FINAL
Site Inspection Report
Vega Baja Readiness Center
Vega Baja, Puerto Rico

Site Inspections for Perfluorooctanoic Acid (PFOA), Perfluorooctanesulfonic Acid (PFOS), Perfluorohexanesulfonic Acid (PFHxS), Perfluorononanoic Acid (PFNA), Hexafluoropropylene oxide dimer acid (HFPO-DA) and Perfluorobutanesulfonic Acid (PFBS)
ARNG Installations, Nationwide

August 2023

Prepared for:

Army National Guard Headquarters
111 S. George Mason Drive
Arlington, VA 22204

UNCLASSIFIED

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* A Technical Project Planning Meeting was not held for Vega Baja Readiness Center; regulators did not respond to the request to attend a Technical Project Planning Meeting.

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LIST OF ACRONYMS AND ABBREVIATIONS

°C	Degrees Celsius
°F	Degrees Fahrenheit
%	Percent
µg/kg	Microgram(s) per kilogram
AECOM	AECOM Technical Services, Inc.
AFFF	Aqueous film forming foam
amsl	Above mean sea level
AOI	Area of Interest
ARNG	Army National Guard
ASTM	American Society for Testing and Materials
bgs	Below ground surface
btoc	Below top of casing
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CoC	Chain-of-Custody
CSM	Conceptual site model
DA	U.S. Department of the Army
DoD	Department of Defense
DPT	Direct-push technology
DQO	Data quality objective
DUA	Data Usability Assessment
EA	EA Engineering, Science, and Technology, Inc., PBC
EDR ™	Environmental Data Resources, Inc., ™
ELAP	Environmental Laboratory Accreditation Program
EM	Engineer Manual
EB	Equipment blank
FedEx	Federal Express
FMS	Field Maintenance Shop
ft	Foot (feet)
HDPE	High-density polyethylene
HEMTT	Heavy Expanded Mobility Tactical Truck
HFPO-DA	Hexafluoropropylene oxide dimer acid
ID	Identification
IDW	Investigation-derived waste
ITRC	Interstate Technology Regulatory Council
LC/MS/MS	Liquid chromatography tandem mass spectrometry

LIST OF ACRONYMS AND ABBREVIATIONS (continued)

MS	Matrix spike
MSD	Matrix spike duplicate
MIL-SPEC	Military specification
NELAP	National Environmental Laboratory Accreditation Program
ng/L	Nanogram(s) per liter
No.	Number
OSD	Office of the Secretary of Defense
PA	Preliminary Assessment
PFAS	Per- and polyfluoroalkyl substances
PFBS	Perfluorobutanesulfonic acid
PFHxS	Perfluorohexanesulfonic acid
PFNA	Perfluorononanoic acid
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctanesulfonic acid
PVC	Polyvinyl chloride
PRARNG	Puerto Rico Army National Guard
PRDNER	Puerto Rico Department of Natural and Environmental Resources
QAPP	Quality Assurance Project Plan
QSM	Quality Systems Manual
RI	Remedial investigation
SI	Site Inspection
SL	Screening level
SOP	Standard Operating Procedure
TOC	Total organic carbon
TPP	Technical Project Planning
UFP	Uniform Federal Policy
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
WWTP	Wastewater Treatment Plant

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EXECUTIVE SUMMARY

The Army National Guard (ARNG) G-9 is performing Preliminary Assessments (PAs) and Site Inspections (SIs) at ARNG facilities nationwide based on the current or potential historical use of per- and polyfluoroalkyl substances (PFAS) with a focus on the six compounds presented in the memorandum from the Office of the Secretary of Defense (OSD) (Assistant Secretary of Defense) dated 6 July 2022. The six compounds listed in the OSD memorandum include perfluorooctanesulfonic acid (PFOS), perfluorooctanoic acid (PFOA), perfluorononanoic acid (PFNA), perfluorohexanesulfonic acid (PFHxS), hexafluoropropylene oxide dimer acid (HFPO-DA)[1], and perfluorobutanesulfonic acid (PFBS). These compounds are collectively referred to as "relevant compounds" throughout the document and the applicable screening levels (SLs) are provided in **Table ES-1**.

The PA identified three Areas of Interest (AOIs) where PFAS-containing materials may have been used, stored, disposed, or released historically (see **Table ES-2** for AOI locations). The objective of the SI is to identify whether there has been a release to the environment from the AOIs identified in the PA and determine whether further investigation is warranted, a removal action is required to address immediate threats, or no further action is required based on SLs for the relevant compounds. This SI was completed at Vega Baja Readiness Center, in Vega Baja, Puerto Rico and determined further evaluation under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) is warranted for AOIs 1, 2, and 3. Vega Baja Readiness Center will also be referred to as the "Facility" throughout this document.

The Facility, operated by Puerto Rico ARNG (PRARNG), encompasses approximately 15 acres in Vega Baja, Puerto Rico. The Facility is situated between residential areas, recreational fields, and a wildlife refuge area off State Road 687, in the Vega Baja Municipality of Puerto Rico. The PRARNG licensed a portion of the former Camp Tortuguero between 1947 and 1976. The Facility currently hosts a PRARNG Engineer Battalion and a PRARNG Firefighter Engineer Detachment, which includes several parking areas, office space, a gym, Field Maintenance Shop (FMS) #7, a wash rack, additional vehicle maintenance areas, a fire department storage area, and a helipad (AECOM Technical Services, Inc. [AECOM] 2020).

The PA identified three AOIs for investigation during the SI phase. SI sampling results from the AOIs were compared to OSD SLs. After the fieldwork was completed an additional potential PFAS release area was identified: AOI 4: Firefighting Materials Storage Area. **Table ES-2** summarizes the SI results for the AOIs. Based on the results of this SI, further evaluation under CERCLA is warranted in a remedial investigation (RI) for AOIs 2, and 3; no further evaluation is warranted for AOI 1 at this time. As the identification of AOI 4 did not occur until after the SI fieldwork, investigation of this AOI was not completed during the SI. AOI 4: Firefighting Materials Storage Area.

[1] Of the six PFAS compounds presented in the 6 July 2022 OSD memorandum, HFPO-DA (commonly referred to as GenX) was not included as an analyte at the time of this SI. Based on the conceptual site model (CSM) developed during the PA and revised based on SI findings, the presence of HFPO-DA is not anticipated at the facility because HFPO-DA is generally not a component of military specification (MIL-SPEC) aqueous film forming foam (AFFF) and based on its history including distribution limitations that restricted use of GenX, it is generally not a component of other products the military used. In addition, it is unlikely that GenX would be an individual chemical of concern in the absence of other PFAS.

Table ES-1. Screening Levels (Soil and Groundwater)

Analyte[2]	Residential (Soil) (µg/kg)[1] (0 to 2 ft bgs)	Industrial/Commercial Composite Worker (Soil) (µg/kg)[1] (2 to 15 ft bgs)	Tap Water (Groundwater) (ng/L)[1]
PFOA	19	250	6
PFOS	13	160	4
PFBS	1,900	25,000	601
PFHxS	130	1,600	39
PFNA	19	250	6

Notes:
1. Assistant Secretary of Defense. 2022. Risk-Based Screening Levels Calculated for Groundwater and Soil using U.S. Environmental Protection Agency's (USEPA's) Regional Screening Level Calculator. Hazard Quotient (HQ)=0.1. 6 July 2022.
2. Of the six PFAS compounds presented in the 6 July 2022 OSD memorandum, HFPO-DA (commonly referred to as GenX) was not included as an analyte at the time of this SI. Based on the CSM developed during the PA and revised based on SI findings, the presence of HFPO-DA is not anticipated at the facility because HFPO-DA is generally not a component of MIL-SPEC AFFF and based on its history including distribution limitations that restricted use of GenX, it is generally not a component of other products the military used. In addition, it is unlikely that GenX would be an individual chemical of concern in the absence of other PFAS.

µg/kg = Microgram(s) per kilogram
bgs = Below ground surface
ft = Foot (feet)
ng/L = Nanogram(s) per liter

Table ES-2. Summary of Site Inspection Findings and Recommendations

AOI	Potential Release Area	Soil Source Area	Groundwater Source Area	Groundwater Facility Boundary	Future Action
1	Helipad	○	◐	◐	No Further Action
2	Wash Rack	◐	●	◐	Proceed to RI
3	Vehicle Parking Area	◐	●	◐	Proceed to RI
4	Firefighting Materials Storage Area	TBD	TBD	TBD	Proceed to RI

Legend:
● = Detected; exceedance of screening levels
◐ = Detected; no exceedance of screening levels
○ = Not detected
TBD = to be determined during RI

1. INTRODUCTION

1.1 PROJECT AUTHORIZATION

The Army National Guard (ARNG) G-9 is the lead agency in performing Preliminary Assessments (PAs) and Site Inspections (SIs) at ARNG facilities nationwide based on the current or potential historical use of per- and polyfluoroalkyl substances (PFAS) with a focus on six compounds presented in the memorandum from the Office of the Secretary of Defense (OSD) dated 6 July 2022 (Assistant Secretary of Defense 2022). The six compounds listed in the OSD memorandum will be referred to as "relevant compounds" throughout this document and include perfluorooctanesulfonic acid (PFOS), perfluorooctanoic acid (PFOA), perfluorobutanesulfonic acid (PFBS), perfluorononanoic acid (PFNA), perfluorohexanesulfonic acid (PFHxS), and hexafluoropropylene oxide-dimer acid (HFPO-DA)[2] at ARNG facilities nationwide. The ARNG performed this SI at Vega Baja Readiness Center in Vega Baja, Puerto Rico. Vega Baja Readiness Center will also be referred to as the "Facility" throughout this document.

The SI project elements were performed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (U.S. Environmental Protection Agency [USEPA] 1980), as amended, the National Oil and Hazardous Substances Pollution Contingency Plan (40 Code of Federal Regulations Part 300) (USEPA 1994), and in compliance with U.S. Department of the Army (DA) requirements and guidance for field investigations.

1.2 SITE INSPECTION PURPOSE

A PA was performed at the Vega Baja Readiness Center (AECOM Technical Services, Inc. [AECOM] 2020) that identified three Areas of Interest (AOIs) where PFAS-containing materials were used, stored, disposed, or released historically. The objective of the SI is to identify whether there has been a release to the environment from the AOIs identified in the PA and determine whether further investigation is warranted, a removal action is required to address immediate threats, or no further action is required based on screening levels (SLs) for the relevant compounds.

[2] Of the six PFAS compounds presented in the 6 July 2022 OSD memorandum, HFPO-DA (commonly referred to as GenX) was not included as an analyte at the time of this SI. Based on the conceptual site model (CSM) developed during the PA and revised based on SI findings, the presence of HFPO-DA is not anticipated at the facility because HFPO-DA is generally not a component of military specification (MIL-SPEC) aqueous film forming foam (AFFF) and based on its history including distribution limitations that restricted use of GenX, it is generally not a component of other products the military used. In addition, it is unlikely that GenX would be an individual chemical of concern in the absence of other PFAS.

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2. FACILITY BACKGROUND

2.1 FACILITY LOCATION AND DESCRIPTION

The Vega Baja Readiness Center is situated between residential areas, recreational fields, and a wildlife refuge area off State Road 687, in the Vega Baja Municipality of Puerto Rico (**Figure 2-1**). The Facility currently hosts a PRARNG Engineer Battalion and a PRARNG Firefighter Engineer Detachment. The Facility comprises approximately 15 acres and includes several parking areas, office space, a gym, FMS #7, a wash rack, additional vehicle maintenance areas, a fire department storage area, a helipad, and other improvements (AECOM 2020).

The U.S. Army established Camp Tortuguero, which encapsulated the current Vega Baja Readiness Center property, in 1941 for basic training purposes. The full extent of the former Camp Tortuguero is unknown. The PRARNG licensed a portion of the former Camp Tortuguero including a small arms firing range between 1947 and 1976. It is unknown whether the Vega Baja Readiness Center was acquired by the PRARNG at the same time. Aerial imagery included in the Facility Environmental Data Resources, Inc., ™ (EDR ™) report shows activity within the current property boundary as early as 1977. The former Camp Tortuguero was transferred to the Puerto Rico Land Authority in 1980 (AECOM 2020).

2.2 FACILITY ENVIRONMENTAL SETTING

Vega Baja Readiness Center lies within the limestone uplands of north central Puerto Rico, approximately 2.5 miles south of the island's northern coast and 2 miles south of the Sandin Neighborhood within the Vega Baja Municipality (**Figure 2-2)**. The northern coast is lined with small bays and lagoons. The karst terrain of the North Coast Limestone Province generally consists of a northward-sloping limestone plateau. Topography across the Vega Baja Readiness Center is generally flat but slopes downward to the north in the northern portions of the Facility (AECOM 2020).

The following sections include information on geology, hydrogeology, hydrology, climate, and current and future land use. The topography at the Facility is shown on **Figure 2-2**. The regional geology and groundwater features are shown on **Figure 2-3**. The regional surface water features and drainage basins are shown on **Figure 2-4**. Groundwater elevations and contours are presented on **Figure 2-5**.

2.2.1 Geology

The municipality of Vega Baja is located within the North Coast Limestone geologic province. The north side of the island is underlain by limestones, marls, and some noncarbonate sediments of late Oligocene to early Miocene age. The formations in this area comprise a series of early Miocene limestones consisting of the Aymamon Limestone; the Aguada Limestone, which is encountered in the subsurface below the Aymamon Limestone and in sinkholes; and the underlying Cibao formation that is comprised of calcareous clay, marl, and chalky limestone. The unnamed upper member of the Cibao formation, comprised of claystone, marl, and limestone containing terrigenous material, acts as a lower confining unit (USGS 2016 and

Rodriguez-Martinez 1995). The limestone sequence has a general east-to-west strike and dips gently to the north.

Blanket deposits of reddish or sandy clays and sands overlie the limestones in some areas of the Northern Limestone Province. This overburden ranges in thickness from 0 to 100 feet (ft). More recent alluvial deposits are also found along major river valleys (AECOM 2020).

During the SI, low-medium plasticity sandy clay, clayey sands, and fine sands were observed as the dominant lithology. In many of the boreholes interbedded clays of various thickness were observed within the fine sands. The borings were completed at depths between 21 and 45 ft below ground surface (bgs). Varying quantities of sand were noted, specifically isolated layers of silty sand, sandy silt, poorly-graded sand with silt, and poorly graded sand were also observed in the borings with thicknesses ranging from a few inches to 25 ft. Samples for grain size analyses were collected at three locations, AOI01-01, AOI02-01, and AOI03-01, and analyzed via American Society for Testing and Materials (ASTM) Method D-422. The results indicate that the soil samples are comprised primarily of sand (50.6 percent [%] to 71.5%) and clay (21.0% to 40.4%). These results and Facility observations are consistent with the reported depositional environment of the region. Boring logs are presented in **Appendix E** and grain size results are presented in **Appendix F**.

2.2.2 Hydrogeology

Vega Baja Readiness Center is located within the North Coast Limestone aquifer system of Puerto Rico, which comprises three regional hydrogeologic units: an upper aquifer, a middle confining unit, and a lower aquifer. The upper aquifer mainly consists of the Aymamon and underlying Aguada limestones and is confined in coastal areas, such as Vega Baja, by fine-grained surficial deposits. The thickness of the upper aquifer in the regional vicinity of Vega Baja is up to approximately 1,000 ft thick. The base of the upper aquifer is defined by the upper members of the underlying Cibao Formation, which acts as a confining unit to the deeper Cibao aquifer. Three inactive U.S. Geological Survey monitoring piezometers are located adjacent to the northern border of the Vega Baja Readiness Center, shown on **Figure 2-2**. The most recent data from the piezometers indicate that groundwater depth is approximately 24 to 26 ft bgs in piezometer U.S. Geological Survey 182712066251700. According to information provided by the National Water Quality Monitoring Council, the piezometer is located in the Unconfined Upper North Coast Limestone Aquifer and extends to a depth of 221.0 ft bgs (National Water Quality Monitoring Council (NWQMC) 2021). Groundwater depth at the inactive piezometer was last recorded in 2008. Groundwater is expected to flow northwest towards Laguna Rica, Laguna Tortuguero, and the Atlantic Ocean (**Figure 2-3**) (AECOM 2020).

There are no drinking water wells at the Vega Baja Readiness Center; the Facility is provided municipal water by the Puerto Rico Aqueducts and Sewers Authority. According to the Facility EDR TM report, several water wells are located within a 1-mile radius of the Facility, including one public water supply well located approximately 0.6 miles to the east (AECOM 2020).

Depths to water measured in November 2022 during the SI ranged from 13.19 to 34.44 ft bgs. Groundwater elevation contours from the SI are presented on **Figure 2-4** and indicate the groundwater flow direction at the Facility is primarily to the northeast.

2.2.3 Hydrology

The Vega Baja Municipality is located in the Rio Cibuco watershed, between the Rio Grande de Manatí and the Rio Cibuco. Both rivers originate in the Cordillera Central mountain range, flow north through the foothills, and ultimately discharge unto the Atlantic Ocean. Flooding may occur during periods of heavy rainfall; however, no flooding occurs on-site at the Vega Baja Readiness Center (AECOM 2020).

There are no surface water bodies located within the Facility boundary. General surface water flow at the Facility flows north/northeast towards stormwater drains and culverts along State Road 687. The freshwater lake Laguna Rica and its smaller surrounding wetlands are located approximately 0.2 miles west of the Vega Baja Readiness Center Facility boundary. The Laguna Tortuguero, which is listed by the National Wetlands Inventory as an estuarine and marine deepwater habitat, is located approximately 0.8 miles northwest of the Facility (**Figure 2-3**). Laguna Tortuguero is a designated wildlife refuge area (AECOM 2020).

Surface water runoff at FMS #7 and the Wash Rack specifically is captured within unlined concrete basins that direct flow into an oil-water separator, which then discharges to stormwater drains. A wastewater treatment system captures used wash water from the Wash Rack and provides degreasing, chlorine treatment, and photoionization. The wastewater is stored in a 3,000-gallon tank and collected by a private contractor for disposal as needed, approximately once per every 2 years. Surface water features are presented on **Figure 2-5**. Information on the private contractor and location of disposal was not available for this PA (AECOM 2020).

2.2.4 Climate

Puerto Rico's maritime climate experiences warm sea breezes throughout the year, preventing major fluctuations in temperature. The average temperature in the summer in the nearby town of Manatí, which is located approximately 4 miles southwest of the Facility, is 80.5 degrees Fahrenheit (°F), while the average temperature in the winter is 74.7°F. The coastal plains endure the smallest temperature fluctuations. Seasonal variation in the temperate zone is very low; however, there is considerable variation in temperature and precipitation resulting from variable topography and prevailing winds. The east-west mountain chain intercepts the easterly trade winds and provides the north side of the island with an abundance of rain. Rainfall is distributed throughout the year, with May through November considered as the rainy period. January to March is dryer than May through August but may have cold fronts coming in from the temperate zone to the north that can produce rain. Annual precipitation in Manatí is approximately 61.64 inches (AECOM 2020).

Puerto Rico is in the hurricane belt of the western Atlantic and Caribbean. Hurricanes are Puerto Rico's predominant weather problem because of the catastrophic high winds and waves, large volumes of rain, and the enormous structural change they can produce on natural ecosystems, and on human populations and their infrastructure. Typically, 6 to 10 hurricanes develop yearly in the western North Atlantic region. Hurricanes have impacted Puerto Rico recently, most notably with Hurricane Maria in 2017 (AECOM 2020).

2.2.5 Current and Future Land Use

According to PRARNG personnel, the land use at the Vega Baja Readiness Center is expected to remain the same (AECOM 2020). The Facility serves largely as an office and materials storage area, as well as a firefighting vehicle storage area. Two firefighting vehicles are occasionally stored at the Facility.

2.2.6 Sensitive Habitat and Threatened/Endangered Species

The following species are listed as federally endangered, threatened, proposed, and/or candidate species in Vega Baja Municipality, Puerto Rico (U.S. Fish and Wildlife Services 2022):

- Birds: Puerto Rican Parrot (*Amazona vittate)* – Endangered
- Reptiles: Hawksbill Sea Turtle *(Eretmochelys imbricata)* – Endangered; Leatherback Sea Turtle (*Dermochelys coriacea)* – Endangered; Puerto Rican Boa (*Epicrates inornatus)* – Endangered
- Amphibians: Puerto Rican Crested Toad (*Peltophryne lemur)* – Endangered
- Flowering Plants: *Chamaecrista glandulosa var. mirabilis* – Endangered; *Daphnopsis helleriana* – Endangered; Palo De Rosa (*Ottoschulzia rhodoxylon)* – Endangered; *Schoepfia arenaria* – Threatened.

2.3 HISTORY OF PFAS USE

Three potential PFAS release areas were identified at the Facility during the PA (AECOM 2020). Interviews and records obtained during the PA indicate that aqueous film forming foam (AFFF) was stored on-site within Facility firefighting vehicles. Additionally, while no formal scheduled fire training exercises were reported to occur at the Facility, a one-time fire training event took place at the northern boundary of the Facility property, within the Facility helipad. Only water was reportedly used during this training event. A description of each AOI is presented in **Section 3**.

