## **CONTRACTOR SUPPORT BUILDING #7**

## PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) SITE ASSESSMENT WORK PLAN

## KENNEDY SPACE CENTER, FLORIDA

## **Prepared for:**



National Aeronautics and Space Administration Kennedy Space Center, Florida

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#### LIST OF ACRONYMS AND ABBREVIATIONS

mg/kg milligrams per kilogram ng/L nanograms per liter

AOPC Area of Potential Concern

bgs below ground surface

DPT Direct Push Technology

EPA Environmental Protection Agency

FDEP Florida Department of Environmental Protection

HGL HydroGeoLogic, Inc.

KSC John F. Kennedy Space Center

NASA National Aeronautics and Space Administration

No. number

PFAS Per- and Polyfluoroalkyl Substances

PFBS Perfluorobutanesulfonic acid PFHxS Perfluorohexanesulfonic acid

PFNA Perfluorononanoic acid PFOA Perfluorooctanoic acid

PFOS Perfluorooctanesulfonic acid PRL Potential Release Location

RCRA Resource Conservation and Recovery Act

RSL Regional Screening Level

SLF Shuttle Landing Facility

SW SL Surface Water Screening Level SWMU Solid Waste Management Unit

# CONTRACTOR SUPPORT BUILDING #7 PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) SITE ASSESSMENT WORK PLAN

#### 1.0 KENNEDY SPACE CENTER, FLORIDA INTRODUCTION

Contractor Support Building #7 (J6-2327) is located at John F. Kennedy Space Center (KSC), Florida ("the Site;" **Figure 1**) and is designated Potential Release Location (PRL) Number (No.) 237, Area of Potential Concern (AOPC) No. 2 under KSC's Resource Conservation and Recovery Act (RCRA) Corrective Action Program. In accordance with the RCRA Corrective Action Program, HydroGeoLogic, Inc. (HGL) prepared this Per-and Polyfluoroalkyl Substances (PFAS) Site Assessment Work Plan for the National Aeronautics and Space Administration (NASA) under Contract No. 80KSC019D0012, Delivery Order 80KSC021F0168, Technical Directive No. 1. This document presents and summarizes the approach to investigating soil, groundwater, and surface water with PFAS impacts that were previously identified at the Site.

#### 1.1 SITE DESCRIPTION

Contractor Support Building #7 (J6-2327) is located east-northeast of State Road 3 (Kennedy Parkway North) and was formerly investigated under PRL 78, Contractor Support Building #7, which was granted No Further Action status in 2014. Contractor Support Building #7 is located within and on the east side of Solid Waste Management Unit (SWMU) No. 114 and to the southeast of SWMU No. 119.

#### 1.2 SITE HISTORY

Information regarding the current and historical use of this property is summarized from the Contractor Support Building #7 (J6-2377) Kennedy Space Center, Florida Confirmatory Sampling Report (PRL #78) (Revision 2) (J-BOSC Environmental Health Services [J-BOSC] 2000). In 1963, the Contractor Support Building was constructed and used mostly for storage; a photography lab was also present. The septic tank and dry well associated with this building may have received discharges that contained solvents and/or metal residuals. The septic tank was removed in 1999. This building was historically identified as PRL 078. Additionally, this site was identified by Mr. Moore and Chief Anderson as a former storage area for aqueous film-forming foam materials. Therefore, this area was identified as an AOPC.

Phase I activities indicated groundwater concentrations from samples collected at AOPC #2 exceeded the Florida Department of Environmental Protection provisional Groundwater Cleanup Target Levels for PFOS and PFOA.

#### 1.3 PREVIOUS INVESTIGATIONS

As part of the KSC Center-Wide PFAS Confirmatory Sampling, four groundwater samples were collected from one location (PFAS-DPT0019) in March 2019. In August and September 2021, a total of eight additional groundwater samples from two direct push technology (DPT) locations (PFAS-DPT0221 and PFAS-DPT0222) and four soil samples from two soil boring locations

(PFAS-SB0101 and PFAS-SB102) were collected from this site. Additionally, in October 2021, two surface water samples (PFAS-SW0199 and PFAS-SW0200) were collected from this site. One surface water sample (PFAS-SW0184) was collected from a stormwater pond located south of the Site and three surface water samples were collected in the vicinity of the site (PFAS-SW0065, PFAS-SW0199 and PFAS-SW0200).

As part of the initial SWMU #114 PFAS Site Assessment Activities, four groundwater samples were collected from one location (S114-DPT1025) in June 2022 and one intermediate monitoring well was installed and sampled in August 2022 (Figure 2).

Surface water analytical results for PFAS-SW0065, PFAS-SW0184, PFAS-SW0199, and PFAS-SW0200 indicate perfluorooctanoic acid (PFOA) concentrations are below the FDEP surface water screening level (SW SL). Perfluorooctanesulfonic acid (PFOS) concentrations are above the SW SL at concentrations of 79.1 ng/L, 80.3 ng/L, 30.1 ng/L, and 774 ng/L, respectively.

