



FINAL PRELIMINARY ASSESSMENT AND SITE INSPECTION OF PER- AND POLYFLUOROALKYL SUBSTANCES

White Sands Missile Range, New Mexico

Prepared For:
U.S. Army Corps of Engineers, Baltimore District
2 Hopkins Plaza
Baltimore, Maryland 21201

July 2023

FIGURES

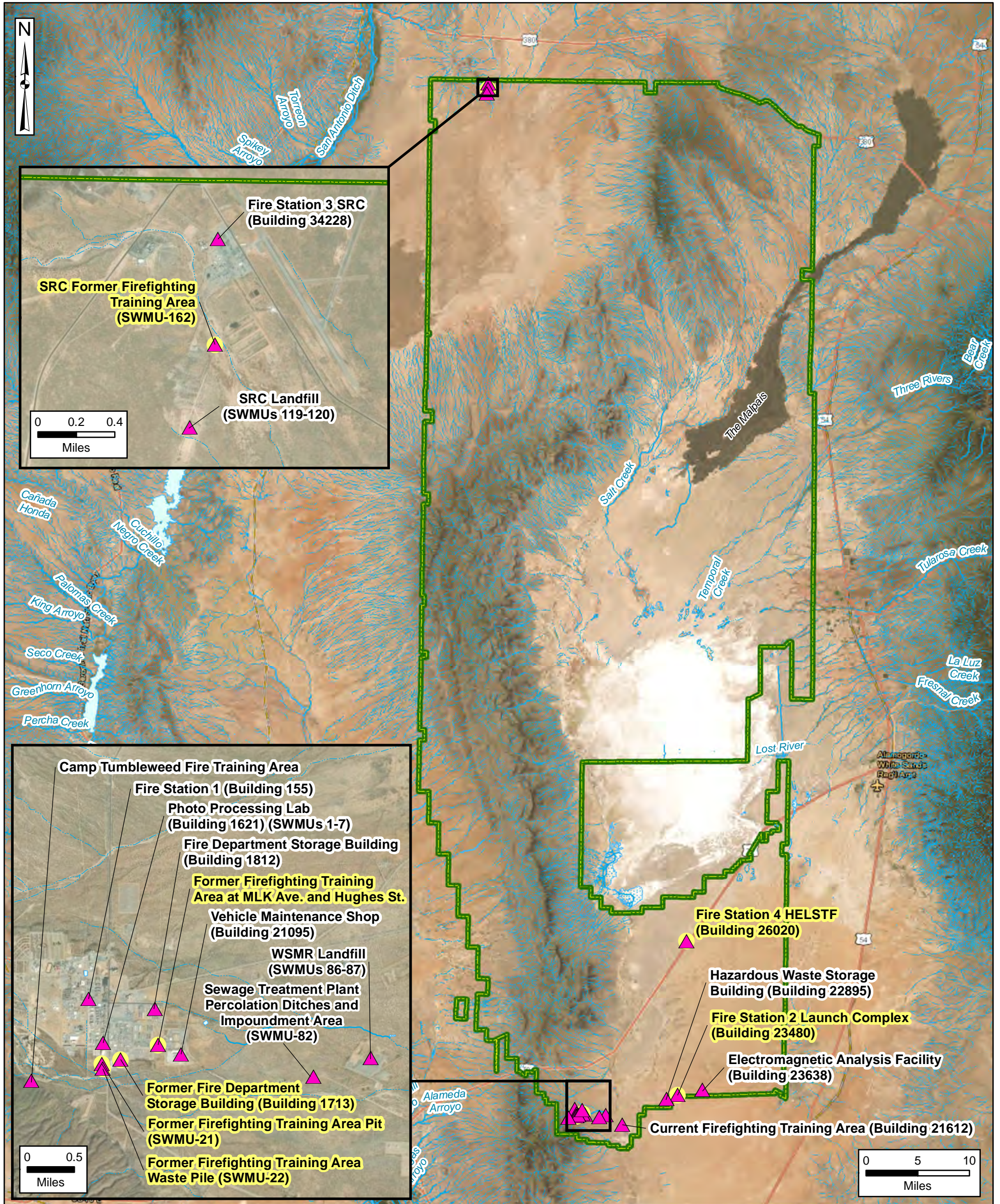




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White Sands Missile Range, NM



Figure 7-1
AOPI Locations and
OSD Risk Screening Level Exceedances



Installation Boundary

AOPI Location

AOPI with OSD Risk Screening Level Exceedance

River/Stream (Perennial)

Stream (Intermittent)

Canal/Ditch

Water Body (Perennial)

Water Body (Intermittent)

Playa

AOPI = area of potential interest

HELSTF = High Energy Laser System Test Facility

MLK Ave. = Martin Luther King Jr. Avenue

OSD = Office of the Secretary of Defense

SRC = Stallion Range Center

St. = Street

SWMU = solid waste management unit

Data Sources:

NHD, Water Bodies, 2019

ESRI ArcGIS Online, Aerial Imagery

Coordinate System:

WGS 1984, UTM Zone 13 North



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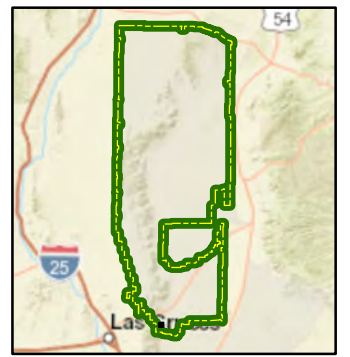
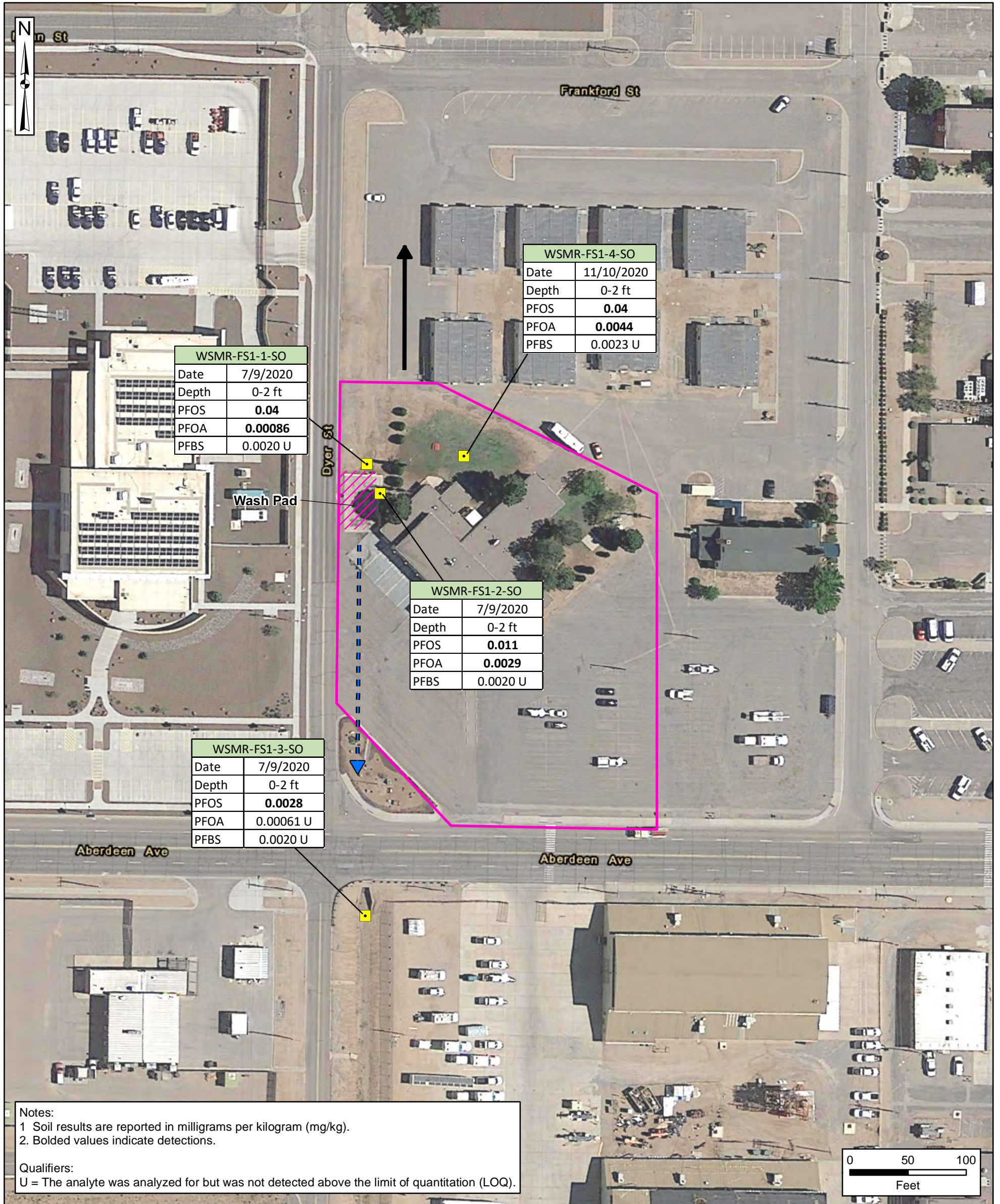


Figure 7-2
Fire Station 1 (Building 155)
PFOS, PFOA, and PFBS Analytical Results

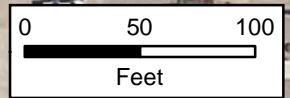


Notes:
1. Soil results are reported in milligrams per kilogram (mg/kg).
2. Bolded values indicate detections.

Qualifiers:
U = The analyte was analyzed for but was not detected above the limit of quantitation (LOQ).

- Installation Boundary
- AOPI
- AFFF Release Area
- Surface Runoff Flow Direction
- Groundwater Flow Direction
- Shallow Soil Sampling Location

AFFF = aqueous film-forming foam
AOPI = area of potential interest
ft = feet
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate



Data Sources:
Google Earth, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 13 North



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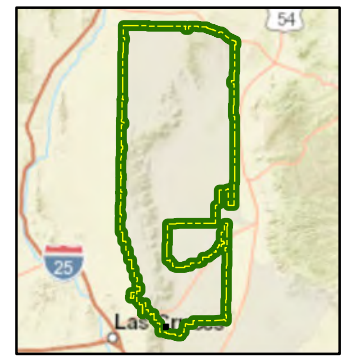
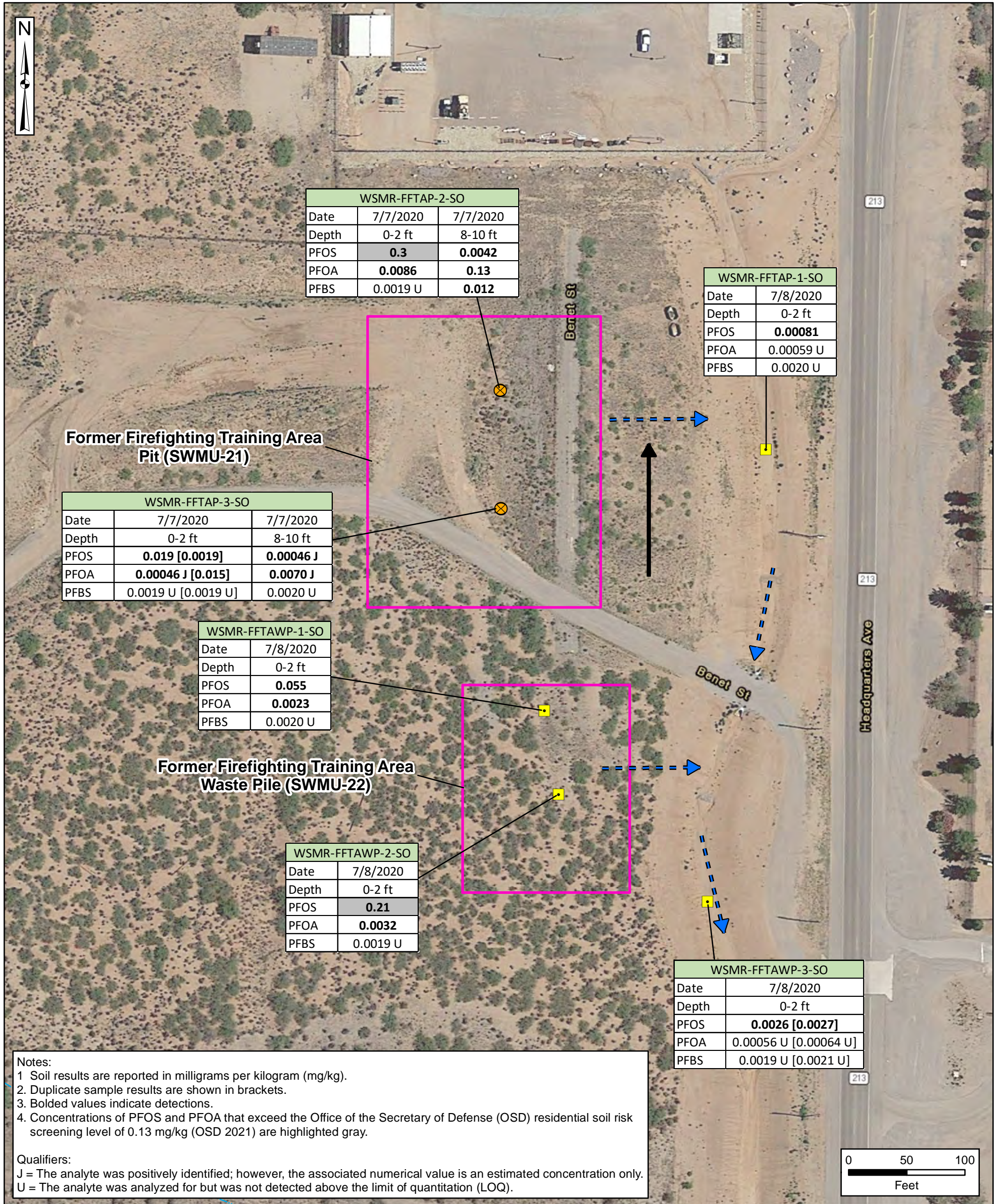


Figure 7-3
Former Firefighting Training Area Pit (SWMU-21) and
Former Firefighting Training Area Waste Pile (SWMU-22)
PFOS, PFOA, and PFBS Analytical Results