During preparation of the SI report, it was noted that the Firefighting Material Storage Area associated with the 215th Firefighter Engineer Detachment is located within the Readiness Center building. A "No suspected release" determination was made for this area during the PA. This determination was based on interviewees who stated that no AFFF has ever been accidently released and that floor drains discharge to municipal sanitary sewer systems. Because Chemguard 3% AFFF was stored within the Firefighting Materials Storage Area, a fourth AOI was added that will be investigated as part of the RI.

Army National Guard Site Inspections
Site Inspection Report
Vega Baja Readiness Center, Puerto Rico

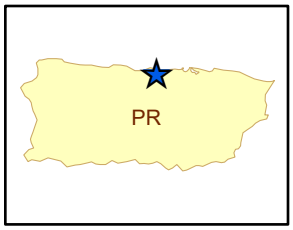
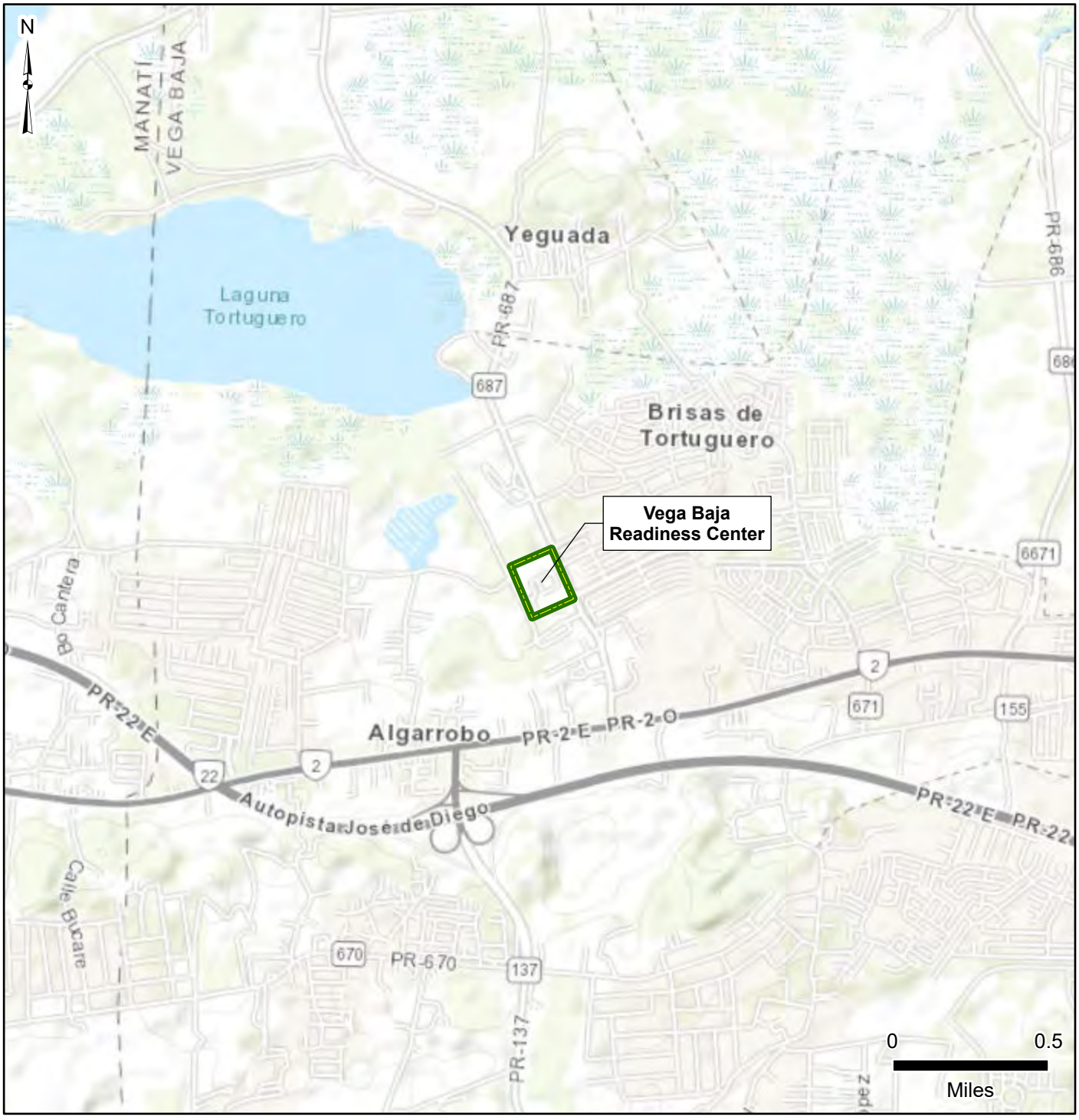


Figure 2-1
Facility Location



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Facility Data

Facility Boundary

Data Sources:
ESRI 2020
AECOM 2020

Date:.....February 2023
Prepared By:.....EA
Prepared For:.....USACE
Projection:.....WGS 84 UTM 20N

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Army National Guard Site Inspections
Site Inspection Report
Vega Baja Readiness Center, Puerto Rico

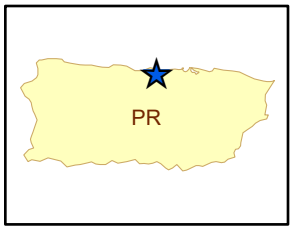
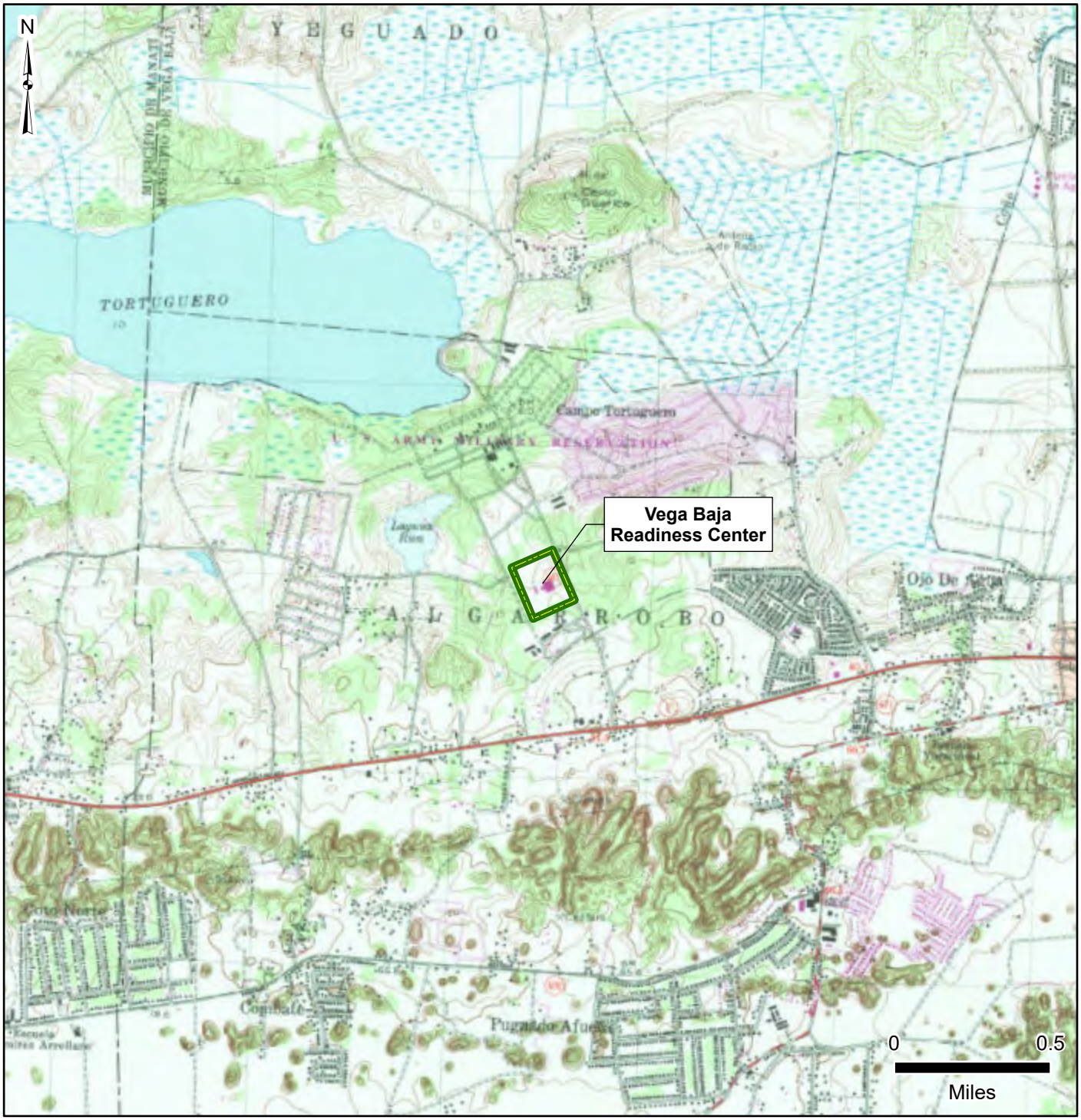


Figure 2-2
Topography



Facility Data

Facility Boundary

Data Sources:
ESRI 2020
AECOM 2020

Date:.....February 2023
Prepared By:.....EA
Prepared For:.....USACE
Projection:.....WGS 84 UTM 20N

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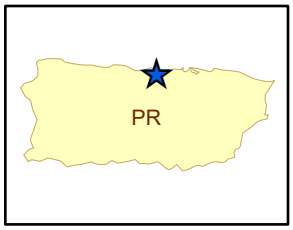
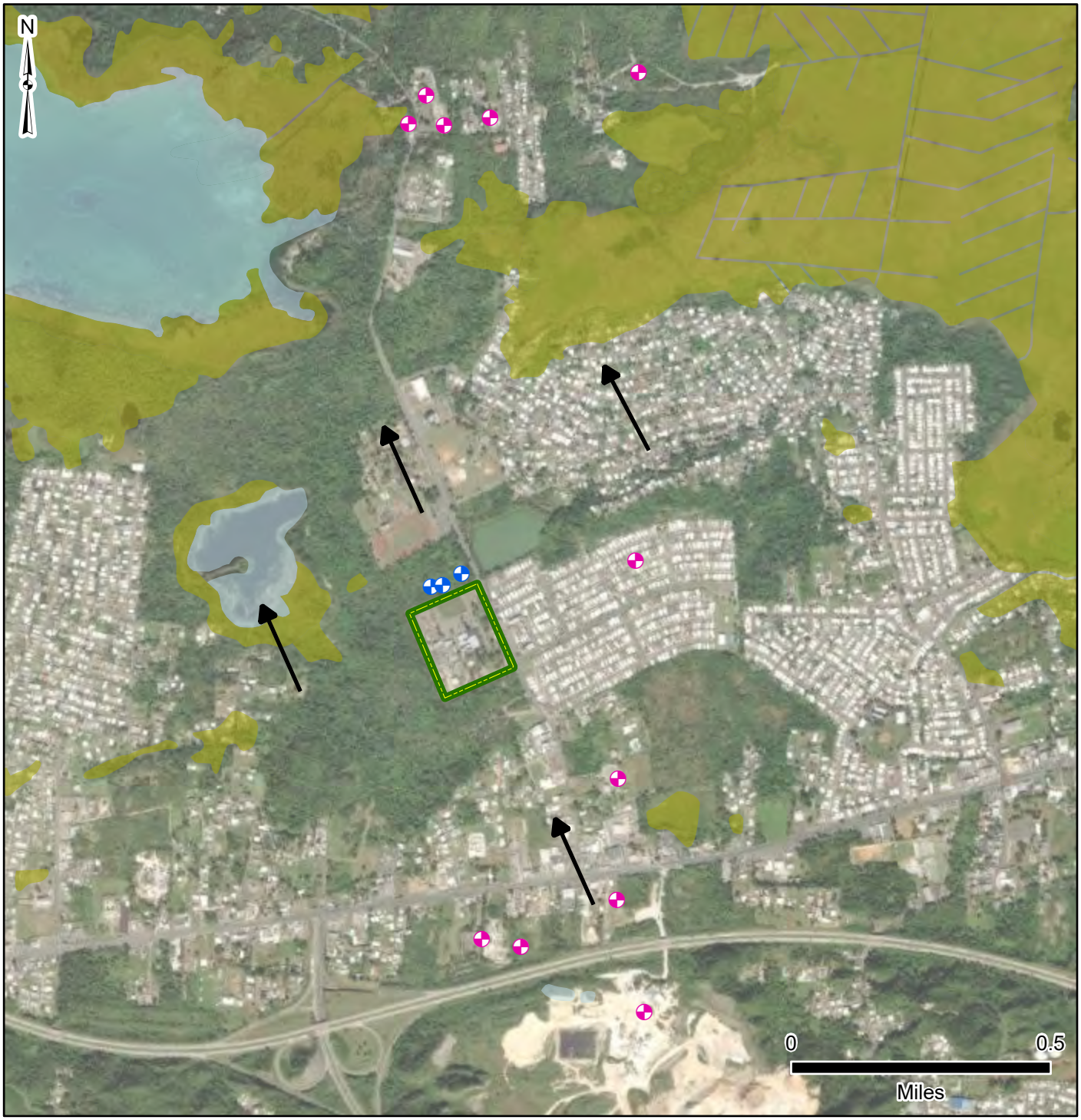


Figure 2-3
Groundwater Features



Facility Data
- Facility Boundary

Well Type
- Inactive USGS piezometers
- Unknown/Other Well

Hydrology/Hydrogeology
- Groundwater Flow Direction
- Waterbody
- Wetlands

Data Sources:
ESRI 2020
AECOM 2020

Date:.....February 2023
Prepared By:.....EA
Prepared For:.....USACE
Projection:.....WGS 84 UTM 20N

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Vega Baja Readiness Center, Puerto Rico

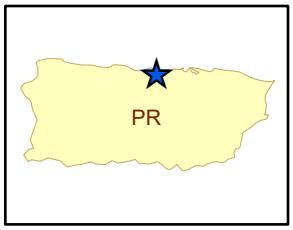
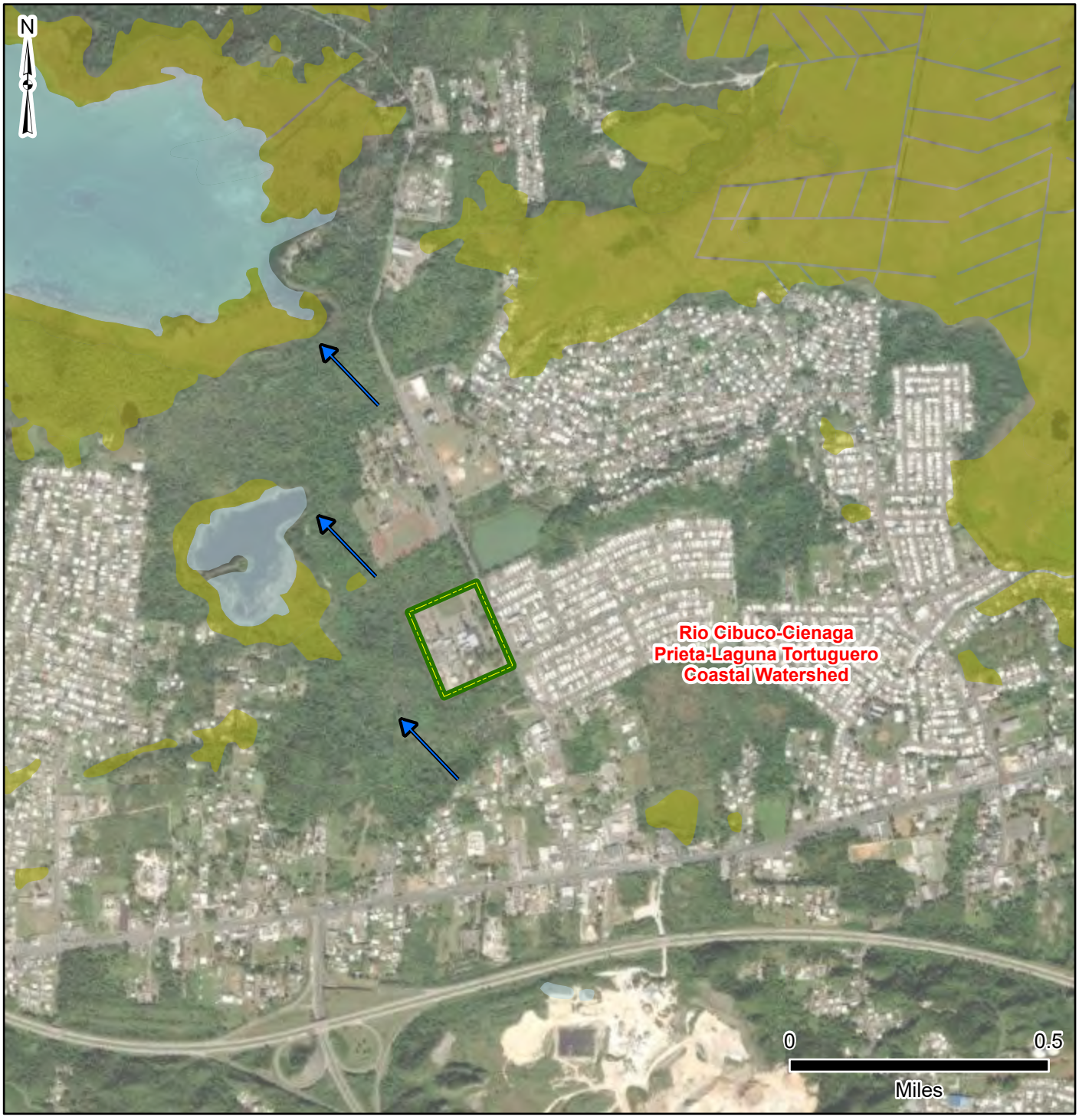


Figure 2-4
Surface Water Features



Facility Data
- Facility Boundary

Hydrology
- Surface Water Flow Direction
- Waterbody
- Wetlands

Data Sources:
ESRI 2020
AECOM 2020

Date:.....February 2023
Prepared By:.....EA
Prepared For:.....USACE
Projection:.....WGS 84 UTM 20N

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Vega Baja Readiness Center, Puerto Rico

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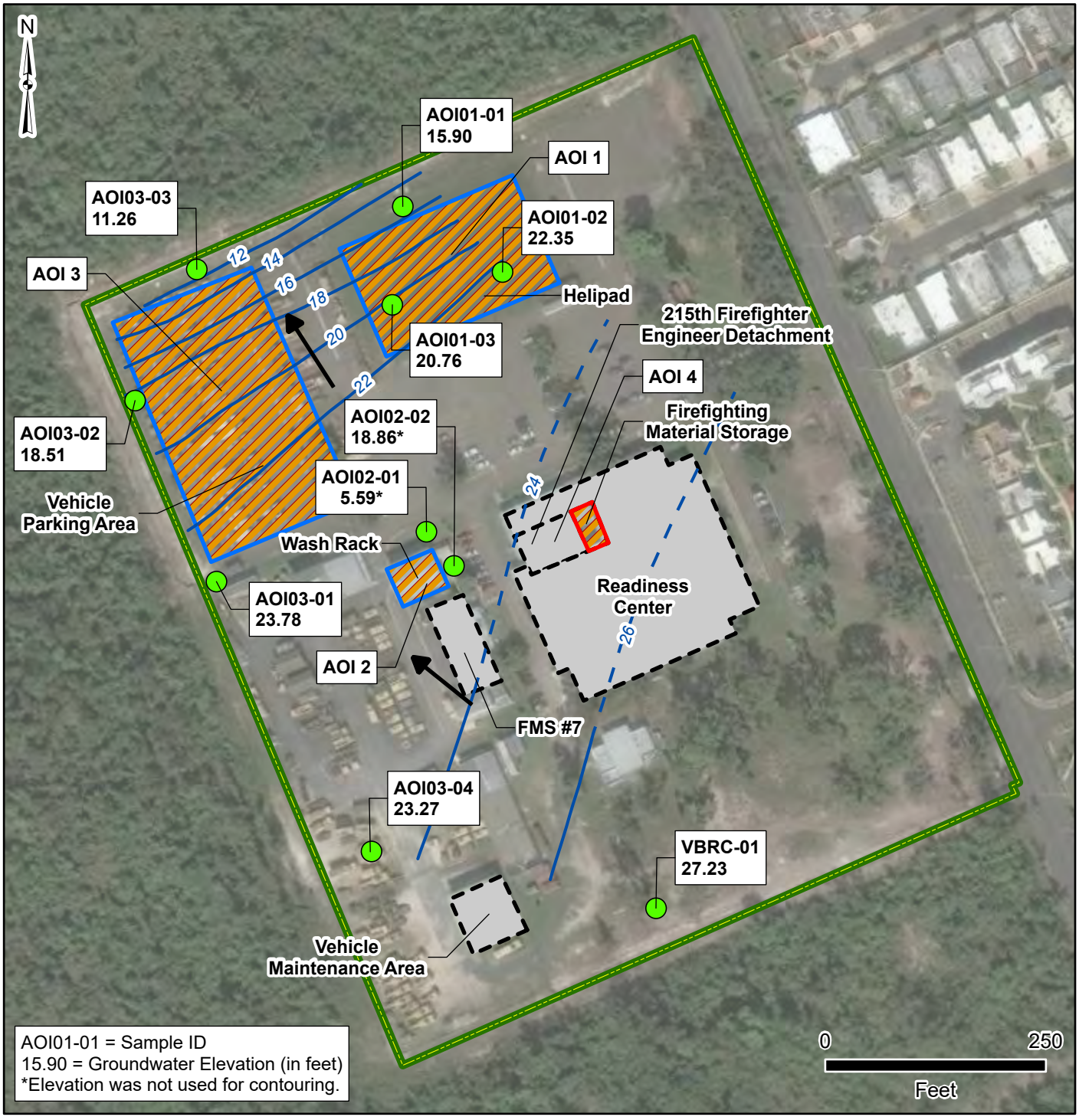
Figure 2-5
Groundwater Elevations



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Facility Data
- Facility Boundary
- Area of Interest
- Area of Interest Identified after SI, to be investigated in RI
- Potential PFAS Release
- No Suspected Release

Sample Locations
- DPT

Hydrology/Hydrogeology
- Groundwater Flow Direction
- Groundwater Elevation Contour (2 foot interval)
- Inferred Groundwater Elevation Contour (2 foot interval)

Data Sources:
ESRI 2020
AECOM 2020

Date:.....July 2023
Prepared By:.....EA
Prepared For:.....USACE
Projection:.....WGS 84 UTM 20N

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3. SUMMARY OF AREAS OF INTEREST

The PA evaluated areas where PFAS-containing materials may have been used, stored, disposed, or released historically. Based on the PA findings, three potential release areas were identified at Vega Baja Readiness Center. During preparation of the SI report, one additional potential release area was identified: AOI 4 Firefighting Materials Storage Area. This area will be assessed during the RI. The potential source areas are shown on **Figure 3-1** and described in the subsequent sections.

