467			1.637			1.542		

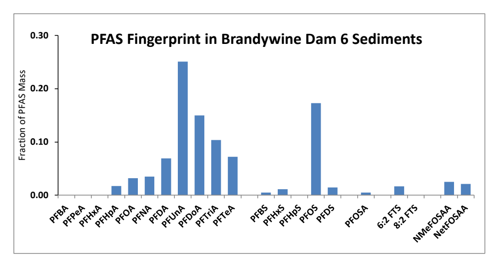
Client ID	BWR-DAM9-T1-0620			BWR-DAM10-T1-0620			BWR-DAM11-T1-0320			BWR-DUP1-0320			BWR-DUP2-0620		
Lab Sample ID	460-210989-4			460-210989-6			460-205020-16			460-205020-18			460-210989-8		
Sampling Date	06/09/2020 14:15:00			06/09/2020 11:10:00			03/12/2020 12:10:00			03/12/2020 00:00:00			06/10/2020 00:00:00		
Matrix	Soil			Soil			Soil			Soil			Soil		
Dilution Factor	1			1			1			1			1		
Unit	ug/kg			ug/kg			ug/kg			ug/kg			ug/kg		
	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
SOIL BY 537 (MODIFIED)															
Perluoroalkylcarboxylic Acids (PFCAs)															
Perfluorobutanoic acid (PFBA)	0	U	0.4	0	U	0.37	0	U	0.34	0	U	0.26	0	U	0.35
Perfluoropentanoic acid (PFPeA)	0	U	0.037	0	U	0.035	0.056	J	0.032	0.084	J	0.025	0	U	0.033
Perfluorohexanoic acid (PFHxA)	0	U	0.05	0	U	0.047	0	U	0.043	0	U	0.033	0	U	0.044
Perfluoroheptanoic acid (PFHpA)	0	U	0.048	0	U	0.045	0.041	J	0.041	0	U	0.032	0.066	J	0.042
Perfluorooctanoic acid (PFOA)	0.082	J B	0.029	0.096	J B	0.027	0.13	J B	0.025	0.12	J B	0.019	0.12	J B	0.026
Perfluorononanoic acid (PFNA)	0.082	J	0.042	0.043	J	0.039	0.053	J	0.036	0.046	J	0.028	0.12	J	0.036
Perfluorodecanoic acid (PFDA)	0.17	J	0.044	0.091	J	0.041	0.067	J	0.038	0.063	J	0.029	0.2	J	0.038
Perfluoroundecanoic acid (PFUnA)	0.84		0.05	0.55		0.047	0.33	J	0.043	0.23	J	0.033	0.7		0.044
Perfluorododecanoic acid (PFDoA)	0.37	J Z	0.031	0.35	J Z	0.029	0.23	J	0.027	0.18	J	0.021	0.43	Z	0.027
Perfluorotridecanoic acid (PFTriA)	0.33	J	0.027	0.3	J	0.025	0.15	J	0.023	0.16	J	0.018	0.33	J	0.024
Perfluorotetradecanoic acid (PFTeA)	0.22	J	0.04	0.21	J	0.037	0.15	J	0.034	0.11	J	0.026	0.22	J	0.035
Perluoroalkylsulfonic Acids (PFSAs)															
Perfluorobutanesulfonic acid (PFBS)	0	U	0.018	0.019	J B	0.017	0.028	J B	0.016	0.017	J B	0.012	0.016	J B	0.016
Perfluorohexanesulfonic acid (PFHxS)	0.057	J B	0.031	0.063	J B	0.029	0.046	J B	0.027	0.041	J B	0.021	0.067	J B	0.027
Perfluoroheptanesulfonic Acid (PFHpS)	0	U	0.031	0.029	J	0.029	0	U	0.027	0	U	0.021	0	U	0.027
Perfluorooctanesulfonic acid (PFOS)	0.51		0.14	0.32	J	0.13	0.33	J	0.12	0.23	J	0.092	0.51		0.12
Perfluorodecanesulfonic acid (PFDS)	0.05	J	0.04	0.045	J	0.037	0.044	J	0.034	0	U	0.026	0.039	J	0.035
Perfluorooctanesulfonamides (FOSAs)															
Perfluorooctanesulfonamide (PFOSA)	0.018	J	0.018	0	U	0.017	0	U	0.016	0	U	0.012	0.024	J	0.016
Telomer Sulfonic Acids															
1H,1H,2H,2H-perfluorooctanesulfonic acid (6:2)	0	U	0.046	0	U	0.043	0	U	0.039	0	U	0.03	0.093	J	0.04
1H,1H,2H,2H-perfluorodecanesulfonic acid (8:2)	0	U	0	0	U	0	0	U	0.052	0	U	0.04	0	U	0
Perfluorooctanesulfonamidoacedic acids (FOSAAs)															
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	0.13	J	0.071	0.13	J	0.067	0.14	J	0.061	0.089	J	0.047	0.12	J	0.062
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	0.14	J B	0.062	0.093	J B	0.059	0.085	J	0.054	0	U	0.041	0.1	J B	0.055
Sum PFAS	2.999			2.339			1.88			1.37			3.155		

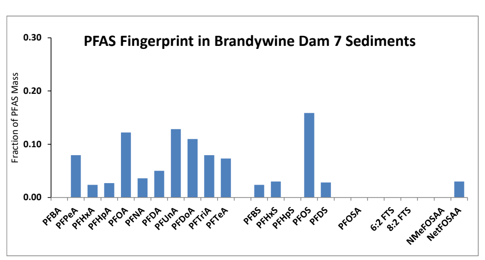
Fingerprints - Total PFAS

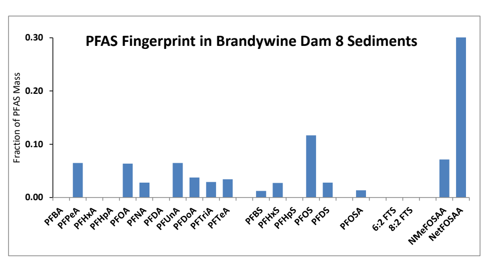
Client ID	BWR-DAM2-T1-0320	BWR-DAM4-T1-0320	BWR-DAM6-T1-0620	BWR-DAM7-T1-0320	BWR-DAM8-T1-0320	BWR-DAM9-T1-0620	BWR-DAM10-T1-0620	BWR-DAM11-T1-0320	BWR-DUP1-0320	BWR-DUP2-0620
Lab Sample ID	460-205020-1	460-205020-4	460-210989-1	460-205020-11	460-205020-14	460-210989-4	460-210989-6	460-205020-16	460-205020-18	460-210989-8
Sampling Date	03/06/2020 10:30:00	03/09/2020 13:55:00	06/10/2020 11:15:00	03/10/2020 13:15:00	03/11/2020 12:15:00	06/09/2020 14:15:00	06/09/2020 11:10:00	03/12/2020 12:10:00	03/12/2020 00:00:00	06/10/2020 00:00:00
Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Dilution Factor	1	1	1	1	1	1	1	1	1	1
Unit	Decimal	Decimal	Decimal	Decimal	Decimal	Decimal	Decimal	Decimal	Decimal	Decimal
	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
SOIL BY 537 (MODIFIED)										
Perluoroalkylcarboxylic Acids (PFCAs)										
Perfluorobutanoic acid (PFBA)	0	0	0	0	0	0	0	0	0	0
Perfluoropentanoic acid (PFPeA)	0.054092	0.018972	0	0.079414	0.064851	0	0	0.029787	0.061314	0
Perfluorohexanoic acid (PFHxA)	0.04577	0	0	0.023824	0	0	0	0	0	0
Perfluoroheptanoic acid (PFHpA)	0	0	0.017018	0.026878	0	0	0	0.021809	0	0.020919
Perfluorooctanoic acid (PFOA)	0.083218	0.042161	0.031728	0.122175	0.063554	0.027342	0.041043	0.069149	0.087591	0.038035
Perfluorononanoic acid (PFNA)	0.033981	0.028986	0.034612	0.036042	0.027886	0.027342	0.018384	0.028191	0.033577	0.038035
Perfluorodecanoic acid (PFDA)	0.031207	0.063241	0.069224	0.050092	0	0.056686	0.038906	0.035638	0.045985	0.063391
Perfluoroundecanoic acid (PFUnA)	0.131761	0.200264	0.250937	0.128283	0.064851	0.280093	0.235143	0.175532	0.167883	0.22187
Perfluorododecanoic acid (PFDoA)	0.083218	0.163373	0.149986	0.109957	0.037613	0.123374	0.149637	0.12234	0.131387	0.136292
Perfluorotridecanoic acid (PFTriA)	0.062413	0.110672	0.103836	0.079414	0.029183	0.110037	0.12826	0.079787	0.116788	0.104596
Perfluorotetradecanoic acid (PFTeA)	0.069348	0.108037	0.072108	0.073305	0.034371	0.073358	0.089782	0.079787	0.080292	0.069731
Perluoroalkylsulfonic Acids (PFSAs)										
Perfluorobutanesulfonic acid (PFBS)	0.035368	0.008169	0.004903	0.023824	0.012322	0	0.008123	0.014894	0.012409	0.005071
Perfluorohexanesulfonic acid (PFHxS)	0.030513	0.016601	0.01096	0.029933	0.027237	0.019006	0.026935	0.024468	0.029927	0.021236
Perfluoroheptanesulfonic Acid (PFHpS)	0	0	0	0	0	0	0.012398	0	0	0
Perfluorooctanesulfonic acid (PFOS)	0.131761	0.142292	0.17306	0.158827	0.116732	0.170057	0.136811	0.175532	0.167883	0.161648
Perfluorodecanesulfonic acid (PFDS)	0	0.020026	0.014422	0.0281	0.027886	0.016672	0.019239	0.023404	0	0.012361
Perfluorooctanesulfonamides (FOSAs)										
Perfluorooctanesulfonamide (PFOSA)	0.012483	0.007905	0.004903	0	0.013619	0.006002	0	0	0	0.007607
Telomer Sulfonic Acids										
1H,1H,2H,2H-perfluorooctanesulfonic acid (6:2)	0.038835	0	0.016441	0	0	0	0	0	0	0.029477
1H,1H,2H,2H-perfluorodecanesulfonic acid (8:2)	0	0	0	0	0	0	0	0	0	0
Perfluorooctanesulfonamidoacedic acids (FOSAAs)										
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	0.038141	0.047431	0.024805	0	0.071336	0.043348	0.055579	0.074468	0.064964	0.038035
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	0.117892	0.021871	0.021056	0.029933	0.40856	0.046682	0.039761	0.045213	0	0.031696
	1	1	1	1	1	1	1	1	1	1

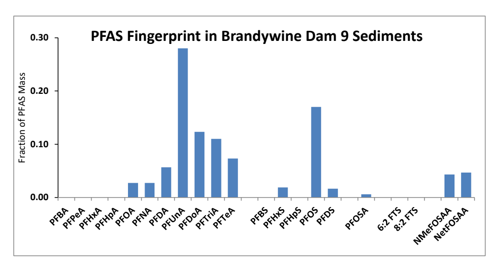


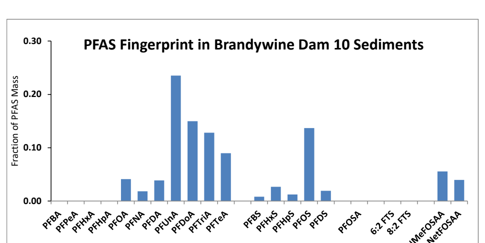


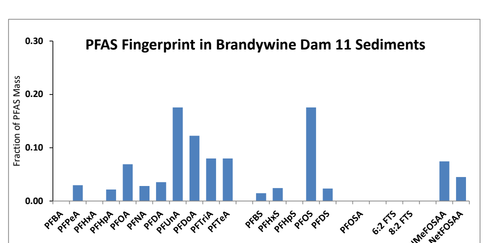












Carbon Ch	Abbreviation	Perluoroalkylcarboxylic Acids (PFCAs)
4	PFBA	Perfluorobutanoic acid (PFBA)
5	PFPeA	Perfluoropentanoic acid (PFPeA)
6	PFHxA	Perfluorohexanoic acid (PFHxA)
7	PFHpA	Perfluoroheptanoic acid (PFHpA)
8	PFOA	Perfluorooctanoic acid (PFOA)
9	PFNA	Perfluorononanoic acid (PFNA)
10	PFDA	Perfluorodecanoic acid (PFDA)
11	PFUnA	Perfluoroundecanoic acid (PFUnA)
12	PFDoA	Perfluorododecanoic acid (PFDoA)
13	PFTriA	Perfluorotridecanoic acid (PFTriA)
14	PFTeA	Perfluorotetradecanoic acid (PFTeA)
		Perluoroalkylsulfonic Acids (PFSAs)
4	PFBS	Perfluorobutanesulfonic acid (PFBS)
6	PFHxS	Perfluorohexanesulfonic acid (PFHxS)
7	PFHpS	Perfluoroheptanesulfonic Acid (PFHpS)
8	PFOS	Perfluorooctanesulfonic acid (PFOS)
10	PFDS	Perfluorodecanesulfonic acid (PFDS)
		Perfluorooctanesulfonamides (FOSAs)
8	PFOSA	Perfluorooctanesulfonamide (PFOSA)
		Telomer Sulfonic Acids
8	6:2 FTS	1H,1H,2H,2H-Perfluorooctanesulfonic acid (6:2 FTS)
10	8:2 FTS	1H,1H,2H,2H-Perfluorodecanesulfonic acid (8:2 FTS)
		Perfluorooctanesulfonamidoacedic acids (FOSAAs)
8	NMeFOSAA	N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)
8	NetFOSAA	N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)

References

DNREC. 2013. Department of Natural Resources and Environmental Control, Division of Waste and Hazardous Substances, Remediation Section, HSCA Screening Level Table, Last updated February 2020. New Castle, DE.

