FINAL
Preliminary Assessment Report
Stern Armory,
Wilmington, Delaware

Perfluorooctanesulfonic Acid (PFOS) and Perfluorooctanoic Acid (PFOA) Impacted Sites
ARNG Installations, Nationwide

June 2020

Prepared for:

Army National Guard Bureau
111 S. George Mason Drive
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UNCLASSIFIED

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Acronyms and Abbreviations

°F	degrees Fahrenheit
AECOM	AECOM Technical Services, Inc.
AFFF	aqueous film forming foam
AFW	Amec Foster Wheeler
amsl	Above Mean Sea Level
ANG	Air National Guard
AOI	Area of Interest
ARNG	Army National Guard
bmsl	Below Mean Sea Level
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CRA	Conestoga-Rovers & Associates
CSM	conceptual site model
DEANG	Delaware Air National Guard
DEARNG	Delaware Army National Guard
DGS	Delaware Geological Survey
DNREC	Delaware Department of Natural Resources and Environmental Control
DRBC	Delaware River Basin Commission
EDR™	Environmental Data Resources, Inc.™
FMS	Field Maintenance Shop
FTA	fire training area
GM	General Motors
HA	Health Advisory
IED	Installations & Environment Division
NCCDE	New Castle County Delaware Government
PA	Preliminary Assessment
PFAS	per- and poly-fluoroalkyl substances
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
SI	Site Inspection
UCMR3	Unregulated Contaminant Monitoring Rule 3
US	United States
USACE	United States Army Corps of Engineers
USCB	United States Census Bureau
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VSI	visual site inspection

Executive Summary

The Army National Guard (ARNG) is performing Preliminary Assessments (PAs) and Site Inspections (SIs) for Perfluorooctanesulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA) Impacted Sites at ARNG Facilities Nationwide. A PA for per- and polyfluoroalkyl substances (PFAS)-containing materials was completed for Stern Armory (also referred to as the "facility") in Wilmington, Delaware, to assess potential PFAS release areas and exposure pathways to receptors. Stern Armory currently resides on a portion of land deeded to the Delaware ARNG (DEARNG) in 1971 from the State of Delaware through the Division of Highway and Transportation. The performance of this PA included the following tasks:

- Reviewed available administrative record documents and Environmental Data Resources, Inc. (EDR)™ report packages to obtain information relevant to potential PFAS releases, such as: drinking water well locations, historical aerial photographs, Sanborn maps, and environmental compliance actions in the area surrounding the facility;
- Conducted a site visit on 5 August 2019 and completed visual site inspections (VSIs) at locations where PFAS-containing materials were suspected of being stored, used, or disposed;
- Interviewed current Stern Armory and DEARNG personnel, including environmental managers and operations staff during the site visit;
- Identified Areas of Interest (AOIs) and developed a preliminary conceptual site model to summarize potential PFAS source-pathway-receptor linkages for each AOI.

No AOIs related to potential PFAS use, release, or storage were identified at Stern Armory during the PA (**Figure ES-1**). Based on facility history and interviews with various personnel, there is no potential for exposure to PFAS contamination in media at or near the facility.

Based on the US Environmental Protection Agency's (USEPA) Unregulated Contaminant Monitoring Rule 3 (UCMR3) data, it was indicated that PFAS were detected in a public water system above the USEPA's Health Advisory (HA) within 20 miles of the facility (**Appendix A**). PFAS analyses performed in 2016 had method detection limits that were higher than currently achievable. Thus, it is possible that low concentrations of PFAS were not detected during the UCMR3 but might be detected if analyzed today.

CLIENT	ARNG			
NOTES	Preliminary Assessment for PFAS at Stern Armory, DE			
REVISED	12/6/2019	GIS BY	GC	12/6/2019
SCALE	1:6,000	CHK BY	VK	12/6/2019
Base Map: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	RG	12/6/2019

Summary of Findings

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure ES-1

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1. Introduction

1.1 Authority and Purpose

The Army National Guard (ARNG)-Installations & Environment Division (IED) is the lead agency in performing *Preliminary Assessments (PAs) and Site Inspections (SIs) for Perfluorooctanesulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA) at Impacted Sites at ARNG Facilities Nationwide*. This work is supported by the United States (US) Army Corps of Engineers (USACE) Baltimore District and their contractor AECOM Technical Services, Inc. (AECOM) under Contract Number W912DR-12-D-0014, Task Order W912DR17F0192, issued 11 August 2017.

The ARNG is assessing potential effects on human health related to processes at facilities that used per- and poly-fluoroalkyl substances (PFAS), primarily in the form of aqueous film forming foam (AFFF) released as part of firefighting activities, although other PFAS sources are possible. In addition, the ARNG is assessing businesses or operations adjacent to the ARNG facility (not under the control of ARNG) that could potentially be responsible for a PFAS release.

PFAS are classified as emerging environmental contaminants that are garnering increasing regulatory interest due to their potential risks to human health and the environment. PFAS formulations contain highly diverse mixtures of compounds. Thus, the fate of PFAS compounds in the environment varies. The regulatory framework at both federal and state levels continues to evolve. The US Environmental Protection Agency (USEPA) issued a lifetime Health Advisory (HA) for PFOA and PFOS in May 2016, but there are currently no promulgated national standards regulating PFAS in drinking water.

This report presents the findings of a PA for PFAS-containing materials at Stern Armory (also referred to as the "facility") in Wilmington, Delaware, in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, the National Oil and Hazardous Substances Pollution Contingency Plan (40 Code of Federal Regulations [CFR] Part 300), and USACE requirements and guidance.

This PA documents potential locations where PFAS may have been released into the environment at Stern Armory. The term PFAS will be used throughout this report to encompass all PFAS chemicals being evaluated, including PFOS and PFOA, which are key components of AFFF.

1.2 Preliminary Assessment Methods

The performance of this PA included the following tasks:

- Reviewed available administrative record documents and Environmental Data Resources, Inc. (EDR)™ report packages to obtain information relevant to potential PFAS releases, such as: drinking water well locations, historical aerial photographs, Sanborn maps, and environmental compliance actions in the area surrounding the facility;
- Conducted a site visit on 5 August 2019 and completed visual site inspections (VSIs) at locations where PFAS-containing materials were suspected of being stored, used, or disposed;
- Interviewed current Stern Armory and Delaware ARNG (DEARNG) personnel including environmental managers and operations staff during the site visit;
- Identified Areas of Interest (AOIs) and developed a preliminary conceptual site model (CSM) to summarize potential PFAS source-pathway-receptor linkages for each AOI.

