Final
Site Inspection Report of Aqueous Film Forming Foam Areas at Malmstrom Air Force Base Great Falls, Montana

August 2018

Submitted to:

Air Force Civil Engineer Center
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San Antonio, Texas 78226-2018

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under
Contract No. W9128F-15-D-0051
Delivery Order No. 0003

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Acronyms and Abbreviations

µg/kg	micrograms per kilogram
µg/L	micrograms per liter
AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
AFFF	aqueous film forming foam
amsl	above mean sea level
ASL	Aerostar SES LLC
B	analyte detected in blank sample
bgs	below ground surface
CAS	Chemical Abstract Service
CRTC	Combat Readiness Training Center
CSM	conceptual site model
DOT	Department of Transportation
EPA	Environmental Protection Agency
ERP	Environmental Restoration Program
FTA	fire training area
EZ	exclusion zone
HA	health advisory
HDPE	High-density polyethylene
HDR	HDR Engineering, Inc.
ID	identification
IDW	investigation-derived waste
IRP	Installation Restoration Program
J	estimated value
MDL	method detection limit
mg/kg	milligrams per kilogram
MW	missile wing
NL	not listed
OWS	oil/water separator
PA	preliminary assessment
PFAS	per- and polyfluorinated alkyl substances
PFBS	perfluorobutane sulfonate
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
PVC	polyvinyl chloride
pH	potential of hydrogen
QAPP	quality assurance project plan
QC	quality control
RSL	Regional Screening Level
SI	site inspection
TCLP	toxicity characteristic leaching procedure
TOC	total organic carbon
U	analyte not detected
U.S.	United States
USACE	U.S. Army Corps of Engineers
USAF	U.S. Air Force
USCS	Unified Soil Classification System
USDA	U.S. Department of Agriculture

1.0 INTRODUCTION

Aerostar SES LLC (ASL), under contract to the U.S. Army Corps of Engineers (USACE) Omaha District (Contract No. W9128F-15-D-0051, Deliver Order No. 0003), conducted screening-level site inspections (SIs) at six areas at Malmstrom Air Force Base (AFB), Cascade County, Montana (Figure 1, Appendix A). The purpose of the inspection is to determine the presence or absence of perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) in the environment at this area. The SI was conducted in accordance with contract requirements (USACE, July 2015), the quality assurance project plan (QAPP) (ASL, March 2016), and the Malmstrom AFB site-specific addendum to the QAPP (ASL, September 2016). The QAPP and QAPP addendum were prepared in accordance with United States (U.S.) Environmental Protection Agency (EPA) guidance (EPA, March 2012) and Air Force Civil Engineer Center (AFCEC) requirements.

PFOA and PFOS are in a class of synthetic fluorinated chemicals used in industrial and consumer products, including defense-related applications. This class of compounds is also referred to as per- and polyfluorinated alkyl substances (PFAS). In 1970, the U.S. Air Force (USAF) began using aqueous film forming foam (AFFF)—firefighting agents containing PFOA and PFOS—to extinguish petroleum fires. Releases of AFFF to the environment routinely occur during fire training, equipment maintenance, storage, and use. Although manufacturers have reformulated AFFF to eliminate PFOS, the U.S. EPA continues to permit the use of PFOS-based AFFF, and the USAF maintains a significant inventory of PFOS-based AFFF. As of this report, the USAF is actively removing PFOS-based AFFF from its inventory and replacing it with formulations based on shorter carbon chains, which may be less persistent and bioaccumulative in the environment.

The objectives of the SIs were to

- determine if a confirmed release of PFOS and PFOA has occurred at the area selected for inspection,
- determine if PFOS and PFOA are present in groundwater or surface water at the inspection area at concentrations exceeding the EPA lifetime health advisory (HA) for drinking water,
- determine if PFOA and PFOS are present in soil or sediment at the inspection area at concentrations exceeding calculated screening levels, and
- Identify potential receptor pathways with immediate impacts to human health (immediate impact to human health is considered consumption of drinking water with PFOS/PFOA above the HA, or PFBS above the Regional Screening Level [RSL]).

Following the QAPP addendum issuance in September 2016, EPA published a Regional Screening Level (RSL) calculator that was used to calculate new screening levels, using a target hazard quotient of 0.1, for PFOS and PFOA in soil and sediment. Appendix B presents the RSL calculations for soil and sediment based on a Tier 3 toxicity value reference dose of 0.00002 mg/kg/day derived by EPA in their “Drinking Water Health Advisory” for both PFOA and PFOS (EPA, May 2016c). Screening levels for PFOS and PFOA in groundwater and surface water are based on EPA lifetime drinking water HAs for PFOA (EPA, May 2016a) and PFOS (EPA, May 2016b). A release will be considered confirmed when exceedances of the following concentrations are identified:

PFOS:

- 0.07 micrograms per liter (µg/L) in groundwater/surface water (combined with PFOA value).
- 126 micrograms per kilogram (µg/kg) in soil/sediment (calculated RSL).

PFOA:

- 0.07 µg/L in groundwater/surface water (combined with PFOS value).
- 126 µg/kg in soil/sediment (calculated RSL).

Although PFOS and PFOA are the focus of the HA and provide specific targets for the USAF to address in this SI, EPA has also derived RSLs for perfluorobutane sulfonate (PFBS), for which there is a Tier 2 toxicity value (Provisional Peer Reviewed Toxicity Value) (EPA, May 2016c). The USAF also considers a release to be confirmed when exceedances of the following concentrations are identified:

PFBS:

- 40 µg/L in groundwater/surface water.
- 130,000 µg/kg in soil/sediment.

To better facilitate reporting and discussion of the investigation, sampling, and analysis of PFOA/PFOS/PFBS in this report, these compounds are hereafter referred to collectively as PFAS.

Table 1 presents the screening values used for comparing the analytical results for each of the PFAS compounds.

Table 1 Regulatory Screening Values

Parameter	Chemical Abstracts Number	EPA Regional Screening Level Table (May 2018) [a]		Calculated Screening Levels for Soil and Sediment[b] (µg/kg)	EPA Health Advisory for Drinking Water (Surface Water or Groundwater) (µg/L) [c]
		Residential Soil (µg/kg)	Tap Water (µg/L)		
Perfluorobutane sulfonate (PFBS)[e]	375-73-5	130,000	40	NL	NL
Perfluorooctanoic acid (PFOA)	335-67-1	NL	NL	126	0.07[d]
Perfluorooctane sulfonate (PFOS)	1763-23-1	NL	NL	126	

[a] EPA Regional Screening Levels (May 2018) (https://semspub.epa.goc/work/HQ/197235.pdf).
[b] Screening levels were calculated using the EPA RSL calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).
[c] EPA, May 2016a. *Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS).* EPA, May 2016b. *Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA).*
[d] When both PFOA and PFOS were present, the combined concentrations of PFOA and PFOS were compared with the 0.07 µg/L health advisory level.
[e] PFBS screening was added by AFCEC after the QAPP addendum (ASL, September 2016) was issued.
µg/kg = micrograms per kilogram µg/L = micrograms per liter
EPA = Environmental Protection Agency NL = not listed

This report only addresses potential human exposure risks, not ecological exposure risks from PFAS impacts to the environment. Assessment of ecological risk was not included in the scope of this project due in part to a lack of appropriate PFAS reference values/target species. Ecological exposure pathways, receptors, and risk may be evaluated during follow-on investigations.

AFFF areas were selected for further inspection through the SI process at Malmstrom AFB during the preliminary assessment (PA) phase and documented in the PA report (CH2M Hill, April 2015). The PA

recommended four sites (Historical Fire Training Area, CT-117 Crash, Outfall 1, and Outfall 3) for an SI. However, since both Hangar 1440 and the fire station have known AFFF releases, they are included in this SI. The six areas selected for SI and the rationale for inclusion are listed in Table 2 and shown on Figure 2 (Appendix A). Media evaluated included surface soil (0 to 6 inches in depth), subsurface soil (collected in the vadose zone immediately above the water saturated/unsaturated soil interface), groundwater, and surface water/sediment (as applicable). Unless otherwise noted, this SI was conducted in accordance with the QAPP (ASL, March 2016) and the Malmstrom AFB site-specific addendum to the QAPP (ASL, September 2016). AFCEC added the requirement to screen for PFBS at all bases in this project after the QAPP addendum had been finalized.

Table 2 Aqueous Film Forming Foam Areas and Selection Rationale

AFFF Area	AFFF Inspection Areas	Associated Existing ERP Site	Area Selection Rationale
1	Historical Fire Training Area and Old Taxiway Land Farm	FT-01 & SS-22	FT-01, a former FTA with a 30-year history of operation, was remediated in 1997. The unlined FTA had a history of leaded fuel use along with firefighting activities, including the use of AFFF. Soils from FT-01 were removed as part of a remedial activity in 1997 and land farmed at the Old Taxiway Land Farm area; no sampling was performed for PFAS.
2	Canadian Snowbirds CT-117 Crash and Soil Placement Area	New Site	While practicing for an air show, a Canadian Forces Snowbirds Air Demonstration jet crashed near the current FTA. Base response included a single firefighting truck containing 30 gallons of AFFF concentrate. Remediation was managed by the Royal Canadian Air Force. Based on an interview with the Restoration Program Manager, some soil excavation and offsite disposal was conducted, but no sampling was performed for PFAS (CH2M Hill, 2015).
3	Outfall 1	New Site	Outfall 1 is the discharge point for Watershed 1 and includes Hangar 1440, which historically pushed AFFF outside onto the apron where the AFFF was allowed to dissipate and drain into stormwater drop inlets nearby (CH2M Hill, 2015).
4	Outfall 3	New Site	Outfall 3 is the discharge point for Watershed 3 and Fire Station Building 349, which had a 600-gallon AFFF spill in the late 1990s when an AFFF trailer parked outside was backed into, causing the entire contents to drain into a nearby stormwater drop inlet. Routine fire response vehicle spray testing was also conducted on the apron outside Fire Station (Building 349), which drained into stormwater drop inlets leading to Outfall 3 (CH2M Hill, 2015).
5	Hangar 1440	New Site	Based on personnel interviews, periodic testing of the fire suppression system resulted in AFFF being drained into the stormwater system (CH2M Hill, 2015). This section of the stormwater drainage system in this area leaves the base through Outfall 1.
6	Fire Station (Building 349)	New Site	The fire station has been in operation throughout the history of the base and housed response vehicles containing AFFF. One of the building bays has a vehicles wash rack system, which drains into an OWS. In the late 1990s, a 600-gallon AFFF spill drained into a nearby stormwater system. Also, AFFF spray testing occurred adjacent to the building in an area that drains into the stormwater system. The stormwater drainage system in this area leaves the base through Outfall 3.

AFFF = aqueous film forming foam
ERP = Environmental Restoration Program
FTA = fire training area
OWS = oil/water separator
PFAS = per- and polyfluorinated alkyl substances

2.0 AFFF AREA DESCRIPTIONS

Malmstrom AFB is on the eastern border of the city of Great Falls in Cascade County, Montana. Malmstrom AFB is currently home to the 341st Missile Wing (MW) and is one of three United States AFBs that maintains and operates the Minuteman III intercontinental ballistic missile. The 341st MW reports directly to Twentieth Air Force at F.E. Warren AFB, Wyoming. It is part of Air Force Space Command headquartered at Peterson AFB, Colorado (ASL, September 2016).

Malmstrom AFB consists of approximately 3,500 acres situated in a section of rolling plains about 75 miles east of the Rocky Mountains. At the southern edge of the facility, Malmstrom AFB lies at an elevation of 3,535 feet above sea level. Malmstrom AFB is located on a plateau that slopes to the north, away from the Little Belt Mountains and toward the Missouri River, which is approximately one mile away. Ephemeral stream valleys, which are dry most of the year, are interspersed throughout the area. Storm water runoff is directed into ditches that ultimately flow toward the Missouri River. The regional climate is semi-arid with low humidity. According to the Soil Conservation Service, the growing season is approximately 140 days (HDR Engineering, Inc., February 1995).

The following site descriptions are from the QAPP addendum (ASL, September 2016) unless otherwise referenced.

2.1 HISTORICAL FIRE TRAINING AREA (FT-01) AND OLD TAXIWAY LAND FARM (SS-22) (AFFF AREA 1)

The historical fire training area (FTA) (FT-01) is located immediately southeast of the current FTA (Figure 2, Appendix A). Historically, approximately 75 gallons of AFFF were used during each fire training exercise that occurred three to nine times each month during 1983 and 1984. Training exercises during prior years followed similar schedules (JRB Associates, January 1985). FT-01 was in operation for approximately 30 years and was deactivated in 1990 before achieving final closure in 1997.

Throughout years of operation, training exercises included setting fire to fuels and then extinguishing the fires using fire suppression fluids that included AFFF. In 1997, a remedial action removed 2,000 cubic yards of soil, of which 147 cubic yards were hauled offsite for disposal. The remaining 1,853 cubic yards of soil were taken to the Old Taxiway Land Farm (SS-22), 300 feet to the east, and have since been removed from the installation and disposed offsite. The old taxiway land farm was located on the asphalt surface of an abandoned taxiway, was approximately 2,100 feet in length, and varied from 60 to 80 feet wide, becoming narrower on the east end (HDR, February 1995). Releases of AFFF from the soil farm could have impacted soils and/or groundwater before soil being removed. Clean soils from a local soil borrow area were used to restore FT-01 to match the surrounding ground elevations.

2.2 CANADIAN SNOWBIRD CT-117 CRASH AND SOIL PLACEMENT AREA (AFFF AREA 2)

In preparation of an air show in May 2007, a Canadian Forces Snowbirds Air Demonstration CT-117 Tutor Jet crashed approximately 1,200 feet southwest of the current FTA (Figure 2, Appendix A). Due to the small size of the jet and nature of the crash (nosedive), the debris field was limited to less than 1 acre. Malmstrom AFB fire response vehicles were the first responders to the crash. A single truck extinguished the flames, using approximately 1,000 gallons of water and 30 gallons of AFFF foam concentrate. Approximately 12.25 cubic yards of petroleum hydrocarbon contaminated soil were removed and placed in the Old Taxiway Land Farm (SS-22).

2.3 OUTFALL 1 (AFFF AREA 3)

Outfall 1 is a controlled stormwater discharge point for Watershed 1 and the westernmost base outfall, on the northern boundary of Malmstrom AFB (Figure 2, Appendix A). The outfall includes a culvert structure and a normally open valve that, when closed, prevents surface water from exiting the base. The culvert passes under a manmade dike designed to retain surface water when the outfall valve is closed. Outfall 1 is immediately north of base housing and discharges off-base through agricultural grasslands to the north.

On at least one occasion, AFFF from Hangar 1440 was pushed onto the hangar apron, where it dissipated. Storm drain inlets near the hangar would have collected any residual AFFF and conveyed it to Outfall 1, where runoff leaves the base boundary.

2.4 OUTFALL 3 (AFFF AREA 4)

Outfall 3 is a controlled discharge point for Watershed 3, on the northern boundary of Malmstrom AFB (Figure 2, Appendix A). The outfall includes a culvert structure and a normally open valve that, when closed, prevents surface water from exiting the base. The culvert passes under a manmade dike designed to retain surface water when the outfall valve is closed. North of the base, Outfall 3 discharges into grasslands that are primarily surrounded by cropland.

In the late 1990s, a moving vehicle ruptured a 600-gallon AFFF trailer parked near the northeast corner of Building 349. All 600 gallons of AFFF spilled into a nearby stormwater inlet that drains to Outfall 3. Routine spray testing of mobile fire-response vehicles were also conducted beside Building 349. The sprayed AFFF drained into nearby stormwater inlets, which flow through Outfall 3 before leaving Air Force property.

2.5 HANGAR 1440 (AFFF AREA 5)

Hangar 1440 is bounded by Building 1439 to the northwest and paved and concrete areas to the east, south, and west (Figure 2, Appendix A). The hangar, constructed in 1993, includes an AFFF fire suppression system. The original AFFF system is operational only in Bay 5; Bays 3 and 4 were converted to a water-only system in the late 1990s. As originally constructed, the hangar includes a floor drain holding system to contain the AFFF. Each bay is equipped with two fire suppression systems: ceiling sprinkler systems with heat-regulated sprinkler heads and hand-controlled fire suppression cannons. The AFFF system can be isolated (water only) inside the mechanical room for testing purposes. A 1,500-gallon AFFF tank is located in the mechanical room.

Historically, annual fire suppression system testing resulted in 3% AFFF solution being pushed out onto the apron and allowed to evaporate or drain into a grated drop inlet stormwater drain that discharges at Outfall 1. Within the hangar bays, residual AFFF was washed into floor drains that collect in an oil/water separator (OWS) that discharges to the City of Great Falls wastewater treatment system. Since 2007, approximately 300 gallons of AFFF has been discharged from the AFFF tank during fire suppression system testing and evaporation/line losses. On at least one occasion, the volume of AFFF that was washed through the OWS overflowed and came up through the access manhole (CH2M Hill, 2015).

2.6 FIRE STATION (BUILDING 349) (AFFF AREA 6)

Fire Station Building 349 (Fire Station 1) is surrounded by a paved concrete area with small grassy areas bordering it to the southeast and southwest (Figure 2, Appendix A). Fire Station 1 serves as the main fire station for Malmstrom AFB and houses two P-34 fire trucks, each with a 400-gallon water capacity, as well as a 50-gallon AFFF capacity in one of the trucks and a 56-gallon AFFF capacity in the other. Fire Station 1 also stores 220 gallons of AFFF and 150 gallons of foam in a storage room that includes no secondary containment.

Historically, Fire Station 1 has housed a number of fire suppression vehicles that contained AFFF, including the following:

- P-2 – 2,300-gallon water capacity and 200-gallon AFFF capacity,
- P-4 – 1,500-gallon water capacity and 100-gallon AFFF capacity,
- P-8 – a pumper truck with 50-gallon AFFF capacity,
- P-19 – 1,000-gallon water capacity and 50-gallon AFFF capacity, and
- A 600-gallon AFFF trailer.

Typically, response vehicles are parked inside the fire station; however, when the weather is warm, the trucks and trailer are parked along the flightline, adjacent to the fire station. The south bay includes a vehicle wash rack and floor drain. The floor drain leads to an OWS, connected to the City of Great Falls wastewater system.

In the late 1990s, a moving vehicle ruptured a 600-gallon AFFF trailer, parked near the northeast corner of Building 349. All 600 gallons of AFFF spilled into a nearby stormwater inlet, draining to Outfall 3. In addition to the 1990s spill, routine spray tests were conducted on mobile fire response vehicles, parked on the apron beside Fire Station 349. The sprayed AFFF drained into nearby stormwater inlets, which flow through Outfall 3 before leaving the base boundary.

3.0 FIELD ACTIVITIES AND FINDINGS

A readiness review was conducted for all field personnel prior to mobilizing to the site. The completed readiness review forms for field personnel are presented in Appendix C. The readiness review covered anticipated hazards, types, and proper use of equipment needed for the field activities, sampling procedures, and procedures to be used to prevent cross-contamination of samples with PFAS-containing compounds.

3.1 FIELD ACTIVITIES AND SAMPLING PROCEDURES

ASL personnel mobilized to Malmstrom AFB twice to complete the SI sampling for all six AFFF Areas. The first mobilization began on Tuesday, October 11, 2016, and included completing soil borings and installing new monitoring wells, sampling groundwater wells, collecting surface and subsurface soil samples from soil borings, and collecting surface water and sediment samples from surface water bodies and drainage channels. Only three of the ten new monitoring wells produced enough water to be sampled during the first mobilization, so ASL mobilized a second time on May 2, 2017, to collect groundwater samples from the remaining seven new monitoring wells. ASL used a targeted sampling design to collect samples in locations most likely to have detectable concentrations of the three target compounds resulting from AFFF releases. Field forms generated during the sampling activities are in Appendix B. Field activities for the two separate mobilizations were completed on October 22, 2016, and May 3, 2017. Samples were shipped, via overnight courier, to Maxxam Analytics International Corporation of

Mississauga, Ontario, Canada, under chain of custody procedures. Samples were analyzed for eighteen PFAS compounds, using modified EPA Method 537. The following three, of the eighteen compounds, are the only PFAS compounds that have health-based screening levels.

Analyte	*CAS Number
• Perfluorooctane sulfonate (PFOS)	1763-23-1
• Perfluorooctanoic acid (PFOA)	335-67-1
• Perfluorobutane sulfonate (PFBS)	375-73-5

*CAS = Chemical Abstract Service

Third-party data validation was conducted on 100% of the analytical data for the PFAS compounds. Data validation qualifiers were applied as needed to the data. All the results were evaluated as usable for the decisions being made. No determinations of an AFFF release are based upon quality control (QC)-qualified data. The data validation report, laboratory data sheets (which include results for the 18 PFAS compounds analyzed), and chain of custody forms are in Appendix E.

Composite soil samples were submitted to CT Laboratories of Baraboo, Wisconsin, for physiochemical analyses. The physiochemical analyses include soil pH (EPA Method 9045D), particle size analysis (American Society for Testing and Materials [ASTM] D422), and total organic carbon content in soil (EPA Lloyd Kahn Method). The laboratory data sheets and a data summary table are presented in Appendix G.

Field activities included collecting surface soil, subsurface soil, groundwater, surface water, and sediment samples. Sample locations were selected in areas most likely to have been impacted by suspected AFFF releases. Soil borings were advanced with a track-mounted, compact sonic drill rig. Soil cores were collected by advancing a 4-inch, inner core barrel to the desired sample depth and overdrilling with a 6-inch outer casing. The core barrel and soil core were-retrieved, leaving the 6-inch outer casing to maintain the integrity of the borehole. Soil cores were then vibrated from the core barrel into plastic sleeves for logging, field screening, and sample collection. Prior to logging, slits were cut in the sample sleeve and the soil cores screened with a photoionization detector (PID). After recording the PID readings on the boring log, the soil core was measured and the recovered length recorded in the boring log. The sample sleeve was then opened and the core visually logged. All borings were logged by a trained geologist (with a degree from an accredited university) experienced in describing soil cores, under the supervision of a senior geologist. The soil descriptions were assigned in accordance with the *Geology Supplement to the Scope of Services* (USACE, June 2013) and followed this general format:

- Color (using Munsell soil color charts);
- Soil type (fat clay, lean clay, sand, silty gravel, etc.);
- Grading, grain size, consistency/density, moisture content, cementing;
- Other notable features (staining, organics, fossils, odors, etc.); and
- Unified Soil Classification System symbol (CH, CL, SP, GM, etc.).

Surface soil samples were collected from 0 to 6 inches bgs with stainless steel hand augers and stainless steel spoons. Subsurface soil samples were collected from the soil core generated during sonic drilling, immediately above the water saturated/unsaturated soil interface. Sediment samples were collected using a combination of dip samplers and stainless steel spoons. Surface water samples were collected directly from surface water bodies into the sample containers.

Ten groundwater monitoring wells were installed across four AFFF Areas. The wells were constructed with 2-inch diameter, 10-foot long Schedule 40 polyvinyl chloride screens (continuous wrap 0.010-inch

slot) and risers with flush-threaded joints. Sand filter packs were installed by tremieing sand through the outer sonic casing and vibrating it in place. Boring logs and well construction diagrams are included in Appendix C. Filter packs were sealed using 3/8" uncoated bentonite pellets, which were allowed to hydrate for at least 24 hours (and typically up to 48 hours) before development. Only three of the new monitoring wells (MALMS01-MW001, MALMS04-MW001, and MALMS04-MW002) produced water during the first mobilization in October 2016. The three monitoring wells were developed until the column of water in the well was free of visible sediment, and/or potential of hydrogen (pH), temperature, turbidity, and specific conductivity stabilized. Well development was completed after hydration of the bentonite seal and before grouting. Groundwater sampling was completed at least 24 hours after development. The remaining seven monitoring wells did not produce water after drilling and were not developed.

In compliance with standard procedure ASL-SOP-002a – *Groundwater Sampling at Perfluorinated Compound (PFC) Sites,* groundwater sampling was completed using either a peristaltic pump or a disposable bailer, following applicable low-flow sampling methods. Groundwater samples were collected from wells MALMS04-001 and MALMS04-002 in October 2016 with a peristaltic pump and disposable polyvinyl tubing, using low-flow sampling methodology. Well MALMS01-MW001 was pumped dry during well development and the recharge was very slow, so it was not sampled in October 2016.

ASL mobilized a second time in May 2017, to sample the eight remaining wells. Seven of the eight remaining wells were not developed. As previously mentioned, the eighth well (MALMS01-MW001) was pumped dry during well development in October 2016. Groundwater samples from six of the seven undeveloped wells and well MALMS01-MW001, were collected as grab samples using disposable bailers. Because of the extremely slow recharge rate of the glacial till, the wells were sampled without purging the wells or collecting water quality parameters. Well MALMS01-MW003 did not contain enough water to sample. A depth to groundwater measurement was recorded for each of the eight wells.

Groundwater samples from AFFF Area 1 wells MALMS01-MW001 and MALSM01-MW002 were turbid. However, the analytical data still meets the SI data quality objectives since PFAS compounds do not readily sorb to suspended solids. The remaining seven groundwater samples were clear. Boring logs, sample collection logs, chain of custody forms and new well construction details are included in Appendix C.

Land survey was used to record the surface elevations and top-of-casing elevations of the new groundwater monitoring wells. The existing wells were not surveyed during the SI. ASL relied on ERPMS data for all existing monitoring wells, which are in U.S. survey feet. Survey data obtained from Big Sky Civil and Environmental, LLC (Great Falls, Montana) provides accuracy of one hundredth of a foot (horizontal and vertical) for the soil borings and monitor wells. Northing and easting coordinates were recorded in international feet using the Montana State Plane Coordinates – North American Datum 1983. Elevations were referenced to the North American Vertical Datum 1988. The survey data for the new wells was converted to U.S survey feet and reference the same datum, as required by ERPMS. Surface water and sediment sample locations were recorded with a Trimble® Geo 7X handheld global positioning system (GPS) unit. Post processed horizontal data collected with the Trimble® Geo 7X is accurate to sub-meter intervals.

Sample locations, area-specific lithology, groundwater flow direction, analytical results, and conclusions are presented in Sections 3.1 through 3.8.

3.2 PFAS CROSS-CONTAMINATION AVOIDANCE PROCEDURES

3.2.1 Field Equipment

- Teflon®-containing materials (e.g., Teflon® tubing, bailers, tape, plumbing paste, or other Teflon® materials) were not used since Teflon® contains fluorinated compounds.
- High-density polyethylene (HDPE) and silicon materials are acceptable.
- Peristaltic pumps were used to sample groundwater at depths shallower than 25 feet. ProActive SS Pumps with PVC leads or Geotech SS Geosub pumps were used to sample groundwater at depths greater than 25 feet. These pumps are stainless steel and minimize introductions of PFCs. Pumps with Teflon impellers, such as Grundfos RediFlo pumps, were not used. Field notes were recorded in a bound fieldbook that is not constructed with waterproof paper. All personnel changed gloves between recording and sampling activities to prevent cross contamination.
- Post-It Notes were not allowed on site.
- No markers other than Sharpies® brand were used. Pens were used to document field activities in the field log and on field forms, as well as for labeling sample containers and preparing the chain of custody.
- Chemical (blue) ice packs were not used to store samples, food, or drinks.

3.2.2 Field Clothing and Personal Protective Equipment

- The sampling personnel wore field clothing made of synthetic and natural fibers (preferably cotton). The clothing had to have been laundered at least six times without using a fabric softener since it was purchased. New clothing was not allowed because it could contain PFAS-related treatments.
- Only rain gear made from polyurethane and wax-coated materials was allowed.
- No clothing or boots were allowed that contained Gore-Tex™, which consists of a PFAS membrane.
- Tyvek® clothing was not allowed on site because it contains fluorinated compounds.
- Disposable nitrile gloves were worn at all times when field activities were being conducted, and a new pair was donned prior to the following activities at each sample location:
    - Decontamination of reusable sampling equipment;
    - Contact with sample bottles or water containers;
    - Insertion of anything into the well (HDPE tubing, HydraSleeve® bailer, etc.);
    - Insertion of silicon tubing into the peristaltic pump;
    - Completion of monitor well purging;
    - Sample collection; and
    - Handling of any quality assurance/QC samples, including field blanks and equipment blanks.
- A new pair of nitrile gloves was worn after handling any nondedicated sampling equipment, after contact with surfaces that had not been decontaminated, or when field personnel thought it was necessary.

3.2.3 Sample Containers

- All samples were collected in polypropylene or HDPE bottles with screw caps made of the same materials. The liners of lined screw caps were not made of Teflon® and did not contain PFASs.
- Glass sample containers were not used.

- Container labels were completed using a Sharpie® pen after the caps had been placed on each bottle.

3.2.4 Wet Weather

- Field personnel who were sampling during wet weather (such as rainfall or snowfall) wore appropriate clothing that did not pose a risk of cross-contamination. Sampling personnel avoided synthetic gear treated with water-repellant finishes containing PFASs. Only rain gear made from polyurethane and wax-coated materials was allowed.
- Field personnel wore gloves when erecting or moving a gazebo tent overtop used for protection from rain at sampling locations because the canopy material may have been treated with a PFAS-based coating. Gloves were changed immediately after handling the tent, and any further contact with the tent was avoided until all sampling activities were finished and the team was ready to move on to the next sample location.

3.2.5 Equipment Decontamination

Field sampling equipment, including oil/water interface meters and water level indicators, were decontaminated using Alconox® or Liquinox® soap. Decon 90® was not used during decontamination activities. Laboratory-certified PFAS-free water was used for the final decontamination rinse of sampling equipment. Larger equipment, such as drill rigs, was decontaminated using potable water and a high-pressure washer and then rinsed with potable water.

3.2.6 Personnel Hygiene

- Field personnel did not use cosmetics, moisturizers, hand cream, or other related products as part of their personal hygiene routine before a sampling event because these products may contain surfactants and be a potential source of PFASs.
- Because many manufactured sunblock and insect repellants contain PFASs, only sunblock and insect repellants that contain 100% natural ingredients were allowed.
- For restroom breaks, field personnel left the exclusion zone (EZ) before removing PPE. Before returning to the EZ, field personnel washed as normal, allowing extra time to rinse with water after using soap. Field personnel used a mechanical dryer to avoid using paper towels if possible.

3.2.7 Food Considerations

Field personnel did not eat or drink inside the EZ.

3.2.8 Visitors

Site visitors remained outside of the exclusion zone during all sampling activities.

3.3 HISTORICAL FIRE TRAINING AREA (FT-01) AND OLD TAXIWAY LAND FARM (SS-22) (AFFF AREA 1)

The media of concern at AFFF Area 1 are surface soil, subsurface soil, and shallow groundwater. Surface water bodies are not present near the area, so neither surface water nor sediment samples were collected.

3.3.1 Sample Locations

Three sets of surface soil and subsurface soil samples were collected from the grass-covered area of the former fire training area. Two sample sets were collected from borings MALMS01-001 and MALMS01-002 within the footprint of the training area. A third sample set was collected from boring MALMS01-003, northeast of the former training area, within the footprint of the Old Taxiway Land Farm. Monitoring wells were constructed in all three borings. Well MALMS01-MW001 (boring MALMS01-001) was constructed with a 20-foot screen, rather than a 10-foot screen, because groundwater was not encountered down to 55 feet bgs. However, damp clays (CL) were encountered at 4 feet bgs and extended to 36 feet bgs, so the longer screen was installed across the 15 to 35 foot bgs interval. At the time of construction (October 2016), all three monitoring wells were dry and unable to be sampled. Groundwater samples were collected from monitoring wells MALMS01-MW001 and MALMS01-MW002 in May 2017, six months after construction. A sample from MALMS01-MW003 could not be collected because the well was dry. Sampling locations for AFFF Area 1 are shown on Figure 3 in Appendix A.

3.3.2 Soil Description

Three soil borings were completed at depths ranging from 35 to 55 feet bgs within Quaternary sediments of the surficial aquifer. The primary soil types and classifications include sandy gravels (GW), clays (CL) and sandy clays (CL). Detailed boring logs are presented in Appendix C.

3.3.3 Groundwater Flow

Three new monitoring wells (MALMS01-MW001, MALMS01-MW002, and MALMS01-MW003) were constructed in October 2016. At the time of their construction, all three wells were dry. ASL remobilized to the base in May 2017, and well MALMS01-MW003 was still dry. Groundwater elevation at MALMS01-MW001 was 3438.99 (26.20 feet btoc). Groundwater elevations at MALS010MW002 were 3442.96 (31.29 feet btoc). The groundwater elevation measurements are presented in Appendix H and on Figure 3 of Appendix A. Site specific groundwater flow direction at AFFF Area 1 is unknown because a minimum of three data points is necessary to determine groundwater flow direction. The PA report (CH2M Hill, April 2015) indicated groundwater at Malmstrom AFB generally flows north, toward the Missouri River.

3.3.4 Analytical Results

Four surface soil samples (three primary samples and one field duplicate sample), four subsurface soil samples (three primary samples and one field duplicate sample), and two primary groundwater samples were submitted to the project laboratory for analysis from AFFF Area 1.

Surface Soil
PFBS, PFOA, and PFOS were detected in the three primary samples and one field duplicate sample. The detected concentrations of PFBS and PFOA do not exceed the RSLs for soil. However, PFOS was detected a concentrations above the screening level in one primary and its field duplicate sample (MALMS01-001-SS-001 at 890 µg/kg and MALMS01-001-SS-901 at 800 µg/kg.

PFBS concentrations range from an estimated 0.72 µg/kg (MALMS01-003-SS-001) to an estimated 4.3 µg/kg (MALMS01-001-SS-001). PFOA concentrations range from 3.1 µg/kg (MALMS01-002-SS-001) to 26 µg/kg (MALMS01-001-SS-001). PFOS concentrations range from 30 µg/kg (MALMS01-002-SS-

001) to 890 µg/kg (MALMS01-001-SS-001). Surface soil analytical results are summarized in Table 3 and shown on Figure 4 (Appendix A).

