



Naval Facilities Engineering Systems Command Northwest
Silverdale, Washington

Final

**Site Inspection Report
Per- and Polyfluoroalkyl Substances
Seaplane Base**

Naval Air Station Whidbey Island
Washington

June 2023



Naval Facilities Engineering Systems Command Northwest
Silverdale, Washington

Final

**Site Inspection Report
Per- and Polyfluoroalkyl Substances
Seaplane Base**

Naval Air Station Whidbey Island
Washington

June 2023

Prepared for NAVFAC Northwest
by CH2M HILL, Inc.
Bellevue, Washington
Contract N62470-16-D-9000
Contract Task Order 4041



Executive Summary

The Department of the Navy (Navy), Naval Facilities Engineering Systems Command (NAVFAC) Northwest contracted CH2M HILL, Inc. (CH2M), a wholly owned subsidiary of Jacobs, to conduct a Site Inspection (SI) at Naval Air Station Whidbey Island Seaplane Base (**Figure 1**), in Oak Harbor, Washington, to evaluate the presence or absence of per- and polyfluoroalkyl substances (PFAS) in soil and groundwater at the two potential release areas (**Figure 2**) identified in the Preliminary Assessment (PA) for Seaplane Base (CH2M, 2018) and one other area that was identified as a potential PFAS release area after the PA was issued. CH2M prepared this document under the NAVFAC Comprehensive Long-term Environmental Action – Navy 9000 Contract N62470-16-D-9000, Contract Task Order 4041, for submittal to NAVFAC Northwest, NAVFAC Atlantic, and the United States Environmental Protection Agency (USEPA).

Based on the PA at Seaplane Base, two potential release areas exist where PFAS may have been stored, used, or released (CH2M, 2018). The following areas were identified in the PA for Seaplane Base as requiring further investigation:

- Vehicle Maintenance – Building 18
- Biosolids Land Application Area (BLAA)

Building 18 is used for maintenance of vehicles including fire trucks. There are no formal records of aqueous film-forming foam (AFFF) storage, use, or release in this area; however, fire trucks with AFFF in their holding tanks have been observed parked at the building. Filling of fire truck AFFF tanks and washing of fire trucks may have occurred at the large storm drain/wash rack north of Building 18. Small amounts of AFFF may have been splashed/washed into the storm sewer system during these activities. Cracks or joints in the storm sewer pipes present a potential release mechanism to the environment.

The BLAA was the site of the application of approximately 800 cubic yards of biosolids from the Ault Field wastewater treatment plant (WWTP) in 2015 and 2017 (approximately 400 cubic yards each year). There are no formal records of AFFF storage, use, or release in this area; however, the applied biosolids may have contained AFFF from a 2014 release at Ault Field, which was potentially disposed of at the Ault Field WWTP.

After the PA was finalized, additional information was provided regarding the potential discharge of wastewater from the eastern Building 18 wash rack, where fire trucks were washed. A manually operated valve on the wash rack allows for direct discharge of wastewater from the wash rack to the sanitary WWTP (SWWTP). Building 18 was identified as a potential release area for further investigation in the SI; therefore, the SWWTP was conservatively included in the SI, even though there were no confirmed releases of PFAS-containing materials at the SWWTP. After further evaluation, the Navy acknowledges that the SWWTP should not have been investigated in the Seaplane Base SI for the following reasons: the discharge of wastewater from the eastern Building 18 wash rack was not associated with environmental releases at the SWWTP, the SWWTP is an active operation and receives wastewater from multiple other sources through the existing sewer system, and the SWWTP is in a hydrologic basin where stormwater runoff discharges to the wetland area surrounding the SWWTP. At this time, the conceptual site model (CSM) does not support that detections of PFAS in groundwater or soil at the SWWTP are associated with discharge of wastewater from the eastern Building 18 wash rack. In addition, Navy Environmental Restoration Program funds cannot be used to fund the investigation of releases of PFAS-containing materials from the SWWTP because it is an active operation. As a result, this SI report does not include an evaluation of the SWWTP nor does this SI report provide recommendations for further investigation of the SWWTP at this time. Data for the SWWTP are provided in **Appendix I** (and **Appendix E**, Data Quality Evaluation, which were prepared for the entire SI dataset as a whole, including the SWWTP).

The SI objectives are as follows:

- Determine if PFAS are present in soil at Building 18 and the BLAA, at levels that pose potential risks to human health and the environment.

- Determine if PFAS are present in groundwater in the two potential source areas at concentrations posing potential risks to human receptors or the environment.

Groundwater and soil samples were collected from the two potential source areas and analyzed for PFAS by Liquid Chromatography Tandem Mass Spectrometry compliant with Quality Systems Manual (QSM) Version 5.3 Table B-15, or the most recent version of the QSM for which the lab is accredited at the time of the investigation. All work was performed in accordance with the *Final Sampling and Analysis Plan, Site Inspection, Seaplane Base, Naval Air Station Whidbey Island* (CH2M, 2021).

The Seaplane Base PFAS SI field investigation included the following activities at the potential release areas:

- Building 18
 - Five subsurface soil samples collected from the capillary fringe (unsaturated soil just above the water table) via boreholes drilled in locations targeting areas near and downgradient of the wash rack.
 - Three groundwater samples collected from new monitoring wells installed in three of the soil borings targeting areas near and downgradient of the wash rack where PFAS may have been released to the groundwater system.
 - Two groundwater grab samples collected from two of the borings where monitoring wells could not be installed due to conditions in the field.
- BLAA
 - Four composite surface soil samples collected from the area where anecdotal evidence indicates that biosolids, potentially containing PFAS, were applied to the ground surface.
 - One subsurface soil sample collected from the capillary fringe via a borehole drilled within the application area where PFAS, if released, could have migrated deeper into the soil.
 - One groundwater sample collected from a new monitoring well installed in the soil boring targeting the area where PFAS, if released, could have leached from the soil to groundwater.

All soil and groundwater samples were analyzed for 18 PFAS.

Project action levels (PALs) were defined in the Sampling and Analysis Plan (SAP) for the following three PFAS:

- Perfluorobutanesulfonic acid (PFBS)
- Perfluorooctanoic acid (PFOA)
- Perfluorooctane sulfonate (PFOS)

For this report, the PALs have been updated from the PALs defined in the SAP based on the May 2022 USEPA regional screening levels (RSL) table (USEPA, 2022; DoD, 2022). The PALs are residential scenario RSLs based on a hazard quotient of 0.1.

Therefore, the PALs are as follows:

- PFBS – Soil PAL: 1,900 micrograms per kilogram ($\mu\text{g}/\text{kg}$); groundwater PAL: 600 nanograms per liter (ng/L)
- PFOA – Soil PAL: 19 $\mu\text{g}/\text{kg}$; groundwater PAL: 6 ng/L
- PFOS – Soil PAL: 13 $\mu\text{g}/\text{kg}$; groundwater PAL: 4 ng/L
- Perfluorononanoic acid (PFNA) – Soil PAL: 19 $\mu\text{g}/\text{kg}$; groundwater PAL: 5.9 ng/L
- Perfluorohexanesulfonic acid (PFHxS) – Soil PAL: 130 $\mu\text{g}/\text{kg}$; groundwater PAL: 39 ng/L
- Hexafluoropropylene oxide dimer acid – Soil PAL: 23 $\mu\text{g}/\text{kg}$; groundwater PAL: 6 ng/L

Soil samples did not exceed the PALs for any of the six PFAS for which screening criteria are available. Four groundwater samples exceeded PALs for PFOA, PFOS, PFNA, and PFHxS at Building 18, and one groundwater sample exceeded the PALs for PFOA, PFOS, PFNA, and PFHxS at the BLAA. Based on an assessment of the data collected during the Seaplane Base PFAS SI, the following conclusions and recommendations are made for the potential release areas investigated at Seaplane Base:

- Building 18
 - PFAS are significantly above PALs in groundwater.
 - Soil sampling results did not indicate a PFAS soil source.
 - The CSM for Building 18 suggests that PFAS could be released directly to groundwater through the storm sewer system.
 - The Human Health Risk Screening (HHRS) identified potential unacceptable risk associated with PFOA, PFOS, PFHxS, and PFNA in groundwater in this area.
 - Based on the sampling results and the HHRS findings, further investigation is recommended to be conducted in a Remedial Investigation (RI) at Building 18 to delineate the nature and extent of PFAS in soil and groundwater and consider the need to assess the leaching potential of PFOA, PFOS, PFHxS, and PFNA in soil.

- BLAA
 - PFAS are significantly above the PALs in groundwater.
 - Soil sampling results did not indicate a PFAS soil source.
 - There is no information to suggest that the groundwater concentrations are the result of an upgradient source; therefore, these concentrations can be assumed to be related to a source associated with the application of biosolids in this area.
 - The lack of PFAS concentrations in the soil samples indicates that the exact location where biosolids were applied may be further to the north, east, or west, than what anecdotal evidence had indicated.
 - The HHRS identified potential unacceptable risk associated with PFOA, PFOS, PFHxS, and PFNA in groundwater at the BLAA.
 - Based on the sampling results and the HHRS findings, further investigation is recommended to be conducted in an RI at the BLAA to delineate the nature and extent of PFAS in groundwater and soil, and consider the need to assess the leaching potential of PFOA, PFOS, PFHxS, and PFNA in soil.

Contents

Executive Summary	iii
Acronyms and Abbreviations	ix
1 Introduction	1-1
1.1 Per- and Polyfluoroalkyl Substances.....	1-1
2 Installation Background and Physical Setting	2-1
2.1 Facility Description and Background	2-1
2.1.1 Regulatory Setting	2-1
2.1.2 Investigation History.....	2-2
2.1.3 Description of Investigation Areas.....	2-2
2.2 Physical Setting.....	2-3
2.2.1 Physical Characteristics.....	2-3
2.2.2 Climate.....	2-3
2.2.3 Geologic Setting.....	2-3
2.2.4 Hydrogeologic Setting.....	2-4
2.2.5 Hydrologic Setting	2-4
2.2.6 Water Use.....	2-4
3 Investigation Methodology	3-1
3.1 Investigation Approach.....	3-1
3.2 Field Operations Summary	3-1
3.3 Site Preparation and Utility Location.....	3-1
3.4 Soil Borings	3-2
3.4.1 Soil Sampling.....	3-2
3.5 Monitoring Well Installation.....	3-2
3.5.1 Monitoring Well Construction.....	3-2
3.5.2 Monitoring Well Development.....	3-3
3.6 Groundwater Sampling.....	3-3
3.7 Sample Analysis and Quality Control.....	3-5
3.8 Land Surveying.....	3-6
3.9 Groundwater Elevation Measurements	3-6
3.10 Decontamination Procedures.....	3-6
3.11 Investigation-derived Waste Management.....	3-6
3.12 Sample Analysis and Data Validation	3-7
3.13 Deviations from the Sampling and Analysis Plan	3-8
4 Investigation Results and Evaluation	4-1
4.1 Data Evaluation.....	4-1
4.2 Human Health Risk Screening.....	4-1
4.3 Building 18	4-2
4.4 Biosolids Land Application Area	4-4
5 Conclusions and Recommendations	5-1
6 References	6-1

Appendices

- A Soil Boring Logs, Well Completion Diagrams, and Well Development Logs
- B Groundwater Sample Data Sheets
- C Survey Report
- D Investigation-derived Waste Documentation
- E Data Quality Evaluation
- F Field Change Request
- G Raw Data Tables
- H Human Health Risk Screening
- I Sanitary Wastewater Treatment Plant Data

Tables

- 2-1 Project Action Limits
- 3-1 Monitoring Well Construction Details and Groundwater Elevations (April 2021)
- 3-2 Water Quality Parameters (April 2021)
- 3-3 Data Qualifiers and Frequency of Use
- 4-1 Conceptual Site Model – Building 18
- 4-2 Conceptual Site Model – Biosolids Land Application Area
- 4-3 Soil Analytical Data for PFBS, PFOA, PFOS, PFHxS, and HFPO-DA (April 2021)
- 4-4 Groundwater Analytical Data for PFBS, PFOA, PFOS, PFNA, PFHxS, and HFPO-DA (April 2021)
- 5-1 Conclusions of PFAS Site Inspection

Figures

- 1 Installation Location Map
- 2 Potential PFAS Release Areas
- 3 Sample Locations – Building 18
- 4 Sample Locations – Biosolids Land Application Area
- 5 Groundwater Elevations – Building 18
- 6 PFAS Soil Concentrations – Building 18
- 7 Groundwater Concentrations – Building 18
- 8 Groundwater Elevations – Biosolids Land Application Area
- 9 PFAS Soil Concentrations – Biosolids Land Application Area
- 10 PFAS Groundwater Concentrations – Biosolids Land Application Area

Acronyms and Abbreviations

°C	degrees Celsius
°F	degrees Fahrenheit
µg/kg	micrograms per kilogram
%	percent
AFFF	aqueous film-forming foam
APS	Applied Professional Services, Inc.
BLAA	Biosolids Land Application Area
CH2M	CH2M HILL, Inc.
CLEAN	Comprehensive Long-term Environmental Action—Navy
CSM	conceptual site model
COPC	chemical of potential concern
DI	deionized
DO	dissolved oxygen
DoD	Department of Defense
FD	field duplicate
ft	feet
ft bgs	feet below ground surface
ft btoc	feet below top of casing
GW	groundwater
HFPO-DA	hexafluoropropylene oxide dimer acid
HHRS	Human Health Risk Screening
HQ	hazard quotient
ID	identification
IDW	investigation-derived waste
J	Estimated
LC/MS	Liquid Chromatography Tandem Mass Spectrometry
LOD	limit of detection
mg/L	milligrams per liter
mS/cm	milliSiemens per centimeter
msl	mean sea level
mV	millivolt
MW	monitoring well
ND	not detected
ng/L	nanograms per liter
NAD83	North American Datum of 1983

NAVD88	North American Vertical Datum of 1988
NAVFAC	Naval Facilities Engineering Systems Command
Navy	Department of the Navy
NTU	nephelometric turbidity unit
ORP	oxidation-reduction potential
PA	Preliminary Assessment
PAL	project action limit
PFAS	per- and polyfluoroalkyl substances
PFBS	perfluorobutane sulfonate
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
pH	potential of Hydrogen
PVC	polyvinyl chloride
QC	quality control
QSM	Quality Systems Manual
R	Rejected
RI	Remedial Investigation
RSL	regional screening level
SAP	Sampling and Analysis Plan
SB	soil boring
SDWA	Safe Drinking Water Act
SI	Site Inspection
SL	screening level
SOP	standard operating procedure
SS	surface soil
SWWTP	sanitary wastewater treatment plant
U	Nondetect
UJ	Nondetect, estimated quantitation limit
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound
WI	Whidbey Island
WQP	water quality parameter
WWTP	wastewater treatment plant

Introduction

CH2M Hill, Inc. (CH2M) was contracted by Naval Facilities Engineering Systems Command (NAVFAC) Northwest to perform a Site Inspection (SI) for per- and polyfluoroalkyl substances (PFAS) at Naval Air Station Whidbey Island, Seaplane Base, in Oak Harbor, Washington in Island County (**Figure 1**). This SI report presents the data and findings obtained during field investigations associated with the SI.

The overall objectives of the SI were defined in the *Final Sampling and Analysis Plan, Site Inspection, Seaplane Base, Naval Air Station Whidbey Island* (CH2M, 2021), henceforth referred to as the SAP.

The SI objectives were as follows:

- Determine if PFAS are present in soil at Building 18 and Biosolids Land Application Area (BLAA) at levels that pose potential risks to human health and the environment.
- Determine if PFAS are present in groundwater in the two potential areas at concentrations posing potential risks to human receptors or the environment.

This SI report outlines the approach taken to achieve the listed objectives and provides conclusions based on data collected and recommendations for further study. This report was prepared for NAVFAC Northwest under the Comprehensive Long-term Environmental Action – Navy (CLEAN) 9000, Contract N62470-16-D-9000, Contract Task Order 4041.

The SI report is organized as follows:

- **Section 1** – Introduction
- **Section 2** – Installation Background and Physical Setting
- **Section 3** – Investigation Methodology
- **Section 4** – Investigation Results and Evaluation
- **Section 5** – Conclusions and Recommendations
- **Section 6** – References

Tables are presented within the text. Figures and appendixes follow **Section 6**.

1.1 Per- and Polyfluoroalkyl Substances

PFAS are manufactured chemicals that have been used since the 1950s in many household and industrial products because of their stain- and water-repellant properties. Within the Department of the Navy's (Navy's) operations, PFAS are most commonly associated with aqueous film-forming foam (AFFF) used primarily for firefighting (including emergency response, equipment testing and/or training, and fire suppression systems in buildings). PFAS can also be present in other industrial and household materials, in vapor suppression systems, and in waste streams. PFAS are now present virtually everywhere in the world because of the large amounts that have been manufactured and used as well as their high mobility and persistence. Once these compounds are released to the environment, many degrade very slowly. PFAS are considered "emerging chemicals of environmental concern," which currently have no Safe Drinking Water Act regulatory standards or routine water quality testing requirements. The USEPA is studying PFAS to determine if national regulation is needed. The State of Washington does not have an established state standard or promulgated screening value for any PFAS in either groundwater or drinking water.

Installation Background and Physical Setting

This section presents background information pertaining to Seaplane Base, including installation history, potential sources of PFAS, and relevant information on the physical, environmental, and hydrogeologic setting at the Base.

2.1 Facility Description and Background

Seaplane Base is on Whidbey Island in Oak Harbor, Washington, and is one of three installations associated with Naval Air Station Whidbey Island. Naval Air Station Whidbey Island is at the juncture of Puget Sound and the Strait of Juan de Fuca, which is approximately 100 miles north of Seattle. Naval Air Station includes Ault Field, Seaplane Base, and Outlying Landing Field Coupeville (**Figure 1**).

Seaplane Base is adjacent to the eastern border of the town of Oak Harbor, which has a population of 23,204 (CH2M, 2018). The installation occupies 2,688 acres and is bordered by residential and farming communities to the north and east, the town of Oak Harbor to the west, and Crescent/Oak Harbors to the south (**Figure 1**).

Seaplane Base was commissioned in 1942 and was constructed using dredged fill from Oak and Crescent Harbors. The Patrol Bomber Catalina, which resembled a large flying boat, began operations from Seaplane Base in December 1942.

Although flight operations ceased by the mid-1960s, Seaplane Base continued operational support of Ault Field, including a constructed fuel farm (removed in the 1990s), housing, and storage areas. Currently, Seaplane Base contains the Family Services Center, Commissary, Navy Exchange, family housing and lodge, sanitary wastewater treatment plant (SWWTP), gas station, vehicle maintenance facility, fire station, and storage facilities.

2.1.1 Regulatory Setting

PFAS have been identified by the USEPA as “emerging chemicals of environmental concern”, which are defined by the Department of Defense (DoD) as chemicals that have a perceived or real threat to human health or the environment, and that have new or changing toxicity values or new or changing human health or environmental regulatory standards. Changes may be due to new science discoveries, detection capabilities, or exposure pathways (DoD, 2019). There are currently no Safe Drinking Water Act (SDWA) federal regulations or Clean Water Act Ambient Water Quality Human Health Criteria for any PFAS (Navy, 2020). For chemicals not subject to national primary drinking water regulation, the SDWA authorized the USEPA to publish nonregulatory lifetime health advisories and risk-based regional screening levels (RSLs) to assist state and local officials in evaluating risks from PFAS in drinking water and groundwater, respectively. Lifetime health advisories are applicable for drinking water-related decisions only and are not considered project action limits (PALs) for this project. **Table 2-1** presents the PALs used for this SI.

Table 2-1. Project Action Limits

Analyte	Media (units)	Project Action Limits ^a
PFOS	Soil (µg/kg)	13
	Groundwater (ng/L)	4
PFOA	Soil (µg/kg)	19
	Groundwater (ng/L)	6
PFBS	Soil (µg/kg)	1,900
	Groundwater (ng/L)	600
PFNA	Soil (µg/kg)	19
	Groundwater (ng/L)	5.9

Table 2-1. Project Action Limits

Analyte	Media (units)	Project Action Limits ^a
PFHxS	Soil (µg/kg)	130
	Groundwater (ng/L)	39
HFPO-DA	Soil (µg/kg)	23
	Groundwater (ng/L)	6

^a PALs are the RSLs from the May 2022 USEPA RSL table based on a hazard quotient (HQ) of 0.1 as described in the Assistant Secretary of Defense July 6, 2022 memorandum, “Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program” (DoD, 2022).

µg/kg = micrograms(s) per kilogram

HFPO-DA = hexafluoropropylene oxide dimer acid

ng/L = nanogram(s) per liter

PFBS = perfluorobutane sulfonate

PFHxS = perfluorohexanesulfonic acid

PFNA = perfluorononanoic acid

2.1.2 Investigation History

A Preliminary Assessment (PA) for PFAS was completed in September 2018 (CH2M, 2018). The PA recommended the following two areas at Seaplane Base for further investigation in an SI:

- Vehicle Maintenance Building (Building 18)
- BLAA

After the PA was finalized, additional information was provided regarding the potential discharge of wastewater from the eastern Building 18 wash rack, where fire trucks were washed. A manually operated valve on the wash rack allows for direct discharge of wastewater from the wash rack to the SWWTP. Building 18 was identified as a potential release area for further investigation in the SI; therefore, the SWWTP was conservatively included in the SI, even though there were no confirmed releases of PFAS-containing materials at the SWWTP. After further evaluation, the Navy acknowledges that the SWWTP should not have been investigated in the Seaplane Base SI for the following reasons: the discharge of wastewater from the eastern Building 18 wash rack was not associated with environmental releases at the SWWTP, the SWWTP is an active operation and receives wastewater from multiple other sources through the existing sewer system, and the SWWTP is in a hydrologic basin where stormwater runoff discharges to the wetland area surrounding the SWWTP. At this time, the CSM does not support that detections of PFAS in groundwater or soil at the SWWTP are associated with discharge of wastewater from the eastern Building 18 wash rack. In addition, Navy Environmental Restoration Program funds cannot be used to fund the investigation of releases of PFAS-containing materials from the SWWTP because it is an active operation. As a result, this SI report does not include an evaluation of the SWWTP nor does this SI report provide recommendations for further investigation of the SWWTP at this time. Data for the SWWTP are provided in **Appendix I** (and **Appendix E**, Data Quality Evaluation, which were prepared for the entire SI dataset as a whole, including the SWWTP).

2.1.3 Description of Investigation Areas

The following potential release areas were investigated during the SI:

- Vehicle Maintenance Building (Building 18)
- BLAA

Building 18

The vehicle maintenance building, Building 18, is on the peninsula of Seaplane Base northwest of the intersection of Coral Sea Avenue and Tulagi Avenue (**Figures 2 and 3**). The building is surrounded by a large concrete parking lot with small areas of grass to the east, south, and west. One storm drain inlet is on the north side of the building.

This inlet also serves as a vehicle wash rack and can discharge into the sanitary sewer system via a manually operated valve. Cracks or joints in the storm sewer system could present pathways for PFAS to the subsurface.

Biosolids Land Application Area

The BLAA is northeast of Crescent Harbor and encompasses 2.3 acres of land (**Figures 2 and 4**). This area is secured due to nearby munitions storage areas and includes an open field area with trees to the north and east and Crescent Harbor to the south and west. The biosolids from Ault Field wastewater treatment plant (WWTP) were applied in 2015 and in 2017 with approximately 400 cubic yards of material during each year. There is significant uncertainty as to the location of the application area. This area is not consistently used for disposal of biosolids. The 2015 and 2017 applications are isolated events for this area. The location where these applications occurred is not well documented, and there is no remaining physical evidence that would indicate where biosolids were applied. The mapped location shown on **Figures 2 and 4**, are based on the recollections of staff members involved with the 2015 and 2017 application events.

Navy-operated areas or facilities have not been identified upgradient of the BLAA; therefore, PFAS detected in soil or groundwater in this area can be assumed to be associated with the 2015 and/or 2017 biosolids application events.

2.2 Physical Setting

This section describes the physical setting of Seaplane Base, including geologic and hydrogeologic features relevant to this investigation.

2.2.1 Physical Characteristics

Whidbey Island lies within the Puget Lowland, a topographic and structural depression between the Olympic Mountains and the Cascade Range. Seaplane Base sits on the Maylor peninsula, protruding south-southeast from the town of Oak Harbor, and along the Crescent Harbor. The Maylor peninsula splits Oak Harbor and Crescent Harbor, which connects to the larger Skagit Bay, with Deception Pass to the north and Saratoga Passage to the south.

2.2.2 Climate

The climate at Seaplane Base is a temperate marine climate with warm, dry summers and cool wet winters. Marine breezes from Puget Sound keep temperatures mild throughout the year (USGS, 1988). Temperatures typically range from the 35 to 50 degrees Fahrenheit (°F) in the winter to 55 to 70°F in the summer. Seaplane Base lies within the rain shadow of the Olympic Mountains resulting in a lower annual rainfall than other areas in western Washington. Average annual precipitation is approximately 19 inches per year.

2.2.3 Geologic Setting

Whidbey Island is within the Puget Lowland structural depression between the Olympic Mountains and the Cascade Range. The geologic units on Whidbey Island consist of Quaternary glacial and inter glacial deposits that exceed 3,000 feet in thickness (URS, 1993).

Seaplane Base is largely situated on the Maylor peninsula, which was originally a trombolo connecting Whidbey Island to Maylor Point. Dredged marine sediment was used to fill in the area during construction of Seaplane Base (URS, 1993). Seaplane Base is generally level in the developed areas of the Base with localized elevation ranges from 0 to 50 feet above mean sea level (msl). The stratigraphy of the Base generally consists of glaciomarine drift overlying Vashon till and advance outwash (Shannon and Wilson, 1978; USGS, 1986). The low-lying marsh area north of Crescent Harbor generally contains organic-rich silt and clay.

Additional geologic information, including subsurface lithology at the potential PFAS release areas, was gathered during this SI and is presented in **Section 4**.

2.2.4 Hydrogeologic Setting

A near-surface, unconfined aquifer exists near Seaplane Base (CH2M, 2018). This unconfined aquifer contains surficial dredged material, which appear to behave as a single aquifer with the shallow underlying sediments. Monitoring wells drilled in the area defined the bottom of the surficial aquifer to be about 67 feet below ground surface (ft bgs), where the lithology changed to silty sand with clay and acts as an aquitard.

Tidal forces also influence groundwater flow, especially in the low-lying area north of Crescent Harbor. Based on groundwater elevations measured during previous investigations at Seaplane Base (CH2M, 2018), the groundwater flow direction is generally to the south. However, the groundwater elevation changes with the tides and the degree of change and lag times in groundwater levels appears to be inversely related to the distance of the wells from Crescent Harbor. As shown on **Figure 2**, a groundwater divide is likely present in the groundwater flow system within the fill material between Whidbey Island and the Maylor peninsula. Groundwater in the western portion of the fill material flows due west toward Oak Harbor whereas groundwater in the eastern portion of the fill material flows east toward Crescent Harbor (**Figure 2**) (CH2M, 2018).

Additional hydrogeologic information, including depth to water and groundwater flow directions at potential PFAS release areas, was gathered during this SI and is presented in **Section 4**.

2.2.5 Hydrologic Setting

Annual precipitation is approximately 19 inches; however, surface runoff is minimal due to the high rate of evapotranspiration (URS, 1993). Most of the surface water in the developed areas of the Base flows across paved areas and into storm drains before discharging into outlets into Oak and Crescent Harbors.

2.2.6 Water Use

Because of the proximity to Puget Sound, groundwater at Seaplane Base is tidally influenced and brackish; therefore, the groundwater is not a suitable source of potable water. The primary source of fresh water is supplied to the City of Oak Harbor and Seaplane Base from the City of Anacortes on the mainland 16 miles to the north via a pipeline (URS, 1993).

Some residents upgradient of Seaplane Base to the north have private water supply wells but these are completed several hundred feet below ground surface within the sea level aquifer, with the nearest well approximately 1.3 miles away. In addition, Whidbey Island County Department of Health regulations prohibit the installation of private or public drinking water wells within 100 feet of the mean high tide levels to diminish the likelihood of saltwater intrusion.

Investigation Methodology

This section describes the methodology used in the SI to accomplish the stated objectives.

3.1 Investigation Approach

The field activities discussed in this report were performed in accordance with the SAP (CH2M, 2021). Deviations from the SAP are discussed in **Section 3.13**. Field activities were planned and carried out from March to April 2021 and included drilling of on-Base soil borings, soil sampling, monitoring well installation, and sampling of new monitoring wells. Sampling locations are shown on **Figures 3** and **4**.

3.2 Field Operations Summary

The following is a summary of the media sampled and the sampling locations at the two areas:

- Five soil borings (WI-SP-SB01/WI-SP-SB01N/WI-SP-SB02/WI-SP-SB03/WI-SP-SB04) were drilled near and downgradient of a potential PFAS release location at the Building 18 wash rack. One soil sample was collected from each boring near the water table interface (**Figure 3**). WI-SP-SB02, WI-SP-SB03, and WI-SP-SB04 were completed and developed as monitoring wells WI-SP-MW02, WI-SP-MW03, and WI-SP-MW04, respectively, and a groundwater sample was collected from each well.
 - Soil boring SB01 was abandoned due to collapsing sands at 3.5 ft bgs during hand clearing of the pilot hole. A soil sample was collected from the pilot hole cuttings, and a groundwater grab sample was collected from the open borehole. A new boring (WI-SP-SB01N) was attempted 10 feet to the north but groundwater was encountered, and the borehole collapsed at 3.5 ft bgs. WI-SP-SB01N was abandoned after collecting soil and groundwater grab samples. Both abandoned boreholes were capped with bentonite and concrete.
- One soil boring (WI-SP-SB08) was drilled within the presumed boundary of the BLAA (**Figure 4**) where biosolids potentially containing PFAS were applied to the ground surface. One soil sample was collected from the boring at the water table interface. The soil boring was completed and developed as a monitoring well (WI-SP-MW08), and a groundwater sample was collected from the well.
 - In addition to the subsurface soil boring, four composite surface soil samples were collected from gridded locations within the application area (WI-SP-SS01/WI-SP-SS02/WI-SP-SS03/WI-SP-SS04).

All soil and groundwater samples were analyzed for the 18 PFAS listed in USEPA Method 537.1 via Liquid Chromatography Tandem Mass Spectrometry (LC/MS/MS) compliant with the version 5.3 of the Quality Systems Manual (QSM), Table B-15.

The screen intervals for new monitoring wells were determined based on the lithology and saturation conditions observed in the soil cores. Screened intervals were selected to intersect the water table.

Drilling, soil sampling, and monitoring well construction were performed April 13 through 16, 2021. Monitoring well development was performed April 18 and 19, 2021. Sampling of the newly completed monitoring wells was performed from April 18 and 19, 2021.

3.3 Site Preparation and Utility Location

During field operations, prior to the initiation of drilling activities, proposed drilling locations were demarcated, and an 811 call-before-you-dig ticket was submitted for public utility providers. Each drilling location was also scanned for utilities by Applied Professional Services, Inc. (APS), a licensed third-party utility locating company. APS scanned a 25-foot radius around each location using a combination of ground-penetrating radar and radio

frequency instruments. Soil borings WI-SP-SB02 and WI-SP-SB03 were relocated approximately 10 feet northwest of the original proposed locations due to avoid underground utilities.

3.4 Soil Borings

A total of six soil borings were completed during field operations. Four of the six boreholes were drilled using sonic drilling techniques by a Washington-licensed driller in accordance with applicable standard operating procedures (SOPs) included in the SAP. Soil borings were drilled to 5 to 10 feet below the water table. Each drilling location was manually cleared to a depth of 5 feet bgs using a hand auger prior to drilling to ensure that undetected buried utilities were not present. Two soil borings (WI-SP-SB01 and WI-SP-SB01N) encountered groundwater during manual clearing, and completion of pilot holes to 5 feet was not possible. Therefore, sonic drilling was not conducted at these locations. Materials containing PFAS were not used during drilling.

In addition, continuous soil cores were collected for lithologic classification and screened for volatile organic compounds (VOCs) using a photoionization detector. Soil cores were closely examined for signs of saturation and the presence of fine-grained beds that could indicate the presence of perched groundwater or confining conditions. Lithology observed in the soil cores was classified according to the Unified Soil Classification System and logged in accordance with applicable SOPs included in the SAP. Lithologic information obtained from the soil borings is summarized for each of the two areas in **Sections 4.3** and **4.4**. Soil boring logs are included in **Appendix A**.

3.4.1 Soil Sampling

Soil samples were collected at each of the six soil borings near the on-Base potential PFAS release areas (WI-SP-SB01 through WI-SP-SB04 and WI-SP-SB08) as described in **Section 3.2** and shown on **Figures 3** and **4**. One soil sample was collected from each boring at the water table interface, except as noted in Section 3.4 for WI-SP-SB01 and WI-SP-SB01N. Soil samples were sent to an offsite laboratory for PFAS analysis.

Four composite surface soil samples were collected in the BLAA (WI-SP-SS01/WI-SP-SS02/WI-SP-SS03/WI-SP-SS04). The application area was divided into 4 quadrants (**Figure 4**), and 4 surface soil samples were composited from 40 gridded sampling locations (10 locations per sample) divided equally within the 4 quadrants. Surface soil samples were collected from 0 to 0.5 ft bgs.

3.5 Monitoring Well Installation

Four of the six total soil borings drilled during field operations were completed as monitoring wells. Monitoring wells were installed in accordance with State of Washington well construction standards by a Washington-licensed driller (Holt Services, Inc. of Edgewood, Washington).

3.5.1 Monitoring Well Construction

Monitoring wells were constructed with a Schedule 40 polyvinyl chloride (PVC) riser connected to a 10-foot, factory-slotted 0.020-inch PVC screen with a bottom end cap. WI-SP-MW04 was constructed with a 5-foot screen because the well is less than 10 feet deep. Each monitoring well installed was 2 inches in diameter. A sand filter pack (12/20 washed silica) was placed around the annular space of the well screen from the bottom of the boring extending to a minimum height of 2 feet above the top of the well screen. A bentonite seal, at least 5-foot thick, was placed above the top of the sand pack. After the bentonite had been hydrated, a cement-bentonite grout was placed in the remaining annular space. Well construction materials were free of PFAS. No greases, bentonite, or other materials used contained PFAS. Monitoring wells were finished with flush-mount completions that included a metal well vault and a concrete pad. A locking watertight cap was placed on the top of the PVC casing. Monitoring well construction information is provided in **Table 3-1**. Monitoring well completion diagrams are provided in **Appendix A**.

3.5.2 Monitoring Well Development

After construction, each newly installed monitoring well was developed by the drilling subcontractor using a combination of bailing, surging, and pumping throughout the well screen in accordance with the applicable SOP included in the SAP. Surge blocks and pumps with Teflon parts were not used during development.

During monitoring well development, the CH2M field staff members measured field water quality parameters (WQPs), including potential of Hydrogen (pH), temperature, conductivity, and turbidity with a water quality meter. Pumping and recording of WQPs continued until one of the following criteria was met:

- The water was free of visible sediment and WQPs were stable for three consecutive readings including turbidity readings below 10 nephelometric turbidity units (NTUs).
- A minimum of five well casing volumes had been purged.

Only monitoring well WI-SP-MW03 was developed to a turbidity reading of less than 10 NTU. Monitoring wells WI-SP-MW02 and WI-SP-MW04 did not reach turbidities of less than 10 NTU and were developed until five well casing volumes had been removed. Monitoring well WI-SP-MW04 ran dry during development due to low recharge rate. The well was allowed to recharge to ensure the full screen interval was surged and bailed and then purged using a disposable bailer to the extent practicable (three total purges).

Development information, including turbidity, pH, specific conductivity, temperature, and gallons of water removed were recorded as field notes. In addition, the water quality meter was calibrated daily (at a minimum) and the calibration documented in the field notes. Well development logs are provided in **Appendix A**.

3.6 Groundwater Sampling

Groundwater samples were collected from the four newly installed monitoring wells immediately following well development. Where achievable, WQPs were stabilized prior to sample collection. The final WQPs from development were recorded and are presented in **Table 3-2**. Groundwater development logs are provided in **Appendix A** and groundwater sampling data sheets are provided in **Appendix B**.

Groundwater grab samples were also collected directly from the open auger holes at WI-SP-SB01 and WI-SP-SB01N north of Building 18. WQPs were not recorded for these samples.

During well development purging, depth to water readings and WQPs were measured and recorded at regular time intervals of 5 to 10 minutes. Depth to water was measured with a water level indicator, and WQPs were measured using a water quality meter, calibrated daily at a minimum. Where achievable, purging continued until WQPs stabilized for three consecutive readings according to the following stabilization criteria:

- Temperature within 0.1 degree Celsius (°C)
- pH within 0.1 pH units
- Conductivity within 0.01 milliSiemens per centimeter (mS/cm)
- Oxidation-reduction potential (ORP) within 10 millivolts (mV)
- Dissolved oxygen (DO) within 0.05 milligram per liter (mg/L)

Turbidity measurements are within 10 percent or less than 10 NTU

Water levels were recorded at the start of development for new monitoring wells). These water levels were used to calculate groundwater elevations and assess groundwater flow directions at each of the two areas. Discussions of groundwater flow at each of the two areas are presented in **Sections 4.3** and **4.4**.

Table 3-1. Monitoring Well Construction Details and Groundwater Elevations (April 2021)

Station ID	Installation Date	Northing (ft NAD83)	Easting (ft NAD83)	Ground Elevation (ft NAVD88)	Top of Casing Elevation (ft NAVD88)	Total Depth (ft bgs)	Casing Diameter (inches)	Top of Screen Depth (ft bgs)	Screen Length (ft)	Depth to Water (ft btoc)	Groundwater Elevation (ft NAVD88)
<i>Building 18 – New Wells and Soil Borings</i>											
WI-SP-SB01	4/16/2021	473778.53	1203239.29	17.120	--	--	--	--	--	3.50 ^a	13.62
WI-SP-SB01N	4/16/2021	473795.81	1203235.34	17.120	--	--	--	--	--	3.50 ^a	13.62
WI-SP-MW02	4/15/2021	473733.20	1203000.00	16.231	15.950	15	2	5	10	4.33 ^b	11.62
WI-SP-MW03	4/16/2021	473684.38	1203010.66	16.308	15.957	15.5	2	5.5	10	4.70 ^b	11.26
WI-SP-MW04	4/16/2021	473682.73	1203276.63	16.871	16.182	9	2	4	5	4.04 ^b	12.14
<i>Biosolids Land Application Area – New Well</i>											
WI-SP-MW08	4/19/2021	477016.47	1217867.48	139.384	138.962	90	2	80	10	48.42 ^c	90.54

^a approximate depth to water observed in pilot hole on 4/16/2021

^b starting depth to water measurement recorded during well development on 4/18/2021

^c starting depth to water measurement recorded during well development on 4/19/2021

-- = information not available

ID = identification

ft = feet

ft btoc = feet below top of casing

NAD83 = North American Datum of 1983, Washington State Plane North Zone

NAVD88 = North American Vertical Datum of 1988

Table 3-2. Water Quality Parameters (April 2021)

Monitoring Well ID	Date Sampled	Sample Time	Sample Depth (ft bgs)	Temperature (°C)	pH (standard units)	Specific Conductance (mS/cm)	Turbidity (NTU)	DO (mg/L)	ORP (mV)
Building 18									
WI-SP-SB01 ^a	4/16/2021	15:05	3.5	--	--	--	--	--	--
WI-SP-SB01N ^a	4/16/2021	15:55	3.5	--	--	--	--	--	--
WI-SP-MW02	4/18/2021	12:25	10	13.17	7.09	0.421	81.7	1.14	-19
WI-SP-MW03	4/18/2021	14:25	10.5	13.09	6.86	0.514	8.80	1.05	-60
WI-SP-MW04	4/18/2021	17:05	7	19.20	8.25	0.382	129	4.52	149
Biosolids Land Application Area									
WI-SP-MW08	4/19/2021	16:00	85	18.36	9.63	0.220	839	2.08	-60

^a WQPs were not recorded for groundwater grab samples collected from WI-SP-SB01 and WI-SP-SB01N.

3.7 Sample Analysis and Quality Control

Groundwater and soil samples were collected according to the applicable SOPs referenced in the SAP.

Groundwater and soil samples were sent to Battelle Analytical Services in Norwell, Massachusetts to be analyzed for the 18 PFAS listed in USEPA Method 537.1. Samples were analyzed using LC/MS/MS compliant with the QSM Version 5.3 Table B-15.

Field quality control (QC) samples were collected during the sampling program. These samples were obtained to ensure that disposable and reusable sampling equipment were free of contaminants, evaluate field methodology, establish ambient field background conditions, and evaluate whether cross-contamination occurred during sampling and/or shipping. Several types of field QC samples that were collected and analyzed are defined as follows:

- **Equipment Rinsate Blank (decontaminated equipment):** Equipment blanks were collected at the frequency of one per day of sampling. These samples were obtained by running laboratory-grade, certified PFAS-free deionized (DI) water over or through decontaminated sample collection equipment.
- **Equipment Rinsate Blank (disposable equipment):** Equipment blanks were collected at the frequency of one per lot. These samples were obtained by running laboratory-grade, certified PFAS-free DI water over or through unused sample collection equipment.
- **Field Blank:** Field blanks were collected at the frequency of one per week. These samples were collected by pouring the laboratory-provided blank water into the blank container.
- **Duplicate Sample:** Field duplicate (FD) samples were collected at the same time and under identical conditions as their respective associated sample at the frequency of 1 per 10 field samples of similar matrix.

In addition to field QC samples, the following lab QC samples were also collected at a rate of one per every 20 samples of a given medium:

- **Matrix Spike:** An aliquot of sampled groundwater and/or soil was spiked with known quantities of analytes of interest and subjected to the entire analytical procedure. By measuring the recovery of these spiked quantities, the appropriateness of the method for the matrix was demonstrated.
- **Matrix Spike Duplicate:** These samples were collected as second aliquots of the same matrix as the matrix spike to determine the precision of the method.

3.8 Land Surveying

Soil boring locations and newly installed monitoring wells were horizontally and vertically surveyed by a Washington-licensed surveyor. The surveyor provided easting and northing horizontal coordinates according to Washington State Plane North Zone based on NAD83. Horizontal coordinates were provided to the nearest 0.01 foot. The surveyor provided vertical elevations in feet above msl based on NAVD88. Vertical coordinates were provided to the nearest 0.001 foot. The survey reports are provided in **Appendix C**.

3.9 Groundwater Elevation Measurements

Base security protocols limited access to the BLAA; therefore, a synoptic groundwater elevation survey was not performed. Instead, groundwater elevation data were obtained from water levels measured in monitoring wells during well development and sampling to provide some indication of groundwater flow direction. Approximate water level measurements were obtained at soil borings WI-SP-SB01 and WI-SP-SB01N based on the depth at which groundwater was encountered during the hand clearing of the pilot hole. Water level measurements and groundwater elevations are presented in **Table 3-1**.

3.10 Decontamination Procedures

Decontamination activities were conducted in accordance with the applicable SOPs included in the SAP. Nondisposable equipment was decontaminated using the following solutions in this order:

1. Wash with Alconox/Liquinox solution.
2. Rinse with distilled water.
3. Rinse with laboratory-grade DI water (laboratory-certified PFAS-free).

Disposable sampling equipment and personal protective equipment, such as Masterflex tubing and nitrile gloves, were not decontaminated after use and instead were disposed of as nonhazardous solid waste. After use, disposable equipment was placed in plastic contractor bags and disposed of in an onsite trash dumpster.

Reusable heavy equipment, such as drilling rods and augers, was decontaminated before and in between the collection of each sample using a high-pressure steam cleaner with potable-grade water from a PFAS-free source. Pressure washing was conducted at the temporary decontamination pad, which had been constructed prior to the start of drilling activities.

3.11 Investigation-derived Waste Management

Investigation-derived waste (IDW) management activities were conducted in accordance with the SAP. IDW generated during the SI included soil cuttings, well development groundwater, groundwater sampling purge water, disposable sampling equipment, and decontamination rinse water from nondisposable sampling equipment and heavy equipment. IDW was containerized and stored in either a fractionation tank or tote (for aqueous IDW), or roll-off container (for solid IDW), which were properly labeled and staged with secondary containment. IDW containers were inspected weekly during and after the completion of field work until waste characterization was complete, the results of which indicated that all IDW was nonhazardous; thereafter, inspections were conducted on a monthly basis. IDW removal and disposal are pending. The IDW sampling results are provided in **Appendix D**.

Prior to disposal, CH2M field staff members collected waste characterization samples from the fractionation tank, totes, and the roll-off container. Solid and aqueous IDW samples analyzed for PFAS and full Toxicity Characteristic Leaching Procedure analyses (VOCs, semivolatile organic compounds, pesticides, and inorganic constituents), gasoline and diesel range petroleum hydrocarbons, ignitability, reactive cyanide, reactive sulfide, and corrosivity.

3.12 Sample Analysis and Data Validation

Groundwater and soil samples were submitted to Battelle Norwell Operations, Norwell, Massachusetts, a DoD Environmental Laboratory Accreditation Program accredited laboratory, in accordance with chain-of-custody procedures. All samples were analyzed for the 18 PFAS listed in USEPA Method 537.1 via LC/MS/MS compliant with QSM Version 5.3 Table B-15, in accordance with current Navy guidance:

- PFBS
- PFOS
- PFOA
- Perfluorodecanoic acid
- Perfluorododecanoic acid
- Perfluoroheptanoic acid
- PFHxS
- Perfluorohexanoic acid
- PFNA
- Perfluorotetradecanoic acid
- Perfluorotridecanoic acid
- Perfluoroundecanoic acid
- 4,8-dioxa-3H-perfluorononanoic acid
- 9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid
- 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid
- N-Ethyl Perfluorooctanesulfonamidoacetic acid
- N-Methyl Perfluorooctanesulfonamidoacetic acid
- Perfluoro-2-methyl-3-oxahexanoic acid (HFPO-DA)

Data quality evaluation and validation were performed on the soil and groundwater analytical data using a multitiered approach which includes an internal laboratory review, an independent review by a third-party validator, and an overall review by the CH2M project chemistry team. The data validation included a review for systematic errors or patterns that are found in the distribution of data qualifiers. The data validation reports are provided in **Appendix E**.

Table 3-3 presents a summary of the data validation qualifiers used during the validation process for the data collected during the Seaplane Base PFAS SI.

Table 3-3. Data Qualifiers and Frequency of Use

Groundwater Qualifiers	Meaning	Description	% of Total	Number of Results ^a
U	Nondetect	Analyte is not detected at a concentration greater than the quantitation limit.	61.73%	100
[none]	Detected	Analyte is usable at the concentration reported.	32.10%	52
J	Estimated	Analyte is estimated because it is below the quantitation limit or because of an associated QC exceedance. The result may be inaccurate or imprecise.	1.23%	2
UJ	Nondetect, estimated quantitation limit	Analyte is not detected. The quantitation limit may be inaccurate or imprecise.	4.32%	7
R	Rejected	The presence or absence of the analyte cannot be verified. The analyte is rejected because QC limits are exceeded.	0.62%	1

Table 3-3. Data Qualifiers and Frequency of Use

Soil Qualifiers	Meaning	Description	% of Total	Number of Results
U	Nondetect	Analyte is not detected at a concentration greater than the quantitation limit.	72.65%	170
J	Estimated	Analyte is estimated because it is below the quantitation limit or because of an associated QC exceedance. The result may be inaccurate or imprecise.	15.38%	36
[none]	Detected	Analyte is usable at the concentration reported.	11.97%	28
UJ	Nondetect, estimated quantitation limit	Analyte is not detected. The quantitation limit may be inaccurate or imprecise.	0.00%	0

^a The number of results excludes field QC samples.

% = percent

Excluding field QC samples, 162 distinct groundwater data points and 234 distinct soil data points were generated (including data generated for the SWWTP; **Appendix I**). The result that was R-flagged was for perfluorotetradecanoic acid in the groundwater sample from WI-SP-GW01N. Refer to the data quality evaluation in **Appendix E** for additional details regarding the R-flagged result. All other results are usable as qualified. The overall conclusion is that the dataset generated is acceptable and appropriate for its intended use.

3.13 Deviations from the Sampling and Analysis Plan

All deviations were approved by the Navy via a Field Change Request (**Appendix F**). The following is a summary of the deviations.

Borehole drilling and monitoring well installation was not completed at WI-SP-SB01/WI-SP-MW01. Collapsing sands and water were encountered at 3.5 ft bgs. A soil sample and a groundwater grab sample were collected at this interval before the hole was backfilled with a concrete and bentonite mix. A new location was selected 10 feet north of the original WI-SP-SB01/WI-SP-MW01 location. Collapsing sands and water were also encountered at this location at a depth of 3.5 ft bgs. A soil sample and a groundwater grab sample were collected, and the hole was also backfilled with a concrete and bentonite mix. The project management team and senior hydrogeologist were consulted, and it was determined that WI-SP-SB01/WI-SP-MW01 would be abandoned.