1.3 Report Organization

This report has been prepared in accordance with the USEPA *Guidance for Performing Preliminary Assessments under CERCLA* (USEPA 1991). The report sections and descriptions of each are presented below:

- **Section 1** – **Introduction:** identifies the project purpose and authority and describes the facility location, environmental setting, and methods used to complete the PA.
- **Section 2** – **Fire Training Areas:** describes the fire training areas (FTAs) at the facility identified during the site visit.
- **Section 3** – **Non-Fire Training Areas:** describes other locations of potential PFAS releases at the facility identified during the site visit.
- **Section 4** – **Emergency Response Areas:** describes areas of potential PFAS release at the facility, specifically in response to emergency situations.
- **Section 5** – **Adjacent Sources:** describes sources of potential PFAS release adjacent to the facility that are not under the control of ARNG.
- **Section 6** – **Preliminary Conceptual Site Model:** describes the pathways of PFAS transport and receptors for the AOIs and the facility.
- **Section 7** – **Conclusions:** summarizes the data findings and presents the conclusions and uncertainties of the PA.
- **Section 8** – **References:** provides the references used to develop this document.
- **Appendix A** – Data Resources
- **Appendix B** – Preliminary Assessment Documentation
- **Appendix C** – Photographic Log

1.4 Facility Location and Description

Stern Armory occupies approximately 4 acres in Wilmington, Delaware (**Figure 1-1**). The facility is located adjacent to Delcastle Technical High School, with the west side of the facility running along the eastern property boundary for the school. Directly across the street from Stern Armory is another DEARNG enclave as well as the location of a former General Motors (GM) production plant. Wilmington, Delaware is a metropolitan area with a population of approximately 70,000 (US Census Bureau [USCB], 2018). Properties surrounding Stern Armory are primarily zoned for single-family homes and industrial areas (New Castle County Delaware Government [NCCDE], 2018).

Stern Armory is home to the DEARNG Recruiting and Retention Battalion. The facility operates under a deed enacted in 1971 between the State of Delaware Division of Highway and Transportation and the DEARNG. The DEARNG has custodial rights over the tract of land and is responsible for its maintenance and upkeep.

Stern Armory has been used as an active military facility since 1971. Currently and historically, the facility has been used for vehicle maintenance and ammunition storage. The facility includes an armory, a facility maintenance shop (FMS), and administrative offices.

1.5 Facility Environmental Setting

The facility is located in northern New Castle County, Delaware, between Wilmington and Newark. Major geographic features include the Christina River, which flows generally northeast, into the

Delaware River, and is part of the Christina River Basin reaching into Pennsylvania (Delaware Watersheds, n.d.). The Delaware River flows south to the Delaware Bay. Buildings, asphalt, and concrete cover much of the facility, but small green spaces exist around the parking lot and on the southwestern corner of the property. Stern Armory lies within the Coastal Plain region of Delaware and is a predominantly low, flat area about 100 feet above mean sea level (amsl) **(Figure 1-2)**.

Little environmental work has been performed at Stern Armory. Therefore, information in the following sections has been drawn primarily from the Remedial Investigation report for the nearby Delaware Air National Guard (DEANG) in New Castle, Delaware and an environmental assessment for the nearby former GM facility (Amec Foster Wheeler [AFW], 2019; Conestoga-Rovers & Associates [CRA], 2010).

1.5.1 Geology

Based on the available data from US Geological Survey (USGS) maps, the facility lies within the Coastal Plain Delaware Bay Group (USGS, 2005). The Potomac Formation, mostly consisting of variegated silt and clay with interbedded quartzitic sands, underlies the facility (CRA, 2010). Soil type within this group, and subsequently within the boundary of the facility, appears to consist of medium to medium-to-coarse sands above fine-to-medium to fine sandy silt **(Figure 1-2)**. The sands of this group are primarily quartzose, with varying quantities of feldspar. Deposits in this group are vertically and laterally heterogeneous, with an upward fining of sediment texture (Delaware Geological Survey [DGS], 2019).

1.5.2 Hydrogeology

New Castle County, Delaware has two aquifers: the Columbia and Potomac. The Columbia is the surficial aquifer in this area and can either be perched or act as a hydrologic unit with the Potomac aquifer. Previous environmental investigations were performed at the GM Facility, located 0.2 miles from Stern Armory, as well as investigations at a DEANG facility 3.5 miles from Stern Armory. Due to the proximity of these studies, it is inferred that the geologic information provided is similar to that at Stern Armory. The study indicated that the Columbia formation in this area is predominantly dry, with perched water tables present. The Potomac aquifer consists of two independent (Upper and Middle), laterally-continuous sand bodies within the water-bearing zones of the Potomac formation. Groundwater around the facility is typically observed at approximately 11 to 13.5 feet below ground surface, or around 66 to 68.5 feet amsl, and flows to the west/southwest (CRA, 2010).

The Upper Potomac Aquifer lies in both the shallow and intermediate groundwater-bearing zones. The shallow zone extends from 0 to 30 feet amsl, and there is no clear distinction between the surficial Columbia aquifer and the Upper Potomac Aquifer. Separated from the shallow zone by a semi-confining layer of clay, the intermediate groundwater-bearing zone ranges from 1 to 20 feet thick, extends approximately 50 feet below mean sea level (bmsl), and is considered to be part of the Upper Potomac aquifer. Results of groundwater elevation data from a previous investigation suggest that the shallow and intermediate zones are interconnected, as they show similar trends. Groundwater flow in both zones of the Upper Potomac Aquifer as well as the Columbia Aquifer is generally to the southwest **(Figure 1-2)**.

The Middle Potomac Aquifer is considered the deep groundwater-bearing zone and is separated from the Upper Potomac Aquifer by a layer of clay 60 to 80 feet thick; it does not vertically transmit water. Below the clay layer, the aquifer's water-bearing sands extend from 120 to 130 feet bmsl, while groundwater elevation measurements from deep monitoring wells in the study are approximately 5 to 10 feet bmsl. These measurements suggest that groundwater of this aquifer is confined, and there is little transmission of water vertically between the Upper and Middle

Potomac Aquifers. Groundwater in the Middle Potomac Aquifer flows to the south-southeast **(Figure 1-2)**.

In New Castle County, south of the Chesapeake and Delaware Canal and approximately 13 miles south of the facility, nearly all drinking water is supplied from groundwater provided by public and private wells. However, north of the canal, in northern New Castle County, groundwater supplies only 30 percent of drinking water (DGS, 2019). The Delaware Department of Natural Resources and Environmental Control (DNREC) reported that Artesian Water Company, a primary drinking water provider in the area, and the City of New Castle Municipal Services Commission detected PFAS in public water supply wells in the area of Stern Armory. The area of contamination is located 2.3 miles south of the facility, and it is approximately 7 square miles and bounded to the north by Interstate 295, the Delaware River to the east, Route 273 to the south, and Route 13 and New Castle Airport to the west. The public water supply is treated for PFAS contamination before distribution (DNREC, 2019); however, there are two private domestic supply wells and one potable geothermal recharge well within 1 mile of the facility.