Groundwater analytical results indicate that concentrations of PFAS compounds exceeded the Environmental Protection Agency (EPA) Regional Screening Level (RSL) at one or more depths at four of the five sample locations. Maximum PFOA, perfluorobutanesulfonic acid (PFBS), perfluorohexanesulfonic acid (PFHxs) and PFOS concentrations were detected at the 25' depth interval of PFAS-DPT0019 at 160 ng/L, 1,100 ng/L, 3,000 ng/L and 990 ng/L, respectively (**Figure 2**). Perfluorononanoic acid (PFNA) was not detected in any of the samples.

Analytical results for soil samples PFAS-SB0101 and PFAS-SB0102 indicate that PFOA and PFOS concentrations are below the pSCTLs in all depth intervals. Maximum PFOA concentrations are located within PFAS-SB0102 at 0 to 0.5 foot below ground surface (bgs) at a concentration of 0.00029 milligrams per kilogram (mg/kg). Maximum PFOS concentrations are located within PFAS-SB0101 at 0 to 0.5 foot bgs at a concentration of 0.00046 mg/kg.

Two monitoring wells have been installed at the Site. Based on groundwater elevation data from adjacent SWMU 114, groundwater flow is towards the southeast (**Figures 3 and 4**).

No lithologic borings have been advanced at the Site. Lithologic borings advanced at SWMU 114 located to the southwest of the Site, indicate that the lithology consists primarily of sand and shell to a depth of 43 to 48 feet bgs. This layer is underlain by a semi-confining or retarding layer of silt, shell and/or clay.

KSCRT consensus was reached to conduct SA investigations at AOPC #2 during the January 2022 KSCRT meeting (KSCRT Decision 2201-D04).

#### 2.0 SITE ASSESSMENT ACTIVITIES

The proposed site assessment approach and activities are described in the following sections.

#### 2.1 SITE ASSESSMENT APPROACH

Site assessment activities will be performed using a phased approach. Initial site assessment activities will consist of the following activities:

- Advancement of a lithologic boring to 60 feet bgs for lithologic description;
- Installation of one staff gauge to monitor surface water levels at the Site;
- Collection of DPT groundwater samples at five depths (3'-7', 13'-17', 23'-27', 33'-37', and 43'-47') from eight DPT groundwater sample locations to continue the delineation of PFAS compounds; and
- Collection of four surface water samples.

Based on the results of the activities listed above, additional soil, groundwater, and/or surface water sample locations may be proposed. Additional proposed groundwater and surface water samples may be specific to the Site or as part of the greater Shuttle Landing Facility (SLF) study area investigation.

Additionally, on a quarterly basis for 1 year, water level measurements will be collected from the two recently installed monitoring wells and the staff gauge, one monitoring well will be sampled, and one surface water sample will be collected.

All collected samples will be analyzed by EPA Method 537.1.1 Mod for the 25 PFAS compounds listed below.

Analyte	Acronym	CAS No.
Perfluorobutanoic acid	PFBA	375-22-4
Perfluoropentanoic acid	PFPeA	2706-90-3
Perfluorohexanoic acid	PFHxA	307-24-4
Perfluoroheptanoic acid	PFHpA	375-85-9
Perfluorooctanoic acid	PFOA	335-67-1
Perfluorononanoic acid	PFNA	375-95-1
Perfluorodecanesulfonic acid	PFDA	335-76-2
Perfluoroundecanoic acid	PFUnA	2058-94-8
Perfluorodecanoic acid	PFDoA	307-55-1
Perfluorotridecanoic acid	PFTriA	72629-94-8
Perfluorotetradecanoic acid	PFTeA	376-06-7
Perfluorobutanesulfonic acid	PFBS	375-73-5
Perfluoropentanesulfonic acid	PFPeS	2706-91-4
Perfluorohexanesulfonic acid	PFHxS	355-46-4
Perfluoroheptanesulfonic acid	PFHpS	375-92-8
Perfluorooctanesulfonic acid	PFOS	1763-23-1
Perfluorononanesulfonic acid	PFNS	68259-12-1
Perfluorododecanoic acid	PFDS	335-77-3
Perfluorooctanesulfonamide	PFOSA	754-91-6

Analyte	Acronym	CAS No.
N-methylperfluorooctanesulfonamidoacetic acid	NMeFOSAA	2355-31-9
N-ethylperfluorooctanesulfonamidoacetic acid	NEtFOSAA	2991-50-6
4:2 Fluorotelomer sulfonate	4:2 FTS	757124-72-4
6:2 Fluorotelomer sulfonate	6:2 FTS	27619-97-2
8:2 Fluorotelomer sulfonate	8:2 FTS	39108-34-4
Hexafluoropropylene oxide dimer acid	GenX	13252-13-6

Additionally, select samples may be analyzed for branched and linear PFOS, PFOA, PFNA, and/or PFHxS analysis.

