White Clay Creek Dams
Analysis of Chemical Contaminants in Sediments

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Executive Summary

DNREC's Watershed Approach to Toxics Assessment and Restoration (WATAR) team evaluated physical and chemical data from sediment samples collected along 16 transects behind 5 dams in the Delaware portion of the White Clay Creek during the fall of 2022. 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 White Clay Creek for spawning. In addition, the City of Newark and Veolia Delaware utilize the White Clay Creek 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 (PBT) 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 impact downstream water quality and threatens the health of fish and wildlife and water users. As a relatively steep river located near eastern markets and ports, the White Clay Creek, like others in the region, was heavily utilized as a source of waterpower for mills during the last 300 years. 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 White Clay Creek dams.

Results of assessment activities and subsequent data evaluation indicate that there are less sediments by volume behind the dams in the White Clay Creek than originally expected. In addition, based upon the evaluations conducted, sediment release associated with dam modification, removal and/or failure is not likely to increase the risk of toxicity to aquatic life or human health 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 or chronic toxicity to aquatic life is not expected. Human health risk due to the presence of metals in the sediment is also not expected.
- Mercury was detected in sediments behind three of the five White Clay Creek Dams, 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 not detected (above the analytical method detection limit) in any of the White Clay Creek dam sediment samples. However, using a concentration equal to ½ of the laboratory detection limit, there appears to be potential for

PCBs to bioaccumulate in fish. This potential is confirmed by the presence of PCB driven fish consumption advisories in the White Clay Creek. It is concluded that low concentrations of dissolved PCBs in sediment porewater and surface water collectively contribute to some level of bioaccumulation. It is also concluded that there are no major sources of PCBs in the sediments of the Delaware portion of the White Clay Creek.

- Dioxins and furans were detected in all samples collected as part of this study. Even so, impacts to aquatic life are not expected. Slightly elevated bioaccumulation risk is predicted from these compounds at 5 of the 16 sample locations, as supported by fish tissue data from the White Clay Creek (although not a risk driver for fish consumption advisories). Although an increase in risk due to the release of sediments through dam removal, modification or failure is not expected, any removal of dioxins/furans from sediments would represent a net benefit to the White Clay Creek ecosystem.
- Total PAHs were detected in all sediment samples collected behind the White Clay Creek dams. In general, concentrations are higher at transect samples collected from Dam #2, Dam #4 and Dam #7. Although assessment models predicted potential human health impacts, review of multiple lines of evidence suggests that impacts to human health due to PAHs in the sediment are not expected.
- Pesticides were not detected in the White Clay Creek sediments, and therefore no aquatic life or human health risk is expected.
- PFAS compounds were detected in two of the five sediment samples for which they were analyzed. Due to the evolving nature of the science surrounding PFAS and its toxicity, no conclusions regarding benthic aquatic life can be made at this time. PFAS compounds were also detected in White Clay Creek surface water. One compound slightly exceeded its proposed MCL (at the time of report publication). Finally, it does not appear that sediments are the source of PFAS impacts in surface water.

Conclusions presented in this report only account for potential toxicity to aquatic life and human health due to the presence of toxic compounds in the sediment. Additional assessment or consideration should be given regarding 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 metals, PCBs, dioxins and furans, PAHs, pesticides, and PFAS. Removal of these contaminated materials is often extremely expensive, and the threat of re-suspending these sediments in the process of dam removal has the potential to damage downstream water quality and threaten the health of fish, wildlife, and water users.

The Delaware portion of the White Clay Creek contains a number of dams (Figure 1), which are not regulated under Delaware's Dam Safety Program. The White Clay Creek is also a source of drinking water to the City of Newark and other areas in Northern Delaware. The City of Newark has an intake upstream of Dam #5 and Veolia Delaware has an intake below Dam #2 near the mouth of White Clay Creek. 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 White Clay Creek, DNREC's Watershed Approach to Toxics Assessment and Restoration (WATAR) team has evaluated chemical data from sediment samples collected from 16 transects behind 5 dams during the fall of 2022. 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 New Castle Conservation District and the University of Delaware] for all dams in the White Clay Creek 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 removal, modification, or failure is critical to protecting downstream drinking water sources and existing fish habitat. Finally, and given the increasing frequency of major storm and flow events in our region, characterization of potential impacts that might result from the release of sediments during a catastrophic failure of any dam in the White Clay Creek 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 White Clay Creek Watershed Characteristics

The White Clay Creek (Figure 1) drains 107 square miles and is one of the four major watersheds of the Christina River Basin. The Christina River Basin is part of the larger Delaware River Basin. In 2000, the President signed a law adding 190 miles of the White Clay Creek and its tributaries to the National Wild and Scenic Rivers System (UDWRA, 2008). Approximately 55% of the White Clay Creek watershed lies in Pennsylvania, 45% lies in Delaware, and less than 1% lies in Maryland (UDWRA, 2010). The northern portion of the watershed in Chester County, Pennsylvania, includes the East, Middle, and West Branches of the White Clay Creek. The White Clay Creek flows southeast into New Castle County, Delaware, and is joined by Middle Run and Pike and Mill Creeks before emptying into the Christina River. Towns within the White Clay Creek watershed include Newark, Delaware, and Avondale and West Grove, Pennsylvania.

As a steep river located near eastern markets and ports, the White Clay Creek, like the Brandywine River and others in the region, were heavily utilized as a source of waterpower for a variety of mills in the colonial period and early America. It is estimated that there were approximately 41 dams in the Pennsylvania portion alone (UDWRA 2010).

The region was originally settled by the Native Americans, followed by the Dutch and Swedes in the early- to mid-1600s. Many noteworthy historical events followed, including: William Penn's acquisition of the land (including White Clay Creek) in the 18th century, the flourish of farms and small mills; the march of American and British armies through the watershed on their way to battle in 1777; the advent of railroad tracks throughout the region; and the opposition of a proposed dam on the White Clay Creek, which resulted in the creation of the White Clay Creek Watershed Association in 1965. Today, after the hard work of many citizens, the states' acquisition of land, and the donation of thousands of acres of land, the total area of Pennsylvania's White Clay Creek Preserve and Delaware's White Clay Creek State Park exceeds 5,000 acres (UDWRA, 2008).

1.1.1 Delaware's White Clay Creek Dams

There are currently five functional dams (out of 7 total) on the White Clay Creek in Delaware. One dam has been removed, and one dam has already breached. Dam owners include the Delaware Racing Association (former Dam #1); Mac Shar Enterprises and New Castle County (Dam #2); the City of Newark (Dam #3, Dam #4 and Dam #5); and the State of Delaware (Dam #7). The following is a brief description of the dam heights and construction. All of the information was obtained from "Restoration of Shad and Anadromous Fish to the White Clay Creek National Wild and Scenic River: A Feasibility Report" (UDWRA, 2010):

- Former Dam #1: Delaware Park Dam/Byrnes Mill Dam -The Delaware Park Dam, located at river mile 4.1, was approximately 3-8 feet high, and was made of stone and timber crib. Little is known about the original purpose of the dam, but it does appear in a 1936 aerial photo. The University of Delaware and DNREC F&W partnered to remove the dam in December 2014.

- Dam #2: Red Mill Dam -The Red Mill Dam, located at river mile 7.6, is a rockfill dam, approximately 3 feet high and 140 feet long. The dam pools water for a raceway for the former "Red Mill." No historic records have been found for the dam.
- Dam #3: Karpinski Park Dam - The Karpinski Park Dam is located at river mile 9.5, is approximately 4 feet high and 10 feet wide. The dam is reportedly constructed of concrete, and encases an 18–20-inch diameter sanitary sewer line. No historic records have been found for the dam.
- Dam #4: Paper Mill Dam -The Paper Mill Dam is a concrete dam, approximately 6 feet high, located at river mile 10.1. Prior to is use by the Curtis Paper Mill, the dam was associated with the National Vulcanized Fibre (NVF) Company operation. Currently, the dam functions as a hydraulic control for a USGS stream gage station.
- Dam #5: Newark Intake Dam -The Newark Intake Dam is located at river mile 11.1, is approximately 10 feet high, and is constructed of concrete. The dam was originally constructed for the Curtis Paper Mill, and now serves as the City of Newark's intake for the raceway that flows to the White Clay Creek water treatment plant.
- Former Dam #6: Creek Road Dam - The Creek Road Dam, located at river mile 12.7, is currently breached. It is likely that the former rock filled dam was breached during flood events in 2003 and 2004.
- Dam 7: Deerfield Dam – The Deerfield Dam is another rock fill dam, approximately 6 feet high, and located at river mile 12.7. The dam pools water for an intake used to irrigate the adjacent Deerfield Country Club Golf Course, when necessary.

In addition to the dams described above, Veolia Delaware maintains and operates a tidal capture structure (TCS) at river mile 1.8 of the White Clay Creek, upstream of the confluence of the White Clay Creek and the Christina River. An inflatable structure, the TCS is about 125 feet long, inflates to approximately 5 feet above the stream bed, and improves intake conditions during low streamflow periods and/or during high salinity conditions observed in the Delaware River. The TCS is controlled remotely to provide for immediate operational adjustments as needed (UDWRA, 2010).

1.1.2 Geology

A series of folds and uplifts, beginning billions of years ago with the Appalachia land mass off the present coast, and continuing through erosion and weathering, has created the landscape we see today in the White Clay Creek watershed. The topography of most of the watershed is characterized by rolling terrain, moderately steep-sided ridges and fertile soils of the Piedmont region. The small southwest section of the watershed is characterized by the flat terrain and the sandy and fertile soils of the Coastal Plain. There are three dominant geologic formations found throughout the watershed: the Mt. Cuba Gniess, Cockeysville marble; and the Wilmington Complex (Schenck, 2021).

The Piedmont region was formed between 200 and 400 million years ago when pressure and heat physically and chemically changed the composition of the sediment to form hard crystalline rock formations. There are folds of metamorphosed sedimentary rock underground in the Piedmont portion of the watershed. The Mt. Cuba Gneiss is the predominant bedrock and has weathered to create the terrain. There are some areas of Cockeysville marble found near West Grove and Avondale, Pennsylvania, and Hockessin and Pleasant Hill, Delaware. The White Clay Creek has cut into these erodible formations.

Cockeysville marble is composed of metamorphosed carbonate rocks such as limestone and dolomite; it is harder than the original substance. It has been widely used for buildings and monuments. Because of its hydrogeologic characteristics, the White Clay Creek watershed is an important regional source of drinking water.

The third geologic formation in the watershed is the Wilmington complex, which contains granite, gneiss, quartz and amphibolite. These rocks are younger and are more resistant to weathering, and thus creates a more level terrain (NPS, 1999).

1.1.3 Precipitation

Annual precipitation measured at the at the Wilmington Airport in Delaware averages 44 inches per year, ranging from 27.76 inches in 1997 to 56.75 inches in 2004. Precipitation as measured by a five-year moving average has remained relatively constant, with a slight increase in the second half of the 20-year period. Overall, the precipitation trend has remained relatively unchanged over the past 20 years.

The mean annual flow in the White Clay Creek near Newark fluctuates based on precipitation and averages 133 cubic feet per second (cfs) (20 inches per year) or half the average annual precipitation. This indicates relatively plentiful groundwater recharge to stream baseflow. As the intensity of storms increase, the more urbanized portions of the White Clay Creek watershed will see reduced recharge and negative impacts to streamflow (UDWRA, 2016).

1.1.4 Water Supply

The surface water of the White Clay Creek and the aquifers in the watershed provide over 120,000 residents with drinking water. The creek serves as a major drinking water source for much of northern Delaware, accounting for 33 million gallons per day (mgd) of the overall production of water supply from the watershed. Delaware and Pennsylvania residents in the White Clay Creek watershed also receive a significant amount of their water supply from groundwater resources in the watershed. The City of Newark's groundwater supplies provide up to 1.8 mgd from five wells in the watershed. The Artesian Water Company operates numerous wells that provide up to 1.9 mgd in the Cockeysville Marble Formation near Hockessin, Delaware. The Cockeysville Marble Formation is an exceptional aquifer, which is an important source of drinking water. It also supplies continuous and relatively high base flows to the stream (UDWRA, 2008).

1.1.5 Land Use

The Pennsylvania portion of the watershed is largely rural with a few small towns and villages, such as West Grove and Avondale, and some suburban clusters. The Delaware portion of the watershed includes the City of Newark and is highly suburbanized, although several very large tracts of public open space remain intact and flank the river. Normal rainfall for this region supplies enough water to support a mature deciduous forest and an extensive freshwater tidal wetlands system downstream (UDWRA, 2008).

1.1.6 Cultural and Recreational Resources

The tributaries of the White Clay Creek have several state designations that garner protection and regional significance. The Pennsylvania Department of Environmental Protection (PADEP) has identified the East Fork of the White Clay Creek's East Branch, from the northern boundary of the Avondale Borough to the headwaters, as Exceptional Value Waters (EV), while the remainder of the East Branch is designated as Cold-Water Fisheries (CWF) for the propagation of trout. The PADEP has provided additional protection to the Middle and West Branches through its Trout Stocking designations. DNREC also classifies the White Clay Creek from the Delaware state line to the dam at the former Curtis Paper Mill in Newark (Dam #4) as Exceptional Recreational or Ecological Significance Waters (ERES).

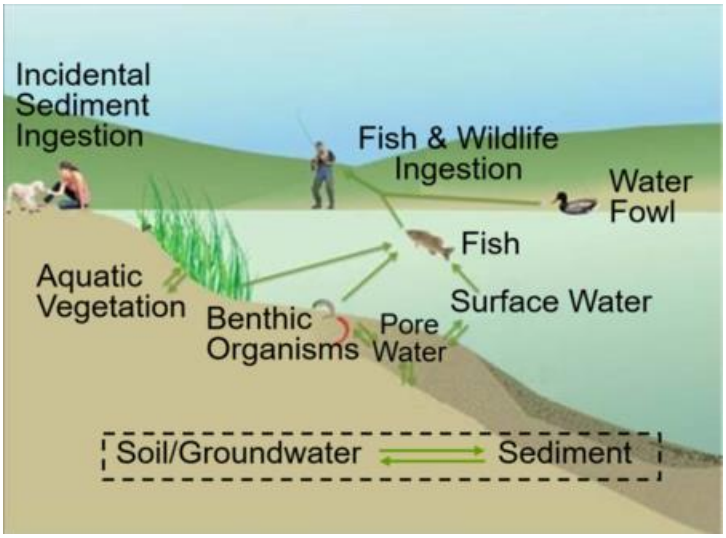
The watershed is home to a wide variety of fish and wildlife. The waters of the White Clay Creek support over 24 species of fish. The creek is stocked annually by both Delaware and Pennsylvania and is considered Delaware's premier trout-fishing stream. Surveys estimate that 93 species of birds nest in the White Clay Creek watershed. Thirty-three species of small mammals have been documented in the watershed. Beavers and an occasional river otter are seen swimming in the creek. Twenty-seven species of amphibians and reptiles live in the watershed. The rare long-tailed salamander and the four-toed salamander have also been found breeding in the springs, streams, and marshes of the White Clay Creek watershed (UDWRA, 2008).

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 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 White Clay Creek. 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/or eating fish from the White Clay Creek; 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 White Clay Creek 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 ecological and human 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 New Castle Conservation District) in November 2022. ASI conducted all sediment sampling activities, while DNREC conducted all sediment sample processing for laboratory analysis by Eurofins Environmental Testing Northeast, LLC (under State contract). DNREC-WATAR conducted subsequent data analysis and reporting, as well. White Clay Creek Dam #2, #3, #4, #5 and #7 were sampled between November 9 and 18, 2022. Sampling behind White Clay Creek Dam #1 was not conducted as part of this study because the dam was successfully removed in December 2014. Sampling behind dam #6 was not conducted because it had been previously breached, and any stored sediments have already been redistributed downstream.

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, 3 or 4 transects were sampled at each dam 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 the desired analysis. Standard DNREC sampling protocols and procedures, including the 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 6. 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 consisted of inorganics (metals) including mercury, PCB homologs, chlorinated pesticides, PAHs including alkylated homologs, dioxins and furans, grain size, and total organic carbon (TOC). One composited transect sample per dam was also analyzed for PFAS compounds. 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. 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 White Clay Creek dams in November 2022.

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	
4,4’-DDD	8081A
4,4’-DDE	8081A
4,4’-DDT	8081A
Aldrin	8081A
Alpha BHC	8081A
Beta BHC	8081A
Cis-Chlordane	8081A
Delta BHC	8081A
Dieldrin	8081A
Endosulfan I	8081A
Endosulfan II	8081A
Endosulfan Sulfate	8081A
Endrin and compounds	8081A
Gamma BHC (Lindane)	8081A
Heptachlor	8081A
Heptachlor Epoxide	8081A
Methoxychlor	8081A
Toxaphane	8081A
Trans-Chlordane	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
C1-Chrysenes	8270E SIM
C1-Fluoranthenes/pyrene	8270E SIM
C1-Fluorenes	8270E SIM
C1-Phenanthrenes/Anthracenes	8270E SIM
C2-Chrysenes	8270E SIM
C2-Fluorenes	8270E SIM
C2-Naphthalenes	8270E SIM
C2-Phenanthrenes/Anthracenes	8270E SIM
C3-Chrysenes	8270E SIM
C3-Fluorenes	8270E SIM
C3-Naphthalenes	8270E SIM
C3-Phenanthrenes/Anthracenes	8270E SIM
C4-Chrysenes	8270E SIM

C4-Naphthalenes	8270E SIM
C4-Phenanthrenes/Anthracenes	8270E SIM
Chrysene	8270E SIM
Dibenz(a,h)anthracene	8270E SIM
Fluoranthene	8270E SIM
Fluorene	8270E SIM
Indeno(1,2,3-cd)pyrene	8270E SIM
Naphthalene	8270E SIM
Perylene	8270E SIM
Phenanthrene	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)	
11Cl-PF3OUdS	537 (Modified)
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	537 (Modified)
4:2 FTS	537 (Modified)
5:3 FTCA	537 (Modified)
6:2 FTCA	537 (Modified)
6:2 FTS	537 (Modified)
6:2 FTUCA	537 (Modified)
8:2 FTS	537 (Modified)
9Cl-PF3ONS	537 (Modified)
HFPO-DA (GenX)	537 (Modified)
Hydro-PS Acid	537 (Modified)
NEtFOSAA	537 (Modified)
NFDHA	537 (Modified)
NMeFOSAA	537 (Modified)
Perfluorobutanesulfonic acid (PFBS)	537 (Modified)

Perfluorobutanoic acid (PFBA)	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)
Perfluorooctanesulfonic acid (PFOS)	537 (Modified)
Perfluorooctanoic acid (PFOA)	537 (Modified)
Perfluoropentanesulfonic acid (PFPeS)	537 (Modified)
Perfluoropentanoic acid (PFPeA)	537 (Modified)
Perfluorotetradecanoic acid (PFTeA)	537 (Modified)
Perfluorotridecanoic acid (PFTrDA)	537 (Modified)
Perfluoroundecanoic acid (PFUnA)	537 (Modified)
PFEESA	537 (Modified)
PFMBA	537 (Modified)
PFMOAA	537 (Modified)
PFMPA	537 (Modified)
PFO2HxA	537 (Modified)
PFO3OA	537 (Modified)
PPF Acid	537 (Modified)
Miscellaneous	
Grain Size	D422
Total Organic Carbon	EPA Lloyd Kahn

2.3 Sediment Volume Assessment Methods

Two different methods were used to estimate the volume of sediment stored behind the White Clay Creek dams. Each method utilized the probe depths measured during sampling activities to determine sediment wedge thickness. The total volume generated by using the probe depth should be considered a conservative estimate (biased high) of potentially mobile sediment. During sampling activities, a probe was used to find suitable sampling locations and to determine the approximate depth of potentially mobile sediment. Often however, when a larger diameter core barrel was driven into the sediment for sample collection, many returned with no recoverable material. This is due to the presence of coarse-grained sediment, essentially free of fine-grained material. At these locations, a petite ponar was used to collect a sample from the top 4 to 6 inches of the sediment.

2.3.1 Method 1- 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 is shown in Table 3-2.

2.3.2 Method 2-Transect Estimate

Method 2 used the maximum thickness of sediment found at any point in a transect and applied it to the areas generated by the Thiessen Polygons for all points within a transect. This method overestimates the amount of sediment by assuming the maximum thicknesses measured was consistent across each transect. Usually, the maximum thickness of sediment was measured along the banks of the creek as opposed to within the channel.

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, 2023a). In other words, results from bulk sediment analyses were converted to an estimated dissolved phase 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 during dam 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 White Clay Creek, 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, 2023a) associated with drinking water and eating fish from a body of water. This evaluation is relevant here because the White Clay Creek provides a source of drinking water to the City of Newark and other areas of New Castle County. 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 doesn't 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 White Clay Creek.

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, 2023b), 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 White Clay Creek 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 White Clay Creek. DNREC Surface Water Quality Standards (DNREC, 2023a) and DNREC-RS Screening Level Values for soil (DNREC, 2023b) were used for data and modeled concentration estimate comparison because the assessment area is located in the State of Delaware.

3.1.1 Grain Size Distribution & Total Organic Carbon

The grain size compositions of the White Clay Creek dam sediment transect samples ranged from 1.4 to 35.4 percent gravel, 31.1 to 94.8 percent sand, 1.3 to 38.5 percent silt, and 0.8 to 17.0 percent clay (Table 3-1). Total organic carbon (TOC) content ranged from 312 milligrams per kilogram (mg/kg) (0.03%) to 21,700 mg/kg (2.17%). The distribution of TOC in the samples is shown in the plot below.

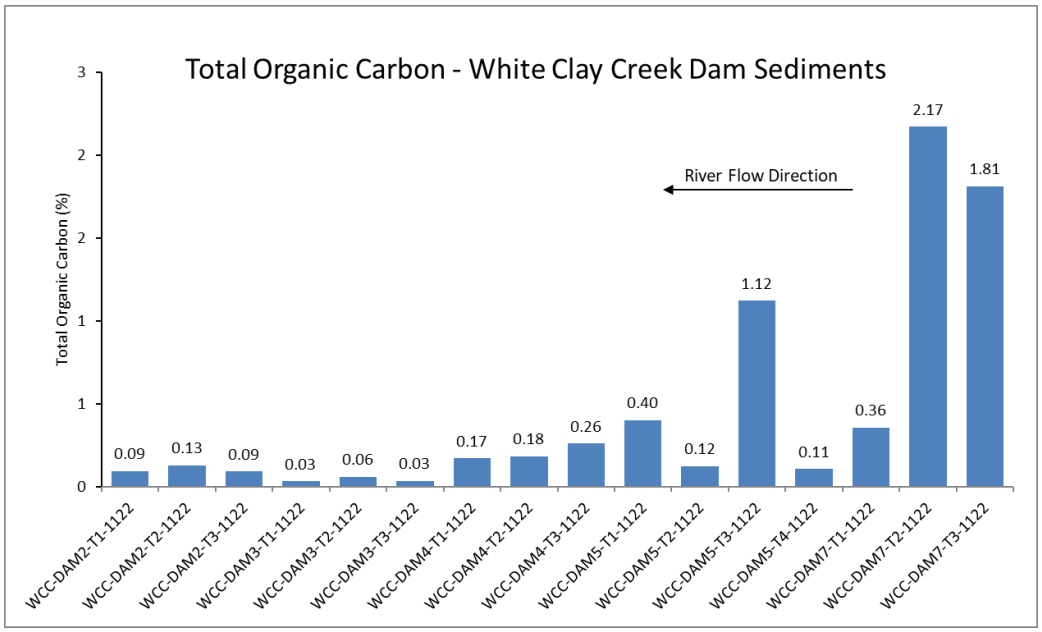
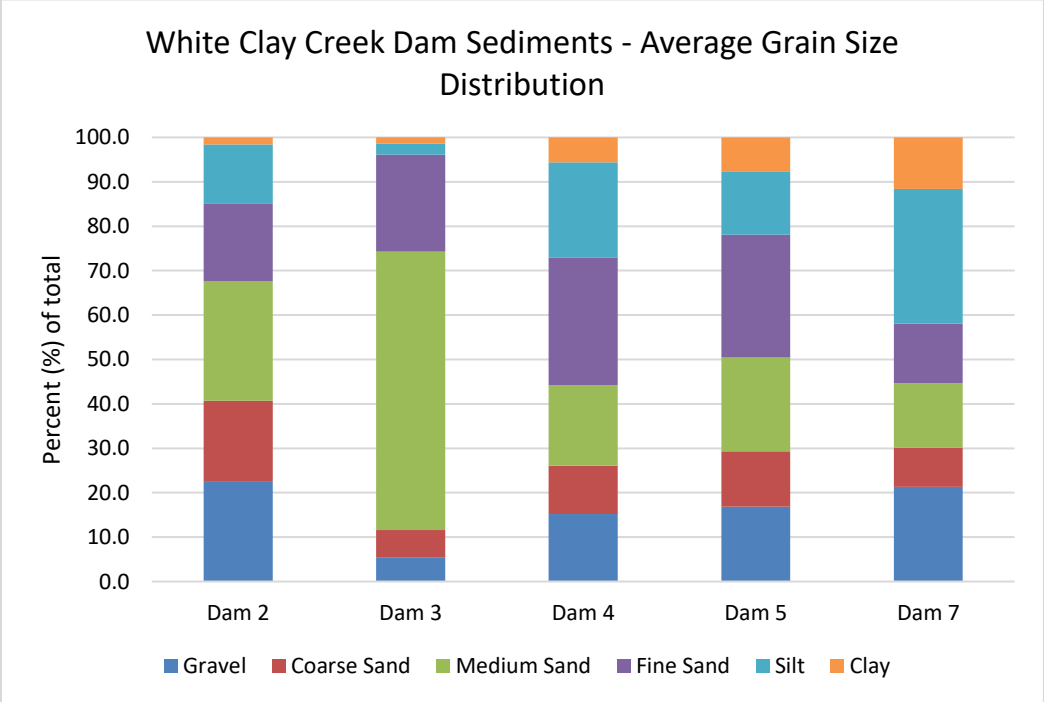


Table 3-1. Grain size distribution and total organic carbon content for composite sediment samples collected from the White Clay Creek dams in November 2022.

Composite Sample	Percent Gravel	Percent Sand	Percent Silt	Percent Clay	TOC (mg/kg)
Dam 1	Dam Removed in 2014				
Dam 2 Transect 1	35.4	48.1	15.4	1.1	908
Dam 2 Transect 2	23.4	54.1	20.7	1.8	1,270
Dam 2 Transect 3	9.1	85.3	3.8	1.8	904
Dam 3 Transect 1	6.1	91.8	1.3	0.8	303
Dam 3 Transect 2	1.4	94.8	1.9	1.9	583
Dam 3 Transect 3	8.9	85.4	4.4	1.4	312
Dam 4 Transect 1	28.2	31.1	38.5	2.2	1,690
Dam 4 Transect 2	4.8	72.6	13.5	9.1	1,830
Dam 4 Transect 3	12.5	69.7	12.2	5.6	2,580
Dam 5 Transect 1	18.7	44.4	22.5	14.4	3,980
Dam 5 Transect 2	28.4	65.1	3.4	3.1	1,240
Dam 5 Transect 3	4.6	63.8	21.2	10.4	11,200
Dam 5 Transect 4	15.6	71.8	10.0	2.6	1,050
Dam 6	Dam Previously Failed/Breached				
Dam 7 Transect 1	25.7	51.8	20.8	1.7	3,550
Dam 7 Transect 2	23.1	25.2	35.7	16.0	21,700
Dam 7 Transect 3	15.2	33.1	34.7	17.0	18,100

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 WCC_2022_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 higher energy environments that transport finer grained particles downstream. By comparison, the data presented shows that sediments behind Dam #4, Dam #5 and Dam #7 contain more fine-grained material than Dam #2 or Dam #3.

3.1.2 Sediment Volume Estimates

As described in Section 2, two methods were used to estimate the volume of sediment stored behind the White Clay Creek dams. Results of each method of estimation are shown on Table 3-2. Method 1 used the measured sediment thickness at each probe point to provide a refined volume of sediment around each point of each transect. Method 2 used data collected during sample collection (probe data) but was more conservative in that it used the maximum thickness along each transect to calculate a total volume.