Based on the USEPA Unregulated Contaminant Monitoring Rule 3 (UCMR3) data, it was indicated that PFAS were detected in a public water system above the HA within 20 miles of the facility (**Appendix A**). PFAS analyses performed in 2016 had method detection limits that were higher than currently achievable. Thus, it is possible that low concentrations of PFAS were not detected during the UCMR3 but might be detected if analyzed today.

1.5.3 Hydrology

South of Stern Armory is the Christina River, a part of the Christina River Basin that extends from Pennsylvania through New Castle County, Delaware. The Christina River Basin is characterized by dendritic interconnected rivers, streams, and wetlands, with outflow to the Delaware River. The Christina River is in the southernmost area of the basin and flows northeast, into the Delaware River. Surface water accounts for 70 percent of New Castle County's water supply, the majority of which comes from the Christina River Basin, which provides 60 percent of New Castle County's water overall (DGS, 2019). The majority of Christina River is in New Castle County, with headwaters in Maryland. The Christina River is tidal from just south of the town of Christiana to its convergence with the Delaware River. This section of the Christina River lies approximately 1 mile west of the facility, and tidal freshwater wetlands occur throughout the area (Delaware Watersheds, n.d.).

Stern Armory sits on the Lower White Clay Creek Watershed. On the facility, runoff flows away from the paved areas and structures towards the wooded areas to the northeast and north. However, surrounding the facility, general surface water flow is south towards the Christina River, which flows northeast to the Delaware River.

The facility is closest to the 68-mile marker of the Delaware River (Delaware River Basin Commission [DRBC], 2011). A presentation from the Delaware River Basin Commission provides 2009 PFAS concentration data for media tested along the Delaware river. PFAS were detected in surface water in the section closest to the facility, between river miles 68 and 70 (DRBC, 2012). The 2009 PFOA concentration at river mile 68.1 was 0.0277 micrograms per liter (µg/L), and the PFOS concentration was 0.00575 µg/L (DRBC, 2012).

1.5.4 Climate

The climate at Stern Armory is humid continental. The Delaware Bay and Atlantic Ocean to the east and south, and Chesapeake Bay to the west moderate temperature extremes in the winter and summer months. Although the extremes are moderated, the climate at Stern Armory is still continental, with hot summers, cold winters, and precipitation throughout the year (AFW, 2019). Mean annual temperature in New Castle is 54 degrees Fahrenheit (°F). The average annual high

temperature for Wilmington, Delaware in New Castle County, is 64.1°F, and the average annual low temperature is 45.8°F. Annual precipitation for Wilmington is approximately 43 inches of rain and 19 inches of snowfall (US Climate Data, 2019).

1.5.5 Current and Future Land Use

Stern Armory currently resides on a portion of land deeded to the DEARNG in 1971 from the State of Delaware through the Division of Highway and Transportation; it has been an active military facility since the signing of the lease in October 1971. The facility is currently used as an armory and ammunition supply space, a vehicle maintenance shop, and for administrative activities. Future land use is not anticipated to change.

CLIENT	ARNG			
NOTES	Preliminary Assessment for PFAS at Stern Armory, DE			
REVISED	12/6/2019	GIS BY	GC	12/6/2019
SCALE	1:48,000	CHK BY	VK	12/6/2019
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI,		PM	RG	12/6/2019

Facility Location

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 1-1

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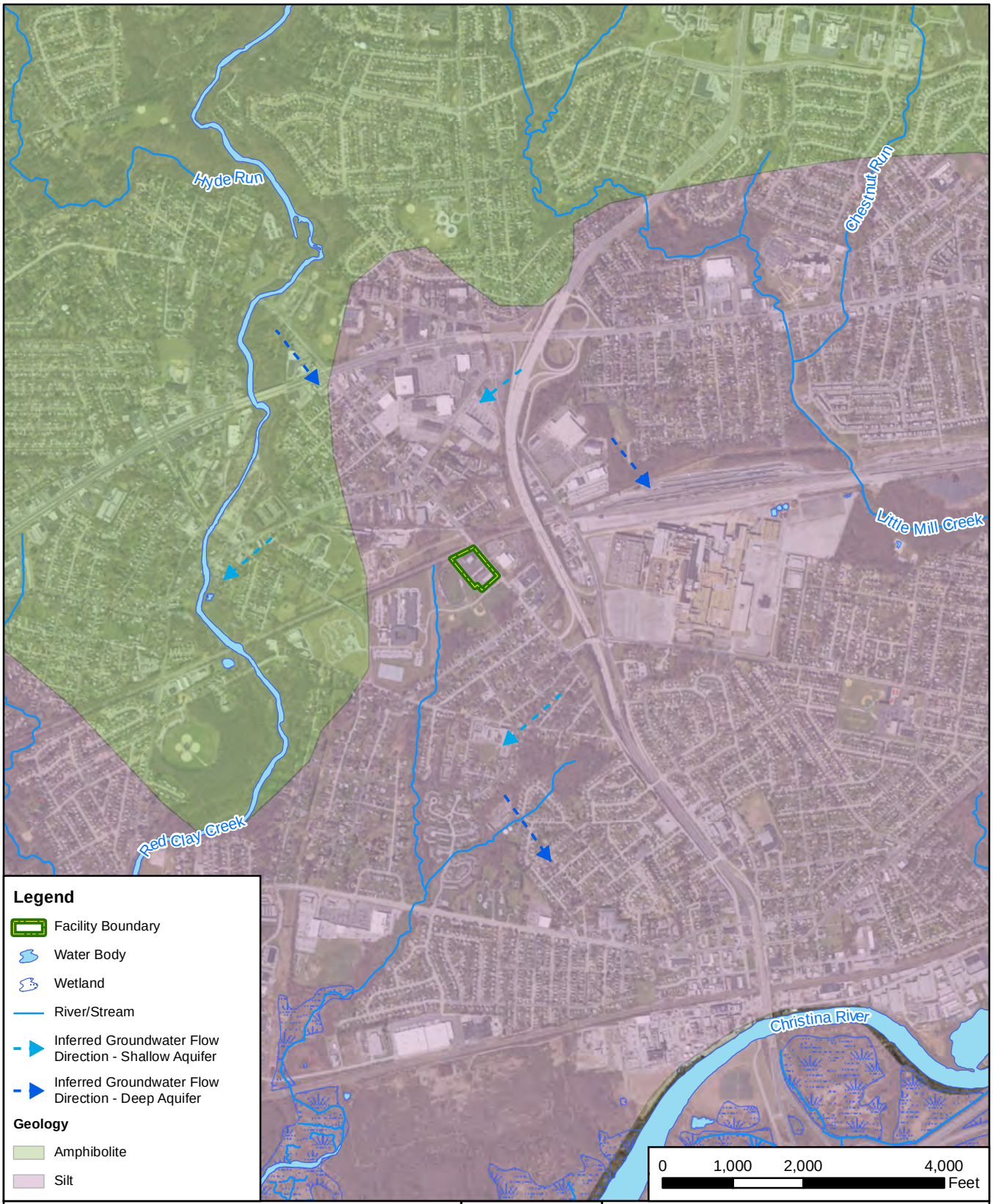