Laboratory analytical results for soil and groundwater samples will be screened against the EPA RSLs. Laboratory analytical results for surface water samples will be screened against the FDEP SW SLs. The screening levels for specific PFAS compounds are summarized below.

Compound	EPA Soil RSL <sup>(1)</sup> (mg/kg)	EPA Groundwater RSL <sup>(2)</sup> (ng/L)	FDEP SW SL (ng/L)
PFOA	0.19	6	500
PFNA	0.19	6	-
PFBS	19	600	-
PFHxS	1.3	40	-
PFOS	0.13	4	10
GenX	0.23	6	-

<sup>(1):</sup> EPA, 2022. Regional Screening Level Resident Soil Table (TR=1E-06, HQ=1.0)

#### 2.2 INITIAL SITE ASSESSMENT ACTIVITIES

The proposed initial site assessment activities are summarized in the following sections. The rationale for the proposed sample locations is given in **Table 1**.

#### 2.2.1 Lithologic Boring

One soil boring will be advanced to a depth of 60 feet using a rotosonic drill rig for lithologic description. Photographs will be taken of the soil cores. The proposed boring (PLB-1) is located on the eastern side of the Site in an area where high PFAS concentrations are not expected (**Figure 2**). No soil samples will be collected from the boring for laboratory analysis. It is anticipated that deep soil samples will be collected during a future phase during installation of a deep monitoring well. The borehole will be pressure grouted from total depth to land surface immediately following completion of the boring.

#### 2.2.2 Staff Gauge Installations

One staff gauge will be installed in the canal on the southern side if the Site. The proposed location of the staff gauge (PSG-1) is shown on **Figure 2**. The water level elevation at the staff gauge will be measured on a quarterly basis for 1 year to assess temporal variations in water level elevations.

<sup>(2):</sup> EPA, 2022. Regional Screening Level Resident Tapwater Table (TR=1E-06, HQ=0.1)

#### 2.2.3 Monitoring Well Sampling

Monitoring well S114-MW004S will be sampled on a quarterly basis for 1 year to assess temporal variations in PFAS concentrations. Monitoring well S114-MW004S has not yest been sampled.

#### 2.2.4 DPT Groundwater Sampling

The objective of the initial groundwater investigation is to gain an understanding of the magnitude of PFAS impacts in the vicinity of the Site. Groundwater sampling at eight DPT groundwater sample locations are proposed. At each sample location, groundwater samples will be collected at intervals of 3 to 7 feet (or water table), 13 to 17 feet, 23 to 27 feet, 33 to 37 feet, and 43 to 47 feet bgs. The boreholes will be pressure grouted from total depth to land surface immediately following sample collection. No samples from these proposed locations will be collected below the 43 to 47 feet bgs interval. Prior to groundwater sampling, a lithologic boring will be advanced to a depth of 60 feet bgs. Groundwater sample intervals may be revised based on the lithologies encountered during the advancement of the lithologic soil boring. The proposed DPT groundwater sample locations are shown on **Figure 2**.

#### 2.2.5 Surface Water Sampling

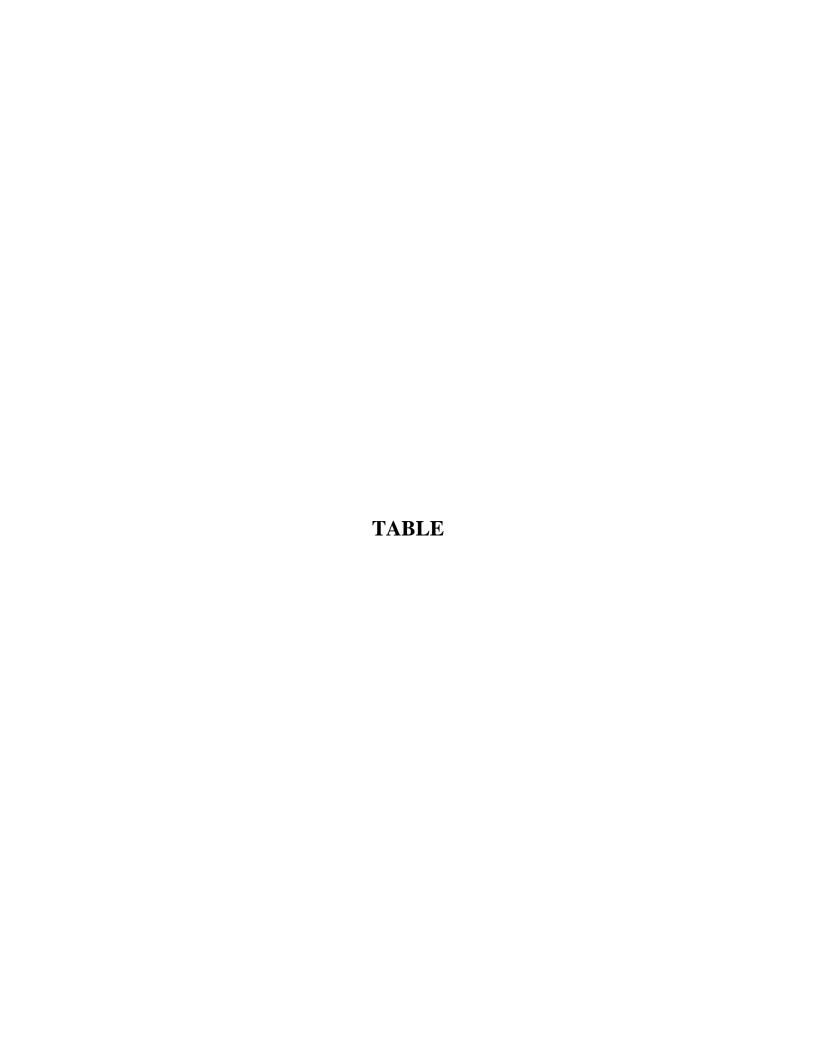
Surface water samples will be collected from four locations at the immediate surface. Additionally, surface water sample location PSW-3 will be sampled on a quarterly basis for 1 year to assess temporal variations in PFAS concentrations. The proposed surface water sample locations are shown on **Figure 2**.