USEPA, 2020. Drinking Water Health Advisories for PFOA and PFOS. Webpage. https://www.epa.gov/ground-water-and-drinking-water/drinking-water-health-advisories-pfoa-and-pfos

APPENDIX D

RAIS RISK CALCULATOR OUTPUT

Site-specific Risk
Excavation Worker Soil Inputs

Variable	Excavation Worker Soil Default Value	Form-input Value
A (PEF Dispersion Constant)	16.2302	16.2302
A (VF Dispersion Constant)	11.911	11.911
A (VF Dispersion Constant - mass limit)	11.911	11.911
B (PEF Dispersion Constant)	18.7762	18.7762
B (VF Dispersion Constant)	18.4385	18.4385
B (VF Dispersion Constant - mass limit)	18.4385	18.4385
City (PEF Climate Zone) Selection	Default	Default
City (VF Climate Zone) Selection	Default	Default
C (PEF Dispersion Constant)	216.108	216.108
C (VF Dispersion Constant)	209.7845	209.7845
C (VF Dispersion Constant - mass limit)	209.7845	209.7845
foc (fraction organic carbon in soil) g/g	0.006	0.006
F(x) (function dependent on U_m/U_t) unitless	0.194	0.194
n (total soil porosity) L_{pore}/L_{soil}	0.43396	0.43396
p_b (dry soil bulk density) g/cm^3	1.5	1.5
p_b (dry soil bulk density - mass limit) g/cm^3	1.5	1.5
PEF (particulate emission factor) m^3/kg	1359344438	1359344438
p_s (soil particle density) g/cm^3	2.65	2.65
Q/C_{wind} (g/m^2-s per kg/m^3)	93.77	93.77
Q/C_{vol} (g/m^2-s per kg/m^3)	68.18	68.18
Q/C_{vol} (g/m^2-s per kg/m^3 - mass limit)	68.18	68.18
A_s (PEF acres)	0.5	0.5
A_s (VF acres)	0.5	0.5
A_s (VF mass-limit acres)	0.5	0.5
AF_{ew} (skin adherence factor - excavation worker) mg/cm^2	0.3	0.3
AT_{ew} (averaging time - excavation worker)	365	365
BW_{ew} (body weight - excavation worker) kg	80	80
ED_{ew} (exposure duration - excavation worker) yr	1	1
EF_{ew} (exposure frequency - excavation worker) day/yr	20	20
ET_{ew} (exposure time - excavation worker) hr	8	8
IR_{ew} (soil ingestion rate - excavation worker) mg/day	330	330

Output generated 03SEP2020:15:48:47

Site-specific Risk
Excavation Worker Soil Inputs

Variable	Excavation Worker Soil Default Value	Form-input Value
LT (lifetime) yr	70	70
SA_{ew} (surface area - excavation worker) cm^2/day	3527	3527
T_w (groundwater temperature) Celsius	25	25
$Theta_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396	0.28396
$Theta_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15	0.15
T (exposure interval) s	819936000	819936000
T (exposure interval) yr	26	26
U_m (mean annual wind speed) m/s	4.69	4.69
U_t (equivalent threshold value)	11.32	11.32
V (fraction of vegetative cover) unitless	0.5	0.5

Output generated 03SEP2020:15:48:47

Site-specific Risk
Excavation Worker for Soil

Chemical	CAS Number	Mutagen?	VOC?	Subchronic RfD (mg/kg-day)	SRfD Ref	Subchronic RfC (mg/m³)	SRfC Ref	SF_o (mg/kg-day)$^{-1}$	SF_o Ref	IUR (ug/m³)$^{-1}$	IUR Ref	ABS_{gi}	ABS_{derm}
Antimony (metallic)	7440-36-0	No	No	4.00E-04	PPRTV Current	1.00E-03	ATSDR Final	-		-		0.15	-
Thallium (Soluble Salts)	7440-28-0	No	No	4.00E-05	SCREEN Current	-		-		-		1	-
*Total Risk/HI				-		-		-		-		-	-

Chemical	Volatilization Factor (m³/kg)	DA	Particulate Emission Factor (m³/kg)	Soil Saturation Concentration (mg/kg)	HLC (atm-m³/mole)	Henry's Law Constant (unitless)	H` and HLC Ref	Henry's Law Constant Used in Calcs (unitless)	Normal Boiling Point BP (K)	BP Ref
Antimony (metallic)	-	-	1.36E+09	-	-	-		-	1.91E+03	PHYSPROP
Thallium (Soluble Salts)	-	-	1.36E+09	-	-	-		-	1.73E+03	PHYSPROP
*Total Risk/HI	-	-	-	-	-	-		-	-	

Chemical	Critical Temperature TC (K)	TC Ref	D_{ia}\ (cm²/s)	D_{iw}\ (cm²/s)	Soil Concentration (mg/kg)	Ingestion Noncarcinogenic CDI (mg/kg-day)	Dermal Noncarcinogenic CDI (mg/kg-day)	Inhalation Noncarcinogenic CDI (mg/m³)
Antimony (metallic)	5.07E+03	YAWS	-	-	5.5	1.24E-06	-	7.39E-11
Thallium (Soluble Salts)	4.65E+03	YAWS	-	-	0.23	5.20E-08	-	3.09E-12
*Total Risk/HI	-		-	-	-	-	-	-

Chemical	Ingestion Carcinogenic CDI (mg/kg-day)	Dermal Carcinogenic CDI (mg/kg-day)	Inhalation Carcinogenic CDI (ug/m³)	Ingestion HQ	Dermal HQ	Inhalation HQ	Total HI	Ingestion Risk	Dermal Risk	Inhalation Risk	Total Risk
Antimony (metallic)	1.78E-08	-	1.06E-09	3.11E-03	-	7.39E-08	3.11E-03	-	-	-	-
Thallium (Soluble Salts)	7.43E-10	-	4.41E-11	1.30E-03	-	-	1.30E-03	-	-	-	-
*Total Risk/HI	-	-	-	4.41E-03	-	7.39E-08	4.41E-03	-	-	-	-

Output generated 03SEP2020:15:48:47

Site-specific Risk
Excavation Worker Soil Inputs

Variable	Excavation Worker Soil Default Value	Form-input Value
A (PEF Dispersion Constant)	16.2302	16.2302
A (VF Dispersion Constant)	11.911	11.911
A (VF Dispersion Constant - mass limit)	11.911	11.911
B (PEF Dispersion Constant)	18.7762	18.7762
B (VF Dispersion Constant)	18.4385	18.4385
B (VF Dispersion Constant - mass limit)	18.4385	18.4385
City (PEF Climate Zone) Selection	Default	Default
City (VF Climate Zone) Selection	Default	Default
C (PEF Dispersion Constant)	216.108	216.108
C (VF Dispersion Constant)	209.7845	209.7845
C (VF Dispersion Constant - mass limit)	209.7845	209.7845
foc (fraction organic carbon in soil) g/g	0.006	0.006
F(x) (function dependent on U_m/U_t) unitless	0.194	0.194
n (total soil porosity) L_{pore}/L_{soil}	0.43396	0.43396
p_b (dry soil bulk density) g/cm^3	1.5	1.5
p_b (dry soil bulk density - mass limit) g/cm^3	1.5	1.5
PEF (particulate emission factor) m^3/kg	1359344438	1359344438
p_s (soil particle density) g/cm^3	2.65	2.65
Q/C_{wind} (g/m^2-s per kg/m^3)	93.77	93.77
Q/C_{vol} (g/m^2-s per kg/m^3)	68.18	68.18
Q/C_{vol} (g/m^2-s per kg/m^3 - mass limit)	68.18	68.18
A_s (PEF acres)	0.5	0.5
A_s (VF acres)	0.5	0.5
A_s (VF mass-limit acres)	0.5	0.5
AF_{ew} (skin adherence factor - excavation worker) mg/cm^2	0.3	0.3
AT_{ew} (averaging time - excavation worker)	365	365
BW_{ew} (body weight - excavation worker) kg	80	80
ED_{ew} (exposure duration - excavation worker) yr	1	1
EF_{ew} (exposure frequency - excavation worker) day/yr	20	20
ET_{ew} (exposure time - excavation worker) hr	8	8
IR_{ew} (soil ingestion rate - excavation worker) mg/day	330	330

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Site-specific Risk
Excavation Worker Soil Inputs

Variable	Excavation Worker Soil Default Value	Form-input Value
LT (lifetime) yr	70	70
SA_{ew} (surface area - excavation worker) cm^2/day	3527	3527
T_w (groundwater temperature) Celsius	25	25
$Theta_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396	0.28396
$Theta_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15	0.15
T (exposure interval) s	819936000	819936000
T (exposure interval) yr	26	26
U_m (mean annual wind speed) m/s	4.69	4.69
U_t (equivalent threshold value)	11.32	11.32
V (fraction of vegetative cover) unitless	0.5	0.5

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Site-specific Risk
Excavation Worker for Soil

Chemical	CAS Number	Mutagen?	VOC?	Subchronic RfD (mg/kg-day)	SRfD Ref	Subchronic RfC (mg/m³)	SRfC Ref	SF_o (mg/kg-day)$^{-1}$	SF_o Ref	IUR (ug/m³)$^{-1}$	IUR Ref	ABS_{gi}	ABS_{derm}	Volatilization Factor (m³/kg)	DA
Benzo[a]pyrene	50-32-8	Yes	No	-		-		1.00E+00	IRIS	6.00E-04	IRIS	1	0.13	-	-
**Total Risk/HI*				-		-		-		-		-	-	-	-

Chemical	Particulate Emission Factor (m³/kg)	Soil Saturation Concentration (mg/kg)	HLC (atm-m³/mole)	Henry's Law Constant (unitless)	H` and HLC Ref	Henry's Law Constant Used in Calcs (unitless)	Normal Boiling Point BP (K)	BP Ref	Critical Temperature TC (K)	TC Ref	D_{ia}\ (cm²/s)
Benzo[a]pyrene	1.36E+09	-	4.57E-07	1.87E-05	PHYSPROP	1.87E-05	7.68E+02	PHYSPROP	9.69E+02	EPA 2001 Fact Sheet	2.55E-02
**Total Risk/HI*	-	-	-	-		-	-		-		-

Chemical	D_{iw}\ (cm²/s)	Soil Concentration (mg/kg)	Ingestion Noncarcinogenic CDI (mg/kg-day)	Dermal Noncarcinogenic CDI (mg/kg-day)	Inhalation Noncarcinogenic CDI (mg/m³)	Ingestion Carcinogenic CDI (mg/kg-day)	Dermal Carcinogenic CDI (mg/kg-day)	Inhalation Carcinogenic CDI (ug/m³)
Benzo[a]pyrene	6.58E-06	0.6	1.36E-07	5.65E-08	8.06E-12	1.94E-09	8.08E-10	1.15E-10
**Total Risk/HI*	-	-	-	-	-	-	-	-

Chemical	Ingestion HQ	Dermal HQ	Inhalation HQ	Total HI	Ingestion Risk	Dermal Risk	Inhalation Risk	Total Risk
Benzo[a]pyrene	4.52E-04	1.88E-04	4.03E-06	6.45E-04	1.94E-09	8.08E-10	6.91E-14	2.74E-09
**Total Risk/HI*	*4.52E-04*	*1.88E-04*	*4.03E-06*	*6.45E-04*	*1.94E-09*	*8.08E-10*	*6.91E-14*	*2.74E-09*

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Site-specific Risk
Excavation Worker Soil Inputs

Variable	Excavation Worker Soil Default Value	Form-input Value
A (PEF Dispersion Constant)	16.2302	16.2302
A (VF Dispersion Constant)	11.911	11.911
A (VF Dispersion Constant - mass limit)	11.911	11.911
B (PEF Dispersion Constant)	18.7762	18.7762
B (VF Dispersion Constant)	18.4385	18.4385
B (VF Dispersion Constant - mass limit)	18.4385	18.4385
City (PEF Climate Zone) Selection	Default	Default
City (VF Climate Zone) Selection	Default	Default
C (PEF Dispersion Constant)	216.108	216.108
C (VF Dispersion Constant)	209.7845	209.7845
C (VF Dispersion Constant - mass limit)	209.7845	209.7845
foc (fraction organic carbon in soil) g/g	0.006	0.006
F(x) (function dependent on U_m/U_t) unitless	0.194	0.194
n (total soil porosity) L_{pore}/L_{soil}	0.43396	0.43396
p_b (dry soil bulk density) g/cm^3	1.5	1.5
p_b (dry soil bulk density - mass limit) g/cm^3	1.5	1.5
PEF (particulate emission factor) m^3/kg	1359344438	1359344438
p_s (soil particle density) g/cm^3	2.65	2.65
Q/C_{wind} (g/m^2-s per kg/m^3)	93.77	93.77
Q/C_{vol} (g/m^2-s per kg/m^3)	68.18	68.18
Q/C_{vol} (g/m^2-s per kg/m^3 - mass limit)	68.18	68.18
A_s (PEF acres)	0.5	0.5
A_s (VF acres)	0.5	0.5
A_s (VF mass-limit acres)	0.5	0.5
AF_{ew} (skin adherence factor - excavation worker) mg/cm^2	0.3	0.3
AT_{ew} (averaging time - excavation worker)	365	365
BW_{ew} (body weight - excavation worker) kg	80	80
ED_{ew} (exposure duration - excavation worker) yr	1	1
EF_{ew} (exposure frequency - excavation worker) day/yr	20	20
ET_{ew} (exposure time - excavation worker) hr	8	8
IR_{ew} (soil ingestion rate - excavation worker) mg/day	330	330

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Site-specific Risk
Excavation Worker Soil Inputs

Variable	Excavation Worker Soil Default Value	Form-input Value
LT (lifetime) yr	70	70
SA_{ew} (surface area - excavation worker) cm^2/day	3527	3527
T_w (groundwater temperature) Celsius	25	25
$Theta_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396	0.28396
$Theta_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15	0.15
T (exposure interval) s	819936000	819936000
T (exposure interval) yr	26	26
U_m (mean annual wind speed) m/s	4.69	4.69
U_t (equivalent threshold value)	11.32	11.32
V (fraction of vegetative cover) unitless	0.5	0.5

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Site-specific Risk
Excavation Worker for Soil

Chemical	CAS Number	Mutagen?	VOC?	Subchronic RfD (mg/kg-day)	SRfD Ref	Subchronic RfC (mg/m³)	SRfC Ref	SF_o (mg/kg-day)$^{-1}$	SF_o Ref	IUR (ug/m³)$^{-1}$	IUR Ref	ABS_{gi}	ABS_{derm}
TCDD, 2,3,7,8-	1746-01-6	No	Yes	2.00E-08	ATSDR Final	-		1.30E+05	CALEPA	3.80E+01	CALEPA	1	0.03
Total Risk/HI				-		-		-		-		-	-

Chemical	Volatilization Factor (m³/kg)	DA	Particulate Emission Factor (m³/kg)	Soil Saturation Concentration (mg/kg)	HLC (atm-m³/mole)	Henry's Law Constant (unitless)	H` and HLC Ref	Henry's Law Constant Used in Calcs (unitless)	Normal Boiling Point BP (K)	BP Ref	Critical Temperature TC (K)
TCDD, 2,3,7,8-	1.96E+06	3.46E-09	1.36E+09	-	5.00E-05	2.04E-03	EPI	2.04E-03	6.52E+02	EPI	9.78E+02
Total Risk/HI	-	-	-	-	-	-		-	-		-

Chemical	TC Ref	D_{ia}\ (cm²/s)	D_{iw}\ (cm²/s)	Soil Concentration (mg/kg)	Ingestion Noncarcinogenic CDI (mg/kg-day)	Dermal Noncarcinogenic CDI (mg/kg-day)	Inhalation Noncarcinogenic CDI (mg/m³)	Ingestion Carcinogenic CDI (mg/kg-day)
TCDD, 2,3,7,8-	Approx. from Tcrit=1.5xTBoil	4.70E-02	6.76E-06	0.00003885	8.78E-12	8.45E-13	3.62E-13	1.25E-13
Total Risk/HI		-	-	-	-	-	-	-

Chemical	Dermal Carcinogenic CDI (mg/kg-day)	Inhalation Carcinogenic CDI (ug/m³)	Ingestion HQ	Dermal HQ	Inhalation HQ	Total HI	Ingestion Risk	Dermal Risk	Inhalation Risk	Total Risk
TCDD, 2,3,7,8-	1.21E-14	5.17E-12	4.39E-04	4.22E-05	9.06E-06	4.90E-04	1.63E-08	1.57E-09	1.97E-10	1.81E-08
Total Risk/HI	-	-	*4.39E-04*	*4.22E-05*	*9.06E-06*	*4.90E-04*	*1.63E-08*	*1.57E-09*	*1.97E-10*	*1.81E-08*

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Site-specific Risk
Excavation Worker Soil Inputs