CLIENT	ARNG			
NOTES	Preliminary Assessment for PFAS at Stern Armory, DE			
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SCALE	1:24,000	CHK BY	VK	2/12/2020
Base Map: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	RG	2/12/2020

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Groundwater Features

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Figure 1-2

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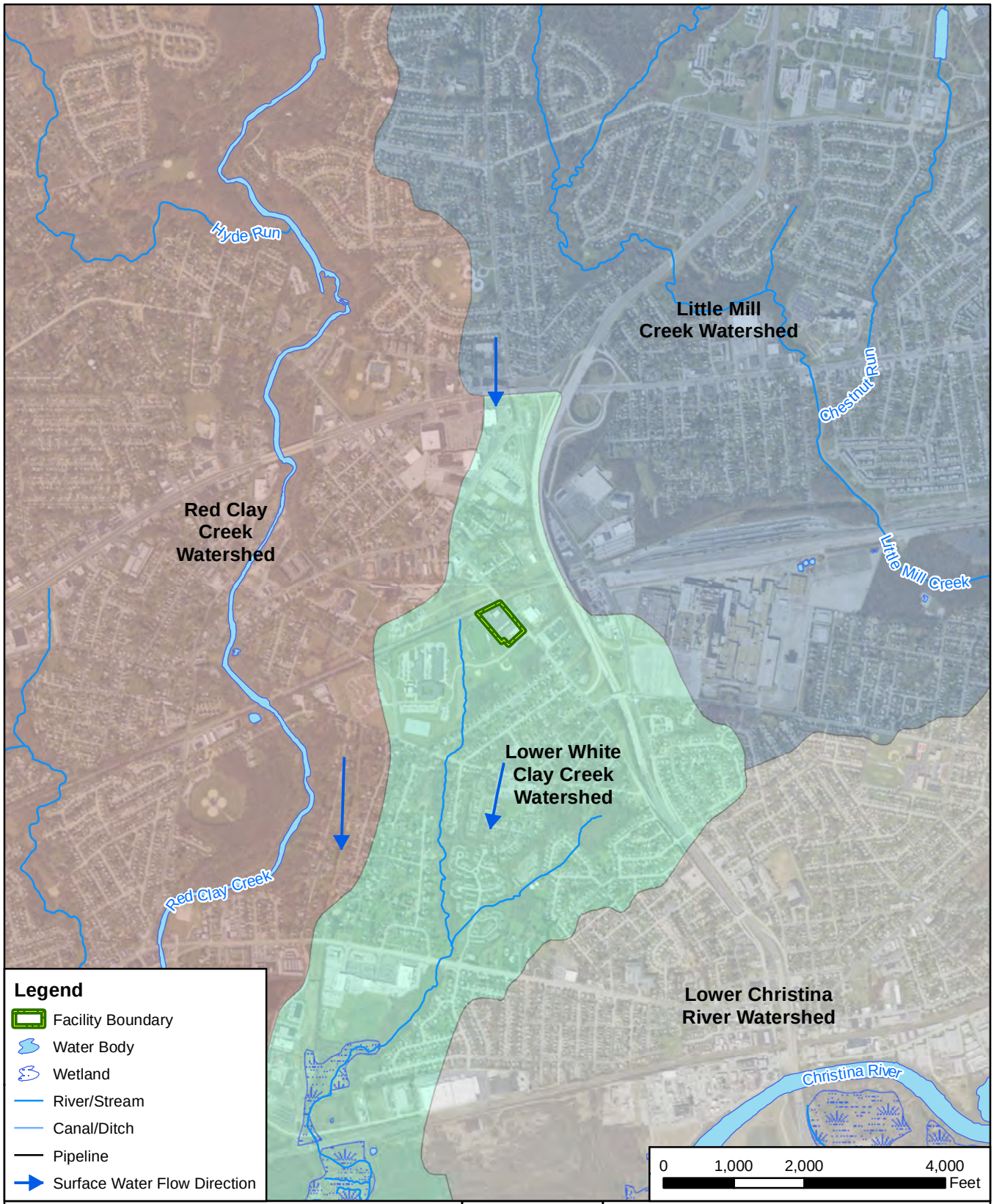

CLIENT	ARNG			
NOTES	Preliminary Assessment for PFAS at Stern Armory, DE			
REVISED	2/10/2020	GIS BY	GC	2/10/2020
SCALE	1:24,000	CHK BY	VK	2/10/2020
Base Map: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	RG	2/10/2020

Surface Water Features

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Figure 1-3

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2. Fire Training Areas

One FTA was identified within Stern Armory during the PA through interviews. This FTA is described below and shown on **Figure 2-1**.

2.1 Controlled Burn

During interviews, personnel indicated that controlled burns historically occurred at Stern Armory approximately every 3 years. These burns occurred at a designated location and involved the burning of drums with flammable materials (such as gasoline or diesel) for fire training purposes. The controlled burns would be extinguished using either water or A/B fire extinguishers. It was verified that type A/B fire extinguishers were the only kind to ever be used at the facility. Interviewees stated that no AFFF or other PFAS-containing foams were used during any controlled burns or fire training activities. Interviewee knowledge dates to at least 1995. The exact timeframe of these controlled burns is unknown, but some interviewees stated controlled burns have not been conducted at the facility since 1990. Firefighting training logs could not be located to verify training type and timeframe.

CLIENT	ARNG			
NOTES	Preliminary Assessment for PFAS at Stern Armory, DE			
REVISED	12/6/2019	GIS BY	GC	12/6/2019
SCALE	1:2,400	CHK BY	VK	12/6/2019
Base Map: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	RG	12/6/2019

Fire Training Areas

AECOM
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Germantown, MD 20876

Figure 2-1

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3. Non-Fire Training Areas

In addition to FTAs, the PA evaluated areas where PFAS-containing materials may have been broadly used, stored, or disposed. This may include buildings with fire suppression systems, paint booths, AFFF storage areas, and areas of compliance demonstrations. Information on these features obtained during the PA are included in **Appendices A** and **B**. No non-FTA areas where AFFF was stored or used were identified during the PA through interviews or historical document review.

4. Emergency Response Areas

No emergency response areas were identified within Stern Armory during the PA through interviews or historical document review. The City of Wilmington Fire Department would handle any potential fire or emergency response incident at Stern Armory.

5. Adjacent Sources

Four potential off-facility sources of PFAS located adjacent to Stern Armory, not under the control of ARNG, were identified during the PA through interviews and news reports. A description of each adjacent source is presented below, and the adjacent sources are shown on **Figure 5-1**.

5.1 Supply Room Fire

In approximately 2002, a fire broke out in the supply room of the ARNG readiness center, directly across the street from Stern Armory. Belvedere Fire Company responded to the fire and extinguished the flames with only water; no AFFF or PFAS-containing materials were used to suppress the fire. Additionally, all fire suppression systems within the readiness center contain only water.