3.1 AOI 1 – HELIPAD

The Firefighter Engineer Detachment's presence at the Vega Baja Readiness Center is largely administrative. The detachment occupies office and material storage space within the Readiness Center and stores firefighting vehicles at the Facility. No scheduled or formal fire training exercises occur at the Facility, nor does any training by non-PRARNG units; however, a PRARNG interviewee stated that a one-time fire training event using only water occurred in 2010 at the helipad near the northern boundary of the Facility property. No evidence indicates that AFFF has ever been used for training at the helipad. No other known fire training events have occurred at the Facility.

Two firefighting vehicles are occasionally stored at the Facility. At the time of the visit, one Osh Kosh water tanker truck with a 50-gallon AFFF tank and a 2,500-gallon water tank was stored at the Facility. PRARNG personnel stated that firefighting vehicle nozzles have experienced corrosion, but no AFFF leaks have ever occurred. The make and model of the second firefighting vehicle occasionally stored at the Facility is unknown, but PRARNG staff stated during interviews that is it not capable of storing or using AFFF (AECOM 2020).

Because Facility personnel stated that firefighting vehicle nozzles have experienced corrosion, it is possible that the integrity of firefighting vehicle tanks and lines may be compromised. As such, AFFF may potentially migrate into the vehicle bulk tanks, or remain present in vehicle nozzles during nozzle testing and fire training. Based on the reported corrosion of vehicle nozzles, the one-time fire training event at the helipad may have resulted in PFAS releases to the environment. The helipad is considered a potential PFAS release area (AECOM 2020).

3.2 AOI 2 – WASH RACK

The Facility Wash Rack is located adjacent to FMS #7 to the north. The Wash Rack is also used to perform maintenance on PRARNG vehicles, including firefighting vehicles. Despite the Wash Rack's use to perform maintenance on firefighting vehicles, PRARNG personnel stated during interviews that no AFFF releases have occurred as a result of nozzle testing or general maintenance at the Wash Rack. Based on the reported corrosion of firefighting vehicle nozzles however, it is possible that the integrity of tanks and lines in the vehicles has been compromised. As such, AFFF may potentially migrate into the vehicle bulk tanks, or remain present in vehicle nozzle during nozzle testing and fire training. Based on the reported corrosion of vehicle nozzles, vehicle maintenance at the Wash Rack may have resulted in PFAS releases to the environment. The Wash Rack is considered a potential PFAS release area (AECOM 2020).

A fixed fire suppression system is not present at the Wash Rack, but the area includes staged dry chemical handheld fire extinguishers. PRARNG personnel stated during interviews that no accidents requiring the use of AFFF fire suppression have occurred at the Wash Rack. Floor drains at the Wash Rack flow to an oil-water separator and discharge to stormwater drains (AECOM 2020).

3.3 AOI 3 – VEHICLE PARKING AREA

Several areas within the Vega Baja Readiness Center are used for PRARNG vehicle parking. The Vehicle Parking Area in the northwestern area is regularly used for the parking of firefighting vehicles. According to Facility personnel, the water tank cracked on an Osh Kosh Heavy Expanded Mobility Tactical Truck (HEMTT) Model Number (No.) M1158 stored in the Vehicle Parking Area in 2017. The HEMTT based water tender is stored and maintained by the Firefighter Engineer Detachment. Photographs of the vehicle are included in Appendix C. The vehicle is equipped with a 50-gallon AFFF tank and a 2,500-gallon water tank. During repairs, a private contractor emptied AFFF from the vehicle in a controlled manner and repaired the broken tank. PRARNG personnel stated that no AFFF releases occurred as a result of the broken tank or the required maintenance. AFFF stored in the smaller tank can be mixed with water on the truck as designed but has never been used at the Vega Baja Readiness Center (AECOM 2020).

If the vehicle tanks or lines have been compromised, it is possible that AFFF migrated from its tank into other parts of the vehicle. Based on the reported corrosion of vehicle nozzles, it is possible that PFAS was present in the water released from the vehicle's broken tank, or during the vehicle repair. No AFFF solution was present in the Osh Kosh water tanker truck at the time of the PA site visit, but the Vehicle Parking Area is considered a potential PFAS release area (AECOM 2020).

Additionally, one of the firefighting vehicles typically stored at the Vega Baja Readiness Center has regularly been staged in front of the Vehicle Maintenance Area; however, Facility staff stated that no known AFFF leaks have ever occurred.

3.4 AOI 4 - FIREFIGHTING MATERIALS STORAGE AREA

Following the SI fieldwork it was noted that Chemguard 3% AFFF was stored in the Firefighting Materials Storage Area. The Firefighting Materials Storage Area is a part of the Readiness Center. A "No suspected release" determination was made for this area during the PA. This determination was based on interviewees who stated that no AFFF has ever been accidently released and that floor drains discharge to municipal sanitary sewer systems. Because Chemguard 3% AFFF was stored within the Firefighting Materials Storage Area, a fourth AOI (identified as AOI 4 - Firefighting Materials Storage Area) was added. This area will be investigated as part of the next phase which is the RI.

3.5 ADJACENT SOURCES

Three potential off-facility sources of PFAS are adjacent to the Facility and are not under the control of the PRARNG. These adjacent potential sources are identified for informational purposes, and potential PFAS contamination from these downgradient, cross gradient or adjacent

sources are not anticipated to migrate towards the facility. A description of each off-facility source is presented below and shown on **Figure 3-1**.

3.5.1 Former Camp Tortuguero

The former Camp Tortuguero encapsulated the current Vega Baja Readiness Center property, and extended northeast towards the coast. Historical photos of the Camp were unavailable during this PA, so the exact boundary of Camp Tortuguero is unknown. The EDR TM report indicated that between 1940 and 1943, the U.S. Army acquired 1383.9 acres for use as a basic training camp and other related military purposes. The PRARNG licensed a portion of the former Camp Tortuguero including a small arms firing range between 1947 and 1976. In 1952, the site became surplus and was conveyed to the Commonwealth of Puerto Rico. PFAS use by ARNG in firefighting materials, such as AFFF, did not begin until 1969; however, other historical activities may have potentially used PFAS-containing materials or resulted in PFAS releases to the environment (AECOM 2020).

Industrial laundry facilities and metal plating activities are examples of potential historical operations capable of resulting in PFAS releases to the environment. Due to the unknown nature of historical operations at Camp Tortuguero, the Camp is considered a potential PFAS release area as an adjacent source. Camp Tortuguero is located downgradient from the Vega Baja Readiness Center and is not expected to contribute PFAS to soil or groundwater at the PRARNG Facility (AECOM 2020).

3.5.2 Vega Baja Fire Department

The Vega Baja Fire Department is located approximately 1.8 miles east of the Vega Baja Readiness Center, in the neighborhood of Las Flores in the city of Vega Baja. The Vega Baja Fire Department responds to emergencies at the Vega Baja Readiness Center and surrounding areas; however, no emergencies requiring fire suppression emergency response have occurred at the Facility during the tenure of interviewees (2003-2023). According to Vega Baja Readiness Center personnel, the Firefighter Engineer Detachment renews a mutual aid agreement with the Vega Baja Fire Department annually. It is unknown whether the Vega Baja Fire Department stores AFFF at the fire station, trains with AFFF, or maintains firefighting vehicles capable of using AFFF (AECOM 2020).

Due to the unknown firefighting materials and practices by the Vega Baja Fire Department, its fire station is considered a potential PFAS release area as an adjacent source. The Vega Baja Fire Department is located cross-gradient of the Vega Baja Readiness Center and is not expected to contribute PFAS to soil or groundwater at the PRARNG Facility (AECOM 2020).

3.5.3 Vega Baja Wastewater Treatment Plant

The Vega Baja Wastewater Treatment Plant (WWTP) is the nearest WWTP and is located approximately 2 miles northeast of the PRARNG Facility. It is a publicly-owned treatment works that treats sanitary wastewater through secondary treatment of the domestic sewage from Vega Baja. The WWTP provides secondary treatment and discharges its effluent to the Chico River. The sanitary wastewater is processed via grit removal, anaerobic and aerobic reactors, secondary

sedimentation, aerobic digestion, and ultraviolet disinfection. Sludge generated at the landfill is disposed in an unknown landfill (AECOM 2020).

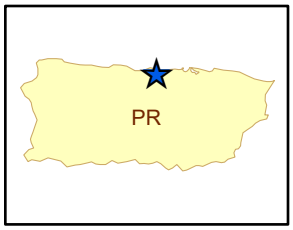
WWTPs are not usually a primary potential release area of PFAS, but sludges and liquids from areas of potential release that are treated at WWTPs may create a secondary source of contamination. The Vega Baja WWTP is located cross-gradient of the Vega Baja Readiness Center, and it is not expected to contribute to PFAS in soil or groundwater at the PRARNG Facility (AECOM 2020).

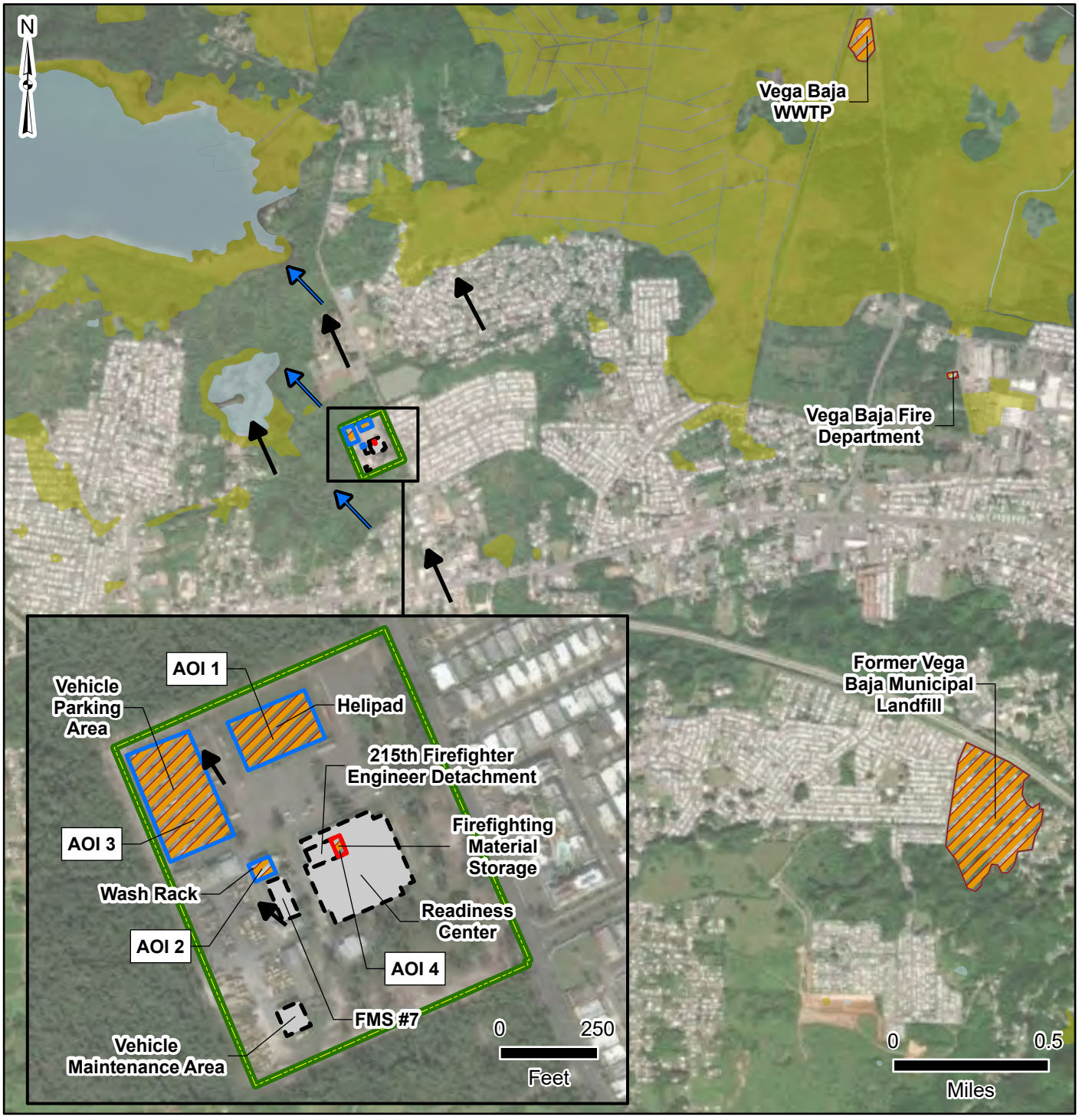
3.5.4 Vega Baja Municipal Landfill

The former Vega Baja Municipal Landfill is located approximately 2 miles southeast of the facility. The 72-acre former landfill included an unlined and uncapped solid waste disposal and open burning area. The landfill was used for disposal and open burning of commercial, industrial, and domestic waste from about 1948 to 1979. More than 1.1 million cubic yards of waste were disposed of or burned at the landfill. Residents began building homes on portions of the uncapped waste disposal area in the late 1970s (USEPA, 2010).

Army National Guard Site Inspections
Site Inspection Report
Vega Baja Readiness Center, Puerto Rico

Figure 3-1
Areas of Interest





Path: \\lovetongis\GISdata\Federal\Nationwide\PFAS\MAES_634250383\PROJECTS\SIReport\VegaBaja\VegaBajaSI.aprx

Facility Data

- Facility Boundary
- Area of Interest
- Area of Interest Identified after SI, to be investigated in RI
- Potential PFAS Release
- No Suspected Release

Hydrology/Hydrogeology

- Surface Water Flow Direction
- Groundwater Flow Direction
- Waterbody
- Wetlands

Data Sources:
ESRI 2020
AECOM 2020

Date:.....July 2023
Prepared By:.....EA
Prepared For:.....USACE
Projection:.....WGS 84 UTM 20N

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4. PROJECT DATA QUALITY OBJECTIVES

As identified during the data quality objective (DQO) process and outlined in the SI Uniform Federal Policy (UFP) Quality Assurance Project Plan (QAPP) Addendum (EA Engineering, Science, and Technology, Inc., PBC [EA] 2021a), the objective of the SI is to identify whether there has been a release to the environment at the AOIs identified in the PA. For each AOI, ARNG determines if further investigation is warranted, a removal action is required to address immediate threats, or whether no further action is warranted. This SI evaluated groundwater and soil for presence or absence of relevant compounds above their respective SLs at each of the sampled AOIs.

4.1 PROBLEM STATEMENT

ARNG may recommend AOIs for remedial investigation (RI) if related soil and groundwater samples have concentrations of the relevant compounds above OSD risk-based SLs. The SLs are presented in **Section 6.1** of this report.

4.2 INFORMATION INPUTS

Primary information inputs for the SI include the following:

- The PA Report for Vega Baja Readiness Center (AECOM 2020);
- Analytical data from the groundwater and soil samples collected as part of this SI in accordance with the UFP – QAPP Addendum (EA 2021a); and
- Field data collected including groundwater elevation and water quality parameters measured at the time of sampling.

4.3 STUDY BOUNDARIES

The scope of the SI was bounded horizontally by the property limits of the Facility (**Figure 2-2**). Off-facility sampling was not included in the scope of this SI. If future off-facility sampling is required, the proper stakeholders will be notified, and necessary rights-of-entry will be obtained by ARNG with property owner(s). The vertical boundaries of the subsurface investigation were based on the depth of target samples and advancement to achieve temporary well construction. Temporal boundaries were limited to the earliest available time field resources were available to complete the study.

4.4 ANALYTICAL APPROACH

Samples were analyzed by Eurofins Lancaster Laboratories Environmental LLC, accredited under the Department of Defense (DoD) Environmental Laboratory Accreditation Program (ELAP); Accreditation No. 101 and the National Environmental Laboratory Accreditation Program (NELAP); Certificate No. 6408. Data results were compared to applicable SLs and decision rules as defined in the UFP-QAPP Addendum (EA 2021a).

4.5 DATA USABILITY ASSESSMENT

The Data Usability Assessment (DUA), which is provided in **Appendix A**, is an evaluation at the conclusion of data collection activities that uses the results of both data verification and validation in the context of the overall project decisions or objectives. Using both quantitative and qualitative methods, the assessment determines whether project execution and the resulting data have met installation specific DQOs. Both sampling and analytical activities are considered to assess whether the collected data are of the right type, quality, and quantity to support the decision-making (DoD 2019a, 2019b; USEPA 2017).

Based on the DUA, the environmental data collected during the SI were found to be acceptable and usable for this SI evaluation with the qualifications documented in the DUA and its associated data validation reports. These data are of sufficient quality to meet the objectives and requirements of the UFP-QAPP Addendum (EA 2021a).

5. SITE INSPECTION ACTIVITIES

This section describes the environmental investigation and sampling activities that occurred as part of the SI. The SI sampling approach was based on the findings of the PA and was implemented in accordance with the following approved documents:

- *Final Preliminary Assessment Report*, *Vega Baja Readiness Center, Vega Baja, Puerto Rico,* dated March 2020 (AECOM 2020)

- *Final Programmatic Uniform Federal Policy-Quality Assurance Project Plan, Site Inspections for Per- and Polyfluoroalkyl Substances Impacted Sites, ARNG Installations, Nationwide*, dated December 2020 (EA 2020a)

- *Final Site Inspection Uniform Federal Policy-Quality Assurance Project Plan Addendum, Vega Baja Readiness Center, Vega Baja, Puerto Rico,* dated August 2021 (EA 2021a)

- *Final Programmatic Accident Prevention Plan, Revision 1*, dated November 2020 (EA 2020b)

- *Final Site Safety and Health Plan, Vega Baja Readiness Center, Vega Baja, Puerto Rico,* dated March 2021 (EA 2021b).

The SI field activities were conducted from 17 October to 1 November 2022 and consisted of direct-push technology (DPT) borings and soil sample collection, temporary monitoring well installation, and grab groundwater sample collection. Field activities were conducted in accordance with the UFP-QAPP Addendum (EA 2021a), except as noted in **Section 5.8**.

The following samples were collected during the SI and analyzed for a subset of 24 PFAS via liquid chromatography/tandem mass spectrometry (LC/MS/MS) compliant with Quality Systems Manual (QSM) Version 5.3 Table B-15, as well as three samples for total organic carbon (TOC), pH, and grain size to fulfill the project DQOs:

- Thirty-three (33) soil samples from 10 soil boring locations

- Ten (10) grab groundwater samples from 10 temporary well locations

- Thirty-four (34) quality assurance/quality control samples.

Figure 5-1 provides the sample locations for all media across the Facility. **Table 5-1** presents the list of samples collected for each medium. Field documentation is provided in **Appendix B**. A log of Daily Notice of Field Activity was completed throughout the SI field activities, which is provided in **Appendix B1**. Field notes are provided in **Appendix B2**. Survey data is presented in **Appendix B3**. Additionally, a photographic log of field activities is provided in **Appendix C**.

5.1 PRE-INVESTIGATION ACTIVITIES

In preparation for the SI field activities, project team members participated in Technical Project Planning (TPP) meetings (**Appendix D)**, performed utility clearance, and sampled decontamination source water. Details of these activities are presented below.