#### 2.3 SUBSEQUENT SITE ASSESSMENT ACTIVITIES

After data from the initial round of site assessment activities has been reviewed by HGL and NASA KSC, additional soil and DPT groundwater sample locations may be proposed to complete horizontal delineation, complete vertical delineation, reduce the footprint of the interpreted area of PFAS above RSLs and/or investigate groundwater/surface water interactions. Additional surface water sampling locations will be proposed as part of a SLF area-wide surface water investigation to be performed after the initial site assessment activities have been completed at the Site and other sites in the SLF study area. All currently proposed DPT groundwater sample and monitoring well locations for the SLF study area are shown on **Figure 5**.

#### 3.0 REFERENCES

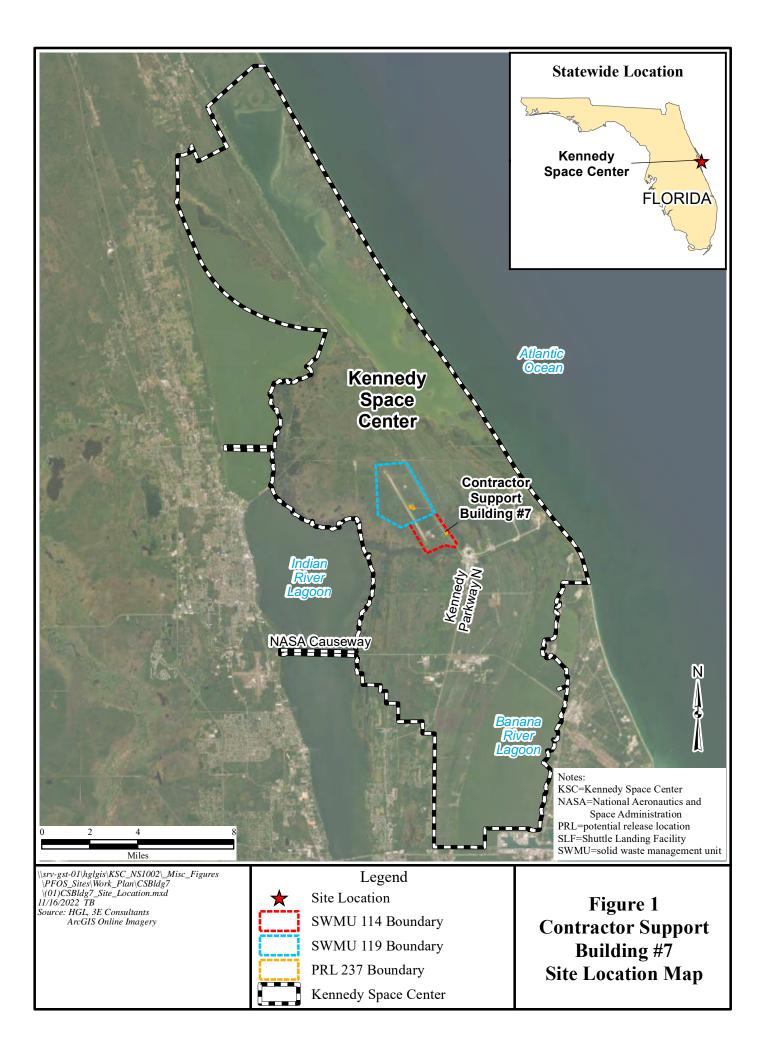
- AECOM, 2022. Center-Wide Phase II and III Solid Waste Management Unit Assessment and Confirmatory Sampling Report for Per- and Polyfluorinated Alkyl Substances, Potential Release Location (PRL) No. 237, Kennedy Space Center, Florida. 2022.
- J-BOSC. 2000. Contractor Support Building #7 (CSB #7) (J6-2377) Kennedy Space Center, Florida Confirmatory Sampling Report (PRL #78) (Revision 2). June 2000.
- National Aeronautics and Space Administration (NASA). 2019. Phase I Solid Waste Management Unit Assessment and Confirmatory Sampling Report Center-Wide Per- and Polyfluoroalkyl Substances (PFAS) Potential Release Location 237, John F. Kennedy Space Center, Florida (Revision 0). Prepared by Geosyntec Consultants. September 2019.