Historically, an Ansul fire suppression system was present in the kitchen within the readiness center. This fire suppression system was inspected annually; however, according to interviews, the system was non-PFAS containing, and no known spills or releases occurred from this system throughout the duration of its use.

5.2 Former GM Factory

A GM automobile factory was historically located approximately 0.75 miles east of Stern Armory. In 2001, a release of approximately 150 gallons of fire-fighting foam was reported at this facility (CRA, 2010). An out of service tank was being transported to another location on the facility when the tank malfunctioned, and foam was released. This foam was believed to have entered a nearby stormwater catch basin. The GM factory contacted the Division of Water Resources shortly after to report the incident.

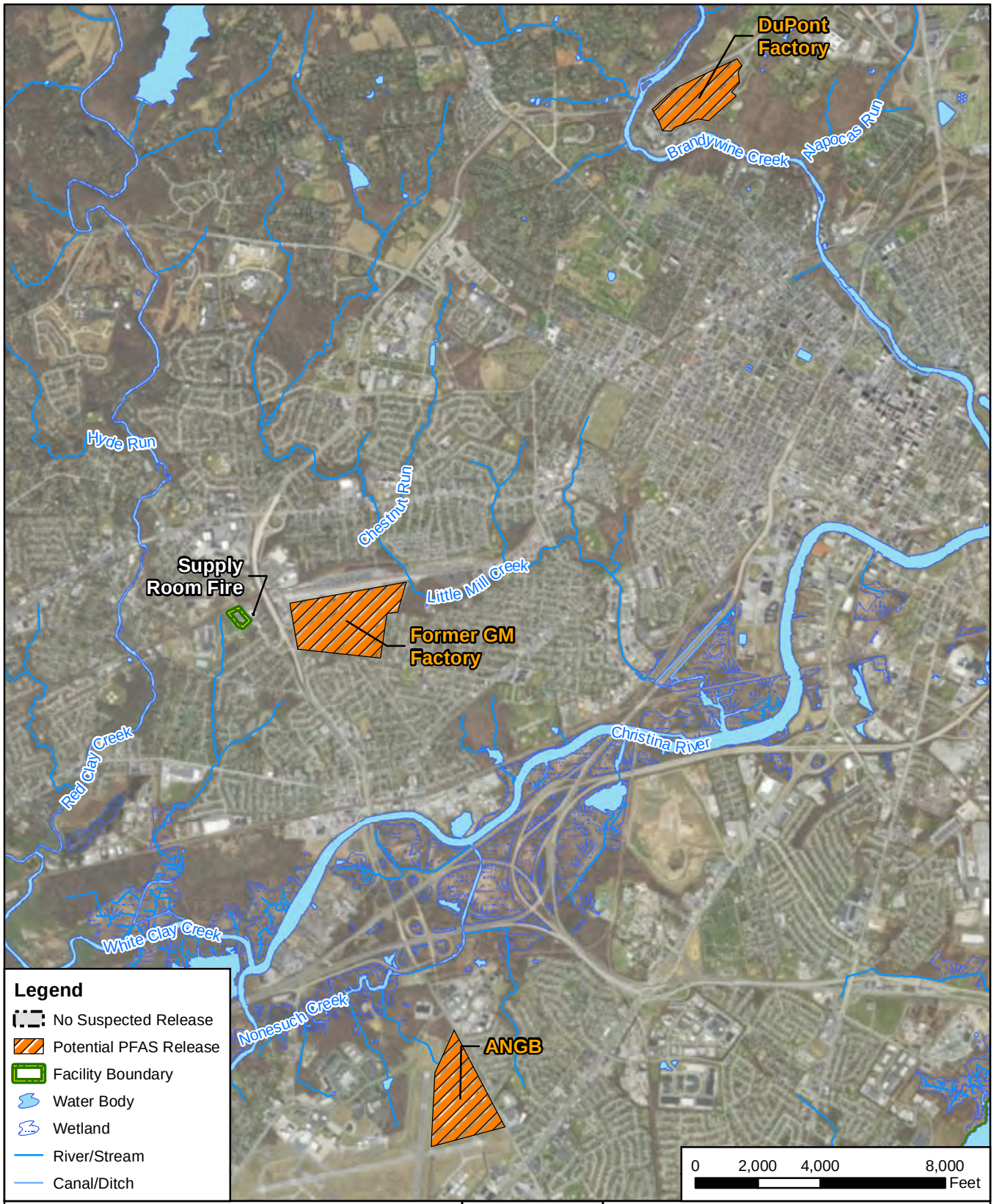
Additionally, at about the same timeframe, a fire was reported at the GM factory. Several nearby emergency response entities helped respond to this incident. It is unknown whether PFAS-containing foam were used for fire suppression during this emergency response incident or during the reported spill at the facility; however, given operational activities at the GM factory, the requirement for fire suppression, and the number of entities who responded to the emergency response incident, there is the potential for the foam released during both of these events to be PFAS-containing.

5.3 DuPont Facility

Approximately 3.5 miles northeast of Stern Armory is a DuPont Experimental Station. This facility, originally built in 1903, is the first industrial research laboratory in the nation and the largest research and development facility of DuPont (DuPont, 2019). While no direct spills or releases of PFAS-containing chemicals could be confirmed during interviews or historical document review, the entire facility is responsible for researching and developing various goods and materials that contain PFAS chemicals. This location has the potential for unintended spills or releases.

5.4 Air National Guard Base

The nearby Air National Guard (ANG) base, located 3 miles south-southeast of the facility, has undergone an SI for PFAS. Results of the study show HA exceedances for PFAS in groundwater and detections in a surface water sample (AFW, 2019). Of the groundwater sample locations, eight locations had results above the HA, and one of two surface water sample locations had a combined PFOS and PFOA detection of 0.4247 micrograms per liter (µg/L) (AFW, 2019). Due to the ANGB's downgradient location, contamination there is not believed to influence Stern Armory.



CLIENT	ARNG			
NOTES	Preliminary Assessment for PFAS at Stern Armory, DE			
REVISED	4/10/2020	GIS BY	GC	4/10/2020
SCALE	1:54,127	CHK BY	VK	4/10/2020
Base Map: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	RG	4/10/2020

N

Adjacent Sources

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 5-1

C:\Users\grace.canham\AECOM Directory\Stankevich, Michael - ARNG_PFAS_GIS_60552172\MXDs\DE\Stern_Armory\Fig_5-1_Stern_Armory_AdjacentSources.mxd

6. Preliminary Conceptual Site Model

Based on the PA findings from interviews with facility personnel, on-facility observations, review of EDR™ reports, and online research, no release areas were identified as AOIs at Stern Armory. A CSM identifies three components necessary for potentially complete exposure pathways related to a site: (1) source, (2) pathway, and (3) receptor. If any of these elements are missing, the pathway is considered incomplete. However, since no PFAS sources were identified to originate at Stern Armory or from activities associated with the facility, preliminary CSMs were not developed.