5.1.1 Technical Project Planning

The U.S. Army Corps of Engineers (USACE) TPP Process, Engineers Manual (EM) 200-1-2 (DA 2016) defines four phases to project planning: (1) defining the project phase; (2) determining data needs; (3) developing data collection strategies; and (4) finalizing the data collection plan. The process encourages stakeholder involvement in the SI, beginning with defining overall project objectives, including DQOs, and formulating a sampling approach to address the AOIs identified in the PA.

The stakeholders for this SI include ARNG, USACE, Puerto Rico Department of Natural and Environmental Resources (PRDNER), and PRARNG representatives familiar with the Facility, the regulations, and the community. There was no PRDNER regulatory involvement in the planning process; therefore, the initial meetings included ARNG, PRARNG, USACE, and representatives familiar with the Facility. ARNG attempted to engage PRDNER, however, PRDNER did not provide a response. A future TPP meeting, if needed, will provide an opportunity to discuss results, findings, and future actions where warranted.

5.1.2 Utility Clearance

EA contacted the Puerto Rico 811 Miss Utility to notify them of intrusive work at the Facility. In addition, EA's drilling subcontractor, Jaca and Sierra Engineering, performed a utility clearance at each of the proposed boring location on 28 September 2022 with input from PRARNG and the EA field team. General locating services and ground-penetrating radar were used to complete the clearance. The first 5 ft of each boring were also pre-cleared by EA's drilling subcontractor, Jaca and Sierra Engineering, using a hand auger to verify utility clearance in shallow subsurface where utilities would typically be encountered.

5.1.3 Source Water and PFAS Sampling Equipment Acceptability

Prior to mobilization for drilling, water samples were collected from on-site potable water sources to determine if source water could be used for drilling equipment decontamination. On 19 January 2022, samples were collected from one Facility potable water spigot, located on the western side of the Readiness Center building. Water sourced from the Indio River and treated at the Vega Baja Water Treatment Plant is supplied by the Puerto Rico Aqueduct and Sewer Authority to the Facility. Each sample was collected in laboratory-supplied PFAS-free high-density polyethylene (HDPE) bottles and labeled using a PFAS-free marker or pen. Samples were packaged on ice and transported via Federal Express (FedEx) under standard chain-of-custody (CoC) procedures to the laboratory and analyzed by LC/MS/MS compliant with QSM 5.3 Table B-15 in accordance with the SI UFP-QAPP Addendum (EA 2021a). PFAS concentrations were reported to be below the limit of quantitation which met acceptance criteria presented in the UFP-QAPP Addendum (EA 2021a) for the source water to be used for

decontamination of drilling equipment. However, due to level observed, it was determined that decontamination water should be pumped through a 5-gal granular activated carbon pail prior to use during equipment decontamination. Decontamination water pre-carbon sampling results can be found in **Appendix F**.

Materials that were used for sampling were confirmed as acceptable for use in the PFAS sampling environment. The checklist of acceptable materials for use in the PFAS sampling environment was provided in the Standard Operating Procedures (SOP) appendix to the Programmatic UFP-QAPP (EA 2020a).

5.2 SOIL BORINGS AND SOIL SAMPLING

The first 5 ft of each boring were pre-cleared by EA's drilling subcontractor, Jaca and Sierra Engineering, using a hand auger to verify utility clearance in the shallow subsurface where utilities would typically be encountered. No borings were advanced exclusively by hand auger based on terminal depth. Soil samples collected from depths shallower than 5 ft bgs were collected using the hand auger. All soil sample locations are shown on **Figure 5-1**. Non-dedicated sampling equipment (e.g., hand auger) was decontaminated between sampling locations.

Subsurface soil samples were collected via hollow stem auger technology, rather than DPT drilling methods, as discussed in **Section 5.8** which presents deviations from the SI UFP-QAPP Addendum. A Fraste® MultiDrill ML split-spoon sampling system was used to collect continuous soil cores to the target depth using hollow stem auger technology. A hand auger was used to collect soil from the top 5 ft of the boring in accordance with utility clearance procedures.

Three discrete soil samples were collected for chemical analysis from each soil boring: one sample at the surface (0 to 2 ft bgs) and two subsurface soil samples. One subsurface soil sample was collected approximately 1 ft above the groundwater table, and one collected at the midpoint between the surface and the groundwater table (not to exceed 15 ft bgs). Groundwater was encountered at depths ranging from 15 to 25 ft bgs during drilling. Total boring completion depths, to accommodate temporary well installation, ranged from 21 to 45 ft bgs.

All soil sample locations are shown on **Figure 5-1**, and boring sample depths are provided in **Table 5-1**. The soil boring locations were selected based on information provided in the PA (AECOM 2020) and as agreed upon by stakeholders during the TPP and review of the UFP-QAPP Addendum (EA 2021a).

During the drilling, the soil cores were continuously logged for lithological descriptions by a field geologist using the Unified Soil Classification System (USCS). A photoionization detector was used to screen the breathing zone during boring activities as a part of personal safety requirements. Observations and measurements were recorded on sampling forms (**Appendix B2**) and in a non-treated field logbook. Depth interval, recovery thickness, photoionization detector concentrations, moisture, relative density, Munsell color, and USCS texture were recorded. The boring logs are provided in **Appendix E**.

The hand auger and hollow-stem auger equipment were decontaminated between locations use using a six-step, PFAS-free decontamination procedure with Liquinox™, PFAS-free deionization water, and methyl alcohol (methanol). The drill casing was also rinsed with PFAS-free deionization water between locations, though the casing did not come in contact with soil samples due to the use of the acetate core liner.

Each sample was collected into a laboratory-supplied PFAS-free HDPE bottle and labeled using a PFAS-free marker or pen. Samples were packaged on ice and transported via FedEx under standard CoC procedures to the laboratory and analyzed for PFAS (LC/MS/MS compliant with QSM Version 5.3 Table B-15), TOC (USEPA Method 9060A) and pH (USEPA Method 9045D) in accordance with the UFP-QAPP Addendum (EA 2021a).

Field duplicate samples were collected at a rate of 10% and analyzed for the same parameters as the accompanying samples. Matrix spike (MS)/matrix spike duplicates (MSDs) were collected at a rate of 5% and analyzed for the same parameters as the accompanying samples. In instances when non-dedicated sampling equipment was used, such as a hand auger for the shallow soil samples, one field blank and one equipment blank (EB) was collected per day and analyzed for the same parameters as the soil samples. A temperature blank was placed in each cooler to ensure that samples were preserved at or below 6 degrees Celsius (°C) during shipment.

DPT borings were converted to temporary wells, which were subsequently abandoned after sampling and surveying in accordance with the UFP-QAPP Addendum (EA 2021a). After removal of the casings, boreholes were abandoned using bentonite chips. Borings were installed in grass areas to avoid disturbing concrete or asphalt surfaces.

5.3 TEMPORARY WELL INSTALLATION AND GROUNDWATER GRAB SAMPLING

Temporary wells were installed using a Fraste® MultiDrill ML split-spoon, hollow stem auger sampling system as described in **Section 5.3**. Once the borehole was advanced to the desired depth, a temporary well was constructed using a 5 to 10-ft section of 1-inch Schedule 40 polyvinyl chloride (PVC) screen with sufficient casing to reach the ground surface. New PVC pipe and screen were used at each location to avoid cross contamination between locations. The screen intervals for the temporary wells are provided in **Table 5-2**.

Groundwater samples were collected after a period of time following well installation to allow groundwater to infiltrate and recharge the temporary well screen intervals. After the recharge period, groundwater samples were collected using PFAS-free HDPE tubing and a peristaltic pump. The temporary wells were purged at a rate determined in the field to reduce turbidity and draw down prior to sampling. However, due to the tightness of the formation, some wells experienced poor groundwater recharge. In these cases, temporary wells were purged until dry and then sampled immediately upon recharge; this is identified as a deviation of the UFP-QAPP Addendum in **Section 5.8**. Water quality parameters (e.g., temperature, specific conductance, pH, dissolved oxygen, and oxidation-reduction potential) were measured using a water quality meter and recorded on the field sampling form (**Appendix B2**) during purging at 5-minute intervals. After parameters adequately stabilized as listed in the UFP-QAPP Addendum (EA 2021a) or 1-hour of purging, each groundwater grab sample was collected in a separate

container. No foaming was observed in any of the groundwater samples. Additionally, a subsample of each groundwater sample was collected in a separate container, and a shaker test was completed to identify if there were any foaming. No foaming was noted in any of the groundwater samples.

Each sample was collected into laboratory-supplied PFAS-free HDPE bottles and labeled using a PFAS-free marker or pen. Samples were packaged on ice and transported via FedEx under standard CoC procedures to the laboratory and analyzed by LC/MS/MS compliant with QSM 5.3 Table B-15 in accordance with the SI QAPP Addendum (EA 2021a).

Field duplicate samples were collected at a rate of 10% and analyzed for the same parameters as their accompanying parent samples. MS/MSDs were collected at a rate of 5% and analyzed for the same parameters. One field reagent blank was collected per day in accordance with the UFP-QAPP Addendum (EA 2021a).

A temperature blank was placed in each cooler to ensure that samples were preserved at or below 6°C during shipment. Samples were packaged on ice and transported via FedEx under standard CoC procedures to the laboratory and analyzed for PFAS by LC/MS/MS compliant with QSM Version 5.3 Table B-15 in accordance with the UFP-QAPP Addendum (EA 2021a).

5.4 SYNOPTIC WATER LEVEL MEASUREMENTS

Groundwater levels were measured to determine groundwater flow direction and develop a potentiometric surface. Synoptic water level elevation measurements were collected from the newly installed temporary monitoring wells; the northern side of the well casing was used as the measurement reference elevation point (Appendix B4). Further, because the on-site water level probe was not PFAS-free, water level measurements were taken after all wells had been sampled and prior to the wells being pulled and abandoned. Groundwater levels obtained in AOI02-01 and AOI02-02 were not in agreement with the surrounding potentiometric gradient; this was likely caused by the tightness of the formation which led to slow recharge and infiltration within the wells. Due to this, the groundwater levels obtained in AOI02-01 and AOI02-02 were not considered representative of the formation and they were not used for contouring and no elevations for these two wells are shown on **Figure 2-5**. Groundwater elevation data is provided in **Table 5-3**.

5.5 SURVEYING

A well survey was performed by EA's subcontractor MForce Surveying, PSC, a Puerto Rico-licensed surveyor, on 1 November 2022 prior to well abandonment. When surveying the 10 newly installed temporary wells, the SOP is to survey the northern side of each new temporary well casing. With the exception of two locations (AOI03-01; AOI02-01), due to the temporary nature of the wells (i.e., lack of supporting material in the annular space) and the flexibility of the casing materials, the temporary wells were not stable and were determined to be unsuitable for direct measurement. Instead, the ground elevation at each well location was surveyed, and the length of the casing sticking out of the ground (top of casing) was measured in inches. AOI03-01 and AOI02-01 had their top of casing surveyed due to the temporary well casings being cut off at the ground surface, allowing for more stability during the survey. Positions were collected in

Universal Transverse Mercator Zone 19Q projection with World Geodetic System 1984 Datum (horizontal) and Puerto Rico Vertical Datum 2002 (vertical). Surveying data were collected on 1 November 2022 and are provided in **Appendix B3**.

5.6 INVESTIGATION-DERIVED WASTE

As of the date of this report, the disposal of PFAS investigation-derived waste (IDW) is not regulated federally. IDW generated during the SI is considered non-hazardous waste and was managed in accordance with the UFP-QAPP Addendum (EA 2021a).

Solid IDW (i.e., soil cuttings) generated during SI activities were left in place at the point of the source. The soil cuttings were replaced in the borehole and distributed on the downgradient side of the borehole. Liquid IDW generated during SI activities (i.e., purge water, development water, and decontamination fluids) were discharged directly to the ground surface slightly downgradient of the source of generation (downgradient of each well location).

Other solids such as spent personal protective equipment, plastic sheeting, tubing, rope, unused monitoring well construction materials, and other consumables generated during the field activities were properly disposed of as municipal solid waste.

5.7 LABORATORY ANALYTICAL METHODS

Samples were analyzed for PFAS by LC/MS/MS compliant with QSM Version 5.3 Table B-15 at Eurofins Lancaster Laboratories Environmental, LLC, in Lancaster, Pennsylvania, a DoD ELAP- and NELAP-certified laboratory. Due to the high turbidity noted during sampling, several of the water samples were centrifuged and decanted prior to analysis.

Soil samples were analyzed for TOC using USEPA Method 9060A and pH by USEPA Method 9045D. Additionally, the samples were submitted for grain size analysis (ASTM D-422) (i.e., clay content). The grain size analyses were collected from locations where clays were identified by the field geologist.

5.8 DEVIATIONS FROM SITE INVESTIGATION UFP-QAPP ADDENDUM

Deviations from the UFP-QAPP Addendum occurred based on conditions encountered during the field investigation activities. These deviations were discussed between EA, ARNG, USACE, and PRARNG. Deviations from the UFP-QAPP Addendum are noted below:

- The approved SI UFP-QAPP Addendum (EA 2021a) states that drilling would be conducted using DPT drilling methods in accordance with SOP 047 DPT Sampling (EA 2021a). During drilling activities, the field geologists determined for several borings (noted on logs) that DPT drilling methods were insufficient for drilling the necessary boreholes (the team hit refusal and was unable to reach the groundwater at the initial locations); therefore, the field team switched to hollow stem auger technology to ensure the target depths could be achieved.

- The approved SI UFP-QAPP Addendum (EA 2021a) states that survey data would be collected at both the top of casing and ground surface elevation for each newly installed temporary monitoring well. During surveying, ground surface elevation data was collected for all but two of the temporary monitoring wells. For the two wells where ground surface elevation was not measured, top of casing elevation data was collected. See Section 5.5.

- The approved SI UFP-QAPP Addendum (EA 2021a) states that once the borehole has been advanced to the specified depth, a temporary well with a 5-ft section of 1-in. Schedule 40 PVC screen will be installed to the target interval; the target screen interval being 5 ft from the top of the groundwater table. During drilling activities, the field geologists determined that, based on the lithological conditions, insufficient water would likely be generated within some of the wells (AOI02-01, AOI03-03, and AOI03-04) using a 5-ft screen interval and the field team switched to a 10-ft screen interval to ensure a groundwater sample could be collected.

- The temporary wells were purged at a rate determined in the field to reduce turbidity and draw down prior to sampling. However, due to the tightness of the formation, some wells experienced poor groundwater recharge. In these cases, temporary wells were purged until dry and then sampled immediately upon recharge.

- A field Change request was issued on 3 November to address and accidental release of hydraulic fluid from the hollow stem auger drilling rig which occurred while drilling at AOI02-01 on October 26th, 2022. EA and its subcontractor removed visibly stained surface soil with hand tools, conducted GPR for utility clearance, then used an excavator to remove the remainder of visibly stained soil and a buffer of clean soil (the excavation went from to 3 to 6 inches in depth). The excavated soil was stockpiled on plastic sheeting to avoid contaminating clean soil and subsequently containerized in three (3) 55-gallon drums. EA collected a confirmation soil sample from the base of the excavation, which was submitted for analysis by EPA method 8270 SIM for PAHs. The L-shaped excavation which was approximately 6’ by 6’ by 4.5” (13.5 ft3) was backfilled with clean top soil and seeded. The soils drums were disposed at a landfill as nonhazardous materials; see **Appendix B4** for additional details.

Table 5-1. Samples by Medium
Vega Baja Readiness Center, Vega Baja, Puerto Rico
Site Inspection Report

Sample Identification	Sample Collection Date	Sample Depth (ft bgs)	PFAS (USEPA Method 537 Modified)	TOC (USEPA Method 9060A)	pH (USEPA Method 9045D)	Grain Size (ASTM D-422)	Comments
Soil Samples							
AOI01-01-SB-0-2	10/17/2022	0-2	X				
AOI01-01-SB-0-DUP	10/17/2022	0-2	X				Field Duplicate for AOI01-01-SB-0-2
AOI01-02-SB-0-2	10/24/2022	0-2	X				
AOI01-03-SB-0-2	10/21/2022	0-2	X				
AOI02-01-SB-0-2	10/25/2022	0-2	X				
AOI02-02-SB-0-2	10/26/2022	0-2	X				
AOI03-01-SB-0-2	10/18/2022	0-2	X				
AOI03-02-SB-0-2	10/18/2022	0-2	X				
AOI03-03-SB-0-2	10/18/2022	0-2	X				
AOI03-04-SB-0-2	10/25/2022	0-2	X				
VBRC-01-SB-0-2	10/31/2022	0-2	X				
AOI01-01-SB-14-15	10/17/2022	14-15	X				
AOI01-02-SB-9-10	10/24/2022	9-10	X				
AOI01-03-SB-13-14	10/24/2022	13-14	X				
AOI02-01-SB-13-15	10/25/2022	13-15	X				MS/MSD
AOI02-01-SB-13-15-DUP	10/25/2022	13-15	X				Field Duplicate for AOI02-01-SB-13-15
AOI02-02-SB-14-15	10/28/2022	14-15	X				
AOI03-01-SB-13-14	10/18/2022	13-14	X				
AOI03-02-SB-14-15	10/18/2022	14-15	X				
AOI03-03-SB-14-15	10/18/2022	14-15	X				
AOI03-040SB-7-8	10/25/2022	7-8	X				
VBRC-01-SB-14-15	10/31/2022	14-15	X				
AOI01-01-SB-25-26	10/21/2022	25-26	X				
AOI01-02-SB-11-12	10/24/2022	11-12	X				
AOI01-03-SB-14-15	10/24/2022	14-15	X				
AOI02-01-SB-39-41	10/31/2022	39-41	X				
AOI02-02-SB-26-27	10/28/2022	26-27	X				
AOI03-01-SB-24-25	10/18/2022	24-25	X				MS/MSD
AOI03-01-SB-24-25-DUP	10/18/2022	24-25	X				Field Duplicate for AOI03-01-SB-24-25
AOI03-02-SB-22-23	10/18/2022	22-23	X				
AOI03-03-SB-35-36	10/20/2022	35-36	X				
AOI03-04-SB-15-16	10/25/2022	15-16	X				
VBRC-01-SB-21-22	10/31/2022	21-22	X				
AOI01-01-SB-5-7	10/17/2022	5-7		X	X	X	
AOI01-01-SB-5-7-DUP	10/17/2022	5-7		X	X	X	Field Duplicate for AOI01-01-SB-5-7
AOI02-01-SB-11-13	10/25/2022	11-13		X	X	X	
AOI03-01-SB-15-16	10/18/2022	15-16		X	X	X	
Groundwater Samples							
AOI01-01-GW	10/21/2022	—	X				
AOI01-02-GW	10/25/2022	—	X				
AOI01-03-GW	10/24/2022	—	X				
AOI02-01-GW	10/31/2022	—	X				

Table 5-1. Samples by Medium
Vega Baja Readiness Center, Vega Baja, Puerto Rico
Site Inspection Report

Sample Identification	Sample Collection Date	Sample Depth (ft bgs)	PFAS (USEPA Method 537 Modified)	TOC (USEPA Method 9060A)	pH (USEPA Method 9045D)	Grain Size (ASTM D-422)	Comments
AOI02-02-GW	10/31/2022	—	X				
AOI03-01-GW	10/21/2022	—	X				
AOI03-02-GW	10/20/2022	—	X				
AOI03-03-GW	10/20/2022	—	X				MS/MSD
AOI03-04-GW	10/27/2022	—	X				
AOI03-03-GW-DUP	10/20/2022	—	X				Field Duplicate for AOI03-03-GW
VBRC-01-GW	11/1/2022	—	X				
Blank Samples							
VBRC-FB-01-GW	10/20/2022	—					
VBRC-EB-01-GW	10/20/2022	—					
VBRC-FB-02-GW	10/21/2022	—					
VBRC-EB-02-GW	10/21/2022	—					
VBRC-FB-03-GW	10/24/2022	—					
VBRC-EB-03-GW	10/24/2022	—					
VBRC-FB-04-GW	10/25/2022	—					
VBRC-EB-04-GW	10/25/2022	—					
VBRC-FB-05-GW	10/27/2022	—					
VBRC-EB-05-GW	10/27/2022	—					
VBRC-FB-06-GW	10/31/2022	—					
VBRC-EB-06-GW	10/31/2022	—					
VBRC-FB-07-GW	11/1/2022	—					
VBRC-EB-07-GW	11/1/2022	—					
VBRC-EB-01-SB	10/17/2022	—					
VBRC-EB-02-SB	10/18/2022	—					
VBRC-EB-03-SB	10/20/2022	—					
VBRC-EB-04-SB	10/21/2022	—					
VBRC-EB-05-SB	10/24/2022	—					
VBRC-EB-06-SB	10/25/2022	—					
VBRC-EB-07-SB	10/26/2022	—					
VBRC-EB-08-SB	10/28/2022	—					
VBRC-EB-09-SB	10/31/2022	—					

Table 5-2. Soil Boring Depths and Temporary Well Screen Intervals
Vega Baja Readiness Center, Vega Baja, Puerto Rico
Site Inspection Report

Area of Interest	Temporary Monitoring Well / Soil Boring ID	Soil Boring Depth (ft bgs)	Temporary Monitoring Well Screen Interval (ft bgs)
1	AOI01-01	25	20-25
	AOI01-02	21	15-20
	AOI01-03	25	20-25
2	AOI02-01	45	35-45
	AOI02-02	32	27-32
3	AOI03-01	30	25-30
	AOI03-02	29	24-29
	AOI03-03	39	29-39
	AOI03-04	23	13-23
Facility boundary	VBRC-01	28	23-28

Table 5-3. Groundwater Elevations
Vega Baja Readiness Center, Vega Baja, Puerto Rico
Site Inspection Report

Temporary Monitoring Well ID	Top of Casing Elevation (ft amsl)	Ground Surface Elevation (ft NAVD 88)	Depth to Water (ft btoc)	Depth to Water (ft bgs)	Groundwater Elevation (ft amsl)[1]
AOI01-01	33.04	33.15[2]	17.14	17.26	16.13
AOI01-02	35.54	35.33[2]	13.19	12.98	22.35
AOI01-03	35.08	34.92[2]	14.32	14.16	20.76
AOI02-01	40.03	40.03	34.44	34.44	5.59[3]
AOI02-02	40.33	39.70[2]	21.47	20.84	18.86[3]
AOI03-01	38.10	38.10	14.32	14.32	23.78
AOI03-02	35.63	34.46[2]	17.12	15.95	18.51
AOI03-03	33.18	32.77[2]	21.92	21.51	11.26
AOI03-04	46.34	44.19[2]	23.07	20.92	23.27
VBRC-01	49.32	48.37[2]	22.09	21.14	27.23

Notes:
1. Elevation measurements were collected relative to the Puerto Rico Vertical Datum of 2002.
2. Some of the temporary well casings were not stable enough for precise survey measurement. At these locations the ground next to the hole was measured instead and a tape measure was used to measure the top of casing relative the ground.
3. Values excluded from groundwater contours, as they are not representative of the potentiometric surface. Due to the tightness of the formation, soils exhibited slow recharge and infiltration rates into wells.

amsl = Above mean sea level
btoc = Below top of casing
ID = Identification

Army National Guard Site Inspections
Site Inspection Report
Vega Baja Readiness Center, Puerto Rico

PR

Figure 5-1
Site Inspection Sample Locations

Path: \\lovetongis\GISdata\Federal\Nationwide\PFAS\MAES_634250383\PROJECTS\SIReport\VegaBaja\VegaBajaSI.aprx

Facility Data
- Facility Boundary
- Area of Interest
- Area of Interest Identified after SI, to be investigated in RI
- Potential PFAS Release
- No Suspected Release

Sample Locations
- DPT

Hydrology/Hydrogeology
- Groundwater Flow Direction

Data Sources:
ESRI 2020
AECOM 2020

Date:.....July 2023
Prepared By:.....EA
Prepared For:.....USACE
Projection:.....WGS 84 UTM 20N

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6. SITE INSPECTION RESULTS

This section presents the analytical results of the SI. The SLs used in this evaluation are presented in **Section 6.1**. A discussion of the results for the AOI is provided in **Section 6.3**. **Tables 6-2 through 6-5** present results for the relevant compounds in soil and groundwater. Tables that contain all results are provided in **Appendix F**, and the laboratory reports are provided in **Appendix G**.