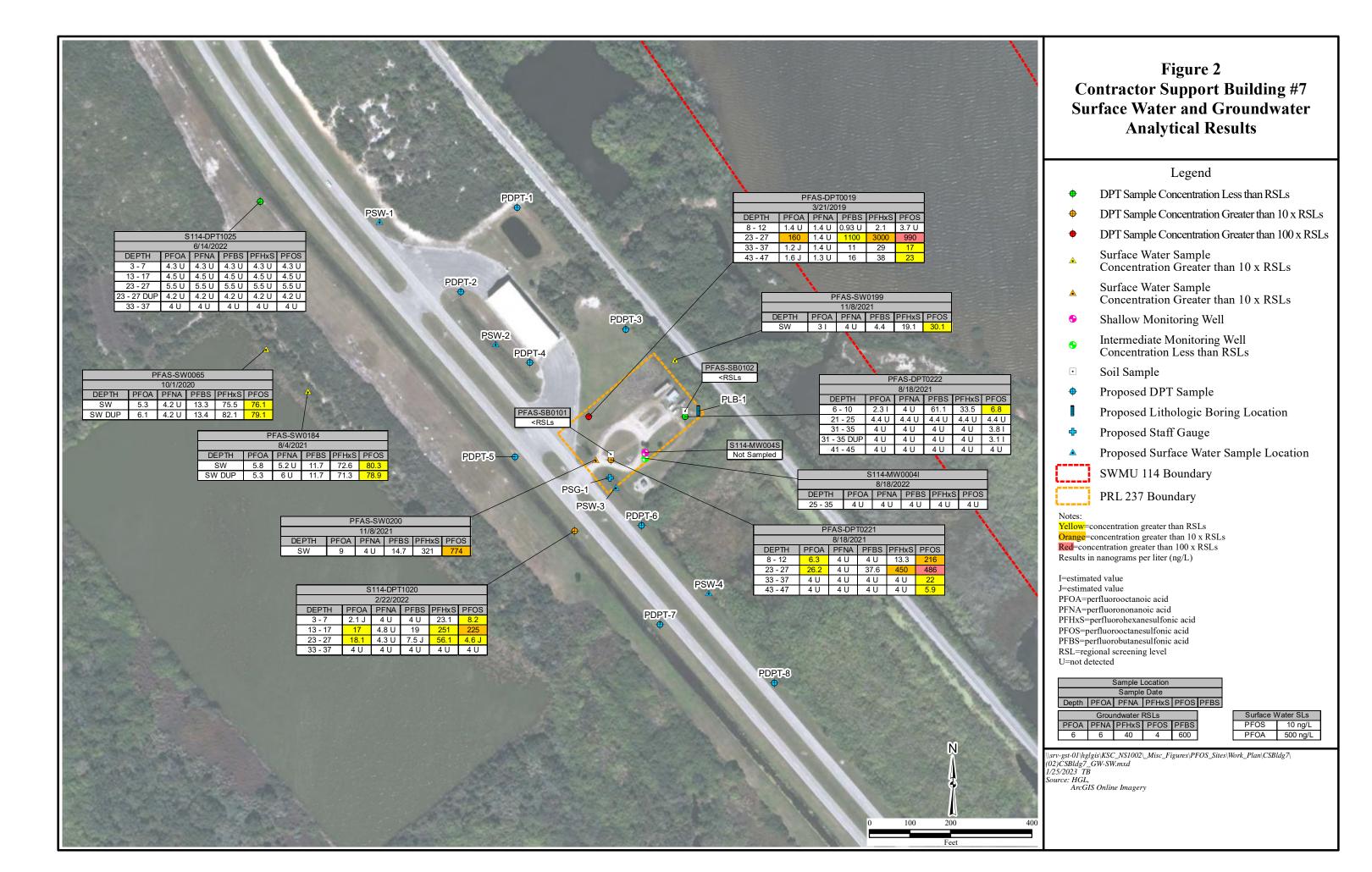


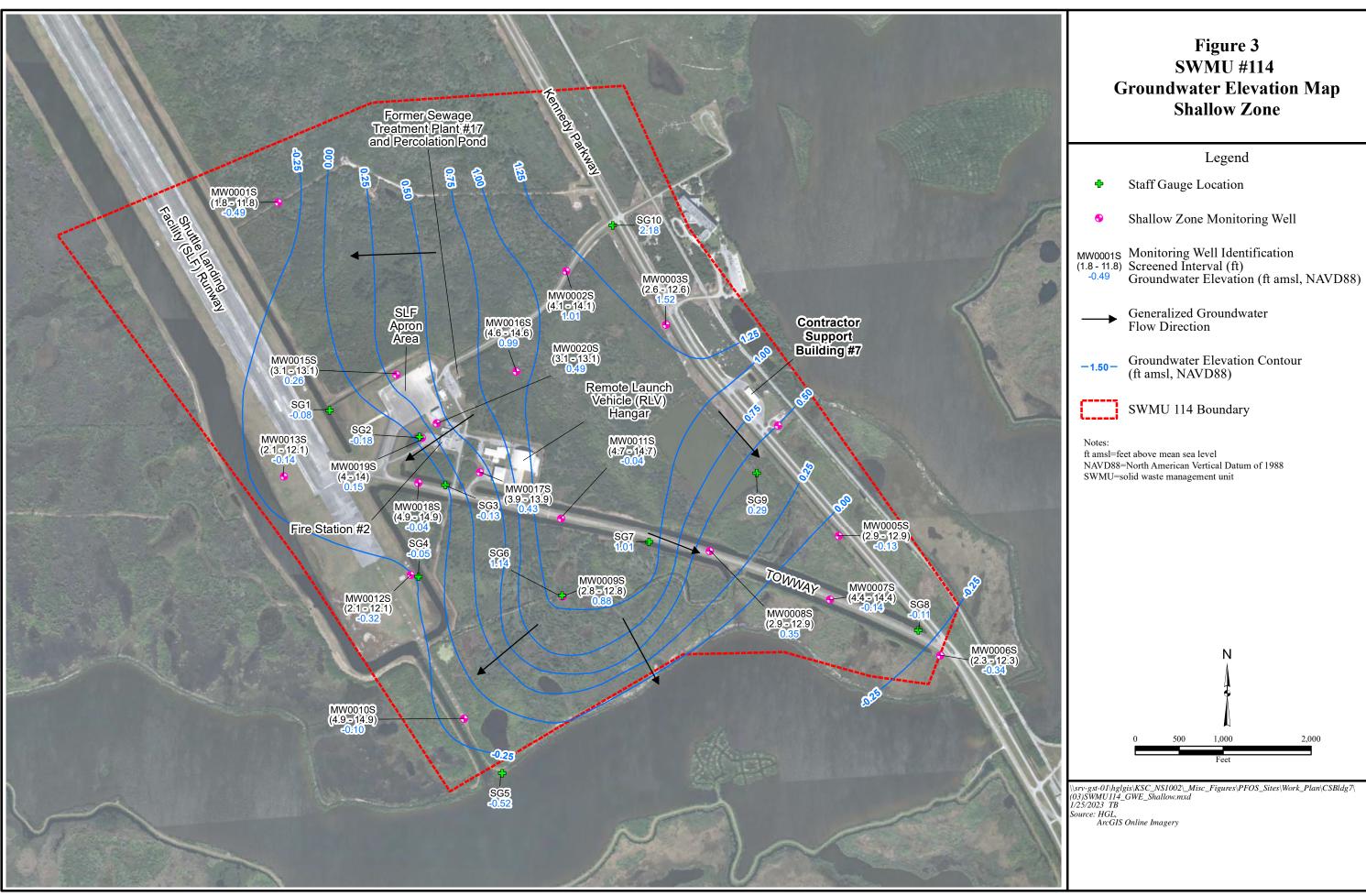
## Table 1 Contractor Support Building #7 Work Plan Sample Location Rationale

Proposed Sample	
Location	Rationale
PDPT-1	Assess groundwater quality on northern edge of site
PDPT-2	Assess groundwater quality on westrn edge of site
PDPT-3	Assess groundwater quality northeast of PFAS-DPT0019 Hotspot
PDPT-4	Assess groundwater quality northwest of PFAS-DPT0019 Hotspot
PDPT-5	Assess groundwater quality southwest of PFAS-DPT0019 Hotspot
PDPT-6	Assess groundwater quality southeast of PFAS-DPT0019 Hotspot
PDPT-7	Assess groundwater quality downgradient of site
PDPT-8	Assess groundwater quality downgradient of site
PSW-1	Assess groundwater quality upstream of previous surface water exceedance
PSW-2	Assess groundwater quality upstream of previous surface water exceedance
PSW-3	Assess groundwater quality downstream of previous surface water exceedance
PSW-4	Assess groundwater quality downstream of previous surface water exceedance
PSG-1	Staff Gauge adjacent to MW0004S