Variable	Excavation Worker Soil Default Value	Form-input Value
A (PEF Dispersion Constant)	16.2302	16.2302
A (VF Dispersion Constant)	11.911	11.911
A (VF Dispersion Constant - mass limit)	11.911	11.911
B (PEF Dispersion Constant)	18.7762	18.7762
B (VF Dispersion Constant)	18.4385	18.4385
B (VF Dispersion Constant - mass limit)	18.4385	18.4385
City (PEF Climate Zone) Selection	Default	Default
City (VF Climate Zone) Selection	Default	Default
C (PEF Dispersion Constant)	216.108	216.108
C (VF Dispersion Constant)	209.7845	209.7845
C (VF Dispersion Constant - mass limit)	209.7845	209.7845
foc (fraction organic carbon in soil) g/g	0.006	0.006
F(x) (function dependent on U_m/U_t) unitless	0.194	0.194
n (total soil porosity) L_{pore}/L_{soil}	0.43396	0.43396
p_b (dry soil bulk density) g/cm^3	1.5	1.5
p_b (dry soil bulk density - mass limit) g/cm^3	1.5	1.5
PEF (particulate emission factor) m^3/kg	1359344438	1359344438
p_s (soil particle density) g/cm^3	2.65	2.65
Q/C_{wind} (g/m^2-s per kg/m^3)	93.77	93.77
Q/C_{vol} (g/m^2-s per kg/m^3)	68.18	68.18
Q/C_{vol} (g/m^2-s per kg/m^3 - mass limit)	68.18	68.18
A_s (PEF acres)	0.5	0.5
A_s (VF acres)	0.5	0.5
A_s (VF mass-limit acres)	0.5	0.5
AF_{ew} (skin adherence factor - excavation worker) mg/cm^2	0.3	0.3
AT_{ew} (averaging time - excavation worker)	365	365
BW_{ew} (body weight - excavation worker) kg	80	80
ED_{ew} (exposure duration - excavation worker) yr	1	1
EF_{ew} (exposure frequency - excavation worker) day/yr	20	20
ET_{ew} (exposure time - excavation worker) hr	8	8
IR_{ew} (soil ingestion rate - excavation worker) mg/day	330	330

Output generated 03SEP2020:15:43:10

Site-specific Risk
Excavation Worker Soil Inputs

Variable	Excavation Worker Soil Default Value	Form-input Value
LT (lifetime) yr	70	70
SA_{ew} (surface area - excavation worker) cm^2/day	3527	3527
T_w (groundwater temperature) Celsius	25	25
$Theta_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396	0.28396
$Theta_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15	0.15
T (exposure interval) s	819936000	819936000
T (exposure interval) yr	26	26
U_m (mean annual wind speed) m/s	4.69	4.69
U_t (equivalent threshold value)	11.32	11.32
V (fraction of vegetative cover) unitless	0.5	0.5

Output generated 03SEP2020:15:43:10

Site-specific Risk
Excavation Worker for Soil

Chemical	CAS Number	Mutagen?	VOC?	Subchronic RfD (mg/kg-day)	SRfD Ref	Subchronic RfC (mg/m^3)	SRfC Ref	SF_o (mg/kg-day)$^{-1}$	SF_o Ref	IUR (ug/m^3)$^{-1}$	IUR Ref	ABS_{gi}	ABS_{derm}
Thallium (Soluble Salts)	7440-28-0	No	No	4.00E-05	SCREEN Current	-		-		-		1	-
**Total Risk/HI*				-		-		-		-		-	-

Chemical	Volatilization Factor (m^3/kg)	DA	Particulate Emission Factor (m^3/kg)	Soil Saturation Concentration (mg/kg)	HLC (atm-m^3/mole)	Henry's Law Constant (unitless)	H` and HLC Ref	Henry's Law Constant Used in Calcs (unitless)	Normal Boiling Point BP (K)	BP Ref
Thallium (Soluble Salts)	-	-	1.36E+09	-	-	-		-	1.73E+03	PHYSPROP
**Total Risk/HI*	-	-	-	-	-	-		-	-	

Chemical	Critical Temperature TC (K)	TC Ref	D_{ia}\ (cm^2/s)	D_{iw}\ (cm^2/s)	Soil Concentration (mg/kg)	Ingestion Noncarcinogenic CDI (mg/kg-day)	Dermal Noncarcinogenic CDI (mg/kg-day)	Inhalation Noncarcinogenic CDI (mg/m^3)
Thallium (Soluble Salts)	4.65E+03	YAWS	-	-	0.29	6.55E-08	-	3.90E-12
**Total Risk/HI*	-		-	-	-	-	-	-

Chemical	Ingestion Carcinogenic CDI (mg/kg-day)	Dermal Carcinogenic CDI (mg/kg-day)	Inhalation Carcinogenic CDI (ug/m^3)	Ingestion HQ	Dermal HQ	Inhalation HQ	Total HI	Ingestion Risk	Dermal Risk	Inhalation Risk	Total Risk
Thallium (Soluble Salts)	9.36E-10	-	5.57E-11	1.64E-03	-	-	1.64E-03	-	-	-	-
**Total Risk/HI*	-	-	-	*1.64E-03*	-	-	*1.64E-03*	-	-	-	-

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Site-specific Risk
Recreator Soil/Sediment Inputs

Variable	Recreator Soil/Sediment Default Value	Form-input Value
A (PEF Dispersion Constant)	16.2302	16.2302
A (VF Dispersion Constant)	11.911	11.911
A (VF Dispersion Constant - mass limit)	11.911	11.911
B (PEF Dispersion Constant)	18.7762	18.7762
B (VF Dispersion Constant)	18.4385	18.4385
B (VF Dispersion Constant - mass limit)	18.4385	18.4385
City (PEF Climate Zone) Selection	Default	Default
City (VF Climate Zone) Selection	Default	Default
C (PEF Dispersion Constant)	216.108	216.108
C (VF Dispersion Constant)	209.7845	209.7845
C (VF Dispersion Constant - mass limit)	209.7845	209.7845
foc (fraction organic carbon in soil) g/g	0.006	0.006
F(x) (function dependent on U_m/U_t) unitless	0.194	0.194
n (total soil porosity) L_{pore}/L_{soil}	0.43396	0.43396
p_b (dry soil bulk density) g/cm^3	1.5	1.5
p_b (dry soil bulk density - mass limit) g/cm^3	1.5	1.5
PEF (particulate emission factor) m^3/kg	1359344438	1359344438
p_s (soil particle density) g/cm^3	2.65	2.65
Q/C_{wind} (g/m^2-s per kg/m^3)	93.77	93.77
Q/C_{vol} (g/m^2-s per kg/m^3)	68.18	68.18
Q/C_{vol} (g/m^2-s per kg/m^3 - mass limit)	68.18	68.18
A_s (PEF acres)	0.5	0.5
A_s (VF acres)	0.5	0.5
A_s (VF mass-limit acres)	0.5	0.5
AF_{0-2} (skin adherence factor) mg/cm^2	0.2	0.2
AF_{2-6} (skin adherence factor) mg/cm^2	0.2	0.2
AF_{6-16} (skin adherence factor) mg/cm^2	0.07	0.07
AF_{16-30} (skin adherence factor) mg/cm^2	0.07	0.07
AF_{rec-a} (skin adherence factor - adult) mg/cm^2	0.07	0.07
AF_{rec-c} (skin adherence factor - child) mg/cm^2	0.2	0.2
AT_{rec} (averaging time)	365	365
BW_{0-2} (body weight) kg	15	15

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Site-specific Risk
Recreator Soil/Sediment Inputs

Variable	Recreator Soil/Sediment Default Value	Form-input Value
BW_{2-6} (body weight) kg	15	15
BW_{6-16} (body weight) kg	80	80
BW_{16-30} (body weight) kg	80	80
BW_{rec-a} (body weight - adult) kg	80	80
BW_{rec-c} (body weight - child) kg	15	15
$DFS_{rec-adj}$ (age-adjusted soil dermal factor) mg/kg	22155	22155
$DFSM_{rec-adj}$ (mutagenic age-adjusted soil dermal factor) mg/kg	91770	91770
ED_{rec} (exposure duration - recreator) years	26	26
ED_{0-2} (exposure duration) year	2	2
ED_{2-6} (exposure duration) year	4	4
ED_{6-16} (exposure duration) year	10	10
ED_{16-30} (exposure duration) year	10	10
ED_{rec-c} (exposure duration - child) years	6	6
EF_{rec} (exposure frequency) days/year	75	75
EF_{0-2} (exposure frequency) days/year	75	75
EF_{2-6} (exposure frequency) days/year	75	75
EF_{6-16} (exposure frequency) days/year	75	75
EF_{16-30} (exposure frequency) days/year	75	75
EF_{rec-a} (exposure frequency - adult) days/year	75	75
EF_{rec-c} (exposure frequency - child) days/year	75	75
ET_{rec} (exposure time - recreator) hours/day	1	1
ET_{0-2} (exposure time) hours/day	1	1
ET_{2-6} (exposure time) hours/day	1	1
ET_{6-16} (exposure time) hours/day	1	1
ET_{16-30} (exposure time) hours/day	1	1
ET_{rec-a} (adult exposure time) hours/day	1	1
ET_{rec-c} (child exposure time) hours/day	1	1
$IFS_{rec-adj}$ (age-adjusted soil ingestion factor) mg/kg	7875	7875
$IFSM_{rec-adj}$ (mutagenic age-adjusted soil ingestion factor) mg/kg	35750	35750
IRS_{0-2} (soil intake rate) mg/day	200	200
IRS_{2-6} (soil intake rate) mg/day	200	200
IRS_{6-16} (soil intake rate) mg/day	100	100

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Site-specific Risk
Recreator Soil/Sediment Inputs

Variable	Recreator Soil/Sediment Default Value	Form-input Value
IRS_{16-30} (soil intake rate) mg/day	100	100
IRS_{rec-a} (soil intake rate - adult) mg/day	100	100
IRS_{rec-c} (soil intake rate - child) mg/day	200	200
LT (lifetime - recreator) years	70	70
SA_{0-2} (skin surface area) cm^2/day	2373	2373
SA_{2-6} (skin surface area) cm^2/day	2373	2373
SA_{6-16} (skin surface area) cm^2/day	6032	6032
SA_{16-30} (skin surface area) cm^2/day	6032	6032
SA_{rec-a} (skin surface area - adult) cm^2/day	6032	6032
SA_{rec-c} (skin surface area - child) cm^2/day	2373	2373
T_w (groundwater temperature) Celsius	25	25
$Theta_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396	0.28396
$Theta_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15	0.15
T (exposure interval) s	819936000	819936000
T (exposure interval) yr	26	26
U_m (mean annual wind speed) m/s	4.69	4.69
U_t (equivalent threshold value)	11.32	11.32
V (fraction of vegetative cover) unitless	0.5	0.5

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Site-specific Risk
Recreator for Soil/Sediment

Chemical	CAS Number	Mutagen?	VOC?	Chronic RfD (mg/kg-day)	RfD Ref	Chronic RfC (mg/m^3)	RfC Ref	SF_o (mg/kg-day)$^{-1}$	SF_o Ref	IUR (ug/m^3)$^{-1}$	IUR Ref	ABS_{gi}	ABS_{derm}	Volatilization Factor (m^3/kg)	DA
Antimony (metallic)	7440-36-0	No	No	4.00E-04	IRIS	3.00E-04	ATSDR Final	-		-		0.15	-	-	-
Thallium (Soluble Salts)	7440-28-0	No	No	1.00E-05	SCREEN Current	-		-		-		1	-	-	-
**Total Risk/HI*				-		-		-		-		-	-	-	-

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Site-specific Risk
Recreator for Soil/Sediment

Chemical	Particulate Emission Factor (m^3/kg)	Soil Saturation Concentration (mg/kg)	RBA	HLC (atm-m^3/mole)	Henry's Law Constant (unitless)	H` and HLC Ref	Henry's Law Constant Used in Calcs (unitless)	Normal Boiling Point BP (K)	BP Ref	Critical Temperature TC (K)	TC Ref	D_{ia}\ (cm^2/s)	D_{iw}\ (cm^2/s)
Antimony (metallic)	1.36E+09	-	1	-	-		-	1.91E+03	PHYSPROP	5.07E+03	YAWS	-	-
Thallium (Soluble Salts)	1.36E+09	-	1	-	-		-	1.73E+03	PHYSPROP	4.65E+03	YAWS	-	-
**Total Risk/HI*	-	-	-	-	-		-	-		-		-	-

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Site-specific Risk

Recreator for Soil/Sediment

Chemical	Soil Concentration (mg/kg)	Child Ingestion Noncarcinogenic CDI (mg/kg-day)	Child Dermal Noncarcinogenic CDI (mg/kg-day)	Child Inhalation Noncarcinogenic CDI (mg/m^3)	Adult Ingestion Noncarcinogenic CDI (mg/kg-day)	Adult Dermal Noncarcinogenic CDI (mg/kg-day)	Adult Inhalation Noncarcinogenic CDI (mg/m^3)
Antimony (metallic)	5.5	1.51E-05	-	3.46E-11	1.41E-06	-	3.46E-11
Thallium (Soluble Salts)	0.29	7.95E-07	-	1.83E-12	7.45E-08	-	1.83E-12
**Total Risk/HI*	-	-	-	-	-	-	-

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Site-specific Risk
Recreator for Soil/Sediment

Chemical	Adjusted Ingestion Noncarcinogenic CDI (mg/kg-day)	Adjusted Dermal Noncarcinogenic CDI (mg/kg-day)	Adjusted Inhalation Noncarcinogenic CDI (mg/m^3)	Ingestion Carcinogenic CDI (mg/kg-day)	Dermal Carcinogenic CDI (mg/kg-day)	Inhalation Carcinogenic CDI (ug/m^3)	Child Ingestion HQ	Child Dermal HQ	Child Inhalation HQ
Antimony (metallic)	4.56E-06	-	3.46E-11	1.70E-06	-	1.29E-08	3.77E-02	-	1.15E-07
Thallium (Soluble Salts)	2.41E-07	-	1.83E-12	8.94E-08	-	6.78E-10	7.95E-02	-	-
**Total Risk/HI*	-	-	-	-	-	-	***1.17E-01***	-	*1.15E-07*

Output generated 02SEP2020:12:49:35

Site-specific Risk
Recreator for Soil/Sediment

Chemical	Child Total HI	Adult Ingestion HQ	Adult Dermal HQ	Adult Inhalation HQ	Adult Total HI	Adjusted Ingestion HQ	Adjusted Dermal HQ	Adjusted Inhalation HQ	Adjusted Total HI	Ingestion Risk	Dermal Risk	Inhalation Risk	Total Risk
Antimony (metallic)	3.77E-02	3.53E-03	-	1.15E-07	3.53E-03	1.14E-02	-	1.15E-07	1.14E-02	-	-	-	-
Thallium (Soluble Salts)	7.95E-02	7.45E-03	-	-	7.45E-03	2.41E-02	-	-	2.41E-02	-	-	-	-
**Total Risk/HI*	***1.17E-01***	*1.10E-02*	*-*	*1.15E-07*	*1.10E-02*	*3.55E-02*	*-*	*1.15E-07*	*3.55E-02*	*-*	*-*	*-*	*-*

Output generated 02SEP2020:12:49:35

Site-specific Risk
Recreator Soil/Sediment Inputs

Variable	Recreator Soil/Sediment Default Value	Form-input Value
A (PEF Dispersion Constant)	16.2302	16.2302
A (VF Dispersion Constant)	11.911	11.911
A (VF Dispersion Constant - mass limit)	11.911	11.911
B (PEF Dispersion Constant)	18.7762	18.7762
B (VF Dispersion Constant)	18.4385	18.4385
B (VF Dispersion Constant - mass limit)	18.4385	18.4385
City (PEF Climate Zone) Selection	Default	Default
City (VF Climate Zone) Selection	Default	Default
C (PEF Dispersion Constant)	216.108	216.108
C (VF Dispersion Constant)	209.7845	209.7845
C (VF Dispersion Constant - mass limit)	209.7845	209.7845
foc (fraction organic carbon in soil) g/g	0.006	0.006
F(x) (function dependent on U_m/U_t) unitless	0.194	0.194
n (total soil porosity) L_{pore}/L_{soil}	0.43396	0.43396
p_b (dry soil bulk density) g/cm^3	1.5	1.5
p_b (dry soil bulk density - mass limit) g/cm^3	1.5	1.5
PEF (particulate emission factor) m^3/kg	1359344438	1359344438
p_s (soil particle density) g/cm^3	2.65	2.65
Q/C_{wind} (g/m^2-s per kg/m^3)	93.77	93.77
Q/C_{vol} (g/m^2-s per kg/m^3)	68.18	68.18
Q/C_{vol} (g/m^2-s per kg/m^3 - mass limit)	68.18	68.18
A_s (PEF acres)	0.5	0.5
A_s (VF acres)	0.5	0.5
A_s (VF mass-limit acres)	0.5	0.5
AF_{0-2} (skin adherence factor) mg/cm^2	0.2	0.2
AF_{2-6} (skin adherence factor) mg/cm^2	0.2	0.2
AF_{6-16} (skin adherence factor) mg/cm^2	0.07	0.07
AF_{16-30} (skin adherence factor) mg/cm^2	0.07	0.07
AF_{rec-a} (skin adherence factor - adult) mg/cm^2	0.07	0.07
AF_{rec-c} (skin adherence factor - child) mg/cm^2	0.2	0.2
AT_{rec} (averaging time)	365	365
BW_{0-2} (body weight) kg	15	15