Table 3-2. Sediment Volume Estimates behind White Clay Creek Dams.

Dam #	Method 1-Theissen (yd^3)	Samples Collected per 1,000 yd^3	Method 2-Transect (yd^3)	Samples Collected per 1,000 yd^3
2	2,200	1.4	2,300	1.3
3	400	7.5	400	7.5
4	3,300	0.9	3,900	0.8
5	1,800	2.2	3,000	1.0
7	1,500	2.0	2,600	1.1

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 (PAHs), 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.

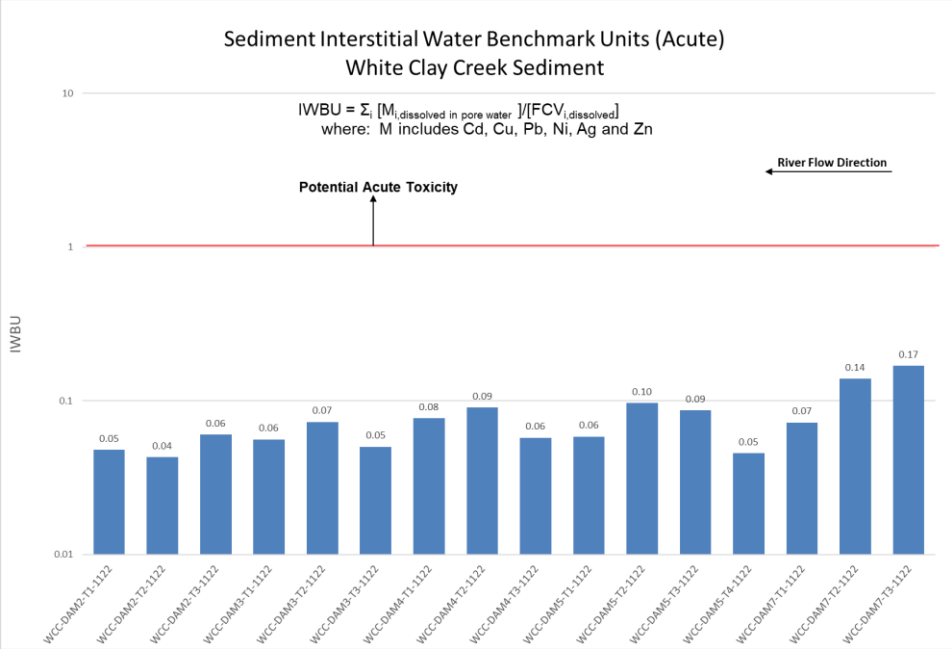
3.2.1 Inorganic (Metals) Assessment

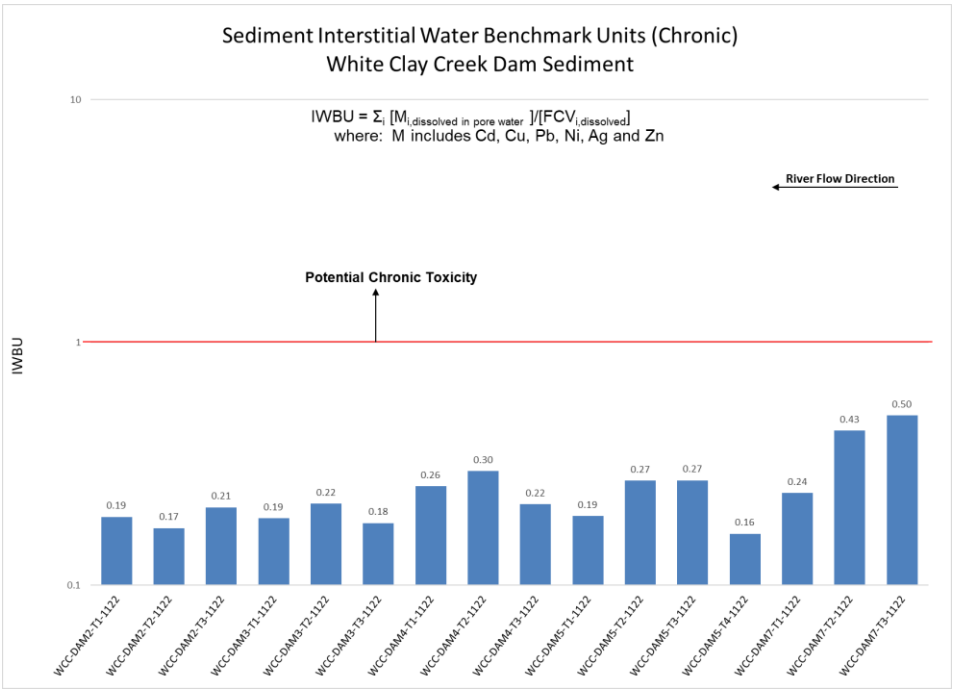
Various metals were detected in all sediment samples collected from the White Clay Creek at concentrations exceeding method detection limits.

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, 2023a). 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 16 composite samples from White Clay Creek dam sediments had IWBU values for acute and chronic toxicity less than 1. Close examination of the data indicates that IWBU values, although low, are dominated by copper and cadmium in all cases (Dam #2, Dam #3, Dam #4, Dam #5, and Dam #7).





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 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. None of the composite samples had calculated acute or chronic toxic unit values greater than 1 for any of the referenced metals.

The estimated porewater concentration of arsenic exceeded the applicable human health water quality criterion (fish and water ingestion) in 1 of the 16 composite sediment samples collected during this study ($T.U._{hh}$ values of 1.15 at Dam 7 Transect 3). The calculated porewater concentration of thallium exceeded the human health criterion in all 16 composite samples collected during this study ($T.U._{hh}$ values ranged from 4.90 to 66.78). The median predicted porewater concentrations for arsenic and thallium across all sampling sites were 3.10 micrograms per liter (µg/L) and 6.10 µg/L, respectively. The median concentration of arsenic does not exceed the human health criterion for drinking water and eating fish (10 µg/L, which is also its drinking water Maximum Contaminant Level (MCL), as established by the USEPA). The median predicted porewater concentration of thallium does exceed the surface water quality criterion established for protection of human health from drinking water and eating fish (0.24 µg/L) and the EPA established MCL for drinking water (2 µg/L). As such, and as cautioned earlier, these screening level exceedances do not imply risk, but instead simply mean that thallium needs to be assessed more closely. Unfortunately, there is not any available surface water analytical data or fish tissue data for thallium to evaluate whether dilution is occurring to mitigate potential health effects from exposure. However, all of the detections of thallium

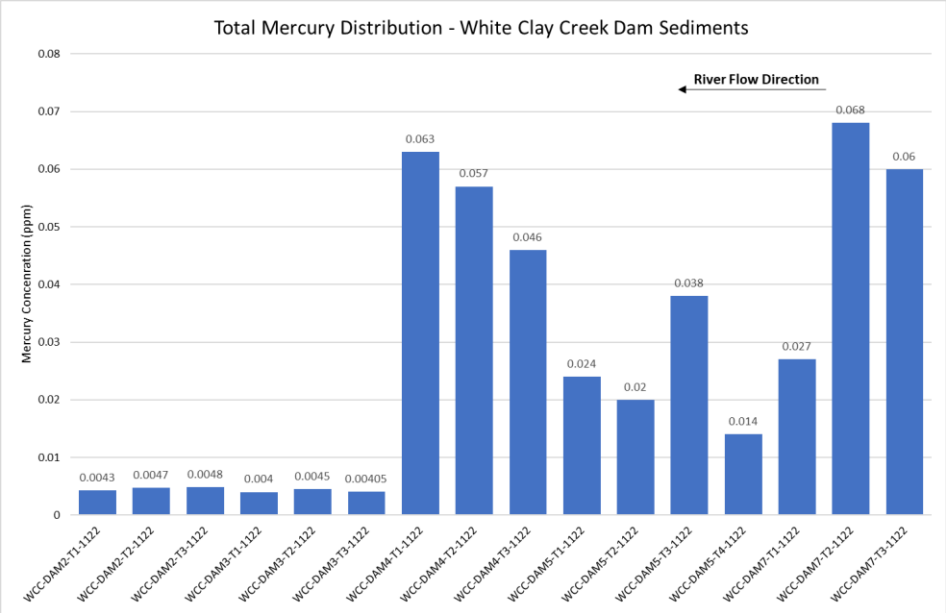
in White Clay Creek sediment samples were estimated concentrations (J flagged), meaning that the results were all less than the Reporting Level but greater than or equal to the Method Detection Limit, resulting in an approximate result. In addition, the mean predicted thallium concentrations in sediment porewater in the White Clay Creek (6.18 µg/L) is similar to the mean predicted thallium concentrations in the Brandywine River sediment porewater (6.55 µg/L) (DNREC, 2020). In the case of the Brandywine River, data was available to confirm that dilution was occurring and that surface water concentrations were below regulatory MCLs. By extension, it is assumed that similar dilution is occurring the White Clay Creek, and that there is no increase in human health risk associated with thallium.

Finally, a comparison of metals concentrations in the sediment samples to DNREC-RS Soil Screening Levels (DNREC, 2023b) 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 12 of the 16 composite samples, and all at estimated (J flagged) concentrations. The remainder were reported as "not detected" but at a detection limit that is very close to the screening level. No other metals exceeded their respective human health soil screening criteria. 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 Delaware Risk Assessment Calculator (DERAC), which is modeled from the USEPA supported Risk Assessment Information System (RAIS) online risk calculator. The maximum detected concentration of thallium, and therefore the most conservative value (worst case scenario), was used in the DERAC online risk calculator. Results indicated that human health risk from thallium 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 WCC_2022_Metals_Final spreadsheet included in Appendix C. DERAC output is included in Appendix D.

3.2.2 Mercury Assessment

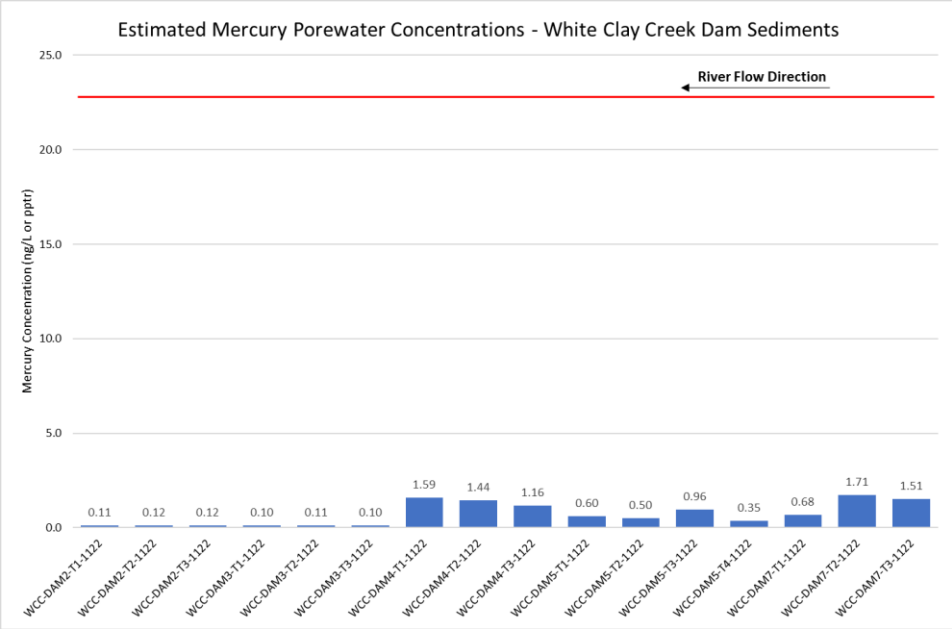
Total mercury was detected in 10 of the 16 sediment samples collected from the White Clay Creek at concentrations exceeding method detection limits. Concentrations ranged from 0.013 milligrams per kilogram (mg/kg) at Dam 5 Transect 4 to 0.068 mg/kg at Dam 7 Transect 2. The plot below shows total mercury concentration in sediments at each sample location. Concentrations plotted for Dams #1, #2, and #3 were set at ½ of the laboratory method detection limit.



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 porewater 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, 2023a), Table 2, lists a methyl-mercury concentration in fish tissue of 0.3 milligrams per kilogram (mg/kg) as the 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 parts per trillion), or 0.0231 µg/L (ppb), total mercury in porewater. As shown in the diagram below, the highest resulting estimated porewater concentration was 1.71 ng/L at Dam 7 Transect 2, which is 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 recently assessed fish tissue data from the White Clay Creek (2015)

indicates that methylmercury did not exceed the regulatory thresholds in any of the 3 composite fish tissue samples collected (Greene, 2016a).



Finally, a comparison of mercury concentrations in the sediment samples to DNREC-RS Soil Screening Levels (DNREC, 2023b) was conducted to evaluate whether concentrations of mercury in sediment would pose a risk to human health if sediment were excavated/removed, dewatered, and deposited in an upland setting. Here, human exposure is based primarily upon incidental ingestion and inhalation. As shown in Table 3-3, none of the sample results for total mercury exceeded the applicable soil screening level.

More detailed information regarding the approach used for this assessment and its results is included in the WCC_2022_Mercury_Final spreadsheet included in Appendix C.

3.2.3 Polychlorinated Biphenyl (PCB) Assessment

PCBs were not detected in any of the sediment samples collected during this study at concentrations exceeding the method detection limit, however an assessment was conducted using a concentration set to ½ of the analytical method detection limit.

The approach used to evaluate potential toxicity of PCBs in sediments to benthic aquatic organisms follows that of Fuchsman et. al. (2006), with minor modification. The aim of the approach is to determine an organic carbon normalized concentration in the sediments that is in equilibrium with a porewater concentration equal to the chronic aquatic life criterion (0.014 µg/L). Fuchsman (2006) refers to such an organic carbon normalized sediment concentration as a Sediment Quality Benchmark (SQB). If the ratio of the measured organic carbon normalized concentration in the sediment to the SQB is less than 1, then chronic aquatic life toxicity in the sediments is unlikely. Ratios greater than 1 indicate that the porewater exposure may be high enough to cause toxicity to benthic

aquatic life. For this particular dataset, however, all chronic toxicity unit values are zero, which is below 1, thereby indicating that aquatic toxicity due to PCBs is not expected. Even utilizing a PCB concentration that is equal to ½ of the method detection limit, only two samples exhibited a chronic toxicity unit slightly greater than 1 (1.14 at Dam 3 Transect 1 and 1.11 at Dam 3 Transect 3).

Because the White Clay Creek is used as a drinking water source for the City of Newark and other areas in New Castle County, the calculated dissolved porewater concentration at each location was next compared to Delaware's Water Quality Criteria for Protection of Human Heath (from fish and water ingestion) (DNERC, 2023a). Because PCBs were not detected in the samples, there is no apparent risk due to PCBs. However, utilizing concentrations equal to ½ of the method detection limit, and under the conservative assumption that the estimated porewater concentration is in equilibrium with the surface water, all estimated porewater concentrations are greater than the referenced criterion of 0.000064 ug/L, thus indicating the potential for human health impact from fish and water ingestion. For additional context, the drinking water MCL for PCBs is 0.5 ug/L, which is more than 30 times greater than the highest estimated concentration of 0.016 ug/L at Dam 3 Transect 1 (using 1/2 of the method detection limits). Therefore, the identified potential risk is dominated by consumption of fish that have bioaccumulated PCBs. In fact, PCBs are the primary risk driver for fish consumption advisories in Delaware, including in the White Clay Creek.

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. Because PCBs were not detected at concentrations above the method detection limit in any of the samples, none exceeded the BBSQC. Even utilizing ½ of the method detection limit, predicted concentrations do not exceed the BBSQC for PCBs.

Because PCBs are the primary risk driver for fish consumption advisories in Delaware (including in the White Clay Creek), additional context is needed as to the source of PCB impacts measured in fish. In order to evaluate this, the calculations described above to assess potential PCB risk to aquatic life and human health were conducted utilizing laboratory results equal to ½ of the laboratory method detection limit, and equal to the method detection limit (MDL). Further, higher resolution assessment data (sediment and surface water) measured in 2015 from the White Clay Creek were reviewed for comparison to estimated values. Sediment and surface water analytical data from two locations, Paper Mill Road and Chambers Rock Road, indicated that total PCB concentrations in sediment were 2.70 and 0.283 ug/kg, respectively. By comparison, estimated concentrations of PCBs derived using ½ the MDL (using 2022 data) ranged from approximately 8 ug/kg to 18 ug/kg at all locations. In addition, predicted porewater PCB concentrations utilizing ½ of the MDL (average concentration from 16 sites of 0.0047 ug/L) are greater than dissolved PCBs measured in surface water at the same two locations in 2015 (0.000355 ug/L and 0.000481 ug/L). From this, it can be concluded that results from the current (2022)

assessment of PCBs utilizing ½ of the MDL are biased high, and the evaluation using zero for "non-detect" results more closely represents actual conditions. Based upon review of the assessment, even using ½ of the MDL, all conclusions stated above regarding potential toxicity to benthic aquatic life and comparison of data to the BBSQC are unchanged. However, instead of no exceedances of the criterion developed to protect humans from drinking water and eating fish containing PCBs, each of the 16 estimated porewater concentrations exceeded the criterion. Finally, and as a result of all of the lines of evidence presented, it appears that relatively low concentrations of PCBs in sediments, and/or PCBs dissolved in surface water from upstream sources, are likely contributing to bioaccumulation in fish. At the time of this assessment a consumption advisory of no more than twelve 8oz servings of fish per year from the White Clay Creek has been established.

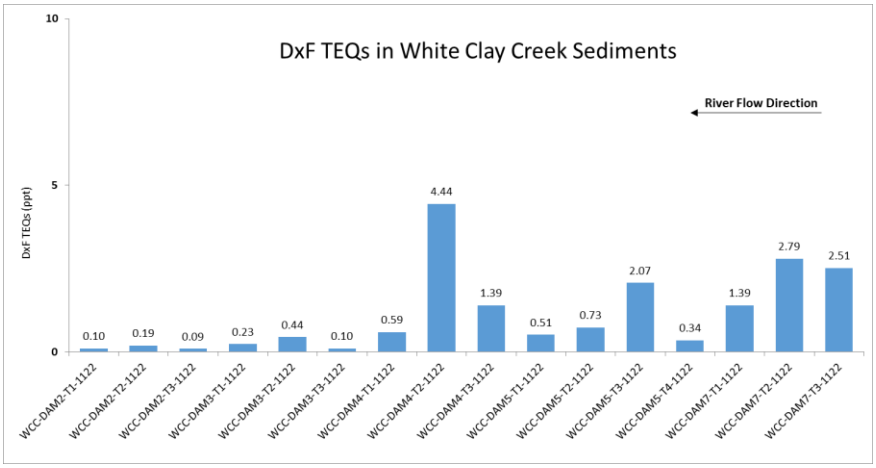
Finally, a comparison of PCB concentrations in the sediment samples to DNREC-RS Soil Screening Levels (DNREC, 2023b) was conducted to evaluate whether concentrations of PCBs in sediment would pose a risk to human health if sediment were excavated/removed, dewatered, and deposited in an upland setting. 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 WCC_2022_PCB_Final spreadsheet included in Appendix C.

3.2.4 Dioxins and Furans Assessment

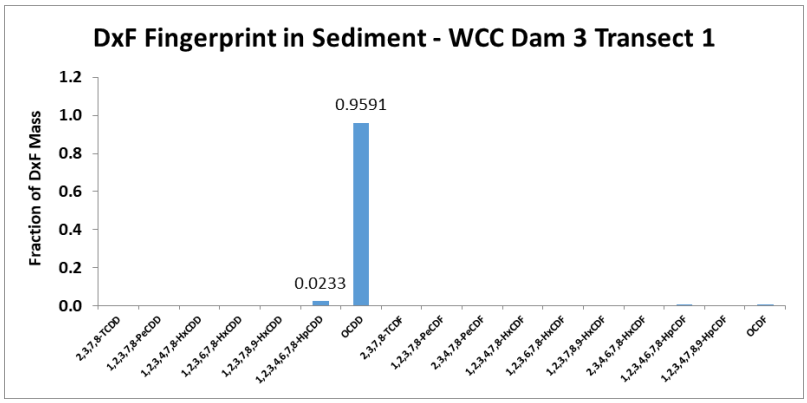
Dioxins and furans (DxF) were detected in all of the White Clay Creek sediment samples at concentrations exceeding method detection limits. Of the dioxin and furan compounds present, OCDD (1,2,3,4,6,7,8,9-octachlorodibenzodioxin) dominates on a weight percentage basis, a finding which is consistent with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

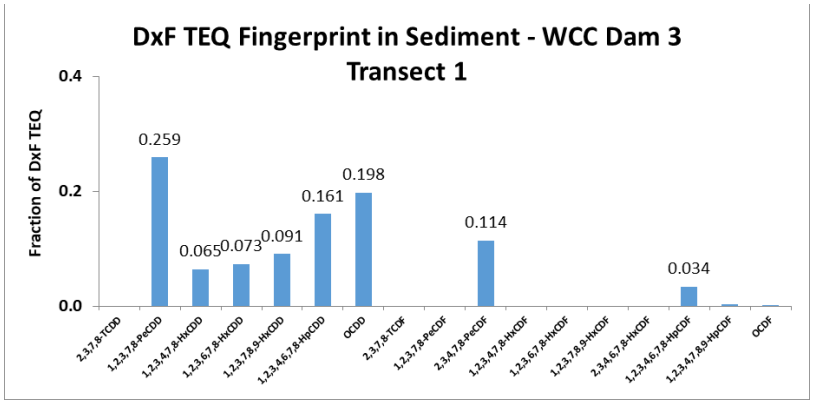
The approach used to assess potential toxicity to benthic aquatic life was to first calculate dioxin-like (2,3,7,8-TCDD) Toxicity Equivalency Quotients (TEQs) for each sample by multiplying the concentration of each dioxin and furan compound by its associated toxicity equivalence factor, or TEF (Van den Berg, et.al., 2006). The sum of individual TEQs for each compound is its Total 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 16 sediment sampling sites in the White Clay Creek, with OCDD dominating the dioxin and furan mass present in the samples (contributing between 91.78% and 96.74% of the dioxin and furan mass). A similar compound, 1,2,3,4,6,7,8-HpCDD, was second most abundant, contributing between 1.85% to 5.93% of the dioxin and furan mass. The results for White Clay Creek 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 3 Transect 1. The maximum contribution of OCDD on a mass basis was 95.91%, while on a TEQ basis, OCDD contributed 19.82% in this same sample. All of the other sediment samples collected in the White Clay Creek exhibited a similar characteristic.

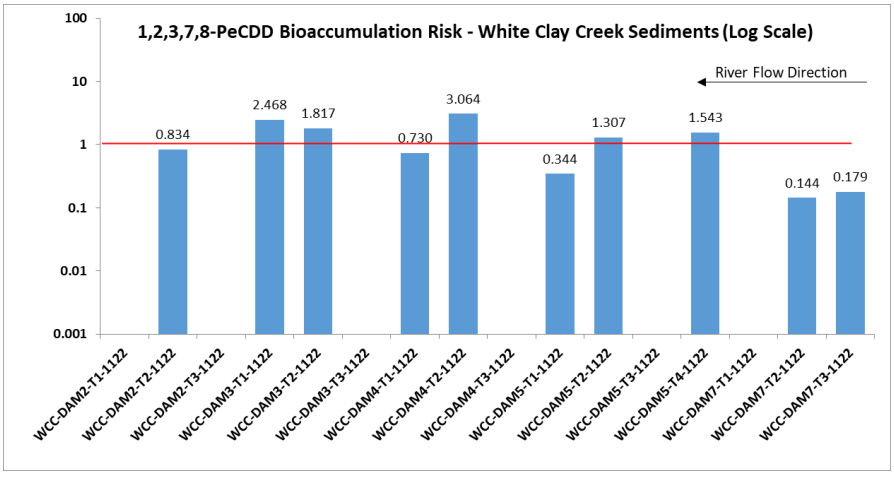




Equilibrium partitioning calculations were again performed to assess potential toxicity of dioxin and furan compounds to benthic aquatic life. The overall approach mirrors the method described above for PCBs (Fuchsman et al., 2006) but was adapted here for dioxins and furans. The idea is to predict an 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, 2023a) 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 (USEPA, 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 the acute toxicity of 2,3,7,8-TCDD to aquatic life may occur at exposure concentrations of 1 µg/L, while chronic toxicity may occur at an exposure concentration of 0.001 µg/L. Results of the assessment indicate that $T.U._a$ and $T.U._c$ values are orders of magnitude less than 1, and

therefore the presence of 2,3,7,8-TCDD specifically is not expected to cause acute or chronic aquatic life toxicity to benthic organisms living in and on the White Clay Creek 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 White Clay Creek. 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 because they are the two most dominant dioxin and furan compounds in the White Clay Creek sediments, and 1,2,3,7,8-PeCDD since it is the most prominent dioxin and furan compounds found in fish on a TEQ basis (Greene, 2008, 2009, and 2016a). The assessment for White Clay Creek 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 the BBSQC calculated to prevent health risk to people who may consume the fish (see toxic unit plot below) at several locations, specifically at Dam 3 Transect 1 (T.U.=2.47) and Transect 2 (T.U.=1.82), Dam 4 Transect 2 (T.U.=3.06), and Dam 5 Transect 2 (T.U.=1.31) and Transect 4 (T.U.=1.54). It is notable that the reported concentration of 1,2,3,7,8-PeCDD at 11 of the 16 transects (every detection) were "J-flagged", meaning that the concentration fell between the MDL and the RL and hence the concentration is only an estimate at those stations. Concentrations at the other 5 sites were "U-qualified," meaning that concentrations were not detected above the method detection limits. Further, there is already a fish advisory in place for the White Clay Creek to deter excessive fish consumption. These issues aside, the presence of 1,2,3,7,8-PeCDD in the sediments of White Clay Creek is not the primary driver for fish contamination and human health risk in this system.



Understanding that direct measurements are the best way to verify predictions, comparison of dioxin and furan data from the most recent DNREC fish contaminant monitoring program was performed. The most recently assessed data, collected in 2015 for fish in the White Clay Creek, indicates that dioxins and furans (as TEQs) exceeded regulatory thresholds for fish consumption in 1 of 3 samples. Specifically, three composite fish tissue samples were analyzed in 2015 for dioxins/furans, along with other bioaccumulative compounds. Sample locations ranged from just below Dam 2 at Delaware Park to just below the state line at Chambers Rock Road. White sucker composite sample results indicated that 2,3,7,8-TCDD TEQs (which incorporate OCDD, 1,2,3,4,6,7,8-HpCDD and 1,2,3,7,8- PeCDD) ranged from 0.244 ppt to 0.427 ppt. The applicable fish tissue screening level is 0.35 ppt. The only sample that exceeded the screening criteria was collected near Delaware Park.

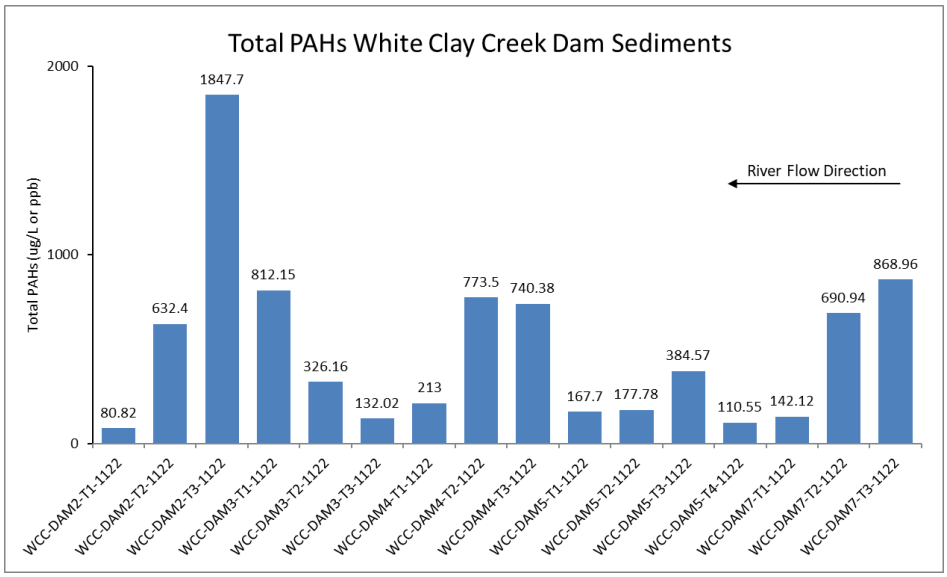
As with other contaminants in this study, the human health assessment was expanded to include the potential risk from both consuming fish and drinking water from the White Clay Creek. The assessment focused on OCDD, 1,2,3,4,6,7,8-HpCDD and 1,2,3,7,8- PeCDD for the same reasons stated above. Results predicted that all 16 sample locations would exceed the surface water quality criterion of 5.0 E^{-9} µg/L (ppb) for 2,3,7,8-TCDD (as TEQs). Toxic units ranged from 4.5 at Dam 2 Transect 1 to 212 at Dam 4 Transect 2. 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 White Clay Creek in 2015, it appears that measured surface water concentrations of dioxins/furans are 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 MCL for dioxin (2,3,7,8 TCDD) (USEPA, 2009) indicates no exceedances. In fact, predicted concentrations are two to four 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, which has been shown to be relatively low.