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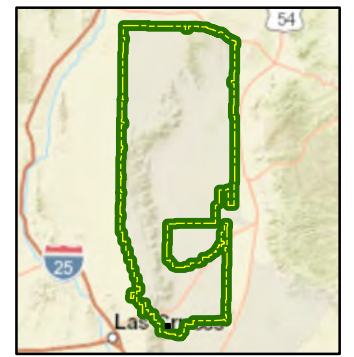
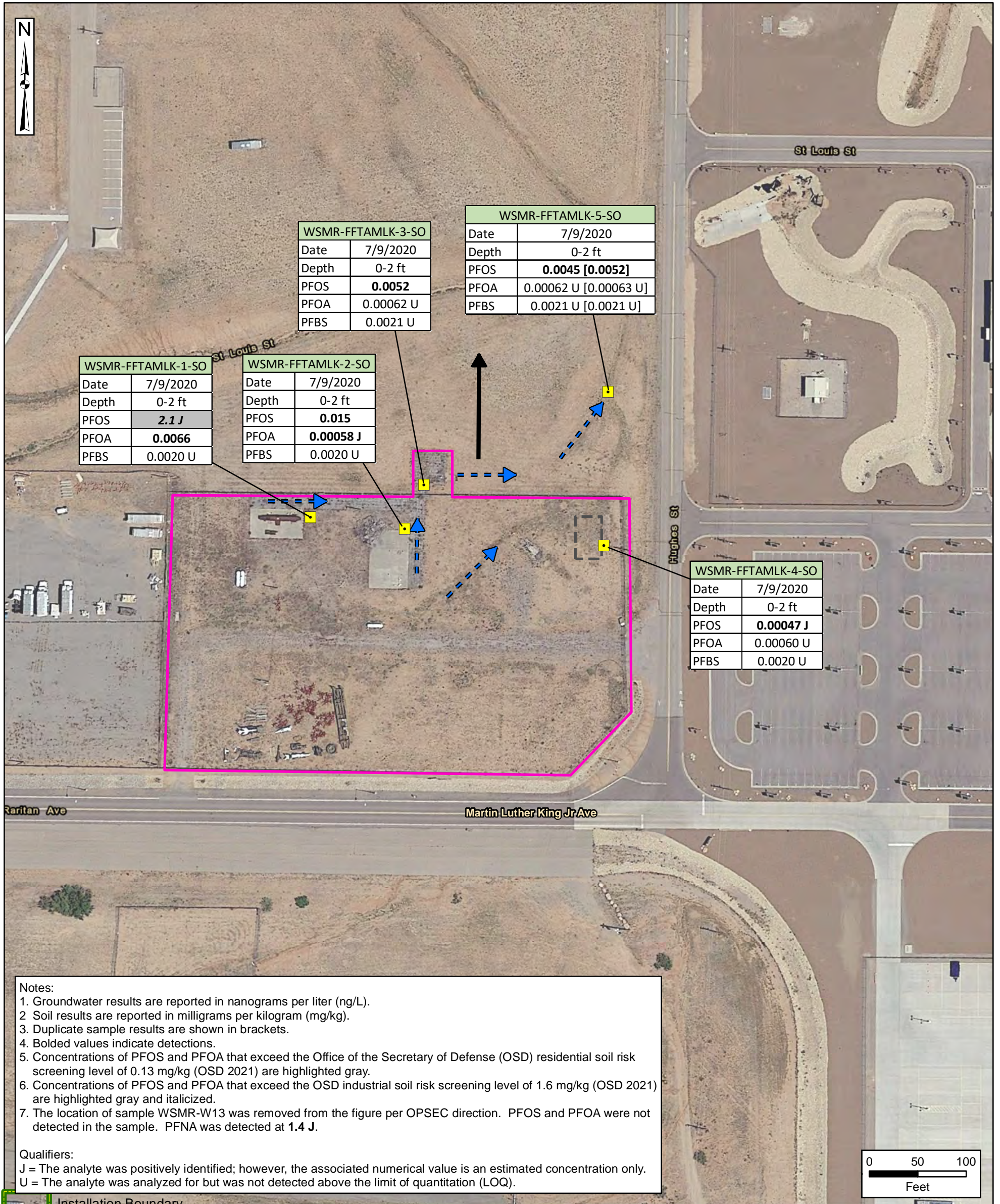


Figure 7-4
Former Firefighting Training Area at
Martin Luther King Jr. Avenue and Hughes Street
PFOS, PFOA, and PFBS Analytical Results

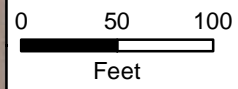


Notes:

1. Groundwater results are reported in nanograms per liter (ng/L).
2. Soil results are reported in milligrams per kilogram (mg/kg).
3. Duplicate sample results are shown in brackets.
4. Bolded values indicate detections.
5. Concentrations of PFOS and PFOA that exceed the Office of the Secretary of Defense (OSD) residential soil risk screening level of 0.13 mg/kg (OSD 2021) are highlighted gray.
6. Concentrations of PFOS and PFOA that exceed the OSD industrial soil risk screening level of 1.6 mg/kg (OSD 2021) are highlighted gray and italicized.
7. The location of sample WSMR-W13 was removed from the figure per OPSEC direction. PFOS and PFOA were not detected in the sample. PFNA was detected at **1.4 J**.

Qualifiers:
 J = The analyte was positively identified; however, the associated numerical value is an estimated concentration only.
 U = The analyte was analyzed for but was not detected above the limit of quantitation (LOQ).

- Installation Boundary
- AOPI
- Historical Building Footprint
- Surface Runoff Flow Direction
- Groundwater Flow Direction
- Shallow Soil Sampling Location



AOPI = area of potential interest
 ft = feet
 PFBS = perfluorobutanesulfonic acid
 PFOA = perfluorooctanoic acid
 PFOS = perfluorooctane sulfonate

Data Sources:
 Google Earth, Aerial Imagery

Coordinate System:
 WGS 1984, UTM Zone 13 North



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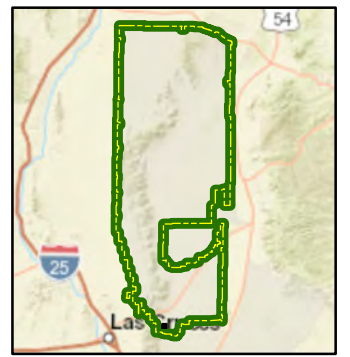
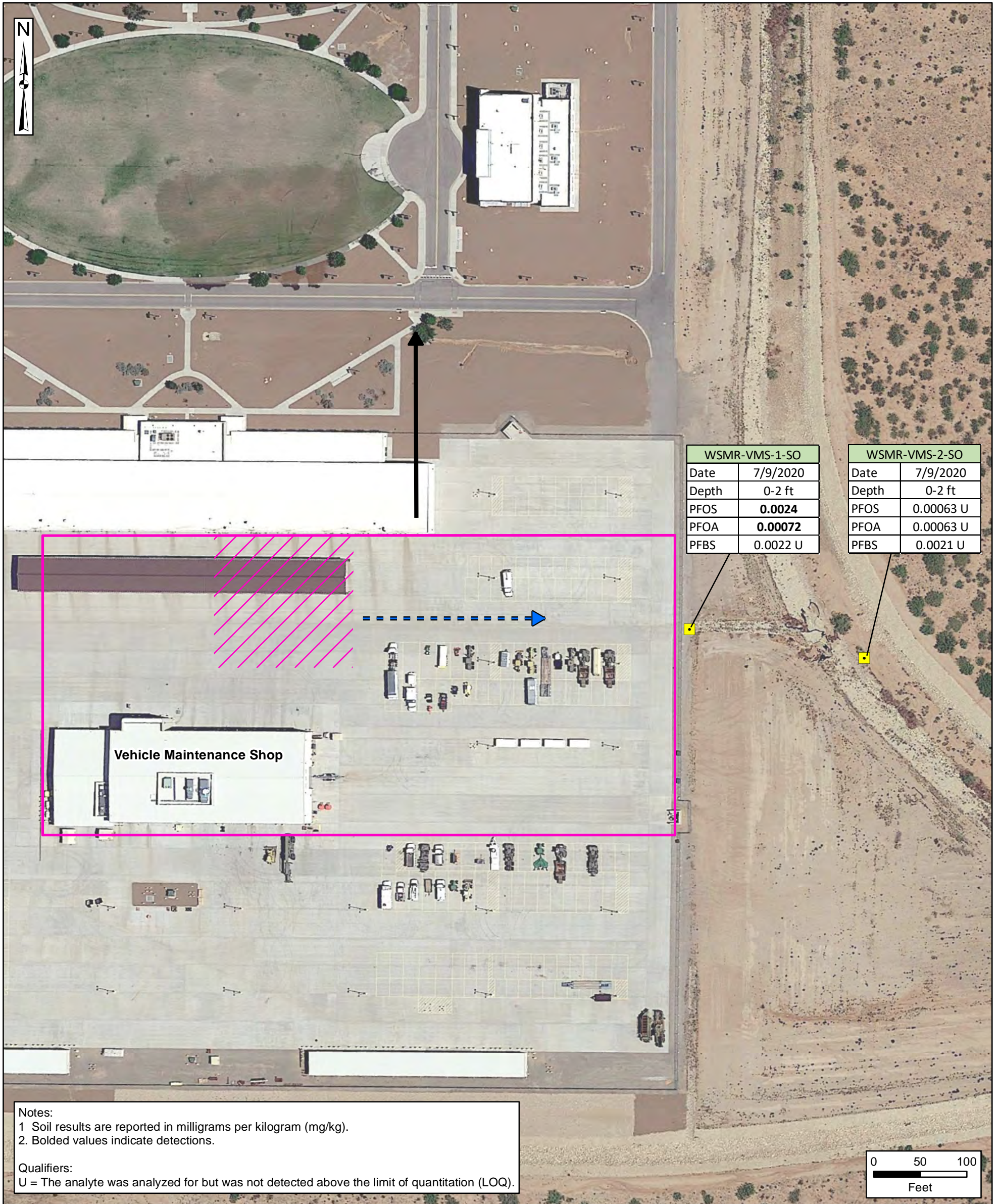


Figure 7-5
Vehicle Maintenance Shop (Building 21095)
PFOS, PFOA, and PFBS Analytical Results



WSMR-VMS-1-SO	
Date	7/9/2020
Depth	0-2 ft
PFOS	0.0024
PFOA	0.00072
PFBS	0.0022 U

WSMR-VMS-2-SO	
Date	7/9/2020
Depth	0-2 ft
PFOS	0.00063 U
PFOA	0.00063 U
PFBS	0.0021 U

Notes:
1. Soil results are reported in milligrams per kilogram (mg/kg).
2. Bolded values indicate detections.

Qualifiers:
U = The analyte was analyzed for but was not detected above the limit of quantitation (LOQ).

- Installation Boundary
- AOPI
- AFFF Release Area
- Surface Runoff Flow Direction
- Groundwater Flow Direction
- Shallow Soil Sampling Location

AOPI = area of potential interest
AFFF = aqueous film-forming foam
ft = feet
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

Data Sources:
Google Earth, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 13 North



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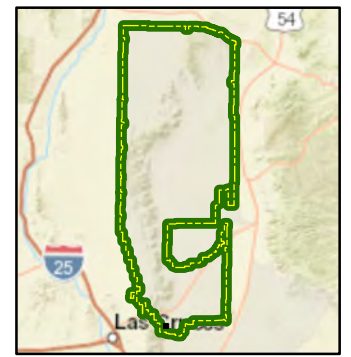
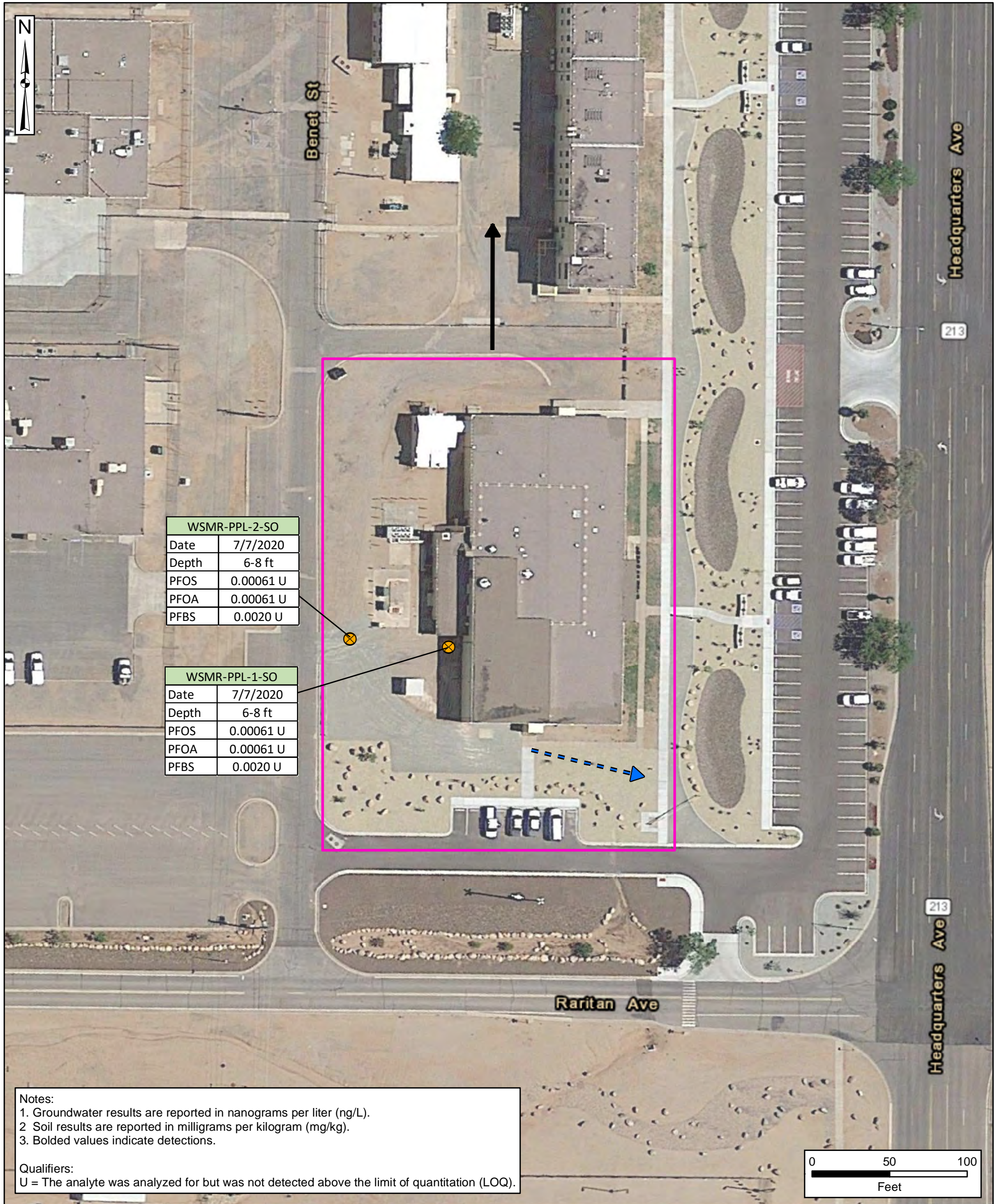