Investigation Results and Evaluation

This section presents updated conceptual site models (CSMs) for the two investigation areas reflecting the data obtained during this SI. The CSMs are presented in **Tables 4-1** and **4-2**. The CSMs include descriptions and operational history, the SI approach, area-specific lithology, groundwater flow directions, a summary of PFAS concentrations in soil and groundwater, conclusions and recommendations. Soil and groundwater analytical results for PFBS, PFOA, PFOS, PFHxS, PFNA, and HFPO-DA are presented in **Tables 4-3** and **4-4**.

4.1 Data Evaluation

The analytical results for soil and groundwater were compared to PALs. The PALs have been updated from the PALs defined in the SAP based on the current USEPA RSL table (the PALs are residential scenario RSLs based on an HQ of 0.1) and the current DoD technical guidance (DoD, 2022).

Thus, the PALs for PFBS, PFOA, PFOS, PFNA, PFHxS, and HFPO-DA are as follows:

- PFBS – Soil PAL: 1,900 µg/kg; groundwater PAL: 600 ng/L
- PFOA – Soil PAL: 19 µg/kg; groundwater PAL: 6 ng/L
- PFOS – Soil PAL: 13 µg/kg; groundwater PAL: 4 ng/L
- PFNA – Soil PAL: 19 µg/kg; groundwater PAL: 5.9 ng/L
- PFHxS – Soil PAL: 130 µg/kg; groundwater PAL: 39 ng/L
- HFPO-DA – Soil PAL: 23 µg/kg; groundwater PAL: 6 ng/L

Screening criteria do not exist for the remaining 12 PFAS for soil or groundwater; therefore, PALs were not developed for the compounds. Data for PFAS other than PFBS, PFOA, PFOS, PFNA, PFHxS, and HFPO-DA are presented in **Appendix G**. The data may be further evaluated if criteria are established.

4.2 Human Health Risk Screening

A Human Health Risk Screening (HHRS) based on a conservative future residential exposure and potable use of groundwater was conducted for each of the investigation areas and is presented in detail in **Appendix H**. The analytical results used in the HHRS were limited to those PFAS that have developed risk-based screening levels (SLs) (PFBS, PFOA, PFOS, PFNA, PFHxS, and HFPO-DA). The HHRS was conducted in two steps using a risk ratio technique. The first step involved comparison of the data to the SLs identified in **Section 4.1**. PFAS with maximum detected concentrations above the SLs were evaluated in the second step, calculation of a risk ratio and comparison of the calculated carcinogenic risk and noncarcinogenic hazard to target levels. If the cumulative HI for a target organ/effect was greater than the target HI of 0.5, or the cumulative carcinogenic risk was greater than the target carcinogenic risk of 5×10^{-5} , the chemicals contributing to these values were identified as human health chemicals of potential concern (COPCs).

4.3 Building 18

The updated CSM for Building 18 is presented in **Table 4-1**. Groundwater elevations and flow directions are shown on **Figure 5**. PFBS, PFOA, PFOS, PFNA, PFHxS, and HFPO-DA concentrations in soil and groundwater are shown on **Figures 6 and 7**, respectively.

Table 4-1. Conceptual Site Model – Building 18

Description, Operational History, and Potential for PFAS Release	Building 18 is on the peninsula of Seaplane Base northwest of the intersection of Coral Sea Avenue and Tulagi Avenue and serves as a vehicle maintenance building. The building is surrounded by a large concrete parking lot with small areas of grass to the east, south, and west. One storm drain inlet is on the north side of the building. The location of the outfall for this storm drain is to the west of Building 22. An additional drain is on the east side of the building associated with a wash rack. The wash rack drain is known to be tied to the sanitary sewer system via a manual valve. AFFF holding tanks on the fire trucks at Seaplane Base were filled using 5-gallon buckets. Based on interviews during the PA, filling at the storm drain inlet or at the wash rack may have occurred. A designated wash rack for vehicles is on the eastern side of the building. A large storm drain inlet north of the building was used while washing trucks. Small releases of PFAS may have occurred during fire truck washing activities if AFFF was washed off of trucks. If PFAS were introduced into the storm sewer system, PFAS could have been dispersed to the subsurface through leaks in the storm sewer system.						
	<ul style="list-style-type: none"> A total of five subsurface soil samples were collected from five locations. Three of the five samples were collected from the capillary fringe (depth intervals ranging from 1.5 to 2 ft bgs to 8 to 8.5 ft bgs). The remaining two soil samples were collected from hand auger soil cuttings from the pilot holes for WI-SP-SB01 and WI-SP-SB01N. Five groundwater samples were collected from three newly installed monitoring wells (screen intervals ranging from 4 to 9 ft bgs to 5.5 to 15.5 ft bgs) and two open soil borings (grab samples taken at approximately 1.5 ft bgs). 						
PALs	PFOA	PFOS	PFBS	PFNA	PFHxS	HFPO-DA	
	Soil: 19 µg/kg GW: 6ng/L	Soil: 13 µg/kg GW: 4 ng/L	Soil: 1,900 µg/kg GW: 600 ng/L	Soil: 19 µg/kg GW: 5.9 ng/L	Soil: 130 µg/kg GW: 39 ng/L	Soil: 23 µg/kg GW: 6 ng/L	
Sample Stations	WI-SP-SB01/ WI-SP-GW01	WI-SP-SB01N/ WI-SP-GW01N	WI-SP-SB02/ WI-SP-MW02	WI-SP-SB03/ WI-SP-MW03	WI-SP-SB04/ WI-SP-MW04		
Lithology	Soils encountered in the soil borings drilled near Building 18 consisted of well-graded sand and clayey sand from the surface down to between 5 and 13 ft bgs underlain by lean clay.						
Groundwater Flow	Water levels measured during sampling of the new monitoring wells and during drilling of soil borings near Building 18 indicate that depth to groundwater near Building 18 is between 3.5 and 4.7 feet bgs. Groundwater elevations calculated from these water levels indicate that the groundwater flow direction near Building 18 is to the southwest toward Oak Harbor (water body) (Figure 5). However, the lack of synoptic water level data presents some uncertainty in the groundwater flow direction.						
SI Results Compared to PALs^a	Analyte	Soil			Groundwater		
		Frequency of Detection	Frequency of Exceedance	Maximum Concentration (µg/kg) and Location	Frequency of Detection	Frequency of Exceedance	Maximum Concentration (ng/L) and Location
	PFBS	4/5	0/5	0.117 J (WI-SP-SB04)	4/5	0/5	153 (WI-SP-MW02)
	PFOA	3/5	0/5	0.258 J (WI-SP-SB02)	4/5	4/5	134 (WI-SP-GW01N)
	PFOS	5/5	0/5	9.24 (WI-SP-SB02)	4/5	4/5	3,220 (WI-SP-MW03)
	PFNA	3/5	0/5	0.125 J (WI-SP-SB02)	4/5	4/5	19.1 (WI-SP-GW01)
	PFHxS	5/5	0/5	0.598 (WI-SP-SB02)	4/5	4/5	847 (WI-SP-MW02)
HFPO-DA	1/5	0/5	0.033 J (WI-SP-SB01)	0/5	0/5	ND	

Table 4-1. Conceptual Site Model – Building 18

<p>Results Summary, HRS Findings, Conclusions and Recommendations</p>	<p>PFAS concentrations in groundwater near Building 18 are significantly above the PALs; however, PFAS soil concentrations are well below the PALs in this area.</p> <p>The inconsistency between soil and groundwater concentrations may be a result of PFAS being released to the subsurface through cracks or joints in the storm sewer pipes near Building 18. Due to the shallow water table, PFAS in the storm sewer system may be released directly to the groundwater system without impacting soil in the vadose zone.</p> <p>The HRS for Building 18 identified PFOA, PFOS, PFHxS, and PFNA as COPCs for exposure to groundwater that warrant further evaluation of potential risks to exposed human receptors (only the monitoring well groundwater samples were evaluated in the HRS); however, no unacceptable human health risks associated with PFAS were identified in soil (Appendix H).</p> <p>PFAS concentrations in groundwater near Building 18 indicate a release has occurred associated with this area; however, further investigation is needed to delineate the nature and extent of PFAS in soil and groundwater in this area. Therefore, an RI is recommended for the Building 18 area.</p>
--	--

^a PFBS, PFOA, and PFOS are the only PFAS that currently have PALs. Full analytical results are presented in **Appendix G**.

ND = not detected

RI = Remedial Investigation

4.4 Biosolids Land Application Area

The updated CSM for the BLAA is presented in **Table 4-2**. Groundwater elevations and flow directions are shown on **Figure 8**. PFBS, PFOA, PFOS, PFNA, PFHxS, and HFPO-DA concentrations in soil and groundwater are shown on **Figures 9 and 10**, respectively.

Table 4-2. Conceptual Site Model – Biosolids Land Application Area

Description, Operational History, and Potential for PFAS Release	<p>The BLAA is northeast of Crescent Harbor and encompasses 2.3 acres of land. The application area is in a secured area due to nearby munitions storage areas and consists of an open field area with trees to the north and east and Crescent Harbor to the south and west. The biosolids from Ault Field WWTP were applied in 2015 and in 2017 with approximately 400 cubic yards of material during each year.</p> <p>There is significant uncertainty as to the location of the application area. This area is not consistently used for disposal of biosolids. The 2015 and 2017 applications are isolated events for this area. The location where these applications occurred is not well documented, and there is no remaining physical evidence that would indicate where biosolids were applied. The mapped location shown on Figures 2, 4, 8, 9, and 10 is based on the recollections of staff members interviewed.</p>											
	<ul style="list-style-type: none"> Four composite surface soil samples were collected from 0 to 0.5 ft bgs from gridded locations within the application area; each sample was composited from 10 locations from 1 of 4 quadrants. One subsurface soil sample was collected from depth interval of the first encountered groundwater (80.5 to 81.5) at a location downgradient of the application area. One groundwater sample was collected from a newly installed monitoring well (screen interval 80 to 90 ft bgs). 											
SI Approach	PFOA		PFOS		PFBS		PFNA		PFHxS		HFPO-DA	
	Soil: 19 µg/kg GW: 6 ng/L		Soil: 13 µg/kg GW: 4 ng/L		Soil: 1,900 µg/kg GW: 600 ng/L		Soil: 19 µg/kg GW: 5.9 ng/L		Soil: 130 µg/kg GW: 39 ng/L		Soil: 23 µg/kg GW: 6 ng/L	
PALs	WI-SP-SS01		WI-SP-SS02		WI-SP-SS03		WI-SP-SS04		WI-SP-SB08/WI-SP-MW08			
Sample Stations	WI-SP-SS01		WI-SP-SS02		WI-SP-SS03		WI-SP-SS04		WI-SP-SB08/WI-SP-MW08			
Lithology	<p>Lithology observed in boring WI-SP-SB08 consisted of approximately 60 feet of silt and sandy silt. At approximately 60 ft bgs, lithology changes to sand and gravel interbedded with silt with gravel.</p>											
Groundwater Flow	<p>During drilling of WI-SP-SB08 saturated conditions were first observed in soil cuttings at approximately 80 ft bgs; however, depth to water measured in the completed monitoring well WI-SP-MW08 was 48.42 ft bgs (over 30 feet higher than the saturated conditions observed in the borehole) (Figure 8). This suggests that the shallow aquifer in this location is likely confined, resulting in a potentiometric surface that is higher than the depth where saturated conditions were first encountered during drilling.</p> <p>An insufficient number of monitoring wells exists in this area to calculate a precise groundwater flow direction; however, based on topography and location relative to Crescent Harbor, the inferred predominant groundwater flow direction at the BLAA is to the southwest toward Crescent Harbor (Figure 8).</p>											
SI Results Compared to PALs	Analyte	Surface Soil			Subsurface Soil			Groundwater				
		Frequency of Detection	Frequency of Exceedance	Maximum Concentration (µg/kg) and Location	Frequency of Detection	Frequency of Exceedance	Maximum Concentration (µg/kg)	Frequency of Detection	Frequency of Exceedance	Maximum Concentration (ng/L) and Location		
		PFBS	1/4	0/4	0.039 J (WI-SP-SS03)	0/1	--	ND	1/1	0/1	427 (WI-SP-MW08)	
		PFOA	0/4	--	ND	0/1	--	ND	1/1	1/1	329 (WI-SP-MW08)	
PFOS	4/4	0/4	0.156 J (WI-SP-SS04)	0/1	--	ND	1/1	1/1	269 (WI-SP-MW08)			

Table 4-2. Conceptual Site Model – Biosolids Land Application Area

SI Results Compared to PALs (continued)	Analyte	Surface Soil			Subsurface Soil			Groundwater		
		Frequency of Detection	Frequency of Exceedance	Maximum Concentration (µg/kg) and Location	Frequency of Detection	Frequency of Exceedance	Maximum Concentration (µg/kg)	Frequency of Detection	Frequency of Exceedance	Maximum Concentration (ng/L) and Location
	PFNA	0/4	--	ND	0/1	--	ND	1/1	1/1	24.4 (WI-SP-MW08)
	PFHxS	1/4	0/4	0.0516 J (WI-SP-SS03)	0/1	--	ND	1/1	1/1	266 (WI-SP-MW08)
	HFPO-DA	0/4	--	ND	0/1	--	ND	0/1	0/1	ND
Results Summary, HHS Findings, Conclusions and Recommendations	<p>PFAS concentrations in groundwater at the BLAA are above the respective PALs; however, surface and subsurface PFAS soil concentrations are well below the PALs.</p> <p>Any PFAS present in the biosolids would have been released directly to the ground surface and should still be detectable at high concentrations in the soil. The 2015 and 2017 events are the only recorded instances where this area was used for application of biosolids. Documentation of the specific location of the application area were unavailable, and no physical evidence remains to identify the exact location of the application area in the field. Therefore, significant uncertainty remains as to the exact location of the application area, and it is possible that the area is further upgradient than the recollections of interviewed staff had indicated. While the possibility of an alternative upgradient source cannot not be ruled out at this point, there is no physical evidence on the ground surface that points to any of the surrounding areas as potential upgradient sources of PFAS to groundwater. The possibility that the sampling area is not the true location of the application area seems to be the more likely scenario given the uncertainty associated with where the exact location of the application events.</p> <p>The depth of the water table presents a potential data gap as it is unclear if 3 to 5 years is sufficient time for PFAS to travel from the ground surface to the water table at 80 ft bgs; however, additional investigation would be necessary to evaluate PFAS vadose zone travel times.</p> <p>The HHS for the BLAA identified COPCs (PFOA, PFOS, PFHxS, and PFNA) for exposure to groundwater that warrant further evaluation of potential risks to exposed human receptors.; however, no unacceptable human health risks associated with PFAS were identified in soil (Appendix H).</p> <p>PFAS concentrations in groundwater at the BLAA indicate a release has occurred in this area; however, further investigation including an expansion of the surface soil sampling area and installation and sampling of additional monitoring wells is necessary to delineate the extent of PFAS in groundwater and soil. Therefore, an RI is recommended for the BLAA.</p>									

^a PFBS, PFOA, and PFOS are the only PFAS that currently have PALs. Full analytical results are presented in **Appendix G**.

Table 4-3. Soil Analytical Data for PFBS, PFOA PFOS, PFNA, PFHxS, and HFPO-DA (April 2021) ^a

Sample Location	Date Sampled	PFBS (µg/kg)	PFOA (µg/kg)	PFOS (µg/kg)	PFNA (µg/kg)	PFHxS (µg/kg)	HFPO-DA (µg/kg)
Project Action Limits ^b		1,900	19	13	19	130	23
Building 18							
SUBSURFACE SOIL							
WI-SP-SB01	4/16/2021	0.0814 J	0.11 J	2.91	0.0478 J	0.169 J	0.033 J
WI-SP-SB01N	4/16/2021	0.0207 J	0.0775 U	0.765	0.0388 U	0.0928 J	0.0775 U
WI-SP-SB02	4/15/2021	0.0395 U	0.258	9.24	0.125 J	0.598	0.0791 U
WI-SP-SB03	4/16/2021	0.0289 J	0.113 J	2.26	0.0393 U	0.186 J	0.0786 U
WI-SP-SB04	4/16/2021	0.117 J	0.0786 U	0.246	0.0393 U	0.218	0.0786 U
Biosolids Land Application Area							
SURFACE SOIL							
WI-SP-SS01	4/21/2021	0.0396 U	0.0792 U	0.0899 J	0.0396 U	0.0792 U	0.0792 U
WI-SP-SS02	4/21/2021	0.0398 U	0.0797 U	0.148 J	0.0398 U	0.0797 U	0.0797 U
WI-SP-SS03	4/21/2021	0.039 J	0.0784 U	0.13 J	0.0392 U	0.0516 J	0.0784 U
WI-SP-SS04	4/21/2021	0.0396 U	0.0792 U	0.156 J	0.0396 U	0.0792 U	0.0792 U
SUBSURFACE SOIL							
WI-SP-SB08	4/14/2021	0.0392 U	0.0784 U	0.0784 U	0.0392 U	0.0784 U	0.0784 U

Bolding indicates detection of analyte in the sample.

^a Limits of detection (LODs) for each sample are provided in **Appendix G**.

^b Values are from the May 2022 USEPA RSL table (DoD, 2022).

Table 4-4. Groundwater Analytical Data for PFBS, PFOA, PFOS, PFNA, PFHxS, HFPO-DA (April 2021) ^a

Sample Location	Date Sampled	PFBS (ng/L)	PFOA (ng/L)	PFOS (ng/L)	PFNA (ng/L)	PFHxS (ng/L)	HFPO-DA (ng/L)
Project Action Limits ^b		600	6	4	6	5.9	6
Building 18							
GROUNDWATER							
WI-SP-MW02	4/18/2021	153	124 ^c	568 ^c	19	847	ND
WI-SP-MW03	4/18/2021	70.2	114	3,220	9.43	508	ND
WI-SP-MW04	4/19/2021	0.466 U	1.4 U	0.933 U	0.933 U	0.373 U	ND
GROUNDWATER GRAB							
WI-SP-GW01	4/16/2021	122	131	2,330	19.1	539	ND
WI-SP-GW01N	4/16/2021	50.2	134	2,270	16.7	764	ND
Biosolids Land Application Area							
GROUNDWATER							
WI-SP-MW08	4/19/2021	427	329	269	24.4	266	ND

Notes:

Bolding indicates detection.

Shading and bolding indicate exceedance of screening value.

^a LODs for each sample are provided in **Appendix G**.^b Values are from the May 2022 USEPA RSL table (DoD, 2022).^c Result is from an FD sample.

Conclusions and Recommendations

Table 5-1 summarizes the results of the PFAS SI conducted at Building 18 and the BLAA at Naval Air Station Whidbey Island Seaplane Base.

Table 5-1. Conclusions of PFAS Site Inspection

Objective	Results and Conclusions
Determine if PFAS are present in soil at Building 18 and the BLAA at levels that pose potential risks to human health and the environment.	<p>Building 18:</p> <ul style="list-style-type: none"> PFBS, PFOA, PFOS, PFNA, PFHxS, and HFPO-DA were detected in soils near Building 18, but concentrations were several orders of magnitude below PALs. No unacceptable human health risks were identified for any PFAS in soil near Building 18. Because of the shallow depth of the water table near Building 18, PFAS may could have been released from cracks or joints in the storm sewer pipes directly to the groundwater without impacting soil in the vadose zone. <p>BLAA:</p> <ul style="list-style-type: none"> PFBS, PFOS, and PFHxS were detected in soils at the BLAA, but concentrations were several orders of magnitude below PALs. No unacceptable human health risks were identified for any PFAS in soil at the BLAA. Although the location of the application area was based on the best available information at the time, due to the uncertainty regarding the location of the application area, it is possible that the location of the 2015 and 2017 biosolids application events is upgradient of where sampling was conducted.
Determine if PFAS are present in groundwater in the two potential release areas at concentrations posing potential risks to human receptors or the environment.	<p>Building 18:</p> <ul style="list-style-type: none"> PFOA PFOS, PFNA, and PFHxS are present in groundwater near Building 18 at concentrations above PALs. The HHRS for Building 18 identified potential unacceptable human health risks associated with exposure to PFOA, PFOS, PFNA, and PFHxS in groundwater. <p>BLAA:</p> <ul style="list-style-type: none"> PFOA and PFOS are present in groundwater near the BLAA at concentrations above PALs. It is unclear if there has been sufficient time since the 2015 and 2017 biosolids application events for PFAS to have traveled to the water table at 80 ft bgs; however, there is no evidence that points to any of the surrounding areas as potential upgradient sources of PFAS to groundwater. The HHRS for the BLAA identified potential unacceptable human health risks associated with exposure to PFOA, PFOS, PFHxS, and PFNA in groundwater.

Based on an assessment of the results of the PFAS SI, the following actions are proposed for the areas investigated at Seaplane Base:

- Building 18** – Based on the confirmed presence of PFOA, PFOS, PFHxS, and PFNA groundwater near Building 18 at concentrations that pose potential unacceptable risk to human health receptors, this area is recommended for an RI. The RI should include additional soil sampling and installation and sampling of additional groundwater monitoring wells near Building 18 as well as in upgradient areas to fully delineate the extent of PFAS in soil and groundwater. The RI should also consider the need to assess the leaching potential of PFOA, PFOS, PFHxS, and PFNA in soil near the Building 18 wash rack and in adjacent areas.
- BLAA** – Based on the confirmed presence of PFOA PFOS, PFNA, and PFHxS in groundwater near the BLAA at concentrations that pose potential unacceptable risk to human health receptors, this area is recommended for an RI. The RI should include installation and sampling of additional groundwater monitoring wells to delineate the extent of PFOA, PFOS, PFNA, and PFHxS in groundwater. The RI sampling area should be expanded to include adjacent upgradient areas to more fully delineate the extent of PFAS in groundwater and upgradient soil. Simulation of PFAS vadose zone migration should also be considered for the RI to estimate travel time of PFAS from a shallow source to a deep water table and assess whether PFAS in shallow soil represents a viable source to groundwater at the BLAA.

References

- CH2M Hill, Inc (CH2M). 2018. *Preliminary Assessment for Per- and Polyfluoroalkyl Substances (PFAS), Seaplane Base, Naval Air Station Whidbey Island, Oak Harbor, Washington*. September.
- CH2M. 2021. *Sampling and Analysis Plan Per- and Polyfluoroalkyl Substances Site Inspection Seaplane Base Naval Air Station Whidbey Island Oak Harbor, Washington*. March.
- Department of the Navy (Navy). 2020. *Interim Per- and Polyfluoroalkyl Substances (PFAS) Site Guidance for NAVFAC Remedial Project Managers (RPMs)/September 2017 Update*. November.
- Office of the Under Secretary of Defense for Acquisition and Sustainment. (DoD). 2019. *DoD Instruction 4715.18, Emerging Chemicals (ECs) of Environmental Concern*. September. accessed November 27, 2020, <https://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodi/471518p.pdf>.
- DoD. 2022. Assistant Secretary of Defense memorandum, *Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program*. July 6.
- Shannon and Wilson. 1978. *Geotechnical Report, Sanitary Sewer Rehabilitation Naval Air Station Whidbey Island, Washington*.
- URS Consultants, Inc. (URS) 1993. *Remedial Investigation for Operable Unit 4 Naval Air Station Whidbey Island, Washington*. Volume 1. June.
- United States Geological Survey (USGS). 1988. *Ground-water Resources and Simulations of Flow in Aquifers Containing Freshwater and Seawater, Island County, Washington*.
- United States Environmental Protection Agency. 2022. Regional Screening Levels (RSLs) - Generic Tables. May 18.
- USGS. 1986. *Map Showing Unconsolidated Deposits Grouped on the Basis of Texture, Port Townsend 30'x60' Quadrangle, Puget Sound Region, Washington*. <https://pubs.er.usgs.gov/publication/i1198D>. Map I-1198-D.

Figures



- Legend**
- City
 - State Route
 - Local Road
 - ▭ Base Boundary

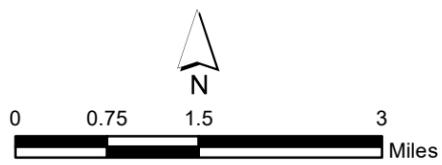


Figure 1
Installation Location Map
Site Inspection for PFAS
Naval Air Station Whidbey Island
Seaplane Base
Oak Harbor, Washington



DATA SOURCE: ESRI & NIRIS
IMAGERY SOURCE: ESRI 2018

- Legend**
- City
 - ▶ Approximate Groundwater Flow Direction
 - - - Groundwater Divide
 - Building
 - Housing
 - Potential PFAS Release Area
 - - - Base Boundary

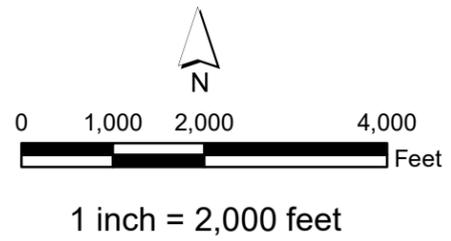


Figure 2
Potential PFAS Release Areas
Site Inspection for PFAS
Naval Air Station Whidbey Island
Seaplane Base
Oak Harbor, Washington



DATA SOURCE: ESRI & NIRIS
 IMAGERY SOURCE: ESRI, Maxar 2018

- Legend**
- Groundwater monitoring well sample and soil sample location
 - Groundwater and soil grab sample location
 - Stormwater Catch Basin
 - ▲ Stormwater Outfall
 - Unpaved Ditch
 - Approximate Groundwater Flow Direction
 - Building
 - Housing
 - Potential PFAS Release Area
 - Base Boundary

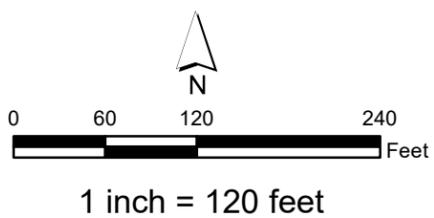


Figure 3
 Sample Locations: Building 18
 Site Inspection for PFAS
 Naval Air Station Whidbey Island
 Seaplane Base
 Oak Harbor, Washington



DATA SOURCE: ESRI & NIRIS
 IMAGERY SOURCE: ESRI, Maxar 2018

- Legend**
- Groundwater monitoring well sample and soil sample location
 - Culvert
 - Unpaved Ditch
 - Approximate Groundwater Flow Direction
 - Building
 - Housing
 - Potential PFAS Release Area
 - Base Boundary

- Gridded composite surface soil sample location
- Sampling Grid

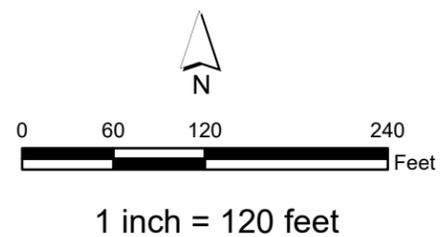


Figure 4
 Sample Locations: Biosolids Land Application Area
 Site Inspection for PFAS
 Naval Air Station Whidbey Island
 Seaplane Base
 Oak Harbor, Washington



DATA SOURCE: ESRI & NIRIS
 IMAGERY SOURCE: ESRI, Maxar 2018

- Legend**
- Groundwater monitoring well sample and soil sample location
 - Groundwater and soil grab sample location
 - Stormwater Catch Basin
 - ▲ Stormwater Outfall
 - Unpaved Ditch
 - Approximate Groundwater Flow Direction
 - Building
 - Housing
 - Potential PFAS Release Area
 - Base Boundary

WI-SP-GW01 Well ID
13.62 Groundwater Elevation

NOTES:
 1. Groundwater elevations were measured on the following dates:
 WI-SP-GW01: 4/16/2021
 WI-SP-GW01N: 4/16/2021
 WI-SP-MW02: 4/18/2021
 WI-SP-MW03: 4/18/2021
 WI-SP-MW04: 4/18/2021
 2. Groundwater elevations are in feet NAVD88

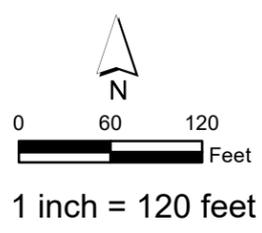


Figure 5
 Groundwater Elevations: Building 18
 Site Inspection for PFAS
 Naval Air Station Whidbey Island
 Seaplane Base
 Oak Harbor, Washington

Notes:

1. **Bolded text indicates detection**
2. units = micrograms per kilogram (µg/kg)
3. USEPA Soil RSLs
 HFPO-DA = 23 µg/kg
 PFBS = 1,900 µg/kg
 PFHxS = 130 µg/kg
 PFNA = 19 µg/kg
 PFOS = 13 µg/kg
 PFOA = 19 µg/kg
4. Where applicable, the higher concentration between the primary and field duplicate samples is shown.
5. ft bgs = feet below ground surface
6. J = Analyte present. Value may or may not be accurate or precise.
7. U = The material was analyzed for, but not detected.
8. HFPO-DA = perfluoro-2-methyl-3-oxahexanoic acid
9. PFBS = perfluorobutanesulfonic acid
10. PFHxS = perfluorohexanesulfonic acid
11. PFNA = perfluorononanoic acid
12. PFOS = perfluorooctane sulfonate
13. PFOA = perfluorooctanoic acid

WI-SP-SB01N	4/16/21
<i>Depth (ft bgs)</i>	1.5-2.0
HFPO-DA	0.0775 U
PFBS	0.0207 J
PFHxS	0.0928 J
PFNA	0.0388 U
PFOS	0.765
PFOA	0.0775 U

WI-SP-SB01	4/16/21
<i>Depth (ft bgs)</i>	1.5-2.0
HFPO-DA	0.033 J
PFBS	0.0814 J
PFHxS	0.169 J
PFNA	0.0478 J
PFOS	2.91
PFOA	0.11 J

WI-SP-SB02	4/15/21
<i>Depth (ft bgs)</i>	4.5-5.0
HFPO-DA	0.0791 U
PFBS	0.0395 U
PFHxS	0.598
PFNA	0.125 J
PFOS	9.24
PFOA	0.258

Storm Drain Inlet

2797

Wash Rack

WI-SP-SB04	4/16/21
<i>Depth (ft bgs)</i>	5-5.5
HFPO-DA	0.0786 U
PFBS	0.117 J
PFHxS	0.218
PFNA	0.0393 U
PFOS	0.246
PFOA	0.0786 U

WI-SP-SB03	4/16/21
<i>Depth (ft bgs)</i>	8.0-8.5
HFPO-DA	0.0786 U
PFBS	0.0289 J
PFHxS	0.186 J
PFNA	0.0393 U
PFOS	2.26
PFOA	0.113 J



DATA SOURCE: ESRI & NIRIS
 IMAGERY SOURCE: ESRI, Maxar 2021

- Legend**
- Groundwater monitoring well sample and soil sample location
 - Groundwater and soil grab sample location
 - Stormwater Catch Basin
 - ▲ Stormwater Outfall
 - Unpaved Ditch
 - Approximate Groundwater Flow Direction
 - Building
 - Housing
 - Potential PFAS Release Area
 - Base Boundary

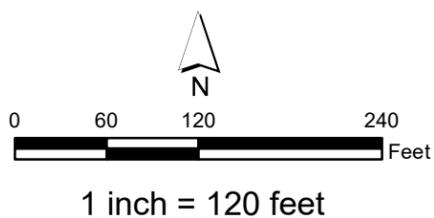


Figure 6
 PFAS Soil Concentrations: Building 18
 Site Inspection for PFAS
 Naval Air Station Whidbey Island
 Seaplane Base
 Oak Harbor, Washington

Notes:
 1. **Bolded text indicates detection**
 2. Shading indicates exceedence of USEPA Tapwater RSL
 3. units = nanograms per liter (ng/L)
 4. USEPA Tapwater RSLs
 PFBS = 600 ng/L
 PFHxS = 5.9 ng/L
 PFNA = 6 ng/L
 PFOS = 4 ng/L
 PFOA = 6 ng/L
 5. Where applicable, the higher concentration between the primary and field duplicate samples is shown.
 6. J = Analyte present. Value may or may not be accurate or precise.
 7. U = The material was analyzed for, but not detected.
 8. UJ = Analyte not detected, quantitation limit may be inaccurate.
 9. PFBS = perfluorobutanesulfonic acid
 10. PFHxS = perfluorohexanesulfonic acid
 11. PFNA = perfluorononanoic acid
 12. PFOS = perfluorooctane sulfonate
 13. PFOA = perfluorooctanoic acid

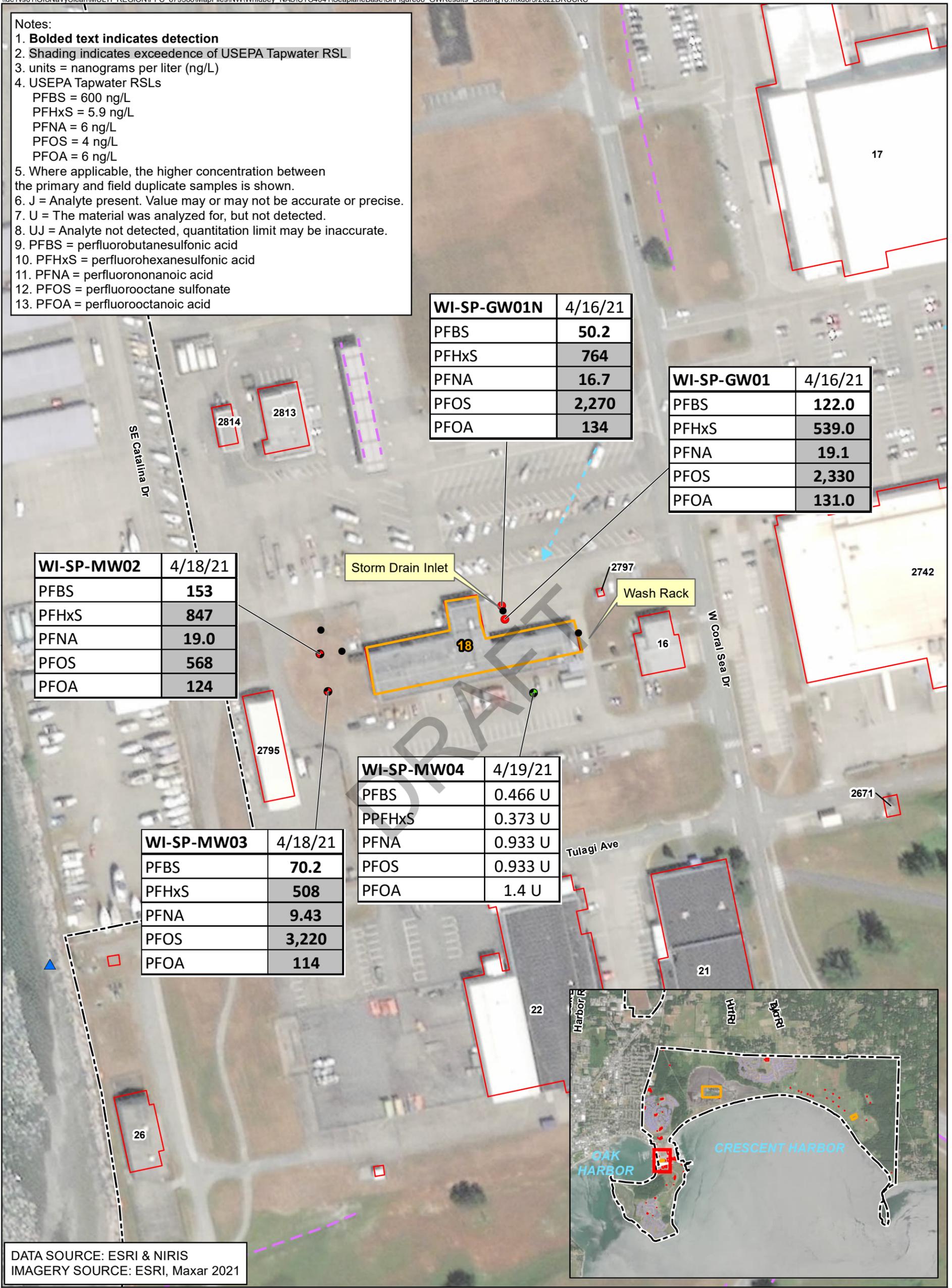
WI-SP-GW01N	4/16/21
PFBS	50.2
PFHxS	764
PFNA	16.7
PFOS	2,270
PFOA	134

WI-SP-GW01	4/16/21
PFBS	122.0
PFHxS	539.0
PFNA	19.1
PFOS	2,330
PFOA	131.0

WI-SP-MW02	4/18/21
PFBS	153
PFHxS	847
PFNA	19.0
PFOS	568
PFOA	124

WI-SP-MW04	4/19/21
PFBS	0.466 U
PFHxS	0.373 U
PFNA	0.933 U
PFOS	0.933 U
PFOA	1.4 U

WI-SP-MW03	4/18/21
PFBS	70.2
PFHxS	508
PFNA	9.43
PFOS	3,220
PFOA	114



DATA SOURCE: ESRI & NIRIS
 IMAGERY SOURCE: ESRI, Maxar 2021

- Legend**
- Groundwater monitoring well sample and soil sample location with no exceedance
 - Groundwater monitoring well sample and soil sample location with exceedance
 - Groundwater and soil grab sample location with exceedance
 - Stormwater Catch Basin
 - ▲ Stormwater Outfall
 - Unpaved Ditch
 - Approximate Groundwater Flow Direction
 - Building
 - Housing
 - Potential PFAS Release Area
 - Base Boundary

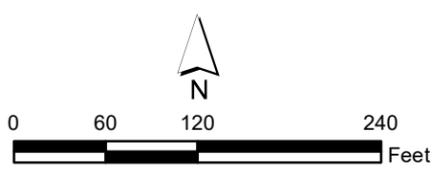


Figure 7
 Groundwater Elevations and PFAS
 Groundwater Concentrations: Building 18
 Site Inspection for PFAS
 Naval Air Station Whidbey Island
 Seaplane Base
 Oak Harbor, Washington



DATA SOURCE: ESRI & NIRIS
 IMAGERY SOURCE: ESRI, Maxar 2018

- Legend**
- Groundwater monitoring well sample and soil sample location
 - Culvert
 - Unpaved Ditch
 - Approximate Groundwater Flow Direction
 - Building
 - Housing
 - Potential PFAS Release Area
 - Base Boundary

Gridded composite surface soil sample location

Sampling Grid

WI-SP-GW01 Well ID
13.62 Groundwater Elevation

NOTES:
 1. Groundwater elevation at WI-SP-MW08 was measured on 4/19/2021
 2. Groundwater elevations are in feet NAVD88

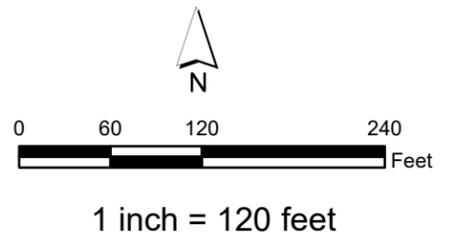
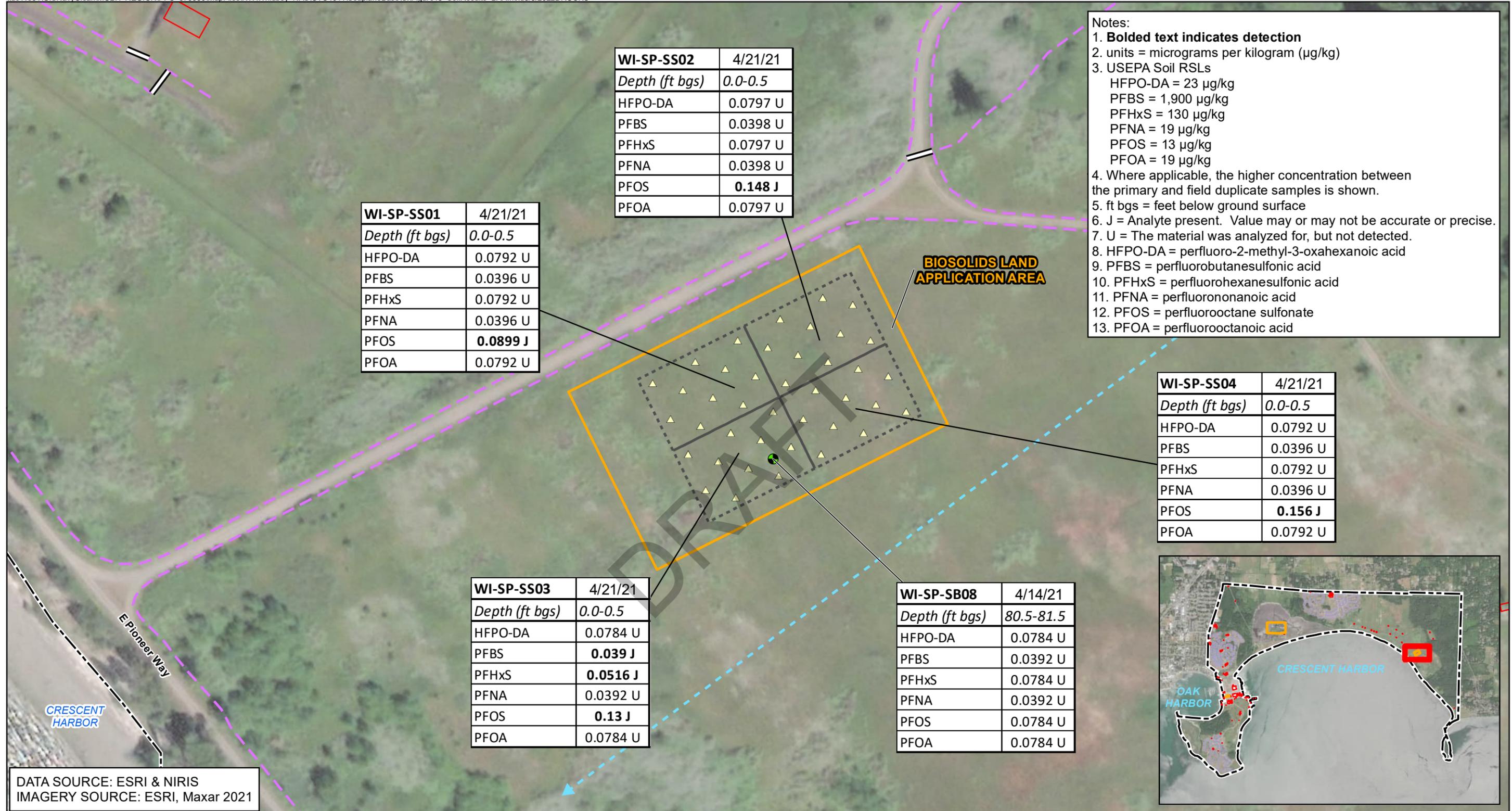


Figure 8
 Groundwater Elevations: Biosolids Land Application Area
 Site Inspection for PFAS
 Naval Air Station Whidbey Island
 Seaplane Base
 Oak Harbor, Washington



WI-SP-SS02	4/21/21
<i>Depth (ft bgs)</i>	0.0-0.5
HFPO-DA	0.0797 U
PFBS	0.0398 U
PFHxS	0.0797 U
PFNA	0.0398 U
PFOS	0.148 J
PFOA	0.0797 U

WI-SP-SS01	4/21/21
<i>Depth (ft bgs)</i>	0.0-0.5
HFPO-DA	0.0792 U
PFBS	0.0396 U
PFHxS	0.0792 U
PFNA	0.0396 U
PFOS	0.0899 J
PFOA	0.0792 U

- Notes:
- 1. Bolded text indicates detection**
 - units = micrograms per kilogram (µg/kg)
 - USEPA Soil RSLs
 HFPO-DA = 23 µg/kg
 PFBS = 1,900 µg/kg
 PFHxS = 130 µg/kg
 PFNA = 19 µg/kg
 PFOS = 13 µg/kg
 PFOA = 19 µg/kg
 - Where applicable, the higher concentration between the primary and field duplicate samples is shown.
 - ft bgs = feet below ground surface
 - J = Analyte present. Value may or may not be accurate or precise.
 - U = The material was analyzed for, but not detected.
 - HFPO-DA = perfluoro-2-methyl-3-oxahexanoic acid
 - PFBS = perfluorobutanesulfonic acid
 - PFHxS = perfluorohexanesulfonic acid
 - PFNA = perfluorononanoic acid
 - PFOS = perfluorooctane sulfonate
 - PFOA = perfluorooctanoic acid

WI-SP-SS04	4/21/21
<i>Depth (ft bgs)</i>	0.0-0.5
HFPO-DA	0.0792 U
PFBS	0.0396 U
PFHxS	0.0792 U
PFNA	0.0396 U
PFOS	0.156 J
PFOA	0.0792 U

WI-SP-SS03	4/21/21
<i>Depth (ft bgs)</i>	0.0-0.5
HFPO-DA	0.0784 U
PFBS	0.039 J
PFHxS	0.0516 J
PFNA	0.0392 U
PFOS	0.13 J
PFOA	0.0784 U

WI-SP-SB08	4/14/21
<i>Depth (ft bgs)</i>	80.5-81.5
HFPO-DA	0.0784 U
PFBS	0.0392 U
PFHxS	0.0784 U
PFNA	0.0392 U
PFOS	0.0784 U
PFOA	0.0784 U

DATA SOURCE: ESRI & NIRIS
 IMAGERY SOURCE: ESRI, Maxar 2021

- Legend**
- Groundwater monitoring well sample and soil sample location
 - Culvert
 - Unpaved Ditch
 - Approximate Groundwater Flow Direction
 - Building
 - Housing
 - Potential PFAS Release Area

- Gridded composite surface soil sample location
- Sampling Grid
- Base Boundary

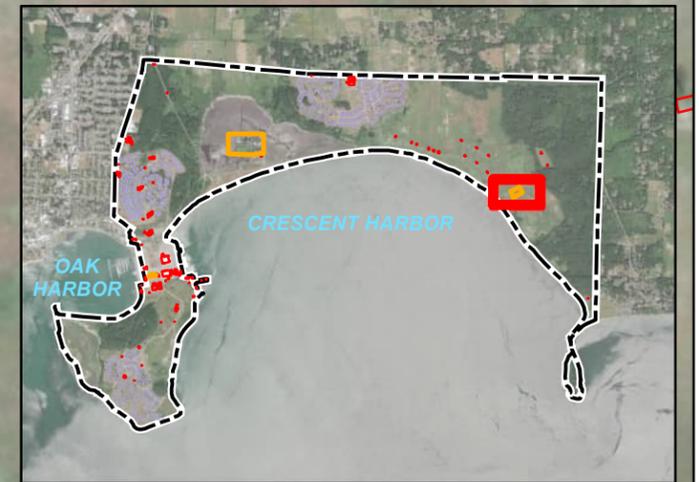
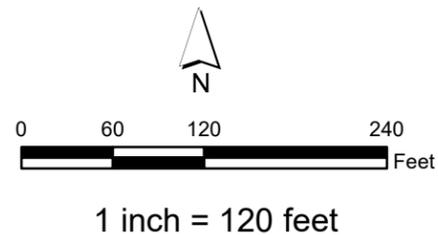


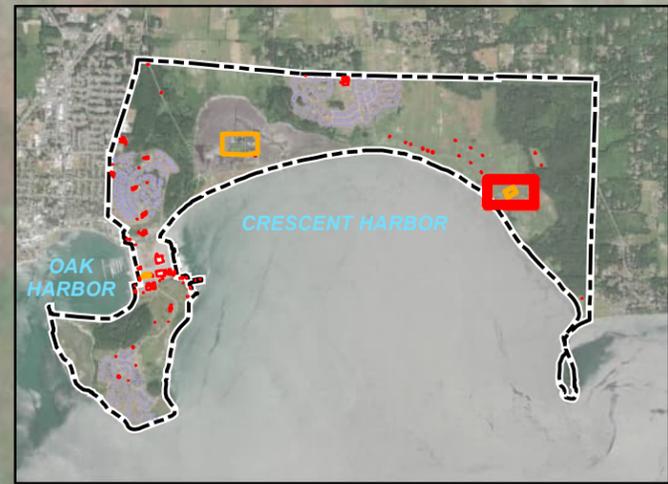
Figure 9
 PFAS Soil Concentrations: Biosolids Land Application Area
 Site Inspection for PFAS
 Naval Air Station Whidbey Island
 Seaplane Base
 Oak Harbor, Washington