6.1 SCREENING LEVELS

The SLs established in the OSD memorandum apply to the five compounds presented on **Table 6-1**.

Table 6-1. Screening Levels (Soil and Groundwater)

Analyte[2]	Residential (Soil) (µg/kg)[1] 0 to 2 ft bgs	Industrial/Commercial Composite Worker (Soil) (µg/kg)[1] 2 to 15 ft bgs	Tap Water (Groundwater) (ng/L)[1]
PFOA	19	250	6
PFOS	13	160	4
PFBS	1,900	25,000	601
PFHxS	130	1,600	39
PFNA	19	250	6

Notes:
1. Assistant Secretary of Defense. 2022. Risk Based Screening Levels Calculated for Groundwater and Soil using USEPA's Regional Screening Level Calculator. Hazard Quotient=0.1. May 2022.
2. Of the six PFAS compounds presented in the 6 July 2022 OSD memorandum, HFPO-DA (commonly referred to as GenX) was not included as an analyte at the time of this SI. Based on the CSM developed during the PA and revised based on SI findings, the presence of HFPO-DA is not anticipated at the facility because HFPO-DA is generally not a component of MIL-SPEC AFFF and based on its history including distribution limitations that restricted use of GenX, it is generally not a component of other products the military used. In addition, it is unlikely that GenX would be an individual chemical of concern in the absence of other PFAS.

µg/kg = Microgram(s) per kilogram
ng/L = Nanogram(s) per liter

The data in the subsequent sections are compared against the SLs presented in **Table 6-1**. The SLs for groundwater are based on direct ingestion. The SLs for soil are based on incidental ingestion and are applied to the depth intervals reasonably anticipated to be encountered by the receptors identified at the Facility; the residential scenario is applied to surface soil results (0 to 2 ft bgs) and the industrial/commercial worker scenario is applied to all subsurface soil results (2 to 15 ft bgs). The SLs are not applied to deep subsurface soil results (greater than 15 ft bgs) because 15 ft is the anticipated limit of construction activities.

6.2 SOIL PHYSICOCHEMICAL ANALYSES

To provide basic soil parameter information, soil samples were analyzed for TOC, pH, and grain size, which are important for evaluating transport through the soil medium. **Appendix F** contains the results of the TOC, pH, and grain size sampling.

The data collected in this investigation will be used in subsequent investigations, where appropriate, to assess fate and transport. According to the Interstate Technology Regulatory Council (ITRC), several important PFAS partitioning mechanisms include hydrophobic and lipophobic effects, electrostatic interactions, and interfacial behaviors. At relevant environmental pH values, certain PFAS are present as organic anions, and are therefore relatively mobile in groundwater (Xiao et al. 2015) but tend to associate with the organic carbon fraction that may be present in soil or sediment (Higgins and Luthy 2006; Guelfo and Higgins 2013). When sufficient organic carbon is present, organic carbon-normalized distribution coefficients (K_{oc} values) can help in evaluating transport potential, though other geochemical factors (for example, pH and presence of polyvalent cations) may also affect PFAS sorption to solid phases (ITRC 2018).

Soil grain size, pH, and TOC was analyzed in soil samples AOI01-01-SB- [5-7], AOI02-01-SB-[11-13], and AOI03-01-SB-[15-16]. Results showed pH values of 7.9, 6.5, and 5.2 respectively, and TOC results of 1700, 740, and 1300 mg/kg, respectively. The grain size analysis indicated varying amounts of sand (49.8–70.2%), clay (21–40.4%), silt (4–9%), and 0% gravel. This result corresponds to a soil texture of "sandy clay loam."

6.3 AOI 1

This section presents the analytical results for soil and groundwater in comparison to SLs for AOI 1: Helipad. The soil and groundwater results are summarized in **Tables 6-2 through 6-5**. Soil and groundwater results are presented on **Figures 6-1 through 6-7**.

6.3.1 AOI 1 – Soil Analytical Results

Tables 6-2 through 6-4 summarize the detected compounds in soil. **Figures 6-1 through 6-5** present the ranges of detections in soil.

Soil was sampled at three boring locations associated with the potential release area at AOI 1. Soil was sampled from three intervals at each of the boring locations except location AOI01-01 where four samples were collected (only three were analyzed for PFAS and one was collected/analyzed for TOC, pH, and grain size). Samples were generally collected from: surface (0 to 2 ft bgs), shallow subsurface soil (9 to14 ft bgs), and deep subsurface soil (11 to 26 ft bgs).

Soil was sampled from surface soil (0 to 2 ft bgs) from boring locations AOI01-01 through AOI01-03. None of the relevant compounds (PFBS, PFHxS, PFOS, PFOA, and PFNA) were detected in any of the surface soil samples.

Shallow subsurface soil samples were collected from soil boring locations AOI01-01 through AOI01-03 at depths ranging from 9 to 15 ft bgs. None of the relevant compounds were detected in any of the shallow subsurface samples.

Deep subsurface soil samples were collected from soil boring locations AOI01-01 through AOI01-03 at depths ranging from 11 to 26 ft bgs. None of the relevant compounds were detected in any of the deep subsurface samples.

6.3.2 AOI 1 – Groundwater Analytical Results

Table 6-5 summarizes the groundwater results. **Figures 6-6 and 6-7** present the ranges of detections in groundwater.

Groundwater samples were collected from three temporary wells associated within the potential release area of AOI 1. Three of the five relevant compounds, PFOA, PFOS, and PFBS, were detected in groundwater at AOI 1. Each temporary well had at least one compound detected, with one compound (PFOA) being detected at all three wells in AOI 1.

PFBS was detected below the SL (601 ng/L) with estimated concentrations of 1.1 J ng/L and 0.83 J ng/L at AOI01-01 and AOI01-02, respectively. PFOS was detected below the SL (4 ng/L) at an estimated concentration of 2.4 J+ ng/L at AOI01-02. PFOA was detected below the SL (6 ng/L) at all three temporary wells, with estimated concentrations of 0.79 J ng/L, 1.0 J+ ng/L, and 1.1 J ng/L, at AOI01-01, AOI01-02, and AOI01-03, respectively.

6.3.3 AOI 1 – Conclusions

Based on the results of the SI, none of the relevant compounds were detected in any of the surface or subsurface soil samples at AOI 1. Three of the five relevant compounds (PFOA, PFOS, and PFBS) were detected below their respective SLs in groundwater at AOI 1. Therefore, further evaluation at AOI 1 is not warranted at this time.

6.4 AOI 2

This section presents the analytical results for soil and groundwater in comparison to SLs for AOI 2: Wash Rack. The soil and groundwater results are summarized in **Tables 6-2 through 6-5**. Soil and groundwater results are presented on **Figures 6-1 through 6-7**.

6.4.1 AOI 2 – Soil Analytical Results

Tables 6-2 through 6-4 summarize the detected compounds in soil. **Figures 6-1 through 6-5** present the ranges of detections in soil.

Soil was sampled at two boring locations associated with the potential release area at AOI 2. Soil was sampled from three intervals at each of the boring location except location AOI02-01 where four samples were collected (only three were analyzed for PFAS and one was collected/analyzed for TOC, pH, and grain size). Samples were generally collected from: surface (0 to 2 ft bgs), shallow subsurface soil (13 to 15 ft bgs), and deep subsurface soil (26 to 41 ft bgs).

Soil was sampled from surface soil (0 to 2 ft bgs) from boring locations AOI02-01 and AOI02-02. PFBS, PFHxS, and PFNA were not detected in any of the surface soil samples. PFOS was detected below the SL at both sample locations, at estimated concentrations of 0.31 J µg/kg and 0.65 J µg/kg at AOI02-01 and AOI02-02, respectively. PFOA was detected at one of the sample locations, at a concentration of 0.28 µg/kg at AOI02-02.

Shallow subsurface soil samples were collected from soil boring locations AOI02-01 and AOI02-02 at depths of from 13 to 15 ft bgs. None of the relevant compounds were detected in any of the shallow subsurface samples.

Deep subsurface soil samples were collected from soil boring locations AOI02-01 and AOI02-02 at depths of 26 to 41 ft bgs. PFOS was detected below the SL at AOI02-01 at a concentration of 0.54 J µg/kg.

6.4.2 AOI 2 – Groundwater Analytical Results

Table 6-5 summarizes the groundwater results. **Figures 6-6 and 6-7** present the ranges of detections in groundwater.

Groundwater samples were collected from both temporary wells associated within the potential release area of AOI 2. Four of the five relevant compounds, PFOA, PFOS, PFHxS, and PFBS were detected in groundwater at AOI 2.

PFBS was detected below the SL at both wells with concentrations of 1.3 J ng/L (estimated) and 8.0 ng/L, associated with wells AOI02-01 and AOI02-02, respectively. PFHxS was detected below the SL at one well, AOI02-02, at a concentrations of 1.9 ng/L. PFOS was detected above the SL at one well, AOI02-02, at an estimated concentration of 8.6 J+ ng/L. PFOA was detected above the SL at one well, AOI02-02, at an estimated concentration of 8.3 J+ ng/L.

6.4.3 AOI 2 – Conclusions

Based on the results of the SI, PFOA and PFOS were detected in both surface and deep subsurface soil samples below the SLs. PFHxS was detected in groundwater at one well below its SL. At AOI02-02, PFOS and PFOA were both detected above their SLs. Based on the exceedances of the SLs in groundwater for PFOA and PFOS, further evaluation at AOI 2 is warranted.

6.5 AOI 3

This section presents the analytical results for soil and groundwater in comparison to SLs for AOI 3: Vehicle Parking Area. The soil and groundwater results are summarized in **Tables 6-2 through 6-5**. Soil and groundwater results are presented on **Figures 6-1 through 6-7**.

6.5.1 AOI 3 – Soil Analytical Results

Tables 6-2 through 6-4 summarize the detected compounds in soil. **Figures 6-1 through 6-5** present the ranges of detections in soil.

Soil was sampled at four boring locations associated with the potential release area at AOI 3. Soil was sampled from three intervals at each of the boring location except location AOI03-01 where four samples were collected (only three were analyzed for PFAS and one was

collected/analyzed for TOC, pH, and grain size). Samples were generally collected from: surface (0 to 2 ft bgs), shallow subsurface soil (9 to15 ft bgs), and deep subsurface soil (11 to 26 ft bgs).

Soil was sampled from surface soil (0 to 2 ft bgs) from boring locations AOI03-01 through AOI03-04. PFHxS was not detected in any of the surface soil samples. PFOA, PFOS, and PFNA were detected below SLs in one or more of the surface soil samples. PFNA was detected below the SL at one of the four locations (AOI03-01 at an estimated concentration of 0.61 J µg/kg). PFOS was detected below the SL at three of the four locations (AOI03-02, AOI03-03, and AOI03-04) and with concentrations ranging from 0.25 J+ µg/kg to 0.66 J µg/kg in samples collected from AOI03-03 and AOI03-04, respectively. PFOA was detected below the SL in two of the four locations, at concentrations of 0.25 µg/kg to 0.52 J µg/kg from AOI03-04 and AOI03-01, respectively.

Shallow subsurface soil samples were collected from soil boring locations AOI03-01 through AOI03-04 at depths ranging from 7 to 15 ft bgs. None of the relevant compounds were detected in any of the shallow subsurface samples.

Deep subsurface soil samples were collected from soil boring locations AOI03-01 through AOI03-04 at depths ranging from 15 to 36 ft bgs. None of the relevant compounds were detected in any of the deep subsurface samples.

6.5.2 AOI 3 – Groundwater Analytical Results

Table 6-5 summarizes the groundwater results. **Figures 6-6 and 6-7** present the ranges of detections in groundwater.

Groundwater samples were collected from four temporary wells associated within the potential release area of AOI 3. Four of the five relevant compounds, PFOA, PFOS, PFBS, and PFNA, were detected in groundwater at AOI 3. Each temporary well had at least three compounds detected, with two of the four wells (AOI3-01 and AOI03-04) having reported detections of four relevant compounds.

PFBS was detected below the SL in all four wells, with estimated concentrations ranging from 0.61 J ng/L to 1.6 J ng/L, associated with well locations AOI03-03 and AOI03-04, respectively. PFNA was detected above the SL(6 ng/L) at one location (AOI03-01) with at a concentration of 25 ng/L, and below the SL at the one other location (AOI03-04) with an estimated concentration of 1.5 J ng/L. PFOS was detected in all four wells, and it was above the SL (4 ng/L) in two locations, AOI03-02 and AOI03-04 with values of 7.7 ng/L and 8.0 J + ng/L, respectively, It was report below the SL at locations AOI03-01 and AOI03-03, with values of 3.4 ng/L and 2.1 ng/L, respectively. PFOA was detected at all four wells. It was reported above the SL (6 ng/L) at two location AOI03-01 and AOI03-04, with values of 280 ng/L and 7.2 ng/L, respectively, and below the SL at two location AOI03-02 and AOI03-03, with values of 0.57 J ng/L and 1.4 J ng/l, respectively.

6.5.3 AOI 3 – Conclusions

Based on the results of the SI, four of the five relevant compounds (PFOA, PFOS, PFNA, and PFBS) were detected in groundwater, with three of the five relevant compounds (PFOA, PFOS, and PFNA) detected at concentrations above their respective SLs. Based on the exceedances of the SLs in groundwater, further evaluation at AOI 3 is warranted.

6.6 AOI 4

Following the SI fieldwork it was noted that Chemguard 3% AFFF was stored in the Firefighting Materials Storage Area. This area will be investigated in the future as part of the next phase of the investigation (RI).

6.7 Facility boundary

This section presents the analytical results for soil and groundwater in comparison to SLs for the Facility boundary (VBRC-01). The soil and groundwater results are summarized in **Tables 6-2 through 6-5**. Soil and groundwater results are presented on **Figures 6-1 through 6-7**.

6.7.1 Facility boundary – Soil Analytical Results

Tables 6-2 through 6-4 summarize the detected compounds in soil. **Figures 6-1 through 6-5** present the ranges of detections in soil.

Soil was sampled at the single boring location at the upgradient Facility boundary (VBRC-01). Soil was sampled from three intervals at the boring location. Samples were collected from: surface (0 to 2 ft bgs), shallow subsurface soil (14 to 15 ft bgs), and deep subsurface soil (21 to22 ft bgs).

One of the five relevant compounds (PFOS) was detected in surface soil at a concentration below its SL (0.26 J µg/kg). None of the relevant compounds were detected in the shallow subsurface sample or the deep subsurface sample.

6.7.2 Facility boundary – Groundwater Analytical Results

Table 6-5 summarizes the groundwater results. **Figures 6-6 and 6-7** present the ranges of detections in groundwater.

One groundwater sample was collected from a single temporary well (VBRC-01) associated with the upgradient Facility boundary. One of the five relevant compounds (PFOA) was detected in groundwater at an estimated concentration below its SL (1.1 J+ ng/L).

6.7.3 Facility boundary – Conclusions

Based on the results of the SI, one of the five relevant compounds (PFOS) was detected in surface soil at a concentration below its SL, and one of the five relevant compounds (PFOA) was detected in groundwater at a concentration below its SL.

Table 6-2. PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Surface Soil
Site Inspection Report, Vega Baja Readiness Center

Location ID		AOI01-01		AOI01-01		AOI01-02		AOI01-03		AOI02-01		AOI02-02	
Sample Name		AOI01-01-SB-0-2		AOI01-01-SB-0-2DUP		AOI01-02-SB-0-2		AOI01-03-SB-0-2		AOI02-01-SB-0-2		AOI02-02-SB-0-2	
Parent Sample ID				AOI01-01-SB-0-2									
Sample Date		10/17/2022		10/17/2022		10/24/2022		10/21/2022		10/25/2022		10/26/2022	
Sample Depth (ft bgs)		0-2		0-2		0-2		0-2		0-2		0-2	
Analyte	**Screening Level[1,2]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
PFAS by LC/MS/MS compliant with QSM Version 5.3 Table B-15 (µg/kg)													
Perfluorobutanesulfonic acid (PFBS)	1900	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorohexanesulfonic acid (PFHxS)	130	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorononanoic acid (PFNA)	19	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorooctanesulfonic acid (PFOS)	13	ND	U	ND	U	ND	U	ND	U	0.31	J	0.65	
Perfluorooctanoic acid (PFOA)	19	ND	U	ND	U	ND	U	ND	U	ND	U	0.28	J

Notes:
1. Assistant Secretary of Defense. 2022. Risk-Based Screening Levels in Groundwater and Soil using USEPA's Regional Screening Level Calculator. Hazard Quotient (HQ)=0.1. May 2022.
2. The Screening Levels for soil are based on a residential scenario for incidental ingestion of contaminated soil.
µg/kg = Microgram(s) per kilogram.
ft bgs = Feet below ground surface.
ID = Identification.
J = Estimated concentration.
LC/MS/MS = Liquid chromatography tandem mass spectrometry.
ND = Analyte not detected above the LOD (LOD values are presented in Appendix F).
PFAS = Per- and polyfluoroalkyl substances
QSM = Quality Systems Manual
Qual = Qualifier.
U = The analyte was not detected at a level greater than or equal to the
Values exceeding the Screening Level are shaded gray.

