

Brandywine River Dams Analysis of Chemical Contaminants in Sediments



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**Watershed Assessment & Management Section
and
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Contents

Executive Summary	i
1 Introduction	1
1.1 Brandywine River Watershed Characteristics	2
1.1.1 Delaware’s Brandywine River Dams	2
1.1.2 Topography	4
1.1.3 Geology	4
1.1.4 Precipitation	4
1.1.5 Surface Water Discharge and Peak Discharge Events	4
1.1.6 Land Use Type and Population	5
1.1.7 Cultural and Recreational Resources	5
1.2 Conceptual Exposure Model	5
1.3 Bioavailability	6
2 Methods	7
2.1 Field Methods	7
2.2 Laboratory Methods	8
2.3 Sediment Volume Assessment Methods	11
2.3.1 Method 1-Wedge Estimate	11
2.3.2 Method 2-Transect Estimate	12
2.3.3 Method 3-Thiessen Polygons, Point Estimate	12
2.4 Chemical Data Assessment Methods	12
3 Results and Discussion	15
3.1 Sediment Evaluation	15
3.1.1 Grain Size Distribution & Total Organic Carbon	15
3.1.2 Sediment Volume Estimates	16
3.2 Sediment Contamination Evaluation	17
3.2.1 Inorganic (Metals) Assessment	17
3.2.2 Mercury Assessment	20
3.2.3 Polychlorinated Biphenyl (PCB) Assessment	22
3.2.4 Dioxins and Furans Assessment	23

3.2.5	Polycyclic Aromatic Hydrocarbon (PAH) Assessment	28
3.2.6	Pesticide Assessment	30
3.2.7	Per- and Polyfluoroalkyl Substances (PFAS) Assessment	32
4	Conclusions.....	35
4.1	Sediment Volume	35
4.2	Metals.....	35
4.3	Mercury	36
4.4	PCBs	36
4.4.1	Former PCB Source at Dam 4	37
4.5	Dioxins and Furans	38
4.6	PAHs	38
4.7	Pesticides.....	39
4.8	PFAS	40
5	References.....	41

LIST OF TABLES

Table 3-3 Inorganic Results - Brandywine River Dam Sediments

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

Table 3-5 PAH Results - Brandywine River Dam Sediments

Table 3-6 Pesticide Results - Brandywine River Dam Sediments

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

LIST OF FIGURES

Figure 1 Brandywine River Dams - Sediment Evaluation Middle and Lower
Brandywine River Watersheds

Figure 2 Brandywine River Dam 2 Sample Locations and Transects

Figure 3 Brandywine River Dam 4 Sample Locations and Transects

Figure 4 Brandywine River Dam 5 Sample Locations and Transects

Figure 5 Brandywine River Dam 6 Sample Locations and Transects

Figure 6 Brandywine River Dam 7 Sample Locations and Transects

Figure 7 Brandywine River Dam 8 Sample Locations and Transects

Figure 8 Brandywine River Dam 9 Sample Locations and Transects

Figure 9 Brandywine River Dam 10 Sample Locations and Transects

Figure 10 Brandywine River Dam 11 Sample locations and Transects

LIST OF APPENDICES

Appendix A Aquasurvey, Inc. Field Logs

Appendix B Laboratory Analytical Reports

Appendix C Toxicity Evaluations of Brandywine River Sediments

Appendix D RAIS Risk Calculator Output

Appendix E Dam 4 PCB Source Summary

Executive Summary

DNREC's Watershed Approach to Toxics Assessment and Restoration (WATAR) team evaluated physical and chemical data from sediment samples collected along 26 transects behind 9 dams in the Delaware portion of the Brandywine River during the summer of 2020 (Dams #2, #4, #6, #7, #8, #9, #10 and #11) and winter of 2023 (Dam #5). 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 11 of the 26 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 #5 and Dam #8 appear to be greater than the other dams sampled, but neither acute nor chronic toxicity to aquatic life is expected.

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 #5, 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 three locations where pesticides were detected during this study (at Dam #2, Dam #5 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 upstream 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 and winter of 2023 (Dam #5). 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 (aka Brandywine River Restoration Trust) 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. Lastly, 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's 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 the 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 Hurricanes Floyd, Agnes, and Ida. 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). Based upon 75 years of record, the Brandywine River at Wilmington, DE station recorded Hurricane Agnes (June 1972) as the second highest peak flow at 29,000

cfs. The highest measured stream flow of 33,700 cfs was recorded at Wilmington, Delaware in September 2021.

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

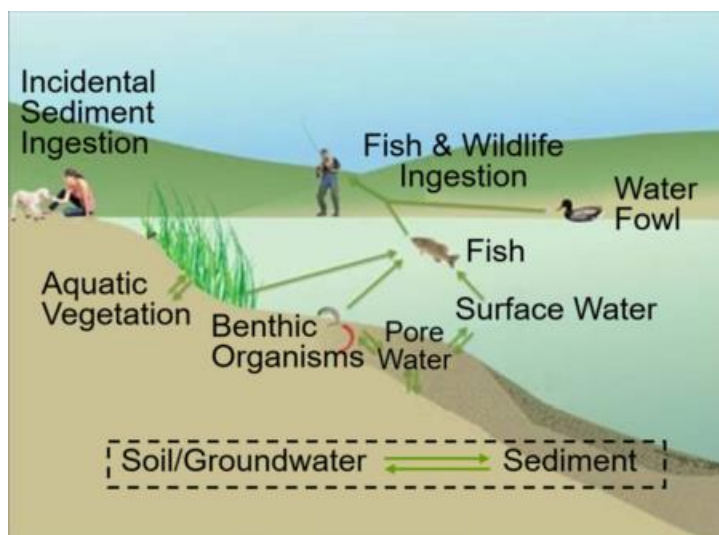
The Brandywine River watershed provides numerous ecological and natural functions while also serving as a recreation destination. The watershed has a robust and growing ecotourism industry and is an important attraction for a variety of popular tourism and recreational activities in the mid-Atlantic 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, June 2020, and January 2023. ASI conducted all sediment sampling activities, while DNREC conducted all sediment sample processing for laboratory analysis by Eurofins Environment Testing Northeast, L.L.C. (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 representative of the entire sediment wedge behind those dams. Finally, sampling behind Brandywine Dam #5 was completed in January 2023 after access related issues and COVID-19 communication complications were resolved.

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 10. 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 Eurofins Environment Testing Northeast, L.L.C. 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 and January 2023.	
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	8270E SIM
2-Methylnaphthalene	8270E SIM
Acenaphthene	8270E SIM
Acenaphthylene	8270E SIM
Anthracene	8270E SIM
Benzo(a)anthracene	8270E SIM
Benzo(a)pyrene	8270E SIM
Benzo(b)fluoranthene	8270E SIM
Benzo(e)pyrene	8270E SIM
Benzo(g,h,i)perylene	8270E SIM
Benzo(k)fluoranthene	8270E SIM
Chrysene	8270E SIM
C1-Chrysenes	8270E SIM
C2-Chrysenes	8270E SIM
C3-Chrysenes	8270E SIM
C4-Chrysenes	8270E SIM

Dibenz(a,h)anthracene	8270E SIM
Fluoranthene	8270E SIM
C1-Fluoranthenes/pyrene	8270E SIM
Fluorene	8270E SIM
C1-Fluorenes	8270E SIM
C2-Fluorenes	8270E SIM
C3-Fluorenes	8270E SIM
Indeno(1,2,3-cd)pyrene	8270E SIM
Naphthalene	8270E SIM
C2-Naphthalenes	8270E SIM
C3-Naphthalenes	8270E SIM
C4-Naphthalenes	8270E SIM
Perylene	8270E SIM
Phenanthrene	8270E SIM
C1-Phenanthrenes/Anthracenes	8270E SIM
C2-Phenanthrenes/Anthracenes	8270E SIM
C3-Phenanthrenes/Anthracenes	8270E SIM
C4-Phenanthrenes/Anthracenes	8270E SIM
Pyrene	8270E 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

*Due to modified DNREC policy and procedure between 2020 and 2023, the Dam #5 samples reported a different list of PFAS compounds than the samples analyzed in 2020. See Table 3-7.

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 River 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. Thiessen polygons are not uniform in size but are driven by the number and location of data 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/around each probe location, which was subsequently multiplied by the sediment thickness at that point to generate a volume of sediment associated with each point. 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), 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 (DNREC, 2013) were used for data and modeled concentration estimate comparison.

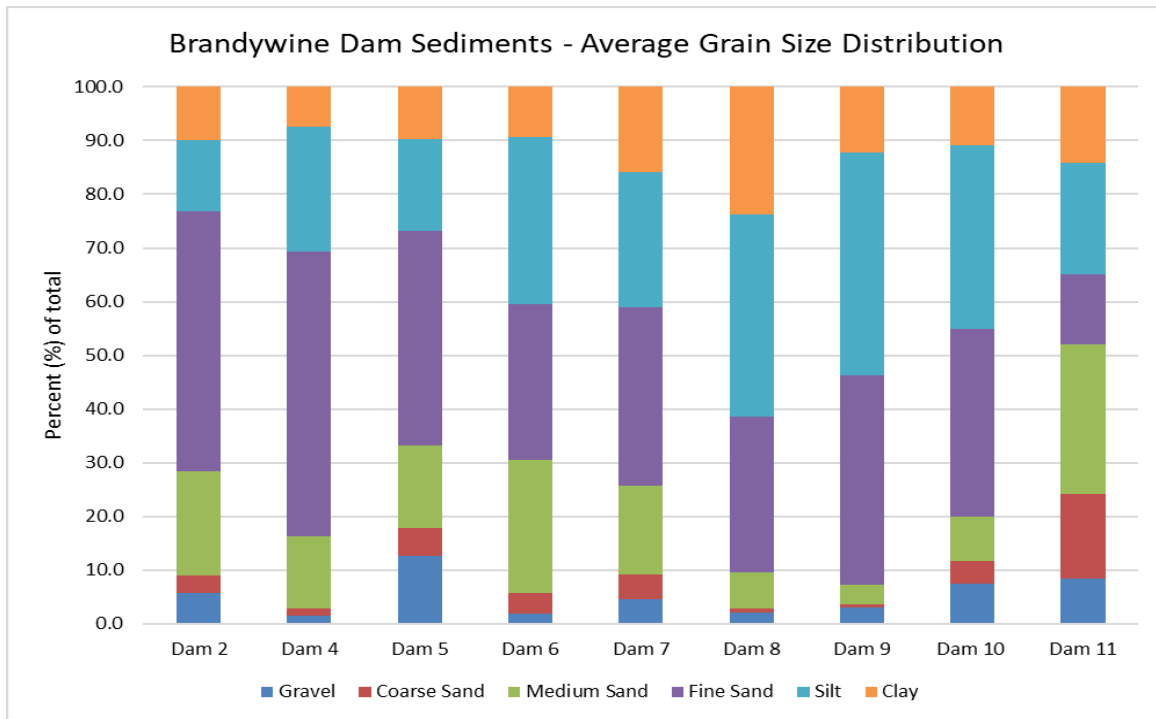
3.1.1 Grain Size Distribution & Total Organic Carbon

The grain size compositions of the Brandywine River dam composited sediment transect samples ranged from 0.3 to 28.1 percent gravel, 27.0 to 78.4 percent sand, 10.0 to 47.3 percent silt, and 3.8 to 24.2 percent clay (Table 3-1). Total organic carbon content ranged from 1,740 milligrams per kilogram (mg/kg) (0.17%) 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 Transect 1	3.2	49.4	31.2	16.2	1,740
Dam 5 Transect 2	28.1	48.9	13.9	9.1	15,800
Dam 5 Transect 3	10.9	69.5	10.6	9.0	4,290
Dam 5 Transect 4	8.7	73.7	12.7	4.9	6,660
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_Revised 2023_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 coarse 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	12,100	8,500	9,800
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.

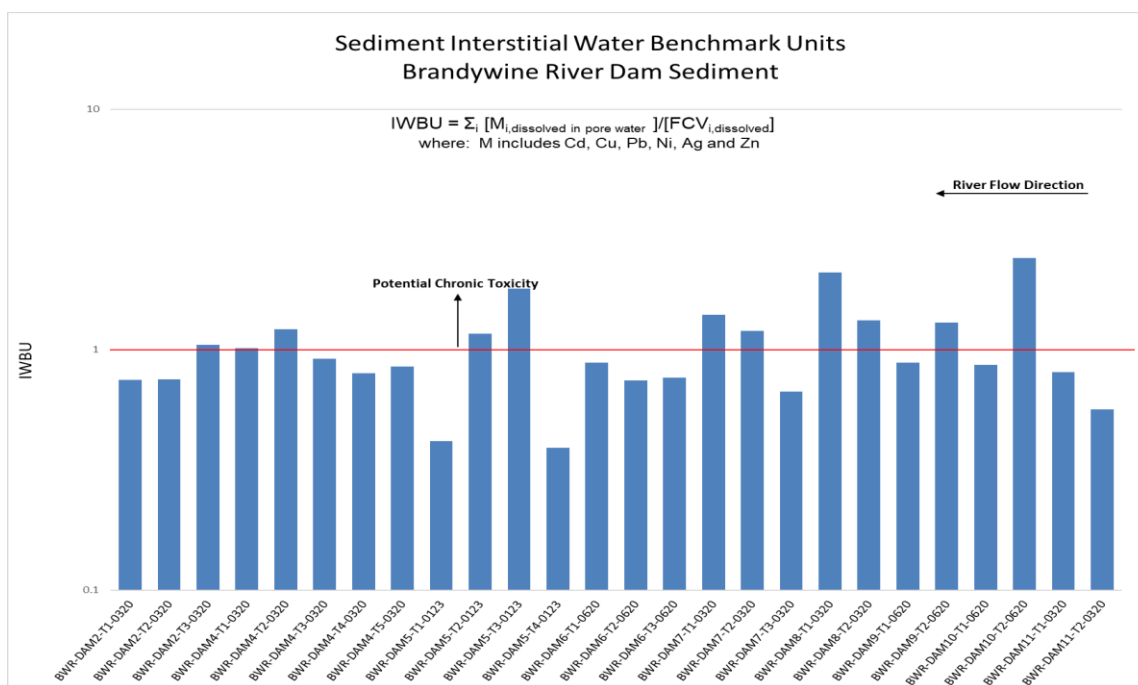
3.2.1 Inorganic (Metals) Assessment

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 26 composite samples from Brandywine River dam sediments had IWBU values for acute toxicity less than 1. A total of 11 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.



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. =

= 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.

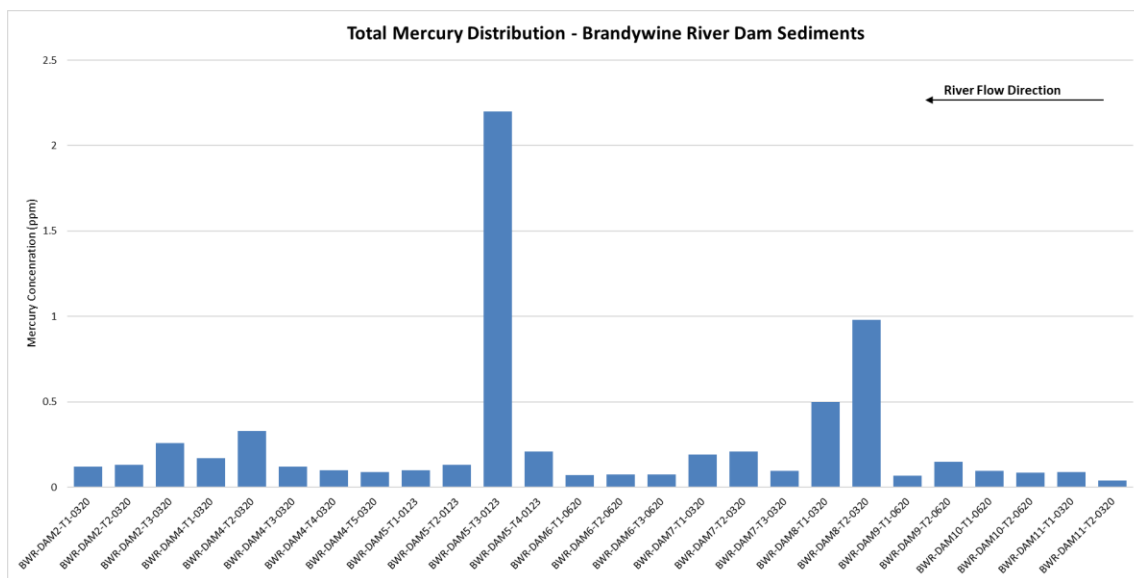
The estimated porewater concentration of arsenic exceeded the applicable human health water quality criterion (fish and water ingestion) in 18 of the 26 composite sediment samples collected during this study ($T.U._{hh}$ values ranged from 1.07 to 3.18). The calculated porewater concentration of thallium exceeded the human health criterion in all 26 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 11.72 micrograms per liter ($\mu\text{g/L}$) and 5.26 $\mu\text{g/L}$, 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 $\mu\text{g/L}$ for arsenic and 2 $\mu\text{g/L}$ 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 possible, however, that dilution from surface water might mitigate any potential risk. To evaluate this hypothesis, the most recent City of Wilmington Surface Water Quality Report (2022) 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 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 from drinking water and/or eating fish from the Brandywine River.

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 26 composite samples. Estimated concentrations of thallium were reported for 10 of the 26 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 26 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 thallium, were used in the RAIS online risk calculator. Results indicated that human health risk from these compounds (along with mercury) 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_Revised 2023_Metals_Final spreadsheet included in Appendix C. RAIS output is included in Appendix D.

3.2.2 Mercury Assessment

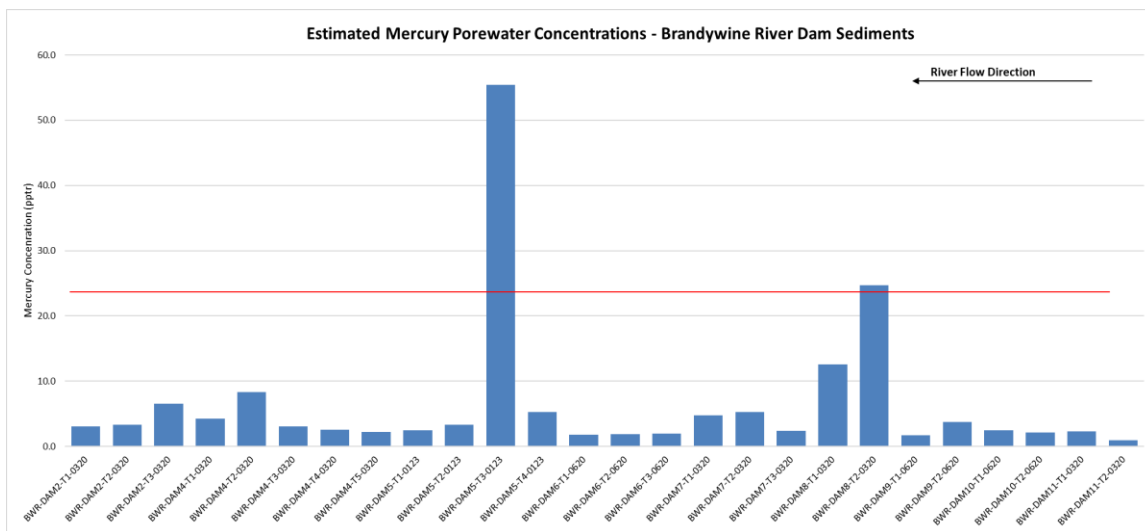
Total mercury was detected in all of the sediment samples collected from the Brandywine River at concentrations exceeding method detection limits. Concentrations ranged from 0.038 milligrams per kilogram (mg/kg) at Dam 11 Transect 2 to 2.2 mg/kg at Dam 5 Transect 3. The plot below shows total mercury 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 concentrations were 55.39 ng/L at Dam 5 Transect 3 and 24.7 ng/L at Dam 8 Transect 2, both 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 evaluated (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, only one of the sample results for total mercury exceeded the applicable soil screening level (Dam 5 Transect 3). Utilizing the maximum concentrations of mercury, and the other two metals that exceeded screening levels (antimony and thallium), the RAIS online risk calculator indicated that cumulative human health risk from these compounds are not expected under the "recreator" scenario, "excavation worker" scenario" or "residential" scenario.

More detailed information regarding the approach used for this assessment and its results is included in the BWR_Revised 2023_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 ($\mu\text{g/kg}$), 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 ($0.014 \mu\text{g/L}$). 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 Health (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 $0.00212 \mu\text{g/L}$ at Dam 4 Transect 1 is approximately 30 times greater than the referenced surface water quality criterion of $0.000064 \mu\text{g/L}$. This indicates the potential for human health impact from fish and water ingestion. For additional context, the drinking water MCL for PCBs is $0.5 \mu\text{g/L}$ (DNREC, 2011), which is more than 200 times greater than the estimated concentration of $0.00212 \mu\text{g/L}$ 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 $\frac{1}{2}$ 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 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 26 sites of 0.000384 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 (2020/2022) 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 26 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.

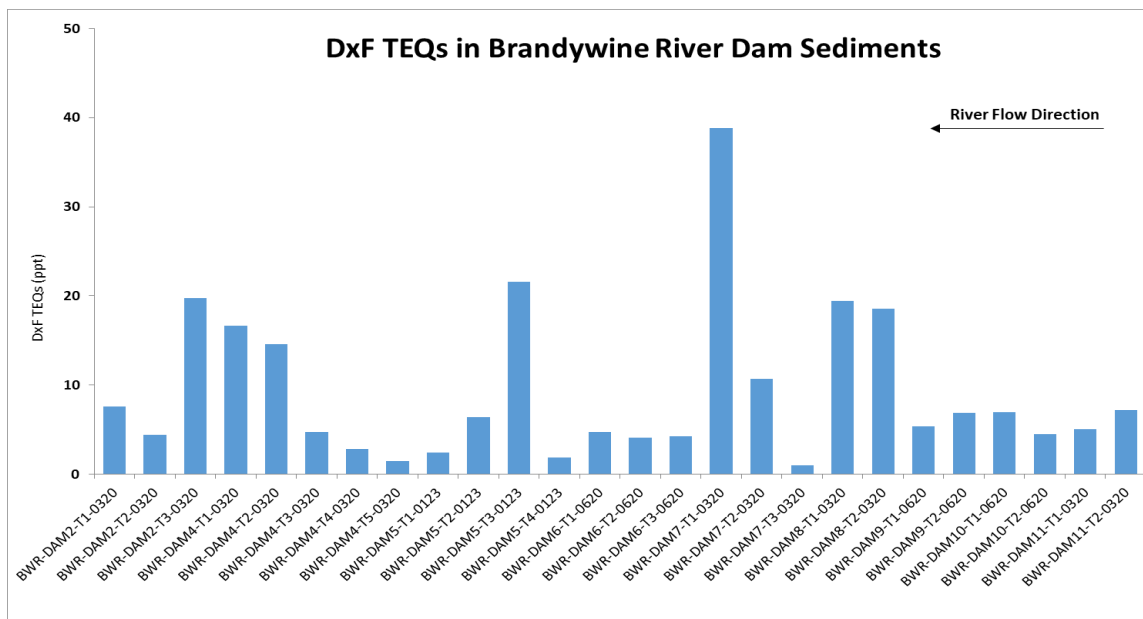
Finally, a comparison of PCB concentrations in the sediment samples to DNREC-RS Soil Screening Levels (DNREC, 2013) was conducted to evaluate whether concentrations of PCBs in sediment would pose a risk to human health if sediment were excavated/removed, dewatered, and deposited in an upland setting. 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_Revised 2023_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).

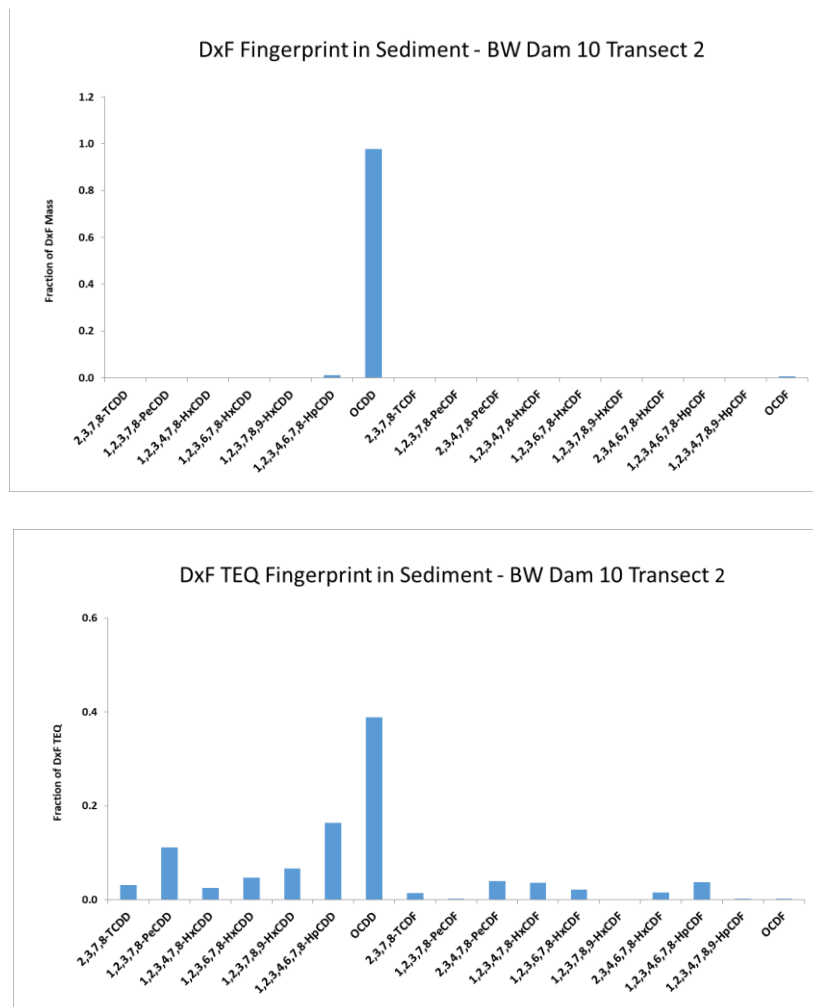
The approach used to assess potential toxicity to benthic aquatic life was to first calculate dioxin-like (2,3,7,8-TCDD) Toxicity Equivalency Quotients (TEQs) for each sample by multiplying the concentration of each dioxin and furan compound detected by its associated toxicity equivalence factor, or 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, along with other information, may provide clues regarding potential sources, especially when the fingerprint is unusual or unique. 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 26 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. Data suggests that air deposition may be the primary source, although according to the

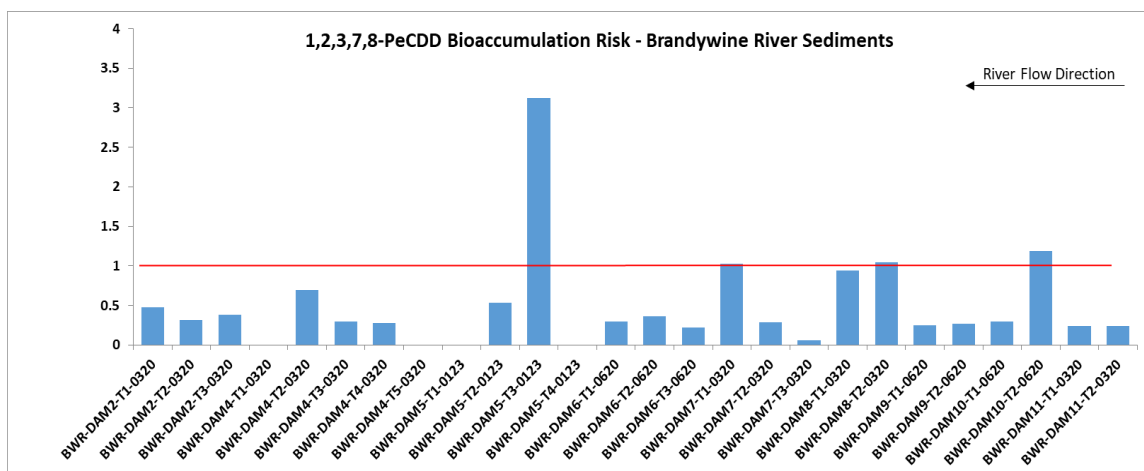
USEPA (2006), the overall emissions of dioxins and furans appear to be declining over time in the U.S. This trend also appears to be occurring in the Christina Basin based upon dated sediment cores which show higher dioxin and furan concentrations in the past (Velinsky et.al, 2010). Of note is that the 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 only 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. This analysis assumes that 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 measured 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 5 Transect 3 (T.U.=3.12), 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).