Subsurface Soil
PFBS was detected in two of the three primary samples (MALMS01-001-SO-021 and MALMS01-003-SO-011). PFOA and PFOS were detected in all three primary and one field duplicate sample. The detected concentrations of PFBS and PFOA do not exceed the RSLs for soil. However, PFOS was detected at a concentration above the RSLs in one primary sample (MALMS01-002-SO-005 at 11,000 µg/kg).

Estimated PFBS concentrations ranged from 0.38 µg/kg (MALMS01-001-SO-021) to 4.4 µg/kg (MALMS01-003-SO-011). PFOA concentrations range from 6.1 µg/kg (MALMS01-001-SO-921) to 110 µg/kg (MALMS01-002-SO-005). PFOS concentrations range from 16 µg/kg (MALMS01-001-SO-921) to 11,000 µg/kg (MALMS01-002-SO-005). Subsurface soil analytical results are summarized in Table 4 and shown on Figure 4 (Appendix A).

Soil Physiochemical Analyses
Two composite soil samples from AFFF Area 1 were submitted for physiochemical analyses. The composite surface soil sample (MALMS01-004-SS-001) was composed of aliquots of the surface soil samples from ground surface to 6 inches bgs. The composite subsurface soil sample (MALMS01-004-SO-021) was composed of aliquots of the subsurface soil samples, which ranged from 4 to 21 feet bgs. The composite physiochemical sample results are contained in Appendix G.

Groundwater
Two primary groundwater samples were collected from monitoring wells MALS01-MW001 and MALS01-MW002. At the time of the SI, well MALMS01-MW003 was dry and unable to be sampled. PFBS, PFOA, and PFOS were detected in both primary samples. PFBS concentrations in both samples were below the screening level. PFOA and the combined PFOA and PFOS concentrations exceeded the screening levels in both groundwater samples. PFOS concentrations exceeded the screening level in sample MALMS01-002-GW-030.

PFBS was detected at 0.056 µg/L (MALMS01-001-GW-035) and 0.13 µg/L (MALMS01-002-GW-030). PFOA was detected at 0.20 µg/L (MALMS01-001-GW-035) and 1.3 µg/L (MALMS01-002-GW-030). PFOS was detected at 0.067 µg/L (MALMS01-001-GW-035) and 1.9 µg/L (MALMS01-002-GW-030). The combined PFOA and PFOS concentrations were calculated at 0.267 µg/L (MALMS01-001-GW-035) and 3.2 µg/L (MALMS01-002-GW-030). Groundwater analytical results are summarized in Table 5 and are shown on Figure 5 (Appendix A).

3.3.5 Conclusions

Regular releases of AFFF at the former FTA during its 30-year operational life has resulted in releases of PFAS to the environment. The analyses of the surface soil and subsurface soil samples indicate that neither PFBS nor PFOA were present at concentrations above the screening levels. However, PFOS was detected at concentrations above the screening levels in surface soil (MALMS01-001-SS-001) and subsurface soil (MALMS01-002-SO-005). None of the three soil borings completed during the SI encountered sufficient groundwater to sample; however, all three borings were converted to groundwater monitoring wells. Two of the wells (MALS01-MW001 and MALS01-MW002) produced water and were sampled in May 2017. The analyses of groundwater samples indicate both PFOA and PFOS were present

above the screening levels. Based on these analytical results, a release of AFFF has been confirmed at AFFF Area 1 that has impacted groundwater and subsurface soil in the FT-01 area.

Table 3 Historical Fire Training Area (FT-01) and Old Taxiway Land Farm (SS-22) (AFFF Area 1) Surface Soil Analytical Results

Analyte	Sample ID	MALMS01-001-SS-001	MALMS01-001-SS-901 (duplicate)	MALMS01-002-SS-001	MALMS01-003-SS-001
	Depth (ft)	0–0.5	0–0.5	0–0.5	0–0.5
	Screening Level (µg/kg)	Result (µg/kg)	Result (µg/kg)	Result (µg/kg)	Result (µg/kg)
Perfluorobutane sulfonate (PFBS)	130,000[a]	**4.3 J**	**3.7 J**	**1.4**	**0.72 J**
Perfluorooctanoic acid (PFOA)	126[b]	**26**	**20**	**3.1**	**3.8**
Perfluorooctane sulfonate (PFOS)	126[b]	**890**	**800**	**30**	**110**

Bold values indicate analyte detected at concentration indicated.
[a] EPA Regional Screening Levels for Residential Soil (May 2018) (https://semspub.epa.goc/work/HQ/197235.pdf).
[b] Screening levels calculated using the EPA Regional Screening Level calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).
µg/kg = micrograms per kilogram dup = duplicate
ft = foot or feet ID = identification
J = The reported concentration is an estimated value.

Table 4 Historical Fire Training Area (FT-01) and Old Taxiway Land Farm (SS-22) (AFFF Area 1) Subsurface Soil Analytical Results

Analyte	Sample ID	MALMS01-001-SO-021	MALMS01-001-SO-921 (duplicate)	MALMS01-002-SO-005	MALMS01-003-SO-011
	Depth (ft)	20–21	20–21	4–5	10–11
	Screening Level (µg/kg)	Result (µg/kg)	Result (µg/kg)	Result (µg/kg)	Result (µg/kg)
Perfluorobutane sulfonate (PFBS)	130,000[a]	**0.38 J**	0.24 U	25 U	**4.4 J**
Perfluorooctanoic acid (PFOA)	126[b]	**7.1**	**6.1**	**110**	**9.2 J**
Perfluorooctane sulfonate (PFOS)	126[b]	**19 J**	**16**	**11,000**	**29 J**

Bold values indicate analyte detected at concentration indicated.
Shaded cells indicate analyte detected above screening level.
[a] EPA Regional Screening Levels for Residential Soil (May 2018) (https://semspub.epa.gov/work/HQ/197235.pdf).
[b] Screening levels calculated using the EPA Regional Screening Level calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).
µg/kg = micrograms per kilogram
dup = duplicate
ft = foot or feet
ID = identification
J = The reported concentration is an estimated value.
U = The analyte was analyzed for but was not detected above the reported sample quantification limit

Table 5 Historical Fire Training Area (FT-01) and Old Taxiway Land Farm (SS-22) (AFFF Area 1), Groundwater Analytical Results

Analyte	Sample ID	MALMS01-001-GW-035	MALMS01-002-GW-030
	Screening Level (µg/L)	Result (µg/L)	Result (µg/L)
Perfluorobutane Sulfonate (PFBS)	40[a]	**0.056**	**0.13**
Perfluorooctanoic Acid (PFOA)	0.07[b]	**0.20**	**1.3**
Perfluorooctane Sulfonate (PFOS)	0.07[b]	**0.067**	**1.9**
PFOS + PFOA	0.07[c]	**0.267**	**3.2**

Note: Monitoring well MALMS01-MW003 was dry and could not be sampled.
Bold values indicate analyte detected at concentration indicated.
Shaded values indicate analyte detected above screening level.
[a] EPA Regional Screening Levels for Tapwater (May 2018) (https://semspub.epa.gov/work/HQ/197235.pdf).
[b] Screening Level listed in "Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA)" (EPA, May 2016b) and "Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS)" (EPA, May 2016a).
[c] EPA recommends comparing the combined analytical results for PFOA and PFOS when both are present.
µg/L = micrograms per liter
GW = groundwater
ID = identification

3.4 CANADIAN SNOWBIRDS CT-117 CRASH (AFFF AREA 2)

The media of concern at the Canadian Snowbirds CT-117 Crash area are surface soil, subsurface soil, shallow groundwater, and surface water/sediment.

3.4.1 Sample Locations

Three sets of surface soil and subsurface soil samples were collected. Two sample sets were collected from borings MALMS02-001 and MALMS02-002 within the grass covered crash site. A third sample set was collected from boring MALMS02-003 at the east end of the Old Taxiway Land Farm, where 12.25-cy of soil excavated from the crash site was placed. Shallow groundwater depths were anticipated to be between 12 and 40 feet bgs (ASL, September 2016). However, during installation of the three borings a saturated soil interface (groundwater) was not encountered at depths ranging from 52 to 70 feet bgs. The absence of significant moisture in the soil led to a decision not to install monitoring wells at AFFF Area 2 and abandon all three borings. The borings were terminated at 52 feet bgs (MALMS02-002), 55 feet bgs (MALMS02-003), and 70 feet bgs (MALMS02-001). Two pairs of surface water and sediment samples were collected from the ditch near the crash site. The sample locations for AFFF Area 2 are shown on Figure 3 in Appendix A.

3.4.2 Soil Description

Three soil borings were completed at depths ranging from 52 to 70 feet bgs within Quaternary Glacial Till. Primary soil types and classifications include silty sand (SM), fat clays (CH), and silty clays (CL) with intermittent limestone and shale fragments. Detailed boring logs are presented in Appendix C.

3.4.3 Groundwater Flow

Shallow groundwater at MAFB, when present, is typically encountered within the Quaternary deposits at depths less than 40 feet bgs. In many areas of MAFB the glacial tills are aquitards, temporarily confining groundwater to fractured gravel layers to create perched groundwater conditions. Groundwater was not encountered during installation of the three borings and monitoring wells were not installed. Based on the discontinuous characteristics of perched shallow groundwater in the area and the absence of saturated soils down to 70 feet bgs, shallow groundwater does not appear present at AFFF Area 2.

3.4.4 Analytical Results

Four surface soil samples (three primary sample and one field duplicate sample), four subsurface soil samples (three primary samples and one field duplicate sample), and three paired surface water/sediment samples (two primary and one field duplicate) were submitted to the project laboratory for analysis from AFFF Area 2.

Surface Soil
PFBS was detected in sample MALMS02-001-SS-001. PFOA was detected in two primary samples (MALMS02-002-SS-001 and MALMS02-003-SS-00). PFOS was detected in all three primary samples. None of the detected concentrations exceeded the RSLs for soil.

The only PFBS detection (MALMS02-001-SS-001) was estimated at 0.42 µg/kg. PFOA concentrations ranged from an estimated 0.45 µg/kg (MALMS02-002-SS-001) to 2.3 µg/kg (MALMS02-003-SS-001). PFOS concentration ranged from an estimated 0.43 µg/kg (MALMS02-001-SS-001) to 6.3 µg/kg

(MALMS02-003-SS-001). Surface soil analytical results are summarized in Table 6 and shown on Figure 4 (Appendix A).

Subsurface Soil
PFBS, PFOA, and PFOS were detected in one primary sample (MALMS02-003-SO-006). None of the detected concentrations exceeded the RSLs for soil.

The only PFBS detection (MALMS02-003-SO-006) was estimated at 0.50 µg/kg. The only PFOA detection (MALMS02-003-SO-006) was 1.1 µg/kg. The only PFOS detection (MALMS02-003-SO-006) was 1.1 µg/kg. Subsurface soil analytical results are summarized in Table 7 and shown on Figure 4 (Appendix A).

Soil Physiochemical Analyses
Two composite samples from AFFF Area 2 were submitted for physiochemical analyses. The composite surface soil sample (MALMS02-006-SS-001) was composed of aliquots of the surface soil samples from ground surface to 6 inches bgs. The composite subsurface soil sample (MALMS02-006-SO-020) was composed of aliquots of the subsurface soil samples, which ranged from 5 to 20 feet bgs. The composite physiochemical sample results are contained in Appendix G.

Groundwater
Monitoring wells were not installed at AFFF Area 2 because groundwater was not encountered during boring advancement; therefore, groundwater sampling was not conducted.

Surface Water
PFBS, PFOA, and PFOS were detected in all three surface water samples. None of the detected PFBS concentrations exceeded the screening levels for water. However, the PFOA, PFOS, and the combined PFOA and PFOS concentrations exceeded screening levels in all three samples.

PFBS concentrations ranged from an estimated 0.0081 µg/L (MALMS02-004-SW-001) to an estimated 0.0090 µg/L (MALMS02-004-SW-901). PFOA concentrations ranged from 0.080 µg/L (MALMS02-005-SW-001) to an estimated 0.092 µg/L (MALMS02-004-SW-901). PFOS concentration ranged from an estimated 0.39 µg/L (MALMS02-004-SW-001) to 0.47 µg/L (MALMS02-005-SW-001). The combined PFOA and PFOS concentrations ranged from an estimated 0.48 µg/L (MALMS02-004-SW-001) to 0.55 µg/L (MALMS02-005-SW-001). Surface water sample analytical results are summarized in Table 8 and shown on Figure 5 in Appendix A.

Sediment
PFBS was not detected in the two primary samples or the field duplicate sample. PFOA was detected in both primary samples and the filed duplicate sample, but none of the detected concentrations exceeded the RSLs for sediment. PFOS was detected in both primary samples and the field duplicate sample, but the detected concentrations only exceeded the screening levels in one primary sample (MALMS02-004-SD-001 at an estimated 160 µg/kg).

PFOA concentrations ranged from an estimated 1.1 µg/kg (MALMS02-004-SD-901) to an estimated 2.3 µg/kg (MALMS02-004-SD-001). The combined PFOA and PFOS concentrations ranged from an estimated 46 µg/kg (MALMS02-005-SD-001) to an estimated 160 µg/kg (MALMS02-004-SD-001). Sediment sample analytical results are summarized in Table 9 and shown on Figure 4 (Appendix A).

3.4.5 Conclusions

In May of 2007, approximately 30 gallons of AFFF were used to extinguish an aircraft fire approximately 1,200 feet southwest of the current FTA. The surface soil and subsurface soil sample analyses results indicate that the target compounds are not present in soils at concentrations above the RSLs. However, PFOS was detected in one sediment sample (MALMS02-004-SD-001) above the screening level. Similarly, the surface water sample analyses results indicate that the target compounds are present in surface water at concentrations above the screening levels. Shallow groundwater was not encountered during completion of the three soil borings, so all three borings were abandoned. Based on these conditions, it is concluded that shallow groundwater is not present at AFFF Area 2 and is not a media of a concern. Based on these analytical results, a release of AFFF that has impacted surface water at AFFF Area 2 is confirmed.

Table 6 Canadian Snowbirds CT-117 Crash Site (AFFF Area 2) Surface Soil Analytical Results

Analyte	Sample ID	MALMS02-001-SS-001	MALMS02-001-SS-901 (duplicate)	MALMS02-002-SS-001	MALMS02-003-SS-001
	Depth (ft)	0–0.5	0–0.5	0–0.5	0–0.5
	Screening Level (µg/kg)	Result (µg/kg)	Result (µg/kg)	Result (µg/kg)	Result (µg/kg)
Perfluorobutane sulfonate (PFBS)	130,000[a]	**0.42 J**	0.25 U	0.25 UJ	0.25 U
Perfluorooctanoic acid (PFOA)	126[b]	0.12 U	0.12 U	**0.45 J**	**2.3**
Perfluorooctane sulfonate (PFOS)	126[b]	**0.43 J**	0.16 U	**1.9 J**	**6.3**

Bold values indicate analyte detected at concentration indicated.
[a] EPA Regional Screening Levels for Residential Soil (May 2018) (https://semspub.epa.goc/work/HQ/197235.pdf).
[b] Screening levels calculated using the EPA Regional Screening Level calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).
µg/kg = micrograms per kilogram
dup = duplicate
ft = foot or feet
ID = identification
J = The reported concentration is an estimated value.
U = The analyte was analyzed for but was not detected above the reported sample quantification limit.

Table 7 Canadian Snowbirds CT-117 Crash Site (AFFF Area 2) Subsurface Soil Analytical Results

Analyte	Sample ID	MALMS02-001-SO-020	MALMS02-001-SO-920 (duplicate)	MALMS02-002-SO-020	MALMS02-003-SO-006
	Depth (ft)	19–20	19–20	19–20	5–6
	Screening Level (µg/kg)	Result (µg/kg)	Result (µg/kg)	Result (µg/kg)	Result (µg/kg)
Perfluorobutane sulfonate (PFBS)	130,000[a]	0.25 U	0.28 U	0.25 U	**0.50 J**
Perfluorooctanoic acid (PFOA)	126[b]	0.12 U	0.13 U	0.12 U	**1.1**
Perfluorooctane sulfonate (PFOS)	126[b]	0.16 U	0.18 U	0.16 U	**1.1**

Bold values indicate analyte detected at concentration indicated.
[a] EPA Regional Screening Levels for Residential Soil (May 2018) (https://semspub.epa.goc/work/HQ/197235.pdf).
[b] Screening levels calculated using the EPA Regional Screening Level calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).
µg/kg = micrograms per kilogram
dup = duplicate
ft = foot or feet
ID = identification
J = The reported concentration is an estimated value.
U = The analyte was analyzed for but was not detected above the reported sample quantification limit

Table 8 Canadian Snowbirds CT-117 Crash Site (AFFF Area 2) Surface Water Analytical Results

Analyte	Sample ID	MALMS02-004-SW-001	MALMS02-004-SW-901 (duplicate)	MALMS02-005-SW-001
	Screening Level (µg/L)	Result (µg/L)	Result (µg/L)	Result (µg/L)
Perfluorobutane Sulfonate (PFBS)	40[a]	**0.0081 J**	**0.0090 J**	**0.0086 J**
Perfluorooctanoic Acid (PFOA)	0.07[b]	**0.090 J**	**0.092 J**	**0.080**
Perfluorooctane Sulfonate (PFOS)	0.07[b]	**0.39 J**	**0.43 J**	**0.47**
PFOS + PFOA	0.07[c]	**0.48 J**	**0.522 J**	**0.55**

Bold values indicate analyte detected at concentration indicated.
Shaded cells indicate analyte detected above screening level.
[a] EPA Regional Screening Levels for Tapwater (May 2018) (https://semspub.epa.goc/work/HQ/197235.pdf).
[b] Screening Level listed in *Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA)*, (EPA, May 2016b) and Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS) (EPA, May 2016a).
[c] EPA recommends comparing the combined analytical results for PFOA and PFOS when both are present.
µg/L = micrograms per liter ID = identification
SW = surface water

Table 9 Canadian Snowbirds CT-117 Crash Site (AFFF Area 2) Sediment Analytical Results

Analyte	Sample ID	MALMS02-004-SD-001	MALMS02-004-SD-901 (duplicate)	MALMS02-005-SD-001
	Depth (ft)	0–0.5	0–0.5	0–0.5
	Screening Level (µg/kg)	Result (µg/kg)	Result (µg/kg)	Result (µg/kg)
Perfluorobutane Sulfonate (PFBS)	130,000[a]	0.35 UJ	0.28 UJ	0.48 UJ
Perfluorooctanoic Acid (PFOA)	126[b]	**2.3 J**	**1.1 J**	**2.0 J**
Perfluorooctane sulfonate (PFOS)	126[b]	**160 J**	**55 J**	**46 J**

Bold values indicate analyte detected at concentration indicated.
[a] EPA Regional Screening Levels for Residential Soil (May 2018) (https://semspub.epa.goc/work/HQ/197235.pdf).
[b] Screening levels calculated using the EPA Regional Screening Level calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).
µg/kg = micrograms per kilogram ft = foot or feet
ID = identification
J = The reported concentration is an estimated value.
U = The analyte was analyzed for but was not detected above the reported sample quantification limit.

3.5 OUTFALL 1 (AFFF AREA 3)

The media of concern at Outfall 1 are subsurface soil, shallow groundwater, surface water and sediment. Surface soils are not a medium of concern at AFFF Area 3 because it is a concrete lined stormwater drainage outfall that would have prevented surface soil exposure to AFFF.

3.5.1 Sample Locations

Subsurface soil samples were collected from borings MALMS03-001, MALMS03-002, and MALMS03-003. The borings were converted to monitoring wells (MALMS03-MW001, MALMS03-MW002, and MALMS03-MW003 respectively). Well MALMS03-MW002 was constructed with a 20 foot screen, rather than a 10 foot screen, because groundwater was not encountered down to 30 feet bgs. However, slightly damp silty clays (CL) were encountered at 5 feet bgs and extended to 30 feet bgs, so the longer screen was installed across the 9.6 to 29.6 foot bgs interval. At the time of construction (October 2016), all three monitoring wells failed to produce sufficient groundwater to be sampled. Groundwater samples were collected in May 2017, six months after the wells were constructed. One set of surface water and sediment samples were collected from the outfall ditch. The sample locations for AFFF Area 3 are shown on Figure 6 in Appendix A.

3.5.2 Soil Description

Three soil borings were completed at depths ranging from 30 to 60 feet bgs within Quaternary sediments of the surficial aquifer. Primary soil types and classifications include silty clay (CL), silty sand (SM), and clays (CL) with gravel and limestone laminations. Detailed boring logs are presented in Appendix C.

3.5.3 Groundwater Flow

Three new monitoring wells (MALMS03-MW001, MALMS03-MW002, and MALMS03-MW003) were constructed in October 2016. At the time of their construction, all three wells were dry. ASL remobilized to the base in May 2017 and recorded depth to groundwater measurements. Groundwater elevations range from 3390.97 feet amsl (22.32 feet btoc) to 3393.34 feet amsl (16.90 feet btoc).The groundwater elevation measurements are presented in Appendix G. Figure 6 (Appendix A) shows the potentiometric surface contours developed from these measurements. The contours indicate that when the static water levels were measured in May 2017, groundwater flow direction at AFFF Area 3 was to the south.

3.5.4 Analytical Results

Three primary subsurface soil samples, four groundwater samples (three primary samples and one field duplicate sample), and one paired set of surface water and sediment samples were submitted to the project laboratory for analyses from AFFF Area 3.

Subsurface Soil
Neither PFBS nor PFOA were detected in any of the samples. PFOS was detected in two of the three subsurface soil samples (MALMS03-001-SO-020 and MALMS03-002-SO-020). None of the detected concentrations exceeded the RSLs for soil.

PFOS concentrations were an estimated 0.32 µg/kg (MALMS03-002-SO-020) and estimated 0.36 µg/kg (MALMS03-001-SO-020). Subsurface soil sample analytical results are summarized in Table 10 and shown on Figure 7 (Appendix A).

Soil Physiochemical Analyses
Two composite samples from AFFF Area 1were submitted for physiochemical analyses. The composite surface soil sample (MALMS03-005-SS-001) was composed of aliquots of the surface soil samples from ground surface to 6 inches bgs. The composite subsurface soil sample (MALMS03-005-SO-020) was composed of aliquots of the subsurface soil samples, which ranged from 8 to 20 feet bgs. The composite physiochemical sample results are contained in Appendix G.

Groundwater
PFBS and PFOA were detected in all four samples. PFBS concentrations in all four samples were below the screening level. The PFOA concentration in primary sample MALMS03-002-GW-030 exceeded the screening level. PFOS was detected in two (MALMS03-002-GW-030 and MALMS03-003-GW-020) primary samples and duplicate sample MALMS03-003-GW-920. Detected PFOS concentrations were all below the screening levels. The combined PFOA and PFOS concentrations exceeded the screening levels in primary sample MALMS03-002-GW-030.

PFBS concentrations ranged from an estimated 0.020 µg/L (MALMS03-001-GW-025) to 0.031 µg/L (MALMS03-003-GW-020). PFOA concentrations ranged from an estimated 0.017 µg/L (MALMS03-001-GW-025) and an estimated 0.070 µg/L (MALMS03-002-GW-030). PFOS concentrations ranged from an estimated 0.024 µg/L (MALMS03-002-GW-030) to 0.033 µg/L (MALMS03-003-GW-020). Combined PFOA and PFOS concentrations ranged from an estimated 0.017 µg/L (MALMS03-001-GW-025) to an estimated 0.094 µg/L (MALMS03-002-GW-030). Groundwater sample analytical results are summarized in Table 11 and are shown on Figure 8 (Appendix A).

Surface Water
PFBS, PFOA, and PFOS were all detected in the sample. PFBS was not detected at concentrations above the screen levels for water. However, PFOA, PFOS, and the combined PFOA and PFOS concentrations exceed the screening levels for water.

The detected concentration of PFBS was 0.057 µg/L. The detected concentration of PFOA was 0.10 µg/L. The detected concentration of PFOS was 0.46 µg/L. The combined PFOA and PFOS concentration was 0.56 µg/L. The surface water sample analytical results are summarized in Table 12 and shown on Figure 8 (Appendix A).

Sediment
PFBS was not detected in the sediment sample. PFOA and PFOS were both detected in the sediment sample. Neither of the detected concentrations exceeded the RSLs for soil.

The detected concentration of PFOA was estimated at 0.28 µg/kg. The detected concentration of PFOS was estimated at 4.8 µg/kg. Sediment sample analytical results are summarized in Table 13 and shown on Figure 7 (Appendix A).

3.5.5 Conclusions

Outfall 1 is a controlled stormwater discharge point for Watershed 1 on the northern boundary of Malmstrom AFB. On at least one occasion, AFFF from Hangar 1440 was pushed onto the hangar apron. Storm drain inlets near the hangar would have collected any residual AFFF and conveyed it to Outfall 1.

The subsurface soil sample analyses results indicate that the target compounds are not present in the soil at concentrations above the screening levels. Likewise, the sediment analyses results indicate that the target compounds are not present in sediments at concentrations above the RSLs. However, the groundwater sample analyses indicate PFOA and the combined PFOA and PFOS concentrations are above the screening levels. Similarly, the surface water analyses results indicate PFOA, PFOS, and the combined PFOA and PFOS concentrations are above the screening levels. Based on these analytical results, a release of AFFF has been confirmed at AFFF Area 3 that has impacted groundwater and surface water at Outfall 1.

Table 10 Outfall 1 (AFFF Area 3) Subsurface Soil Analytical Results

Analyte	Sample ID	MALMS03-001-SO-020	MALMS03-002-SO-020	MALMS03-003-SO-009
	Depth (ft)	19–20	19–20	8–9
	Screening Level (µg/kg)	Result (µg/kg)	Result (µg/kg)	Result (µg/kg)
Perfluorobutane sulfonate (PFBS)	130,000[a]	0.24 UJ	0.24 UJ	0.30 U
Perfluorooctanoic acid (PFOA)	126[b]	0.11 U	0.11 U	0.14 U
Perfluorooctane sulfonate (PFOS)	126[b]	**0.36 J**	**0.32 J**	0.19 U

Bold values indicate analyte detected at concentration indicated.
[a] EPA Regional Screening Levels for Residential Soil (May 2018). (https://semspub.epa.goc/work/HQ/197235.pdf).
[b] Screening levels calculated using the EPA Regional Screening Level calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).
µg/kg = micrograms per kilogram dup = duplicate
ft = foot or feet ID = identification
J = The reported concentration is an estimated value.
U = The analyte was analyzed for but was not detected above the reported sample quantification limit

Table 11 Outfall 1 (AFFF Area 3) Groundwater Analytical Results

Analyte	Well ID	MALMS03-MW001	MALMS03-MW002	MALMS03-MW003	MALMS03-MW003
	Sample ID	MALMS03-001-GW-025	MALMS03-002-GW-030	MALMS03-003-GW-020	MALMS03-003-GW-920 (duplicate)
	Screening Level (µg/L)	Result (µg/L)	Result (µg/L)	Result (µg/L)	Result (µg/L)
Perfluorobutane Sulfonate (PFBS)	40[a]	**0.020 J**	**0.022 J**	**0.031**	**0.030**
Perfluorooctanoic Acid (PFOA)	0.07[b]	**0.017 J**	**0.070 J**	**0.021**	**0.022**
Perfluorooctane Sulfonate (PFOS)	0.07[b]	0.0026 U	**0.024 J**	**0.033**	**0.029**
PFOS + PFOA	0.07[c]	**0.017 J**	**0.094 J**	**0.054**	**0.051**

Bold values indicate analyte detected at concentration indicated.
Shaded values indicate analyte detected above screening level.
[a] EPA Regional Screening Levels for Tapwater (May 2018) (https://semspub.epa.goc/work/HQ/197235.pdf).
[b] Screening Level listed in "Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA)" (EPA, May 2016b) and "Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS)" (EPA, May 2016a).
[c] EPA recommends comparing the combined analytical results for PFOA and PFOS when both are present.
µg/L = micrograms per liter
GW = groundwater ID = identification
J = reported concentration is an estimated value U = analyte was not detected above the reported value.

Table 12 Outfall 1 (AFFF Area 3) Surface Water Analytical Results

Analyte	Sample ID	MALMS03-004-SW-001
	Screening Level (µg/L)	Result (µg/L)
Perfluorobutane Sulfonate (PFBS)	40[a]	**0.057**
Perfluorooctanoic Acid (PFOA)	0.07[b]	**0.10**
Perfluorooctane sulfonate (PFOS)	0.07[b]	**0.46**
Combined PFOA + PFOS	0.07[b]	**0.56**

Bold values indicate analyte detected at concentration indicated.
Shaded cells indicate analyte detected above screening level.
[a] EPA Regional Screening Levels for Tapwater (May 2018) (https://semspub.epa.goc/work/HQ/197235.pdf).
[b] May 2016a. *Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA)* and EPA, May 2016b. *Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS).* Note: When PFOA and PFOS are both present, the combined detected concentrations of the compounds are compared with the 0.07 µg/L Health Advisory value.
µg/L = micrograms per liter ID = identification

Table 13 Outfall 1 (AFFF Area 3) Sediment Analytical Results

Analyte	Sample ID	MALMS03-004-SD-001
	Depth (ft)	0–1
	Screening Level (µg/kg)	Result (µg/kg)
Perfluorobutane Sulfonate (PFBS)	130,000[a]	0.30 UJ
Perfluorooctanoic Acid (PFOA)	126[b]	**0.28 J**
Perfluorooctane sulfonate (PFOS)	126[b]	**4.8 J**

Bold values indicate analyte detected at concentration indicated.
[a] EPA Regional Screening Levels for Residential Soil (May 2018) (https://semspub.epa.goc/work/HQ/197235.pdf).
[b] Screening levels calculated using the EPA Regional Screening Level calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).
µg/kg = micrograms per kilogram ft = foot or feet
ID = identification
J =The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
U = The analyte was analyzed for but was not detected above the reported sample quantification limit.

3.6 OUTFALL 3 (AFFF AREA 4)

The media of concern at Outfall 3 are surface soil, subsurface soil, shallow groundwater, and surface water/sediment.

3.6.1 Sample Locations

Two sets of surface soil and subsurface soil samples were collected from borings (MALMS04-001 and MALMS04-002) in the outfall drainage area. The borings were converted into groundwater monitoring wells (MALMS04-MW001 and MALMS04-MW002), and groundwater samples were collected from both wells. Two sets of surface water and sediment samples were collected from the outfall drainage area. Sample locations for AFFF Area 4 are shown on Figure 9 in Appendix A.

3.6.2 Soil Description

Two soil borings were completed to 15 feet bgs within Quaternary sediments of the surficial aquifer. Primary soil types and classifications include silty sandy clay (CL), silty sand (SM), and clays (CL) with trace weathered limestone laminations. Detailed boring logs are presented in Appendix C.

3.6.3 Groundwater Flow

Two new monitoring wells (MALMS04-MW001 and MALMS04-MW002) were constructed in October 2016. At the time of their construction, both wells were dry. ASL remobilized to the base in May 2017 and recorded depth to groundwater measurements. Groundwater elevation at well MALSM04-MW001 was 3389.11 feet amsl (5.38 feet btoc). Groundwater elevation at MALMS04-MW002 was 3391.10 feet amsl (4.32 feet btoc). The groundwater elevation measurements are presented in Appendix H and on Figure 9 of Appendix A. Site specific groundwater flow direction at AFFF Area 4 is unknown because a minimum of three data points are required to determine groundwater flow direction. The PA report (CH2M Hill, April 2015) indicates that, based on regional groundwater flow direction, groundwater at Malmstrom AFB generally flows north.

3.6.4 Analytical Results

Two primary surface soil samples, two primary subsurface soil samples, three groundwater samples (two primary samples and one field duplicate sample), two primary sediment samples, and two primary surface water samples were submitted to the project laboratory for analyses from AFFF Area 4.

Surface Soil
PFBS was detected in the surface soil sample MALMS04-001-SS-001. PFOA and PFOS were detected in both surface soil samples. None of the target analytes were detected at concentrations above the RSLs for soil.

The only PFBS detection was estimated at 0.39 µg/kg in sample MALMS04-001-SS-001. PFOA was detected at an estimated 0.67 µg/kg (MALMS04-002-SS-001) and 2.1 µg/kg (MALMS04-001-SS-001). PFOS concentrations ranged from an estimated 0.46 µg/kg (MALMS04-002-SS-001) to 3.3 µg/kg (MALMS04-001-SS-001). Surface soil sample analytical results are summarized in Table 14 and shown on Figure 10 (Appendix A).

Subsurface Soil
PFBS was not detected in the surface soil samples. PFOA was detected in both surface soil samples. PFOS was detected in sample MALMS04-001-SO-004. None of the compounds were detected at concentrations exceeding the RSLs for soil.

PFOA concentrations range from an estimated 0.23 µg/kg (MALMS04-002-SO-002) and 1.4 µg/kg (MALMS04-001-SO-004). The only PFOS detection was at 7.8 µg/kg in sample MALMS04-001-SO-004. Subsurface soil sample results are summarized in Table 15 and sown on Figure 10 (Appendix A).

Soil Physiochemical Analyses
Two composite samples from AFFF Area 1 were submitted for physiochemical analyses. The composite surface soil sample (MALMS04-005-SS-001) was composed of aliquots of the surface soil samples from ground surface to 6 inches bgs. The composite subsurface soil sample (MALMS04-005-SO-003) was composed of aliquots of the subsurface soil samples, which ranged from 1 to 4 feet bgs. The composite physiochemical sample results are contained in Appendix G.

Groundwater
PFBS, PFOA, and PFOS were detected in the three groundwater samples. Neither PFBS nor PFOS were detected at concentrations above the screening levels for water. However, PFOA and the combined PFOA and PFOS concentrations exceed the screening levels for water.

PFBS concentrations ranged from 0.045 µg/L (MALMS04-002-GW-904) to 0.17 µg/L (MALMS04-001-GW-005). PFOA concentrations ranged from 0.19 µg/L (MALMS04-002-GW-904) to 0.45 µg/L (MALMS04-001-GW-005). PFOS concentrations ranged from an estimated 0.010 µg/L (MALMS04-001-GW-005) to 0.039 µg/L (MALMS04-002-GW-904). The combined PFOA and PFOS concentrations ranged from 0.229 µg/L (MALMS04-002-GW-904) to an estimated 0.460 µg/L (MALMS04-001-GW-005). Groundwater sample analytical results are summarized in Table 16 and shown on Figure 11 (Appendix A).