- Notes:
- 1. Bolded text indicates detection**
 2. Shading indicates exceedence of USEPA Tapwater RSL
 3. units = nanograms per liter (ng/L)
 4. USEPA Tapwater RSLs
 PFBS = 600 ng/L
 PFHxS = 5.9 ng/L
 PFNA = 6 ng/L
 PFOS = 4 ng/L
 PFOA = 6 ng/L
 5. Where applicable, the higher concentration between the primary and field duplicate samples is shown.
 6. J = Analyte present. Value may or may not be accurate or precise.
 7. U = The material was analyzed for, but not detected.
 8. UJ = Analyte not detected, quantitation limit may be inaccurate.
 9. PFBS = perfluorobutanesulfonic acid
 10. PFHxS = perfluorohexanesulfonic acid
 11. PFNA = perfluorononanoic acid
 12. PFOS = perfluorooctane sulfonate
 13. PFOA = perfluorooctanoic acid



WI-SP-MW08	4/19/21
PFBS	427
PFHxS	266
PFNA	24.4
PFOS	269
PFOA	329

DATA SOURCE: ESRI & NIRIS
 IMAGERY SOURCE: ESRI, Maxar 2021



- Legend**
- Groundwater monitoring well sample and soil sample location with exceedance
 - Culvert
 - - - Unpaved Ditch
 - Approximate Groundwater Flow Direction
 - ▭ Building
 - ▭ Housing
 - ▭ Potential PFAS Release Area
 - ▭ Sampling Grid
 - ▭ Base Boundary

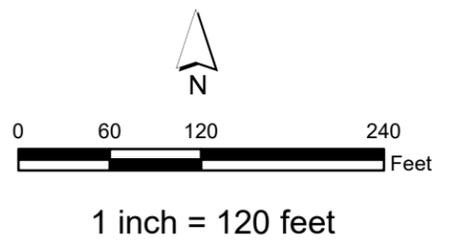


Figure 10
 PFAS Groundwater Concentrations: Biosolids Land Application Area
 Site Inspection for PFAS
 Naval Air Station Whidbey Island
 Seaplane Base
 Oak Harbor, Washington

Appendix A
Soil Boring Logs, Well Completion
Diagrams, and Well Development Logs



PROJECT NUMBER: 695610CH	BORING NUMBER: WI-SP-SB02 / WI-SP-MW02	SHEET 1 OF 1
------------------------------------	--	---------------------

Borehole Log

PROJECT : Seaplane Base - Site Inspection for Per- and Polyfluoroalkyl Substances

LOCATION : Naval Air Station Whidbey Island COORDINATES : N 473733.2 ft, E 1203000 ft ELEVATION : 16.2 ft above mean sea level

DRILLING CONTRACTOR : Holt Services Inc. DRILLING METHOD AND EQUIPMENT : Sonic - Terrasonic International, 6-in casing with 4-in core barrel

WATER LEVEL : 4.3 ft bgs Start : 4/15/21 15:00 END : 4/15/21 18:45 LOGGER : T. Chalmers

NEW SOIL BORING LOG: NASWI_SEAPLANE_BASE_SI.GLB; NASWI_SEAPLANE_BASE_SI.GPJ; CH2M GEOTECH_12.GDT; 7/14/21

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL / RECOVERY (ft)	CORE ID	GRAPHIC LOG	SOIL DESCRIPTION: Soil name, USCS, Color, Description	<u>COMMENTS</u>	<u>WELL DETAILS</u>
5.0	5.0	HA-1		WELL GRADED SAND (SW) black (7.5YR 2.5/1), moist, fine to coarse grained, subround to subangular sand, with trace gravel up to 2 cm diameter.	PID = 0.0 ppm, 0-5 ft Dense concentration of shells at 4 ft.	Monument - Flush mount and concrete Seal - Hydrated 3/8" bentonite chips
5				SANDY LEAN CLAY (CL) very dark gray (10YR 3/1), clay, with medium grained sand.	Hand augered to 5 ft for utility clearance.	Filter sand pack - 12/20 washed silica Screen 5-15 ft - 0.020" slot SCH 40 PVC
5.0	5.0	S-1	WELL GRADED SAND (SW) very dark gray (10YR 3/1), wet, loose, fine to coarse grained sand, with shell fragments, and trace gravel up to 5 cm diameter.	Collected soil sample WI-SP-SB02-04H05 on 4/15/21 at 1645.		
				POORLY GRADED SAND (SP) very dark gray (GLEY 1 3/N), wet, loose, medium grained sand, with trace coarse grained sand.	PID = 0.0 ppm, 5-10 ft	
10				LEAN CLAY (CL) very dark gray (GLEY 1 3/N), moist, soft, non-dilatant, low plasticity clay.	Miscellaneous organics in the 9.2-10 ft PT unit.	Backfill - 3/8" bentonite chips
				PEAT (PT) very dark brown (10YR 2/2), dry peat.		
				CLAYEY SAND (SC) very dark gray (GLEY 1 3/N), wet, low toughness clay, with medium grained sand.		
15	10.0	S-2		SANDY LEAN CLAY (CL) very dark gray (GLEY 1 3/N), wet, low toughness clay, with medium grained sand, and gravel up to 2 cm diameter.	PID = 0.0 ppm, 10-20 ft	
				LEAN CLAY (CL) gray (GLEY 1 5/N), dry, stif, tough, non-dilatant clay.	Well graded sand (SW) lenses 0.5 cm thick from 18-18.5 ft interbedded in the CL unit from 13.3-20 ft.	
20				Boring terminated at 20 ft bgs.		
25	Notes: ft bgs = feet below ground surface PID = photoionization detector Horizontal Datum: NAD83/11 Vertical Datum: NAVD88					



PROJECT NUMBER: 695610CH	BORING NUMBER: WI-SP-SB03 / WI-SP-MW03	SHEET 1 OF 1
------------------------------------	--	---------------------

Borehole Log

PROJECT : Seaplane Base - Site Inspection for Per- and Polyfluoroalkyl Substances
 LOCATION : Naval Air Station Whidbey Island COORDINATES : N 473684.38 ft, E 1203010.66 ft ELEVATION : 16.3 ft above mean sea level
 DRILLING CONTRACTOR : Holt Services Inc. DRILLING METHOD AND EQUIPMENT : Sonic - Terrasonic International, 6-in casing with 4-in core barrel
 WATER LEVEL : 4.7 ft bgs Start : 4/16/21 08:05 END : 4/16/21 12:15 LOGGER : T. Chalmers

NEW SOIL BORING LOG: NASWI_SEAPLANE_BASE_SI.GPJ; CH2M GEOTECH_12.GDT; 7/14/21

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL / RECOVERY (ft)	CORE ID	GRAPHIC LOG	SOIL DESCRIPTION: Soil name, USCS, Color, Description	COMMENTS	WELL DETAILS
5.0	5.0	HA-1		WELL GRADED SAND (SW) black (7.5YR 2.5/1), moist, fine to coarse grained, subround to subangular sand, with fine to coarse grained gravel up to 2.5 cm diameter.	PID = 0.0 ppm, 0-5 ft Hand augered to 5 ft for utility clearance.	Monument - Flush mount and concrete Seal - Hydrated 3/8" bentonite chips
5.0 - 10.0	No Recovery, 5-6 ft.					Filter sand pack - 12/20 washed silica
4.0	4.0	S-1		WELL GRADED SAND (SW) brown (7.5YR 4/2), moist, loose, very fine to medium grained, subround to subangular sand.	PID = 0.0 ppm, 5-10 ft	Screen 5-15 ft - 0.020" slot SCH 40 PVC
				WELL GRADED SAND (SW) black (7.5YR 2.5/1), moist, loose, fine to coarse grained sand, with shell fragments, and trace gravel up to 2 cm diameter.	Collected soil sample WI-SP-SB03-0808H on 4/16/21 at 1015.	
				POORLY GRADED SAND (SP) very dark gray (GLE Y 1 3.5/N), wet, loose, medium grained, subround to subangular sand.		
10.0				SANDY LEAN CLAY (CL) very dark gray (GLE Y 1 3.5/N), wet, soft clay, with medium grained sand.		
5.0	5.0	S-2		WELL GRADED SAND WITH GRAVEL (SW) very dark gray (GLE Y 1 3.5/N), wet, loose, fine to coarse grained sand, with subround to subangular gravel up to 1.5 cm diameter.	PID = 0.1 ppm, 10-15 ft	
				SANDY LEAN CLAY (CL) very dark gray (GLE Y 1 3.5/N), wet, soft clay, with medium grained sand.		
				WELL GRADED GRAVEL WITH SAND (GW) very dark gray (GLE Y 1 3.5/N), wet, loose, fine to coarse grained gravel up to 2.5 cm diameter, with fine to coarse grained sand.		
15.0				POORLY GRADED SAND (SP) very dark gray (GLE Y 1 3.5/N), wet, loose, medium grained, subround to subangular sand.		
2.0	2.0	S-3		LEAN CLAY (CL) gray (GLE Y 1 5/N), dry, stiff, tough, non-dilatant clay.	PID = 0.0 ppm, 15-17 ft	Filter sand pack - 12/20 washed silica. Sands heaved to 16 ft
				Boring terminated at 17 ft bgs.	Notes: ft bgs = feet below ground surface PID = photoionization detector Horizontal Datum: NAD83/11 Vertical Datum: NAVD88	



PROJECT NUMBER: 695610CH	BORING NUMBER: WI-SP-SB04 / WI-SP-MW04	SHEET 1 OF 1
------------------------------------	--	---------------------

Borehole Log

PROJECT : Seaplane Base - Site Inspection for Per- and Polyfluoroalkyl Substances

LOCATION : Naval Air Station Whidbey Island COORDINATES : N 473682.73 ft, E 1203276.63 ft ELEVATION : 16.9 ft above mean sea level

DRILLING CONTRACTOR : Holt Services Inc. DRILLING METHOD AND EQUIPMENT : Sonic - Terrasonic International, 6-in casing with 4-in core barrel

WATER LEVEL : 4.0 ft bgs Start : 4/16/21 13:10 END : 4/16/21 15:00 LOGGER : T. Chalmers

NEW SOIL BORING LOG; NAS\WI_SEAPLANE_BASE_S\GPJ_CH2M\GEOTECH_12.GDT; 7/14/21

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL / RECOVERY (ft)	CORE ID	GRAPHIC LOG	SOIL DESCRIPTION: Soil name, USCS, Color, Description	<u>COMMENTS</u>	<u>WELL DETAILS</u>
5	5.0	HA-1		CLAYEY SAND WITH GRAVEL (SC) brown (7.5YR 4/2), dry to moist, fine to coarse grained, subround to subangular sand, with medium toughness clay, trace fine to coarse grained gravel, and trace cobble up to 10 cm diameter.	PID = 0.0 ppm, 0-5 ft Hand augered to 5 ft for utility clearance.	Monument - Flush mount and concrete Seal - Hydrated 3/8" bentonite chips Filter sand pack - 12/20 washed silica Screen 4-9 ft - 0.020" slot SCH 40 PVC
5				WELL GRADED SAND (SW) brown (7.5YR 5/2), wet, loose, very fine to medium grained, subround to subangular sand, with trace gravel up to 2.5 cm diameter.	Collected soil sample WI-SP-SB04-0505H on 4/16/21 at 1420. 3-in thick silty sand lense at 5.75 ft, interbedded in the SW 5-7 ft unit.	
5	5.0	S-1		SILT (ML) brown (7.5YR 5/2), dry, stiff silt, with trace gravel up to 2.5 cm diameter.	PID = 0.0 ppm, 5-10 ft	
10				LEAN CLAY (CL) brown (7.5YR 5/2), dry, stiff, tough clay, with trace silt.		Backfill - 3/8" bentonite chips
				Boring terminated at 10 ft bgs.	Notes: ft bgs = feet below ground surface PID = photoionization detector Horizontal Datum: NAD83/11 Vertical Datum: NAVD88	



PROJECT NUMBER: 695610CH	BORING NUMBER: WI-SP-SB08 / WI-SP-MW08	SHEET 1 OF 5
------------------------------------	--	---------------------

Borehole Log

PROJECT : Seaplane Base - Site Inspection for Per- and Polyfluoroalkyl Substances

LOCATION : Naval Air Station Whidbey Island COORDINATES : N 477016.47 ft, E 1217867.48 ft ELEVATION : 139.4 ft above mean sea level

DRILLING CONTRACTOR : Holt Services Inc. DRILLING METHOD AND EQUIPMENT : Sonic - Terrasonic International, 6-in casing with 4-in core barrel

WATER LEVEL : 48.4 ft bgs Start : 4/13/21 13:45 END : 4/14/21 12:55 LOGGER : T. Chalmers

NEW SOIL BORING LOG; NASWI_SEAPLANE_BASE_SI.GLB; NASWI_SEAPLANE_BASE_SI.GPJ; CH2M GEOTECH_12.GDT; 7/14/21

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL / RECOVERY (ft)	CORE ID	GRAPHIC LOG	SOIL DESCRIPTION: Soil name, USCS, Color, Description	<u>COMMENTS</u>	<u>WELL DETAILS</u>
5	5.0	HA-1		SILT (ML) dark brown (7.5YR 3/3), dry silt, with fine grained sand. SILT (ML) very dark grayish brown (10YR 3/2), moist, medium grained silt.	PID = 0.0 ppm, 0-5 ft Hand augered to 5 ft for utility clearance.	Monument - Flush mount and concrete Seal - Hydrated 3/8" bentonite chips
10	5.0	S-1		SANDY SILT WITH GRAVEL (ML) brown (7.5YR 4/2), dry, loose silt, with fine to coarse grained sand, and subround to angular gravel up to 6 cm diameter.	PID = 0.0 ppm, 5-10 ft	
15	10.0	S-2		SILT WITH GRAVEL (ML) dark yellowish brown (10YR 3/4), moist, medium grained silt, with fine to coarse grained, subround to subangular gravel up to 6.5 cm diameter.	PID = 0.1 ppm, 10-20 ft	
20				SANDY SILT WITH GRAVEL (ML) brown (7.5YR 4/2), dry, loose silt, with fine to coarse grained sand, and subround to angular gravel up to 6 cm diameter.		



PROJECT NUMBER: 695610CH	BORING NUMBER: WI-SP-SB08 / WI-SP-MW08	SHEET 2 OF 5
------------------------------------	--	---------------------

Borehole Log

PROJECT : Seaplane Base - Site Inspection for Per- and Polyfluoroalkyl Substances

LOCATION : Naval Air Station Whidbey Island COORDINATES : N 477016.47 ft, E 1217867.48 ft ELEVATION : 139.4 ft above mean sea level

DRILLING CONTRACTOR : Holt Services Inc. DRILLING METHOD AND EQUIPMENT : Sonic - Terrasonic International, 6-in casing with 4-in core barrel

WATER LEVEL : 48.4 ft bgs Start : 4/13/21 13:45 END : 4/14/21 12:55 LOGGER : T. Chalmers

NEW SOIL BORING LOG: \NASWI_SEAPLANE_BASE_SI.GLB; \NASWI_SEAPLANE_BASE_SI.GPJ; CH2M GEOTECH_12.GDT; 7/14/21

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL / RECOVERY (ft)	CORE ID	GRAPHIC LOG	SOIL DESCRIPTION: Soil name, USCS, Color, Description	<u>COMMENTS</u>	<u>WELL DETAILS</u>
25	11.5	S-3		SILT WITH GRAVEL (ML) dark yellowish brown (10YR 3/4), dry, dense, medium grained silt, with fine to coarse grained, subround to subangular gravel up to 7.5 cm diameter.	PID = 0.0 ppm, 20-30 ft	
30				SANDY SILT WITH GRAVEL (ML) brown (7.5YR 4/2), dry, dense silt, with fine to coarse grained sand, and fine to coarse grained, subround to angular gravel up to 6 cm diameter.		
35	11.0	S-4		SILT WITH GRAVEL (ML) dark yellowish brown (10YR 3/4), dry, dense, medium grained silt, with fine to coarse grained, subround to subangular gravel up to 8 cm diameter.	PID = 0.0 ppm, 30-40 ft Gravel content and size decrease with depth through ML unit 30-37 ft to ML unit 37-39 ft.	
40				SILT WITH GRAVEL (ML) dark yellowish brown (10YR 3/4), moist, dense, medium grained silt, with fine to coarse grained, subround to subangular gravel up to 3.5 cm diameter.		
				SILTY SAND WITH GRAVEL (SM) dark yellowish brown (10YR 3/4), dry, moderately cemented, well graded, fine to coarse grained, subround to subangular sand, with	Well graded sand lenses from 38.5-39 ft interbedded in the ML unit from 37-39 ft. Predominantly fine grained	



PROJECT NUMBER: 695610CH	BORING NUMBER: WI-SP-SB08 / WI-SP-MW08	SHEET 3 OF 5
------------------------------------	--	---------------------

Borehole Log

PROJECT : Seaplane Base - Site Inspection for Per- and Polyfluoroalkyl Substances

LOCATION : Naval Air Station Whidbey Island COORDINATES : N 477016.47 ft, E 1217867.48 ft ELEVATION : 139.4 ft above mean sea level

DRILLING CONTRACTOR : Holt Services Inc. DRILLING METHOD AND EQUIPMENT : Sonic - Terrasonic International, 6-in casing with 4-in core barrel

WATER LEVEL : 48.4 ft bgs Start : 4/13/21 13:45 END : 4/14/21 12:55 LOGGER : T. Chalmers

NEW SOIL BORING LOG: NASWI_SEAPLANE_BASE_SI.GPJ; CH2M GEOTECH_12.GDT; 7/14/21

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL / RECOVERY (ft)	CORE ID	GRAPHIC LOG	SOIL DESCRIPTION: Soil name, USCS, Color, Description	<u>COMMENTS</u>	<u>WELL DETAILS</u>
45	8.0	S-5		silt, and subround to subangular gravel up to 1 cm diameter.	sand in SM unit 39-46 ft.	
				SILT (ML) gray (10YR 5/1), moist, medium dense, fine grained silt, with trace gravel up to 1.5 cm diameter.	PID = 0.0 ppm, 40-50 ft PID measured CO at 26 ppm at 43 ft.	
50				SILT WITH GRAVEL (ML) gray (10YR 5/1), moist, medium dense, fine grained silt, with gravel up to 7.5 cm diameter, and trace fine grained sand.		
55	10.0	S-6		SILT WITH SAND AND GRAVEL (ML) gray (10YR 6/1), dry, fine grained silt, with sand, and round to angular gravel up to 6 cm diameter.	ML unit from 50-60 ft possibly rock flour.	
60					PID = 0.0 ppm, 50-60 ft	



PROJECT NUMBER: 695610CH	BORING NUMBER: WI-SP-SB08 / WI-SP-MW08	SHEET 4 OF 5
------------------------------------	--	---------------------

Borehole Log

PROJECT : Seaplane Base - Site Inspection for Per- and Polyfluoroalkyl Substances
 LOCATION : Naval Air Station Whidbey Island COORDINATES : N 477016.47 ft, E 1217867.48 ft ELEVATION : 139.4 ft above mean sea level
 DRILLING CONTRACTOR : Holt Services Inc. DRILLING METHOD AND EQUIPMENT : Sonic - Terrasonic International, 6-in casing with 4-in core barrel
 WATER LEVEL : 48.4 ft bgs Start : 4/13/21 13:45 END : 4/14/21 12:55 LOGGER : T. Chalmers

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL / RECOVERY (ft)	CORE ID	GRAPHIC LOG	SOIL DESCRIPTION: Soil name, USCS, Color, Description	<u>COMMENTS</u>	<u>WELL DETAILS</u>
				No Recovery, 60-63 ft.		
65	10.0	S-7		WELL GRADED GRAVEL WITH SAND (GW) gray (10YR 6/1), dry, loose, fine to coarse grained, subround to subangular gravel up to 3 cm diameter, with fine to coarse grained, subround to subangular sand. WELL GRADED SAND WITH GRAVEL (SW) gray (10YR 6/1), dry, loose, fine to coarse grained, subround to subangular sand, with gravel up to 3.5 cm diameter.	PID = 0.0 ppm, 60-70 ft	
70				No Recovery, 70-75 ft.	Medium dense silt lense at 69 ft. End of day, 4/13/21, at 70 ft bgs. Beginning of day, 4/14/21, at 70 ft bgs.	
75	5.0	S-8		SILT WITH GRAVEL (ML) gray (10YR 6/1), dry, medium dense silt, with gravel up to 5.5 cm diameter, and trace fine grained sand.	PID = 0.0 ppm, 70-80 ft Hard drilling 70-80 ft.	
80						Filter sand pack - 12/20 washed silica

NEW SOIL BORING LOG: NASWI_SEAPLANE_BASE_SI.GPJ; CH2M GEOTECH_12.GDT; 7/14/21



PROJECT NUMBER: 695610CH	BORING NUMBER: WI-SP-SB08 / WI-SP-MW08	SHEET 5 OF 5
------------------------------------	--	---------------------

Borehole Log

PROJECT : Seaplane Base - Site Inspection for Per- and Polyfluoroalkyl Substances

LOCATION : Naval Air Station Whidbey Island COORDINATES : N 477016.47 ft, E 1217867.48 ft ELEVATION : 139.4 ft above mean sea level

DRILLING CONTRACTOR : Holt Services Inc. DRILLING METHOD AND EQUIPMENT : Sonic - Terrasonic International, 6-in casing with 4-in core barrel

WATER LEVEL : 48.4 ft bgs Start : 4/13/21 13:45 END : 4/14/21 12:55 LOGGER : T. Chalmers

NEW SOIL BORING LOG: NASWI_SEAPLANE_BASE_SI.GLB; NASWI_SEAPLANE_BASE_SI.GPJ; CH2M GEOTECH_12.GDT; 7/14/21

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL / RECOVERY (ft)	CORE ID	GRAPHIC LOG	SOIL DESCRIPTION: Soil name, USCS, Color, Description	<u>COMMENTS</u>	<u>WELL DETAILS</u>
85	10.0	S-9		<p>POORLY GRADED SAND (SP) very dark gray (10YR 3/1), wet, medium dense, fine grained sand.</p> <p>WELL GRADED SAND (SW) very dark gray (10YR 3/1), wet, medium dense, fine to coarse grained sand, with trace gravel up to 2 cm diameter, and trace silt.</p>	<p>Collected soil sample WI-SP-SB08-80H81H on 4/14/21 at 1215. Hard drilling 80-90 ft.</p> <p>PID = 0.0 ppm, 80-90 ft</p>	<p>Screen 80-90 ft - 0.020" slot SCH 40 PVC</p>
90				<p>SILT WITH GRAVEL (ML) very dark gray (10YR 3/1), moist, dense silt, with gravel up to 2.5 cm diameter, and trace fine grained sand.</p> <p>SILT WITH GRAVEL (ML) very dark gray (10YR 3/1), dry, dense silt, with subround to subangular gravel up to 4.5 cm diameter, and trace sand.</p>		
				Boring terminated at 90 ft bgs.		
				<p>Notes: ft bgs = feet below ground surface PID = photoionization detector Horizontal Datum: NAD83/11 Vertical Datum: NAVD88</p>		
95						
100						

4/18/21

ch2m PROJECT NUMBER: 695610 CH WELL ID: WI-SP-MWØ2 Sheet 1 of 1
WELL DEVELOPMENT LOG

PROJECT NAME: NAJWI Soapstone Base SI MAXIMUM DRAWDOWN DURING PUMPING: -
 DEVELOPMENT CONTRACTOR: Jacobs RANGE AND AVERAGE DISCHARGE RATE: 500 mL/min ^{6.5}
 DEVELOPMENT METHOD AND EQUIPMENT USED: Surge/Bail/Pump ^(*) TOTAL QUANTITY OF WATER DISCHARGED: 42,500 mL = 11.2 gal + 8 gal (removed w/bail) = 17.7 gal
 START WATER LEVELS: 4.33 START TIME: 0940 END TIME: 1240 DISPOSITION OF DISCHARGED WATER: IDW Staging

LOGGER: T. Chalmers TD: 14.73 CASING VOLUME (GALLONS PER FOOT): 1" WELL = 0.041 2" WELL = 0.163 4" WELL = 0.653
10.4 (water column height in ft) x (casing volume) = 1.70 well volume (gallons) DISCHARGE 3-5 VOLUMES (3x = 5.01, 5x = 8.48 gal)
 5 VOLUMES IF TURBIDITY > 10 NTU AFTER 3 VOLUMES 3x = 18,765 mL, 5x = 31,797

Time	Water Volume Discharged (gal)	Pump Rate (gpm)	Water Level (ft BTOC)	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity (NTU)	Odor	Color	Clarity	Method (Surge, Bail, Pump)	Remarks
0940														Begin Surge
0955														Begin Bail
1020														Finish Bail, removed 6.5 gal of water
1043			4.40											Start Purge
1053	500	500	4.64											still too cloudy to run through WQ meter
1058	750	500	4.65											
1108	1000	500	4.65											
1118	27,500	500	4.67	13.40	0.440	4.42	6.76	35	334	None	gray	milky	pump	-
1123	29,000	500	4.66	13.50	0.434	2.39	6.96	12	252	None	gray	milky	pump	-
1128	22,500	500	4.65	13.32	0.427	1.84	7.03	3	218	"	gray	"	"	
1133	25,000	500	4.65	13.21	0.426	1.65	7.02	0	180	"	gray	"	"	
1138	27,500	500	4.68	13.17	0.427	1.55	7.01	-3	158	"			"	
														HOLD
1150	30,000	500	4.67	13.45	0.415	1.62	7.10	-2	50.9	"			"	
1155	32,500	500	4.68	13.21	0.421	1.32	7.06	-8	87.6	"	SLIGHTLY GRAY		"	
1200	35,000	500	4.66	13.15	0.423	1.24	7.07	-13	99.4	"	"		"	
1205	37,500	500	4.69	13.11	0.427	1.19	7.07	-17	96.2	"	"	Clear	"	
1210	40,000	500	4.68	13.16	0.425	1.20	7.09	-19	88.8	"	"	Clear	"	
1215	42,500	500	4.67	13.17	0.421	1.14	7.09	-19	81.7	"	"	Clear	"	
1225			4.41											SAMPLE LOOKED CLEARER THAN 81.7 NTU. TESTED A GRAB SAMPLE AFTER SAMPLING TO RESULT OF 31 NTU. TURBIDIMETER MAY BE MALFUNCTIONING.

(*) WL METER NO. C103132 - HERON
 CONTROLLER NO. MP50-1798 - MICRO PURGE
 PUMP NO. SN. 12868 - RENTAL# 29864 - QED Sample Pro

Sample ID: WI-SP-GWØ2-Ø421 4/18/21 1225
 Duplicate ID: WI-SP-GWØ2P-Ø421 4/18/21 1225
 QSM v5.3 Table B-15 (18 analyte, PEAS)

PROJECT NUMBER
695610CHWELL ID
WI-SP-MW04

Sheet 1 of 1

WELL DEVELOPMENT LOG

PROJECT NAME: NASWI Seaplane Base SI

MAXIMUM DRAWDOWN DURING PUMPING Bailed dry

DEVELOPMENT CONTRACTOR: Jacobs

RANGE AND AVERAGE DISCHARGE RATE: -

DEVELOPMENT METHOD AND EQUIPMENT USED: Surge/bail

TOTAL QUANTITY OF WATER DISCHARGED: 5.0 gal

START WATER LEVELS: 4.04

START TIME: 4/18/21 1425 END TIME: 4/19/21 1705

DISPOSITION OF DISCHARGED WATER: EDW Staging Area

LOGGER:

T. Chalvers

CASING VOLUME (GALLONS PER FOOT): 1" WELL = 0.041 2" WELL = 0.163 4" WELL = 0.653
4.84 (water column height in ft) x (casing volume) = 0.79 well volume (gallons)DISCHARGE 3-5 VOLUMES. 3x = 2.37 gal = 8,971.4 ml
5 VOLUMES IF TURBIDITY > 10 NTU AFTER 3 VOLUMES 5x = 3.94 gal = 14,914.5 ml

Time	Water Volume Discharged (gal)	Pump Rate (gpm)	Water Level (ft BTOC)	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity (NTU)	Odor	Color	Clarity	Method (Surge, Bail, Pump)	Remarks
1425	Begin	Surge												
1520	4.04		4.04											Begin bail using disposable HDPE Bailor
1532	2.5 gal													Bailed dry will let recharge
1602	2.5 gal	-	7.62	21.89	0.436	4.58	9.91	1	791	None	gray	milky	Bail	
1607	2.75 gal	-												Bailed dry will let recharge.
1703	3.00 gal	-	7.14	14.17	0.393	6.54	9.37	67	817	"	"	"	"	
4/19/21 0713			4.18											Water column recovered
0715	Begin	bail.		15.23	0.402	4.33	7.35	204	130	None	gray	cleaning slightly	Bail	-
0725	5.00													Bailed dry, removed 20 gal. 5 x Well Volume has been removed.
1655	5.00	-												
1700	5.00	-	4.21	19.20	0.382	4.52	8.25	149	129	None	colorless	clear	Bail	Sample collected
1705														
Sample ID: WI-SP-MW04-0421 4/20/21 1000 4/19/21 1705 QSM v5.3 Table B-15 (PEAS 18 analyte)														

90% recharge will be 4.52 ft btoc

TD = 8.88 ft btoc



PROJECT NUMBER
695610 CH

WELL ID
WI-SP-MW08

Sheet 1 of 1

WELL DEVELOPMENT LOG

PROJECT NAME: NASWF Seaplane Base SI

MAXIMUM DRAWDOWN DURING PUMPING

DEVELOPMENT CONTRACTOR: Jacobs

RANGE AND AVERAGE DISCHARGE RATE:

DEVELOPMENT METHOD AND EQUIPMENT USED: Bail/Pump

TOTAL QUANTITY OF WATER DISCHARGED: 33.50 gal

START WATER LEVELS: 48.42' * START TIME: 4/19/21 0850 END TIME: 4/19/21 1450

DISPOSITION OF DISCHARGED WATER: IDW Staging Area

LOGGER:

I. Chalmers

CASING VOLUME (GALLONS PER FOOT): 1" WELL = 0.041 2" WELL = 0.163 4" WELL = 0.653
58.08 (water column height in ft) x (casing volume) = 6.21 well volume (gallons)

DISCHARGE 3-5 VOLUMES. 3x = 18.62 gal = 70,484 mL

5 VOLUMES IF TURBIDITY > 10 NTU AFTER 3 VOLUMES 5x = 31.03 gal = 117,461 mL

Time	Water Volume Discharged (gal)	Pump Rate (gpm)	Water Level (ft BTOC)	Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity (NTU)	Odor	Color	Clarity	Method (Surge, Bail, Pump)	Remarks
0905	Begin	bail												
0935	5 gal	Bailing												
0955			64.09											
1010	8 gal	STOP												
1033		start												
1038		STOP												having pump issues.
1100	10 gal	Pump												setting
1110	11.75		74.42	18.55	0.207	4.39	10.17	-151	MAX	None	Gray	milky		Pump
1120	13.50		76.37	18.42	0.227	7.09	10.23	-147	MAX	"	"	"		"
1130			78.54	19.31	0.222	1.06	10.13	-130	MAX	"	"	"		"
1140			82.13	18.34	0.238	1.33	10.40	-143	MAX	"	"	"		"
1150			82.02	19.76	0.194	0.85	10.23	-125	MAX	"	"	"		"
1154	18.50													
1200			83.00	18.92	0.223	0.82	9.95	-123	MAX	"	"	"		"
1225			83.40	18.76	0.212	0.33	9.77	-171	MAX	"	"	"		"
1230	23.50													
1240			83.48	18.81	0.222	0.27	9.62	-165	MAX	"	"	"		"
1250			83.20	19.06	0.212	0.58	9.70	-112	MAX	"	"	"		"
1300			83.33	19.31	0.209	1.59	9.81	-105	MAX	"	"	"		"
1310			83.55	19.10	0.216	2.02	9.63	-69	MAX	"	"	"		"
1315	28.50		83.82	19.59	0.228	1.79	9.64	-87	MAX	"	"	"		"
1330			83.98	19.57	0.228	1.83	9.59	-66	MAX	"	"	"		"
1340			83.55	18.77	0.222	1.63	9.69	-102	MAX	"	"	"		"
1350			83.78	19.13	0.231	0.89	9.54	-119	MAX	"	"	"		"
1400	33.50		83.52	19.27	0.227	0.94	9.62	-113	MAX	"	"	"		"
1550			51.21											Recharge greater than 90%
1600	33.50		51.21	18.36	0.220	2.08	9.63	-60	839	None	gray	slight milky	Disposable bailer	Sample Collected

MINI MONSOON GW PUMP # C-102 815 (CH2M ID)

90% recharge will be at 52.23 ft bto

Sample ID: WI-SP-GW08-0421
4/19/21 @ 1705-1600

*TD = 86.50 ftoc (ft)

QSM v5.3 Table B-15 (PEAS 18 gph) Pump set at 81.50 ft bto

Appendix B
Groundwater Sample Data Sheets



GROUNDWATER SAMPLING DATA SHEET

WELL ID: WI-SP-MWØZ

Project Name: NASWI Seaplane Base SF

Project Number: 095610CH

Start Date: 4/18/21

Sampling Team: T. Chalmers

L. Baumann

Purge Method: Bladder Pump

Equipment: GED Sample Pro

S/N: 12868 Rental # 29854

Tubing Materials: HDPE

Water Level Meter: Hevon - Rental # C103132

Casing Materials: 2-in PVC

PID Reading: 0.1 ppm

Weather: 60's Sunny

Well Depth: 14.73 ft btoc

Start Water Level: 4.33 ft btoc

Water Column: 0 ft

Well Diameter: 2 in

Volume per foot: _____ gal/ft

Well Volume: _____ gal

Start Time: 4/18/21 1118

End Time: 4/18/21 1225

Screened Interval: 5-15 ft btoc

Pump/Tubing Intake: 10 ft btoc

Diam. (in)	Vol. (gal/ft)
1	0.041
1.25	0.064
2	0.163
4	0.653

WELL STABILIZATION DATA

Time	Pumping rate (mL/min)	Volume Removed	Water level (ft)	pH	SPCOND. (mS/cm)	Temp. (°C)	ORP (mV)	D.O. (mg/L)	Turbidity (NTU)	Appearance
Requirements ¹	< 0.3 ft			+/- 0.1	+/- 3%	+/- 0.2	+/- 10 mV	+/- 10%	<10 or +/- 10%	
<i>See sample development log for full data set. Sample collected after 5 times well volume removed and parameters stabilized. (C) Water column recharged 90%</i>										
LAST READING										
1215	500	42,500 mLs	4.67	7.09	0.421	13.17	-19	1.14	81.7	

SAMPLE INFORMATION

Sample ID: * WI-SP-GWØZ-Ø421
 Analyses: QSM v5.3 Table B-15 PFAS 18 analyte
 Collection Date: 4/18/21
 Collection Time: 1225
 Field Filter? (Y/N): N

Primary Laboratory: Battelle
 QA/QC Laboratory: -
 Shipment Method: Fed Ex overnight
 Well Condition/Comments: None

* Duplicate sample collected: Sample ID = WI-SP-GWØZP-Ø421 Date/Time: 4/18/21 1225

¹ Sampling standards adapted from USEPA Groundwater Sampling Guidelines for Superfund and RCRA Project Managers, 2002





GROUNDWATER SAMPLING DATA SHEET

WELL ID: WI-SP-MW03

Project Name: NASWI Seaplane Base SI

Casing Materials: 2-in PVC

Well Depth: 15.05 ft btoc

Project Number: 695610CH

Start Water Level: 4.70 ft btoc

Start Date: 4/18/21

* PID Reading: 0.0 ppm

Water Column: 0 ft

Sampling Team: T. Chalmers

Weather: 60's Sunny

Well Diameter: 2 in

L. Baumann

Volume per foot: _____ gal/ft

Purge Method: Bladder Pump

Well Volume: _____ gal

Equipment: QED Sample Pro

Start Time: 1315

S/N: 12868 Rental # 29854

End Time: 1425

Tubing Materials: HDPE

Screened Interval: 5-15 ft btoc

Water Level Meter: Hevon-Rental # C103132

Pump/Tubing Intake: 10 ft btoc

Diam. (in)	Vol. (gal/ft)
1	0.041
1.25	0.064
2	0.163
4	0.653

WELL STABILIZATION DATA

Time	Pumping rate (mL/min)	Volume Removed	Water level (ft)	pH	SPCOND (µS/cm)	Temp. (°C)	ORP (mV)	D.O. (mg/L)	Turbidity (NTU)	Appearance
Requirements ¹	< 0.3 ft			+/- 0.1	+/- 3%	+/- 0.2	+/- 10 mV	+/- 10%	<10 or +/- 10%	
<i>see sample development log for full data sets. Sample collected after 5 times well volume removed, parameters stabilized, @ 90% recharge.</i>										
LAST READING										
1420	500	32,500 mL	4.81	6.86	0.514	13.09	-60	1.05	8.8	Clear

SAMPLE INFORMATION

Sample ID: WI-SP-GW03-0421

Primary Laboratory: Battelle

Analyses: QSM v5.3 Table B-15 PFAS 18 analyte

QA/QC Laboratory: _____

Collection Date: 4/18/21

Shipment Method: FedEx overnight

Collection Time: 1425

Well Condition/Comments: None

Field Filter? (Y/N): N

¹ Sampling standards adapted from USEPA Groundwater Sampling Guidelines for Superfund and RCRA Project Managers, 2002

* PID measured elevated parameters when well was opened. LEL = 99%. Cleared after one hour. Page 1 of 1



GROUNDWATER SAMPLING DATA SHEET

WELL ID: WI-SP-MW04

Project Name: NASWI Seaplane Base SI
 Project Number: 695610CH
 Start Date: 4/18/21
 Sampling Team: T. Chalmers
L. Baumann
 Purge Method: Bail
 Equipment: Disposable HDPE
pail
 Tubing Materials: _____
 Water Level Meter: Hevon - Rental # C103132

Casing Materials: 2-in PVC
 PID Reading: 0.0 ppm
 Weather: 60's sunny

Well Depth: 8.88 ft btoc
 Start Water Level: 4.04 ft btoc
 Water Column: 0 ft
 Well Diameter: _____ in
 Volume per foot: _____ gal/ft
 Well Volume: _____ gal
 Start Time: 4/18/21 1520
 End Time: 4/19/21 1705
 Screened Interval: 4-9 ft btoc
 Pump/Tubing Intake: N/A ft btoc

Diam. (in)	Vol. (gal/ft)
1	0.041
1.25	0.064
2	0.163
4	0.653

WELL STABILIZATION DATA

Time	Pumping rate (mL/min)	Volume Removed	Water level (ft)	pH	SPCOND. (mS/cm)	Temp. (°C)	ORP (mV)	D.O. (mg/L)	Turbidity (NTU)	Appearance
Requirements ¹	< 0.3 ft			+/- 0.1	+/- 3%	+/- 0.2	+/- 10 mV	+/- 10%	<10 or +/- 10%	
<i>see development log for full data set. Sample collected with disposable bailer (HDPE) after 5 times well volume removed & water column recharged 90%</i>										
FINAL READINGS										
1705	—	5.0 gal	4.21	8.25	0.382	19.20	149	4.52	129	clear

SAMPLE INFORMATION

Sample ID: WI-SP-GW04-0421
 Analyses: QSM v5.3 Table B-15 (PFAS 18 analyte)
 Collection Date: 4/19/21 1705 (10)
 Collection Time: 1705
 Field Filter? (Y/N): N

Primary Laboratory: Battelle
 QA/QC Laboratory: _____
 Shipment Method: FedEx Overnight
 Well Condition/Comments: _____

Appendix C

Survey Report



Set Monitoring Wells

Whidbey Island Naval Air Station - Seaplane Base

Oak Harbor, WA

Survey Date: April 2021

New Wells Point Id	Northing	Easting	Top of Metal	Top of PVC
			Case Elev	Casing Elev
MW-02	473733.20	1203000.00	16.231	15.950
MW-03	473684.38	1203010.66	16.308	15.957
MW-04	473682.73	1203276.63	16.871	16.182
MW1-SP-MW08	477016.47	1217867.48	139.384	138.962

Soil Borings Point Id	Northing	Easting	Ground
			Elev
SB01	473778.53	1203239.29	17.12
SB01N	473795.81	1203235.34	17.12
SB05	479015.43	1206519.16	15.77
SB06	478878.53	1207164.84	15.34
SB07	478598.43	1207680.19	15.19

Notes:

1. HORIZONTAL DATUM: NAD83/11, WASHINGTON STATE PLANE COORDINATE SYSTEM, NORTH ZONE NAD83/11
US SURVEY FOOT
HORIZONTAL COORDINATES WERE OBTAINED BASED UPON 'BASE' NGS COORDINATES ON DATA SHEET

2. VERTICAL DATUM: NAVD88

BENCHMARKS USED (PER NGS DATA SHEET)

BASE NAVD 88 ELEV: 32.410

*A PUNCH MARK IN A LEAD PLUG IN AN 8in x 8in CONCRETE MONUMENT

CRES NAVD 88 ELEV: 122.360

*STANDARD BRONZE DISK STAMPED "CRES 1951" SET IN LARGE GRANITE BOULDER

3. EQUIPMENT USED: LEICA GS15 RECEIVER, LEICA DNA10 DIGITAL LEVEL



Appendix D
Investigation-derived
Waste Documentation

Sample ID	WI-SP-IDW-AQ01-042121
Sample Date	4/21/21
Chemical Name	
Volatile Organic Compounds (UG/L)	
1,1,1,2-Tetrachloroethane	0.5 U
1,1,1-Trichloroethane	0.5 U
1,1,2,2-Tetrachloroethane	0.5 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	0.5 U
1,1,2-Trichloroethane	0.5 U
1,1-Dichloroethane	0.5 U
1,1-Dichloroethene	0.5 U
1,1-Dichloropropene	0.5 U
1,2,3-Trichlorobenzene	0.5 U
1,2,3-Trichloropropane	0.5 U
1,2,4-Trichlorobenzene	0.5 U
1,2,4-Trimethylbenzene	0.5 U
1,2-Dibromo-3-chloropropane	0.5 U
1,2-Dibromoethane	0.5 U
1,2-Dichlorobenzene	0.5 U
1,2-Dichloroethane	0.5 U
1,2-Dichloropropane	0.5 U
1,3,5-Trimethylbenzene	0.5 U
1,3-Dichlorobenzene	0.5 U
1,3-Dichloropropane	0.5 U
1,4-Dichlorobenzene	0.5 U
1-Butanol	ND
2,2-Dichloropropane	0.5 U
2-Butanone	1.57 J
2-Chlorotoluene	0.5 U
2-Hexanone	0.734 J
2-propanol	ND
4-Isopropyltoluene	0.5 U
4-Methyl-2-pentanone	0.887 J
Acetone	5.34
Acetonitrile	10 U
Benzene	0.5 U
Benzyl chloride	ND
Bromobenzene	0.5 U
Bromochloromethane	0.5 U
Bromodichloromethane	0.5 U
Bromoform	0.5 U
Bromomethane	0.75 U
Carbon disulfide	0.5 U
Carbon tetrachloride	0.5 U
Chlorobenzene	0.262 J
Chloroethane	0.5 U
Chloroform	0.5 U
Chloromethane	0.5 U
cis-1,2-Dichloroethene	0.5 U
cis-1,3-Dichloropropene	0.5 U
Cyclohexane	1 U
Dibromochloromethane	0.5 U
Dibromomethane	0.5 U
Dichlorodifluoromethane (Freon-12)	0.5 U
diisopropyl Ether (DIPE)	1 U
Ethyl acrylate	ND
Ethylbenzene	0.359 J

Sample ID	WI-SP-IDW-AQ01-042121
Sample Date	4/21/21
Chemical Name	
Hexachlorobutadiene	1 U
Isopropylbenzene	0.5 U
m- and p-Xylene	1.96 J
Methyl Acetate	2 U
Methyl methacrylate	2 U
Methylcyclohexane	0.5 U
Methylene chloride	1.43 J
Methyl-tert-butyl ether (MTBE)	1.36
Naphthalene	0.5 U
n-Butyl alcohol	10 U
n-Butylbenzene	0.5 U
n-Hexane	0.517 J
n-Propylbenzene	2 U
o-Xylene	0.612 J
p-Chlorotoluene	0.5 U
sec-Butylbenzene	0.5 U
Styrene	0.5 U
tert-Butanol	1 U
tert-Butylbenzene	0.5 U
Tetrachloroethene	0.5 U
Tetrahydrofuran	2.24 J
Toluene	3.34
trans-1,2-Dichloroethene	0.5 U
trans-1,3-Dichloropropene	0.5 U
trans-1,4-Dichloro-2-butene	1 U
Trichloroethene	0.5 U
Trichlorofluoromethane (Freon-11)	0.5 U
Vinyl acetate	0.5 U
Vinyl chloride	0.5 U
Xylene, total	2.57 J
Semivolatile Organic Compounds (UG/L)	
1,1-Biphenyl	1.01 U
1,2,4,5-Tetrachlorobenzene	1.01 U
1,2,4-Trichlorobenzene	1.01 U
1,2-Dichlorobenzene	1.01 U
1,3-Dichlorobenzene	1.01 U
1,4-Dichlorobenzene	1.01 U
1,4-Dioxane	2.7
1-Methylnaphthalene	0.091 U
2,2'-Oxybis(1-chloropropane)	1.01 U
2,3,4,6-Tetrachlorophenol	1.01 U
2,4,5-Trichlorophenol	1.01 U
2,4,6-Trichlorophenol	1.01 U
2,4-Dichlorophenol	1.01 U
2,4-Dimethylphenol	1.01 U
2,4-Dinitrophenol	5.05 U
2,4-Dinitrotoluene	1.01 U
2,6-Dinitrotoluene	1.01 U
2-Chloronaphthalene	1.01 U
2-Chlorophenol	1.01 U
2-Methylnaphthalene	0.091 U
2-Methylphenol	1.01 U
2-Nitroaniline	1.01 U

Sample ID	WI-SP-IDW-AQ01-042121
Sample Date	4/21/21
Chemical Name	
2-Nitrophenol	1.01 U
3- and 4-Methylphenol	0.505 U
3,3'-Dichlorobenzidine	1.01 U
3-Nitroaniline	1.01 U
4,6-Dinitro-2-methylphenol	5.05 U
4-Bromophenyl-phenylether	1.01 U
4-Chloroaniline	1.01 U
4-Chlorophenyl-phenylether	1.01 U
4-Nitroaniline	5.05 U
4-Nitrophenol	5.05 U
Acenaphthene	0.051 U
Acenaphthylene	0.091 U
Acetophenone	1.01 U
Anthracene	0.091 U
Benzo(a)anthracene	0.051 U
Benzo(a)pyrene	0.051 U
Benzo(b)fluoranthene	0.051 U
Benzo(g,h,i)perylene	0.051 U
Benzo(k)fluoranthene	0.051 U
Benzoic acid	5.05 U
Benzyl alcohol	1.01 U
Bis(2-Chloroethoxy)methane	1.01 U
Bis(2-Chloroethyl)ether	1.01 U
Bis(2-Ethylhexyl)phthalate	0.505 U
Butylbenzylphthalate	0.505 U
Carbazole	1.01 U
Chrysene	0.051 U
Dibenz(a,h)anthracene	0.051 U
Dibenzo(a,e)pyrene	ND
Dibenzo(a,h)pyrene	ND
Dibenzo(a,j)acridine	ND
Dibenzo(a,l)pyrene	ND
Dibenzofuran	1.01 U
Diethylphthalate	1.01 U
Dimethyl phthalate	1.01 U
Di-n-butylphthalate	1.01 U
Di-n-octylphthalate	0.505 U
Fluoranthene	0.051 U
Fluorene	0.091 U
Hexachlorobenzene	1.01 U
Hexachlorobutadiene	1.01 U
Hexachlorocyclopentadiene	5.05 U
Hexachloroethane	1.01 U
Indeno(1,2,3-cd)pyrene	0.051 U
Isophorone	1.01 U
Naphthalene	0.059 J
Nitrobenzene	1.01 U
n-Nitrosodimethylamine	1.01 U
n-Nitroso-di-n-propylamine	1.01 U
n-Nitrosodiphenylamine	1.01 U
Pentachlorophenol	1.01 U
Phenanthrene	0.051 U
Phenol	1.01 U
Pyrene	0.051 U

Sample ID	WI-SP-IDW-AQ01-042121
Sample Date	4/21/21
Chemical Name	
Per- and Polyfluorinated Alkyl Substances (NG/L)	
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)	0.451 U
4,8-dioxa-3H-perfluorononanoic acid (ADONA)	0.903 U
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid (9Cl-PF3ONS)	0.903 U
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (EtFOSAA)	0.903 U
N-Methyl Perfluorooctanesulfonamidoacetic Acid (MeFOSAA)	0.903 U
Perfluoro-2-methyl-3-oxahexanoic acid (HFPO-DA)	0.451 U
Perfluorobutanesulfonic acid (PFBS)	281
Perfluorodecanoic Acid (PFDA)	0.451 U
Perfluorododecanoic Acid (PFDoA)	0.451 U
Perfluoroheptanoic acid (PFHpA)	47.1
Perfluorohexanesulfonic acid (PFHxS)	497
Perfluorohexanoic Acid (PFHxA)	278
Perfluorononanoic acid (PFNA)	6.19
Perfluorooctane Sulfonate (PFOS)	1,250 D
Perfluorooctanoic acid (PFOA)	80.3
Perfluorotetradecanoic Acid (PFTeDA)	1.81 U
Perfluorotridecanoic Acid (PFTrDA)	0.451 U
Perfluoroundecanoic Acid (PFUnA)	0.451 U
Total Metals (MG/L)	
Arsenic	0.0069
Barium	0.055
Cadmium	0.0005 U
Chromium	0.0035
Copper	0.0049
Lead	5.30E-04 J
Mercury	0.00015 U
Nickel	0.0071
Selenium	4.70E-04 J
Silver	0.0005 U
Zinc	0.01 J
Wet Chemistry (PH)	
pH	7
Total Petroleum Hydrocarbons (UG/L)	
Diesel Range Organics (DRO)	346
Gasoline Range Organics-NWTPH	62.4 BJ
Residual Range Organics (RRO)	125 U

Notes:

B - Not detected substantially above the level reported in laboratory or field blanks

D - Compound identified in an analysis at a secondary dilution factor.