It is notable that the reported concentration of 1,2,3,7,8-PeCDD at 23 of the 26 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 three sites were "U-qualified," meaning that concentrations were not detected at all above the MDL. Understanding that direct measurements are the best way to verify predictions, comparison of dioxin and furan results from this assessment to DNREC fish contaminant monitoring program data was performed. The most recently assessed 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.

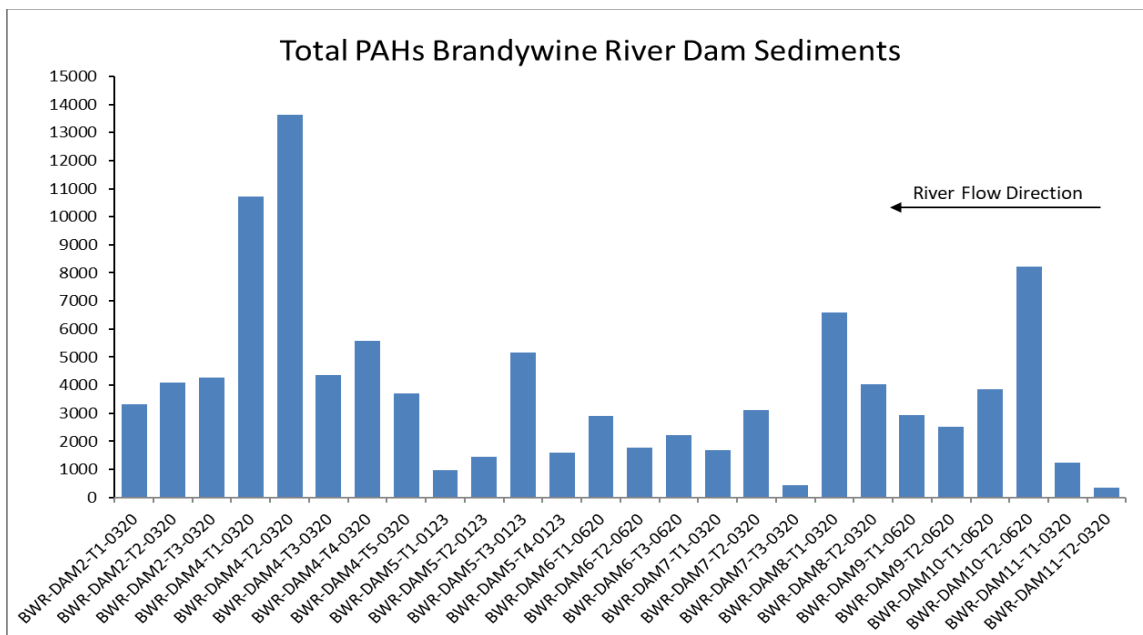
As with other contaminants in this study, the human health assessment was expanded to include the potential risk from both consuming fish and drinking water from the Brandywine River. The assessment focused on OCDD, 1,2,3,4,6,7,8-HpCDD and 1,2,3,7,8-PeCDD for the same reasons stated above. Results predicted that all 26 sample locations would exceed the surface water quality criterion of $5.0 \times 10^{-9} \mu\text{g/L}$ (ppb) for 2,3,7,8-TCDD (as TEQs). Toxic units ranged from 4.5 at Dam 7 Transect 3 to 230.2 at Dam 5, Transect 3. The conservative assumption that predicted porewater concentrations are in equilibrium with surface water applies, so additional evaluation is necessary to determine whether dilution from overlying surface water is occurring. 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 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. 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 1.00 parts per trillion (ppt) at Dam 7 Transect 3, 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 15 of the 26 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.

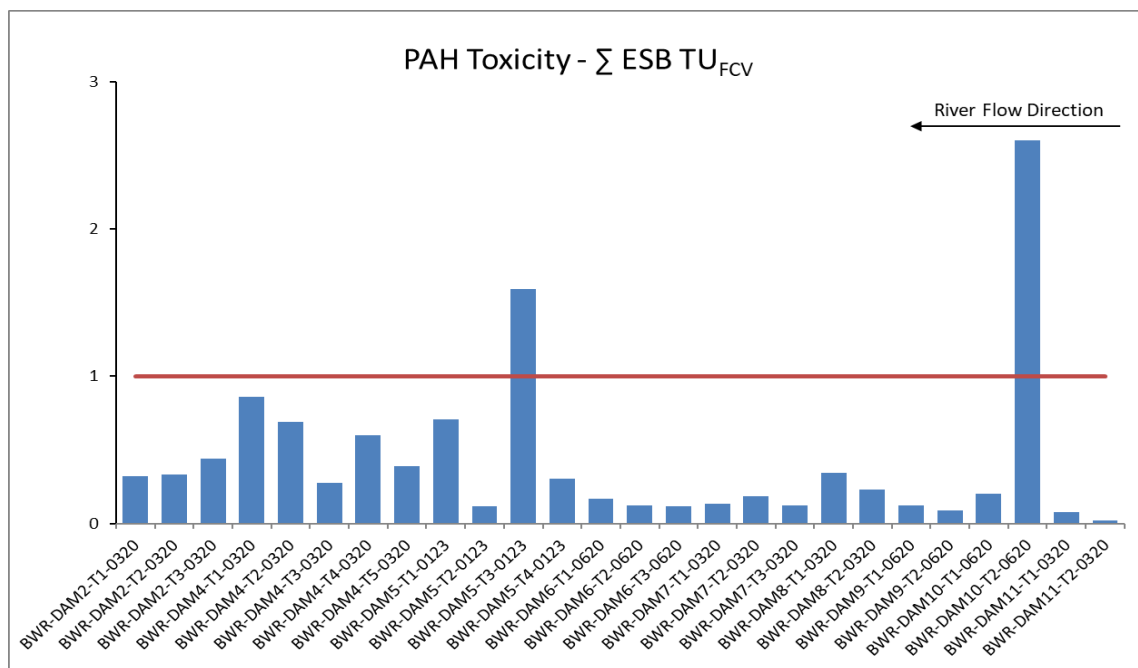
More detailed information regarding the approach used for this assessment and its results is included in the BWR_Revised 2023_DxF_Final spreadsheet, included in Appendix C. RAIS calculations are included in Appendix D.

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 and 1.59 at Dam 5 Transect 3, both of which are greater than 1, thereby indicating that chronic toxicity due to PAHs is possible at those locations.



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, Dam #5, 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 sampled 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. 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 DNREC fish contaminant monitoring program sampling was performed. The most recently assessed 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_Revised 2023_PAH_Final spreadsheet, included in Appendix C. RAIS calculations are included in Appendix D.

3.2.6 Pesticide Assessment

Three 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), 4,4-DDT at Dam 2 Transect 1 (4.1 ppb), and 4,4-

DDD at Dam 5 Transect 3 (21 ppb). Almost 90% (23 out of 26 stations) of the results were 'non-detected' for all pesticides tested. And of those three 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 any of the locations where pesticides were detected. Chronic toxicity is, however, predicted at all three transect locations. T.U._c were calculated to be 6.7 for DDE at Dam 8 Transect 1, 4.5 for DDT at Dam 2 Transect 1, and 295 for DDD at Dam 5 Transect 3. 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 0.07 at Dam 2 Transect 1 and 0.06 at Dam 8 Transect 1, and 2.9 at Dam 5 Transect 3.

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. Toxic units greater than 1 were calculated for DDT at Dam 2 Transect 1 (T.U.=20.3), for DDE at Dam 8 Transect 1 (T.U.=30.5), and for DDT at Dam 5 Transect 3 (T.U.=1,341). 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 two of the three samples with detections were less than the calculated BBSQB, and the third was just slightly greater than the BBSQC (T.U. of 1.05).

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. Upon review of surface water data from samples collected in the Brandywine River in 2015, it appears that measured surface water concentrations of DDT, DDD 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, DDD or DDE for comparison to drinking water standards.

To validate the predicted results, pesticide data from the DNREC fish contaminant monitoring program were reviewed. The most recently assessed data, collected in 2015 from fish in the non-tidal Brandywine River, indicated that organochlorine pesticides (specifically DDT, DDD 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, DDD 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_Revised 2023_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). Peer reviewed studies indicate that exposure to PFAS compounds over certain levels may result in adverse health effects (USEPA, 2020). Because of this, and because such little data exists regarding PFAS in Delaware sediments, 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 environmental partitioning behavior and 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).

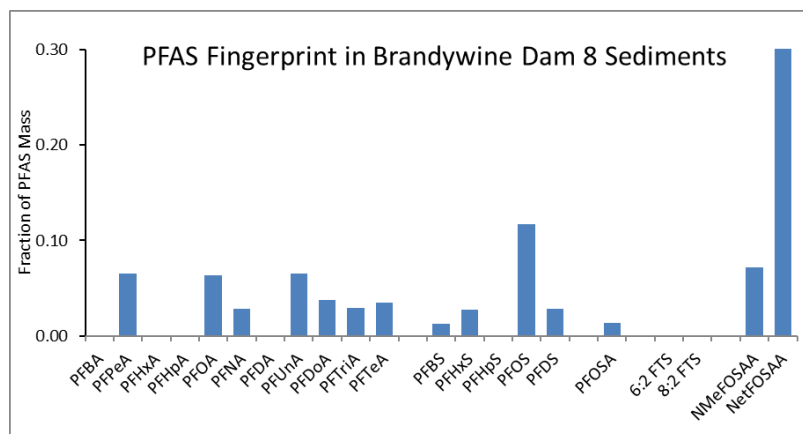
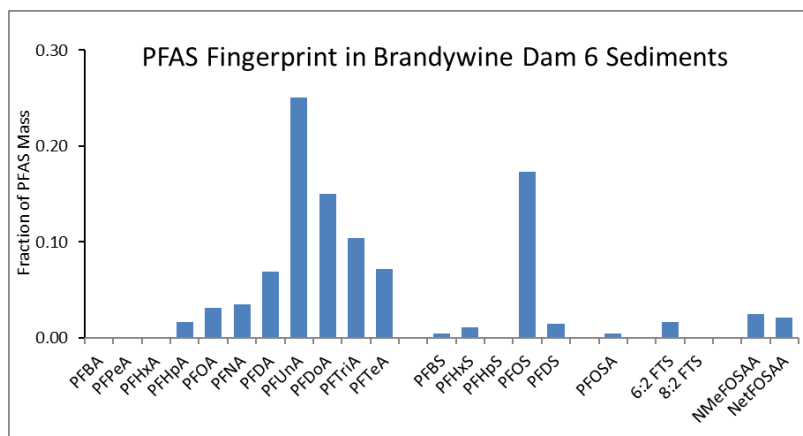
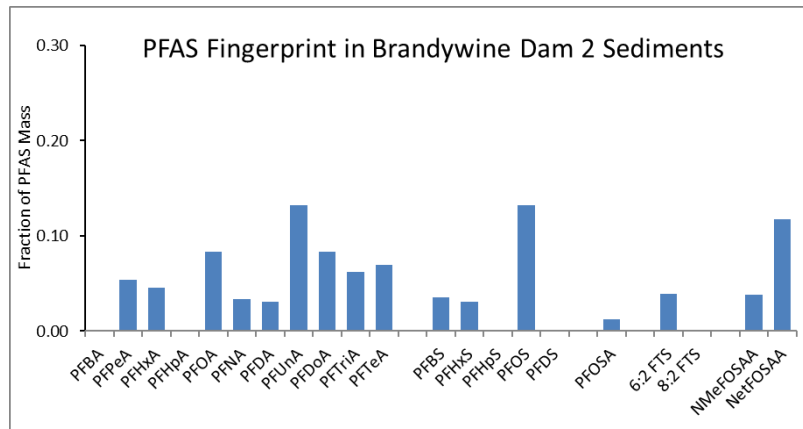
As such, USEPA (2020) has proposed MCLs for drinking water for two PFAS compounds, PFOA and PFOS, each at 4.0 parts per trillion, or ppt. In addition, EPA has proposed Health Based Water Concentrations (HBWCs) for PFHxS (9.0 ppt), PFNA (10 ppt), PFBS (2,000 ppt) and HFPODA (10 ppt). DNREC has established soil screening values for HFPO-DA (0.023 parts per million, or ppm), PFBS (1.9 ppm), PFHxS (0.13 ppm), PFNA (0.019 ppm), PFOS (0.013 ppm) and PFOA (0.019 ppm). DNREC-RS soil screening values are generally adopted from USEPA soil screening values (DNREC 2023b). Finally, USEPA has issued Draft Recommended Freshwater Aquatic Life Water Quality Criteria for PFOA and PFOS (USEPA, 2022). Recommended acute criteria are 49 ppm and 3.0 ppm for PFOA and PFOS, respectively. Recommended chronic criteria are 0.094 ppm and 0.0084 ppm for PFOA and PFOS respectively.

Comparison of sediment data to soil screening values is applicable if sediment is excavated, dewatered, and moved to an upland location. Further, an exceedance of DNREC-RS screening criteria simply means that the soil containing the contaminant should undergo further risk assessment. The concentrations of HFPO-DA, PFBS, PFHxS, PFNA, PFOA and PFOS detected in the Brandywine Dam sediments are several orders of magnitude less than the DNREC-RS human health soil Screening Levels.

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 (2022) Water Quality Report was reviewed. According to Table 3 of the report, PFBS, PFHpA, PFHxA, PFNA, PFOS and PFOA were detected at the intake upstream of Dam #2 at concentrations ranging from 2.22 parts per trillion (ppt)(PFNA) to 7.27 ppt (PFHxA). PFOA was detected at an average concentration of 6.27 ppt, while PFOS was detected at an average concentration of 2.68 ppt. Only the average concentration of PFOA exceeds the USEPA proposed MCL of 4 ppt.

Because there are no 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.), 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. Fingerprints, or mass contributions of each specific compound, were also calculated and plotted in a similar way to other compounds assessed during this study. 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.



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 eleven 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. 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.

Lastly, 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 Dam 5 Transect 3 and Dam 8 Transect 2 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.

Finally, 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.

Lastly, 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://den.dnrec.delaware.gov/>).

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 throughout the region. 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 26 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.

Finally, 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

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.

Overall, potential chronic toxicity to aquatic life from PAHs was observed for two samples (Dam 10 Transect 2 and Dam 5 Transect 3). 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 and Dam 5 Transect 3 have among 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 and Dam 5 Transect 3 (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 and Dam 5 Transect 3 samples was measured at 0.4%. As an additional exercise, the TOC content was averaged between the composited samples collected at Dam 10 and the four composited samples collected at Dam 5 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 samples. Using an average TOC content of 1.4% for Dam 10 and 0.7% for Dam 5, the resulting sum of toxic units was calculated to be 0.73 and 0.96 respectively, both of which are 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.

Lastly, 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, Dam 5 Transect 3, 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 three 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 three 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.

Finally, 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 six compounds in drinking water and for six compounds in soil. 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, only the average concentration of PFAS exceeds the USEPA proposed MCL of 4 ppt. Further, concentrations of HFPO-DA, PFBS, PFHxS, PFNA, PFOA and PFOS detected in sediments 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 Willamette 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 April 2023. 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 Polyfluoroalkyl 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 States 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. 2020. Drinking Water Health Advisories for PFOA and PFOS. Webpage. <https://www.epa.gov/sdwa/drinking-water-health-advisories-pfoa-and-pfos>

USEPA. 2022. Draft 2022 Aquatic Life Ambient Water Quality Criteria for Perfluorooctanoic acid (PFOA) and Perfluorooctane Sulfonic Acid (PFOS). (EPA 842-D-22-005), USEPA Office of Water, Washington, DC, April 2022.

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 5 Transect 1	Dam 5 Transect 2	Dam 5 Transect 3	Dam 5 Transect 4	Dam 6 Transect 1	Dam 6 Transect 2	Dam 6 Transect 3	Dam 7 Transect 1	Dam 7 Transect 2	DNREC Soil Screening Value (Human Health)
Aluminum	mg/kg	11,700	11,800	10,100	7,640	14,100	10,900	11,000	18,700	17,100	51,200
Antimony	mg/kg	0.21 (U)	0.22 (U)	0.55	0.2	0.46 (U)	0.39 (U)	0.43 (U)	0.46 (U)	5.5	3.1
Arsenic	mg/kg	3	2.8	8	1.8	3.2	2.4	2.3	4.6	4.1	11
Barium	mg/kg	66.4	97.3	81	69.4	141	104	104	151	136	1,500
Beryllium	mg/kg	0.52 (J)	0.51 (J)	0.44	0.29	0.57 (J)	0.48 (J)	0.51 (J)	0.75	0.66 (J)	16
Cadmium	mg/kg	0.16 (U)	0.39 (J)	0.45	0.15	0.52 (U)	0.45 (U)	0.49 (U)	0.52 (U)	0.56 (U)	7.1
Calcium	mg/kg	1,120	1,830	1,340	1,080	4,350	6,700	2,130	1,500	1,460	NS
Chromium	mg/kg	27.9	30.7	34	19.6	34.1	29.9	29.7	42.7	41.1	214
Cobalt	mg/kg	7.1	8.9	8.7	6.4	11.1	9.5	9.7	13.1	12.8	34
Copper	mg/kg	16.4	30.4	99.7	20.1	28.0	22.5	21.9	85.0	43.9	310
Iron	mg/kg	22,100	19,500	16,600	15,000	23,200	18,700	18,200	29,400	26,800	74,767
Lead	mg/kg	25.6	38.5	58.6	17.9	32.2	27.1	24.4	61.0	74.0	400
Magnesium	mg/kg	2,420	2,830	2,110	2,330	4,010	3,440	3,450	4,100	4,250	NS
Manganese	mg/kg	179	265	213	283	586	455	378	324	321	2,100
Nickel	mg/kg	17.7	29.4	22.2	15.1	27.6	23.2	22.6	34.3	27.3	150
Potassium	mg/kg	854	1,300	1,020	1,290	1,560	1,390	1490	1,630	1,760	NS
Selenium	mg/kg	0.42 (J)	0.74 (J)	0.73	0.3	0.73 (J)	0.46 (J)	0.58 (J)	0.83 (J)	0.57 (J)	39
Silver	mg/kg	0.13 (J)	0.18 (J)	0.28	0.12	0.96 (U)	0.82 (U)	0.91 (U)	0.96 (U)	1.0 (U)	39
Sodium	mg/kg	112 (J)	14,200	661	948	130 (J)	142	173	150 (J)	144 (J)	NS
Thallium	mg/kg	0.11 (J)	0.15 (J)	0.14 (J)	0.09 (J)	0.19 (U)	0.17 (U)	0.18 (U)	0.23 (J)	0.21 (U)	0.078
Vanadium	mg/kg	41.1	35.9	54.8	24.4	36.6	29.0	29.8	49.0	46.5	134
Zinc	mg/kg	74.5	102	94.9	59.8	119	94.4	93.2	143	121	2,300

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

Analyte Name	Units	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)
Aluminum	mg/kg	15,400	20,100	20,800	13,800	20,200	14,900	21,700	13,800	10,700	51,200
Antimony	mg/kg	0.41 (U)	0.55 (U)	0.51 (U)	0.48 (U)	0.67 (U)	0.42 (U)	0.41 (U)	0.49 (U)	0.37 (U)	3.1
Arsenic	mg/kg	4.7	5.4	4.7	2.9	5.1	3.2	4.6	2.7	1.8	11
Barium	mg/kg	54.8	183	180	136	207	147	172	96.8	92.8	1,500
Beryllium	mg/kg	0.74	0.93	0.99	0.59 (J)	0.87 (J)	0.69	0.79	0.58 (J)	0.49 (J)	16
Cadmium	mg/kg	0.47 (U)	0.67 (J)	0.59 (U)	0.55 (U)	0.77 (U)	0.48 (U)	0.47 (U)	0.56 (U)	0.43 (U)	7.1
Calcium	mg/kg	1,310	2,150	1,700	2570	4490	3090	2550	1,510	780	NS
Chromium	mg/kg	36.7	46.1	50.0	33.3	45.6	37.2	49.5	31.2	20.5	214
Cobalt	mg/kg	20.6	16.8	15.9	11.3	16.6	12.5	16.3	10.6	9.1	34
Copper	mg/kg	20.9	61.0	59.2	27.1	40.9	29.9	43.0	20.5	13.6	310
Iron	mg/kg	53,300	32,900	32,400	22,600	33,000	25,300	30,700	24,400	17,400	74,767
Lead	mg/kg	11.8	73.0	63.0	28.1	45.9	32.5	383	21.5	8.0	400
Magnesium	mg/kg	2,810	5,030	4,800	4,220	5,890	4,710	4,710	3,560	2,710	NS
Manganese	mg/kg	501	752	538	442	838	455	514	338	325	2,100
Nickel	mg/kg	17.6	54.3	46.2	26.9	40.8	30.3	32.8	22.3	16.6	150
Potassium	mg/kg	843	2,170	2,070	1,790	2,250	1,890	1,930	1,360	1,310	NS
Selenium	mg/kg	0.57 (J)	0.73 (J)	0.65 (J)	0.56 (J)	1.2 (J)	0.67 (J)	0.65 (J)	0.48 (U)	0.37 (U)	39
Silver	mg/kg	0.86 (U)	1.2 (U)	1.1 (U)	1.0 (U)	1.4 (U)	0.89 (U)	0.86 (U)	1.0 (U)	0.79 (U)	39
Sodium	mg/kg	316	109 (J)	99.8 (J)	135 (J)	200 (J)	135 (J)	152	82.6 (J)	54.3 (J)	NS
Thallium	mg/kg	0.17 (U)	0.29 (J)	0.25 (J)	0.21 (U)	0.29 (U)	0.20 (J)	0.19 (J)	0.21 (U)	0.16 (U)	0.078
Vanadium	mg/kg	55.7	47.9	51.8	36.6	50.2	39.8	60.2	38.0	25.9	134
Zinc	mg/kg	57.2	180	145	112	173	119	101	87.9	48.4	2,300
Mercury											
Mercury	mg/kg	0.094	0.50	0.98	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

[illegible]

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

[illegible]