Surface Water
PFBS, PFOA, and PFOS were detected in both surface water samples. PFOA and the combined PFOA and PFOS concentrations exceed the screening levels for water in both samples. PFOS was detected at concentrations above the screening levels for water in sample MALMS04-003-SW-001.

PFBS concentrations were detected at 0.065 µg/L (MALMS04-004-SW-001) and 0.14 µg/L (MALMS04-003-SW-001). PFOA was detected at 0.32 µg/L (MALMS04-004-SW-001) and 0.49 µg/L (MALMS04-003-SW-001). PFOS was detected at an estimated 0.057 µg/L (MALMS04-004-SW-001) and 1.2 µg/L (MALMS04-003-SW-001). The combined PFOA and PFOS concentrations were calculated at 0.377 µg/L (MALMS04-004-SW-001) and 1.69 µg/L (MALMS04-003-SW-001). Surface water sample analytical results are summarized in Table 17 and shown on Figure 11 (Appendix A).

Sediment
PFBS was not detected in the sediment samples. PFOA and PFOS were detected in both samples. None of the detected concentrations of PFOA or PFOS exceeded the RSLs for soil.

PFOA was detected at an estimated 0.20 µg/kg (MALMS04-003-SD-001) and an estimated 1.3 µg/kg (MALMS04-004-SD-001). PFOS was detected at an estimated 2.1 µg/kg (MALMS04-004-SD-001) and 10 µg/kg (MALMS04-003-SD-001). Sediment sample analytical results are summarized in Table 18 and shown on Figure 10 (Appendix A).

3.6.5 Conclusions

Outfall 3 is a controlled discharge point for Watershed 3 on the northern boundary of Malmstrom AFB. In the late 1990s, an AFFF tank was ruptured, releasing 600 gallons of AFFF into a nearby stormwater inlet that drains to Outfall 3. In addition to the spill, routine spray tests of mobile fire response vehicles were conducted at Fire Station 349 (within Watershed 3). AFFF released during the tests drained into nearby stormwater inlets, which drain to Outfall 3. Therefore, an unknown quantity of AFFF may have been carried to Outfall 3.

The surface soil and subsurface soil sample analyses results indicate that the target compounds are not present in the soil at concentrations above the RSLs. Likewise, the sediment analyses results indicate that the target compounds are not present in sediments at concentrations above the RSLs. However, the surface water analyses results indicate PFOA and PFOS are present in the surface water at concentrations above the screening levels. Groundwater sample results indicate PFOA and the combined PFOA and PFOS concentrations are present above screening levels. Based on these analytical results, a release of AFFF has been confirmed at AFFF Area 4 that has impacted groundwater and surface water at Outfall 3.

Table 14 Outfall 3 (AFFF Area 4) Surface Soil Analytical Results

Analyte	Sample ID	MALMS04-001-SS-001	MALMS04-002-SS-001
	Depth (ft)	0–0.5	0–0.5
	Screening Level (µg/kg)	Result (µg/kg)	Result (µg/kg)
Perfluorobutane sulfonate (PFBS)	130,000[a]	**0.39 J**	0.23 UJ
Perfluorooctanoic acid (PFOA)	126[b]	**2.1**	**0.67 J**
Perfluorooctane sulfonate (PFOS)	126[b]	**3.3**	**0.46 J**

Bold values indicate analyte detected at concentration indicated.
[a] EPA Regional Screening Levels for Residential Soil (May 2018) (https://semspub.epa.goc/work/HQ/197235.pdf).
[b] Screening levels calculated using the EPA Regional Screening Level calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).
µg/kg = micrograms per kilogram dup = duplicate
ft = foot or feet ID = identification
J = The reported concentration is an estimated value.
U = The analyte was analyzed for but was not detected above the reported sample quantification limit.

Table 15 Outfall 3 (AFFF Area 4) Subsurface Soil Analytical Results

Analyte	Sample ID	MALMS04-001-SO-004	MALMS04-002-SO-002
	Depth (ft)	3–4	1–2
	Screening Level (µg/kg)	Result (µg/kg)	Result (µg/kg)
Perfluorobutane sulfonate (PFBS)	130,000[a]	0.24 U	0.24 UJ
Perfluorooctanoic acid (PFOA)	126[b]	**1.4**	**0.23 J**
Perfluorooctane sulfonate (PFOS)	126[b]	**7.8**	0.15 UJ

Bold values indicate analyte detected at concentration indicated.
[a] EPA Regional Screening Levels for Residential Soil (May 2018) (https://semspub.epa.goc/work/HQ/197235.pdf).
[b] Screening levels calculated using the EPA Regional Screening Level calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).
µg/kg = micrograms per kilogram dup = duplicate
ft = foot or feet ID = identification
J = The reported concentration is an estimated value.
U = The analyte was analyzed for but was not detected above the reported sample quantification limit

Table 16 Outfall 3 (AFFF Area 4) Groundwater Analytical Results

Analyte	Well ID	MALMS04-MW001	MALMS04-MW002	MALMS04-MW002
	Sample ID	MALMS04-001-GW-005	MALMS04-002-GW-004	MALMS04-002-GW-904 (duplicate)
	Depth (ft)	5	4	4
	Screening Level (µg/L)	Result (µg/L)	Result (µg/L)	Result (µg/L)
Perfluorobutane Sulfonate (PFBS)	40[a]	**0.17**	**0.046**	**0.045**
Perfluorooctanoic Acid (PFOA)	0.07[b]	**0.45**	**0.21**	**0.19**
Perfluorooctane sulfonate (PFOS)	0.07[b]	**0.010 J**	**0.036**	**0.039**
Combined PFOA+PFOS	0.07[b]	**0.460 J**	**0.246**	**0.229**

Bold values indicate analyte detected at concentration indicated.
Shaded cells indicate analyte detected above screening level.
[a] EPA Regional Screening Levels for Tapwater (May 2018) (https://semspub.epa.goc/work/HQ/197235.pdf).
[b] May 2016a. *Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA)* and EPA, May 2016b. *Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS).* Note: When PFOA and PFOS are both present, the combined detected concentrations of the compounds are compared with the 0.07 µg/L Health Advisory value.
µg/L = micrograms per liter
dup = duplicate
ft = foot or feet
ID = identification
J = The reported concentration is an estimated value.
U = The analyte was analyzed for but was not detected above the reported sample quantification limit

Table 17 Outfall 3 (AFFF Area 4) Surface Water Analytical Results

Analyte	Sample ID	MALMS04-003-SW-001	MALMS04-004-SW-001
	Screening Level (µg/L)	Result (µg/L)	Result (µg/L)
Perfluorobutane Sulfonate (PFBS)	40[a]	**0.14**	**0.065**
Perfluorooctanoic Acid (PFOA)	0.07[b]	**0.49**	**0.32**
Perfluorooctane sulfonate (PFOS)	0.07[b]	**1.2**	**0.057**
Combined PFOA + PFOS	0.07[b]	**1.69**	**0.377**

Bold values indicate analyte detected at concentration indicated.
Shaded cells indicate analyte detected above screening level.
[a] EPA Regional Screening Levels for Tapwater (May 2018) (https://semspub.epa.goc/work/HQ/197235.pdf).
[b] May 2016a. *Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA)* and EPA, May 2016b. *Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS).* Note: When PFOA and PFOS are both present, the combined detected concentrations of the compounds are compared with the 0.07 µg/L Health Advisory value.
µg/L = micrograms per liter ID = identification

Table 18 Outfall 3 (AFFF Area 4) Sediment Analytical Results

Analyte	Sample ID	MALMS04-003-SD-001	MALMS04-004-SD-001
	Depth (ft)	0–1	0–1
	Screening Level (µg/kg)	Result (µg/kg)	Result (µg/kg)
Perfluorobutane Sulfonate (PFBS)	130,000[a]	0.24 U	0.38 UJ
Perfluorooctanoic Acid (PFOA)	126[b]	**0.20 J**	**1.3 J**
Perfluorooctane sulfonate (PFOS)	126[b]	**10**	**2.1 J**

Bold values indicate analyte detected at concentration indicated.
[a] EPA Regional Screening Levels for Residential Soil (May 2018) (https://semspub.epa.goc/work/HQ/197235.pdf).
[b] Screening levels calculated using the EPA Regional Screening Level calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).
µg/kg = micrograms per kilogram ft = foot or feet
ID = identification
J = The reported concentration is an estimated value.
U = The analyte was analyzed for but was not detected above the reported sample quantification limit.

3.7 HANGAR 1440 (AFFF AREA 5)

The media of concern at Hangar 1440 are surface soil, subsurface soil, and shallow groundwater. Surface water bodies are not present near the area, so neither surface water nor sediment samples were collected.

3.7.1 Sample Locations

Two sets of surface soil, subsurface soil, and groundwater samples were collected from soil borings (MALMS05-001 and MALMS05-002) in grassy areas adjacent to the parking lot northeast of the hangar. Both soil borings were converted into monitoring wells. Well MALMS05-MW002 (boring MALMS05-002) was constructed with a 20-foot screen, rather than a 10-foot screen, because groundwater was not encountered down to 30 feet bgs. However, damp clays (CL) were encountered at 5 feet bgs and extended to 30 feet bgs, so the longer screen was installed across the 5 to 25 foot bgs interval. At the time of construction (October 2016), both new monitoring wells were dry and unable to be sampled. Groundwater samples were collected in May 2017, six months after the wells were constructed. A single groundwater sample was collected from an existing groundwater monitoring well (ST05-MW-5). Sample locations for AFFF Area 5 are shown on Figure 12 in Appendix A.

3.7.2 Soil Description

Two soil borings were completed at depths ranging from 20 to 30 feet bgs within Quaternary sediments of the surficial aquifer. Primary soil types and classifications include clay (CL), sandy silt (ML), and sandy silty clay (CL). Detailed boring logs are presented in Appendix C.

3.7.3 Groundwater Flow

Depth to groundwater measurements were recorded in existing monitoring well ST05-MW-5 and newly installed wells MALMS05-MW001 and MALMS05-MW002. Groundwater elevations ranged from 3454.01 feet amsl (10.34 feet botc) to 3467.06 feet amsl (1.56 feet btoc). The groundwater elevation measurements are presented in Appendix H. Figure 12 (Appendix A) shows the potentiometric surface contours developed from these measurements. The contours indicate that when the static water levels were measured in May 2017, groundwater flow direction was southeast.

3.7.4 Analytical Results

Two primary surface soil samples, two primary subsurface soil samples, and four groundwater samples (three primary samples and one field duplicate sample) were submitted to the project laboratory for analyses from AFFF Area 5.

Surface Soil
PFBS was not detected in either surface soil sample. PFOA and PFOS were detected in both surface soil samples. None of the target analytes were detected at concentrations above the RSLs.

PFOA was detected at an estimated 0.87 µg/kg (MALMS05-002-SS-001) and 1.1 µg/kg (MALMS05-001-SS-001). PFOS was detected at 4.1 µg/kg (MALMS05-002-SS-001) and 12 µg/kg (MALMS05-001-SS-001). Surface soil sample analytical results are summarized in Table 19 and shown on Figure 13 (Appendix A).

Subsurface Soil
Neither PFBS nor PFOA were detected in either subsurface soil sample. PFOS was detected in one sample (MALMS05-002-SO-011), but its concentration did not exceed the RSL for soil.

The only PFOS detection was at an estimated 1.1 µg/kg in sample MALMS05-002-SO-011. Subsurface soil sample analytical results are summarized in Table 20 and shown in Figure 13 (Appendix A).

Soil Physiochemical Analyses
Two composite samples from AFFF Area 1 were submitted for physiochemical analyses. The composite surface soil sample (MALMS05-004-SS-001) was composed of aliquots of the surface soil samples from ground surface to 6 inches bgs. The composite subsurface soil sample (MALMS05-004-SO-010) was composed of aliquots of the subsurface soil samples, which was 6 feet bgs for both borings. The composite physiochemical sample results are contained in Appendix G.

Groundwater
All three target analytes were detected in the three primary samples and the field duplicate sample. Neither PFBS nor PFOA were detected at concentrations above the screening levels for water. However, both PFOS (0.19 µg/L) and the combined PFOA and PFOS concentrations (0.243 µg/L) exceed the screening levels for water in one sample (MALMS05-ST05MW5-002).

PFBS concentrations ranged from 0.025 µg/L (MALMS05-ST05MW5-002) to an estimated 0.11 µg/L (MALMS05-001-GW-017). PFOA concentrations ranged from an estimated 0.018 µg/L (MALMS05-002-GW-025 and MALMS05-002-GW-925) to 0.053 µg/L (MALMS05-ST05MW5-002). PFOS concentrations ranged from an estimated 0.011 µg/L (MALMS05-001-GW-017, MALMS05-002-GW-025, and MALMS05-002-GW-925) to 0.19 µg/L (MALMS05-ST05MW5-002). The combined PFOA and PFOS concentrations ranged from an estimated 0.029 µg/L (MALMS05-002-GW-025 and MALMS05-002-GW-925) to 0.243 µg/L (MALMS05-ST05MW5-002). Groundwater sample analytical results are summarized in Table 21 and shown in Figure 14 (Appendix A).

3.7.5 Conclusions

Annual fire suppression system testing resulted in 3% AFFF solution being pushed out onto the apron and allowed to evaporate or drain into a stormwater drop inlet that drains through Outfall 1. Since 2007, approximately 300 gallons of AFFF have been discharged from the AFFF tank during fire suppression system testing and evaporation/line losses. The results of surface soil and subsurface soil sample analyses indicate that the target compounds are not present in the soil at concentrations above the RSLs. The groundwater sample results indicate PFOS and the combined PFOA and PFOS are present at concentrations above the screening levels. Based on these analytical results, a release of AFFF has been confirmed at AFFF Area 3 that has impacted groundwater at Hangar 1440.

Table 19 Hangar 1440 (AFFF Area 5) Surface Soil Analytical Results

Analyte	Sample ID	MALMS05-001-SS-001	MALMS05-002-SS-001
	Depth (ft)	0–0.5	0–0.5
	Screening Level (µg/kg)	Result (µg/kg)	Result (µg/kg)
Perfluorobutane sulfonate (PFBS)	130,000[a]	0.25 U	0.25 U
Perfluorooctanoic acid (PFOA)	126[b]	**1.1**	**0.87 J**
Perfluorooctane sulfonate (PFOS)	126[b]	**12**	**4.1**

Bold values indicate analyte detected at concentration indicated.
[a] EPA Regional Screening Levels for Residential Soil (May 2018) (https://semspub.epa.goc/work/HQ/197235.pdf).
[b] Screening levels calculated using the EPA Regional Screening Level calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).
µg/kg = micrograms per kilogram dup = duplicate
ft = foot or feet ID = identification
J = The reported concentration is an estimated value.
U = The analyte was analyzed for but was not detected above the reported sample quantification limit.

Table 20 Hangar 1440 (AFFF Area 5) Subsurface Soil Analytical Results

Analyte	Sample ID	MALMS05-001-SO-007	MALMS05-002-SO-011
	Depth (ft)	6–7	10–11
	Screening Level (µg/kg)	Result (µg/kg)	Result (µg/kg)
Perfluorobutane sulfonate (PFBS)	130,000[a]	0.30 U	0.28 U
Perfluorooctanoic acid (PFOA)	126[b]	0.14 U	0.13 U
Perfluorooctane sulfonate (PFOS)	126[b]	0.19 U	**1.1 J**

Bold values indicate analyte detected at concentration indicated.
[a] EPA Regional Screening Levels for Residential Soil (May 2018) (https://semspub.epa.goc/work/HQ/197235.pdf).
[b] Screening levels calculated using the EPA Regional Screening Level calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).
µg/kg = micrograms per kilogram dup = duplicate
ft = foot or feet ID = identification
J = The reported concentration is an estimated value.
U = The analyte was analyzed for but was not detected above the reported sample quantification limit.

Table 21 Hangar 1440 (AFFF Area 5) Groundwater Analytical Results

Analyte	Station	MALMS05-MW001	MALMS05-MW002	MALMS05-MW002	ST05MW5
	Sample ID	MALMS05-001-GW-017	MALMS05-002-GW-025	MALMS05-002-GW-925 (duplicate)	MALMS05-ST05MW5-002
	Depth (ft)	7–17	5–25	5–25	2
	Screening Level (µg/L)	Result (µg/L)	Result (µg/L)	Result (µg/L)	Result (µg/L)
Perfluorobutane Sulfonate (PFBS)	40[a]	**0.11 J**	**0.044 J**	**0.081 J**	**0.025**
Perfluorooctanoic Acid (PFOA)	0.07[b]	**0.036 J**	**0.018 J**	**0.018 J**	**0.053**
Perfluorooctane sulfonate (PFOS)	0.07[b]	**0.011 J**	**0.011 J**	**0.011 J**	**0.19**
Combined PFOA+PFOS	0.07[b]	**0.047 J**	**0.029 J**	**0.029 J**	**0.243**

Bold values indicate analyte detected at concentration indicated.
Shaded cells indicate analyte detected above screening level.
[a] EPA Regional Screening Levels for Tapwater (May 2018) (https://semspub.epa.goc/work/HQ/197235.pdf).
[b] EPA, May 2016a, *Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA)*, and EPA, May 2016b, *Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS).* Note: When PFOA and PFOS are both present, the combined detected concentrations of the compounds are compared with the 0.07 µg/L Health Advisory value.
µg/L = micrograms per liter
ft = foot or feet
ID = identification

3.8 FIRE STATION (BUILDING 349) (AFFF AREA 6)

The media of concern at the Fire Station (Building 349) is shallow groundwater. Surface water bodies are not present near the area, so neither surface water nor sediment samples were collected. Soil at the Fire Station was not a concern because the AFFF released on asphalt that drains directly into the stormwater drainage system of Outfall 3 (investigated during this SI as AFFF Area 4).

3.8.1 Sample Locations

Five groundwater samples were collected from existing groundwater monitoring wells associated with IRP Sites ST04 (Pumphouse 3) and ST-05 (Former Fuel Supply Lines) (ST05-MW-04, PH3-MW-1, PH3-MW-2, PH3-MW-4, and PH3-MW-5). The sample locations for AFFF Area 6 are shown on Figure 15 in Appendix A.

3.8.2 Soil Description

New borings were not drilled during the site inspection at AFFF Area 6. However, boring logs from four (PH3-MW1, PH3-MW2, PH3-4, and PH3-MW5) of the five existing groundwater monitoring wells that were sampled describe the soils as light brown to brown sandy clays and brown sands (EMR, Inc., June 2017). Each of the four borings were drilled to 17 feet bgs.

3.8.3 Groundwater Flow

Depth to groundwater measurements were recorded in five existing monitoring wells (ST05-MW04, PH3-MW1, PH3-MW2, PH3-MW4, and PH3-MW5). Groundwater elevations ranged from 3452.76 feet amsl (9.56 feet btoc at ST05MW04) to 3465.92 feet amsl (7.73 feet btoc at PH3-MW5). The groundwater elevation measurements are presented in Appendix H. Figure 15 (Appendix A) shows the potentiometric surface contours developed from these measurements. The contours indicate that when the static water levels were measured in October 2016, groundwater flow direction was generally to the east.

3.8.4 Analytical Results

Five primary groundwater samples were submitted to the project laboratory for analyses from AFFF Area 6.

Groundwater
PFBS, PFOA, and PFOS were detected in all five groundwater samples. PFBS was not detected at concentrations above the RSLs in the five samples. However, both PFOA and the combined PFOA and PFOS concentrations exceed the RSLs for water in all five samples. PFOS was detected at concentrations above the RSLs for water in three (MALMS06-PH3MW2-009, MALMS06-PH3MW5-008, and MALMS06-ST05MW04-009) of the five samples.

PFBS concentrations ranged from an estimated 0.047 µg/L (MALMS06-ST05MW04-009) to 1.0 µg/L (MALMS06-PH3MW5-008). PFOA concentrations ranged from 0.16 µg/L (MALMS06-ST05MW04-009) to 5.5 µg/L (MALMS06-PH3MW5-008). PFOS concentrations ranged from 0.021 µg/L (MALMS06-PH3MW4-009) to 0.93 µg/L (MALMS06-PH3MW2-009). The combined PFOA and PFOS concentrations ranged from 0.312 µg/L (MALMS06-PH3MW1-019) to 5.73 µg/L (MALMS06-PH3MW5-008). Groundwater sample analytical results are summarized in Table 22 and shown on Figure 16 (Appendix A).

3.8.5 Conclusions

An AFFF spill in the late 1990s and routine spray testing at the fire station have resulted in PFAS impacts to the environment at Building 349. Groundwater samples collected from five existing monitoring wells indicate that PFOA and PFOS are present in the groundwater above screening levels at the Fire Station.

Table 22 Fire Station (Building 349) (AFFF Area 6) Groundwater Analytical Results

Analyte	Well ID	PH3-MW1	PH3-MW2	PH3-MW4	PH3-MW5	ST05-MW04
	Sample ID	MALMS06-PH3MW1-019	MALMS06-PH3MW2-009	MALMS06-PH3MW4-009	MALMS06-PH3MW5-008	MALMS06-ST05MW04-009
	Depth (ft)	19	9	9	8	9
	Screening Level (µg/L)	Result (µg/L)	Result (µg/L)	Result (µg/L)	Result (µg/L)	Result (µg/L)
Perfluorobutane Sulfonate (PFBS)	40[a]	**0.18**	**0.80**	**0.60**	**1.0**	**0.047 J**
Perfluorooctanoic Acid (PFOA)	0.07[b]	**0.29**	**2.9**	**0.54**	**5.5**	**0.16**
Perfluorooctane sulfonate (PFOS)	0.07[b]	**0.022**	**0.93**	**0.021**	**0.23**	**0.23**
Combined PFOA+PFOS	0.07[b]	**0.312**	**3.83**	**0.561**	**5.73**	**0.39**

Bold values indicate analyte detected at concentration indicated.
Shaded cells indicate analyte detected above screening level.
[a] EPA Regional Screening Levels for Tapwater (May 2018) (https://semspub.epa.goc/work/HQ/197235.pdf).
[b] EPA, May 2016a, *Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA)*, and EPA, May 2016b, *Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS).* Note: When PFOA and PFOS are both present, the combined detected concentrations of the compounds are compared with the 0.07 µg/L Health Advisory value.
µg/L = micrograms per liter
ft = foot or feet
ID = identification
J = The reported concentration is an estimated value.
U = The analyte was analyzed for but was not detected above the reported sample quantification limit

3.9 INVESTIGATION-DERIVED WASTE

All investigation-derived waste (IDW) was managed in accordance with the specific waste management guidance provided by Malmstrom AFB. IDW generated during the SI field effort consisted of soil and wastewater potentially impacted with PFAS and construction waste such as used personal protective equipment, paper, rags, and plastic sheeting.

3.9.1 Waste Soil

Waste soil generated during the installation of soil borings was placed in Department of Transportation (DOT)-approved steel drums for waste sampling and proper disposal. A representative sample was collected from the waste soil and submitted to the project laboratory and analyzed for PFAS, toxicity characteristic leaching procedure (TCLP) list (volatile organic compounds, semivolatile organic compounds, pesticides, herbicides, and metals), polychlorinated biphenyls, total petroleum hydrocarbons, flashpoint, corrosivity (pH), sulfide, and cyanide. Twenty-two drums of waste soil were disposed at the Clean Harbors, Inc., facility in LaPorte, Texas. A copy of the disposal manifest is presented in Appendix F.

3.9.2 Wastewater

Waste fluids generated during groundwater sampling and decontamination activities were placed in DOT-approved steel drums and staged to a secure location for waste sampling and proper disposal. A representative sample was collected from the waste fluids and submitted to the project laboratory and

analyzed for PFAS and full TCLP list. Six drums of wastewater were disposed of at the Clean Harbors Aragonite LLC incineration facility in Grantsville, Utah. A copy of the disposal manifest is presented in Appendix F.

3.9.3 Construction Waste

Construction waste was placed in plastic garbage bags and put in dumpsters on the base for disposal at an off-site Resource Conservation and Recovery Act Subtitle D industrial landfill.

4.0 GROUNDWATER PATHWAY

The following hydrogeologic descriptions are taken from the QAPP addendum (ASL, September 2016) unless otherwise noted.

Malmstrom AFB lies within a glaciated region that extends from the Rocky Mountains in the west to the Dakotas. Several episodes of glaciation deposited layers of till material as the glaciers retreated, and these layers buried much of the landscape. Underlying most of the glaciated area is sedimentary rock. Rivers, such as the Missouri River, have cut through the glaciated till to other exposed sedimentary rock. The lower cretaceous bedrock ranges from 20 to more than 100 feet bgs from south to north. The bedrock dates to the Mesozoic era and is primarily overlain with silty clay material.

The uppermost shallow groundwater beneath the base ranges in depth from 40 feet bgs along the southern boundary of the base to 12 feet bgs along the northern boundary of the base. Clay lenses occur throughout the subsurface, starting at about 5 feet bgs. Thin layers of perched groundwater may be present on top of these clay layers. The depth to the clay lenses and the areal extent of the clay lenses vary throughout the base. Local groundwater flow direction varies significantly, but generally, shallow groundwater flows north toward the Missouri River. Figure 17 (Appendix A) presents a geologic cross section for Malmstrom AFB.

The deep water-bearing zone at Malmstrom AFB is composed of unconsolidated, older Pleistocene terrace gravels. These terrace gravels are probably associated with a paleochannel and most likely overlie bedrock. The groundwater in the gravel is confined by the overlying glacial till and may be connected to the underlying Madison Limestone by fractures. The fractures are projected from Giant Springs, which is on the Missouri River 3 miles northeast of the site. Groundwater flow direction in the Madison aquifer near the base is principally to the north, following the dip and plunge of the northeast flank of the Sweetgrass Arch.

There are currently no drinking water wells at Malmstrom AFB (primary or contingency), with the Missouri River serving as the drinking water source for both Great Falls and Malmstrom AFB. The raw water river intake is approximately 8 miles upstream from the base. There are approximately 450 private water supply wells located off base within a 4-mile radius of Malmstrom AFB; however, no information is readily available regarding the depths of these wells. They are likely used for domestic drinking water, drinking water for livestock, and irrigation water for agriculture. Groundwater, used as raw drinking water for the Great Falls area, is generally at least 180 feet bgs and primarily taken from the Madison aquifer.

4.1 HISTORICAL FIRE TRAINING AREA (FT-01) AND OLD TAXIWAY LAND FARM (SS-22) (AFFF AREA 1)

The analytical results of the two groundwater samples (Table 5) collected from the Historical Fire Training Area indicate that shallow groundwater contains concentrations of PFOA, PFOS, and combined concentrations of PFOA and PFOS that exceed the health-based screening values. This indicates that the shallow groundwater in the area has been impacted by the release of AFFF.

Based on historical groundwater flow direction (north), there are no downgradient wells within four miles of AFFF Area 1.The nearest domestic water well is approximately 0.8 miles west (side-gradient) of AFFF Area 1 and approximately 440 feet deep (EDR, 2015). Information about the population served by this well is unavailable. Approximately 25,320 people live within a 4-mile radius of FT-01, most of whom receive drinking water from the City of Great Falls, which has a raw water intake on the Missouri River approximately 8 miles upstream of the Base (CH2M Hill, 2015). Since there are no downgradient water wells within 4 miles of the area, the human exposure pathway to groundwater at AFFF Area 1 is incomplete.

4.2 CANADIAN SNOWBIRDS CT-117 CRASH (AFFF AREA 2)

Based on the discontinuous characteristics of perched shallow groundwater in the area and the absence of saturated soils down to 70 feet bgs, shallow groundwater is not present at AFFF Area 2 and is not a media of concern.

4.3 OUTFALL 1 (AFFF AREA 3)

The analytical results of the two primary and one field duplicate groundwater samples collected from Outfall 1 indicate that shallow groundwater contains concentrations of PFOA and combined concentrations of PFOA and PFOS that exceed the health-based screening values. This indicates that the shallow groundwater in the area has been impacted by the release of AFFF.

The nearest domestic water wells are two wells that are both approximately 1 mile southwest (side-downgradient) of AFFF Area 3 and approximately 282 deep and 300 feet deep (EDR, 2015). Information about the population served by the wells is unavailable. Approximately 17,210 people live within a 4-mile radius of Outfall 1, most of whom receive drinking water from the City of Great Falls, which has a raw water intake on the Missouri River approximately 8 miles upstream of the Base (CH2MHill, 2015). Based on the depths of the nearest domestic water wells, a complete groundwater exposure pathway for AFFF Area 3 is unlikely.

4.4 OUTFALL 3 (AFFF AREA 4)

The analytical results of the two primary and one field duplicate groundwater samples collected at Outfall 3 during the SI indicate that shallow groundwater contains concentrations of PFOA and combined concentrations of PFOA and PFOS that exceed the health-based screening values. This indicates that the shallow groundwater in the area has been impacted by the release of AFFF.

The nearest domestic water well is approximately 1.5 miles east (side-upgradient) of AFFF Area 4. The well is approximately 90 feet deep. There are no down-gradient water wells within four miles of AFFF Area 4. Approximately 17,210 people live within a 4-mile radius of Outfall 3, most of whom receive drinking water from the City of Great Falls, which has a raw water intake on the Missouri River approximately 8 miles upstream of the Base (CH2MHill, 2015). Since there are not any down-gradient

domestic water wells within 4 miles of the area, the human exposure pathway to groundwater at AFFF Area 4 is incomplete.

4.5 HANGAR 1440 (AFFF AREA 5)

The analytical results of the three primary and one field duplicate groundwater samples collected from Hangar 1440 indicate that the shallow groundwater contains concentrations of PFOS and combined concentrations of PFOA and PFOS exceeding the health-based screening values. This indicates that the shallow groundwater in the area has been impacted by the release of AFFF.

The nearest domestic water well is approximately 0.68 miles southwest (side-gradient) of AFFF Area 5 and approximately 440 feet deep. The nearest downgradient domestic water well is approximately 1.5 miles south-southwest (side-downgradient) of AFFF Area 5 and approximately 380 feet deep. Information about the population served by this well is unavailable. Approximately 25,320 people live within a 4-mile radius of Malmstrom AFB, most of whom receive drinking water from the City of Great Falls, which has a raw water intake on the Missouri River approximately 8 miles upstream of the Base (CH2MHill, 2015). Based on the location and depth of the nearest downgradient domestic water well, a complete groundwater exposure pathway for AFFF Area 5 is unlikely.

4.6 FIRE STATION (BUILDING 349) (AFFF AREA 6)

The analytical results of the five groundwater samples collected at the Fire Station indicate that shallow groundwater contains concentrations of PFOA, PFOS, and combined concentrations of PFOA and PFOS that exceed the health-based screening values. This indicates that the shallow groundwater in the area has been impacted by the release of AFFF.

The nearest domestic water well is approximately 0.92 miles southwest (upgradient) of AFFF Area 6 and is approximately 440 feet deep. The nearest downgradient domestic well is approximately 2.2 miles east-northeast of AFFF Area 6 and approximately 90 feet deep. Information about the population served by this well is unavailable. Approximately 25,320 people live within a 4-mile radius of Malmstrom AFB, most of whom receive drinking water from the City of Great Falls, which has a raw water intake on the Missouri River approximately 8 miles upstream of the Base (CH2M Hill, 2015). Based on the distance to the nearest downgradient domestic water well, a complete groundwater exposure pathway for AFFF Area 6 is unlikely.

5.0 SURFACE WATER PATHWAY

The following hydrologic descriptions are taken from the QAPP addendum (ASL, September 2016) unless otherwise noted.

Malmstrom AFB is on a plateau in west-central Montana, at an elevation of 3,525 feet amsl. The plateau is bounded by mountains on the south, east, and west sides and drains into the Missouri River north of the base.

The base lies within the Upper Missouri River watershed and has nine drainage watersheds and six stormwater outfalls along the northern base boundary. All six stormwater outfalls converge prior to their release into the Missouri River, north of the base. Discharge from Outfalls 1 and 2 (Watersheds 1 and 2, respectively) travel approximately 1.6 miles to reach the Missouri River. The distance from Outfalls 3 and 4 (Watersheds 3 and 4, respectively) to the Missouri River is slightly less, at approximately 1.5 miles. Discharge from Outfalls 5 and 6 (Watersheds 5 and 6, respectively) travel the furthest distance to reach the Missouri River, at approximately 2.9 miles. Watersheds 7, 8, and 9 have no natural drainages (water

either evaporates or infiltrates into the ground). Each of the Outfalls 1 through 6 has a flow control device that can prevent the release of surface water. The retention capacity of each outfall is controlled by the ground surface elevations. The City of Great Falls drinking water intake is on the Missouri River, approximately 8.3 miles upstream of the Malmstrom AFB surface water discharge point.

There are two small wetlands on Malmstrom AFB property, near the southern boundary. There are additional wetlands within 1 mile of the bases southern boundary. The nearest 500-year floodplain is approximately 2 miles south of the Malmstrom AFB boundary.

Pow Wow Pond is located in Watershed 6, which is frequently used by on-base residents for recreational fishing. The pond is approximately 2,800 feet away from the closest site, FT-01.

The nearest federal fish hatchery is approximately 135 miles west of Malmstrom AFB, in the Clark Fork watershed, near Kalispell, Montana. However, the Giant Springs Montana State Park and Fish Hatchery borders the Missouri River, approximately 2.25 miles upstream of where Malmstrom AFB surface water flows into the river. There are no fisheries within 15 miles downstream of the Malmstrom AFB surface water discharge.

5.1 HISTORICAL FIRE TRAINING AREA (FT-01) AND OLD TAXIWAY LAND FARM (SS-22) (AFFF AREA 1)

Surface water is not a media of concern for AFFF Area 1 because surface water bodies do not exist in the area.

5.2 CANADIAN SNOWBIRDS CT-117 CRASH (AFFF AREA 2)

As presented in Section 3.4, and Table 8, PFAS was detected in surface water samples above the screening levels, indicating that surface water at AFFF Area 2 has been impacted by an AFFF release.