## Figure 3 SWMU #114 **Groundwater Elevation Map Shallow Zone**

#### Legend

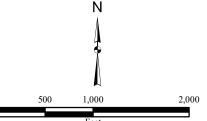
- Staff Gauge Location
- Shallow Zone Monitoring Well

Generalized Groundwater Flow Direction

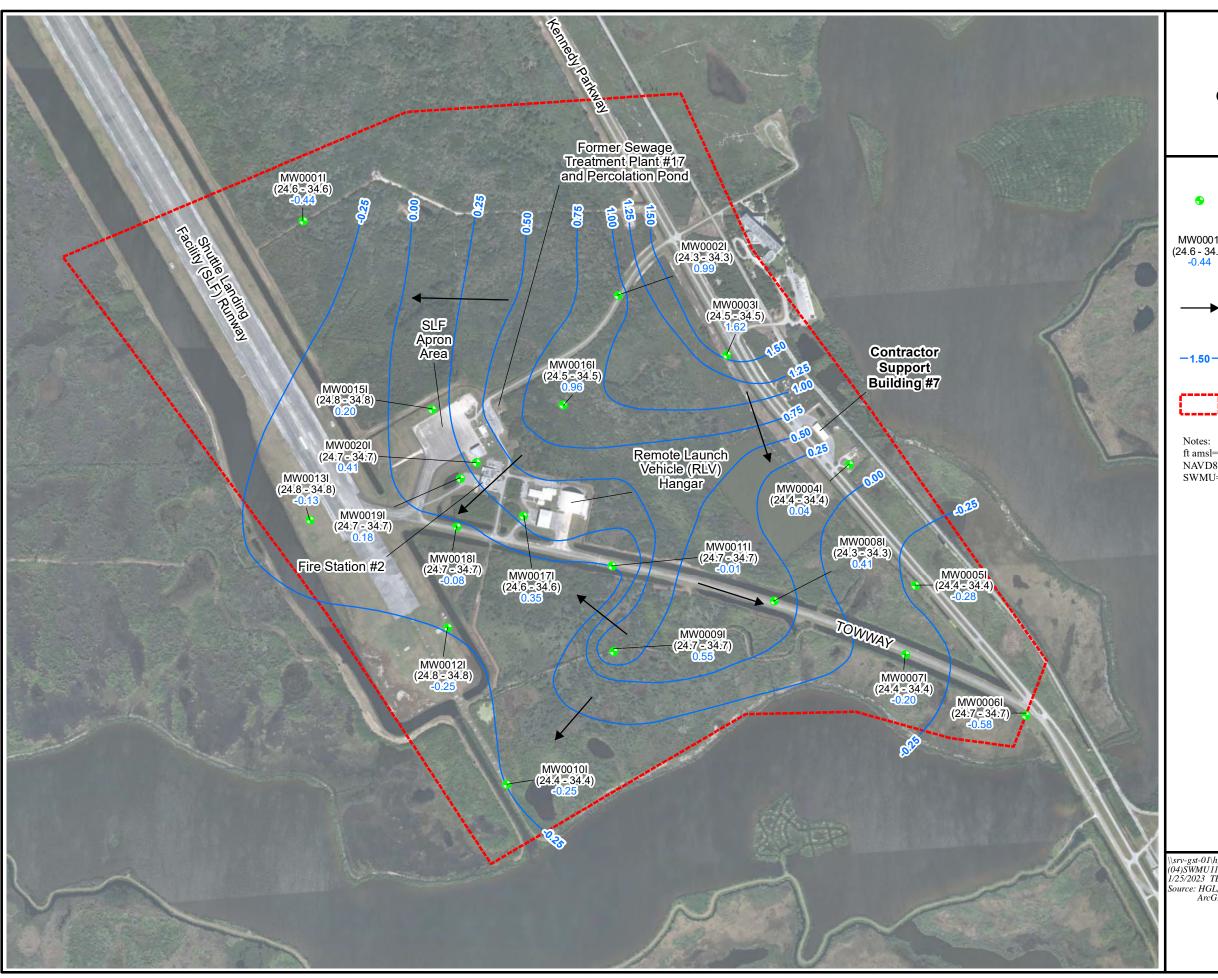
Groundwater Elevation Contour (ft amsl, NAVD88)

SWMU 114 Boundary

ft amsl=feet above mean sea level NAVD88=North American Vertical Datum of 1988 SWMU=solid waste management unit



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## Figure 4 SWMU #114 **Groundwater Elevation Map Intermediate Zone**

#### Legend

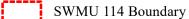
Intermediate Zone Monitoring Well

MW00011 Monitoring Well Identification
(24.6 - 34.6) Screened Interval (ft)

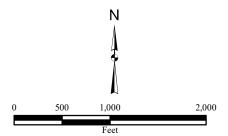
-0.44 Groundwater Elevation (ft amsl, NAVD88)