Table 6-2. PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Surface Soil
Site Inspection Report, Vega Baja Readiness Center, Vega Baja, Puerto Rico

Location ID		AOI03-01		AOI03-02		AOI03-03		AOI03-04		VBRC-01	
Sample Name		AOI03-01-SB-0-2		AOI03-02-SB-0-2		AOI03-03-SB-0-2		AOI03-04-SB-0-2		VBRC-01-SB-0-2	
Parent Sample ID											
Sample Date		10/18/2022		10/18/2022		10/18/2022		10/25/2022		10/31/2022	
Sample Depth (ft bgs)		0-2		0-2		0-2		0-2		0-2	
Analyte	**Screening Level[1,2]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
PFAS by LC/MS/MS compliant with QSM Version 5.3 Table B-15 (µg/kg)											
Perfluorobutanesulfonic acid (PFBS)	1900	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorohexanesulfonic acid (PFHxS)	130	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorononanoic acid (PFNA)	19	0.61	J	ND	U	ND	U	ND	U	ND	U
Perfluorooctanesulfonic acid (PFOS)	13	ND	U	0.28	J	0.25	J	0.66		0.26	J
Perfluorooctanoic acid (PFOA)	19	0.52	J	ND	U	ND	U	0.25	J	ND	U

Notes:
1. Assistant Secretary of Defense. 2022. Risk-Based Screening Levels in Groundwater and Soil using USEPA's Regional Screening Level Calculator. Hazard Quotient (HQ)=0.1. May 2022.
2. The Screening Levels for soil are based on a residential scenario for incidental ingestion of contaminated soil.
µg/kg = Microgram(s) per kilogram.
ft bgs = Feet below ground surface.
ID = Identification.
J = Estimated concentration.
LC/MS/MS = Liquid chromatography tandem mass spectrometry.
ND = Analyte not detected above the LOD (LOD values are presented in Appendix F).
PFAS = Per- and polyfluoroalkyl substances
QSM = Quality Systems Manual
Qual = Qualifier.
U = The analyte was not detected at a level greater than or equal to the
Values exceeding the Screening Level are shaded gray.

Table 6-3. PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Shallow Subsurface Soil
Site Inspection Report, Vega Baja Readiness Center

Location ID		AOI01-01		AOI01-02		AOI01-03		AOI02-01		AOI02-01		AOI02-02	
Sample Name		AOI01-01-SB-14-15		AOI01-02-SB-9-10		AOI01-03-SB-13-14		AOI02-01-SB-13-15		AOI02-01-SB-13-15-DUP		AOI-02-02-SB-14-15	
Parent Sample ID										AOI02-01-SB-13-15			
Sample Date		10/17/2022		10/24/2022		10/24/2022		10/25/2022		10/25/2022		10/28/2022	
Sample Depth (ft bgs)		14-15		9-10		13-14		13-15		13-15		14-15	
Analyte	**Screening Level[1,2]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
PFAS by LC/MS/MS compliant with QSM Version 5.3 Table B-15 (µg/kg)													
Perfluorobutanesulfonic acid (PFBS)	25000	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorohexanesulfonic acid (PFHxS)	1600	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorononanoic acid (PFNA)	250	ND	UJ	ND	U	ND	UJ	ND	U	ND	U	ND	U
Perfluorooctanesulfonic acid (PFOS)	160	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorooctanoic acid (PFOA)	250	ND	UJ	ND	U	ND	UJ	ND	U	ND	U	ND	U

Notes:
1. Assistant Secretary of Defense. July 2022. Risk-Based Screening Levels in Groundwater and Soil using USEPA's Regional Screening Level Calculator. Hazard Quotient (HQ)=0.1. May 2022.
2. The Screening Levels for soil are based on incidental ingestion of soil in a industrial/commercial worker scenario.

µg/kg = Microgram(s) per kilogram.

ft bgs = Feet below ground surface.

ID = Identification.

LC/MS/MS = Liquid chromatography tandem mass spectrometry.

ND = Analyte not detected above the LOD (LOD values are presented in Appendix F).

QSM = Quality Systems Manual

Qual = Qualifier.

U = The analyte was not detected at a level greater than or equal to the adjusted Limit of Detection (LOD).

UJ = The analyte was not detected at a level greater than or equal to the adjusted LOD. However, the reported adjusted detection limit is approximate

Values exceeding the Screening Level are shaded gray.

Table 6-3. PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Shallow Subsurface Soil
Site Inspection Report, Vega Baja Readiness Center

Location ID		AOI03-01		AOI03-02		AOI03-03		AOI03-04		VBRC-01	
Sample Name		AOI03-01-SB-13-14		AOI03-02-SB-14-15		AOI03-03-SB-14-15		AOI03-04-SB-7-8		VBRC-01-SB-14-15	
Parent Sample ID											
Sample Date		10/18/2022		10/18/2022		10/18/2022		10/25/2022		10/31/2022	
Sample Depth (ft bgs)		13-14		14-15		14-15		7-8		14-15	
Analyte	**Screening Level[1,2]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
PFAS by LC/MS/MS compliant with QSM Version 5.3 Table B-15 (µg/kg)											
Perfluorobutanesulfonic acid (PFBS)	25000	ND	U	ND	U	ND	UJ	ND	U	ND	U
Perfluorohexanesulfonic acid (PFHxS)	1600	ND	U	ND	U	ND	UJ	ND	U	ND	U
Perfluorononanoic acid (PFNA)	250	ND	U	ND	U	ND	UJ	ND	U	ND	U
Perfluorooctanesulfonic acid (PFOS)	160	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorooctanoic acid (PFOA)	250	ND	U	ND	U	ND	UJ	ND	U	ND	U

Notes:
1. Assistant Secretary of Defense. July 2022. Risk-Based Screening Levels in Groundwater and Soil using USEPA's Regional Screening Level Calculator. Hazard Quotient (HQ)=0.1. May 2022.
2. The Screening Levels for soil are based on incidental ingestion of soil in a industrial/commercial worker scenario.

µg/kg = Microgram(s) per kilogram.

ft bgs = Feet below ground surface.

ID = Identification.

LC/MS/MS = Liquid chromatography tandem mass spectrometry.

ND = Analyte not detected above the LOD (LOD values are presented in Appendix F).

QSM = Quality Systems Manual

Qual = Qualifier.

U = The analyte was not detected at a level greater than or equal to the adjusted Limit of Detection (LOD).

UJ = The analyte was not detected at a level greater than or equal to the adjusted LOD. However, the reported adjusted detection limit is approximate

Values exceeding the Screening Level are shaded gray.

Table 6-4. PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Deep Subsurface Soil
Site Inspection Report, Vega Baja Readiness Center

Location ID	AOI01-01		AOI01-02		AOI01-03		AOI02-01		AOI02-02		AOI03-01	
Sample Name	AOI01-01-SB-25-26		AOI01-02-SB-11-12		AOI01-03-SB-14-15		AOI-02-01-SB-39-41		AOI-02-02-SB-26-27		AOI03-01-SB-24-25	
Parent Sample ID												
Sample Date	10/21/2022		10/24/2022		10/24/2022		10/31/2022		10/28/2022		10/18/2022	
Sample Depth (ft bgs)	25-26		11-12		14-15		39-41		26-27		24-25	
Analyte	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
PFAS by LC/MS/MS compliant with QSM Version 5.3 Table B-15 (µg/kg)												
Perfluorobutanesulfonic acid (PFBS)	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorohexanesulfonic acid (PFHxS)	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorononanoic acid (PFNA)	ND	UJ	ND	U	ND	UJ	ND	U	ND	U	ND	U
Perfluorooctanesulfonic acid (PFOS)	ND	U	ND	U	ND	U	0.54	J	ND	U	ND	U
Perfluorooctanoic acid (PFOA)	ND	UJ	ND	U	ND	UJ	ND	U	ND	U	ND	U

Notes:
µg/kg = Microgram(s) per kilogram.
ft bgs = Feet below ground surface.
ID = Identification.
J = Estimated concentration.
LC/MS/MS = Liquid chromatography tandem mass spectrometry.
ND = Analyte not detected above the LOD (LOD values are presented in Appendix F).
QSM = Quality Systems Manual
Qual = Qualifier.
U = The analyte was not detected at a level greater than or equal to the adjusted Limit of Detection (LOD).
UJ = The analyte was not detected at a level greater than or equal to the adjusted LOD. However, the reported adjusted detection limit is approximate and may be inaccurate or imprecise.

Table 6-4. I **Table 6-4. PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Deep Subsurface Soil**
Site Inspection Report, Vega Baja Readiness Center

Location ID	AOI03-01		AOI03-02		AOI03-03		AOI03-04		VBRC-01	
Sample Name	AOI03-01-SB-24-25-DUP		AOI03-02-SB-22-23		AOI03-03-SB-35-36		AOI03-04-SB-15-16		VBRC-01-SB-21-22	
Parent Sample ID	AOI03-01-SB-24-25									
Sample Date	10/18/2022		10/18/2022		10/20/2022		10/25/2022		10/31/2022	
Sample Depth (ft bgs)	24-25		22-23		35-36		15-16		21-22	
Analyte	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
PFAS by LC/MS/MS compliant with QSM Version 5.3 Table B-15 (µg/kg)										
Perfluorobutanesulfonic acid (PFBS)	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorohexanesulfonic acid (PFHxS)	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorononanoic acid (PFNA)	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorooctanesulfonic acid (PFOS)	ND	U	ND	U	ND	U	ND	U	ND	U
Perfluorooctanoic acid (PFOA)	ND	U	ND	U	ND	UJ	ND	U	ND	U

Notes:
µg/kg = Microgram(s) per kilogram.
ft bgs = Feet below ground surface.
ID = Identification.
J = Estimated concentration.
LC/MS/MS = Liquid chromatography tandem mass spectrometry.
ND = Analyte not detected above the LOD (LOD values are presented in Appendix F).
QSM = Quality Systems Manual
Qual = Qualifier.
U = The analyte was not detected at a level greater than or equal to the adjusted Limit of Detection (LOD).
UJ = The analyte was not detected at a level greater than or equal to the adjusted LOD. However, the reported adjusted detection limit is approximate and may be inaccurate or imprecise.

Table 6-5. PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Groundwater
Site Inspection Report, Vega Baja Readiness Center

Location ID		AOI01-01		AOI01-02		AOI01-03		AOI02-01		AOI02-02		AOI03-01	
Sample Name		AOI01-01-GW		AOI01-02-GW		AOI01-03-GW		AOI-02-01-GW		AOI-02-02-GW		AOI03-01-GW	
Parent Sample ID													
Sample Date		10/21/2022		10/25/2022		10/24/2022		10/31/2022		10/31/2022		10/21/2022	
Analyte	**Screening Level[1]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
PFAS by LC/MS/MS compliant with QSM Version 5.3 Table B-15 (ng/L)													
Perfluorobutanesulfonic acid (PFBS)	601	1.1	J	0.83	J+	ND	U	1.3	J	8		0.99	J
Perfluorohexanesulfonic acid (PFHxS)	39	ND	U	ND	UJ	ND	U	ND	U	1.9	J+	ND	U
Perfluorononanoic acid (PFNA)	6	ND	U	ND	UJ	ND	U	ND	U	ND	UJ	25	
Perfluorooctanesulfonic acid (PFOS)	4	ND	U	2.4	J+	ND	U	ND	U	8.6	J+	3.4	
Perfluorooctanoic acid (PFOA)	6	0.79	J	1	J+	1.1	J	ND	U	8.3	J+	280	

Notes:
1. Assistant Secretary of Defense. 2022. Risk-Based Screening Levels in Groundwater and Soil using USEPA's Regional Screening Level Calculator. Hazard Quotient (HQ)=0.1. May 2022.

J = Estimated concentration.
J+ = Estimated concentration, biased high.
LC/MS/MS = Liquid chromatography tandem mass spectrometry
ng/L = Nanogram(s) per liter.
ND = Analyte not detected above the LOD (LOD values are presented in Appendix F).
Qual = Qualifier.
U = The analyte was not detected at a level greater than or equal to the adjusted Limit of Detection (LOD).
UJ = The analyte was not detected at a level greater than or equal to the adjusted LOD. However, the reported adjusted detection limit is approximate and may be inaccurate or imprecise.
Values exceeding the Screening Level are shaded gray.

Table 6-5. PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Groundwater
Site Inspection Report, Vega Baja Readiness Center

	Location ID	AOI03-02		AOI03-03		AOI03-03		AOI03-04		VBRC-01	
	Sample Name	AOI03-02-GW		AOI03-03-GW		AOI03-03-GW-DUP		AOI-03-04-GW		VBRC-01-GW	
	Parent Sample ID					AOI03-03-GW					
	Sample Date	10/20/2022		10/20/2022		10/20/2022		10/27/2022		11/1/2022	
Analyte	**Screening Level[1]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
PFAS by LC/MS/MS compliant with QSM Version 5.3 Table B-15 (ng/L)											
Perfluorobutanesulfonic acid (PFBS)	601	0.72	J	0.7	J	0.61	J	1.6	J	ND	UJ
Perfluorohexanesulfonic acid (PFHxS)	39	ND	U	ND	U	ND	U	ND	U	ND	UJ
Perfluorononanoic acid (PFNA)	6	ND	U	ND	U	ND	U	1.5	J	ND	UJ
Perfluorooctanesulfonic acid (PFOS)	4	7.7		2.1		2		8	J+	ND	UJ
Perfluorooctanoic acid (PFOA)	6	0.57	J	1.4	J	1.4	J	7.2		1.1	J+

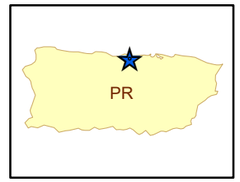
Notes:

1. Assistant Secretary of Defense. 2022. Risk-Based Screening Levels in Groundwater and Soil using USEPA's Regional Screening Level Calculator. Hazard Quotient (HQ)=0.1. May 2022.

J = Estimated concentration.
J+ = Estimated concentration, biased high.
LC/MS/MS = Liquid chromatography tandem mass spectrometry
ng/L = Nanogram(s) per liter.
ND = Analyte not detected above the LOD (LOD values are presented in Appendix F).
Qual = Qualifier.
U = The analyte was not detected at a level greater than or equal to the adjusted Limit of Detection (LOD).
UJ = The analyte was not detected at a level greater than or equal to the adjusted LOD. However, the reported adjusted detection limit is approximate and may be inaccurate or imprecise.
Values exceeding the Screening Level are shaded gray.

Army National Guard Site Inspections
Site Inspection Report
Vega Baja Readiness Center, Puerto Rico

Figure 6-1
AOI 1, 2 and 3
PFOS Detections in Soil



Facility Data
- Facility Boundary
- Area of Interest
- Area of Interest Identified after SI, to be investigated in RI
- Potential PFAS Release
- No Suspected Release

Hydrology/Hydrogeology
- Groundwater Flow Direction

Notes:
PFOS = Perfluorooctanesulfonic acid
Exceedances of the OSD SL are depicted with a yellow halo. Depth intervals shown represent respective sampling position within a given soil boring location.

Data Sources:
ESRI 2022
AECOM 2019

Date:.....July 2023
Prepared By:.....EA
Prepared For:.....USACE
Projection:.....WGS 84 UTM 20N

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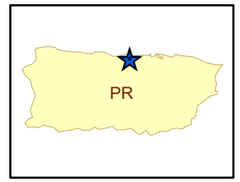
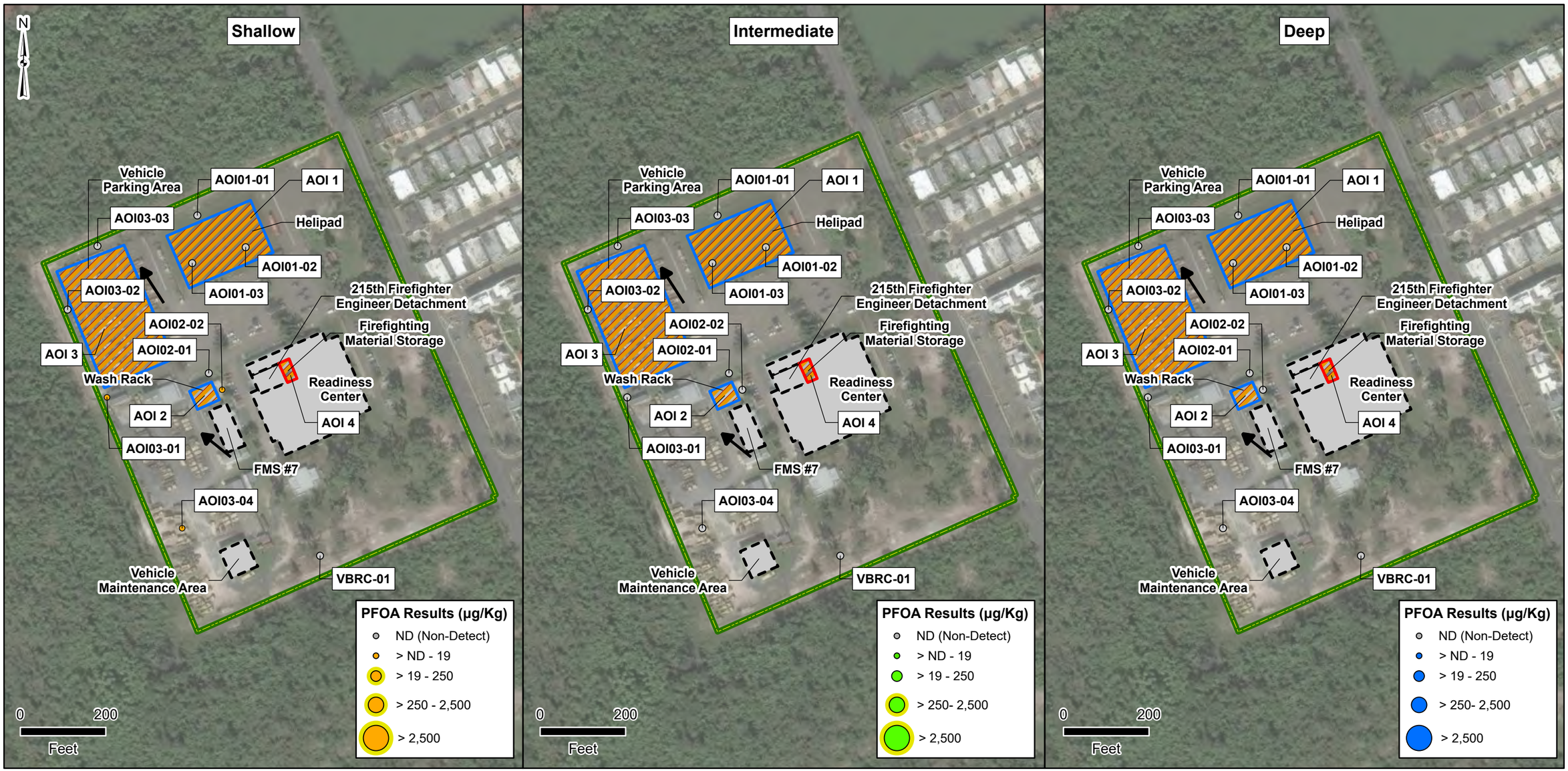
Army National Guard Site Inspections
Site Inspection Report
Vega Baja Readiness Center, Puerto Rico

Figure 6-2
AOI 1, 2 and 3
PFOA Detections in Soil





Facility Data
- Facility Boundary
- Area of Interest
- Area of Interest Identified after SI, to be investigated in RI
- Potential PFAS Release
- No Suspected Release

Hydrology/Hydrogeology
- Groundwater Flow Direction

Notes:
PFOA = Perfluorooctanoic acid
Exceedances of the OSD SL are depicted with a yellow halo. Depth intervals shown represent respective sampling position within a given soil boring location.

Data Sources:
ESRI 2022
AECOM 2019

Date:.....July 2023
Prepared By:.....EA
Prepared For:.....USACE
Projection:.....WGS 84 UTM 20N

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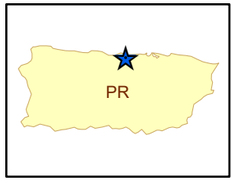
Army National Guard Site Inspections
Site Inspection Report
Vega Baja Readiness Center, Puerto Rico

Figure 6-3
AOI 1, 2 and 3
PFBS Detections in Soil



Facility Data
- Facility Boundary
- Area of Interest
- Area of Interest Identified after SI, to be investigated in RI
- Potential PFAS Release
- No Suspected Release

Hydrology/Hydrogeology
- Groundwater Flow Direction

Notes:
PFBS = Perfluorobutanesulfonic acid
Exceedances of the OSD SL are depicted with a yellow halo. Depth intervals shown represent respective sampling position within a given soil boring location.

Data Sources:
ESRI 2022
AECOM 2019

Date:.....July 2023
Prepared By:.....EA
Prepared For:.....USACE
Projection:.....WGS 84 UTM 20N

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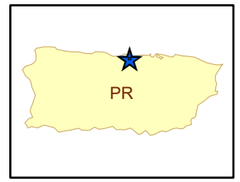
Army National Guard Site Inspections
Site Inspection Report
Vega Baja Readiness Center, Puerto Rico

Figure 6-4
AOI 1, 2 and 3
PFHxS Detections in Soil



Facility Data
- Facility Boundary
- Area of Interest
- Area of Interest Identified after SI, to be investigated in RI
- Potential PFAS Release
- No Suspected Release

Hydrology/Hydrogeology
- Groundwater Flow Direction

Notes:
PFHxS = Perfluorohexanesulfonic acid
Exceedances of the OSD SL are depicted with a yellow halo. Depth intervals shown represent respective sampling position within a given soil boring location.

Data Sources:
ESRI 2022
AECOM 2019

Date:.....July 2023
Prepared By:.....EA
Prepared For:.....USACE
Projection:.....WGS 84 UTM 20N

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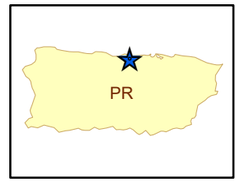
Army National Guard Site Inspections
Site Inspection Report
Vega Baja Readiness Center, Puerto Rico

Figure 6-5
AOI 1, 2 and 3
PFNA Detections in Soil



Facility Data
- Facility Boundary
- Area of Interest
- Area of Interest Identified after SI, to be investigated in RI
- Potential PFAS Release
- No Suspected Release

Hydrology/Hydrogeology
- Groundwater Flow Direction

Notes:
PFNA = Perfluorononanoic acid
Exceedances of the OSD SL are depicted with a yellow halo. Depth intervals shown represent respective sampling position within a given soil boring location.