The crash occurred in Watershed 7, which has no natural drainage pathway. A drainage channel south of the crash site flows southeast, approximately 4,300 feet, into a wetland (within Watershed 7). The crash site is above the 500-year flood stage. The nearest surface water body is the drainage wetland within Watershed 7, located 4,300 feet southeast. There are no surface water intakes within 15 miles downstream of the area. The nearest drinking water intake is the City of Great Falls raw water intake on the Missouri River approximately 8 miles upstream of the Base (CH2M Hill, 2015). Although surface water has been impacted by an AFFF release, in the absence of a surface water intake within 15 miles downstream of the area, the human ingestion exposure pathway for surface water is incomplete.

5.3 OUTFALL 1 (AFFF AREA 3)

As presented in Section 3.5, and Table 12, PFAS was detected in the surface water sample at concentrations above the screening levels, indicating that surface water at AFFF Area 3 has been impacted by an AFFF release.

Surface water discharged through Outfall 1 flows through an open channel approximately 2 miles, before spilling into the Missouri River. The Malmstrom AFB surface water discharges into the Missouri River between Rainbow Dam (1.2 miles upstream) and Cochrane Dam (2 miles downstream) (Google Earth, 2017). Outfall 1 is above the 500-year flood stage. The nearest downgradient surface water body is a wetland where surface water from Outfall 1 spills into the Missouri River, approximately 2 miles

downstream (CH2M Hill, April 2015). There are no surface water intakes within 15 miles downstream of the area. The nearest drinking water intake is the City of Great Falls raw water intake on the Missouri River, approximately 8 miles upstream of the Base (CH2M Hill, 2015). Although surface water has been impacted by an AFFF release, in the absence of a surface water intake within 15 miles downstream of the area, the human ingestion exposure pathway for surface water is incomplete.

5.4 OUTFALL 3 (AFFF AREA 4)

As presented in Section 3.6, and Table 17, PFAS was detected in surface water samples above the screening levels, indicating that surface water at AFFF Area 4 has been impacted by an AFFF release.

Surface water leaving the Base though Outfall 3 flows through an open channel for approximately 1.9 miles before spilling into the Missouri River. The Malmstrom AFB surface water discharges into the Missouri River between Rainbow Dam (1.2 miles upstream) and Cochrane Dam (2 miles downstream) (Google Earth, 2017). Outfall 3 is above the 500-year flood stage. The nearest downgradient surface water body is a wetland where surface water from Outfall 3 spills into the Missouri River, approximately 8,700 feet downstream (CH2M Hill, April 2015). There are no surface water intakes within 15 miles downstream of the area. The nearest drinking water intake is the City of Great Falls raw water intake on the Missouri River approximately 8 miles upstream of the Base (CH2M Hill, April 2015). Although surface water has been impacted by an AFFF release, in the absence of a surface water intake within 15 miles downstream of the area, the human ingestion exposure pathway for surface water is incomplete.

5.5 HANGAR 1440 (AFFF AREA 5)

Surface water is not a media of concern for AFFF Area 5 because surface water bodies do not exist in the area. See section 5.3 for possible exposure pathways related to Outfall 1.

5.6 FIRE STATION (BUILDING 349) (AFFF AREA 6)

Neither surface water nor sediment were media of concern for AFFF Area 6 because surface water bodies do not exist in the area. See section 5.4 for possible exposure pathways related to Outfall 3.

6.0 SOIL AND SEDIMENT EXPOSURE AND AIR PATHWAYS

6.1 HISTORICAL FIRE TRAINING AREA (FT-01) AND OLD TAXIWAY LAND FARM (SS-22) (AFFF AREA 1)

As discussed in Section 3.3, sediment is not a media of concern at AFFF Area 1 because surface water bodies are not present in the area. As presented in Section 3.3, and Table 3, PFOS was detected in surface soil samples above the screening levels, indicating that surface soils at AFFF Area 1 have been impacted by an AFFF release. As presented in Section 3.3 and Table 4, PFOS was detected in one subsurface soil sample above the screening level, indicating that subsurface soils at AFFF Area 1 have been impacted by an AFFF release. The human exposure pathway for surface soil and subsurface soil is unlikely, but may be a continuing PFAS source to groundwater.

6.2 CANADIAN SNOWBIRDS CT-117 CRASH (AFFF AREA 2)

The PFAS concentrations in the surface and subsurface soil samples collected during the SI were below screening levels. In the absence of PFAS concentrations above the screening levels, the soil and air

pathways at AFFF Area 2 are incomplete. However, as presented in Section 3.4, and Table 9, PFOS was detected in one sediment sample above the screening levels, indicating that sediments at AFFF Area 2 have been impacted by an AFFF release. As such, the human exposure pathway for sediment is unlikely, but may be a continuing PFAS source for surface water.

6.3 OUTFALL 1 (AFFF AREA 3)

Surface soils are not a medium of concern at AFFF Area 3 because the stormwater drainage outfall is lined with concrete, precluding surface soil exposure to AFFF. The PFAS concentrations in the subsurface soil samples and sediment samples collected during the SI were below screening levels. In the absence of PFAS concentrations above the screening levels, the soil, sediment and air pathways at AFFF Area 3 are incomplete.

6.4 OUTFALL 3 (AFFF AREA 4)

The PFAS concentrations in the surface soil, subsurface soil, and sediment samples collected during the SI were below screening levels. In the absence of PFAS concentrations above the screening levels, the soil, sediment, and air pathways at AFFF Area 4 are incomplete.

6.5 HANGAR 1440 (AFFF AREA 5)

As discussed in Section 3.7, sediment is not a media of concern at AFFF Area 5 because surface water bodies are not present in the area. The PFAS concentrations in the surface and subsurface soil samples collected during the SI were below the screening levels. In the absence of PFAS concentrations above the screening levels, the soil and air pathways at AFFF Area 5 are incomplete.

6.6 FIRE STATION (BUILDING 349) (AFFF AREA 6)

As discussed in Section 3.8, sediment is not a media of concern at AFFF Area 6 because surface water bodies are not present in the area. The only known release of AFFF at Area 5 drained into the stormwater drainage system, and would not have impacted soils in the area. Based on the site history, neither surface soil nor subsurface soil are considered a media of concern at AFFF Area 5, and were not sampled during the SI.

7.0 UPDATE TO CONCEPTUAL SITE MODELS

7.1 HISTORICAL FIRE TRAINING AREA (FT-01) AND OLD TAXIWAY LAND FARM (SS-22) (AFFF AREA 1)

The conceptual site model (CSM) for the FT-01 presented in the QAPP addendum (ASL, September 2016) identified surface soil, subsurface soil, and shallow groundwater as media potentially impacted by previous releases of AFFF in the area. The CSM in the QAPP identified construction workers and/or base personnel exposed to impacted surface soil, subsurface soil, or shallow groundwater as potential human receptors. The findings presented in Section 6.1 indicates that a potential source of PFAS contamination exists in the surface soil and subsurface soil. As discussed in Section 4.1, analytical results indicate groundwater has been impacted by PFAS. However, in the absence of domestic water wells within 4 miles downgradient of the area, the human exposure pathway for groundwater is incomplete.

7.2 CANADIAN SNOWBIRDS CT-117 CRASH (AFFF AREA 2)

The CSM for the crash site identified surface soil, subsurface soil, shallow groundwater, surface water, and sediment as media potentially impacted by previous releases of AFFF in the area. The QAPP CSM (ASL, August 2016) identified construction workers and/or base personnel exposed to impacted surface soil, subsurface soil, shallow groundwater, surface water, or sediment as potential human receptors. The findings presented in Section 3.4 indicate that the surface soil and subsurface soil samples did not have detected concentrations of PFAS above the screening level. One sediment sample detected PFOS concentrations above the screening level, indicating sediment at AFFF Area 2 has been impacted by PFAS. Surface water samples had detections of PFOA, PFOS, and combined PFOA and PFOS concentrations above screening levels, indicating surface water at AFFF Area 2 has been impacted by PFAS. However, in the absence of a surface water intake within 15 miles downstream of the area, the surface water pathway is incomplete. As presented in Section 4.2, shallow groundwater is not present at AFFF Area 2. As such, groundwater at AFFF Area 2 in not a medium of concern.

7.3 OUTFALL 1 (AFFF AREA 3)

The CSM for Outfall 1 identified subsurface soil, shallow groundwater, surface water, and sediment as media potentially impacted by previous releases of AFFF within Watershed 1. The QAPP CSM (ASL, August 2016) identified construction workers and/or base personnel exposed to impacted subsurface soil, shallow groundwater, surface water, or sediment as potential human receptors. The findings presented in Section 3.5 indicate that neither the subsurface soil samples nor the sediment sample had detected concentrations of PFAS above the screening levels. The findings presented in section 5.3 indicate surface water at Outfall 1 has been impacted by PFAS. However, in the absence of a surface water intake within 15 miles downstream of the area, the surface water exposure pathway is incomplete. Similarly, groundwater sample MALMS03-002-GW-030 had detected concentrations of PFOA and the combined PFOA and PFOS concentrations above the screening levels for water, indicating shallow groundwater at Outfall 1 has been impacted by PFAS. As discussed in Section 4.3, based on the depth of the nearest domestic water well, a complete groundwater pathway at AFFF Area 3 is unlikely.

7.4 OUTFALL 3 (AFFF AREA 4)

The CSM for Outfall 3 identified surface soil, subsurface soil, shallow groundwater, surface water, and sediment as media potentially impacted by previous releases of AFFF in the area. The QAPP CSM (ASL, August 2016) identified construction workers and/or base personnel exposed to impacted surface soil, subsurface soil, shallow groundwater, surface water, or sediment as potential human receptors. The findings presented in Section 3.6 indicate that none of the surface soil, subsurface soil, or sediment samples had detected concentrations of PFAS contamination above the RSLs. The findings presented in section 5.4 indicate surface water has been impacted by PFOA, PFOS, and combined PFOA and PFOS at concentrations above screening levels for water. However, in the absence of a surface water intake within 15 miles downstream of the area, the surface water exposure pathway is incomplete. As presented in Section 4.4, all three groundwater samples had detected PFOA and combined PFOA and PFOS concentrations above the screening levels for water, indicating shallow groundwater has been impacted by PFAS. However, in the absence of domestic water wells within 4 miles downgradient of the area, the human exposure pathway to groundwater is incomplete.

7.5 HANGAR 1440 (AFFF AREA 5)

The CSM for Hangar 1440 identified surface soil, subsurface soil, and shallow groundwater as media potentially impacted by previous releases of AFFF in the area. The QAPP CSM (ASL, August 2016)

identified construction workers and/or base personnel exposed to impacted surface soil, subsurface soil, or shallow groundwater as potential human receptors. The findings discussed in Section 3.7 indicate neither surface soil nor subsurface soil samples had detected concentrations of PFAS contamination above the RSLs. However, Section 3.7 presents findings that indicated shallow groundwater has been impacted by PFOS and combined PFOA and PFOS at concentrations above the screening levels. As discussed in Section 4.5, based on the location and depth of the nearest downgradient domestic water well, a complete shallow groundwater exposure pathway at AFFF Area 5 is unlikely.

7.6 FIRE STATION (BUILDING 349) (AFFF AREA 6)

The CSM for the Fire Station identified shallow groundwater as media potentially impacted by previous releases of AFFF in the area. The QAPP CSM (ASL, August 2016) identified site construction workers and/or base personnel exposed to shallow groundwater as potential human receptors. The findings discussed in Section 3.8 indicate shallow groundwater has been impacted by PFOA, PFOS, and combined PFOA and PFOS at concentrations exceeding the screening levels. As discussed in Section 4.6, based on the distance to the nearest downgradient domestic water well, a complete shallow groundwater exposure pathway at AFFF Area 6 is unlikely.

8.0 CONCLUSIONS AND RECOMMENDATIONS

Six AFFF areas at Malmstrom AFB were evaluated through the SI process based on the reported or suspected release of AFFF material containing PFAS compounds. Media evaluated included surface soil, subsurface soil (vadose zone in the source area), shallow groundwater (including samples from existing monitoring wells or newly installed monitoring wells), and surface water/sediment (if applicable). The objectives of the SI were to

- determine if a confirmed release of PFOA or PFOS has occurred at AFFF areas selected for inspection;
- determine if PFOA or PFOS are present in soil, groundwater, or surface water/sediments in concentrations exceeding the EPA lifetime HA; and
- identify potential receptor pathways with immediate impacts to human health.

Site Inspections were completed at the following areas at Malmstrom AFB.

- AFFF Area 1 – Historical Fire Training Area (FT-01) and Old Taxiway Land Farm (ST-22)
- AFFF Area 2 – Canadian Snowbirds CT-117 Crash
- AFFF Area 3 – Outfall 1
- AFFF Area 4 – Outfall 3
- AFFF Area 5 – Hangar 1440
- AFFF Area 6 – Fire Station (Building 349)

The maximum detected concentrations of PFBS did not exceed the health-based screening criteria in any media at the six AFFF areas. Table 23 presents a summary of the maximum detected concentrations of PFBS, PFOA, and PFOS for each media at the six AFFF areas and indicates where those concentrations exceeded the corresponding screening levels. All six AFFF areas had concentrations of PFOA or PFOS in one or more media that exceeded the corresponding screening levels.

Table 23 Summary of Detections and Screening Level Exceedances

AFFF Area	Associated Existing ERP ID	Parameter	Maximum Detected Concentration	Screening Value	Number of Samples / Number of Exceedances	Exceeds Screening Value	Units	Potentially Complete Drinking Water Exposure Pathway	Recommendations
Historical Fire Training Area and Old Taxiway Land Farm (AFFF Area 1)	FT-01 & SS-22	**Surface Soil**						**No**	Advance area to RI
		PFBS	4.3 J	130,000	3 / 0	No	µg/kg		
		PFOA	26	126	3 / 0	No	µg/kg		
		PFOS	**890**	126	**3 / 3**	**Yes**	µg/kg		
		Subsurface Soil							
		PFBS	4.4 J	130,000	3 / 0	No	µg/kg		
		PFOA	110	126	3 / 0	No	µg/kg		
		PFOS	**11,000**	126	**3 / 1**	**Yes**	µg/kg		
		Groundwater							
		PFBS	0.13	40	2 / 0	No	µg/L		
		PFOA	**1.3**	0.07	**2 / 2**	**Yes**	µg/L		
		PFOS	**1.9**	0.07	**2 / 1**	**Yes**	µg/L		
		PFOA + PFOS	**3.2**	0.07	**2 / 2**	**Yes**	µg/L		
Canadian Snowbirds CT-117 Crash (AFFF Area 2)	Not Applicable (New Area)	**Surface Soil**						**No**	Advance area to RI
		PFBS	0.42 J	130,000	3 / 0	No	µg/kg		
		PFOA	2.3	126	3 / 0	No	µg/kg		
		PFOS	6.3	126	3 / 0	No	µg/kg		
		Subsurface Soil							
		PFBS	0.50 J	130,000	3 / 0	No	µg/kg		
		PFOA	1.1	126	3 / 0	No	µg/kg		
		PFOS	1.1	126	3 / 0	No	µg/kg		
		Surface Water							
		PFBS	0.0090 J	40	2 / 0	No	µg/L		
		PFOA	**0.092 J**	0.07	**2 / 2**	**Yes**	µg/L		
		PFOS	**0.47**	0.07	**2 / 2**	**Yes**	µg/L		
		PFOA + PFOS	**0.55**	0.07	**2 / 2**	**Yes**	µg/L		
		Sediment							
		PFBS	ND	130,000	2 / 0	No	µg/kg		
		PFOA	2.3 J	126	2 / 0	No	µg/kg		
		PFOS	**160 J**	126	**2 / 1**	**Yes**	µg/kg		

AFFF Area	Associated Existing ERP ID	Parameter	Maximum Detected Concentration	Screening Value	Number of Samples / Number of Exceedances	Exceeds Screening Value	Units	Potentially Complete Drinking Water Exposure Pathway	Recommendations
Outfall 1 (AFFF Area 3)	Not Applicable (New Area)	**Subsurface Soil**						**No**	Advance area to RI
		PFBS	ND	130,000	3 / 0	No	µg/kg		
		PFOA	ND	126	3 / 0	No	µg/kg		
		PFOS	0.36 J	126	3 / 0	No	µg/kg		
		Groundwater							
		PFBS	0.031	40	3 / 0	No	µg/L		
		PFOA	**0.070 J**	0.07	**3 / 1**	**Yes**	µg/L		
		PFOS	0.033	0.07	3 / 0	No	µg/L		
		PFOA + PFOS	**0.094 J**	0.07	**3 / 1**	**Yes**	µg/L		
		Surface Water							
		PFBS	0.057	40	1 / 0	No	µg/L		
		PFOA	**0.10**	0.07	**1 / 1**	**Yes**	µg/L		
		PFOS	**0.46**	0.07	**1 / 1**	**Yes**	µg/L		
		PFOA + PFOS	**0.56**	0.07	**1 / 1**	**Yes**	µg/L		
		Sediment							
		PFBS	ND	130,000	1 / 0	No	µg/kg		
		PFOA	0.28 J	126	1 / 0	No	µg/kg		
		PFOS	4.8 J	126	1 / 0	No	µg/kg		
Outfall 3 (AFFF Area 4)	Not Applicable (New Area)	**Surface Soil**						**No**	Advance area to RI
		PFBS	0.39 J	130,000	2 / 0	No	µg/kg		
		PFOA	2.1	126	2 / 0	No	µg/kg		
		PFOS	3.3	126	2 / 0	No	µg/kg		
		Subsurface Soil							
		PFBS	ND	130,000	2 / 0	No	µg/kg		
		PFOA	1.4	126	2 / 0	No	µg/kg		
		PFOS	7.8	126	2 / 0	No	µg/kg		
		Groundwater							
		PFBS	0.17	40	2 / 0	No	µg/L		
		PFOA	**0.45**	0.07	**2 / 2**	**Yes**	µg/L		
		PFOS	0.039	0.07	2 / 0	No	µg/L		
		PFOA + PFOS	**0.460 J**	0.07	**2 / 2**	**Yes**	µg/L		
		Surface Water							
		PFBS	0.14	40	2 / 0	No	µg/L		

AFFF Area	Associated Existing ERP ID	Parameter	Maximum Detected Concentration	Screening Value	Number of Samples / Number of Exceedances	Exceeds Screening Value	Units	Potentially Complete Drinking Water Exposure Pathway	Recommendations
		PFOA	**0.49**	0.07	**2 / 2**	**Yes**	µg/L		
		PFOS	**1.2**	0.07	**2 / 1**	**Yes**	µg/L		
		PFOA + PFOS	**1.69**	0.07	**2 / 2**	**Yes**	µg/L		
		Sediment							
		PFBS	ND	130,000	2 / 0	No	µg/kg		
		PFOA	1.3 J	126	2 / 0	No	µg/kg		
		PFOS	10	126	2 / 0	No	µg/kg		
Hangar 1440 (AFFF Area 5)	Not Applicable (New Area)	**Surface Soil**						**No**	Advance area to RI
		PFBS	ND	130,000	2 / 0	No	µg/kg		
		PFOA	1.1	126	2 / 0	No	µg/kg		
		PFOS	12	126	2 / 0	No	µg/kg		
		Subsurface Soil							
		PFBS	ND	130,000	2 / 0	No	µg/kg		
		PFOA	ND	126	2 / 0	No	µg/kg		
		PFOS	1.1 J	126	2 / 0	No	µg/kg		
		Groundwater							
		PFBS	0.11 J	40	3 / 0	No	µg/L		
		PFOA	0.053	0.07	3 / 0	No	µg/L		
		PFOS	**0.19**	0.07	**3 / 1**	**Yes**	µg/L		
		PFOA + PFOS	**0.243**	0.07	**3 / 1**	**Yes**	µg/L		
Fire Station, Building 349 (AFFF Area 6)	Not Applicable (New Area)	**Groundwater**						**No**	Advance area to RI
		PFBS	1.0	40	5 / 0	No	µg/L		
		PFOA	**5.5**	0.07	**5 / 5**	**Yes**	µg/L		
		PFOS	**0.93**	0.07	**5 / 3**	**Yes**	µg/L		
		PFOA + PFOS	**5.73**	0.07	**5 / 5**	**Yes**	µg/L		

Note: **Bold** values exceeded the screening levels. Number of samples and exceedances does not include field duplicate samples, only primary samples. The maximum detected PFOA+PFOS may not be the sum of the maximum individual PFOA and PFOS concentrations because the maximum PFOA and PFOS concentrations may not occur in the same sample.

µg/kg = micrograms per kilogram
µg/L = micrograms per liter
AFFF = aqueous film forming foam
ERP = Environmental Restoration Program
FTA = fire training area
ID = identification
J = estimated value
ND = not detected at the Method Detection Limit
PFBS = perfluorobutane sulfonate
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
RI = remedial investigation

8.1 HISTORICAL FIRE TRAINING AREA (FT-01) AND OLD TAXIWAY LAND FARM (SS-22) (AFFF AREA 1)

The media of concern at AFFF Area 1 are surface soil, subsurface soil, and shallow groundwater. Surface water bodies are not present near the area, so neither surface water nor sediment samples were collected. The surface soil and subsurface soil analytical results indicate PFOS is present at concentrations above the screening levels. Results of the shallow groundwater samples indicate PFOA, PFOS, and the combined PFOA and PFOS concentrations are present above the screening levels for water. The analytical results for AFFF Area 1 confirm a release of AFFF has impacted surface soil and subsurface soil at concentrations above the screening levels, indicating that a potentially complete exposure pathway exists for soils. Similarly, analytical results confirm a release of AFFF has impacted shallow groundwater at concentrations above the screening levels; however, the exposure pathway for AFFF Area 1 is incomplete. Based on PFAS impacts to surface soil, subsurface soil, and shallow groundwater, AFFF Area 1 is recommended for a remedial investigation.

8.2 CANADIAN SNOWBIRDS CT-117 CRASH (AFFF AREA 2)

The media of concern at the Canadian Snowbirds CT-117 Crash area are surface soil, subsurface soil, shallow groundwater, and surface water/sediment. The analytical results indicate that the target analytes are not present at concentrations in soils above the RSLs. The sediment analytical results indicate PFOS is present at a concentration above screening levels. Groundwater was not encountered in the three borings, indicating shallow groundwater is not present at AFFF Area 2 and is not a medium of concern. The analytical results from the surface water samples detected PFOA, PFOS, and the combined PFOA and PFOS at concentrations above the screening levels, indicating that an AFFF release has impacted surface water at AFFF Area 2. However, since there is not a downstream surface water intake within 15 miles of the area, the exposure pathway is incomplete. Likewise, the analytical results indicate that an AFFF release has impacted sediment at AFFF Area 2, which may be a continuing source to surface water, but the exposure pathway is unlikely. Based on PFAS impacts to surface water and sediment, AFFF Area 2 is recommended for a remedial investigation.

8.3 OUTFALL 1 (AFFF AREA 3)

The media of concern at Outfall 1 are subsurface soil, shallow groundwater, and surface water/sediment. Surface soils are not a medium of concern at AFFF Area 3 because the stormwater drainage outfall is lined with concrete, precluding surface soil exposure to AFFF. The analytical results indicate that the target analytes are not present at concentrations in subsurface soils or sediments above the RSLs. The analytical results indicate that an AFFF release has impacted surface water at AFFF Area 3; however, because there is not a downstream surface water intake within 15 miles of the area, the exposure pathway is incomplete. Similarly, analytical results indicate that an AFFF release has impacted the shallow groundwater at AFFF Area 3; however, based on the depths of the nearest domestic water wells a complete exposure pathway is unlikely. Based on PFAS impacts to shallow groundwater and surface water, AFFF Area 3 is recommended for a remedial investigation.

8.4 OUTFALL 3 (AFFF AREA 4)

The media of concern at Outfall 3 are surface soil, subsurface soil, shallow groundwater, and surface water/sediment. The analytical results for AFFF Area 4 indicate that a release of AFFF has not impacted soils or sediments. However, surface water analytical results indicate PFOA, PFOS, and the combined PFOA and PFOS have impacted surface water at concentrations above the screening levels; however, because there is not a downstream surface water intake within 15 miles of the area, the exposure pathway

is incomplete. Analytical results confirm that a release of AFFF has occurred at AFFF Area 4 that has impacted shallow groundwater; however, based on the distance to the nearest downgradient domestic water well, the exposure pathway is incomplete. Based on PFAS impacts to shallow groundwater and surface water, AFFF Area 4 is recommended for a remedial investigation.

8.5 HANGAR 1440 (AFFF AREA 5)

The media of concern at Hangar 1440 are surface soil, subsurface soil, and shallow groundwater. Surface water bodies are not present near the area, so neither surface water nor sediment samples were collected. The analytical results for AFFF Area 5 indicate that a release of AFFF has not impacted soils. Analytical results confirm that a release of AFFF has occurred at AFFF Area 5 that has impacted shallow groundwater; however, based on the location and depth of the nearest downgradient domestic water well, a complete groundwater exposure pathway at AFFF Area 5 is unlikely. Based on PFAS impacts to shallow groundwater, AFFF Area 5 is recommended for a remedial investigation.

8.6 FIRE STATION (BUILDING 349) (AFFF AREA 6)

The media of concern at the Fire Station (Building 349) is shallow groundwater. Surface water bodies are not present near the area, so neither surface water nor sediment samples were collected. Analytical results confirm that a release of AFFF has occurred at AFFF Area 6 that has impacted shallow groundwater; however, based on the location of the nearest downgradient domestic water well, a complete groundwater exposure pathway at AFFF Area 6 is unlikely. Based on PFAS impacts to shallow groundwater, AFFF Area 6 is recommended for a remedial investigation.

9.0 REFERENCES

Aerostar SES LLC (ASL), March 2016. *Final Uniform Federal Policy (UFP) Quality Assurance Project Plan (QAPP) for Site Inspections of Fire Fighting Foam Usage at Various Air Force Bases in the United States.*

ASL, September 2016. *Final Uniform Federal Policy (UFP) Quality Assurance Project Plan (QAPP) for Site Inspection of Aqueous Film Forming Foam Areas, Multiple Sites, United States Air Force Installations, Addendum 4, Field Sampling Plan for Malmstrom Air Force Base, Great Falls, Montana.*

CH2M Hill, April 2015. *Final Preliminary Assessment Report for Perfluorinated Compounds at Malmstrom Air Force Base, Great Falls, Montana.*

EMR, Inc., October 2016. *Initial Remedial Investigation Report, Final, IRP Site ST05 – Former Fuel Supply Lines, Malmstrom Air Force Base – Cascade County, Montana.*

EMR, Inc., June 2017. *Initial Remedial Investigation Report, Final Revision 1, IRP Site ST04 – Former Pumphouse 3, Malmstrom Air Force Base – Cascade County, Montana.*

Environmental Protection Agency (EPA), *USEPA Contract Laboratory Program* (OSWER 9240.1-51. USEPA-540-R-10-011). (http://www.epa.gov/superfund/programs/clp/download/ism/ism1nfg.pdf).

EPA, September 1992. United States Environmental Protection Agency (EPA), *Guidance for Performing Site Inspections Under CERCLA* (EPA/540-R-92-021. PB92-963375).

EPA, January 2009. *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use* (OSWER No. 9200.1-85. EPA 540-R-08-005).

EPA, August 2014a. *National Functional Guidelines for Inorganic Superfund Data Review. Final. USEPA Contract Laboratory Program* (OSWER 9355.0-131. USEPA-540-R-013-001).

EPA, August 2014b. *EPA Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review* (EPA/540-R-014-002).

EPA, March 2012. *Uniform Federal Policy for Quality Assurance Project Plans Workbook.*

EPA, May 2016a. *Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA).*

EPA, May 2016b. *Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS).*

EPA, May 2016c. *Regional Screening Level (RSL) Summary Table.*

EPA, November 2017. Regional Screening Levels (https://semspub.epa.goc/work/HQ/197235.pdf).

Google Earth, 2017 (https://earth.google.com).

HDR Engineering, Inc., February 1995. *Final RCRA Facility Investigation Report, Volume 1*

JRB Associates, January 1985. *Installation Restoration Program Phase 1 – Records Search, 341st Strategic Missile Wing, Malmstrom AFB, Montana*.

U.S. Air Force, August 2012. *Interim AF Guidance on Sampling and Response Actions for Perfluorinated Compounds at Active and BRAC Installations*.

United States Army Corps of Engineers (USACE) Omaha District, June 2013. *Geology Supplement to the Scope of Services*

USACE Omaha District, July 2015. *Performance Work Statement for Site Inspection of Aqueous Film Forming Areas, Multiple Sites, United States Air Force Installations.*

Appendix A
AFFF Area-Specific Figures

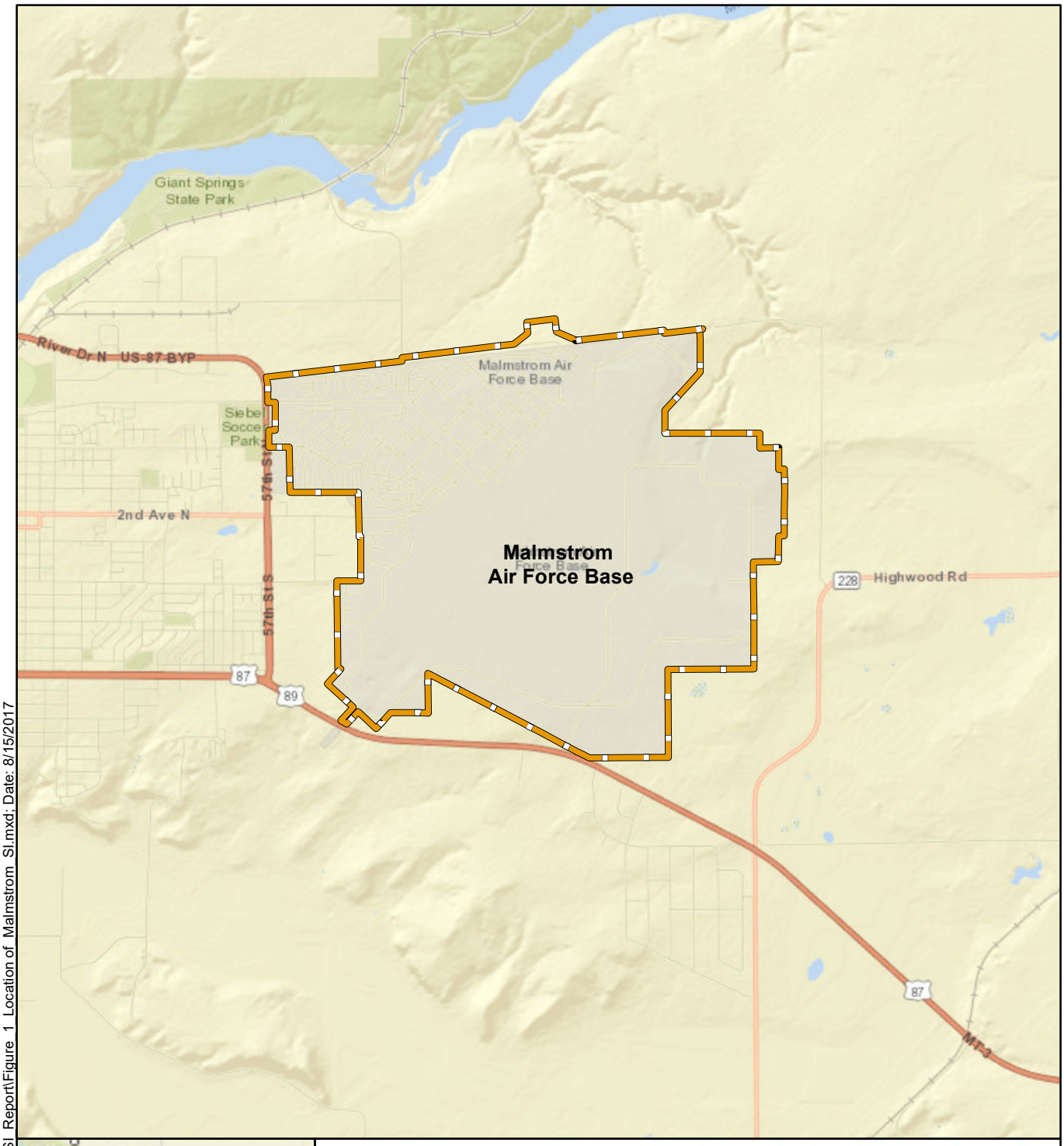

Figure 1
Location of Malmstrom Air Force Base,
Cascade County, Montana

Legend

Installation Boundary

Service Layer Credits: Esri StreetMap North America

Drawn: tmorse

Date: 8/15/2017

0 0.5 1 Mile

N

G:\M2027.0003_OmahaMalmstrom\MXD\SI_Report\Figure_1_Location of_Malmstrom_SI.mxd; Date: 8/15/2017