Output generated 10SEP2020:12:17:32

Site-specific Risk
Recreator Soil/Sediment Inputs

Variable	Recreator Soil/Sediment Default Value	Form-input Value
BW_{2-6} (body weight) kg	15	15
BW_{6-16} (body weight) kg	80	80
BW_{16-30} (body weight) kg	80	80
BW_{rec-a} (body weight - adult) kg	80	80
BW_{rec-c} (body weight - child) kg	15	15
$DFS_{rec-adj}$ (age-adjusted soil dermal factor) mg/kg	22155	22155
$DFSM_{rec-adj}$ (mutagenic age-adjusted soil dermal factor) mg/kg	91770	91770
ED_{rec} (exposure duration - recreator) years	26	26
ED_{0-2} (exposure duration) year	2	2
ED_{2-6} (exposure duration) year	4	4
ED_{6-16} (exposure duration) year	10	10
ED_{16-30} (exposure duration) year	10	10
ED_{rec-c} (exposure duration - child) years	6	6
EF_{rec} (exposure frequency) days/year	75	75
EF_{0-2} (exposure frequency) days/year	75	75
EF_{2-6} (exposure frequency) days/year	75	75
EF_{6-16} (exposure frequency) days/year	75	75
EF_{16-30} (exposure frequency) days/year	75	75
EF_{rec-a} (exposure frequency - adult) days/year	75	75
EF_{rec-c} (exposure frequency - child) days/year	75	75
ET_{rec} (exposure time - recreator) hours/day	1	1
ET_{0-2} (exposure time) hours/day	1	1
ET_{2-6} (exposure time) hours/day	1	1
ET_{6-16} (exposure time) hours/day	1	1
ET_{16-30} (exposure time) hours/day	1	1
ET_{rec-a} (adult exposure time) hours/day	1	1
ET_{rec-c} (child exposure time) hours/day	1	1
$IFS_{rec-adj}$ (age-adjusted soil ingestion factor) mg/kg	7875	7875
$IFSM_{rec-adj}$ (mutagenic age-adjusted soil ingestion factor) mg/kg	35750	35750
IRS_{0-2} (soil intake rate) mg/day	200	200
IRS_{2-6} (soil intake rate) mg/day	200	200
IRS_{6-16} (soil intake rate) mg/day	100	100

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Site-specific Risk
Recreator Soil/Sediment Inputs

Variable	Recreator Soil/Sediment Default Value	Form-input Value
IRS_{16-30} (soil intake rate) mg/day	100	100
IRS_{rec-a} (soil intake rate - adult) mg/day	100	100
IRS_{rec-c} (soil intake rate - child) mg/day	200	200
LT (lifetime - recreator) years	70	70
SA_{0-2} (skin surface area) cm^2/day	2373	2373
SA_{2-6} (skin surface area) cm^2/day	2373	2373
SA_{6-16} (skin surface area) cm^2/day	6032	6032
SA_{16-30} (skin surface area) cm^2/day	6032	6032
SA_{rec-a} (skin surface area - adult) cm^2/day	6032	6032
SA_{rec-c} (skin surface area - child) cm^2/day	2373	2373
T_w (groundwater temperature) Celsius	25	25
$Theta_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396	0.28396
$Theta_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15	0.15
T (exposure interval) s	819936000	819936000
T (exposure interval) yr	26	26
U_m (mean annual wind speed) m/s	4.69	4.69
U_t (equivalent threshold value)	11.32	11.32
V (fraction of vegetative cover) unitless	0.5	0.5

Output generated 10SEP2020:12:17:32

Site-specific Risk
Recreator for Soil/Sediment

Chemical	CAS Number	Mutagen?	VOC?	Chronic RfD (mg/kg-day)	RfD Ref	Chronic RfC (mg/m^3)	RfC Ref	SF_o (mg/kg-day)$^{-1}$	SF_o Ref	IUR (ug/m^3)$^{-1}$	IUR Ref	ABS_{gi}	ABS_{derm}	Volatilization Factor (m^3/kg)	DA
Benzo[a]pyrene	50-32-8	Yes	No	3.00E-04	IRIS	2.00E-06	IRIS	1.00E+00	IRIS	6.00E-04	IRIS	1	0.13	-	-
**Total Risk/HI*				-		-		-		-		-	-	-	-

Output generated 10SEP2020:12:17:32

Site-specific Risk
Recreator for Soil/Sediment

Chemical	Particulate Emission Factor (m^3/kg)	Soil Saturation Concentration (mg/kg)	RBA	HLC (atm-m^3/mole)	Henry's Law Constant (unitless)	H` and HLC Ref	Henry's Law Constant Used in Calcs (unitless)	Normal Boiling Point BP (K)	BP Ref	Critical Temperature TC (K)	TC Ref	D_{ia}\ (cm^2/s)
Benzo[a]pyrene	1.36E+09	-	1	4.57E-07	1.87E-05	PHYSPROP	1.87E-05	7.68E+02	PHYSPROP	9.69E+02	EPA 2001 Fact Sheet	2.55E-02
*Total Risk/HI	-	-	-	-	-		-	-		-		-

Output generated 10SEP2020:12:17:32

Site-specific Risk
Recreator for Soil/Sediment

Chemical	D_{iw}\ (cm^2/s)	Soil Concentration (mg/kg)	Child Ingestion Noncarcinogenic CDI (mg/kg-day)	Child Dermal Noncarcinogenic CDI (mg/kg-day)	Child Inhalation Noncarcinogenic CDI (mg/m^3)	Adult Ingestion Noncarcinogenic CDI (mg/kg-day)	Adult Dermal Noncarcinogenic CDI (mg/kg-day)	Adult Inhalation Noncarcinogenic CDI (mg/m^3)
Benzo[a]pyrene	6.58E-06	0.6	1.64E-06	5.07E-07	3.78E-12	1.54E-07	8.46E-08	3.78E-12
**Total Risk/HI*	-	-	-	-	-	-	-	-

Output generated 10SEP2020:12:17:32

Site-specific Risk
Recreator for Soil/Sediment

Chemical	Adjusted Ingestion Noncarcinogenic CDI (mg/kg-day)	Adjusted Dermal Noncarcinogenic CDI (mg/kg-day)	Adjusted Inhalation Noncarcinogenic CDI (mg/m³)	Ingestion Carcinogenic CDI (mg/kg-day)	Dermal Carcinogenic CDI (mg/kg-day)	Inhalation Carcinogenic CDI (ug/m³)	Child Ingestion HQ	Child Dermal HQ	Child Inhalation HQ
Benzo[a]pyrene	4.98E-07	1.82E-07	3.78E-12	8.40E-07	2.80E-07	3.89E-09	5.48E-03	1.69E-03	1.89E-06
*Total Risk/HI	-	-	-	-	-	-	5.48E-03	1.69E-03	1.89E-06

Output generated 10SEP2020:12:17:32

Site-specific Risk
Recreator for Soil/Sediment

Chemical	Child Total HI	Adult Ingestion HQ	Adult Dermal HQ	Adult Inhalation HQ	Adult Total HI	Adjusted Ingestion HQ	Adjusted Dermal HQ	Adjusted Inhalation HQ	Adjusted Total HI	Ingestion Risk	Dermal Risk	Inhalation Risk	Total Risk
Benzo[a]pyrene	7.17E-03	5.14E-04	2.82E-04	1.89E-06	7.98E-04	1.66E-03	6.07E-04	1.89E-06	2.27E-03	8.40E-07	2.80E-07	2.33E-12	1.12E-06
**Total Risk/HI*	*7.17E-03*	*5.14E-04*	*2.82E-04*	*1.89E-06*	*7.98E-04*	*1.66E-03*	*6.07E-04*	*1.89E-06*	*2.27E-03*	*8.40E-07*	*2.80E-07*	*2.33E-12*	*1.12E-06*

Output generated 10SEP2020:12:17:32

Site-specific Risk
Recreator Soil/Sediment Inputs

Variable	Recreator Soil/Sediment Default Value	Form-input Value
A (PEF Dispersion Constant)	16.2302	16.2302
A (VF Dispersion Constant)	11.911	11.911
A (VF Dispersion Constant - mass limit)	11.911	11.911
B (PEF Dispersion Constant)	18.7762	18.7762
B (VF Dispersion Constant)	18.4385	18.4385
B (VF Dispersion Constant - mass limit)	18.4385	18.4385
City (PEF Climate Zone) Selection	Default	Default
City (VF Climate Zone) Selection	Default	Default
C (PEF Dispersion Constant)	216.108	216.108
C (VF Dispersion Constant)	209.7845	209.7845
C (VF Dispersion Constant - mass limit)	209.7845	209.7845
foc (fraction organic carbon in soil) g/g	0.006	0.006
F(x) (function dependent on U_m/U_t) unitless	0.194	0.194
n (total soil porosity) L_{pore}/L_{soil}	0.43396	0.43396
p_b (dry soil bulk density) g/cm^3	1.5	1.5
p_b (dry soil bulk density - mass limit) g/cm^3	1.5	1.5
PEF (particulate emission factor) m^3/kg	1359344438	1359344438
p_s (soil particle density) g/cm^3	2.65	2.65
Q/C_{wind} (g/m^2-s per kg/m^3)	93.77	93.77
Q/C_{vol} (g/m^2-s per kg/m^3)	68.18	68.18
Q/C_{vol} (g/m^2-s per kg/m^3 - mass limit)	68.18	68.18
A_s (PEF acres)	0.5	0.5
A_s (VF acres)	0.5	0.5
A_s (VF mass-limit acres)	0.5	0.5
AF_{0-2} (skin adherence factor) mg/cm^2	0.2	0.2
AF_{2-6} (skin adherence factor) mg/cm^2	0.2	0.2
AF_{6-16} (skin adherence factor) mg/cm^2	0.07	0.07
AF_{16-30} (skin adherence factor) mg/cm^2	0.07	0.07
AF_{rec-a} (skin adherence factor - adult) mg/cm^2	0.07	0.07
AF_{rec-c} (skin adherence factor - child) mg/cm^2	0.2	0.2
AT_{rec} (averaging time)	365	365
BW_{0-2} (body weight) kg	15	15

Output generated 09OCT2020:14:03:17

Site-specific Risk
Recreator Soil/Sediment Inputs

Variable	Recreator Soil/Sediment Default Value	Form-input Value
BW_{2-6} (body weight) kg	15	15
BW_{6-16} (body weight) kg	80	80
BW_{16-30} (body weight) kg	80	80
BW_{rec-a} (body weight - adult) kg	80	80
BW_{rec-c} (body weight - child) kg	15	15
$DFS_{rec-adj}$ (age-adjusted soil dermal factor) mg/kg	22155	22155
$DFSM_{rec-adj}$ (mutagenic age-adjusted soil dermal factor) mg/kg	91770	91770
ED_{rec} (exposure duration - recreator) years	26	26
ED_{0-2} (exposure duration) year	2	2
ED_{2-6} (exposure duration) year	4	4
ED_{6-16} (exposure duration) year	10	10
ED_{16-30} (exposure duration) year	10	10
ED_{rec-c} (exposure duration - child) years	6	6
EF_{rec} (exposure frequency) days/year	75	75
EF_{0-2} (exposure frequency) days/year	75	75
EF_{2-6} (exposure frequency) days/year	75	75
EF_{6-16} (exposure frequency) days/year	75	75
EF_{16-30} (exposure frequency) days/year	75	75
EF_{rec-a} (exposure frequency - adult) days/year	75	75
EF_{rec-c} (exposure frequency - child) days/year	75	75
ET_{rec} (exposure time - recreator) hours/day	1	1
ET_{0-2} (exposure time) hours/day	1	1
ET_{2-6} (exposure time) hours/day	1	1
ET_{6-16} (exposure time) hours/day	1	1
ET_{16-30} (exposure time) hours/day	1	1
ET_{rec-a} (adult exposure time) hours/day	1	1
ET_{rec-c} (child exposure time) hours/day	1	1
$IFS_{rec-adj}$ (age-adjusted soil ingestion factor) mg/kg	7875	7875
$IFSM_{rec-adj}$ (mutagenic age-adjusted soil ingestion factor) mg/kg	35750	35750
IRS_{0-2} (soil intake rate) mg/day	200	200
IRS_{2-6} (soil intake rate) mg/day	200	200
IRS_{6-16} (soil intake rate) mg/day	100	100

Output generated 09OCT2020:14:03:17

Site-specific Risk
Recreator Soil/Sediment Inputs

Variable	Recreator Soil/Sediment Default Value	Form-input Value
IRS_{16-30} (soil intake rate) mg/day	100	100
IRS_{rec-a} (soil intake rate - adult) mg/day	100	100
IRS_{rec-c} (soil intake rate - child) mg/day	200	200
LT (lifetime - recreator) years	70	70
SA_{0-2} (skin surface area) cm^2/day	2373	2373
SA_{2-6} (skin surface area) cm^2/day	2373	2373
SA_{6-16} (skin surface area) cm^2/day	6032	6032
SA_{16-30} (skin surface area) cm^2/day	6032	6032
SA_{rec-a} (skin surface area - adult) cm^2/day	6032	6032
SA_{rec-c} (skin surface area - child) cm^2/day	2373	2373
T_w (groundwater temperature) Celsius	25	25
$Theta_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396	0.28396
$Theta_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15	0.15
T (exposure interval) s	819936000	819936000
T (exposure interval) yr	26	26
U_m (mean annual wind speed) m/s	4.69	4.69
U_t (equivalent threshold value)	11.32	11.32
V (fraction of vegetative cover) unitless	0.5	0.5

Output generated 09OCT2020:14:03:17

Site-specific Risk
Recreator for Soil/Sediment

Chemical	CAS Number	Mutagen?	VOC?	Chronic RfD (mg/kg-day)	RfD Ref	Chronic RfC (mg/m³)	RfC Ref	SF_o (mg/kg-day)$^{-1}$	SF_o Ref	IUR (ug/m³)$^{-1}$	IUR Ref	ABS_{gi}	ABS_{derm}	Volatilization Factor (m³/kg)
TCDD, 2,3,7,8-	1746-01-6	No	Yes	7.00E-10	IRIS	4.00E-08	CALEPA	1.30E+05	CALEPA	3.80E+01	CALEPA	1	0.03	1.96E+06
**Total Risk/HI*				-		-		-		-		-	-	-