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 0.086 parts per trillion (ppt) at Dam 2 Transect 3, to 4.43 ppt at Dam 4 Transect 2. The screening value for 2,3,7,8-TCDD (as TEQs) is 4.8 ppt. Therefore, all samples are below the screening level and need no further evaluation.

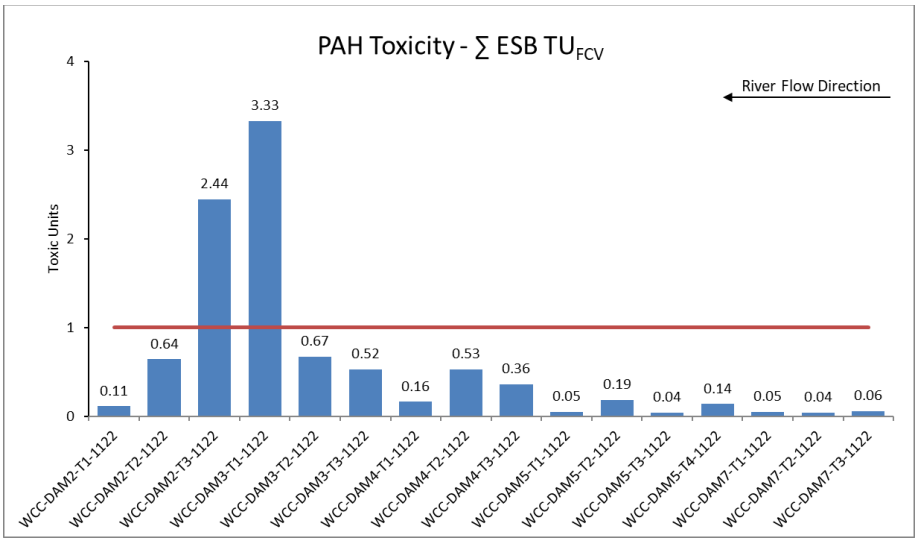
More detailed information regarding the approach used for this assessment and its results is included in the WCC_2022_DxF_Final spreadsheet, included in Appendix C.

3.2.5 Polycyclic Aromatic Hydrocarbon (PAH) Assessment

Total PAHs were detected in each of the samples collected, at concentrations between 80.8 ppb and 1,847.7 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 normalized 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 units calculated were 3.33 at Dam 3 Transect 1 and 2.44 at Dam 2 transect 3, which are greater than 1, thereby indicating that chronic toxicity due to PAHs is possible at these locations.



Porewater concentrations were estimated for additional individual PAHs for comparison to Delaware human health water quality criteria for fish and water ingestion (DNREC, 2023a), since the White Clay Creek is used as a drinking water source for the City of Newark. 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). Five individual PAH compounds were estimated to be above DNREC Water Quality Standards for protection of human health from the consumption of fish and water (DNREC, 2023a). 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 #3 and Dam #4. Toxic unit values ranged from 1.60 at Dam 4 Transect 2 to 10.02 at Dam 2 Transect 3. Toxic units greater than 1 were calculated for benzo(a)pyrene at Dam #2, Dam #3, Dam #4 and Dam #5. Toxic unit values ranged from 1.25 at Dam 5 Transect 2 to 31.48 at Dam 3 Transect 1. Toxic units greater than 1 were calculated for benzo(b)fluoranthene at Dam #2 and Dam #3. Toxic unit values ranged from 2.71 at Dam 3 Transect 1 to 2.90 at Dam 2 Transect 3. Toxic units greater than 1 were calculated for Dibenz(a,h)anthracene at Dam #3. The toxic unit value was calculated as 1.01 at Dam 3 Transect 1. Finally, toxic units greater than 1 were calculated for indeno[1,2,3-cd]pyrene at Dam #2, Dam #3 and Dam #4. Toxic unit values ranged from 1.24 at Dam 4 Transect 2 to 15.21 at Dam 3 Transect 1. Examining the data for benzo(a)pyrene specifically, none of the predicted porewater concentrations exceed the drinking water MCL of 0.20 µg/L 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 White Clay Creek PAH data in fish tissue from the most recent DNREC fish contaminant monitoring program sampling was performed. The most recently assessed data, collected in 2015 for fish in the White Clay Creek, 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 White Clay Creek 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, 2013b). Here, human exposure is based primarily upon incidental ingestion and inhalation. As shown in Table 3-5, PAH compounds did not exceed any of the screening criteria.

More detailed information regarding the approach used for this assessment and its results is included in the WCC_2022_PAH_Final spreadsheet, included in Appendix C.

3.2.6 Pesticide Assessment

No pesticides were detected in the White Clay Creek sediment samples at concentrations above analytical method detection limits. Therefore, there is no predicted aquatic life or human health impacts from pesticides in sediments behind the dams.

Note, however, that the latest fish consumption advisory for the White Clay Creek (2018) lists pesticides as a contaminant(s) of concern. Specifically, dieldrin is a contaminant of concern in fish from the non-tidal portion of the White Clay Creek and dieldrin, chlordane and DDx (DDT/DDD/DDE) are contaminants of concern in fish from the tidal portion of the creek.

Upon review of the most recent surface water data from the White Clay Creek, collected in 2015, it appears that measured surface water concentrations of dieldrin and DDx were slightly greater, but similar, at the Chambers Rock Rd (state line) samples (0.292 ppt and 0.257 ppt, respectively) as compared to downstream samples collected at Papermill Rd (0.233 ppt and 0.182 ppt, respectively). In the case of dieldrin and chlordane, concentrations reported from samples collected in 2015 show an increase downstream within the tidal portion of the river (from Delaware Park to the mouth). This could be due to localized influences from the Christina River. There is not currently an MCL for dieldrin or DDx for comparison to drinking water standards. The MCL for chlordane is 2 ppb, which is orders of magnitude greater than the concentration detected in surface water at Delaware Park in 2015 (0.345 ppt).

Understanding that direct measurements are the best way to verify predictions, comparison of pesticide data from the most recent DNREC fish contaminant monitoring program was performed. Data from 2015 indicates that within the non-tidal section of White Clay Creek, dieldrin in fish tissue barely exceeded the applicable screening level. Specifically, dieldrin was measured in fish tissue at a concentration of 5.39 ppb at Chambers Rock Rd (above Dam #7, near the state line) and at 3.09 ppb at Papermill Road (in the vicinity of Dam #4) in 2015. The fish tissue screening level for dieldrin is 3.0 ppb.

From review of all information available, it appears that pesticides within the non-tidal White Clay Creek are coming from upstream sources, as evidenced by measured concentrations in fish tissue and surface water in 2015, and because pesticides were not detected above method detection limits in this study.

Although pesticides were not detected above laboratory method detection limits during this study, a comparison of results to DNREC-RS Soil Screening Levels (DNREC, 2023b) was conducted. As shown in Table 3-6, none of the pesticide results exceeded their applicable soil screening levels, and therefore do not pose a risk to human health if sediment were excavated/removed, dewatered, and deposited in an upland setting.

More detailed information regarding the approach used for this assessment and its results is included in the WCC_2022_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 White Clay Creek 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 other compounds evaluated above. PFAS compounds were detected using USEPA Method 537 (Modified) at two of the five transect locations 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 criteria related to specific 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).

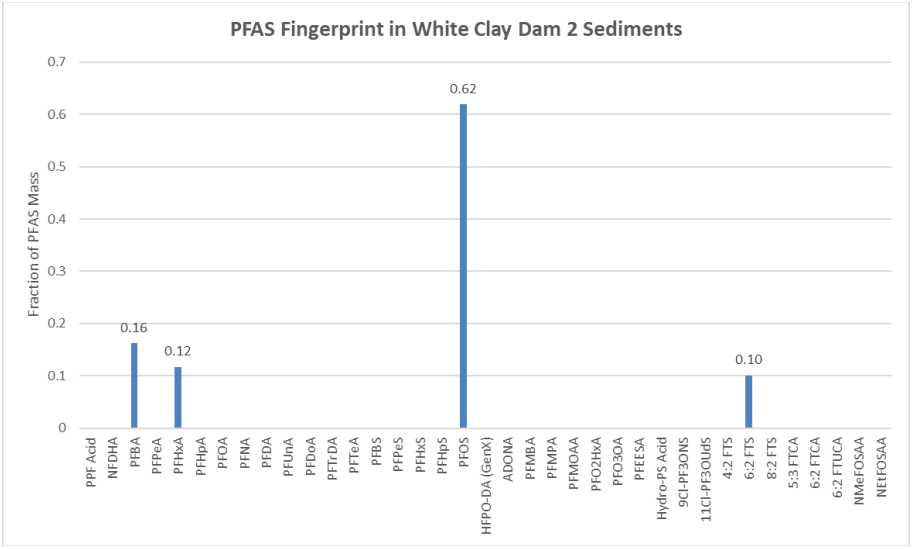
As such, USEPA has proposed MCLs for drinking water for two PFAS compounds, PFOA and PFOS, each at 4.0 parts per trillion, or ppt. In addition, EPA has proposed Health Based Water Concentrations (HBWCs) for PFHxS (9.0 ppt), PFNA (10 ppt), PFBS (2,000 ppt) and HFPODA (10 ppt). DNREC has established soil 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). DRNEC-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

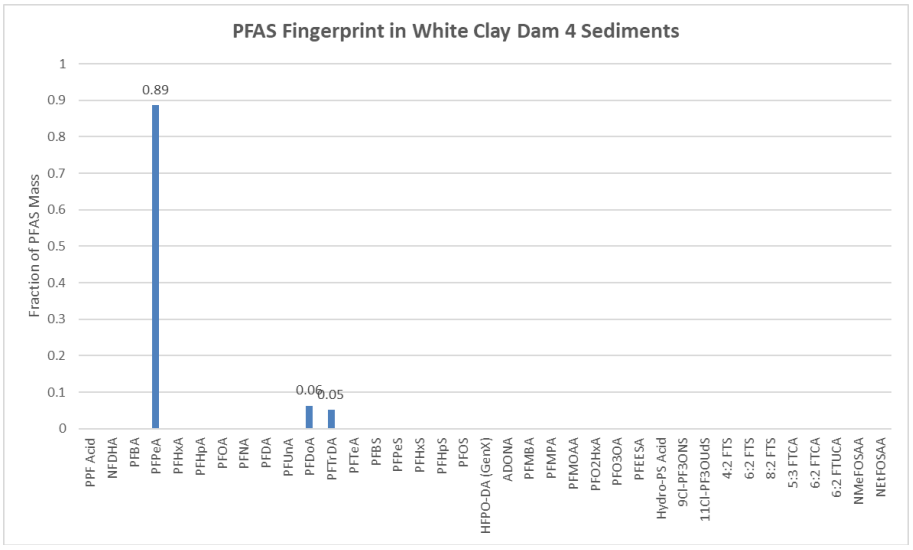
ppm for PFOA and PFOS, respectively. Recommended chronic criteria are 0.094 ppm and 0.0084 ppm for PFOA and PFOS respectively.

Seven different PFAS compounds were detected in two of the five transect samples collected during this study (Dam #2 and Dam #4). Three of the composited transect samples did not contain PFAS above method detection limits. Individual PFAS compound concentrations ranged from 0.03 ppb to 0.52 ppb, and all but two of the detections were "J flagged," meaning they were estimated concentrations. Comparison of sediment data to the HSCA soil screening levels are applicable if sediment is excavated, dewatered, and moved to an upland location. PFOS was the only compound detected in the White Clay Creek sediments that has an associated soil screening level. The concentration of PFOS detected in the White Clay Creek sediments (0.38 ppb at Dam #2) is orders of magnitude less than the DNREC-RS human health soil Screening Level of 0.013 ppm (13 ppb).

Because there are no additional human health or ecological criteria to directly compare to White Clay Creek sediment results, the data were organized and plotted based upon carbon chain length, and functional group (carboxylic acids, sulfonic acids, sulfonamides, etc.), in order to determine if there were any trends that could be identified, and to further help understand the distribution of PFAS compounds in the environment. Fingerprints, or mass contributions of each specific compound, were also calculated and plotted in a similar way to other compounds assessed during this study in order to determine if there were any trends that could be identified, and to further help understand the distribution of PFAS compounds in the environment. The fingerprint plots for the two samples that had PFAS detections are provided below to show the variation in results. No conclusions could be drawn at this time regarding trends through comparison of fingerprints.

To understand whether PFAS compounds are present in White Clay Creek surface water are elevated enough to cause an impact to drinking water, data summarized in the recently published Persistent Pollutants Sampling Report - Focusing on PFAS (DNREC, 2023c), was reviewed. In summer 2022, a surface water sample was collected near the City of Newark intake and analyzed for PFAS compounds. Upon review of the data, the concentration of PFOA detected in the surface water sample (5.73 ppt) slightly exceeded the proposed MCL of 4.0 ppt. Other PFAS compounds detected were either below the proposed drinking water criteria or do not have associated proposed criteria.


PFAS Fingerprint in White Clay Dam 2 Sediments
Fraction of PFAS Mass
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.62
0.16
0.12
0.10
PPF Acid
NFDHA
PFBA
PFPeA
PFHxA
PFHpA
PFOA
PFNA
PFDA
PFUnA
PFDoA
PFTrDA
PFTeA
PFBS
PFPeS
PFHxS
PFHpS
PFOS
HFPO-DA (GenX)
ADONA
PFMBA
PFMPA
PFMOAA
PFO2HxA
PFO3OA
PFEESA
Hydro-PS Acid
9Cl-PF3ONS
11Cl-PF3OUdS
4:2 FTS
6:2 FTS
8:2 FTS
5:3 FTCA
6:2 FTCA
6:2 FTUCA
NMeFOSAA
NEtFOSAA


PFAS Fingerprint in White Clay Dam 4 Sediments
Fraction of PFAS Mass
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.89
0.06
0.05
PPF Acid
NFDHA
PFBA
PFPeA
PFHxA
PFHpA
PFOA
PFNA
PFDA
PFUnA
PFDoA
PFTrDA
PFTeA
PFBS
PFPeS
PFHxS
PFHpS
PFOS
HFPO-DA (GenX)
ADONA
PFMBA
PFMPA
PFMOAA
PFO2HxA
PFO3OA
PFEESA
Hydro-PS Acid
9Cl-PF3ONS
11Cl-PF3OUdS
4:2 FTS
6:2 FTS
8:2 FTS
5:3 FTCA
6:2 FTCA
6:2 FTUCA
NMeFOSAA
NEtFOSAA

4 Conclusions

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

Finally, the results provided below do not consider the mixing of sediment from different transects at any dam location as a result of dam modification, removal, or failure.

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 White Clay Creek. Field observations indicate material that remains within the center channel is primarily coarser-grained material, which is less mobile and less of an environmental concern based on its surface area to volume ratio. 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. Based on volume calculations it appears that the number of samples collected adequately characterizes the sediment (generally more than 1 sample per 1,000 yd^3).

4.2 Metals

Despite the presence of metals in the samples, acute or chronic toxicity due to individual metals or from the additive effect of divalent metals is not likely based upon this assessment, and therefore impacts to aquatic life are not expected during dam removal, modification, or failure.

In addition, although conservative assessment methods predicted the potential for human health impacts due to thallium (and for arsenic at one sample location) from drinking water and eating fish from the White Clay Creek, multiple lines of evidence suggest that unacceptable human health risk due to metals (primarily thallium) from drinking water or eating fish is not expected in relation to a release of sediment during dam removal, modification, or failure.

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

4.3 Mercury

Mercury was detected in sediments behind three of the five White Clay Creek dams. Regardless, neither acute nor chronic toxicity to benthic aquatic life was predicted.

Estimated porewater concentrations did not exceed the calculated water quality target derived to protect humans from eating fish with elevated mercury concentrations. The results were between 14 and 115 times lower than the calculated water quality target. As a result, and considering the conservative model assumptions, toxicity due to bioaccumulation of mercury is not expected. In addition, mercury is not a primary contributor to the exiting fish advisories within the White Clay Creek.

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

4.4 PCBs

Total PCBs were not detected in any of the sediment samples at concentrations exceeding the method detection limit of EPA Method 680. Results of the assessment conducted indicate that even using assumed concentrations in the environment of ½ the laboratory method detection limit, the PCBs are not expected to cause adverse impacts to benthic aquatic life.

Impacts to human health from PCBs are not expected from drinking White Clay Creek water; however, there appears to be potential for PCBs to bioaccumulate in fish which are then consumed by humans. Further, and as previously noted, PCBs are the main risk driver for fish consumption advisories in the White Clay Creek, therefore some exposure and bioaccumulation must be occurring in fish. After evaluating the surface water PCB concentrations detected in 2015 from the state line and from the Paper Mill Road sample, one can conclude that PCBs are entering the White Clay Creek from upstream locations, and that there are no additional significant PCB sources between Chambers Rock Road and Paper Mill Road (the concentrations are similar, and even slightly higher at the upstream extent of the White Clay Creek in Delaware).

It is concluded that, since PCBs are either not present in the sediments, or are present at extremely low concentrations, an increase in PCB risk to benthic aquatic life or human health from fish consumption associated with dam removal, modification or failure is not expected.

Lastly, human health risk associated with incidental ingestion of PCBs in sediment is not anticipated. Even utilizing ½ the laboratory method detection limits, bulk sediment concentrations do not exceed applicable soil screening criteria.

4.5 Dioxins and Furans

Dioxins and furans are present in the sediments of the White Clay Creek. 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. Despite the presence of dioxin and furan compounds in the sediments of the White Clay Creek, 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 White Clay Creek 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 5 of the 16 sample locations (transects). This prediction is supported by exceedances of fish tissue screening levels in one of the fish samples collected from the White Clay Creek in 2015. Actual human exposure through this pathway is expected to be reduced because there is already a fish consumption advisory in place for both the tidal and non-tidal White Clay Creek. Risk related to human exposure via drinking water and consuming fish was predicted based upon conservative model assumptions. Upon further evaluation, unacceptable exposure from drinking water, by itself, is not expected. Nevertheless, there are areas of the White Clay Creek identified during this sediment evaluation that may contribute more to 1,2,3,7,8-PeCDD bioaccumulation than other areas (see graph above). 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 removal or modification at those locations. Based on fate and transport considerations, however, 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.

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

4.6 PAHs

Overall, potential chronic toxicity to aquatic life from PAHs was predicted for only two samples (Dam 2 Transect 3 and Dam 3 Transect 1). This assessment assumes, conservatively, that predicted concentrations in sediment porewater are in equilibrium with surface water. Further, careful review of the data indicate that the composite samples collected at Dam 2 Transect 3 and Dam 3 Transect 1 has some of the lowest reported concentrations of total organic carbon of all samples collected. Organic carbon plays an important role in the bioavailability of many organic compounds, including PAHs. As an

additional exercise, the toxic units between the three composited samples collected at Dam 2 (1.06 toxic units) and Dam 3 (1.51 toxic units) were averaged to represent a mixing of the material through dam modification, removal, or failure. Results indicate that risk of adverse effects to aquatic life due to PAHs at these two locations is very low.

Potential impacts to human health from exposure to benzo(a)pyrene were predicted at approximately half (8 of 15 transects) of the locations sampled, and from several other PAHs, including benzo(a)anthracene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno[1,2,3-cd]pyrene at other locations. 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 White Clay Creek 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, adverse effects from the release of sediments through dam modification, removal or failure is not expected.

Finally, 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 detected in White Clay Creek sediments above laboratory method detection limits. Therefore, there is no predicted aquatic life or human health impacts from pesticides in sediments behind the dams.

However, review of actual surface water and fish tissue data from samples collected in the White Clay Creek in 2015 showed that relatively low concentrations of certain pesticides were present. Spatial data points to an upstream source of pesticides, but trends also indicate that concentrations of pesticides in White Clay Creek fish are going down.

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, adverse effects from the release of sediments through dam modification, removal or failure is not expected.

Lastly, 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 two of the five sediment samples collected for PFAS analysis during this study. Due to the evolving nature of the science surrounding PFAS and its toxicity, no conclusions regarding benthic aquatic life can be made at this time.

With regards to human health, the only appropriate criteria available are draft MCLs for drinking water for two PFAS compounds, PFOA and PFOS, and proposed HBWCs for another four compounds. Additionally, DNREC has established/adopted soil screening values six PFAS compounds. Concentrations detected in the sediments (of PFOS only) did not exceed its soil screening level for protection of human health through ingestion or inhalation. Direct measurement of surface water near the City of Newark surface water intake (at Dam #5) verified that PFAS chemicals are present in the surface water. The concentration of PFOA in the surface water slightly exceeded its proposed MCL. It does not appear, however, that the sediments are the primary source of PFAS to the surface water.

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TABLES

Table 3-3 Inorganic Results – White Clay Creek Dam Sediments

Analyte Name	Units	Dam 2 Transect 1	Dam 2 Transect 2	Dam 2 Transect 3	Dam 3 Transect 1	Dam 3 Transect 2	Dam 3 Transect 3	Dam 4 Transect 1	Dam 4 Transect 2	DNREC Soil Screening Value (Human Health)
Aluminum	mg/kg	2,490	1,950	4,410	3,600	3,940	2,930	6,950	7,440	51,200
Antimony	mg/kg	0.17 (U)	0.17 (U)	0.16 (U)	0.16 (U)	0.16 (U)	0.15 (U)	0.15 (U)	0.16 (U)	3.1
Arsenic	mg/kg	0.39 (J)	0.34 (J)	0.44 (J)	0.39 (J)	0.40 (J)	0.41 (J)	1.2	1.3	11
Barium	mg/kg	29.0	22.8	50.2	36.2	41.5	30.9	69.8	65.7	1,500
Beryllium	mg/kg	0.11 (J)	0.089 (J)	0.17 (J)	0.15 (J)	0.16 (J)	0.17 (J)	0.40 (J)	0.41 (J)	16
Cadmium	mg/kg	0.13 (U)	0.13 (U)	0.13 (U)	0.12 (U)	0.12 (U)	0.12 (U)	0.12 (U)	0.13 (U)	7.1
Calcium	mg/kg	291	167	384	345	342	325	1,170	738	NS
Chromium	mg/kg	7.1	7.0	10.7	8.4	8.7	7.2	15.7	18.2	214
Cobalt	mg/kg	2.3	1.9 (J)	4.6	4.0	4.1	2.9	5.8	6.2	34
Copper	mg/kg	5.0	4.4	7.4	7.0	10.7	5.3	11.0	13.2	310
Iron	mg/kg	5,590	4,460	8,340	7,000	7,710	6,410	12,200	12,200	74,767
Lead	mg/kg	5.7	2.8	4.0	2.7	3.2	2.5	10.3	12.9	400
Magnesium	mg/kg	983	661	1,890	1,560	1,790	1,500	2,150	2,570	NS
Manganese	mg/kg	94.3	62.0	153	116	129	104	226	126	2,100
Nickel	mg/kg	4.3	3.6	8.1	6.8	7.4	7.8	10.0	11.8	150
Potassium	mg/kg	1,290	869	2170	1,640	1,760	1,400	1,740	1,960	NS
Selenium	mg/kg	0.14 (U)	0.15 (U)	0.14 (U)	0.14 (U)	0.14 (U)	0.14 (U)	0.33 (J)	0.31 (J)	39
Silver	mg/kg	0.10 (U)	0.10 (U)	0.099 (U)	0.096 (U)	0.098 (U)	0.094 (U)	0.093 (U)	0.10 (U)	39
Sodium	mg/kg	51.7 (U)	52.8 (U)	50.7 (U)	49.4 (U)	50.5 (U)	48.4 (U)	61.6 (J)	52.3 (J)	NS
Thallium	mg/kg	0.060 (J)	0.047 (U)	**0.10 (J)**	0.077 (J)	**0.087 (J)**	0.062 (J)	**0.12 (J)**	**0.14 (J)**	0.078
Vanadium	mg/kg	9.4	7.5	14.1	11.3	11.8	9.8	19.9	23.4	134
Zinc	mg/kg	27.5	19.0	32.7	29.4	31.0	36.3	36.5	45.6	2,300
Mercury										
Mercury	mg/kg	0.0086 (U)	0.0095 (U)	0.0096 (U)	0.0080 (U)	0.0090 (U)	0.0081 (U)	0.063	0.057	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 – White Clay Creek Dam Sediments (Continued)

Analyte Name	Units	Dam 4 Transect 3	Dam 5 Transect 1	Dam 5 Transect 2	Dam 5 Transect 3	Dam 5 Transect 4	Dam 7 Transect 1	Dam 7 Transect 2	Dam 7 Transect 3	DNREC Soil Screening Value (Human Health)
Aluminum	mg/kg	6,310	7,690	7,720	9,810	4,380	6,460	16,600	23,000	51,200
Antimony	mg/kg	0.16 (U)	0.13 (U)	0.15 (U)	0.16 (U)	0.13 (U)	0.17 (U)	0.27 (U)	0.29 (U)	3.1
Arsenic	mg/kg	0.67 (J)	0.85 (J)	0.80 (J)	1.4	0.78 (J)	1.2	2.2	2.9	11
Barium	mg/kg	48.2	65.4	65.4	74.6	37.6	72.9	148	203	1,500
Beryllium	mg/kg	0.26 (J)	0.47	0.31 (J)	0.55	0.32 (J)	0.40 (J)	0.97	1.3	16
Cadmium	mg/kg	0.12 (U)	0.097 (U)	0.12 (U)	0.12 (U)	0.10 (U)	0.13 (U)	0.21 (U)	0.23 (U)	7.1
Calcium	mg/kg	448	941	450	766	414	771	1,720	1,590	NS
Chromium	mg/kg	14.5	13.9	14.8	17.6	9.7	17.1	29.5	37.3	214
Cobalt	mg/kg	6.6	5.0	6.7	6.2	3.7	6.3	10.7	14.7	34
Copper	mg/kg	6.9	8.3	15.8	12.8	5.7	9.7	20.2	25.9	310
Iron	mg/kg	13,700	9,680	13,700	12,700	9,430	17,900	22,900	31,400	74,767
Lead	mg/kg	7.1	5.9	5.3	9.6	3.7	4.0	11.8	12.1	400
Magnesium	mg/kg	2,540	2,000	3,140	2,470	1,400	2,740	4270	5,100	NS
Manganese	mg/kg	238	138	199	261	120	257	450	1,150	2,100
Nickel	mg/kg	10.7	8.7	12.1	12.3	6.4	15.2	20.5	24.0	150
Potassium	mg/kg	1,920	1,530	3,470	1,630	1,320	2,390	2,950	3,540	NS
Selenium	mg/kg	0.14 (U)	0.21 (J)	0.15 (J)	0.34 (J)	0.12 (J)	0.16 (J)	0.61 (J)	0.66 (J)	39
Silver	mg/kg	0.095 (U)	0.076 (U)	0.094 (U)	0.096 (U)	0.080 (U)	0.11 (U)	0.17 (U)	0.18 (U)	39
Sodium	mg/kg	48.7 (U)	44.6 (J)	71.2 (J)	49.2 (U)	41.2 (U)	54.1 (U)	90.7 (J)	98.7 (J)	NS
Thallium	mg/kg	**0.12 (J)**	**0.12 (J)**	**0.17 (J)**	**0.16 (J)**	**0.079 (J)**	**0.13 (J)**	**0.26 (J)**	**0.32 (J)**	0.078
Vanadium	mg/kg	21.9	19.9	22.2	24.1	13.9	23.4	41.7	54.4	134
Zinc	mg/kg	30.9	25.5	33.9	42.6	19.9	31.9	63.8	73.7	2,300
Mercury										
Mercury	mg/kg	0.046	0.024	0.020	0.038	0.014 (J)	0.027	0.068	0.060	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 – White Clay Creek Dam Sediments