Legend

- AFFF Inspection Area
- Installation Boundary

N

0 850 1,700

Feet

Malmstrom Air Force Base
Cascade County, Montana

Figure 2
Malmstrom AFB AFFF
Site Inspection Areas

Aerostar SES LLC

Drawn: tmorse

Date: 9/18/2017

Service Layer Credits: Esri ArcGIS Online Aerial Photography

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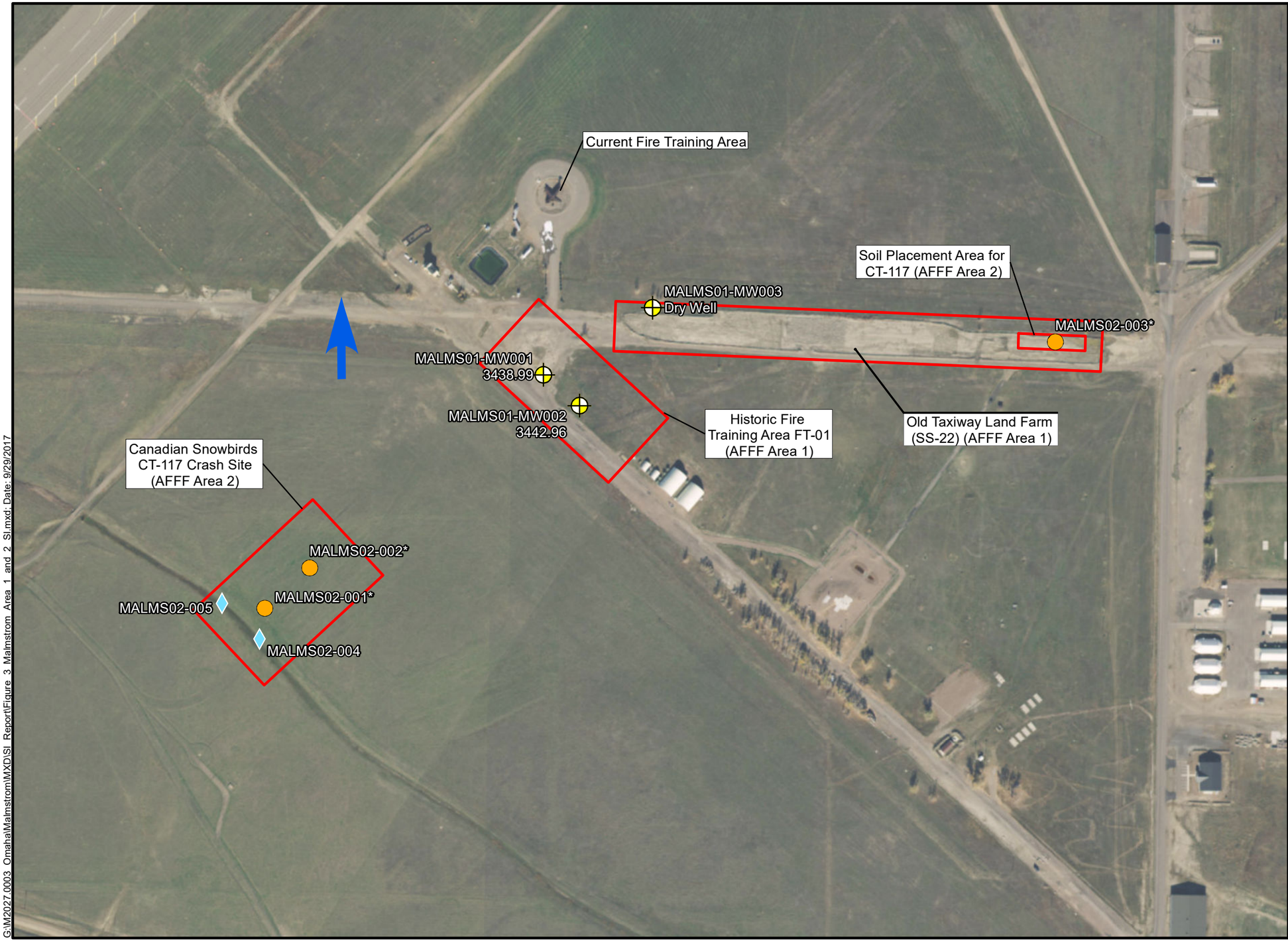
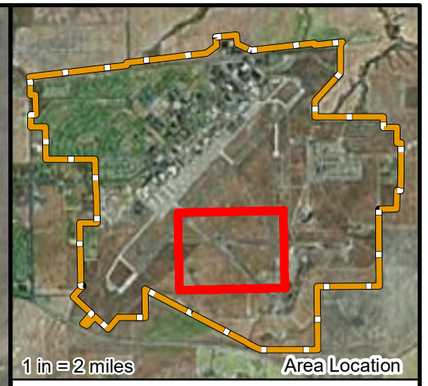




Legend

- Soil Boring with Surface and Subsurface Samples
- New Monitoring Well with Surface and Subsurface Soil Samples
- Surface Water and Sediment Samples
- AFFF Inspection Area
- Installation Boundary
- Groundwater Flow Direction (CH2M Hill, 2015)

MALMS01-MW001
3438.99 = Groundwater Elevation (ft)

* Dry Boring, Groundwater not Encountered

N

0 175 350

Feet

Malmstrom Air Force Base
Cascade County, Montana

Figure 3
Historical Fire Training Area FT01 (AFFF Area 1) and Canadian Snowbirds CT-117 Crash (AFFF Area 2) Sample Locations

Aerostar SES LLC

Drawn: tmorse

Date: 9/29/2017

Service Layer Credits: Esri ArcGIS Online Aerial Photography

G:\M2027.0003_OmahaMalmstromMXD\SI_Report\Figure_3_Malmstrom_Area_1_and_2_SI.mxd; Date: 9/29/2017

MALMS01-001-SS-001	
Analyte	Result (µg/kg)
PFBS	4.3 J
PFOA	26
PFOS	890

MALMS01-001-SS-901 (dup)	
Analyte	Result (µg/kg)
PFBS	3.7 J
PFOA	20
PFOS	800

MALMS01-001-SO-021	
Analyte	Result (µg/kg)
PFBS	0.38 J
PFOA	7.1
PFOS	19 J

MALMS01-001-SO-921 (dup)	
Analyte	Result (µg/kg)
PFBS	0.24 U
PFOA	6.1
PFOS	16

MALMS01-003-SS-001	
Analyte	Result (µg/kg)
PFBS	0.72 J
PFOA	3.8
PFOS	110

MALMS01-003-SO-011	
Analyte	Result (µg/kg)
PFBS	4.4 J
PFOA	9.2 J
PFOS	29 J

MALMS02-003-SS-001	
Analyte	Result (µg/kg)
PFBS	0.25 U
PFOA	2.3
PFOS	6.3

MALMS02-003-SO-006	
Analyte	Result (µg/kg)
PFBS	0.50 J
PFOA	1.1
PFOS	1.1

MALMS02-001-SS-001	
Analyte	Result (µg/kg)
PFBS	0.42 J
PFOA	0.12 U
PFOS	0.43 J

MALMS02-001-SS-901 (dup)	
Analyte	Result (µg/kg)
PFBS	0.25 U
PFOA	0.12 U
PFOS	0.16 U

MALMS02-001-SO-020	
Analyte	Result (µg/kg)
PFBS	0.25 U
PFOA	0.12 U
PFOS	0.16 U

MALMS02-001-SO-920 (dup)	
Analyte	Result (µg/kg)
PFBS	0.28 U
PFOA	0.13 U
PFOS	0.18 U

MALMS01-002-SS-001	
Analyte	Result (µg/kg)
PFBS	1.4
PFOA	3.1
PFOS	30

MALMS01-002-SO-005	
Analyte	Result (µg/kg)
PFBS	25 U
PFOA	110
PFOS	11,000

MALMS02-004-SD-001	
Analyte	Result (µg/kg)
PFBS	0.35 UJ
PFOA	2.3 J
PFOS	160 J

MALMS02-004-SD-901 (dup)	
Analyte	Result (µg/kg)
PFBS	0.28 UJ
PFOA	1.1 J
PFOS	55 J

MALMS02-005-SD-001	
Analyte	Result (µg/kg)
PFBS	0.48 UJ
PFOA	2.0 J
PFOS	46 J

MALMS02-002-SS-001	
Analyte	Result (µg/kg)
PFBS	0.25 UJ
PFOA	0.45 J
PFOS	1.9 J

MALMS02-002-SO-020	
Analyte	Result (µg/kg)
PFBS	0.25 U
PFOA	0.12 U
PFOS	0.16 U

Current Fire Training Area

Soil Placement Area for CT-117 (AFFF Area 2)

MALMS01-MW003
Dry Well

Old Taxiway Land Farm (SS-22) (AFFF Area 1)

MALMS01-MW001

MALMS02-003*

MALMS01-MW002

Canadian Snowbirds CT-117 Crash Site (AFFF Area 2)

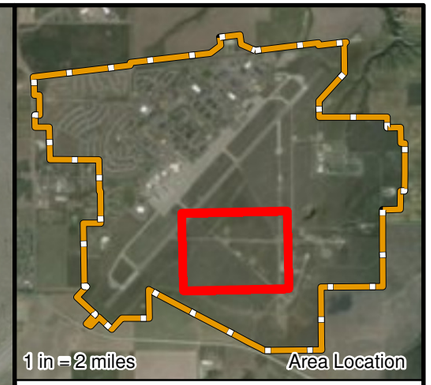
Historic Fire Training Area FT-01 (AFFF Area 1)

MALMS02-002*

MALMS02-005

MALMS02-001*

MALMS02-004



Legend

- Soil Boring with Surface and Subsurface Samples
- New Monitoring Well with Surface and Subsurface Soil Samples
- Surface Water and Sediment Samples
- AFFF Inspection Area
- Installation Boundary
- Groundwater Flow Direction (CH2M Hill, 2015)

* Dry Boring, Groundwater not Encountered

N

0 175 350

Feet

Soil and Sediment Screening Levels:

PFBS - 130,000 µg/kg PFOA - 126 µg/kg PFOS - 126 µg/kg

Notes:

Bold value indicates analyte detected at concentration indicated.

= indicates value exceeds screening level

J = The reported concentration is an estimated value.

U = The analyte was not detected above the reported value.

UJ = The analyte was not detected at the reported value. The reported value is approximate.

SD = sediment SO = subsurface soil

SS = surface soil dup = duplicate sample

Malmstrom Air Force Base
Cascade County, Montana

Figure 4
Historical Fire Training Area FT01 (AFFF Area 1) and Canadian Snowbirds CT-117 Crash (AFFF Area 2) - PFBS, PFOA, and PFOS in Soil and Sediment

Aerostar SES LLC

Drawn: tmorse Date: 2/28/2018

Service Layer Credits: Esri ArcGIS Online Aerial Photography

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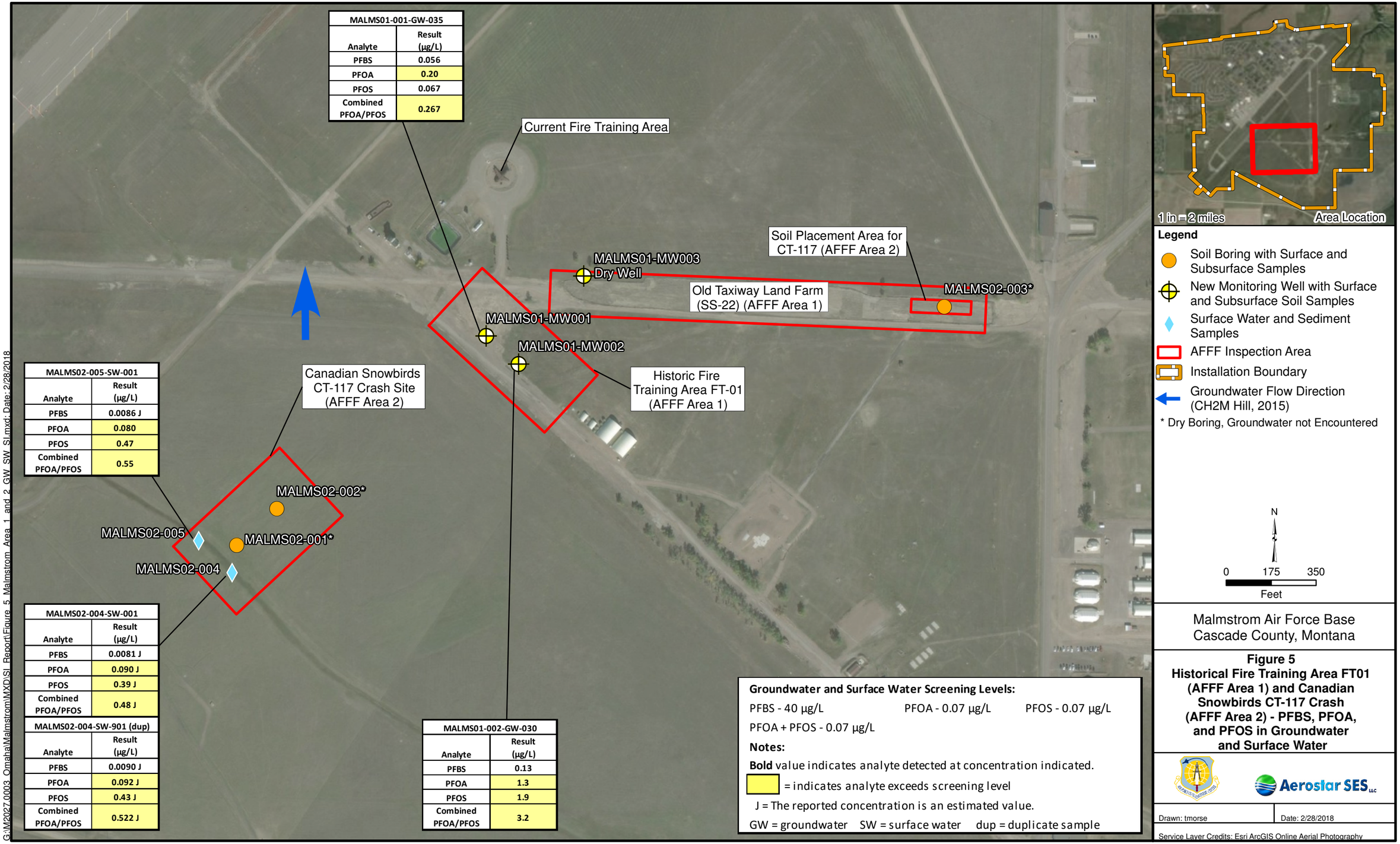


Malmstrom Air Force Base
Cascade County, Montana

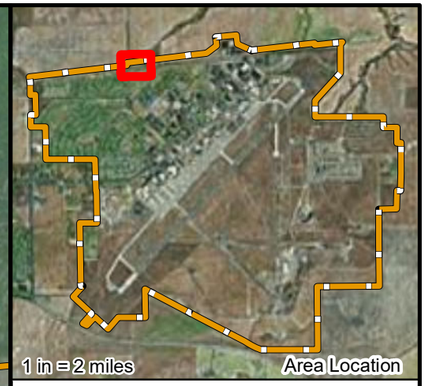
Figure 5
Historical Fire Training Area FT01 (AFFF Area 1) and Canadian Snowbirds CT-117 Crash (AFFF Area 2) - PFBS, PFOA, and PFOS in Groundwater and Surface Water

Aerostar SES LLC

Drawn: tmorse | Date: 2/28/2018

Service Layer Credits: Esri ArcGIS Online Aerial Photography

G:\M2027.0003_Omaha\Malmstrom\MXD\SI_Report\Figure_5_Malmstrom_Area_1_and_2_GW_SW_SI.mxd; Date: 2/28/2018



Legend

- New Monitoring Well with Subsurface Soil Sample
- Surface Water and Sediment Samples
- Railroad
- Base Boundary Fence
- AFFF Inspection Area
- Installation Boundary
- Groundwater Elevation Contour
- Groundwater Flow Direction

MALMS03-MW001
3393.26 = Groundwater Elevation (ft)

N

0 50 100

Feet

Malmstrom Air Force Base
Cascade County, Montana

Figure 6
Outfall 1 (AFFF Area 3)
Sample Locations and
Potentiometric Contours

Aerostar SES LLC

Drawn: tmorse

Date: 9/28/2017

Service Layer Credits: Esri ArcGIS Online Aerial Photography

G:\M2027.0003_OmahaMalmstromMXD\SI_Report\Figure_6_Malmstrom_Area_3_SI.mxd; Date: 9/28/2017

MALMS03-003-SO-009	
Analyte	Result (µg/kg)
PFBS	0.30 U
PFOA	0.14 U
PFOS	0.19 U

MALMS03-001-SO-020	
Analyte	Result (µg/kg)
PFBS	0.24 UJ
PFOA	0.11 U
PFOS	**0.36 J**

MALMS03-004-SD-001	
Analyte	Result (µg/kg)
PFBS	0.30 UJ
PFOA	**0.28 J**
PFOS	**4.8 J**

MALMS03-002-SO-020	
Analyte	Result (µg/kg)
PFBS	0.24 UJ
PFOA	0.11 U
PFOS	**0.32 J**

MALMS03-MW003

MALMS03-MW001

MALMS03-MW002

MALMS03-004

67th Street Northeast

Walnut Street

Soil and Sediment Screening Levels:

PFBS - 130,000 µg/kg PFOA - 126 µg/kg PFOS - 126 µg/kg

Notes:

Bold value indicates analyte detected at concentration indicated.

J = The reported concentration is an estimated value.

U = The analyte was not detected above the reported value.

UJ = The analyte was not detected at the reported value. The reported value is approximate.

SD = sediment SO = subsurface soil

1 in = 2 miles

Area Location

Legend

- New Monitoring Well with Subsurface Soil Sample
- Surface Water and Sediment Samples
- Railroad
- Base Boundary Fence
- AFFF Inspection Area
- Installation Boundary

N

0 50 100

Feet

Malmstrom Air Force Base
Cascade County, Montana

Figure 7
Outfall 1 (AFFF Area 3) - PFBS, PFOA, and PFOS in Soil and Sediment

Aerostar SES LLC

Drawn: tmorse

Date: 2/28/2018

Service Layer Credits: Esri ArcGIS Online Aerial Photography

G:\M2027.0003_Omaha\Malmstrom\MXD\SI_Report\Figure_7_Malmstrom_Area_3_Soil_SI.mxd; Date: 2/28/2018

MALMS03-003-GW-020	
Analyte	Result (µg/L)
PFBS	0.031
PFOA	0.021
PFOS	0.033
Combined PFOA/PFOS	0.054

MALMS03-003-GW-920 (dup)	
Analyte	Result (µg/L)
PFBS	0.030
PFOA	0.022
PFOS	0.029
Combined PFOA/PFOS	0.051

MALMS03-001-GW-025	
Analyte	Result (µg/L)
PFBS	0.020 J
PFOA	0.017 J
PFOS	0.0026 U
Combined PFOA/PFOS	0.017 J

MALMS03-004-SW-001	
Analyte	Result (µg/L)
PFBS	0.057
PFOA	0.10
PFOS	0.46
Combined PFOA/PFOS	0.56

MALMS03-002-GW-030	
Analyte	Result (µg/L)
PFBS	0.022 J
PFOA	0.070 J
PFOS	0.024 J
Combined PFOA/PFOS	0.094 J

MALMS03-MW003

MALMS03-MW001

MALMS03-004

MALMS03-MW002

67th Street Northeast

Walnut Street

Groundwater and Surface Water Screening Levels:

PFBS - 40 µg/L PFOA - 0.07 µg/L PFOS - 0.07 µg/L

PFOA + PFOS - 0.07 µg/L

Notes:

Bold value indicates analyte detected at concentration indicated.

= indicates analyte exceeds screening level

J = The reported concentration is an estimated value.

U = The analyte was not detected above the reported value.

GW = groundwater SW = surface water

dup = duplicate sample

1 in = 2 miles

Area Location

Legend

- New Monitoring Well with Subsurface Soil Sample
- Surface Water and Sediment Samples
- Railroad
- Base Boundary Fence
- AFFF Inspection Area
- Installation Boundary
- Groundwater Flow Direction

N

0 50 100

Feet

Malmstrom Air Force Base
Cascade County, Montana

Figure 8
Outfall 1 (AFFF Area 3) -
PFBS, PFOA, and PFOS
in Groundwater and Surface Water

Aerostar SES LLC

Drawn: tmorse

Date: 2/28/2018

Service Layer Credits: Esri ArcGIS Online Aerial Photography

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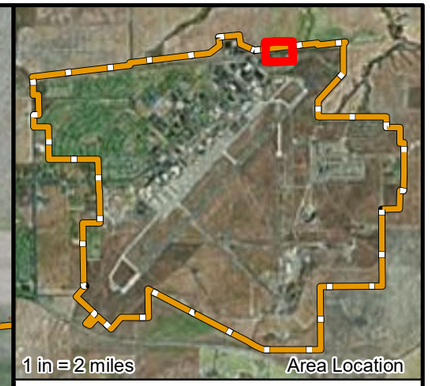

Legend

- New Monitoring Well with Surface and Subsurface Soil Samples
- Surface Water and Sediment Samples
- Railroad
- Base Boundary Fence
- AFFF Inspection Area
- Installation Boundary
- Groundwater Flow Direction (CH2M Hill, 2015)

MALMS04-MW001
3389.11 = Groundwater Elevation (ft)

N

0 45 90

Feet

Malmstrom Air Force Base
Cascade County, Montana

Figure 9
Outfall 3 (AFFF Area 4) -
Sample Locations

Aerostar SES LLC

Drawn: tmorse

Date: 9/29/2017

Service Layer Credits: Esri ArcGIS Online Aerial Photography

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MALMS04-001-SS-001	
Analyte	Result (µg/kg)
PFBS	0.39 J
PFOA	2.1
PFOS	3.3

MALMS04-001-SO-004	
Analyte	Result (µg/kg)
PFBS	0.24 U
PFOA	1.4
PFOS	7.8

MALMS04-003-SD-001	
Analyte	Result (µg/kg)
PFBS	0.24 U
PFOA	0.20 J
PFOS	10

MALMS04-004-SD-001	
Analyte	Result (µg/kg)
PFBS	0.38 UJ
PFOA	1.3 J
PFOS	2.1 J

MALMS04-002-SS-001	
Analyte	Result (µg/kg)
PFBS	0.23 UJ
PFOA	0.67 J
PFOS	0.46 J

MALMS04-002-SO-002	
Analyte	Result (µg/kg)
PFBS	0.24 UJ
PFOA	0.23 J
PFOS	0.15 UJ

MALMS04-MW001

MALMS04-003

MALMS04-004

MALMS04-MW002

POV Camper Sotrage Yard

Perimeter Road

Soil and Sediment Screening Levels:

PFBS - 130,000 µg/kg PFOA - 126 µg/kg PFOS - 126 µg/kg

Notes:

Bold value indicates analyte detected at concentration indicated.

J = The reported concentration is an estimated value.

U = The analyte was not detected above the reported value.

UJ = The analyte was not detected at the reported value. The reported value is approximate.

SD = sediment SO = subsurface soil SS = surface soil

1 in = 2 miles

Area Location

Legend

- New Monitoring Well with Surface and Subsurface Soil Samples
- Surface Water and Sediment Samples
- Railroad
- Base Boundary Fence
- AFFF Inspection Area
- Installation Boundary

N

0 45 90

Feet

Malmstrom Air Force Base
Cascade County, Montana

Figure 10
Outfall 3 (AFFF Area 4) -
PFBS, PFOA, and PFOS
in Soil and Sediment

Aerostar SES LLC

Drawn: tmorse

Date: 2/28/2018

Service Layer Credits: Esri ArcGIS Online Aerial Photography

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MALMS04-001-GW-005	
Analyte	Result (µg/L)
PFBS	0.17
PFOA	0.45
PFOS	0.010 J
Combined PFOA/PFOS	0.46 J

MALMS04-003-SW-001	
Analyte	Result (µg/L)
PFBS	0.14
PFOA	0.49
PFOS	1.2
Combined PFOA/PFOS	1.69

MALMS04-004-SW-001	
Analyte	Result (µg/L)
PFBS	0.065
PFOA	0.32
PFOS	0.057
Combined PFOA/PFOS	0.377

MALMS04-002-GW-004	
Analyte	Result (µg/L)
PFBS	0.046
PFOA	0.21
PFOS	0.036
Combined PFOA/PFOS	0.246
MALMS04-002-GW-904 (dup)	
Analyte	Result (µg/L)
PFBS	0.045
PFOA	0.19
PFOS	0.039
Combined PFOA/PFOS	0.229

MALMS04-MW001

MALMS04-003

MALMS04-004

MALMS04-MW002

POV Camper Sotrage Yard

Perimeter Road

Groundwater and Surface Water Screening Levels:

PFBS - 40 µg/L PFOA - 0.07 µg/L PFOS - 0.07 µg/L

PFOA + PFOS - 0.07 µg/L

Notes:

Bold value indicates analyte detected at concentration indicated.

= indicates analyte exceeds screening level

J = The reported concentration is an estimated value.

GW = groundwater SW = surface water

dup = duplicate sample

Legend

- New Monitoring Well with Surface and Subsurface Soil Samples
- Surface Water and Sediment Samples
- Railroad
- Base Boundary Fence
- AFFF Inspection Area
- Installation Boundary
- Groundwater Flow Direction (CH2M Hill, 2015)

N

0 45 90

Feet

Malmstrom Air Force Base
Cascade County, Montana

Figure 11
Outfall 3 (AFFF Area 4) -
PFBS, PFOA, and PFOS in
Groundwater and Surface Water

Aerostar SES LLC

Drawn: tmorse

Date: 2/28/2018

Service Layer Credits: Esri ArcGIS Online Aerial Photography

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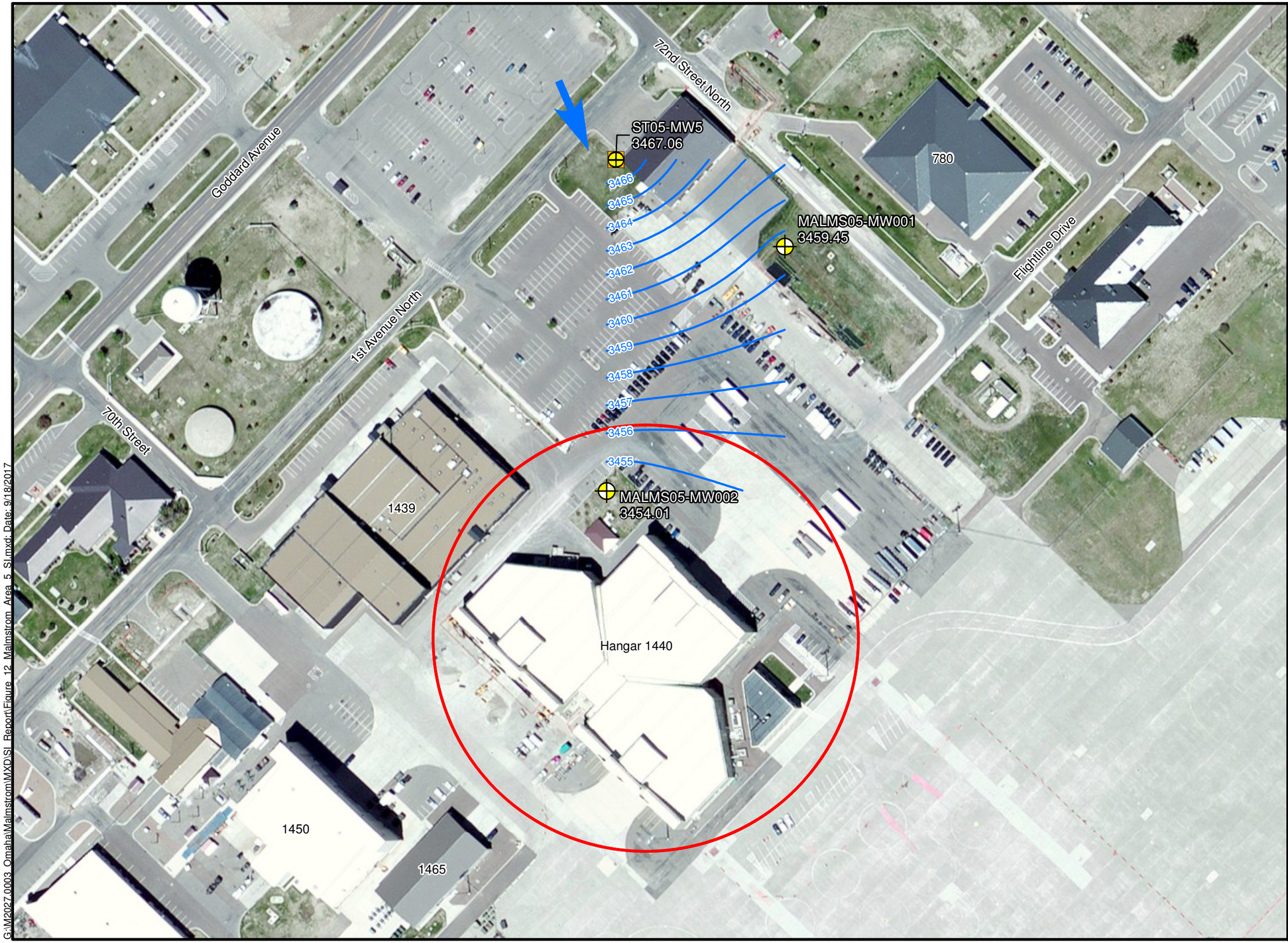

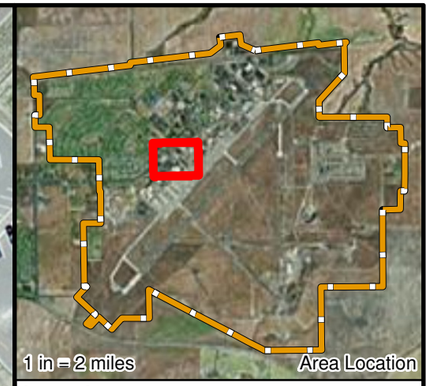

Legend

- New Monitoring Well with Surface and Subsurface Soil Samples
- Existing Groundwater Monitoring Well
- AFFF Inspection Area
- Installation Boundary
- Groundwater Elevation Contour
- Groundwater Flow Direction

MALMS05-MW001
3459.45 = Groundwater Elevation (ft)

N

0 75 150

Feet

Malmstrom Air Force Base
Cascade County, Montana

Figure 12
Hangar 1440 (AFFF Area 5)
Sample Locations and
Potentiometric Contours

Aerostar SES LLC

Drawn: tmorse

Date: 9/18/2017

Service Layer Credits: Esri ArcGIS Online Aerial Photography

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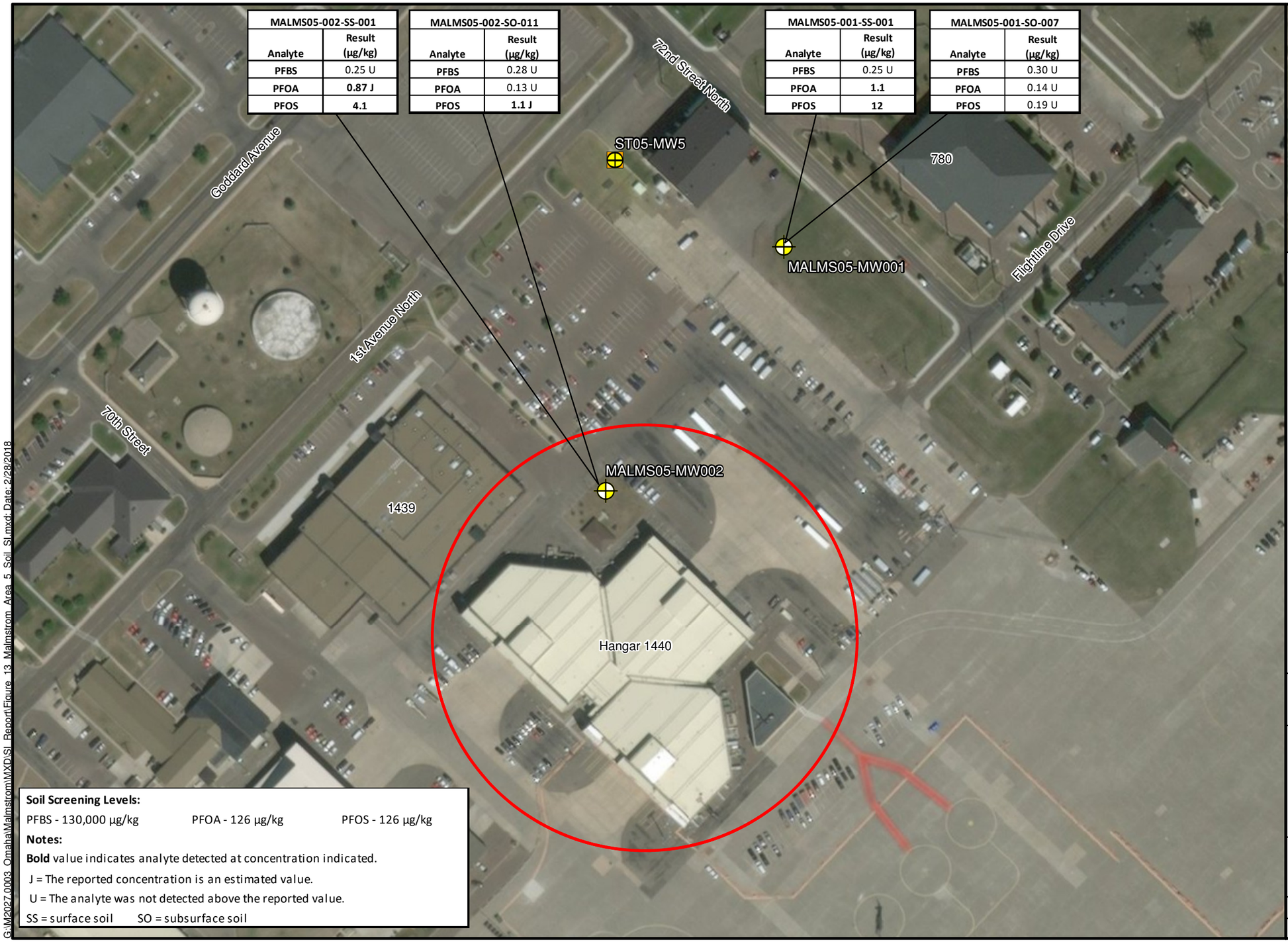

Legend

- New Monitoring Well with Surface and Subsurface Soil Samples
- Existing Groundwater Monitoring Well
- AFFF Inspection Area
- Installation Boundary

N

0 75 150

Feet

Soil Screening Levels:

PFBS - 130,000 µg/kg PFOA - 126 µg/kg PFOS - 126 µg/kg

Notes:

Bold value indicates analyte detected at concentration indicated.

J = The reported concentration is an estimated value.

U = The analyte was not detected above the reported value.

SS = surface soil SO = subsurface soil

Malmstrom Air Force Base
Cascade County, Montana

Figure 13
Hangar 1440 (AFFF Area 5) -
PFBS, PFOA, and PFOS in Soil

Aerostar SES LLC

Drawn: tmorse

Date: 2/28/2018

Service Layer Credits: Esri ArcGIS Online Aerial Photography

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Legend

- New Monitoring Well with Surface and Subsurface Soil Samples
- Existing Groundwater Monitoring Well
- AFFF Inspection Area
- Installation Boundary
- Groundwater Flow Direction

N

0 75 150

Feet

Groundwater Screening Levels:

PFBS - 40 µg/L PFOA - 0.07 µg/L PFOS - 0.07 µg/L

PFOA + PFOS - 0.07 µg/L

Notes:

= indicates analyte exceeds screening level

Bold value indicates analyte detected at concentration indicated.