Generalized Groundwater Flow Direction

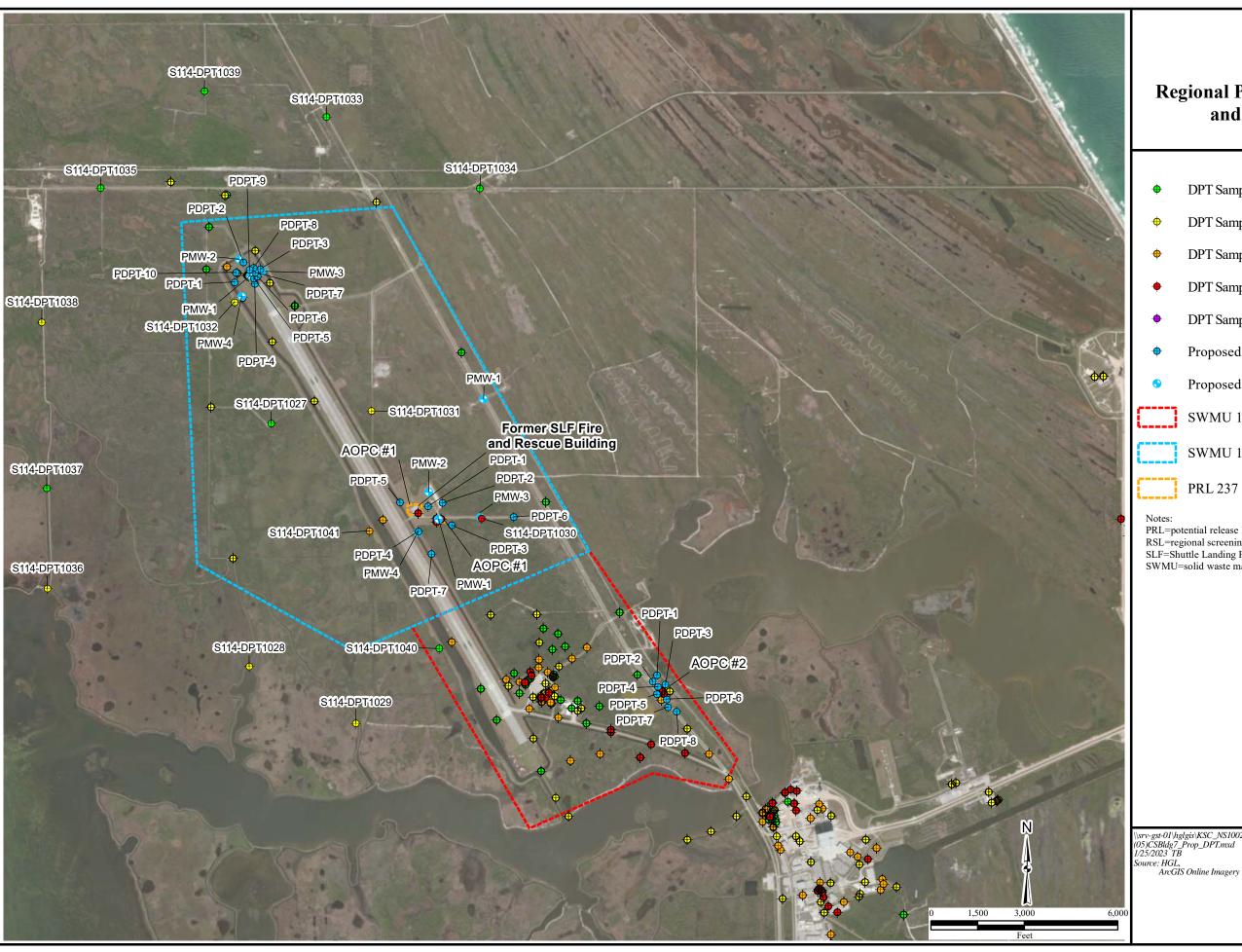
Groundwater Elevation Contour (ft amsl, NAVD88)



ft amsl=feet above mean sea level NAVD88=North American Vertical Datum of 1988 SWMU=solid waste management unit



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ArcGIS Online Imagery



## Figure 5 **SLF** Area **Regional Proposed DPT Locations** and Monitoring Wells

## Legend

- DPT Sample Concentration Less than RSLs
- DPT Sample Concentration Greater than RSLs
- DPT Sample Concentration Greater than 10 x RSLs
- DPT Sample Concentration Greater than 100 x RSLs
- DPT Sample Concentration Greater than 1000 x RSLs
- Proposed DPT Sample
- Proposed Monitoring Well

SWMU 114 Boundary

SWMU 119 Boundary

PRL 237 Boundary

PRL=potential release location RSL=regional screening level SLF=Shuttle Landing Facility SWMU=solid waste management unit

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