Analyte Name	Units	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)
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)	0.0 (U)	230
Dioxins and Furans											
1,2,3,4,6,7,8-HpCDD	pg/g	20.9 (B)	350 (B)	309 (B)	103	134	156	73.8	114 (B)	239 (B)	NS
1,2,3,4,6,7,8-HpCDF	pg/g	2.86 (J B)	86.6 (B)	176 (B)	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	0.11 (J Z B)	2.82 (J B)	3.42 (J B)	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	0.24 (J Z)	5.05	4.79 (J)	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	0.20 (J B)	10.5 (B)	5.93 (B)	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	0.53 (J Z B)	11.3 (B)	12.3 (B)	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	0.24 (J)	4.26 (J)	8.55	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	1.02 (J B)	13.6 (B)	12.7 (B)	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	0.029 (U)	0.14 (U)	0.15 (U)	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	0.13 (J B)	2.46 (J Z B)	2.50 (J Z B)	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	0.11 (J Z B)	4.30 (J B)	3.01 (J B)	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	0.095 (J Z B)	2.47 (J B)	2.73 (J B)	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	0.11 (J Z B)	4.03 (J B)	3.01 (J B)	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	0.039 (J Z)	1.24	0.72 (J)	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	0.43 (J)	16.7	7.84	0.89 (J)	1.08 (J)	0.99	0.64 (J)	1.16 (J)	0.052 (J)	NS
OCDD	pg/g	935 (B)	11,900 (E B)	13,000 (E B)	4,720 (E B)	6,120 (E B)	5,590 (E B)	5,840 (E B)	5,600 (B)	10,600 (E B)	NS
OCDF	pg/g	3.91 (J B)	115 (B)	120 (B)	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 5 Transect 1	Dam 5 Transect 2	Dam 5 Transect 3	Dam 5 Transect 4	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)	2.5	6.5	59 (D)	2.6	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)	3.6	7.8	6.6	3.7	24,000
Acenaphthene	ug/kg	9.2 (J)	8.8 (J)	11	93	120	14 (J)	21	15	2.1	4.2	14	2.5	360,000
Acenaphthylene	ug/kg	15	35	37	18	44	26 (Z)	27	16	9.9	12	96 (D)	16	NS
Anthracene	ug/kg	32	34	46	140	260	41 (Z)	69	51	8.7	13	61 (D)	12	1,800,000
Benzo[a]anthracene	ug/kg	150	230	230	550	690 (D)	240	370	220	37	75 (D)	150 (D)	87 (D)	1,100
Benzo[a]pyrene	ug/kg	160 (B)	280 (B)	230 (B)	580 (B)	590 (D)	290 (Z B)	350 (B)	240 (B)	37	88 (D)	230 (D)	92 (D)	240
Benzo[b]fluoranthene	ug/kg	180 (B)	310 (B)	180 (B)	680 (B)	570 (D)	340 (Z B)	470 (B)	280 (B)	41	110 (D)	150 (D)	110 (D)	1,110
Benzo[e]pyrene	ug/kg	130	230	170	470	460	250 (Z)	290	190	34	79 (D)	170 (D)	87 (D)	NS
Benzo[g,h,i]perylene	ug/kg	93	140	110	240	190	110 (Z)	110	75	14	31	180 (D)	28	NS
Benzo[k]fluoranthene	ug/kg	160	300	210	650	650 (D)	330 (Z)	400	270	39	84 (D)	160 (D)	97 (D)	11,000
C1-Chrysenes	ug/kg	110	160	140	250	390	130	120	94	40	48	53	45	NS
C1-Fluoranthenes/pyrene	ug/kg	180	230	270	530	750	240	320	200	68	96	200	120	NS
C1-Fluorenes	ug/kg	13	11 (U)	16	28	89	15 (U)	10 (U)	11 (U)	7.7	5.8	13	5.9	NS
C1-Phenanthrenes/Anthracenes	ug/kg	140	93	160	370	630	140	120	120	38	39	69	42	NS
C2-Chrysenes	ug/kg	74	83	78	100	210	44	40	39	53	29	32	25	NS
C2-Fluorenes	ug/kg	20	15	20	39	150	15 (U)	10 (U)	11 (U)	16	9.8	22	11	NS
C2-Naphthalenes	ug/kg	36	30	40	120	200	55	36	42	15	33	53	23	NS
C2-Phenanthrenes/Anthracenes	ug/kg	92	80	130	200	570	92	87	88	46	33	69	39	NS
C3-Chrysenes	ug/kg	33	23	45	30	99	18	12	13	15	9.3	15	12	NS
C3-Fluorenes	ug/kg	36	11 (U)	36	15 (U)	180	15 (U)	10 (U)	11 (U)	22	1.1 (U)	42	0.96 (U)	NS
C3-Naphthalenes	ug/kg	42	24	43	77	270	35	28	31	26	26	64	20	NS
C3-Phenanthrenes/Anthracenes	ug/kg	61	37	88	78	330	40	34	34	45	22	130	35	NS
C4-Chrysenes	ug/kg	20	11 (U)	29	15 (U)	49	15	10	11 (U)	6.2	4.2	6	5.1	NS
C4-Naphthalenes	ug/kg	39	16	36	44	240	20	16	19	27	14	62	16	NS
C4-Phenanthrenes/Anthracenes	ug/kg	46	22	100	43	230	21	18	15	34	17	260	28	NS
Chrysene	ug/kg	200	320	260	740 (D)	830 (D)	340	430	270	47 (D)	96 (D)	190 (D)	120 (D)	110,000
Dibenz(a,h)anthracene	ug/kg	27	46	36	90	82	40	44	27	5.5	10	11	9.5	170
Fluoranthene	ug/kg	310	460	380	1,400 (D)	1,500 (D)	550	730 (D)	490	73 (D)	170 (D)	790 (D)	200 (D)	240,000
Fluorene	ug/kg	13	12	16	120	120	23	38	22	3.9	7.3	29	8.3	240,000
Indeno[1,2,3-cd]pyrene	ug/kg	89	150	110	240	220	120 (Z)	130	81	15	33	110 (D)	30	1,300
Naphthalene	ug/kg	14	16	19	57	59	24	12	17	2.2	5.3	14	3.1	3,800
Perylene	ug/kg	340	100	450	170	380	100 (Z)	120	64	56 (D)	40	110 (D)	55 (D)	NS
Phenanthrene	ug/kg	140	170	160	1,300 (D)	1,100 (D)	200	410	240	29	58 (D)	430 (D)	69 (D)	180,000
Pyrene	ug/kg	300	430	370	1,200 (D)	1,300 (D)	470	700 (D)	430	61 (D)	130 (D)	1,100 (D)	150 (D)	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 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	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	4.4 (J)	4 (J)	4.5 (J)	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	3.4 (J)	2.9 (J)	3 (U)	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	5 (U)	5.2 (J)	5.1 (U)	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	10 (J)	6.9 (J)	9 (J)	16	24	1.2 (J)	35	17	13 (J)	13 (J)	16	100	5.3	0.61 (J)	NS
Anthracene	ug/kg	24	21	19	13	26	4.8	51	27	25	23	33	120	6.1	0.41 (J)	1,800,000
Benzo[a]anthracene	ug/kg	170	100	110	75	120	24	210	120	160	120	190	480	51	3.2	1,100
Benzo[a]pyrene	ug/kg	210	120	150	94 (B)	130 (B)	27	280	130	210	170	260 (Z)	600	75	4.1	240
Benzo[b]fluoranthene	ug/kg	250	130	190	100 (B)	120 (B)	33	250	130	290	200	330 (Z)	560	110	5.4	1,110
Benzo[e]pyrene	ug/kg	180	110	140	85	110	24	240	110	200	170	220 (Z)	440	79	3.5	NS
Benzo[g,h,i]perylene	ug/kg	71	35	53	40	43	16	140	48	66	73	100 (Z)	350	41	1.7	NS
Benzo[k]fluoranthene	ug/kg	250	110	210	110	140	28	250	120	270	200	320 (Z)	550 (D)	96	5.0	11,000
C1-Chrysenes	ug/kg	83	51	71	72	140	21	300	190	120	72	100	290	33	2.0	NS
C1-Fluoranthenes/pyrene	ug/kg	140	93	110	120	180	22	350	220	160	120	210	460	60	4.5	NS
C1-Fluorenes	ug/kg	12 (U)	11 (U)	13 (U)	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	68	47	47	58	110	9.3	240	160	63	57	94	240	33	2.1	NS
C2-Chrysenes	ug/kg	40	24	28	44	140	7.2	230	140	54	30	44	110	4.0 (U)	1.6	NS
C2-Fluorenes	ug/kg	12 (U)	11 (U)	13 (U)	13	27	2.0 (U)	75	47	15 (U)	22	13 (U)	19	4.0 (U)	0.92 (U)	NS
C2-Naphthalenes	ug/kg	24	20	22	25	47	3.1	120	65	23	64	35	52	17	2.7	NS
C2-Phenanthrenes/Anthracenes	ug/kg	47	33	46	64	130	7.9	330	210	48	48	110	150	26	4.3	NS
C3-Chrysenes	ug/kg	17	15	13 (U)	20	48	3.3	160	120	24	22	19	48	11	0.92 (U)	NS
C3-Fluorenes	ug/kg	12 (U)	11 (U)	13 (U)	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	17 (B)	14 (B)	15 (B)	28	93	4.9	190	120	17 (B)	26 (B)	27 (B)	46 (B)	13	4.0	NS
C3-Phenanthrenes/Anthracenes	ug/kg	24	18	25	40	110	4.7	270	210	27	26	40	64	11	2.7	NS
C4-Chrysenes	ug/kg	12 (U)	11 (U)	13 (U)	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	12 (U)	11 (U)	13 (U)	23	85	2.0 (U)	230	190	15 (U)	20 (U)	18	27	12	1.8	NS
C4-Phenanthrenes/Anthracenes	ug/kg	12	11 (U)	13	28	95	3.6	220	180	19	20	18	23	7.5	3.0	NS
Chrysene	ug/kg	250	150	170	110	150	30	280	160	230	210	280	570	96	4.8	110,000
Dibenz(a,h)anthracene	ug/kg	25	18	21	13	31	5.1	45	19	26	27	34 (Z)	130	13	0.86 (J)	170
Fluoranthene	ug/kg	420	240	340	150	240	51	400	240	330	310	550	790 (D)	140	5.9	240,000
Fluorene	ug/kg	6 (U)	6.6 (J)	6.1 (U)	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	72	49	57	40	51	16	130	48	73	81	100 (Z)	350	41	1.8	1,300
Naphthalene	ug/kg	8 (U)	7.3 (J)	8.1 (U)	14	16	2.3	52	14	9.3 (U)	13 (U)	8.3 (U)	13	5.7	1.2	3,800
Perylene	ug/kg	56	38	55	65	260	13	440	430 (D)	64	62	76 (Z)	180	73	270 (D)	NS
Phenanthrene	ug/kg	140	96	95	62	130	22	250	150	130	120	190	540	44	2.5	180,000
Pyrene	ug/kg	310	200	220	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 5 Transect 1	Dam 5 Transect 2	Dam 5 Transect 3	Dam 5 Transect 4	Dam 6 Transect 1	Dam 6 Transect 2	Dam 6 Transect 3	Dam 7 Transect 1	Dam 7 Transect 2	DNREC Soil Screening Value (Human Health)
4,4'-DDD	ug/kg	1.7 (U)	2 (U)	21 (U)	1.7 (U)	2.2 (U)	1.9 (U)	2.1 (U)	1.9 (U)	1.9 (U)	190
4,4'-DDE	ug/kg	1.2 (U)	1.4 (U)	1.1 (U)	1.1 (U)	1.5 (U)	1.3 (U)	1.5 (U)	1.3 (U)	1.3 (U)	2,000
4,4'-DDT	ug/kg	1.8 (U)	2.1 (U)	1.7 (U)	1.8 (U)	2.3 (U)	2.1 (U)	2.3 (U)	2.1 (U)	2.1 (U)	1,900
Aldrin	ug/kg	1.5 (U)	1.7 (U)	1.4 (U)	1.5 (U)	1.9 (U)	1.7 (U)	1.9 (U)	1.7 (U)	1.7 (U)	39
alpha-BHC	ug/kg	1 (U)	1.2 (U)	0.95 (U)	0.99 (U)	1.3 (U)	1.1 (U)	1.3 (U)	1.1 (U)	1.2 (U)	86
beta-BHC	ug/kg	1.1 (U)	1.3 (U)	1.1 (U)	1.1 (U)	1.4 (U)	1.3 (U)	1.4 (U)	1.3 (U)	1.3 (U)	300
cis-Chlordane	ug/kg	1.6 (U)	1.8 (U)	1.5 (U)	1.5 (U)	2 (U)	1.8 (U)	1.9 (U)	1.8 (U)	1.8 (U)	NS
delta-BHC	ug/kg	0.6 (U)	0.71 (U)	0.57 (U)	0.6 (U)	0.77 (U)	0.69 (U)	0.75 (U)	0.69 (U)	0.70 (U)	NS
Dieldrin	ug/kg	1.3 (U)	1.5 (U)	1.2 (U)	1.3 (U)	1.6 (U)	1.5 (U)	1.6 (U)	1.5 (U)	1.5 (U)	34
Endosulfan I	ug/kg	1.5 (U)	1.8 (U)	1.4 (U)	1.5 (U)	1.9 (U)	1.7 (U)	1.9 (U)	1.7 (U)	1.7 (U)	NS
Endosulfan II	ug/kg	2.5 (U)	3 (U)	2.4 (U)	2.5 (U)	3.2 (U)	2.9 (U)	3.2 (U)	2.9 (U)	2.9 (U)	NS
Endosulfan sulfate	ug/kg	1.2 (U)	1.4 (U)	1.2 (U)	1.2 (U)	1.6 (U)	1.4 (U)	1.5 (U)	1.4 (U)	1.4 (U)	38,000
Endrin	ug/kg	1.4 (U)	1.7 (U)	1.3 (U)	1.4 (U)	1.8 (U)	1.6 (U)	1.8 (U)	1.6 (U)	1.6 (U)	1,900
Endrin aldehyde	ug/kg	2.3 (U)	2.7 (U)	2.2 (U)	2.3 (U)	3 (U)	2.7 (U)	2.9 (U)	2.7 (U)	2.7 (U)	NS
Endrin ketone	ug/kg	1.9 (U)	2.2 (U)	1.8 (U)	1.9 (U)	2.5 (U)	2.2 (U)	2.4 (U)	2.2 (U)	2.2 (U)	NS
gamma-BHC (Lindane)	ug/kg	0.91 (U)	1.1 (U)	0.87 (U)	0.9 (U)	1.2 (U)	1 (U)	1.1 (U)	1.0 (U)	1.1 (U)	570
Heptachlor	ug/kg	1.2 (U)	1.4 (U)	1.1 (U)	1.1 (U)	1.5 (U)	1.3 (U)	1.5 (U)	1.3 (U)	1.3 (U)	130
Heptachlor epoxide	ug/kg	1.5 (U)	1.7 (U)	1.4 (U)	1.5 (U)	1.9 (U)	1.7 (U)	1.8 (U)	1.7 (U)	1.7 (U)	70
Methoxychlor	ug/kg	2.3 (U)	2.6 (U)	2.1 (U)	2.2 (U)	2.9 (U)	2.6 (U)	2.8 (U)	2.6 (U)	2.6 (U)	32,000
Toxaphene	ug/kg	36 (U)	42 (U)	34 (U)	35 (U)	46 (U)	41 (U)	45 (U)	41 (U)	41 (U)	490
trans-Chlordane	ug/kg	1.7 (U)	2 (U)	1.7 (U)	1.7 (U)	2.2 (U)	2 (U)	2.2 (U)	2.0 (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 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)
4,4'-DDD	ug/kg	1.7 (U)	2.2 (U)	2.1 (U)	2.4 (U)	3.4 (U)	2.2 (U)	2.1 (U)	2.1 (U)	1.6 (U)	190
4,4'-DDE	ug/kg	1.2 (U)	3.8 (J)	1.4 (U)	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	1.8 (U)	2.4 (U)	2.2 (U)	2.6 (U)	3.7 (U)	2.4 (U)	2.2 (U)	2.2 (U)	1.7 (U)	1,900
Aldrin	ug/kg	1.5 (U)	2.0 (U)	1.8 (U)	2.1 (U)	3 (U)	2 (U)	1.8 (U)	1.8 (U)	1.4 (U)	39
alpha-BHC	ug/kg	1.0 (U)	1.3 (U)	1.2 (U)	1.4 (U)	2 (U)	1.3 (U)	1.2 (U)	1.2 (U)	0.95 (U)	86
beta-BHC	ug/kg	1.1 (U)	1.5 (U)	1.4 (U)	1.6 (U)	2.2 (U)	1.5 (U)	1.4 (U)	1.4 (U)	1.0 (U)	300
cis-Chlordane	ug/kg	1.6 (U)	2.1 (U)	1.9 (U)	2.2 (U)	3.2 (U)	2.1 (U)	1.9 (U)	1.9 (U)	1.5 (U)	NS
delta-BHC	ug/kg	0.60 (U)	0.81 (U)	0.74 (U)	0.87 (U)	1.2 (U)	0.8 (U)	0.75 (U)	0.74 (U)	0.57 (U)	NS
Dieldrin	ug/kg	1.3 (U)	1.7 (U)	1.6 (U)	1.8 (U)	2.6 (U)	1.7 (U)	1.6 (U)	1.6 (U)	1.2 (U)	34
Endosulfan I	ug/kg	1.5 (U)	2.0 (U)	1.9 (U)	2.2 (U)	3 (U)	2 (U)	1.9 (U)	1.8 (U)	1.4 (U)	NS
Endosulfan II	ug/kg	2.5 (U)	3.4 (U)	3.1 (U)	3.6 (U)	5.1 (U)	3.4 (U)	3.1 (U)	3.1 (U)	2.4 (U)	NS
Endosulfan sulfate	ug/kg	1.2 (U)	1.7 (U)	1.5 (U)	1.8 (U)	2.5 (U)	1.6 (U)	1.5 (U)	1.5 (U)	1.2 (U)	38,000
Endrin	ug/kg	1.4 (U)	1.9 (U)	1.7 (U)	2 (U)	2.9 (U)	1.9 (U)	1.7 (U)	1.7 (U)	1.3 (U)	1,900
Endrin aldehyde	ug/kg	2.3 (U)	3.1 (U)	2.9 (U)	3.3 (U)	4.7 (U)	3.1 (U)	2.9 (U)	2.9 (U)	2.2 (U)	NS
Endrin ketone	ug/kg	1.9 (U)	2.6 (U)	2.4 (U)	2.7 (U)	3.9 (U)	2.5 (U)	2.4 (U)	2.4 (U)	1.8 (U)	NS
gamma-BHC (Lindane)	ug/kg	0.91 (U)	1.2 (U)	1.1 (U)	1.3 (U)	1.9 (U)	1.2 (U)	1.1 (U)	1.1 (U)	0.86 (U)	570
Heptachlor	ug/kg	1.2 (U)	1.6 (U)	1.4 (U)	1.7 (U)	2.4 (U)	1.5 (U)	1.4 (U)	1.4 (U)	1.1 (U)	130
Heptachlor epoxide	ug/kg	1.5 (U)	2.0 (U)	1.8 (U)	2.1 (U)	3 (U)	2 (U)	1.8 (U)	1.8 (U)	1.4 (U)	70
Methoxychlor	ug/kg	2.3 (U)	3.0 (U)	2.8 (U)	3.2 (U)	4.6 (U)	3 (U)	2.8 (U)	2.8 (U)	2.1 (U)	32,000
Toxaphene	ug/kg	36 (U)	48 (U)	44 (U)	51 (U)	72 (U)	47 (U)	44 (U)	44 (U)	34 (U)	490
trans-Chlordane	ug/kg	1.7 (U)	2.3 (U)	2.1(U)	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 5 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)	NA	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)	NA	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)	0.11 (J)	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)	0.034 (J)	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)	0.055 (U)	0.017 (J B)	0.039 (J Z B)	0.019 (J B)	0.018 (U)	0.019 (J B)	0.028 (J B)	1,900
Perfluorobutanoic acid (PFBA)	ug/kg	0.30 (U Z)	0.42 (U Z)	0.066 (U)	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)	NA	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)	0.069 (U)	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)	0.043 (U)	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)	0.070 (U)	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)	0.083 (J)	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)	0.042 (U)	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)	130
Perfluorohexanoic acid (PFHxA)	ug/kg	0.066 (J Z)	0.053 (U Z)	0.10 (J)	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)	0.085 (J)	0.12 (J)	0.059 (J Z)	0.043 (J)	0.082 (J)	0.043 (J)	0.053 (J)	19
Perfluorooctanesulfonamide (PFOSA)	ug/kg	0.018 (J Z)	0.030 (J Z)	NA	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)	0.79	0.6	0.26 (J Z)	0.18 (J)	0.51	0.32 (J)	0.33 (J)	13
Perfluorooctanoic acid (PFOA)	ug/kg	0.12 (J Z B)	0.16 (J Z B)	0.43	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)	19
Perfluoropentanoic acid (PFPeA)	ug/kg	0.078 (J Z)	0.072 (J Z)	0.084 (J)	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)	0.053 (U)	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)	0.030 (U)	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)	0.060 (U)	0.87	0.21 (J Z)	0.10 (J)	0.84	0.55	0.33 (J)	NS
Perfluoropentanesulfonic acid (PFPeS)	ug/kg	NA	NA	0.053 (U)	NA	NA	NA	NA	NA	NA	NS
Perfluoropropionic acid	ug/kg	NA	NA	0.36 (U)	NA	NA	NA	NA	NA	NA	NS
11Cl-PF3OUdS	ug/kg	NA	NA	0.045 (U)	NA	NA	NA	NA	NA	NA	NS
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	ug/kg	NA	NA	0.056 (U)	NA	NA	NA	NA	NA	NA	NS
4:2 FTS	ug/kg	NA	NA	0.073 (U)	NA	NA	NA	NA	NA	NA	NS
5:3 FTCA	ug/kg	NA	NA	0.055 (U Z)	NA	NA	NA	NA	NA	NA	NS
6:2 FTCA	ug/kg	NA	NA	0.14 (U)	NA	NA	NA	NA	NA	NA	NS
6:2 FTS	ug/kg	NA	NA	0.039 (U)	NA	NA	NA	NA	NA	NA	NS
6:2 FTUCA	ug/kg	NA	NA	0.10 (U)	NA	NA	NA	NA	NA	NA	NS
8:2 FTS	ug/kg	NA	NA	0.050 (U)	NA	NA	NA	NA	NA	NA	NS
9Cl-PF3ONS	ug/kg	NA	NA	0.050 (U)	NA	NA	NA	NA	NA	NA	NS
HFPO-DA (GenX)	ug/kg	NA	NA	0.063 (J)	NA	NA	NA	NA	NA	NA	23
Hydro-PS Acid	ug/kg	NA	NA	0.069 (U)	NA	NA	NA	NA	NA	NA	NS
NFDHA	ug/kg	NA	NA	0.057 (U)	NA	NA	NA	NA	NA	NA	NS
PFEESA	ug/kg	NA	NA	0.046 (U)	NA	NA	NA	NA	NA	NA	NS
PFMBA	ug/kg	NA	NA	0.065 (U)	NA	NA	NA	NA	NA	NA	NS
PFMOAA	ug/kg	NA	NA	0.030 (U Z)	NA	NA	NA	NA	NA	NA	NS
PFMPA	ug/kg	NA	NA	0.034 (U)	NA	NA	NA	NA	NA	NA	NS
PFO2HxA	ug/kg	NA	NA	0.21 (J)	NA	NA	NA	NA	NA	NA	NS
PFO3OA	ug/kg	NA	NA	0.12 (J)	NA	NA	NA	NA	NA	NA	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.											
* Dam #5 was sampled at a different time than other samples, using the same PFAS analytical Method (537(M)), but with a different compound reporting list.											

FIGURES

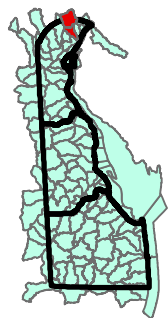


FIGURE 1
BRANDYWINE RIVER DAMS -
SEDIMENT EVALUATION
MIDDLE AND LOWER BRANDYWINE
CREEK WATERSHEDS
DAM LOCATION MAP
NEW CASTLE COUNTY, DELAWARE

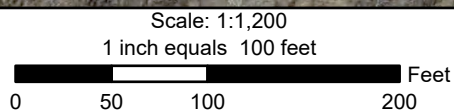
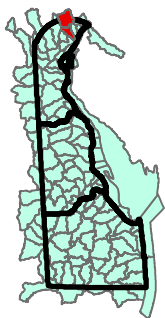
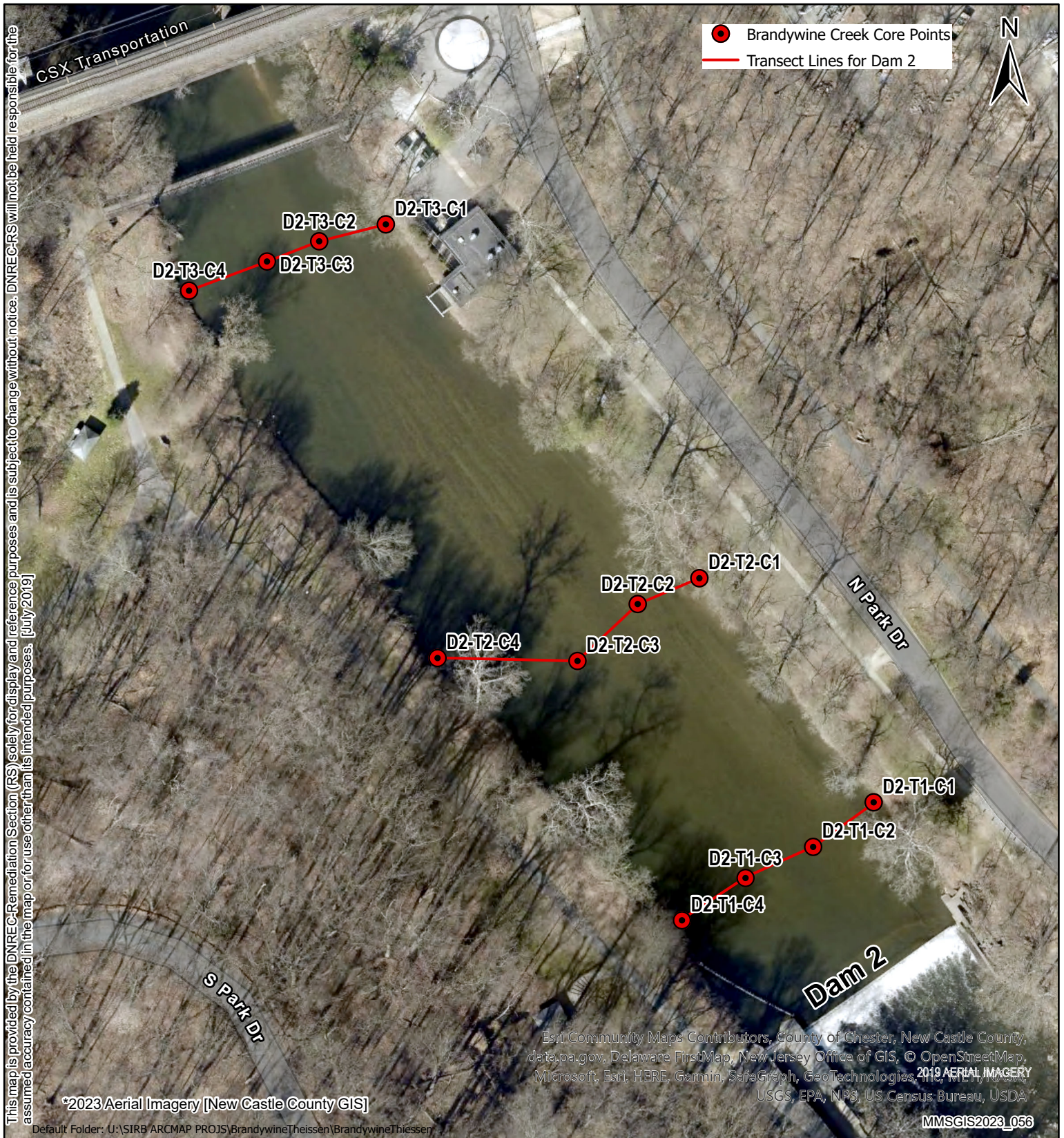