J = The reported concentration is an estimated value.

GW = groundwater dup = duplicate sample

Malmstrom Air Force Base
Cascade County, Montana

Figure 14
Hangar 1440 (AFFF Area 5) - PFBS, PFOA, and PFOS in Groundwater

Aerostar SES LLC

Drawn: tmorse | Date: 2/28/2018

Service Layer Credits: Esri ArcGIS Online Aerial Photography

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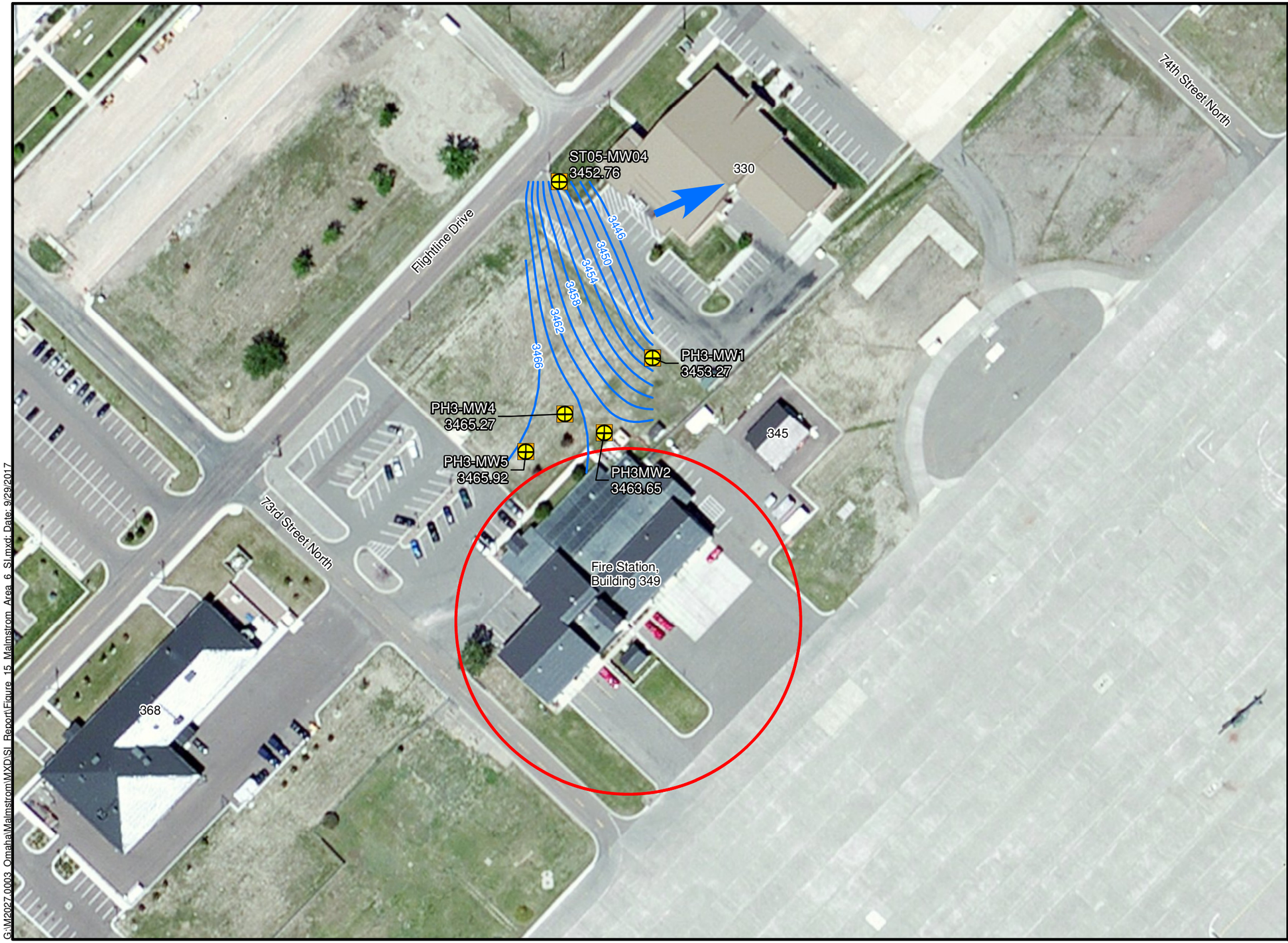
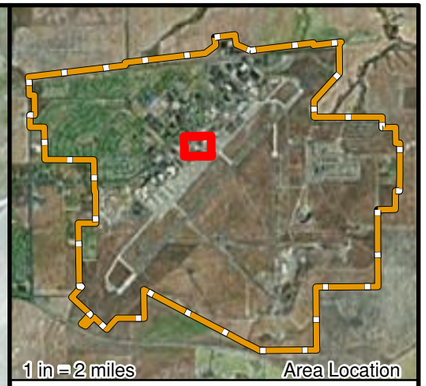




Legend

- Existing Groundwater Monitoring Well
- AFFF Inspection Area
- Installation Boundary
- Groundwater Elevation Contour
- Groundwater Flow Direction

PH3-MW1
3453.27 = Groundwater Elevation (ft)

N

0 45 90

Feet

Malmstrom Air Force Base
Cascade County, Montana

Figure 15
Fire Station, Building 349
(AFFF Area 6) Sample Locations and Potentiometric Contours

Aerostar SES LLC

Drawn: tmorse | Date: 9/29/2017

Service Layer Credits: Esri ArcGIS Online Aerial Photography

G:\M2027.0003_Omaha\Malmstrom\MXD\SI_Report\Figure_15_Malmstrom_Area_6_SI.mxd Date: 9/29/2017

MALMS06-ST05MW4-009	
Analyte	Result (µg/L)
PFBS	0.047 J
PFOA	0.16
PFOS	0.23
Combined PFOA/PFOS	0.39

MALMS06-PH3MW4-009	
Analyte	Result (µg/L)
PFBS	0.60
PFOA	0.54
PFOS	0.021
Combined PFOA/PFOS	0.561

MALMS06-PH3MW1-019	
Analyte	Result (µg/L)
PFBS	0.18
PFOA	0.29
PFOS	0.022
Combined PFOA/PFOS	0.312

MALMS06-PH3MW2-009	
Analyte	Result (µg/L)
PFBS	0.80
PFOA	2.9
PFOS	0.93
Combined PFOA/PFOS	3.83

MALMS06-PH3MW5-008	
Analyte	Result (µg/L)
PFBS	1.0
PFOA	5.5
PFOS	0.23
Combined PFOA/PFOS	5.73

ST05-MW04
PH3-MW1
PH3-MW4
PH3-MW2
PH3-MW5
330
345
368
Flightline Drive
74th Street North
73rd Street North
Fire Station Building 349

Groundwater Screening Levels:

PFBS - 40 µg/L PFOA - 0.07 µg/L PFOS - 0.07 µg/L

PFOA + PFOS - 0.07 µg/L

Notes:

= indicates analyte exceeds screening level

Bold value indicates analyte detected at concentration indicated.

J = The reported concentration is an estimated value.

GW = groundwater

1 in = 2 miles

Area Location

Legend

- Existing Groundwater Monitoring Well
- AFFF Inspection Area
- Installation Boundary
- Groundwater Flow Direction

N

0 45 90

Feet

Malmstrom Air Force Base
Cascade County, Montana

Figure 16
Fire Station, Building 349 (AFFF Area 6) - PFBS, PFOA, and PFOS in Groundwater

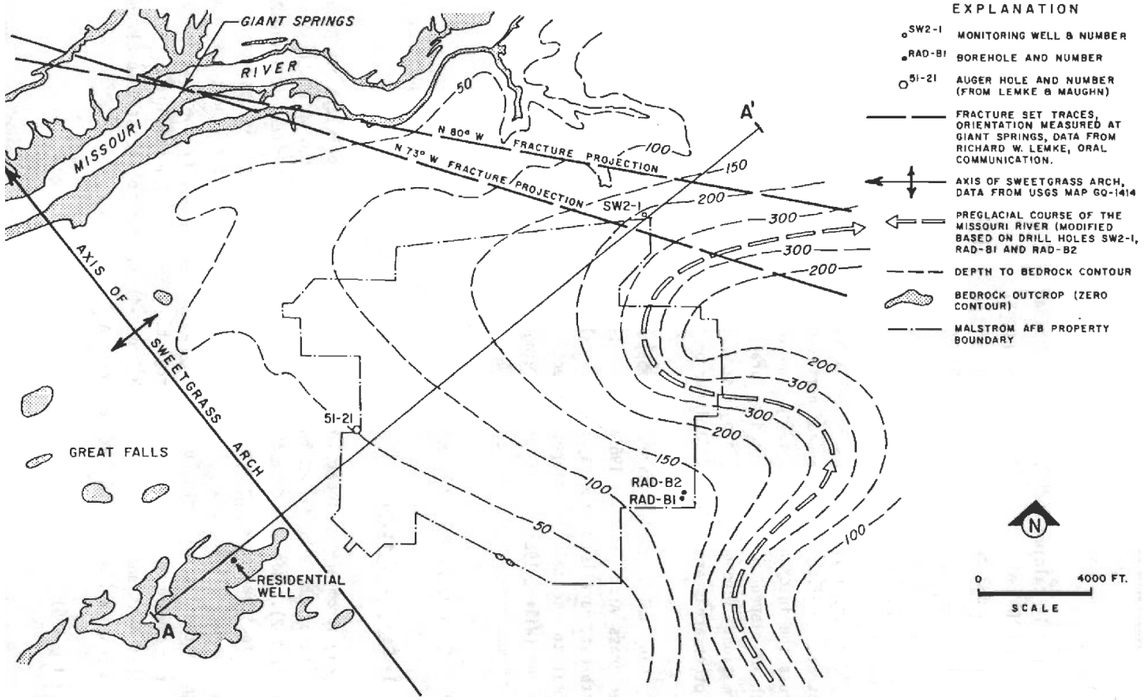
Aerostar SES LLC

Drawn: tmorse

Date: 2/28/2018

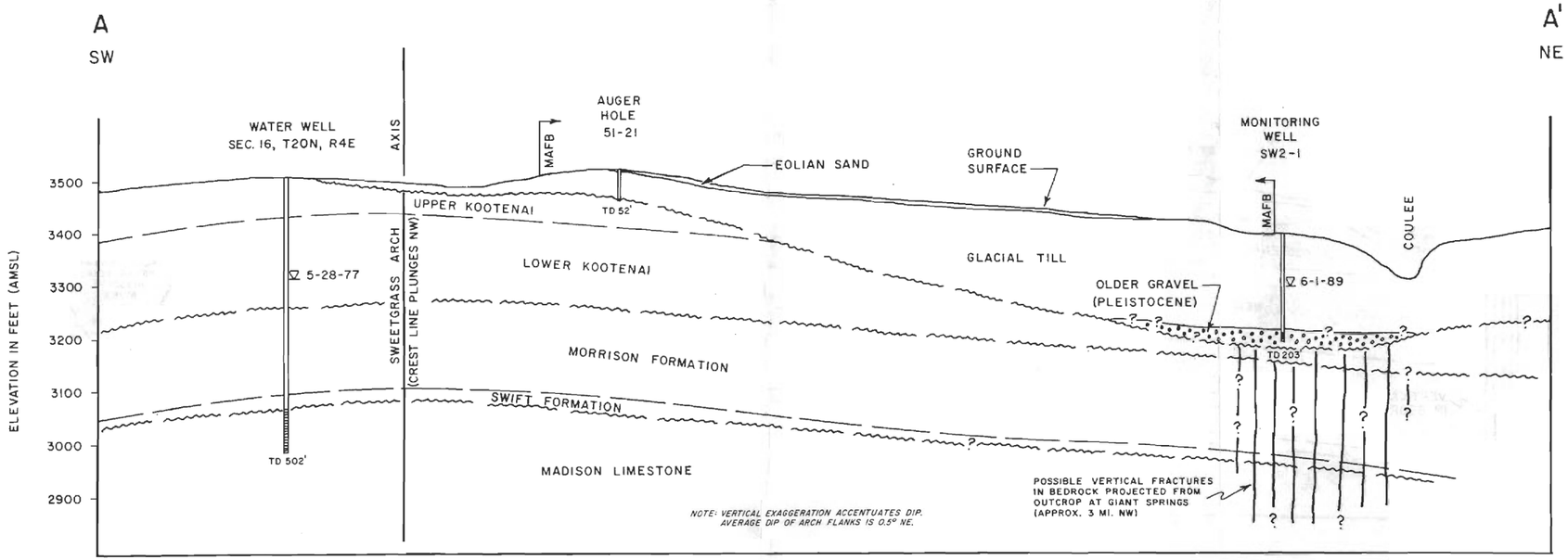
Service Layer Credits: Esri ArcGIS Online Aerial Photography

G:\M2027.0003 Omaha\Malmstrom\MXD\SI Report\Figure 16 Malmstrom Area 6 GW SI.mxd; Date: 2/28/2018



Source: SAIC, July 1991. Installation Restoration Program, Stage 2, Remedial Investigation/Feasibility Study, Malmstrom Air Force Base, Montana

Bedrock Geology, with Cross-Section A-A'



Malmstrom Air Force Base,
Cascade County, Montana

Figure 17
Geologic Cross Section

Aerostar SES LLC

Drawn: See Source

Date: 9/18/2017

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Appendix B
Regional Screening Level Calculations

Default
Resident Equation Inputs for Soil

Variable	Value
THQ (target hazard quotient) unitless	0.1
TR (target risk) unitless	1E-06
LT (lifetime) years	70
ET_{res} (exposure time) hours/day	24
ET_{res-c} (child exposure time) hours/day	24
ET_{res-a} (adult exposure time) hours/day	24
ET_{0-2} (mutagenic exposure time) hours/day	24
ET_{2-6} (mutagenic exposure time) hours/day	24
ET_{6-16} (mutagenic exposure time) hours/day	24
ET_{16-26} (mutagenic exposure time) hours/day	24
ED_{res} (exposure duration) years	26
ED_{res-c} (exposure duration - child) years	6
ED_{res-a} (exposure duration - adult) years	20
ED_{0-2} (mutagenic exposure duration) years	2
ED_{2-6} (mutagenic exposure duration) years	4
ED_{6-16} (mutagenic exposure duration) years	10
ED_{16-26} (mutagenic exposure duration) years	10
BW_{res-c} (body weight - child) kg	15
BW_{res-a} (body weight - adult) kg	80
BW_{0-2} (mutagenic body weight) kg	15
BW_{2-6} (mutagenic body weight) kg	15
BW_{6-16} (mutagenic body weight) kg	80
BW_{16-26} (mutagenic body weight) kg	80
SA_{res-c} (skin surface area - child) cm^2/day	2373
SA_{res-a} (skin surface area - adult) cm^2/day	6032
SA_{0-2} (mutagenic skin surface area) cm^2/day	2373
SA_{2-6} (mutagenic skin surface area) cm^2/day	2373
SA_{6-16} (mutagenic skin surface area) cm^2/day	6032
SA_{16-26} (mutagenic skin surface area) cm^2/day	6032
EF_{res} (exposure frequency) days/year	350
EF_{res-c} (exposure frequency - child) days/year	350
EF_{res-a} (exposure frequency - adult) days/year	350

Default
Resident Equation Inputs for Soil

Variable	Value
EF_{0-2} (mutagenic exposure frequency) days/year	350
EF_{2-6} (mutagenic exposure frequency) days/year	350
EF_{6-16} (mutagenic exposure frequency) days/year	350
EF_{16-26} (mutagenic exposure frequency) days/year	350
$IFS_{res-adj}$ (age-adjusted soil ingestion factor) mg/kg	36750
$IFSM_{res-adj}$ (mutagenic age-adjusted soil ingestion factor) mg/kg	166833.3
IRS_{res-c} (soil intake rate - child) mg/day	200
IRS_{res-a} (soil intake rate - adult) mg/day	100
IRS_{0-2} (mutagenic soil intake rate) mg/day	200
IRS_{2-6} (mutagenic soil intake rate) mg/day	200
IRS_{6-16} (mutagenic soil intake rate) mg/day	100
IRS_{16-26} (mutagenic soil intake rate) mg/day	100
AF_{res-a} (skin adherence factor - adult) mg/cm ^{2}	0.07
AF_{res-c} (skin adherence factor - child) mg/cm ^{2}	0.2
AF_{0-2} (mutagenic skin adherence factor) mg/cm ^{2}	0.2
AF_{2-6} (mutagenic skin adherence factor) mg/cm ^{2}	0.2
AF_{6-16} (mutagenic skin adherence factor) mg/cm ^{2}	0.07
AF_{16-26} (mutagenic skin adherence factor) mg/cm ^{2}	0.07
$DFS_{res-adj}$ (age-adjusted soil dermal factor) mg/kg	103390
$DFSM_{res-adj}$ (mutagenic age-adjusted soil dermal factor) mg/kg	428260
AT_{res} (averaging time - resident carcinogenic)	365
$City_{PEF}$ (Climate Zone) Selection	Default
A_s (PEF acres)	0.5
Q/C_{wind} (g/m^2-s per kg/m^3)	93.77
PEF (particulate emission factor) m ^{3}/kg	1359344438
A (PEF Dispersion Constant)	16.2302
B (PEF Dispersion Constant)	18.7762
C (PEF Dispersion Constant)	216.108
V (fraction of vegetative cover) unitless	0.5
U_m (mean annual wind speed) m/s	4.69
U_t (equivalent threshold value)	11.32
F(x) (function dependent on U_m/U_t) unitless	0.194

Default
Resident Equation Inputs for Soil

Variable	Value
$City_{VF}$ (Climate Zone) Selection	Default
A_c (VF acres)	0.5
Q/C_{vol} (g/m^2-s per kg/m^3)	68.18
foc (fraction organic carbon in soil) g/g	0.006
p_b (dry soil bulk density) g/cm^3	1.5
p_s (soil particle density) g/cm^3	2.65
n (total soil porosity) L_{pore}/L_{soil}	0.43396
$Theta_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396
$Theta_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15
T (exposure interval) s	819936000
A (VF Dispersion Constant)	11.911
B (VF Dispersion Constant)	18.4385
C (VF Dispersion Constant)	209.7845
$City_{VF\ mass\text{-}loading}$ (Climate Zone) Selection	Default
VF_{ml} (volitization factor - mass-limit) m^3/kg	.
Q/C_{vol} (g/m^2-s per kg/m^3)	68.18
A_c (VF mass-limit acres)	0.5
T (exposure interval) yr	26
d_e (depth of source) m	.
p_b (dry soil bulk density) g/cm^3	1.5
A (VF Dispersion Constant - Mass Limit)	11.911
B (VF Dispersion Constant - Mass Limit)	18.4385
C (VF Dispersion Constant - Mass Limit)	209.7845
T_w (groundwater temperature) Celsius	25

Default
Resident Risk-Based Screening Levels (RSL) for Soil

Key: I = IRIS; P = PPRTV; D = DWSHA; O = OPP; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #29); H = HEAST; F = See FAQ; E = see user guide Section 2.3.5; W = see user guide Section 2.3.6; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); U = User-provided

Chemical	CAS Number	Mutagen?	VOC?	Ingestion SF (mg/kg-day) $^{-1}$	SFO Ref	Inhalation Unit Risk (ug/m ^{3}) $^{-1}$	IUR Ref	RfD (mg/kg-day)	RfD Ref	RfC (mg/m ^{3})	RfC Ref	GIABS	ABS	RBA	Soil Saturation Concentration (mg/kg)	S (mg/L)
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	No	No	-		-		2.00E-05	D	-		1	0.1	1	-	6.80E+02
Perfluorooctanoic acid (PFOA)	335-67-1	No	No	7.00E-02	D	-		2.00E-05	D	-		1	0.1	1	-	9.50E+03

K_{oc} (cm3/g)	K_d (cm³/g)	HLC (atm-m ^{3}/mole)	Henry's Law Constant (unitless)	H` and HLC Ref	Normal Boiling Point T_{boil} (K)	BP Ref	Critical Temperature T_{crit} (K)	T_{crit} Ref	D_{ia} (cm ^{2}/s)	D_{iw} (cm ^{2}/s)	D_A (cm ^{2}/s)	Particulate Emission Factor (m ^{3}/kg)	Volatilization Factor (m ^{3}/kg)
3.72E+02	-	-	-		532.15	PHYSPROP	-		2.07E-02	5.25E-06	-	1.36E+09	-
1.15E+02	-	-	-		465.55	PHYSPROP	-		2.26E-02	5.79E-06	-	1.36E+09	-

Ingestion SL TR=1E-06 (mg/kg)	Dermal SL TR=1E-06 (mg/kg)	Inhalation SL TR=1E-06 (mg/kg)	Carcinogenic SL TR=1E-06 (mg/kg)	Ingestion SL Child THQ=0.1 (mg/kg)	Dermal SL Child THQ=0.1 (mg/kg)	Inhalation SL Child THQ=0.1 (mg/kg)	Noncarcinogenic SL Child THI=0.1 (mg/kg)	Ingestion SL Adult THQ=0.1 (mg/kg)	Dermal SL Adult THQ=0.1 (mg/kg)	Inhalation SL Adult THQ=0.1 (mg/kg)	Noncarcinogenic SL Adult THI=0.1 (mg/kg)	Screening Level (mg/kg)
-	-	-	-	1.56E-01	6.59E-01	-	1.26E-01	1.67E+00	3.95E+00	-	1.17E+00	1.26E-01 nc
9.93E+00	3.53E+01	-	7.75E+00	1.56E-01	6.59E-01	-	1.26E-01	1.67E+00	3.95E+00	-	1.17E+00	1.26E-01 nc

Inhalation Unit Risk Toxicity Metadata

Chemical	CASNUM	Inhalation Unit Risk (µg/m ³)⁻¹	Toxicity Source	EPA Cancer Classification	Inhalation Unit Risk Tumor Type	Inhalation Unit Risk Target Organ	Inhalation Unit Risk Species	Inhalation Unit Risk Method	Inhalation Unit Risk Route	Inhalation Unit Risk Treatment Duration	Inhalation Unit Risk Study Reference	Inhalation Unit Risk Notes
Perfluorooctane sulfonic acid (PFOS)	1763-23-1											
Perfluorooctanoic acid (PFOA)	335-67-1											

Oral Slope Factor Toxicity Metadata

Chemical	CASNUM	Oral Slope Factor (mg/kg-day) $^{-1}$	Toxicity Source	EPA Cancer Classification	Oral Slope Factor Tumor Type	Oral Slope Factor Target Organ	Oral Slope Factor Species	Oral Slope Factor Method	Oral Slope Factor Route	Oral Slope Factor Treatment Duration	Oral Slope Factor Study Reference	Oral Slope Factor Notes
Perfluorooctane sulfonic acid (PFOS)	1763-23-1											
Perfluorooctanoic acid (PFOA)	335-67-1	7.00E-02	DWSHA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Oral Chronic Toxicity Metadata

Chemical	CASNUM	Chronic Oral Reference Dose (mg/kg-day)	Toxicity Source	Oral Chronic Reference Dose Basis	Oral Chronic Reference Dose Confidence Level	Oral Chronic Reference Dose Critical Effect
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	2.00E-05	DWSHA	NA	NA	NA
Perfluorooctanoic acid (PFOA)	335-67-1	2.00E-05	DWSHA	NA	NA	NA

Oral Chronic Reference Dose Target Organ	Oral Chronic Reference Dose Modifying Factor	Oral Chronic Reference Dose Uncertainty Factor	Oral Chronic Reference Dose Species	Oral Chronic Reference Dose Route	Oral Chronic Reference Dose Study Duration	Oral Chronic Reference Dose Study Reference	Oral Chronic Reference Dose Notes
NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA

Inhalation Chronic Toxicity Metadata

Chemical	CASNUM	Chronic Inhalation Reference Concentration (mg/m^3)	Toxicity Source	Inhalation Chronic Reference Concentration Basis	Inhalation Chronic Reference Concentration Confidence Level	Inhalation Chronic Reference Concentration Critical Effect	Inhalation Chronic Reference Concentration Target Organ
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	-					
Perfluorooctanoic acid (PFOA)	335-67-1	-					

Inhalation Chronic Reference Concentration Modifying Factor	Inhalation Chronic Reference Concentration Uncertainty Factor	Inhalation Chronic Reference Concentration Species	Inhalation Chronic Reference Concentration Route	Inhalation Chronic Reference Concentration Study Duration	Inhalation Chronic Reference Concentration Study Reference	Inhalation Chronic Reference Concentration Notes

Appendix C

Field Forms and Boring Logs

Aerostar SES LLC

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Malmstrom Air Force Base

BORING LOG - MALMS01-001

Well ID - MALMS01-MW001

Start Date	: 10/13/16
End Date	: 10/13/16
Northing	: 1189067.44
Easting	: 1552825.21
Surface Elev. (ft)*	: 3473.69
Total Depth (ft)**	: 55.0

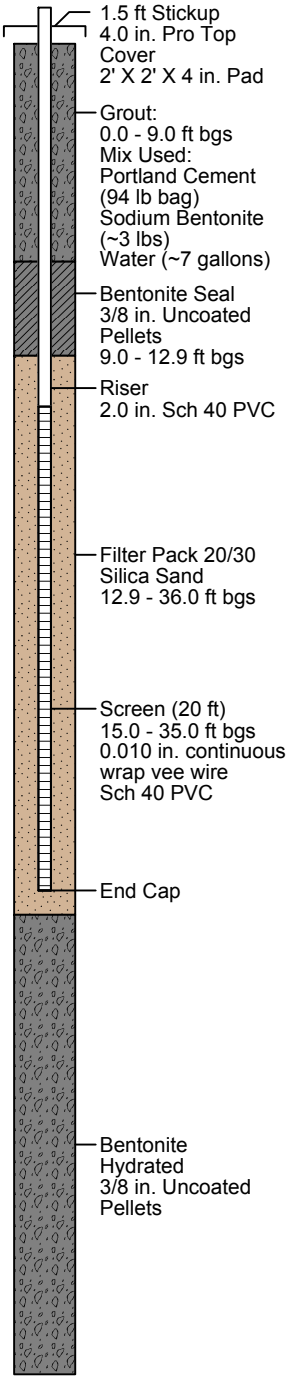
Site Name	: AFFF Area 01
Drilling Company	: Cascade Drilling
Drilling Method	: Rotary Sonic
Driller	: Jeremiah Charlton
Logged By	: Ash Willis
Borehole Diameter	: 6.0 in.
Boring Completion	: 2.0 in. PVC Monitoring Well
Depth to Water (ft)	: Not Encountered
Signature	: _____

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet (ft)
**Below Ground Surface (BGS) feet (ft)

DEPTH IN FEET (BGS)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS	Munsell Soil Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0	1	96	(0.0 - 4.0) SANDY GRAVEL, 10YR 2/1, brown, moist, medium plasticity, cohesive, no odor, organics	0	GW			SS	MALMS01-001-SS-001 MALMS01-001-SS-901 Note: SS Interval 0.0 - 0.5 ft
5	2	112	(4.0 - 36.0) CLAY, medium plasticity, 10YR 4/1, dark gray, damp, no odor	0					
10	3	100	13.0 ft bgs, cobbles & pebbles to depth	0					
15	4	102		0					
20	5	104	General Note: Swelling clays account for postive recoveries	0	CL			SO	MALMS01-001-SO-021 MALMS01-001-SO-921 Note: Sample Interval is 20.0 - 21.0 ft
25	6	103		0					
30	7	126		0					
35			30.0 - 35.0 ft bgs, Recovery % due to swelling clays	0					
	8	122	(36.0 - 55.0) SANDY CLAY, 10YR 4/1, dark gray clay, medium plasticity, damp, no odor, pebbles, lignite and calcite						
40	9	100		0					
45	10	112		0	CL				
50	11	102	No groundwater encountered	0					
55			Total Depth of Boring 55.0 feet						

Well: MALMS01-MW001
Elev (TOC): 3475.19



Aerostar SES LLC

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Malmstrom Air Force Base

BORING LOG - MALMS01-002

Well ID - MALMS01-MW002

Start Date	: 10/14/16
End Date	: 10/14/16
Northing	: 1188959.16
Easting	: 1552951.05
Surface Elev. (ft)*	: 3471.35
Total Depth (ft)**	: 35.0

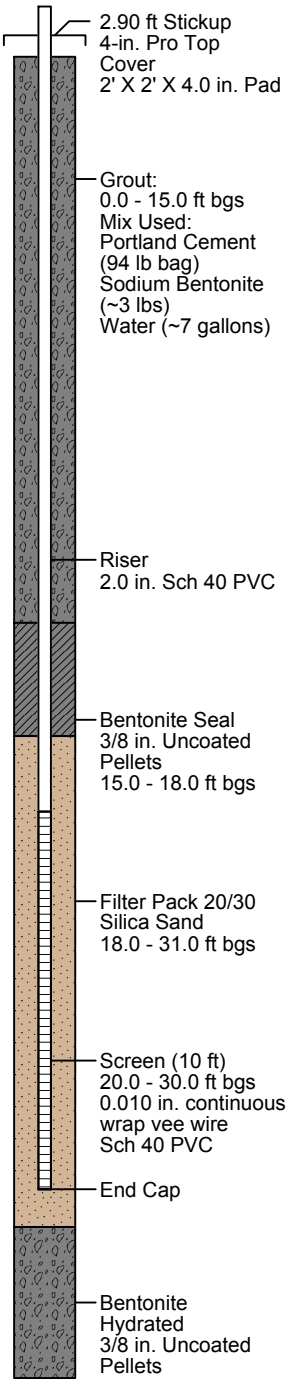
Site Name	: AFFF Area 01
Drilling Company	: Cascade Drilling
Drilling Method	: Rotary Sonic
Driller	: Jeremiah Charlton
Logged By	: Ash Willis
Borehole Diameter	: 6.0 in.
Boring Completion	: 2.0 in. PVC Monitoring Well
Depth to Water (ft)	: Not Encountered
Signature	: _____

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet (ft)
**Below Ground Surface (BGS) feet (ft)

DEPTH IN FEET (BGS)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS	Munsell Soil Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0	1	68	(0.0 - 1.0) SANDY GRAVEL, 10YR 2/1, black, well graded, non-cohesive, dry, no odor	0	GW			SS	MALMS01-002-SS-001 Note: Interval 0.0 - 0.5 ft
			(1.0 - 4.0) SANDY GRAVEL, 10YR 6/8, brownish yellow, well graded, non-cohesive, dry, no odor		GW				
5	2	62	(4.0 - 6.0) CLAY, medium plasticity, 10YR 4/1, dark gray, damp, no odor	0	CL			SO	MALMS01-002-SO-005 Note: Interval 4.0 - 5.0 ft
			(6.0 - 35.0) CLAY, medium plasticity, 10YR 4/1, dark gray, with pebbles, damp, no odor						
10	3	72	13.0 ft bgs, cobbles present	0					
15	4	82		0					
20	5	102	General Note: Swelling clays account for postive recoveries.	0	CL				
25	6	122		0					
30	7	122	28.0 ft bgs, lignite present, no groundwater encounted	0					
35			Total Depth of Boring 35.0 feet	0					

Well: MALMS01-MW002
Elev (TOC): 3474.25



Aerostar SES LLC

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Malmstrom Air Force Base

BORING LOG - MALMS01-003

Well ID - MALMS01-MW003

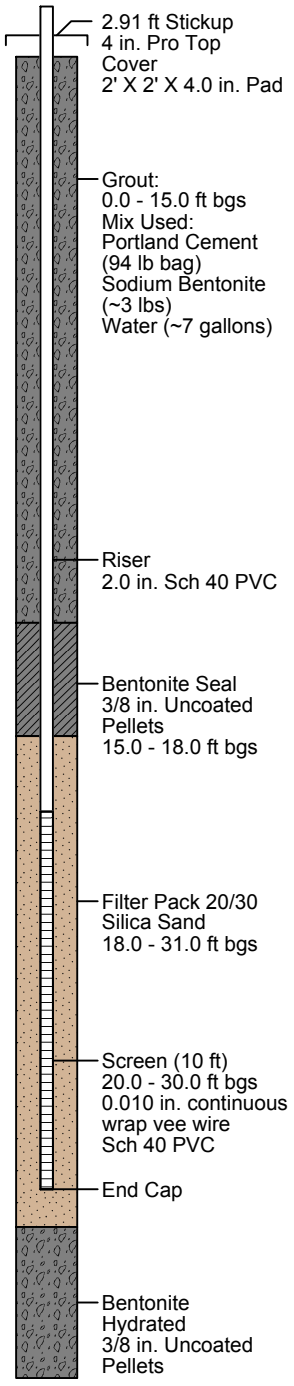
Start Date	: 10/14/16
End Date	: 10/14/16
Northing	: 1189300.51
Easting	: 1553204.84
Surface Elev. (ft)*	: 3466.85
Total Depth (ft)**	: 35.0

Site Name	: AFFF Area 01
Drilling Company	: Cascade Drilling
Drilling Method	: Rotary Sonic
Driller	: Jeremiah Charlton
Logged By	: Ash Willis
Borehole Diameter	: 6.0 in.
Boring Completion	: 2.0 in. PVC Monitoring Wel
Depth to Water (ft)	: Not Encountered
Signature	: _____

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet (ft)
**Below Ground Surface (BGS) feet (ft)

DEPTH IN FEET (BGS)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS	Munsell Soil Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0									
	1	104	(0.0 - 1.0) BACKFILL, Gravely, 10YR 3/6, dark yellowish brown, well graded, non-cohesive, dry, no odor	0	FB			SS	MALMS01-003-SS-001 Note: Interval 0.0 - 0.5 ft.
			(1.0 - 3.0) SILTY CLAY, 10YR 3/6, dark yellowish brown, non plastic, non-cohesive, dry, no odor, organics		OL				
5			(3.0 - 4.0) SILTY CLAY, 10YR 5/2, grayish brown, dry, non-plastic, non-cohesive, no odor		CL				
	2	114	(4.0 - 35.0) SILTY CLAY, 10YR 3/2, very dark grayish brown, dry, medium plasticity, cohesive, no odor 8.0 ft bgs, cobbles and pebbles present	0					
10				0				SO	MALMS01-003-SO-011 Note: Interval 10.0 - 11.0 ft
	3	114	11.0 ft bgs, cohesive 13.0 - 35.0 ft bgs, grading to moist, cobbles, pebbles and lignite						
15				0					
	4	116							
20			General Note: Swelling clays account for postive % recoveries.	0	CL				
	5	100							
25				0					
	6	128							
30				0					
	7	102							
35			Total Depth of Boring 35.0 feet	0					