J - Analyte present. Value may or may not be accurate or precise

MG/L - Milligrams per liter

NG/L - Nanograms per liter

ND - Not detected

PH - pH units

U - The material was analyzed for, but not detected

UG/L - Micrograms per liter

Sample ID	WI-SP-IDW-SO01-042121
Sample Date	4/21/21
Chemical Name	
Volatile Organic Compounds (UG/KG)	
1,1,1,2-Tetrachloroethane	0.379 U
1,1,1-Trichloroethane	0.379 U
1,1,2,2-Tetrachloroethane	0.379 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	0.758 U
1,1,2-Trichloroethane	0.379 U
1,1-Dichloroethane	0.379 U
1,1-Dichloroethene	0.379 U
1,1-Dichloropropene	0.379 U
1,2,3-Trichlorobenzene	0.758 U
1,2,3-Trichloropropane	0.758 U
1,2,4-Trichlorobenzene	0.758 U
1,2,4-Trimethylbenzene	0.379 U
1,2-Dibromo-3-chloropropane	1.52 U
1,2-Dibromoethane	1.52 U
1,2-Dichlorobenzene	0.379 U
1,2-Dichloroethane	0.379 U
1,2-Dichloropropane	0.379 U
1,3,5-Trimethylbenzene	0.379 U
1,3-Dichlorobenzene	0.379 U
1,3-Dichloropropane	0.379 U
1,4-Dichlorobenzene	0.379 U
1-Butanol	ND
2,2-Dichloropropane	0.379 U
2-Butanone	1.22 J
2-Chlorotoluene	0.379 U
2-Hexanone	1.52 U
2-propanol	ND
4-Isopropyltoluene	0.379 U
4-Methyl-2-pentanone	0.379 U
Acetone	3.7 J
Acetonitrile	3.79 U
Benzene	0.379 U
Benzyl chloride	ND
Bromobenzene	0.379 U
Bromochloromethane	0.758 U
Bromodichloromethane	0.379 U
Bromoform	0.758 U
Bromomethane	1.52 U
Carbon disulfide	0.379 U
Carbon tetrachloride	0.379 U
Chlorobenzene	0.379 U
Chloroethane	0.379 U
Chloroform	0.379 U
Chloromethane	1.52 U
cis-1,2-Dichloroethene	0.379 U
cis-1,3-Dichloropropene	0.379 U
Cyclohexane	0.379 U
Dibromochloromethane	0.379 U
Dibromomethane	0.379 U
Dichlorodifluoromethane (Freon-12)	0.379 U
diisopropyl Ether (DIPE)	0.758 U
Ethyl acrylate	ND
Ethylbenzene	0.379 U

Sample ID	WI-SP-IDW-SO01-042121
Sample Date	4/21/21
Chemical Name	
Hexachlorobutadiene	0.758 U
Isopropylbenzene	0.379 U
m- and p-Xylene	0.758 U
Methyl Acetate	0.758 U
Methyl methacrylate	1.52 U
Methylcyclohexane	0.379 U
Methylene chloride	1.52 U
Methyl-tert-butyl ether (MTBE)	0.379 U
Naphthalene	0.758 U
n-Butyl alcohol	7.58 U
n-Butylbenzene	0.379 U
n-Hexane	1.52 U
n-Propylbenzene	0.379 U
o-Xylene	0.379 U
p-Chlorotoluene	0.379 U
sec-Butylbenzene	0.379 U
Styrene	0.379 U
tert-Butanol	3.79 U
tert-Butylbenzene	0.758 U
Tetrachloroethene	0.758 U
Tetrahydrofuran	6.07 U
Toluene	0.379 U
trans-1,2-Dichloroethene	0.379 U
trans-1,3-Dichloropropene	0.379 U
trans-1,4-Dichloro-2-butene	1.52 U
Trichloroethene	0.379 U
Trichlorofluoromethane (Freon-11)	0.379 U
Vinyl acetate	0.758 U
Vinyl chloride	0.379 U
Xylene, total	1.14 U
Semivolatile Organic Compounds (UG/KG)	
1,1-Biphenyl	19.1 U
1,2,4,5-Tetrachlorobenzene	57.2 U
1,2,4-Trichlorobenzene	34.3 U
1,2-Dichlorobenzene	34.3 U
1,3-Dichlorobenzene	19.1 U
1,4-Dichlorobenzene	34.3 U
1,4-Dioxane	34.3 U
1-Methylnaphthalene	0.572 U
2,2'-Oxybis(1-chloropropane)	34.3 U
2,3,4,6-Tetrachlorophenol	91.5 U
2,4,5-Trichlorophenol	57.2 U
2,4,6-Trichlorophenol	45.7 U
2,4-Dichlorophenol	34.3 U
2,4-Dimethylphenol	97.2 U
2,4-Dinitrophenol	57.2 U
2,4-Dinitrotoluene	91.5 U
2,6-Dinitrotoluene	34.3 U
2-Chloronaphthalene	34.3 U
2-Chlorophenol	34.3 U
2-Methylnaphthalene	0.572 U
2-Methylphenol	45.7 U
2-Nitroaniline	19.1 U

Sample ID	WI-SP-IDW-SO01-042121
Sample Date	4/21/21
Chemical Name	
2-Nitrophenol	34.3 U
3- and 4-Methylphenol	45.7 U
3,3'-Dichlorobenzidine	137 U
3-Nitroaniline	191 U
4,6-Dinitro-2-methylphenol	91.5 U
4-Bromophenyl-phenylether	34.3 U
4-Chloroaniline	191 U
4-Chlorophenyl-phenylether	34.3 U
4-Nitroaniline	91.5 U
4-Nitrophenol	343 U
Acenaphthene	0.572 U
Acenaphthylene	0.572 U
Acetophenone	57.2 U
Anthracene	1.14 U
Benzo(a)anthracene	1.6 J
Benzo(a)pyrene	1.77 J
Benzo(b)fluoranthene	1.66 J
Benzo(g,h,i)perylene	3.31 J
Benzo(k)fluoranthene	2.62 J
Benzoic acid	229 U
Benzyl alcohol	229 U
Bis(2-Chloroethoxy)methane	57.2 U
Bis(2-Chloroethyl)ether	57.2 U
Bis(2-Ethylhexyl)phthalate	34.3 U
Butylbenzylphthalate	34.3 U
Carbazole	45.7 U
Chrysene	1.66 J
Dibenz(a,h)anthracene	3 J
Dibenzo(a,e)pyrene	ND
Dibenzo(a,h)pyrene	ND
Dibenzo(a,j)acridine	ND
Dibenzo(a,l)pyrene	ND
Dibenzofuran	34.3 U
Diethylphthalate	68.6 U
Dimethyl phthalate	19.1 U
Di-n-butylphthalate	57.2 U
Di-n-octylphthalate	45.7 U
Fluoranthene	1.14 U
Fluorene	1.14 U
Hexachlorobenzene	19.1 U
Hexachlorobutadiene	34.3 U
Hexachlorocyclopentadiene	57.2 U
Hexachloroethane	34.3 U
Indeno(1,2,3-cd)pyrene	2.84 J
Isophorone	34.3 U
Naphthalene	0.572 U
Nitrobenzene	45.7 U
n-Nitrosodimethylamine	45.7 U
n-Nitroso-di-n-propylamine	19.1 U
n-Nitrosodiphenylamine	34.3 U
Pentachlorophenol	91.5 U
Phenanthrene	1.14 U
Phenol	45.7 U
Pyrene	0.572 U

Sample ID	WI-SP-IDW-SO01-042121
Sample Date	4/21/21
Chemical Name	
Per- and Polyfluorinated Alkyl Substances (UG/KG)	
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)	0.0596 U
4,8-dioxa-3H-perfluorononanoic acid (ADONA)	0.0795 U
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid (9Cl-PF3ONS)	0.0398 U
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (EtFOSAA)	0.0795 U
N-Methyl Perfluorooctanesulfonamidoacetic Acid (MeFOSAA)	0.0994 U
Perfluoro-2-methyl-3-oxahexanoic acid (HFPO-DA)	0.0795 U
Perfluorobutanesulfonic acid (PFBS)	7.53
Perfluorodecanoic Acid (PFDA)	0.0412 J
Perfluorododecanoic Acid (PFDoA)	0.0795 U
Perfluoroheptanoic acid (PFHpA)	1.03
Perfluorohexanesulfonic acid (PFHxS)	12.8
Perfluorohexanoic Acid (PFHxA)	5.72
Perfluorononanoic acid (PFNA)	0.149 J
Perfluorooctane Sulfonate (PFOS)	45
Perfluorooctanoic acid (PFOA)	1.72
Perfluorotetradecanoic Acid (PFTeDA)	0.0994 U
Perfluorotridecanoic Acid (PFTrDA)	0.0398 U
Perfluoroundecanoic Acid (PFUnA)	0.0398 U
Total Metals (MG/KG)	
Arsenic	2.71
Barium	41.4
Cadmium	0.23 U
Chromium	27.6
Copper	13.3
Lead	1.76
Mercury	0.0066 J
Nickel	51.4
Selenium	0.23 U
Silver	0.23 U
Zinc	26.8
Wet Chemistry (PH)	
pH	9.39
Total Petroleum Hydrocarbons (MG/KG)	
Diesel Range Organics (DRO)	2.27 U
Gasoline Range Organics-NWTPH	1.66 U
Residual Range Organics (RRO)	5.67 U

Notes:

J - Analyte present. Value may or may not be accurate or precise

MG/KG - Milligrams per kilogram

ND - Not detected

PH - pH units

U - The material was analyzed for, but not detected

UG/KG - Micrograms per kilogram

Appendix E

Data Quality Evaluation

Data Quality Assessment, Per- and Polyfluoroalkyl Substances Site Inspection at Seaplane Base, Naval Air Station Whidbey Island, Oak Harbor, Washington

DATE: September 17th, 2021

1.0 Introduction

The purpose of this technical memorandum is to present the results of the data validation process for the soil and water samples collected from April 14th, 2021 through April 23rd, 2021 at the vehicle maintenance – building 18, biosolids land application area, and sanitary wastewater treatment plant.

Soil and water samples were submitted to Battelle Laboratories for PFAS analysis by analytical method LC-MS/MS compliant with QSM v5.3 Table B-15. The sample results were validated by Environmental Data Services, Inc. (EDS) for compliance with the analytical method requirements. Data validation reports included in **Attachment 3** for the following sample delivery groups (SDGs) were reviewed and summarized:

SDG
21-0523
21-0524
21-0525
21-0541
21-0645

The process for conducting this data quality assessment included a review of the data to assess the accuracy, precision, and completeness based on procedures described in the guidance document *Data Validation Guidelines Module 3: Data Validation Procedure for Per- and Polyfluoroalkyl Substances Analysis by Quality Systems Manual for Environmental Laboratories (QSM) Table B-15* (DoD, 2020), the project-specific sampling and analysis plan (SAP) for the PFAS SI (CH2M, 2021), and professional judgment. The quality assurance (QA)/quality control (QC) summary forms and data reports were reviewed, and the resulting findings are documented within each subsection that follows.

During the data validation by EDS, if QA/QC parameters were not within the acceptance limits, associated sample results were appended with a primary qualifying flag that indicated a possible anomaly with these data. The qualifying flags were applied during the data review and validation processes. This qualification also included the use of secondary qualifier flags. The secondary qualifiers provide the reasoning behind the assignment of a qualifier to these data. The definitions of the primary qualifiers are presented below. The secondary qualifiers are listed in **Attachment 1**.

2.0 Validation Flag Definitions

The following primary qualifiers were used to qualify the data:

[NULL]: **Detected.** The analyte was analyzed for and detected at the concentration shown.

[J]: **Estimated.** The reported result was an estimated value with an unknown bias.

- [U]: **Undetected.** The analyte was not detected and was reported as less than the limit of detection (LOD) or as defined by the customer. The LOD has been adjusted for any dilution or concentration of the sample.
- [UJ]: **Detection limit estimated.** The analyte was not detected and was reported as less than the LOD or as defined by the customer. However, the associated numerical value is approximate.
- [X]: **Recommended for Rejection.** The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.
- [R]: **Rejected.** The data are not useable.
- [Exclude]: **Excluded.** Data were not used due to another value being more appropriate.

3.0 Quality Control Measures

The following list represents the QA/QC measures that were reviewed during the data quality evaluation procedure:

- **Holding Times:** The holding times are evaluated to verify that samples were extracted and analyzed within holding times.
- **Blank samples:** Method blank, equipment blank, and field blank samples were provided for this project. Blank samples enable the reviewer to determine if an analyte may be attributed to sampling or laboratory procedures, rather than environmental contamination from site activities.
- **Surrogate Recoveries:** Surrogate Compounds are added to each sample and the recoveries are used to monitor lab performance and possible matrix interference.
- **Lab Control Sample (LCS)/Lab Control Sample Duplicate (LCSD):** These samples are a "controlled matrix", laboratory reagent water, in which target compounds have been added prior to extraction/analysis. The recoveries serve as a monitor of the overall performance of each step during the analysis, including sample preparation.
- **Matrix Spike/Matrix Spike Duplicate (MS/MSD) Samples:** Spike recovery is used to evaluate potential matrix interferences, as well as accuracy. Precision information is also determined by calculating the reproducibility between the recoveries of each spiked parameter.
- **Field Duplicate:** These samples are collected to determine precision between a native and its duplicates. This information can only be determined when target compounds are detected.
- **Internal Standards:** These are compounds added to the sample extracts prior to analysis. Their retention times and response are evaluated for method compliance. The internal standards are used in quantification of the target parameters and to monitor the instrument sensitivity and response for stability during analysis.
- **Initial Calibration:** The initial calibration ensures the instrument is capable of producing acceptable qualitative and quantitative data for the compounds of interest. Multiple standard solutions are analyzed to determine the response and linearity of the instrument over a varying concentration range.
- **Continuing Calibration:** The continuing calibration checks satisfactory performance of the instrument and its predicted response to the target compounds by analysis of a standard solution(s) at known concentrations.

4.0 Quality Control Review

The QA/QC parameters for all samples were within acceptable control limits with the exceptions listed below. A brief overview of the data evaluation follows:

4.1 Holding Time

All holding time requirements were met.

4.2 Recoveries - Surrogate, MS/MSD and LCS/LCSD

Surrogates, MS/MSD, and LCS/LCSD recoveries all met acceptance criteria with the exception of those listed below:

- **MS/MSD:**
 - For spiked sample WI-SP-GW72-0421, perfluorobutanesulfonic acid (PFBS) exhibited high recoveries in the MS/MSD. As a result, “J” qualification for the sample detect was required.
- **Surrogates:**
 - Surrogates for samples WI-SP-GW01-0421, WI-SP-GW01N-0421, and SI-SP-GW70-0421 exhibited low recoveries for the PFAS analysis. As a result, “UJ” qualifications for non-detects were required for all results except PFTeDA for sample WI-SP-GW01N-0421 which was given an “X” qualification during validation due to the extremely low surrogate recovery. The PFTeDA result for sample WI-SP-GW01N-0421 was ultimately rejected (qualified as “R”) by the project team.

Associated results were qualified as estimated unless otherwise noted. Affected data are summarized in **Attachment 2**.

4.3 Field Duplicate Precision

- Field duplicate precision was met.

4.4 Analytical Blanks

- All method blank results were non-detect and met acceptance criteria.
- All field blanks were non-detect and met acceptance criteria.
- There was a detect noted in equipment blank sample WI-SP-EB03-GW-041921 for perfluorobutanesulfonic acid (PFBS). The associated sample results were either non-detect or greater than 5 times the blank detect; therefore, no qualifiers were required.

4.5 Calibration

All calibration acceptance criteria were met.

4.7 Reporting Limits Evaluation

Laboratory detection limits (DL), limits of detection, and limit of quantitation (LOQ) were evaluated and compared to the project limits and were found to be within an acceptable range.

4.8 Evaluation of Rejected Data

The majority of the data are usable, with only 0.22% of the total results “R” qualified as rejected (**Table E-1**). Only one compound, perfluorotetradecanoic acid (PFTeDA), for sample WI-SP-GW01N-0421 was qualified with a “X” flag by the validator, and in turn, was rejected by the project team and qualified with a “R”. There is not actually a data need for this compound, and so there is no impact on decisions made using this data.

5.0 PARCC

Precision is defined as the agreement between duplicate results, and was estimated by comparing duplicate MS recoveries, and field duplicate sample results. The precision between the native and field duplicate sample results

were within acceptable criteria indicating that the sample matrix did not interfere with the overall analytical process.

Accuracy is a measure of the agreement between an experimental determination and the true value of the parameter being measured. For organic analyses, each sample was spiked with surrogate compounds. Additionally, an MS/MSD and LCS were spiked with a known parameter concentration before preparation. Internal standards also provide a measure of accuracy. Internal standards, surrogates, and MS/MSD provide a measure of the matrix effects on the analytical accuracy. The LCS demonstrates accuracy of the method and the laboratory's ability to meet the method criteria. Accuracy is also assessed by calibration responses. Potential biases and trends were evaluated by first determining whether a QA/QC exceedance may indicate a potential bias or trend. If so, then the exceedance was examined to determine whether the bias or trend was significant enough to warrant rejection of data. A negative bias was identified as evidenced by the 0.22% rejection of the perfluorotetradecanoic acid (PFTeDA) non-detect result for sample WI-SP-GW01N-0421, which was qualified as an "X" flag during the validation process, and ultimately rejected by the project team and qualified as "R" due to low surrogate recovery (**Table E-2**). Although there is a data gap created by this issue, there is not actually a data need, and so there is no impact on decisions made using the data. Additionally, 1.78 percent of the usable analytical results were qualified as estimated with a ("J") or estimated non-detect ("UJ") because of MS/MSD and surrogate outliers indicating matrix interference (**Table E-3**).

Representativeness is a qualitative measure of the degree to which sample data accurately and precisely represent a characteristic environmental condition (e.g., nature and extent of contamination). Representativeness is a subjective parameter and is used to evaluate the efficacy of the sample planning design. In terms of data quality, representativeness was assured, because the sampling team followed approved standard operating procedures for sample collection and handling, and the laboratory followed approved standard operating procedures for sample handling, preparation, and analysis. All field samples were collected and analyzed as proposed in the SAP.

Completeness is defined as the percentage of measurements that are judged to be valid; validity being defined by the data quality objectives (DQOs). Therefore, completeness is calculated as the number of analytically sound results that are available for use compared to the total number of measurements made. The National Functional Guidelines data validation guidance designates all results except those R-qualified as "rejected" to be available for use as analytically sound results. The R-qualifier is the only qualifier that negatively affects a data point's availability. One perfluorotetradecanoic acid (PFTeDA) result for sample WI-SP-GW01N-0421 was qualified as an "X" flag due to extremely low surrogate recoveries, and ultimately the result was rejected by the project team and qualified as "R". A total of 450 analytical results were considered in the analytical completeness calculation with 99.78% considered usable meeting the completeness goal of 95%.

Comparability is another qualitative measure designed to express the confidence with which one data set may be compared to another. Factors that affect comparability are sample collection and handling techniques, sample matrix, and analytical methods. In this case, because approved SOPs were used for sample collection and handling, common sample matrices were evaluated (soil and water), and EPA SW-846 methods were utilized, the data user may express confidence in that fact that this data set is comparable to others of acceptable data quality. Comparability is controlled by the other PARCC parameters, because data sets can be compared with confidence only when precision and accuracy are known. Precision and accuracy were demonstrated to be acceptable, and the data user may be confident that this data set is comparable to others of high data quality.

The recalculation of the laboratory quantitation was performed at a 10% frequency as per the statement of work with no anomalies found. The assumptions made about the PARCC were proper and correct. No error in judgment was found during this review of the data validation reports.

6.0 Conclusion

A review of the analytical data submitted regarding the NAS Whidbey Island, Oak Harbor, Washington vehicle maintenance building 18, biosolids land application area, and sanitary wastewater treatment plant sampling event

from April 14th, 2021 through April 23rd, 2021 by Jacobs has been completed. The validation review demonstrated that the analytical systems were generally in control, and all of the data results except for the rejected result for perfluorotetradecanoic acid (PFTeDA) for sample WI-SP-GW01N-0421, can be used in the project decision making process.

7.0 References

CH2M HILL. 2021. *Per- and Polyfluoroalkyl Substances Site Inspection Sampling and Analysis Plan, Seaplane Base, Naval Air Station Whidbey Island, Oak Harbor, Washington*. March.

Department of Defense (DoD). 2020. *Data Validation Guidelines Module 3, Data Validation Procedure for Per- and Polyfluoroalkyl Substances Analysis by Quality Systems Manual for Environmental Laboratories (QSM) Table B-15*. May.

Tables

Table E-1 Percentage of Data Qualified for Complete Dataset

Per- and Polyfluoroalkyl Substances Site Inspection Seaplane Base, NAS Whidbey Island

Validator_Qualifier	Count	Percent
U	315	70.00%
NULL	86	19.11%
J	41	9.11%
UJ	7	1.56%
R	1	0.22%
	450	100.00%

Notes:

99.78% not R-flagged and available for use

J - Analyte present. Reported value may or may not be accurate or precise.

NAS - Naval Air Station

NULL - No qualifier

U - Not Detected

UJ - Not detected, quantitation limit may be inaccurate or imprecise.

R - Rejected. The result is not usable.

Table E-2 Percentage of Data Qualified for Complete Dataset with Secondary Data Qualifier or Validation Reason Codes

Per- and Polyfluoroalkyl Substances Site Inspection Seaplane Base, NAS Whidbey Island

Validator Qualifier QC Narrative		Count	Percent
U	NULL	315	70.00%
NULL	NULL	86	19.11%
J	NULL	40	8.89%
Data Not Qualified During Data Validation		441	98.00%
UJ	SSL	7	1.56%
J	MSH	1	0.22%
R	SSL	1	0.22%
Data Qualified During Data Validation		9	2.00%
Total Results		450	100.00%

Notes:

99.78% not R-flagged and available for use

J - Analyte present. Reported value may or may not be accurate or precise.

MSH - Matrix Spike and/or Matrix Spike Duplicate - High Recovery

NAS - Naval Air Station

NULL - No qualifier

R - Rejected. The result is not usable.

SSL - Spiked Surrogate - Low Recovery

U - Not Detected

UJ - Not detected, quantitation limit may be inaccurate or imprecise.

Table E-3 Percentage of Data Qualified for PFAS with Secondary Data Qualifier or Validation Reason Codes
Per- and Polyfluoroalkyl Substances Site Inspection Seaplane Base, NAS Whidbey Island

Analysis Group	Validator Qualifier	QC Narrative	Count	Percent
SVOA	U	NULL	315	70.00%
SVOA	NULL	NULL	86	19.11%
SVOA	J	NULL	40	8.89%
Data Not Qualified During Data Validation			441	98.00%
SVOA	UJ	SSL	7	1.56%
SVOA	J	MSH	1	0.22%
SVOA	R	SSL	1	0.22%
Data Qualified During Data Validation			9	2.00%
Total Results			450	100.00%

Notes:

99.78% not R-flagged and available for use

J - Analyte present. Reported value may or may not be accurate or precise.

MSH - Matrix Spike and/or Matrix Spike Duplicate - High Recovery

NAS - Naval Air Station

NULL - No qualifier

R - Rejected. The result is not usable.

SSL - Spiked Surrogate - Low Recovery

U - Not Detected

UJ - Not detected, quantitation limit may be inaccurate or imprecise.

Table E-4 Percentage of Data Qualified based on Accuracy Criteria with Secondary Data Qualifier or Validation Reason Codes
Per- and Polyfluoroalkyl Substances Site Inspection Seaplane Base, NAS Whidbey Island

Analysis Group	Validator Qualifier	Quality Control Narrative	Count	Total Results	Percent
SVOA	J	MSH	1	450	0.22%

Notes:

99.78% not R-flagged and available for use

J - Analyte present. Reported value may or may not be accurate or precise.

MSH - Matrix Spike and/or Matrix Spike Duplicate - High Recovery

NAS - Naval Air Station

SVOA - Semi-volatile Organic Analytes

Attachment 1
Secondary Data Qualifier Codes

Attachment 1. Secondary Data Qualifier, or Validation Reason, Codes

Secondary Data Qualifier	Description
%SOL	High Moisture content
2C	Second Column – Poor Dual Column Reproducibility
2S	Second Source – Bad reproducibility between tandem detectors
BD	Blank Spike/Blank Spike Duplicate(LCS/LCSD) Precision
BRL	Below Reporting Limit
BSH	Blank Spike/LCS – High Recovery
BSL	Blank Spike/LCS – Low Recovery
CC	Continuing Calibration
CCBL	Continuing Calibration Blank Contamination
CCH	Continuing Calibration Verification – High Recovery
CCL	Continuing Calibration Verification – Low Recovery
DL	Redundant Result – due to Dilution
EBL	Equipment Blank Contamination
EMPC	Estimated Possible Maximum Concentration
ESH	Extraction Standard - High Recovery
ESL	Extraction Standard - Low Recovery
FBL	Field Blank Contamination
FD	Field Duplicate
GBL	Grinding Blank Contamination
GBSH	Ground Blank Spike/LCS – High Recovery
GBSL	Ground Blank Spike/LCS – Low Recovery
HT	Holding Time
ICB	Initial Calibration – Bad Linearity or Curve Function
ICH	Initial Calibration – High Relative Response Factors
ICL	Initial Calibration – Low Relative Response Factors
IR15	Ion ratio exceeds +/- 15% difference
ISH	Internal Standard – High Recovery
ISL	Internal Standard – Low Recovery
LD	Lab Duplicate Reproducibility
LR	Concentration Exceeds Linear Range
MBL	Method Blank Contamination
MDP	Matrix Spike/Matrix Spike Duplicate Precision
MI	Matrix interference obscuring the raw data
MSH	Matrix Spike and/or Matrix Spike Duplicate – High Recovery
MSL	Matrix Spike and/or Matrix Spike Duplicate – Low Recovery

Attachment 1. Secondary Data Qualifier, or Validation Reason, Codes

Secondary Data Qualifier	Description
OT	Other
PD	Pesticide Degradation
RE	Redundant Result - due to Reanalysis or Re-extraction
SD	Serial Dilution Reproducibility
SSH	Spiked Surrogate – High Recovery
SSL	Spiked Surrogate – Low Recovery
TBL	Trip Blank Contamination
TN	Tune

Attachment 2
Assigned Qualifiers

Attachment 2. Assigned Qualifiers.

Sample ID	Sample Type	Analytical Method	Parameter	Lab Result	Lab Qual	Final Result	Primary Qualifier	Units	Secondary Qualifier
WI-SP-GW01-0421	REG	PFAS_QSM5.3	Perfluorododecanoic Acid (PFDoA)	0.488	U	0.488	UJ	NG_L	SSL
WI-SP-GW01-0421	REG	PFAS_QSM5.3	Perfluorotetradecanoic Acid (PFTeDA)	1.95	U	1.95	UJ	NG_L	SSL
WI-SP-GW01-0421	REG	PFAS_QSM5.3	N-Ethyl Perfluorooctanesulfonamidoacetic Acid (EtFOSAA)	0.977	U	0.977	UJ	NG_L	SSL
WI-SP-GW01N-0421	REG	PFAS_QSM5.3	Perfluorododecanoic Acid (PFDoA)	0.568	U	0.568	UJ	NG_L	SSL
WI-SP-GW01N-0421	REG	PFAS_QSM5.3	Perfluorotetradecanoic Acid (PFTeDA)	2.27	U	2.27	R	NG_L	SSL
WI-SP-GW70-0421	REG	PFAS_QSM5.3	Perfluorohexanoic Acid (PFHxA)	1.31	U	1.31	UJ	NG_L	SSL
WI-SP-GW70-0421	REG	PFAS_QSM5.3	N-Methyl Perfluorooctanesulfonamidoacetic Acid (MeFOSAA)	0.871	U	0.871	UJ	NG_L	SSL
WI-SP-GW70-0421	REG	PFAS_QSM5.3	Perfluorobutanesulfonic acid (PFBS)	0.436	U	0.436	UJ	NG_L	SSL
WI-SP-GW72-0421	REG	PFAS_QSM5.3	Perfluorobutanesulfonic acid (PFBS)	113	Q	113	J	NG_L	MSH

Attachment 3
Data Validation Reports

**DATA VALIDATION SUMMARY REPORT
NAS WHIDBEY ISLAND, WASHINGTON**

Client: CH2M HILL, Inc., Corvallis, Oregon
 SDG: 21-0523
 Laboratory: Battelle Norwell Operations, Norwell, Massachusetts
 Site: NAS Whidbey Island (NASWI), Seaplane Base, CTO-4041, Washington
 Date: June 20, 2021

PFAS			
EDS ID	Client Sample ID	Laboratory Sample ID	Matrix
1	WI-SP-SB08-80H81H	G8409-FS	Soil
2	WI-SP-SB08P-80H81H	G8410-FS	Soil
3	WI-SP-SB07-13H14	G8411-FS	Soil
4	WI-SP-SB06-1313H	G8412-FS	Soil
5	WI-SP-SB05-09H10	G8413-FS	Soil
5MS	WI-SP-SB05-09H10MS	G8414-FSMS	Soil
5MSD	WI-SP-SB05-09H10MSD	G8415-FSMSD	Soil
6	WI-SP-SB02-04H05	G8416-FS	Soil
7	WI-SP-SB03-0808H	G8417-FS	Soil

A Stage 2B/4 data validation was performed on the analytical data for seven soil samples collected on April 14-16, 2021 by CH2M HILL at the NAS Whidbey Island site in Washington. The samples were analyzed under the Analysis of Perfluoroalkyl Substances in Environmental Samples by Liquid Chromatography and Tandem Mass Spectrometry (LC-MS/MS).

Specific method references are as follows:

Analysis
PFAS

Method References
Battelle SOP 5-369-08

The data have been validated according to the protocols and quality control (QC) requirements of the analytical method, the Final Sampling and Analysis Plan Per- and Polyfluoroalkyl Substances Site Inspection Seaplane Base, Naval Air Station Whidbey Island, March 2021, the DoD Final General Data Validation Guidelines, November 2019, including the following Module:

- The Department of Defense (DoD) Data Validation Guidelines Module 3, Data Validation Procedure for Per- and Polyfluoroalkyl Substances Analysis by Quality Systems Manual for Environmental Laboratories (QSM) Table B-15, May 2020;
- and the reviewer's professional judgment.

The following data quality indicators were reviewed for this report:

PFAS

- Date Completeness, Case Narrative & Custody Documentation
- Holding times
- Liquid Chromatography/Mass Spectrometry (LC/MS) Tuning
- Initial and continuing calibration summaries
- Method blank and field QC blank contamination
- Surrogate Spike recoveries
- Laboratory Fortified Blank (LFB)
- Matrix Spike/Matrix Spike Duplicate (MS/MSD) recoveries
- Internal standard area and retention time summary forms
- Target Compound Identification
- Compound Quantitation
- Field Duplicate sample precision

A Stage 2B/4 data validation was performed with this review including a recalculation of 10% of the detected results in the samples.

Data Usability Assessment

There were no serious deficiencies of data.

The data are acceptable for the intended purposes. There were no qualifications.

Polyfluoroalkyl Substances (PFAS)

Data Completeness, Case Narrative & Custody Documentation

- The case narrative and chain-of-custody documentation were included in the data package as required. All criteria were met.

Holding Times

- All samples were extracted within 14 days for soil samples and analyzed within 28 days.

LC/MS Tuning

- All criteria were met.

Initial Calibration

- All relative standard deviation (%RSD) and/or correlation coefficients criteria were met.

Continuing Calibration

- All percent recovery (%R) criteria were met.

Method Blank

- The method blanks were free of contamination.

Field QC Blank

- Field QC results are summarized below.

Blank ID	Compound	Conc. ng/L	Qualifier	Affected Samples
WI-SP-EB05-SO-042321	None - ND	-	-	-
WI-SP-FB01-041721	None - ND	-	-	-

Surrogate Spike Recoveries

- All samples exhibited acceptable surrogate percent recoveries (%R).

Laboratory Fortified Blank (LFB)

- The LFB samples exhibited acceptable percent recoveries (%R).

Matrix Spike/Matrix Spike Duplicate (MS/MSD) Recoveries

- The MS/MSD samples exhibited acceptable percent recoveries (%R) and relative percent differences (RPD).

Internal Standard (IS) Area Performance

- All internal standards met response and retention time (RT) criteria.

Target Compound Identification

- All mass spectra and quantitation criteria were met.

Compound Quantitation

- All criteria were met.

Field Duplicate Sample Precision

- Field duplicate results are summarized below. The precision was acceptable.

Compound	WI-SP-SB08-80H81H ng/g	WI-SP-SB08P-80H81H ng/g	RPD	Qualifier
None	ND	ND	-	-

Please contact the undersigned at (561) 475-2000 if you have any questions or need further information.

Signed:

Nancy Weaver
Nancy Weaver
Senior Chemist

Dated:

6/21/21

Qualifier	Definition
U	The analyte was not detected and was reported as less than the LOD or as defined by the customer. The LOD has been adjusted for any dilution or concentration of the sample.
J	The reported result was an estimated value with an unknown bias.
J+	The result was an estimated quantity, but the result may be biased high.
J-	The result was an estimated quantity, but the result may be biased low.
N	The analysis indicates the presence of an analyte for which there was presumptive evidence to make a "tentative identification."
NJ	The analyte has been "tentatively identified" or "presumptively" as present and the associated numerical value was the estimated concentration in the sample.
UJ	The analyte was not detected and was reported as less than the LOD or as defined by the customer. However, the associated numerical value is approximate.
X	<p>The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided.</p> <p>Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.</p>



Project Client: CH2M
 Project Name: CTO-4041: NAS Whidbey Island, Seaplane Base
 Project No.: 100146377

Client ID WI-SP-5B08-80H81H

Battelle ID G8409-FS
 Sample Type SA
 Collection Date 04/14/2021
 Extraction Date 04/27/2021
 Analytical Instrument Sciex 6500+ (AE) LC/MS/MS
 % Moisture 16.92
 Matrix SOIL
 Sample Size 5.100
 Size Unit-Basis g

Analyte	CAS No.	Result (ng/g_Dry)	Extract ID	DF	Analysis Date	DL	LOD	LOQ
PFHxA	307-24-4	0.0784 U	G8409-FS(0)	1.000	5/5/2021	0.0277	0.0784	0.196
PFHpA	375-85-9	0.0588 U	G8409-FS(0)	1.000	5/5/2021	0.0198	0.0588	0.196
PFOA	335-67-1	0.0784 U	G8409-FS(0)	1.000	5/5/2021	0.0238	0.0784	0.196
PFNA	375-95-1	0.0392 U	G8409-FS(0)	1.000	5/5/2021	0.0193	0.0392	0.196
PFDA	335-76-2	0.0392 U	G8409-FS(0)	1.000	5/5/2021	0.0182	0.0392	0.196
PFUnA	2058-94-8	0.0392 U	G8409-FS(0)	1.000	5/5/2021	0.0179	0.0392	0.196
PFDoA	307-55-1	0.0784 U	G8409-FS(0)	1.000	5/5/2021	0.0240	0.0784	0.196
PFTeDA	72629-94-8	0.0392 U	G8409-FS(0)	1.000	5/5/2021	0.0110	0.0392	0.196
PFTeDA	376-06-7	0.0980 U	G8409-FS(0)	1.000	5/5/2021	0.0424	0.0980	0.196
NMeFOSAA	2355-31-9	0.0980 U	G8409-FS(0)	1.000	5/5/2021	0.0400	0.0980	0.196
NEtFOSAA	2991-50-6	0.0784 U	G8409-FS(0)	1.000	5/5/2021	0.0293	0.0784	0.196
PFBS	375-73-5	0.0392 U	G8409-FS(0)	1.000	5/5/2021	0.0137	0.0392	0.196
PFHxS	355-46-4	0.0784 U	G8409-FS(0)	1.000	5/5/2021	0.0317	0.0784	0.196
PFOS	1763-23-1	0.0784 U	G8409-FS(0)	1.000	5/5/2021	0.0271	0.0784	0.196
HFPO-DA	13252-13-6	0.0784 U	G8409-FS(0)	1.000	5/5/2021	0.0251	0.0784	0.196
Adona	919005-14-4	0.0784 U	G8409-FS(0)	1.000	5/5/2021	0.0325	0.0784	0.196
9Cl-PF3ONS	756426-58-1	0.0392 U	G8409-FS(0)	1.000	5/5/2021	0.0189	0.0392	0.196
11Cl-PF3OUdS	763051-92-9	0.0588 U	G8409-FS(0)	1.000	5/5/2021	0.0205	0.0588	0.196

NW6/20/21

Analyzed by: Schumitz, Denise
 Printed: 5/18/2021



2

Project Client: CH2M
 Project Name: CTO-4041: NAS Whidbey Island, Seaplane Base
 Project No.: 100146377

Client ID WI-SP-SB08P-80H81H

Battelle ID GB410-FS
 Sample Type SA
 Collection Date 04/14/2021
 Extraction Date 04/27/2021
 Analytical Instrument Sciex 6500+ (AE) LC/MS/MS
 % Moisture 16.72
 Matrix SOIL
 Sample Size 5.070

Analyte	CAS No.	Result (ng/g_Dry)	Extract ID	DF	Analysis Date	DL	LOD	LOQ
PFHxA	307-24-4	0.0789 U	G8410-FS(0)	1.000	5/5/2021	0.0279	0.0789	0.197
PFHpA	375-85-9	0.0592 U	G8410-FS(0)	1.000	5/5/2021	0.0200	0.0592	0.197
PFOA	335-67-1	0.0789 U	G8410-FS(0)	1.000	5/5/2021	0.0239	0.0789	0.197
PFNA	375-95-1	0.0394 U	G8410-FS(0)	1.000	5/5/2021	0.0194	0.0394	0.197
PFDA	335-76-2	0.0394 U	G8410-FS(0)	1.000	5/5/2021	0.0183	0.0394	0.197
PFUnA	2058-94-8	0.0394 U	G8410-FS(0)	1.000	5/5/2021	0.0180	0.0394	0.197
PFDnA	307-55-1	0.0789 U	G8410-FS(0)	1.000	5/5/2021	0.0241	0.0789	0.197
PFTrDA	72629-94-8	0.0394 U	G8410-FS(0)	1.000	5/5/2021	0.0110	0.0394	0.197
PFTeDA	376-06-7	0.0986 U	G8410-FS(0)	1.000	5/5/2021	0.0426	0.0986	0.197
NMeFOSAA	2355-31-9	0.0986 U	G8410-FS(0)	1.000	5/5/2021	0.0402	0.0986	0.197
NEtFOSAA	2991-50-6	0.0789 U	G8410-FS(0)	1.000	5/5/2021	0.0295	0.0789	0.197
PFBS	375-73-5	0.0394 U	G8410-FS(0)	1.000	5/5/2021	0.0138	0.0394	0.197
PFHxS	355-46-4	0.0789 U	G8410-FS(0)	1.000	5/5/2021	0.0319	0.0789	0.197
PFOS	1763-23-1	0.0789 U	G8410-FS(0)	1.000	5/5/2021	0.0273	0.0789	0.197
HFPO-DA	13252-13-6	0.0789 U	G8410-FS(0)	1.000	5/5/2021	0.0253	0.0789	0.197
Adona	919005-14-4	0.0789 U	G8410-FS(0)	1.000	5/5/2021	0.0327	0.0789	0.197
9CI-PF3ONS	756426-58-1	0.0394 U	G8410-FS(0)	1.000	5/5/2021	0.0190	0.0394	0.197
11CI-PF3OUdS	763051-92-9	0.0592 U	G8410-FS(0)	1.000	5/5/2021	0.0207	0.0592	0.197

5/6/2021

Analyzed by: Schumitz, Denise
 Printed: 5/18/2021



Project Client: CH2M
 Project Name: CTO-4041: NAS Whidbey Island, Seaplane Base
 Project No.: 100146377

3

Client ID WI-SP-SB07-13H14

Battelle ID G8411-FS
 Sample Type SA
 Collection Date 04/15/2021
 Extraction Date 04/27/2021
 Analytical Instrument Sciex 6500+ (AE) LC/MS/MS
 % Moisture 16.67
 Matrix SOIL
 Sample Size 5.050
 Size Unit-Basis g

Analyte	CAS No.	Result (ng/g_Dry)	Extract ID	DF	Analysis Date	DL	LOD	LOQ
PFHxA	307-24-4	0.0792 U	G8411-FS(0)	1.000	5/5/2021	0.0280	0.0792	0.198
PFHpA	375-85-9	0.0594 U	G8411-FS(0)	1.000	5/5/2021	0.0200	0.0594	0.198
PFOA	335-67-1	0.0792 U	G8411-FS(0)	1.000	5/5/2021	0.0240	0.0792	0.198
PFNA	375-95-1	0.0396 U	G8411-FS(0)	1.000	5/5/2021	0.0194	0.0396	0.198
PFDA	335-76-2	0.0396 U	G8411-FS(0)	1.000	5/5/2021	0.0183	0.0396	0.198
PFUnA	2058-94-8	0.0396 U	G8411-FS(0)	1.000	5/5/2021	0.0181	0.0396	0.198
PFDoA	307-55-1	0.0792 U	G8411-FS(0)	1.000	5/5/2021	0.0242	0.0792	0.198
PFTeDA	72629-94-8	0.0396 U	G8411-FS(0)	1.000	5/5/2021	0.0111	0.0396	0.198
PFTeDA	376-06-7	0.0990 U	G8411-FS(0)	1.000	5/5/2021	0.0428	0.0990	0.198
NMeFOSAA	2355-31-9	0.0990 U	G8411-FS(0)	1.000	5/5/2021	0.0404	0.0990	0.198
NEtFOSAA	2991-50-6	0.0792 U	G8411-FS(0)	1.000	5/5/2021	0.0296	0.0792	0.198
PFBS	375-73-5	0.0396 U	G8411-FS(0)	1.000	5/5/2021	0.0139	0.0396	0.198
PFHxS	355-46-4	0.0792 U	G8411-FS(0)	1.000	5/5/2021	0.0320	0.0792	0.198
PFOS	1763-23-1	0.0792 U	G8411-FS(0)	1.000	5/5/2021	0.0274	0.0792	0.198
HFPO-DA	13252-13-6	0.0792 U	G8411-FS(0)	1.000	5/5/2021	0.0254	0.0792	0.198
Adona	919005-14-4	0.0792 U	G8411-FS(0)	1.000	5/5/2021	0.0329	0.0792	0.198
9Cl-PF3ONS	756426-58-1	0.0396 U	G8411-FS(0)	1.000	5/5/2021	0.0191	0.0396	0.198
11Cl-PF3OUds	763051-92-9	0.0594 U	G8411-FS(0)	1.000	5/5/2021	0.0208	0.0594	0.198

MW 6/20/21

Analyzed by: Schumitz, Denise
 Printed: 5/18/2021



Project Client: CH2M
 Project Name: CTO-4041: NAS Whidbey Island, Seaplane Base
 Project No.: 100146377

4

Client ID WI-SP-SB06-1313H

Battelle ID G8412-FS
 Sample Type SA
 Collection Date 04/15/2021
 Extraction Date 04/27/2021
 Analytical Instrument Sciex 6500+ (AE) LC/MS/MS
 % Moisture 16.71
 Matrix SOIL
 Sample Size 5.210
 Size Unit-Basis g

Analyte	CAS No.	Result (ng/g_Dry)	Extract ID	DF	Analysis Date	DL	LOD	LOQ
PFHxA	307-24-4	0.0768 U	G8412-FS(0)	1.000	5/5/2021	0.0271	0.0768	0.192
PFHpA	375-85-9	0.0576 U	G8412-FS(0)	1.000	5/5/2021	0.0194	0.0576	0.192
PFOA	335-67-1	0.0768 U	G8412-FS(0)	1.000	5/5/2021	0.0233	0.0768	0.192
PFNA	375-95-1	0.0384 U	G8412-FS(0)	1.000	5/5/2021	0.0188	0.0384	0.192
PFDA	335-76-2	0.0384 U	G8412-FS(0)	1.000	5/5/2021	0.0178	0.0384	0.192
PFUnA	2058-94-8	0.0384 U	G8412-FS(0)	1.000	5/5/2021	0.0175	0.0384	0.192
PFDoA	307-55-1	0.0768 U	G8412-FS(0)	1.000	5/5/2021	0.0235	0.0768	0.192
PFTrDA	72629-94-8	0.0384 U	G8412-FS(0)	1.000	5/5/2021	0.0107	0.0384	0.192
PFTeDA	376-06-7	0.0960 U	G8412-FS(0)	1.000	5/5/2021	0.0415	0.0960	0.192
NMeFOSAA	2355-31-9	0.0960 U	G8412-FS(0)	1.000	5/5/2021	0.0392	0.0960	0.192
NEtFOSAA	2991-50-6	0.0768 U	G8412-FS(0)	1.000	5/5/2021	0.0287	0.0768	0.192
PFBS	375-73-5	0.0384 U	G8412-FS(0)	1.000	5/5/2021	0.0134	0.0384	0.192
PFHxS	355-46-4	0.0768 U	G8412-FS(0)	1.000	5/5/2021	0.0310	0.0768	0.192
PFOS	1763-23-1	0.0768 U	G8412-FS(0)	1.000	5/5/2021	0.0266	0.0768	0.192
HFPO-DA	13252-13-6	0.0768 U	G8412-FS(0)	1.000	5/5/2021	0.0246	0.0768	0.192
Adona	919005-14-4	0.0768 U	G8412-FS(0)	1.000	5/5/2021	0.0319	0.0768	0.192
9Cl-PF3ONS	756426-58-1	0.0384 U	G8412-FS(0)	1.000	5/5/2021	0.0185	0.0384	0.192
11Cl-PF3OUdS	763051-92-9	0.0576 U	G8412-FS(0)	1.000	5/5/2021	0.0201	0.0576	0.192

5/18/2021

Analyzed by: Schumitz, Denise
 Printed: 5/18/2021



Project Client: CH2M
 Project Name: CTO-4041: NAS Whidbey Island, Seaplane Base
 Project No.: 100146377

5

Client ID WI-SP-SB05-09H10

Battelle ID G8413-FS
 Sample Type SA
 Collection Date 04/15/2021
 Extraction Date 04/27/2021
 Analytical Instrument Sciex 6500+ (AE) LC/MS/MS
 % Moisture 9.46
 Matrix SOIL
 Sample Size 5.060
 Size Unit-Basis g