Output generated 09OCT2020:14:03:17

Site-specific Risk
Recreator for Soil/Sediment

Chemical	DA	Particulate Emission Factor (m^3/kg)	Soil Saturation Concentration (mg/kg)	RBA	HLC (atm-m^3/mole)	Henry's Law Constant (unitless)	H` and HLC Ref	Henry's Law Constant Used in Calcs (unitless)	Normal Boiling Point BP (K)	BP Ref	Critical Temperature TC (K)	TC Ref	D_{ia}\ (cm^2/s)
TCDD, 2,3,7,8-	3.46E-09	1.36E+09	-	1	5.00E-05	2.04E-03	EPI	2.04E-03	6.52E+02	EPI	9.78E+02	Approx. from Tcrit=1.5xTBoil	4.70E-02
**Total Risk/HI*	-	-	-	-	-	-		-	-		-		-

Output generated 09OCT2020:14:03:17

Site-specific Risk
Recreator for Soil/Sediment

Chemical	D_{iw}\ (cm^2/s)	Soil Concentration (mg/kg)	Child Ingestion Noncarcinogenic CDI (mg/kg-day)	Child Dermal Noncarcinogenic CDI (mg/kg-day)	Child Inhalation Noncarcinogenic CDI (mg/m^3)	Adult Ingestion Noncarcinogenic CDI (mg/kg-day)	Adult Dermal Noncarcinogenic CDI (mg/kg-day)	Adult Inhalation Noncarcinogenic CDI (mg/m^3)
TCDD, 2,3,7,8-	6.76E-06	0.00003885	1.06E-10	7.58E-12	1.70E-13	9.98E-12	1.26E-12	1.70E-13
Total Risk/HI	-	-	-	-	-	-	-	-

Output generated 09OCT2020:14:03:17

Site-specific Risk
Recreator for Soil/Sediment

Chemical	Adjusted Ingestion Noncarcinogenic CDI (mg/kg-day)	Adjusted Dermal Noncarcinogenic CDI (mg/kg-day)	Adjusted Inhalation Noncarcinogenic CDI (mg/m³)	Ingestion Carcinogenic CDI (mg/kg-day)	Dermal Carcinogenic CDI (mg/kg-day)	Inhalation Carcinogenic CDI (ug/m³)	Child Ingestion HQ	Child Dermal HQ	Child Inhalation HQ
TCDD, 2,3,7,8-	3.22E-11	2.72E-12	1.70E-13	1.20E-11	1.01E-12	6.31E-11	**1.52E-01**	1.08E-02	4.24E-06
**Total Risk/HI*	-	-	-	-	-	-	***1.52E-01***	*1.08E-02*	*4.24E-06*

Output generated 09OCT2020:14:03:17

Site-specific Risk
Recreator for Soil/Sediment

Chemical	Child Total HI	Adult Ingestion HQ	Adult Dermal HQ	Adult Inhalation HQ	Adult Total HI	Adjusted Ingestion HQ	Adjusted Dermal HQ	Adjusted Inhalation HQ	Adjusted Total HI	Ingestion Risk	Dermal Risk	Inhalation Risk	Total Risk
TCDD, 2,3,7,8-	**1.63E-01**	1.43E-02	1.81E-03	4.24E-06	1.61E-02	4.61E-02	3.89E-03	4.24E-06	4.99E-02	**1.56E-06**	1.31E-07	2.40E-09	**1.69E-06**
**Total Risk/HI*	***1.63E-01***	*1.43E-02*	*1.81E-03*	*4.24E-06*	*1.61E-02*	*4.61E-02*	*3.89E-03*	*4.24E-06*	*4.99E-02*	***1.56E-06***	*1.31E-07*	*2.40E-09*	***1.69E-06***

Output generated 09OCT2020:14:03:17

Site-specific Risk
Recreator Soil/Sediment Inputs

Variable	Recreator Soil/Sediment Default Value	Form-input Value
A (PEF Dispersion Constant)	16.2302	16.2302
A (VF Dispersion Constant)	11.911	11.911
A (VF Dispersion Constant - mass limit)	11.911	11.911
B (PEF Dispersion Constant)	18.7762	18.7762
B (VF Dispersion Constant)	18.4385	18.4385
B (VF Dispersion Constant - mass limit)	18.4385	18.4385
City (PEF Climate Zone) Selection	Default	Default
City (VF Climate Zone) Selection	Default	Default
C (PEF Dispersion Constant)	216.108	216.108
C (VF Dispersion Constant)	209.7845	209.7845
C (VF Dispersion Constant - mass limit)	209.7845	209.7845
foc (fraction organic carbon in soil) g/g	0.006	0.006
F(x) (function dependent on U_m/U_t) unitless	0.194	0.194
n (total soil porosity) L_{pore}/L_{soil}	0.43396	0.43396
p_b (dry soil bulk density) g/cm^3	1.5	1.5
p_b (dry soil bulk density - mass limit) g/cm^3	1.5	1.5
PEF (particulate emission factor) m^3/kg	1359344438	1359344438
p_s (soil particle density) g/cm^3	2.65	2.65
Q/C_{wind} (g/m^2-s per kg/m^3)	93.77	93.77
Q/C_{vol} (g/m^2-s per kg/m^3)	68.18	68.18
Q/C_{vol} (g/m^2-s per kg/m^3 - mass limit)	68.18	68.18
A_s (PEF acres)	0.5	0.5
A_s (VF acres)	0.5	0.5
A_s (VF mass-limit acres)	0.5	0.5
AF_{0-2} (skin adherence factor) mg/cm^2	0.2	0.2
AF_{2-6} (skin adherence factor) mg/cm^2	0.2	0.2
AF_{6-16} (skin adherence factor) mg/cm^2	0.07	0.07
AF_{16-30} (skin adherence factor) mg/cm^2	0.07	0.07
AF_{rec-a} (skin adherence factor - adult) mg/cm^2	0.07	0.07
AF_{rec-c} (skin adherence factor - child) mg/cm^2	0.2	0.2
AT_{rec} (averaging time)	365	365
BW_{0-2} (body weight) kg	15	15

Output generated 02SEP2020:12:45:01

Site-specific Risk
Recreator Soil/Sediment Inputs

Variable	Recreator Soil/Sediment Default Value	Form-input Value
BW_{2-6} (body weight) kg	15	15
BW_{6-16} (body weight) kg	80	80
BW_{16-30} (body weight) kg	80	80
BW_{rec-a} (body weight - adult) kg	80	80
BW_{rec-c} (body weight - child) kg	15	15
$DFS_{rec-adj}$ (age-adjusted soil dermal factor) mg/kg	22155	22155
$DFSM_{rec-adj}$ (mutagenic age-adjusted soil dermal factor) mg/kg	91770	91770
ED_{rec} (exposure duration - recreator) years	26	26
ED_{0-2} (exposure duration) year	2	2
ED_{2-6} (exposure duration) year	4	4
ED_{6-16} (exposure duration) year	10	10
ED_{16-30} (exposure duration) year	10	10
ED_{rec-c} (exposure duration - child) years	6	6
EF_{rec} (exposure frequency) days/year	75	75
EF_{0-2} (exposure frequency) days/year	75	75
EF_{2-6} (exposure frequency) days/year	75	75
EF_{6-16} (exposure frequency) days/year	75	75
EF_{16-30} (exposure frequency) days/year	75	75
EF_{rec-a} (exposure frequency - adult) days/year	75	75
EF_{rec-c} (exposure frequency - child) days/year	75	75
ET_{rec} (exposure time - recreator) hours/day	1	1
ET_{0-2} (exposure time) hours/day	1	1
ET_{2-6} (exposure time) hours/day	1	1
ET_{6-16} (exposure time) hours/day	1	1
ET_{16-30} (exposure time) hours/day	1	1
ET_{rec-a} (adult exposure time) hours/day	1	1
ET_{rec-c} (child exposure time) hours/day	1	1
$IFS_{rec-adj}$ (age-adjusted soil ingestion factor) mg/kg	7875	7875
$IFSM_{rec-adj}$ (mutagenic age-adjusted soil ingestion factor) mg/kg	35750	35750
IRS_{0-2} (soil intake rate) mg/day	200	200
IRS_{2-6} (soil intake rate) mg/day	200	200
IRS_{6-16} (soil intake rate) mg/day	100	100

Output generated 02SEP2020:12:45:01

Site-specific Risk
Recreator Soil/Sediment Inputs

Variable	Recreator Soil/Sediment Default Value	Form-input Value
IRS_{16-30} (soil intake rate) mg/day	100	100
IRS_{rec-a} (soil intake rate - adult) mg/day	100	100
IRS_{rec-c} (soil intake rate - child) mg/day	200	200
LT (lifetime - recreator) years	70	70
SA_{0-2} (skin surface area) cm^2/day	2373	2373
SA_{2-6} (skin surface area) cm^2/day	2373	2373
SA_{6-16} (skin surface area) cm^2/day	6032	6032
SA_{16-30} (skin surface area) cm^2/day	6032	6032
SA_{rec-a} (skin surface area - adult) cm^2/day	6032	6032
SA_{rec-c} (skin surface area - child) cm^2/day	2373	2373
T_w (groundwater temperature) Celsius	25	25
$Theta_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396	0.28396
$Theta_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15	0.15
T (exposure interval) s	819936000	819936000
T (exposure interval) yr	26	26
U_m (mean annual wind speed) m/s	4.69	4.69
U_t (equivalent threshold value)	11.32	11.32
V (fraction of vegetative cover) unitless	0.5	0.5

Output generated 02SEP2020:12:45:01

Site-specific Risk
Recreator for Soil/Sediment

Chemical	CAS Number	Mutagen?	VOC?	Chronic RfD (mg/kg-day)	RfD Ref	Chronic RfC (mg/m³)	RfC Ref	SF_o (mg/kg-day)$^{-1}$	SF_o Ref	IUR (ug/m³)$^{-1}$	IUR Ref	ABS_{gi}	ABS_{derm}	Volatilization Factor (m³/kg)	DA	Particulate Emission Factor (m³/kg)
Thallium (Soluble Salts)	7440-28-0	No	No	1.00E-05	SCREEN Current	-		-		-		1	-	-	-	1.36E+09
**Total Risk/HI*				-		-		-		-		-	-	-	-	-

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Site-specific Risk
Recreator for Soil/Sediment

Chemical	Soil Saturation Concentration (mg/kg)	RBA	HLC (atm-m³/mole)	Henry's Law Constant (unitless)	H` and HLC Ref	Henry's Law Constant Used in Calcs (unitless)	Normal Boiling Point BP (K)	BP Ref	Critical Temperature TC (K)	TC Ref	D_{ia}\ (cm^2/s)	D_{iw}\ (cm^2/s)	Soil Concentration (mg/kg)
Thallium (Soluble Salts)	-	1	-	-		-	1.73E+03	PHYSPROP	4.65E+03	YAWS	-	-	0.29
**Total Risk/HI*	-	-	-	-		-	-		-		-	-	-

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Site-specific Risk
Recreator for Soil/Sediment

Chemical	Child Ingestion Noncarcinogenic CDI (mg/kg-day)	Child Dermal Noncarcinogenic CDI (mg/kg-day)	Child Inhalation Noncarcinogenic CDI (mg/m³)	Adult Ingestion Noncarcinogenic CDI (mg/kg-day)	Adult Dermal Noncarcinogenic CDI (mg/kg-day)	Adult Inhalation Noncarcinogenic CDI (mg/m³)	Adjusted Ingestion Noncarcinogenic CDI (mg/kg-day)
Thallium (Soluble Salts)	7.95E-07	-	1.83E-12	7.45E-08	-	1.83E-12	2.41E-07
Total Risk/HI	-	-	-	-	-	-	-

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Site-specific Risk
Recreator for Soil/Sediment

Chemical	Adjusted Dermal Noncarcinogenic CDI (mg/kg-day)	Adjusted Inhalation Noncarcinogenic CDI (mg/m³)	Ingestion Carcinogenic CDI (mg/kg-day)	Dermal Carcinogenic CDI (mg/kg-day)	Inhalation Carcinogenic CDI (ug/m³)	Child Ingestion HQ	Child Dermal HQ	Child Inhalation HQ	Child Total HI	Adult Ingestion HQ	Adult Dermal HQ
Thallium (Soluble Salts)	-	1.83E-12	8.94E-08	-	6.78E-10	7.95E-02	-	-	7.95E-02	7.45E-03	-
**Total Risk/HI*	*-*	*-*	*-*	*-*	*-*	*7.95E-02*	*-*	*-*	*7.95E-02*	*7.45E-03*	*-*

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Site-specific Risk
Recreator for Soil/Sediment

Chemical	Adult Inhalation HQ	Adult Total HI	Adjusted Ingestion HQ	Adjusted Dermal HQ	Adjusted Inhalation HQ	Adjusted Total HI	Ingestion Risk	Dermal Risk	Inhalation Risk	Total Risk
Thallium (Soluble Salts)	-	7.45E-03	2.41E-02	-	-	2.41E-02	-	-	-	-
**Total Risk/HI*	*-*	*7.45E-03*	*2.41E-02*	*-*	*-*	*2.41E-02*	*-*	*-*	*-*	*-*

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Site-specific Risk
Resident Soil Inputs

Variable	Resident Soil Default Value	Form-input Value
A (PEF Dispersion Constant)	16.2302	16.2302
A (VF Dispersion Constant)	11.911	11.911
A (VF Dispersion Constant - mass limit)	11.911	11.911
B (PEF Dispersion Constant)	18.7762	18.7762
B (VF Dispersion Constant)	18.4385	18.4385
B (VF Dispersion Constant - mass limit)	18.4385	18.4385
City (PEF Climate Zone) Selection	Default	Default
City (VF Climate Zone) Selection	Default	Default
C (PEF Dispersion Constant)	216.108	216.108
C (VF Dispersion Constant)	209.7845	209.7845
C (VF Dispersion Constant - mass limit)	209.7845	209.7845
foc (fraction organic carbon in soil) g/g	0.006	0.006
F(x) (function dependent on U_m/U_t) unitless	0.194	0.194
n (total soil porosity) L_{pore}/L_{soil}	0.43396	0.43396
p_b (dry soil bulk density) g/cm^3	1.5	1.5
p_b (dry soil bulk density - mass limit) g/cm^3	1.5	1.5
PEF (particulate emission factor) m^3/kg	1359344438	1359344438
p_s (soil particle density) g/cm^3	2.65	2.65
Q/C_{wind} (g/m^2-s per kg/m^3)	93.77	93.77
Q/C_{vol} (g/m^2-s per kg/m^3)	68.18	68.18
Q/C_{vol} (g/m^2-s per kg/m^3 - mass limit)	68.18	68.18
A_s (PEF acres)	0.5	0.5
A_s (VF acres)	0.5	0.5
A_s (VF mass-limit acres)	0.5	0.5
AF_{0-2} (mutagenic skin adherence factor) mg/cm^2	0.2	0.2
AF_{2-6} (mutagenic skin adherence factor) mg/cm^2	0.2	0.2
AF_{6-16} (mutagenic skin adherence factor) mg/cm^2	0.07	0.07
AF_{16-26} (mutagenic skin adherence factor) mg/cm^2	0.07	0.07
AF_{res-a} (skin adherence factor - adult) mg/cm^2	0.07	0.07
AF_{res-c} (skin adherence factor - child) mg/cm^2	0.2	0.2
AT_{res} (averaging time - resident carcinogenic)	365	365
BW_{0-2} (mutagenic body weight) kg	15	15

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Site-specific Risk
Resident Soil Inputs