Nearby adjacent sources were identified during this PA. According to a USEPA Radius Map Report run in 2019, there are 344 water wells within a 1-mile radius of the facility, with three of these listed as potable water wells (EDR™, 2019). Based on actual and potential AFFF releases at sources adjacent to Stern Armory coupled with fluctuating groundwater and surface water flow directions, there is the potential for adjacent AFFF releases to impact groundwater and surface water at Stern Armory.

7. Conclusions

This report presents a summary of available information gathered during the PA on the use of AFFF at Stern Armory. The PA findings are based on the information presented in **Appendix A** and **Appendix B**.

7.1 Findings

Based on information obtained during interviews conducted with facility personnel, facility observations, and reviewed documentation, it is confirmed that AFFF has never been stored, used, or released Stern Armory; therefore, no AOIs related to PFAS releases were identified.

Interviewee knowledge from DEARNG personnel at the facility and from other DEARNG personnel dates to at least 1995. Evidence obtained during the PA supports that current or former ARNG activities have not contributed to any potential PFAS contamination in media at or near the facility.

The area shown in **Table 7-1** and discussed in **Section 2** was determined to have no suspected release.

Table 7-1 No Suspected Release Areas

No Suspected Release Area	Used by	Rationale for No Suspected Release Determination
Controlled Burn	DEARNG	Interviewee knowledge indicates no AFFF was ever used, stored, or released during fire training activities throughout facility operational history

Adjacent sources of PFAS exist near Stern Armory, including the Former GM Factory and the DuPont facility. Potential long-term storage or release of AFFF at these locations could result in potential exposure to PFAS in all media at Stern Armory.

7.2 Uncertainties

A number of information sources were investigated during this PA to determine the potential for PFAS-containing materials to have been present, used, or released at the facility. Historically, documentation of PFAS use was not required because PFAS were considered benign. Therefore, records were not typically kept by the facility or available during the PA on the use of PFAS in training, firefighting, other non-traditional activities, or on its disposition.

The conclusions of this PA are based on all available information, including: previous environmental reports, EDRs™, observations made during the VSI, and interviews. Interviews of personnel with direct knowledge of a facility generally provided the most useful insights regarding a facility's historical and current PFAS-containing materials. Sometimes, the provided information was vague. Gathered information has a degree of uncertainty due to the absence of written documentation, the limited number of personnel with direct knowledge due to staffing changes, the time passed since PFAS were first used (1969 to present), and a reliance on personal recollection. Inaccuracies may arise in potential PFAS release locations, dates of release, volume of releases, and the concentration of AFFF used. There is also a possibility the PA has missed a source of PFAS, as the science of how PFAS may enter the environment continually evolves.

In order to minimize the level of uncertainty, readily available data regarding the use and storage of PFAS were reviewed, retired and current personnel were interviewed, multiple persons were

interviewed for the same potential source area, and potential source areas were visually inspected. **Table 7-2** summarizes the uncertainties associated with the PA.

Table 7-2 Uncertainties

Location	Source of Uncertainty
Former GM Factory	It is unknown whether PFAS-containing chemicals were used, stored, or released during the operational history of this facility, as well as whether there is an effect on Stern Armory
DuPont Facility	While use and storage of PFAS-containing chemicals can be confirmed at this location, dates, quantity, and concentration of potential spills or releases at this location are unknown, as well as whether there is an effect on Stern Armory
Controlled Burn	The exact timeframe of fire training at this location could not be determined. There is conflicting information on whether fire training was conducted with water or A/B fire extinguishers.
General	Activities at Stern Armory are unknown between when the property was acquired in 1971 and when interviewee knowledge began in 1995.

7.3 Potential Future Actions

Based on the absence (1995-present) of the use, storage, or release of PFAS-containing materials at Stern Armory, no AOIs were identified during the PA. Evidence does not indicate that current or former ARNG activities contributed PFAS contamination in media at or near the facility. Stern Armory will not move forward in the CERCLA process.

CLIENT	ARNG			
NOTES	Preliminary Assessment for PFAS at Stern Armory, DE			
REVISED	12/6/2019	GIS BY	GC	12/6/2019
SCALE	1:6,000	CHK BY	VK	12/6/2019
Base Map: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	RG	12/6/2019

Summary of Findings

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 7-1

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Appendix A
Data Resources

Data Resources will be provided separately on CD. Data Resources for Stern Armory:

Stern Armory Pervious Site Investigations

- Phase 1 Environmental Site Assessment, Conestoga-Rovers & Associates, February 2010
- Final Report FY16 Phase 1 Regional Site Inspections for Perfluorinated Compounds, Amec Foster Wheeler, April 1, 2019
- Delaware Department of Natural Resources and Environmental Control's New Castle County Airport Area Fact Sheet, PFOS/PFOA Detected in Ground Water from New Castle Public Wells

Stern Armory Site Background Documents

- UCMR 3 Data
- USGS Geologic Map of New Castle County, Delaware, Kelvin W. Ramsey, 2005

Stern Armory Site Property Documents

- Stern Armory Land Deed, October 5, 1971

Environmental Data Resources Reports

- Certified Sanborn Map Report, Environmental Data Resources, Inc., August 26, 2019
- Aerial Photo Decade Package, Environmental Data Resources, Inc., August 26, 2019
- Historical Aerials Package, Environmental Data Resources, Inc., August 26, 2019
- Radius Map Report with Geocheck, Environmental Data Resources, Inc., August 26, 2019

Appendix B
Preliminary Assessment Documentation

Appendix B.1
Interview Records

PA Interview Questionnaire - Environmental Manager

Facility: Stern Armory
Interviewer: V. Kirkpatrick, G Canham
Date/Time: 8/5/2019

Interviewee: [redacted] **Title:** [redacted] **Phone Number:** [redacted] **Email:** [redacted]	Can your name/role be used in the PA Report? Y or N Can you recommend anyone we can interview? Y or N

1. Roles or activities with the Facility/years working at the Facility.

   Environmental Program manager - 10 years

2. Where can I find previous facility ownership information?

3. What can you tell us about the history of PFAS including aqueous film forming foam (AFFF) at the Facility? Was it used for any of the following activities, circle all that apply and indicate years of active use, if known? Identify these locations on a facility map.

   Maintenance
   Fire Training Areas
   Firefighting (Active Fire)
   Crash
   Fire Suppression Systems (Hangers/Dining Facilities)
   Fire Protection at Fueling Stations
   Non-Technical/Recreational/ Pest Management
   Metals Plating Facility
   Waterproofing Uniforms (Laundry Facilities)
   Other

4. Fill out CSM Information worksheet with the Environmental Manager.

5. Are any current buildings constructed with AFFF dispensing systems or fire suppression systems? What are the AFFF/suppression system test requirements? What is the frequency of testing the AFFF/suppression system? Do you have "As Built" drawings for the buildings?