Data Sources:
ESRI 2022
AECOM 2019

Date:.....July 2023
Prepared By:.....EA
Prepared For:.....USACE
Projection:.....WGS 84 UTM 20N

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Army National Guard Site Inspections
Site Inspection Report
Vega Baja Readiness Center, Puerto Rico

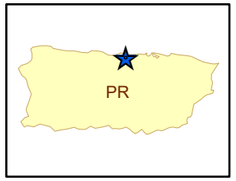
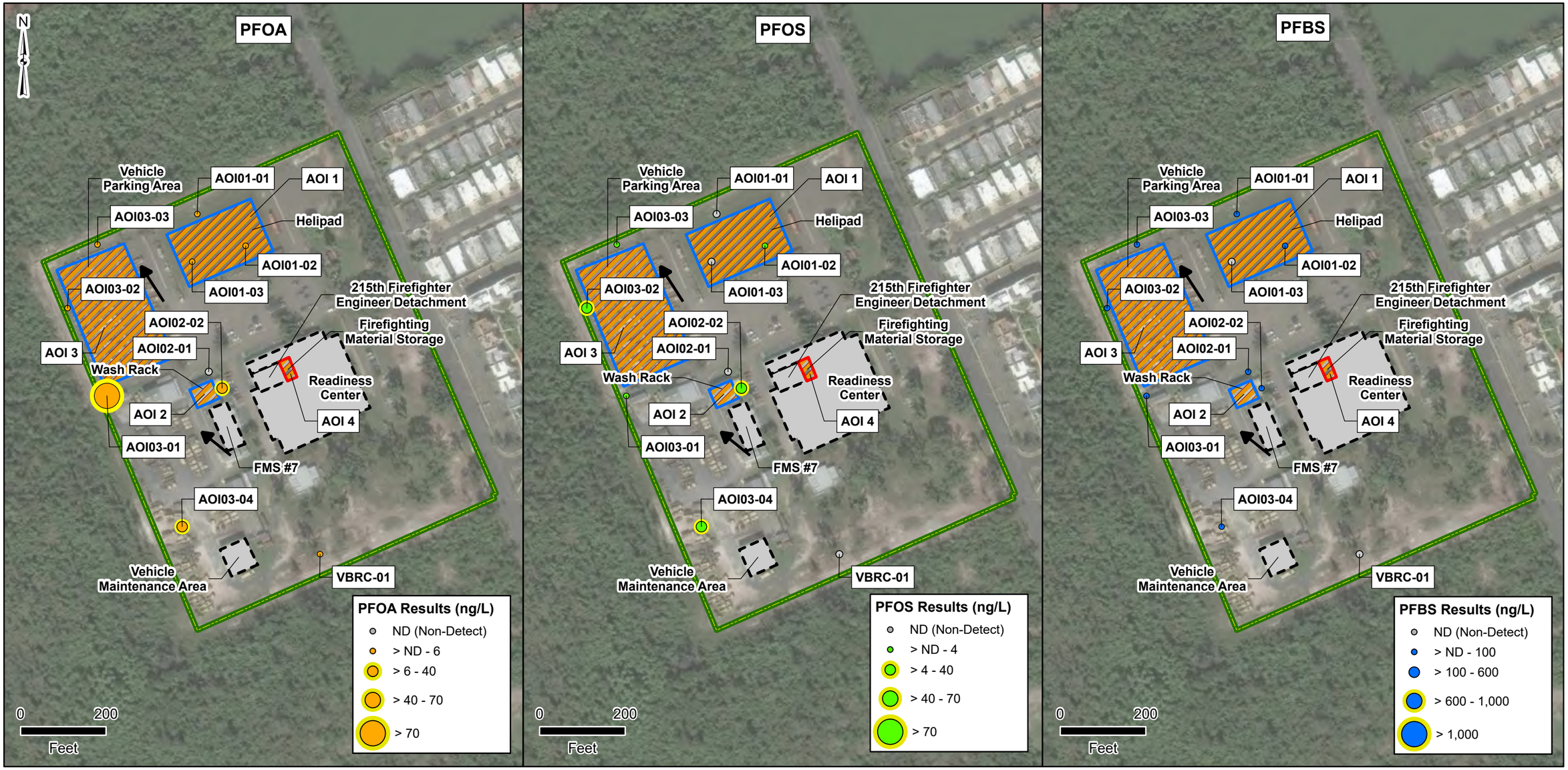


Figure 6-6
PFOA, PFOS and PFBS Detections in Groundwater (AOI 1, AOI 2 and AOI 3)



Facility Data
- Facility Boundary
- Area of Interest
- Area of Interest Identified after SI, to be investigated in RI
- Potential PFAS Release
- No Suspected Release

Hydrology/Hydrogeology
- Groundwater Flow Direction

Note:
PFOA = Perfluorooctanesulfonic acid
PFOS = Perfluorooctanoic acid
PFBS = Perfluorobutanesulfonic acid
Exceedances of the OSD SL are depicted with a yellow halo

Data Sources:
ESRI 2022
AECOM 2019

Date:.....July 2023
Prepared By:.....EA
Prepared For:.....USACE
Projection:.....WGS 84 UTM 20N

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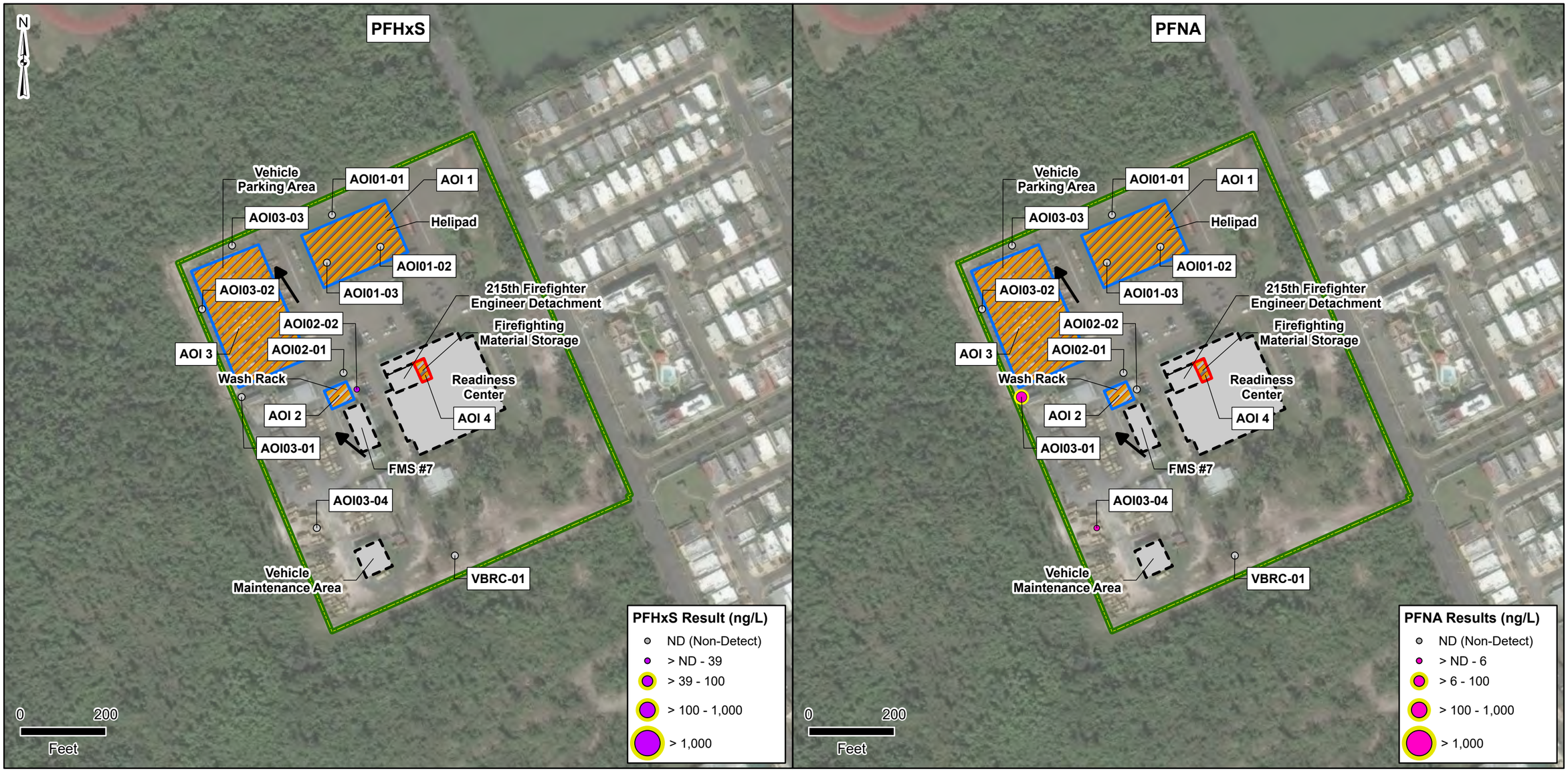
Army National Guard Site Inspections
Site Inspection Report
Vega Baja Readiness Center, Puerto Rico

Figure 6-7
PFHxS and PFNA Detections in Groundwater (AOI 1, AOI 2 and AOI 3)



Facility Data
- Facility Boundary
- Area of Interest
- Area of Interest Identified after SI, to be investigated in RI
- Potential PFAS Release
- No Suspected Release

Hydrology/Hydrogeology
- Groundwater Flow Direction

Notes:
PFHxS = Perfluorohexanesulfonic acid
PFNA = Perfluorononanoic acid
Exceedances of the OSD SL are depicted with a yellow halo.

Data Sources:
ESRI 2020
AECOM 2020

Date:.....July 2023
Prepared By:.....EA
Prepared For:.....USACE
Projection:.....WGS 84 UTM 20N

Path: \\lovetongis\GISdata\Federal\Nationwide\PFAS\MAES_6342503831\PROJECTS\SIReport\VegaBaja\VegaBajaSI.aprx

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7. EXPOSURE PATHWAYS

The conceptual site model (CSM) for the AOIs, revised based on the SI findings, are presented on **Figures 7-1 thru 7-3**. Additionally, a preliminary CSM for AOI 4 is included as **Figure 7-4**. Following the SI fieldwork it was noted that Chemguard 3% AFFF was stored in the Firefighting Materials Storage Area.

Please note that while the CSM discussion assists in determining if a receptor may be impacted, the decision to move from SI to RI or interim action is determined based upon exceedances of the SLs for the relevant compounds and whether the release is more than likely attributable to the DoD. A CSM presents the current understanding of the site conditions with respect to known and suspected sources, potential transport mechanisms and migration pathways, and potentially exposed human receptors. A human exposure pathway is considered potentially complete when the following conditions are present:

1. Contaminant source
2. Environmental fate and transport
3. Exposure point
4. Exposure route
5. Potentially exposed populations.

If any of these elements are missing, the pathway is incomplete. The CSM figures use an empty circle symbol to represent an incomplete exposure pathway. Areas with no identified complete pathway generally warrant no further action. However, the pathway is considered potentially complete if the relevant compounds are detected, in which case the CSM figure uses a half-filled circle symbol to represent a potentially complete exposure pathway. Additionally, a completely filled circle symbol is used to indicate when a potentially complete exposure pathway has detections of relevant compounds above the SLs. Areas with an identified potentially complete pathway that have detections of the relevant compounds above the SLs may warrant further investigation. Although the CSMs indicate whether potentially complete exposure pathways may exist, the recommendation for future study in an RI or no action at this time is based on the comparison of the SI analytical results for the relevant compounds to the SLs.

In general, the potential routes of exposure for the relevant compounds are ingestion and inhalation. Human exposure via the dermal contact pathway may occur, and current risk practice suggests it is an insignificant pathway compared to ingestion; however, exposure data for dermal pathways are sparse and continue to be the subject of toxicological study. The receptors evaluated are consistent with those listed in USEPA guidance for risk screening (USEPA 2001). Receptors at the Facility include site workers (e.g., Facility staff and visitors), construction workers, residents outside the Facility boundary, and recreational users outside of the Facility boundary.

7.1 SOIL EXPOSURE PATHWAY

The SI results for soil were used to determine whether a potentially complete pathway exists between the source and potential receptors at AOI 1, AOI 2, and AOI 3 based on the aforementioned criteria.

7.1.1 AOI 1

AOI 1 consists of the Helipad located in the northern portion of the Facility area, east of the Vehicle Parking Area (AOI 3). Although no evidence indicates that AFFF has been released at the Helipad, the corrosive nature of AFFF and the potential for AFFF to have been stored at this location may have led to unknown releases of AFFF.

None of the five relevant PFAS compounds were detected in surface soil, subsurface shallow soil, or subsurface deep soil at AOI 1, therefore, the soil exposure pathways for site workers and construction workers are incomplete. The CSM is presented on **Figure 7-1**.

7.1.2 AOI 2

AOI 2 encompasses the Wash Rack, which is situated adjacent to FMS #7 and south of AOI 1 and AOI 3. Activities at AOI 2 are documented as having included the washing and maintenance of firetrucks, with the possibility of AFFF having been present in vehicle nozzles and vehicle bulk tanks during washing and maintenance which may have leaked into the wash pad.

PFOA and PFOS were detected in both boring locations at AOI 2 at concentrations below the SL within the surface soil. Based on the results of the SI in AOI 2, ground-disturbing activities to surface soil could result in site worker and construction worker exposure to PFOA and PFOS via inhalation of dust. Ground-disturbing activities to subsurface soil could result in construction worker exposure to PFOA and PFOS via ingestion. The site is fenced, but visitors could potentially enter the site. Therefore, the exposure pathways for inhalation and ingestion for AOI 2 are potentially complete for these receptors. The CSM is presented in **Figure 7-2**.

7.1.3 AOI 3

AOI 3 encompasses the Vehicle Parking Area, situated in the northwest corner of the site area, west of AOI 1 and north of AOI 2. Activities at AOI 3 are documented as having included PRARING vehicle parking, including parking for firefighting vehicles. According to Facility personnel, the water tank cracked on an Osh Kosh HEMTT Model No. M1158 stored in the Vehicle Parking Area in 2017. During the PA it was observed that a HEMTT based water tender was stored and maintained by the Firefighter Engineer Detachment. The vehicle is equipped with a 50-gallon AFFF tank and a 2,500-gallon water tank. During repairs, a private contractor emptied AFFF from the vehicle in a controlled manner and repaired the broken tank. It is possible that AFFF migrated from its tank into other parts of the vehicle through corroded vehicle nozzles.

PFOA, PFOS, and PFNA were detected in multiple boring locations at AOI 3 at concentrations below the SL within the surface soil. Based on the results of the SI in AOI 3, ground-disturbing activities to surface soil could result in site worker and construction worker exposure to PFOA and PFOS via inhalation of dust. Ground-disturbing activities to subsurface soil could result in construction worker exposure to PFOA and PFOS via ingestion. Therefore, the exposure pathways for inhalation and ingestion are potentially complete for these receptors. The CSM is presented on **Figure 7-3**.

7.1.4 AOI 4 Firefighting Materials Storage Area

AOI 4 is the Firefighting Materials Storage Area and it is located within the Readiness Center. During the PA site visit it was noted that containers of Chemguard 3% AFFF were stored in the Firefighting Materials Storage Area. According to PRARNG interviewees, no AFFF has been used or accidentally released within the Firefighters Materials Storage Area. No sampling was conducted in AOI 4. Potential releases may have occurred to the floor or to floor drains. PFAS releases to the floor or floor drains could have impacted soil through cracks or joints between slabs and pipes. Direct contact with subsurface soil (during excavation activities) could result in construction worker exposure to PFAS via inhalation of dust or incidental ingestion of soil particles. Further assessment will be conducted during the RI. The preliminary CSM is presented in **Figure 7-4**.

7.2 GROUNDWATER EXPOSURE PATHWAY

The SI results for PFOA, PFOS, and PFBS in groundwater were used to determine whether a potentially complete pathway exists between the source and potential receptors at each AOI based on the aforementioned criteria.

The Vega Baja Municipality is located in the Rio Cibuco watershed, between the Rio Grande de Manatí and the Rio Cibuco. Both rivers originate in the Cordillera Central Mountain range, flow north through the foothills, and ultimately discharge unto the Atlantic Ocean. Flooding of the surrounding area may occur during periods of heavy rainfall; however, no flooding reportedly occurs on-site at the Vega Baja Readiness Center (AECOM 2020).

There are no surface water bodies located within the Facility boundary. General surface water flow at the Facility flows north/northeast towards stormwater drains and culverts along State Road 687. The freshwater lake Laguna Rica and its smaller surrounding wetlands are located approximately 0.2 miles west of the Vega Baja Readiness Center Facility boundary. The Laguna Tortuguero, which is listed by the National Wetlands Inventory as an estuarine and marine deepwater habitat, is located approximately 0.8 miles northwest of the Facility.

There are no drinking water wells at the Vega Baja Readiness Center; the Facility is provided municipal water by the Puerto Rico Aqueducts and Sewers Authority. Several water wells are located within a 1-mile radius of the Facility, including one public water supply well located approximately 0.6 miles to the east (cross gradient). There are no known drinking water wells north of the Facility.

7.2.1 AOI 1

PFBS, PFOS and PFOS were detected in groundwater below their respective SLs.

The well with the shallowest depth to water was AOI01-02 at 13.19 ft btoc, so at this depth it is possible that trenching and excavation activities could result in construction worker exposure via incidental ingestion, therefore this pathway is considered potentially complete. The surrounding communities are reportedly on municipal drinking water; therefore, the groundwater pathway for Residents is considered incomplete. The freshwater lake Laguna Rica and its smaller

surrounding wetlands are located approximately 0.2 miles west of the Vega Baja Readiness Center Facility boundary and groundwater is shallow; therefore, the groundwater pathways for the trespasser/Recreational User is considered potentially complete. The CSM is presented on **Figure 7-1**.

7.2.2 AOI 2

PFBS and PFHxS were detected in groundwater below their respective SLs. PFOS and PFOA were detected in groundwater at concentrations exceeding their respective SLs.

Depths to water measured at AOI02-01 and AOI02-02 were found to be at 34.44 ft btoc and 21.47 ft btoc respectively. It is possible that trenching and excavation activities could result in construction worker exposure via incidental ingestion, therefore this pathway is considered potentially complete. The surrounding communities are reportedly on municipal drinking water; therefore, the groundwater pathway for Residents is considered incomplete. The freshwater lake Laguna Rica and its smaller surrounding wetlands are located approximately 0.2 miles west of the Vega Baja Readiness Center Facility boundary and groundwater is shallow; therefore, the groundwater pathways for the trespasser/Recreational User is considered potentially complete. The CSM is presented on **Figure 7-2**.

7.2.3 AOI 3

Four of the five relevant compounds (PFOA, PFOS, PFNA, and PFBS) were detected in groundwater in AOI 3, with three of the five relevant compounds (PFOA, PFOS, and PFNA) detected at concentrations above their respective SLs. The well with the shallowest depth to water was AOI03-01 at 14.32 ft btoc. It is possible that trenching and excavation activities could result in construction worker exposure via incidental ingestion; therefore, this pathway is considered potentially complete. The surrounding communities are reportedly on municipal drinking water; therefore, the groundwater pathway for Residents is considered incomplete. The freshwater lake Laguna Rica and its smaller surrounding wetlands are located approximately 0.2 miles west of the Vega Baja Readiness Center Facility boundary and groundwater is shallow; therefore, the groundwater pathways for the trespasser/Recreational User is considered potentially complete. The CSM is presented on **Figure 7-3**.

7.2.4 AOI 4

No sampling was conducted in AOI 4. Potential releases may have occurred to the floor or to floor drains. PFAS releases to the floor or floor drains could have impacted soil through cracks or joints between slabs and pipes. PFAS releases to the soil can migrate to groundwater, as such, ground disturbing activities that extend to the water table (approximately 15 ft bgs) could result in construction worker exposure to PFAS via incidental ingestion. Potential resident receptors downgradient of the AOI 4 could also be exposed by ingestion of groundwater. Further assessment will be conducted during the RI. The preliminary CSM is presented in **Figure 7-4**.