FIGURE 2
BRANDYWINE RIVER DAM 2
SAMPLE LOCATIONS AND TRANSECTS
NEW CASTLE COUNTY, DELAWARE

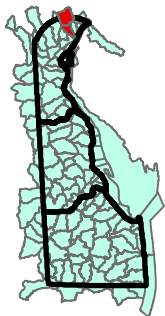
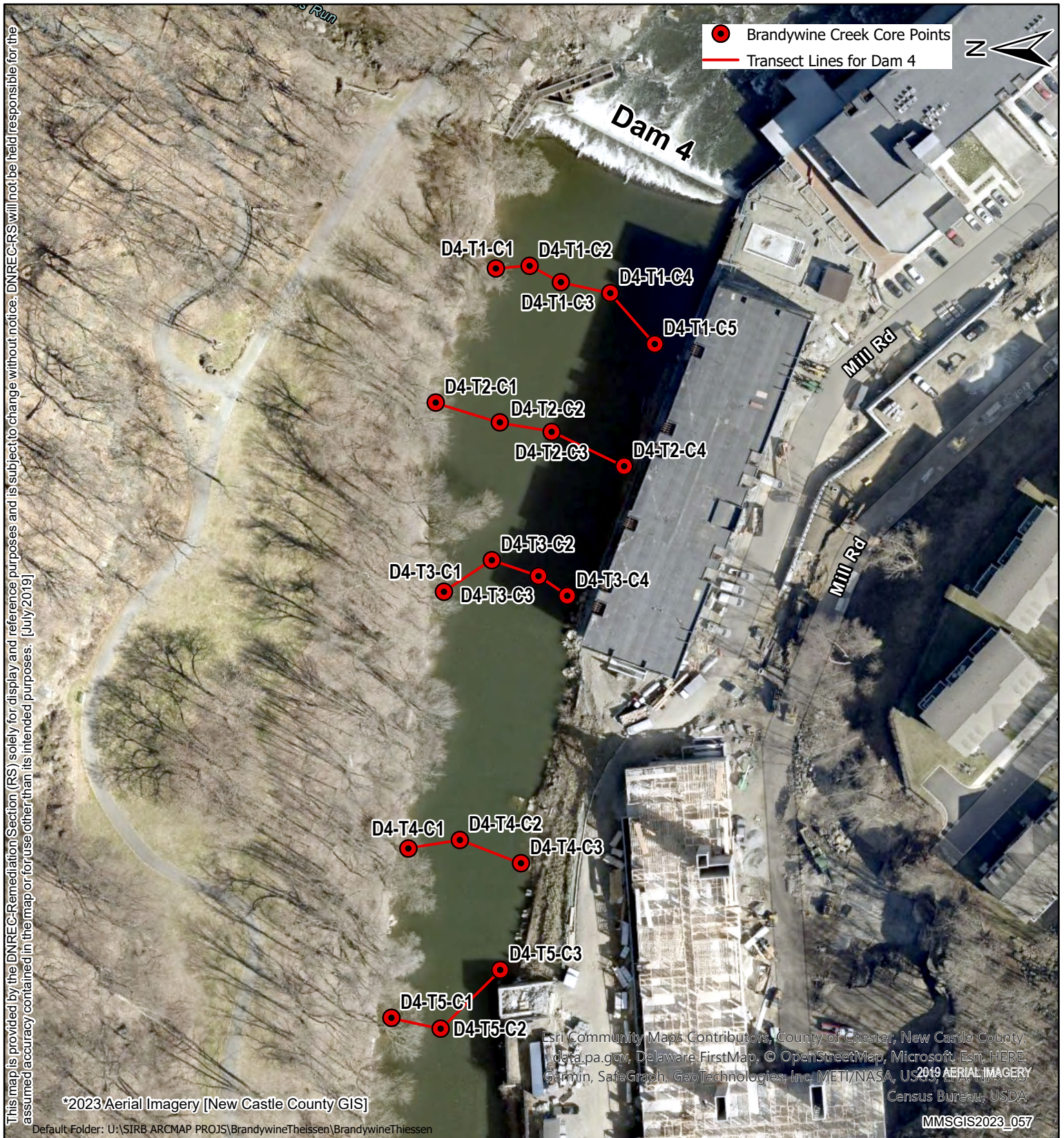


FIGURE 3
BRANDYWINE RIVER DAM 4
SAMPLE LOCATIONS AND TRANSECTS
NEW CASTLE COUNTY, DELAWARE



FIGURE 4
BRANDYWINE RIVER DAM 5
SAMPLE LOCATIONS AND TRANSECTS
NEW CASTLE COUNTY, DELAWARE

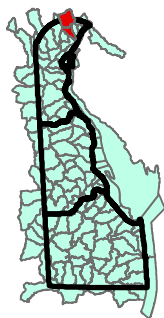


FIGURE 5
BRANDYWINE RIVER DAM 6
SAMPLE LOCATIONS AND TRANSECTS
NEW CASTLE COUNTY, DELAWARE

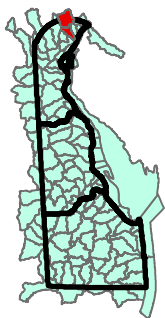
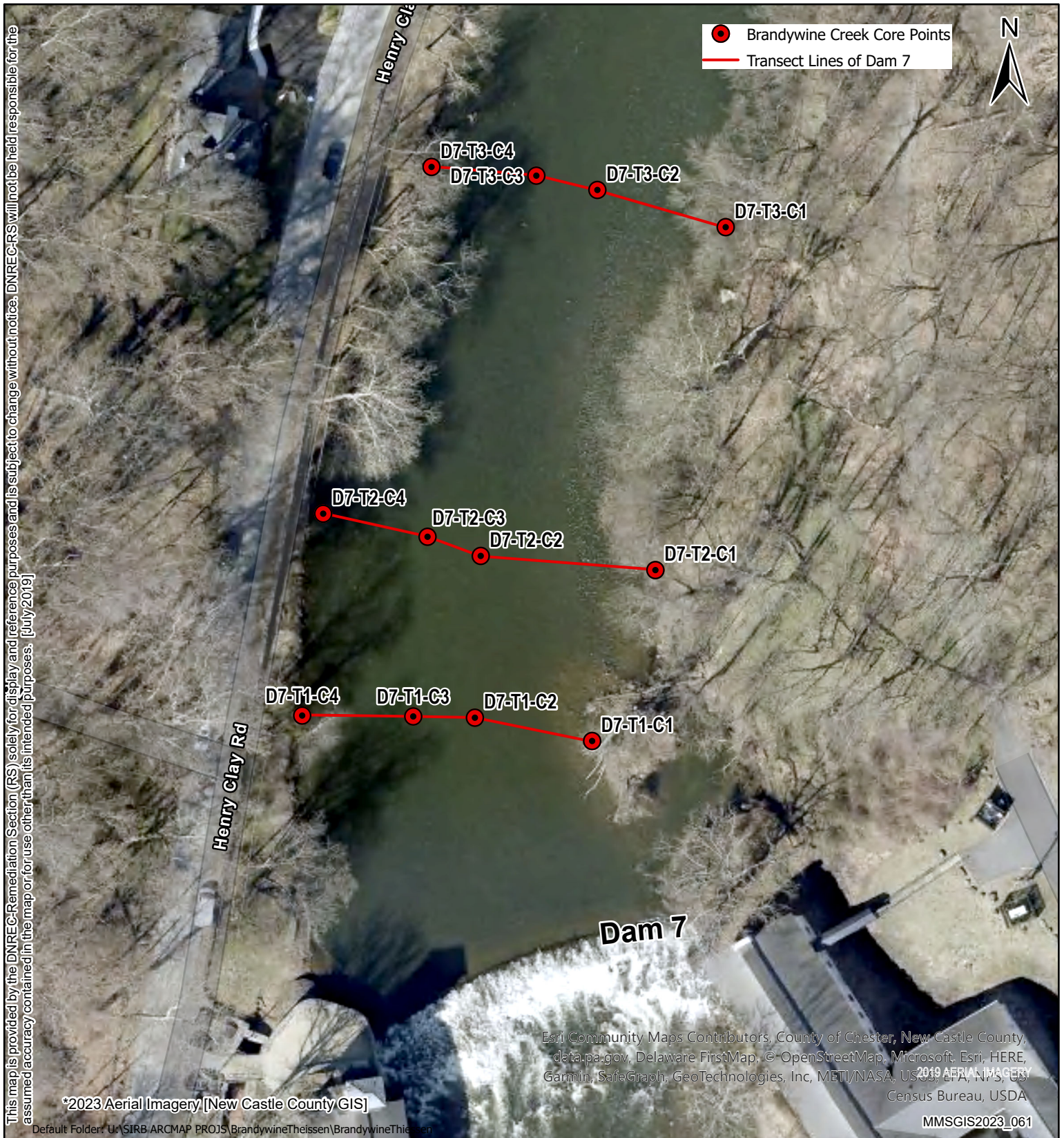
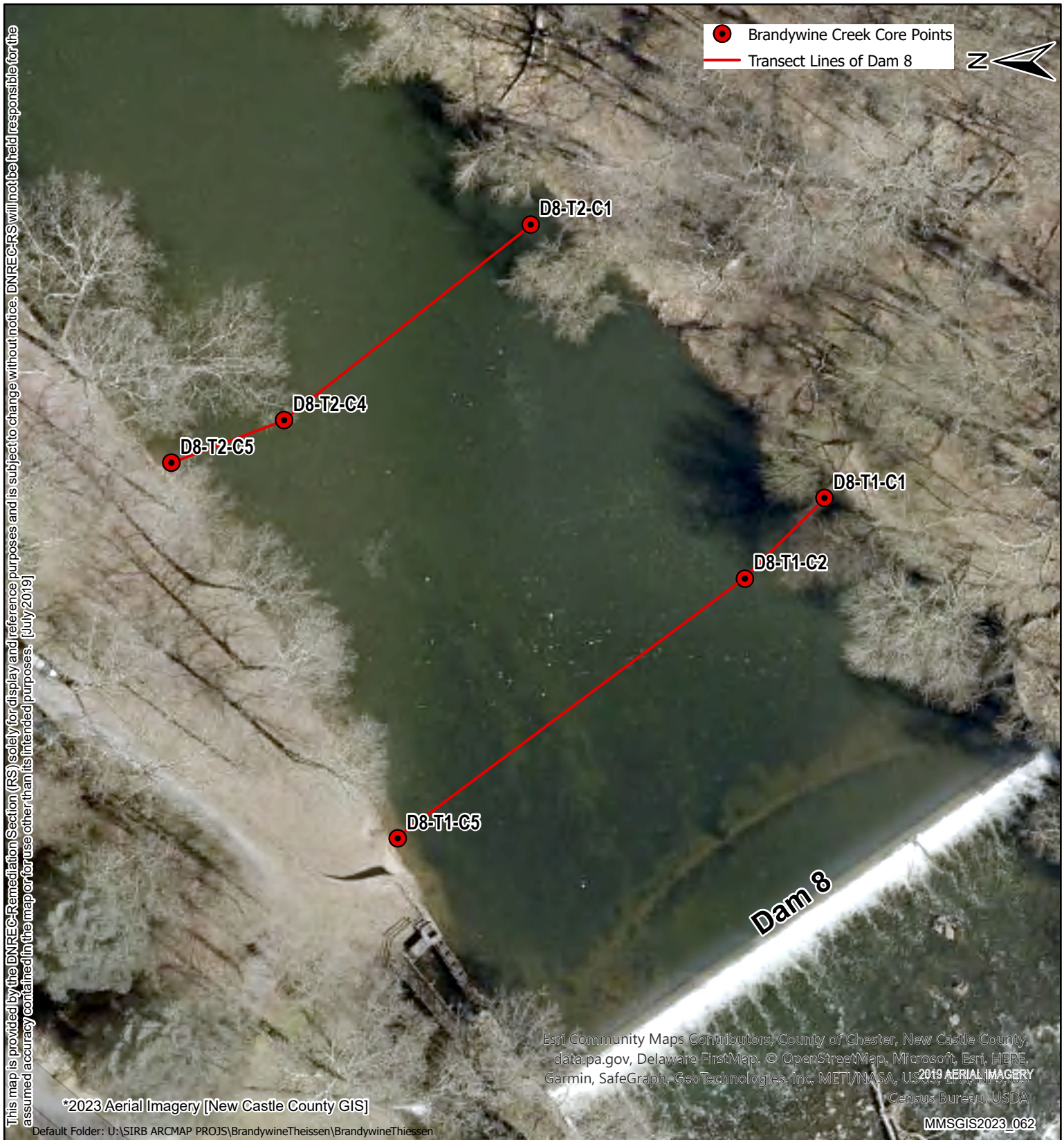


FIGURE 6
BRANDYWINE RIVER DAM 7
SAMPLE LOCATIONS AND TRANSECTS
NEW CASTLE COUNTY, DELAWARE

This map is provided by the DNREC Remediation Section (RS) solely for display and reference purposes and is subject to change without notice. DNRECRS will not be held responsible for the assumed accuracy contained in the map or for use other than its intended purposes. [July 2019]

● Brandywine Creek Core Points
— Transect Lines of Dam 8



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



FIGURE 7
BRANDYWINE RIVER DAM 8
SAMPLE LOCATIONS AND TRANSECTS
NEW CASTLE COUNTY, DELAWARE

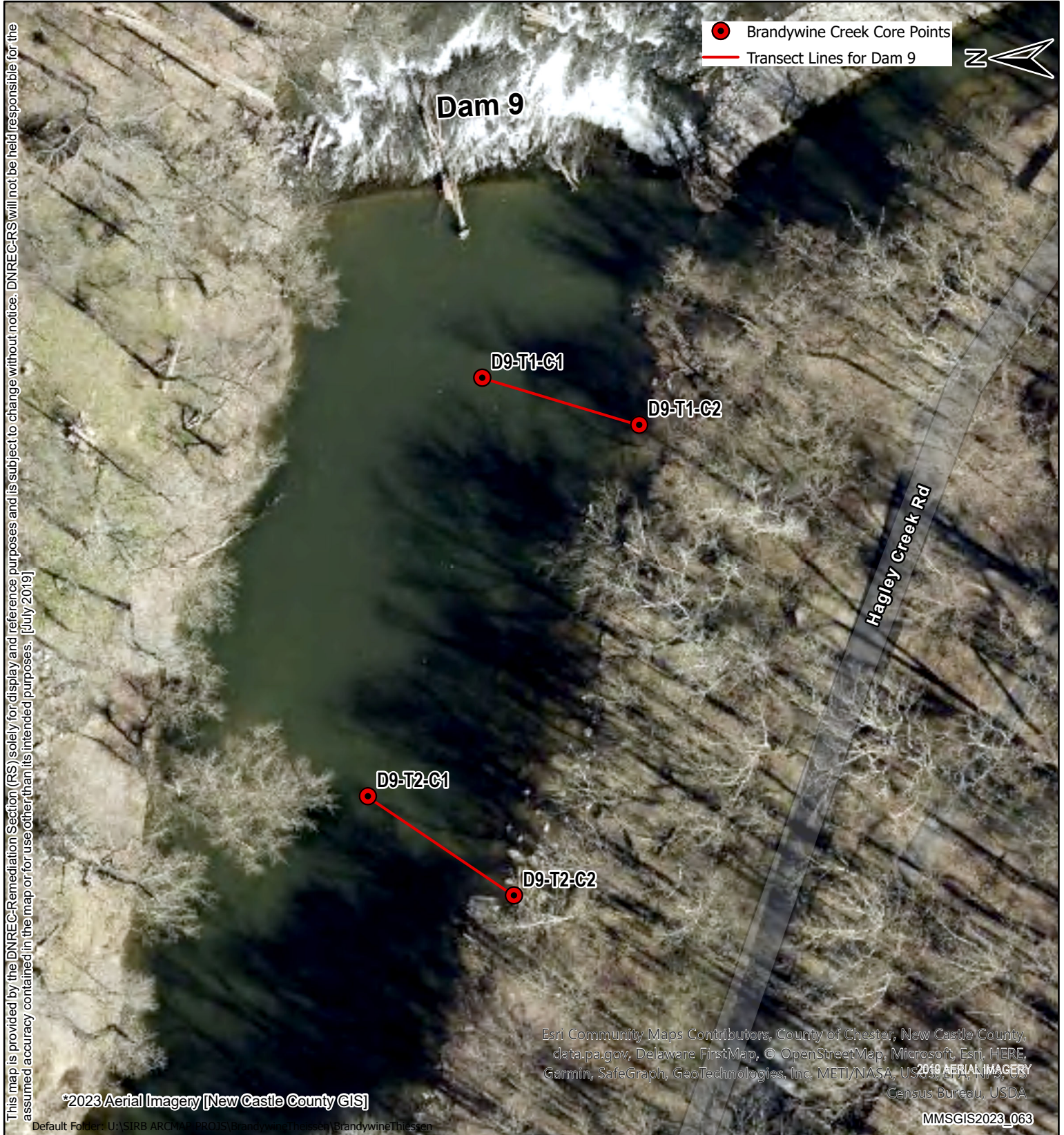


FIGURE 8
BRANDYWINE RIVER DAM 9
SAMPLE LOCATIONS AND TRANSECTS
NEW CASTLE COUNTY, DELAWARE

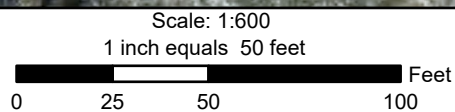
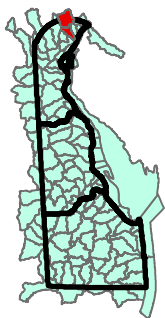


FIGURE 9
BRANDYWINE RIVER DAM 10
SAMPLE LOCATIONS AND TRANSECTS
NEW CASTLE COUNTY, DELAWARE

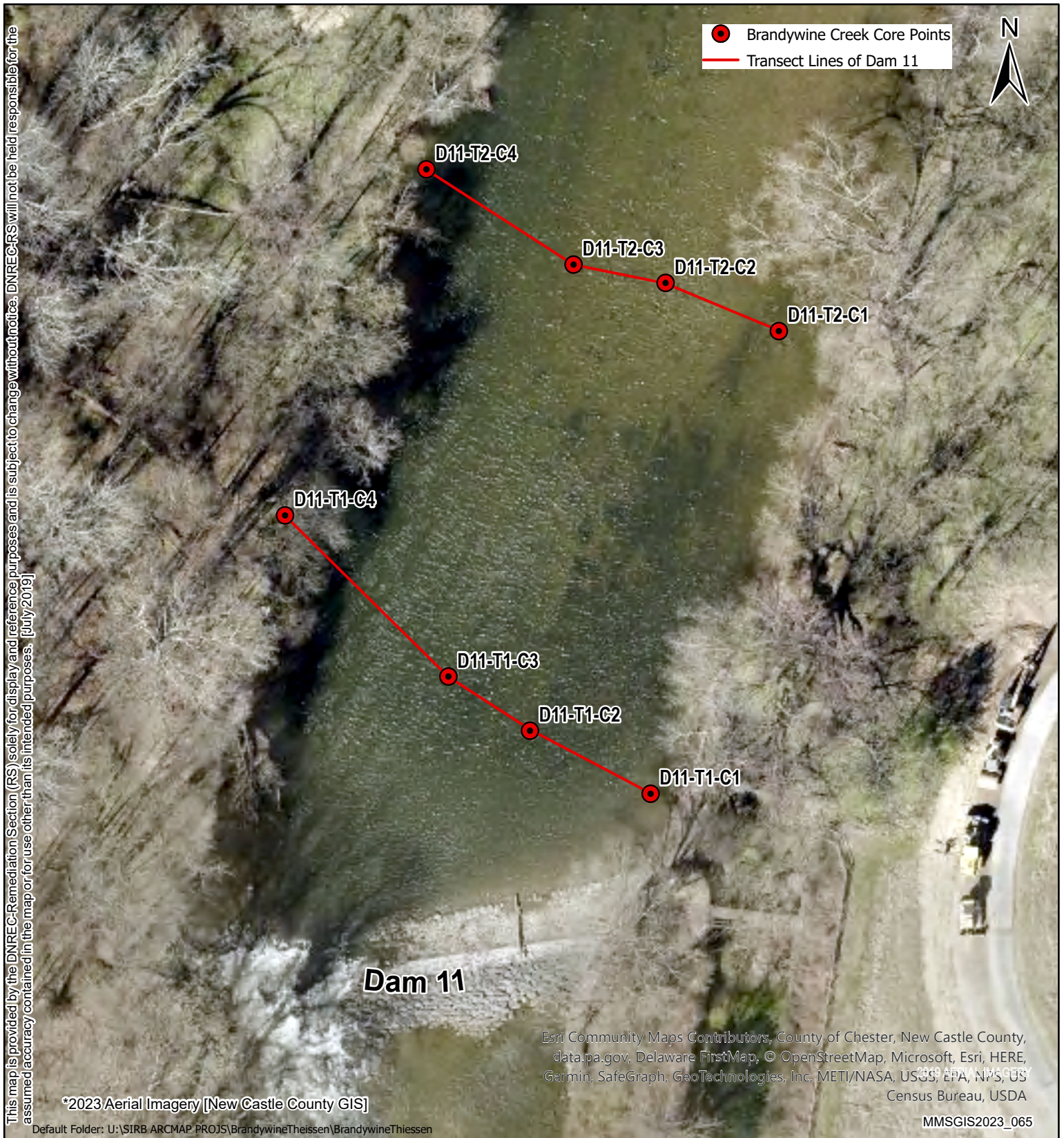


FIGURE 10
BRANDYWINE RIVER DAM 11
SAMPLE LOCATIONS AND TRANSECTS
NEW CASTLE COUNTY, DELAWARE

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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>	
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 <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
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: 0956		Crew: CS		
Coordinates:		N 640659.02		E 617211.39		Vessel: Jon boats		
Core #: D2-T1-C2		Zone: DE		Datum: NAD 83		Deploy:		
						<div style="display: flex; justify-content: space-around;"> 1 2 3 </div>		
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:				Core Penetration Length (ft.):				0
Measured Water Depth [MWD] [ft.]: 4.0				Recovered Core Length (ft.):				0
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:				Sample Length Retained (ft.):				0
Corrected Depth @ MLLW [ft.]:				Core Volume Retained (gal.):				0
+ MLW Adjustment [ft.]				Collected to Project Depth:				Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Refusal <input checked="" type="checkbox"/>
Corrected Depth @ MLW [ft.]:								
Required Sample Core Length [SCL] [ft.]:								
All Length Measurements are in Decimal Feet								
Sample Interval (ft.)		Sample Id #		Description				
Top				solid rocky bottom				
Bottom								
# of containers:						Core Volumes		
Type of container:		bucket		hardliner				
								Nominal core-barrel
								diameter: 3.5" .33 gal/ft EST. Volume
Conditions: Rain						Liner Type: Soft		
Comments: -lots of rocks -no sample collected						Vibracorer: Slambar		
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>		
						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: 1004		Crew: CS		
Coordinates:		N 640635.56		E 617160.37		Vessel: Jon boats		
Core #: D2-T1-C3		Zone: DE		Datum: NAD 83		Deploy:		
						<div style="display: flex; justify-content: space-around;"> 1 2 3 </div>		
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:				Core Penetration Length (ft.):				0
Measured Water Depth [MWD] [ft.]: 4.6				Recovered Core Length (ft.):				0
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:				Sample Length Retained (ft.):				0
Corrected Depth @ MLLW [ft.]:				Core Volume Retained (gal.):				0
+ MLW Adjustment [ft.]				Collected to Project Depth:				Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Refusal <input checked="" type="checkbox"/>
Corrected Depth @ MLW [ft.]:								
Required Sample Core Length [SCL] [ft.]:								
All Length Measurements are in Decimal Feet								
Sample Interval (ft.)		Sample Id #		Description				
Top				solid rocky bottom				
Bottom								
# of containers:						Core Volumes		
Type of container:		bucket	hardliner	cup	other	Nominal core-barrel diameter: 3.5" .33 gal/ft EST. Volume		
Conditions: Rain					Liner Type: Soft			
Comments: -lots of rocks -no sample collected					Vibracorer: Slambar			
					Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>			
					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: 1014		Crew:		CS		
Coordinates:		N 640603.63		E 617112.43		Vessel:		Jon boats			
Core #: D2-T1-C4		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		2.1			
Measured Water Depth [MWD] [ft.]: 3.0						Recovered Core Length (ft.):		1.1			
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>	
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 <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Klein				Project: Brandywine Creek				Logger: WR					
Job #: 40-046			Date: 3-5-2020		Time: 1040		Crew:		CS, KS				
Coordinates:		N 640861.66		E 617125.55		Vessel:		Jon boats					
Core #: D2-T2-C1		Zone: DE		Datum: NAD 83		Deploy:		1	2	3			
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		0.8	0.8	0.8			
Measured Water Depth [MWD] [ft.]: 0.5						Recovered Core Length (ft.):		0.8	0.8	0.8			
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>			
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					
Conditions:						Nominal core-barrel diameter: 4.0" .50 gal/ft EST. Volume							
Comments: * Core to DNREC						Liner Type: Soft							
						Vibracorer: Pushcorer							
						Live Organisms Present						Yes <input type="checkbox"/>	No <input type="checkbox"/>
						Oil Present						Yes <input type="checkbox"/>	No <input type="checkbox"/>
						Odor Present						Yes <input type="checkbox"/>	No <input type="checkbox"/>
						Debris Present						Yes <input type="checkbox"/>	No <input type="checkbox"/>
Within 10% of Req'd Core Length						Yes <input type="checkbox"/>	No <input type="checkbox"/>						
Photo						Yes <input type="checkbox"/>	No <input type="checkbox"/>						
MLW #td ver 021820													



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Klein				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 3-5-2020		Time: 1212		Crew:		CS, KS		
Coordinates:		N 640842.18		E 617079.05			Vessel:		Jon boats		
Core #: D2-T2-C2		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):			1.5		
Measured Water Depth [MWD] [ft.]: 2.2						Recovered Core Length (ft.):			0.8		
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>
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 <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 3-5-2020		Time: 1240		Crew:		CS, KS		
Coordinates:		N 640799.25		E 617033.63		Vessel:		Jon boats			
Core #: D2-T2-C3		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		0	1.0		
Measured Water Depth [MWD] [ft.]: 4.3						Recovered Core Length (ft.):		0	0		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:						Sample Length Retained (ft.):		0	*		
Corrected Depth @ MLLW [ft.]:						Core Volume Retained (gal.):		0	*		
+ MLW Adjustment [ft.]						Collected to Project Depth:		Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	Refusal <input checked="" type="checkbox"/>	
Corrected Depth @ MLW [ft.]:											
Required Sample Core Length [SCL] [ft.]:											
All Length Measurements are in Decimal Feet											
Sample Interval (ft.)			Sample Id #			Description					
Top						1st attempt push core- no penetration/recovery					
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: No recovery						Vibracorer: Slambar					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
						MLW #td ver 021820					