   No AFFF FSS

PA Interview Questionnaire - Environmental Manager

Facility:_____
Interviewer:_____
Date/Time:_____

6. Are fire suppression systems currently charged with AFFF or have they been retrofitted for use of high expansion foam? If retrofitted, when was that done?

   No AFFF FSS at Stern

7. How is AFFF procured? Do you have an inventory/procurement system that tracks use?

   No AFFF on-site

8. What type of AFFF has been/is being used (3%, 6%, Mil Spec Mil-F-24385, High Expansion)? Manufacturer (3M, Dupont, Ansul, National Foam, Angus, Chemguard, Buckeye, Fire Service Plus)?

   No AFFF in use or previously in use

9. Where is the AFFF stored? How is it stored (tanks, 55-gallon drums, 5-gallon buckets)? What size are the storage tanks? Is the AFFF stored as a mixed solution (3% or 6%) or concentrated material?

   No AFFF

10. How many FTAs are/were on this facility and where are they? Locate on a map. How many FTAs are active and inactive? For inactive FTAs, when was the last time that fire training using AFFF was conducted at them?

    One (Non-AFFF) FTA in center of asphalt between the two buildings. Once every 3 years. Timeframe unknown.

PA Interview Questionnaire - Environmental Manager

Facility:_____
Interviewer:_____
Date/Time:_____

11. When a release of AFFF occurs during a fire training exercise, now and in the past, how is the AFFF cleaned and disposed of? Were retention ponds built to store discharged AFFF? Was the AFFF trickled to the sanitary sewer or left in the pond to infiltrate?

N/A. No AFFF

12. Can you recall specific times when city, county, and/or state personnel came on-post for training? If so, please state which state/county agency or military entity? Do you have any records, including photographs to share with us?

No outside entities came on-site for training

13. Did military routinely or occasionally fire train off-post? List the units that you can recall used/trained at various areas.

No off-post fire training

14. Did individual units come with their own safety personnel, did they also bring their own AFFF? Was training with AFFF part of these exercises? How were emergencies handled under these circumstances?

N/A

15. Are there specific emergency response incident reports (i.e., aircraft or vehicle crash sites and fires)? If so, may we please copy these reports? Who (entity) was the responder?

No incidents where AFFF was used

PA Interview Questionnaire - Environmental Manager

Facility:_____
Interviewer:_____
Date/Time:_____

16. Do you have records of fuel spill logs? Was it common practice to wash away fuel spills with AFFF? Is/was AFFF used as a precaution in response to fuel releases or emergency runway landings to prevent fires?

No recorded fuel spills.

17. Was AFFF used for forest fires or fire management on-post/off-post? If so, please describe what happened and who was involved?

No knowledge of off-site events using AFFF.

18. Are there mutual aid/use agreements between county, city, and local fire department? Please list, even if informal. If formalized, may we have a copy of the agreement?

Municipal FD responds to emergencies at Armory.

19. Can you provide any other locations where AFFF has been stored, released, or used (i.e. hangars, buildings, fire stations, firefighting equipment testing and maintenance areas, emergency response sites, storm water/surface water, waste treatment plants, and AFFF ponds)?

No AFFF on-site.

20. Are you aware of any other creative uses of AFFF? If so, how was AFFF used? What entities were involved?

No AFFF on-site

PA Interview Questionnaire - Environmental Manager

Facility:_____
Interviewer:_____
Date/Time:_____

21. Are there past studies you are aware of with environmental information on plants/animals/ groundwater/soil types, etc., such as Integrated Cultural Resources Management Plans or Integrated Natural Resources Management Plans?

22. What other records might be helpful to us (environmental compliance, investigation records, admin record) and where can we find them?

23. Do you have or did you have a chrome plating shop on base? What were/are the years of operation of that chrome plating shop?

No

24. Do you know whether the shop has/had a foam blanket mist suppression system or used a fume hood for emissions control? If foam blanket mist suppression was used, where was the foam stored, mixed, applied, etc.?

No suppression system

25. How is off-spec AFFF disposed (used for training, turned in, or given to a local Fire Station)? If applicable, do you know the name of the vendor that removes off-spec AFFF? Do you have copies of the manifest or B/L?

No AFFF on-site.

Appendix B.2
Visual Site Inspection Checklists

Visual Site Inspection Checklist

Names(s) of people performing VSI: Victoria Kirkpatrick, Grace Canham

Recorded by: Grace Canham

ARNG Contact: [redacted]

Date and Time: 8/5/2019

Method of visit (walking, driving, adjacent): Walking

Source/Release Information

Site Name / Area Name / Unique ID: Stern Armory

Site / Area Acreage: 4 acres

Historic Site Use (Brief Description): Vehicle maintenance and ammunition storage

Current Site Use (Brief Description): Vehicle maintenance and ammunition storage

Physical barriers or access restrictions:

1. Was PFAS used (or spilled) at the site/area? Y (N)

1a. If yes, document how PFAS was used and usage time (e.g., fire fighting training 2001 to 2014):

2. Has usage been documented? Y (N)

2a. If yes, keep a record (place electronic files on a disk):

3. What types of businesses are located near the site? (Industrial) / (Commercial) / Plating / Waterproofing / (Residential)

3a. Indicate what businesses are located near the site

Former GM factory, DuPont factory

4. Is this site located at an airport/flightline? Y (N)

4a. If yes, provide a description of the airport/flightline tenants:

Visual Survey Inspection Log

Other Significant Site Features:

1. Does the facility have a fire suppression system? (Y) N

1a. If yes, indicate which type of AFFF has been used: No AFFF. Only Water FSS

1b. If yes, describe maintenance schedule/leaks:

N/A

1c. If yes, how often is the AFFF replaced:

N/A

1d. If yes, does the facility have floor drains and where do they lead? Can we obtain an as built drawing?

N/A

Transport / Pathway Information

Migration Potential:

1. Does site/area drainage flow off installation? (Y) N

1a. If so, note observation and location: Flows to domestic sewer. O/W separator goes to sewer as well.

2. Is there channelized flow within the site/area? Y (N)

2a. If so, please note observation and location:

3. Are monitoring or drinking water wells located near the site? (Y) N

3a. If so, please note the location: Within 1 mile: 2 private domestic wells + 1 potable geothermal well

4. Are surface water intakes located near the site? (Y) N

4a. If so, please note the location: Streams to the south + west. Red clay creek to the west, Christina River to the South

5. Can wind dispersion information be obtained? Y (N)

5a. If so, please note and observe the location.