Figure 7-6
Photo Processing Lab (Building 1621) (SWMUs 1-7)
PFOS, PFOA, and PFBS Analytical Results



- Installation Boundary
 - AOPI
 - Surface Runoff Flow Direction
 - Groundwater Flow Direction
 - Soil Sampling Location (DPT Boring)
- AOPI = area of potential interest
DPT = direct push technology
ft = feet
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

Data Sources:
Google Earth, Aerial Imagery

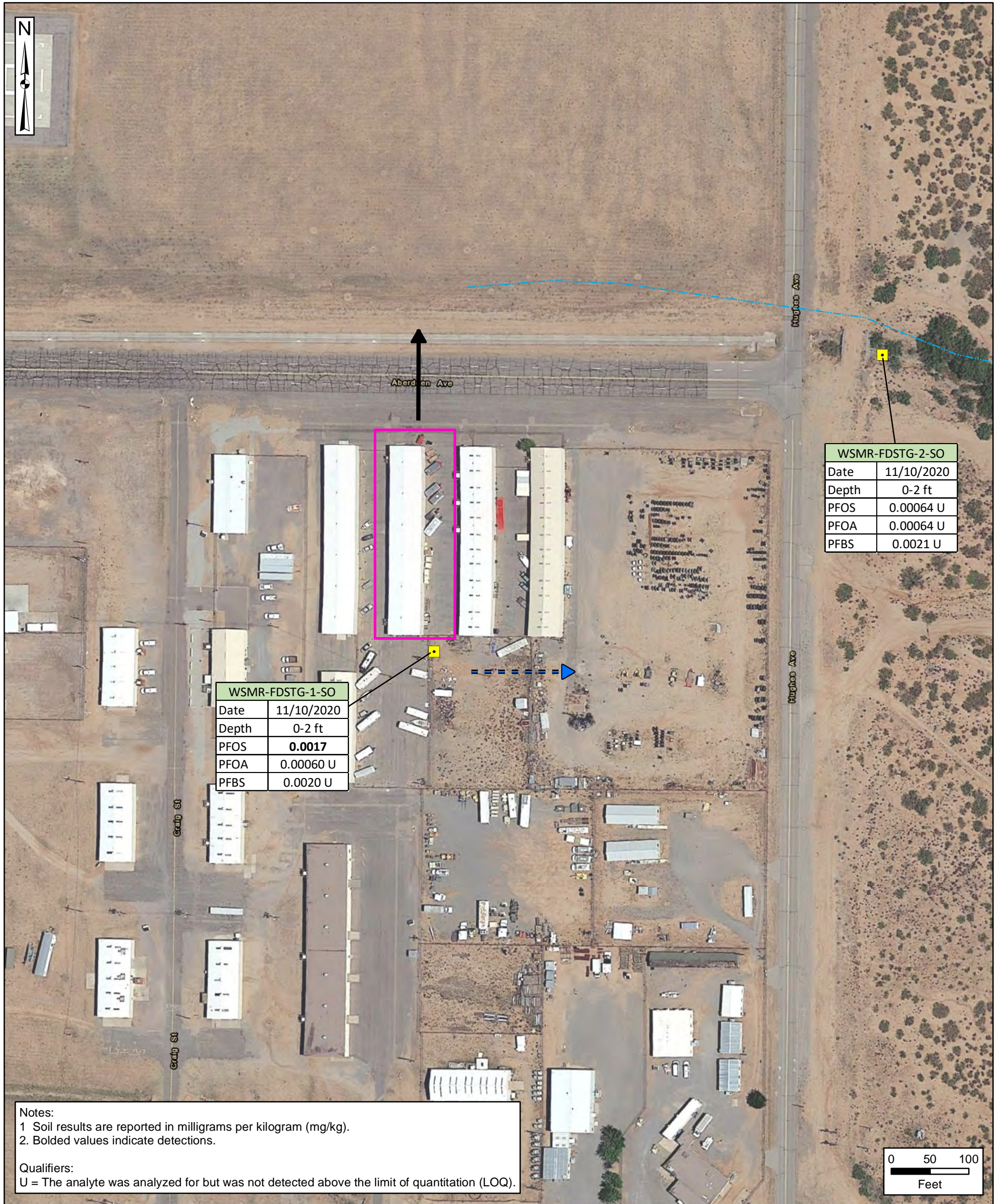
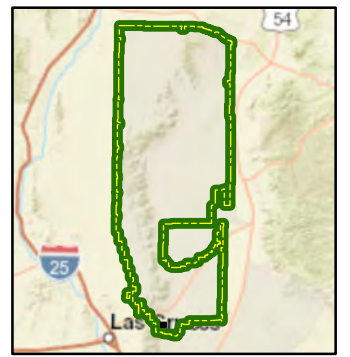
Coordinate System:
WGS 1984, UTM Zone 13 North



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Figure 7-7
Fire Department Storage Building (Building 1812)
PFOS, PFOA, and PFBS Analytical Results



WSMR-FDSTG-2-SO	
Date	11/10/2020
Depth	0-2 ft
PFOS	0.00064 U
PFOA	0.00064 U
PFBS	0.0021 U

WSMR-FDSTG-1-SO	
Date	11/10/2020
Depth	0-2 ft
PFOS	0.0017
PFOA	0.00060 U
PFBS	0.0020 U

Notes:
1. Soil results are reported in milligrams per kilogram (mg/kg).
2. Bolded values indicate detections.

Qualifiers:
U = The analyte was analyzed for but was not detected above the limit of quantitation (LOQ).

- Installation Boundary
 - AOPI
 - Surface Runoff Flow Direction
 - Groundwater Flow Direction
 - Stream (Intermittent)
 - Shallow Soil Sampling Location
- AOPI = area of potential interest
ft = feet
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

Data Sources:
Google Earth, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 13 North



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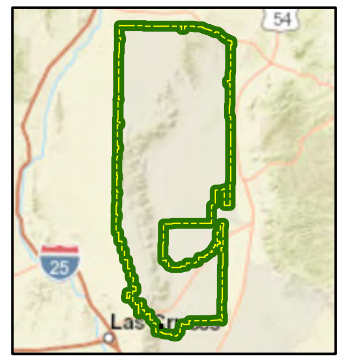
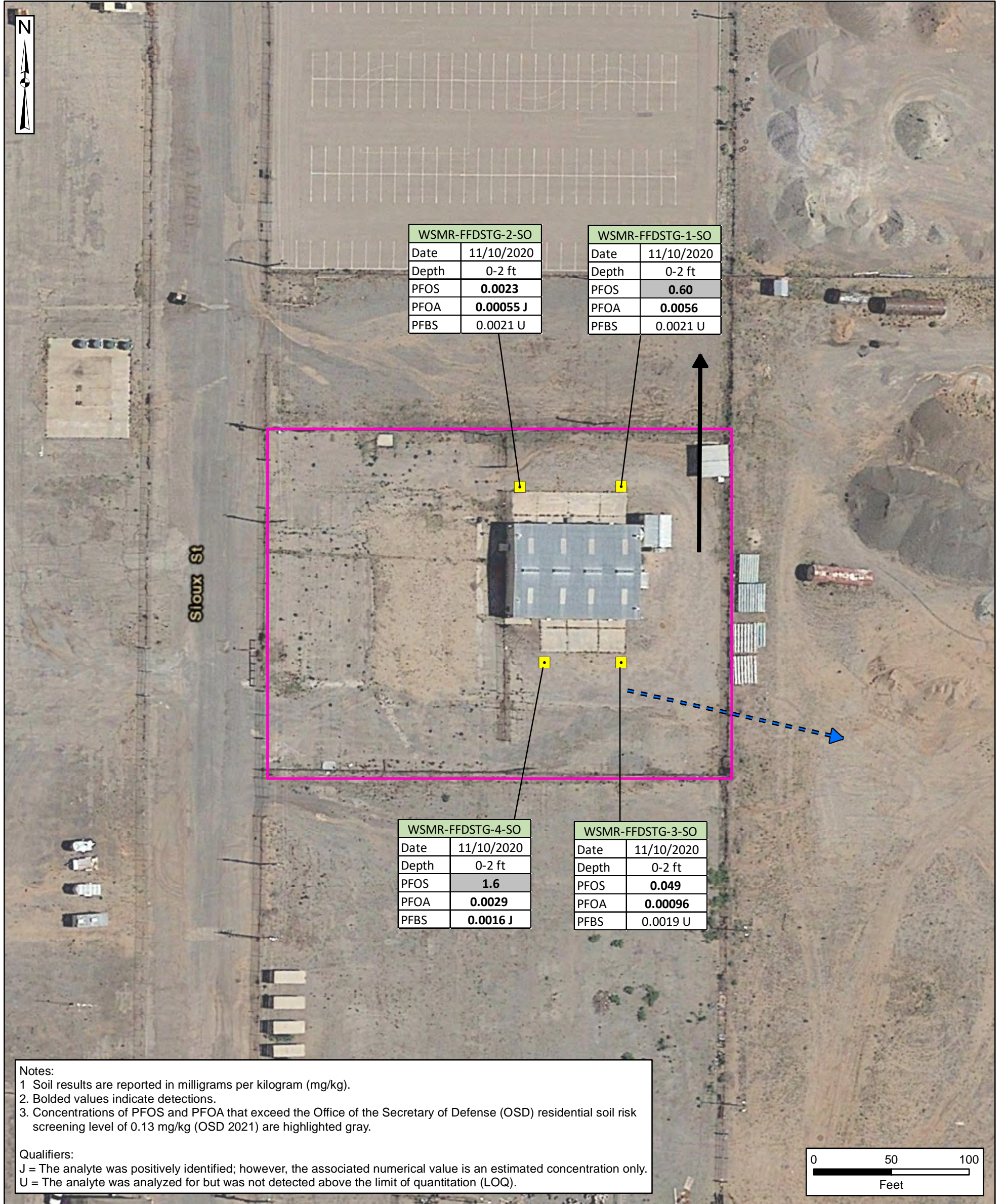


Figure 7-8
Former Fire Department Storage Building (Building 1713)
PFOS, PFOA, and PFBS Analytical Results



- Installation Boundary
- AOPI
- Surface Runoff Flow Direction
- Groundwater Flow Direction
- Shallow Soil Sampling Location

AOPI = area of potential interest
ft = feet
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

Data Sources:
Google Earth, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 13 North



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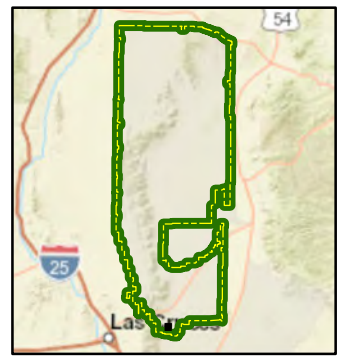
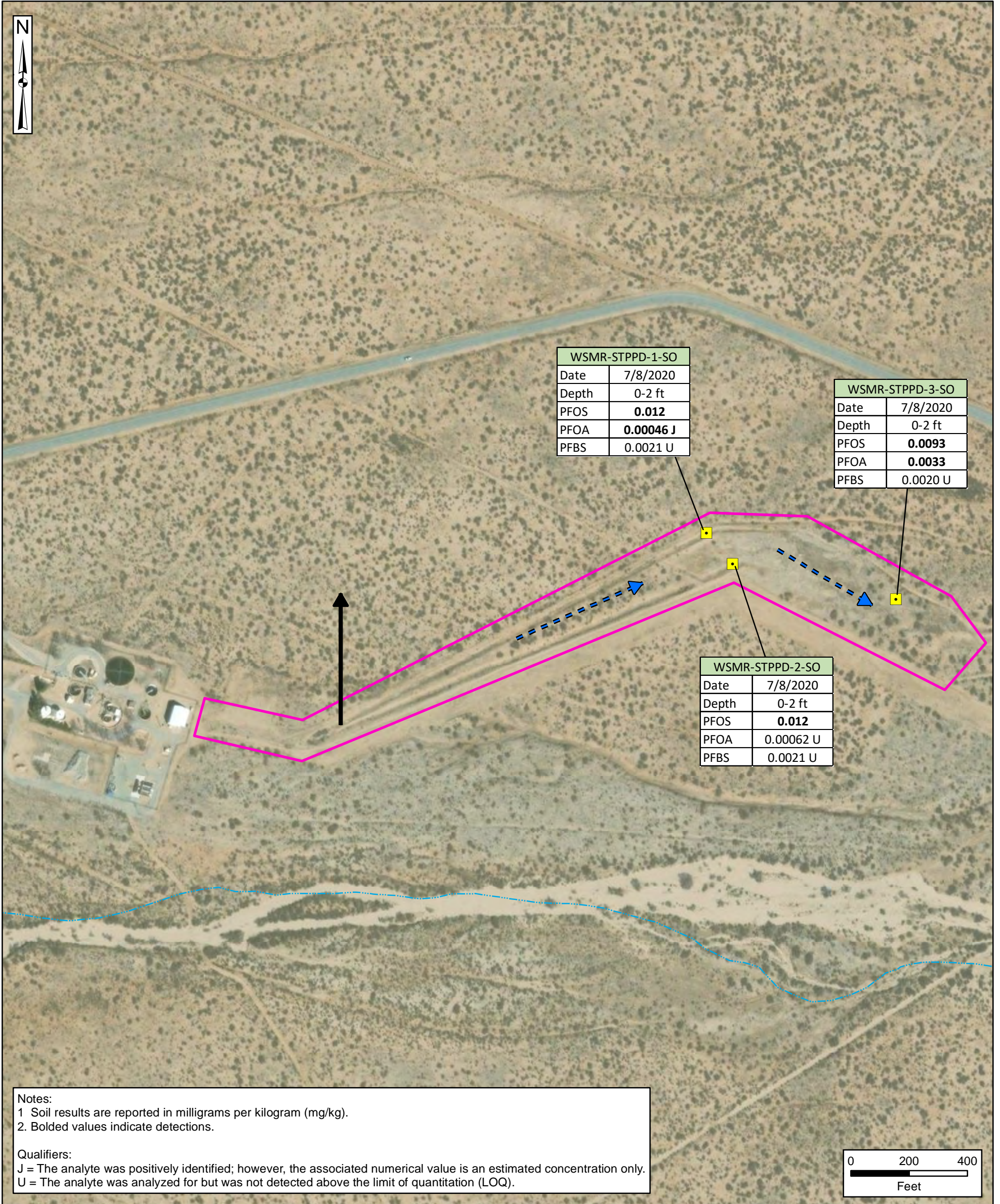


Figure 7-9
Sewage Treatment Plant Percolation Ditches and
Impoundment Area (SWMU-82)
PFOS, PFOA, and PFBS Analytical Results



Notes:
1. Soil results are reported in milligrams per kilogram (mg/kg).
2. Bolded values indicate detections.