Analyte Name	Units	Dam 2 Transect 1	Dam 2 Transect 2	Dam 2 Transect 3	Dam 3 Transect 1	Dam 3 Transect 2	Dam 3 Transect 3	Dam 4 Transect 1	Dam 4 Transect 2	DNREC Soil Screening Value (Human Health)
Polychlorinated Biphenyls (PCBs)										
Total PCBs	µg/kg	0.0 (U)	0.0 (U)	0.0 (U)	0.0 (U)	0.0 (U)	0.0 (U)	0.0 (U)	0.0 (U)	230
Dioxins and Furans										
1,2,3,4,6,7,8-HpCDD	pg/g	2.00 (J Z)	2.34 (J)	2.32 (J)	3.72 (J)	7.93	2.79 (J)	15.7	116	NS
1,2,3,4,6,7,8-HpCDF	pg/g	0.32 (J B)	0.54 (J B)	0.45 (J B)	0.79 (J B)	1.60 (J B)	0.76 (J B)	1.67 (J Z B)	17.8 (B)	NS
1,2,3,4,7,8,9-HpCDF	pg/g	0.086 (J)	0.058 (U)	0.077 (J Z)	0.085 (J)	0.12 (J Z)	0.046 (U)	0.092 (J Z)	1.31 (J)	NS
1,2,3,4,7,8-HxCDD	pg/g	0.16 (J B)	0.15 (J Z B)	0.11 (J Z B)	0.15 (J B)	0.19 (J Z B)	0.22 (U)	0.24 (J Z B)	1.22 (J B)	NS
1,2,3,4,7,8-HxCDF	pg/g	0.085 (J)	0.037 (U)	0.039 (U)	0.066 (U)	0.30 (J)	0.080 (U)	0.25 (U)	1.78 (J)	NS
1,2,3,6,7,8-HxCDD	pg/g	0.089 (J B)	0.13 (J Z B)	0.080 (J Z B)	0.17 (J Z)	0.30 (J)	0.22 (U)	0.43 (J)	3.17 (J Z)	NS
1,2,3,6,7,8-HxCDF	pg/g	0.029 (U)	0.039 (U)	0.041 (U)	0.074 (U)	0.10 (U)	0.086 (U)	0.27 (U)	1.27 (J)	NS
1,2,3,7,8,9-HxCDD	pg/g	0.10 (J Z B)	0.22 (J B)	0.16 (J B)	0.21 (J Z B)	0.34 (J B)	0.21 (U)	0.68 (J B)	3.39 (J B)	NS
1,2,3,7,8,9-HxCDF	pg/g	0.037 (U)	0.051 (U)	0.052 (U)	0.094 (U)	0.13(U)	0.10 (U)	0.32 (U)	0.16 (U)	NS
1,2,3,7,8-PeCDD	pg/g	0.037 (U)	0.085 (J Z B)	0.027 (U)	0.060 (J Z)	0.085 (J Z)	0.048 (U)	0.099 (J)	0.45 (J Z)	NS
1,2,3,7,8-PeCDF	pg/g	0.039 (U)	0.032 (U)	0.070 (U)	0.034 (U)	0.042 (U)	0.038 (U)	0.039 (U)	0.41 (J)	NS
2,3,4,6,7,8-HxCDF	pg/g	0.031 (U)	0.043 (U)	0.042 (U)	0.075 (U)	0.11 (U)	0.081 (U)	0.25 (U)	0.71 (J Z)	NS
2,3,4,7,8-PeCDF	pg/g	0.033 (U)	0.028 (U)	0.063 (U)	0.088 (J Z)	0.053 (J Z)	0.075 (J Z)	0.037 (U)	0.53 (J)	NS
2,3,7,8-TCDD	pg/g	0.033 (U)	0.035 (U)	0.056 (U)	0.027 (U)	0.025 (U)	0.026 (U)	0.075 (U)	0.11 (J Z)	4.8
2,3,7,8-TCDF	pg/g	0.028 (U)	0.049 (J)	0.032 (U)	0.040 (U)	0.045 (J Z)	0.031 (J Z)	0.029 (J Z)	0.71 (J)	NS
OCDD	pg/g	97.5 (B)	53.1 (B)	74.2 (B)	153 (B)	414 (B)	129 (B)	602 (B)	3,700 (B)	NS
OCDF	pg/g	1.29 (J B)	1.24 (J B)	1.39 (J B)	1.25 (J B)	3.00 (J B)	1.65 (J B)	3.40 (J B)	60.5 (B)	NS

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

Table 3-4 PCB and Dioxin/Furan Results – White Clay Creek Dam Sediments (Continued)

Analyte Name	Units	Dam 4 Transect 3	Dam 5 Transect 1	Dam 5 Transect 2	Dam 5 Transect 3	Dam 5 Transect 4	Dam 7 Transect 1	Dam 7 Transect 2	Dam 7 Transect 3	DNREC Soil Screening Value (Human Health)
Polychlorinated Biphenyls (PCBs)										
Total PCBs	µg/kg	0.0 (U)	0.0 (U)	0.0 (U)	0.0 (U)	0.0 (U)	0.0 (U)	0.0 (U)	0.0 (U)	230
Dioxins and Furans										
1,2,3,4,6,7,8-HpCDD	pg/g	37.2	16.6	21.5	83.9	5.67	67.6	101	94.1	NS
1,2,3,4,6,7,8-HpCDF	pg/g	2.71 (J B)	0.092 (J)	1.49 (J)	2.33 (J)	0.48 (J)	2.24 (J)	5.34	2.32 (J)	NS
1,2,3,4,7,8,9-HpCDF	pg/g	0.18 (J Z)	0.039 (U)	0.081 (J Z)	0.21 (J Z)	0.13 (J)	0.39 (J Z)	0.56 (J)	0.23 (J Z)	NS
1,2,3,4,7,8-HxCDD	pg/g	0.39 (J Z B)	0.25 (J B)	0.40 (J B)	0.91 (J B)	0.20 (J Z B)	0.46 (J B Z)	0.86 (J B)	0.92 (J B)	NS
1,2,3,4,7,8-HxCDF	pg/g	0.45 (J Z)	0.043 (U)	0.071 (U)	0.21 (J Z)	0.047 (U)	0.059 (U)	0.39 (J)	0.053 (U)	NS
1,2,3,6,7,8-HxCDD	pg/g	0.94 (J)	0.59 (J B)	0.65 (J B)	2.55 (J B)	0.31 (J B)	1.40 (J B)	2.05 (J B)	2.23 (J B)	NS
1,2,3,6,7,8-HxCDF	pg/g	0.23 (J Z)	0.047 (U)	0.072 (U)	0.17 (J Z)	0.049 (U)	0.14 (J Z)	0.43 (J)	0.15 (J Z)	NS
1,2,3,7,8,9-HxCDD	pg/g	1.23 (J B)	0.66 (J B)	0.71 (J B)	2.70 (J B)	0.31 (J B)	1.64 (J B)	2.59 (J B)	2.69 (J B)	NS
1,2,3,7,8,9-HxCDF	pg/g	0.079 (U)	0.059 (U)	0.084 (U)	0.097 (U)	0.068 (U)	0.090 (U)	0.11 (U)	0.072 (U)	NS
1,2,3,7,8-PeCDD	pg/g	0.14 (J Z)	0.11 (J)	0.13 (J Z)	0.18 (U)	0.13 (J)	0.062 (U)	0.25 (J Z)	0.26 (J Z)	NS
1,2,3,7,8-PeCDF	pg/g	0.23 (J Z)	0.028 (U)	0.094 (U)	0.037 (U)	0.063 (J Z)	0.13 (U)	0.088 (U)	0.066 (U)	NS
2,3,4,6,7,8-HxCDF	pg/g	0.069 (U)	0.046 (U)	0.064 (U)	0.074 (U)	0.058 (U)	0.066 (U)	0.19 (J Z)	0.11 (J Z)	NS
2,3,4,7,8-PeCDF	pg/g	0.14 (J)	0.023 (U)	0.076 (U)	0.048 (U)	0.071 (J Z)	0.12 (U)	0.12 (J Z)	0.051 (U)	NS
2,3,7,8-TCDD	pg/g	0.060 (U)	0.036 (U)	0.045 (U)	0.10 (U)	0.061 (U)	0.045 (U)	0.044 (U)	0.053 (U)	4.8
2,3,7,8-TCDF	pg/g	0.24 (J)	0.031 (U)	0.040 (U)	0.070 (U)	0.048 (U)	0.051 (U)	0.16 (J)	0.12 (J)	NS
OCDD	pg/g	1,490 (B)	282 (B)	628 (B)	1,830 (B)	129 (B)	1,050 (B)	2,550 (B)	2,200 (B)	NS
OCDF	pg/g	6.53 (J B)	0.17 (J B Z)	2.85 (J B)	7.13 (J B)	1.41 (J B)	16.7 (B)	13.9 (B)	6.05 (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 – White Clay Creek Dam Sediments

Analyte Name	Units	Dam 2 Transect 1	Dam 2 Transect 2	Dam 2 Transect 3	Dam 3 Transect 1	Dam 3 Transect 2	Dam 3 Transect 3	Dam 4 Transect 1	Dam 4 Transect 2	DNREC Soil Screening Value (Human Health)
1-Methylnaphthalene	µg/kg	0.53 (U)	2.7 (U)	5.4 (U)	0.49 (U)	0.50 (U)	0.50 (U)	0.49 (U)	1.7	18,000
2-Methylnaphthalene	µg/kg	0.35 (J Z)	1.0 (U Z)	2.0 (U Z)	0.39 (J)	0.38 (J)	0.29 (J)	0.67 (J)	2.0	24,000
Acenaphthene	µg/kg	0.17 (J B)	3.6 (J B)	1.3 (J B)	0.97	0.38 (J)	0.20 (J)	0.27 (J)	3.6	360,000
Acenaphthylene	µg/kg	0.34 (J)	0.94 (U)	1.9 (U)	2.3	2.6	0.23 (J)	0.95	4.3	NS
Anthracene	µg/kg	0.79	5.5	9.2	15	1.7	0.60 (J)	1.3	5.6	1,800,000
Benzo[a]anthracene	µg/kg	5.0	34	120	62 (D)	26	7.4	8.3	39	1,100
Benzo[a]pyrene	µg/kg	4.6	36	130	56 (D)	26	8.5	10	44 (D)	240
Benzo[b]fluoranthene	µg/kg	5.9 (Z)	51 (Z)	190 (Z)	59 (D)	28	11	17	54 (D)	1,110
Benzo[e]pyrene	µg/kg	4.7 (Z B)	32 (Z B)	120 (Z B)	42 (D)	20	7.9	10	41 (D)	NS
Benzo[g,h,i]perylene	µg/kg	1.8 (Z)	13 (Z)	49 (Z)	33	11	4.4	4.8	15	NS
Benzo[k]fluoranthene	µg/kg	5.0	39	140	46	25	9.4	11	49 (D)	11,000
C1-Chrysenes	µg/kg	2.2	11	64	13	13	2.7	4.2	22	NS
C1-Fluoranthenes/pyrene	µg/kg	4.4	30	82	32	17	5.3	8.2	39	NS
C1-Fluorenes	µg/kg	0.79 (U)	4.0 (U)	8.0 (U)	1.5	0.75 (U)	0.74 (U)	0.73 (U)	4.6	NS
C1-Phenanthrenes/Anthracenes	µg/kg	1.6	15	25	15	3.8	2.1	3.2	18	NS
C2-Chrysenes	µg/kg	1.8	4.3	69	6.2	8.2	1.6	2.9	0.80 (U)	NS
C2-Fluorenes	µg/kg	0.79 (U)	4.0 (U)	8.0 (U)	0.99	1.3	0.74 (U)	1.4	5.7	NS
C2-Naphthalenes	µg/kg	1.4	4.0 (U)	8.0 (U)	2.0	6.2	1.6	14	14	NS
C2-Phenanthrenes/Anthracenes	µg/kg	1.4	7.9	15	6.1	6.0	1.4	3.4	16	NS
C3-Chrysenes	µg/kg	1.8	4.0 (U)	35	2.4	4.5	0.97	1.8	7.6	NS
C3-Fluorenes	µg/kg	0.79 (U)	4.0 (U)	8.0 (U)	0.73 (U)	0.75 (U)	0.74 (U)	0.73 (U)	14	NS
C3-Naphthalenes	µg/kg	2.8 (B)	4.5 (B)	8.0 (U)	3.5 (B)	5.9 (B)	2.8 (B)	12 (B)	14 (B)	NS
C3-Phenanthrenes/Anthracenes	µg/kg	0.79 (U)	4.6	8.0 (U)	2.2	3.3	0.74 (U)	2.0	10	NS
C4-Chrysenes	µg/kg	1.8	4.0 (U)	8.0 (U)	0.73 (U)	0.75 (U)	0.74 (U)	0.73 (U)	3.6	NS
C4-Naphthalenes	µg/kg	0.95	4.0 (U)	8.0 (U)	1.1	0.75 (U)	0.74 (U)	6.9	5.5	NS
C4-Phenanthrenes/Anthracenes	µg/kg	0.79 (U)	4.0 (U)	8.0 (U)	1.1	1.6	0.74 (U)	2.9	9.0	NS
Chrysene	µg/kg	5.5 (Z)	50 (Z)	140 (Z)	62	28	12	13	52 (D)	110,000
Dibenz(a,h)anthracene	µg/kg	0.77 (J Z)	5.4 (Z)	20 (Z)	11	4.3	1.6	1.5	6.1	170
Fluoranthene	µg/kg	9.6 (B)	110 (B)	280 (B)	130	29	20	19	88 (D)	240,000
Fluorene	µg/kg	0.85	5.6	4.2 (J)	2.4	1.6	0.73 (J)	2.2	4.8	240,000
Indeno[1,2,3-cd]pyrene	µg/kg	1.8 (Z)	15 (Z)	53 (Z)	34	12	4.9	4.8	17	1,300
Naphthalene	µg/kg	0.46 (U)	2.3 (U)	4.7 (U)	0.42 (U)	0.44 (U)	0.43 (U)	0.51 (J)	1.4	3,800
Perylene	µg/kg	2.2 (Z)	10 (Z)	37 (Z)	18	8.2	2.7	24	57 (D)	NS
Phenanthrene	µg/kg	3.9	69	64	51	8.2	6.7	5.8	31	180,000
Pyrene	µg/kg	7.4	76	200	100	23	15	15	74 (D)	180,000

Table 3-5 PAH Results – White Clay Creek Dam Sediments (Continued)

Analyte Name	Units	Dam 4 Transect 3	Dam 5 Transect 1	Dam 5 Transect 2	Dam 5 Transect 3	Dam 5 Transect 4	Dam 7 Transect 1	Dam 7 Transect 2	Dam 7 Transect 3	DNREC Soil Screening Value (Human Health)
1-Methylnaphthalene	µg/kg	0.95	4.1 (U)	0.48 (U)	0.64 (J)	0.42 (U)	0.57 (U)	1.5	1.5	18,000
2-Methylnaphthalene	µg/kg	1.1	1.5 (U)	0.57 (J)	0.98	0.48 (J)	0.51 (J)	2.1	1.8	24,000
Acenaphthene	µg/kg	1.9	0.69 (U)	0.80	0.63 (J)	0.12 (J)	0.11 (J)	0.64 (J)	0.66 (J)	360,000
Acenaphthylene	µg/kg	2.0	1.4 (U)	0.64 (J)	1.2	0.28 (J)	0.35 (J)	1.9	1.7	NS
Anthracene	µg/kg	4.7	0.77 (U)	3.3	1.4	0.91	0.45 (J)	2.2	2.8	1,800,000
Benzo[a]anthracene	µg/kg	33	1.5 (J)	8.9	13	6.2	2.7	17	18	1,100
Benzo[a]pyrene	µg/kg	37	1.9 (J)	9.2	15	6.2	3.1	20	21	240
Benzo[b]fluoranthene	µg/kg	45 (D)	3.1 (U)	13	19	7.6	4.2	31	33	1,110
Benzo[e]pyrene	µg/kg	34	2.1 (J)	8.5	13	5.4	3.0	21	21	NS
Benzo[g,h,i]perylene	µg/kg	12	1.2 (U)	3.3	5.5	2.6	1.6	8.0	8.8	NS
Benzo[k]fluoranthene	µg/kg	41 (D)	2.0 (J)	10	16	6.6	3.4	24	25	11,000
C1-Chrysenes	µg/kg	18	6.0 (U)	6.3	15	2.7	2.1	10	8.8	NS
C1-Fluoranthenes/pyrene	µg/kg	36	6.0 (U)	8.4	13	5.1	3.1	16	18	NS
C1-Fluorenes	µg/kg	3.1	6.0 (U)	1.9	4.1	0.63 (U)	2.6	12	9.0	NS
C1-Phenanthrenes/Anthracenes	µg/kg	20	6.0 (U)	4.3	6.0	2.0	1.9	7.3	7.2	NS
C2-Chrysenes	µg/kg	11	6.0 (U)	2.5	5.2	1.5	1.9	9.1	5.9	NS
C2-Fluorenes	µg/kg	5.6	6.0 (U)	2.7	1.9	0.67	0.85 (U)	2.4	2.6	NS
C2-Naphthalenes	µg/kg	12	6.0 (U)	5.0	9.5	5.3	5.6	30	34	NS
C2-Phenanthrenes/Anthracenes	µg/kg	14	6.0 (U)	3.9	6.0	1.8	2.0	8.8	7.5	NS
C3-Chrysenes	µg/kg	4.9	6.0 (U)	0.72 (U)	1.5	0.73	0.85 (U)	3.7	2.1	NS
C3-Fluorenes	µg/kg	12	6.0 (U)	2.3	0.76 (U)	0.63 (U)	2.2	12	12	NS
C3-Naphthalenes	µg/kg	18 (B)	6.0 (U)	6.6 (B)	9.4 (B)	8.4 (B)	6.9 (B)	19 (B)	20 (B)	NS
C3-Phenanthrenes/Anthracenes	µg/kg	9.5	6.0 (U)	1.7	3.4	1.1	0.85 (U)	3.9	4.6	NS
C4-Chrysenes	µg/kg	2.7	6.0 (U)	1.0	0.76 (U)	0.63 (U)	0.85	3.0	3.4	NS
C4-Naphthalenes	µg/kg	16	6.0 (U)	1.8	2.8	0.63 (U)	1.5	6.2	6.5	NS
C4-Phenanthrenes/Anthracenes	µg/kg	7.7	6.0 (U)	2.1	3.1	0.63 (U)	1.3	8.3	9.4	NS
Chrysene	µg/kg	46 (D)	3.8 (J)	11	19	7.4	3.9	26	27	110,000
Dibenz(a,h)anthracene	µg/kg	4.9	1.2 (U)	1.4	2.5	1.0	0.95	4.5	2.8	170
Fluoranthene	µg/kg	80 (D)	2.4 (J)	18	31	12	5.4	34	39	240,000
Fluorene	µg/kg	3.6	1.3 (J)	2.3	2.5	0.89	1.6	5.9	5.4	240,000
Indeno[1,2,3-cd]pyrene	µg/kg	14	1.4 (U)	3.5	6.6	2.9	1.8	9.5	8.4	1,300
Naphthalene	µg/kg	0.73 (J)	3.5 (U)	0.47 (J)	0.72 (J)	0.37 (J)	0.49 (U)	1.2 (J)	1.1 (J)	3,800
Perylene	µg/kg	100 (D)	150	7.9	120 (D)	7.7	70 (D)	290 (D)	450 (D)	NS
Phenanthrene	µg/kg	29	3.2 (U)	8.5	12	3.2	2.0	9.8	13	180,000
Pyrene	µg/kg	59 (D)	2.7 (J)	16	23	9.5	5.1	29	36	180,000

Table 3-6 Pesticide Results – White Clay Creek Dam Sediments

Analyte Name	Units	Dam 2 Transect 1	Dam 2 Transect 2	Dam 2 Transect 3	Dam 3 Transect 1	Dam 3 Transect 2	Dam 3 Transect 3	Dam 4 Transect 1	Dam 4 Transect 2	DNREC Soil Screening Value (Human Health)
4,4'-DDD	µg/kg	1.4 (U)	1.4 (U)	1.4 (U)	1.3 (U)	1.3 (U)	1.3 (U)	1.2 (U)	1.4 (U)	190
4,4'-DDE	µg/kg	0.95 (U)	0.94 (U)	0.95 (U)	0.87 (U)	0.90 (U)	0.88 (U)	0.86 (U)	0.95 (U)	2,000
4,4'-DDT	µg/kg	1.5 (U)	1.5 (U)	1.5 (U)	1.4 (U)	1.4 (U)	1.4 (U)	1.3 (U)	1.5 (U)	1,900
Aldrin	µg/kg	1.2 (U)	1.2 (U)	1.2 (U)	1.1 (U)	1.1 (U)	1.1 (U)	1.1 (U)	1.2 (U)	39
alpha-BHC	µg/kg	0.82 (U)	0.81 (U)	0.82 (U)	0.75 (U)	0.77 (U)	0.75 (U)	0.74 (U)	0.81 (U)	86
beta-BHC	µg/kg	0.90 (U)	0.89 (U)	0.90 (U)	0.83 (U)	0.85 (U)	0.83 (U)	0.82 (U)	0.90 (U)	300
cis-Chlordane	µg/kg	1.3 (U)	1.3 (U)	1.3 (U)	1.2 (U)	1.2 (U)	1.2 (U)	1.2 (U)	1.3 (U)	NS
delta-BHC	µg/kg	0.49 (U)	0.49 (U)	0.49 (U)	0.45 (U)	0.46 (U)	0.45 (U)	0.45 (U)	0.49 (U)	NS
Dieldrin	µg/kg	1.0 (U)	1.0 (U)	1.0 (U)	0.96 (U)	0.99 (U)	0.96 (U)	0.95 (U)	1.0 (U)	34
Endosulfan I	µg/kg	1.2 (U)	1.2 (U)	1.2 (U)	1.1 (U)	1.2 (U)	1.1 (U)	1.1 (U)	1.2 (U)	NS
Endosulfan II	µg/kg	2.1 (U)	2.0 (U)	2.1 (U)	1.9 (U)	1.9 (U)	1.9 (U)	1.9 (U)	2.1 (U)	NS
Endosulfan sulfate	µg/kg	1.0 (U)	1.0 (U)	1.0 (U)	0.93 (U)	0.95 (U)	0.93 (U)	0.92 (U)	1.0 (U)	38,000
Endrin	µg/kg	1.2 (U)	1.1 (U)	1.2 (U)	1.1 (U)	1.1 (U)	1.1 (U)	1.1 (U)	1.1 (U)	1,900
Endrin aldehyde	µg/kg	1.9 (U)	1.9 (U)	1.9 (U)	1.7 (U)	1.8 (U)	1.8 (U)	1.7 (U)	1.9 (U)	NS
Endrin ketone	µg/kg	1.6 (U)	1.5 (U)	1.6 (U)	1.4 (U)	1.5 (U)	1.4 (U)	1.4 (U)	1.6 (U)	NS
gamma-BHC (Lindane)	µg/kg	0.74 (U)	0.74 (U)	0.74 (U)	0.68 (U)	0.70 (U)	0.69 (U)	0.68 (U)	0.74 (U)	570
Heptachlor	µg/kg	0.95 (U)	0.94 (U)	0.95 (U)	0.87 (U)	0.90 (U)	0.88 (U)	0.86 (U)	0.95 (U)	130
Heptachlor epoxide	µg/kg	1.2 (U)	1.2 (U)	1.2 (U)	1.1 (U)	1.1 (U)	1.1 (U)	1.1 (U)	1.2 (U)	70
Methoxychlor	µg/kg	1.8 (U)	1.8 (U)	1.8 (U)	1.7 (U)	1.7 (U)	1.7 (U)	1.7 (U)	1.8 (U)	32,000
Toxaphene	µg/kg	29 (U)	29 (U)	29 (U)	27 (U)	27 (U)	27 (U)	26 (U)	29 (U)	490
trans-Chlordane	µg/kg	1.4 (U)	1.4 (U)	1.4 (U)	1.3 (U)	1.3 (U)	1.3 (U)	1.3 (U)	1.4 (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 – White Clay Creek Dam Sediments (Continued)

Analyte Name	Units	Dam 4 Transect 3	Dam 5 Transect 1	Dam 5 Transect 2	Dam 5 Transect 3	Dam 5 Transect 4	Dam 7 Transect 1	Dam 7 Transect 2	Dam 7 Transect 3	DNREC Soil Screening Value (Human Health)
4,4'-DDD	µg/kg	1.3 (U)	1.0 (U)	1.2 (U)	1.3 (U)	1.1 (U)	1.5 (U)	2.3 (U)	2.3 (U)	190
4,4'-DDE	µg/kg	0.88 (U)	0.72 (U)	0.86 (U)	0.91 (U)	0.74 (U)	1.0 (U)	1.6 (U)	1.6 (U)	2,000
4,4'-DDT	µg/kg	1.4 (U)	1.1 (U)	1.3 (U)	1.4 (U)	1.1 (U)	1.6 (U)	2.5 (U)	2.5 (U)	1,900
Aldrin	µg/kg	1.1 (U)	0.92 (U)	1.1 (U)	1.2 (U)	0.94 (U)	1.3 (U)	2.1 (U)	2.1 (U)	39
alpha-BHC	µg/kg	0.76 (U)	0.62 (U)	0.74 (U)	0.78 (U)	0.63 (U)	0.87 (U)	1.4 (U)	1.4 (U)	86
beta-BHC	µg/kg	0.84 (U)	0.68 (U)	0.82 (U)	0.86 (U)	0.70 (U)	0.95 (U)	1.5 (U)	1.5 (U)	300
cis-Chlordane	µg/kg	1.2 (U)	0.97 (U)	1.2 (U)	1.2 (U)	0.99 (U)	1.3 (U)	2.2 (U)	2.2 (U)	NS
delta-BHC	µg/kg	0.46 (U)	0.37 (U)	0.45 (U)	0.47 (U)	0.38 (U)	0.52 (U)	0.83 (U)	0.84 (U)	NS
Dieldrin	µg/kg	0.97 (U)	0.79 (U)	0.95 (U)	1.0 (U)	0.81 (U)	1.1 (U)	1.8 (U)	1.8 (U)	34
Endosulfan I	µg/kg	1.1 (U)	0.93 (U)	1.1 (U)	1.2 (U)	0.95 (U)	1.3 (U)	2.1 (U)	2.1 (U)	NS
Endosulfan II	µg/kg	1.9 (U)	1.6 (U)	1.9 (U)	2.0 (U)	1.6 (U)	2.2 (U)	3.5 (U)	3.5 (U)	NS
Endosulfan sulfate	µg/kg	0.94 (U)	0.77 (U)	0.92 (U)	0.96 (U)	0.78 (U)	1.1 (U)	1.7 (U)	1.7 (U)	38,000
Endrin	µg/kg	1.1 (U)	0.88 (U)	1.0 (U)	1.1 (U)	0.90 (U)	1.2 (U)	2.0 (U)	2.0 (U)	1,900
Endrin aldehyde	µg/kg	1.8 (U)	1.4 (U)	1.7 (U)	1.8 (U)	1.5 (U)	2.0 (U)	3.2 (U)	3.2 (U)	NS
Endrin ketone	µg/kg	1.4 (U)	1.2 (U)	1.4 (U)	1.5 (U)	1.2 (U)	1.7 (U)	2.6 (U)	2.7 (U)	NS
gamma-BHC (Lindane)	µg/kg	0.69 (U)	0.57 (U)	0.68 (U)	0.71 (U)	0.58 (U)	0.79 (U)	1.3 (U)	1.3 (U)	570
Heptachlor	µg/kg	0.88 (U)	0.72 (U)	0.86 (U)	0.91 (U)	0.74 (U)	1.0 (U)	1.6 (U)	1.6 (U)	130
Heptachlor epoxide	µg/kg	1.1 (U)	0.91 (U)	1.1 (U)	1.1 (U)	0.93 (U)	1.3 (U)	2.0 (U)	2.1 (U)	70
Methoxychlor	µg/kg	1.7 (U)	1.4 (U)	1.7 (U)	1.8 (U)	1.4 (U)	1.9 (U)	3.1 (U)	3.1 (U)	32,000
Toxaphene	µg/kg	27 (U)	22 (U)	26 (U)	28 (U)	23 (U)	31 (U)	49 (U)	50 (U)	490
trans-Chlordane	µg/kg	1.3 (U)	1.1 (U)	1.3 (U)	1.4 (U)	1.1 (U)	1.5 (U)	2.4 (U)	2.4 (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.