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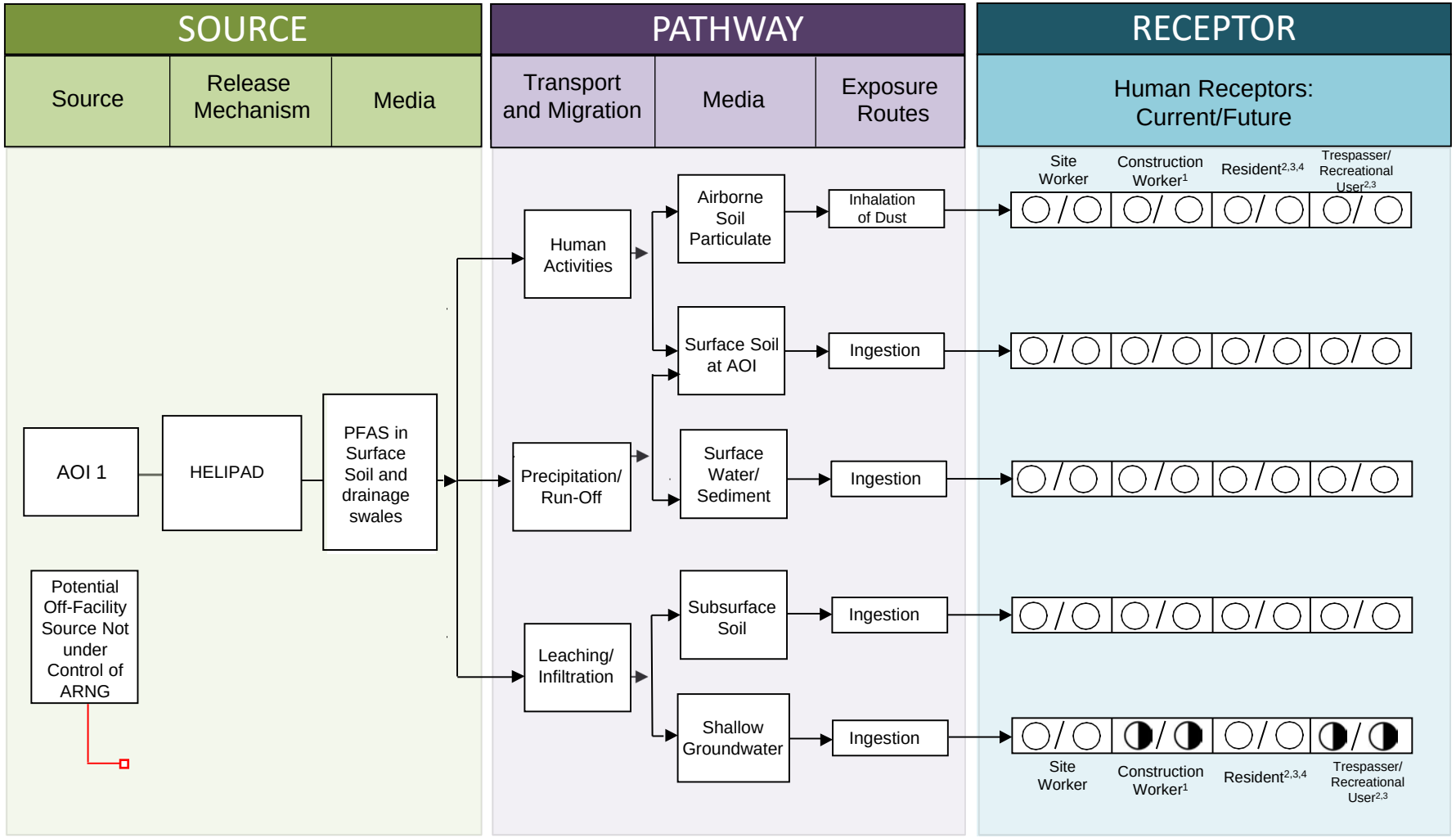

LEGEND

- Flow Chart Stops
- Flow Chart Continues
- Partial/ Possible Flow
- Incomplete Pathway
- Partially Complete Pathway
- Potentially Complete Pathway with Exceedance of Screening Level

Notes:

1. Current active construction at the site.
2. The resident and recreational users refer to off-site receptors.
3. Inhalation of dust for off-site receptors is likely insignificant.
4. Potential pathway for groundwater ingestion still exists due to the relevant compounds detected above SLs in the groundwater at the northwestern facility boundary.

Figure 7-1
Conceptual Site Model
AOC 1 Vega Baja Readiness Center

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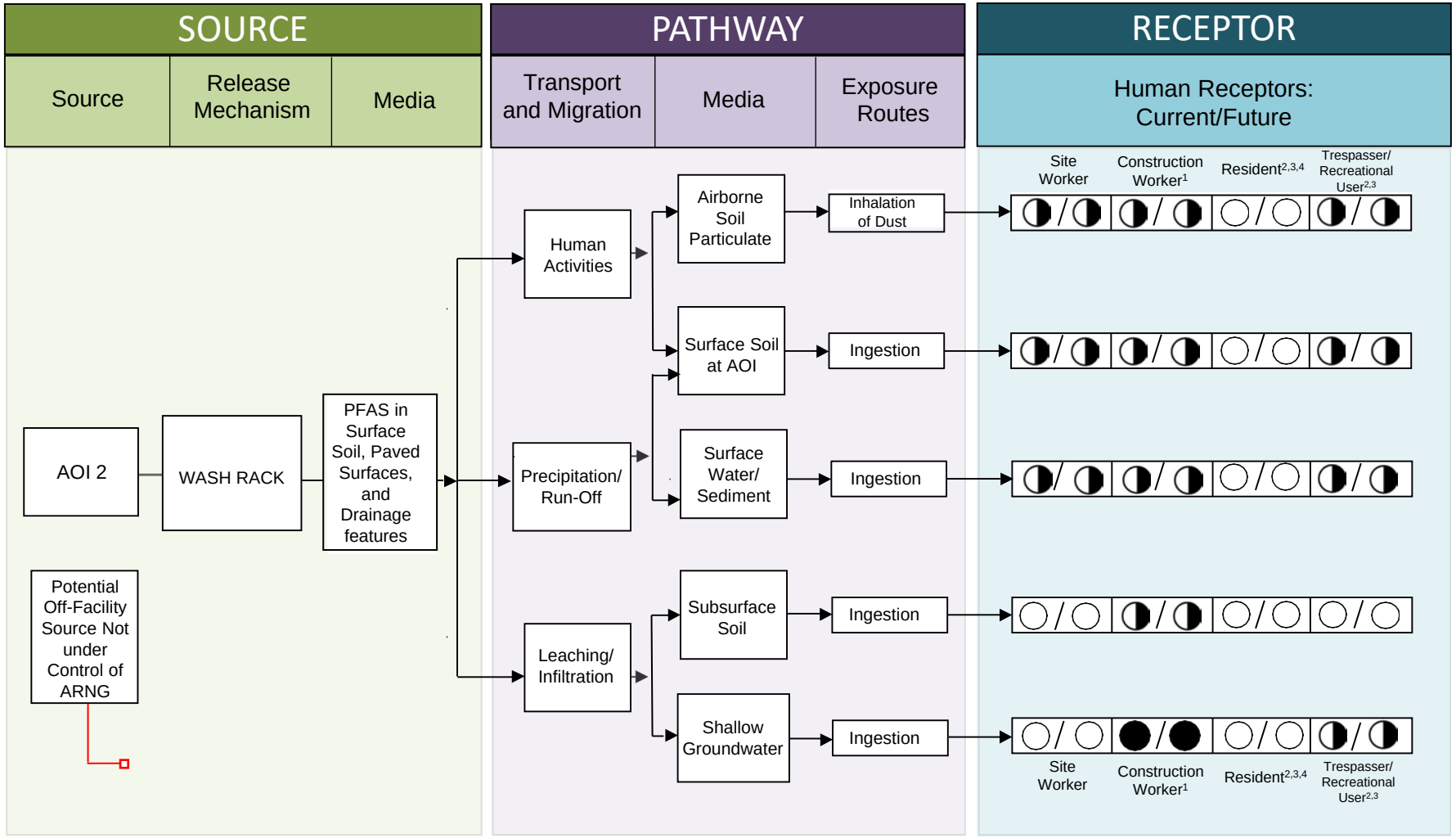

LEGEND

- Flow Chart Stops
- Flow Chart Continues
- Partial/ Possible Flow
- Incomplete Pathway
- Partially Complete Pathway
- Potentially Complete Pathway with Exceedance of Screening Level

Notes:

1. Current active construction at the site.
2. The resident and recreational users refer to off-site receptors.
3. Inhalation of dust for off-site receptors is likely insignificant.
4. Potential pathway for groundwater ingestion still exists due to the relevant compounds detected above SLs in the groundwater at the northwestern facility boundary.

Figure 7-2
Conceptual Site Model
AOI 2 Vega Baja Readiness Center

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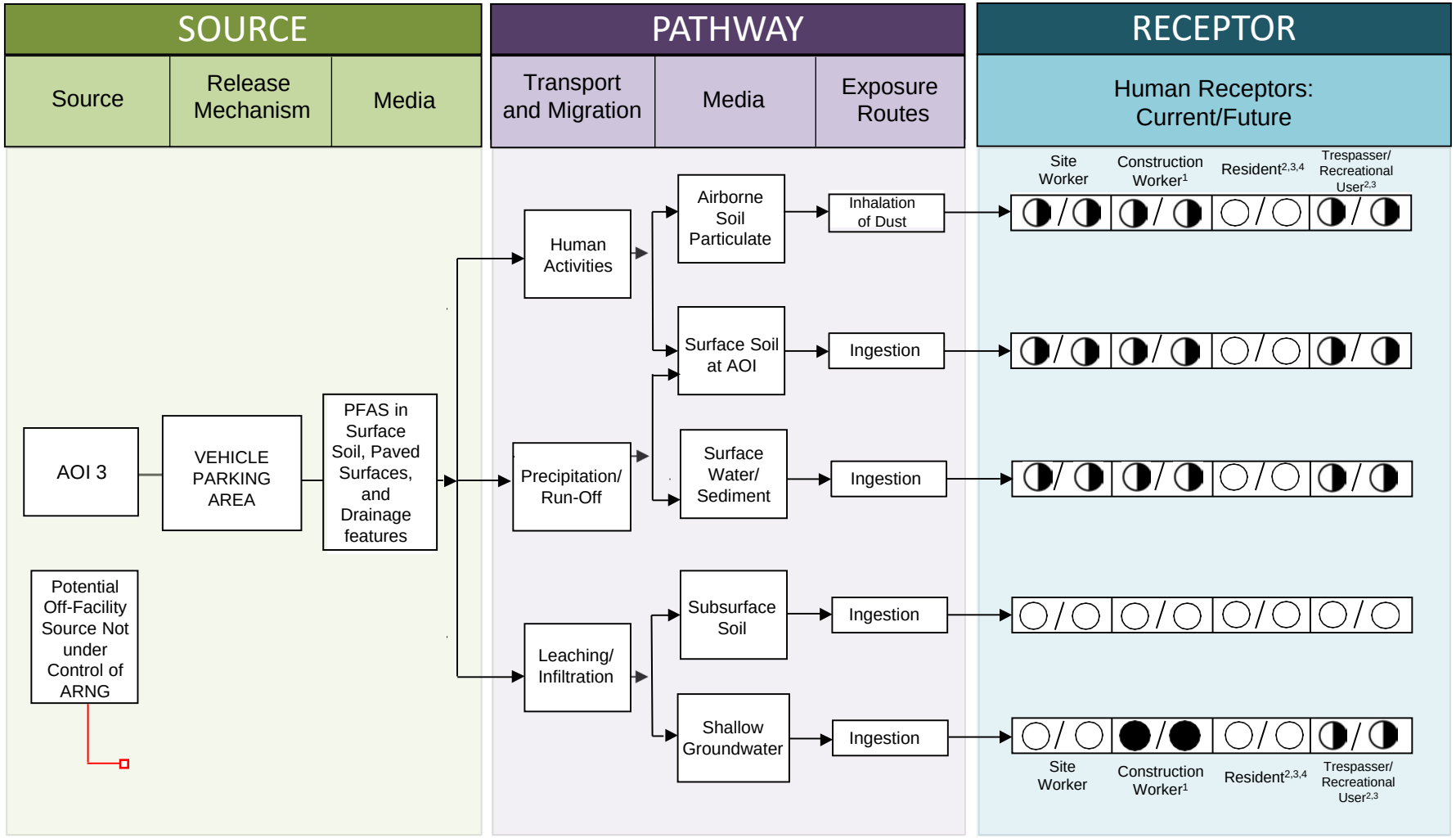

LEGEND

- Flow Chart Stops
- Flow Chart Continues
- Partial/ Possible Flow
- Incomplete Pathway
- Partially Complete Pathway
- Potentially Complete Pathway with Exceedance of Screening Level

Notes:

1. Current active construction at the site.
2. The resident and recreational users refer to off-site receptors.
3. Inhalation of dust for off-site receptors is likely insignificant.
4. Potential pathway for groundwater ingestion still exists due to the relevant compounds detected above SLs in the groundwater at the northwestern facility boundary.

Figure 7-3
Conceptual Site Model
AOI 3 Vega Baja Readiness Center

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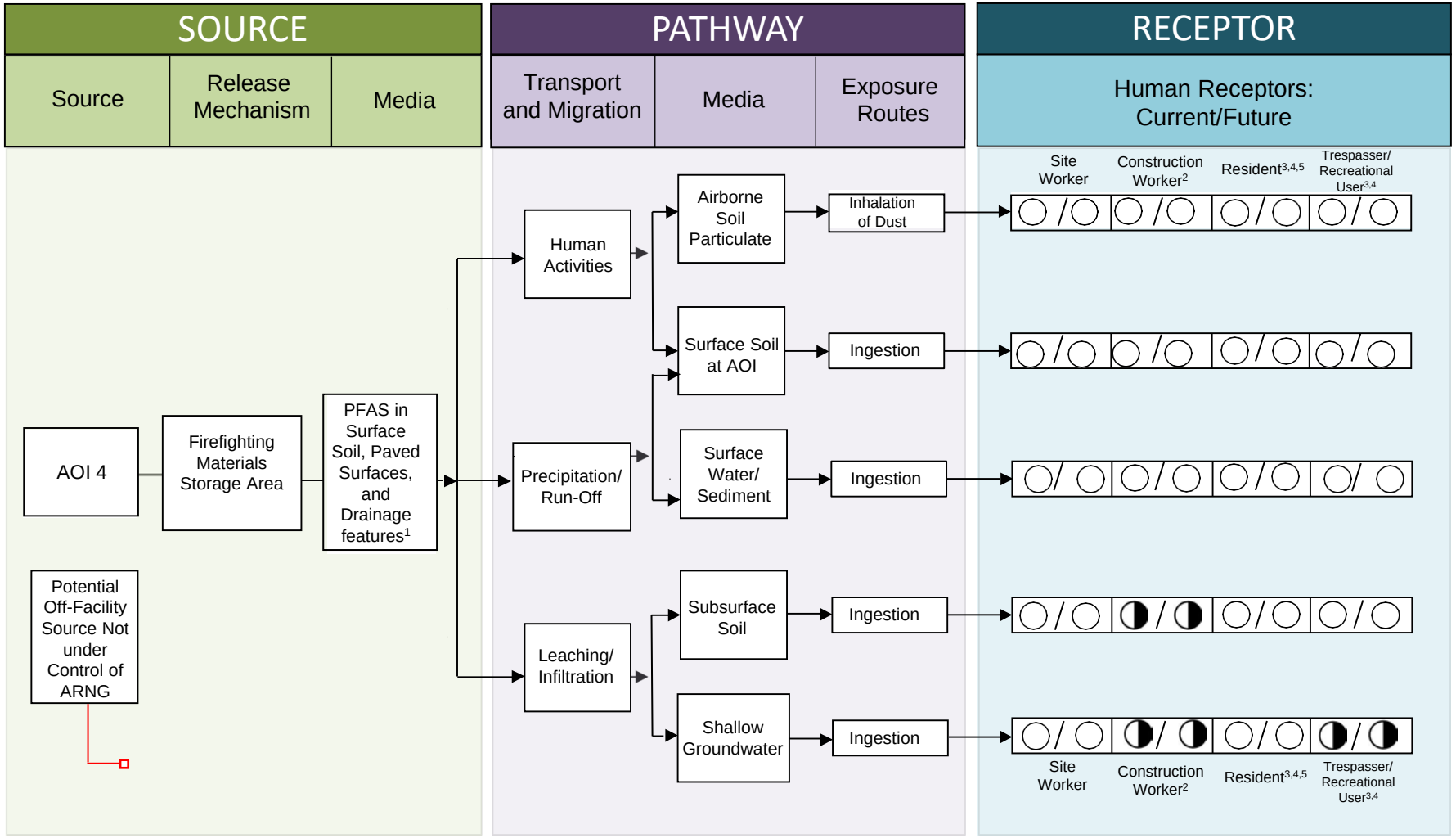

LEGEND

- Flow Chart Stops
- Flow Chart Continues
- Partial/ Possible Flow
- Incomplete Pathway
- Partially Complete Pathway
- Potentially Complete Pathway with Exceedance of Screening Level

Notes:

1. AOI 4 was identified after SI fieldwork had been completed.
2. Current active construction at the site.
3. The resident and recreational users refer to off-site receptors.
4. Inhalation of dust for off-site receptors is likely insignificant.
5. Potential pathway for groundwater ingestion still exists due to the relevant compounds detected above SLs in the groundwater at the northwestern facility boundary.

Figure 7-4
Conceptual Site Model
AOI 4 Vega Baja Readiness Center

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8. SUMMARY AND OUTCOME

This section summarizes SI activities and findings. The most significant findings are summarized in this section and are reproduced directly or abstracted from information contained in this report. The outcome provides general and comparative interpretations of the findings relative to the SLs.

8.1 SITE INSPECTION ACTIVITIES

The SI field activities at the Facility were conducted from 17 October to 1 November 2022. The SI field activities included soil and groundwater sampling. Field activities were conducted in accordance with the UFP-QAPP Addendum (EA 2021), except as previously noted in **Section 5.7**.

To fulfill the project DQOs set forth in the approved SI UFP-QAPP Addendum (EA 2021a), samples were collected and analyzed for a subset of PFAS by LC/MS/MS compliant with QSM 5.3 Table B-15 as follows. The 24 PFAS analyzed as part of the ARNG SI program are specified in **Section 5.6** of this SI Report.

- Thirty (30) soil composite samples from ten boring locations;
- Ten (10) grab groundwater samples from ten temporary well locations.

An SI is conducted when the PA determines an AOI exists based on probable use, storage, and/or disposal of PFAS-containing materials. The SI includes multi-media sampling at the AOIs to determine whether a release has occurred. The SI may conclude further investigation is warranted, a removal action is required to address immediate threats, or no further action is required. Additionally, the CSM was refined to assess whether a potentially complete pathway exists between the source and potential receptors for potential exposure at the AOIs, which is described in **Section 7**.

8.2 OUTCOME

Based on the results of this SI, further evaluation under CERCLA in the form of an RI is warranted for AOIs 2 and 3 and no further evaluation is warranted for AOI 1 at this time (see Table 8-1). Based on the CSMs developed and revised in light of the SI findings, there is potential for exposure to soil and groundwater from releases during historical DoD activities at the Facility. Sample analytical concentrations collected during this SI were compared with the project SLs in soil and groundwater, as described in **Table 6-1**.

A summary of the results of the SI data relative to SLs is as follows:

- AOI 1:
    - None of the relevant compounds were detected in soil at AOI 1.

  - Three of the five relevant compounds (PFOS, PFOA, and PFBS) were detected in the groundwater at AOI 1 at concentrations below their respective SLs.

- AOI 2:

  - Two of the five relevant compounds (PFBs and PFHxS) were detected at concentrations below their SLs in soil at AOI 2.

  - PFOS and PFOA were detected in exceedance of their SLs in groundwater at AOI 2.

- AOI 3:

  - Three of the relevant compounds (PFNA, PFOA, and PFOS) were detected at concentrations below their SLs in soil at AOI 3.

  - Four of the five relevant compounds (PFOA, PFOS, PFNA, and PFBS) were detected in the groundwater at AOI 3. PFOS, PFOA, and PFNA were detected at concentrations exceeding their respective SLs at multiple wells in AOI 3.

- Facility boundary:

  - One of the five relevant compounds (PFOA) was detected at a concentration below its SL in the groundwater at the Facility boundary.

Of the six PFAS compounds presented in the 6 July 2022 OSD memorandum, HFPO-DA (commonly referred to as GenX) was not included as an analyte at the time of this SI. Based on the CSM developed during the PA and revised based on SI findings, the presence of HFPO-DA is not anticipated at the facility because HFPO-DA is generally not a component of MIL-SPEC AFFF and based on its history including distribution limitations that restricted use of GenX, it is generally not a component of other products the military used. In addition, it is unlikely that GenX would be an individual chemical of concern in the absence of other PFAS.

Table 8-1 summarizes the SI results for soil and groundwater used to determine if an AOI should be considered for further investigation under CERCLA and undergo an RI.

Table 8-1. Summary of Site Inspection Findings and Recommendations

AOI	Potential Release Area	Soil Source Area	Groundwater Source Area	Groundwater Facility Boundary	Future Action
1	Helipad	○	◐	◐	No Further Action
2	Wash Rack	◐	●	◐	Proceed to RI
3	Vehicle Parking Area	◐	●	◐	Proceed to RI
4	Firefighting Materials Storage Area	TBD	TBD	TBD	Proceed to RI

Legend:
● = Detected; exceedance of screening levels
◐ = Detected; no exceedance of screening levels
○ = Not detected
TBD = to be determined during RI

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