Qualifiers:
J = The analyte was positively identified; however, the associated numerical value is an estimated concentration only.
U = The analyte was analyzed for but was not detected above the limit of quantitation (LOQ).



- Installation Boundary
 - AOPI
 - Groundwater Flow Direction
 - Stream (Intermittent)
 - Surface Runoff Flow Direction
 - Shallow Soil Sampling Location
- AOPI = area of potential interest
ft = feet
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SWMU = Solid Waste Management Unit

Data Sources:
NHD, Water Bodies, 2019
ESRI ArcGIS Online, Aerial Imagery

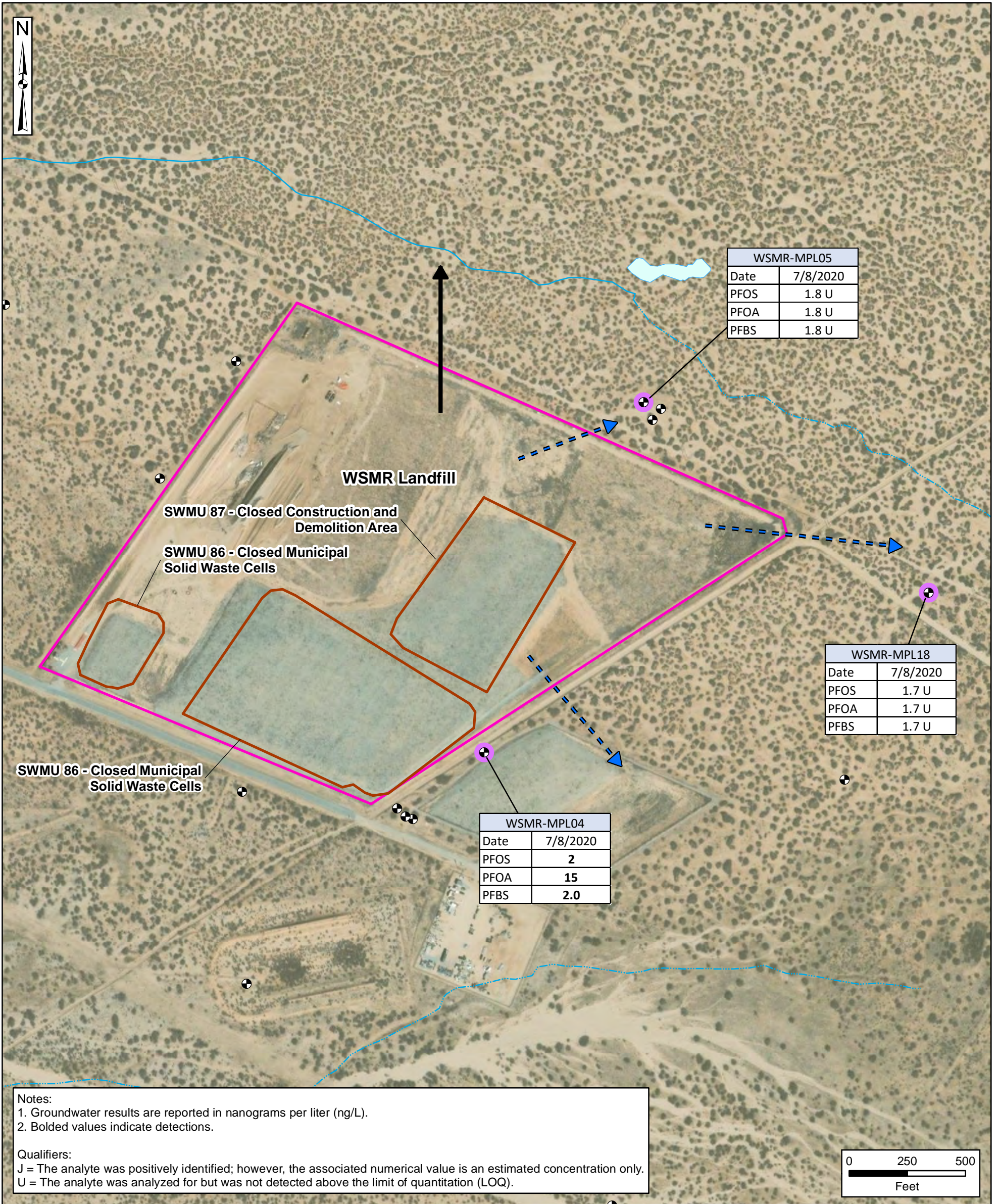
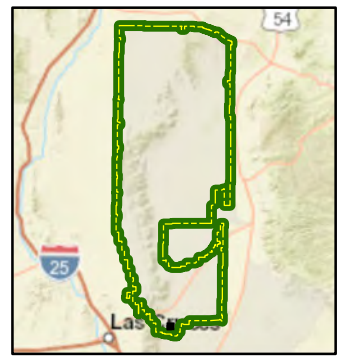
Coordinate System:
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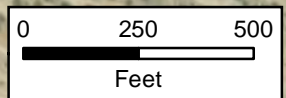


Figure 7-10
WSMR Landfill (SWMUs 86-87)
PFOS, PFOA, and PFBS Analytical Results



Notes:
1. Groundwater results are reported in nanograms per liter (ng/L).
2. Bolded values indicate detections.

Qualifiers:
J = The analyte was positively identified; however, the associated numerical value is an estimated concentration only.
U = The analyte was analyzed for but was not detected above the limit of quantitation (LOQ).



- Installation Boundary
- AOPI
- SWMU
- River/Stream (Perennial)
- Stream (Intermittent)
- Water Body
- Surface Runoff Flow Direction
- Groundwater Flow Direction
- Monitoring Well
- Groundwater Sampling Location (Existing Well)

AOPI = area of potential interest
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SWMU = Solid Waste Management Unit

Data Sources:
NHD, Water Bodies, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 13 North



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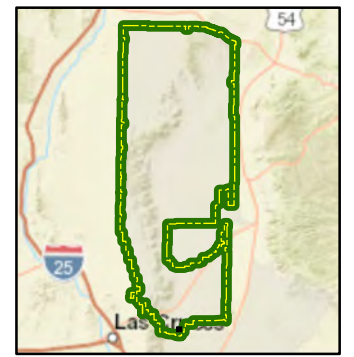
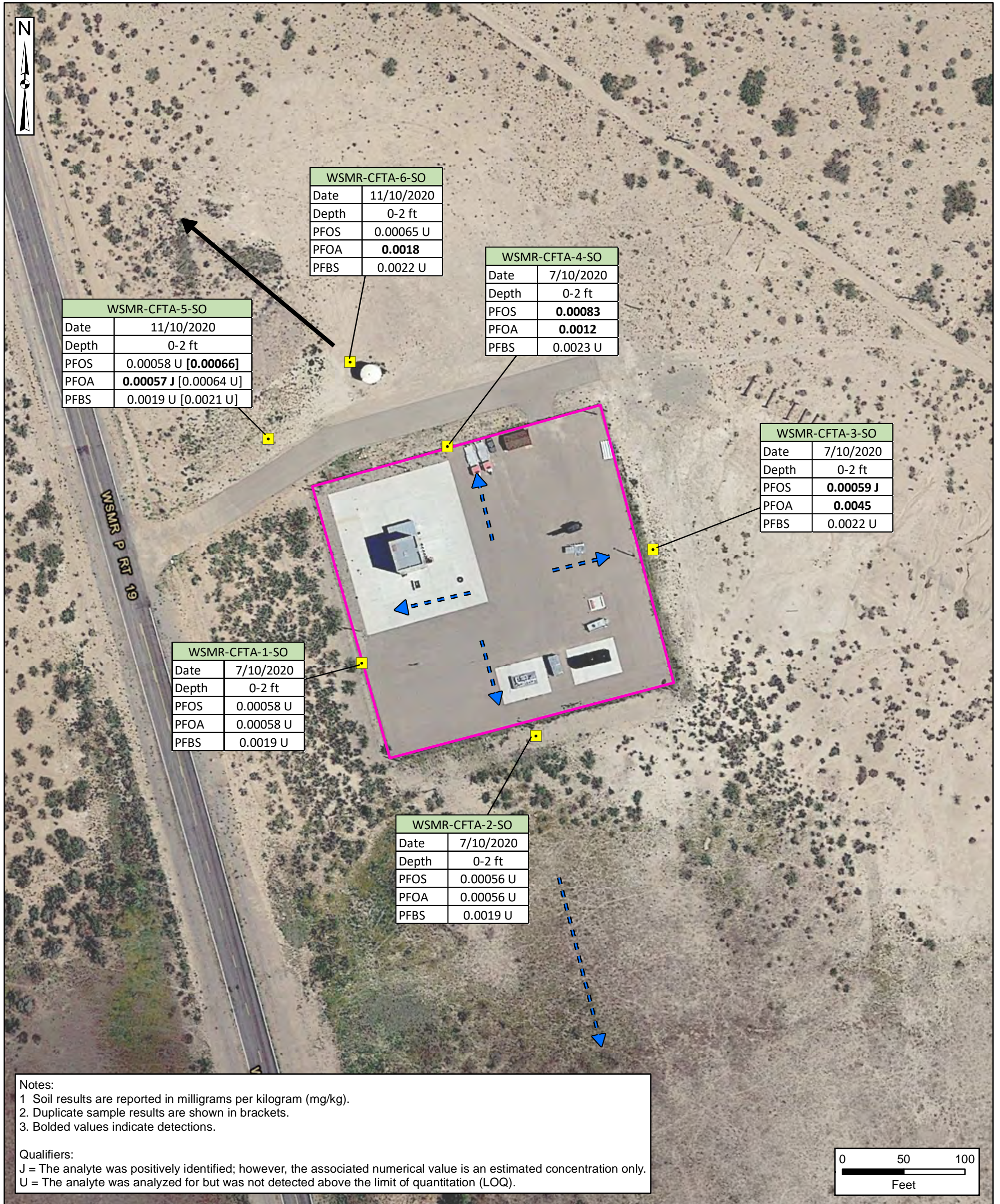


Figure 7-11
Current Firefighting Training Area (Building 21612)
PFOS, PFOA, and PFBS Analytical Results

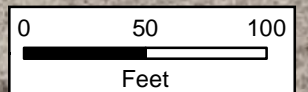


Notes:
1. Soil results are reported in milligrams per kilogram (mg/kg).
2. Duplicate sample results are shown in brackets.
3. Bolded values indicate detections.

Qualifiers:
J = The analyte was positively identified; however, the associated numerical value is an estimated concentration only.
U = The analyte was analyzed for but was not detected above the limit of quantitation (LOQ).

- Installation Boundary
- AOPI
- Surface Runoff Flow Direction
- Groundwater Flow Direction
- Shallow Soil Sampling Location

AOPI = area of potential interest
ft = feet
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate



Data Sources:
Google Earth, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 13 North



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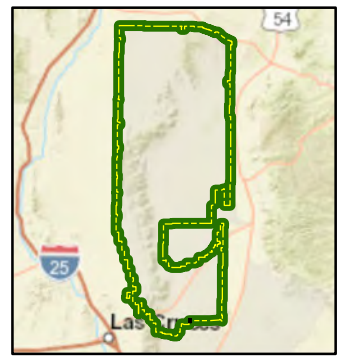
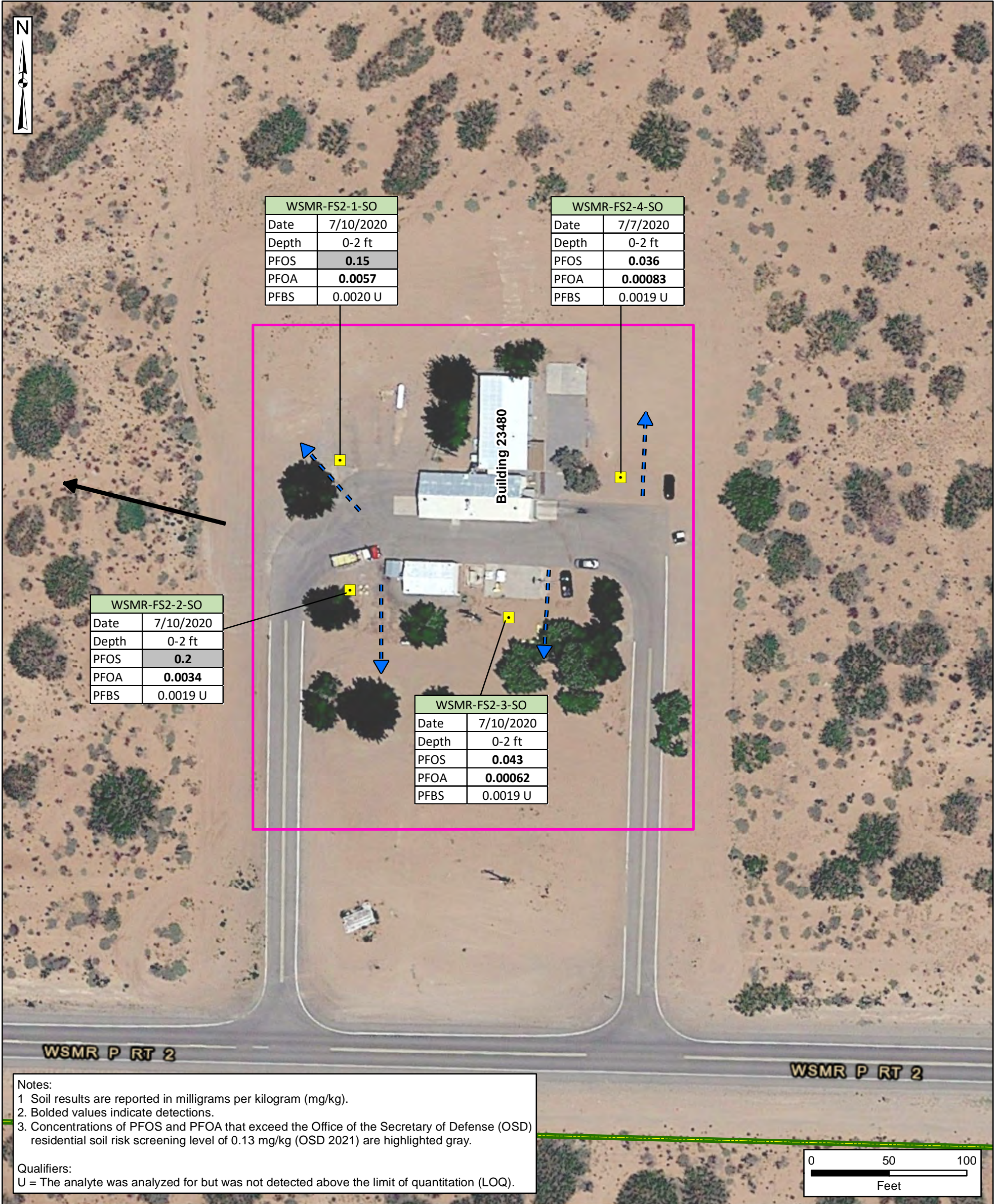