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 3-5-2020		Time: 1327		Crew:		CS, KS		
Coordinates:		N 640801.46		E 616928.05			Vessel:		Jon boats		
Core #: D2-T2-C4		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):			4.5		
Measured Water Depth [MWD] [ft.]: 0.1						Recovered Core Length (ft.):			2.5		
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>
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 <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 3-5-2020		Time: 1356		Crew:		CS		
Coordinates:		N 641128.56		E 616889.04		Vessel:		Jon boats			
Core #: D2-T3-C1		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):			3.0		
Measured Water Depth [MWD] [ft.]: 1.2						Recovered Core Length (ft.):			2.0		
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>
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 -lots of rocks						Vibracorer: Slambar					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 3-5-2020		Time: 1409		Crew:		CS		
Coordinates:		N 641115.80		E 616838.78		Vessel:		Jon boats			
Core #: D2-T3-C2		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		1.4			
Measured Water Depth [MWD] [ft.]: 3.4						Recovered Core Length (ft.):		1.0			
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>	
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 <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 3-5-2020		Time: 1512		Crew:		CS		
Coordinates:		N 641100.54		E 616799.40		Vessel:		Jon boats			
Core #: D2-T3-C3		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		1.2			
Measured Water Depth [MWD] [ft.]: 6.5						Recovered Core Length (ft.):		0			
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 <input type="checkbox"/>	No <input checked="" type="checkbox"/>	Refusal <input checked="" type="checkbox"/>	
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: No recovery. Rock in core bottom.						Vibracorer: Slambar					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 3-5-2020		Time: 1451		Crew:		CS		
Coordinates:		N 641078.54		E 616740.59		Vessel:		Jon boats			
Core #: D2-T3-C4		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		2.5			
Measured Water Depth [MWD] [ft.]: 2.5						Recovered Core Length (ft.):		1.5			
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>	
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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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 <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 3-9-220		Time: 1355		Crew:		CS, KS		
Coordinates:		N 644282.02		E 616003.11		Vessel:		Jon boats			
Core #: D4-T1-C1		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		0.5			
Measured Water Depth [MWD] [ft.]: 0.2						Recovered Core Length (ft.):		0.5			
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input type="checkbox"/>	
Corrected Depth @ MLW [ft.]:											
Required Sample Core Length [SCL] [ft.]:											
All Length Measurements are in Decimal Feet											
Sample Interval (ft.)			Sample Id #			Description					
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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: *DNREC collected grab from bank near probe coordinates above						Vibracorer: Ponar: Petite					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt			Project: Brandywine Creek			Logger: WR		
Job #: 40-046		Date: 3-9-2020		Time: 1118		Crew: CS, KS		
Coordinates:		N 644256.60		E 616005.09		Vessel: Jon boats		
Core #: D4-T1-C2		Zone: DE		Datum: NAD 83		Deploy: 1 2 3		
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:				Core Penetration Length (ft.):				0
Measured Water Depth [MWD] [ft.]: 12.5				Recovered Core Length (ft.):				0
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:				Sample Length Retained (ft.):				0
Corrected Depth @ MLLW [ft.]:				Core Volume Retained (gal.):				0
+ MLW Adjustment [ft.]:				Collected to Project Depth: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Refusal <input checked="" type="checkbox"/>				
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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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: -No sample collected due to rock/boulder -Time and coordinates same as probe						Vibracorer: Slambar		
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>		
MLW #td ver 021820								



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 3-9-2020		Time: 1115		Crew:		CS, KS		
Coordinates:		N 644233.00		E 615992.72		Vessel:		Jon boats			
Core #: D4-T1-C3		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		0			
Measured Water Depth [MWD] [ft.]: 10.0						Recovered Core Length (ft.):		0			
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:						Sample Length Retained (ft.):		0			
Corrected Depth @ MLLW [ft.]:						Core Volume Retained (gal.):		0			
+ MLW Adjustment [ft.]						Collected to Project Depth:		Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	Refusal <input checked="" type="checkbox"/>	
Corrected Depth @ MLW [ft.]:											
Required Sample Core Length [SCL] [ft.]:											
All Length Measurements are in Decimal Feet											
Sample Interval (ft.)			Sample Id #			Description					
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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: <ul style="list-style-type: none"> -No sample collected -Rocks/pebbles/sand -time and coordinates same as probe 						Vibracorer: Slambar					
Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>											
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 3-9-2020		Time: 1113		Crew:		CS, KS		
Coordinates:		N 644195.75		E 615984.51			Vessel:		Jon boats		
Core #: D4-T1-C4		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		0.1			
Measured Water Depth [MWD] [ft.]: 7.7						Recovered Core Length (ft.):		0			
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:						Sample Length Retained (ft.):		0			
Corrected Depth @ MLLW [ft.]:						Core Volume Retained (gal.):		0			
+ MLW Adjustment [ft.]						Collected to Project Depth:		Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	Refusal <input checked="" type="checkbox"/>	
Corrected Depth @ MLW [ft.]:											
Required Sample Core Length [SCL] [ft.]:											
All Length Measurements are in Decimal Feet											
Sample Interval (ft.)			Sample Id #			Description					
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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: <ul style="list-style-type: none"> -No sample collected -rocks/sand -time and coordinates same as probe 						Vibracorer: Slambar					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 3-9-2020		Time: 1332		Crew:		CS, KS		
Coordinates:		N 644162.17		E 615946.09			Vessel:		Jon boats		
Core #: D4-T1-C5		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		0.5			
Measured Water Depth [MWD] [ft.]: 1.0						Recovered Core Length (ft.):		0.5			
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input type="checkbox"/>	
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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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: *Ponar grab to DNREC						Vibracorer: Ponar: Petite					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 3-9-20		Time: 1138		Crew:		CS		
Coordinates:		N 644327.41		E 615901.93		Vessel:		Jon boats			
Core #: D4-T2-C1		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		4.2			
Measured Water Depth [MWD] [ft.]: 1.8						Recovered Core Length (ft.):		2.4			
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>	
Corrected Depth @ MLW [ft.]:											
Required Sample Core Length [SCL] [ft.]:											
All Length Measurements are in Decimal Feet											
Sample Interval (ft.)			Sample Id #			Description					
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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 <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 3-9-2020		Time: 1102		Crew:		CS		
Coordinates:		N 644279.04		E 615886.99		Vessel:		Jon boats			
Core #: D4-T2-C2		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):			0		
Measured Water Depth [MWD] [ft.]: 13.6						Recovered Core Length (ft.):			0		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:						Sample Length Retained (ft.):			0		
Corrected Depth @ MLLW [ft.]:						Core Volume Retained (gal.):			0		
+ MLW Adjustment [ft.]:						Collected to Project Depth:			Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	Refusal <input checked="" type="checkbox"/>
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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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: <ul style="list-style-type: none"> -No sample collected -Rocks/boulder -Time and coordinates same as probe. 						Vibracorer: Slambar					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt			Project: Brandywine Creek			Logger: WR		
Job #: 40-046		Date: 3-9-2020		Time: 1105		Crew: CS		
Coordinates:		N 644239.95		E 615879.84		Vessel: Jon boats		
Core #: D4-T2-C3		Zone: DE		Datum: NAD 83		Deploy: 1 2 3		
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:				Core Penetration Length (ft.):				0
Measured Water Depth [MWD] [ft.]: 10.3				Recovered Core Length (ft.):				0
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:				Sample Length Retained (ft.):				0
Corrected Depth @ MLLW [ft.]:				Core Volume Retained (gal.):				0
+ MLW Adjustment [ft.]				Collected to Project Depth: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Refusal <input checked="" type="checkbox"/>				
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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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: <ul style="list-style-type: none"> -No sample collected -Rocks/boulder -time and coordinates same as probe 						Vibracorer: Slambar		
Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>								
MLW #td ver 021820								



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 3-9-20		Time: 1129		Crew:		CS		
Coordinates:		N 644185.29			E 615853.94			Vessel:		Jon boats	
Core #: D4-T2-C4		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):			6.4		
Measured Water Depth [MWD] [ft.]: 0.7						Recovered Core Length (ft.):			3.0		
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>
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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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 <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 3-9-20		Time: 1230		Crew:		CS, KS		
Coordinates:		N 644321.22		E 615759.24		Vessel:		Jon boats			
Core #: D4-T3-C1		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		0.5			
Measured Water Depth [MWD] [ft.]: 0.5						Recovered Core Length (ft.):		0.5			
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>	
Corrected Depth @ MLW [ft.]:											
Required Sample Core Length [SCL] [ft.]:											
All Length Measurements are in Decimal Feet											
Sample Interval (ft.)			Sample Id #			Description					
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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: *Ponar grab to DNREC						Vibracorer: Ponar: Petite					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 3-9-2020		Time: 1047		Crew:		CS, KS		
Coordinates:		N 644285.09		E 615783.07		Vessel:		Jon boats			
Core #: D4-T3-C2		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):			0		
Measured Water Depth [MWD] [ft.]: 7.0						Recovered Core Length (ft.):			0		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:						Sample Length Retained (ft.):			0		
Corrected Depth @ MLLW [ft.]:						Core Volume Retained (gal.):			0		
+ MLW Adjustment [ft.]:						Collected to Project Depth:			Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	Refusal <input checked="" type="checkbox"/>
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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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: <ul style="list-style-type: none"> -No sample collected -solid rock -time and coordinates same as probe 						Vibracorer: Slambar					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 3-9-2020		Time: 1049		Crew:		CS, KS		
Coordinates:		N 644249.85		E 615771.09		Vessel:		Jon boats			
Core #: D4-T3-C3		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):			0		
Measured Water Depth [MWD] [ft.]: 9.3						Recovered Core Length (ft.):			0		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:						Sample Length Retained (ft.):			0		
Corrected Depth @ MLLW [ft.]:						Core Volume Retained (gal.):			0		
+ MLW Adjustment [ft.]:						Collected to Project Depth:			Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	Refusal <input checked="" type="checkbox"/>
Corrected Depth @ MLW [ft.]:											
Required Sample Core Length [SCL] [ft.]:											
All Length Measurements are in Decimal Feet											
Sample Interval (ft.)			Sample Id #			Description					
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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: <ul style="list-style-type: none"> -No sample collected -Rocks/sand -time and coordinates same as probe 						Vibracorer: Slambar					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 3-9-20		Time: 1236		Crew:		CS		
Coordinates:		N 644228.23		E 615756.22		Vessel:		Jon boats			
Core #: D4-T3-C4		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		0.5			
Measured Water Depth [MWD] [ft.]: 1.0						Recovered Core Length (ft.):		0.5			
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>	
Corrected Depth @ MLW [ft.]:											
Required Sample Core Length [SCL] [ft.]:											
All Length Measurements are in Decimal Feet											
Sample Interval (ft.)			Sample Id #			Description					
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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: *Ponar grab to DNREC						Vibracorer: Ponar: Petite					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 3-9-20		Time: 1249		Crew:		CS, KS		
Coordinates:		N 644348.05		E 615565.60		Vessel:		Jon boats			
Core #: D4-T4-C1		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		0.5			
Measured Water Depth [MWD] [ft.]: 0.6						Recovered Core Length (ft.):		0.5			
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>	
Corrected Depth @ MLW [ft.]:											
Required Sample Core Length [SCL] [ft.]:											
All Length Measurements are in Decimal Feet											
Sample Interval (ft.)			Sample Id #			Description					
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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: *Ponar grab to DNREC						Vibracorer: Ponar: Petite					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt			Project: Brandywine Creek			Logger: WR		
Job #: 40-046		Date: 3-9-2020		Time: 1037		Crew: CS, KS		
Coordinates:		N 644309.21		E 615572.02		Vessel: Jon boats		
Core #: D4-T4-C2		Zone: DE		Datum: NAD 83		Deploy: 1 2 3		
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:				Core Penetration Length (ft.):				0
Measured Water Depth [MWD] [ft.]: 14.0				Recovered Core Length (ft.):				0
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:				Sample Length Retained (ft.):				0
Corrected Depth @ MLLW [ft.]:				Core Volume Retained (gal.):				0
+ MLW Adjustment [ft.]:				Collected to Project Depth: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Refusal <input checked="" type="checkbox"/>				
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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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: - No sample collected - rocks/sand - time and coordinates same as probe						Vibracorer: Slambar		
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>		
						MLW #td ver 021820		



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 3-9-20		Time: 1257		Crew:		CS		
Coordinates:		N 644263.09			E 615554.53			Vessel:		Jon boats	
Core #: D4-T4-C3		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		0.5			
Measured Water Depth [MWD] [ft.]: 0.7						Recovered Core Length (ft.):		0.5			
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>	
Corrected Depth @ MLW [ft.]:											
Required Sample Core Length [SCL] [ft.]:											
All Length Measurements are in Decimal Feet											
Sample Interval (ft.)			Sample Id #			Description					
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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: *Ponar Grab to DNREC						Vibracorer: Ponar: Petite					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 3-9-2020		Time: 1306		Crew:		CS		
Coordinates:		N 644360.83		E 615437.88			Vessel:		Jon boats		
Core #: D4-T5-C1		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		0.5			
Measured Water Depth [MWD] [ft.]: 1.0						Recovered Core Length (ft.):		0.5			
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>	
Corrected Depth @ MLW [ft.]:											
Required Sample Core Length [SCL] [ft.]:											
All Length Measurements are in Decimal Feet											
Sample Interval (ft.)			Sample Id #			Description					
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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: *Ponar Grab to DNREC						Vibracorer: Ponar: Petite					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt			Project: Brandywine Creek			Logger: WR		
Job #: 40-046		Date: 3-9-2020		Time: 1029		Crew: CS, KS		
Coordinates:		N 644323.72		E 615429.72		Vessel: Jon boats		
Core #: D4-T5-C2		Zone: DE		Datum: NAD 83		Deploy: 1 2 3		
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:				Core Penetration Length (ft.):				0
Measured Water Depth [MWD] [ft.]: 12.0				Recovered Core Length (ft.):				0
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:				Sample Length Retained (ft.):				0
Corrected Depth @ MLLW [ft.]:				Core Volume Retained (gal.):				0
+ MLW Adjustment [ft.]:				Collected to Project Depth: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Refusal <input checked="" type="checkbox"/>				
Corrected Depth @ MLW [ft.]:								
Required Sample Core Length [SCL] [ft.]:								
All Length Measurements are in Decimal Feet								
Sample Interval (ft.)		Sample Id #		Description				
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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: <ul style="list-style-type: none"> -No sample collected -rocks/sand -time and coordinates same as probe 						Vibracorer: Slambar		
Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>								
MLW #td ver 021820								



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 3-9-2020		Time: 1310		Crew:		CS, KS		
Coordinates:		N 644278.77		E 615474.03		Vessel:		Jon boats			
Core #: D4-T5-C3		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		0.5			
Measured Water Depth [MWD] [ft.]: 0.3						Recovered Core Length (ft.):		0.5			
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>	
Corrected Depth @ MLW [ft.]:											
Required Sample Core Length [SCL] [ft.]:											
All Length Measurements are in Decimal Feet											
Sample Interval (ft.)			Sample Id #			Description					
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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: *Ponar Grab to DNREC						Vibracorer: Ponar: Petite					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek Dam #5				Logger: AF			
Job #: 42-146			Date: 1-11-2023		Time: 1255		Crew:		PW		
Coordinates:		N 645108.32		E 613252.64		Vessel:		Jon boats			
Core #: D5-T1-C1		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		2.0			
Measured Water Depth [MWD] [ft.]: 3.5						Recovered Core Length (ft.):		1.5			
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>	
Corrected Depth @ MLW [ft.]:											
Required Sample Core Length [SCL] [ft.]:											
All Length Measurements are in Decimal Feet											
Sample Interval (ft.)			Sample Id #			Description					
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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 Unable to collect cores at D5-T1-C2 or D5-T1-C3 due to rocky sediment						Vibracorer: Slambar					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt			Project: Brandywine Creek Dam #5			Logger: AF			
Job #: 42-146		Date: 1-11-2023		Time: 1220		Crew: PW			
Coordinates:		N 645003.99		E 613171.32		Vessel: Jon boats			
Core #: D5-T1-C4		Zone: DE		Datum: NAD 83		Deploy: 1 2 3			
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:				Core Penetration Length (ft.):				1.2	
Measured Water Depth [MWD] [ft.]: 4.2				Recovered Core Length (ft.):				0.0	
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 <input checked="" type="checkbox"/> No <input type="checkbox"/> Refusal <input checked="" type="checkbox"/>	
Corrected Depth @ MLW [ft.]:									
Required Sample Core Length [SCL] [ft.]:									
All Length Measurements are in Decimal Feet									
Sample Interval (ft.)		Sample Id #		Description					
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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 was lost upon retrieval, would not hold in barrel DNREC instructed to move on						Vibracorer: Slambar			
Live Organisms Present						Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Oil Present						Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Odor Present						Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Debris Present						Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Within 10% of Req'd Core Length						Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Photo						Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
MLW #td ver 021820									



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt			Project: Brandywine Creek Dam #5			Logger: AF		
Job #: 42-146		Date: 1-11-2023		Time: 1150		Crew: PW		
Coordinates:		N 644972.07		E 613151.17		Vessel: Jon boats		
Core #: D5-T1-C5		Zone: DE		Datum: NAD 83		Deploy: 1 2 3		
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:				Core Penetration Length (ft.):				2.6
Measured Water Depth [MWD] [ft.]: 2.3				Recovered Core Length (ft.):				1.1
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 <input checked="" type="checkbox"/> No <input type="checkbox"/> Refusal <input checked="" type="checkbox"/>
Corrected Depth @ MLW [ft.]:								
Required Sample Core Length [SCL] [ft.]:								
All Length Measurements are in Decimal Feet								
Sample Interval (ft.)		Sample Id #		Description				
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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		
<div style="display: flex; justify-content: space-between;"> <div> Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/> </div> </div>								
MLW #td ver 021820								



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek Dam #5				Logger: AF			
Job #: 42-146			Date: 1-11-2023		Time: 0950		Crew:		PW		
Coordinates:		N 645141.37		E 613090.54			Vessel:		Jon boats		
Core #: D5-T2-C1		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):			1.5		
Measured Water Depth [MWD] [ft.]: 3.0						Recovered Core Length (ft.):			0.9		
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>
Corrected Depth @ MLW [ft.]:											
Required Sample Core Length [SCL] [ft.]:											
All Length Measurements are in Decimal Feet											
Sample Interval (ft.)			Sample Id #			Description					
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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 <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt			Project: Brandywine Creek Dam #5			Logger: AF		
Job #: 42-146		Date: 1-11-2023		Time: 1025		Crew: PW		
Coordinates:		N 645109.08		E 613086.26		Vessel: Jon boats		
Core #: D5-T2-C2		Zone: DE		Datum: NAD 83		Deploy: 1 2 3		
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:				Core Penetration Length (ft.):				2.2
Measured Water Depth [MWD] [ft.]: 4.7				Recovered Core Length (ft.):				0.2
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 <input checked="" type="checkbox"/> No <input type="checkbox"/> Refusal <input checked="" type="checkbox"/>
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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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 was mostly lost upon retrieval, would not hold in barrel, no usable recovery, only surface vegetation retained DNREC instructed to move on Unable to collect cores at D5-T2-C3 or D5-T2-C4 due to rocky sediment						Vibracorer: Slambar		
Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>								
MLW #td ver 021820								



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek Dam #5				Logger: AF			
Job #: 42-146			Date: 1-11-2023		Time: 1125		Crew:		PW		
Coordinates:		N 644987.54		E 613072.02			Vessel:		Jon boats		
Core #: D5-T2-C5		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):			2.3		
Measured Water Depth [MWD] [ft.]: 2.1						Recovered Core Length (ft.):			1.6		
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>
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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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 <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt			Project: Brandywine Creek Dam #5			Logger: AF		
Job #: 42-146		Date: 1-11-2023		Time: 1525		Crew: PW		
Coordinates:		N 645105.35		E 612852.67		Vessel: Jon boats		
Core #: D5-T3-C1		Zone: DE		Datum: NAD 83		Deploy: 1 2 3		
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:				Core Penetration Length (ft.):				2.4
Measured Water Depth [MWD] [ft.]: 2.7				Recovered Core Length (ft.):				0.7
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 <input checked="" type="checkbox"/> No <input type="checkbox"/> Refusal <input checked="" type="checkbox"/>
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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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 Unable to collect cores at D5-T3-C2, D5-T3-C3, and D5-T3-C4, due to rocky sediment.						Vibracorer: Slambar		
Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>								
MLW #td ver 021820								



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek Dam #5				Logger: AF			
Job #: 42-146			Date: 1-11-2023		Time: 1610		Crew:		PW		
Coordinates:		N 644957.76		E 612862.87		Vessel:		Jon boats			
Core #: D5-T3-C5		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):			Grab		
Measured Water Depth [MWD] [ft.]: 0.6						Recovered Core Length (ft.):					
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>
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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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: *No core possible with rocky sediment, collected a grab sample into a clean tray Grab sample to DNREC						Vibracorer: Slambar					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt			Project: Brandywine Creek Dam #5			Logger: AF		
Job #: 42-146		Date: 1-12-2023		Time: 0850		Crew: PW		
Coordinates:		N 644965.84		E 612636.55		Vessel: Jon boats		
Core #: D5-T4-C1		Zone: DE		Datum: NAD 83		Deploy: 1 2 3		
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:				Core Penetration Length (ft.):				1.0
Measured Water Depth [MWD] [ft.]: 2.5				Recovered Core Length (ft.):				0.0
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 <input checked="" type="checkbox"/> No <input type="checkbox"/> Refusal <input checked="" type="checkbox"/>				
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: *Nothing retained in core, collected a grab sample into a clean tray Grab sample to DNREC Unable to collect core at D5-T4-C2 due to large boulders						Vibracorer: Slambar		
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>		
						MLW #td ver 021820		



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt			Project: Brandywine Creek Dam #5			Logger: AF		
Job #: 42-146		Date: 1-12-2023		Time: 0925		Crew: PW		
Coordinates:		N 644893.22		E 612703.52		Vessel: Jon boats		
Core #: D5-T4-C3		Zone: DE		Datum: NAD 83		Deploy: 1 2 3		
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:				Core Penetration Length (ft.):				1.7
Measured Water Depth [MWD] [ft.]: 3.0				Recovered Core Length (ft.):				1.0
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 <input checked="" type="checkbox"/> No <input type="checkbox"/> Refusal <input checked="" type="checkbox"/>
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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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		
<div style="display: flex; justify-content: space-between;"> <div> Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/> </div> <div> MLW #td ver 021820 </div> </div>								



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek Dam #5				Logger: AF			
Job #: 42-146			Date: 1-12-2023		Time: 1015		Crew:		PW		
Coordinates:		N 644873.47		E 612720.03			Vessel:		Jon boats		
Core #: D5-T4-C4		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):			2.7		
Measured Water Depth [MWD] [ft.]: 1.5						Recovered Core Length (ft.):			1.7		
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>
Corrected Depth @ MLW [ft.]:											
Required Sample Core Length [SCL] [ft.]:											
All Length Measurements are in Decimal Feet											
Sample Interval (ft.)			Sample Id #			Description					
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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 <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 6-10-2020		Time: 1039		Crew:		SC		
Coordinates:		N 644465.19		E 611840.75		Vessel:		Jon boats			
Core #: D6-T1-C1		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		0.5			
Measured Water Depth [MWD] [ft.]: 1.0						Recovered Core Length (ft.):		0.5			
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>	
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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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: * Sample to DNREC - ponar taken at bank						Vibracorer: Ponar: Petite					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 6-10-2020		Time: 1046		Crew:		SC		
Coordinates:		N 644430.38		E 611866.33		Vessel:		Jon boats			
Core #: D6-T1-C2		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		0.1	0.1		
Measured Water Depth [MWD] [ft.]: 5.2						Recovered Core Length (ft.):		0.1	0.1		
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>	
Corrected Depth @ MLW [ft.]:											
Required Sample Core Length [SCL] [ft.]:											
All Length Measurements are in Decimal Feet											
Sample Interval (ft.)			Sample Id #			Description					
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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: * Sample to DNREC						Vibracorer: Ponar: Petite					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 6-10-2020		Time: 1050		Crew:		SC		
Coordinates:		N 644392.73		E 611889.93		Vessel:		Jon boats			
Core #: D6-T1-C3		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):			0		
Measured Water Depth [MWD] [ft.]: 9.0						Recovered Core Length (ft.):			0		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:						Sample Length Retained (ft.):			0		
Corrected Depth @ MLLW [ft.]:						Core Volume Retained (gal.):			0		
+ MLW Adjustment [ft.]						Collected to Project Depth:			Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	Refusal <input type="checkbox"/>
Corrected Depth @ MLW [ft.]:											
Required Sample Core Length [SCL] [ft.]:											
All Length Measurements are in Decimal Feet											
Sample Interval (ft.)			Sample Id #			Description					
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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: * No sample collected						Vibracorer: Ponar: Petite					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 6-10-2020		Time: 1055		Crew:		SC		
Coordinates:		N 644340.36		E 611902.49		Vessel:		Jon boats			
Core #: D6-T1-C4		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		0.5			
Measured Water Depth [MWD] [ft.]: 0.5						Recovered Core Length (ft.):		0.5			
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>	
Corrected Depth @ MLW [ft.]:											
Required Sample Core Length [SCL] [ft.]:											
All Length Measurements are in Decimal Feet											
Sample Interval (ft.)			Sample Id #			Description					
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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: * Sample to DNREC - ponar taken at bank						Vibracorer: Ponar: Petite					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 6-10-2020		Time: 1059		Crew:		SC		
Coordinates:		N 644418.84		E 611767.61		Vessel:		Jon boats			
Core #: D6-T2-C1		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		0.5			
Measured Water Depth [MWD] [ft.]: 1.5						Recovered Core Length (ft.):		0.5			
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>	
Corrected Depth @ MLW [ft.]:											
Required Sample Core Length [SCL] [ft.]:											
All Length Measurements are in Decimal Feet											
Sample Interval (ft.)			Sample Id #			Description					
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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: * Sample to DNREC - ponar taken at bank - lots of leaves/organic debris (no core collected)						Vibracorer: Ponar: Petite					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt			Project: Brandywine Creek			Logger: WR		
Job #: 40-046		Date: 6-10-2020		Time: 1104		Crew: SC		
Coordinates:		N 644371.74		E 611800.95		Vessel: Jon boats		
Core #: D6-T2-C2		Zone: DE		Datum: NAD 83		Deploy: 1 2 3		
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:				Core Penetration Length (ft.):		0.5		
Measured Water Depth [MWD] [ft.]: 9.5				Recovered Core Length (ft.):		0.5		
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 <input checked="" type="checkbox"/> No <input type="checkbox"/> Refusal <input checked="" type="checkbox"/>		
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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Bottom								
# of containers:						Core Volumes		
Type of container:		bucket		hardliner		cup		other
Conditions:						Liner Type: Soft		
Comments: * Sample to DNREC						Vibracorer: Ponar: Petite		
Live Organisms Present						Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Oil Present						Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Odor Present						Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Debris Present						Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Within 10% of Req'd Core Length						Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Photo						Yes <input type="checkbox"/>	No <input type="checkbox"/>	
MLW #td ver 021820								