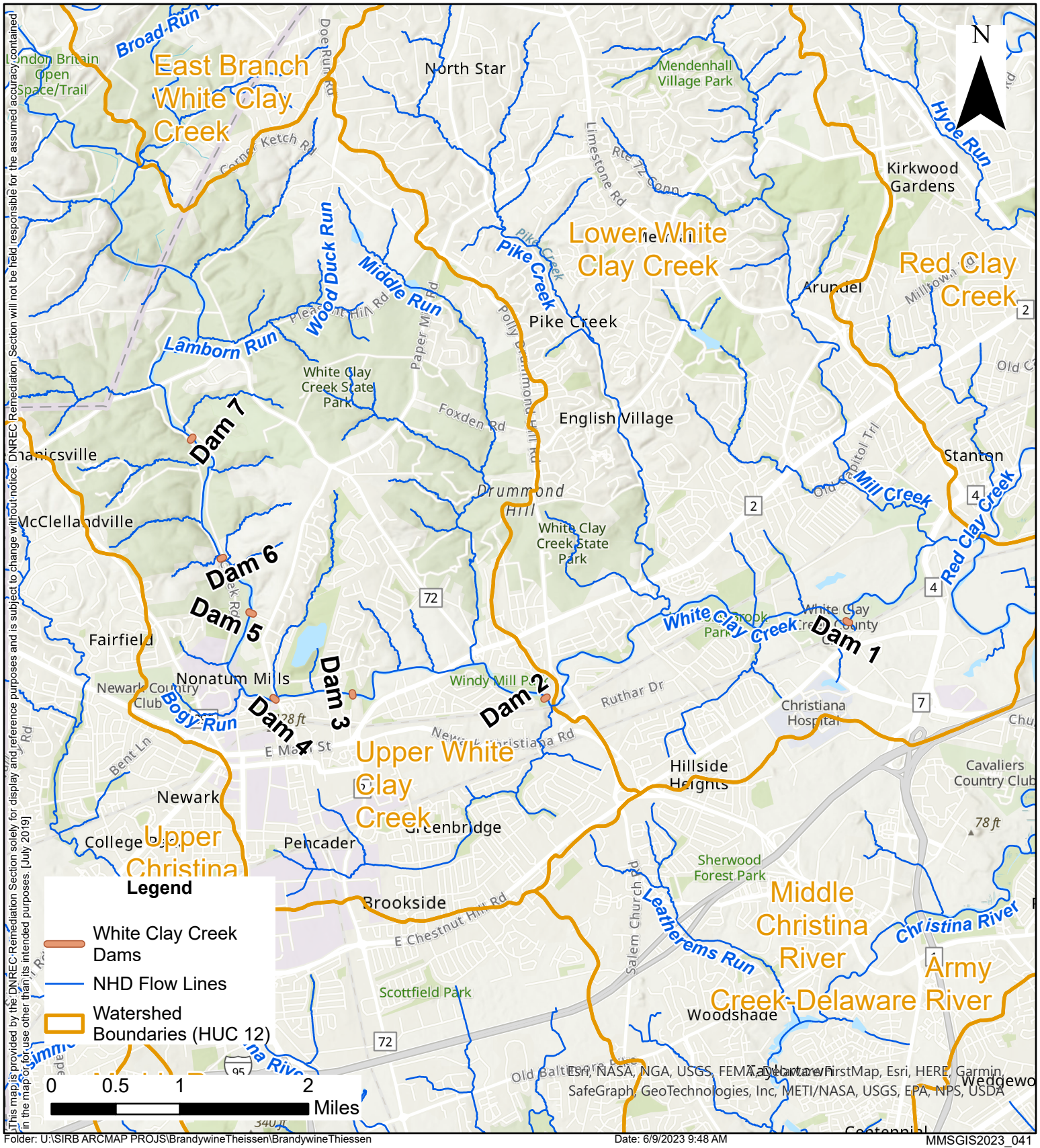
Table 3-7 Per- and Polyfluoroalkyl Substances (PFAS) Results – White Clay Creek Dam Sediments

Analyte Name	Units	Dam 2 Transect 1	Dam 3 Transect 1	Dam 4 Transect 1	Dam 5 Transect 1	Dam 7 Transect 1	DNREC Soil Screening Value (Human Health)
11Cl-PF3OUdS	µg/kg	0.034 (U)	0.031 (U)	0.034 (U)	0.028 (U)	0.037 (U)	NS
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	µg/kg	0.043 (U)	0.039 (U)	0.042 (U)	0.035 (U)	0.046 (U)	NS
4:2 FTS	µg/kg	0.056 (U)	0.052 (U)	0.055 (U)	0.046 (U)	0.060 (U)	NS
5:3 FTCA	µg/kg	0.042 (U)	0.038 (U)	0.041 (U)	0.034 (U)	0.045 (U)	NS
6:2 FTCA	µg/kg	0.11 (U)	0.10 (U)	0.11 (U)	0.091 (U)	0.12 (U)	NS
6:2 FTS	µg/kg	0.062 (J)	0.027 (U)	0.029 (U)	0.024 (U)	0.032 (U)	NS
6:2 FTUCA	µg/kg	0.078 (U)	0.072 (U)	0.077 (U)	0.064 (U)	0.084 (U)	NS
8:2 FTS	µg/kg	0.038 (U)	0.035 (U)	0.038 (U)	0.032 (U)	0.041 (U)	NS
9Cl-PF3ONS	µg/kg	0.038 (U)	0.035 (U)	0.038 (U)	0.032 (U)	0.041 (U)	NS
HFPO-DA (GenX)	µg/kg	0.045 (U)	0.041 (U)	0.045 (U)	0.037 (U)	0.049 (U)	23
Hydro-PS Acid	µg/kg	0.053 (U)	0.048 (U)	0.052 (U)	0.043 (U)	0.057 (U)	NS
NEtFOSAA	µg/kg	0.053 (U)	0.048 (U)	0.052 (U)	0.043 (U)	0.057 (U)	NS
NFDHA	µg/kg	0.044 (U)	0.040 (U)	0.043 (U)	0.036 (U)	0.047 (U)	NS
NMeFOSAA	µg/kg	0.025 (U)	0.023 (U)	0.025 (U)	0.021 (U)	0.027 (U)	NS
Perfluorobutanesulfonic acid (PFBS)	µg/kg	0.042 (U)	0.038 (U)	0.041 (U)	0.034 (U)	0.045 (U)	1,900
Perfluorobutanoic acid (PFBA)	µg/kg	0.10 (J B)	0.046 (U)	0.050 (U)	0.042 (U)	0.055 (U)	NS
Perfluorodecanoic acid (PFDA)	µg/kg	0.053 (U)	0.048 (U)	0.052 (U)	0.043 (U)	0.057 (U)	NS
Perfluorododecanoic acid (PFDoA)	µg/kg	0.033 (U)	0.030 (U)	0.037 (J)	0.027 (U)	0.036 (U)	NS
Perfluoroheptanesulfonic acid (PFHpS)	µg/kg	0.054 (U)	0.049 (U)	0.053 (U)	0.044 (U)	0.058 (U)	NS
Perfluoroheptanoic acid (PFHpA)	µg/kg	0.042 (U)	0.038 (U)	0.041 (U)	0.034 (U)	0.045 (U)	NS
Perfluorohexanesulfonic acid (PFHxS)	µg/kg	0.032 (U)	0.029 (U)	0.032 (U)	0.026 (U)	0.034 (U)	130

Table 3-7 Per- and Polyfluoroalkyl Substances (PFAS) Results – White Clay Creek Dam Sediments (Continued)

Analyte Name	Units	Dam 2 Transect 1	Dam 3 Transect 1	Dam 4 Transect 1	Dam 5 Transect 1	Dam 7 Transect 1	DNREC Soil Screening Value (Human Health)
Perfluorohexanoic acid (PFHxA)	µg/kg	0.072 (J)	0.031 (U)	0.034 (U)	0.028 (U)	0.037 (U)	NS
Perfluorononanoic acid (PFNA)	µg/kg	0.024 (U)	0.022 (U)	0.024 (U)	0.020 (U)	0.026 (U)	19
Perfluorooctanesulfonic acid (PFOS)	µg/kg	0.38	0.043 (U)	0.047 (U)	0.039 (U)	0.051 (U)	13
Perfluorooctanoic acid (PFOA)	µg/kg	0.058 (U)	0.054 (U)	0.058 (U)	0.048 (U)	0.063 (U)	19
Perfluoropentanesulfonic acid (PFPeS)	µg/kg	0.041 (U)	0.037 (U)	0.040 (U)	0.033 (U)	0.044 (U)	NS
Perfluoropentanoic acid (PFPeA)	µg/kg	0.045 (U)	0.041 (U)	0.52	0.037 (U)	0.049 (U)	NS
Perfluorotetradecanoic acid (PFTeA)	µg/kg	0.041 (U)	0.037 (U)	0.040 (U)	0.033 (U)	0.044 (U)	NS
Perfluorotridecanoic acid (PFTrDA)	µg/kg	0.023 (U)	0.021 (U)	0.030 (J)	0.019 (U)	0.025 (U)	NS
Perfluoroundecanoic acid (PFUnA)	µg/kg	0.046 (U)	0.042 (U)	0.046 (U)	0.038 (U)	0.050 (U)	NS
PFEESA	µg/kg	0.035 (U)	0.032 (U)	0.035 (U)	0.029 (U)	0.038 (U)	NS
PFMBA	µg/kg	0.049 (U)	0.045 (U)	0.049 (U)	0.041 (U)	0.053 (U)	NS
PFMOAA	µg/kg	0.023 (U)	0.021 (U)	0.023 (U)	0.019 (U)	0.025 (U)	NS
PFMPA	µg/kg	0.026 (U)	0.024 (U)	0.026 (U)	0.022 (U)	0.028 (U)	NS
PFO2HxA	µg/kg	0.064 (U)	0.059 (U)	0.063 (U)	0.052 (U)	0.069 (U)	NS
PFO3OA	µg/kg	0.044 (U)	0.040 (U)	0.043 (U)	0.036 (U)	0.047 (U)	NS
PPF Acid	µg/kg	0.032 (U Z)	0.029 (U Z)	0.032 (U Z)	0.026 (U Z)	0.034 (U Z)	NS

FIGURES



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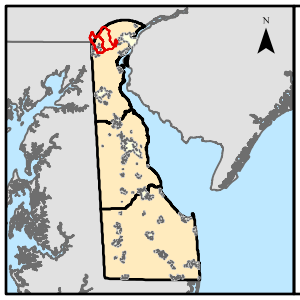
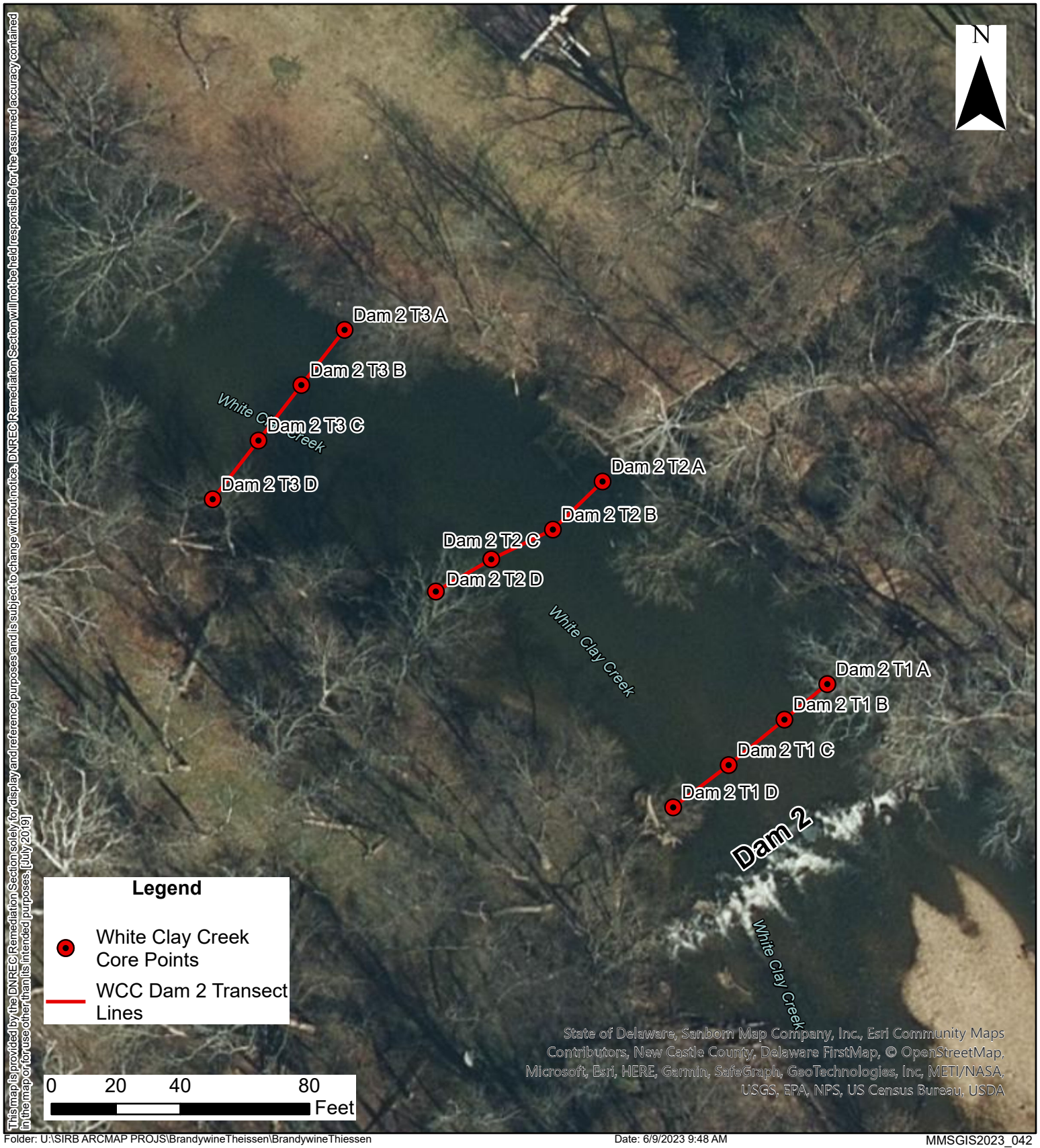


Sources: Dam Locations [DNREC]; NHD flowlines [USGS]; Watershed Boundaries [USGS]

1:63,630
1 inch equals 1 mile

FIGURE 1
WHITE CLAY CREEK DAMS SEDIMENT EVALUATION
DAM LOCATION MAP
NEW CASTLE COUNTY, DELAWARE



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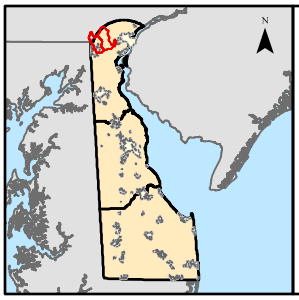

Sources: 2022 Aerial Imagery [FirstMAP]; Dam Locations [DNREC]; Sample locations [DNREC]

1:480
1 inch equals 40 feet

FIGURE 2
WHITE CLAY CREEK DAM 2 SAMPLE LOCATIONS AND TRANSECTS
NEW CASTLE COUNTY, DELAWARE

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Date: 6/9/2023 9:48 AM

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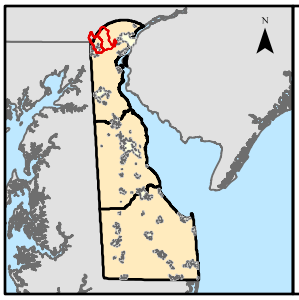
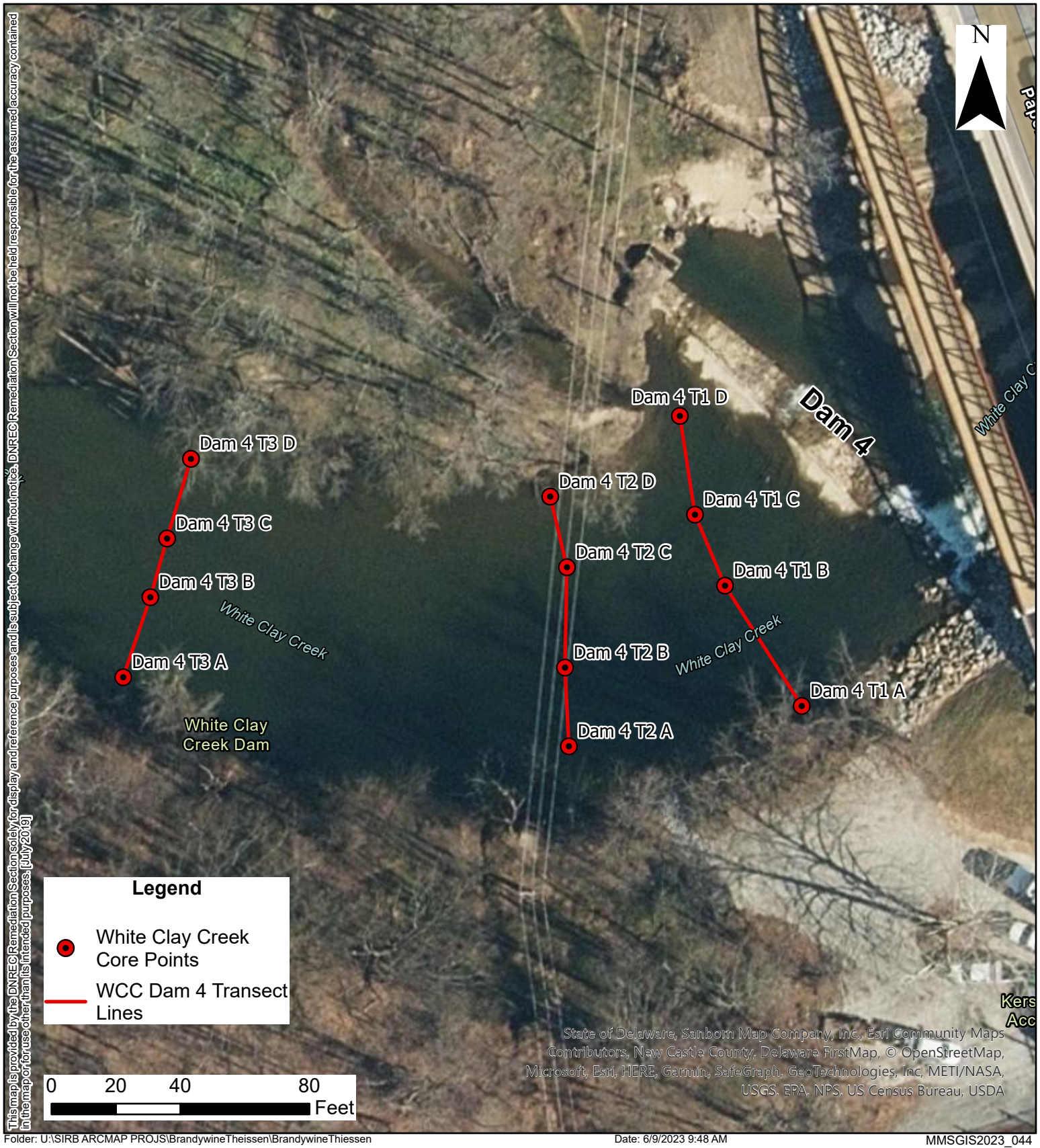


Sources: 2022 Aerial Imagery [FirstMAP]; Dam Locations [DNREC]; Sample locations [DNREC]

1:480
1 inch equals 40 feet

FIGURE 3
WHITE CLAY CREEK DAM 3 SAMPLE LOCATIONS AND TRANSECTS
NEW CASTLE COUNTY, DELAWARE



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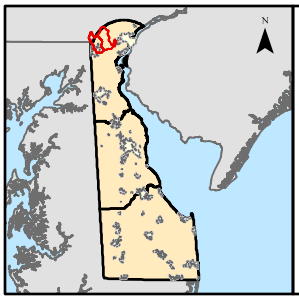
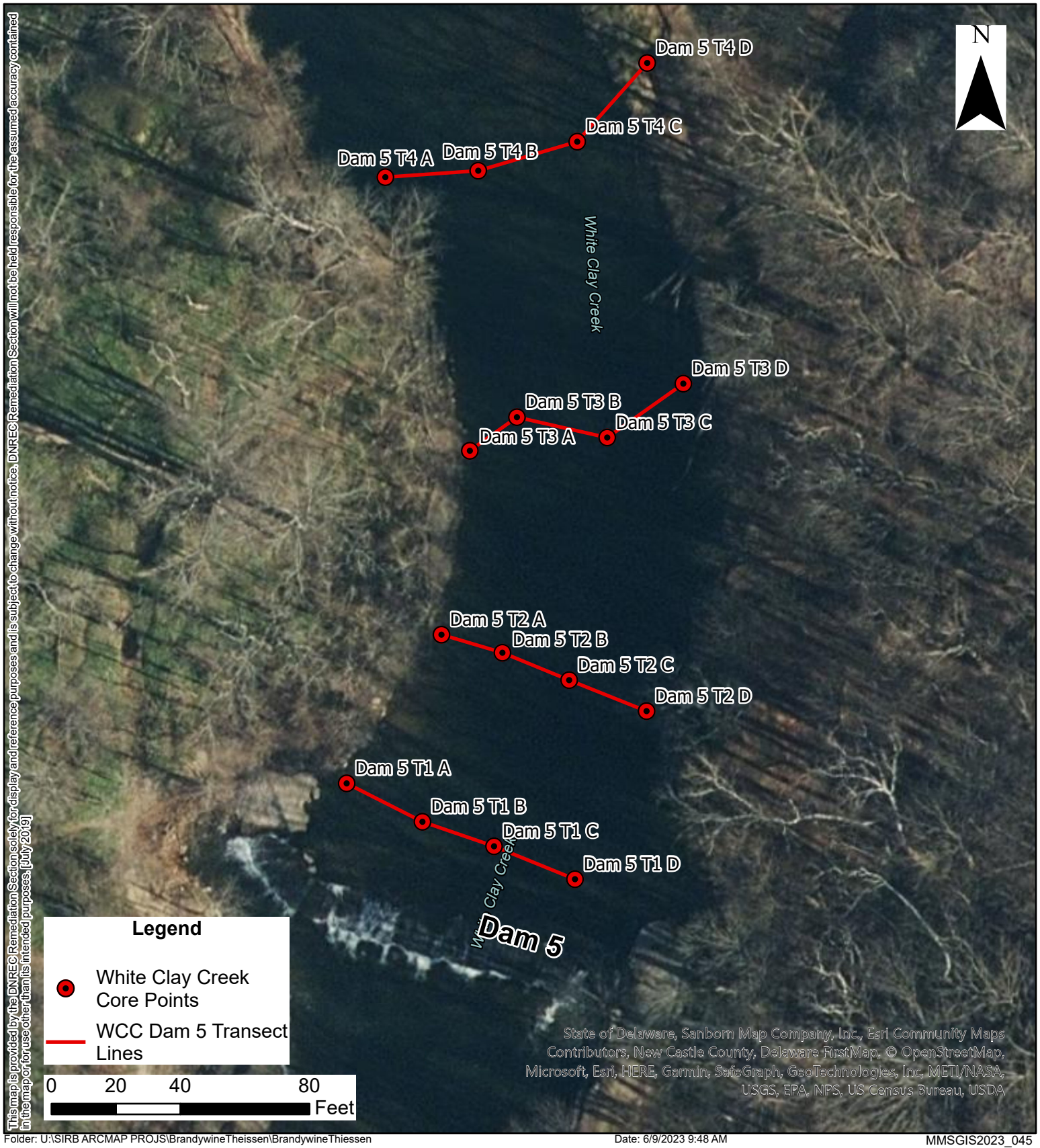


Sources: 2022 Aerial Imagery [FirstMAP]; Dam Locations [DNREC]; Sample locations [DNREC]

1:480
1 inch equals 40 feet

FIGURE 4
WHITE CLAY CREEK DAM 4 SAMPLE LOCATIONS AND TRANSECTS
NEW CASTLE COUNTY, DELAWARE



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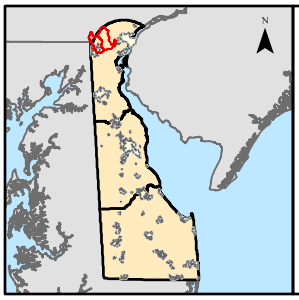
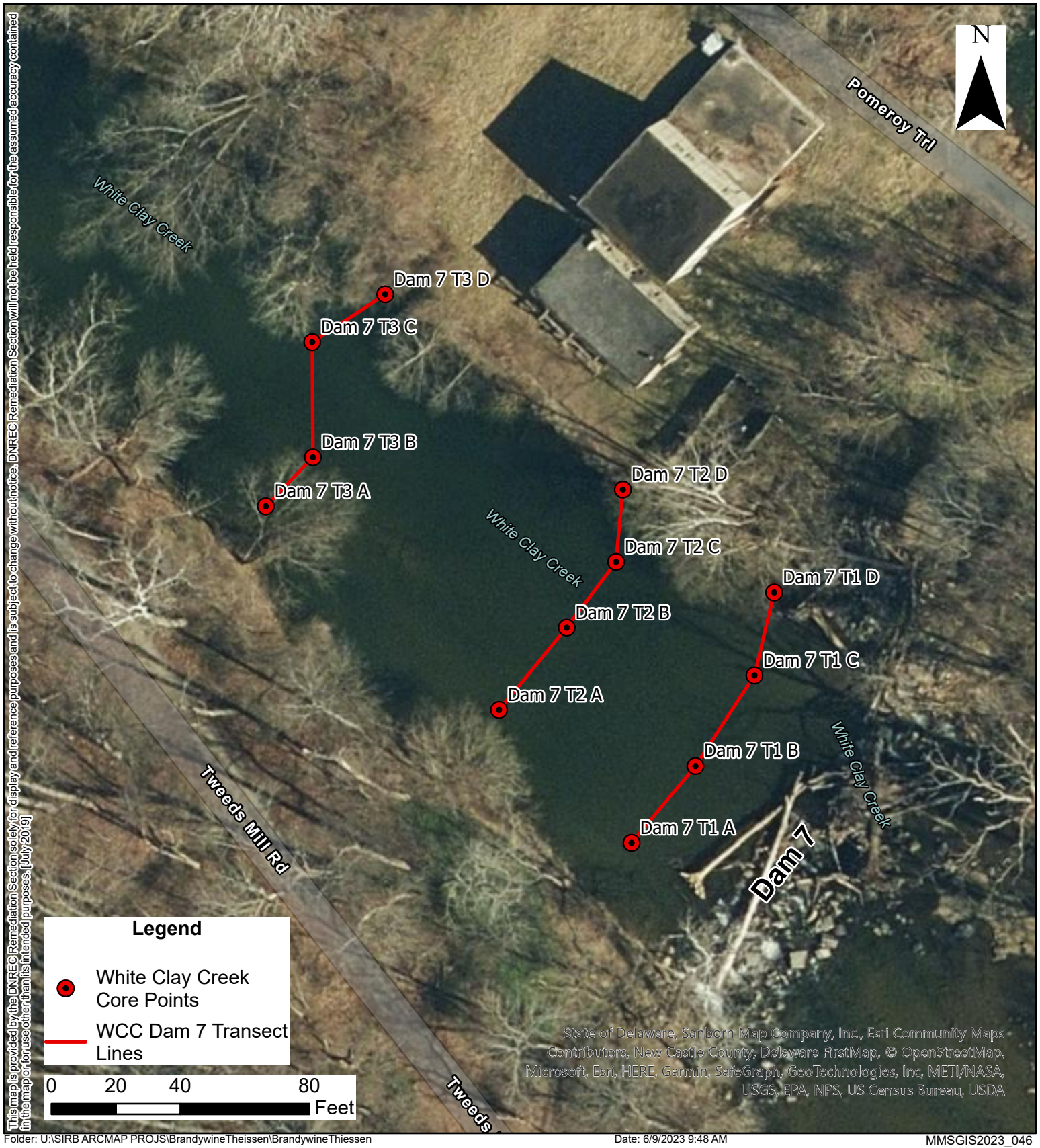
MMSGIS2023_045



Sources: 2022 Aerial Imagery [FirstMAP]; Dam Locations [DNREC]; Sample locations [DNREC]

1:480
1 inch equals 40 feet

FIGURE 5
WHITE CLAY CREEK DAM 5 SAMPLE LOCATIONS AND TRANSECTS
NEW CASTLE COUNTY, DELAWARE



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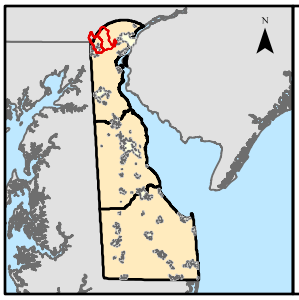

Sources: 2022 Aerial Imagery [FirstMAP]; Dam Locations [DNREC]; Sample locations [DNREC]

1:480
1 inch equals 40 feet

FIGURE 6
WHITE CLAY CREEK DAM 7 SAMPLE LOCATIONS AND TRANSECTS

NEW CASTLE COUNTY, DELAWARE

APPENDIX A

AQUASURVEY, INC. FIELD LOGS

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client :	New Castle Conservation District		Project :	White Clay Creek Dam 2		Logger:	TD	
Job#:	42-126	Date:	11/9/22	Time:	1015	Crew:	AF	
Coordinates:	N	615511.7	E	573786.2		Vessel:	N/A	
Core # :	T1 A	Zone: DE	Datum	NAD 83		Deploy:	1	2	3
Project Depth [PD] [ft]:						Core Penetration Length (ft.):	2.0		
Measured Water Depth [MWD] [ft.]:		2'				Recovered Core Length (ft.):	0.5		
						Sample Length Retained (ft.):	0.5		
						Core Volume Retained (gal.):	-		
						Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:									

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top 0.0		Coarse sand, brown gravel.
0.5		
Bottom		

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

Conditions: Sunny 50's

Comments: Core to client.