Variable	Resident Soil Default Value	Form-input Value
BW_{2-6} (mutagenic body weight) kg	15	15
BW_{6-16} (mutagenic body weight) kg	80	80
BW_{16-26} (mutagenic body weight) kg	80	80
BW_{res-a} (body weight - adult) kg	80	80
BW_{res-c} (body weight - child) kg	15	15
$DFS_{res-adj}$ (age-adjusted soil dermal factor) mg/kg	103390	103390
$DFSM_{res-adj}$ (mutagenic age-adjusted soil dermal factor) mg/kg	428260	428260
ED_{res} (exposure duration) years	26	26
ED_{0-2} (mutagenic exposure duration) years	2	2
ED_{2-6} (mutagenic exposure duration) years	4	4
ED_{6-16} (mutagenic exposure duration) years	10	10
ED_{16-26} (mutagenic exposure duration) years	10	10
ED_{res-a} (exposure duration - adult) years	20	20
ED_{res-c} (exposure duration - child) years	6	6
EF_{res} (exposure frequency) days/year	350	350
EF_{0-2} (mutagenic exposure frequency) days/year	350	350
EF_{2-6} (mutagenic exposure frequency) days/year	350	350
EF_{6-16} (mutagenic exposure frequency) days/year	350	350
EF_{16-26} (mutagenic exposure frequency) days/year	350	350
EF_{res-a} (exposure frequency - adult) days/year	350	350
EF_{res-c} (exposure frequency - child) days/year	350	350
ET_{res} (exposure time) hours/day	24	24
ET_{0-2} (mutagenic exposure time) hours/day	24	24
ET_{2-6} (mutagenic exposure time) hours/day	24	24
ET_{6-16} (mutagenic exposure time) hours/day	24	24
ET_{16-26} (mutagenic exposure time) hours/day	24	24
ET_{res-a} (adult exposure time) hours/day	24	24
ET_{res-c} (child exposure time) hours/day	24	24
$IFS_{res-adj}$ (age-adjusted soil ingestion factor) mg/kg	36750	36750
$IFSM_{res-adj}$ (mutagenic age-adjusted soil ingestion factor) mg/kg	166833.3	166833.3
IRS_{0-2} (mutagenic soil intake rate) mg/day	200	200
IRS_{2-6} (mutagenic soil intake rate) mg/day	200	200

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Site-specific Risk
Resident Soil Inputs

Variable	Resident Soil Default Value	Form-input Value
IRS_{6-16} (mutagenic soil intake rate) mg/day	100	100
IRS_{16-26} (mutagenic soil intake rate) mg/day	100	100
IRS_{res-a} (soil intake rate - adult) mg/day	100	100
IRS_{res-c} (soil intake rate - child) mg/day	200	200
LT (lifetime) years	70	70
SA_{0-2} (mutagenic skin surface area) cm^2/day	2373	2373
SA_{2-6} (mutagenic skin surface area) cm^2/day	2373	2373
SA_{6-16} (mutagenic skin surface area) cm^2/day	6032	6032
SA_{16-26} (mutagenic skin surface area) cm^2/day	6032	6032
SA_{res-a} (skin surface area - adult) cm^2/day	6032	6032
SA_{res-c} (skin surface area - child) cm^2/day	2373	2373
T_w (groundwater temperature) Celsius	25	25
$Theta_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396	0.28396
$Theta_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15	0.15
T (exposure interval) s	819936000	819936000
T (exposure interval) yr	26	26
U_m (mean annual wind speed) m/s	4.69	4.69
U_t (equivalent threshold value)	11.32	11.32
V (fraction of vegetative cover) unitless	0.5	0.5

Site-specific Risk
Resident for Soil

Chemical	CAS Number	Mutagen?	VOC?	Chronic RfD (mg/kg-day)	RfD Ref	Chronic RfC (mg/m^3)	RfC Ref	SF_o (mg/kg-day)$^{-1}$	SF_o Ref	IUR (ug/m^3)$^{-1}$	IUR Ref	ABS_{gi}	ABS_{derm}	Volatilization Factor (m^3/kg)	DA
Benzo[a]pyrene	50-32-8	Yes	No	3.00E-04	IRIS	2.00E-06	IRIS	1.00E+00	IRIS	6.00E-04	IRIS	1	0.13	-	-
**Total Risk/HI*				-		-		-		-		-	-	-	-

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Site-specific Risk
Resident for Soil

Chemical	Particulate Emission Factor (m^3/kg)	Soil Saturation Concentration (mg/kg)	RBA	HLC (atm-m^3/mole)	Henry's Law Constant (unitless)	H` and HLC Ref	Henry's Law Constant Used in Calcs (unitless)	Normal Boiling Point BP (K)	BP Ref	Critical Temperature TC (K)	TC Ref	D_{ia}\ (cm^2/s)
Benzo[a]pyrene	1.36E+09	-	1	4.57E-07	1.87E-05	PHYSPROP	1.87E-05	7.68E+02	PHYSPROP	9.69E+02	EPA 2001 Fact Sheet	2.55E-02
**Total Risk/HI*	-	-	-	-	-		-	-		-		-

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Site-specific Risk
Resident for Soil

Chemical	D_{iw}\ (cm^2/s)	Soil Concentration (mg/kg)	Child Ingestion Noncarcinogenic CDI (mg/kg-day)	Child Dermal Noncarcinogenic CDI (mg/kg-day)	Child Inhalation Noncarcinogenic CDI (mg/m^3)	Adult Ingestion Noncarcinogenic CDI (mg/kg-day)	Adult Dermal Noncarcinogenic CDI (mg/kg-day)	Adult Inhalation Noncarcinogenic CDI (mg/m^3)
Benzo[a]pyrene	6.58E-06	0.6	7.67E-06	2.37E-06	4.23E-10	7.19E-07	3.95E-07	4.23E-10
**Total Risk/HI*	-	-	-	-	-	-	-	-

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Site-specific Risk
Resident for Soil

Chemical	Adjusted Ingestion Noncarcinogenic CDI (mg/kg-day)	Adjusted Dermal Noncarcinogenic CDI (mg/kg-day)	Adjusted Inhalation Noncarcinogenic CDI (mg/m³)	Ingestion Carcinogenic CDI (mg/kg-day)	Dermal Carcinogenic CDI (mg/kg-day)	Inhalation Carcinogenic CDI (ug/m³)	Child Ingestion HQ	Child Dermal HQ	Child Inhalation HQ
Benzo[a]pyrene	2.32E-06	8.50E-07	4.23E-10	3.92E-06	1.31E-06	4.35E-07	2.56E-02	7.89E-03	2.12E-04
**Total Risk/HI*	-	-	-	-	-	-	*2.56E-02*	*7.89E-03*	*2.12E-04*

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Site-specific Risk
Resident for Soil

Chemical	Child Total HI	Adult Ingestion HQ	Adult Dermal HQ	Adult Inhalation HQ	Adult Total HI	Adjusted Ingestion HQ	Adjusted Dermal HQ	Adjusted Inhalation HQ	Adjusted Total HI	Ingestion Risk	Dermal Risk	Inhalation Risk	Total Risk
Benzo[a]pyrene	3.37E-02	2.40E-03	1.32E-03	2.12E-04	3.92E-03	7.74E-03	2.83E-03	2.12E-04	1.08E-02	3.92E-06	1.31E-06	2.61E-10	5.23E-06
Total Risk/HI	*3.37E-02*	*2.40E-03*	*1.32E-03*	*2.12E-04*	*3.92E-03*	*7.74E-03*	*2.83E-03*	*2.12E-04*	*1.08E-02*	*3.92E-06*	*1.31E-06*	*2.61E-10*	*5.23E-06*

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Site-specific Risk
Resident Soil Inputs

Variable	Resident Soil Default Value	Form-input Value
A (PEF Dispersion Constant)	16.2302	16.2302
A (VF Dispersion Constant)	11.911	11.911
A (VF Dispersion Constant - mass limit)	11.911	11.911
B (PEF Dispersion Constant)	18.7762	18.7762
B (VF Dispersion Constant)	18.4385	18.4385
B (VF Dispersion Constant - mass limit)	18.4385	18.4385
City (PEF Climate Zone) Selection	Default	Default
City (VF Climate Zone) Selection	Default	Default
C (PEF Dispersion Constant)	216.108	216.108
C (VF Dispersion Constant)	209.7845	209.7845
C (VF Dispersion Constant - mass limit)	209.7845	209.7845
foc (fraction organic carbon in soil) g/g	0.006	0.006
F(x) (function dependent on U_m/U_t) unitless	0.194	0.194
n (total soil porosity) L_{pore}/L_{soil}	0.43396	0.43396
p_b (dry soil bulk density) g/cm^3	1.5	1.5
p_b (dry soil bulk density - mass limit) g/cm^3	1.5	1.5
PEF (particulate emission factor) m^3/kg	1359344438	1359344438
p_s (soil particle density) g/cm^3	2.65	2.65
Q/C_{wind} (g/m^2-s per kg/m^3)	93.77	93.77
Q/C_{vol} (g/m^2-s per kg/m^3)	68.18	68.18
Q/C_{vol} (g/m^2-s per kg/m^3 - mass limit)	68.18	68.18
A_s (PEF acres)	0.5	0.5
A_s (VF acres)	0.5	0.5
A_s (VF mass-limit acres)	0.5	0.5
AF_{0-2} (mutagenic skin adherence factor) mg/cm^2	0.2	0.2
AF_{2-6} (mutagenic skin adherence factor) mg/cm^2	0.2	0.2
AF_{6-16} (mutagenic skin adherence factor) mg/cm^2	0.07	0.07
AF_{16-26} (mutagenic skin adherence factor) mg/cm^2	0.07	0.07
AF_{res-a} (skin adherence factor - adult) mg/cm^2	0.07	0.07
AF_{res-c} (skin adherence factor - child) mg/cm^2	0.2	0.2
AT_{res} (averaging time - resident carcinogenic)	365	365
BW_{0-2} (mutagenic body weight) kg	15	15

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Site-specific Risk
Resident Soil Inputs

Variable	Resident Soil Default Value	Form-input Value
BW_{2-6} (mutagenic body weight) kg	15	15
BW_{6-16} (mutagenic body weight) kg	80	80
BW_{16-26} (mutagenic body weight) kg	80	80
BW_{res-a} (body weight - adult) kg	80	80
BW_{res-c} (body weight - child) kg	15	15
$DFS_{res-adj}$ (age-adjusted soil dermal factor) mg/kg	103390	103390
$DFSM_{res-adj}$ (mutagenic age-adjusted soil dermal factor) mg/kg	428260	428260
ED_{res} (exposure duration) years	26	26
ED_{0-2} (mutagenic exposure duration) years	2	2
ED_{2-6} (mutagenic exposure duration) years	4	4
ED_{6-16} (mutagenic exposure duration) years	10	10
ED_{16-26} (mutagenic exposure duration) years	10	10
ED_{res-a} (exposure duration - adult) years	20	20
ED_{res-c} (exposure duration - child) years	6	6
EF_{res} (exposure frequency) days/year	350	350
EF_{0-2} (mutagenic exposure frequency) days/year	350	350
EF_{2-6} (mutagenic exposure frequency) days/year	350	350
EF_{6-16} (mutagenic exposure frequency) days/year	350	350
EF_{16-26} (mutagenic exposure frequency) days/year	350	350
EF_{res-a} (exposure frequency - adult) days/year	350	350
EF_{res-c} (exposure frequency - child) days/year	350	350
ET_{res} (exposure time) hours/day	24	24
ET_{0-2} (mutagenic exposure time) hours/day	24	24
ET_{2-6} (mutagenic exposure time) hours/day	24	24
ET_{6-16} (mutagenic exposure time) hours/day	24	24
ET_{16-26} (mutagenic exposure time) hours/day	24	24
ET_{res-a} (adult exposure time) hours/day	24	24
ET_{res-c} (child exposure time) hours/day	24	24
$IFS_{res-adj}$ (age-adjusted soil ingestion factor) mg/kg	36750	36750
$IFSM_{res-adj}$ (mutagenic age-adjusted soil ingestion factor) mg/kg	166833.3	166833.3
IRS_{0-2} (mutagenic soil intake rate) mg/day	200	200
IRS_{2-6} (mutagenic soil intake rate) mg/day	200	200

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Site-specific Risk
Resident Soil Inputs

Variable	Resident Soil Default Value	Form-input Value
IRS_{6-16} (mutagenic soil intake rate) mg/day	100	100
IRS_{16-26} (mutagenic soil intake rate) mg/day	100	100
IRS_{res-a} (soil intake rate - adult) mg/day	100	100
IRS_{res-c} (soil intake rate - child) mg/day	200	200
LT (lifetime) years	70	70
SA_{0-2} (mutagenic skin surface area) cm^2/day	2373	2373
SA_{2-6} (mutagenic skin surface area) cm^2/day	2373	2373
SA_{6-16} (mutagenic skin surface area) cm^2/day	6032	6032
SA_{16-26} (mutagenic skin surface area) cm^2/day	6032	6032
SA_{res-a} (skin surface area - adult) cm^2/day	6032	6032
SA_{res-c} (skin surface area - child) cm^2/day	2373	2373
T_w (groundwater temperature) Celsius	25	25
$Theta_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396	0.28396
$Theta_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15	0.15
T (exposure interval) s	819936000	819936000
T (exposure interval) yr	26	26
U_m (mean annual wind speed) m/s	4.69	4.69
U_t (equivalent threshold value)	11.32	11.32
V (fraction of vegetative cover) unitless	0.5	0.5

Site-specific Risk
Resident for Soil

Chemical	CAS Number	Mutagen?	VOC?	Chronic RfD (mg/kg-day)	RfD Ref	Chronic RfC (mg/m^3)	RfC Ref	SF_o (mg/kg-day)$^{-1}$	SF_o Ref	IUR (ug/m^3)$^{-1}$	IUR Ref	ABS_{gi}	ABS_{derm}	Volatilization Factor (m^3/kg)
TCDD, 2,3,7,8-	1746-01-6	No	Yes	7.00E-10	IRIS	4.00E-08	CALEPA	1.30E+05	CALEPA	3.80E+01	CALEPA	1	0.03	1.96E+06
**Total Risk/HI*				-		-		-		-		-	-	-

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Site-specific Risk
Resident for Soil

Chemical	DA	Particulate Emission Factor (m^3/kg)	Soil Saturation Concentration (mg/kg)	RBA	HLC (atm-m^3/mole)	Henry's Law Constant (unitless)	H` and HLC Ref	Henry's Law Constant Used in Calcs (unitless)	Normal Boiling Point BP (K)	BP Ref	Critical Temperature TC (K)	TC Ref	D_{ia}\ (cm^2/s)
TCDD, 2,3,7,8-	3.46E-09	1.36E+09	-	1	5.00E-05	2.04E-03	EPI	2.04E-03	6.52E+02	EPI	9.78E+02	Approx. from Tcrit=1.5xTBoil	4.70E-02
**Total Risk/HI*	-	-	-	-	-	-		-	-		-		-

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Site-specific Risk
Resident for Soil

Chemical	D_{iw}\ (cm^2/s)	Soil Concentration (mg/kg)	Child Ingestion Noncarcinogenic CDI (mg/kg-day)	Child Dermal Noncarcinogenic CDI (mg/kg-day)	Child Inhalation Noncarcinogenic CDI (mg/m^3)	Adult Ingestion Noncarcinogenic CDI (mg/kg-day)	Adult Dermal Noncarcinogenic CDI (mg/kg-day)	Adult Inhalation Noncarcinogenic CDI (mg/m^3)
TCDD, 2,3,7,8-	6.76E-06	0.00003885	4.97E-10	3.54E-11	1.90E-11	4.66E-11	5.90E-12	1.90E-11
**Total Risk/HI*	-	-	-	-	-	-	-	-