Figure 7-12
Fire Station 2 Launch Complex (Building 23480)
PFOS, PFOA, and PFBS Analytical Results



- Installation Boundary
- AOPI
- Surface Runoff Flow Direction
- Groundwater Flow Direction
- Shallow Soil Sampling Location

AOPI = area of potential interest
ft = feet
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

Data Sources:
Google Earth, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 13 North



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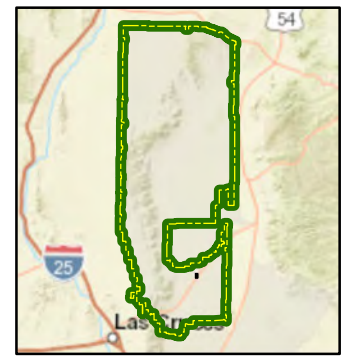
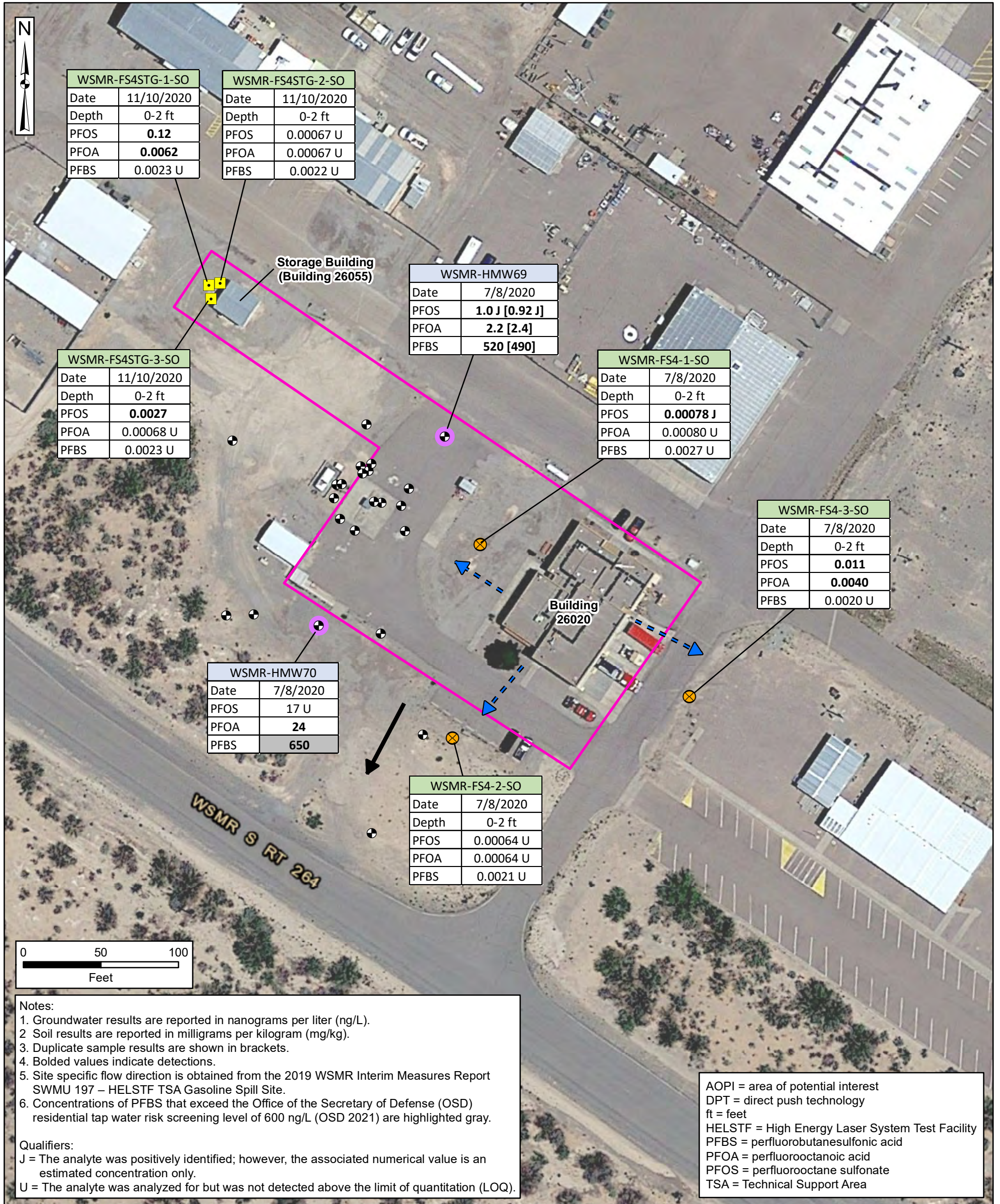


Figure 7-13
Fire Station 4 High Energy Laser System Test Facility
(Building 26020)
PFOS, PFOA, and PFBS Analytical Results



Notes:

- Groundwater results are reported in nanograms per liter (ng/L).
- Soil results are reported in milligrams per kilogram (mg/kg).
- Duplicate sample results are shown in brackets.
- Bolded values indicate detections.
- Site specific flow direction is obtained from the 2019 WSMR Interim Measures Report SWMU 197 – HELSTF TSA Gasoline Spill Site.
- Concentrations of PFBS that exceed the Office of the Secretary of Defense (OSD) residential tap water risk screening level of 600 ng/L (OSD 2021) are highlighted gray.

Qualifiers:

J = The analyte was positively identified; however, the associated numerical value is an estimated concentration only.

U = The analyte was analyzed for but was not detected above the limit of quantitation (LOQ).

AOPI = area of potential interest
DPT = direct push technology
ft = feet
HELSTF = High Energy Laser System Test Facility
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
TSA = Technical Support Area

- Installation Boundary
- AOPI
- Surface Runoff Flow Direction
- Groundwater Flow Direction
- Monitoring Well
- Shallow Soil Sampling Location
- Soil Sampling Location (DPT Boring)
- Groundwater Sampling Location (Existing Well)

Data Sources:
Google Earth, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 13 North



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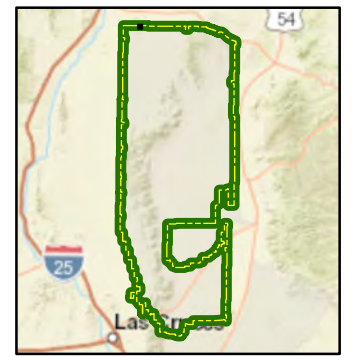
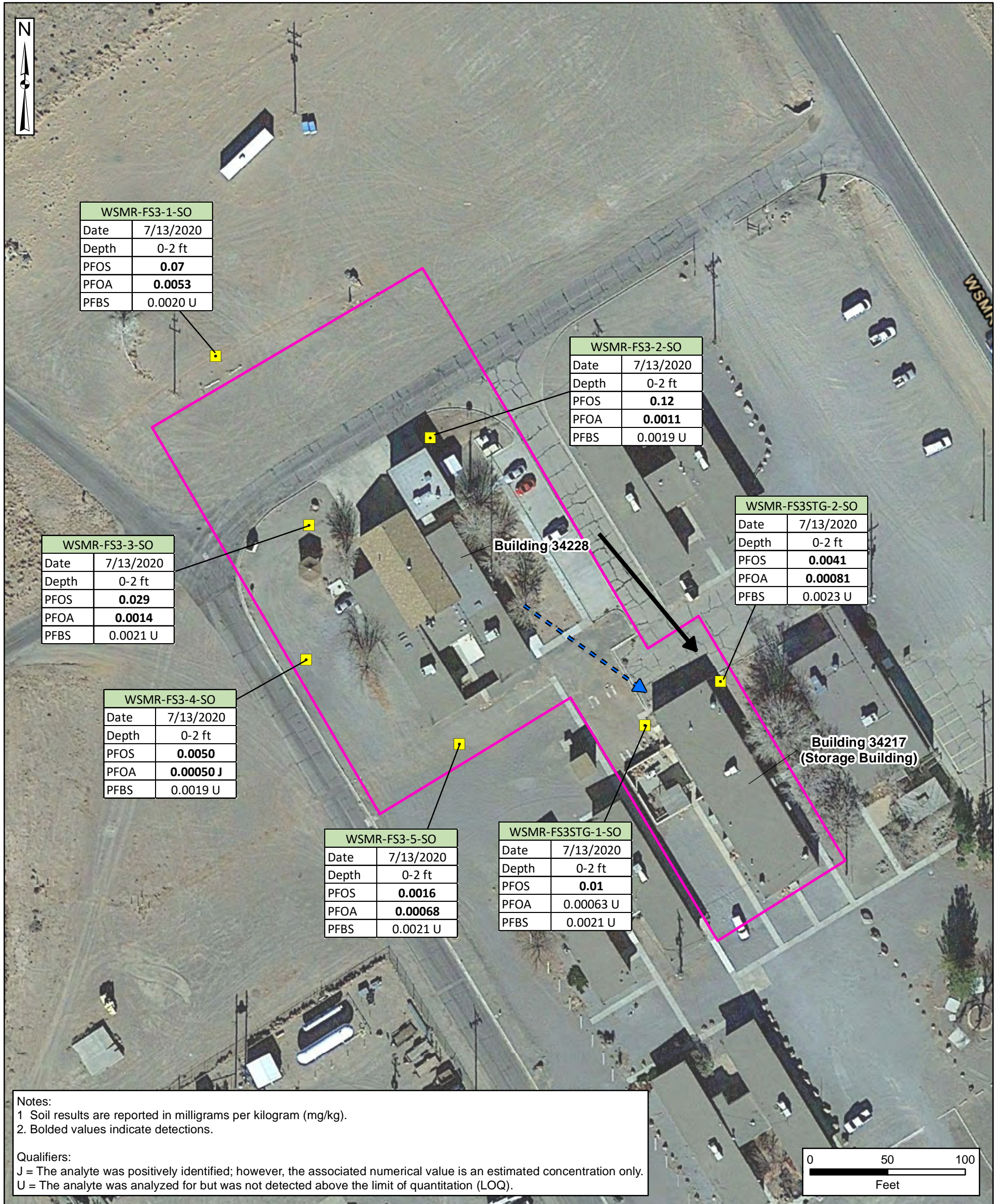


Figure 7-14
Fire Station 3 Stallion Range Center (Building 34228)
PFOS, PFOA, and PFBS Analytical Results



- Installation Boundary
- AOPI
- Surface Runoff Flow Direction
- Groundwater Flow Direction
- Shallow Soil Sampling Location

AOPI = area of potential interest
ft = feet
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

Data Sources:
Google Earth, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 13 North



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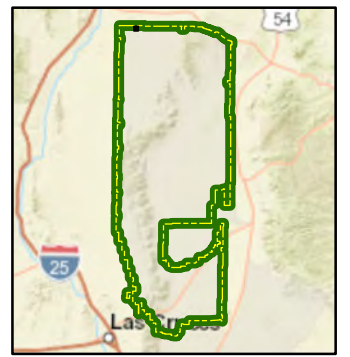
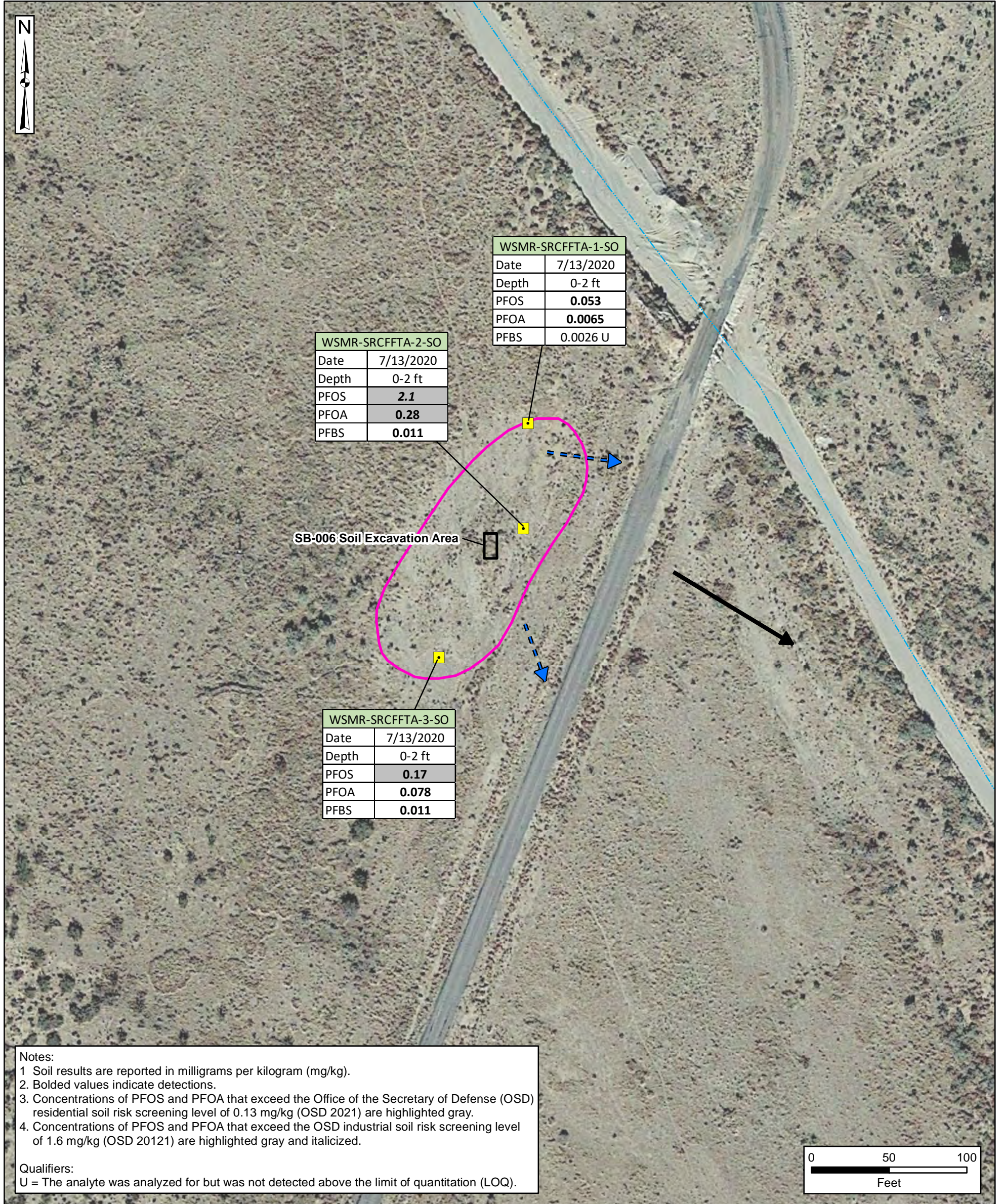