Analyte	CAS No.	Result (ng/g_Dry)	Extract ID	DF	Analysis Date	DL	LOD	LOQ
PFHxA	307-24-4	0.327	G8413-FS(0)	1.000	5/5/2021	0.0279	0.0791	0.198
PFHpA	375-85-9	0.297	G8413-FS(0)	1.000	5/5/2021	0.0200	0.0593	0.198
PFOA	335-67-1	0.334	G8413-FS(0)	1.000	5/5/2021	0.0240	0.0791	0.198
PFNA	375-95-1	0.300	G8413-FS(0)	1.000	5/5/2021	0.0194	0.0395	0.198
PFDA	335-76-2	0.359	G8413-FS(0)	1.000	5/5/2021	0.0183	0.0395	0.198
PFUnA	2058-94-8	0.398	G8413-FS(0)	1.000	5/5/2021	0.0181	0.0395	0.198
PFDoA	307-55-1	0.311	G8413-FS(0)	1.000	5/5/2021	0.0242	0.0791	0.198
PFTrDA	72629-94-8	0.303	G8413-FS(0)	1.000	5/5/2021	0.0111	0.0395	0.198
PFTeDA	376-06-7	0.303	G8413-FS(0)	1.000	5/5/2021	0.0427	0.0988	0.198
NMeFOSAA	2355-31-9	0.262	G8413-FS(0)	1.000	5/5/2021	0.0403	0.0988	0.198
NEtFOSAA	2991-50-6	0.264	G8413-FS(0)	1.000	5/5/2021	0.0296	0.0791	0.198
PFBS	375-73-5	0.292	G8413-FS(0)	1.000	5/5/2021	0.0138	0.0395	0.198
PFHxS	355-46-4	0.301	G8413-FS(0)	1.000	5/5/2021	0.0319	0.0791	0.198
PFOS	1763-23-1	0.534	G8413-FS(0)	1.000	5/5/2021	0.0274	0.0791	0.198
HFPO-DA	13252-13-6	0.292	G8413-FS(0)	1.000	5/5/2021	0.0253	0.0791	0.198
Adona	919005-14-4	0.284	G8413-FS(0)	1.000	5/5/2021	0.0328	0.0791	0.198
9CI-PF3ONS	756426-58-1	0.258	G8413-FS(0)	1.000	5/5/2021	0.0191	0.0395	0.198
11CI-PF3OUds	763051-92-9	0.273	G8413-FS(0)	1.000	5/5/2021	0.0207	0.0593	0.198

mw6/20/21

Analyzed by: Schumitz, Denise
 Printed: 5/18/2021



6

Project Client: CH2M
 Project Name: CTO-4041: NAS Whidbey Island, Seaplane Base
 Project No.: 100146377

Client ID WI-SP-5B02-04H05

Battelle ID G8416-FS
 Sample Type SA
 Collection Date 04/15/2021
 Extraction Date 04/27/2021
 Analytical Instrument Sciex 6500+ (AE) LC/MS/MS
 % Moisture 14.90
 Matrix SOIL
 Sample Size 5.060
 Size Unit-Basis g

Analyte	CAS No.	Result (ng/g_Dry)	Extract ID	DF	Analysis Date	DL	LOD	LOQ
PFHxA	307-24-4	0.0791 U	G8416-FS(0)	1.000	5/5/2021	0.0279	0.0791	0.198
PFHpA	375-85-9	0.0298 J	G8416-FS(0)	1.000	5/5/2021	0.0200	0.0593	0.198
PFOA	335-67-1	0.258	G8416-FS(0)	1.000	5/5/2021	0.0240	0.0791	0.198
PFNA	375-95-1	0.125 J	G8416-FS(0)	1.000	5/5/2021	0.0194	0.0395	0.198
PFDA	335-76-2	0.0569 J	G8416-FS(0)	1.000	5/5/2021	0.0183	0.0395	0.198
PFUnA	2058-94-8	0.0190 J	G8416-FS(0)	1.000	5/5/2021	0.0181	0.0395	0.198
PFDoA	307-55-1	0.0791 U	G8416-FS(0)	1.000	5/5/2021	0.0242	0.0791	0.198
PFTrDA	72629-94-8	0.0395 U	G8416-FS(0)	1.000	5/5/2021	0.0111	0.0395	0.198
PFTeDA	376-06-7	0.0988 U	G8416-FS(0)	1.000	5/5/2021	0.0427	0.0988	0.198
NMeFOSAA	2355-31-9	0.0988 U	G8416-FS(0)	1.000	5/5/2021	0.0403	0.0988	0.198
NEtFOSAA	2991-50-6	0.0791 U	G8416-FS(0)	1.000	5/5/2021	0.0296	0.0791	0.198
PFBS	375-73-5	0.0395 U	G8416-FS(0)	1.000	5/5/2021	0.0138	0.0395	0.198
PFHxS	355-46-4	0.598	G8416-FS(0)	1.000	5/5/2021	0.0319	0.0791	0.198
PFOS	1763-23-1	9.24	G8416-FS(0)	1.000	5/5/2021	0.0274	0.0791	0.198
HFPO-DA	13252-13-6	0.0791 U	G8416-FS(0)	1.000	5/5/2021	0.0253	0.0791	0.198
Adona	919005-14-4	0.0791 U	G8416-FS(0)	1.000	5/5/2021	0.0328	0.0791	0.198
9Cl-PF3ONS	756426-58-1	0.0395 U	G8416-FS(0)	1.000	5/5/2021	0.0191	0.0395	0.198
11Cl-PF3OUdS	763051-92-9	0.0593 U	G8416-FS(0)	1.000	5/5/2021	0.0207	0.0593	0.198

MW6/20/21

Analyzed by: Schumitz, Denise
 Printed: 5/18/2021



7

Project Client: CH2M
 Project Name: CTO-4041: NAS Whidbey Island, Seaplane Base
 Project No.: 100146377

Client ID WI-SP-5B03-0808H

Battelle ID G8417-FS
 Sample Type SA
 Collection Date 04/16/2021
 Extraction Date 04/27/2021
 Analytical Instrument Sciex 6500+ (AE) LC/MS/MS
 % Moisture 13.66
 Matrix SOIL
 Sample Size 5.090
 Size Unit-Basis g

Analyte	CAS No.	Result (ng/g_Dry)	Extract ID	DF	Analysis Date	DL	LOD	LOQ
PFHxA	307-24-4	0.0316 J	G8417-FS(0)	1.000	5/5/2021	0.0278	0.0786	0.196
PFHpA	375-85-9	0.0589 U	G8417-FS(0)	1.000	5/5/2021	0.0199	0.0589	0.196
PFOA	335-67-1	0.113 J	G8417-FS(0)	1.000	5/5/2021	0.0239	0.0786	0.196
PFNA	375-95-1	0.0393 U	G8417-FS(0)	1.000	5/5/2021	0.0193	0.0393	0.196
PFDA	335-76-2	0.0393 U	G8417-FS(0)	1.000	5/5/2021	0.0182	0.0393	0.196
PFUnA	2058-94-8	0.0393 U	G8417-FS(0)	1.000	5/5/2021	0.0180	0.0393	0.196
PFDoA	307-55-1	0.0786 U	G8417-FS(0)	1.000	5/5/2021	0.0240	0.0786	0.196
PFTrDA	72629-94-8	0.0393 U	G8417-FS(0)	1.000	5/5/2021	0.0110	0.0393	0.196
PFTeDA	376-06-7	0.0982 U	G8417-FS(0)	1.000	5/5/2021	0.0424	0.0982	0.196
NMeFOSAA	2355-31-9	0.0982 U	G8417-FS(0)	1.000	5/5/2021	0.0401	0.0982	0.196
NEtFOSAA	2991-50-6	0.0786 U	G8417-FS(0)	1.000	5/5/2021	0.0294	0.0786	0.196
PFBS	375-73-5	0.0289 J	G8417-FS(0)	1.000	5/5/2021	0.0138	0.0393	0.196
PFHxS	355-46-4	0.186 J	G8417-FS(0)	1.000	5/5/2021	0.0317	0.0786	0.196
PFOS	1763-23-1	2.26	G8417-FS(0)	1.000	5/5/2021	0.0272	0.0786	0.196
HFPO-DA	13252-13-6	0.0786 U	G8417-FS(0)	1.000	5/5/2021	0.0252	0.0786	0.196
Adona	919005-14-4	0.0786 U	G8417-FS(0)	1.000	5/5/2021	0.0326	0.0786	0.196
9CI-PF3ONS	756426-58-1	0.0393 U	G8417-FS(0)	1.000	5/5/2021	0.0189	0.0393	0.196
11CI-PF3OUds	763051-92-9	0.0589 U	G8417-FS(0)	1.000	5/5/2021	0.0206	0.0589	0.196

nw 6/20/21

Analyzed by: Schumitz, Denise
 Printed: 5/18/2021

**DATA VALIDATION SUMMARY REPORT
NAS WHIDBEY ISLAND, WASHINGTON**

Client: CH2M HILL, Inc., Corvallis, Oregon
 SDG: 21-0524
 Laboratory: Battelle Norwell Operations, Norwell, Massachusetts
 Site: NAS Whidbey Island (NASWI), Seaplane Base, CTO-4041, Washington
 Date: June 20, 2021

PFAS			
EDS ID	Client Sample ID	Laboratory Sample ID	Matrix
1	WI-SP-GW72-0421	G8391-FS	Water
1MS	WI-SP-GW72-0421MS	G8392-FSMS	Water
1MSD	WI-SP-GW72-0421MSD	G8393-FSMSD	Water
2	WI-SP-EB01-GW-041721	G8394-FS	Water
3	WI-SP-GW71-0421	G8395-FS	Water
4	WI-SP-GW02-0421	G8396-FS	Water
5	WI-SP-GW02P-0421	G8397-FS	Water
6	WI-SP-FB01-041721	G8398-FS	Water
7	WI-SP-GW03-0421	G8399-FS	Water
8	WI-SP-GW01-0421	G8400-FS	Water
9	WI-SP-GW01N-0421	G8401-FS	Water
10	WI-SP-EB02-GW-041821	G8402-FS	Water
11	WI-SP-EB03-GW-041921	G8403-FS	Water
12	WI-SP-GW08-0421	G8404-FS	Water
13	WI-SP-GW04-0421	G8405-FS	Water
14	WI-SP-EB04-042021	G8406-FS	Water
15	WI-SP-FB02-042021	G8407-FS	Water
16	WI-SP-GW70-0421	G8408-FS	Water

A Stage 2B/4 data validation was performed on the analytical data for ten water samples, four aqueous equipment blank samples, and two aqueous field blank samples collected on April 16-20, 2021 by CH2M HILL at the NAS Whidbey Island site in Washington. The samples were analyzed under the Analysis of Perfluoroalkyl Substances in Environmental Samples by Liquid Chromatography and Tandem Mass Spectrometry (LC-MS/MS).

Specific method references are as follows:

Analysis
PFAS

Method References
Battelle SOP 5-369-08

The data have been validated according to the protocols and quality control (QC) requirements of the analytical method, the Final Sampling and Analysis Plan Per- and Polyfluoroalkyl Substances Site

Inspection Seaplane Base, Naval Air Station Whidbey Island, March 2021, the DoD Final General Data Validation Guidelines, November 2019, including the following Module:

- The Department of Defense (DoD) Data Validation Guidelines Module 3, Data Validation Procedure for Per- and Polyfluoroalkyl Substances Analysis by Quality Systems Manual for Environmental Laboratories (QSM) Table B-15, May 2020;
- and the reviewer's professional judgment.

The following data quality indicators were reviewed for this report:

PFAS

- Date Completeness, Case Narrative & Custody Documentation
- Holding times
- Liquid Chromatography/Mass Spectrometry (LC/MS) Tuning
- Initial and continuing calibration summaries
- Method blank and field QC blank contamination
- Surrogate Spike recoveries
- Laboratory Fortified Blank (LFB)
- Matrix Spike/Matrix Spike Duplicate (MS/MSD) recoveries
- Internal standard area and retention time summary forms
- Target Compound Identification
- Compound Quantitation
- Field Duplicate sample precision

A Stage 2B/4 data validation was performed with this review including a recalculation of 10% of the detected results in the samples.

Data Usability Assessment

There were serious deficiencies of data. Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.

- PFTeDA was qualified (X) in one sample due to a severely low surrogate recovery.

The remaining data are acceptable for the intended purposes as qualified for the deficiencies detailed in this report.

Please note that any results qualified (U) due to blank contamination may be then qualified (J) due to another action. Therefore, the results may be qualified (UJ) due to the culmination of the blank contaminations and actions from other exceedances of QC criteria.

Polyfluoroalkyl Substances (PFAS)

Data Completeness, Case Narrative & Custody Documentation

- The case narrative and chain-of-custody documentation were included in the data package as required. All criteria were met.

Holding Times

- All samples were extracted within 14 days for water samples and analyzed within 28 days.

LC/MS Tuning

- All criteria were met.

Initial Calibration

- All relative standard deviation (%RSD) and/or correlation coefficients criteria were met.

Continuing Calibration

- All percent recovery (%R) criteria were met.

Method Blank

- The method blanks were free of contamination.

Field QC Blank

- Field QC results are summarized below.

Blank ID	Compound	Conc. ng/L	Qualifier	Affected Samples
WI-SP-EB01-GW-041721	None - ND	-	-	-
WI-SP-FB01-041721	None - ND	-	-	-
WI-SP-EB02-GW-041821	None - ND	-	-	-
WI-SP-EB03-GW-041921	PFBS	1.29	None	Associated Samples ND or >5X
WI-SP-EB04-042021	None - ND	-	-	-
WI-SP-FB02-042021	None - ND	-	-	-

Surrogate Spike Recoveries

- All samples exhibited acceptable surrogate percent recoveries (%R) except for the following.

EDS Sample	Surrogate	%R	Qualifier
8	13C2-PFD _o A	23%	UJ - Associated Cmpd
	13C2-PFTeDA	11%	UJ - Associated Cmpd
	d5-EtFOSAA	49%	UJ - Associated Cmpd
9	13C2-PFD _o A	27%	UJ - Associated Cmpd
	13C2-PFTeDA	8%	X - Associated Cmpd
16	13C5-PFH _x A	45%	UJ - Associated Cmpd
	d3-MeFOSAA	47%	UJ - Associated Cmpd
	13C3-PFBS	36%	UJ - Associated Cmpd

Laboratory Fortified Blank (LFB)

- The LFB samples exhibited acceptable percent recoveries (%R).

Matrix Spike/Matrix Spike Duplicate (MS/MSD) Recoveries

- The MS/MSD samples exhibited acceptable percent recoveries (%R) and relative percent differences (RPD) except for the following.

MS/MSD Sample	Compound	MS %R/MSD %R/RPD	Qualifier	Affected Samples
1	PFBS	145%/153%/OK	J	1

Internal Standard (IS) Area Performance

- All internal standards met response and retention time (RT) criteria.

Target Compound Identification

- All mass spectra and quantitation criteria were met.

Compound Quantitation

- Several samples were analyzed at various dilutions due to high concentrations of target compounds. The reporting limits were adjusted accordingly. No action was required.

Field Duplicate Sample Precision

- Field duplicate results are summarized below. The precision was acceptable.

Compound	WI-SP-GW02-0421 ng/L	WI-SP-GW02P-0421 ng/L	RPD	Qualifier
PFHxA	249	258	4%	None
PFHpA	105	118	12%	
PFOA	123	124	1%	
PFNA	18.4	19.0	3%	
PFDA	0.439U	1.47	NC	
PFBS	153	150	2%	
PFHxS	847	833	2%	
PFOS	436	568	26%	

Please contact the undersigned at (561) 475-2000 if you have any questions or need further information.

Signed: Nancy Weaver
Nancy Weaver
Senior Chemist

Dated: 6/21/21

Qualifier	Definition
U	The analyte was not detected and was reported as less than the LOD or as defined by the customer. The LOD has been adjusted for any dilution or concentration of the sample.
J	The reported result was an estimated value with an unknown bias.
J+	The result was an estimated quantity, but the result may be biased high.
J-	The result was an estimated quantity, but the result may be biased low.
N	The analysis indicates the presence of an analyte for which there was presumptive evidence to make a "tentative identification."
NJ	The analyte has been "tentatively identified" or "presumptively" as present and the associated numerical value was the estimated concentration in the sample.
UJ	The analyte was not detected and was reported as less than the LOD or as defined by the customer. However, the associated numerical value is approximate.
X	<p>The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided.</p> <p>Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.</p>



Project Client: CH2M
 Project Name: CTO-4041: NAS Whidbey Island, Seaplane Base
 Project No.: 100146377

Client ID WI-SP-GW72-0421

Battelle ID G8391-FS
 Sample Type SA
 Collection Date 04/17/2021
 Extraction Date 04/26/2021
 Analytical Instrument Sciex 6500+ (AE) LC/MS/MS
 % Moisture NA
 Matrix GW
 Sample Size 0.280
 Size Unit-Basis L

Analyte	CAS No.	Result (ng/L)	Extract ID	DF	Analysis Date	DL	LOD	LOQ
PFHxA	307-24-4	124	G8391-FS(0)	1.000	5/17/2021	0.471	1.34	4.46
PFHpA	375-85-9	33.7	G8391-FS(0)	1.000	5/17/2021	0.235	0.893	4.46
PFOA	335-67-1	68.3	G8391-FS(0)	1.000	5/17/2021	0.456	1.34	4.46
PFNA	375-95-1	5.53	G8391-FS(0)	1.000	5/17/2021	0.276	0.893	4.46
PFDA	335-76-2	9.04	G8391-FS(0)	1.000	5/17/2021	0.127	0.446	4.46
PFUnA	2058-94-8	0.446 U	G8391-FS(0)	1.000	5/17/2021	0.196	0.446	4.46
PFDoA	307-55-1	0.446 U	G8391-FS(0)	1.000	5/17/2021	0.171	0.446	4.46
PFTrDA	72629-94-8	0.446 U	G8391-FS(0)	1.000	5/17/2021	0.138	0.446	4.46
PFTeDA	376-06-7	1.79 U	G8391-FS(0)	1.000	5/17/2021	0.654	1.79	4.46
NMeFOSAA	2355-31-9	3.00 J	G8391-FS(0)	1.000	5/17/2021	0.313	0.893	4.46
NEtFOSAA	2991-50-6	0.893 U	G8391-FS(0)	1.000	5/17/2021	0.446	0.893	4.46
PFBS	375-73-5	113 J	G8391-FS(0)	1.000	5/17/2021	0.129	0.446	4.46
PFHxS	355-46-4	21.1	G8391-FS(0)	1.000	5/17/2021	0.100	0.357	4.46
PFOS	1763-23-1	82.9	G8391-FS(0)	1.000	5/17/2021	0.390	0.893	4.46
HFPO-DA	13252-13-6	0.446 U	G8391-FS(0)	1.000	5/17/2021	0.221	0.446	4.46
Adona	919005-14-4	0.893 U	G8391-FS(0)	1.000	5/17/2021	0.237	0.893	4.46
9Cl-PF3ONS	756426-58-1	0.893 U	G8391-FS(0)	1.000	5/17/2021	0.239	0.893	4.46
11Cl-PF3OUdS	763051-92-9	0.446 U	G8391-FS(0)	1.000	5/17/2021	0.206	0.446	4.46

MSH

NW6/20/21

Analyzed by: Schumitz, Denise
Printed: 5/21/2021



2

Project Client: CH2M
 Project Name: CTO-4041: NAS Whidbey Island, Seaplane Base
 Project No.: 100146377

Client ID WI-SP-EB01-GW-041721

Battelle ID G8394-FS
 Sample Type SA
 Collection Date 04/17/2021
 Extraction Date 04/26/2021
 Analytical Instrument Sciex 6500+ (AE) LC/MS/MS
 % Moisture NA
 Matrix GW
 Sample Size 0.263
 Size Unit-Basis L

Analyte	CAS No.	Result (ng/L)	Extract ID	DF	Analysis Date	DL	LOD	LOQ
PFHxA	307-24-4	1.43 U	G8394-FS(0)	1.000	5/17/2021	0.501	1.43	4.75
PFHpA	375-85-9	0.951 U	G8394-FS(0)	1.000	5/17/2021	0.250	0.951	4.75
PFOA	335-67-1	1.43 U	G8394-FS(0)	1.000	5/17/2021	0.486	1.43	4.75
PFNA	375-95-1	0.951 U	G8394-FS(0)	1.000	5/17/2021	0.294	0.951	4.75
PFDA	335-76-2	0.475 U	G8394-FS(0)	1.000	5/17/2021	0.135	0.475	4.75
PFUxA	2058-94-8	0.475 U	G8394-FS(0)	1.000	5/17/2021	0.208	0.475	4.75
PFDoA	307-55-1	0.475 U	G8394-FS(0)	1.000	5/17/2021	0.183	0.475	4.75
PFTroA	72629-94-8	0.475 U	G8394-FS(0)	1.000	5/17/2021	0.146	0.475	4.75
PFTeDA	376-06-7	1.90 U	G8394-FS(0)	1.000	5/17/2021	0.697	1.90	4.75
NMeFOSAA	2355-31-9	0.951 U	G8394-FS(0)	1.000	5/17/2021	0.333	0.951	4.75
NEFOSAA	2991-50-6	0.951 U	G8394-FS(0)	1.000	5/17/2021	0.475	0.951	4.75
PFBS	375-73-5	0.475 U	G8394-FS(0)	1.000	5/17/2021	0.137	0.475	4.75
PFHxS	355-46-4	0.380 U	G8394-FS(0)	1.000	5/17/2021	0.106	0.380	4.75
PFOS	1763-23-1	0.951 U	G8394-FS(0)	1.000	5/17/2021	0.415	0.951	4.75
HFPO-DA	13252-13-6	0.475 U	G8394-FS(0)	1.000	5/17/2021	0.236	0.475	4.75
Adona	919005-14-4	0.951 U	G8394-FS(0)	1.000	5/17/2021	0.292	0.951	4.75
9Cl-PF3ONS	756426-58-1	0.951 U	G8394-FS(0)	1.000	5/17/2021	0.255	0.951	4.75
11Cl-PF3OUdS	763051-92-9	0.475 U	G8394-FS(0)	1.000	5/17/2021	0.220	0.475	4.75

MW6/20/21

Analyzed by: Schumitz, Denise
 Printed: 5/21/2021



3

Project Client: CH2M
 Project Name: CTO-4041: NAS Whidbey Island, Seaplane Base
 Project No.: 100146377

Client ID WI-SP-GW71-0421

Battelle ID G8395-FS
 Sample Type SA
 Collection Date 04/17/2021
 Extraction Date 04/26/2021
 Analytical Instrument Sciex 6500+ (AE) LC/MS/MS
 % Moisture NA
 Matrix GW
 Sample Size 0.259
 Size Unit-Basis L

Analyte	CAS No.	Result (ng/L)	Extract ID	DF	Analysis Date	DL	LOD	LOQ
PFHxA	307-24-4	120	G8395-FS(0)	1.000	5/17/2021	0.509	1.45	4.83
PFHpA	375-85-9	30.2	G8395-FS(0)	1.000	5/17/2021	0.254	0.965	4.83
PFOA	335-67-1	81.8	G8395-FS(0)	1.000	5/17/2021	0.493	1.45	4.83
PFNA	375-95-1	0.965 U	G8395-FS(0)	1.000	5/17/2021	0.298	0.965	4.83
PFDA	335-76-2	0.483 U	G8395-FS(0)	1.000	5/17/2021	0.137	0.483	4.83
PFUnA	2058-94-8	0.483 U	G8395-FS(0)	1.000	5/17/2021	0.211	0.483	4.83
PFDoA	307-55-1	0.483 U	G8395-FS(0)	1.000	5/17/2021	0.185	0.483	4.83
PFTrDA	72629-94-8	0.483 U	G8395-FS(0)	1.000	5/17/2021	0.149	0.483	4.83
PFTeDA	376-06-7	1.93 U	G8395-FS(0)	1.000	5/17/2021	0.708	1.93	4.83
NMeFOSAA	2355-31-9	0.965 U	G8395-FS(0)	1.000	5/17/2021	0.338	0.965	4.83
NETFOSAA	2991-50-6	0.965 U	G8395-FS(0)	1.000	5/17/2021	0.483	0.965	4.83
PFBS	375-73-5	19.3	G8395-FS(0)	1.000	5/17/2021	0.139	0.483	4.83
PFHxS	355-46-4	42.5	G8395-FS(0)	1.000	5/17/2021	0.108	0.386	4.83
PFOS	1763-23-1	21.1	G8395-FS(0)	1.000	5/17/2021	0.422	0.965	4.83
HFPO-DA	13252-13-6	0.483 U	G8395-FS(0)	1.000	5/17/2021	0.239	0.483	4.83
Adona	919005-14-4	0.965 U	G8395-FS(0)	1.000	5/17/2021	0.256	0.965	4.83
9CI-PF3ONS	756426-58-1	0.965 U	G8395-FS(0)	1.000	5/17/2021	0.259	0.965	4.83
11CI-PF3OUdS	763051-92-9	0.483 U	G8395-FS(0)	1.000	5/17/2021	0.223	0.483	4.83

5/21/2021

Analyzed by: Schumitz, Denise
 Printed: 5/21/2021



4

Project Client: CH2M
 Project Name: CTO-4041: NAS Whidbey Island, Seaplane Base
 Project No.: 100146377

Client ID WI-SP-GW02-0421

Battelle ID G8396-FS
 Sample Type SA
 Collection Date 04/18/2021
 Extraction Date 04/26/2021
 Analytical Instrument Sciex 6500+ (AE) LC/MS/MS
 % Moisture NA
 Matrix GW
 Sample Size 0.285
 Size Unit-Basis L

Analyte	CAS No.	Result (ng/L)	Extract ID	DF	Analysis Date	DL	LOD	LOQ
PFHxA	307-24-4	249	G8396-FS(0)	1.000	5/17/2021	0.462	1.32	4.39
PFHpA	375-85-9	105	G8396-FS(0)	1.000	5/17/2021	0.231	0.877	4.39
PFOA	335-67-1	123	G8396-FS(0)	1.000	5/17/2021	0.448	1.32	4.39
PFNA	375-95-1	18.4	G8396-FS(0)	1.000	5/17/2021	0.271	0.877	4.39
PFDA	335-76-2	0.439 U	G8396-FS(0)	1.000	5/17/2021	0.125	0.439	4.39
PFUnA	2058-94-8	0.439 U	G8396-FS(0)	1.000	5/17/2021	0.192	0.439	4.39
PFDoA	307-55-1	0.439 U	G8396-FS(0)	1.000	5/17/2021	0.168	0.439	4.39
PFTriDA	72629-94-8	0.439 U	G8396-FS(0)	1.000	5/17/2021	0.135	0.439	4.39
PFTeDA	376-06-7	1.75 U	G8396-FS(0)	1.000	5/17/2021	0.643	1.75	4.39
NMeFOSAA	2355-31-9	0.877 U	G8396-FS(0)	1.000	5/17/2021	0.307	0.877	4.39
NETFOSAA	2991-50-6	0.877 U	G8396-FS(0)	1.000	5/17/2021	0.439	0.877	4.39
PFBS	375-73-3	153	G8396-FS(0)	1.000	5/17/2021	0.126	0.439	4.39
PFHxS	355-46-4	847	G8396-FS(0)	1.000	5/17/2021	0.0982	0.351	4.39
PFOS	1763-23-1	436 ✓	G8396-FS-D(3)	5.000	5/18/2021	1.92	4.39	21.9
HFPO-DA	13252-13-6	0.439 U	G8396-FS(0)	1.000	5/17/2021	0.218	0.439	4.39
Adona	919005-14-4	0.877 U	G8396-FS(0)	1.000	5/17/2021	0.232	0.877	4.39
9Cl-PF3ONS	756426-58-1	0.877 U	G8396-FS(0)	1.000	5/17/2021	0.235	0.877	4.39
11Cl-PF3OUdS	763051-92-9	0.439 U	G8396-FS(0)	1.000	5/17/2021	0.203	0.439	4.39



5

Project Client: CH2M
 Project Name: CTO-4041: NAS Whidbey Island, Seaplane Base
 Project No.: 100146377

Client ID WI-SP-GW02P-0421

Battelle ID G8397-FS
 Sample Type SA
 Collection Date 04/18/2021
 Extraction Date 04/26/2021
 Analytical Instrument Sciex 6500+ (AE) LC/MS/MS
 % Moisture NA
 Matrix GW
 Sample Size 0.283
 Size Unit-Basis L

Analyte	CAS No.	Result (ng/L)	Extract ID	DF	Analysis Date	DL	LOD	LOQ
PFHxA	307-24-4	258	G8397-FS(0)	1.000	5/18/2021	0.466	1.33	4.42
PFHpA	375-85-9	118	G8397-FS(0)	1.000	5/18/2021	0.232	0.883	4.42
PFOA	335-67-1	124	G8397-FS(0)	1.000	5/18/2021	0.451	1.33	4.42
PFNA	375-95-1	19.0	G8397-FS(0)	1.000	5/18/2021	0.273	0.883	4.42
PFDA	335-76-2	1.47 J	G8397-FS(0)	1.000	5/18/2021	0.125	0.442	4.42
PFUnA	2058-94-8	0.442 U	G8397-FS(0)	1.000	5/18/2021	0.193	0.442	4.42
PFDoA	307-55-1	0.442 U	G8397-FS(0)	1.000	5/18/2021	0.170	0.442	4.42
PFTrDA	72629-94-8	0.442 U	G8397-FS(0)	1.000	5/18/2021	0.136	0.442	4.42
PFTeDA	376-06-7	1.77 U	G8397-FS(0)	1.000	5/18/2021	0.648	1.77	4.42
NMeFOSAA	2355-31-9	0.883 U	G8397-FS(0)	1.000	5/18/2021	0.309	0.883	4.42
NEFOSAA	2991-50-6	0.883 U	G8397-FS(0)	1.000	5/18/2021	0.442	0.883	4.42
PFBS	375-73-5	150	G8397-FS(0)	1.000	5/18/2021	0.127	0.442	4.42
PFHxS	355-46-4	833	G8397-FS(0)	1.000	5/18/2021	0.0989	0.353	4.42
PFOS	1763-23-1	568	G8397-FS-D(3)	5.000	5/18/2021	1.93	4.42	22.1
HFPO-DA	13252-13-6	0.442 U	G8397-FS(0)	1.000	5/18/2021	0.219	0.442	4.42
Adona	919005-14-4	0.883 U	G8397-FS(0)	1.000	5/18/2021	0.234	0.883	4.42
9CI-PF3ONS	756426-58-1	0.883 U	G8397-FS(0)	1.000	5/18/2021	0.237	0.883	4.42
11CI-PF3OUdS	763051-92-9	0.442 U	G8397-FS(0)	1.000	5/18/2021	0.204	0.442	4.42

MW6/20/21

Analyzed by: Schumitz, Denise
 Printed: 5/21/2021



6

Project Client: CH2M
 Project Name: CTO-4041: NAS Whidbey Island, Seaplane Base
 Project No.: 100146377

Client ID WI-SP-FB01-041721

Battelle ID G8398-FS
 Sample Type SA
 Collection Date 04/17/2021
 Extraction Date 04/26/2021
 Analytical Instrument Sciex 6500+ (AE) LC/MS/MS
 % Moisture NA
 Matrix GW
 Sample Size 0.267
 Size Unit-Basis L

Analyte	CAS No.	Result (ng/L)	Extract ID	DF	Analysis Date	DL	LOD	LOQ
PFHxA	307-24-4	1.40 U	G8398-FS(0)	1.000	5/17/2021	0.493	1.40	4.68
PFHpA	375-85-9	0.936 U	G8398-FS(0)	1.000	5/17/2021	0.246	0.936	4.68
PFOA	335-67-1	1.40 U	G8398-FS(0)	1.000	5/17/2021	0.478	1.40	4.68
PFNA	375-95-1	0.936 U	G8398-FS(0)	1.000	5/17/2021	0.289	0.936	4.68
PFDA	335-76-2	0.468 U	G8398-FS(0)	1.000	5/17/2021	0.133	0.468	4.68
PFUnA	2058-94-8	0.468 U	G8398-FS(0)	1.000	5/17/2021	0.205	0.468	4.68
PFDoA	307-55-1	0.468 U	G8398-FS(0)	1.000	5/17/2021	0.180	0.468	4.68
PFTrDA	72629-94-8	0.468 U	G8398-FS(0)	1.000	5/17/2021	0.144	0.468	4.68
PFTeDA	376-06-7	1.87 U	G8398-FS(0)	1.000	5/17/2021	0.686	1.87	4.68
NMeFOSAA	2355-31-9	0.936 U	G8398-FS(0)	1.000	5/17/2021	0.328	0.936	4.68
NEFOSAA	2991-50-6	0.936 U	G8398-FS(0)	1.000	5/17/2021	0.468	0.936	4.68
PFBS	375-73-3	0.468 U	G8398-FS(0)	1.000	5/17/2021	0.135	0.468	4.68
PFHxS	355-46-4	0.375 U	G8398-FS(0)	1.000	5/17/2021	0.105	0.375	4.68
PFOS	1763-23-1	0.936 U	G8398-FS(0)	1.000	5/17/2021	0.409	0.936	4.68
HFPO-DA	13252-13-6	0.468 U	G8398-FS(0)	1.000	5/17/2021	0.232	0.468	4.68
Adona	919005-14-4	0.936 U	G8398-FS(0)	1.000	5/17/2021	0.248	0.936	4.68
9CI-PF3ONS	756426-58-1	0.936 U	G8398-FS(0)	1.000	5/17/2021	0.251	0.936	4.68
11CI-PF3OUdS	763051-92-9	0.468 U	G8398-FS(0)	1.000	5/17/2021	0.216	0.468	4.68

5/21/2021

Analyzed by: Schumitz, Denise
 Printed: 5/21/2021



7

Project Client: CH2M
 Project Name: CTO-4041: NAS Whidbey Island, Seaplane Base
 Project No.: 100146377

Client ID WI-SP-GW03-0421

Battelle ID G8399-FS
 Sample Type SA
 Collection Date 04/18/2021
 Extraction Date 04/26/2021
 Analytical Instrument Sciex 6500+ (AE) LC/MS/MS
 % Moisture NA
 Matrix GW
 Sample Size 0.289
 Size Unit-Basis L

Analyte	CAS No.	Result (ng/L)	Extract ID	DF	Analysis Date	DL	LOD	LOQ
PFHxA	307-24-4	149	G8399-FS(0)	1.000	5/18/2021	0.456	1.30	4.33
PFHpA	375-85-9	62.9	G8399-FS(0)	1.000	5/18/2021	0.228	0.865	4.33
PFOA	335-67-1	114	G8399-FS(0)	1.000	5/18/2021	0.442	1.30	4.33
PFNA	375-95-1	9.43	G8399-FS(0)	1.000	5/18/2021	0.267	0.865	4.33
PFDA	335-76-2	0.433 U	G8399-FS(0)	1.000	5/18/2021	0.123	0.433	4.33
PFUnA	2058-94-8	0.433 U	G8399-FS(0)	1.000	5/18/2021	0.189	0.433	4.33
PFDoA	307-55-1	0.433 U	G8399-FS(0)	1.000	5/18/2021	0.166	0.433	4.33
PFTTrDA	72629-94-8	0.433 U	G8399-FS(0)	1.000	5/18/2021	0.133	0.433	4.33
PFTeDA	376-06-7	1.73 U	G8399-FS(0)	1.000	5/18/2021	0.634	1.73	4.33
NMeFOSAA	2355-31-9	0.865 U	G8399-FS(0)	1.000	5/18/2021	0.303	0.865	4.33
NEtFOSAA	2991-50-6	0.865 U	G8399-FS(0)	1.000	5/18/2021	0.433	0.865	4.33
PFBS	375-73-3	70.2	G8399-FS(0)	1.000	5/18/2021	0.125	0.433	4.33
PFHxS	355-46-4	508	G8399-FS(0)	1.000	5/18/2021	0.0969	0.346	4.33
PFOS	1763-23-1	3220 ✓	G8399-FS-D(3)	5.000	5/18/2021	1.89	4.33	21.6
HFPO-DA	13252-13-6	0.433 U	G8399-FS(0)	1.000	5/18/2021	0.215	0.433	4.33
Adona	919005-14-4	0.865 U	G8399-FS(0)	1.000	5/18/2021	0.229	0.865	4.33
9CI-PF3ONS	756426-58-1	0.865 U	G8399-FS(0)	1.000	5/18/2021	0.232	0.865	4.33
11CI-PF3OUdS	763051-92-9	0.433 U	G8399-FS(0)	1.000	5/18/2021	0.200	0.433	4.33

5/6/2021
 Analyzed by: Schumitz, Denise
 Printed: 5/21/2021



8

Project Client: CH2M
 Project Name: CTO-4041: NAS Whidbey Island, Seaplane Base
 Project No.: 100146377

Client ID WI-SP-GW01-0421

Battelle ID G8400-FS
 Sample Type SA
 Collection Date 04/16/2021
 Extraction Date 04/26/2021
 Analytical Instrument Sciex 6500+ (AE) LC/MS/MS
 % Moisture NA
 Matrix GW
 Sample Size 0.256
 Size Unit-Basis L

Analyte	CAS No.	Result (ng/L)	Extract ID	DF	Analysis Date	DL	LOD	LOQ
PFHxA	307-24-4	245	G8400-FS(0)	1.000	5/18/2021	0.515	1.46	4.88
PFHpA	375-85-9	88.0	G8400-FS(0)	1.000	5/18/2021	0.257	0.977	4.88
PFOA	335-67-1	131	G8400-FS(0)	1.000	5/18/2021	0.499	1.46	4.88
PFNA	375-95-1	19.1	G8400-FS(0)	1.000	5/18/2021	0.302	0.977	4.88
PFDA	335-76-2	14.5	G8400-FS(0)	1.000	5/18/2021	0.139	0.488	4.88
PFUnA	2058-94-8	0.488 U	G8400-FS(0)	1.000	5/18/2021	0.214	0.488	4.88
PFDoA	307-55-1	0.488 <i>Y UJ</i>	G8400-FS(0)	1.000	5/18/2021	0.188	0.488	4.88 <i>SSL</i>
PFTroA	72629-94-8	0.488 U	G8400-FS(0)	1.000	5/18/2021	0.150	0.488	4.88 <i>SSL</i>
PFTeDA	376-06-7	1.95 <i>Y UJ</i>	G8400-FS(0)	1.000	5/18/2021	0.716	1.95	4.88 <i>SSL</i>
NMeFOSAA	2355-31-9	0.977 U	G8400-FS(0)	1.000	5/18/2021	0.342	0.977	4.88 <i>SSL</i>
NEtFOSAA	2991-50-6	0.977 <i>Y UJ</i>	G8400-FS(0)	1.000	5/18/2021	0.488	0.977	4.88 <i>SSL</i>
PFBS	375-73-5	122	G8400-FS(0)	1.000	5/18/2021	0.141	0.488	4.88
PFHxS	355-46-4	539	G8400-FS(0)	1.000	5/18/2021	0.109	0.391	4.88
PFOS	1763-23-1	2330	G8400-FS-D(3)	5.000	5/18/2021	2.13	4.88	24.4
HFPO-DA	13252-13-6	0.488 U	G8400-FS(0)	1.000	5/18/2021	0.242	0.488	4.88
Adona	919005-14-4	0.977 U	G8400-FS(0)	1.000	5/18/2021	0.259	0.977	4.88
9Cl-PF3ONS	756426-58-1	0.977 U	G8400-FS(0)	1.000	5/18/2021	0.262	0.977	4.88
11Cl-PF3OUdS	763051-92-9	0.488 U	G8400-FS(0)	1.000	5/18/2021	0.226	0.488	4.88

MW6/20/21

Analyzed by: Schumitz, Denise
 Printed: 5/21/2021



8

Project Client: CH2M
 Project Name: CTO-4041: NAS Whidbey Island, Seaplane Base
 Project No.: 100146377

Client ID WI-SP-GW01-0421

Battelle ID G8400-FS
 Sample Type SA
 Collection Date 04/16/2021
 Extraction Date 04/26/2021
 Analytical Instrument Sciex 6500+ (AE) LC/MS/MS

<i>Surrogate Recoveries (%)</i>	<i>Recovery</i>	<i>Extract ID</i>	<i>Analysis Date</i>
13C5-PFHxA	80	G8400-FS(0)	5/18/2021
13C4-PFHpA	79	G8400-FS(0)	5/18/2021
13C8-PFOA	90	G8400-FS(0)	5/18/2021
13C9-PFNA	88	G8400-FS(0)	5/18/2021
13C6-PFDA	77	G8400-FS(0)	5/18/2021
13C7-PFUnA	54	G8400-FS(0)	5/18/2021
13C2-PFDoA	23	G8400-FS(0)	5/18/2021
13C2-PFTeDA	11	G8400-FS(0)	5/18/2021
d3-MeFOSAA	52	G8400-FS(0)	5/18/2021
d5-EtFOSAA	49	G8400-FS(0)	5/18/2021
13C3-PFBS	85	G8400-FS-D(3)	5/18/2021
13C3-PFHxS	93	G8400-FS-D(3)	5/18/2021
13C8-PFOS	97	G8400-FS-D(3)	5/18/2021
13C3-HFPO-DA	117	G8400-FS(0)	5/18/2021



9

Project Client: CH2M
 Project Name: CTO-4041: NAS Whidbey Island, Seaplane Base
 Project No.: 100146377

Client ID WI-SP-GW01N-0421

Battelle ID G8401-FS
 Sample Type SA
 Collection Date 04/16/2021
 Extraction Date 04/26/2021
 Analytical Instrument Sciex 6500+ (AE) LC/MS/MS
 % Moisture NA
 Matrix GW
 Sample Size 0.220
 Size Unit-Basis L

Analyte	CAS No.	Result (ng/L)	Extract ID	DF	Analysis Date	DL	LOD	LOQ
PFHxA	307-24-4	201	G8401-FS(0)	1.000	5/18/2021	0.599	1.70	5.68
PFHpA	375-85-9	88.1	G8401-FS(0)	1.000	5/18/2021	0.299	1.14	5.68
PFOA	335-67-1	134	G8401-FS(0)	1.000	5/18/2021	0.581	1.70	5.68
PFNA	375-95-1	16.7	G8401-FS(0)	1.000	5/18/2021	0.351	1.14	5.68
PFDA	335-76-2	8.35	G8401-FS(0)	1.000	5/18/2021	0.161	0.568	5.68
PFUnA	2058-94-8	0.568 U	G8401-FS(0)	1.000	5/18/2021	0.249	0.568	5.68
PFDoA	307-55-1	0.568 U	G8401-FS(0)	1.000	5/18/2021	0.218	0.568	5.68
PFTTrDA	72629-94-8	0.568 U	G8401-FS(0)	1.000	5/18/2021	0.175	0.568	5.68
PFTeDA	376-06-7	2.27 U	G8401-FS(0)	1.000	5/18/2021	0.833	2.27	5.68
NMeFOSAA	2355-31-9	1.14 U	G8401-FS(0)	1.000	5/18/2021	0.398	1.14	5.68
NEtFOSAA	2991-50-6	1.14 U	G8401-FS(0)	1.000	5/18/2021	0.568	1.14	5.68
PFBS	375-73-5	50.2	G8401-FS(0)	1.000	5/18/2021	0.164	0.568	5.68
PFHxS	355-46-4	764	G8401-FS(0)	1.000	5/18/2021	0.127	0.455	5.68
PFOS	1763-23-1	2270 U	G8401-FS-D(3)	5.000	5/18/2021	2.48	5.68	28.4
HFPO-DA	13252-13-6	0.568 U	G8401-FS(0)	1.000	5/18/2021	0.282	0.568	5.68
Adona	919005-14-4	1.14 U	G8401-FS(0)	1.000	5/18/2021	0.301	1.14	5.68
9CI-PF3ONS	756426-58-1	1.14 U	G8401-FS(0)	1.000	5/18/2021	0.305	1.14	5.68
11CI-PF3OUdS	763051-92-9	0.568 U	G8401-FS(0)	1.000	5/18/2021	0.263	0.568	5.68

SSL
 SSL

MW 6/20/21

Analyzed by: Schumitz, Denise
 Printed: 5/21/2021



9

Project Client: CH2M
 Project Name: CTO-4041: NAS Whidbey Island, Seaplane Base
 Project No.: 100146377

Client ID WI-SP-GW01N-0421

Battelle ID G8401-FS
 Sample Type SA
 Collection Date 04/16/2021
 Extraction Date 04/26/2021
 Analytical Instrument Sciex 6500+ (AE) LC/MS/MS

Surrogate Recoveries (%)	Recovery	Extract ID	Analysis
			Date
13C5-PFHxA	74	G8401-FS(0)	5/18/2021
13C4-PFHpA	76	G8401-FS(0)	5/18/2021
13C8-PFOA	92	G8401-FS(0)	5/18/2021
13C9-PFNA	87	G8401-FS(0)	5/18/2021
13C6-PFDA	81	G8401-FS(0)	5/18/2021
13C7-PFUnA	61	G8401-FS(0)	5/18/2021
13C2-PFDoA	27	G8401-FS(0)	5/18/2021
13C2-PFTaDA	8	G8401-FS(0)	5/18/2021
d3-MeFOSAA	54	G8401-FS(0)	5/18/2021
d5-ttFOSAA	61	G8401-FS(0)	5/18/2021
13C3-PFBS	82	G8401-FS-D(3)	5/18/2021
13C3-PFHxS	89	G8401-FS-D(3)	5/18/2021
13C8-PFOS	89	G8401-FS-D(3)	5/18/2021
13C3-HFPO-DA	113	G8401-FS(0)	5/18/2021



10

Project Client: CH2M
 Project Name: CTO-4041: NAS Whidbey Island, Seaplane Base
 Project No.: 100146377

Client ID WI-SP-EB02-GW-041821

Battelle ID G8402-FS
 Sample Type SA
 Collection Date 04/18/2021
 Extraction Date 04/26/2021
 Analytical Instrument Sciex 6500+ (AE) LC/MS/MS
 % Moisture NA
 Matrix GW
 Sample Size 0.268
 Size Unit-Basis L

Analyte	CAS No.	Result (ng/L)	Extract ID	DF	Analysis Date	DL	LOD	LOQ
PFHxA	307-24-4	1.40 U	G8402-FS(0)	1.000	5/18/2021	0.492	1.40	4.66
PFHpA	375-85-9	0.933 U	G8402-FS(0)	1.000	5/18/2021	0.245	0.933	4.66
PFOA	335-67-1	1.40 U	G8402-FS(0)	1.000	5/18/2021	0.477	1.40	4.66
PFNA	375-95-1	0.933 U	G8402-FS(0)	1.000	5/18/2021	0.288	0.933	4.66
PFDA	335-76-2	0.466 U	G8402-FS(0)	1.000	5/18/2021	0.132	0.466	4.66
PFUnA	2058-94-8	0.466 U	G8402-FS(0)	1.000	5/18/2021	0.204	0.466	4.66
PFDoA	307-55-1	0.466 U	G8402-FS(0)	1.000	5/18/2021	0.179	0.466	4.66
PFTTrDA	72629-94-8	0.466 U	G8402-FS(0)	1.000	5/18/2021	0.144	0.466	4.66
PFTeDA	376-06-7	1.87 U	G8402-FS(0)	1.000	5/18/2021	0.684	1.87	4.66
NMeFOSAA	2355-31-9	0.933 U	G8402-FS(0)	1.000	5/18/2021	0.326	0.933	4.66
NEtFOSAA	2991-50-6	0.933 U	G8402-FS(0)	1.000	5/18/2021	0.466	0.933	4.66
PFBS	375-73-5	0.466 U	G8402-FS(0)	1.000	5/18/2021	0.134	0.466	4.66
PFHxS	355-46-4	0.373 U	G8402-FS(0)	1.000	5/18/2021	0.104	0.373	4.66
PFOS	1763-23-1	0.933 U	G8402-FS(0)	1.000	5/18/2021	0.408	0.933	4.66
HFPO-DA	13252-13-6	0.466 U	G8402-FS(0)	1.000	5/18/2021	0.231	0.466	4.66
Adona	919005-14-4	0.933 U	G8402-FS(0)	1.000	5/18/2021	0.247	0.933	4.66
9Cl-PF3ONS	756426-58-1	0.933 U	G8402-FS(0)	1.000	5/18/2021	0.250	0.933	4.66
11Cl-PF3OUdS	763051-92-9	0.466 U	G8402-FS(0)	1.000	5/18/2021	0.215	0.466	4.66



Project Client: CH2M
 Project Name: CTO-4041: NAS Whidbey Island, Seaplane Base
 Project No.: 100146377

Client ID WI-SP-EB03-GW-041921

Battelle ID G8403-FS
 Sample Type SA
 Collection Date 04/19/2021
 Extraction Date 04/26/2021
 Analytical Instrument Sciex 6500+ (AE) LC/MS/MS
 % Moisture NA
 Matrix GW
 Sample Size 0.271
 Size Unit-Basis L