Output generated 09OCT2020:13:46:11

Site-specific Risk
Resident for Soil

Chemical	Adjusted Ingestion Noncarcinogenic CDI (mg/kg-day)	Adjusted Dermal Noncarcinogenic CDI (mg/kg-day)	Adjusted Inhalation Noncarcinogenic CDI (mg/m^3)	Ingestion Carcinogenic CDI (mg/kg-day)	Dermal Carcinogenic CDI (mg/kg-day)	Inhalation Carcinogenic CDI (ug/m^3)	Child Ingestion HQ	Child Dermal HQ	Child Inhalation HQ
TCDD, 2,3,7,8-	1.50E-10	1.27E-11	1.90E-11	5.59E-11	4.72E-12	7.06E-09	**7.10E-01**	5.05E-02	4.75E-04
**Total Risk/HI*	-	-	-	-	-	-	***7.10E-01***	*5.05E-02*	*4.75E-04*

Output generated 09OCT2020:13:46:11

Site-specific Risk
Resident for Soil

Chemical	Child Total HI	Adult Ingestion HQ	Adult Dermal HQ	Adult Inhalation HQ	Adult Total HI	Adjusted Ingestion HQ	Adjusted Dermal HQ	Adjusted Inhalation HQ	Adjusted Total HI	Ingestion Risk	Dermal Risk	Inhalation Risk	Total Risk
TCDD, 2,3,7,8-	**7.61E-01**	6.65E-02	8.43E-03	4.75E-04	7.54E-02	**2.15E-01**	1.81E-02	4.75E-04	**2.34E-01**	7.26E-06	6.13E-07	2.68E-07	8.15E-06
**Total Risk/HI*	***7.61E-01***	*6.65E-02*	*8.43E-03*	*4.75E-04*	*7.54E-02*	***2.15E-01***	*1.81E-02*	*4.75E-04*	***2.34E-01***	*7.26E-06*	*6.13E-07*	*2.68E-07*	*8.15E-06*

Output generated 09OCT2020:13:46:11

Site-specific Risk
Resident Soil Inputs

Variable	Resident Soil Default Value	Form-input Value
A (PEF Dispersion Constant)	16.2302	16.2302
A (VF Dispersion Constant)	11.911	11.911
A (VF Dispersion Constant - mass limit)	11.911	11.911
B (PEF Dispersion Constant)	18.7762	18.7762
B (VF Dispersion Constant)	18.4385	18.4385
B (VF Dispersion Constant - mass limit)	18.4385	18.4385
City (PEF Climate Zone) Selection	Default	Default
City (VF Climate Zone) Selection	Default	Default
C (PEF Dispersion Constant)	216.108	216.108
C (VF Dispersion Constant)	209.7845	209.7845
C (VF Dispersion Constant - mass limit)	209.7845	209.7845
foc (fraction organic carbon in soil) g/g	0.006	0.006
F(x) (function dependent on U_m/U_t) unitless	0.194	0.194
n (total soil porosity) L_{pore}/L_{soil}	0.43396	0.43396
p_b (dry soil bulk density) g/cm^3	1.5	1.5
p_b (dry soil bulk density - mass limit) g/cm^3	1.5	1.5
PEF (particulate emission factor) m^3/kg	1359344438	1359344438
p_s (soil particle density) g/cm^3	2.65	2.65
Q/C_{wind} (g/m^2-s per kg/m^3)	93.77	93.77
Q/C_{vol} (g/m^2-s per kg/m^3)	68.18	68.18
Q/C_{vol} (g/m^2-s per kg/m^3 - mass limit)	68.18	68.18
A_s (PEF acres)	0.5	0.5
A_s (VF acres)	0.5	0.5
A_s (VF mass-limit acres)	0.5	0.5
AF_{0-2} (mutagenic skin adherence factor) mg/cm^2	0.2	0.2
AF_{2-6} (mutagenic skin adherence factor) mg/cm^2	0.2	0.2
AF_{6-16} (mutagenic skin adherence factor) mg/cm^2	0.07	0.07
AF_{16-26} (mutagenic skin adherence factor) mg/cm^2	0.07	0.07
AF_{res-a} (skin adherence factor - adult) mg/cm^2	0.07	0.07
AF_{res-c} (skin adherence factor - child) mg/cm^2	0.2	0.2
AT_{res} (averaging time - resident carcinogenic)	365	365
BW_{0-2} (mutagenic body weight) kg	15	15

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Site-specific Risk
Resident Soil Inputs

Variable	Resident Soil Default Value	Form-input Value
BW_{2-6} (mutagenic body weight) kg	15	15
BW_{6-16} (mutagenic body weight) kg	80	80
BW_{16-26} (mutagenic body weight) kg	80	80
BW_{res-a} (body weight - adult) kg	80	80
BW_{res-c} (body weight - child) kg	15	15
$DFS_{res-adj}$ (age-adjusted soil dermal factor) mg/kg	103390	103390
$DFSM_{res-adj}$ (mutagenic age-adjusted soil dermal factor) mg/kg	428260	428260
ED_{res} (exposure duration) years	26	26
ED_{0-2} (mutagenic exposure duration) years	2	2
ED_{2-6} (mutagenic exposure duration) years	4	4
ED_{6-16} (mutagenic exposure duration) years	10	10
ED_{16-26} (mutagenic exposure duration) years	10	10
ED_{res-a} (exposure duration - adult) years	20	20
ED_{res-c} (exposure duration - child) years	6	6
EF_{res} (exposure frequency) days/year	350	350
EF_{0-2} (mutagenic exposure frequency) days/year	350	350
EF_{2-6} (mutagenic exposure frequency) days/year	350	350
EF_{6-16} (mutagenic exposure frequency) days/year	350	350
EF_{16-26} (mutagenic exposure frequency) days/year	350	350
EF_{res-a} (exposure frequency - adult) days/year	350	350
EF_{res-c} (exposure frequency - child) days/year	350	350
ET_{res} (exposure time) hours/day	24	24
ET_{0-2} (mutagenic exposure time) hours/day	24	24
ET_{2-6} (mutagenic exposure time) hours/day	24	24
ET_{6-16} (mutagenic exposure time) hours/day	24	24
ET_{16-26} (mutagenic exposure time) hours/day	24	24
ET_{res-a} (adult exposure time) hours/day	24	24
ET_{res-c} (child exposure time) hours/day	24	24
$IFS_{res-adj}$ (age-adjusted soil ingestion factor) mg/kg	36750	36750
$IFSM_{res-adj}$ (mutagenic age-adjusted soil ingestion factor) mg/kg	166833.3	166833.3
IRS_{0-2} (mutagenic soil intake rate) mg/day	200	200
IRS_{2-6} (mutagenic soil intake rate) mg/day	200	200

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Site-specific Risk
Resident Soil Inputs

Variable	Resident Soil Default Value	Form-input Value
IRS_{6-16} (mutagenic soil intake rate) mg/day	100	100
IRS_{16-26} (mutagenic soil intake rate) mg/day	100	100
IRS_{res-a} (soil intake rate - adult) mg/day	100	100
IRS_{res-c} (soil intake rate - child) mg/day	200	200
LT (lifetime) years	70	70
SA_{0-2} (mutagenic skin surface area) cm^2/day	2373	2373
SA_{2-6} (mutagenic skin surface area) cm^2/day	2373	2373
SA_{6-16} (mutagenic skin surface area) cm^2/day	6032	6032
SA_{16-26} (mutagenic skin surface area) cm^2/day	6032	6032
SA_{res-a} (skin surface area - adult) cm^2/day	6032	6032
SA_{res-c} (skin surface area - child) cm^2/day	2373	2373
T_w (groundwater temperature) Celsius	25	25
$Theta_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396	0.28396
$Theta_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15	0.15
T (exposure interval) s	819936000	819936000
T (exposure interval) yr	26	26
U_m (mean annual wind speed) m/s	4.69	4.69
U_t (equivalent threshold value)	11.32	11.32
V (fraction of vegetative cover) unitless	0.5	0.5

Output generated 02SEP2020:11:50:31

Site-specific Risk

Resident for Soil

Chemical	CAS Number	Mutagen?	VOC?	Chronic RfD (mg/kg-day)	RfD Ref	Chronic RfC (mg/m^3)	RfC Ref	SF_o (mg/kg-day)$^{-1}$	SF_o Ref	IUR (ug/m^3)$^{-1}$	IUR Ref	ABS_{gi}	ABS_{derm}	Volatilization Factor (m^3/kg)	DA
Antimony (metallic)	7440-36-0	No	No	4.00E-04	IRIS	3.00E-04	ATSDR Final	-		-		0.15	-	-	-
Thallium (Soluble Salts)	7440-28-0	No	No	1.00E-05	SCREEN Current	-		-		-		1	-	-	-
**Total Risk/HI*				-		-		-		-		-	-	-	-

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Site-specific Risk
Resident for Soil

Chemical	Particulate Emission Factor (m^3/kg)	Soil Saturation Concentration (mg/kg)	RBA	HLC (atm-m^3/mole)	Henry's Law Constant (unitless)	H` and HLC Ref	Henry's Law Constant Used in Calcs (unitless)	Normal Boiling Point BP (K)	BP Ref	Critical Temperature TC (K)	TC Ref	D_{ia}\ (cm^2/s)	D_{iw}\ (cm^2/s)
Antimony (metallic)	1.36E+09	-	1	-	-		-	1.91E+03	PHYSPROP	5.07E+03	YAWS	-	-
Thallium (Soluble Salts)	1.36E+09	-	1	-	-		-	1.73E+03	PHYSPROP	4.65E+03	YAWS	-	-
**Total Risk/HI*	-	-	-	-	-		-	-		-		-	-

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Site-specific Risk
Resident for Soil

Chemical	Soil Concentration (mg/kg)	Child Ingestion Noncarcinogenic CDI (mg/kg-day)	Child Dermal Noncarcinogenic CDI (mg/kg-day)	Child Inhalation Noncarcinogenic CDI (mg/m^3)	Adult Ingestion Noncarcinogenic CDI (mg/kg-day)	Adult Dermal Noncarcinogenic CDI (mg/kg-day)	Adult Inhalation Noncarcinogenic CDI (mg/m^3)
Antimony (metallic)	5.5	7.03E-05	-	3.88E-09	6.59E-06	-	3.88E-09
Thallium (Soluble Salts)	0.23	2.94E-06	-	1.62E-10	2.76E-07	-	1.62E-10
**Total Risk/HI*	-	-	-	-	-	-	-

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Site-specific Risk
Resident for Soil

Chemical	Adjusted Ingestion Noncarcinogenic CDI (mg/kg-day)	Adjusted Dermal Noncarcinogenic CDI (mg/kg-day)	Adjusted Inhalation Noncarcinogenic CDI (mg/m^3)	Ingestion Carcinogenic CDI (mg/kg-day)	Dermal Carcinogenic CDI (mg/kg-day)	Inhalation Carcinogenic CDI (ug/m^3)	Child Ingestion HQ	Child Dermal HQ	Child Inhalation HQ
Antimony (metallic)	2.13E-05	-	3.88E-09	7.91E-06	-	1.44E-06	**1.76E-01**	-	1.29E-05
Thallium (Soluble Salts)	8.91E-07	-	1.62E-10	3.31E-07	-	6.03E-08	**2.94E-01**	-	-
**Total Risk/HI*	-	-	-	-	-	-	***4.70E-01***	-	*1.29E-05*

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Site-specific Risk
Resident for Soil

Chemical	Child Total HI	Adult Ingestion HQ	Adult Dermal HQ	Adult Inhalation HQ	Adult Total HI	Adjusted Ingestion HQ	Adjusted Dermal HQ	Adjusted Inhalation HQ	Adjusted Total HI	Ingestion Risk	Dermal Risk	Inhalation Risk	Total Risk
Antimony (metallic)	**1.76E-01**	1.65E-02	-	1.29E-05	1.65E-02	5.32E-02	-	1.29E-05	5.33E-02	-	-	-	-
Thallium (Soluble Salts)	**2.94E-01**	2.76E-02	-	-	2.76E-02	8.91E-02	-	-	8.91E-02	-	-	-	-
**Total Risk/HI*	***4.70E-01***	*4.40E-02*	*-*	*1.29E-05*	*4.41E-02*	***1.42E-01***	*-*	*1.29E-05*	***1.42E-01***	*-*	*-*	*-*	*-*

Output generated 02SEP2020:11:50:31

Site-specific Risk
Resident Soil Inputs

Variable	Resident Soil Default Value	Form-input Value
A (PEF Dispersion Constant)	16.2302	16.2302
A (VF Dispersion Constant)	11.911	11.911
A (VF Dispersion Constant - mass limit)	11.911	11.911
B (PEF Dispersion Constant)	18.7762	18.7762
B (VF Dispersion Constant)	18.4385	18.4385
B (VF Dispersion Constant - mass limit)	18.4385	18.4385
City (PEF Climate Zone) Selection	Default	Default
City (VF Climate Zone) Selection	Default	Default
C (PEF Dispersion Constant)	216.108	216.108
C (VF Dispersion Constant)	209.7845	209.7845
C (VF Dispersion Constant - mass limit)	209.7845	209.7845
foc (fraction organic carbon in soil) g/g	0.006	0.006
F(x) (function dependent on U_m/U_t) unitless	0.194	0.194
n (total soil porosity) L_{pore}/L_{soil}	0.43396	0.43396
p_b (dry soil bulk density) g/cm^3	1.5	1.5
p_b (dry soil bulk density - mass limit) g/cm^3	1.5	1.5
PEF (particulate emission factor) m^3/kg	1359344438	1359344438
p_s (soil particle density) g/cm^3	2.65	2.65
Q/C_{wind} (g/m^2-s per kg/m^3)	93.77	93.77
Q/C_{vol} (g/m^2-s per kg/m^3)	68.18	68.18
Q/C_{vol} (g/m^2-s per kg/m^3 - mass limit)	68.18	68.18
A_s (PEF acres)	0.5	0.5
A_s (VF acres)	0.5	0.5
A_s (VF mass-limit acres)	0.5	0.5
AF_{0-2} (mutagenic skin adherence factor) mg/cm^2	0.2	0.2
AF_{2-6} (mutagenic skin adherence factor) mg/cm^2	0.2	0.2
AF_{6-16} (mutagenic skin adherence factor) mg/cm^2	0.07	0.07
AF_{16-26} (mutagenic skin adherence factor) mg/cm^2	0.07	0.07
AF_{res-a} (skin adherence factor - adult) mg/cm^2	0.07	0.07
AF_{res-c} (skin adherence factor - child) mg/cm^2	0.2	0.2
AT_{res} (averaging time - resident carcinogenic)	365	365
BW_{0-2} (mutagenic body weight) kg	15	15

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Site-specific Risk
Resident Soil Inputs

Variable	Resident Soil Default Value	Form-input Value
BW_{2-6} (mutagenic body weight) kg	15	15
BW_{6-16} (mutagenic body weight) kg	80	80
BW_{16-26} (mutagenic body weight) kg	80	80
BW_{res-a} (body weight - adult) kg	80	80
BW_{res-c} (body weight - child) kg	15	15
$DFS_{res-adj}$ (age-adjusted soil dermal factor) mg/kg	103390	103390
$DFSM_{res-adj}$ (mutagenic age-adjusted soil dermal factor) mg/kg	428260	428260
ED_{res} (exposure duration) years	26	26
ED_{0-2} (mutagenic exposure duration) years	2	2
ED_{2-6} (mutagenic exposure duration) years	4	4
ED_{6-16} (mutagenic exposure duration) years	10	10
ED_{16-26} (mutagenic exposure duration) years	10	10
ED_{res-a} (exposure duration - adult) years	20	20
ED_{res-c} (exposure duration - child) years	6	6
EF_{res} (exposure frequency) days/year	350	350
EF_{0-2} (mutagenic exposure frequency) days/year	350	350
EF_{2-6} (mutagenic exposure frequency) days/year	350	350
EF_{6-16} (mutagenic exposure frequency) days/year	350	350
EF_{16-26} (mutagenic exposure frequency) days/year	350	350
EF_{res-a} (exposure frequency - adult) days/year	350	350
EF_{res-c} (exposure frequency - child) days/year	350	350
ET_{res} (exposure time) hours/day	24	24
ET_{0-2} (mutagenic exposure time) hours/day	24	24
ET_{2-6} (mutagenic exposure time) hours/day	24	24
ET_{6-16} (mutagenic exposure time) hours/day	24	24
ET_{16-26} (mutagenic exposure time) hours/day	24	24
ET_{res-a} (adult exposure time) hours/day	24	24
ET_{res-c} (child exposure time) hours/day	24	24
$IFS_{res-adj}$ (age-adjusted soil ingestion factor) mg/kg	36750	36750
$IFSM_{res-adj}$ (mutagenic age-adjusted soil ingestion factor) mg/kg	166833.3	166833.3
IRS_{0-2} (mutagenic soil intake rate) mg/day	200	200
IRS_{2-6} (mutagenic soil intake rate) mg/day	200	200