Aerostar SES LLC

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Malmstrom Air Force Base

Boring Log: MALMS02-001

Start Date	: 10/11/16
End Date	: 10/12/16
Northing	: 1188255.24
Easting	: 1551853.96
Surface Elev. (ft)*	: 3485.70
Total Depth (ft)**	: 70.0

Site Name	: AFFF Area 2
Drilling Company	: Cascade Drilling
Drilling Method	: Rotary Sonic
Driller	: Jeremiah Charlton
Logged by	: Ash Willis
Borehole Diameter	: 6.0 in.
Boring Completion	: No Well Installed
Depth to Water (ft)	: Not Encountered
Signature	: _____

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet (ft)
**Below Ground Surface (BGS) feet (ft)

DEPTH IN FEET (BGS)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS	Munsell Soil Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID	REMARKS
0	1		(0.0 - 4.0) SILTY SAND, 10YR 4/4, dark yellowish brown, non cohesive, dry, no odor	0	SM			SO	MALMS02-001-SS-001 MALMS02-001-SS-901 Note: Interval 0.0 - 0.5 ft	**Borehole Abandoned **Groundwater not encountered
	2	94								
	3		(4.0 - 5.5) CLAY, 10YR 4/4, dark yellowish brown, cohesive, dry, no odor, low plasticity		CL					**No Well Installed**
5	4	100	(5.5 - 18.0) CLAY, low to high plasticity, 10YR 2/2, very dark brown, pebbles, cohesive, no odor, moist	0						
10	5	134		0	CL					
15	6	108		0						General Note: Swelling clays account for postive recoveries.
			(18.0 - 34.0) FAT CLAY, medium to high plasticity, 10YR 2/2, very dark brown clay with 10YR 7/8 yellow, silty sand mottles, moist, cohesive, no odor							
20	7	126		0				SO	MALMS02-001-S0-020 MALMS02-001-S0-920 Note: Interval 19.0 - 20.0 ft	
25	8	122		0	CH					
30	9	102		0						
			(34.0 - 43.0) SILTY CLAY, 10YR 2/2, very dark brown, with cobbles, low plasticity, friable, cohesive, no odor, dry							
35	10	112		0	OL					
40				0						

Aerostar SES LLC

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Malmstrom Air Force Base

Boring Log: MALMS02-001

Start Date	: 10/11/16
End Date	: 10/12/16
Northing	: 1188255.24
Easting	: 1551853.96
Surface Elev. (ft)*	: 3485.70
Total Depth (ft)**	: 70.0

Site Name	: AFFF Area 2
Drilling Company	: Cascade Drilling
Drilling Method	: Rotary Sonic
Driller	: Jeremiah Charlton
Logged by	: Ash Willis
Borehole Diameter	: 6.0 in.
Boring Completion	: No Well Installed
Depth to Water (ft)	: Not Encountered
Signature	: _____

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet (ft)
**Below Ground Surface (BGS) feet (ft)

DEPTH IN FEET (BGS)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS	Munsell Soil Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID	REMARKS
40	11	112		0	OL					
45	12	122	(43.0 - 70.0) SILTY CLAY, 10YR 2/2, very dark brown silty clay with limestone fragments and lignite, mica, shale and calcite, low plasticity, friable, cohesive, no odor, dry	0	CL					
50	13	106		0						
55	14	108		0						
60	15	104		0						
65	16	112		0						
70			End of Borehole 70.0 ft BGS							
75										
80										

Aerostar SES LLC

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Malmstrom Air Force Base

Boring Log: MALMS02-002

Start Date	: 10/12/16
End Date	: 10/12/16
Northing	: 1188395.40
Easting	: 1552010.13
Surface Elev. (ft)*	: 3482.50
Total Depth (ft)**	: 52.0

Site Name	: AFFF Area 2
Drilling Company	: Cascade Drilling
Drilling Method	: Rotary Sonic
Driller	: Jeremiah Charlton
Logged by	: Ash Willis
Borehole Diameter	: 6.0 in.
Boring Completion	: No Well Installed
Depth to Water (ft)	: Not Encountered
Logged by	: Ash Willis
Signature	: _____

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet (ft)
**Below Ground Surface (BGS) feet (ft)

DEPTH IN FEET (BGS)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS	Munsell Soil Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID	REMARKS
0	1		(0.0 - 2.0) SANDY CLAY, 10YR 3/2, very dark grayish brown, moist, cohesive, medium plasticity, with organics, no odor	0	SM			SO	MALMS02-002-SS-001 Note: Interval 0.0 - 0.5 ft	**Borehole Abandoned **Groundwater not encountered during drilling
	2	70			CL					
	3		(2.0 - 4.0) SILTY SAND, 10YR 3/2, very dark grayish brown, dry, non-cohesive, no odor							**No Well Installed**
5	4	104	(4.0 - 13.0) SILTY CLAY, 10YR 4/4, dark yellowish brown, dry, low plasticity, no odor, cobbles	0 0	OH					
10	5	82		0						
			(13.0 - 41.0) FAT CLAY, 10YR 5/8, yellowish brown, dry, low plasticity, no odor	0						General Note: Swelling clays account for postive recoveries.
15	6	104	16.0 ft bgs, lignite and limestone fragments							
20	7	108	21.0 ft bgs, lignite, limestone fragments & pebbles	0				SO	MALMS02-002-S0-020 Note:Interval 19.0 - 20.0 ft	
25	8	104		0	CH					
30	9	90		0						
35	10	104		0						
40	11	122	(41.0 - 44.0) CLAY, 10YR 3/3, dark brown, damp, low plasticity, no odor, lignite, limestone, pebbles	0	CH					
45	12	93	(44.0 - 52.0) CLAY, 10YR 5/7, yellowish brown, damp, low plasticity, no odor, lignite, limestone, pebbles to cobbles	2	CH					
50	13	100		1						

End of Borehole 52.0 ft BGS

Aerostar SES LLC

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Malmstrom Air Force Base

Boring Log: MALMS02-003

Start Date	: 10/15/16
End Date	: 10/15/16
Northing	: 1189182.07
Easting	: 1554609.12
Surface Elev. (ft)*	: 3455.00
Total Depth (ft) **	: 55.0

Site Name	: AFFF Area 2
Drilling Company	: Cascade Drilling
Drilling Method	: Rotary Sonic
Driller	: Jeremiah Charlton
Logged by	: Ash Willis
Borehole Diameter	: 6.0 in.
Boring Completion	: No Well Installed
Depth to Water (ft)	: Not Encountered
Logged by	: Ash Willis
Signature	: _____

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet (ft)
**Below Ground Surface (BGS) feet (ft)

DEPTH IN FEET (BGS)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS	Munsell Soil Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID	REMARKS
0	1	78	(0.0 - 2.0) SILTY CLAY, 10YR 3/3, dark brown, dry, cohesive, no plasticity, no odor, organics	0	OL			SO	MALMS02-003-SS-001 Note:Interval 0.0 - 0.5 ft	**Borehole Abandoned **Groundwater not encountered **No Well Installed**
	2		(2.0 - 24.0) SILTY CLAY, 10YR 3/3, dark brown, dry, cohesive, non plasticity, no odor							
	3			0						
5	4	78	7.0 ft bgs, grading moist to dark grayish brown, medium plasticity	0				SO	MALMS02-003-S0-006 Note: Interval 5.0 - 6.0 ft	
10	5	84		0	CL					General Note: Swelling clays account for postive recoveries.
15	6	110	14.0 ft bgs, dry, cohesive, medium plasticity, no odor, lignite	0						
20	7	100		0						
25	8	100	(24.0 - 47.0) SILTY CLAY, 10YR 5/8, yellowish brown, dry, non-cohesive, non-plastic, no odor, cobbles and pebbles, shale, limestone, chalk, mica	0						
30	9	100		0						
35	10	100		0	CL					
40	11	100		0						
45	12	100		2						
50		100	(47 - 55.0) SILTY CLAY, 10YR 3/3, dark brown dry, cohesive, medium plasticity, no odor, pebbles, lignite, limestone	1	CL					
55			Total Depth of Boring 55.0 feet							

Aerostar SES LLC

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Malmstrom Air Force Base

Boring Log: MALMS03-001

Well ID - MALMS03-MW001

Start Date	: 10/19/16
End Date	: 10/19/16
Northing	: 1196651.16
Easting	: 1549478.61
Surface Elev. (ft)*	: 3411.02
Total Depth (ft)**	: 60.0

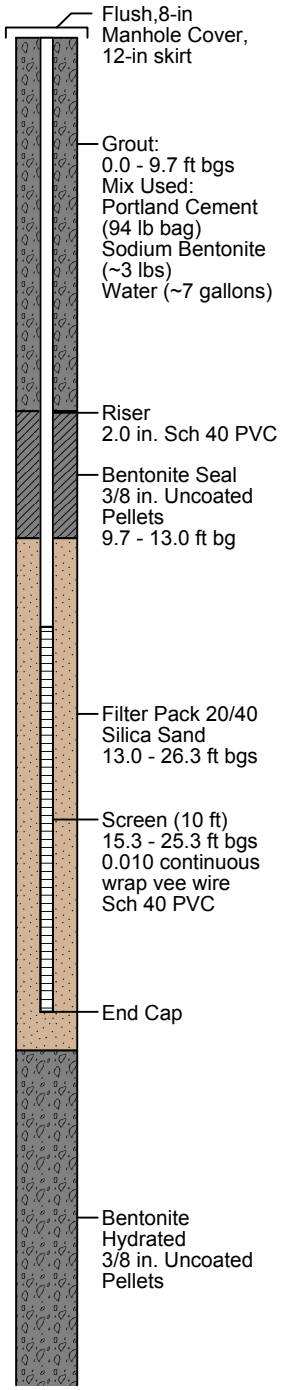
Site Name	: AFFF Area 3
Drilling Company	: Cascade Drilling
Drilling Method	: Rotary Sonic
Driller	: Jeremiah Charlton
Logged by	: Ash Willis
Borehole Diameter	: 6.0 in.
Boring Completion	: 2.0 in. PVC Monitoring Well
Depth to Water (ft)	: Not Encountered
Signature	: _____

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet (ft)
**Below Ground Surface (BGS) feet (ft)

DEPTH IN FEET (BGS)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS	Munsell Soil Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0	1	100	(0.0 - 1.0) SILTY CLAY, 10YR 4/3, brown with trace sand, low plasticity, no odor, slightly damp, with backfill, and trace limestone, organics (roots), soft	0	CL				
	2				SC				
	3		(1.0 - 3.0) CLAYEY SAND, 10YR 4/2 to 4/3, dark grayish brown, with some silt, medium stiff, medium plasticity, slightly damp, no odor		CL				
5	4	90	(3.0 - 5.0) SILTY CLAY, 10YR 5/2, grayish brown, damp to moist, low to medium plasticity, tree organics (roots), trace pebbles, soft, moderate to well sorted, fine grained.	0					
			(5.0 - 30.0) SILTY CLAY, 10YR 5/2, grayish brown, slightly damp with trace limestone, lignite & pebbles, low to medium plasticity, firm to medium density						
10	5	100		0					
15	6	100		0	CL				
20	7	100		0				SO	MALMS03-001-SO-020 Note: Interval 19.0 - 20.0 ft
25	8	100		0					
30	9	100	(30.0 - 60.0) CLAY with gravel, 10YR 5/2 gray, low to medium plastic, no odor, trace lignite, limestone and pebbles, firm to dense 31.0 - 32.8 ft bgs, slightly damp to damp	0	CL				
35									

Well: MALMS03-MW001
Elev (TOC): 3410.54



Aerostar SES LLC

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Malmstrom Air Force Base

Boring Log: MALMS03-001

Well ID - MALMS03-MW001

Start Date	: 10/19/16
End Date	: 10/19/16
Northing	: 1196651.16
Easting	: 1549478.61
Surface Elev. (ft)*	: 3411.02
Total Depth (ft)**	: 60.0

Site Name	: AFFF Area 3
Drilling Company	: Cascade Drilling
Drilling Method	: Rotary Sonic
Driller	: Jeremiah Charlton
Logged by	: Ash Willis
Borehole Diameter	: 6.0 in.
Boring Completion	: 2.0 in. PVC Monitoring Well
Depth to Water (ft)	: Not Encountered
Signature	: _____

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet (ft)
**Below Ground Surface (BGS) feet (ft)

DEPTH IN FEET (BGS)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS	Munsell Soil Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
35		100							
40	10	100	41.5 ft bgs, abundant calcite & weathered limestone laminations						
45	11	100			CL				
50	12	100	50.0 ft bgs, weathered limestone and calcite decreases with depth						
55	13	100							
60			End of Borehole 60.0 ft BGS						
65									
70									

Well: MALMS03-MW001
Elev (TOC): 3410.54

Bentonite Hydrated 3/8 in. Uncoated Pellets

Aerostar SES LLC

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Malmstrom Air Force Base

Boring Log: MALMS03-002

Well ID - MALMS03-MW002

Start Date	: 10/19/16
End Date	: 10/20/16
Northing	: 1196560.89
Easting	: 1549370.09
Surface Elev. (ft)*	: 3413.90
Total Depth (ft)**	: 30.0

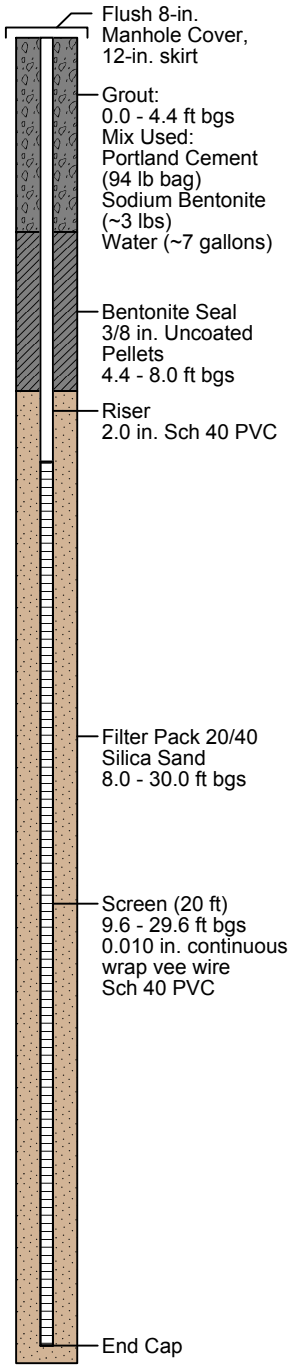
Site Name	: AFFF Area 3
Drilling Company	: Cascade Drilling
Drilling Method	: Rotary Sonic
Driller	: Jeremiah Charlton
Logged by	: Ash Willis
Borehole Diameter	: 6.0 in.
Boring Completion	: 2.0 in. PVC Monitoring Well
Depth to Water (ft)	: Not Encountered
Signature	: _____

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet (ft)
**Below Ground Surface (BGS) feet (ft)

DEPTH IN FEET (BGS)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS	Munsell Soil Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0	1		(0.0 - 5.0) SILTY SAND with gravel and cobble backfill, 10YR 5/3 brown to 5/4 yellowish brown, trace argillaceous matrix, firm to hard due to compaction, well graded, fine to medium grained, dry	0	ML				
	2	100							
	3								
5	4	100	(5.0 - 10.0) SILTY CLAY, 10YR 5/6 to 4/2, grayish brown to dark grayish brown, slightly damp, medium to high plasticity, firm to very stiff, trace gravel, weathered limestone and lignite, no odor	0	CL				
10	5	90	(10.0 - 30.0) SILTY CLAY, 10YR 5/6 to 4/2, grayish brown to dark grayish brown silty clay, slightly damp to dry, medium to high plasticity, firm to very stiff, trace gravel and mica, weathered limestone and lignite, no odor	0					
15	6	100		0					
20	7	100		0	CL			SO	MALMS03-002-S0-020 Note: Interval 19.0 - 20.0 ft
25	8	100		0					
30			No groundwater encountered during drilling.	0					
			End of Borehole 30.0 ft BGS						

Well: MALMS03-MW003
Elev (TOC): 3413.29



Aerostar SES LLC

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Malmstrom Air Force Base

Boring Log: MALMS03-003

Well ID - MALMS03-MW003

Start Date	: 10/19/16
End Date	: 10/19/16
Northing	: 1196641.77
Easting	: 1549310.28
Surface Elev. (ft)*	: 3410.76
Total Depth (ft)**	: 30.0

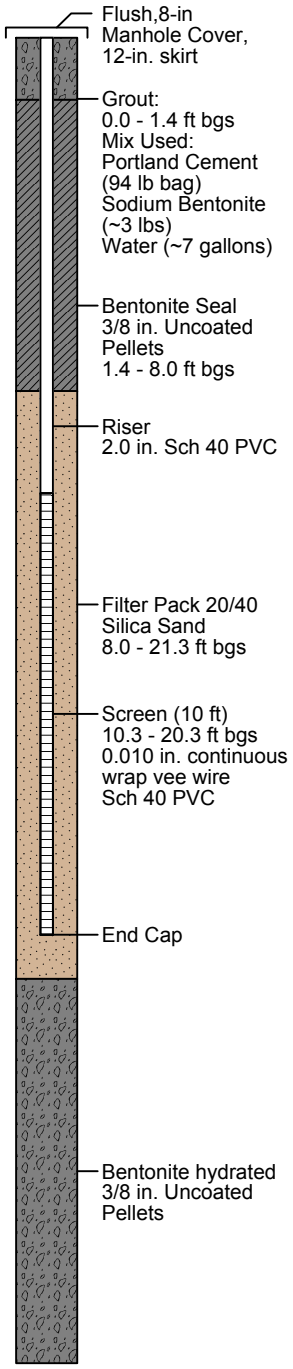
Site Name	: AFFF Area 3
Drilling Company	: Cascade Drilling
Drilling Method	: Rotary Sonic
Driller	: Jeremiah Charlton
Logged by	: Ash Willis
Borehole Diameter	: 6.0 in.
Boring Completion	: 2" PVC Monitoring Well
Depth to Water (ft)	: Not Encountered
Signature	: _____

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet (ft)
**Below Ground Surface (BGS) feet (ft)

DEPTH IN FEET (BGS)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS	Munsell Soil Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0	1		(0.0 - 5.0) SILTY SAND 10YR 4/3 brown, trace argillaceous matrix, no odor, loose, soft, organics (roots), fine grained, poorly graded, slightly damp	0	ML			SS	MALMS03-003-SS-001 Note: Interval 0.0 - 0.5 ft
	2	100							
	3								
5	4	100	(5.0 - 30.0) SILTY CLAY, 10YR 5/3, brown, high plasticity, stiff to very stiff, trace gravel, lignite and limestone, slightly damp to damp, no odor, dense	0					
								SO	MALMS03-003-SO-009 Note: Interval 8.0 - 9.0 ft
10	5	100		0					
15	6	100		0	CL				
20	7	100	20.0 ft bgs, some trace calcite	0					
25	8	100	No groundwater encountered during drilling	0					
30			End of Borehole 30.0 ft BGS						

Well: MALMS03-MW003
Elev (TOC): 3410.24



Aerostar SES LLC

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Malmstrom Air Force Base

Boring Log: MALMS04-001

Well ID - MALMS04-MW001

Start Date	: 10/18/16
End Date	: 10/20/16
Northing	: 1197072.50
Easting	: 1555143.47
Surface Elev. (ft)*	: 3391.85
Total Depth (ft)**	: 15.0

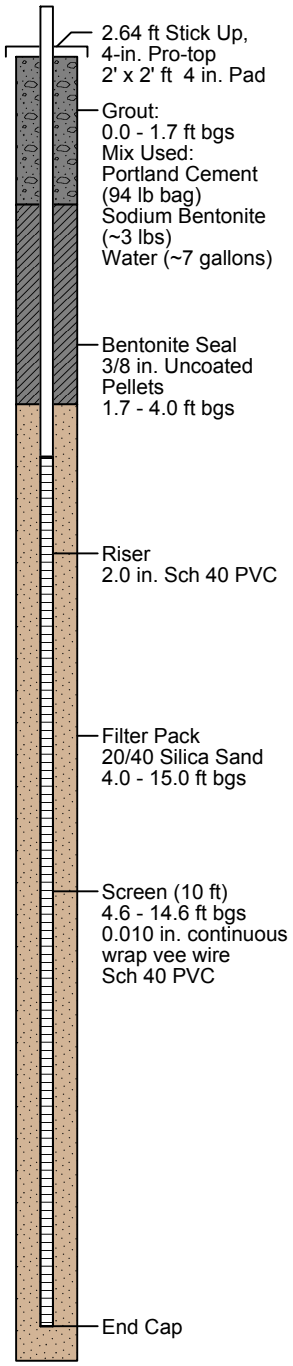
Site Name	: AFFF Area 4
Drilling Company	: Cascade Drilling
Drilling Method	: Rotary Sonic
Driller	: Jeremiah Charlton
Logged by	: Ash Willis
Borehole Diameter	: 6.0 in.
Boring Completion	: 2.0 in. PVC Monitoring Well
Depth to Water (ft)	: 5.0
Signature	: _____

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet (ft)
**Below Ground Surface (BGS) feet (ft)

DEPTH IN FEET (BGS)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS	Munsell Soil Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0			(0.0 - 1.0) SILTY SANDY CLAY, 10YR 4/1, dark gray damp, low to medium plasticity, well sorted, soft	0	CL			SS	MALMS04-001-SS-001 Note: Interval 0.0 - 0.5 ft
		40	(1.0 - 6.5) SAND with trace silt, 10YR 4/1 to 5/1, dark gray to gray, trace lignite, trace argillaceous matrix, soft, moist to wet, fine grained, well sorted	0	SM			SO	MALMS04-001-S0-004 Note: Interval 3.0 - 4.0 ft
5			5.0 ft. bgs, saturated				▼		
		100	(6.5 - 10.0) SANDY SILTY CLAY, 10YR 7/3, very pale brown to 7/2 light gray, medium plastic, cobble, pebbles, and trace limestone and lignite present, slightly damp to damp	0	CL				
10			(10.0 - 11.5) SAND with trace silt, 10YR 5/1 to 7/1, gray to light gray, trace argillaceous matrix, trace pebbles, loose, soft, well sorted, saturated	0	SM				
		100	(11.5 - 15.0) SANDY SILTY CLAY, 10YR 6/1 to 6/2, gray to light brownish gray, medium plasticity, medium dense to dense, trace pebble, cobble and lignite	0	CL				
15			End of Borehole 15.0 ft BGS						

Well: MALMS04-MW001
Elev (TOC): 3394.49



Aerostar SES LLC

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Malmstrom Air Force Base

Boring Log: MALMS04-002

Well ID - MALMS04-MW002

Start Date	: 10/18/16
End Date	: 10/20/16
Northing	: 1196959.44
Easting	: 1555117.26
Surface Elev. (ft)*	: 3393.70
Total Depth (ft)**	: 15.0

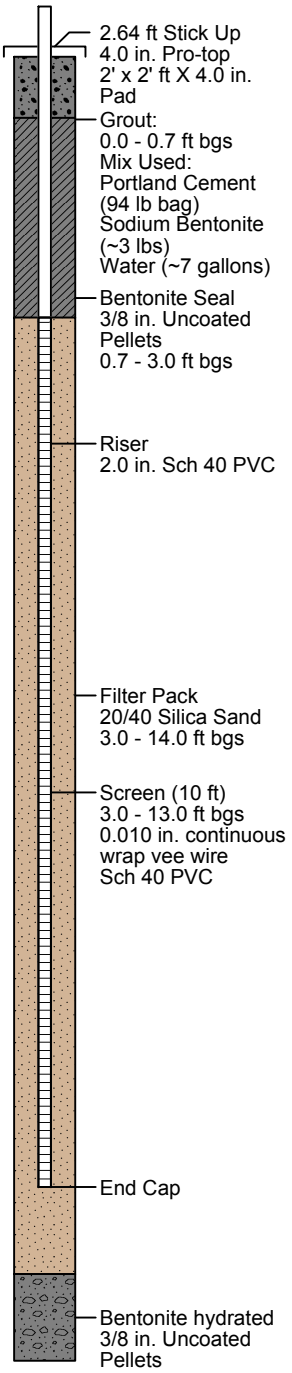
Site Name	: AFFF Area 4
Drilling Company	: Cascade Drilling
Drilling Method	: Rotary Sonic
Driller	: Jeremiah Charlton
Logged by	: Ash Willis
Borehole Diameter	: 6.0 in.
Boring Completion	: 2.0 in. PVC Monitoring Well
Depth to Water (ft)	: 3.0
Signature	: _____

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet (ft)
**Below Ground Surface (BGS) feet (ft)

DEPTH IN FEET (BGS)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS	Munsell Soil Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0			(0 - 5.0) SILTY SAND, 10YR 4/1, dark gray, moist to wet, trace argillaceous matrix, soft, fine grained, poorly graded, no odor, organics (roots), trace mica	0				SS	MALMS04-002-SS-001 Note: Interval 0.0 - 0.5 ft
								SO	MALMS04-002-S0-002 Note: Interval 1.0 - 2.0 ft
		100	6.0 - 6.2 ft bgs, saturated		CL		▼		
5			(5.0 - 10.0) SANDY SILTY CLAY, 10YR 4/1, dark gray to 3/1, very dark gray, weathered limestone lamination at 8.5 to 9.6 feet, medium plasticity, dense, stiff, dry to slightly damp, trace pebbles, cobbles	0					
		100	8.5 to 9.6 ft bgs, weathered limestone lamination		CL				
10			(10.0 - 10.40) SILTY SAND with trace silt, 10YR 4/1 dark gray, trace argillaceous matrix, soft, fine grained, poorly graded, no odor, saturated	0	ML				
			(10.4 - 12.0) SILTY SANDY CLAY, 10YR 4/1, dark gray to 5/1, gray, moist to damp, soft, medium to low plasticity, trace weathered limestone		ML				
		100	(12.0 - 15.0) CLAY, 10YR 4/1, dark gray, dense, medium to high plasticity, trace limestone & lignite, trace weathered limestone lamination		CL				
			14.0 ft bgs, dry						
15			End of Borehole 15.0 ft BGS	0					

Well: MALM04-MW002
Elev (TOC): 3395.42



Aerostar SES LLC

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Malmstrom Air Force Base

Boring Log: MALMS05-001

Well ID - MALMS05-MW001

Start Date	: 10/15/16
End Date	: 10/15/16
Northing	: 1192966.02
Easting	: 1550976.21
Surface Elev. (ft)*	: 3470.04
Total Depth (ft)**	: 20.0

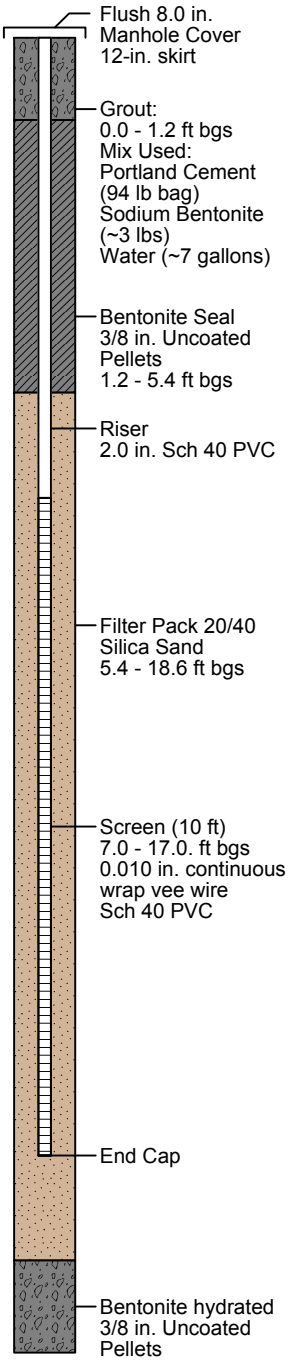
Site Name	: AFFF Area 5
Drilling Company	: Cascade Drilling
Drilling Method	: Rotary Sonic
Driller	: Jeremiah Charlton
Logged by	: Ash Willis
Borehole Diameter	: 6.0 in.
Boring Completion	: 2.0 in. PVC Monitoring Well
Depth to Water (ft)	: 8.0
Signature	: _____

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet (ft)
**Below Ground Surface (BGS) feet (ft)

DEPTH IN FEET (BGS)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS	Munsell Soil Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0	1		(0.0 - 0.5) CLAY, 10YR 6/2, light brownish gray, slightly damp, low to medium plasticity, organics (roots), trace silt and sand to moderate amounts	0	CL			SS	MALMS05-001-SS-001 Note: Interval 0.0 - 0.5 ft
	2	100	(0.5 - 4.5) SANDY SILT, 10YR 4/3, brown, no organics, trace cobbles, loose, soft, poorly graded, fine grained to trace medium grained, rounded to sub angular, dry to slightly damp		ML				
	3								
5			(4.5 - 8.0) SANDY SILTY CLAY, 10YR 4/3 brown to 10YR 3/2 very dark grayish brown, low to medium plasticity, trace lignite & trace limestone, grading very pale brown with depth, dry	0	CL			SO	MALMS05-001-SO-007 Note: Interval 6.0 - 7.0 ft
	4	100							
			(8.0 - 10.0) SILTY CLAY, 10YR 6/2, light brownish gray, medium to high plasticity, wet to saturated, soft 9.5 ft, dry to slightly damp		CL				
10	5	100	(10.0 - 20.0) SILTY SANDY CLAY, 10YR 6/3, pale brown, dry to 14 to 14.2 feet moist to wet, trace lignite & calcite, cobbles and pebbles, with sandy portion, medium to hard density, low plasticity 14.0 to 14.2 ft bgs moist to wet	0	CL				
15				0	CL				
	6	100							
20			End of Borehole 20.0 ft BGS	0					

Well: MALMS05-MW001
Elev (TOC): 3469.79



Aerostar SES LLC

AFFF Areas (Omaha District)
AFFF Site Inspection
Project# M2027.0003

Malmstrom Air Force Base

Boring Log: MALMS05-002

Well ID - MALMS05-MW002

Start Date	: 10/17/16
End Date	: 10/17/16
Northing	: 1192966.16
Easting	: 1550709.94
Surface Elev. (ft)*	: 3473.09
Total Depth (ft)**	: 30.0

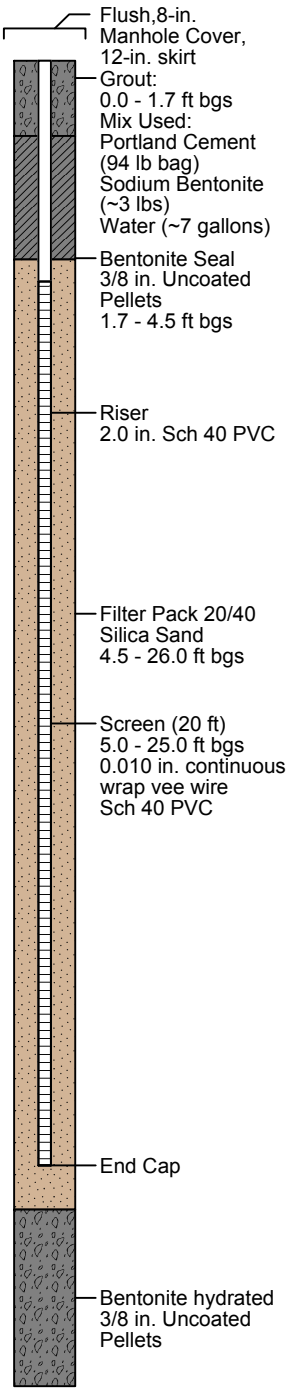
Site Name	: AFFF Area 5
Drilling Company	: Cascade Drilling
Drilling Method	: Rotary Sonic
Driller	: Jeremiah Charlton
Logged by	: Ash Willis
Borehole Diameter	: 6.0 in.
Boring Completion	: 2.0 in. PVC Monitoring Well
Depth to Water (ft)	: Not Encountered
Signature	: _____

Water Levels
▼ During Drilling

Measurements
*North American Vertical Datum (NAVD88) feet (ft)
**Below Ground Surface (BGS) feet (ft)

DEPTH IN FEET (BGS)	INTERVAL	% RECOVERY	DESCRIPTION	PID (ppm)	USCS	Munsell Soil Color	Depth to Water (DTW)	SAMPLE TYPE	SAMPLE ID
0	1		(0.0 - 0.5) SILT, 10YR 4/3, brown, trace gravel, & organics (roots), soft, loose, dry	0	ML			SS	MALMS05-001-SS-001 Note: Interval 0.0 - 0.5 ft
	2	100	(6" - 5.0) SILT with CLAY, 10YR 4/3, brown, trace gravel, backfill, medium to high plasticity, dense to medium dense		ML				
	3								
5	4	100	(5.0 - 20.0) LEAN CLAY, 10YR 4/3 to 5/3, brown, high to medium plasticity, trace gravel, cobbles & pebbles, medium to very dense, damp to moist	0				SO	MALMS05-001-SO-007 Note: Interval 6.0 - 7.0 ft
10	5	100	12.0 - 13.0 ft bgs dry to damp	0	CL				
15	6	100	15.0 - 17.0 ft bgs, damp to moist, some silt	0					
20		80	(20.0 - 30.0) LEAN CLAY with SILT, 10YR 5/2, grayish brown, medium to high plasticity, soft to med. density, some lignite, limstone, cobble & pebbles, damp	0					
25		100	26.0 -30.0 ft bgs, some calciite & limestone fragments		CL				
			No saturated zone encountered during drilling						
30			End of Borehole 30.0 ft BGS						

Well: MALMS05-MW002
Elev (TOC): 3472.54



AerostarSES LLC

GROUNDWATER SAMPLING LOG

PROJECT: M2027.0003 | INSTALLATION: Malmstrom AFB

WELL NO: ~~MALM~~ JAS PH3MW1 | SAMPLE ID: MALMS06-PH3MW1-019 | DATE: 10/12/16 and 10/14/16

1/4"O.D .17ID

PURGING DATA

WELL DIAMETER (inches): 2.0	TUBING DIAMETER (inches): ~~3/8" O.D.~~ 1/4" O.D.	WELL SCREEN INTERVAL DEPTH: ~~10.36~~ feet to 20.36 feet (BTOC)	STATIC DEPTH TO WATER (feet): 18.05 (BTOC)	PURGE PUMP TYPE OR BAILER:

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY (only fill out if applicable)

= (20.36 feet – 18.05 feet) X 0.16 gallons/foot = 0.37 gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME (only fill out if applicable)

~~0.37~~ gallons + (gallons/foot X feet) + gallons = gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet):	FINAL PUMP OR TUBING DEPTH IN WELL (feet):	PID RESULT AT WELLHEAD (PPM):	PURGING ENDED AT:	TOTAL VOLUME PURGED (gallons):

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or (µS/cm)	DISSOLVED OXYGEN (circle units) mg/L or % saturation	TURBIDITY (NTUs)	ORP (mV)	ODOR/ COLOR (describe)
JAS ~~1500~~ 1455	NA	NA		18.01	NA	NA	NA	NA	NA	NA	JAS
~~1527~~ 1555	NA	NA	0.05	18.03	NA	NA	NA	NA	NA	NA	milky
1542	0.25	0.25	0.05	19.44	7.23	15.1	6218	~~23.5~~ 2.16	57.9	147.5	clear
1545	0.15	0.40	0.05	19.68	7.25	15.0	7697	1.97	44.8	148.3	clear
1548	0.15	0.65	0.05	19.74	7.26	14.7	7724	1.89	42.3	148.7	clear
1550	0.10	0.75	0.05	20.05	7.27	14.7	7724	1.86		149.0	clear
Well went dry @ 1550, waited for well to recharge until 1755 when the well was checked and was still dry.											