Core Volumes

Nominal core-barrel diameter		EST. Volume
(3.0")		.25 gal/ft
3.5"	8.0"	.33 gal/ft
4.0"		.50 gal/ft

Liner Type: (Soft) Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	N
Oil Present	N
Odor Present	N
Debris Present	N
Within 10% of Req'd Core Length	N
Photo	N

Pushcorer (Slambar)

Eckman Ponar: Standard / Petite

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client :	New Castle Conservation District		Project :	White Clay Creek Dam 2		Logger:	TD	
Job#:	42-126	Date:	11/9/22	Time:	1035	Crew:	AF	
Coordinates:	N	615500.7	E	573772.9		Vessel:	N/A	
Core # :	T1 B	Zone: DE	Datum	NAD 83		Deploy:	1	2	3
Project Depth [PD] [ft]:						Core Penetration Length (ft.):	2.0		
Measured Water Depth [MWD] [ft.]:		1.0"				Recovered Core Length (ft.):	0.9		
						Sample Length Retained (ft.):	0.9		
						Core Volume Retained (gal.):	-		
						Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:									

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top 0.0		Brown coarse sand & gravel
0.9		
Bottom		

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

Conditions: Sunny 50's

Comments: Core to client.

Core Volumes

Nominal core-barrel diameter	EST. Volume
(3.0")	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: (Soft) Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	N
Oil Present	N
Odor Present	N
Debris Present	N
Within 10% of Req'd Core Length	N
Photo	N

Pushcorer (Slambar)

Eckman Ponar: Standard / Petite

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client :	New Castle Conservation District		Project :	White Clay Creek Dam 2		Logger:	TD	
Job#:	42-126	Date:	11/9/22	Time:	1100	Crew:	AF	
Coordinates:	N	615486.6	E	573755.6		Vessel:	N/A	
Core # :	T1 C	Zone: DE	Datum	NAD 83		Deploy:	1	2	3
Project Depth [PD] [ft]:						Core Penetration Length (ft.):	2.5		
Measured Water Depth [MWD] [ft.]:		0.5				Recovered Core Length (ft.):	1.0		
						Sample Length Retained (ft.):	1.0		
						Core Volume Retained (gal.):	-		
						Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:									

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top 0.0		Brown sand to coarse gravel.
1.3		
Bottom		

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

Conditions:

Comments: Core to client.

Core Volumes

Nominal core-barrel diameter	EST. Volume
(3.0")	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: (Soft) Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	N
Oil Present	N
Odor Present	N
Debris Present	N
Within 10% of Req'd Core Length	N
Photo	N

Pushcorer (Slambar)

Eckman Ponar: Standard / Petite

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client :	New Castle Conservation District		Project :	White Clay Creek Dam 2		Logger:	TD	
Job#:	42-126	Date:	11/9/22	Time:	1130	Crew:	AF	
Coordinates:	N	615473.5	E	573738.4		Vessel:	N/A	
Core # :	T1 D	Zone: DE	Datum	NAD 83		Deploy:	1	2	3
Project Depth [PD] [ft]:						Core Penetration Length (ft.):	2.5		
Measured Water Depth [MWD] [ft.]:		1.0				Recovered Core Length (ft.):	1.1		
						Sample Length Retained (ft.):	1.1		
						Core Volume Retained (gal.):	-		
						Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:									

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top 0.0		Brown coarse sand & gravel.
1.1		
Bottom		

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

Conditions: Sunny 50's

Comments: Core to client.

Core Volumes

Nominal core-barrel diameter	EST. Volume
(3.0")	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: (Soft) Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	N
Oil Present	N
Odor Present	N
Debris Present	N
Within 10% of Req'd Core Length	N
Photo	N

Pushcorer (Slambar)

Eckman Ponar: Standard / Petite

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client :	New Castle Conservation District		Project :	White Clay Creek Dam 2		Logger:	TD	
Job#:	42-126	Date:	11/9/22	Time:	1220	Crew:	AF	
Coordinates:	N	615474.5	E	573716.5		Vessel:	N/A	
Core # :	T2 A	Zone: DE	Datum	NAD 83		Deploy:	1	2	3
Project Depth [PD] [ft]:						Core Penetration Length (ft.):	2.5		
Measured Water Depth [MWD] [ft.]:		2.5				Recovered Core Length (ft.):	1.7		
						Sample Length Retained (ft.):	1.7		
						Core Volume Retained (gal.):	-		
						Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:									

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top 0.0		Brown coarse sand & gravel.
1.7		
Bottom		

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

Conditions: Sunny 50's

Comments: Core to client.

Core Volumes

Nominal core-barrel diameter		EST. Volume
(3.0")		.25 gal/ft
3.5"	8.0"	.33 gal/ft
4.0"		.50 gal/ft

Liner Type: (Soft) Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	N
Oil Present	N
Odor Present	N
Debris Present	N
Within 10% of Req'd Core Length	N
Photo	N

Pushcorer (Slambar)

Eckman Ponar: Standard / Petite

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client :	New Castle Conservation District		Project :	White Clay Creek Dam 2		Logger:	TD	
Job#:	42-126	Date:	11/9/22	Time:	1205	Crew:	AF	
Coordinates:	N	615559.6	W	573701.1		Vessel:	N/A	
Core # :	T2 B	Zone: DE	Datum	NAD 83		Deploy:	1	2	3
Project Depth [PD] [ft]:						Core Penetration Length (ft.):	2.5		
Measured Water Depth [MWD] [ft.]:		2.0				Recovered Core Length (ft.):	1.3		
						Sample Length Retained (ft.):	1.3		
						Core Volume Retained (gal.):	-		
						Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:									

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top 0.0		Brown coarse sand & gravel.
1.3		
Bottom		

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

Conditions: Sunny 50's

Comments: Core to client.

Core Volumes

Nominal core-barrel diameter	EST. Volume
(3.0")	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: (Soft) Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	N
Oil Present	N
Odor Present	N
Debris Present	N
Within 10% of Req'd Core Length	N
Photo	N

Pushcorer (Slambar)

Eckman Ponar: Standard / Petite

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client :	New Castle Conservation District		Project :	White Clay Creek Dam 2		Logger:	TD	
Job#:	42-126	Date:	11/9/22	Time:	1155	Crew:	AF	
Coordinates:	N	615450.4	E	573682.0		Vessel:	N/A	
Core # :	T2 C	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:						Core Penetration Length (ft.):	2.0		
Measured Water Depth [MWD] [ft.]:		2.0				Recovered Core Length (ft.):	0.9		
						Sample Length Retained (ft.):	0.9		
						Core Volume Retained (gal.):	-		
						Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:									

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top 0.0		Brown coarse sand & gravel.
0.9		
Bottom		

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

Conditions: Sunny 50's

Comments: Core to client.

Core Volumes

Nominal core-barrel diameter	EST. Volume
(3.0")	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: (Soft) Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	N
Oil Present	N
Odor Present	N
Debris Present	N
Within 10% of Req'd Core Length	N
Photo	N

Pushcorer (Slambar)

Eckman Ponar: Standard / Petite

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client :	New Castle Conservation District		Project :	White Clay Creek Dam 2		Logger:	TD	
Job#:	42-126	Date:	11/9/22	Time:	1145	Crew:	AF	
Coordinates:	N	615450.4	E	573664.8		Vessel:	N/A	
Core # :	T2 D	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:				Core Penetration Length (ft.):			2.5		
Measured Water Depth [MWD] [ft.]:		1.0		Recovered Core Length (ft.):			1.1		
				Sample Length Retained (ft.):			1.1		
				Core Volume Retained (gal.):			-		
				Collected to Project Depth:			Y / N		
Required Sample Core Length [SCL] [ft.]:									

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top 0.0		Brown coarse sand.
1.1		
Bottom		

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

Conditions: Sunny 50's

Comments: Core to client.

Core Volumes

Nominal core-barrel diameter		EST. Volume
(3.0")		.25 gal/ft
3.5"	8.0"	.33 gal/ft
4.0"		.50 gal/ft

Liner Type: (Soft) Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	N
Oil Present	N
Odor Present	N
Debris Present	N
Within 10% of Req'd Core Length	N
Photo	N

Pushcorer (Slambar)

Eckman Ponar: Standard / Petite

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client :	New Castle Conservation District		Project :	White Clay Creek Dam 2		Logger:	TD	
Job#:	42-126	Date:	11/9/22	Time:	1320	Crew:	AF	
Coordinates:	N	615621.5	E	573636.5		Vessel:	N/A	
Core # :	T3 A	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:				Core Penetration Length (ft.):			2.5		
Measured Water Depth [MWD] [ft.]:		2.5		Recovered Core Length (ft.):			1.0		
				Sample Length Retained (ft.):			1.0		
				Core Volume Retained (gal.):			-		
				Collected to Project Depth:			Y / N		
Required Sample Core Length [SCL] [ft.]:									

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top 0.0		Brown coarse sand & gravel, pieces of wood.
1.0		
Bottom		

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

Conditions: Sunny 50's

Comments: Core to client.

Core Volumes

Nominal core-barrel diameter	EST. Volume
(3.0")	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: (Soft) Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	N
Oil Present	N
Odor Present	N
Debris Present	Y
Within 10% of Req'd Core Length	N
Photo	N

Pushcorer (Slambar)

Eckman Ponar: Standard / Petite

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client :	New Castle Conservation District		Project :	White Clay Creek Dam 2		Logger:	TD	
Job#:	42-126	Date:	11/9/22	Time:	1300	Crew:	AF	
Coordinates:	N	615604.4	E	573623.1		Vessel:	N/A	
Core # :	T3 B	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:				Core Penetration Length (ft.):			2.5		
Measured Water Depth [MWD] [ft.]:		2.0		Recovered Core Length (ft.):			2.0		
				Sample Length Retained (ft.):			2.0		
				Core Volume Retained (gal.):			-		
				Collected to Project Depth:			Y / N		
Required Sample Core Length [SCL] [ft.]:									

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top 0.0		Brown coarse sand & gravel.
2.0		
Bottom		

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

Conditions: Sunny 50's

Comments: Core to client.

Core Volumes

Nominal core-barrel diameter	EST. Volume
(3.0")	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: (Soft) Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	N
Oil Present	N
Odor Present	N
Debris Present	Y
Within 10% of Req'd Core Length	N
Photo	N

Pushcorer (Slambar)

Eckman Ponar: Standard / Petite

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client :	New Castle Conservation District		Project :	White Clay Creek Dam 2		Logger:	TD	
Job#:	42-126	Date:	11/9/22	Time:	1240	Crew:	AF	
Coordinates:	N	615587.2	E	573609.8		Vessel:	N/A	
Core # :	T3 C	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:				Core Penetration Length (ft.):			2.5		
Measured Water Depth [MWD] [ft.]:		2.5		Recovered Core Length (ft.):			1.7		
				Sample Length Retained (ft.):			1.7		
				Core Volume Retained (gal.):			-		
				Collected to Project Depth:			Y / N		
Required Sample Core Length [SCL] [ft.]:									

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top 0.0		Brown coarse sand & gravel.
1.7		
Bottom		

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

Conditions: Sunny 50's

Comments: Core to client.

Core Volumes

Nominal core-barrel diameter	EST. Volume
(3.0")	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: (Soft) Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	N
Oil Present	N
Odor Present	N
Debris Present	N
Within 10% of Req'd Core Length	N
Photo	N

Pushcorer (Slambar)

Eckman Ponar: Standard / Petite

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client :	New Castle Conservation District		Project :	White Clay Creek Dam 2		Logger:	TD	
Job#:	42-126	Date:	11/9/22	Time:	1230	Crew:	AF	
Coordinates:	N	615569.0	E	573595.6		Vessel:	N/A	
Core # :	T3 D	Zone: DE	Datum	NAD 83		Deploy:	1	2	3
Project Depth [PD] [ft]:						Core Penetration Length (ft.):	2.0		
Measured Water Depth [MWD] [ft.]:		1.5				Recovered Core Length (ft.):	1.0		
						Sample Length Retained (ft.):	1.0		
						Core Volume Retained (gal.):	-		
						Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:									

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top 0.0		Brown coarse sand & gravel.
1.0		
Bottom		

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

Conditions: Sunny 50's

Comments: Core to client.

Core Volumes

Nominal core-barrel diameter		EST. Volume
(3.0")		.25 gal/ft
3.5"	8.0"	.33 gal/ft
4.0"		.50 gal/ft

Liner Type: (Soft) Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	N
Oil Present	N
Odor Present	N
Debris Present	N
Within 10% of Req'd Core Length	N
Photo	N

Pushcorer (Slambar)

Eckman Ponar: Standard / Petite

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client :	New Castle Conservation District		Project :	White Clay Creek Dam 3		Logger:	TD	
Job#:	42-126	Date:	11/10/22	Time:	1045	Crew:	AF	
Coordinates:	N	615647.3	E	565798.7		Vessel:	N/A	
Core # :	T1 A	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:						Core Penetration Length (ft.):	0.5	0.5	
Measured Water Depth [MWD] [ft.]:		2.5				Recovered Core Length (ft.):	0.5	0.5	
						Sample Length Retained (ft.):	0.5	0.5	
						Core Volume Retained (gal.):			
						Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:									

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top 0.0		Coarse brown sand, some organic debris.
0.5		
Bottom		

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

Conditions: Sunny 60's

Comments: Grab to client. 6-8" refusal met.

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	N
Oil Present	N
Odor Present	N
Debris Present	Y
Within 10% of Req'd Core Length	N
Photo	N

Pushcorer Slambar

Eckman Ponar: Standard / (Petite)

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client :	New Castle Conservation District		Project :	White Clay Creek Dam 3		Logger:	TD	
Job#:	42-126	Date:	11/10/22	Time:	1040	Crew:	AF	
Coordinates:	N	615636.2	E	565804.2		Vessel:	N/A	
Core # :	T1 B	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:						Core Penetration Length (ft.):	0.5	0.5	
Measured Water Depth [MWD] [ft.]:		3.0				Recovered Core Length (ft.):	0.5	0.5	
						Sample Length Retained (ft.):	0.5	0.5	
						Core Volume Retained (gal.):			
						Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:									

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top 0.0		Coarse brown sand, some organic.
0.5		
Bottom		

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

Conditions: Sunny 60's

Comments: Grab to client. Hard refusal at 6".

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	N
Oil Present	N
Odor Present	N
Debris Present	Y
Within 10% of Req'd Core Length	N
Photo	N

Pushcorer Slambar

Eckman Ponar: Standard / (Petite)

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client :	New Castle Conservation District		Project :	White Clay Creek Dam 3		Logger:	TD	
Job#:	42-126	Date:	11/10/22	Time:	1030	Crew:	AF	
Coordinates:	N	615624.0	E	565804.1		Vessel:	N/A	
Core # :	T1 C	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:						Core Penetration Length (ft.):	0.5	0.5	
Measured Water Depth [MWD] [ft.]:		3.0				Recovered Core Length (ft.):	0.5	0.5	
						Sample Length Retained (ft.):	0.5	0.5	
						Core Volume Retained (gal.):			
						Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:									

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top 0.0		Coarse brown sand, some organic.
0.5		
Bottom		

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

Conditions: Sunny 60's

Comments: Grab to client. Hard refusal at 6".

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	Y
Oil Present	N
Odor Present	N
Debris Present	Y
Within 10% of Req'd Core Length	N
Photo	N

Pushcorer Slambar

Eckman Ponar: Standard / (Petite)

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client :	New Castle Conservation District		Project :	White Clay Creek Dam 3		Logger:	TD	
Job#:	42-126	Date:	11/10/22	Time:	1020	Crew:	AF	
Coordinates:	N	615609.9	E	565806.4		Vessel:	N/A	
Core # :	T1 D	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:				Core Penetration Length (ft.):			0.5	0.5	
Measured Water Depth [MWD] [ft.]:		3.0		Recovered Core Length (ft.):			0.5	0.5	
				Sample Length Retained (ft.):			0.5	0.5	
				Core Volume Retained (gal.):					
				Collected to Project Depth:			Y / N		
Required Sample Core Length [SCL] [ft.]:									

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top 0.0		Coarse brown sand.
0.5		
Bottom		

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

Conditions: Sunny 60's

Comments: Grab to client. Hard refusal at 6".

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	N
Oil Present	N
Odor Present	N
Debris Present	N
Within 10% of Req'd Core Length	N
Photo	N

Pushcorer Slambar

Eckman Ponar: Standard / (Petite)

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client :	New Castle Conservation District		Project :	White Clay Creek Dam 3		Logger:	TD	
Job#:	42-126	Date:	11/10/22	Time:	1150	Crew:	AF	
Coordinates:	N	615653.7	E	565728.4		Vessel:	N/A	
Core # :	T2 A	Zone: DE	Datum	NAD 83		Deploy:	1	2	3
Project Depth [PD] [ft]:						Core Penetration Length (ft.):	0.5	0.5	
Measured Water Depth [MWD] [ft.]:		2.5				Recovered Core Length (ft.):	0.5	0.5	
						Sample Length Retained (ft.):	0.5	0.5	
						Core Volume Retained (gal.):			
						Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:									

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top 0.0		Brown-grey, medium-fine sand w/ leaves.
0.5		
Bottom		

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

Conditions: Sunny 60's

Comments: Grab to client. Met refusal at 6-8"

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	N
Oil Present	N
Odor Present	N
Debris Present	Y
Within 10% of Req'd Core Length	N
Photo	N

Pushcorer Slambar

Eckman Ponar: Standard / (Petite)

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client :	New Castle Conservation District		Project :	White Clay Creek Dam 3		Logger:	TD	
Job#:	42-126	Date:	11/10/22	Time:	1145	Crew:	AF	
Coordinates:	N	615642.5	E	565725.2		Vessel:	N/A	
Core # :	T2 B	Zone: DE	Datum	NAD 83		Deploy:	1	2	3
Project Depth [PD] [ft]:						Core Penetration Length (ft.):	0.5	0.5	
Measured Water Depth [MWD] [ft.]:		3.0				Recovered Core Length (ft.):	0.5	0.5	
						Sample Length Retained (ft.):	0.5	0.5	
						Core Volume Retained (gal.):			
						Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:									

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top 0.0		Brown medium-coarse sand, some organic shells.
0.5		
Bottom		

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

Conditions: Sunny 60's

Comments: Grab to client. Met refusal at 6-8"

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	N
Oil Present	N
Odor Present	N
Debris Present	Y
Within 10% of Req'd Core Length	N
Photo	N

Pushcorer Slambar

Eckman Ponar: Standard / (Petite)

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client :	New Castle Conservation District		Project :	White Clay Creek Dam 3		Logger:	TD	
Job#:	42-126	Date:	11/10/22	Time:	1140	Crew:	AF	
Coordinates:	N	615619.3	E	565725.9		Vessel:	N/A	
Core # :	T2 C	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:				Core Penetration Length (ft.):			0.5	0.5	
Measured Water Depth [MWD] [ft.]:		2.0		Recovered Core Length (ft.):			0.5	0.5	
				Sample Length Retained (ft.):			0.5	0.5	
				Core Volume Retained (gal.):					
				Collected to Project Depth:			Y / N		
Required Sample Core Length [SCL] [ft.]:									

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top 0.0		Medium to coarse brown sand.
0.5		
Bottom		

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

Conditions: Sunny 60's

Comments: Grab to client. Met refusal at 6-8"

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	N
Oil Present	N
Odor Present	N
Debris Present	N
Within 10% of Req'd Core Length	N
Photo	N

Pushcorer Slambar

Eckman Ponar: Standard / (Petite)

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client :	New Castle Conservation District		Project :	White Clay Creek Dam 3		Logger:	TD	
Job#:	42-126	Date:	11/10/22	Time:	1135	Crew:	AF	
Coordinates:	N	615616.2	E	565722.0		Vessel:	N/A	
Core # :	T2 D	Zone: DE	Datum	NAD 83		Deploy:	1	2	3
Project Depth [PD] [ft]:						Core Penetration Length (ft.):	0.5	0.5	
Measured Water Depth [MWD] [ft.]:		2.5				Recovered Core Length (ft.):	0.5	0.5	
						Sample Length Retained (ft.):	0.5	0.5	
						Core Volume Retained (gal.):			
						Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:									

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top 0.0		Medium/coarse brown sand/gravel.
0.5		
Bottom		

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

Conditions: Sunny 60's

Comments: Grab to client. Met refusal at 6-8"

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	N
Oil Present	N
Odor Present	N
Debris Present	N
Within 10% of Req'd Core Length	N
Photo	N

Pushcorer Slambar

Eckman Ponar: Standard / (Petite)

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client :	New Castle Conservation District		Project :	White Clay Creek Dam 3		Logger:	TD	
Job#:	42-126	Date:	11/10/22	Time:	1125	Crew:	AF	
Coordinates:	N	615682.5	E	565591.7		Vessel:	N/A	
Core # :	T3 A	Zone: DE	Datum	NAD 83		Deploy:	1	2	3
Project Depth [PD] [ft]:						Core Penetration Length (ft.):	0.5	0.5	
Measured Water Depth [MWD] [ft.]:		3.0				Recovered Core Length (ft.):	0.5	0.5	
						Sample Length Retained (ft.):	0.5	0.5	
						Core Volume Retained (gal.):			
						Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:									

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top 0.0		Grey-brown, fine sand, lots of leaves/organic
0.5		
Bottom		

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

Conditions: Sunny 60's

Comments: Grab to client.

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	N
Oil Present	N
Odor Present	N
Debris Present	Y
Within 10% of Req'd Core Length	N
Photo	N

Pushcorer Slambar

Eckman Ponar: Standard / (Petite)

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client :	New Castle Conservation District		Project :	White Clay Creek Dam 3		Logger:	TD	
Job#:	42-126	Date:	11/10/22	Time:	1120	Crew:	AF	
Coordinates:	N	615669.3	E	565590.9		Vessel:	N/A	
Core # :	T3 B	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:				Core Penetration Length (ft.):			0.5	0.5	
Measured Water Depth [MWD] [ft.]:		3.0		Recovered Core Length (ft.):			0.5	0.5	
				Sample Length Retained (ft.):			0.5	0.5	
				Core Volume Retained (gal.):					
				Collected to Project Depth:			Y / N		
Required Sample Core Length [SCL] [ft.]:									

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top 0.0		Coarse medium-brown sand.
0.5		
Bottom		

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

Conditions: Sunny 60's

Comments: Grab to client. 6-8" refusal met.

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	N
Oil Present	N
Odor Present	N
Debris Present	Y
Within 10% of Req'd Core Length	N
Photo	N

Pushcorer Slambar

Eckman Ponar: Standard / (Petite)

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client :	New Castle Conservation District		Project :	White Clay Creek Dam 3		Logger:	TD	
Job#:	42-126	Date:	11/10/22	Time:	1115	Crew:	AF	
Coordinates:	N	615654.2	E	565586.9		Vessel:	N/A	
Core # :	T3 C	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:				Core Penetration Length (ft.):			0.5	0.5	
Measured Water Depth [MWD] [ft.]:		2.5		Recovered Core Length (ft.):			0.5	0.5	
				Sample Length Retained (ft.):			0.5	0.5	
				Core Volume Retained (gal.):					
				Collected to Project Depth:			Y / N		
Required Sample Core Length [SCL] [ft.]:									

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top 0.0		Brown coarse sand & gravel.
0.5		
Bottom		

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

Conditions: Sunny 60's

Comments: Grab to client. 6-8" refusal met.

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	N
Oil Present	N
Odor Present	N
Debris Present	N
Within 10% of Req'd Core Length	N
Photo	N

Pushcorer Slambar

Eckman Ponar: Standard / (Petite)

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client :	New Castle Conservation District		Project :	White Clay Creek Dam 3		Logger:	TD	
Job#:	42-126	Date:	11/10/22	Time:	1110	Crew:	AF	
Coordinates:	N	615648.1	E	565584.6		Vessel:	N/A	
Core # :	T3 D	Zone: DE	Datum	NAD 83		Deploy:	1	2	3
Project Depth [PD] [ft]:						Core Penetration Length (ft.):	0.5	0.5	
Measured Water Depth [MWD] [ft.]:		2.5				Recovered Core Length (ft.):	0.5	0.5	
						Sample Length Retained (ft.):	0.5	0.5	
						Core Volume Retained (gal.):			
						Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:									

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top 0.0		Coarse brown sand, some organic & clams.
0.5		
Bottom		

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

Conditions: Sunny 60's

Comments: Grab to client. 6-8" refusal met.

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	Y
Oil Present	N
Odor Present	N
Debris Present	Y
Within 10% of Req'd Core Length	N
Photo	N

Pushcorer Slambar

Eckman Ponar: Standard / (Petite)

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client : New Castle Conservation District			Project : White Clay Creek Dam 4			Logger: KS	
Job#: 42-126	Date: 11/14/22		Time: 1455		Crew:	JP, SM	
Coordinates:	N 615345.2		E 562628.9		Vessel:		
Core # : T1 A	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:					Core Penetration Length (ft.):	3.0	0.5	
Measured Water Depth [MWD] [ft.]: 2.8					Recovered Core Length (ft.):	0.0	0.5	
					Sample Length Retained (ft.):	-	-	
					Core Volume Retained (gal.):	-	-	
					Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:								

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top 0.0		Loose, brown silt and organic debris.
0.5		
Bottom		

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

Conditions:

Comments: Grab handed off to client.