Analyte	CAS No.	Result (ng/L)	Extract ID	DF	Analysis Date	DL	LOD	LOQ
PFHxA	307-24-4	1.38 U	G8403-FS(0)	1.000	5/18/2021	0.486	1.38	4.61
PFHpA	375-85-0	0.923 U	G8403-FS(0)	1.000	5/18/2021	0.243	0.923	4.61
PFOA	335-67-1	1.38 U	G8403-FS(0)	1.000	5/18/2021	0.471	1.38	4.61
PFNA	375-95-1	0.923 U	G8403-FS(0)	1.000	5/18/2021	0.285	0.923	4.61
PFDA	335-76-2	0.461 U	G8403-FS(0)	1.000	5/18/2021	0.131	0.461	4.61
PFUnA	2058-94-8	0.461 U	G8403-FS(0)	1.000	5/18/2021	0.202	0.461	4.61
PFDoA	307-55-1	0.461 U	G8403-FS(0)	1.000	5/18/2021	0.177	0.461	4.61
PFTeDA	72629-94-8	0.461 U	G8403-FS(0)	1.000	5/18/2021	0.142	0.461	4.61
PFTeDA	376-06-7	1.85 U	G8403-FS(0)	1.000	5/18/2021	0.676	1.85	4.61
NMeFOSAA	2395-31-9	0.923 U	G8403-FS(0)	1.000	5/18/2021	0.323	0.923	4.61
NETFOSAA	2991-50-6	0.923 U	G8403-FS(0)	1.000	5/18/2021	0.461	0.923	4.61
PFBS	375-73-5	1.28 J	G8403-FS(0)	1.000	5/18/2021	0.133	0.461	4.61
PFHxS	355-46-4	0.369 U	G8403-FS(0)	1.000	5/18/2021	0.103	0.369	4.61
PFOS	1763-23-1	0.923 U	G8403-FS(0)	1.000	5/18/2021	0.403	0.923	4.61
HFPO-DA	13252-13-6	0.461 U	G8403-FS(0)	1.000	5/18/2021	0.229	0.461	4.61
Adona	919005-14-4	0.923 U	G8403-FS(0)	1.000	5/18/2021	0.244	0.923	4.61
9CI-PF3ONS	756426-58-1	0.923 U	G8403-FS(0)	1.000	5/18/2021	0.247	0.923	4.61
11CI-PF3OUdS	763051-92-9	0.461 U	G8403-FS(0)	1.000	5/18/2021	0.213	0.461	4.61

5/21/2021
 Analyzed by: Schumitz, Denise
 Printed: 5/21/2021



12

Project Client: CH2M
 Project Name: CTO-4041: NAS Whidbey Island, Seaplane Base
 Project No.: 100146377

Client ID WI-SP-GW08-0421

Battelle ID G8404-FS
 Sample Type SA
 Collection Date 04/19/2021
 Extraction Date 04/26/2021
 Analytical Instrument Sciex 6500+ (AE) LC/MS/MS
 % Moisture NA
 Matrix GW
 Sample Size 0.273
 Size Unit-Basis L

Analyte	CAS No.	Result (ng/L)	Extract ID	DF	Analysis Date	DL	LOD	LOQ
PFHxA	307-24-4	312	G8404-FS-D(3)	5.000	5/18/2021	2.41	6.87	22.9
PFHpA	375-85-9	438	G8404-FS(0)	1.000	5/18/2021	0.241	0.916	4.58
PFOA	335-67-1	329	G8404-FS(0)	1.000	5/18/2021	0.468	1.37	4.58
PFNA	375-95-1	24.4	G8404-FS(0)	1.000	5/18/2021	0.283	0.916	4.58
PFDA	335-76-2	0.458 U	G8404-FS(0)	1.000	5/18/2021	0.130	0.458	4.58
PFUnA	2058-94-8	0.458 U	G8404-FS(0)	1.000	5/18/2021	0.201	0.458	4.58
PFDoA	307-55-1	0.458 U	G8404-FS(0)	1.000	5/18/2021	0.176	0.458	4.58
PFTrDA	72629-94-8	0.458 U	G8404-FS(0)	1.000	5/18/2021	0.141	0.458	4.58
PFTeDA	376-06-7	1.83 U	G8404-FS(0)	1.000	5/18/2021	0.671	1.83	4.58
NMeFOSAA	2355-31-9	0.916 U	G8404-FS(0)	1.000	5/18/2021	0.321	0.916	4.58
NEtFOSAA	2991-50-6	0.916 U	G8404-FS(0)	1.000	5/18/2021	0.458	0.916	4.58
PFBS	375-73-5	427	G8404-FS-D(3)	5.000	5/18/2021	0.659	2.29	22.9
PFHxS	355-46-4	266	G8404-FS-D(3)	5.000	5/18/2021	0.513	1.83	22.9
PFOS	1763-23-1	269	G8404-FS-D(3)	5.000	5/18/2021	2.00	4.58	22.9
HFPO-DA	13252-13-6	0.458 U	G8404-FS(0)	1.000	5/18/2021	0.227	0.458	4.58
Adona	919005-14-4	0.916 U	G8404-FS(0)	1.000	5/18/2021	0.243	0.916	4.58
9CI-PF3ONS	756426-58-1	0.916 U	G8404-FS(0)	1.000	5/18/2021	0.245	0.916	4.58
11CI-PF3OUdS	763051-92-9	0.458 U	G8404-FS(0)	1.000	5/18/2021	0.212	0.458	4.58

MW6/20/21

Analyzed by: Schumitz, Denise
 Printed: 5/21/2021



13

Project Client: CH2M
 Project Name: CTO-4041: NAS Whidbey Island, Seaplane Base
 Project No.: 100146377

Client ID WI-SP-GW04-0421

Battelle ID G8405-FS
 Sample Type SA
 Collection Date 04/19/2021
 Extraction Date 04/26/2021
 Analytical Instrument Sciex 6500+ (AE) LC/MS/MS
 % Moisture NA
 Matrix GW
 Sample Size 0.268
 Size Unit-Basis L

Analyte	CAS No.	Result (ng/L)	Extract ID	DF	Analysis Date	DL	LOD	LOQ
PFHxA	307-24-4	1.40 U	G8405-FS(0)	1.000	5/18/2021	0.492	1.40	4.66
PFHpA	375-85-9	0.933 U	G8405-FS(0)	1.000	5/18/2021	0.245	0.933	4.66
PFOA	335-67-1	1.40 U	G8405-FS(0)	1.000	5/18/2021	0.477	1.40	4.66
PFNA	375-95-1	0.933 U	G8405-FS(0)	1.000	5/18/2021	0.288	0.933	4.66
PFDA	335-76-2	0.466 U	G8405-FS(0)	1.000	5/18/2021	0.132	0.466	4.66
PFUnA	2058-94-8	0.466 U	G8405-FS(0)	1.000	5/18/2021	0.204	0.466	4.66
PFDoA	307-55-1	0.466 U	G8405-FS(0)	1.000	5/18/2021	0.179	0.466	4.66
PFTTrDA	72629-94-8	0.466 U	G8405-FS(0)	1.000	5/18/2021	0.144	0.466	4.66
PFTeDA	376-06-7	1.87 U	G8405-FS(0)	1.000	5/18/2021	0.684	1.87	4.66
NMeFOSAA	2355-31-9	0.933 U	G8405-FS(0)	1.000	5/18/2021	0.326	0.933	4.66
NETFOSAA	2991-50-6	0.933 U	G8405-FS(0)	1.000	5/18/2021	0.466	0.933	4.66
PFBS	375-73-5	0.466 U	G8405-FS(0)	1.000	5/18/2021	0.134	0.466	4.66
PFHxS	355-46-4	0.373 U	G8405-FS(0)	1.000	5/18/2021	0.104	0.373	4.66
PFOS	1763-23-1	0.933 U	G8405-FS(0)	1.000	5/18/2021	0.408	0.933	4.66
HFPO-DA	13252-13-6	0.466 U	G8405-FS(0)	1.000	5/18/2021	0.231	0.466	4.66
Adona	919005-14-4	0.933 U	G8405-FS(0)	1.000	5/18/2021	0.247	0.933	4.66
9Cl-PF3ONS	756426-58-1	0.933 U	G8405-FS(0)	1.000	5/18/2021	0.250	0.933	4.66
11Cl-PF3OUdS	763051-92-9	0.466 U	G8405-FS(0)	1.000	5/18/2021	0.215	0.466	4.66



14

Project Client: CH2M
 Project Name: CTO-4041: NAS Whidbey Island, Seaplane Base
 Project No.: 100146377

Client ID WI-SP-EB04-042021

Battelle ID G8406-FS
 Sample Type SA
 Collection Date 04/20/2021
 Extraction Date 04/26/2021
 Analytical Instrument Sciex 6500+ (AE) LC/MS/MS
 % Moisture NA
 Matrix GW
 Sample Size 0.271
 Size Unit-Basis L

Analyte	CAS No.	Result (ng/L)	Extract ID	DF	Analysis Date	DL	LOD	LOQ
PFHxA	307-24-4	1.38 U	G8406-FS(0)	1.000	5/18/2021	0.486	1.38	4.61
PFHpA	375-85-9	0.923 U	G8406-FS(0)	1.000	5/18/2021	0.243	0.923	4.61
PFOA	335-67-1	1.38 U	G8406-FS(0)	1.000	5/18/2021	0.471	1.38	4.61
PFNA	375-95-1	0.923 U	G8406-FS(0)	1.000	5/18/2021	0.285	0.923	4.61
PFDA	335-76-2	0.461 U	G8406-FS(0)	1.000	5/18/2021	0.131	0.461	4.61
PFUnA	2058-94-8	0.461 U	G8406-FS(0)	1.000	5/18/2021	0.202	0.461	4.61
PFDoA	307-55-1	0.461 U	G8406-FS(0)	1.000	5/18/2021	0.177	0.461	4.61
PFTrDA	72629-94-8	0.461 U	G8406-FS(0)	1.000	5/18/2021	0.142	0.461	4.61
PFTeDA	376-06-7	1.85 U	G8406-FS(0)	1.000	5/18/2021	0.676	1.85	4.61
NMeFOSAA	2355-31-9	0.923 U	G8406-FS(0)	1.000	5/18/2021	0.323	0.923	4.61
NETFOSAA	2991-50-6	0.923 U	G8406-FS(0)	1.000	5/18/2021	0.461	0.923	4.61
PFBS	375-73-5	0.461 U	G8406-FS(0)	1.000	5/18/2021	0.133	0.461	4.61
PFHxS	355-46-4	0.369 U	G8406-FS(0)	1.000	5/18/2021	0.103	0.369	4.61
PFOS	1763-23-1	0.923 U	G8406-FS(0)	1.000	5/18/2021	0.403	0.923	4.61
HFPO-DA	13252-13-6	0.461 U	G8406-FS(0)	1.000	5/18/2021	0.229	0.461	4.61
Adona	919005-14-4	0.923 U	G8406-FS(0)	1.000	5/18/2021	0.244	0.923	4.61
9Cl-PF3ONS	756426-58-1	0.923 U	G8406-FS(0)	1.000	5/18/2021	0.247	0.923	4.61
11Cl-PF3OUdS	763051-92-9	0.461 U	G8406-FS(0)	1.000	5/18/2021	0.213	0.461	4.61

MW6/20/21

Analyzed by: Schumitz, Denise
 Printed: 5/21/2021



15

Project Client: CH2M
 Project Name: CTO-4041: NAS Whidbey Island, Seaplane Base
 Project No.: 100146377

Client ID WI-SP-FB02-042021

Battelle ID G8407-FS
 Sample Type SA
 Collection Date 04/20/2021
 Extraction Date 04/26/2021
 Analytical Instrument Sciex 6500+ (AE) LC/MS/MS
 % Moisture NA
 Matrix GW
 Sample Size 0.280
 Size Unit-Basis L

Analyte	CAS No.	Result (ng/L)	Extract ID	DF	Analysis Date	DL	LOD	LOQ
PFHxA	307-24-4	1.34 U	G8407-FS(0)	1.000	5/18/2021	0.471	1.34	4.46
PFHpA	375-85-9	0.893 U	G8407-FS(0)	1.000	5/18/2021	0.235	0.893	4.46
PFOA	335-67-1	1.34 U	G8407-FS(0)	1.000	5/18/2021	0.456	1.34	4.46
PFNA	375-85-1	0.893 U	G8407-FS(0)	1.000	5/18/2021	0.278	0.893	4.46
PFDA	335-76-2	0.446 U	G8407-FS(0)	1.000	5/18/2021	0.127	0.446	4.46
PFUnA	2058-94-8	0.446 U	G8407-FS(0)	1.000	5/18/2021	0.196	0.446	4.46
PFDoA	307-55-1	0.446 U	G8407-FS(0)	1.000	5/18/2021	0.171	0.446	4.46
PFTeDA	72629-94-8	0.446 U	G8407-FS(0)	1.000	5/18/2021	0.138	0.446	4.46
PFTeDA	376-06-7	1.79 U	G8407-FS(0)	1.000	5/18/2021	0.654	1.79	4.46
NMeFOSAA	2355-31-9	0.893 U	G8407-FS(0)	1.000	5/18/2021	0.313	0.893	4.46
NEtFOSAA	2991-50-6	0.893 U	G8407-FS(0)	1.000	5/18/2021	0.446	0.893	4.46
PFBS	375-73-5	0.446 U	G8407-FS(0)	1.000	5/18/2021	0.129	0.446	4.46
PFHxS	355-46-4	0.357 U	G8407-FS(0)	1.000	5/18/2021	0.100	0.357	4.46
PFOS	1763-23-1	0.893 U	G8407-FS(0)	1.000	5/18/2021	0.390	0.893	4.46
HFPO-DA	13252-13-6	0.446 U	G8407-FS(0)	1.000	5/18/2021	0.221	0.446	4.46
Adona	919005-14-4	0.893 U	G8407-FS(0)	1.000	5/18/2021	0.237	0.893	4.46
9Cl-PF3ONS	756426-58-1	0.893 U	G8407-FS(0)	1.000	5/18/2021	0.239	0.893	4.46
11Cl-PF3OUdS	763051-92-9	0.446 U	G8407-FS(0)	1.000	5/18/2021	0.206	0.446	4.46



16

Project Client: CH2M
 Project Name: CTO-4041: NAS Whidbey Island, Seaplane Base
 Project No.: 100146377

Client ID WI-SP-GW70-0421

Battelle ID G8408-FS
 Sample Type SA
 Collection Date 04/20/2021
 Extraction Date 04/26/2021
 Analytical Instrument Sciex 6500+ (AE) LC/MS/MS
 % Moisture NA
 Matrix GW
 Sample Size 0.287
 Size Unit-Basis L

Analyte	CAS No.	Result (ng/L)	Extract ID	DF	Analysis Date	DL	LOD	LOQ	
PFHxA	307-24-4	1.31 <i>uJ</i>	G8408-FS(0)	1.000	5/18/2021	0.459	1.31	4.36	<i>SSL</i>
PFHpA	375-85-9	0.871 U	G8408-FS(0)	1.000	5/18/2021	0.229	0.871	4.36	
PFOA	335-67-1	1.31 U	G8408-FS(0)	1.000	5/18/2021	0.445	1.31	4.36	
PFNA	375-95-1	0.871 U	G8408-FS(0)	1.000	5/18/2021	0.269	0.871	4.36	
PFDA	335-76-2	0.436 U	G8408-FS(0)	1.000	5/18/2021	0.124	0.436	4.36	
PFUnA	2058-94-8	0.436 U	G8408-FS(0)	1.000	5/18/2021	0.191	0.436	4.36	
PFDoA	307-55-1	0.436 U	G8408-FS(0)	1.000	5/18/2021	0.167	0.436	4.36	
PFTtDA	72629-94-8	0.436 U	G8408-FS(0)	1.000	5/18/2021	0.134	0.436	4.36	
PFTeDA	376-06-7	1.74 U	G8408-FS(0)	1.000	5/18/2021	0.639	1.74	4.36	
NMeFOSAA	2355-31-9	0.871 <i>uJ</i>	G8408-FS(0)	1.000	5/18/2021	0.305	0.871	4.36	<i>SSL</i>
NEtFOSAA	2991-50-6	0.871 U	G8408-FS(0)	1.000	5/18/2021	0.436	0.871	4.36	
PFBS	375-73-5	0.436 <i>uJ</i>	G8408-FS(0)	1.000	5/18/2021	0.125	0.436	4.36	<i>SSL</i>
PFHxS	355-46-4	8.14	G8408-FS(0)	1.000	5/18/2021	0.0976	0.348	4.36	
PFOS	1763-23-1	20.0	G8408-FS(0)	1.000	5/18/2021	0.381	0.871	4.36	
HFPO-DA	13252-13-6	0.436 U	G8408-FS(0)	1.000	5/18/2021	0.216	0.436	4.36	
Adona	919005-14-4	0.871 U	G8408-FS(0)	1.000	5/18/2021	0.231	0.871	4.36	
9CI-PF3ONS	756426-58-1	0.871 U	G8408-FS(0)	1.000	5/18/2021	0.233	0.871	4.36	
11CI-PF3OUdS	763051-92-9	0.436 U	G8408-FS(0)	1.000	5/18/2021	0.201	0.436	4.36	

5/21/2021
 Analyzed by: Schumitz, Denise
 Printed: 5/21/2021



16

Project Client: CH2M
 Project Name: CTO-4041: NAS Whidbey Island, Seaplane Base
 Project No.: 100146377

Client ID WI-SP-GW70-0421

Battelle ID G8408-FS
 Sample Type SA
 Collection Date 04/20/2021
 Extraction Date 04/26/2021
 Analytical Instrument Sciex 6500+ (AE) LC/MS/MS

<i>Surrogate Recoveries (%)</i>	<i>Recovery</i>	<i>Extract ID</i>	<i>Analysis Date</i>
13C5-PFHxA	45	G8408-FS(0)	5/18/2021
13C4-PFHpA	55	G8408-FS(0)	5/18/2021
13C8-PFOA	104	G8408-FS(0)	5/18/2021
13C9-PFNA	126	G8408-FS(0)	5/18/2021
13C6-PFDA	95	G8408-FS(0)	5/18/2021
13C7-PFUhA	89	G8408-FS(0)	5/18/2021
13C2-PFDoA	60	G8408-FS(0)	5/18/2021
13C2-PFTeDA	51	G8408-FS(0)	5/18/2021
d3-MeFOSAA	47	G8408-FS(0)	5/18/2021
d5-ttFOSAA	54	G8408-FS(0)	5/18/2021
13C3-PFBS	36	G8408-FS(0)	5/18/2021
13C3-PFHxS	61	G8408-FS(0)	5/18/2021
13C8-PFOS	88	G8408-FS(0)	5/18/2021
13C3-HFPO-DA	52	G8408-FS(0)	5/18/2021

**DATA VALIDATION SUMMARY REPORT
NAS WHIDBEY ISLAND, WASHINGTON**

Client: CH2M HILL, Inc., Corvallis, Oregon
 SDG: 21-0525
 Laboratory: Battelle Norwell Operations, Norwell, Massachusetts
 Site: NAS Whidbey Island (NASWI), Seaplane Base, CTO-4041, Washington
 Date: June 21, 2021

PFAS			
EDS ID	Client Sample ID	Laboratory Sample ID	Matrix
1	WI-SP-SB04-0505H	G8418-FS	Soil
2	WI-SP-SB01-01H02	G8419-FS	Soil
3	WI-SP-SB01N-01H02	G8420-FS	Soil
4	WI-SP-SS04-000H	G8421-FS	Soil
5	WI-SP-SS02-000H	G8422-FS	Soil
6	WI-SP-SS02P-000H	G8423-FS	Soil
7	WI-SP-SS01-000H	G8424-FS	Soil
8	WI-SP-SS03-000H	G8425-FS	Soil
8MS	WI-SP-SS03-000HMS	G8426-FSMS	Soil
8MSD	WI-SP-SS03-000HMSD	G8427-FSMSD	Soil

A Stage 2B/4 data validation was performed on the analytical data for eight soil samples collected on April 14-21, 2021 by CH2M HILL at the NAS Whidbey Island site in Washington. The samples were analyzed under the Analysis of Perfluoroalkyl Substances in Environmental Samples by Liquid Chromatography and Tandem Mass Spectrometry (LC-MS/MS).

Specific method references are as follows:

Analysis
PFAS

Method References
Battelle SOP 5-369-08

The data have been validated according to the protocols and quality control (QC) requirements of the analytical method, the Final Sampling and Analysis Plan Per- and Polyfluoroalkyl Substances Site Inspection Seaplane Base, Naval Air Station Whidbey Island, March 2021, the DoD Final General Data Validation Guidelines, November 2019, including the following Module:

- The Department of Defense (DoD) Data Validation Guidelines Module 3, Data Validation Procedure for Per- and Polyfluoroalkyl Substances Analysis by Quality Systems Manual for Environmental Laboratories (QSM) Table B-15, May 2020;
- and the reviewer's professional judgment.

The following data quality indicators were reviewed for this report:

PFAS

- Date Completeness, Case Narrative & Custody Documentation
- Holding times
- Liquid Chromatography/Mass Spectrometry (LC/MS) Tuning
- Initial and continuing calibration summaries
- Method blank and field QC blank contamination
- Surrogate Spike recoveries
- Laboratory Fortified Blank (LFB)
- Matrix Spike/Matrix Spike Duplicate (MS/MSD) recoveries
- Internal standard area and retention time summary forms
- Target Compound Identification
- Compound Quantitation
- Field Duplicate sample precision

A Stage 2B/4 data validation was performed with this review including a recalculation of 10% of the detected results in the samples.

Data Usability Assessment

There were no serious deficiencies of data.

The data are acceptable for the intended purposes. There were no qualifications.

Polyfluoroalkyl Substances (PFAS)

Data Completeness, Case Narrative & Custody Documentation

- The case narrative and chain-of-custody documentation were included in the data package as required. All criteria were met.

Holding Times

- All samples were extracted within 14 days for soil samples and analyzed within 28 days.

LC/MS Tuning

- All criteria were met.

Initial Calibration

- All relative standard deviation (%RSD) and/or correlation coefficients criteria were met.

Continuing Calibration

- All percent recovery (%R) criteria were met.

Method Blank

- The method blanks were free of contamination.

Field QC Blank

- Field QC results are summarized below.

Blank ID	Compound	Conc. ng/L	Qualifier	Affected Samples
WI-SP-EB05-SO-042321	None - ND	-	-	-
WI-SP-FB01-041721	None - ND	-	-	-
WI-SP-FB02-042021	None - ND	-	-	-

Surrogate Spike Recoveries

- All samples exhibited acceptable surrogate percent recoveries (%R).

Laboratory Fortified Blank (LFB)

- The LFB samples exhibited acceptable percent recoveries (%R).

Matrix Spike/Matrix Spike Duplicate (MS/MSD) Recoveries

- The MS/MSD samples exhibited acceptable percent recoveries (%R) and relative percent differences (RPD).

Internal Standard (IS) Area Performance

- All internal standards met response and retention time (RT) criteria.

Target Compound Identification

- All mass spectra and quantitation criteria were met.

Compound Quantitation

- All criteria were met.

Field Duplicate Sample Precision

- Field duplicate results are summarized below. The precision was acceptable.

Compound	WI-SP-SS02-000H ng/g	WI-SP-SS02P-000H ng/g	RPD	Qualifier
PFOS	0.148	0.119	22%	None

Please contact the undersigned at (561) 475-2000 if you have any questions or need further information.

Signed:

Nancy Weaver
Nancy Weaver
Senior Chemist

Dated: 6/21/21

Qualifier	Definition
U	The analyte was not detected and was reported as less than the LOD or as defined by the customer. The LOD has been adjusted for any dilution or concentration of the sample.
J	The reported result was an estimated value with an unknown bias.
J+	The result was an estimated quantity, but the result may be biased high.
J-	The result was an estimated quantity, but the result may be biased low.
N	The analysis indicates the presence of an analyte for which there was presumptive evidence to make a "tentative identification."
NJ	The analyte has been "tentatively identified" or "presumptively" as present and the associated numerical value was the estimated concentration in the sample.
UJ	The analyte was not detected and was reported as less than the LOD or as defined by the customer. However, the associated numerical value is approximate.
X	<p>The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided.</p> <p>Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.</p>



Project Client: CH2M
 Project Name: CTO-4041: NAS Whidbey Island, Seaplane Base
 Project No.: 100146377

Client ID WI-SP-SB04-0505H

Battelle ID G8418-FS
 Sample Type SA
 Collection Date 04/16/2021
 Extraction Date 04/27/2021
 Analytical Instrument Sciex 6500+ (AE) LC/MS/MS
 % Moisture 11.83
 Matrix SOIL
 Sample Size 5.090
 Size Unit-Basis g

Analyte	CAS No.	Result (ng/g_Dry)	Extract ID	DF	Analysis Date	DL	LOD	LOQ
PFHxA	307-24-4	0.0963 J	G8418-FS(0)	1.000	5/6/2021	0.0278	0.0786	0.196
PFHpA	375-85-9	0.0589 U	G8418-FS(0)	1.000	5/6/2021	0.0190	0.0589	0.196
PFOA	335-67-1	0.0786 U	G8418-FS(0)	1.000	5/6/2021	0.0239	0.0786	0.196
PFNA	375-95-1	0.0393 U	G8418-FS(0)	1.000	5/6/2021	0.0193	0.0393	0.196
PFDA	335-76-2	0.0393 U	G8418-FS(0)	1.000	5/6/2021	0.0182	0.0393	0.196
PFUnA	2058-94-8	0.0393 U	G8418-FS(0)	1.000	5/6/2021	0.0180	0.0393	0.196
PFDoA	307-55-1	0.0786 U	G8418-FS(0)	1.000	5/6/2021	0.0240	0.0786	0.196
PFTtDA	72629-94-8	0.0393 U	G8418-FS(0)	1.000	5/6/2021	0.0110	0.0393	0.196
PFTeDA	376-06-7	0.0982 U	G8418-FS(0)	1.000	5/6/2021	0.0424	0.0982	0.196
NMeFOSAA	2355-31-9	0.0982 U	G8418-FS(0)	1.000	5/6/2021	0.0401	0.0982	0.196
NEtFOSAA	2991-50-6	0.0786 U	G8418-FS(0)	1.000	5/6/2021	0.0294	0.0786	0.196
PFBS	375-73-5	0.117 J	G8418-FS(0)	1.000	5/6/2021	0.0138	0.0393	0.196
PFHxS	355-46-4	0.218	G8418-FS(0)	1.000	5/6/2021	0.0317	0.0786	0.196
PFOS	1763-23-1	0.246	G8418-FS(0)	1.000	5/6/2021	0.0272	0.0786	0.196
HFPO-DA	13252-13-6	0.0786 U	G8418-FS(0)	1.000	5/6/2021	0.0252	0.0786	0.196
Adona	919005-14-4	0.0786 U	G8418-FS(0)	1.000	5/6/2021	0.0326	0.0786	0.196
9CI-PF3ONS	756426-58-1	0.0393 U	G8418-FS(0)	1.000	5/6/2021	0.0189	0.0393	0.196
11CI-PF3OUds	763051-92-9	0.0589 U	G8418-FS(0)	1.000	5/6/2021	0.0206	0.0589	0.196

5/6/21/21

Analyzed by: Bailey, Kevin
 Printed: 5/19/2021



2

Project Client: CH2M
 Project Name: CTO-4041: NAS Whidbey Island, Seaplane Base
 Project No.: 100146377

Client ID WI-SP-SB01-01H02

Battelle ID G8419-FS
 Sample Type SA
 Collection Date 04/16/2021
 Extraction Date 04/27/2021
 Analytical Instrument Sciex 6500+ (AE) LC/MS/MS
 % Moisture 9.52
 Matrix SOIL
 Sample Size 5.000
 Size Unit-Basis g

Analyte	CAS No.	Result (ng/g_Dry)	Extract ID	DF	Analysis Date	DL	LOD	LOQ
PFHxA	307-24-4	0.119 J	G8419-FS(0)	1.000	5/6/2021	0.0283	0.0800	0.200
PFHpA	375-85-9	0.0626 J	G8419-FS(0)	1.000	5/6/2021	0.0202	0.0600	0.200
PFOA	335-67-1	0.110 J	G8419-FS(0)	1.000	5/6/2021	0.0243	0.0800	0.200
PFNA	375-95-1	0.0478 J	G8419-FS(0)	1.000	5/6/2021	0.0196	0.0400	0.200
PFDA	335-76-2	0.0474 J	G8419-FS(0)	1.000	5/6/2021	0.0185	0.0400	0.200
PFUnA	2058-94-8	0.0436 J	G8419-FS(0)	1.000	5/6/2021	0.0183	0.0400	0.200
PFDoA	307-55-1	0.0384 J	G8419-FS(0)	1.000	5/6/2021	0.0245	0.0800	0.200
PFTrDA	72629-94-8	0.0490 J	G8419-FS(0)	1.000	5/6/2021	0.0112	0.0400	0.200
PFTeDA	376-06-7	0.100 U	G8419-FS(0)	1.000	5/6/2021	0.0432	0.100	0.200
NMeFOSAA	2395-31-9	0.110 J	G8419-FS(0)	1.000	5/6/2021	0.0408	0.100	0.200
NEtFOSAA	2991-50-6	0.114 J	G8419-FS(0)	1.000	5/6/2021	0.0299	0.0800	0.200
PFBS	375-73-5	0.0814 J	G8419-FS(0)	1.000	5/6/2021	0.0140	0.0400	0.200
PFHxS	355-46-4	0.169 J	G8419-FS(0)	1.000	5/6/2021	0.0323	0.0800	0.200
PFOS	1763-23-1	2.91	G8419-FS(0)	1.000	5/6/2021	0.0277	0.0800	0.200
HFPO-DA	13252-13-6	0.0330 J	G8419-FS(0)	1.000	5/6/2021	0.0256	0.0800	0.200
Adona	919005-14-4	0.0558 J	G8419-FS(0)	1.000	5/6/2021	0.0332	0.0800	0.200
9Cl-PF3ONS	756426-58-1	0.0464 J	G8419-FS(0)	1.000	5/6/2021	0.0193	0.0400	0.200
11Cl-PF3OUdS	763051-92-9	0.0600 J	G8419-FS(0)	1.000	5/6/2021	0.0210	0.0600	0.200

MW 6/21/21

Analyzed by: Bailey, Kevin
 Printed: 5/19/2021



3

Project Client: CH2M
 Project Name: CTO-4041: NAS Whidbey Island, Seaplane Base
 Project No.: 100146377

Client ID WI-SP-SB01N-01H02

Battelle ID G8420-FS
 Sample Type SA
 Collection Date 04/16/2021
 Extraction Date 04/27/2021
 Analytical Instrument Sciex 6500+ (AE) LC/MS/MS
 % Moisture 8.79
 Matrix SOIL
 Sample Size 5.160
 Size Unit-Basis g

Analyte	CAS No.	Result (ng/g_Dry)	Extract ID	DF	Analysis Date	DL	LOD	LOQ
PFHxA	307-24-4	0.0316 J	G8420-FS(0)	1.000	5/6/2021	0.0274	0.0775	0.194
PFHpA	375-85-9	0.0581 U	G8420-FS(0)	1.000	5/6/2021	0.0196	0.0581	0.194
PFOA	335-67-1	0.0775 U	G8420-FS(0)	1.000	5/6/2021	0.0235	0.0775	0.194
PFNA	375-95-1	0.0388 U	G8420-FS(0)	1.000	5/6/2021	0.0190	0.0388	0.194
PFDA	335-76-2	0.0388 U	G8420-FS(0)	1.000	5/6/2021	0.0179	0.0388	0.194
PFUnA	2058-94-8	0.0388 U	G8420-FS(0)	1.000	5/6/2021	0.0177	0.0388	0.194
PFDoA	307-55-1	0.0775 U	G8420-FS(0)	1.000	5/6/2021	0.0237	0.0775	0.194
PFTrDA	72629-94-8	0.0388 U	G8420-FS(0)	1.000	5/6/2021	0.0109	0.0388	0.194
PFTeDA	376-06-7	0.0969 U	G8420-FS(0)	1.000	5/6/2021	0.0419	0.0969	0.194
NMeFOSAA	2355-31-9	0.0969 U	G8420-FS(0)	1.000	5/6/2021	0.0395	0.0969	0.194
NEtFOSAA	2991-50-6	0.0775 U	G8420-FS(0)	1.000	5/6/2021	0.0290	0.0775	0.194
PFBS	375-73-5	0.0207 J	G8420-FS(0)	1.000	5/6/2021	0.0136	0.0388	0.194
PFHxS	355-46-4	0.0928 J	G8420-FS(0)	1.000	5/6/2021	0.0313	0.0775	0.194
PFO5	1763-23-1	0.765	G8420-FS(0)	1.000	5/6/2021	0.0268	0.0775	0.194
HFPO-DA	13252-13-6	0.0775 U	G8420-FS(0)	1.000	5/6/2021	0.0248	0.0775	0.194
Adona	919005-14-4	0.0775 U	G8420-FS(0)	1.000	5/6/2021	0.0322	0.0775	0.194
9Cl-PF3ONS	756426-58-1	0.0388 U	G8420-FS(0)	1.000	5/6/2021	0.0187	0.0388	0.194
11Cl-PF3OUds	763051-92-9	0.0581 U	G8420-FS(0)	1.000	5/6/2021	0.0203	0.0581	0.194

5/19/2021
 Analyzed by: Bailey, Kevin
 Printed: 5/19/2021



4

Project Client: CH2M
 Project Name: CTO-4041: NAS Whidbey Island, Seaplane Base
 Project No.: 100146377

Client ID WI-SP-SS04-000H

Battelle ID G8421-FS
 Sample Type SA
 Collection Date 04/21/2021
 Extraction Date 04/27/2021
 Analytical Instrument Sciex 6500+ (AE) LC/MS/MS
 % Moisture 14.07
 Matrix SOIL
 Sample Size 5.050
 Size Unit-Basis g

Analyte	CAS No.	Result (ng/g_Dry)	Extract ID	DF	Analysis Date	DL	LOD	LOQ
PFHxA	307-24-4	0.0792 U	G8421-FS(0)	1.000	5/6/2021	0.0280	0.0792	0.198
PFHpA	375-85-9	0.0594 U	G8421-FS(0)	1.000	5/6/2021	0.0200	0.0594	0.198
PFOA	335-67-1	0.0792 U	G8421-FS(0)	1.000	5/6/2021	0.0240	0.0792	0.198
PFNA	375-95-1	0.0396 U	G8421-FS(0)	1.000	5/6/2021	0.0194	0.0396	0.198
PFDA	335-76-2	0.0396 U	G8421-FS(0)	1.000	5/6/2021	0.0183	0.0396	0.198
PFUnA	2058-94-8	0.0396 U	G8421-FS(0)	1.000	5/6/2021	0.0181	0.0396	0.198
PFDoA	307-55-1	0.0792 U	G8421-FS(0)	1.000	5/6/2021	0.0242	0.0792	0.198
PFTrDA	72629-94-8	0.0396 U	G8421-FS(0)	1.000	5/6/2021	0.0111	0.0396	0.198
PFTeDA	376-06-7	0.0990 U	G8421-FS(0)	1.000	5/6/2021	0.0428	0.0990	0.198
NMeFOsAA	2355-31-9	0.0990 U	G8421-FS(0)	1.000	5/6/2021	0.0404	0.0990	0.198
NEtFOsAA	2991-50-6	0.0792 U	G8421-FS(0)	1.000	5/6/2021	0.0296	0.0792	0.198
PFBS	375-73-5	0.0396 U	G8421-FS(0)	1.000	5/6/2021	0.0139	0.0396	0.198
PFHxS	355-46-4	0.0792 U	G8421-FS(0)	1.000	5/6/2021	0.0320	0.0792	0.198
PFOS	1763-23-1	0.156 J	G8421-FS(0)	1.000	5/6/2021	0.0274	0.0792	0.198
HFPO-DA	13252-13-6	0.0792 U	G8421-FS(0)	1.000	5/6/2021	0.0254	0.0792	0.198
Adona	919005-14-4	0.0792 U	G8421-FS(0)	1.000	5/6/2021	0.0329	0.0792	0.198
9CI-PF3ONS	756426-58-1	0.0396 U	G8421-FS(0)	1.000	5/6/2021	0.0191	0.0396	0.198
11CI-PF3OUdS	763051-92-9	0.0594 U	G8421-FS(0)	1.000	5/6/2021	0.0208	0.0594	0.198

MW 6/21/21

Analyzed by: Bailey, Kevin
 Printed: 5/19/2021



5

Project Client: CH2M
 Project Name: CTO-4041: NAS Whidbey Island, Seaplane Base
 Project No.: 100146377

Client ID WI-SP-SS02-000H

Battelle ID G8422-FS
 Sample Type SA
 Collection Date 04/21/2021
 Extraction Date 04/27/2021
 Analytical Instrument Sciex 6500+ (AE) LC/MS/MS
 % Moisture 13.96
 Matrix SOIL
 Sample Size 5.020
 Size Unit-Basis g

Analyte	CAS No.	Result (ng/g_Dry)	Extract ID	DF	Analysis Date	DL	LOD	LOQ
PFHxA	307-24-4	0.0797 U	G8422-FS(0)	1.000	5/6/2021	0.0282	0.0797	0.199
PFHxA	375-85-9	0.0598 U	G8422-FS(0)	1.000	5/6/2021	0.0202	0.0598	0.199
PFOA	335-67-1	0.0797 U	G8422-FS(0)	1.000	5/6/2021	0.0242	0.0797	0.199
PFNA	375-96-1	0.0398 U	G8422-FS(0)	1.000	5/6/2021	0.0196	0.0398	0.199
PFDA	335-76-2	0.0398 U	G8422-FS(0)	1.000	5/6/2021	0.0184	0.0398	0.199
PFUnA	2058-94-8	0.0398 U	G8422-FS(0)	1.000	5/6/2021	0.0182	0.0398	0.199
PFDoA	307-55-1	0.0797 U	G8422-FS(0)	1.000	5/6/2021	0.0244	0.0797	0.199
PFTeDA	72629-94-8	0.0398 U	G8422-FS(0)	1.000	5/6/2021	0.0112	0.0398	0.199
PFTeDA	376-06-7	0.0996 U	G8422-FS(0)	1.000	5/6/2021	0.0430	0.0996	0.199
NMeFOSAA	2353-31-9	0.0996 U	G8422-FS(0)	1.000	5/6/2021	0.0406	0.0996	0.199
NEtFOSAA	2991-50-6	0.0797 U	G8422-FS(0)	1.000	5/6/2021	0.0298	0.0797	0.199
PFBS	375-73-5	0.0398 U	G8422-FS(0)	1.000	5/6/2021	0.0139	0.0398	0.199
PFHxS	355-46-4	0.0797 U	G8422-FS(0)	1.000	5/6/2021	0.0322	0.0797	0.199
PFOS	1763-23-1	0.148 J	G8422-FS(0)	1.000	5/6/2021	0.0276	0.0797	0.199
HFPO-DA	13252-13-6	0.0797 U	G8422-FS(0)	1.000	5/6/2021	0.0255	0.0797	0.199
Adona	919005-14-4	0.0797 U	G8422-FS(0)	1.000	5/6/2021	0.0331	0.0797	0.199
9CI-PF3ONS	756426-58-1	0.0398 U	G8422-FS(0)	1.000	5/6/2021	0.0192	0.0398	0.199
11CI-PF3OUds	763051-92-9	0.0598 U	G8422-FS(0)	1.000	5/6/2021	0.0209	0.0598	0.199

MW 6/21/21
 Analyzed by: Bailey, Kevin
 Printed: 5/19/2021



6

Project Client: CH2M
 Project Name: CTO-4041: NAS Whidbey Island, Seaplane Base
 Project No.: 100146377

Client ID WI-SP-SS02P-000H

Battelle ID G8423-FS
 Sample Type SA
 Collection Date 04/21/2021
 Extraction Date 04/27/2021
 Analytical Instrument Sciex 6500+ (AE) LC/MS/MS
 % Moisture 13.70
 Matrix SOIL
 Sample Size 5.110
 Size Unit-Basis g

Analyte	CAS No.	Result (ng/g_Dry)	Extract ID	DF	Analysis Date	DL	LOD	LOQ
PFHxA	307-24-4	0.0783 U	G8423-FS(0)	1.000	5/6/2021	0.0277	0.0783	0.196
PFHpA	375-85-9	0.0587 U	G8423-FS(0)	1.000	5/6/2021	0.0198	0.0587	0.196
PFOA	335-67-1	0.0783 U	G8423-FS(0)	1.000	5/6/2021	0.0238	0.0783	0.196
PFNA	375-95-1	0.0391 U	G8423-FS(0)	1.000	5/6/2021	0.0192	0.0391	0.196
PFDA	335-76-2	0.0391 U	G8423-FS(0)	1.000	5/6/2021	0.0181	0.0391	0.196
PFUnA	2058-94-8	0.0391 U	G8423-FS(0)	1.000	5/6/2021	0.0179	0.0391	0.196
PFDoA	307-55-1	0.0783 U	G8423-FS(0)	1.000	5/6/2021	0.0240	0.0783	0.196
PFTrDA	72629-94-8	0.0391 U	G8423-FS(0)	1.000	5/6/2021	0.0110	0.0391	0.196
PFTeDA	376-06-7	0.0978 U	G8423-FS(0)	1.000	5/6/2021	0.0423	0.0978	0.196
NMeFOSAA	2355-31-9	0.0978 U	G8423-FS(0)	1.000	5/6/2021	0.0399	0.0978	0.196
NEtFOSAA	2991-50-6	0.0783 U	G8423-FS(0)	1.000	5/6/2021	0.0293	0.0783	0.196
PFBS	375-73-5	0.0391 U	G8423-FS(0)	1.000	5/6/2021	0.0137	0.0391	0.196
PFHxS	355-46-4	0.0783 U	G8423-FS(0)	1.000	5/6/2021	0.0316	0.0783	0.196
PFOS	1763-23-1	0.119 J	G8423-FS(0)	1.000	5/6/2021	0.0271	0.0783	0.196
HFPO-DA	13252-13-6	0.0783 U	G8423-FS(0)	1.000	5/6/2021	0.0251	0.0783	0.196
Adona	919005-14-4	0.0783 U	G8423-FS(0)	1.000	5/6/2021	0.0325	0.0783	0.196
9Cl-PF3ONS	756426-58-1	0.0391 U	G8423-FS(0)	1.000	5/6/2021	0.0189	0.0391	0.196
11Cl-PF3OUdS	763051-92-9	0.0587 U	G8423-FS(0)	1.000	5/6/2021	0.0205	0.0587	0.196

mw 5/19/21

Analyzed by: Bailey, Kevin
 Printed: 5/19/2021



7

Project Client: CH2M
 Project Name: CTO-4041: NAS Whidbey Island, Seaplane Base
 Project No.: 100146377

Client ID WI-SP-SS01-000H

Battelle ID G8424-FS
 Sample Type SA
 Collection Date 04/21/2021
 Extraction Date 04/27/2021
 Analytical Instrument Sciex 6500+ (AE) LC/MS/MS
 % Moisture 22.06
 Matrix SOIL
 Sample Size 5.050

Analyte	CAS No.	Result (ng/g_Dry)	Extract ID	DF	Analysis Date	DL	LOD	LOQ
PFHxA	307-24-4	0.0792 U	G8424-FS(0)	1.000	5/6/2021	0.0280	0.0792	0.198
PFHpA	375-85-9	0.0782 J	G8424-FS(0)	1.000	5/6/2021	0.0200	0.0594	0.198
PFOA	335-67-1	0.0792 U	G8424-FS(0)	1.000	5/6/2021	0.0240	0.0792	0.198
PFNA	375-95-1	0.0396 U	G8424-FS(0)	1.000	5/6/2021	0.0194	0.0396	0.198
PFDA	335-76-2	0.0396 U	G8424-FS(0)	1.000	5/6/2021	0.0183	0.0396	0.198
PFUnA	2058-94-8	0.0396 U	G8424-FS(0)	1.000	5/6/2021	0.0181	0.0396	0.198
PFDoA	307-55-1	0.0792 U	G8424-FS(0)	1.000	5/6/2021	0.0242	0.0792	0.198
PFTrDA	72629-94-8	0.0396 U	G8424-FS(0)	1.000	5/6/2021	0.0111	0.0396	0.198
PFTeDA	376-06-7	0.0990 U	G8424-FS(0)	1.000	5/6/2021	0.0428	0.0990	0.198
NMeFOSAA	2355-31-9	0.0990 U	G8424-FS(0)	1.000	5/6/2021	0.0404	0.0990	0.198
NEtFOSAA	2991-50-6	0.0792 U	G8424-FS(0)	1.000	5/6/2021	0.0296	0.0792	0.198
PFBS	375-73-5	0.0396 U	G8424-FS(0)	1.000	5/6/2021	0.0139	0.0396	0.198
PFHxS	355-46-4	0.0792 U	G8424-FS(0)	1.000	5/6/2021	0.0320	0.0792	0.198
PFOs	1763-23-1	0.0899 J	G8424-FS(0)	1.000	5/6/2021	0.0274	0.0792	0.198
HFPO-DA	13252-13-6	0.0792 U	G8424-FS(0)	1.000	5/6/2021	0.0254	0.0792	0.198
Adona	919005-14-4	0.0792 U	G8424-FS(0)	1.000	5/6/2021	0.0329	0.0792	0.198
9CI-PF3ONS	756426-58-1	0.0396 U	G8424-FS(0)	1.000	5/6/2021	0.0191	0.0396	0.198
11CI-PF3OUds	763051-92-9	0.0594 U	G8424-FS(0)	1.000	5/6/2021	0.0208	0.0594	0.198

NW 6/21/21
 Analyzed by: Bailey, Kevin
 Printed: 5/19/2021



8

Project Client: CH2M
 Project Name: CTO-4041: NAS Whidbey Island, Seaplane Base
 Project No.: 100146377

Client ID WI-SP-SS03-000H

Battelle ID G8425-FS
 Sample Type SA
 Collection Date 04/21/2021
 Extraction Date 04/27/2021
 Analytical Instrument Sciex 6500+ (AE) LC/MS/MS
 % Moisture 23.36
 Matrix SOIL
 Sample Size 5.100
 Size Unit-Basis g

Analyte	CAS No.	Result (ng/g_Dry)	Extract ID	DF	Analysis Date	DL	LOD	LOQ
PFHxA	307-24-4	0.254	G8425-FS(0)	1.000	5/6/2021	0.0277	0.0784	0.196
PFHpA	375-85-9	0.149 J	G8425-FS(0)	1.000	5/6/2021	0.0198	0.0588	0.196
PFOA	335-67-1	0.0784 U	G8425-FS(0)	1.000	5/6/2021	0.0238	0.0784	0.196
PFNA	375-95-1	0.0392 U	G8425-FS(0)	1.000	5/6/2021	0.0193	0.0392	0.196
PFDA	335-76-2	0.0392 U	G8425-FS(0)	1.000	5/6/2021	0.0182	0.0392	0.196
PFUnA	2058-94-8	0.0392 U	G8425-FS(0)	1.000	5/6/2021	0.0179	0.0392	0.196
PFDoA	307-55-1	0.0784 U	G8425-FS(0)	1.000	5/6/2021	0.0240	0.0784	0.196
PFTrDA	72629-94-8	0.0392 U	G8425-FS(0)	1.000	5/6/2021	0.0110	0.0392	0.196
PFTeDA	376-06-7	0.0980 U	G8425-FS(0)	1.000	5/6/2021	0.0424	0.0980	0.196
NMeFOSAA	2355-31-9	0.0980 U	G8425-FS(0)	1.000	5/6/2021	0.0400	0.0980	0.196
NEtFOSAA	2991-50-6	0.0784 U	G8425-FS(0)	1.000	5/6/2021	0.0293	0.0784	0.196
PFBS	375-73-5	0.0390 J	G8425-FS(0)	1.000	5/6/2021	0.0137	0.0392	0.196
PFHxS	355-46-4	0.0516 J	G8425-FS(0)	1.000	5/6/2021	0.0317	0.0784	0.196
PFOS	1763-23-1	0.130 J	G8425-FS(0)	1.000	5/6/2021	0.0271	0.0784	0.196
HFPO-DA	13252-13-6	0.0784 U	G8425-FS(0)	1.000	5/6/2021	0.0251	0.0784	0.196
Adona	919005-14-4	0.0784 U	G8425-FS(0)	1.000	5/6/2021	0.0325	0.0784	0.196
9CI-PF3ONS	756426-58-1	0.0392 U	G8425-FS(0)	1.000	5/6/2021	0.0189	0.0392	0.196
11CI-PF3OUdS	763051-92-9	0.0588 U	G8425-FS(0)	1.000	5/6/2021	0.0205	0.0588	0.196

5/19/2021
 Analyzed by: Bailey, Kevin
 Printed: 5/19/2021

**DATA VALIDATION SUMMARY REPORT
NAS WHIDBEY ISLAND, WASHINGTON**

Client: CH2M HILL, Inc., Corvallis, Oregon
SDG: 21-0541
Laboratory: Battelle Norwell Operations, Norwell, Massachusetts
Site: NAS Whidbey Island (NASWI), Seaplane Base, CTO-4041, Washington
Date: June 21, 2021

PFAS			
EDS ID	Client Sample ID	Laboratory Sample ID	Matrix
1	WI-SP-EB05-SO-042321	G8462-FS	Water

A Stage 2B/4 data validation was performed on the analytical data for one aqueous equipment blank sample collected on April 23, 2021 by CH2M HILL at the NAS Whidbey Island site in Washington. The samples were analyzed under the Analysis of Perfluoroalkyl Substances in Environmental Samples by Liquid Chromatography and Tandem Mass Spectrometry (LC-MS/MS).