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt			Project: Brandywine Creek			Logger: WR		
Job #: 40-046		Date: 6-10-2020		Time: 1107		Crew: SC		
Coordinates:		N 644344.41		E 611828.28		Vessel: Jon boats		
Core #: D6-T2-C3		Zone: DE		Datum: NAD 83		Deploy: 1 2 3		
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:				Core Penetration Length (ft.):				0
Measured Water Depth [MWD] [ft.]: 8.5				Recovered Core Length (ft.):				0
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:				Sample Length Retained (ft.):				0
Corrected Depth @ MLLW [ft.]:				Core Volume Retained (gal.):				0
+ MLW Adjustment [ft.]				Collected to Project Depth: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Refusal <input type="checkbox"/>				
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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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: * No Sample collected						Vibracorer: Ponar: Petite		
<div style="display: flex; justify-content: space-between;"> <div> Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/> </div> </div>								
MLW #td ver 021820								



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 6-10-2020		Time: 1109		Crew:		SC		
Coordinates:		N 644313.22		E 611849.54		Vessel:		Jon boats			
Core #: D6-T2-C4		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		0.1	0.1		
Measured Water Depth [MWD] [ft.]: 1.0						Recovered Core Length (ft.):		0.1	0.1		
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>	
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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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: * Sample to DNREC - ponar taken at bank						Vibracorer: Ponar: Petite					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 6-10-2020		Time: 1144		Crew:		SC		
Coordinates:		N 644356.80		E 611593.01		Vessel:		Jon boats			
Core #: D6-T3-C1		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		3.5	0.5		
Measured Water Depth [MWD] [ft.]: 1.0						Recovered Core Length (ft.):		*	0.5		
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>	
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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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: * Sample to DNREC - 2nd deployment taken by ponar - core/ponar taken at bank						Vibracorer: Slambar					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 6-10-2020		Time: 1157		Crew:		SC		
Coordinates:		N 644311.69			E 611606.15			Vessel:		Jon boats	
Core #: D6-T3-C2		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		0.5	0.5	0.5	
Measured Water Depth [MWD] [ft.]: 6.5						Recovered Core Length (ft.):		0	0	0	
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:						Sample Length Retained (ft.):		0	0	0	
Corrected Depth @ MLLW [ft.]:						Core Volume Retained (gal.):		0	0	0	
+ MLW Adjustment [ft.]						Collected to Project Depth:		Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	Refusal <input type="checkbox"/>	
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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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: <ul style="list-style-type: none"> - No recovery - No sample collected - rocks caught in ponar 						Vibracorer: Ponar: Petite					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 6-10-2020		Time: 1205		Crew:		SC		
Coordinates:		N 644266.69		E 611613.05		Vessel:		Jon boats			
Core #: D6-T3-C3		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):			0	0	0
Measured Water Depth [MWD] [ft.]: 8.0						Recovered Core Length (ft.):			0	0	0
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:						Sample Length Retained (ft.):			0	0	0
Corrected Depth @ MLLW [ft.]:						Core Volume Retained (gal.):			0	0	0
+ MLW Adjustment [ft.]						Collected to Project Depth:			Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	Refusal <input type="checkbox"/>
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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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: - No recovery - No sample collected						Vibracorer: Ponar: Petite					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 6-10-2020		Time: 1211		Crew:		SC		
Coordinates:		N 644204.44		E 611578.18		Vessel:		Jon boats			
Core #: D6-T3-C4		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		0.5			
Measured Water Depth [MWD] [ft.]: 0.5						Recovered Core Length (ft.):		0.5			
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>	
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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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: * Sample to DNREC - ponar taken at bank						Vibracorer: Ponar: Petite					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt			Project: Brandywine Creek			Logger: WR		
Job #: 40-046		Date: 3-10-2020		Time: 1259		Crew: CS		
Coordinates:		N 645110.59		E 610548.58		Vessel: Jon boats		
Core #: D7-T1-C1		Zone: DE		Datum: NAD 83		Deploy: 1 2 3		
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:				Core Penetration Length (ft.):		0.5		
Measured Water Depth [MWD] [ft.]: 0.4				Recovered Core Length (ft.):		0.5		
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 <input checked="" type="checkbox"/> No <input type="checkbox"/> Refusal <input checked="" type="checkbox"/>		
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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Bottom								
# of containers:						Core Volumes		
Type of container:		bucket		hardliner		cup		other
Conditions:						Nominal core-barrel diameter: 3.5" .33 gal/ft EST. Volume		
Comments: *Ponar Grab to DNREC						Liner Type: Soft		
						Vibracorer: Ponar: Petite		
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>		
						MLW #td ver 021820		



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt			Project: Brandywine Creek			Logger: WR		
Job #: 40-046		Date: 3-10-2020		Time: 1032		Crew: CS		
Coordinates:		N 645121.13		E 610495.52		Vessel: Jon boats		
Core #: D7-T1-C2		Zone: DE		Datum: NAD 83		Deploy: 1 2 3		
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:				Core Penetration Length (ft.):				0
Measured Water Depth [MWD] [ft.]: 7.0				Recovered Core Length (ft.):				0
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:				Sample Length Retained (ft.):				0
Corrected Depth @ MLLW [ft.]:				Core Volume Retained (gal.):				0
+ MLW Adjustment [ft.]				Collected to Project Depth: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Refusal <input checked="" type="checkbox"/>				
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: - No sample collected - time and coordinates same as probe						Vibracorer: Slambar		
Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>								
MLW #td ver 021820								



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt			Project: Brandywine Creek			Logger: WR		
Job #: 40-046		Date: 3-10-2020		Time: 1030		Crew: CS		
Coordinates:		N 645121.70		E 610467.62		Vessel: Jon boats		
Core #: D7-T1-C3		Zone: DE		Datum: NAD 83		Deploy: 1 2 3		
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:				Core Penetration Length (ft.):				0
Measured Water Depth [MWD] [ft.]: 9.8				Recovered Core Length (ft.):				0
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:				Sample Length Retained (ft.):				0
Corrected Depth @ MLLW [ft.]:				Core Volume Retained (gal.):				0
+ MLW Adjustment [ft.]				Collected to Project Depth: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Refusal <input checked="" type="checkbox"/>				
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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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: <ul style="list-style-type: none"> - No sample collected - rocks/sand - time and coordinates same as probe 						Vibracorer: Slambar		
Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>								
MLW #td ver 021820								



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 3-10-2020		Time: 1246		Crew:		CS		
Coordinates:		N 645122.10		E 610417.35		Vessel:		Jon boats			
Core #: D7-T1-C4		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		0.5			
Measured Water Depth [MWD] [ft.]: 0.4						Recovered Core Length (ft.):		0.5			
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>	
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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Bottom											
# of containers:										Core Volumes	
Type of container:		bucket		hardliner		cup		other		Nominal core-barrel diameter: 3.5" .33 gal/ft EST. Volume	
Conditions: rain						Liner Type: Soft					
Comments: *Ponar grab to DNREC - sample taken at bank						Vibracorer: Ponar: Petite					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt			Project: Brandywine Creek			Logger: WR		
Job #: 40-046		Date: 3-10-2020		Time: 1040		Crew: CS		
Coordinates:		N 645187.93		E 610577.22		Vessel: Jon boats		
Core #: D7-T2-C1		Zone: DE		Datum: NAD 83		Deploy: 1 2 3		
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:				Core Penetration Length (ft.):				2.5
Measured Water Depth [MWD] [ft.]: 1.5				Recovered Core Length (ft.):				1.8
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 <input checked="" type="checkbox"/> No <input type="checkbox"/> Refusal <input checked="" type="checkbox"/>
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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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		
<div style="display: flex; justify-content: space-between;"> <div> Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/> </div> </div>								
MLW #td ver 021820								



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt			Project: Brandywine Creek			Logger: WR		
Job #: 40-046		Date: 3-10-2020		Time: 1128		Crew: CS		
Coordinates:		N 645194.34		E 610498.16		Vessel: Jon boats		
Core #: D7-T2-C2		Zone: DE		Datum: NAD 83		Deploy: 1 2 3		
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:				Core Penetration Length (ft.):		0.5		
Measured Water Depth [MWD] [ft.]: 6.9				Recovered Core Length (ft.):		0		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:				Sample Length Retained (ft.):		0		
Corrected Depth @ MLLW [ft.]:				Core Volume Retained (gal.):		0		
+ MLW Adjustment [ft.]				Collected to Project Depth:		Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Refusal <input checked="" type="checkbox"/>		
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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↓								
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↓								
↓								
↓								
↓								
Bottom								
# of containers:						Core Volumes		
Type of container:		bucket		hardliner		cup		other
Conditions:						Liner Type: Soft		
Comments: - No sample collected - rocks/sand						Vibracorer: Slambar		
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>		
MLW #td ver 021820								



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 3-10-2020		Time: 1123		Crew:		CS		
Coordinates:		N 645203.01		E 610474.09			Vessel:		Jon boats		
Core #: D7-T2-C3		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):			1.5		
Measured Water Depth [MWD] [ft.]: 7.5						Recovered Core Length (ft.):			0		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:						Sample Length Retained (ft.):			0		
Corrected Depth @ MLLW [ft.]:						Core Volume Retained (gal.):			0		
+ MLW Adjustment [ft.]						Collected to Project Depth:			Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	Refusal <input checked="" type="checkbox"/>
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: - No sample collected						Vibracorer: Slambar					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt			Project: Brandywine Creek			Logger: WR		
Job #: 40-046		Date: 3-10-2020		Time: 1045		Crew: CS		
Coordinates:		N 645213.45		E 610426.87		Vessel: Jon boats		
Core #: D7-T2-C4		Zone: DE		Datum: NAD 83		Deploy: 1 2 3		
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:				Core Penetration Length (ft.):		5.5		
Measured Water Depth [MWD] [ft.]: 1.0				Recovered Core Length (ft.):		4.5		
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 <input checked="" type="checkbox"/> No <input type="checkbox"/> Refusal <input checked="" type="checkbox"/>		
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
Conditions:						Liner Type: Soft		
Comments: * Core to DNREC - core taken 3ft closer to bank						Vibracorer: Slambar		
Live Organisms Present						Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Oil Present						Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Odor Present						Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Debris Present						Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Within 10% of Req'd Core Length						Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Photo						Yes <input type="checkbox"/>	No <input type="checkbox"/>	
MLW #td ver 021820								



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 3-10-2020		Time: 1200		Crew:		CS		
Coordinates:		N 645343.12		E 610609.03		Vessel:		Jon boats			
Core #: D7-T3-C1		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		0.5			
Measured Water Depth [MWD] [ft.]: 0.4						Recovered Core Length (ft.):		0.5			
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>	
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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↓											
↓											
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: *Ponar grab to DNREC						Vibracorer: Ponar: Petite					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt			Project: Brandywine Creek			Logger: WR		
Job #: 40-046		Date: 3-10-2020		Time: 1008		Crew: CS		
Coordinates:		N 645359.96		E 610550.96		Vessel: Jon boats		
Core #: D7-T3-C2		Zone: DE		Datum: NAD 83		Deploy: 1 2 3		
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:				Core Penetration Length (ft.):				0
Measured Water Depth [MWD] [ft.]: 8.0				Recovered Core Length (ft.):				0
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:				Sample Length Retained (ft.):				0
Corrected Depth @ MLLW [ft.]:				Core Volume Retained (gal.):				0
+ MLW Adjustment [ft.]				Collected to Project Depth: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Refusal <input checked="" type="checkbox"/>				
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: <ul style="list-style-type: none"> - No sample collected - rocks/sand - time and coordinates same as probe 						Vibracorer: Slambar		
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>		
						MLW #td ver 021820		



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt			Project: Brandywine Creek			Logger: WR		
Job #: 40-046		Date: 3-10-2020		Time: 1139		Crew: CS		
Coordinates:		N 645366.42		E 610523.33		Vessel: Jon boats		
Core #: D7-T3-C3		Zone: DE		Datum: NAD 83		Deploy: 1 2 3		
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:				Core Penetration Length (ft.):				2.2
Measured Water Depth [MWD] [ft.]: 7.8				Recovered Core Length (ft.):				0
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:				Sample Length Retained (ft.):				0
Corrected Depth @ MLLW [ft.]:				Core Volume Retained (gal.):				0
+ MLW Adjustment [ft.]				Collected to Project Depth: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Refusal <input checked="" type="checkbox"/>				
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: - No sample collected						Vibracorer: Slambar		
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>		
MLW #td ver 021820								



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 3-10-2020		Time: 1132		Crew:		CS		
Coordinates:		N 645370.38		E 610475.90		Vessel:		Jon boats			
Core #: D7-T3-C4		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		2.0			
Measured Water Depth [MWD] [ft.]: 1.6						Recovered Core Length (ft.):		1.8			
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>	
Corrected Depth @ MLW [ft.]:											
Required Sample Core Length [SCL] [ft.]:											
All Length Measurements are in Decimal Feet											
Sample Interval (ft.)			Sample Id #			Description					
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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 <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 3-11-2020		Time: 1144		Crew:		CS		
Coordinates:		N 646995.45		E 611738.64		Vessel:		Jon boats			
Core #: D8-T1-C1		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		6.5			
Measured Water Depth [MWD] [ft.]: 0.5						Recovered Core Length (ft.):		4.0			
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>	
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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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 -Core taken close to bank						Vibracorer: Slambar					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 3-11-2020		Time: 1152		Crew:		CS		
Coordinates:		N 647025.41		E 611708.24		Vessel:		Jon boats			
Core #: D8-T1-C2		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):			0		
Measured Water Depth [MWD] [ft.]: 8.1						Recovered Core Length (ft.):			0		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:						Sample Length Retained (ft.):			0		
Corrected Depth @ MLLW [ft.]:						Core Volume Retained (gal.):			0		
+ MLW Adjustment [ft.]						Collected to Project Depth:			Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	Refusal <input checked="" type="checkbox"/>
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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↓											
↓											
↓											
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: No sample collected						Vibracorer: Slambar					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 3-11-2020		Time:		Crew:		CS		
Coordinates:		N		E		Vessel:		Jon boats			
Core #: D8-T1-C3		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):					
Measured Water Depth [MWD] [ft.]:						Recovered Core Length (ft.):					
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 <input type="checkbox"/> No <input checked="" type="checkbox"/> Refusal <input checked="" type="checkbox"/>					
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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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: No sample collected						Vibracorer: Slambar					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt			Project: Brandywine Creek			Logger: WR						
Job #: 40-046		Date: 3-11-2020		Time:		Crew: CS						
Coordinates:		N		E		Vessel:		Jon boats				
Core #: D8-T1-C4		Zone: DE		Datum: NAD 83		Deploy:		<div style="display: flex; justify-content: space-around;"> 1 2 3 </div>				
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:				Core Penetration Length (ft.):								
Measured Water Depth [MWD] [ft.]:				Recovered Core Length (ft.):								
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 <input type="checkbox"/> No <input type="checkbox"/> Refusal <input checked="" type="checkbox"/>				
Corrected Depth @ MLW [ft.]:												
Required Sample Core Length [SCL] [ft.]:												
All Length Measurements are in Decimal Feet												
Sample Interval (ft.)			Sample Id #		Description							
<div style="display: flex; align-items: center; justify-content: center;"> <div style="text-align: right; margin-right: 10px;">Top</div> <div style="flex-grow: 1; border-left: 1px solid black; position: relative;"> <div style="position: absolute; top: 0; bottom: 0; left: -5px; right: -5px; border-left: 2px solid black;"></div> <div style="position: absolute; bottom: 0; left: -5px; right: -5px; border-left: 2px solid black;"></div> </div> <div style="text-align: left; margin-left: 10px;">Bottom</div> </div>												
# of containers:					Core Volumes							
Type of container:			<div style="display: flex; justify-content: space-around;"> bucket hardliner cup other </div>		Nominal core-barrel diameter: 3.5" .33 gal/ft EST. Volume							
Conditions:					Liner Type: Soft							
Comments: No sample collected					Vibracorer: Slambar							
					<div style="display: flex; justify-content: space-between;"> <div>Live Organisms Present</div> <div>Yes <input type="checkbox"/></div> <div>No <input type="checkbox"/></div> </div> <div style="display: flex; justify-content: space-between;"> <div>Oil Present</div> <div>Yes <input type="checkbox"/></div> <div>No <input type="checkbox"/></div> </div> <div style="display: flex; justify-content: space-between;"> <div>Odor Present</div> <div>Yes <input type="checkbox"/></div> <div>No <input type="checkbox"/></div> </div> <div style="display: flex; justify-content: space-between;"> <div>Debris Present</div> <div>Yes <input type="checkbox"/></div> <div>No <input type="checkbox"/></div> </div> <div style="display: flex; justify-content: space-between;"> <div>Within 10% of Req'd Core Length</div> <div>Yes <input type="checkbox"/></div> <div>No <input type="checkbox"/></div> </div> <div style="display: flex; justify-content: space-between;"> <div>Photo</div> <div>Yes <input type="checkbox"/></div> <div>No <input type="checkbox"/></div> </div>							
MLW #td ver 021820												



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 3-11-2020		Time: 1155		Crew:		CS		
Coordinates:		N 647156.09		E 611610.48		Vessel:		Jon boats			
Core #: D8-T1-C5		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		5.9			
Measured Water Depth [MWD] [ft.]: 0.4						Recovered Core Length (ft.):		2.25			
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>	
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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↓											
↓											
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 - Core taken close to bank						Vibracorer: Slambar					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 3-11-2020		Time: 1102		Crew:		CS		
Coordinates:		N 647106.06		E 611841.54		Vessel:		Jon boats			
Core #: D8-T2-C1		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		6.0			
Measured Water Depth [MWD] [ft.]: 0.5						Recovered Core Length (ft.):		2.9			
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>	
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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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 - Core taken close to bank						Vibracorer: Slambar					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 3-11-2020		Time:		Crew:		CS		
Coordinates:		N		E		Vessel:		Jon boats			
Core #: D8-T2-C2		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):					
Measured Water Depth [MWD] [ft.]:						Recovered Core Length (ft.):					
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 <input type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>
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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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: No sample collected						Vibracorer: Slambar					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 3-11-2020		Time:		Crew:		CS		
Coordinates:		N		E		Vessel:		Jon boats			
Core #: D8-T2-C3		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):					
Measured Water Depth [MWD] [ft.]:						Recovered Core Length (ft.):					
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 <input type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>
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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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: No sample collected						Vibracorer: Slambar					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 3-11-2020		Time: 1109		Crew:		CS		
Coordinates:		N 647198.88		E 611767.93		Vessel:		Jon boats			
Core #: D8-T2-C4		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		1.5			
Measured Water Depth [MWD] [ft.]: 6.7						Recovered Core Length (ft.):		0.5			
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>	
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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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 <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 3-11-2020		Time: 1113		Crew:		CS		
Coordinates:		N 647241.30		E 611751.91		Vessel:		Jon boats			
Core #: D8-T2-C5		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		5.0			
Measured Water Depth [MWD] [ft.]: 1.0						Recovered Core Length (ft.):		2.75			
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>	
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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Bottom											
# of containers:										Core Volumes	
Type of container:		bucket		hardliner		cup		other		Nominal core-barrel diameter: 3.5" .33 gal/ft EST. Volume	
Conditions: sunny, cool						Liner Type: Soft					
Comments: * Core to DNREC						Vibracorer: Slambar					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 6-09-2020		Time: 1340		Crew:		SC		
Coordinates:		N 649345.59		E 612653.79		Vessel:		Jon boats			
Core #: D9-T1-C1		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):			0		
Measured Water Depth [MWD] [ft.]: 10.9						Recovered Core Length (ft.):			0		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:						Sample Length Retained (ft.):			0		
Corrected Depth @ MLLW [ft.]:						Core Volume Retained (gal.):			0		
+ MLW Adjustment [ft.]						Collected to Project Depth:			Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	Refusal <input type="checkbox"/>
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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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: * No sample collected						Vibracorer: Slambar					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 6-09-2020		Time: 1358		Crew:		SC		
Coordinates:		N 649286.39		E 612636.02		Vessel:		Jon boats			
Core #: D9-T1-C2		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		7.0	0.5		
Measured Water Depth [MWD] [ft.]: 1.0						Recovered Core Length (ft.):		0.2	0.5		
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>	
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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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: * sample to DNREC - 2nd deployment taken with ponar						Vibracorer: Slambar					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 6-09-2020		Time: 1410		Crew:		SC		
Coordinates:		N 649388.72		E 612495.93		Vessel:		Jon boats			
Core #: D9-T2-C1		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):			0		
Measured Water Depth [MWD] [ft.]: 1.0						Recovered Core Length (ft.):			0		
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:						Sample Length Retained (ft.):			0		
Corrected Depth @ MLLW [ft.]:						Core Volume Retained (gal.):			0		
+ MLW Adjustment [ft.]						Collected to Project Depth:			Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	Refusal <input checked="" type="checkbox"/>
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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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: * No sample collected - no penetration with probe due to large rocks						Vibracorer: Slambar					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 6-09-2020		Time: 1425		Crew:		SC		
Coordinates:		N 649333.64		E 612458.52			Vessel:		Jon boats		
Core #: D9-T2-C2		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		0.5			
Measured Water Depth [MWD] [ft.]: 1.0						Recovered Core Length (ft.):		0.5			
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>	
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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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: * Sample to DNREC - sample collected at bank						Vibracorer: Ponar: Petite					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 6-09-2020		Time: 1040		Crew:		SC		
Coordinates:		N 650462.19		E 610997.83		Vessel:		Jon boats			
Core #: D10-T1-C1		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		1.0			
Measured Water Depth [MWD] [ft.]: 4.5						Recovered Core Length (ft.):		0			
Tide Adjust [TA] (+/- ft. from MLLW) [ft.]:						Sample Length Retained (ft.):		0			
Corrected Depth @ MLLW [ft.]:						Core Volume Retained (gal.):		0			
+ MLW Adjustment [ft.]						Collected to Project Depth:		Yes <input type="checkbox"/>	No <input type="checkbox"/>	Refusal <input type="checkbox"/>	
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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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: *No Sample collected						Vibracorer: Slambar					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 6-09-2020		Time: 1020		Crew:		SC		
Coordinates:		N 650475.79		E 610933.79		Vessel:		Jon boats			
Core #: D10-T1-C2		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		0.5			
Measured Water Depth [MWD] [ft.]: 1.5						Recovered Core Length (ft.):		0.5			
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>	
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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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: *Ponar to DNREC -sample collected near bank						Vibracorer: Slambar					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 6-09-2020		Time: 1105		Crew:		SC		
Coordinates:		N 650624.86		E 611017.45		Vessel:		Jon boats			
Core #: D10-T2-C1		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		2.7			
Measured Water Depth [MWD] [ft.]: 4.3						Recovered Core Length (ft.):		0.2			
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>	
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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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: *sample to DNREC						Vibracorer: Slambar					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 6-09-2020		Time: 1125		Crew:		SC		
Coordinates:		N 650606.97		E 610957.13			Vessel:		Jon boats		
Core #: D10-T2-C2		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		0.5			
Measured Water Depth [MWD] [ft.]: 1.0						Recovered Core Length (ft.):		0.5			
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>	
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: *sample to DNREC						Vibracorer: Slambar					
<div style="display: flex; justify-content: space-between;"> <div> Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/> </div> </div>											
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt			Project: Brandywine Creek			Logger: WR			
Job #: 40-046		Date: 3-12-2020		Time: 1112		Crew: CS			
Coordinates:		N 654799.55		E 611765.66		Vessel: Jon boats			
Core #: D11-T1-C1		Zone: DE		Datum: NAD 83		Deploy: 1 2 3			
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:				Core Penetration Length (ft.):				3.0	
Measured Water Depth [MWD] [ft.]: 0.3				Recovered Core Length (ft.):				2.16	
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 <input checked="" type="checkbox"/> No <input type="checkbox"/> Refusal <input type="checkbox"/>	
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: calm, cloudy						Liner Type: Soft			
Comments: *Core to DNREC						Vibracorer: Slambar			
Live Organisms Present						Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Oil Present						Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Odor Present						Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Debris Present						Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Within 10% of Req'd Core Length						Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Photo						Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
MLW #td ver 021820									



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 3-12-2020		Time: 1124		Crew:		CS		
Coordinates:		N 654823.32		E 611720.17		Vessel:		Jon boats			
Core #: D11-T1-C2		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):			3.0		
Measured Water Depth [MWD] [ft.]: 4.2						Recovered Core Length (ft.):			1.25		
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>
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 <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 3-12-2020		Time: 1138		Crew:		CS		
Coordinates:		N 654843.76		E 611689.40		Vessel:		Jon boats			
Core #: D11-T1-C3		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		3.0			
Measured Water Depth [MWD] [ft.]: 4.6						Recovered Core Length (ft.):		0.8			
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>	
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 <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 3-12-2020		Time: 1143		Crew:		CS		
Coordinates:		N 654904.52		E 611627.79		Vessel:		Jon boats			
Core #: D11-T1-C4		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		3.5			
Measured Water Depth [MWD] [ft.]: 1.0						Recovered Core Length (ft.):		2.58			
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>	
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 <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt			Project: Brandywine Creek			Logger: WR		
Job #: 40-046		Date: 3-12-2020		Time: 0959		Crew: CS		
Coordinates:		N 654974.03		E 611814.03		Vessel: Jon boats		
Core #: D11-T2-C1		Zone: DE		Datum: NAD 83		Deploy: 1 2 3		
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:				Core Penetration Length (ft.):				4.0
Measured Water Depth [MWD] [ft.]: 1.4				Recovered Core Length (ft.):				0
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 <input checked="" type="checkbox"/> No <input type="checkbox"/> Refusal <input checked="" type="checkbox"/>
Corrected Depth @ MLW [ft.]:								
Required Sample Core Length [SCL] [ft.]:								
All Length Measurements are in Decimal Feet								
Sample Interval (ft.)		Sample Id #		Description				
Top				Deploy 2 - Grab Sample: 0.5 ft. Penetration, 0.5 ft. Recovered				
Bottom								
# of containers:						Core Volumes		
Type of container:		bucket	hardliner	cup	other	Nominal core-barrel diameter: 3.5" .33 gal/ft EST. Volume		
Conditions: calm, cloudy						Liner Type: Soft		
Comments: *Core to DNREC						Vibracorer: Slambar		
Live Organisms Present						Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Oil Present						Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Odor Present						Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Debris Present						Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Within 10% of Req'd Core Length						Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Photo						Yes <input type="checkbox"/>	No <input type="checkbox"/>	
MLW #td ver 021820								



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 3-12-2020		Time: 1010		Crew:		CS		
Coordinates:		N 654992.20		E 611771.31		Vessel:		Jon boats			
Core #: D11-T2-C2		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		4.5			
Measured Water Depth [MWD] [ft.]: 2.0						Recovered Core Length (ft.):		1.9			
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>	
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 <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 3-12-2020		Time: 1036		Crew:		CS		
Coordinates:		N 654999.11		E 611736.60		Vessel:		Jon boats			
Core #: D11-T2-C3		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		2.5			
Measured Water Depth [MWD] [ft.]: 3.7						Recovered Core Length (ft.):		1.5			
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>	
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: light breeze, overcast, cool						Liner Type: Soft					
Comments: *Core to DNREC						Vibracorer: Slambar					
						Live Organisms Present Yes <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											



AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client: Kleinschmidt				Project: Brandywine Creek				Logger: WR			
Job #: 40-046			Date: 3-12-2020		Time: 1044		Crew:		CS		
Coordinates:		N 655035.03		E 611681.11		Vessel:		Jon boats			
Core #: D11-T2-C4		Zone: DE		Datum: NAD 83		Deploy:		1	2	3	
Project Depth (incl. ft. Overdredge) [PD] [ft] MLW:						Core Penetration Length (ft.):		4.5			
Measured Water Depth [MWD] [ft.]: 0.6						Recovered Core Length (ft.):		3.6			
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 <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Refusal <input checked="" type="checkbox"/>	
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 <input type="checkbox"/> No <input type="checkbox"/> Oil Present Yes <input type="checkbox"/> No <input type="checkbox"/> Odor Present Yes <input type="checkbox"/> No <input type="checkbox"/> Debris Present Yes <input type="checkbox"/> No <input type="checkbox"/> Within 10% of Req'd Core Length Yes <input type="checkbox"/> No <input type="checkbox"/> Photo Yes <input type="checkbox"/> No <input type="checkbox"/>					
MLW #td ver 021820											

APPENDIX B

LABORATORY ANALYTICAL REPORTS

(Large Files - Available Separately)

APPENDIX C

TOXICITY EVALUATIONS OF BRANDYWINE RIVER SEDIMENTS

(Excel Files Available Separately)

APPENDIX D

RAIS RISK CALCULATOR OUTPUT

Site-specific Risk Resident Soil Inputs

Variable	Resident Soil Default Value	Site-Specific 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_{ms}/U_i) unitless	0.194	0.194
n (total soil porosity) L_{pore}/L_{enil}	0.43396	0.43396
p_h (dry soil bulk density) g/cm ³	1.5	1.5
p_h (dry soil bulk density - mass limit) g/cm ³	1.5	1.5
PEF (particulate emission factor) m ³ /kg	1359344438	1359344438
p_e (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_{unl} (g/m ² -s per kg/m ³)	68.18	68.18
Q/C_{unl} (g/m ² -s per kg/m ³ - mass limit)	68.18	68.18
A_e (PEF acres)	0.5	0.5
A_e (VF acres)	0.5	0.5
A_e (VF mass-limit acres)	0.5	0.5
$AF_{n,7}$ (mutagenic skin adherence factor) mg/cm ²	0.2	0.2
$AF_{7,6}$ (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
$AF_{16,76}$ (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

Site-specific Risk Resident Soil Inputs

Variable	Resident Soil Default Value	Site-Specific Value
BW _{0.7} (mutagenic body weight) kg	15	15
BW _{2.6} (mutagenic body weight) kg	15	15
BW ₆₋₁₆ (mutagenic body weight) kg	80	80
BW ₁₆₋₇₆ (mutagenic body weight) kg	80	80
BW _{res-a} (body weight - adult) kg	80	80
BW _{res-r} (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 _{0.7} (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 ₁₆₋₇₆ (mutagenic exposure duration) years	10	10
ED _{res-a} (exposure duration - adult) years	20	20
ED _{res-r} (exposure duration - child) years	6	6
EF _{res} (exposure frequency) days/year	350	350
EF _{0.7} (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 ₁₆₋₇₆ (mutagenic exposure frequency) days/year	350	350
EF _{res-a} (exposure frequency - adult) days/year	350	350
EF _{res-r} (exposure frequency - child) days/year	350	350
ET _{res} (exposure time) hours/day	24	24
ET _{0.7} (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 ₁₆₋₇₆ (mutagenic exposure time) hours/day	24	24
ET _{res-a} (adult exposure time) hours/day	24	24
ET _{res-r} (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

Site-specific Risk

Resident Soil Inputs

Variable	Resident Soil Default Value	Site-Specific Value
IRS _{n,γ} (mutagenic soil intake rate) mg/day	200	200
IRS _{γ,δ} (mutagenic soil intake rate) mg/day	200	200
IRS _{δ,1δ} (mutagenic soil intake rate) mg/day	100	100
IRS _{1δ,γδ} (mutagenic soil intake rate) mg/day	100	100
IRS _{res,α} (soil intake rate - adult) mg/day	100	100
IRS _{res,γ} (soil intake rate - child) mg/day	200	200
LT (lifetime) years	70	70
SA _{n,γ} (mutagenic skin surface area) cm ² /day	2373	2373
SA _{γ,δ} (mutagenic skin surface area) cm ² /day	2373	2373
SA _{δ,1δ} (mutagenic skin surface area) cm ² /day	6032	6032
SA _{1δ,γδ} (mutagenic skin surface area) cm ² /day	6032	6032
SA _{res,α} (skin surface area - adult) cm ² /day	6032	6032
SA _{res,γ} (skin surface area - child) cm ² /day	2373	2373
T _w (groundwater temperature) Celsius	25	25
Theta _α (air-filled soil porosity) L _{air} /L _{cnll}	0.28396	0.28396
Theta _w (water-filled soil porosity) L _{water} /L _{cnll}	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 _i (equivalent threshold value)	11.32	11.32
V (fraction of vegetative cover) unitless	0.5	0.5

Site-specific Risk
Resident for Soil
Key: IC = IRIS Current; IA = IRIS Archive; PC = PPRTV Current; PA = PPRTV Archive; O = OPP; AF = ATSDR Final; AD = ATSDR Draft; C = Cal EPA; XC = PPRTV Screening Level Current; XA = PPRTV Screening Level Archive; HC = HEAST Current; HA = HEAST Archive; D = OW; W = TEF applied; E = RPF applied; SU = Surrogate;

Chemical	CAS Number	Mutagen?	VOC?	RfD (mg/kg-day)	RfD Ref	RfC (mg/m ³)	RfC Ref	SF _o (mg/kg-day) ⁻¹	SF _o Ref	IUR (ug/m ³) ⁻¹	IUR Ref	ABS _{ci}	ABS _{dorm}	Volatilization Factor Unlimited Reservoir (m ³ /kg)	Volatilization Factor Mass Limit (m ³ /kg)
Antimony (metallic)	7440-36-0	No	No	4.00E-04	IC	3.00E-04	AF	-		-		0.15	-	-	-
Mercury (elemental)	7439-97-6	No	Yes	1.60E-04	C	3.00E-04	IC	-		-		1	-	3.47E+04	-
Thallium (Soluble Salts)	7440-28-0	No	No	1.00E-05	XC	-		-		-		1	-	-	-
*Total Risk/Hi				-		-		-		-		-	-	-	-

Site-specific Risk

Resident for Soil

Key: IC = IRIS Current; IA = IRIS Archive; PC = PPRTV Current; PA = PPRTV Archive; O = OPP; AF = ATSDR Final; AD = ATSDR Draft; C = Cal EPA; XC = PPRTV Screening Level Current; XA = PPRTV Screening Level Archive; HC = HEAST Current; HA = HEAST Archive; D = OW; W = TEF applied; E = RPF applied; SU = Surrogate;

Volatilization Factor Selected (m³/kg)	DA	Particulate Emission Factor (m³/kg)	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 T _c (K)	T _c Ref
-	-	1.36E+09	-	1	-	-		-	1.91E+03	PHYSPROP	5.07E+03	YAWS
3.47E+04	1.10E-05	1.36E+09	3.13E+00	1	8.62E-03	3.52E-01	PHYSPROP VP/S	3.52E-01	6.30E+02	PHYSPROP	1.76E+03	CRC
-	-	1.36E+09	-	1	-	-		-	1.73E+03	PHYSPROP	4.65E+03	YAWS
-	-	-	-	-	-	-		-	-		-	

Site-specific Risk

Resident for Soil

Key: IC = IRIS Current; IA = IRIS Archive; PC = PPRTV Current; PA = PPRTV Archive; O = OPP; AF = ATSDR Final; AD = ATSDR Draft; C = Cal EPA; XC = PPRTV Screening Level Current; XA = PPRTV Screening Level Archive; HC = HEAST Current; HA = HEAST Archive; D = OW; W = TEF applied; E = RPF applied; SU = Surrogate;

D _{ia} \ (cm ² /s)	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)
-	-	5.5	7.03E-05	-	3.88E-09	6.59E-06	-	3.88E-09
3.07E-02	6.30E-06	2.2	2.81E-05	-	6.08E-05	2.64E-06	-	6.08E-05
-	-	0.29	3.71E-06	-	2.05E-10	3.48E-07	-	2.05E-10
-	-	-	-	-	-	-	-	-

Site-specific Risk

Resident for Soil

Key: IC = IRIS Current; IA = IRIS Archive; PC = PPRTV Current; PA = PPRTV Archive; O = OPP; AF = ATSDR Final; AD = ATSDR Draft; C = Cal EPA; XC = PPRTV Screening Level Current; XA = PPRTV Screening Level Archive; HC = HEAST Current; HA = HEAST Archive; D = OW; W = TEF applied; E = RPF applied; SU = Surrogate;

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	Child Total HI	Adult Ingestion HQ
2.13E-05	-	3.88E-09	7.91E-06	-	1.44E-06	1.76E-01	-	1.29E-05	1.76E-01	1.65E-02
8.52E-06	-	6.08E-05	3.16E-06	-	2.26E-02	1.76E-01	-	2.03E-01	3.78E-01	1.65E-02
1.12E-06	-	2.05E-10	4.17E-07	-	7.60E-08	3.71E-01	-	-	3.71E-01	3.48E-02
-	-	-	-	-	-	7.22E-01	-	2.03E-01	9.25E-01	6.77E-02

Site-specific Risk

Resident for Soil

Key: IC = IRIS Current; IA = IRIS Archive; PC = PPRTV Current; PA = PPRTV Archive; O = OPP; AF = ATSDR Final; AD = ATSDR Draft; C = Cal EPA; XC = PPRTV Screening Level Current; XA = PPRTV Screening Level Archive; HC = HEAST Current; HA = HEAST Archive; D = OW; W = TEF applied; E = RPF applied; SU = Surrogate;

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
-	1.29E-05	1.65E-02	5.32E-02	-	1.29E-05	5.33E-02	-	-	-	-
-	2.03E-01	2.19E-01	5.32E-02	-	2.03E-01	2.56E-01	-	-	-	-
-	-	3.48E-02	1.12E-01	-	-	1.12E-01	-	-	-	-
-	2.03E-01	2.70E-01	2.19E-01	-	2.03E-01	4.21E-01	-	-	-	-

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_{∞}/U_s) unitless	0.194	0.194
n (total soil porosity) $L_{\text{pore}}/L_{\text{soil}}$	0.43396	0.43396
p_h (dry soil bulk density) g/cm ³	1.5	1.5
p_h (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_{unl} (g/m ² -s per kg/m ³)	68.18	68.18
Q/C_{unl} (g/m ² -s per kg/m ³ - mass limit)	68.18	68.18
A_e (PEF acres)	0.5	0.5
A_e (VF acres)	0.5	0.5
A_e (VF mass-limit acres)	0.5	0.5
AF_{adult} (mutagenic skin adherence factor) mg/cm ²	0.2	0.2
AF_{child} (mutagenic skin adherence factor) mg/cm ²	0.2	0.2
AF_{adult} (mutagenic skin adherence factor) mg/cm ²	0.07	0.07
AF_{child} (mutagenic skin adherence factor) mg/cm ²	0.07	0.07
AF_{adult} (skin adherence factor - adult) mg/cm ²	0.07	0.07
AF_{child} (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

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 ₁₆₋₇₆ (mutagenic 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	103390	103390
DFSM _{rec-adj} (mutagenic age-adjusted soil dermal factor) mg/kg	428260	428260
ED _{rec} (exposure duration) years	26	26
ED ₀₋₇ (mutagenic exposure duration) years	2	2
ED ₇₋₆ (mutagenic exposure duration) years	4	4
ED ₆₋₁₆ (mutagenic exposure duration) years	10	10
ED ₁₆₋₇₆ (mutagenic exposure duration) years	10	10
ED _{rec-a} (exposure duration - adult) years	20	20
ED _{rec-c} (exposure duration - child) years	6	6
EF _{rec} (exposure frequency) days/year	350	350
EF ₀₋₇ (mutagenic exposure frequency) days/year	350	350
EF ₇₋₆ (mutagenic exposure frequency) days/year	350	350
EF ₆₋₁₆ (mutagenic exposure frequency) days/year	350	350
EF ₁₆₋₇₆ (mutagenic exposure frequency) days/year	350	350
EF _{rec-a} (exposure frequency - adult) days/year	350	350
EF _{rec-c} (exposure frequency - child) days/year	350	350
ET _{rec} (exposure time) hours/day	24	24
ET ₀₋₇ (mutagenic exposure time) hours/day	24	24
ET ₇₋₆ (mutagenic exposure time) hours/day	24	24
ET ₆₋₁₆ (mutagenic exposure time) hours/day	24	24
ET ₁₆₋₇₆ (mutagenic exposure time) hours/day	24	24
ET _{rec-a} (adult exposure time) hours/day	24	24
ET _{rec-c} (child exposure time) hours/day	24	24
IFS _{rec-adj} (age-adjusted soil ingestion factor) mg/kg	36750	36750
IFSM _{rec-adj} (mutagenic age-adjusted soil ingestion factor) mg/kg	166833.3	166833.3
IRS ₀₋₇ (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 ₁₆₋₇₆ (mutagenic soil intake rate) mg/day	100	100
IRS _{rec-a} (soil intake rate - adult) mg/day	100	100
IRS _{rec-r} (soil intake rate - child) mg/day	200	200
LT (lifetime) years	70	70
SA ₆₋₇ (mutagenic skin surface area) cm ² /day	2373	2373
SA ₇₋₆ (mutagenic skin surface area) cm ² /day	2373	2373
SA ₆₋₁₆ (mutagenic skin surface area) cm ² /day	6032	6032
SA ₁₆₋₇₆ (mutagenic skin surface area) cm ² /day	6032	6032
SA _{rec-a} (skin surface area - adult) cm ² /day	6032	6032
SA _{rec-r} (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 ₀ (mg/kg-day) ⁻¹	SF ₀ Ref	IUR (ug/m ³) ⁻¹	IUR Ref	ABS _{ci}	ABS _{farm}	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				-		-		-		-		-	-	-	-

Site-specific Risk
Resident for Soil

Chemical	Particulate Emission Factor (m³/kg)	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} \ (cm²/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	-	-	-	-	-		-	-		-		-

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	-	-	-	-	-	-	-	-

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
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
<i>*Total Risk/HI</i>	-	-	-	-	-	-	2.56E-02	7.89E-03	2.12E-04

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

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_{∞}/U_s) unitless	0.194	0.194
n (total soil porosity) $L_{\text{pore}}/L_{\text{soil}}$	0.43396	0.43396
p_h (dry soil bulk density) g/cm ³	1.5	1.5
p_h (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_{unl} (g/m ² -s per kg/m ³)	68.18	68.18
Q/C_{unl} (g/m ² -s per kg/m ³ - mass limit)	68.18	68.18
A_e (PEF acres)	0.5	0.5
A_e (VF acres)	0.5	0.5
A_e (VF mass-limit acres)	0.5	0.5
AF_{adult} (mutagenic skin adherence factor) mg/cm ²	0.2	0.2
AF_{child} (mutagenic skin adherence factor) mg/cm ²	0.2	0.2
AF_{adult} (mutagenic skin adherence factor) mg/cm ²	0.07	0.07
AF_{child} (mutagenic skin adherence factor) mg/cm ²	0.07	0.07
AF_{adult} (skin adherence factor - adult) mg/cm ²	0.07	0.07
AF_{child} (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

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 ₁₆₋₇₆ (mutagenic 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-adl} (age-adjusted soil dermal factor) mg/kg	103390	103390
DFS _{rec-adi} (mutagenic age-adjusted soil dermal factor) mg/kg	428260	428260
ED _{rec} (exposure duration) years	26	26
ED ₀₋₇ (mutagenic exposure duration) years	2	2
ED ₇₋₆ (mutagenic exposure duration) years	4	4
ED ₆₋₁₆ (mutagenic exposure duration) years	10	10
ED ₁₆₋₇₆ (mutagenic exposure duration) years	10	10
ED _{rec-a} (exposure duration - adult) years	20	20
ED _{rec-c} (exposure duration - child) years	6	6
EF _{rec} (exposure frequency) days/year	350	350
EF ₀₋₇ (mutagenic exposure frequency) days/year	350	350
EF ₇₋₆ (mutagenic exposure frequency) days/year	350	350
EF ₆₋₁₆ (mutagenic exposure frequency) days/year	350	350
EF ₁₆₋₇₆ (mutagenic exposure frequency) days/year	350	350
EF _{rec-a} (exposure frequency - adult) days/year	350	350
EF _{rec-c} (exposure frequency - child) days/year	350	350
ET _{rec} (exposure time) hours/day	24	24
ET ₀₋₇ (mutagenic exposure time) hours/day	24	24
ET ₇₋₆ (mutagenic exposure time) hours/day	24	24
ET ₆₋₁₆ (mutagenic exposure time) hours/day	24	24
ET ₁₆₋₇₆ (mutagenic exposure time) hours/day	24	24
ET _{rec-a} (adult exposure time) hours/day	24	24
ET _{rec-c} (child exposure time) hours/day	24	24
IFS _{rec-adl} (age-adjusted soil ingestion factor) mg/kg	36750	36750
IFS _{rec-adi} (mutagenic age-adjusted soil ingestion factor) mg/kg	166833.3	166833.3
IRS ₀₋₇ (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
$IRS_{\text{R-16}}$ (mutagenic soil intake rate) mg/day	100	100
$IRS_{\text{16-76}}$ (mutagenic soil intake rate) mg/day	100	100
$IRS_{\text{rec-a}}$ (soil intake rate - adult) mg/day	100	100
$IRS_{\text{rec-r}}$ (soil intake rate - child) mg/day	200	200
LT (lifetime) years	70	70
$SA_{\text{R-7}}$ (mutagenic skin surface area) cm^2/day	2373	2373
$SA_{\text{7-6}}$ (mutagenic skin surface area) cm^2/day	2373	2373
$SA_{\text{R-16}}$ (mutagenic skin surface area) cm^2/day	6032	6032
$SA_{\text{16-76}}$ (mutagenic skin surface area) cm^2/day	6032	6032
$SA_{\text{rec-a}}$ (skin surface area - adult) cm^2/day	6032	6032
$SA_{\text{rec-r}}$ (skin surface area - child) cm^2/day	2373	2373
T_w (groundwater temperature) Celsius	25	25
Theta_a (air-filled soil porosity) $L_{\text{air}}/L_{\text{soil}}$	0.28396	0.28396
Theta_w (water-filled soil porosity) $L_{\text{water}}/L_{\text{soil}}$	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 ₀ (mg/kg-day) ⁻¹	SF ₀ Ref	IUR (ug/m ³) ⁻¹	IUR Ref	ABS _{ci}	ABS _{darm}	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				-		-		-		-		-	-	-

Site-specific Risk
Resident for Soil

Chemical	DA	Particulate Emission Factor (m³/kg)	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} \ (cm²/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	-	-	-	-	-	-		-	-		-		-

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	-	-	-	-	-	-	-	-

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

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

Site-specific Risk Excavation Worker Soil Inputs

Variable	Excavation Worker Soil Default Value	Site-Specific 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_c) unitless	0.194	0.194
n (total soil porosity) L_{pore}/L_{total}	0.43396	0.43396
p_h (dry soil bulk density) g/cm ³	1.5	1.5
p_h (dry soil bulk density - mass limit) g/cm ³	1.5	1.5
PEF (particulate emission factor) m ³ /kg	1359344438	1359344438
p_c (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_{vent} (g/m ² -s per kg/m ³)	68.18	68.18
Q/C_{vent} (g/m ² -s per kg/m ³ - mass limit)	68.18	68.18
A_c (PEF acres)	0.5	0.5
A_c (VF acres)	0.5	0.5
A_c (VF mass-limit acres)	0.5	0.5
AF_{exc} (skin adherence factor - excavation worker) mg/cm ²	0.3	0.3
AT_{exc} (averaging time - excavation worker)	365	365
BW_{exc} (body weight - excavation worker) kg	80	80
ED_{exc} (exposure duration - excavation worker) yr	1	1
EF_{exc} (exposure frequency - excavation worker) day/yr	20	20
ET_{ew} (exposure time - excavation worker) hr	8	8

Site-specific Risk

Excavation Worker Soil Inputs

Variable	Excavation Worker Soil Default Value	Site-Specific Value
IR _{ow} (soil ingestion rate - excavation worker) mg/day	330	330
LT (lifetime) yr	70	70
SA _{ow} (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 _i (equivalent threshold value)	11.32	11.32
V (fraction of vegetative cover) unitless	0.5	0.5

Site-specific Risk

Excavation Worker for Soil

Key: IC = IRIS Current; IA = IRIS Archive; PC = PPRTV Current; PA = PPRTV Archive; O = OPP; AF = ATSDR Final; AD = ATSDR Draft; C = Cal EPA; XC = PPRTV Screening Level Current; XA = PPRTV Screening Level Archive; HC = HEAST Current; HA = HEAST Archive; D = OW; W = TEF applied; E = RPF applied; SU = Surrogate;
Subchronic toxicity values will be used where available. RfC and RfD references will be followed by either 'Chronic' or 'Subchronic' to indicate which toxicity value was used.

Chemical	CAS Number	Mutagen?	VOC?	RfD (mg/kg-day)	RfD Ref	RfC (mg/m ³)	RfC Ref	SF ₀ (mg/kg-day) ⁻¹	SF ₀ Ref	IUR (ug/m ³) ⁻¹	IUR Ref	ABS _{ni}	ABS _{darm}
Antimony (metallic)	7440-36-0	No	No	4.00E-04	PC/Subchronic	1.00E-03	AF/Subchronic	-		-		0.15	-
Mercury (elemental)	7439-97-6	No	Yes	1.60E-04	C /Chronic	3.00E-04	HC/Subchronic	-		-		1	-
Thallium (Soluble Salts)	7440-28-0	No	No	4.00E-05	XC/Subchronic	-		-		-		1	-
*Total Risk/HI				-		-		-		-		-	-

Site-specific Risk

Excavation Worker for Soil

Key: IC = IRIS Current; IA = IRIS Archive; PC = PPRTV Current; PA = PPRTV Archive; O = OPP; AF = ATSDR Final; AD = ATSDR Draft; C = Cal EPA; XC = PPRTV Screening Level Current; XA = PPRTV Screening Level Archive; HC = HEAST Current; HA = HEAST Archive; D = OW; W = TEF applied; E = RPF applied; SU = Surrogate;
Subchronic toxicity values will be used where available. RfC and RfD references will be followed by either 'Chronic' or 'Subchronic' to indicate which toxicity value was used.

Volatilization Factor Unlimited Reservoir (m³/kg)	Volatilization Factor Mass Limit (m³/kg)	Volatilization Factor Selected (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)
-	-	-	-	1.36E+09	-	-	-		-	1.91E+03
3.47E+04	-	3.47E+04	1.10E-05	1.36E+09	3.13E+00	8.62E-03	3.52E-01	PHYSPROP VP/S	3.52E-01	6.30E+02
-	-	-	-	1.36E+09	-	-	-		-	1.73E+03
-	-	-	-	-	-	-	-		-	-

Site-specific Risk

Excavation Worker for Soil

Key: IC = IRIS Current; IA = IRIS Archive; PC = PPRTV Current; PA = PPRTV Archive; O = OPP; AF = ATSDR Final; AD = ATSDR Draft; C = Cal EPA; XC = PPRTV Screening Level Current; XA = PPRTV Screening Level Archive; HC = HEAST Current; HA = HEAST Archive; D = OW; W = TEF applied; E = RPF applied; SU = Surrogate;
Subchronic toxicity values will be used where available. RfC and RfD references will be followed by either 'Chronic' or 'Subchronic' to indicate which toxicity value was used.

BP Ref	Critical Temperature $T_c \backslash$ (K)	$T_c \backslash$ Ref	$D_{ia} \backslash$ (cm^2/s)	$D_{iw} \backslash$ (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)	Ingestion Carcinogenic CDI (mg/kg-day)
PHYSPROP	5.07E+03	YAWS	-	-	5.5	1.24E-06	-	7.39E-11	1.78E-08
PHYSPROP	1.76E+03	CRC	3.07E-02	6.30E-06	2.2	4.97E-07	-	1.16E-06	7.10E-09
PHYSPROP	4.65E+03	YAWS	-	-	0.29	6.55E-08	-	3.90E-12	9.36E-10
	-		-	-	-	-	-	-	-

Site-specific Risk

Excavation Worker for Soil

Key: IC = IRIS Current; IA = IRIS Archive; PC = PPRTV Current; PA = PPRTV Archive; O = OPP; AF = ATSDR Final; AD = ATSDR Draft; C = Cal EPA; XC = PPRTV Screening Level Current; XA = PPRTV Screening Level Archive; HC = HEAST Current; HA = HEAST Archive; D = OW; W = TEF applied; E = RPF applied; SU = Surrogate;
Subchronic toxicity values will be used where available. RfC and RfD references will be followed by either 'Chronic' or 'Subchronic' to indicate which toxicity value was used.