Figure 7-15
Stallion Range Center
Former Firefighting Training Area (SWMU-162)
PFOS, PFOA, and PFBS Analytical Results



-  Installation Boundary
 -  Shallow Soil Sampling Location
 -  AOPI
 -  Soil Excavation Area (2011)
 -  Stream (Intermittent)
 -  Surface Runoff Flow Direction
 -  Groundwater Flow Direction
- AOPI = area of potential interest
 ft = feet
 PFBS = perfluorobutanesulfonic acid
 PFOA = perfluorooctanoic acid
 PFOS = perfluorooctane sulfonate
 SWMU = solid waste management unit

Data Sources:
NHD, Water Bodies, 2019
Google Earth, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 13 North



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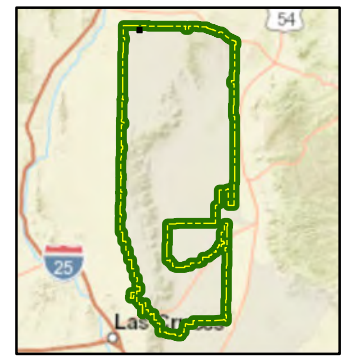
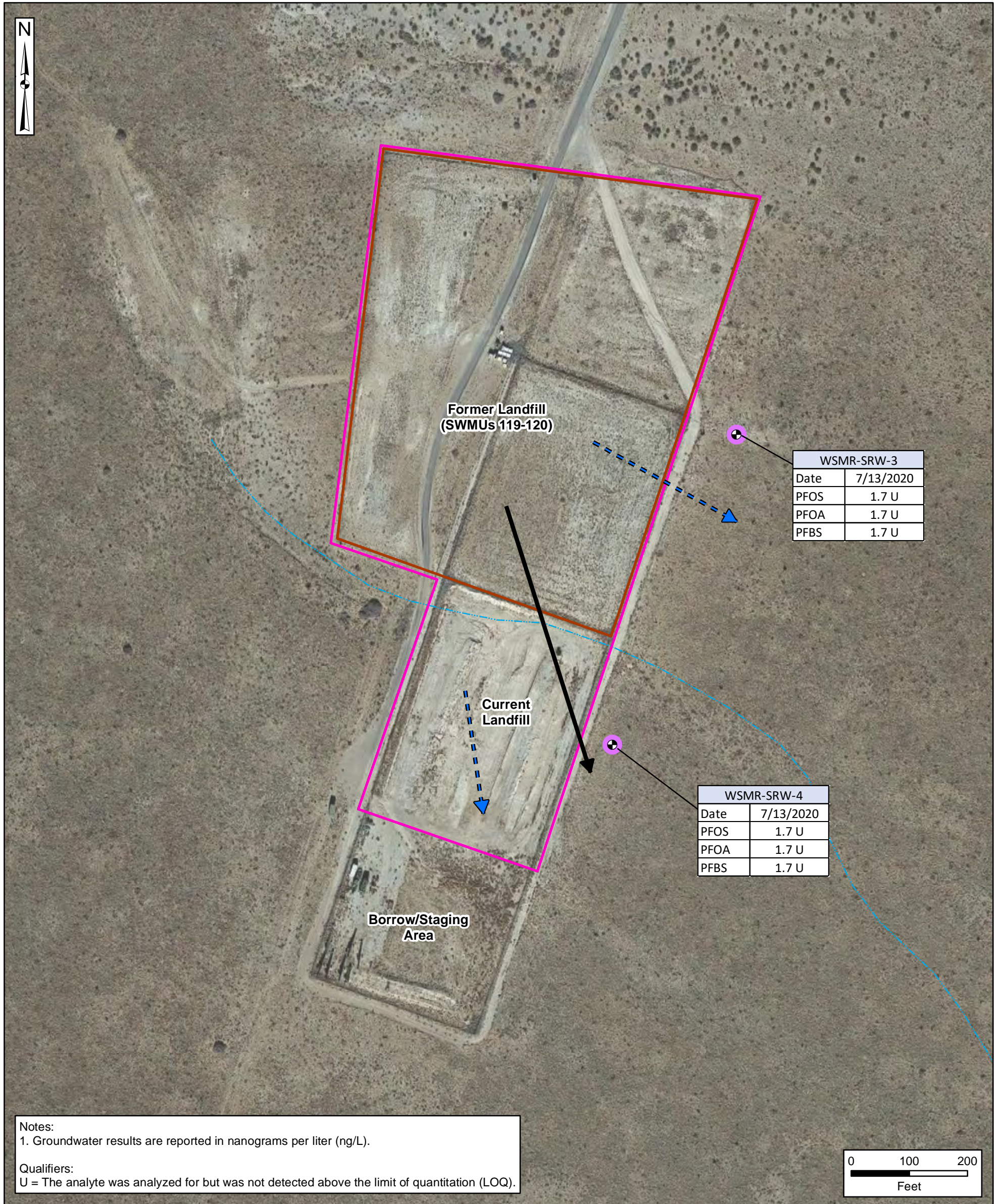


Figure 7-16
Stallion Range Center Landfill (SWMUs 119-120)
PFOS, PFOA, and PFBS Analytical Results



Notes:
1. Groundwater results are reported in nanograms per liter (ng/L).

Qualifiers:
U = The analyte was analyzed for but was not detected above the limit of quantitation (LOQ).

- Installation Boundary
 - SWMU
 - AOPI
 - Groundwater Flow Direction
 - Surface Runoff Flow Direction
 - Monitoring Well
 - Groundwater Sampling Location (Existing Well)
- AOPI = area of potential interest
 PFBS = perfluorobutanesulfonic acid
 PFOA = perfluorooctanoic acid
 PFOS = perfluorooctane sulfonate
 SRC = Stallion Range Center
 SWMU = solid waste management unit

Data Sources:
NHD, Water Bodies, 2019
Google Earth, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 13 North



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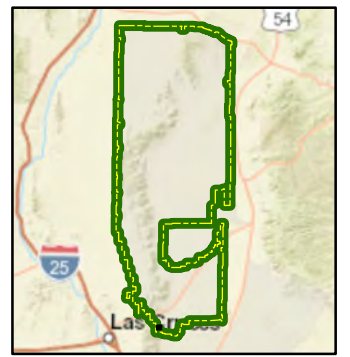
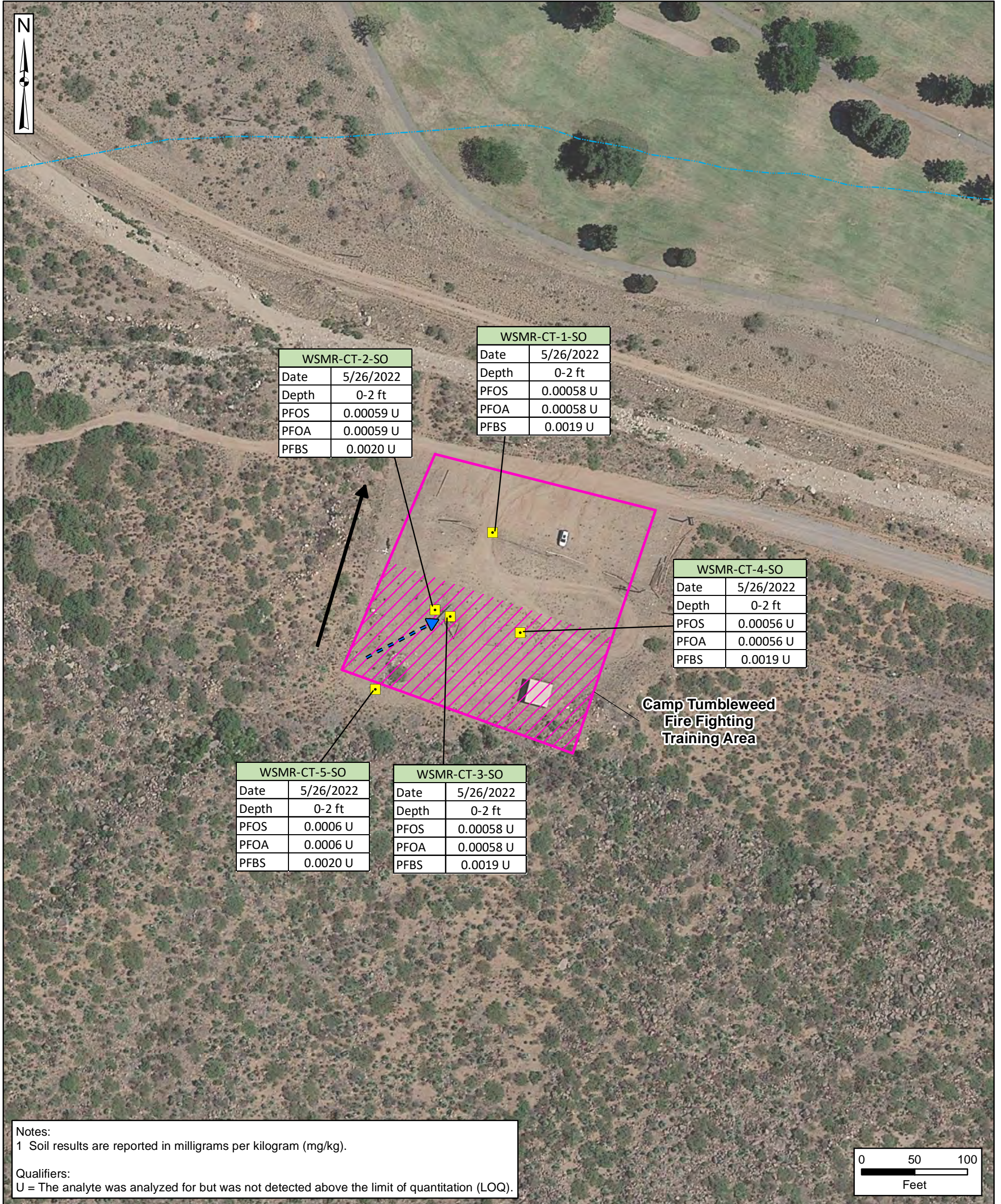
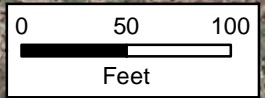


Figure 7-17
Camp Tumbleweed FTA
PFOS, PFOA, and PFBS Analytical Results



Notes:
1 Soil results are reported in milligrams per kilogram (mg/kg).

Qualifiers:
U = The analyte was analyzed for but was not detected above the limit of quantitation (LOQ).



- Installation Boundary
- Shallow Soil Sampling Location
- AOPI
- Surface Runoff Flow Direction
- Groundwater Flow Direction
- Stream (Intermittent)

AFFF = aqueous film-forming foam
AOPI = area of potential interest
ft = feet
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

Data Sources:
Google Earth, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 13 North



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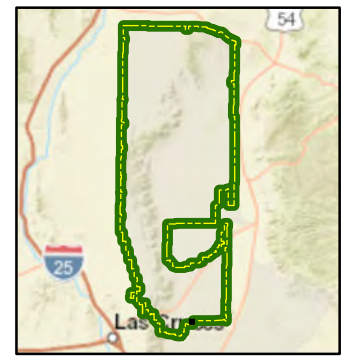
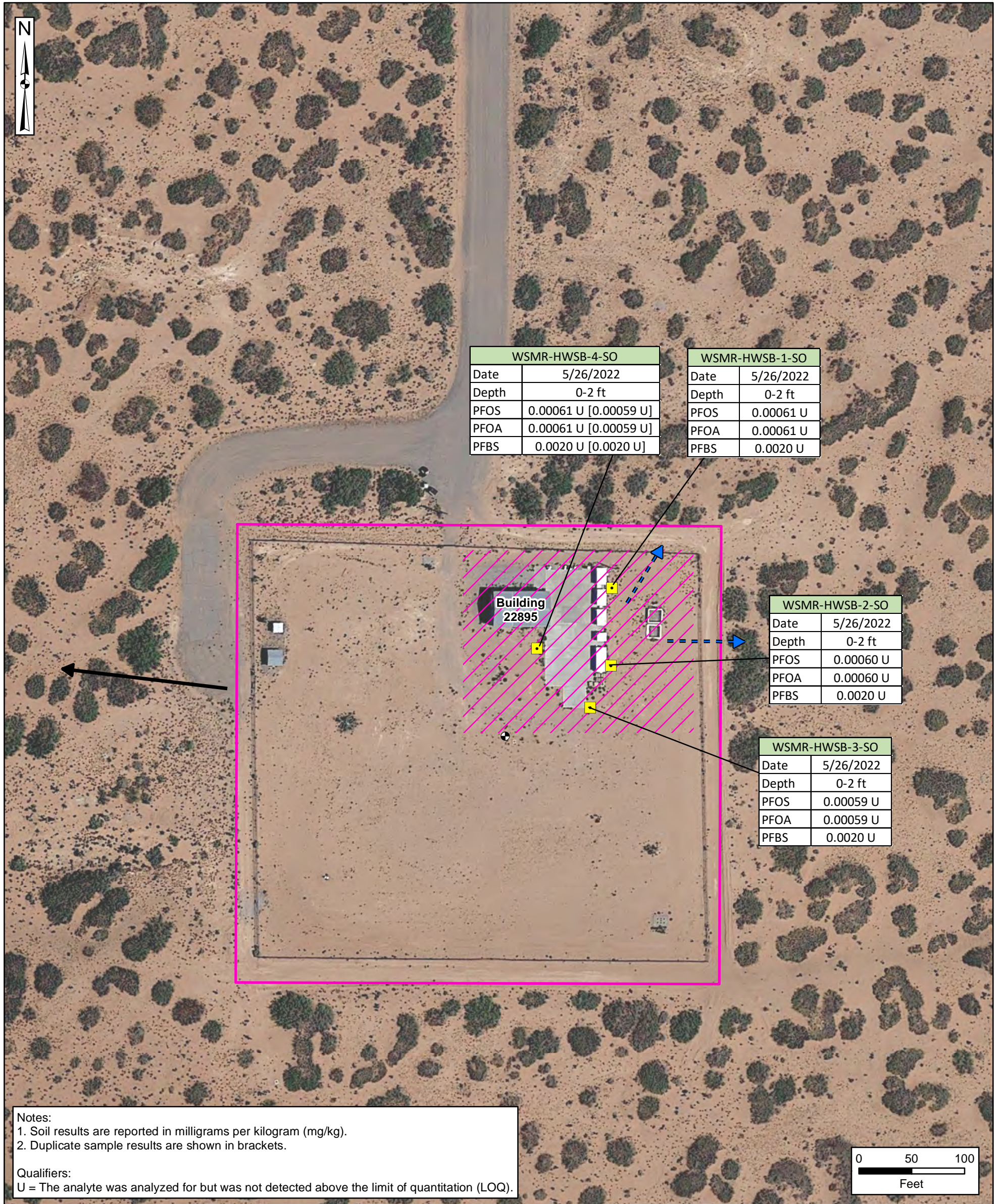
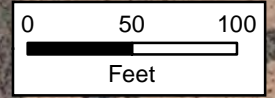


Figure 7-18
Hazardous Waste Storage Building (Building 22895)
PFOS, PFOA, and PFBS Analytical Results



Notes:
1. Soil results are reported in milligrams per kilogram (mg/kg).
2. Duplicate sample results are shown in brackets.