Site-specific Risk
Resident Soil Inputs

Variable	Resident Soil Default Value	Form-input Value
IRS_{6-16} (mutagenic soil intake rate) mg/day	100	100
IRS_{16-26} (mutagenic soil intake rate) mg/day	100	100
IRS_{res-a} (soil intake rate - adult) mg/day	100	100
IRS_{res-c} (soil intake rate - child) mg/day	200	200
LT (lifetime) years	70	70
SA_{0-2} (mutagenic skin surface area) cm^2/day	2373	2373
SA_{2-6} (mutagenic skin surface area) cm^2/day	2373	2373
SA_{6-16} (mutagenic skin surface area) cm^2/day	6032	6032
SA_{16-26} (mutagenic skin surface area) cm^2/day	6032	6032
SA_{res-a} (skin surface area - adult) cm^2/day	6032	6032
SA_{res-c} (skin surface area - child) cm^2/day	2373	2373
T_w (groundwater temperature) Celsius	25	25
$Theta_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396	0.28396
$Theta_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15	0.15
T (exposure interval) s	819936000	819936000
T (exposure interval) yr	26	26
U_m (mean annual wind speed) m/s	4.69	4.69
U_t (equivalent threshold value)	11.32	11.32
V (fraction of vegetative cover) unitless	0.5	0.5

Output generated 02SEP2020:12:37:28

Site-specific Risk
Resident for Soil

Chemical	CAS Number	Mutagen?	VOC?	Chronic RfD (mg/kg-day)	RfD Ref	Chronic RfC (mg/m³)	RfC Ref	SF_o (mg/kg-day)$^{-1}$	SF_o Ref	IUR (ug/m³)$^{-1}$	IUR Ref	ABS_{gi}	ABS_{derm}	Volatilization Factor (m³/kg)	DA	Particulate Emission Factor (m³/kg)
Thallium (Soluble Salts)	7440-28-0	No	No	1.00E-05	SCREEN Current	-		-		-		1	-	-	-	1.36E+09
**Total Risk/HI*				-		-		-		-		-	-	-	-	-

Output generated 02SEP2020:12:37:28

Site-specific Risk
Resident for Soil

Chemical	Soil Saturation Concentration (mg/kg)	RBA	HLC (atm-m^3/mole)	Henry's Law Constant (unitless)	H` and HLC Ref	Henry's Law Constant Used in Calcs (unitless)	Normal Boiling Point BP (K)	BP Ref	Critical Temperature TC (K)	TC Ref	D_{ia}\ (cm^2/s)	D_{iw}\ (cm^2/s)	Soil Concentration (mg/kg)
Thallium (Soluble Salts)	-	1	-	-		-	1.73E+03	PHYSPROP	4.65E+03	YAWS	-	-	0.29
**Total Risk/HI*	-	-	-	-		-	-		-		-	-	-

Output generated 02SEP2020:12:37:28

Site-specific Risk
Resident for Soil

Chemical	Child Ingestion Noncarcinogenic CDI (mg/kg-day)	Child Dermal Noncarcinogenic CDI (mg/kg-day)	Child Inhalation Noncarcinogenic CDI (mg/m^3)	Adult Ingestion Noncarcinogenic CDI (mg/kg-day)	Adult Dermal Noncarcinogenic CDI (mg/kg-day)	Adult Inhalation Noncarcinogenic CDI (mg/m^3)	Adjusted Ingestion Noncarcinogenic CDI (mg/kg-day)
Thallium (Soluble Salts)	3.71E-06	-	2.05E-10	3.48E-07	-	2.05E-10	1.12E-06
**Total Risk/HI*	-	-	-	-	-	-	-

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Site-specific Risk
Resident for Soil

Chemical	Adjusted Dermal Noncarcinogenic CDI (mg/kg-day)	Adjusted Inhalation Noncarcinogenic CDI (mg/m³)	Ingestion Carcinogenic CDI (mg/kg-day)	Dermal Carcinogenic CDI (mg/kg-day)	Inhalation Carcinogenic CDI (ug/m³)	Child Ingestion HQ	Child Dermal HQ	Child Inhalation HQ	Child Total HI	Adult Ingestion HQ	Adult Dermal HQ
Thallium (Soluble Salts)	-	2.05E-10	4.17E-07	-	7.60E-08	**3.71E-01**	-	-	**3.71E-01**	3.48E-02	-
**Total Risk/HI*	-	-	-	-	-	***3.71E-01***	-	-	***3.71E-01***	*3.48E-02*	-

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Site-specific Risk
Resident for Soil

Chemical	Adult Inhalation HQ	Adult Total HI	Adjusted Ingestion HQ	Adjusted Dermal HQ	Adjusted Inhalation HQ	Adjusted Total HI	Ingestion Risk	Dermal Risk	Inhalation Risk	Total Risk
Thallium (Soluble Salts)	-	3.48E-02	**1.12E-01**	-	-	**1.12E-01**	-	-	-	-
**Total Risk/HI*	*-*	*3.48E-02*	***1.12E-01***	*-*	*-*	***1.12E-01***	*-*	*-*	*-*	*-*

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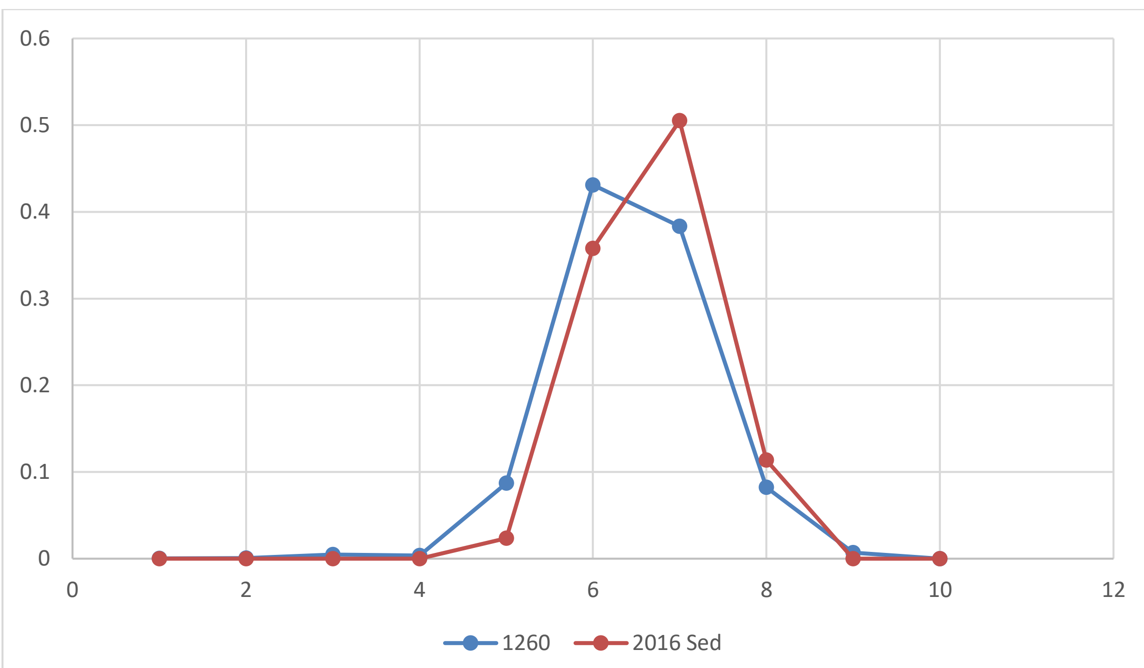
APPENDIX E

DAM 4 PCB SOURCE SUMMARY

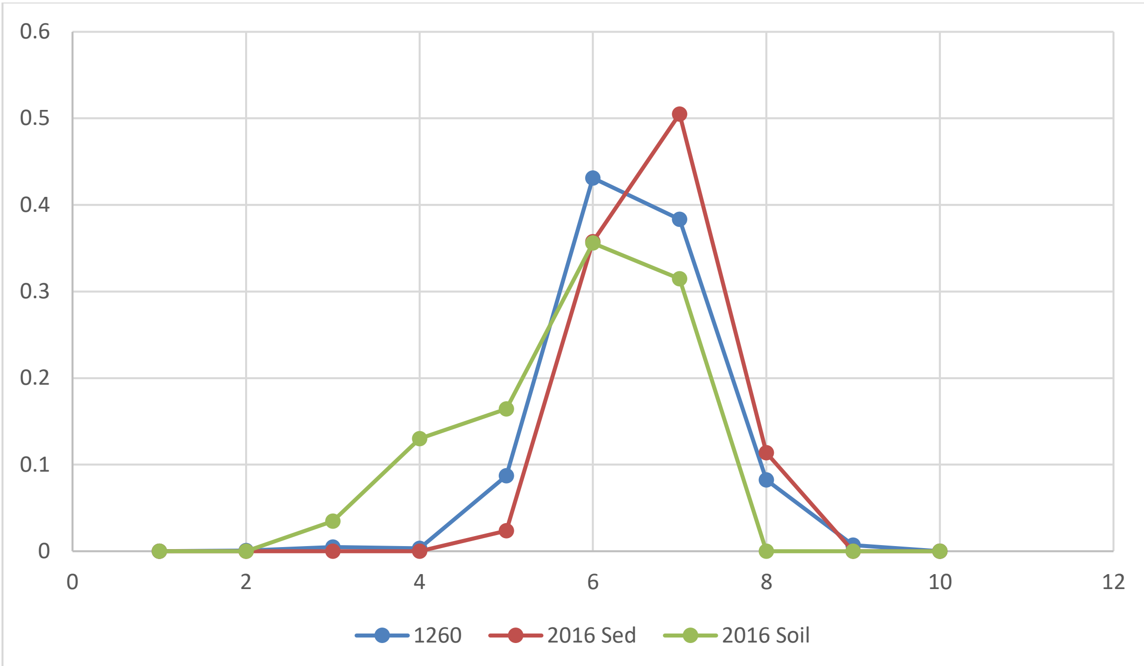
Potential Source of PCB at Dam 4 Transect 1

During the Brandywine River dam sediment characterization effort, one sample reported a concentration of total PCBs above the method detection limits. PCBs were reported at a concentration of 69.0 µg/kg in the composite sample of Dam 4 Transect 1. There is a known source of PCBs in the Hazardous Substance Cleanup Act (HSCA) Site adjacent to Dam 4. Site DE-1304/DE-1695 is an approximate 12-acre site that straddles Dam 4. This site is known as Wilmington Piece Dye, Bancroft Mills, Rockford Falls Lower Parcel, and the Falls. For more information on HSCA investigation, go to https://www.nav.dnrec.delaware.gov/DEN3/.

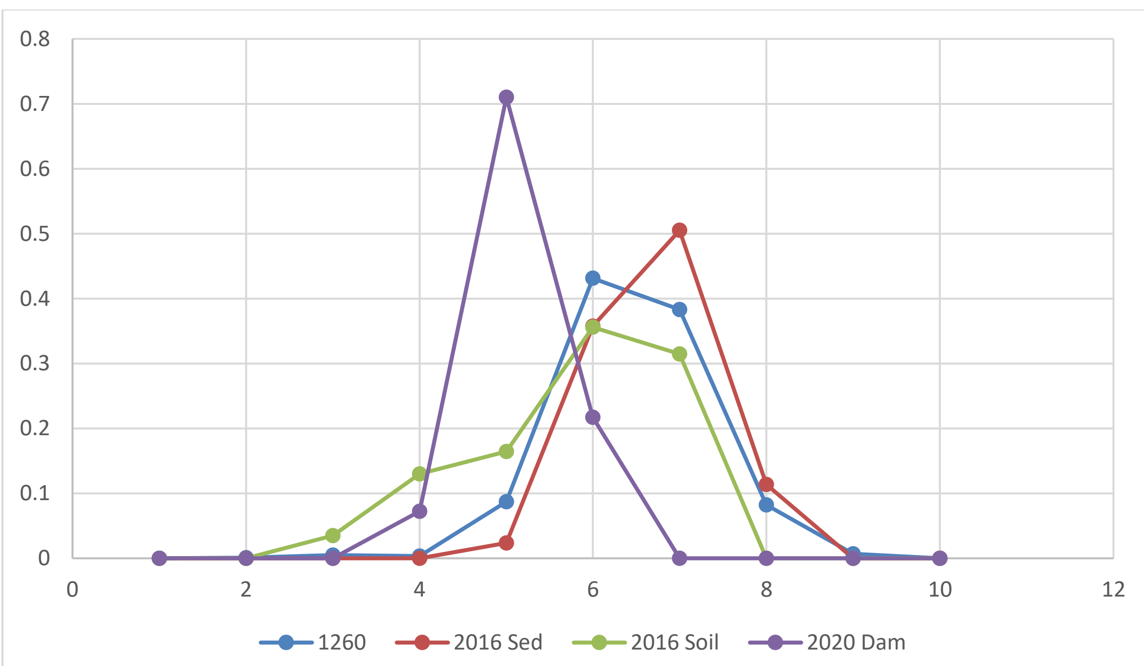
PCBs has never been a contaminant of concern to human health at the site adjacent to Dam 4. However, due to the nature of the contaminant, it is always a concern when detected in or near fishable water. It was first detected in the sediment below the dam in 1997. 40 µg/kg of Aroclor 1260 was reported 550 feet below the dam. During the 2016 Remedial Investigation, total PCBs were reported at 5.3 µg/kg in a sediment sample, but 237.6 µg/kg in the sample's duplicate. Aroclor 1260 contains a high percentage of high chlorine biphenyl (USDHSS, 2000). When PCB mixtures are release in the environment, the lower chlorine biphenyls can be reduced through volatilization or washing, leaving behind a mixture of heavier chlorine biphenyls. Aroclor 1260 lacks these lighter biphenyls and maintains a fingerprint that is more resistant to change. Below is a graph of the relative percent of each homolog group of a standard of Aroclor 1260 and the Duplicate sample collect in 2016.



Added to that chart is the same analysis done on a soil sample collected adjacent to the sediment sample collected in 2016.



This is not a conclusive match, but due to changes in the site and the time that has passed this is the only comparison available. There are similarities in the distribution of a standard of Aroclor 1260, the sediment sample collected in 2016, as well as the soil sample collected in 2016. Below is the same graph with the addition of the relative percent of each homolog group of the sample collected from transect 1.



The primary differences are the high percentage of the penta- homolog group and the lack of the hepta- homolog group in the sample collected during the Dam characterization effort. Based on the relative similarities of the 2016 samples and the 1997 aroclor sample and the differences with the Transect 1 Dam 4 sample, it appears that there are other sources of PCBs to sediments in the Brandywine River.

To address the high concentration of PCBs discovered in sediment during the 2016 investigation, a removal action took place. During removal efforts, very little sediment was found in the area and hand removal was required. A total of 5 gallons of sediment was removed. This was deemed adequate as finer grained sediment did not exist. The lack of sediment was confirmed during dam sediment characterization.