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
-	1.06E-09	3.11E-03	-	7.39E-08	3.11E-03	-	-	-	-
-	1.65E-05	3.11E-03	-	3.86E-03	6.97E-03	-	-	-	-
-	5.57E-11	1.64E-03	-	-	1.64E-03	-	-	-	-
-	-	7.85E-03	-	3.86E-03	1.17E-02	-	-	-	-

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_{enil}	0.43396	0.43396
p_h (dry soil bulk density) g/cm ³	1.5	1.5
p_h (dry soil bulk density - mass limit) g/cm ³	1.5	1.5
PEF (particulate emission factor) m ³ /kg	1359344438	1359344438
p_e (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_{unl} (g/m ² -s per kg/m ³)	68.18	68.18
Q/C_{unl} (g/m ² -s per kg/m ³ - mass limit)	68.18	68.18
A_e (PEF acres)	0.5	0.5
A_e (VF acres)	0.5	0.5
A_e (VF mass-limit acres)	0.5	0.5
AF_{exc} (skin adherence factor - excavation worker) mg/cm ²	0.3	0.3
AT_{exc} (averaging time - excavation worker)	365	365
BW_{exc} (body weight - excavation worker) kg	80	80
ED_{exc} (exposure duration - excavation worker) yr	1	1
EF_{exc} (exposure frequency - excavation worker) day/yr	20	20
ET_{exc} (exposure time - excavation worker) hr	8	8
IR_{ew} (soil ingestion rate - excavation worker) mg/day	330	330

Site-specific Risk
Excavation Worker Soil Inputs

Variable	Excavation Worker Soil Default Value	Form-input Value
LT (lifetime) yr	70	70
SA _{su} (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

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 ₀ (mg/kg-day) ⁻¹	SF ₀ Ref	IUR (ug/m³) ⁻¹	IUR Ref	ABS _{ni}	ABS _{farm}	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 _{hw} (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

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_h (dry soil bulk density) g/cm ³	1.5	1.5
p_h (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_{unl} (g/m ² -s per kg/m ³)	68.18	68.18
Q/C_{unl} (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_{exc} (skin adherence factor - excavation worker) mg/cm ²	0.3	0.3
AT_{exc} (averaging time - excavation worker)	365	365
BW_{exc} (body weight - excavation worker) kg	80	80
ED_{exc} (exposure duration - excavation worker) yr	1	1
EF_{exc} (exposure frequency - excavation worker) day/yr	20	20
ET_{exc} (exposure time - excavation worker) hr	8	8
IR_{exc} (soil ingestion rate - excavation worker) mg/day	330	330

Site-specific Risk
Excavation Worker Soil Inputs

Variable	Excavation Worker Soil Default Value	Form-input Value
LT (lifetime) yr	70	70
SA _{su} (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

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 ₀ (mg/kg-day) ⁻¹	SF ₂ Ref	IUR (ug/m ³) ⁻¹	IUR Ref	ABS _{ni}	ABS _{norm}
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 (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	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} \ (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)	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/m ³)	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

Site-specific Risk Recreator Soil/Sediment Inputs

Variable	Recreator Soil/Sediment Default Value	Site-Specific 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_{total}	0.43396	0.43396
p_h (dry soil bulk density) g/cm ³	1.5	1.5
p_h (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_{unl} (g/m ² -s per kg/m ³)	68.18	68.18
Q/C_{unl} (g/m ² -s per kg/m ³ - mass limit)	68.18	68.18
A_e (PEF acres)	0.5	0.5
A_e (VF acres)	0.5	0.5
A_e (VF mass-limit acres)	0.5	0.5
$AF_{n,7}$ (skin adherence factor) mg/cm ²	0.2	0.2
$AF_{7,6}$ (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

Site-specific Risk

Recreator Soil/Sediment Inputs

Variable	Recreator Soil/Sediment Default Value	Site-Specific Value
BW ₀₋₂ (body weight) kg	15	15
BW ₂₋₆ (body weight) kg	15	15
BW ₆₋₁₆ (body weight) kg	80	80
BW ₁₆₋₂₀ (body weight) kg	80	80
BW _{recre-a} (body weight - adult) kg	80	80
BW _{recre-c} (body weight - child) kg	15	15
DFS _{recre-adult} (age-adjusted soil dermal factor) mg/kg	22155	22155
DFS _{recre-child} (mutagenic age-adjusted soil dermal factor) mg/kg	91770	91770
ED _{recre} (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 ₁₆₋₂₀ (exposure duration) year	10	10
ED _{recre-c} (exposure duration - child) years	6	6
EF _{recre} (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 ₁₆₋₂₀ (exposure frequency) days/year	75	75
EF _{recre-a} (exposure frequency - adult) days/year	75	75
EF _{recre-c} (exposure frequency - child) days/year	75	75
ET _{recre} (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 ₁₆₋₂₀ (exposure time) hours/day	1	1
ET _{recre-a} (adult exposure time) hours/day	1	1
ET _{recre-c} (child exposure time) hours/day	1	1
IFS _{recre-adult} (age-adjusted soil ingestion factor) mg/kg	7875	7875
IFS _{recre-child} (mutagenic age-adjusted soil ingestion factor) mg/kg	35750	35750
IRS ₀₋₂ (soil intake rate) mg/day	200	200

Site-specific Risk

Recreator Soil/Sediment Inputs

Variable	Recreator Soil/Sediment Default Value	Site-Specific Value
IRS _{γ,ε} (soil intake rate) mg/day	200	200
IRS _{ε,1ε} (soil intake rate) mg/day	100	100
IRS _{1ε,2η} (soil intake rate) mg/day	100	100
IRS _{recre,α} (soil intake rate - adult) mg/day	100	100
IRS _{recre,γ} (soil intake rate - child) mg/day	200	200
LT (lifetime - recreator) years	70	70
SA _{η,γ} (skin surface area) cm ² /day	2373	2373
SA _{γ,ε} (skin surface area) cm ² /day	2373	2373
SA _{ε,1ε} (skin surface area) cm ² /day	6032	6032
SA _{1ε,2η} (skin surface area) cm ² /day	6032	6032
SA _{recre,α} (skin surface area - adult) cm ² /day	6032	6032
SA _{recre,γ} (skin surface area - child) cm ² /day	2373	2373
T _w (groundwater temperature) Celsius	25	25
Theta _α (air-filled soil porosity) L _{air} /L _{cnll}	0.28396	0.28396
Theta _w (water-filled soil porosity) L _{water} /L _{cnll}	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
Recreator for Soil/Sediment
Key: IC = IRIS Current; IA = IRIS Archive; PC = PPRTV Current; PA = PPRTV Archive; O = OPP; AF = ATSDR Final; AD = ATSDR Draft; C = Cal EPA; XC = PPRTV Screening Level Current; XA = PPRTV Screening Level Archive; HC = HEAST Current; HA = HEAST Archive; D = OW; W = TEF applied; E = RPF applied; SU = Surrogate;

Chemical	CAS Number	Mutagen?	VOC?	RfD (mg/kg-day)	RfD Ref	RfC (mg/m ³)	RfC Ref	SF _o (mg/kg-day) ⁻¹	SF _o Ref	IUR (ug/m ³) ⁻¹	IUR Ref	ABS _{ci}	ABS _{dorm}	Volatilization Factor Unlimited Reservoir (m ³ /kg)	Volatilization Factor Mass Limit (m ³ /kg)
Antimony (metallic)	7440-36-0	No	No	4.00E-04	IC	3.00E-04	AF	-		-		0.15	-	-	-
Mercury (elemental)	7439-97-6	No	Yes	1.60E-04	C	3.00E-04	IC	-		-		1	-	3.47E+04	-
Thallium (Soluble Salts)	7440-28-0	No	No	1.00E-05	XC	-		-		-		1	-	-	-
*Total Risk/Hi				-		-		-		-		-	-	-	-

Site-specific Risk
Recreator for Soil/Sediment
Key: IC = IRIS Current; IA = IRIS Archive; PC = PPRTV Current; PA = PPRTV Archive; O = OPP; AF = ATSDR Final; AD = ATSDR Draft; C = Cal EPA; XC = PPRTV Screening Level Current; XA = PPRTV Screening Level Archive; HC = HEAST Current; HA = HEAST Archive; D = OW; W = TEF applied; E = RPF applied; SU = Surrogate;

Volatilization Factor Selected (m³/kg)	DA	Particulate Emission Factor (m³/kg)	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 T _c (K)	T _c Ref
-	-	1.36E+09	-	1	-	-		-	1.91E+03	PHYSPROP	5.07E+03	YAWS
3.47E+04	1.10E-05	1.36E+09	3.13E+00	1	8.62E-03	3.52E-01	PHYSPROP VP/S	3.52E-01	6.30E+02	PHYSPROP	1.76E+03	CRC
-	-	1.36E+09	-	1	-	-		-	1.73E+03	PHYSPROP	4.65E+03	YAWS
-	-	-	-	-	-	-		-	-		-	

Site-specific Risk

Recreator for Soil/Sediment

Key: IC = IRIS Current; IA = IRIS Archive; PC = PPRTV Current; PA = PPRTV Archive; O = OPP; AF = ATSDR Final; AD = ATSDR Draft; C = Cal EPA; XC = PPRTV Screening Level Current; XA = PPRTV Screening Level Archive; HC = HEAST Current; HA = HEAST Archive; D = OW; W = TEF applied; E = RPF applied; SU = Surrogate;

D _{ia} \ (cm ² /s)	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)
-	-	5.5	1.51E-05	-	3.46E-11	1.41E-06	-	3.46E-11
3.07E-02	6.30E-06	2.2	6.03E-06	-	5.43E-07	5.65E-07	-	5.43E-07
-	-	0.29	7.95E-07	-	1.83E-12	7.45E-08	-	1.83E-12
-	-	-	-	-	-	-	-	-

Site-specific Risk

Recreator for Soil/Sediment

Key: IC = IRIS Current; IA = IRIS Archive; PC = PPRTV Current; PA = PPRTV Archive; O = OPP; AF = ATSDR Final; AD = ATSDR Draft; C = Cal EPA; XC = PPRTV Screening Level Current; XA = PPRTV Screening Level Archive; HC = HEAST Current; HA = HEAST Archive; D = OW; W = TEF applied; E = RPF applied; SU = Surrogate;

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	Child Total HI	Adult Ingestion HQ
4.56E-06	-	3.46E-11	1.70E-06	-	1.29E-08	3.77E-02	-	1.15E-07	3.77E-02	3.53E-03
1.83E-06	-	5.43E-07	6.78E-07	-	2.02E-04	3.77E-02	-	1.81E-03	3.95E-02	3.53E-03
2.41E-07	-	1.83E-12	8.94E-08	-	6.78E-10	7.95E-02	-	-	7.95E-02	7.45E-03
-	-	-	-	-	-	1.55E-01	-	1.81E-03	1.57E-01	1.45E-02

Site-specific Risk

Recreator for Soil/Sediment

Key: IC = IRIS Current; IA = IRIS Archive; PC = PPRTV Current; PA = PPRTV Archive; O = OPP; AF = ATSDR Final; AD = ATSDR Draft; C = Cal EPA; XC = PPRTV Screening Level Current; XA = PPRTV Screening Level Archive; HC = HEAST Current; HA = HEAST Archive; D = OW; W = TEF applied; E = RPF applied; SU = Surrogate;

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
-	1.15E-07	3.53E-03	1.14E-02	-	1.15E-07	1.14E-02	-	-	-	-
-	1.81E-03	5.34E-03	1.14E-02	-	1.81E-03	1.32E-02	-	-	-	-
-	-	7.45E-03	2.41E-02	-	-	2.41E-02	-	-	-	-
-	1.81E-03	1.63E-02	4.69E-02	-	1.81E-03	4.87E-02	-	-	-	-

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_{∞}/U_s) unitless	0.194	0.194
n (total soil porosity) $L_{\text{pore}}/L_{\text{total}}$	0.43396	0.43396
ρ_h (dry soil bulk density) g/cm ³	1.5	1.5
ρ_h (dry soil bulk density - mass limit) g/cm ³	1.5	1.5
PEF (particulate emission factor) m ³ /kg	1359344438	1359344438
ρ_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_{unl} (g/m ² -s per kg/m ³)	68.18	68.18
Q/C_{unl} (g/m ² -s per kg/m ³ - mass limit)	68.18	68.18
A_e (PEF acres)	0.5	0.5
A_e (VF acres)	0.5	0.5
A_e (VF mass-limit acres)	0.5	0.5
AF_{adult} (skin adherence factor) mg/cm ²	0.2	0.2
AF_{child} (skin adherence factor) mg/cm ²	0.2	0.2
AF_{infant} (skin adherence factor) mg/cm ²	0.07	0.07
AF_{infant} (skin adherence factor) mg/cm ²	0.07	0.07
AF_{adult} (skin adherence factor - adult) mg/cm ²	0.07	0.07
AF_{child} (skin adherence factor - child) mg/cm ²	0.2	0.2
AT_{avg} (averaging time)	365	365
BW_{0-2} (body weight) kg	15	15

Site-specific Risk Recreator Soil/Sediment Inputs

Variable	Recreator Soil/Sediment Default Value	Form-input Value
BW _{γ,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
DFS _M _{rec-adj} (mutagenic age-adjusted soil dermal factor) mg/kg	91770	91770
ED _{rec} (exposure duration - recreator) years	26	26
ED _{γ,2} (exposure duration) year	2	2
ED _{γ,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 _{γ,2} (exposure frequency) days/year	75	75
EF _{γ,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 _{γ,2} (exposure time) hours/day	1	1
ET _{γ,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
IFS _M _{rec-adj} (mutagenic age-adjusted soil ingestion factor) mg/kg	35750	35750
IRS _{γ,2} (soil intake rate) mg/day	200	200
IRS _{γ,6} (soil intake rate) mg/day	200	200
IRS ₆₋₁₆ (soil intake rate) mg/day	100	100

Site-specific Risk Recreator Soil/Sediment Inputs

Variable	Recreator Soil/Sediment Default Value	Form-input Value
IRS ₁₆₋₂₀ (soil intake rate) mg/day	100	100
IRS _{recre-a} (soil intake rate - adult) mg/day	100	100
IRS _{recre-c} (soil intake rate - child) mg/day	200	200
LT (lifetime - recreator) years	70	70
SA ₁₆₋₂₀ (skin surface area) cm ² /day	2373	2373
SA _{recre-a} (skin surface area) cm ² /day	2373	2373
SA _{recre-c} (skin surface area) cm ² /day	6032	6032
SA ₁₆₋₂₀ (skin surface area) cm ² /day	6032	6032
SA _{recre-a} (skin surface area - adult) cm ² /day	6032	6032
SA _{recre-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 _i (equivalent threshold value)	11.32	11.32
V (fraction of vegetative cover) unitless	0.5	0.5

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 ₀ (mg/kg-day) ⁻¹	SF ₀ Ref	IUR (ug/m ³) ⁻¹	IUR Ref	ABS _{ci}	ABS _{farm}	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				-		-		-		-		-	-	-	-

Site-specific Risk
Recreator for Soil/Sediment

Chemical	Particulate Emission Factor (m³/kg)	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} \ (cm²/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	-	-	-	-	-		-	-		-		-

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	-	-	-	-	-	-	-	-

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
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
<i>*Total Risk/HI</i>	-	-	-	-	-	-	<i>5.48E-03</i>	<i>1.69E-03</i>	<i>1.89E-06</i>

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

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_{max}/U_s) unitless	0.194	0.194
n (total soil porosity) $L_{\text{pore}}/L_{\text{total}}$	0.43396	0.43396
ρ_s (dry soil bulk density) g/cm ³	1.5	1.5
ρ_s (dry soil bulk density - mass limit) g/cm ³	1.5	1.5
PEF (particulate emission factor) m ³ /kg	1359344438	1359344438
ρ_p (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_{unl} (g/m ² -s per kg/m ³)	68.18	68.18
Q/C_{unl} (g/m ² -s per kg/m ³ - mass limit)	68.18	68.18
A_e (PEF acres)	0.5	0.5
A_e (VF acres)	0.5	0.5
A_e (VF mass-limit acres)	0.5	0.5
AF_{adult} (skin adherence factor) mg/cm ²	0.2	0.2
AF_{child} (skin adherence factor) mg/cm ²	0.2	0.2
AF_{infant} (skin adherence factor) mg/cm ²	0.07	0.07
AF_{infant} (skin adherence factor) mg/cm ²	0.07	0.07
AF_{adult} (skin adherence factor - adult) mg/cm ²	0.07	0.07
AF_{child} (skin adherence factor - child) mg/cm ²	0.2	0.2
AT_{res} (averaging time)	365	365
BW_{0-2} (body weight) kg	15	15

Site-specific Risk Recreator Soil/Sediment Inputs

Variable	Recreator Soil/Sediment Default Value	Form-input Value
BW _{γ,δ} (body weight) kg	15	15
BW _{δ-1δ} (body weight) kg	80	80
BW _{1δ-2η} (body weight) kg	80	80
BW _{rec-α} (body weight - adult) kg	80	80
BW _{rec-γ} (body weight - child) kg	15	15
DFS _{rec-αdli} (age-adjusted soil dermal factor) mg/kg	22155	22155
DFS _{M_{rec-αdli}} (mutagenic age-adjusted soil dermal factor) mg/kg	91770	91770
ED _{rec} (exposure duration - recreator) years	26	26
ED _{η,γ} (exposure duration) year	2	2
ED _{γ,δ} (exposure duration) year	4	4
ED _{δ-1δ} (exposure duration) year	10	10
ED _{1δ-2η} (exposure duration) year	10	10
ED _{rec-γ} (exposure duration - child) years	6	6
EF _{rec} (exposure frequency) days/year	75	75
EF _{η,γ} (exposure frequency) days/year	75	75
EF _{γ,δ} (exposure frequency) days/year	75	75
EF _{δ-1δ} (exposure frequency) days/year	75	75
EF _{1δ-2η} (exposure frequency) days/year	75	75
EF _{rec-α} (exposure frequency - adult) days/year	75	75
EF _{rec-γ} (exposure frequency - child) days/year	75	75
ET _{rec} (exposure time - recreator) hours/day	1	1
ET _{η,γ} (exposure time) hours/day	1	1
ET _{γ,δ} (exposure time) hours/day	1	1
ET _{δ-1δ} (exposure time) hours/day	1	1
ET _{1δ-2η} (exposure time) hours/day	1	1
ET _{rec-α} (adult exposure time) hours/day	1	1
ET _{rec-γ} (child exposure time) hours/day	1	1
IFS _{rec-αdli} (age-adjusted soil ingestion factor) mg/kg	7875	7875
IFSM _{M_{rec-αdli}} (mutagenic age-adjusted soil ingestion factor) mg/kg	35750	35750
IRS _{η,γ} (soil intake rate) mg/day	200	200
IRS _{γ,δ} (soil intake rate) mg/day	200	200
IRS _{δ-1δ} (soil intake rate) mg/day	100	100

Site-specific Risk Recreator Soil/Sediment Inputs

Variable	Recreator Soil/Sediment Default Value	Form-input Value
IRS ₁₆₋₂₀ (soil intake rate) mg/day	100	100
IRS _{recre-a} (soil intake rate - adult) mg/day	100	100
IRS _{recre-c} (soil intake rate - child) mg/day	200	200
LT (lifetime - recreator) years	70	70
SA ₁₆₋₂₀ (skin surface area) cm ² /day	2373	2373
SA _{recre-a} (skin surface area) cm ² /day	2373	2373
SA _{recre-c} (skin surface area) cm ² /day	6032	6032
SA ₁₆₋₂₀ (skin surface area) cm ² /day	6032	6032
SA _{recre-a} (skin surface area - adult) cm ² /day	6032	6032
SA _{recre-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 _i (equivalent threshold value)	11.32	11.32
V (fraction of vegetative cover) unitless	0.5	0.5

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 ₀ (mg/kg-day) ⁻¹	SF ₀ Ref	IUR (ug/m ³) ⁻¹	IUR Ref	ABS _{ci}	ABS _{darm}	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				-		-		-		-		-	-	-

Site-specific Risk
Recreator for Soil/Sediment

Chemical	DA	Particulate Emission Factor (m³/kg)	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} \ (cm²/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	-	-	-	-	-	-		-	-		-		-

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
<i>*Total Risk/HI</i>	-	-	-	-	-	-	-	-

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
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

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

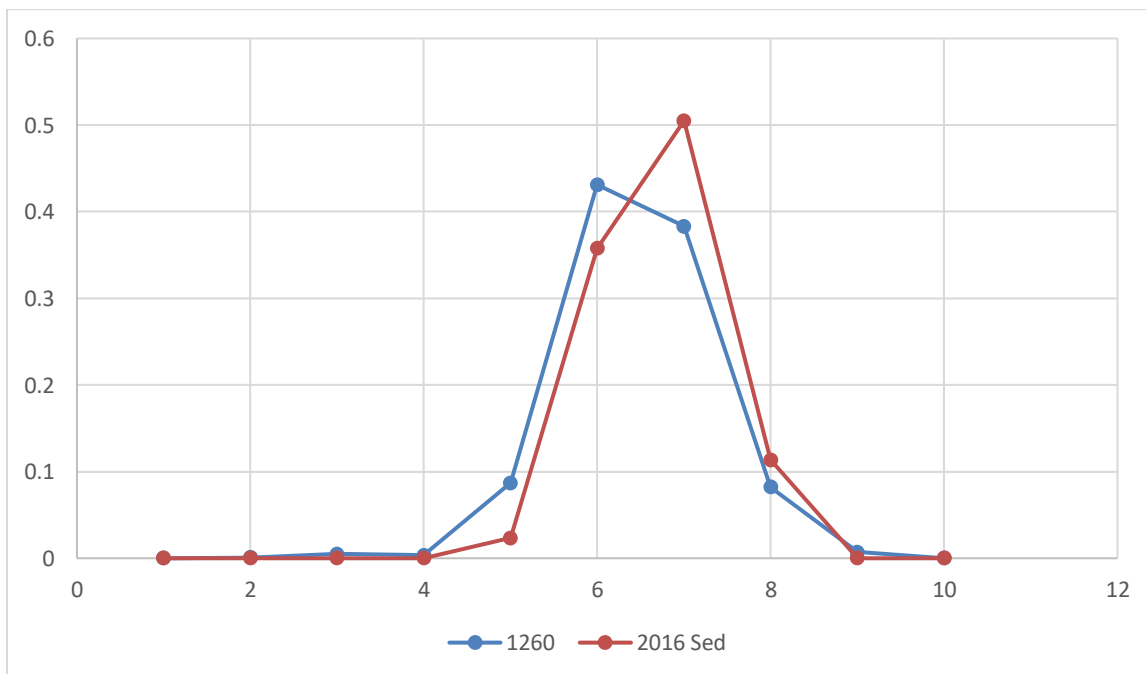
APPENDIX E

DAM 4 PCB SOURCE SUMMARY

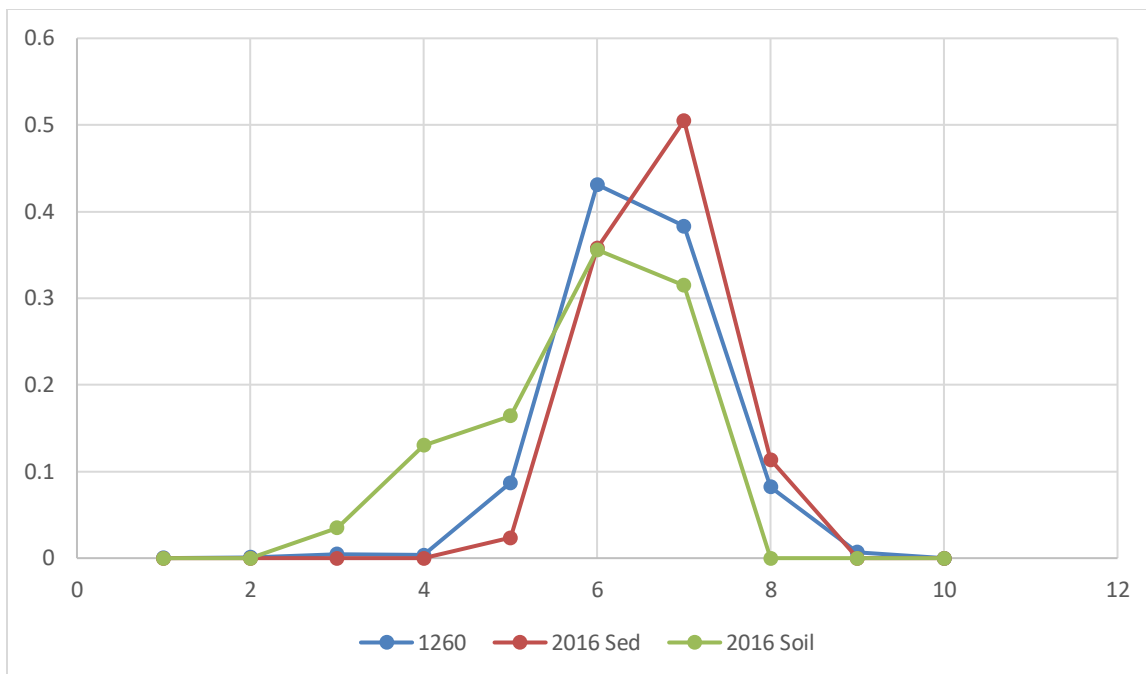
Potential Source of PCB at Dam 4 Transect 1

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/>.

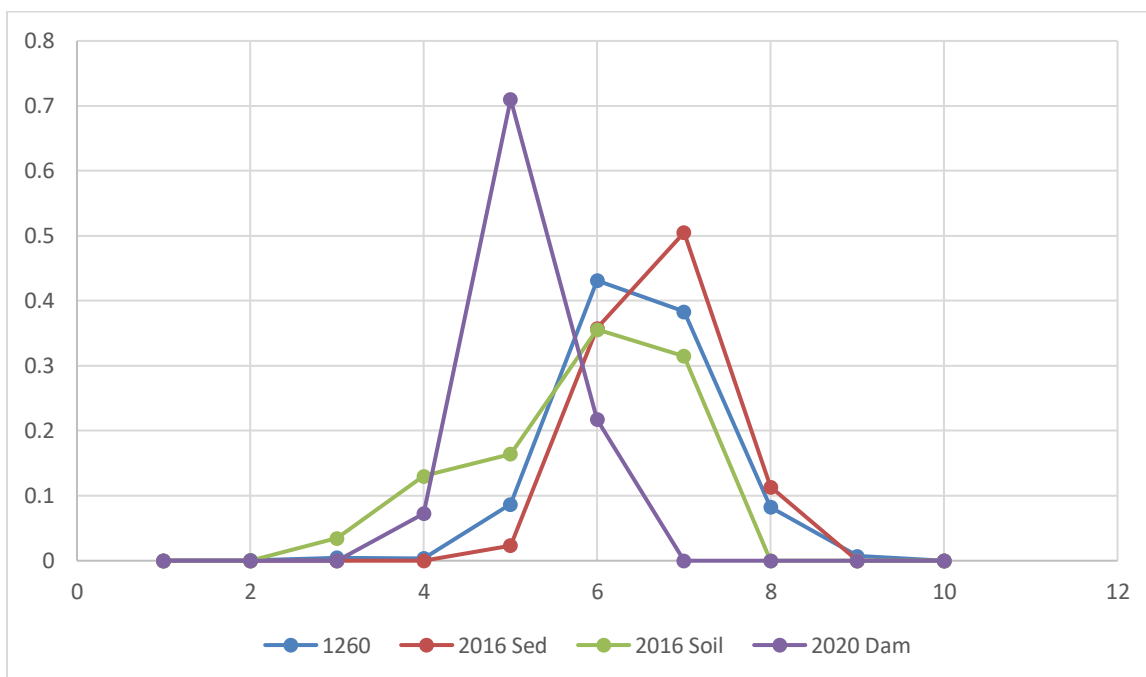
PCBs has never been a contaminant of concern to human health at the site adjacent to Dam 4. However, due to the nature of the contaminant, it is always a concern when detected in or near fishable water. It was first detected in the sediment below the dam in 1997. 40 µg/kg of Aroclor 1260 was reported 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.