Specific method references are as follows:

Analysis
PFAS

Method References
Battelle SOP 5-369-08

The data have been validated according to the protocols and quality control (QC) requirements of the analytical method, the Final Sampling and Analysis Plan Per- and Polyfluoroalkyl Substances Site Inspection Seaplane Base, Naval Air Station Whidbey Island, March 2021, the DoD Final General Data Validation Guidelines, November 2019, including the following Module:

- The Department of Defense (DoD) Data Validation Guidelines Module 3, Data Validation Procedure for Per- and Polyfluoroalkyl Substances Analysis by Quality Systems Manual for Environmental Laboratories (QSM) Table B-15, May 2020;
- and the reviewer's professional judgment.

The following data quality indicators were reviewed for this report:

PFAS

- Date Completeness, Case Narrative & Custody Documentation
- Holding times
- Liquid Chromatography/Mass Spectrometry (LC/MS) Tuning
- Initial and continuing calibration summaries
- Method blank and field QC blank contamination
- Surrogate Spike recoveries

- Laboratory Fortified Blank (LFB)
- Matrix Spike/Matrix Spike Duplicate (MS/MSD) recoveries
- Internal standard area and retention time summary forms
- Target Compound Identification
- Compound Quantitation
- Field Duplicate sample precision

A Stage 2B/4 data validation was performed with this review including a recalculation of 10% of the detected results in the samples.

Data Usability Assessment

There were no serious deficiencies of data.

The data are acceptable for the intended purposes. There were no qualifications.

Polyfluoroalkyl Substances (PFAS)

Data Completeness, Case Narrative & Custody Documentation

- The case narrative and chain-of-custody documentation were included in the data package as required. All criteria were met.

Holding Times

- All samples were extracted within 14 days for water samples and analyzed within 28 days.

LC/MS Tuning

- All criteria were met.

Initial Calibration

- All relative standard deviation (%RSD) and/or correlation coefficients criteria were met.

Continuing Calibration

- All percent recovery (%R) criteria were met.

Method Blank

- The method blanks were free of contamination.

Field QC Blank

- Field QC results are summarized below.

Blank ID	Compound	Conc. ng/L	Qualifier	Affected Samples
WI-SP-EB05-SO-042321	None - ND	-	-	-

Surrogate Spike Recoveries

- All samples exhibited acceptable surrogate percent recoveries (%R).

Laboratory Fortified Blank (LFB)

- The LFB samples exhibited acceptable percent recoveries (%R).

Matrix Spike/Matrix Spike Duplicate (MS/MSD) Recoveries

- MS/MSD samples were not analyzed.

Internal Standard (IS) Area Performance

- All internal standards met response and retention time (RT) criteria.

Target Compound Identification

- All mass spectra and quantitation criteria were met.

Compound Quantitation

- All criteria were met.

Field Duplicate Sample Precision

- Field duplicate samples were not collected.

Please contact the undersigned at (561) 475-2000 if you have any questions or need further information.

Signed: Nancy Weaver
Nancy Weaver
Senior Chemist

Dated: 6/21/21

Qualifier	Definition
U	The analyte was not detected and was reported as less than the LOD or as defined by the customer. The LOD has been adjusted for any dilution or concentration of the sample.
J	The reported result was an estimated value with an unknown bias.
J+	The result was an estimated quantity, but the result may be biased high.
J-	The result was an estimated quantity, but the result may be biased low.
N	The analysis indicates the presence of an analyte for which there was presumptive evidence to make a "tentative identification."
NJ	The analyte has been "tentatively identified" or "presumptively" as present and the associated numerical value was the estimated concentration in the sample.
UJ	The analyte was not detected and was reported as less than the LOD or as defined by the customer. However, the associated numerical value is approximate.
X	<p>The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided.</p> <p>Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.</p>



Project Client: CH2M
 Project Name: CTO-4041 NAS Whidbey Island, Seaplane Base
 Project No.: 100146377

Client ID WI-SP-EB05-SO-042321

Battelle ID G8462-FS
 Sample Type SA
 Collection Date 04/23/2021
 Extraction Date 05/03/2021
 Analytical Instrument Sciex 5500 (AC) LC/MS/MS
 % Moisture NA
 Matrix GW
 Sample Size 0.288
 Size Unit-Basis L

Analyte	CAS No.	Result (ng/L)	Extract ID	DF	Analysis Date	DL	LOD	LOQ
PFHxA	307-24-4	1.30 U	G8462-FS(0)	1.000	5/19/2021	0.457	1.30	4.34
PFHpA	375-85-9	0.868 U	G8462-FS(0)	1.000	5/19/2021	0.228	0.868	4.34
PFOA	335-67-1	1.30 U	G8462-FS(0)	1.000	5/19/2021	0.444	1.30	4.34
PFNA	375-95-1	0.868 U	G8462-FS(0)	1.000	5/19/2021	0.268	0.868	4.34
PFDA	335-76-2	0.434 U	G8462-FS(0)	1.000	5/19/2021	0.123	0.434	4.34
PFUnA	2058-94-8	0.434 U	G8462-FS(0)	1.000	5/19/2021	0.190	0.434	4.34
PFDoA	307-55-1	0.434 U	G8462-FS(0)	1.000	5/19/2021	0.167	0.434	4.34
PFTTrDA	72629-94-8	0.434 U	G8462-FS(0)	1.000	5/19/2021	0.134	0.434	4.34
PFTeDA	376-06-7	1.74 U	G8462-FS(0)	1.000	5/19/2021	0.636	1.74	4.34
NMeFOSAA	2355-31-9	0.868 U	G8462-FS(0)	1.000	5/19/2021	0.304	0.868	4.34
NEtFOSAA	2991-50-6	0.868 U	G8462-FS(0)	1.000	5/19/2021	0.434	0.868	4.34
PFBS	375-73-5	0.434 U	G8462-FS(0)	1.000	5/19/2021	0.125	0.434	4.34
PFHxS	355-46-4	0.347 U	G8462-FS(0)	1.000	5/19/2021	0.0972	0.347	4.34
PFOS	1763-23-1	0.868 U	G8462-FS(0)	1.000	5/19/2021	0.379	0.868	4.34
HFPO-DA	13252-13-6	0.434 U	G8462-FS(0)	1.000	5/19/2021	0.215	0.434	4.34
Adona	919005-14-4	0.868 U	G8462-FS(0)	1.000	5/19/2021	0.230	0.868	4.34
9CI-PF3ONS	756426-58-1	0.868 U	G8462-FS(0)	1.000	5/19/2021	0.233	0.868	4.34
11CI-PF3OUds	763051-92-9	0.434 U	G8462-FS(0)	1.000	5/19/2021	0.201	0.434	4.34

MW 6/21/21

Analyzed by: Griffith, Lauren
 Printed: 5/25/2021

**DATA VALIDATION SUMMARY REPORT
NAS WHIDBEY ISLAND, WASHINGTON**

Client: CH2M HILL, Inc., Corvallis, Oregon
 SDG: 21-0645
 Laboratory: Battelle Norwell Operations, Norwell, Massachusetts
 Site: NAS Whidbey Island (NASWI), Seaplane Base, CTO-4041, Washington
 Date: June 20, 2021

PFAS			
EDS ID	Client Sample ID	Laboratory Sample ID	Matrix
1	WI-SP-GW01-0421	G8400-FS1	Water
2	WI-SP-GW01N-0421	G8401-FS1	Water
3	WI-SP-GW70-0421	G8408-FS1	Water

A Stage 2B/4 data validation was performed on the analytical data for three water samples collected on April 16-20, 2021 by CH2M HILL at the NAS Whidbey Island site in Washington. The samples were analyzed under the Analysis of Perfluoroalkyl Substances in Environmental Samples by Liquid Chromatography and Tandem Mass Spectrometry (LC-MS/MS).

Specific method references are as follows:

Analysis
PFAS

Method References
Battelle SOP 5-369-08

The data have been validated according to the protocols and quality control (QC) requirements of the analytical method, the Final Sampling and Analysis Plan Per- and Polyfluoroalkyl Substances Site Inspection Seaplane Base, Naval Air Station Whidbey Island, March 2021, the DoD Final General Data Validation Guidelines, November 2019, including the following Module:

- The Department of Defense (DoD) Data Validation Guidelines Module 3, Data Validation Procedure for Per- and Polyfluoroalkyl Substances Analysis by Quality Systems Manual for Environmental Laboratories (QSM) Table B-15, May 2020;
- and the reviewer's professional judgment.

The following data quality indicators were reviewed for this report:

PFAS

- Date Completeness, Case Narrative & Custody Documentation
- Holding times
- Liquid Chromatography/Mass Spectrometry (LC/MS) Tuning
- Initial and continuing calibration summaries

- Method blank and field QC blank contamination
- Surrogate Spike recoveries
- Laboratory Fortified Blank (LFB)
- Matrix Spike/Matrix Spike Duplicate (MS/MSD) recoveries
- Internal standard area and retention time summary forms
- Target Compound Identification
- Compound Quantitation
- Field Duplicate sample precision

A Stage 2B/4 data validation was performed with this review including a recalculation of 10% of the detected results in the samples.

Data Usability Assessment

There were serious deficiencies of data. Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.

- All non-detected compounds were qualified (X) in all samples due to grossly exceeded holding times.

The remaining data are acceptable for the intended purposes as qualified for the deficiencies detailed in this report.

Please note that any results qualified (U) due to blank contamination may be then qualified (J) due to another action. Therefore, the results may be qualified (UJ) due to the culmination of the blank contaminations and actions from other exceedances of QC criteria.

Polyfluoroalkyl Substances (PFAS)

Data Completeness, Case Narrative & Custody Documentation

- The case narrative and chain-of-custody documentation were included in the data package as required. All criteria were met.

Holding Times

- All samples were extracted within 14 days for water samples and analyzed within 28 days except for the following.

EDS Sample	Date Sampled	Date Extracted	# of Days	Qualifier
1	04/16/21	05/21/21	35	J/X
2	04/16/21	05/21/21	35	J/X
3	04/20/21	05/21/21	31	J/X

LC/MS Tuning

- All criteria were met.

Initial Calibration

- All relative standard deviation (%RSD) and/or correlation coefficients criteria were met.

Continuing Calibration

- All percent recovery (%R) criteria were met.

Method Blank

- The method blanks were free of contamination.

Field QC Blank

- Field QC results are summarized below.

Blank ID	Compound	Conc. ng/L	Qualifier	Affected Samples
WI-SP-EB01-GW-041721	None - ND	-	-	-
WI-SP-FB01-041721	None - ND	-	-	-
WI-SP-EB04-042021	None - ND	-	-	-
WI-SP-FB02-042021	None - ND	-	-	-

Surrogate Spike Recoveries

- All samples exhibited several low surrogate percent recoveries (%R), however, all results were already qualified due to holding times and no further action was required. Please refer to the Form Is for specific surrogate recoveries.

Laboratory Fortified Blank (LFB)

- The LFB samples exhibited acceptable percent recoveries (%R).

Matrix Spike/Matrix Spike Duplicate (MS/MSD) Recoveries

- MS/MSD samples were not analyzed.

Internal Standard (IS) Area Performance

- All internal standards met response and retention time (RT) criteria.

Target Compound Identification

- All mass spectra and quantitation criteria were met.

Compound Quantitation

- These samples were re-extracted grossly outside of holding times to confirm surrogate deficiencies in the original analysis. The reanalysis exhibited similar results. The original analysis results should be used for reporting purposes.

Field Duplicate Sample Precision

- Field duplicate samples were not collected.

Please contact the undersigned at (561) 475-2000 if you have any questions or need further information.

Signed:

Nancy Weaver
Nancy Weaver
Senior Chemist

Dated: 6/21/21

Qualifier	Definition
U	The analyte was not detected and was reported as less than the LOD or as defined by the customer. The LOD has been adjusted for any dilution or concentration of the sample.
J	The reported result was an estimated value with an unknown bias.
J+	The result was an estimated quantity, but the result may be biased high.
J-	The result was an estimated quantity, but the result may be biased low.
N	The analysis indicates the presence of an analyte for which there was presumptive evidence to make a "tentative identification."
NJ	The analyte has been "tentatively identified" or "presumptively" as present and the associated numerical value was the estimated concentration in the sample.
UJ	The analyte was not detected and was reported as less than the LOD or as defined by the customer. However, the associated numerical value is approximate.
X	<p>The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided.</p> <p>Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.</p>



Project Client: CH2M
 Project Name: CTO-4041 NAS Whidbey Island, Seaplane Base
 Project No.: 100146377

Client ID WI-SP-GW01-0421

Battelle ID G8400-FS1
 Sample Type SA
 Collection Date 04/16/2021
 Extraction Date 05/21/2021
 Analytical Instrument Sciex 5500 (AC) LC/MS/MS
 % Moisture NA
 Matrix GW
 Sample Size 0.270
 Size Unit-Basis L

Analyte	CAS No.	Result (ng/L)	Extract ID	DF	Analysis Date	DL	LOD	LOQ
PFHxA	307-24-4	167	G8400-FS1(0)	1.000	5/25/2021	0.488	1.39	4.63
PFHpA	375-85-9	74.2	G8400-FS1(0)	1.000	5/25/2021	0.244	0.926	4.63
PFOA	335-67-1	114	G8400-FS1(0)	1.000	5/25/2021	0.473	1.39	4.63
PFNA	375-95-1	18.6	G8400-FS1(0)	1.000	5/25/2021	0.286	0.926	4.63
PFDA	335-76-2	12.8	G8400-FS1(0)	1.000	5/25/2021	0.131	0.463	4.63
PFUnA	2058-94-8	2.57	G8400-FS1(0)	1.000	5/25/2021	0.203	0.463	4.63
PFDoA	307-55-1	0.463	G8400-FS1(0)	1.000	5/25/2021	0.178	0.463	4.63
PFTrDA	72629-94-8	0.463	G8400-FS1(0)	1.000	5/25/2021	0.143	0.463	4.63
PFTeDA	376-06-7	1.85	G8400-FS1(0)	1.000	5/25/2021	0.679	1.85	4.63
NMeFOSAA	2355-31-9	0.926	G8400-FS1(0)	1.000	5/25/2021	0.324	0.926	4.63
NEtFOSAA	2991-50-6	0.926	G8400-FS1(0)	1.000	5/25/2021	0.463	0.926	4.63
PFBS	375-73-5	58.3	G8400-FS1(0)	1.000	5/25/2021	0.133	0.463	4.63
PFHxS	355-46-4	453	G8400-FS1(0)	1.000	5/25/2021	0.104	0.370	4.63
PFOS	1763-23-1	2510	G8400-FS1-D(3)	5.000	5/25/2021	2.02	4.63	23.1
HFPO-DA	13252-13-6	0.463	G8400-FS1(0)	1.000	5/25/2021	0.230	0.463	4.63
Adona	919005-14-4	0.926	G8400-FS1(0)	1.000	5/25/2021	0.245	0.926	4.63
9Cl-PF3ONS	756426-58-1	0.926	G8400-FS1(0)	1.000	5/25/2021	0.248	0.926	4.63
11Cl-PF3OUdS	763051-92-9	0.463	G8400-FS1(0)	1.000	5/25/2021	0.214	0.463	4.63

1
 Use original
 in 21-0524

HT

MW 6/21/21
 Analyzed by: Schumitz, Denise
 Printed: 5/27/2021



Project Client: CH2M
 Project Name: CTO-4041 NAS Whidbey Island, Seaplane Base
 Project No.: 100146377

Client ID WI-SP-GW01-0421
 Battelle ID G8400-FS1
 Sample Type SA
 Collection Date 04/16/2021
 Extraction Date 05/21/2021
 Analytical Instrument Sciex 5500 (AC) LC/MS/MS

Use original

Surrogate Recoveries (%)	Recovery	Extract ID	Analysis Date
13C5-PFHxA	100	G8400-FS1(0)	5/25/2021
13C4-PFHpA	97	G8400-FS1(0)	5/25/2021
13C8-PFOA	98	G8400-FS1(0)	5/25/2021
13C9-PFNA	80	G8400-FS1(0)	5/25/2021
13C6-PFDA	80	G8400-FS1(0)	5/25/2021
13C7-PFUnA	61	G8400-FS1(0)	5/25/2021
13C2-PFDoA	25	G8400-FS1(0)	5/25/2021
13C2-PFTeDA	7	G8400-FS1(0)	5/25/2021
d3-MeFOSAA	70	G8400-FS1-D(3)	5/25/2021
d5-EtFOSAA	89	G8400-FS1-D(3)	5/25/2021
13C3-PFBS	122	G8400-FS1-D(3)	5/25/2021
13C3-PFHxS	113	G8400-FS1-D(3)	5/25/2021
13C8-PFOS	99	G8400-FS1-D(3)	5/25/2021
13C3-HFPO-0A	99	G8400-FS1(0)	5/25/2021

MW 6/21/21
 Analyzed by: Schumitz, Denise
 Printed: 5/27/2021



Project Client: CH2M
 Project Name: CTO-4041 NAS Whidbey Island, Seaplane Base
 Project No.: 100146377

Client ID WI-SP-GW01N-0421

Battelle ID G8401-FS1
 Sample Type SA
 Collection Date 04/16/2021
 Extraction Date 05/21/2021
 Analytical Instrument Sciex 5500 (AC) LC/MS/MS
 % Moisture NA
 Matrix GW
 Sample Size 0.275
 Size Unit-Basis L

2
 use original
 IN 21-0524

Analyte	CAS No.	Result (ng/L)	Extract ID	DF	Analysis Date	DL	LOD	LOQ
PFHxA	307-24-4	146 T	G8401-FS1(0)	1.000	5/25/2021	0.479	1.36	4.55
PFHpA	375-85-9	78.1 T	G8401-FS1(0)	1.000	5/25/2021	0.239	0.909	4.55
PFOA	335-67-1	153 T	G8401-FS1(0)	1.000	5/25/2021	0.465	1.36	4.55
PFNA	375-95-1	17.8 T	G8401-FS1(0)	1.000	5/25/2021	0.281	0.909	4.55
PFDA	335-76-2	8.55 T	G8401-FS1(0)	1.000	5/25/2021	0.129	0.455	4.55
PFUnA	2058-94-8	0.335 JT	G8401-FS1(0)	1.000	5/25/2021	0.199	0.455	4.55
PFDoA	307-55-1	0.455 UT	G8401-FS1(0)	1.000	5/25/2021	0.175	0.455	4.55
PFTrDA	72629-94-8	0.455 UT	G8401-FS1(0)	1.000	5/25/2021	0.140	0.455	4.55
PFTeDA	376-06-7	1.82 UT	G8401-FS1(0)	1.000	5/25/2021	0.666	1.82	4.55
NMeFOSAA	2355-31-9	0.909 UT	G8401-FS1(0)	1.000	5/25/2021	0.318	0.909	4.55
NEtFOSAA	2991-50-6	0.909 UT	G8401-FS1(0)	1.000	5/25/2021	0.455	0.909	4.55
PFBS	375-73-5	22.5 T	G8401-FS1(0)	1.000	5/25/2021	0.131	0.455	4.55
PFHxS	355-46-4	722 T	G8401-FS1(0)	1.000	5/25/2021	0.102	0.364	4.55
PFOS	1763-23-1	2010 TD	G8401-FS1-D(3)	5.000	5/25/2021	1.99	4.55	22.7
HFPO-DA	13252-13-6	0.455 UT	G8401-FS1(0)	1.000	5/25/2021	0.225	0.455	4.55
Adona	919005-14-4	0.909 UT	G8401-FS1(0)	1.000	5/25/2021	0.241	0.909	4.55
9CI-PF3ONS	756426-58-1	0.909 UT	G8401-FS1(0)	1.000	5/25/2021	0.244	0.909	4.55
11CI-PF3OUdS	763051-92-9	0.455 UT	G8401-FS1(0)	1.000	5/25/2021	0.210	0.455	4.55

mw 6/21/21
 Analyzed by: Schumitz, Denise
 Printed: 5/27/2021



Project Client: CH2M
 Project Name: CTO-4041 NAS Whidbey Island, Seaplane Base
 Project No.: 100146377

Client ID WI-SP-GW01N-0421
 Battelle ID G8401-FS1
 Sample Type SA
 Collection Date 04/16/2021
 Extraction Date 05/21/2021
 Analytical Instrument Sciex 5500 (AC) LC/MS/MS

2

Use Original

Surrogate Recoveries (%)	Recovery	Extract ID	Analysis Date
13C5-PFHxA	89	G8401-FS1(0)	5/25/2021
13C4-PFHpA	88	G8401-FS1(0)	5/25/2021
13C8-PFOA	84	G8401-FS1(0)	5/25/2021
13C9-PFNA	69	G8401-FS1(0)	5/25/2021
13C6-PFDA	79	G8401-FS1(0)	5/25/2021
13C7-PFUxA	67	G8401-FS1(0)	5/25/2021
13C2-PFDoA	33	G8401-FS1(0)	5/25/2021
13C2-PFTeDA	10	G8401-FS1(0)	5/25/2021
d3-MeFOSAA	81	G8401-FS1-D(3)	5/25/2021
d5-RtFOSAA	98	G8401-FS1-D(3)	5/25/2021
13C3-PFBS	129	G8401-FS1-D(3)	5/25/2021
13C3-PFHbS	119	G8401-FS1-D(3)	5/25/2021
13C8-PFOS	111	G8401-FS1-D(3)	5/25/2021
13C3-HFPO-DA	89	G8401-FS1(0)	5/25/2021

5/27/21

Analyzed by: Schumitz, Denise
 Printed: 5/27/2021



Project Client: CH2M
 Project Name: CTO-4041 NAS Whidbey Island, Seaplane Base
 Project No.: 100146377

Client ID WI-SP-GW70-0421

Battelle ID G8408-FS1
 Sample Type SA
 Collection Date 04/20/2021
 Extraction Date 05/21/2021
 Analytical Instrument Sciex 5500 (AC) LC/MS/MS
 % Moisture NA
 Matrix GW
 Sample Size 0.248
 Size Unit-Basis L

3
 Use original
 IN 21-0524

Analyte	CAS No.	Result (ng/L)	Extract ID	DF	Analysis Date	DL	LOD	LOQ
PFHxA	307-24-4	4.93 JT	G8408-FS1(0)	1.000	5/25/2021	0.531	1.51	5.04
PFHpA	375-85-9	1.01 UT	G8408-FS1(0)	1.000	5/25/2021	0.265	1.01	5.04
PFOA	335-67-1	2.11 JT	G8408-FS1(0)	1.000	5/25/2021	0.515	1.51	5.04
PFNA	375-95-1	1.01 UT	G8408-FS1(0)	1.000	5/29/2021	0.311	1.01	5.04
PFDA	335-76-2	0.504 UT	G8408-FS1(0)	1.000	5/25/2021	0.143	0.504	5.04
PFUnA	2058-94-8	0.504 UT	G8408-FS1(0)	1.000	5/25/2021	0.221	0.504	5.04
PFDoA	307-55-1	0.504 UT	G8408-FS1(0)	1.000	5/25/2021	0.194	0.504	5.04
PFTrDA	72629-94-8	0.504 UT	G8408-FS1(0)	1.000	5/25/2021	0.155	0.504	5.04
PFTeDA	376-06-7	2.02 UT	G8408-FS1(0)	1.000	5/25/2021	0.739	2.02	5.04
NMeFOSAA	2355-31-9	1.01 UT	G8408-FS1(0)	1.000	5/25/2021	0.353	1.01	5.04
NEFOSAA	2991-50-6	1.01 UT	G8408-FS1(0)	1.000	5/25/2021	0.504	1.01	5.04
PFBS	375-73-5	2.21 JT	G8408-FS1(0)	1.000	5/25/2021	0.145	0.504	5.04
PFHxS	355-46-4	6.02 T	G8408-FS1(0)	1.000	5/25/2021	0.113	0.403	5.04
PFOS	1763-23-1	18.8 T	G8408-FS1(0)	1.000	5/25/2021	0.441	1.01	5.04
HFPO-DA	13252-13-6	0.504 UT	G8408-FS1(0)	1.000	5/25/2021	0.250	0.504	5.04
Adona	919005-14-4	1.01 UT	G8408-FS1(0)	1.000	5/25/2021	0.267	1.01	5.04
9CI-PF3ONS	756426-58-1	1.01 UT	G8408-FS1(0)	1.000	5/25/2021	0.270	1.01	5.04
11Cl-PF3OUds	763051-92-9	0.504 UT	G8408-FS1(0)	1.000	5/25/2021	0.233	0.504	5.04

HT

MW 5/21/21
 Analyzed by: Schumitz, Denise
 Printed: 5/27/2021



Project Client: CH2M
 Project Name: CTO-4041 NAS Whidbey Island, Seaplane Base
 Project No.: 100146377

Client ID WI-SP-GW70-0421

Battelle ID G8408-FS1
 Sample Type SA
 Collection Date 04/20/2021
 Extraction Date 05/21/2021
 Analytical Instrument Sciex 5500 (AC) LC/MS/MS

3
 Use original

Surrogate Recoveries (%)	Recovery	Extract ID	Analysis Date
13C5-PFHxA	61	G8408-FS1(0)	5/25/2021
13C4-PFHpA	72	G8408-FS1(0)	5/25/2021
13C8-PFOA	86	G8408-FS1(0)	5/25/2021
13C9-PFNA	79	G8408-FS1(0)	5/25/2021
13C6-PFDA	69	G8408-FS1(0)	5/25/2021
13C7-PFUnA	48 N	G8408-FS1(0)	5/25/2021
13C2-PFDoA	34 N	G8408-FS1(0)	5/25/2021
13C2-PFTeDA	22 N	G8408-FS1(0)	5/25/2021
d3-MeFOSAA	33 N	G8408-FS1(0)	5/25/2021
d5-EtFOSAA	32 N	G8408-FS1(0)	5/25/2021
13C3-PFBS	62	G8408-FS1(0)	5/25/2021
13C3-PFHxS	77	G8408-FS1(0)	5/25/2021
13C8-PFOS	73	G8408-FS1(0)	5/25/2021
13C3-HFPO-DA	67	G8408-FS1(0)	5/25/2021

MW 5/21/21

Analyzed by: Schumitz, Denise
 Printed: 5/27/2021

Appendix F
Field Change Request



Sampling Analysis Plan Field Change Request (FCR) (9000-4041-FCR-01 Seaplane Base SI)

Date of Change: 4/16/2021

FCR No. (assigned by PM): 1

Applicable Sampling Analysis Plan Title:
Site Inspection, Seaplane Base Sampling and Analysis Plan (SAP)

Project Number: 695610CH Project Location: Oak Harbor, WA

Contract Number: N62470-16-D-9000, Contract Task Order 4041

Subject of Change:

1. Change the number of monitoring well installations
2. Collect groundwater and soil grab samples from auger shallow hole

Recommended Changes:

SAP Worksheet #11 Project Quality Objectives/Systematic Planning Process Statements:

Four soil borings, collection of capillary fringe soil boring samples, installation of four groundwater wells, and sampling groundwater from newly installed wells at Building 18.

Recommended Changes: Three soil borings and installation of three groundwater wells. Soil and groundwater collected as a grab sample from fourth and duplicate fifth location in auger shallow holes due to shallow water level.

SAP Worksheet #17 Sampling Design and Rationale:

Groundwater – Sampling will be collected from 5 newly installed wells.

Recommended Change: Groundwater – Sampling will be collected from 4 newly installed wells and two grab samples from auger shallow holes.

Soil – Sampling will be collected at the top of the capillary fringe

Recommended Change: Soil will also be collected as a grab sample from the top of the auger shallow holes.

Reason for Change:

1. During the initial required utility ground clearance with an hand auger, water was encountered at 2.5 feet below grade.
2. The significant water saturation made it too difficult to reach the required 5 feet below grade to confirm utility clearance.
3. The initial hand auger borehole was attempted in two locations, with consistent water saturation not allowing for appropriate utility clearance.
4. Without the ability to install a well, soil and groundwater samples were collected from the auger shallow hole

Submitted by:	Allan Erickson	Company: CH2M	Date: 4/19/2021
Review & Acceptance:			
Activity Manager:	Jennifer Madsen	Date: 4/16/2021	
Project Manager:	Jennifer Madsen	Date: 4/16/2021	
Environmental Manager:	NA	Date:	
Navy RPM:	Kendra Clubb	Date: 4/26/2021	
Distribution:			
1. Approvers above	2. FTL	3. Field Staff	4.
5.	6.	7.	8.

File Copies: Project File

Appendix G

Raw Data Tables

Sample ID	WI-SP-GW01-0421		WI-SP-GW01N-0421		WI-SP-GW02-0421		WI-SP-GW02P-0421		WI-SP-GW03-0421		WI-SP-GW04-0421		WI-SP-GW08-0421	
Station ID	WI-SP-SB01 (Grab)		WI-SP-SB01N (Grab)		WI-SP-MW02		WI-SP-MW02		WI-SP-MW03		WI-SP-MW04		WI-SP-MW08	
Sample Date	4/16/21		4/16/21		4/18/21		4/18/21		4/18/21		4/19/21		4/19/21	
Chemical Name														
Semivolatile Organic Compounds (NG/L)	LOD	Result	LOD	Result	LOD	Result	LOD	Result	LOD	Result	LOD	Result	LOD	Result
11-chloroeicosafuoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)	0.488	0.488 U	0.568	0.568 U	0.439	0.439 U	0.442	0.442 U	0.433	0.433 U	0.466	0.466 U	0.458	0.458 U
4,8-dioxa-3H-perfluorononanoic acid (ADONA)	0.977	0.977 U	1.14	1.14 U	0.877	0.877 U	0.883	0.883 U	0.865	0.865 U	0.933	0.933 U	0.916	0.916 U
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid (9Cl-PF3ONS)	0.977	0.977 U	1.14	1.14 U	0.877	0.877 U	0.883	0.883 U	0.865	0.865 U	0.933	0.933 U	0.916	0.916 U
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (EtFOSAA)	0.977	0.977 UJ	1.14	1.14 U	0.877	0.877 U	0.883	0.883 U	0.865	0.865 U	0.933	0.933 U	0.916	0.916 U
N-Methyl Perfluorooctanesulfonamidoacetic Acid (MeFOSAA)	0.977	0.977 U	1.14	1.14 U	0.877	0.877 U	0.883	0.883 U	0.865	0.865 U	0.933	0.933 U	0.916	0.916 U
Perfluoro-2-methyl-3-oxahexanoic acid (HFPO-DA)	0.488	0.488 U	0.568	0.568 U	0.877	0.439 U	0.442	0.442 U	0.433	0.433 U	0.466	0.466 U	0.458	0.458 U
Perfluorobutanesulfonic acid (PFBS)	0.488	122	0.568	50.2	0.439	153	0.442	150	0.433	70.2	0.466	0.466 U	2.29	427
Perfluorodecanoic Acid (PFDA)	0.488	14.5	0.568	8.35	0.439	0.439 U	0.442	1.47 J	0.433	0.433 U	0.466	0.466 U	0.458	0.458 U
Perfluorododecanoic Acid (PFDoA)	0.488	0.488 UJ	0.568	0.568 UJ	0.439	0.439 U	0.442	0.442 U	0.433	0.433 U	0.466	0.466 U	0.458	0.458 U
Perfluoroheptanoic acid (PFHpA)	0.977	86	1.14	88.1	0.877	105	0.883	118	0.865	62.9	0.933	0.933 U	0.916	438
Perfluorohexanesulfonic acid (PFHxS)	0.391	539	0.455	764	0.351	847	0.353	833	0.346	508	0.373	0.373 U	1.83	266
Perfluorohexanoic Acid (PFHxA)	1.46	245	1.7	201	1.32	249	1.33	258	1.3	149	1.4	1.4 U	6.87	312
Perfluorononanoic acid (PFNA)	0.977	19.1	1.14	16.7	0.877	18.4	0.883	19	0.865	9.43	0.933	0.933 U	0.916	24.4
Perfluorooctane Sulfonate (PFOS)	4.88	2,330	5.68	2,270	4.39	436	4.42	568	4.33	3,220	0.933	0.933 U	4.58	269
Perfluorooctanoic acid (PFOA)	1.46	131	1.7	134	1.32	123	1.33	124	1.3	114	1.4	1.4 U	1.37	329
Perfluorotetradecanoic Acid (PFTeDA)	1.95	1.95 UJ	2.27	2.27 R	1.75	1.75 U	1.77	1.77 U	1.73	1.73 U	1.87	1.87 U	1.83	1.83 U
Perfluorotridecanoic Acid (PFTrDA)	0.488	0.488 U	0.568	0.568 U	0.439	0.439 U	0.442	0.442 U	0.433	0.433 U	0.466	0.466 U	0.458	0.458 U
Perfluoroundecanoic Acid (PFUnA)	0.488	0.488 U	0.568	0.568 U	0.439	0.439 U	0.442	0.442 U	0.433	0.433 U	1.466	0.466 U	0.458	0.458 U

Notes:

J - Analyte present. Value may or may not be accurate or precise

NG/L - Nanograms per liter

NS - Not sampled

R - Unreliable Result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

DRAFT

Sample ID	WI-SP-SB01-01H02		WI-SP-SB01N-01H02		WI-SP-SB02-04H05		WI-SP-SB03-0808H		WI-SP-SB04-0505H		WI-SP-SB08-80H81H		WI-SP-SB08P-80H81H		WI-SP-SS01-000H	
Sample Date	4/16/21		4/16/21		4/15/21		4/16/21		4/16/21		4/14/21		4/14/21		4/21/21	
Chemical Name																
Semivolatile Organic Compounds (NG/G)	LOD	Results	LOD	Results	LOD	Results	LOD	Results	LOD	Results	LOD	Results	LOD	Results	LOD	Results
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)	0.06	0.06 J	0.0581	0.0581 U	0.0593	0.0593 U	0.0589	0.0589 U	0.0589	0.0589 U	0.0588	0.0588 U	0.0592	0.0592 U	0.0594	0.0594 U
4,8-dioxa-3H-perfluorononanoic acid (ADONA)	0.08	0.0558 J	0.0775	0.0775 U	0.0791	0.0791 U	0.0786	0.0786 U	0.0786	0.0786 U	0.0784	0.0784 U	0.0789	0.0789 U	0.0792	0.0792 U
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid (9Cl-PF3ONS)	0.04	0.0464 J	0.0388	0.0388 U	0.0395	0.0395 U	0.0393	0.0393 U	0.0393	0.0393 U	0.0392	0.0392 U	0.0394	0.0394 U	0.0396	0.0396 U
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (EtFOSAA)	0.08	0.114 J	0.0775	0.0775 U	0.0791	0.0791 U	0.0786	0.0786 U	0.0786	0.0786 U	0.0784	0.0784 U	0.0789	0.0789 U	0.0792	0.0792 U
N-Methyl Perfluorooctanesulfonamidoacetic Acid (MeFOSAA)	0.1	0.11 J	0.0969	0.0969 U	0.0988	0.0988 U	0.0982	0.0982 U	0.0982	0.0982 U	0.098	0.098 U	0.0986	0.0986 U	0.099	0.099 U
Perfluoro-2-methyl-3-oxahexanoic acid (HFPO-DA)	0.08	0.033 J	0.0775	0.0775 U	0.0791	0.0791 U	0.0786	0.0786 U	0.0786	0.0786 U	0.0784	0.0784 U	0.0789	0.0789 U	0.0792	0.0792 U
Perfluorobutanesulfonic acid (PFBS)	0.04	0.0814 J	0.0388	0.0207 J	0.0395	0.0395 U	0.0393	0.0289 J	0.0393	0.117 J	0.0392	0.0392 U	0.0394	0.0394 U	0.0396	0.0396 U
Perfluorodecanoic Acid (PFDA)	0.04	0.0474 J	0.0388	0.0388 U	0.0395	0.0569 J	0.0393	0.0393 U	0.0393	0.0393 U	0.0392	0.0392 U	0.0394	0.0394 U	0.0396	0.0396 U
Perfluorododecanoic Acid (PFDoA)	0.08	0.0384 J	0.0775	0.0775 U	0.0791	0.0791 U	0.0786	0.0786 U	0.0786	0.0786 U	0.0784	0.0784 U	0.0789	0.0789 U	0.0792	0.0792 U
Perfluoroheptanoic acid (PFHpA)	0.06	0.0626 J	0.0581	0.0581 U	0.0593	0.0298 J	0.0589	0.0589 U	0.0589	0.0589 U	0.0588	0.0588 U	0.0592	0.0592 U	0.0594	0.0782 J
Perfluorohexanesulfonic acid (PFHxS)	0.08	0.169 J	0.0775	0.0928 J	0.0791	0.598	0.0786	0.186 J	0.0786	0.218	0.0784	0.0784 U	0.0789	0.0789 U	0.0792	0.0792 U
Perfluorohexanoic Acid (PFHxA)	0.08	0.119 J	0.0775	0.0316 J	0.0791	0.0791 U	0.0786	0.0316 J	0.0786	0.0963 J	0.0784	0.0784 U	0.0789	0.0789 U	0.0792	0.0792 U
Perfluorononanoic acid (PFNA)	0.04	0.0478 J	0.0388	0.0388 U	0.0395	0.125 J	0.0393	0.0393 U	0.0393	0.0393 U	0.0392	0.0392 U	0.0394	0.0394 U	0.0396	0.0396 U
Perfluorooctane Sulfonate (PFOS)	0.08	2.91	0.0775	0.765	0.0791	9.24	0.0786	2.26	0.0786	0.246	0.0784	0.0784 U	0.0789	0.0789 U	0.0792	0.0899 J
Perfluorooctanoic acid (PFOA)	0.08	0.11 J	0.0775	0.0775 U	0.0791	0.258	0.0786	0.113 J	0.0786	0.0786 U	0.0784	0.0784 U	0.0789	0.0789 U	0.0792	0.0792 U
Perfluorotetradecanoic Acid (PFTeDA)	0.1	0.1 U	0.0969	0.0969 U	0.0988	0.0988 U	0.0982	0.0982 U	0.0982	0.0982 U	0.098	0.098 U	0.0986	0.0986 U	0.099	0.099 U
Perfluorotridecanoic Acid (PFTrDA)	0.04	0.049 J	0.0388	0.0388 U	0.0395	0.0395 U	0.0393	0.0393 U	0.0393	0.0393 U	0.0392	0.0392 U	0.0394	0.0394 U	0.0396	0.0396 U
Perfluoroundecanoic Acid (PFUnA)	0.04	0.0436 J	0.0388	0.0388 U	0.0395	0.019 J	0.0393	0.0393 U	0.0393	0.0393 U	0.0392	0.0392 U	0.0394	0.0394 U	0.0396	0.0396 U

Notes:

J - Analyte present. Value may or may not be accurate or precise

NG/G - Nanograms per gram

NS - Not sampled

U - The material was analyzed for, but not detected

DRAFT

Sample ID	WI-SP-SS02-000H		WI-SP-SS02P-000H		WI-SP-SS03-000H		WI-SP-SS04-000H	
Sample Date	4/21/21		4/21/21		4/21/21		4/21/21	
Chemical Name								
Semivolatile Organic Compounds (NG/G)	LOD	Results	LOD	Results	LOD	Results	LOD	Results
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)	0.0598	0.0598 U	0.0587	0.0587 U	0.0588	0.0588 U	0.0594	0.0594 U
4,8-dioxa-3H-perfluorononanoic acid (ADONA)	0.0797	0.0797 U	0.0783	0.0783 U	0.0784	0.0784 U	0.0792	0.0792 U
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid (9Cl-PF3ONS)	0.0398	0.0398 U	0.0391	0.0391 U	0.0392	0.0392 U	0.0396	0.0396 U
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (EtFOSAA)	0.0797	0.0797 U	0.0783	0.0783 U	0.0784	0.0784 U	0.0792	0.0792 U
N-Methyl Perfluorooctanesulfonamidoacetic Acid (MeFOSAA)	0.0996	0.0996 U	0.0978	0.0978 U	0.098	0.098 U	0.099	0.099 U
Perfluoro-2-methyl-3-oxahexanoic acid (HFPO-DA)	0.0797	0.0797 U	0.0783	0.0783 U	0.0784	0.0784 U	0.0792	0.0792 U
Perfluorobutanesulfonic acid (PFBS)	0.0398	0.0398 U	0.0391	0.0391 U	0.0392	0.039 J	0.0396	0.0396 U
Perfluorodecanoic Acid (PFDA)	0.0398	0.0398 U	0.0391	0.0391 U	0.0392	0.0392 U	0.0396	0.0396 U
Perfluorododecanoic Acid (PFDoA)	0.0797	0.0797 U	0.0783	0.0783 U	0.0784	0.0784 U	0.0792	0.0792 U
Perfluoroheptanoic acid (PFHpA)	0.0598	0.0598 U	0.0587	0.0587 U	0.0588	0.149 J	0.0594	0.0594 U
Perfluorohexanesulfonic acid (PFHxS)	0.0797	0.0797 U	0.0783	0.0783 U	0.0784	0.0516 J	0.0792	0.0792 U
Perfluorohexanoic Acid (PFHxA)	0.0797	0.0797 U	0.0783	0.0783 U	0.0784	0.254 U	0.0792	0.0792 U
Perfluorononanoic acid (PFNA)	0.0398	0.0398 U	0.0391	0.0391 U	0.0392	0.0392 U	0.0396	0.0396 U
Perfluorooctane Sulfonate (PFOS)	0.0797	0.148 J	0.0783	0.119 J	0.0784	0.13 J	0.0792	0.156 J
Perfluorooctanoic acid (PFOA)	0.0797	0.0797 U	0.0783	0.0783 U	0.0784	0.0784 U	0.0792	0.0792 U
Perfluorotetradecanoic Acid (PFTeDA)	0.0996	0.0996 U	0.0978	0.0978 U	0.098	0.098 U	0.099	0.099 U
Perfluorotridecanoic Acid (PFTrDA)	0.0398	0.0398 U	0.0391	0.0391 U	0.0392	0.0392 U	0.0396	0.0396 U
Perfluoroundecanoic Acid (PFUnA)	0.0398	0.0398 U	0.0391	0.0391 U	0.0392	0.0392 U	0.0396	0.0396 U

Notes:

J - Analyte present. Value may or may not be accurate or precise

NG/G - Nanograms per gram

NS - Not sampled

U - The material was analyzed for, but not detected

DRAFT

Appendix H
Human Health Risk Screening

Human Health Risk Screening

A human health risk screening (HHRS) was performed to assess potential human health risks associated with exposure to per- and polyfluoroalkyl substances (PFAS) in soil and groundwater at Seaplane Base, Naval Air Station Whidbey Island, Washington. The HHRS evaluated the following two investigation areas: (1) Building 18 Wash Rack and (2) Biosolids Land Application Area (BLAA). Potential risks associated with perfluorobutanesulfonic acid (PFBS), perfluorooctanoic acid (PFOA), perfluorooctane sulfonate (PFOS), perfluorohexanesulfonic acid (PFHxS), perfluorononanoic acid (PFNA), and hexafluoropropylene oxide dimer acid (HFPO-DA), the only PFAS with available toxicity values, were quantified in the HHRS. As discussed in the Site Inspection, additional PFAS were also analyzed by the laboratory in the samples; however, because there are no current toxicity or screening values for these PFAS they were not quantitatively evaluated in the HHRS. They were analyzed by the laboratory for comparison to screening levels that may be developed in the future. The results of the HHRS provide a preliminary indication of potential risks from exposure to PFAS in soil and groundwater at the three investigation areas and are used to help evaluate whether future unrestricted use of the site is acceptable, or if the site requires further evaluation.

Although groundwater from these areas is not used as a potable water supply and is unlikely to be used as a future water supply because it is brackish and tidally influenced, human health risk-based levels for potable use were used for the screening evaluation as screening criteria for other exposure scenarios have not been developed. In addition, although the sites are not residential, human health risk-based levels for residential exposure were used for the screening evaluation for soil.

Soil and groundwater samples collected in April 2021 were evaluated in the HHRS. Only groundwater samples collected from monitoring wells were used. Grab groundwater samples were not evaluated in the HHRS due to the lack of precision and reproducibility related to grab samples. The soil and groundwater PFAS data evaluated in the HHRS were validated. Validation of the data identified the following criteria for data usability:

- Estimated values flagged with a J qualifier were treated as unqualified detected concentrations.
- Values flagged with a U or UJ qualifier indicate an analyte was not detected and the UJ qualifier indicates the quantitation limit was estimated.
- For duplicate samples, the maximum concentration between the two samples was used as the sample concentration. If the analyte was only detected in one of the samples, the detected concentration was used as the sample concentration. If the analyte was not detected in either of the samples, the higher detection limit was used as the sample detection limit.

Human Health Risk Screening Methodology

The HHRS was conducted in two steps using the risk ratio technique described in *Overview of Screening, Risk Ratio, and Toxicological Evaluation. Procedures for Northern Division Human Health Risk Assessments* (Navy, 2000). If chemicals of potential concern (COPCs) were identified after Step 1, they were evaluated in Step 2. The following describes the two-step screening process.

Step 1

The maximum detected PFBS, PFOA, PFOS, PFHxS, PFNA, and HFPO-DA concentrations in subsurface soil and groundwater for each area were compared to human health risk-based regional screening levels (RSLs) based on a residential use scenario. RSLs from the current USEPA RSL table (USEPA, 2022) were used for the screening, as described in DoD, 2022.

Soil data were compared to residential soil RSLs and groundwater data were compared to tapwater RSLs. RSLs based on noncarcinogenic effects were based on a hazard quotient (HQ) of 0.1 to account for exposure to multiple constituents with the same target organ/target effect. RSLs based on carcinogenic endpoints were based

on a carcinogenic risk of 1×10^{-6} . For analytes with both noncarcinogenic and carcinogenic effects, the lower RSL was used.

If the maximum detected concentration exceeded the RSL, the constituent was identified as a Step 1 COPC and evaluated in Step 2.

Step 2

Step 2 was only performed for groundwater. Step 2 was not performed for soil because COPCs were not identified in Step 1. A risk level was calculated for the PFAS identified as COPCs in Step 1 following the approach discussed in *Overview of Screening, Risk Ratio, and Toxicological Evaluation. Procedures for Northern Division Human Health Risk Assessments* (Navy, 2000): For carcinogenic chemicals identified as COPCs in Step 1, carcinogenic risk was calculated using the following equation:

$$\text{Carcinogenic risk} = \frac{\text{MDC} \times \text{target risk level of RSL}}{\text{RSL}}$$

Where:

MDC = maximum detected concentration ($\mu\text{g}/\text{kg}$ or $\mu\text{g}/\text{L}$)

target risk level of RSL = 1×10^{-6} (unitless)

RSL = Regional screening level based on carcinogenic risk of 1×10^{-6} ($\mu\text{g}/\text{kg}$ or $\mu\text{g}/\text{L}$)

For noncarcinogenic chemicals identified as COPCs in Step 1, a hazard index (HI) was calculated using the following equation:

$$\text{Noncarcinogenic HQ} = \frac{\text{MDC} \times \text{target HQ of RSL}}{\text{RSL}}$$

Where:

MDC = maximum detected concentration ($\mu\text{g}/\text{kg}$ or $\mu\text{g}/\text{L}$)

target HQ of RSL = 1 (unitless)

RSL = Regional Screening Level based on noncarcinogenic HQ of 1 ($\mu\text{g}/\text{kg}$ or $\mu\text{g}/\text{L}$)

Both the carcinogenic risk and the HI were calculated for COPCs that act through carcinogenic and noncarcinogenic effects. The carcinogenic risks for each COPC were summed to calculate the cumulative carcinogenic risk, and the HQs for each COPC were summed to calculate the cumulative HI. A cumulative HI was also calculated for each target organ/effect. If the cumulative HI for a target organ/effect was greater than 0.5, or the cumulative carcinogenic risk was greater than 5×10^{-5} , the chemicals contributing to these values were identified as COPCs. These conservative target risk levels are used to account for potential risks posed by pathways, routes, and chemicals that are not considered in the screening process.

Human Health Risk Screening Results

Building 18 Wash Rack

Table H-1 presents the HHRS for soil for Building 18 Wash Rack. The MDCs of PFOA, PFOS, PFBS, PFHxS, PFNA, and HFPO-DA were below the residential soil RSLs.

Tables H-2 and H-2a present the HHRS for groundwater for Building 18 Wash Rack. The MDCs of PFOA, PFOS, PFHxS, and PFNA exceeded the tap water RSLs, therefore, these PFAS were evaluated in Step 2. All of these PFAS contribute an HQ greater than 0.1 to a cumulative target organ HI greater than 0.5, therefore, PFOA, PFOS, PFHxS, and PFNA were identified as groundwater COPCs.

Exposure to soil at Building 18 Wash Rack would not result in unacceptable human health risks associated with PFAS. COPCs were identified for exposure to groundwater that warrant further evaluation of potential risks to exposed human receptors.

Biosolids Land Application Area

Table H-3 presents the HHRS for soil for the BLAA. Although the surface soil samples were collected as composite samples and the one subsurface soil was a grab sample, the surface soil and subsurface soil data were combined for the HHRS. The MDCs of PFOS, PFBS, and PFHxS (detected in a composite surface soil sample) were below the residential soil RSLs (PFOA, PFNA, and HFPO-DA were not detected in any samples).