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	Y	N
Oil Present	Y	N
Odor Present	Y	N
Debris Present	Y	N
Within 10% of Req'd Core Length	Y	N
Photo	Y	N

Pushcorer (Slambar)

Eckman Ponar: Standard / (Petite)

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client : New Castle Conservation District			Project : White Clay Creek Dam 4			Logger: KS	
Job#: 42-126	Date: 11/14/22		Time: 1415		Crew:	JP, SM	
Coordinates:	N 615382.5		E 562605.1		Vessel:		
Core # : T1 B	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:					Core Penetration Length (ft.):	3.7		
Measured Water Depth [MWD] [ft.]:	2.4				Recovered Core Length (ft.):	-		
					Sample Length Retained (ft.):	-		
					Core Volume Retained (gal.):	-		
					Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:								

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top 0.0		
Bottom		

					Core Volumes	
# of containers:					Nominal core-barrel	
Type of container:	bucket	hardliner	cup	other	diameter	EST. Volume
Conditions:					3.0"	.25 gal/ft
					3.5" 8.0"	.33 gal/ft
Comments: Core processed by client.					4.0"	.50 gal/ft
					Liner Type: Soft Hard	
					Vibracorer: P3 P5 VT6 Other	

Live Organisms Present	Y	N
Oil Present	Y	N
Odor Present	Y	N
Debris Present	Y	N
Within 10% of Req'd Core Length	Y	N
Photo	Y	N

Pushcorer (Slambar)
Eckman Ponar: Standard / Petite
Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client : New Castle Conservation District			Project : White Clay Creek Dam 4			Logger: KS	
Job#: 42-126		Date: 11/14/22	Time: 1355		Crew:	JP, SM	
Coordinates:	N 615404.5		E 562595.8		Vessel:		
Core # : T1 C	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:					Core Penetration Length (ft.):	4.1		
Measured Water Depth [MWD] [ft.]:		1.4			Recovered Core Length (ft.):	-		
					Sample Length Retained (ft.):	-		
					Core Volume Retained (gal.):	-		
					Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:								

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top 0.0		
Bottom		

					Core Volumes	
# of containers:					Nominal core-barrel	
Type of container:	bucket	hardliner	cup	other	diameter	EST. Volume
Conditions:					3.0"	.25 gal/ft
					3.5" 8.0"	.33 gal/ft
Comments: Core processed by client.					4.0"	.50 gal/ft
					Liner Type: Soft Hard	
					Vibracorer: P3 P5 VT6 Other	

Live Organisms Present	Y	N
Oil Present	Y	N
Odor Present	Y	N
Debris Present	Y	N
Within 10% of Req'd Core Length	Y	N
Photo	Y	N

Pushcorer (Slambar)

Eckman Ponar: Standard / Petite

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client : New Castle Conservation District			Project : White Clay Creek Dam 4			Logger: KS	
Job#: 42-126	Date: 11/14/22		Time: 1310		Crew:	JP, SM	
Coordinates:	N 615435.1		E 562591.1		Vessel:		
Core # : T1 D	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:					Core Penetration Length (ft.):	2.8		
Measured Water Depth [MWD] [ft.]:	0.6				Recovered Core Length (ft.):	-		
					Sample Length Retained (ft.):	-		
					Core Volume Retained (gal.):	-		
					Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:								

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top 0.0		
Bottom		

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

Conditions:

Comments: Core processed by client.

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	Y	N
Oil Present	Y	N
Odor Present	Y	N
Debris Present	Y	N
Within 10% of Req'd Core Length	Y	N
Photo	Y	N

Pushcorer (Slambar)

Eckman Ponar: Standard / Petite

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client : New Castle Conservation District			Project : White Clay Creek Dam 4			Logger: KS	
Job#: 42-126	Date: 11/15/22		Time: 0915		Crew:	JP, SM	
Coordinates:	N 615332.7		E 562556.7		Vessel:		
Core # : T2 A	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:					Core Penetration Length (ft.):	3.0		
Measured Water Depth [MWD] [ft.]:	1.4				Recovered Core Length (ft.):	-		
					Sample Length Retained (ft.):	-		
					Core Volume Retained (gal.):	-		
					Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:								

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top 0.0		
Bottom		

					Core Volumes	
# of containers:					Nominal core-barrel	
Type of container:	bucket	hardliner	cup	other	diameter	EST. Volume
Conditions:					3.0"	.25 gal/ft
					3.5" 8.0"	.33 gal/ft
Comments: Core processed by client.					4.0"	.50 gal/ft
					Liner Type: Soft Hard	
					Vibracorer: P3 P5 VT6 Other	

Live Organisms Present	Y	N
Oil Present	Y	N
Odor Present	Y	N
Debris Present	Y	N
Within 10% of Req'd Core Length	Y	N
Photo	Y	N

Pushcorer (Slambar)

Eckman Ponar: Standard / Petite

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client : New Castle Conservation District			Project : White Clay Creek Dam 4			Logger: KS	
Job#: 42-126	Date: 11/15/22		Time: 0940	Crew:		JP, SM	
Coordinates:	N 615357.1		E 562555.5	Vessel:			
Core # : T2 B	Zone: DE	Datum NAD 83		Deploy:	1	2	3
Project Depth [PD] [ft]:			Core Penetration Length (ft.):		3.5	0.2	
Measured Water Depth [MWD] [ft.]: 5.5			Recovered Core Length (ft.):		0.0	0.2	
			Sample Length Retained (ft.):		-		
			Core Volume Retained (gal.):		-		
			Collected to Project Depth:		Y / N		
Required Sample Core Length [SCL] [ft.]:							

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top 0.0		Medium brown sand.
Bottom		

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

Conditions:

Comments: Grabs processed by client. One ponar deployment.

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	Y	N
Oil Present	Y	N
Odor Present	Y	N
Debris Present	Y	N
Within 10% of Req'd Core Length	Y	N
Photo	Y	N

Pushcorer (Slambar)

Eckman Ponar: Standard / (Petite)

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client : New Castle Conservation District			Project : White Clay Creek Dam 4			Logger: KS	
Job#: 42-126	Date: 11/15/22		Time: 1005		Crew:	JP, SM	
Coordinates:	N 615388.2		E 562556.1		Vessel:		
Core # : T2 C	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:					Core Penetration Length (ft.):	2.9		
Measured Water Depth [MWD] [ft.]: 2.6					Recovered Core Length (ft.):	-		
					Sample Length Retained (ft.):	-		
					Core Volume Retained (gal.):	-		
					Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:								

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top 0.0		
Bottom		

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

Conditions:

Comments: Cores processed by client.

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	Y	N
Oil Present	Y	N
Odor Present	Y	N
Debris Present	Y	N
Within 10% of Req'd Core Length	Y	N
Photo	Y	N

Pushcorer (Slambar)

Eckman Ponar: Standard / Petite

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client : New Castle Conservation District			Project : White Clay Creek Dam 4			Logger: KS	
Job#: 42-126	Date: 11/15/22	Time: 1026		Crew:	JP, SM		
Coordinates:	N 615410.1	E 562550.9		Vessel:			
Core # : T2 D	Zone: DE Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:		Core Penetration Length (ft.):			2.3		
Measured Water Depth [MWD] [ft.]: 1.6		Recovered Core Length (ft.):			-		
		Sample Length Retained (ft.):			-		
		Core Volume Retained (gal.):			-		
		Collected to Project Depth:			Y / N		
Required Sample Core Length [SCL] [ft.]:							

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top 0.0		
Bottom		

					Core Volumes	
# of containers:					Nominal core-barrel	
Type of container:	bucket	hardliner	cup	other	diameter	EST. Volume
Conditions:					3.0"	.25 gal/ft
					3.5" 8.0"	.33 gal/ft
Comments: Cores processed by client.					4.0"	.50 gal/ft
					Liner Type: Soft Hard	
					Vibracorer: P3 P5 VT6 Other	

Live Organisms Present	Y	N
Oil Present	Y	N
Odor Present	Y	N
Debris Present	Y	N
Within 10% of Req'd Core Length	Y	N
Photo	Y	N

Pushcorer (Slambar)

Eckman Ponar: Standard / Petite

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client : New Castle Conservation District			Project : White Clay Creek Dam 4			Logger: KS	
Job#: 42-126	Date: 11/15/22	Time: 1106		Crew:	JP, SM		
Coordinates:	N 615354.1	E 562418.5		Vessel:			
Core # : T3 A	Zone: DE Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:				Core Penetration Length (ft.):	3.9		
Measured Water Depth [MWD] [ft.]:	3.4			Recovered Core Length (ft.):	-		
				Sample Length Retained (ft.):	-		
				Core Volume Retained (gal.):	-		
				Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:							

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top 0.0		
Bottom		

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

Conditions:

Comments: Cores processed by client.

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	Y	N
Oil Present	Y	N
Odor Present	Y	N
Debris Present	Y	N
Within 10% of Req'd Core Length	Y	N
Photo	Y	N

Pushcorer (Slambar)

Eckman Ponar: Standard / Petite

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client : New Castle Conservation District			Project : White Clay Creek Dam 4			Logger: KS	
Job#: 42-126		Date: 11/15/22	Time: 1121		Crew:	JP, SM	
Coordinates:	N 615378.9		E 562426.9		Vessel:		
Core # : T3 B	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:					Core Penetration Length (ft.):	3.6		
Measured Water Depth [MWD] [ft.]:	2.7				Recovered Core Length (ft.):	-		
					Sample Length Retained (ft.):	-		
					Core Volume Retained (gal.):	-		
					Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:								

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top 0.0		
Bottom		

					Core Volumes	
# of containers:					Nominal core-barrel	
Type of container:	bucket	hardliner	cup	other	diameter	EST. Volume
Conditions:					3.0"	.25 gal/ft
					3.5" 8.0"	.33 gal/ft
Comments: Core processed by client.					4.0"	.50 gal/ft
					Liner Type: Soft Hard	
					Vibracorer: P3 P5 VT6 Other	

Live Organisms Present	Y	N
Oil Present	Y	N
Odor Present	Y	N
Debris Present	Y	N
Within 10% of Req'd Core Length	Y	N
Photo	Y	N

Pushcorer (Slambar)

Eckman Ponar: Standard / Petite

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client :	New Castle Conservation District		Project :	White Clay Creek Dam 4		Logger:	KS	
Job#:	42-126	Date:	11/15/22	Time:	1142	Crew:	JP, SM	
Coordinates:	N	615397.1	E	562432.1		Vessel:		
Core # :	T3 C	Zone: DE	Datum	NAD 83		Deploy:	1	2	3
Project Depth [PD] [ft]:						Core Penetration Length (ft.):	2.5	0.1	
Measured Water Depth [MWD] [ft.]:		2.3				Recovered Core Length (ft.):	0.0	0.1	
						Sample Length Retained (ft.):	-	-	
						Core Volume Retained (gal.):	-	-	
						Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:									

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top 0.0		Brown sand w/ rocks and leaves. 11 grab deploys.
Bottom		

					Core Volumes	
# of containers:					Nominal core-barrel	
Type of container:	bucket	hardliner	cup	other	diameter	EST. Volume
Conditions:					3.0"	.25 gal/ft
					3.5" 8.0"	.33 gal/ft
Comments: Grabs processed by client.					4.0"	.50 gal/ft
					Liner Type: Soft Hard	
					Vibracorer: P3 P5 VT6 Other	

Live Organisms Present	Y	N
Oil Present	Y	N
Odor Present	Y	N
Debris Present	Y	N
Within 10% of Req'd Core Length	Y	N
Photo	Y	N

Pushcorer (Slambar)

Eckman Ponar: Standard / (Petite)

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client :	New Castle Conservation District		Project :	White Clay Creek Dam 4		Logger:	KS	
Job#:	42-126	Date:	11/15/22	Time:	1216	Crew:	JP, SM	
Coordinates:	N	615421.8	E	562439.5		Vessel:		
Core # :	T3 D	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:						Core Penetration Length (ft.):	2.8		
Measured Water Depth [MWD] [ft.]:		1.9				Recovered Core Length (ft.):	-		
						Sample Length Retained (ft.):	-		
						Core Volume Retained (gal.):	-		
						Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:									

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top 0.0		
Bottom		

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

Conditions:

Comments: Cores processed by client.

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	Y	N
Oil Present	Y	N
Odor Present	Y	N
Debris Present	Y	N
Within 10% of Req'd Core Length	Y	N
Photo	Y	N

Pushcorer (Slambar)

Eckman Ponar: Standard / Petite

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client : New Castle Conservation District			Project : White Clay Creek Dam 5			Logger: KS	
Job#: 42-126		Date: 11/17/22	Time: 1007		Crew:	JP, SM	
Coordinates:	N 619004.2		E 561612.3		Vessel:		
Core # : T1 A	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:				Core Penetration Length (ft.):		3.0		
Measured Water Depth [MWD] [ft.]:		1.8		Recovered Core Length (ft.):		-		
				Sample Length Retained (ft.):		-		
				Core Volume Retained (gal.):		-		
				Collected to Project Depth:		Y / N		
Required Sample Core Length [SCL] [ft.]:								

All Length Measurements are in Decimal Feet

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

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

Conditions:

Comments: Cores processed by client.

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	Y	N
Oil Present	Y	N
Odor Present	Y	N
Debris Present	Y	N
Within 10% of Req'd Core Length	Y	N
Photo	Y	N

Pushcorer (Slambar)

Eckman Ponar: Standard / Petite

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client : New Castle Conservation District			Project : White Clay Creek Dam 5			Logger: KS	
Job#: 42-126		Date: 11/17/22	Time: 1036		Crew:	JP, SM	
Coordinates:	N 618992.3		E 561635.8		Vessel:		
Core # : T1 B	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:					Core Penetration Length (ft.):	1.8		
Measured Water Depth [MWD] [ft.]:		3.5			Recovered Core Length (ft.):	-		
					Sample Length Retained (ft.):	-		
					Core Volume Retained (gal.):	-		
					Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:								

All Length Measurements are in Decimal Feet

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

					Core Volumes	
# of containers:					Nominal core-barrel	
Type of container:	bucket	hardliner	cup	other	diameter	EST. Volume
Conditions:					3.0"	.25 gal/ft
					3.5" 8.0"	.33 gal/ft
Comments: Cores processed by client.					4.0"	.50 gal/ft
					Liner Type: Soft Hard	
					Vibracorer: P3 P5 VT6 Other	

Live Organisms Present	Y	N
Oil Present	Y	N
Odor Present	Y	N
Debris Present	Y	N
Within 10% of Req'd Core Length	Y	N
Photo	Y	N

Pushcorer (Slambar)

Eckman Ponar: Standard / Petite

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client : New Castle Conservation District			Project : White Clay Creek Dam 5			Logger: KS	
Job#: 42-126	Date: 11/17/22		Time: 1055		Crew:	JP, SM	
Coordinates:	N 618984.7		E 561658.0		Vessel:		
Core # : T1 C	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:					Core Penetration Length (ft.):	0.1		
Measured Water Depth [MWD] [ft.]:	3.1				Recovered Core Length (ft.):	trace		
					Sample Length Retained (ft.):	-		
					Core Volume Retained (gal.):	-		
					Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:								

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		Went straight to ponar grabs. Rocks w/ small amount of sand. 10 deployments.
Bottom		

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

Conditions:

Comments: Grabs processed by client.

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	Y	N
Oil Present	Y	N
Odor Present	Y	N
Debris Present	Y	N
Within 10% of Req'd Core Length	Y	N
Photo	Y	N

Pushcorer Slambar

Eckman Ponar: Standard / (Petite)

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client : New Castle Conservation District			Project : White Clay Creek Dam 5			Logger: KS	
Job#: 42-126	Date: 11/17/22		Time: 1105		Crew:	JP, SM	
Coordinates:	N 618974.5		E 561683.1		Vessel:		
Core # : T1 D	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:					Core Penetration Length (ft.):	1.9		
Measured Water Depth [MWD] [ft.]: 2.2					Recovered Core Length (ft.):	-		
					Sample Length Retained (ft.):	-		
					Core Volume Retained (gal.):	-		
					Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:								

All Length Measurements are in Decimal Feet

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

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

Conditions:

Comments: Cores processed by client.

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	Y	N
Oil Present	Y	N
Odor Present	Y	N
Debris Present	Y	N
Within 10% of Req'd Core Length	Y	N
Photo	Y	N

Pushcorer (Slambar)

Eckman Ponar: Standard / Petite

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client :	New Castle Conservation District		Project :	White Clay Creek Dam 5		Logger:	KS	
Job#:	42-126	Date:	11/17/22	Time:	1140	Crew:	JP, SM	
Coordinates:	N	619050.3	E	561641.7		Vessel:		
Core # :	T2 A	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:						Core Penetration Length (ft.):	2.9		
Measured Water Depth [MWD] [ft.]:		2.0				Recovered Core Length (ft.):	-		
						Sample Length Retained (ft.):	-		
						Core Volume Retained (gal.):	-		
						Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:									

All Length Measurements are in Decimal Feet

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

					Core Volumes	
# of containers:					Nominal core-barrel	
Type of container:	bucket	hardliner	cup	other	diameter	EST. Volume
Conditions:					3.0"	.25 gal/ft
					3.5" 8.0"	.33 gal/ft
Comments: Cores processed by client.					4.0"	.50 gal/ft
					Liner Type: Soft Hard	
					Vibracorer: P3 P5 VT6 Other	

Live Organisms Present	Y	N
Oil Present	Y	N
Odor Present	Y	N
Debris Present	Y	N
Within 10% of Req'd Core Length	Y	N
Photo	Y	N

Pushcorer (Slambar)

Eckman Ponar: Standard / Petite

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client : New Castle Conservation District			Project : White Clay Creek Dam 5			Logger: KS	
Job#: 42-126	Date: 11/17/22		Time: 1205		Crew:	JP, SM	
Coordinates:	N 619044.7		E 561660.6		Vessel:		
Core # : T2 B	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:					Core Penetration Length (ft.):	1.6		
Measured Water Depth [MWD] [ft.]:	4.1				Recovered Core Length (ft.):	-		
					Sample Length Retained (ft.):	-		
					Core Volume Retained (gal.):	-		
					Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:								

All Length Measurements are in Decimal Feet

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

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

Conditions:

Comments: Cores processed by client.

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	Y	N
Oil Present	Y	N
Odor Present	Y	N
Debris Present	Y	N
Within 10% of Req'd Core Length	Y	N
Photo	Y	N

Pushcorer (Slambar)

Eckman Ponar: Standard / Petite

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client : New Castle Conservation District			Project : White Clay Creek Dam 5			Logger: KS	
Job#: 42-126	Date: 11/17/22		Time: 1229		Crew:	JP, SM	
Coordinates:	N 619036.2		E 561681.3		Vessel:		
Core # : T2 C	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:					Core Penetration Length (ft.):	0.5		
Measured Water Depth [MWD] [ft.]: 7.1					Recovered Core Length (ft.):	0.2		
					Sample Length Retained (ft.):	-		
					Core Volume Retained (gal.):	-		
					Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:								

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		Straight to ponar grabs. Brown sand w/ leaves. One deployment.
Bottom		

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

Conditions:

Comments: Grab processed by client.

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	Y	N
Oil Present	Y	N
Odor Present	Y	N
Debris Present	Y	N
Within 10% of Req'd Core Length	Y	N
Photo	Y	N

Pushcorer Slambar

Eckman Ponar: Standard (Petite)

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client : New Castle Conservation District			Project : White Clay Creek Dam 5			Logger: KS	
Job#: 42-126		Date: 11/17/22	Time: 1237		Crew:	JP, SM	
Coordinates:	N 619026.6		E 561705.3		Vessel:		
Core # : T2 D	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:				Core Penetration Length (ft.):		3.0		
Measured Water Depth [MWD] [ft.]:		0.6		Recovered Core Length (ft.):		-		
				Sample Length Retained (ft.):		-		
				Core Volume Retained (gal.):		-		
				Collected to Project Depth:		Y / N		
Required Sample Core Length [SCL] [ft.]:								

All Length Measurements are in Decimal Feet

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

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

Conditions:

Comments: Cores processed by client.

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	Y	N
Oil Present	Y	N
Odor Present	Y	N
Debris Present	Y	N
Within 10% of Req'd Core Length	Y	N
Photo	Y	N

Pushcorer (Slambar)

Eckman Ponar: Standard / Petite

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client : New Castle Conservation District			Project : White Clay Creek Dam 5			Logger: KS	
Job#: 42-126		Date: 11/17/22	Time: 1305		Crew:	JP, SM	
Coordinates:	N 619107.3		E 561650.5		Vessel:		
Core # : T3 A	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:					Core Penetration Length (ft.):	2.8		
Measured Water Depth [MWD] [ft.]:		4.1			Recovered Core Length (ft.):	-		
					Sample Length Retained (ft.):	-		
					Core Volume Retained (gal.):	-		
					Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:								

All Length Measurements are in Decimal Feet

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

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

Conditions:

Comments: Cores processed by client.

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	Y	N
Oil Present	Y	N
Odor Present	Y	N
Debris Present	Y	N
Within 10% of Req'd Core Length	Y	N
Photo	Y	N

Pushcorer (Slambar)

Eckman Ponar: Standard / Petite

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client : New Castle Conservation District			Project : White Clay Creek Dam 5			Logger: KS	
Job#: 42-126	Date: 11/17/22		Time: 1331		Crew:	JP, SM	
Coordinates:	N 619117.7		E 561665.1		Vessel:		
Core # : T3 B	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:				Core Penetration Length (ft.):		2.1	0.3	
Measured Water Depth [MWD] [ft.]: 4.4				Recovered Core Length (ft.):		0.0	0.3	
				Sample Length Retained (ft.):		-	-	
				Core Volume Retained (gal.):		-	-	
				Collected to Project Depth:		Y / N		
Required Sample Core Length [SCL] [ft.]:								

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		Brown sand. One deployment.
Bottom		

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

Conditions:

Comments: Grabs processed by client.

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	Y	N
Oil Present	Y	N
Odor Present	Y	N
Debris Present	Y	N
Within 10% of Req'd Core Length	Y	N
Photo	Y	N

Pushcorer Slambar

Eckman Ponar: Standard / (Petite)

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client :	New Castle Conservation District		Project :	White Clay Creek Dam 5		Logger:	KS	
Job#:	42-126	Date:	11/17/22	Time:	1352	Crew:	JP, SM	
Coordinates:	N	619111.4	E	561693.1		Vessel:		
Core # :	T3 C	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:				Core Penetration Length (ft.):			0.2		
Measured Water Depth [MWD] [ft.]:		4.5		Recovered Core Length (ft.):			0.2		
				Sample Length Retained (ft.):			-		
				Core Volume Retained (gal.):			-		
				Collected to Project Depth:			Y / N		
Required Sample Core Length [SCL] [ft.]:									

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		Went straight to ponar grab. Brown sand. One deployment.
Bottom		

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

Conditions:

Comments: Grabs processed by client.

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	Y	N
Oil Present	Y	N
Odor Present	Y	N
Debris Present	Y	N
Within 10% of Req'd Core Length	Y	N
Photo	Y	N

Pushcorer Slambar

Eckman Ponar: Standard / (Petite)

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client : New Castle Conservation District			Project : White Clay Creek Dam 5			Logger: KS	
Job#: 42-126		Date: 11/17/22	Time: 1405		Crew:	JP, SM	
Coordinates:	N 619128.1		E 561716.7		Vessel:		
Core # : T3 D	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:					Core Penetration Length (ft.):	2.6		
Measured Water Depth [MWD] [ft.]:		3.4			Recovered Core Length (ft.):	-		
					Sample Length Retained (ft.):	-		
					Core Volume Retained (gal.):	-		
					Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:								

All Length Measurements are in Decimal Feet

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

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

Conditions:

Comments: Cores processed by client.

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	Y	N
Oil Present	Y	N
Odor Present	Y	N
Debris Present	Y	N
Within 10% of Req'd Core Length	Y	N
Photo	Y	N

Pushcorer (Slambar)

Eckman Ponar: Standard / Petite

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client : New Castle Conservation District			Project : White Clay Creek Dam 5			Logger: KS	
Job#: 42-126	Date: 11/17/22		Time: 1432		Crew:	JP, SM	
Coordinates:	N 619192.1		E 561624.3		Vessel:		
Core # : T4 A	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:					Core Penetration Length (ft.):	0.4		
Measured Water Depth [MWD] [ft.]:	8.1				Recovered Core Length (ft.):	0.3		
					Sample Length Retained (ft.):	-		
					Core Volume Retained (gal.):	-		
					Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:								

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		Straight to ponar grabs. Brown silt. 2 deployments.
Bottom		

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

Conditions:

Comments: Grabs processed by client.

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	Y	N
Oil Present	Y	N
Odor Present	Y	N
Debris Present	Y	N
Within 10% of Req'd Core Length	Y	N
Photo	Y	N

Pushcorer Slambar

Eckman Ponar: Standard / (Petite)

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client : New Castle Conservation District			Project : White Clay Creek Dam 5			Logger: KS	
Job#: 42-126		Date: 11/17/22	Time: 1445		Crew:	JP, SM	
Coordinates:	N 619194.1		E 561653.1		Vessel:		
Core # : T4 B	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:					Core Penetration Length (ft.):	2.8		
Measured Water Depth [MWD] [ft.]:		4.7			Recovered Core Length (ft.):	-		
					Sample Length Retained (ft.):	-		
					Core Volume Retained (gal.):	-		
					Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:								

All Length Measurements are in Decimal Feet

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

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

Conditions:

Comments: Cores processed by client.

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	Y	N
Oil Present	Y	N
Odor Present	Y	N
Debris Present	Y	N
Within 10% of Req'd Core Length	Y	N
Photo	Y	N

Pushcorer (Slambar)

Eckman Ponar: Standard / Petite

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client : New Castle Conservation District			Project : White Clay Creek Dam 5			Logger: KS	
Job#: 42-126	Date: 11/17/22	Time: 1458		Crew:	JP, SM		
Coordinates:	N 619203.1	E 561683.8		Vessel:			
Core # : T4 C	Zone: DE Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:				Core Penetration Length (ft.):	3.4		
Measured Water Depth [MWD] [ft.]:	3.7			Recovered Core Length (ft.):	-		
				Sample Length Retained (ft.):	-		
				Core Volume Retained (gal.):	-		
				Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:							

All Length Measurements are in Decimal Feet

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

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

Conditions:

Comments: Cores processed by client.

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	Y	N
Oil Present	Y	N
Odor Present	Y	N
Debris Present	Y	N
Within 10% of Req'd Core Length	Y	N
Photo	Y	N

Pushcorer (Slambar)

Eckman Ponar: Standard / Petite

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client : New Castle Conservation District			Project : White Clay Creek Dam 5			Logger: KS	
Job#: 42-126	Date: 11/17/22		Time: 1511		Crew:	JP, SM	
Coordinates:	N 619227.5		E 561705.5		Vessel:		
Core # : T4 D	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:					Core Penetration Length (ft.):	3.2		
Measured Water Depth [MWD] [ft.]:	1.2				Recovered Core Length (ft.):	-		
					Sample Length Retained (ft.):	-		
					Core Volume Retained (gal.):	-		
					Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:								

All Length Measurements are in Decimal Feet

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

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

Conditions:

Comments: Cores processed by client.

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	Y	N
Oil Present	Y	N
Odor Present	Y	N
Debris Present	Y	N
Within 10% of Req'd Core Length	Y	N
Photo	Y	N

Pushcorer (Slambar)

Eckman Ponar: Standard / Petite

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client : New Castle Conservation District			Project : White Clay Creek Dam 7			Logger: KS	
Job#: 42-126		Date: 11/18/22	Time: 1101		Crew:	JP, AF	
Coordinates:	N 626131.9		E 559176.6		Vessel:		
Core # : T1 A	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:					Core Penetration Length (ft.):	3.0		
Measured Water Depth [MWD] [ft.]:		3.5			Recovered Core Length (ft.):	-		
					Sample Length Retained (ft.):	-		
					Core Volume Retained (gal.):	-		
					Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:								

All Length Measurements are in Decimal Feet

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

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

Conditions:

Comments: Cores processed by client.

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	Y	N
Oil Present	Y	N
Odor Present	Y	N
Debris Present	Y	N
Within 10% of Req'd Core Length	Y	N
Photo	Y	N

Pushcorer (Slambar)

Eckman Ponar: Standard / Petite

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client : New Castle Conservation District			Project : White Clay Creek Dam 7			Logger: KS	
Job#: 42-126		Date: 11/18/22	Time: 1056		Crew:	JP, AF	
Coordinates:	N 626155.7		E 559196.4		Vessel:		
Core # : T1 B	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:					Core Penetration Length (ft.):	3.0		
Measured Water Depth [MWD] [ft.]:		3.2			Recovered Core Length (ft.):	-		
					Sample Length Retained (ft.):	-		
					Core Volume Retained (gal.):	-		
					Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:								

All Length Measurements are in Decimal Feet

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

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

Conditions:

Comments: Cores processed by client.