Qualifiers:
U = The analyte was analyzed for but was not detected above the limit of quantitation (LOQ).



- Installation Boundary
- AOPI
- Inferred AFFF Release Area
- Surface Runoff Flow Direction
- Groundwater Flow Direction
- Monitoring Well
- Shallow Soil Sampling Location

AFFF = aqueous film-forming foam
AOPI = area of potential interest
ft = feet
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

Data Sources:
Google Earth, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 13 North



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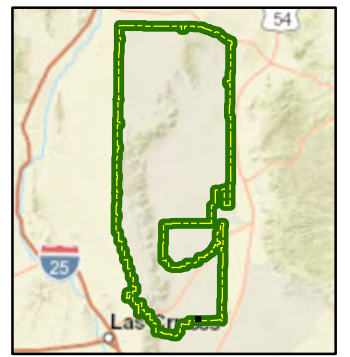
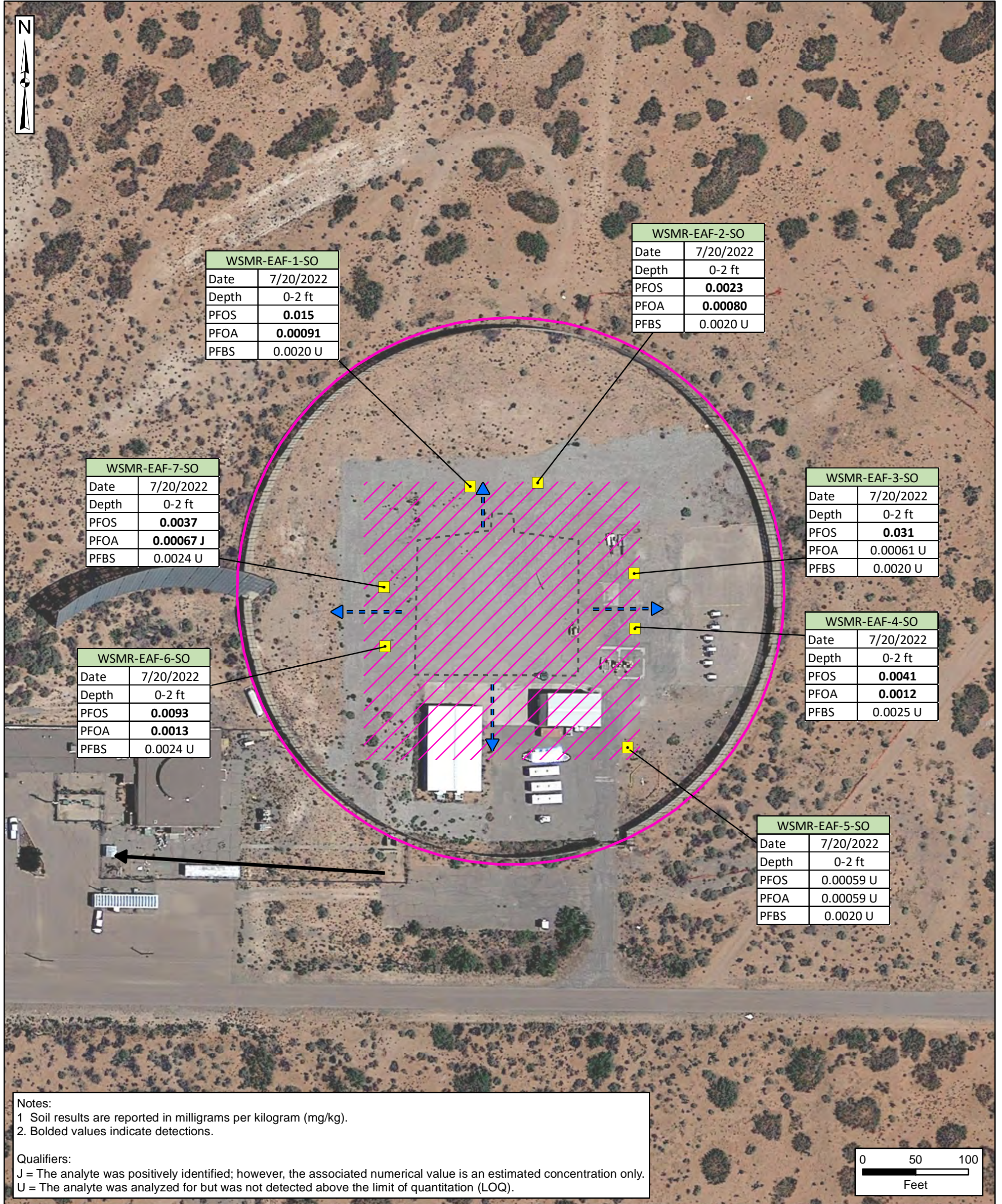


Figure 7-19
Electromagnetic Analysis Facility (Building 23628)
PFOS, PFOA, and PFBS Analytical Results



Installation Boundary

Shallow Soil Sampling Location

AOPI

AFFF Release Area

AFFF = aqueous film-forming foam
AOPI = area of potential interest
ft = feet

Former Building Footprint

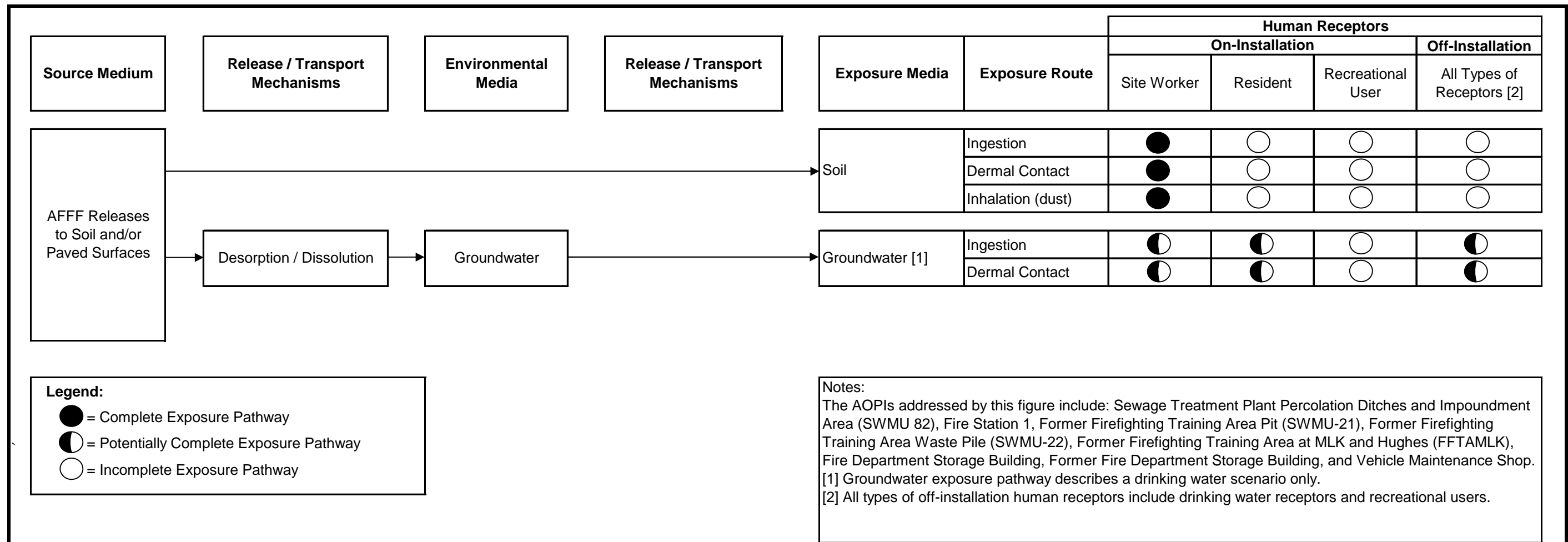
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

Surface Runoff Flow Direction

Groundwater Flow Direction

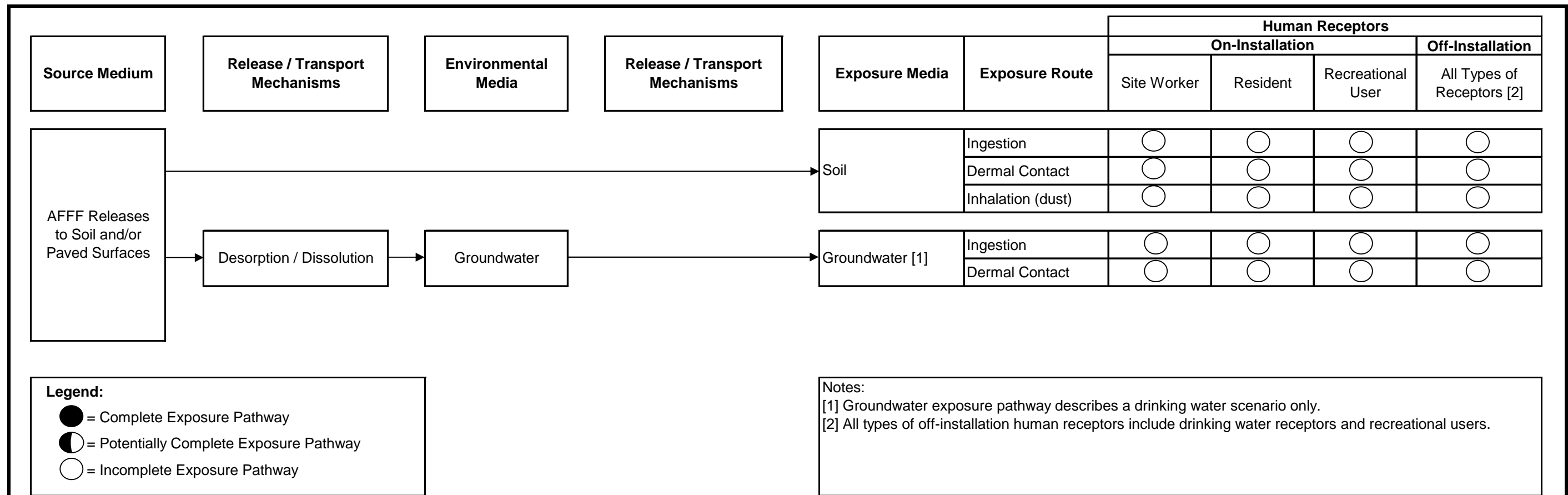
Data Sources:
Google Earth, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 13 North



Conceptual Site Model - STPPD (SWMU-82) and Seven Main Post AOPs
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 White Sands Missile Range, New Mexico

Figure 7-20



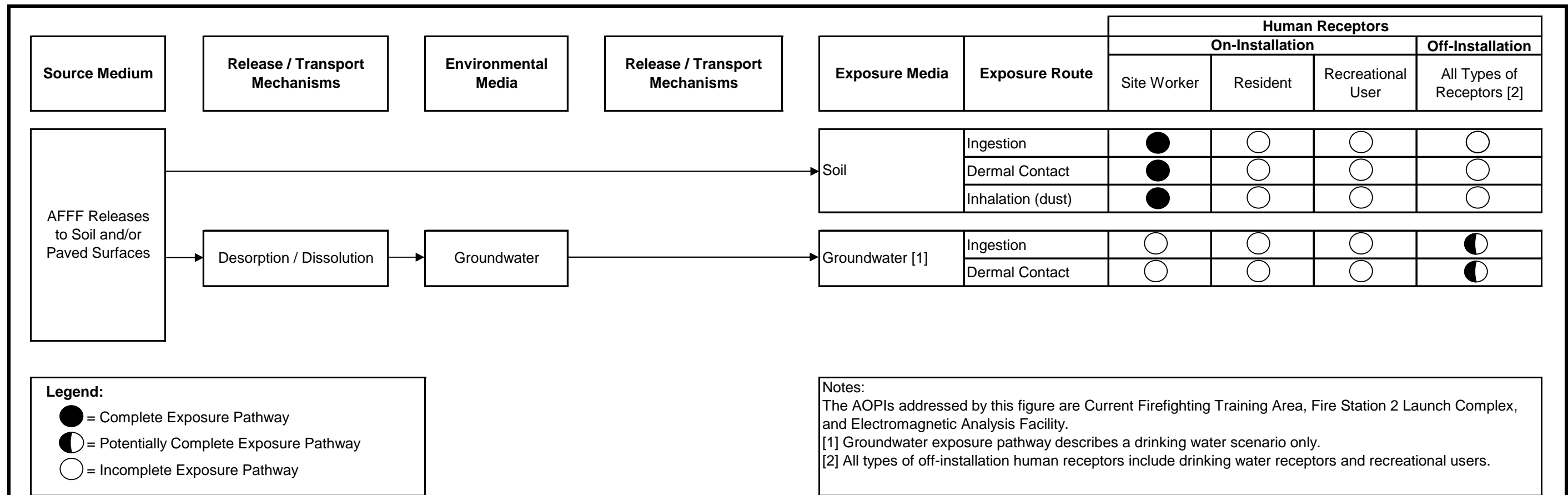
Legend:
 ● = Complete Exposure Pathway
 ◐ = Potentially Complete Exposure Pathway
 ○ = Incomplete Exposure Pathway

Notes:
 [1] Groundwater exposure pathway describes a drinking water scenario only.
 [2] All types of off-installation human receptors include drinking water receptors and recreational users.