Tables H-4 and H-4a present the HHRS for groundwater for the BLAA. The MDCs of PFOA, PFOS, PFHxS, and PFNA exceeded the tap water RSLs, therefore, they were evaluated in Step 2. PFOA, PFOS, PFHxS, and PFNA contribute an HI greater than 0.1 to a cumulative HI greater than 0.5; therefore, they were identified as groundwater COPCs.

Exposure to soil at the BLAA would not result in unacceptable human health risks associated with PFAS. COPCs were identified for exposure to groundwater that warrant further evaluation of potential risks to exposed human receptors.

Uncertainty Assessment

Soil and groundwater samples were analyzed for 18 PFAS; however, toxicity values and screening values are only available for 6 PFAS. Since samples were analyzed for additional PFAS and additional PFAS were detected it is possible risks have been underestimated. In addition, there are more PFAS than the 18 PFAS that were analyzed, which may result in underestimation of risk if they are present in site soil and groundwater.

The detected PFAS concentrations were compared to residential based screening levels; however, the PFAS investigation areas evaluated in the HHRS are not residential sites. Use of residential screening levels to evaluate non-residential sites, including residential screening levels assuming the groundwater is used as a drinking water supply, is conservative; however, residential screening levels were used to consider unrestricted future site use.

For the majority of the PFAS investigation areas, only a few samples were collected, and therefore the COPCs and potential risks were identified based on the maximum detected concentrations of the PFAS. This may result in an overestimate of potential risk.

Human Health Risk Screening Summary

Exposure to soil at the two investigation areas (Building 18 Wash Rack and the BLAA) would not result in unacceptable human health risks associated with PFBS, PFOA, PFOS, PFHxS, PFNA, and HFPO-DA. However, exposure to groundwater at these two areas may result in unacceptable human health risks associated with PFAS based on comparison to tap water RSLs.

References

Department of Defense (DoD). 2022. Assistant Secretary of Defense memorandum, *Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program*. July 6.

Department of the Navy (Navy). 2000. *Overview of Screening, Risk Ratio, and Toxicological Evaluation. Procedures for Northern Division Human Health Risk Assessments*. May.

United States Environmental Protection Agency (USEPA). 2022. *Regional Screening Levels for Chemicals at Superfund Sites*. May.

Tables

Table H-1. Occurrence, Distribution, and Selection of Chemicals of Potential Concern

Site Inspection Report for PFAS

Seaplane Base, Naval Air Station Whidbey Island, Washington

Scenario Timeframe: Future
 Medium: Soil
 Exposure Medium: Soil

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
Building 18 Wash Rack	1763-23-1	Perfluorooctane Sulfonate (PFOS)	2.5E-01	9.2E+00	UG/KG	WI-SP-SB02-04H05	5/5	0.0775 - 0.0800	9.2E+00	N/A	1.3E+01 N	N/A	N/A	NO	BSL
	335-67-1	Perfluorooctanoic acid (PFOA)	1.1E-01 J	2.6E-01	UG/KG	WI-SP-SB02-04H05	3/5	0.0775 - 0.0800	2.6E-01	N/A	1.9E+01 N	N/A	N/A	NO	BSL
	375-73-5	Perfluorobutanesulfonic acid (PFBS)	2.1E-02 J	1.2E-01 J	UG/KG	WI-SP-SB04-0505H	4/5	0.0388 - 0.0400	1.2E-01	N/A	1.9E+03 N	N/A	N/A	NO	BSL
	13252-13-6	Hexafluoropropylene oxide dimer acid (HFPO-DA)	3.3E-02 J	3.3E-02 J	UG/KG	WI-SP-SB01-01H02	1/5	0.0775 - 0.0800	3.3E-02	N/A	2.3E+01 N	N/A	N/A	NO	BSL
	355-46-4	Perfluorohexanesulfonic acid (PFHxS)	9.3E-02 J	6.0E-01	UG/KG	WI-SP-SB02-04H05	5/5	0.0775 - 0.0800	6.0E-01	N/A	1.3E+02 N	N/A	N/A	NO	BSL
	375-95-1	Perfluorononanoic acid (PFNA)	4.8E-02 J	1.3E-01 J	UG/KG	WI-SP-SB02-04H05	2/5	0.0388 - 0.0400	1.3E-01	N/A	1.9E+01 N	N/A	N/A	NO	BSL

- [1] Minimum/maximum detected concentrations (samples WI-SP-SB01-01H02, WI-SP-SB01N-01H02, WI-SP-SB02-04H05, WI-SP-SB03-0808H, and WI-SP-SB04-0505H)
- [2] Maximum detected concentration is used for screening.
- [3] Background values not available
- [4] Oak Ridge National Laboratory (ORNL). May 2022. Regional Screening Levels for Chemical Contaminants at Superfund Sites. Resident Soil. RSLs based on non-cancer (N) based on an HQ = 0.1.
- [5] Rationale Codes

Selection Reason: Above Screening Levels (ASL)
 Deletion Reason: Below Screening Level (BSL)

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/
 To Be Considered
 COPC = Chemical of Potential Concern
 HQ = hazard quotient
 J = Estimated Value
 N = Noncarcinogenic
 N/A = not available
 RSL = Regional Screening Level

Table H-2. Occurrence, Distribution, and Selection of Chemicals of Potential Concern

Site Inspection Report for PFAS

Seaplane Base, Naval Air Station Whidbey Island, Washington

Scenario Timeframe: Future
 Medium: Groundwater
 Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
Building 18 Wash Rack	1763-23-1	Perfluorooctane Sulfonate (PFOS)	5.7E-01	3.2E+00	UG/L	WI-SP-GW03-0421	2/3	0.000865 - 0.000933	3.2E+00	N/A	4.0E-03	N	N/A	YES	ASL
	335-67-1	Perfluorooctanoic acid (PFOA)	1.1E-01	1.2E-01	UG/L	WI-SP-GW02P-0421	2/3	0.0013 - 0.0017	1.2E-01	N/A	6.0E-03	N	N/A	YES	ASL
	375-73-5	Perfluorobutanesulfonic acid (PFBS)	7.0E-02	1.5E-01	UG/L	WI-SP-GW02-0421	2/3	0.000433 - 0.000466	1.5E-01	N/A	6.0E-01	N	N/A	NO	BSL
	355-46-4	Perfluorohexanesulfonic acid (PFHxS)	5.1E-01	8.5E-01	UG/L	WI-SP-GW02-0421	2/3	0.000373 - 0.000373	8.5E-01	N/A	3.9E-02	N	N/A	YES	ASL
	375-95-1	Perfluorononanoic acid (PFNA)	9.4E-03	1.9E-02	UG/L	WI-SP-GW02P-0421	2/3	0.000865 - 0.000933	1.9E-02	N/A	5.9E-03	N	N/A	YES	ASL

- [1] Minimum/maximum detected concentrations (samples WI-SP-GW02-0421, WI-SP-GW02P-0421 [duplicate], WI-SP-GW03-0421, and WI-SP-GW04-0421)
- [2] Maximum detected concentration is used for screening.
- [3] Background values not available
- [4] Oak Ridge National Laboratory (ORNL). May 2022. Regional Screening Levels for Chemical Contaminants at Superfund Sites. Tapwater. RSLs based on non-cancer (N) based on HQ = 0.1.
- [5] Rationale Codes

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/
 To Be Considered
 COPC = Chemical of Potential Concern
 HQ = hazard quotient
 N = Noncarcinogenic
 N/A = Not available
 RSL = Regional Screening Level

Selection Reason: Above Screening Levels (ASL)
 Deletion Reason: Below Screening Level (BSL)

Table H-2a. Risk Ratio Screening, Maximum Detected Concentration - Building 18 Wash Rack Groundwater

Site Inspection Report for PFAS

Seaplane Base, Naval Air Station Whidbey Island, Washington

Analyte	Detection Frequency	Maximum Detected Concentration (Qualifier) (µg/L)	Sample Location of Maximum Detected Concentration	Carcinogenic Tap Water RSL (µg/L) ^a	Target Risk Level of RSL	Cancer Risk ^b	Non-carcinogenic Tap Water RSL (µg/L)	Target Hazard Level of RSL	Hazard Quotient ^c	Target Organ
Perfluorooctane Sulfonate (PFOS)	2 / 3	3.2E+00	WI-SP-GW03-0421	N/A	N/A	N/A	4.0E-02	1	81	Developmental
Perfluorooctanoic acid (PFOA)	2 / 3	1.2E-01	WI-SP-GW02P-0421	1.1E+00	1E-06	1E-07	6.0E-02	1	2.1	Developmental
Perfluorohexanesulfonic acid (PFHxS)	2 / 3	8.5E-01	WI-SP-GW02-0421	N/A	N/A	N/A	3.9E-01	1	2.2	Endocrine
Perfluorononanoic acid (PFNA)	2 / 3	1.9E-02	WI-SP-GW02P-0421	N/A	N/A	N/A	5.9E-02	1	0.32	Developmental
Cumulative Hazard Index^d									85	
Cumulative Cancer Risk^e						1E-07				
Total Developmental HI =										83
Total Endocrine HI =										2

Notes:

^aThe Carcinogenic Tapwater RSL value for PFOA was obtained from the May 2022 Regional Screening Level (RSL) Resident Tapwater Table (TR=1E-06, HQ=1).

^bCancer Risk = maximum detected concentration/(RSL/target risk level of RSL).

^cHazard Quotient = maximum detected concentration/(RSL/target hazard level of RSL)

^dCumulative hazard index (HI) equals sum of hazard quotients for each constituent.

^eCumulative cancer risk equals sum of cancer risks for each constituent.

Constituent selected as constituent of potential concern (COPC) if it contributes a HI greater than 0.1 to a cumulative HI for a target organ greater than 0.5, or contributes to a cumulative cancer risk greater than 5E-05.

Constituents selected as COPCs are indicated by bold and shading.

µg/L = micrograms per Liter

N/A = not available/not applicable

DRAFT

Table H-3. Occurrence, Distribution, and Selection of Chemicals of Potential Concern

Site Inspection Report for PFAS

Seaplane Base, Naval Air Station Whidbey Island, Washington

Scenario Timeframe: Current/Future
 Medium: Soil
 Exposure Medium: Soil

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
Biosolids Land Application Area	1763-23-1	Perfluorooctane Sulfonate (PFOS)	9.0E-02 J	1.6E-01 J	UG/KG	WI-SP-SS04-000H	4/5	0.0783 - 0.0797	1.6E-01	N/A	1.3E+01 N	N/A	N/A	NO	BSL
	375-73-5	Perfluorobutanesulfonic acid (PFBS)	3.9E-02 J	3.9E-02 J	UG/KG	WI-SP-SS03-000H	1/5	0.0391 - 0.0398	3.9E-02	N/A	1.9E+03 N	N/A	N/A	NO	BSL
	355-46-4	Perfluorohexanesulfonic acid (PFHx)	5.2E-02 J	5.2E-02 J	UG/KG	WI-SP-SS03-000H	1/5	0.0783 - 0.0797	5.2E-02	N/A	1.3E+02 N	N/A	N/A	NO	BSL

[1] Minimum/Maximum detected concentrations (samples WI-SP-SB08-80H81H, WI-SP-SB08P-80H81H [duplicate], WI-SP-SS01-000H, WI-SP-SS02-000H, WI-SP-SS02P-000H [duplicate], WI-SP-SS03-000H, and WI-SP-SS04-000H)

[2] Maximum detected concentration is used for screening.

[3] Background values not available

[4] Oak Ridge National Laboratory (ORNL). May 2022. Regional Screening Levels for Chemical Contaminants at Superfund Sites. Resident Soil. RSLs based on non-cancer (N) based on HQ = 0.1.

[5] Rationale Codes

Selection Reason: Above Screening Levels (ASL)

Deletion Reason: Below Screening Level (BSL)

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

COPC = Chemical of Potential Concern

HQ = hazard quotient

J = Estimated Value

N = Noncarcinogenic

N/A = Not available

RSL = Regional Screening Level

Table H-4. Occurrence, Distribution, and Selection of Chemicals of Potential Concern

Site Inspection Report for PFAS

Seaplane Base,

Scenario Timeframe: Future
 Medium: Groundwater
 Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening Toxicity Value [4]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection [5]
Biosolids Land Application Area	1763-23-1	Perfluorooctane Sulfonate (PFOS)	2.7E-01	2.7E-01	UG/L	WI-SP-GW08-0421	1/1	0.00458	2.7E-01	N/A	4.0E-03	N	N/A	YES	ASL
	335-67-1	Perfluorooctanoic acid (PFOA)	3.3E-01	3.3E-01	UG/L	WI-SP-GW08-0421	1/1	0.00137	3.3E-01	N/A	6.0E-03	N	N/A	YES	ASL
	375-73-5	Perfluorobutanesulfonic acid (PFBS)	4.3E-01	4.3E-01	UG/L	WI-SP-GW08-0421	1/1	0.00229	4.3E-01	N/A	6.0E-01	N	N/A	NO	BSL
	355-46-4	Perfluorohexanesulfonic acid (PFHxS)	2.7E-01	2.7E-01	UG/L	WI-SP-GW08-0421	1/1	N/A	2.7E-01	N/A	3.9E-02	N	N/A	YES	ASL
	375-95-1	Perfluorononanoic acid (PFNA)	2.4E-02	2.4E-02	UG/L	WI-SP-GW08-0421	1/1	0.00458	2.4E-02	N/A	5.9E-03	N	N/A	YES	ASL

[1] Minimum/maximum detected concentration (sample WI-SP-GW08-0421)

[2] Maximum detected concentration is used for screening.

[3] Background values not available

[4] Oak Ridge National Laboratory (ORNL). May 2022. Regional Screening Levels for Chemical Contaminants at Superfund Sites. Tapwater. RSLs based on non-cancer (N) based on HQ = 0.1.

[5] Rationale Codes

Selection Reason: Above Screening Levels (ASL)
 Deletion Reason: Below Screening Level (BSL)

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/
 To Be Considered

COPC = Chemical of Potential Concern

HQ = hazard quotient

N = Noncarcinogenic

N/A = Not available

RSL = Regional Screening Level

Table H-4a. Risk Ratio Screening, Maximum Detected Concentration - Biosolids Land Application Area Groundwater

Site Inspection Report for PFAS

Seaplane Base, Naval Air Station Whidbey Island, Washington

Analyte	Detection Frequency	Maximum Detected Concentration (Qualifier) (UG/L)	Sample Location of Maximum Detected Concentration	Carcinogenic Tap Water RSL (µg/L) ^a	Target Risk Level of RSL	Cancer Risk ^b	Non-carcinogenic Tap Water RSL (µg/L)	Target Hazard Level of RSL	Hazard Quotient ^c	Target Organ
Perfluorooctane Sulfonate (PFOS)	1 / 1	2.7E-01	WI-SP-GW08-0421	N/A	N/A	N/A	4.0E-02	1	6.7	Developmental
Perfluorooctanoic acid (PFOA)	1 / 1	3.3E-01	WI-SP-GW08-0421	1.1E+00	1E-06	3E-07	6.0E-02	1	5.5	Developmental
Perfluorohexanesulfonic acid (PFHS)	1 / 1	2.7E-01	WI-SP-GW08-0421	N/A	N/A	N/A	3.9E-01	1	0.68	Endocrine
Perfluorononanoic acid (PFNA)	1 / 1	2.4E-02	WI-SP-GW08-0421	N/A	N/A	N/A	5.9E-02	1	0.41	Developmental
Cumulative Hazard Index^d									13	
Cumulative Cancer Risk^e						3E-07				
Total Developmental HI =										13
Total Endocrine HI =										0.7

Notes:

^aThe Carcinogenic Tapwater RSL value for PFOA was obtained from the May 2022 Regional Screening Level (RSL) Resident Tapwater Table (TR=1E-06, HQ=1).

^bCancer Risk = maximum detected concentration/(RSL/target risk level of RSL).

^cHazard Quotient = maximum detected concentration/(RSL/target hazard level of RSL)

^d Cumulative hazard index (HI) equals sum of hazard quotients for each constituent.

^e Cumulative cancer risk equals sum of cancer risks for each constituent.

Constituent selected as constituent of potential concern (COPC) if it contributes a HI greater than 0.1 to a cumulative HI for a target organ greater than 0.5, or contributes to a cumulative cancer risk greater than 5E-05.

Constituents selected as COPCs are indicated by bold and shading.

µg/L = micrograms per liter

N/A = Not available/not applicable

Appendix I
Sanitary Wastewater
Treatment Plant Data

Sanitary Wastewater Treatment Plant Data

This appendix presents data for the sanitary wastewater treatment plant (SWWTP). As mentioned in the executive summary, the SI report does not include an evaluation of the SWWTP nor does this SI report provide recommendations for further investigation of the SWWTP at this time. The following is a summary of the activities conducted at the SWWTP.

Three soil borings (WI-SP-SB05, WI-SP-SB06, WI-SP-SB07) (**Figure I-1**) were drilled at locations within the SWWTP adjacent to the treatment lagoons on April 15, 2021. One soil sample was collected from each boring at the water table interface. The boreholes were abandoned after drilling and sampling were complete.

Groundwater samples were collected from three existing monitoring wells (WI-SP-MW-2 APN870, WI-SP-MW-3 APN871, and WI-SP-MW-4 APN872) near the SWWTP perimeter (**Figure I-1**). Sampling of the existing monitoring wells was performed from April 17 through 20, 2021. **Table I-1** presents the well construction details and groundwater elevations at the existing monitoring wells, and **Table I-2** presents the final water quality parameters, measured just prior to groundwater sample collection. **Figure I-2** shows the groundwater elevations measured at the existing wells.

The raw analytical data (not compared to project action levels) for soil and groundwater samples collected at the SWWTP are presented in **Tables I-3** and **I-4**.

An appendix is attached to **Appendix I** and includes the borehole logs and groundwater sampling data sheets.

Tables

Table I-1. Monitoring Well Construction Details and Groundwater Elevations (April 2021)

Station ID	Installation Date	Northing (ft NAD83)	Easting (ft NAD83)	Ground Elevation (ft NAVD88)	Top of Casing Elevation (ft NAVD88)	Total Depth (ft bgs)	Casing Diameter (inches)	Top of Screen Depth (ft bgs)	Screen Length (ft)	Depth to Water (ft btoc)	Groundwater Elevation (ft NAVD88)
<i>Sanitary Wastewater Treatment Plant – Existing Wells</i>											
WI-SP-MW-2 APN870	--	478451.36	1207162.96	--	13.003	15	2	5	10	5.85 ^a	7.15
WI-SP-MW-3 APN871	--	479160.17	1206227.18	--	16.292	15	2	5	10	10.06 ^b	6.23
WI-SP-MW-4 APN872	--	479003.05	1207690.20	--	15.625	15	2	5	10	9.73 ^b	5.90

^a depth to water measurement recorded during sampling on 4/20/2021

^b depth to water measurement recorded during sampling on 4/17/2021

-- = information not available

btoc = below top of casing

ID = identification

ft = foot or feet

NAD83 = North American Datum of 1983, Washington State Plane North Zone

NAVD88 = North American Vertical Datum of 1988

Table I-2. Water Quality Parameters (April 2021)

Monitoring Well ID	Date Sampled	Sample Time	Sample Depth (ft bgs)	Temperature (°C)	pH (standard units)	Specific Conductance (mS/cm)	Turbidity (NTU)	DO (mg/L)	ORP (mV)
<i>Sanitary Wastewater Treatment Plant</i>									
WI-SP-MW-2 APN870	4/20/2021	11:15	10	15.02	6.55	36.8	5.90	0.00	-90
WI-SP-MW-3 APN871	4/17/2021	17:35	10	19.58	7.27	7.27	2.10	3.57	-263
WI-SP-MW-4 APN872	4/17/2021	14:25	10	11.18	6.64	6.64	0.10	0.81	-40

°C = degrees Celsius

mg/L = milligram(s) per liter

mS/cm = milliSiemens per centimeter

mV = millivolt(s)

NTU = nephelometric turbidity unit,

Table I-3. Soil Analytical Data

Sample ID	WI-SP-SB05-09H10		WI-SP-SB06-1313H		WI-SP-SB07-13H14	
Sample Date	4/15/21		4/15/21		4/15/21	
Chemical Name						
Semivolatile Organic Compounds (NG/G)	LOD	Results	LOD	Results	LOD	Results
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)	0.0593	0.273	0.0576	0.0576 U	0.0594	0.0594 U
4,8-dioxa-3H-perfluorononanoic acid (ADONA)	0.0791	0.284	0.0768	0.0768 U	0.0792	0.0792 U
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid (9Cl-PF3ONS)	0.0395	0.258	0.0384	0.0384 U	0.0396	0.0396 U
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (EtFOSAA)	0.0791	0.264	0.0768	0.0768 U	0.0792	0.0792 U
N-Methyl Perfluorooctanesulfonamidoacetic Acid (MeFOSAA)	0.0988	0.262	0.096	0.096 U	0.099	0.099 U
Perfluoro-2-methyl-3-oxahexanoic acid (HFPO-DA)	0.0791	0.292	0.0768	0.0768 U	0.0792	0.0792 U
Perfluorobutanesulfonic acid (PFBS)	0.0395	0.292	0.0384	0.0384 U	0.0396	0.0396 U
Perfluorodecanoic Acid (PFDA)	0.0395	0.359	0.0384	0.0384 U	0.0396	0.0396 U
Perfluorododecanoic Acid (PFDoA)	0.0791	0.311	0.0768	0.0768 U	0.0792	0.0792 U
Perfluoroheptanoic acid (PFHpA)	0.0593	0.297	0.0576	0.0576 U	0.0594	0.0594 U
Perfluorohexanesulfonic acid (PFHxS)	0.0791	0.301	0.0768	0.0768 U	0.0792	0.0792 U
Perfluorohexanoic Acid (PFHxA)	0.0791	0.327	0.0768	0.0768 U	0.0792	0.0792 U
Perfluorononanoic acid (PFNA)	0.0395	0.3	0.0384	0.0384 U	0.0396	0.0396 U
Perfluorooctane Sulfonate (PFOS)	0.0791	0.534	0.0768	0.0768 U	0.0792	0.0792 U
Perfluorooctanoic acid (PFOA)	0.0791	0.334	0.0768	0.0768 U	0.0792	0.0792 U
Perfluorotetradecanoic Acid (PFTeDA)	0.0988	0.303	0.096	0.096 U	0.0792	0.099 U
Perfluorotridecanoic Acid (PFTrDA)	0.0395	0.303	0.0384	0.0384 U	0.0396	0.0396 U
Perfluoroundecanoic Acid (PFUnA)	0.0395	0.398	0.0384	0.0384 U	0.0396	0.0396 U

Notes:

J - Analyte present. Value may or may not be accurate or precise

NG/G - Nanograms per gram

NS - Not sampled

U - The material was analyzed for, but not detected

Table I-4. Groundwater Analytical Data

Sample ID	WI-SP-GW70-0421		WI-SP-GW71-0421		WI-SP-GW72-0421	
Station ID	WI-SP-MW-2 APN870		WI-SP-MW-3 APN871		WI-SP-MW-4 APN872	
Sample Date	4/20/21		4/17/21		4/17/21	
Chemical Name						
Semivolatile Organic Compounds (NG/L)	LOD	Result	LOD	Result	LOD	Result
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)	0.436	0.436 U	0.483	0.483 U	0.446	0.446 U
4,8-dioxa-3H-perfluorononanoic acid (ADONA)	0.871	0.871 U	0.965	0.965 U	0.893	0.893 U
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid (9Cl-PF3ONS)	0.871	0.871 U	0.965	0.965 U	0.893	0.893 U
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (EtFOSAA)	0.871	0.871 U	0.965	0.965 U	0.893	0.893 U
N-Methyl Perfluorooctanesulfonamidoacetic Acid (MeFOSAA)	0.871	0.871 UJ	0.965	0.965 U	0.893	3 J
Perfluoro-2-methyl-3-oxahexanoic acid (HFPO-DA)	0.436	0.436 U	0.483	0.483 U	0.446	0.446 U
Perfluorobutanesulfonic acid (PFBS)	0.436	0.436 UJ	0.483	19.3	0.446	113 J
Perfluorodecanoic Acid (PFDA)	0.436	0.436 U	0.483	0.483 U	0.446	9.04
Perfluorododecanoic Acid (PFDoA)	0.436	0.436 U	0.483	0.483 U	0.446	0.446 U
Perfluoroheptanoic acid (PFHpA)	0.871	0.871 U	0.965	30.2	0.893	33.7
Perfluorohexanesulfonic acid (PFHxS)	0.348	8.14	0.386	42.5	0.357	21.1
Perfluorohexanoic Acid (PFHxA)	1.31	1.31 UJ	1.45	120	1.34	124
Perfluorononanoic acid (PFNA)	0.871	0.871 U	0.965	0.965 U	0.893	5.53
Perfluorooctane Sulfonate (PFOS)	0.871	20	0.965	21.1	0.893	82.9
Perfluorooctanoic acid (PFOA)	1.31	1.31 U	1.45	81.8	1.34	68.3
Perfluorotetradecanoic Acid (PFTeDA)	1.74	1.74 U	1.93	1.93 U	1.79	1.79 U
Perfluorotridecanoic Acid (PFTrDA)	0.436	0.436 U	0.483	0.483 U	0.446	0.446 U
Perfluoroundecanoic Acid (PFUnA)	0.436	0.436 U	0.483	0.483 U	0.446	0.446 U

Notes:

J - Analyte present. Value may or may not be accurate or precise

NG/L - Nanograms per liter

NS - Not sampled

R - Unreliable Result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

Figures



DATA SOURCE: ESRI & NIRIS
 IMAGERY SOURCE: ESRI, Maxar 2018

- Legend**
- Groundwater sample from existing monitoring well
 - Soil sample location
 - ▲ Stormwater Outfall
 - Unpaved Ditch
 - Storm Sewer Line
 - Wastewater Gravity Main
 - ▶ Approximate Groundwater Flow Direction
 - ⊗ Fence
 - Building
 - Housing
 - Potential PFAS Release Area
 - Base Boundary

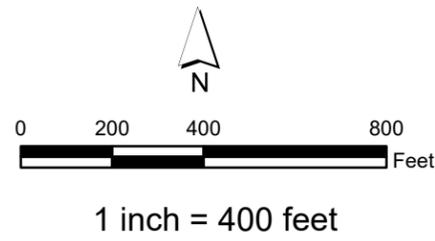


Figure I-1
 Sample Locations: Sanitary Wastewater Treatment Plant
 Site Inspection for PFAS
 Naval Air Station Whidbey Island
 Seaplane Base
 Oak Harbor, Washington



DATA SOURCE: ESRI & NIRIS
IMAGERY SOURCE: ESRI, Maxar 2018

- Legend**
- Groundwater sample from existing monitoring well
 - ▲ Stormwater Outfall
 - Unpaved Ditch
 - Storm Sewer Line
 - Wastewater Gravity Main
 - ▶ Approximate Groundwater Flow Direction
 - ✕ Fence
 - Building
 - Housing
 - Potential PFAS Release Area
 - Base Boundary

WI-SP-GW01 Well ID
13.62 Groundwater Elevation

NOTES:
1. Groundwater elevations were measured on the following dates:
WI-SP-MW-2 APN870: 4/20/2021
WI-SP-MW-3 APN871: 4/17/2021
WI-SP-MW-4 APN872: 4/17/2021
2. Groundwater elevations are in feet NAVD88

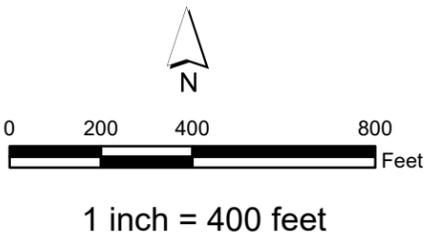


Figure I-2
Groundwater Elevations: Sanitary Wastewater Treatment Plant
Site Inspection for PFAS
Naval Air Station Whidbey Island
Seaplane Base
Oak Harbor, Washington

Attachment 1



PROJECT NUMBER: 695610CH	BORING NUMBER: WI-SP-SB05	SHEET 1 OF 1
------------------------------------	-------------------------------------	---------------------

Borehole Log

PROJECT : Seaplane Base - Site Inspection for Per- and Polyfluoroalkyl Substances

LOCATION : Naval Air Station Whidbey Island COORDINATES : N 479015.43 ft, E 1206519.16 ft ELEVATION : 15.8 ft above mean sea level

DRILLING CONTRACTOR : Holt Services Inc. DRILLING METHOD AND EQUIPMENT : Sonic - Terrasonic International, 6-in casing with 4-in core barrel

WATER LEVEL : 9.5 ft bgs Start : 4/15/21 11:45 END : 4/15/21 13:00 LOGGER : T. Chalmers

NEW SOIL BORING LOG; NASWI_SEAPLANE_BASE_SI_WWTP BORINGS.GLB; NASWI_SEAPLANE_BASE_SI.GPJ; CH2M GEOTECH_12.GDT; 7/14/21

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL / RECOVERY (ft)	CORE ID	GRAPHIC LOG	SOIL DESCRIPTION: Soil name, USCS, Color, Description	<u>COMMENTS</u>
5	5.0	HA-1	[Dotted pattern]	WELL GRADED SAND WITH GRAVEL (SW) dark brown (10YR 3/3), moist, loose, fine to coarse grained, subround to subangular sand, with fine to coarse gravel up to 3.0 cm diameter.	PID = 0.0 ppm, 0-5 ft Hand augered to 5 ft for utility clearance.
10	4.0	S-1	[Dotted pattern]	WELL GRADED SAND (SW) dark grayish brown (10YR 4/2), wet, loose, fine to coarse grained, subround to subangular sand, with trace gravel up to 2.5 cm diameter.	PID = 0.0 ppm, 5-10 ft
15	10.0	S-2	[Wavy pattern]	PEAT (PT) very dark brown (10YR 2/2), damp peat.	Collected soil sample WI-SP-SB05-09H10 on 4/15/21 at 1325. Upper most 2.5-in of SW unit from 9.5-12 ft is dry to moist, water content increases with depth throughout unit.
20			[Dotted pattern]	WELL GRADED SAND WITH GRAVEL (SW) dark gray (10YR 4/1), wet, loose, fine to coarse grained, subround to subangular sand, with gravel up to 4 cm diameter, and shell fragments.	PID = 0.0 ppm, 10-20 ft
20			[Dotted pattern]	WELL GRADED SAND (SW) dark grayish brown (10YR 4/2), wet, loose, fine to coarse grained, subround to subangular sand, with trace gravel up to 2.5 cm diameter.	
20			[Dotted pattern]	WELL GRADED SAND WITH GRAVEL (SW) dark gray (10YR 4/1), wet, loose, fine to coarse grained, subround to subangular sand, with gravel up to 4 cm diameter, and shell fragments.	
20			[Diagonal hatching]	SANDY LEAN CLAY (CL) very dark brown (10YR 2/2), moist, medium dense clay, with medium grained sand. Boring terminated at 20 ft bgs.	1.5-in peat layer above CL unit from 19.5-20 ft.
25					Notes: ft bgs = feet below ground surface PID = photoionization detector Horizontal Datum: NAD83/1 Vertical Datum: NAVD88



PROJECT NUMBER: 695610CH	BORING NUMBER: WI-SP-SB06	SHEET 1 OF 1
------------------------------------	-------------------------------------	---------------------

Borehole Log

PROJECT : Seaplane Base - Site Inspection for Per- and Polyfluoroalkyl Substances

LOCATION : Naval Air Station Whidbey Island COORDINATES : N 478878.53 ft, E 31207164.84 ft ELEVATION : 15.3 ft above mean sea level

DRILLING CONTRACTOR : Holt Services Inc. DRILLING METHOD AND EQUIPMENT : Sonic - Terrasonic International, 6-in casing with 4-in core barrel

WATER LEVEL : 13.0 ft bgs Start : 4/15/21 10:45 END : 4/15/21 11:55 LOGGER : T. Chalmers

NEW SOIL BORING LOG: NASWI_SEAPLANE_BASE_SI_WWTP_BORINGS.GLB: NASWI_SEAPLANE_BASE_SI.GPJ: CH2M GEOTECH_12.GDT: 7/14/21

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL / RECOVERY (ft)	CORE ID	GRAPHIC LOG	SOIL DESCRIPTION: Soil name, USCS, Color, Description	<u>COMMENTS</u>
5	5.0	HA-1		WELL GRADED SAND WITH GRAVEL (SW) very dark grayish brown (10YR 3/2), moist, loose, fine to coarse grained sand, with fine to coarse grained, subround to subangular gravel up to 6 cm diameter.	PID = 0.0 ppm, 0-5 ft Hand augered to 5 ft for utility clearance.
10	5.0	S-1		SILTY SAND WITH GRAVEL (SM) gray (5Y 5/1), dry, medium dense, fine to medium grained sand, with silt, and gravel up to 4 cm diameter.	PID = 0.0 ppm, 5-10 ft
15	10.0	S-2	 	WELL GRADED SAND WITH GRAVEL (SW) dark brown (10YR 3/3), moist, loose, fine to coarse grained sand, with gravel up to 3.5 cm diameter. LEAN CLAY (CL) dark olive gray (5Y 3/2), moist, moderately stiff clay, with trace gravel up to 3 cm diameter. PEAT (PT) very dark brown (10YR 2/2), dry, moderately dense peat. WELL GRADED SAND (SW) black (10YR 2/1), wet, loose, fine to coarse grained, subround to subangular sand.	Miscellaneous organics and roots in the 11.5-13 ft PT unit. Collected soil sample WI-SP-SB06-1313H on 4/15/21 at 1225.
20				WELL GRADED SAND WITH GRAVEL (SW) dark brown (10YR 3/3), wet, loose, fine to coarse grained sand, with gravel up to 8 cm diameter.	PID = 0.0 ppm, 10-20 ft Faint organic odor in SW unit from 15-19 ft.
25				WELL GRADED SAND WITH GRAVEL (SW) dark gray (10YR 4/1), wet, loose, fine to coarse grained sand, with gravel up to 6 cm diameter. Boring terminated at 20 ft bgs.	Notes: ft bgs = feet below ground surface PID = photoionization detector Horizontal Datum: NAD83/1 Vertical Datum: NAVD88



PROJECT NUMBER: 695610CH	BORING NUMBER: WI-SP-SB07	SHEET 1 OF 1
------------------------------------	-------------------------------------	---------------------

Borehole Log

PROJECT : Seaplane Base - Site Inspection for Per- and Polyfluoroalkyl Substances

LOCATION : Naval Air Station Whidbey Island COORDINATES : N 478598.43 ft, E 1207680.19 ft ELEVATION : 15.2 ft above mean sea level

DRILLING CONTRACTOR : Holt Services Inc. DRILLING METHOD AND EQUIPMENT : Sonic - Terrasonic International, 6-in casing with 4-in core barrel

WATER LEVEL : 13.5 ft bgs Start : 4/15/21 08:50 END : 4/15/21 10:30 LOGGER : T. Chalmers

NEW SOIL BORING LOG: NASWI_SEAPLANE_BASE_SI_WWTP_BORINGS.GLB: NASWI_SEAPLANE_BASE_SI.GPJ: CH2M GEOTECH_12.GDT: 7/14/21

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL / RECOVERY (ft)	CORE ID	GRAPHIC LOG	SOIL DESCRIPTION: Soil name, USCS, Color, Description	<u>COMMENTS</u>
5	5.0	HA-1		WELL GRADED SAND WITH GRAVEL (SW) very dark grayish brown (10YR 3/2), moist, fine to coarse grained, subround to subangular sand, with gravel up to 5 cm diameter, and trace silt.	PID = 0.0 ppm, 0-5 ft Hand augered to 5 ft for utility clearance.
10	5.0	S-1		SANDY LEAN CLAY (CL) dark gray (GLY 1 4/N), damp, medium stiff clay, with medium grained sand, and trace gravel up to 4 cm diameter.	PID = 0.0 ppm, 5-10 ft
15	10.0	S-2		LEAN CLAY (CL) dark olive gray (5Y 3/2), moist clay, with trace medium grained sand.	Collected soil sample WI-SP-SB07-13H14 on 4/15/21 at 1105.
15				WELL GRADED SAND WITH GRAVEL (SW) black (5Y 2.5/1), wet, loose, fine to coarse grained sand, with fine to coarse grained, subround to subangular gravel up to 6.5 cm diameter.	PID = 0.0 ppm, 10-20 ft
15				WELL GRADED SAND (SW) black (5Y 2.5/1), wet, loose, fine to coarse grained sand, with trace fine to coarse grained gravel up to 3 cm diameter.	
15				WELL GRADED SAND WITH GRAVEL (SW) black (5Y 2.5/1), wet, loose, fine to coarse grained sand, with fine to coarse grained, subround to subangular gravel up to 6.5 cm diameter.	
20	Boring terminated at 20 ft bgs.				Notes: ft bgs = feet below ground surface PID = photoionization detector Horizontal Datum: NAD83/1 Vertical Datum: NAVD88

Attachment 2



GROUNDWATER SAMPLING DATA SHEET

WELL ID: WI-SP-MW-2 APN 870

Project Name: NASWI seaplane Base SI
 Project Number: 695610 CH
 Start Date: 4/20/21
 Sampling Team: T. Chalvers
L. Baumann
 Purge Method: Bladder pump
 Equipment: RED Sample Pro
S/N: 12868 Rental #: 298521
 Tubing Materials: HDPE
WL: Rental #: C103132 - Heron

Casing Materials: 2-in PVC
 PID Reading: 0.0 ppm
 Weather: Fog 50°S

Well Depth: 14.60 ft btoc
 Start Water Level: 5.85 ft btoc
 Water Column: 8.75 0 ft
 Well Diameter: 2 in
 Volume per foot: 0.163 gal/ft
 Well Volume: 1.43 gal
 Start Time: 050950
 End Time: _____
 Screened Interval: _____ ft btoc
 Pump/Tubing Intake: _____ ft btoc

Diam. (in)	Vol. (gal/ft)
1	0.041
1.25	0.064
2	0.163
4	0.653

WELL STABILIZATION DATA

Time	Pumping rate (mL/min)	mL Volume Removed	Water level (ft)	pH	SPCOND. (mS/cm)	Temp. (°C)	ORP (mV)	D.O. (mg/L)	Turbidity (NTU)	Appearance
Requirements ¹	< 0.3 ft			+/- 0.1	+/- 3%	+/- 0.2	+/- 10 mV	+/- 10%	<10 or +/- 10%	
0950	110		5.83	Begin Purge						
0955	550-110	550	5.88	6.49	33.1	13.61	-89	1.13	706	Brown/murky
1000	110	1100	4.59 5.59	6.53	34.7	13.86	-92	0.49	421	"
1005	110	1650	4.59 5.59	6.52	35.0	13.86	-93	0.27	321	Brown-yellow
1010	110	2200	5.87	6.55	35.1	14.39	-96	0.10	268	"
1015	110	2750	5.87	6.54	35.5	14.54	-95	0.05	179	Brown-yellow
1020	110	3300	5.86	6.54	35.7	14.55	-94	0.02	120	"
1025	110	3850	5.87	6.55	36.0	14.61	-93	0.01	71.2	"
1030	110	4400	5.88	6.55	36.2	14.60	-92	0.01	50.2	"
1035	110	4950	5.89	6.54	36.4	14.49	-91	0.00	34.8	yellowish
1040	110	5500	5.89	6.55	36.6	14.47	-91	0.00	22.7	"
1045	110	6050	5.89	6.55	36.6	14.30	-91	0.00	18.3	"
1050	110	6600	5.89	6.56	36.7	14.52	-90	0.00	14.6	slight yellow
1055	110	7150	5.89	6.55	36.8	14.82	-89	0.00	10.9	
1100	110	7700	5.91	6.55	37.0	14.94	-89	0.00	7.9	

Slight Murky
Sulfur/
Swamp odor

SAMPLE INFORMATION

Sample ID: WI-SP-GW70-0421
 Analyses: QSM v 5.3 Table B-15
 Collection Date: 4/20/21
 Collection Time: 1115
 Field Filter? (Y/N): N

Primary Laboratory: Battelle
 QA/QC Laboratory: _____
 Shipment Method: Fed Ex
 Well Condition/Comments: None

¹ Sampling standards adapted from USEPA Groundwater Sampling Guidelines for Superfund and RCRA Project Managers, 2002



GROUNDWATER SAMPLING DATA SHEET

WELL ID: WI-SP-MW-3 APN871

Project Name: NASWI SEAPLANE BASE SI

Casing Materials: 2" PVC

Well Depth: 14.73 ft btoc

Project Number: 695610 CH

Start Water Level: 10.06 ft btoc

Start Date: 4/17/21

PID Reading: 0.0

Water Column: 0 ft

Sampling Team: L. BAUMANN

Weather: Sunny - 68°F

Well Diameter: 2 in

Purge Method: LOW-FLOW

Volume per foot: 0.163 gal/ft

Equipment: HORIBA U-52

Well Volume: 1605 gal

Tubing Materials: HDPE

Start Time: 1605

End Time: 1730

Screened Interval: _____ ft btoc

Pump/Tubing Intake: _____ ft btoc

Diam. (in)	Vol. (gal/ft)
1	0.041
1.25	0.064
2	0.163
4	0.653

WELL STABILIZATION DATA

Time	Pumping rate (mL/min)	Volume Removed	Water level (ft)	pH	SPCOND. (mS/cm)	Temp. (°C)	ORP (mV)	D.O. (mg/L)	Turbidity (NTU)	Appearance
Requirements ¹	< 0.3 ft			+/- 0.1	+/- 3%	+/- 0.2	+/- 10 mV	+/- 10%	<10 or +/- 10%	
16:00 16:05	150		10.06							
16:10	150	7.50	10.10							
16:15	150	15.00	10.12	7.47	13.9	16.08	-112	0.94	129	
16:20	"	22.50	10.10	7.49	14.5	14.96	-132	0.59	0.5	
	PAUSE									
16:35	150	3,000	10.10	7.52	14.7	15.32	-12.3	0.82	0.0	
	PAUSE									
16:50	150	3,750	10.02	7.14	14.3	21.95	-202	6.42	10.1	yellow/Brown
16:55	150	4,500	10.07	7.25	14.5	20.69	-227	6.00	9.8	
17:00	150	5,250	10.09	7.27	14.6	19.97	-240	5.58	6.2	yellow Bm
17:05	150	6,000	10.11	7.26	14.7	19.81	-248	5.00	5.5	Slight Sulfur odor
17:10	150	6,750	10.11	7.26	14.7	19.83	-253	4.62	3.2	
17:15	150	7,500	10.11	7.26	14.7	19.71	-257	4.22	2.9	
17:20	150	8,250	10.11	7.27	14.8	19.65	-261	3.92	2.4	
17:25	150	9,000	10.11	7.27	14.8	19.58	-263	3.57	2.1	

SAMPLE INFORMATION

Sample ID: WI-SP-GW71-0421

Primary Laboratory: Battelle

Analyses: QSM v5.3 Table B-15 (PFAS 18 analyte)

QA/QC Laboratory: _____

Collection Date: 4/17/21

Shipment Method: Fed Ex

Collection Time: 1735

Well Condition/Comments: None

Field Filter? (Y/N): N

¹ Sampling standards adapted from USEPA Groundwater Sampling Guidelines for Superfund and RCRA Project Managers, 2002



GROUNDWATER SAMPLING DATA SHEET

WELL ID: W1-SP-MW-4 APN 872

Project Name: NASWI SEAPLANE BASE

Casing Materials: PVC-2"

Well Depth: 15.13 ft btoc

Project Number: 695610CH

Start Water Level: 9.70 9.56 ft btoc 9.73

Start Date: 4/17/21

PID Reading: O₂: 20.9% LEL: 0% CO: 0.0 ppm H₂S: 0.0 ppm

Water Column: 0 ft

Sampling Team: L. BAUMANN

Weather: 60's sunny VOC: 0.0 ppm

Well Diameter: in

Purge Method: LOW FLOW PUMP

Volume per foot: gal/ft

Equipment: QED Pump

Well Volume: gal

Tubing Materials: HORIBA U52 SN: X136F2P8

Start Time: 1240

End Time:

Screened Interval: ft btoc

Pump/Tubing Intake: ft btoc

Diam. (in)	Vol. (gal/ft)
1	0.041
1.25	0.064
2	0.163
4	0.653

WELL STABILIZATION DATA

Time	Pumping rate (mL/min)	Volume Removed	Water level (ft)	pH	SPCOND. (mS/cm)	Temp. (°C)	ORP (mV)	D.O. (mg/L)	Turbidity (NTU)	Appearance
Requirements ¹	< 0.3 ft			+/- 0.1	+/- 3%	+/- 0.2	+/- 10 mV	+/- 10%	<10 or +/- 10%	
	<u>100 ml</u>	<u>1900L</u>								
<u>1259</u>		<u>380 ml</u>	<u>10.10</u>	<u>6.39</u>	<u>11.4</u>	<u>12.98</u>	<u>21</u>	<u>3.45</u>	<u>331</u>	<u>Brown</u>
<u>13036</u>	<u>28</u>	<u>2600</u>	<u>10.13</u>	<u>6.41</u>	<u>11.4</u>	<u>12.39</u>	<u>6</u>	<u>2.52</u>	<u>274</u>	<u>Brown</u>
<u>1311</u>	<u>100 ml</u>	<u>3100</u>	<u>10.14</u>	<u>6.40</u>	<u>11.2</u>	<u>12.02</u>	<u>-2</u>	<u>2.25</u>	<u>219</u>	<u>yellow/Briny odor</u>
<u>1316</u>	<u>100 ml</u>	<u>3600</u>	<u>10.15</u>	<u>6.40</u>	<u>11.1</u>	<u>11.93</u>	<u>-4</u>	<u>2.25</u>	<u>202</u>	<u>Yellow-Brown</u>
<u>1321</u>	<u>100 ml</u>	<u>4100</u>	<u>10.17</u>	<u>6.40</u>	<u>11.0</u>	<u>11.81</u>	<u>-5</u>	<u>2.18</u>	<u>179</u>	<u>Yellow-Brown</u>
<u>1326</u>	<u>100 ml</u>	<u>4600</u>	<u>10.17</u>	<u>6.40</u>	<u>11.0</u>	<u>11.81</u>	<u>-5</u>	<u>2.18</u>	<u>179*</u>	<u>Yellow-Brown</u>
<u>1331</u>	<u>100 ml</u>	<u>5100</u>	<u>10.19</u>	<u>6.40</u>	<u>11.0</u>	<u>11.81</u>	<u>-5</u>	<u>2.18</u>	<u>179*</u>	<u>Yellow-Brown</u>
<u>1336</u>	"	<u>5600</u>	<u>10.23</u>	<u>6.45</u>	<u>9.97</u>	<u>11.30</u>	<u>-16</u>	<u>1.79</u>	<u>86.9</u>	
<u>1341</u>	" <u>6100</u>	<u>5710</u>	<u>10.21</u>	<u>6.49</u>	<u>9.67</u>	<u>11.24</u>	<u>-19</u>	<u>1.71</u>	<u>77.2</u>	
<u>1346</u>	"	<u>6600</u>	<u>10.23</u>	<u>6.53</u>	<u>9.34</u>	<u>11.28</u>	<u>-22</u>	<u>1.58</u>	<u>62.0</u>	<u>Yellow-Brown</u>
<u>1351</u>	"	<u>7100</u>	<u>10.26</u>	<u>6.56</u>	<u>8.84</u>	<u>11.26</u>	<u>-27</u>	<u>1.39</u>	<u>44.6</u>	
<u>1356</u>	"	<u>7600</u>	<u>10.27</u>	<u>6.57</u>	<u>8.60</u>	<u>11.24</u>	<u>-29</u>	<u>1.31</u>	<u>36.6</u>	
<u>1401</u>		<u>8100</u>	<u>10.29</u>	<u>6.58</u>	<u>8.36</u>	<u>11.20</u>	<u>-30</u>	<u>1.24</u>	<u>27.6</u>	
<u>1406</u>		<u>8600</u>	<u>10.30</u>	<u>6.61</u>	<u>7.92</u>	<u>11.17</u>	<u>-34</u>	<u>1.08</u>	<u>16.6</u>	

* 1326 to 1331 had instrumentat error,

odor, Yellow-Brown

SAMPLE INFORMATION

Sample ID: W1-SP-GW 72-0421-MS/MSD
 Analyses: QSM v5.3 Table B-15 (PEAS 18 analyte)
 Collection Date: 4/17/21
 Collection Time: 14:25
 Field Filter? (Y/N): N

Primary Laboratory: Battelle
 QA/QC Laboratory:
 Shipment Method: FedEx
 Well Condition/Comments: None

¹ Sampling standards adapted from USEPA Groundwater Sampling Guidelines for Superfund and RCRA Project Managers, 2002