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	Y	N
Oil Present	Y	N
Odor Present	Y	N
Debris Present	Y	N
Within 10% of Req'd Core Length	Y	N
Photo	Y	N

Pushcorer (Slambar)

Eckman Ponar: Standard / Petite

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client : New Castle Conservation District			Project : White Clay Creek Dam 7			Logger: KS	
Job#: 42-126		Date: 11/18/22	Time: 1114		Crew:	JP, AF	
Coordinates:	N 626183.8		E 559214.7		Vessel:		
Core # : T1 C	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:					Core Penetration Length (ft.):	2.3		
Measured Water Depth [MWD] [ft.]:	2.7				Recovered Core Length (ft.):	-		
					Sample Length Retained (ft.):	-		
					Core Volume Retained (gal.):	-		
					Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:								

All Length Measurements are in Decimal Feet

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

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

Conditions:

Comments: Cores processed by client.

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	Y	N
Oil Present	Y	N
Odor Present	Y	N
Debris Present	Y	N
Within 10% of Req'd Core Length	Y	N
Photo	Y	N

Pushcorer (Slambar)

Eckman Ponar: Standard / Petite

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client :	New Castle Conservation District		Project :	White Clay Creek Dam 7		Logger:	KS	
Job#:	42-126	Date:	11/18/22	Time:	1125	Crew:	JP, AF	
Coordinates:	N	626209.5	E	559220.8		Vessel:		
Core # :	T1 D	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:						Core Penetration Length (ft.):	2.7		
Measured Water Depth [MWD] [ft.]:		1.5				Recovered Core Length (ft.):	-		
						Sample Length Retained (ft.):	-		
						Core Volume Retained (gal.):	-		
						Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:									

All Length Measurements are in Decimal Feet

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

					Core Volumes	
# of containers:					Nominal core-barrel	
Type of container:	bucket	hardliner	cup	other	diameter	EST. Volume
Conditions:					3.0"	.25 gal/ft
					3.5" 8.0"	.33 gal/ft
Comments: Cores processed by client.					4.0"	.50 gal/ft
					Liner Type: Soft Hard	
					Vibracorer: P3 P5 VT6 Other	

Live Organisms Present	Y	N
Oil Present	Y	N
Odor Present	Y	N
Debris Present	Y	N
Within 10% of Req'd Core Length	Y	N
Photo	Y	N

Pushcorer (Slambar)

Eckman Ponar: Standard / Petite

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client : New Castle Conservation District			Project : White Clay Creek Dam 7			Logger: KS	
Job#: 42-126		Date: 11/18/22	Time: 1205		Crew:	JP, AF	
Coordinates:	N 626173.1		E 559135.5		Vessel:		
Core # : T2 A	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:					Core Penetration Length (ft.):	2.5		
Measured Water Depth [MWD] [ft.]:		3.0			Recovered Core Length (ft.):	-		
					Sample Length Retained (ft.):	-		
					Core Volume Retained (gal.):	-		
					Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:								

All Length Measurements are in Decimal Feet

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

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

Conditions:

Comments: Cores processed by client.

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	Y	N
Oil Present	Y	N
Odor Present	Y	N
Debris Present	Y	N
Within 10% of Req'd Core Length	Y	N
Photo	Y	N

Pushcorer (Slambar)

Eckman Ponar: Standard / Petite

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client :	New Castle Conservation District		Project :	White Clay Creek Dam 7		Logger:	KS	
Job#:	42-126	Date:	11/18/22	Time:	1216	Crew:	JP, AF	
Coordinates:	N	626198.6	E	559156.5		Vessel:		
Core # :	T2 B	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:				Core Penetration Length (ft.):			0.1		
Measured Water Depth [MWD] [ft.]:		3.0		Recovered Core Length (ft.):			0.1		
				Sample Length Retained (ft.):			-		
				Core Volume Retained (gal.):			-		
				Collected to Project Depth:			Y / N		
Required Sample Core Length [SCL] [ft.]:									

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		Straight to ponar grabs. Rocks, sand and leaves. 6 deployments.
Bottom		

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

Conditions:

Comments: Grabs processed by client.

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	Y	N
Oil Present	Y	N
Odor Present	Y	N
Debris Present	Y	N
Within 10% of Req'd Core Length	Y	N
Photo	Y	N

Pushcorer Slambar

Eckman Ponar: Standard / (Petite)

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client : New Castle Conservation District			Project : White Clay Creek Dam 7			Logger: KS	
Job#: 42-126	Date: 11/18/22		Time: 1222		Crew:	JP, AF	
Coordinates:	N 626219.0		E 559171.8		Vessel:		
Core # : T2 C	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:					Core Penetration Length (ft.):	0.2		
Measured Water Depth [MWD] [ft.]:	3.9				Recovered Core Length (ft.):	0.1		
					Sample Length Retained (ft.):	-		
					Core Volume Retained (gal.):	-		
					Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:								

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		Straight to ponar grabs. Brown sand and rocks. 2 deployments.
Bottom		

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

Conditions:

Comments: Grabs processed by client.

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	Y	N
Oil Present	Y	N
Odor Present	Y	N
Debris Present	Y	N
Within 10% of Req'd Core Length	Y	N
Photo	Y	N

Pushcorer Slambar

Eckman Ponar: Standard / (Petite)

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client : New Castle Conservation District			Project : White Clay Creek Dam 7			Logger: KS	
Job#: 42-126	Date: 11/18/22		Time: 1227		Crew:	JP, AF	
Coordinates:	N 626241.4		E 559173.9		Vessel:		
Core # : T2 D	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:					Core Penetration Length (ft.):	0.5		
Measured Water Depth [MWD] [ft.]: 5.7					Recovered Core Length (ft.):	0.5		
					Sample Length Retained (ft.):	-		
					Core Volume Retained (gal.):	-		
					Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:								

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		Straight to ponar grabs. Brown silt w/ some leaves. One deployment.
Bottom		

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

Conditions:

Comments: Grab processed by client.

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	Y	N
Oil Present	Y	N
Odor Present	Y	N
Debris Present	Y	N
Within 10% of Req'd Core Length	Y	N
Photo	Y	N

Pushcorer Slambar

Eckman Ponar: Standard / (Petite)

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client : New Castle Conservation District			Project : White Clay Creek Dam 7			Logger: KS	
Job#: 42-126		Date: 11/18/22	Time: 1245		Crew:	JP, AF	
Coordinates:	N 626236.2		E 559063.2		Vessel:		
Core # : T3 A	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:					Core Penetration Length (ft.):	3.6		
Measured Water Depth [MWD] [ft.]:		2.5			Recovered Core Length (ft.):	-		
					Sample Length Retained (ft.):	-		
					Core Volume Retained (gal.):	-		
					Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:								

All Length Measurements are in Decimal Feet

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

					Core Volumes	
# of containers:					Nominal core-barrel	
Type of container:	bucket	hardliner	cup	other	diameter	EST. Volume
Conditions:					3.0"	.25 gal/ft
					3.5" 8.0"	.33 gal/ft
Comments: Cores processed by client.					4.0"	.50 gal/ft
					Liner Type: Soft Hard	
					Vibracorer: P3 P5 VT6 Other	

Live Organisms Present	Y	N
Oil Present	Y	N
Odor Present	Y	N
Debris Present	Y	N
Within 10% of Req'd Core Length	Y	N
Photo	Y	N

Pushcorer (Slambar)

Eckman Ponar: Standard / Petite

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client : New Castle Conservation District			Project : White Clay Creek Dam 7			Logger: KS	
Job#: 42-126	Date: 11/18/22		Time: 1251		Crew:	JP, AF	
Coordinates:	N 626251.4		E 559077.8		Vessel:		
Core # : T3 B	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:					Core Penetration Length (ft.):	0.5		
Measured Water Depth [MWD] [ft.]:	2.9				Recovered Core Length (ft.):	0.5		
					Sample Length Retained (ft.):	-		
					Core Volume Retained (gal.):	-		
					Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:								

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		Straight to ponar grabs. Leaves. 3 deployments.
Bottom		

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

Conditions:

Comments: Grabs processed by client.

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	Y	N
Oil Present	Y	N
Odor Present	Y	N
Debris Present	Y	N
Within 10% of Req'd Core Length	Y	N
Photo	Y	N

Pushcorer Slambar

Eckman Ponar: Standard (Petite)

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client : New Castle Conservation District			Project : White Clay Creek Dam 7			Logger: KS	
Job#: 42-126	Date: 11/18/22		Time: 1258		Crew:	JP, AF	
Coordinates:	N 626287.1		E 559077.6		Vessel:		
Core # : T3 C	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:					Core Penetration Length (ft.):	0.1		
Measured Water Depth [MWD] [ft.]: 5.4					Recovered Core Length (ft.):	0.1		
					Sample Length Retained (ft.):	-		
					Core Volume Retained (gal.):	-		
					Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:								

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		Straight to ponar grabs. Brown sand and gravel. 2 deployments.
Bottom		

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

Conditions:

Comments: Grabs processed by client.

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	Y	N
Oil Present	Y	N
Odor Present	Y	N
Debris Present	Y	N
Within 10% of Req'd Core Length	Y	N
Photo	Y	N

Pushcorer Slambar

Eckman Ponar: Standard / (Petite)

Box Core

MLW #td ver 030615

AQUA SURVEY, INC.

SEDIMENT CORE LOG

Client : New Castle Conservation District			Project : White Clay Creek Dam 7			Logger: KS	
Job#: 42-126	Date: 11/18/22		Time: 1309		Crew:	JP, AF	
Coordinates:	N 626301.9		E 559100.2		Vessel:		
Core # : T3 D	Zone: DE	Datum NAD 83			Deploy:	1	2	3
Project Depth [PD] [ft]:					Core Penetration Length (ft.):	0.4		
Measured Water Depth [MWD] [ft.]: 5.1					Recovered Core Length (ft.):	0.4		
					Sample Length Retained (ft.):	-		
					Core Volume Retained (gal.):	-		
					Collected to Project Depth:	Y / N		
Required Sample Core Length [SCL] [ft.]:								

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top		Straight to ponar grabs. Brown silt and leaves. 2 deployments.
Bottom		

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

Conditions:

Comments: Grabs processed by client.

Core Volumes

Nominal core-barrel diameter	EST. Volume
3.0"	.25 gal/ft
3.5" 8.0"	.33 gal/ft
4.0"	.50 gal/ft

Liner Type: Soft Hard

Vibracorer: P3 P5 VT6 Other

Live Organisms Present	Y	N
Oil Present	Y	N
Odor Present	Y	N
Debris Present	Y	N
Within 10% of Req'd Core Length	Y	N
Photo	Y	N

Pushcorer Slambar

Eckman Ponar: Standard (Petite)

Box Core

MLW #td ver 030615

APPENDIX B

LABORATORY ANALYTICAL REPORTS

(Large Files - Available for download at https://dnrec.alpha.delaware.gov/waste-hazardous/remediation/watar/, or upon request)

APPENDIX C

TOXICITY EVALUATIONS OF WHITE CLAY CREEK SEDIMENTS

(Large Files - Available for download at https://dnrec.alpha.delaware.gov/waste-hazardous/remediation/watar/, or upon request)

APPENDIX D

DERAC 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_m/U_t) unitless	0.194	0.194
n (total soil porosity) L_{pore}/L_{soil}	0.43396	0.43396
ρ_b (dry soil bulk density) g/cm ^{3}	1.5	1.5
ρ_b (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_{vol} (g/m^2-s per kg/m^3)	68.18	68.18
Q/C_{vol} (g/m^2-s per kg/m^3 - mass limit)	68.18	68.18
A_s (PEF acres)	0.5	0.5
A_s (VF acres)	0.5	0.5
A_s (VF mass-limit acres)	0.5	0.5
AF_{0-2} (mutagenic skin adherence factor) mg/cm ^{2}	0.2	0.2
AF_{2-6} (mutagenic skin adherence factor) mg/cm ^{2}	0.2	0.2
AF_{6-16} (mutagenic skin adherence factor) mg/cm ^{2}	0.07	0.07
AF_{16-26} (mutagenic skin adherence factor) mg/cm ^{2}	0.07	0.07
AF_{res-a} (skin adherence factor - adult) mg/cm ^{2}	0.07	0.07
AF_{res-c} (skin adherence factor - child) mg/cm ^{2}	0.2	0.2
AT_{res} (averaging time - resident carcinogenic)	365	365

Output generated 28APR2023:11:46:16

Site-specific Risk
Resident Soil Inputs

Variable	Resident Soil Default Value	Site-Specific Value
BW_{0-2} (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_{16-26} (mutagenic body weight) kg	80	80
BW_{res-a} (body weight - adult) kg	80	80
BW_{res-c} (body weight - child) kg	15	15
$DFS_{res-adj}$ (age-adjusted soil dermal factor) mg/kg	103390	103390
$DFSM_{res-adj}$ (mutagenic age-adjusted soil dermal factor) mg/kg	428260	428260
ED_{res} (exposure duration) years	26	26
ED_{0-2} (mutagenic exposure duration) years	2	2
ED_{2-6} (mutagenic exposure duration) years	4	4
ED_{6-16} (mutagenic exposure duration) years	10	10
ED_{16-26} (mutagenic exposure duration) years	10	10
ED_{res-a} (exposure duration - adult) years	20	20
ED_{res-c} (exposure duration - child) years	6	6
EF_{res} (exposure frequency) days/year	350	350
EF_{0-2} (mutagenic exposure frequency) days/year	350	350
EF_{2-6} (mutagenic exposure frequency) days/year	350	350
EF_{6-16} (mutagenic exposure frequency) days/year	350	350
EF_{16-26} (mutagenic exposure frequency) days/year	350	350
EF_{res-a} (exposure frequency - adult) days/year	350	350
EF_{res-c} (exposure frequency - child) days/year	350	350
ET_{res} (exposure time) hours/day	24	24
ET_{0-2} (mutagenic exposure time) hours/day	24	24
ET_{2-6} (mutagenic exposure time) hours/day	24	24
ET_{6-16} (mutagenic exposure time) hours/day	24	24
ET_{16-26} (mutagenic exposure time) hours/day	24	24
ET_{res-a} (adult exposure time) hours/day	24	24
ET_{res-c} (child exposure time) hours/day	24	24
$IFS_{res-adj}$ (age-adjusted soil ingestion factor) mg/kg	36750	36750
$IFSM_{res-adj}$ (mutagenic age-adjusted soil ingestion factor) mg/kg	166833.3	166833.3

Output generated 28APR2023:11:46:16

Site-specific Risk
Resident Soil Inputs

Variable	Resident Soil Default Value	Site-Specific Value
IRS_{0-2} (mutagenic soil intake rate) mg/day	200	200
IRS_{2-6} (mutagenic soil intake rate) mg/day	200	200
IRS_{6-16} (mutagenic soil intake rate) mg/day	100	100
IRS_{16-26} (mutagenic soil intake rate) mg/day	100	100
IRS_{res-a} (soil intake rate - adult) mg/day	100	100
IRS_{res-c} (soil intake rate - child) mg/day	200	200
LT (lifetime) years	70	70
SA_{0-2} (mutagenic skin surface area) cm^2/day	2373	2373
SA_{2-6} (mutagenic skin surface area) cm^2/day	2373	2373
SA_{6-16} (mutagenic skin surface area) cm^2/day	6032	6032
SA_{16-26} (mutagenic skin surface area) cm^2/day	6032	6032
SA_{res-a} (skin surface area - adult) cm^2/day	6032	6032
SA_{res-c} (skin surface area - child) cm^2/day	2373	2373
T_w (groundwater temperature) Celsius	25	25
$Theta_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396	0.28396
$Theta_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15	0.15
T (exposure interval) s	819936000	819936000
T (exposure interval) yr	26	26
U_m (mean annual wind speed) m/s	4.69	4.69
U_t (equivalent threshold value)	11.32	11.32
V (fraction of vegetative cover) unitless	0.5	0.5

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Site-specific Risk
Resident for Soil

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_{gi}	ABS_{derm}	Volatilization Factor Unlimited Reservoir (m^3/kg)	Volatilization Factor Mass Limit (m^3/kg)
Thallium (Soluble Salts)	7440-28-0	No	No	1.00E-05	SCREEN Current	-		-		-		1	-	-	-
**Total Risk/HI*				-		-		-		-		-	-	-	-

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Site-specific Risk
Resident for Soil

Volatilization Factor Selected (m^3/kg)	DA	Particulate Emission Factor (m^3/kg)	Soil Saturation Concentration (mg/kg)	RBA	HLC (atm-m^3/mole)	Henry's Law Constant (unitless)	H` and HLC Ref	Henry's Law Constant Used in Calcs (unitless)	Normal Boiling Point BP (K)	BP Ref	Critical Temperature T_C\ (K)	T_C\ Ref	D_{ia}\ (cm^2/s)	D_{iw}\ (cm^2/s)
-	-	1.36E+09	-	1	-	-		-	1.73E+03	PHYSPROP	4.65E+03	YAWS	-	-
-	-	-	-	-	-	-		-	-		-		-	-

Output generated 28APR2023:11:46:16

Site-specific Risk
Resident for Soil

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)	Adjusted Ingestion Noncarcinogenic CDI (mg/kg-day)
0.32	4.09E-06	-	2.26E-10	3.84E-07	-	2.26E-10	1.24E-06
-	-	-	-	-	-	-	-

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Site-specific Risk
Resident for Soil

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	Adult Dermal HQ	Adult Inhalation HQ
-	2.26E-10	4.60E-07	-	8.38E-08	**4.09E-01**	-	-	**4.09E-01**	3.84E-02	-	-
-	-	-	-	-	***4.09E-01***	-	-	***4.09E-01***	*3.84E-02*	-	-

Output generated 28APR2023:11:46:16

Site-specific Risk
Resident for Soil

Adult Total HI	Adjusted Ingestion HQ	Adjusted Dermal HQ	Adjusted Inhalation HQ	Adjusted Total HI	Ingestion Risk	Dermal Risk	Inhalation Risk	Total Risk
3.84E-02	**1.24E-01**	-	-	**1.24E-01**	-	-	-	-
3.84E-02	***1.24E-01***	-	-	***1.24E-01***	-	-	-	-

Output generated 28APR2023:11:46:16

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_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_{vol} (g/m^2-s per kg/m^3)	68.18	68.18
Q/C_{vol} (g/m^2-s per kg/m^3 - mass limit)	68.18	68.18
A_s (PEF acres)	0.5	0.5
A_s (VF acres)	0.5	0.5
A_s (VF mass-limit acres)	0.5	0.5
AF_{ew} (skin adherence factor - excavation worker) mg/cm ^{2}	0.3	0.3
AT_{ew} (averaging time - excavation worker)	365	365
BW_{ew} (body weight - excavation worker) kg	80	80
ED_{ew} (exposure duration - excavation worker) yr	1	1
EF_{ew} (exposure frequency - excavation worker) day/yr	20	20
ET_{ew} (exposure time - excavation worker) hr	8	8

Output generated 28APR2023:11:50:12

Site-specific Risk
Excavation Worker Soil Inputs

Variable	Excavation Worker Soil Default Value	Site-Specific Value
IR_{ew} (soil ingestion rate - excavation worker) mg/day	330	330
LT (lifetime) yr	70	70
SA_{ew} (surface area - excavation worker) cm^2/day	3527	3527
T_w (groundwater temperature) Celsius	25	25
$Theta_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396	0.28396
$Theta_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15	0.15
T (exposure interval) s	819936000	819936000
T (exposure interval) yr	26	26
U_m (mean annual wind speed) m/s	4.69	4.69
U_t (equivalent threshold value)	11.32	11.32
V (fraction of vegetative cover) unitless	0.5	0.5

Output generated 28APR2023:11:50:12

Site-specific Risk
Excavation Worker for Soil

Chemical	CAS Number	Mutagen?	VOC?	RfD (mg/kg-day)	RfD Ref	RfC (mg/m^3)	RfC Ref	SF_o $(mg/kg\text{-}day)^{-1}$	SF_o Ref	IUR $(ug/m^3)^{-1}$	IUR Ref	ABS_{gi}	ABS_{derm}
Thallium (Soluble Salts)	7440-28-0	No	No	4.00E-05	SCREEN Current	-		-		-		1	-
*Total Risk/HI				-		-		-		-		-	-

Volatilization Factor Unlimited Reservoir (m^3/kg)	Volatilization Factor Mass Limit (m^3/kg)	Volatilization Factor Selected (m^3/kg)	DA	Particulate Emission Factor (m^3/kg)	Soil Saturation Concentration (mg/kg)	HLC ($atm\text{-}m^3/mole$)	Henry's Law Constant (unitless)	H` and HLC Ref	Henry's Law Constant Used in Calcs (unitless)	Normal Boiling Point BP (K)
-	-	-	-	1.36E+09	-	-	-		-	1.73E+03
-	-	-	-	-	-	-	-		-	-

BP Ref	Critical Temperature T_C \ (K)	T_C \ 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)
PHYSPROP	4.65E+03	YAWS	-	-	0.32	7.23E-08	-	4.30E-12
	-		-	-	-	-	-	-

Ingestion Carcinogenic CDI (mg/kg-day)	Dermal Carcinogenic CDI (mg/kg-day)	Inhalation Carcinogenic CDI (ug/m^3)	Ingestion HQ	Dermal HQ	Inhalation HQ	Total HI	Ingestion Risk	Dermal Risk	Inhalation Risk	Total Risk
1.03E-09	-	6.14E-11	1.81E-03	-	-	1.81E-03	-	-	-	-
-	-	-	*1.81E-03*	-	-	*1.81E-03*	-	-	-	-

Output generated 28APR2023:11:50:12

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_{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_{vol} (g/m^2-s per kg/m^3)	68.18	68.18
Q/C_{vol} (g/m^2-s per kg/m^3 - mass limit)	68.18	68.18
A_s (PEF acres)	0.5	0.5
A_s (VF acres)	0.5	0.5
A_s (VF mass-limit acres)	0.5	0.5
AF_{0-2} (skin adherence factor) mg/cm ^{2}	0.2	0.2
AF_{2-6} (skin adherence factor) mg/cm ^{2}	0.2	0.2
AF_{6-16} (skin adherence factor) mg/cm ^{2}	0.07	0.07
AF_{16-30} (skin adherence factor) mg/cm ^{2}	0.07	0.07
AF_{rec-a} (skin adherence factor - adult) mg/cm ^{2}	0.07	0.07
AF_{rec-c} (skin adherence factor - child) mg/cm ^{2}	0.2	0.2
AT_{rec} (averaging time)	365	365

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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_{16-30} (body weight) kg	80	80
BW_{rec-a} (body weight - adult) kg	80	80
BW_{rec-c} (body weight - child) kg	15	15
$DFS_{rec-adj}$ (age-adjusted soil dermal factor) mg/kg	22155	22155
$DFSM_{rec-adj}$ (mutagenic age-adjusted soil dermal factor) mg/kg	91770	91770
ED_{rec} (exposure duration - recreator) years	26	26
ED_{0-2} (exposure duration) year	2	2
ED_{2-6} (exposure duration) year	4	4
ED_{6-16} (exposure duration) year	10	10
ED_{16-30} (exposure duration) year	10	10
ED_{rec-c} (exposure duration - child) years	6	6
EF_{rec} (exposure frequency) days/year	75	75
EF_{0-2} (exposure frequency) days/year	75	75
EF_{2-6} (exposure frequency) days/year	75	75
EF_{6-16} (exposure frequency) days/year	75	75
EF_{16-30} (exposure frequency) days/year	75	75
EF_{rec-a} (exposure frequency - adult) days/year	75	75
EF_{rec-c} (exposure frequency - child) days/year	75	75
ET_{rec} (exposure time - recreator) hours/day	1	1
ET_{0-2} (exposure time) hours/day	1	1
ET_{2-6} (exposure time) hours/day	1	1
ET_{6-16} (exposure time) hours/day	1	1
ET_{16-30} (exposure time) hours/day	1	1
ET_{rec-a} (adult exposure time) hours/day	1	1
ET_{rec-c} (child exposure time) hours/day	1	1
$IFS_{rec-adj}$ (age-adjusted soil ingestion factor) mg/kg	7875	7875
$IFSM_{rec-adj}$ (mutagenic age-adjusted soil ingestion factor) mg/kg	35750	35750
IRS_{0-2} (soil intake rate) mg/day	200	200

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Site-specific Risk
Recreator Soil/Sediment Inputs

Variable	Recreator Soil/Sediment Default Value	Site-Specific Value
IRS_{2-6} (soil intake rate) mg/day	200	200
IRS_{6-16} (soil intake rate) mg/day	100	100
IRS_{16-30} (soil intake rate) mg/day	100	100
IRS_{rec-a} (soil intake rate - adult) mg/day	100	100
IRS_{rec-c} (soil intake rate - child) mg/day	200	200
LT (lifetime - recreator) years	70	70
SA_{0-2} (skin surface area) cm^2/day	2373	2373
SA_{2-6} (skin surface area) cm^2/day	2373	2373
SA_{6-16} (skin surface area) cm^2/day	6032	6032
SA_{16-30} (skin surface area) cm^2/day	6032	6032
SA_{rec-a} (skin surface area - adult) cm^2/day	6032	6032
SA_{rec-c} (skin surface area - child) cm^2/day	2373	2373
T_w (groundwater temperature) Celsius	25	25
$Theta_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396	0.28396
$Theta_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15	0.15
T (exposure interval) s	819936000	819936000
T (exposure interval) yr	26	26
U_m (mean annual wind speed) m/s	4.69	4.69
U_t (equivalent threshold value)	11.32	11.32
V (fraction of vegetative cover) unitless	0.5	0.5

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Site-specific Risk
Recreator for Soil/Sediment

Chemical	CAS Number	Mutagen?	VOC?	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_{gi}	ABS_{derm}	Volatilization Factor Unlimited Reservoir (m^3/kg)	Volatilization Factor Mass Limit (m^3/kg)
Thallium (Soluble Salts)	7440-28-0	No	No	1.00E-05	SCREEN Current	-		-		-		1	-	-	-
**Total Risk/HI*				-		-		-		-		-	-	-	-

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Site-specific Risk
Recreator for Soil/Sediment

Volatilization Factor Selected (m^3/kg)	DA	Particulate Emission Factor (m^3/kg)	Soil Saturation Concentration (mg/kg)	RBA	HLC (atm-m^3/mole)	Henry's Law Constant (unitless)	H` and HLC Ref	Henry's Law Constant Used in Calcs (unitless)	Normal Boiling Point BP (K)	BP Ref	Critical Temperature T_C\ (K)	T_C\ Ref	D_{ia}\ (cm^2/s)	D_{iw}\ (cm^2/s)
-	-	1.36E+09	-	1	-	-		-	1.73E+03	PHYSPROP	4.65E+03	YAWS	-	-
-	-	-	-	-	-	-		-	-		-		-	-

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Site-specific Risk
Recreator for Soil/Sediment

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)	Adjusted Ingestion Noncarcinogenic CDI (mg/kg-day)
0.32	8.77E-07	-	2.02E-12	8.22E-08	-	2.02E-12	2.66E-07
-	-	-	-	-	-	-	-

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Site-specific Risk
Recreator for Soil/Sediment

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	Adult Dermal HQ	Adult Inhalation HQ
-	2.02E-12	9.86E-08	-	7.49E-10	8.77E-02	-	-	8.77E-02	8.22E-03	-	-
-	-	-	-	-	*8.77E-02*	-	-	*8.77E-02*	*8.22E-03*	-	-

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Site-specific Risk
Recreator for Soil/Sediment

Adult Total HI	Adjusted Ingestion HQ	Adjusted Dermal HQ	Adjusted Inhalation HQ	Adjusted Total HI	Ingestion Risk	Dermal Risk	Inhalation Risk	Total Risk
8.22E-03	2.66E-02	-	-	2.66E-02	-	-	-	-
8.22E-03	*2.66E-02*	*-*	*-*	*2.66E-02*	*-*	*-*	*-*	*-*

Output generated 28APR2023:11:51:55