6. Does an adjacent non-ARNG PFAS source exist? (Y) N

6a. If so, please note the source and location. Adjacent readiness center fire, former GM factory, DuPont facility

6b. Will off-site reconnaissance be conducted? Y (N)

Visual Survey Inspection Log

Significant Topographical Features:

1. Has the infrastructure changed at the site/area? Y (N)

1a. If so, please describe change (ex. Structures no longer exist):

2. Is the site/area vegetated? Y / (N)

2a. If not vegetated, briefly describe the site/area composition: Primarily impervious surface (buildings and parking lots) some green space around parking

3. Does the site or area exhibit evidence of erosion? Y / (N)

3a. If yes, describe the location and extent of the erosion:

4. Does the site/area exhibit any areas of ponding or standing water? Y / (N)

4a. If yes, describe the location and extent of the ponding:

Receptor Information

1. Is access to the site restricted? (Y) / N

1a. If so, please note to what extent: Guard booth to limit access. visitors must sign in.

2. Who can access the site? ~~Site Workers~~ / Construction Workers / ~~Trespassers~~ / Residential / Recreational Users / Ecological

2a. Circle all that apply, note any not covered above:

3. Are residential areas located near the site? (Y) / N

3a. If so, please note the location/distance:

< .25 mi to the south

4. Are any schools/day care centers located near the site? (Y) / N

4a. If so, please note the location/distance/type: Bordering Property: Delcastle technical high school

5. Are any wetlands located near the site? (Y) / N

5a. If so, please note the location/distance/type: North- Just outside property boundary. Also to the Northwest, West, and Southwest

Appendix B.3
Conceptual Site Model Information

Preliminary Assessment – Conceptual Site Model Information

Site Name: Stern Armory

Why has this location been identified as a site? A potential for AFFF to be kept on-site (or other PFAS-containing substances) was determined. However, AFFF was not kept at this location.

Are there any other activities nearby that could also impact this location?
Industrial activities nearby may impact the facility (DuPont, Former GM factory)

Training Events

Have any training events with AFFF occurred at this site? No

If so, how often? N/A

How much material was used? Is it documented? N/A

Identify Potential Pathways: Do we have enough information to fully understand over land surface water flow, groundwater flow, and geological formations on and around the facility? Any direct pathways to larger water bodies?

Surface Water:

Surface water flow direction? On Facility - NE, around facility - South

Average rainfall? 43" rain annually

Any flooding during rainy season? No

Direct or indirect pathway to ditches? No

Direct or indirect pathway to larger bodies of water? Yes - Nonesuch Creek to Christina River

Does surface water pond any place on site? No

Any impoundment areas or retention ponds? No

Any NPDES location points near the site? No information

How does surface water drain on and around the flight line? N/A

Preliminary Assessment – Conceptual Site Model Information

Groundwater:

Groundwater flow direction? Shallow - Southwest Deep - Southeast

Depth to groundwater? 11-13 feet bgs

Uses (agricultural, drinking water, irrigation)? 30% of drinking water in area

Any groundwater treatment systems? Artesian Water Company treats water

Any groundwater monitoring well locations near the site? None known of

Is groundwater used for drinking water? Yes

Are there drinking water supply wells on installation? No

Do they serve off-post populations? N/A

Are there off-post drinking water wells downgradient Unsure

Waste Water Treatment Plant:

Has the installation ever had a WWTP, past or present? No

If so, do we understand the process and which water is/was treated at the plant? N/A

Do we understand the fate of sludge waste? N/A

Is surface water from potential contaminated sites treated? N/A

Equipment Rinse Water

1. Is firefighting equipment washed? Where does the rinse water go? N/A No firefighting equipment at facility

2. Are nozzles tested? How often are nozzles tested? Where are nozzles tested? Are nozzles cleaned after use? Where does the rinse water flow after cleaning nozzles? NA No AFFF

3. Other?

Preliminary Assessment – Conceptual Site Model Information

Identify Potential Receptors:

Site Worker None

Construction Worker None

Recreational User None

Residential None

Child None

Ecological None

Note what is located near by the site (e.g. daycare, schools, hospitals, churches, agricultural, livestock)?

Industrial buildings, residential areas, schools

Documentation

Ask for Engineering drawings (if applicable).

Has there been a reconstruction or changes to the drainage system? When did that occur?

Appendix C
Photographic Log

APPENDIX C – Photographic Log

Army National Guard, Preliminary Assessment for PFAS	Stern Armory	Wilmington, Delaware

Photograph No. 1

Description:

Water deluge fire suppression system.

Photograph No. 2

Description:

Armory Kitchen. No foam hood or fire suppression system.

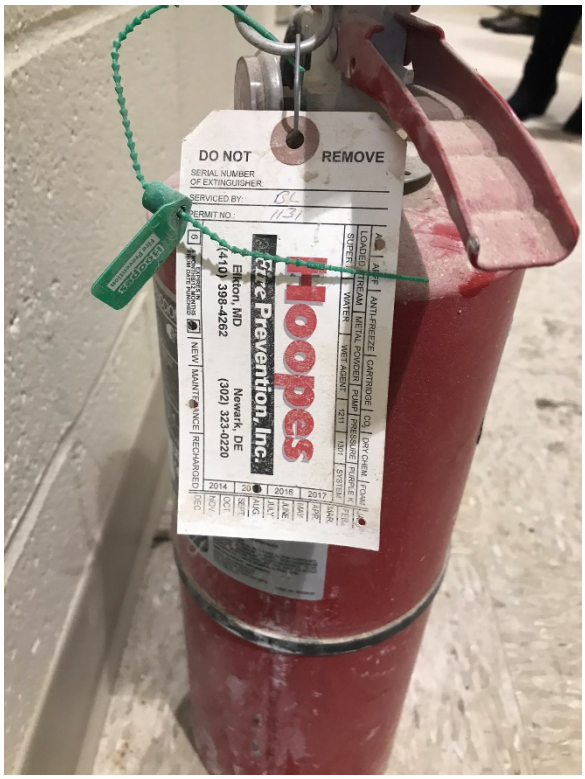
APPENDIX C – Photographic Log

Army National Guard, Preliminary Assessment for PFAS	Stern Armory	Wilmington, Delaware

Photograph No. 3

Description:

Type AB fire extinguishers kept throughout the building.



Photograph No. 4

Description:

Water deluge system control box.

APPENDIX C – Photographic Log

Army National Guard, Preliminary Assessment for PFAS	Stern Armory	Wilmington, Delaware

Photograph No. 5

Description:

Fire department water hook-up.

Photograph No. 6

Description:

Floor drain in the facility garage.

APPENDIX C – Photographic Log

Army National Guard, Preliminary Assessment for PFAS	Stern Armory	Wilmington, Delaware

Photograph No. 7

Description:

Hazmat Shed

Photograph No. 8

Description:

CO2 extinguisher in the facility garage.

APPENDIX C – Photographic Log

Army National Guard, Preliminary Assessment for PFAS	Stern Armory	Wilmington, Delaware

Photograph No. 9

Description:

Location of fire training area outside of the facility garage.