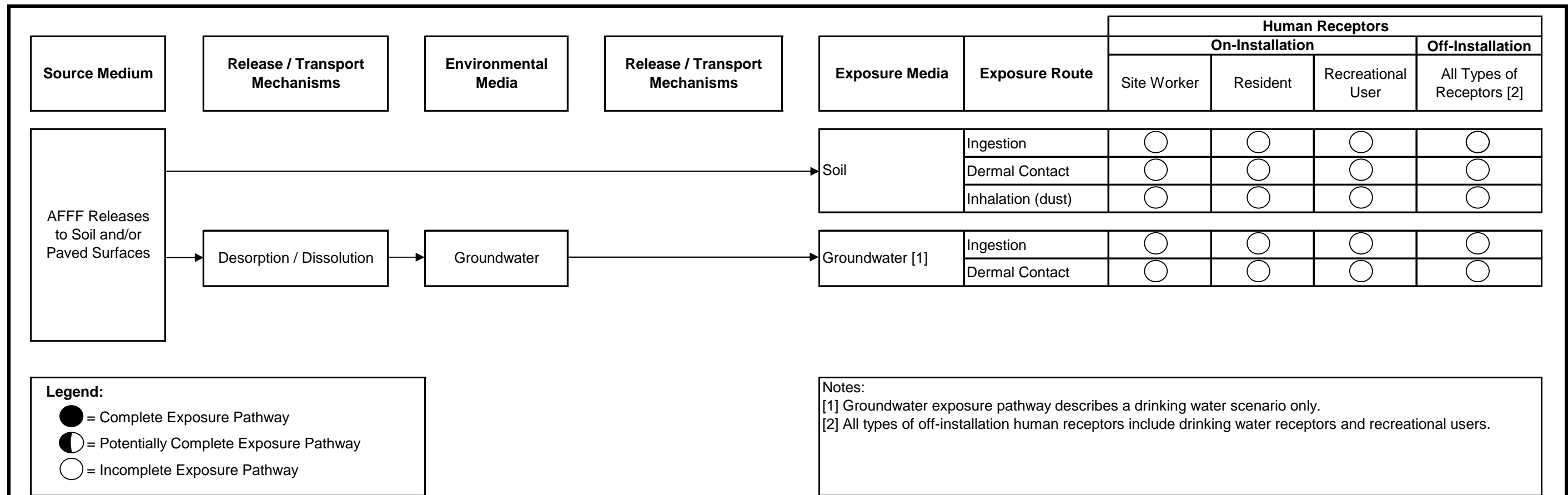
Conceptual Site Model - Photo Processing Lab (SWMU-7) and Camp Tumbleweed Fire Fighting Training Area
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Figure 7-21



Conceptual Site Model - Three AOPs East of Main Post
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Figure 7-22



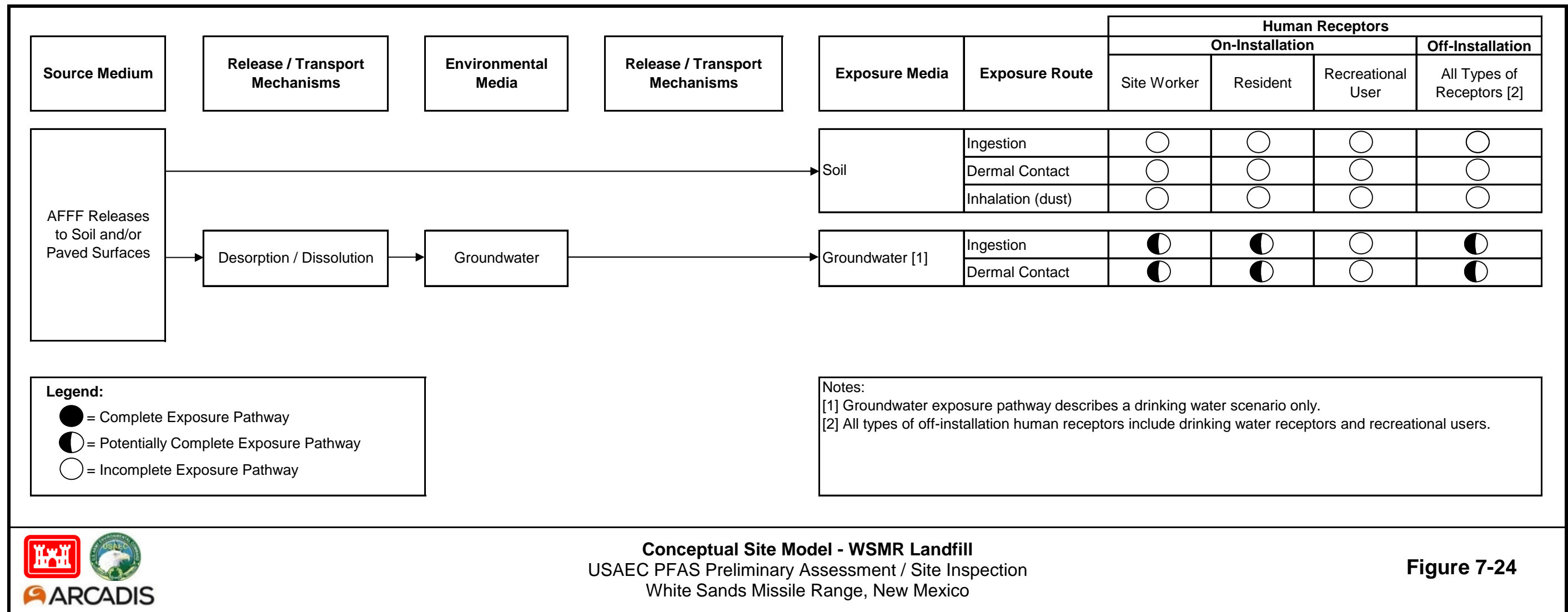
Legend:
 ● = Complete Exposure Pathway
 ◐ = Potentially Complete Exposure Pathway
 ○ = Incomplete Exposure Pathway

Notes:
 [1] Groundwater exposure pathway describes a drinking water scenario only.
 [2] All types of off-installation human receptors include drinking water receptors and recreational users.



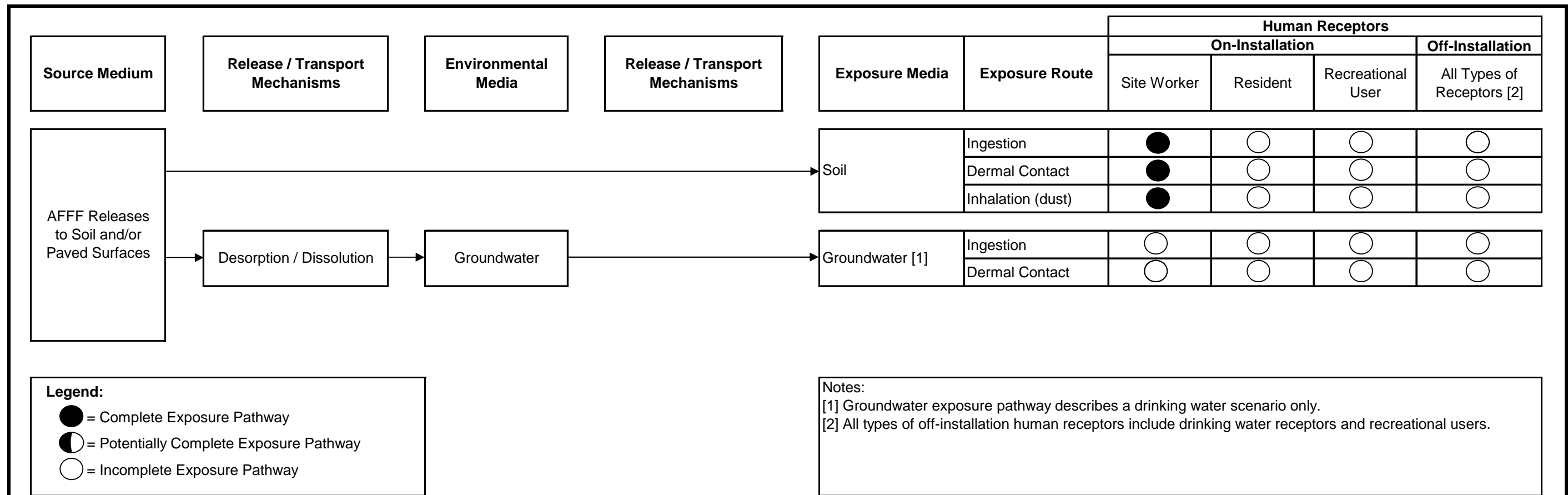
Conceptual Site Model - Hazardous Waste Storage Building
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 White Sands Missile Range, New Mexico

Figure 7-23



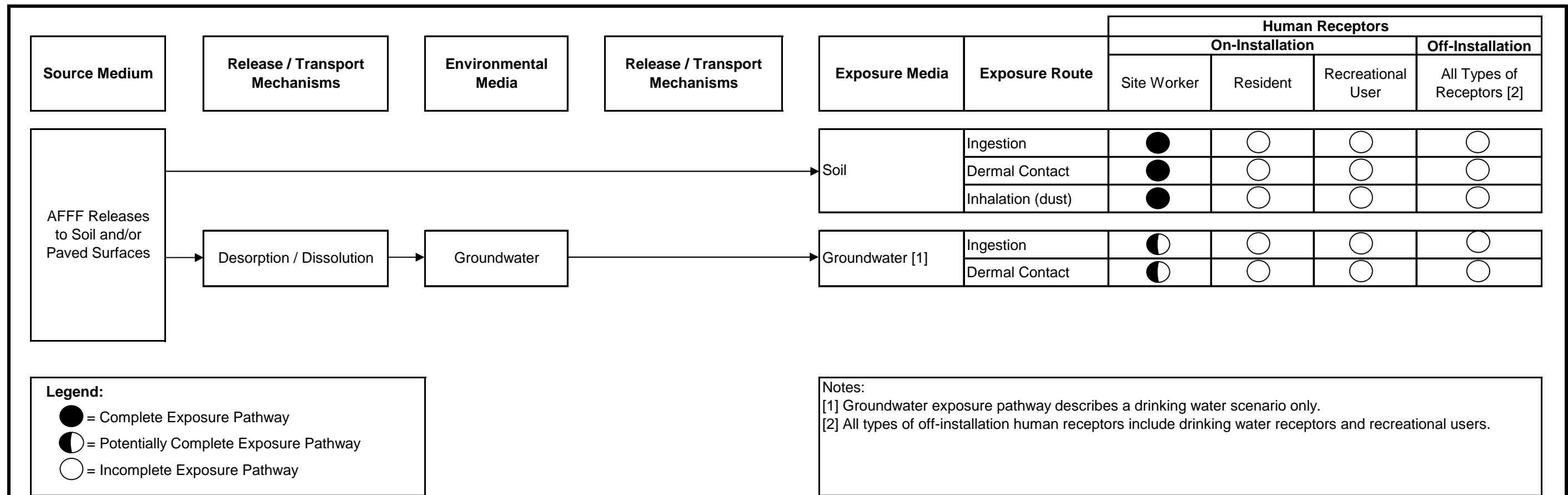
Conceptual Site Model - WSMR Landfill
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Figure 7-24



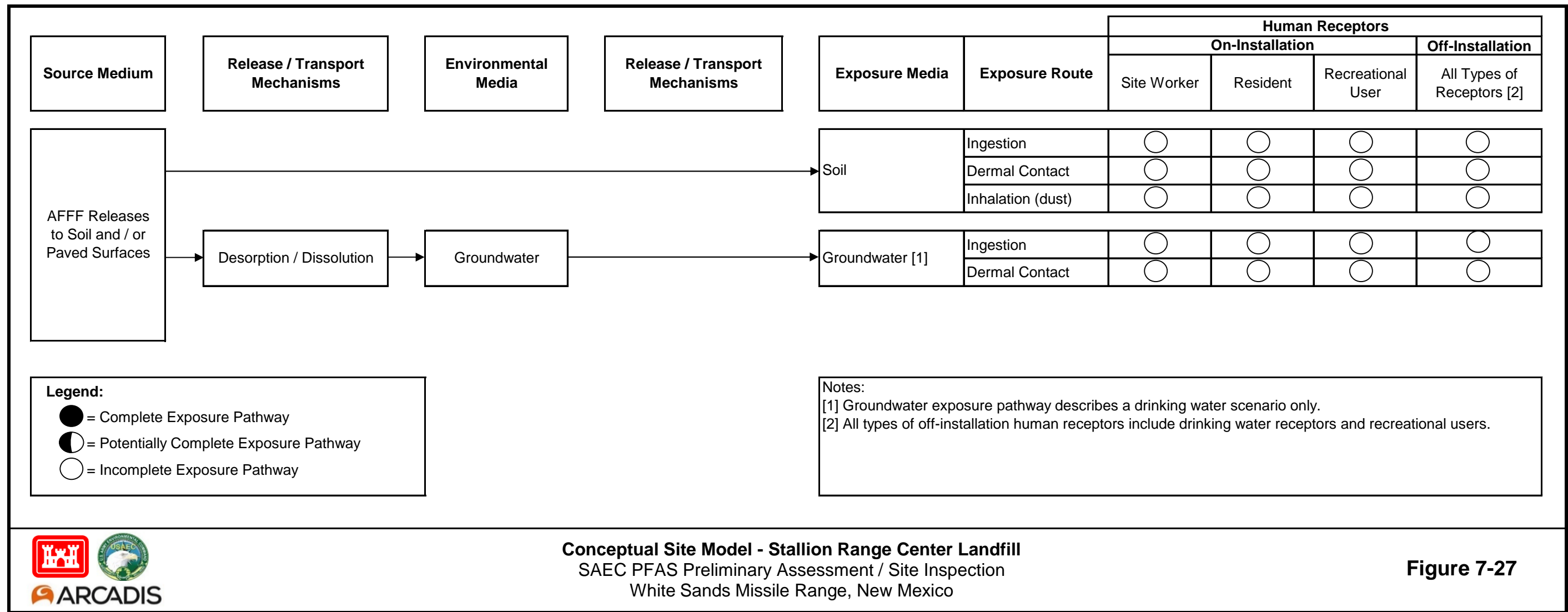
Conceptual Site Model - Fire Station 4 HELSTF (B26020)
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Figure 7-25



Conceptual Site Model - Fire Station 3 and Stallion Range Center Firefighting Training Area AOPIs
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Figure 7-26



Conceptual Site Model - Stallion Range Center Landfill
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Figure 7-27

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A decorative graphic consisting of three thin orange lines. One line is horizontal, extending across the width of the page. Two other lines are diagonal, starting from the bottom left and extending towards the top right, intersecting the horizontal line.