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION:	SAMPLER(S) SIGNATURE(S):	SAMPLING INITIATED AT:	SAMPLING ENDED AT:
Jody Barker / ASL		1050	1110

PUMP OR TUBING DEPTH IN WELL (feet): ~~19.5' BTOC~~ JAS NA | TUBING MATERIAL CODE: PE | FIELD-FILTERED: Y (N) Filtration Equipment Type: NA | FILTER SIZE: NA µm

FIELD DECONTAMINATION: PUMP ~~(Y)~~ JAS NA TUBING Y ~~N (replaced)~~ JAS | DUPLICATE: Y (N)

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION					
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH	INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
MALMS06-PH3MW1-019	1	PE	2	NA	NA	NA	PFOSALCM	B	NA

REMARKS: PH3MW1 was sampled with a bailer on 10/14/16 after the well was allowed to recharge

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

NOTES: BTOC = below top of casing

10/14/16 water level @ 19.76' BTOC @ 1035

Stabilization Criteria for range of variation of last three consecutive readings

pH: ± 0.2 units Temperature: ± 0.2 °C Specific Conductance: ± 5% Dissolved Oxygen: all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) Turbidity: all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

10/13/16 Checked water level in PH3MW1 water was at 19.83' BTOC @ 0820! We will check the well again this afternoon to see if it has re-charged. Water level was at 19.80' BTOC @ 1435

AerostarSES LLC

GROUNDWATER SAMPLING LOG

PROJECT: M2027.0003	INSTALLATION: Malmstrom AFB
WELL NO: PH3MW2	SAMPLE ID: MALMS06-PH3MW2-009 DATE: 10/13/16

PURGING DATA

WELL DIAMETER (inches): 2.0	TUBING ID DIAMETER (inches): .17	WELL SCREEN INTERVAL BTOC DEPTH: 5.39 feet to 20.39 feet	STATIC DEPTH TO WATER (feet): 9.0 BTOC	PURGE PUMP TYPE OR BAILER: ESP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH − STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (20.39 feet − 9.0' feet) X 0.16 gallons/foot = 1.82 gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= gallons + (gallons/foot X feet) + gallons = gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 19.5	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 19.5	PID RESULT AT WELLHEAD (PPM): 0	PURGING ENDED AT: 1025	TOTAL VOLUME PURGED (gallons): 4.74

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or (µS/cm)	DISSOLVED OXYGEN (circle units) (mg/L) or % saturation	TURBIDITY (NTUs)	ORP (mV)	ODOR/ COLOR (describe)
0933 ~~0913~~ ~~0907~~ ~~0902~~ (SMB)	NA	NA	0.16	9.2	NA	NA	NA	NA	NA	NA	milky brown
0940	1.12	1.12	0.16	10.74	7.33	15.0	~~5071~~ 6175	0.46	out of range	159.5	white
0943	0.48	1.60	0.16	11.52	7.36	15.0	5088	0.65	666	157.1	white
0946	0.48	2.08	0.16	12.15	7.38	15.5	4631	0.42	595	155.1	white
0950	0.64	2.72	0.16	12.75	7.38	15.8	4648	0.40	521	154.1	white
0955	0.27	2.99	0.05	13.04	7.36	15.6	4960	0.35	453	155.3	white
1000	0.50	3.49	0.05	13.50	7.33	15.2	5376	0.26	317	157.9	milky white
1010	0.50	3.99	0.05	13.84	7.32	15.1	5530	0.27	176	159.9	slightly milky
1020	0.50	4.49	0.05	14.22	7.31	15.0	5874	0.29	88.6	161.9	clear
1025	0.25	4.74	0.05	14.60	7.32	15.1	5809	0.23	78.7	161.7	clear

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016
PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Jody Barker / ASC	SAMPLER(S) SIGNATURE(S): [signature]	SAMPLING INITIATED AT: 1026	SAMPLING ENDED AT: 1028
PUMP OR TUBING DEPTH IN WELL (feet): 19.5	TUBING MATERIAL CODE: PE	FIELD-FILTERED: Y (N) Filtration Equipment Type: NA	FILTER SIZE: NA µm
FIELD DECONTAMINATION: PUMP (Y) N	TUBING Y (N (replaced))	DUPLICATE: Y (N)	

SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH	INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (~~mL~~ g per minute)
MALMS06-PH3MW2-009	1	HDPE	250 ml	NA	NA	NA	PFOSALCM-S	ESP	0.05

REMARKS:

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

NOTES: BTOC = below top of casing

Stabilization Criteria for range of variation of last three consecutive readings

pH: ± 0.2 units Temperature: ± 0.2 °C Specific Conductance: ± 5% Dissolved Oxygen: all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) Turbidity: all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

AerostarSES LLC

GROUNDWATER SAMPLING LOG

PROJECT: M2027.0003	INSTALLATION: Malmstrom AFB	
WELL NO: PH3MW4	SAMPLE ID: MALMSO6-PH3MW4-009	DATE: 10/13/16

PURGING DATA

WELL DIAMETER (inches): 2.0	TUBING DIAMETER (inches): ID 0.17	WELL SCREEN INTERVAL DEPTH: 5.39 BTOC feet to 20.39 feet	STATIC DEPTH TO WATER (feet): 9.0 BTOC	PURGE PUMP TYPE OR BAILER: ESP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (20.39 feet – 9.0 feet) X 11.39 gallons/foot = 1.82 gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= gallons + (gallons/foot X feet) + gallons = gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 19.5	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 19.5	PID RESULT AT WELLHEAD (PPM): 0	PURGING ENDED AT: 1140	TOTAL VOLUME PURGED (gallons): 3.74

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or (µS/cm)	DISSOLVED OXYGEN (circle units) (mg/L) or % saturation	TURBIDITY (NTUs)	ORP (mV)	ODOR/ COLOR (describe)
1106	NA	NA	0.11	8.87	NA	NA	NA	NA	NA	NA	Slight brown
1110	0.44	0.44	0.11	10.08	7.23	14.4	5838	1.53	166	159.9	clear
1115	0.55	0.99	0.11	11.16	7.20	15.0	4337	1.55	21.5	153.5	clear
1120	0.55	1.54	0.11	12.29	7.16	15.2	4269	0.92	21.3	152.1	clear
1125	0.55	2.09	0.11	13.58	7.15	15.2	4267	0.54	15.9	151.0	clear
1130	0.55	2.64	0.11	14.49	7.12	15.0	4472	1.06	19.8	150.9	clear
1135	0.55	3.19	0.11	15.50	7.21	14.9	4921	1.27	15.6	153.7	clear
1137	0.22	3.41	0.11	16.86	7.23	14.8	5111	1.24	11.3	154.7	clear
1140	0.33	3.74	0.11	16.15	7.24	14.7	5359	1.23	10.4	156.7	clear

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.26" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 6" = 1.02; 6" = 1.47; 12" = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Jody Barker / ASL	SAMPLER(S) SIGNATURE(S):	SAMPLING INITIATED AT: 1141	SAMPLING ENDED AT: 1143
PUMP OR TUBING DEPTH IN WELL (feet): 19.5	TUBING MATERIAL CODE: PE	FIELD-FILTERED: Y (N) Filtration Equipment Type: NA	FILTER SIZE: NA µm
FIELD DECONTAMINATION: PUMP (Y) N	TUBING Y (N (replaced))	DUPLICATE: Y (N)	

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION					
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH	INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
MALMSO6-PH3MW4-009	1	PE	250 ml	NA	NA	NA	PFOS ALCM -	ESP	0.11

REMARKS:

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

NOTES: BTOC = below top of casing

Stabilization Criteria: (all range of variation of last three consecutive readings

pH: ± 0.2 units Temperature: ± 0.2 °C Specific Conductance: ± 5% Dissolved Oxygen: all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) Turbidity: all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

AerostarSES LLC

GROUNDWATER SAMPLING LOG

PROJECT: M2027.0003	INSTALLATION: Malmstrom AFB	
WELL NO: PH3MW5	SAMPLE ID: MALMS06-PH3MW5-008	DATE: 10/13/16

PURGING DATA

WELL DIAMETER (inches): 2.0	TUBING DIAMETER (inches): ID. 0.17	WELL SCREEN INTERVAL DEPTH: BTOC 5.4 feet to 20.4 feet	STATIC DEPTH TO WATER (feet): BTOC 7.73	PURGE PUMP TYPE OR BAILER: ESP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (20.4 feet – 7.73 feet) X .16 gallons/foot = 2.02 gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= gallons + (gallons/foot X feet) + gallons = gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 19.5	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 19.5	PID RESULT AT WELLHEAD (PPM): 0	PURGING ENDED AT: 1232	TOTAL VOLUME PURGED (gallons): 5.0

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or (µS/cm)	DISSOLVED OXYGEN (circle units) mg/L or % saturation	TURBIDITY (NTUs)	ORP (mV)	ODOR/ COLOR (describe)
1212	NA	NA	0.25	7.57	NA	NA	NA	NA	NA	NA	milky brown
1215	0.75	0.75	0.25	8.62	7.19	13.9	6151	0.51	225	120.5	milky brown/sulfur
1220	1.25	2.0	0.25	9.61	7.05	14.7	4866	0.25	142	131.5	milky brown/sulfur
1225	1.25	3.25	0.25	10.82	6.95	14.8	4316	0.23	25.0	128.1	clear
1230	1.25	4.50	0.25	11.80	6.93	15.0	4236	0.14	13.1	124.9	clear
1232	0.5	5.0	0.25	12.26	6.94	14.9	4258	0.13	9.77	126.5	clear

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Jody Barker/ASC	SAMPLER(S) SIGNATURE(S):	SAMPLING INITIATED AT: 1233	SAMPLING ENDED AT: 1234
PUMP OR TUBING DEPTH IN WELL (feet):	TUBING MATERIAL CODE:	FIELD-FILTERED: Y (N) Filtration Equipment Type: NA	FILTER SIZE: NA µm
FIELD DECONTAMINATION: PUMP (Y) N TUBING Y (N (replaced)		DUPLICATE: Y (N)	

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION					
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH	INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
MALMS06-PH3MW5-008	1	PE	250ml	NA	NA	NA	PFOSALCM	ESP	0.25

REMARKS:

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

NOTES: BTOC = below top of casing

Stabilization Criteria for range of variation of last three consecutive readings

pH: ± 0.2 units Temperature: ± 0.2 °C Specific Conductance: ± 5% Dissolved Oxygen: all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) Turbidity: all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

AerostarSES LLC

GROUNDWATER SAMPLING LOG

PROJECT: M2027.0003	INSTALLATION: Malmstrom AFB	
WELL NO: STO5MW04	SAMPLE ID: MALMS06-STO5MW04-009	DATE: 10/13/16

PURGING DATA

WELL DIAMETER (inches): 2.0	TUBING DIAMETER (inches): 0.17	WELL SCREEN INTERVAL DEPTH: 3.92 feet to 18.92 feet BTOC	STATIC DEPTH TO WATER (feet): 9.56 BTOC	PURGE PUMP TYPE OR BAILER: ESP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (18.92 feet – 9.56 feet) X 0.16 gallons/foot = 1.49 gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= gallons + (gallons/foot X feet) + gallons = gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 18.0	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 18.0	PID RESULT AT WELLHEAD (PPM): 0	PURGING ENDED AT: 1405	TOTAL VOLUME PURGED (gallons): 5.20

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or (µS/cm)	DISSOLVED OXYGEN (circle units) (mg/L) or % saturation	TURBIDITY (NTUs)	ORP (mV)	ODOR/ COLOR (describe)
1338	NA	NA	0.20	9.76	NA	NA	NA	NA	NA	NA	grey
1341	0.60	0.60	0.20	9.93	7.20	15.9	5784	0.36	290	93.8	brown
1345	0.80	1.40	0.20	10.49	7.19	16.4	5367	0.42	149	96.5	brown/sulfur
1350	1.00	2.40	0.20	11.19	7.21	16.7	4296	1.03	78.6	101.9	clear
1355	1.00	3.40	0.20	11.68	7.26	16.8	3717	1.57	35.5	101.3	clear
1400	1.00	4.40	0.20	12.13	7.27	16.8	3658	1.60	18.9	102.6	clear
1403	0.6	5.00	0.20	12.36	7.26	16.7	3782	1.29	17.2	104.2	clear
1405	0.2	5.20	0.20	12.43	7.26	16.5	3925	1.19	13.9	105.7	clear

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Jody Barker / ASL	SAMPLER(S) SIGNATURE(S):	SAMPLING INITIATED AT: 1406	SAMPLING ENDED AT: 1407

PUMP OR TUBING DEPTH IN WELL (feet):	TUBING MATERIAL CODE:	FIELD-FILTERED: Y (N) Filtration Equipment Type: NA	FILTER SIZE: NA µm

FIELD DECONTAMINATION: PUMP (Y) N TUBING Y (N (replaced)) DUPLICATE: Y (N)

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION					
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH	INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
MALMS06-STO5MW04-009	1	PE	250ml	NA	NA	NA	PFOSALcm	ESP	

REMARKS:

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

NOTES: BTOC = below top of casing

Stabilization Criteria (or range of variation of last three consecutive readings

pH: ± 0.2 units Temperature: ± 0.2 °C Specific Conductance: ± 5% Dissolved Oxygen: all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) Turbidity: all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

AerostarSES LLC

GROUNDWATER SAMPLING LOG

PROJECT: M2027.0003	INSTALLATION: Malmstrom AFB	
WELL NO: STO5MW5	SAMPLE ID: MALMS05-STO5MW5-002	DATE: 10/13/16

PURGING DATA

WELL DIAMETER (inches): 2.0	TUBING DIAMETER (inches): ID 0.17	WELL SCREEN INTERVAL DEPTH: BTOC 4.43 feet to 19.43 feet	STATIC DEPTH TO WATER (feet): BTOC 1.56	PURGE PUMP TYPE OR BAILER: EPD

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH − STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (19.43 feet − 1.56 feet) X 0.16 gallons/foot = 2.85 gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= gallons + (gallons/foot X feet) + gallons = gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 18.5	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 18.5	PID RESULT AT WELLHEAD (PPM): 0	PURGING ENDED AT: 1535	TOTAL VOLUME PURGED (gallons): 8.05

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or mS/cm	DISSOLVED OXYGEN (circle units) mg/L or % saturation	TURBIDITY (NTUs)	ORP (mV)	ODOR/ COLOR (describe)
1505	NA	NA	0.23	1.72	NA	NA	NA	NA	NA	NA	green
1508	0.69	0.69	0.23	2.24	7.43	13.8	5671	0.35	out of range	112.0	green
1510	0.46	1.15	0.23	2.40	7.48	14.4	4676	0.30	out of range	122.5	green
1515	1.15	2.30	0.23	2.41	7.72	14.8	1312	0.25	out of range	106.9	green
1525	2.30	4.60	0.23	2.42	7.72	14.9	1274	0.19	92.8	93.2	clear
1527	0.46	5.06	0.23	2.42	7.72	14.9	1282	0.24	62.1	91.0	clear
1530	0.69	5.75	0.23	2.44	7.73	15.1	1284	0.33	40.7	88.4	clear
1535	1.15	8.05	0.23	2.44	7.73	15.1	1278	0.35	23.7	83.2	clear

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Jody Barker / ASL	SAMPLER(S) SIGNATURE(S):	SAMPLING INITIATED AT: 1536	SAMPLING ENDED AT: 1536
PUMP OR TUBING DEPTH IN WELL (feet):	TUBING MATERIAL CODE: PE	FIELD-FILTERED: Y (N) Filtration Equipment Type: NA	FILTER SIZE: NA µm
FIELD DECONTAMINATION: PUMP (Y) N	TUBING Y (N (replaced)	DUPLICATE: Y (N)	

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION					
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH	INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
MALMS05-STO5MW5-002	1	PE	250ml	none	NA	NA	PFOSALCM	EPD	0.23

REMARKS:

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

NOTES: BTOC = below top of casing

Stabilization Criteria for range of variation of last three consecutive readings

pH: ± 0.2 units Temperature: ± 0.2 °C Specific Conductance: ± 5% Dissolved Oxygen: all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) Turbidity: all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

AerostarSES LLC

GROUNDWATER SAMPLING LOG

PROJECT: M2027.0003	INSTALLATION: Malmstrom AFB	
WELL NO: MALMS04-001	SAMPLE ID: MALMS04-001-GW-005	DATE: 10/21/16

PURGING DATA

WELL DIAMETER (inches): 2.0'	TUBING DIAMETER (inches): 0.17	WELL SCREEN INTERVAL DEPTH: 8.35' feet to 18.35' feet (BTOC)	STATIC DEPTH TO WATER (feet): 5.38 (BTOC)	PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY (only fill out if applicable)

= (18.35 feet – 5.38 feet) X 0.163 gallons/foot = 2.11 gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME (only fill out if applicable)

= gallons + (gallons/foot X feet) + gallons = gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 17.0'	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 17.0'	PID RESULT AT WELLHEAD (PPM): 0	PURGING ENDED AT: 1413	TOTAL VOLUME PURGED (gallons): 4.98

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or (µS/cm)	DISSOLVED OXYGEN (circle units) (mg/L) or % saturation	TURBIDITY (NTUs)	ORP (mV)	ODOR/ COLOR (describe)
1341	NA	NA	0.18	5.32	NA	NA	NA	NA	NA	NA	clear
1345	0.72	0.72	0.18	7.50	7.85	12.4	2.52	7.68	16.7	147.7	clear
1350	0.90	1.62	0.18	9.28	7.73	12.1	2.28	6.16	14.1	146.6	clear
1355	0.90	2.52	0.18	9.91	7.68	12.2	2.27	4.56	60.5	144.7	clear
1400	0.90	3.42	0.18	10.55	7.67	12.3	2.28	4.79	103.0	144.2	clear
1405	0.60	4.02	0.12	10.80	7.68	12.3	2.28	5.92	104.0	144.7	clear
1408	0.36	4.38	0.12	10.95	7.69	12.4	2.28	6.69	86.7	145.3	clear
1410	0.24	4.62	0.12	11.10	7.70	12.5	2.27	6.25	89.2	145.4	clear
1413	0.36	4.98	0.12	11.40	7.70	12.40	2.28	7.07	81.0	146.3	clear

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Jody Burton / ASL	SAMPLER(S) SIGNATURE(S):	SAMPLING INITIATED AT: 1414	SAMPLING ENDED AT: 1415
PUMP OR TUBING DEPTH IN WELL (feet): 17.0'	TUBING MATERIAL CODE: PE	FIELD-FILTERED: Y (N) Filtration Equipment Type: NA	FILTER SIZE: NA µm
FIELD DECONTAMINATION: PUMP Y (N)	TUBING Y (N replaced)	DUPLICATE: Y (N)	

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION					
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH	INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
MALMS04-001-GW-005	1	PE	250ml	none	NA	NA	PFOSALCM	PP	0.12

REMARKS:

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

NOTES: BTOC = below top of casing

Stabilization Criteria for range of variation of last three consecutive readings

pH: ± 0.2 units Temperature: ± 0.2 °C Specific Conductance: ± 5% Dissolved Oxygen: all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) Turbidity: all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

AerostarSES LLC

GROUNDWATER SAMPLING LOG

PROJECT: M2027.0003	INSTALLATION: Malmstrom AFB	
WELL NO: MALMS04-002	SAMPLE ID: MALMS04-002-GW-004, MALMS04-002-GW-904,	DATE: 10/21/16

PURGING DATA

WELL DIAMETER (inches): 2.0	TUBING DIAMETER (inches): 0.17	WELL SCREEN INTERVAL DEPTH: 6.32 (BTOC) feet to 16.32 feet	STATIC DEPTH TO WATER (feet): 4.32 (BTOC)	PURGE PUMP TYPE OR BAILER: PP

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH − STATIC DEPTH TO WATER) X WELL CAPACITY (only fill out if applicable)

= (16.22 feet − 4.32 feet) X 0.163 gallons/foot = 1.94 gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME (only fill out if applicable)

= gallons + (gallons/foot X feet) + gallons = gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 15.0'	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 15.0	PID RESULT AT WELLHEAD (PPM): 0	PURGING ENDED AT: 1312	TOTAL VOLUME PURGED (gallons):

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or (µS/cm)	DISSOLVED OXYGEN (circle units) (mg/L) or % saturation	TURBIDITY (NTUs)	ORP (mV)	ODOR/ COLOR (describe)
1245	NA	NA	0.14	4.26	NA	NA	NA	NA	NA	NA	clear
1250	0.70	0.70	0.14	5.57	7.15	12.3	2.28	5.43	34.3	152.8	clear
1255	0.90	1.60	0.18	6.43	7.50	12.1	2.24	3.16	17.6	145.9	clear
1300	0.90	2.50	0.18	6.82	7.53	12.1	2.24	2.08	20.6	144.4	clear
1305	0.90	3.40	0.18	7.14	7.54	12.2	2.24	1.84	17.0	143.6	clear
1310	0.90	4.30	0.18	7.40	7.55	12.2	2.25	1.60	12.0	143.1	clear
1312	0.36	4.66	0.18	7.40	7.56	12.2	2.25	1.28	11.9	142.9	clear

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Jody Barbo	SAMPLER(S) SIGNATURE(S):	SAMPLING INITIATED AT: 1313	SAMPLING ENDED AT: 1314
PUMP OR TUBING DEPTH IN WELL (feet): 15.0	TUBING MATERIAL CODE: PE	FIELD-FILTERED: Y (N) Filtration Equipment Type: NA	FILTER SIZE: NA µm
FIELD DECONTAMINATION: PUMP Y (N)	TUBING Y N (replaced)	DUPLICATE: (Y) N	

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION					
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH	INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
MALMS04-002-GW-004	1	PE	250 ml	none	NA	NA	PFOSALCM	PP	0.18
MALMS04-002-GW-904	1	PE	250 ml	none	NA	NA	PFOSALCM	PP	0.18
MALMS04-002-GW-004 MS/MSD	1	PE	250 ml	none	NA	NA	PFOSALCM	PP	0.18

REMARKS:

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); O = Other (Specify)

NOTES: BTOC = below top of casing

Stabilization Criteria for range of variation of last three consecutive readings:

pH: ± 0.2 units Temperature: ± 0.2 °C Specific Conductance: ± 5% Dissolved Oxygen: all readings ≤ 20% saturation; optionally, ± 0.2 mg/L or ± 10% (whichever is greater) Turbidity: all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

Revision Date: March 14, 2016

AerostarSES LLC

SAMPLE COLLECTION LOG
SEDIMENT AND SURFACE WATER

Project Name: AFFF S1 OMAHA
ASL Project No: M2027.0003
Installation: MALMSTROM AFB
Date: 10-12-16
Sample Technician(s): Ash Willis
Station ID: MALMS02-004

Location Description: ~100' 125° SE of MALMS02-005

Type(s) of Sample (circle all that apply): (Sediment) (Surface Water)

Sample Collected from (circle one): (Channel/Ditch) Holding Pond/Lagoon Lake/Pond
River/Stream Trench Other

SEDIMENT SAMPLE

Sample ID: MALMS02-004-SD-001
Sample Collection Time: 1630
Sample Depth: 0.5'
Sediment Description: organic silt
Collection Method: SS Spoon
Analysis/Method: Modified 537 EPA
Sample Container: 250 mL PE
Preservative: N/A

SURFACE WATER SAMPLE

Sample ID: MALMS02-004-SW-001
Sample Collection Time: 1630
Sample Depth: 0.5'
Collection Method: Sample collector
Analysis/Method: Modified 537 EPA
Sample Container: 250 mL PE
Preservative: N/A
Water Quality (circle one): (Clear) Cloudy Turbid Other

COMMENTS: DATA ON GPS UNIT

MS/MSD for Both SD and SW
Duplicate for Both SD and SW

AerostarSES LLC

SAMPLE COLLECTION LOG
SEDIMENT AND SURFACE WATER

Project Name: AFFF SI OMAHA
ASL Project No: M2027.0003
Installation: MALMSTROM AFB
Date: 10-12-16
Sample Technician(s): Ash Willis
Station ID: MALMS02-005

Location Description: 250' 125°SE of Road

Type(s) of Sample (circle all that apply): (Sediment) (Surface Water)

Sample Collected from (circle one): (Channel/Ditch) River/Stream Holding Pond/Lagoon Trench Lake/Pond Other

SEDIMENT SAMPLE

Sample ID: MALMS02-005-SD-001
Sample Collection Time: 1600
Sample Depth: 0.5'
Sediment Description: organic silt
Collection Method: SS Spoon
Analysis/Method: Modified 537 EPA
Sample Container: 250mL PE
Preservative: N/A

SURFACE WATER SAMPLE

Sample ID: MALMS02-005-SW-001
Sample Collection Time: 1600
Sample Depth: 0.5'
Collection Method: sample collector
Analysis/Method: Modified 537EPA
Sample Container: 250mL PE
Preservative: N/A
Water Quality (circle one): (Clear) Cloudy Turbid Other

COMMENTS: DATA on GPS unit

AerostarSES LLC

SAMPLE COLLECTION LOG
SEDIMENT AND SURFACE WATER

Project Name: SI AAF Omaha
ASL Project No: M2027.0003
Installation: MALMSTROM
Date: 10/21/16
Sample Technician(s): Kaleb Brumbaugh
Station ID: MALMS04

Location Description: middle of marsh land, near MALMS04-001, gps point taken

Type(s) of Sample (circle all that apply): (Sediment) (Surface Water)

Sample Collected from (circle one): Channel/Ditch | Holding Pond/Lagoon | Lake/Pond | River/Stream | Trench | (Other) marsh land

SEDIMENT SAMPLE

Sample ID: ~~FS~~ MALMS04-004-SD-001 Sample Collection Time: 1530
Sample Depth: 1' Sediment Description: silt w/sand
Collection Method: grab Analysis/Method: 537M
Sample Container: 250mL HDPE Preservative: N/A

SURFACE WATER SAMPLE

Sample ID: MALMS04-004-SW-001 Sample Collection Time: 1535
Sample Depth: 1' Collection Method: grab
Analysis/Method: 537M* Sample Container: HDPE 250mL
Preservative: N/A Water Quality (circle one): Clear (Cloudy) Turbid Other

COMMENTS:

location moved to where surface water was available

AerostarSES LLC

SAMPLE COLLECTION LOG
SEDIMENT AND SURFACE WATER

Project Name: ~~AFF~~ SI Omaha
ASL Project No: M2027.0003
Installation: MALMStrm
Date: 10/21/16
Sample Technician(s): Kaleb Brumbaugh
Station ID: MALMS03

Location Description: Taken w/Trimble, Creek w/culverts & cement, near MALMS03-001

Type(s) of Sample (circle all that apply): (Sediment) (Surface Water)

Sample Collected from (circle one): Channel/Ditch | Holding Pond/Lagoon | Lake/Pond | River/Stream | Trench | (Other) Creek

SEDIMENT SAMPLE

Sample ID: MALMS03-004-SD-001 Sample Collection Time: 0805
Sample Depth: 1' Sediment Description: Silty Sandy w/Gravel
Collection Method: grab Analysis/Method: ~~8330~~ KB 537M
Sample Container: HDPE 250mL Preservative: N/A

SURFACE WATER SAMPLE

Sample ID: MALMS03-004-SW-001 Sample Collection Time: 0807
Sample Depth: 1' Collection Method: grab
Analysis/Method: 537M Sample Container: HDPE 250mL
Preservative: N/A Water Quality (circle one): (Clear) Cloudy Turbid Other

COMMENTS:

- MALMS-RS-~~001~~ 011 KB assoc w/ MALMS03004-SD-001
- location moved slightly due to cement

AerostarSES LLC

SAMPLE COLLECTION LOG
SEDIMENT AND SURFACE WATER

Project Name: SIA FF Omaha
ASL Project No: M2027.0003
Installation: MALMSTROM
Date: 10/21/16
Sample Technician(s): Kaleb Brumbaugh
Station ID: MALMSO4

Location Description: Creek near /draining to Culvert Structure mentioned in map, GPS point taken w/ Garmin

Type(s) of Sample (circle all that apply): (Sediment) Surface Water

Sample Collected from (circle one): Channel/Ditch Holding Pond/Lagoon Lake/Pond River/Stream Trench (Other) Creek

SEDIMENT SAMPLE

Sample ID: MALMSO4-003-SD-001 Sample Collection Time: 1515
Sample Depth: 1' Sediment Description: Sandy Silty Gravel
Collection Method: grab Analysis/Method: 537M
Sample Container: HDPE 250mL Preservative: N/A

SURFACE WATER SAMPLE

Sample ID: MALMSO4-003-SW-001 Sample Collection Time: 1520
Sample Depth: 1' Collection Method: grab
Analysis/Method: 537M Sample Container: HDPE 250mL
Preservative: N/A Water Quality (circle one): (Clear) Cloudy Turbid Other

COMMENTS:

AerostarSES LLC

SAMPLE COLLECTION LOG
SEDIMENT AND SURFACE WATER

Project Name: AFFF SI OMAHA DISTRICT

ASL Project No: M2027.0003

Installation: ~~WRIGHT PATTERSON AFB~~ Malmstrom AFB

Date: 5/2/17

Sample Technician(s): Jody Barker/Brian Odom

Station ID: MALMS01-MW001

Location Description: Same as the location description for boring MALMS01-001

Type(s) of Sample (circle all that apply):	Sediment	Surface Water	(Ground Water)
Sample Collected from (circle one):	Channel/Ditch	Holding Pond/Lagoon	Lake/Pond
	River/Stream	Trench	(Other) monitoring well

SEDIMENT SAMPLE

Sample ID: JAB Sample Collection Time:

Sample Depth: Sediment Description:

Collection Method: Analysis/Method:

Sample Container: Preservative:

SURFACE WATER SAMPLE

Sample ID: Sample Collection Time:

Sample Depth: JAB Collection Method:

Analysis/Method: Sample Container:

Preservative: Water Quality (circle one): Clear Cloudy Turbid Other

GROUND WATER SAMPLE

Sample ID: MALMS01-001-GW-035 Sample Collection Time: 1655

Sample Depth: 035' Collection Method: bailer

Analysis/Method: EPA 537 Sample Container: 250 ml HDPE

Preservative: none Water Quality (circle one): Clear Cloudy (Turbid) Other

COMMENTS:

Water level @ 36.20' BTOC. T.D. 37.70' BTOC

AerostarSES LLC

SAMPLE COLLECTION LOG
SEDIMENT AND SURFACE WATER

Project Name: AFFF SI OMAHA DISTRICT

ASL Project No: M2027.0003

Installation: ~~WRIGHT PATTERSON AFB~~ Malmstrom AFB

Date: 5/2/17

Sample Technician(s): Jody Barker/ Brian Odom

Station ID: MALMS01-MW002

Location Description: Same as the location description for boring MALMS01-002

Type(s) of Sample (circle all that apply): Sediment | Surface Water | (Ground Water)

Sample Collected from (circle one): Channel/Ditch | Holding Pond/Lagoon | Lake/Pond | River/Stream | Trench | (Other) monitoring well

SEDIMENT SAMPLE

Sample ID: JAB | Sample Collection Time:

Sample Depth: | Sediment Description:

Collection Method: | Analysis/Method:

Sample Container: | Preservative:

SURFACE WATER SAMPLE

Sample ID: | Sample Collection Time:

Sample Depth: JAB | Collection Method:

Analysis/Method: | Sample Container:

Preservative: | Water Quality (circle one): Clear Cloudy Turbid Other

GROUND WATER SAMPLE

Sample ID: MALMS01-002-GW-030 | Sample Collection Time: 1700

Sample Depth: 030' | Collection Method: bailer

Analysis/Method: EPA 537 | Sample Container: 250 ml HDPE

Preservative: none | Water Quality (circle one): Clear Cloudy (Turbid) Other

COMMENTS:

Water level 31.29' BTOC

AerostarSES LLC

SAMPLE COLLECTION LOG
SEDIMENT / SURFACE WATER / GROUNDWATER (GRAB)

Project Name: AFFF Site Investigation

ASL Project No: ~~M2032.0001~~ M2027.0003

Installation: ~~Robins AFB~~ Malmstrom AFB

Date: 5/2/17

Sample Technician(s): Jody Barker/ Brian Odom

Station ID: MALMS01 - MW003

Type(s) of Sample (circle all that apply): Sediment Surface Water (Groundwater)

SEDIMENT SAMPLE

Sample ID: JAB Sample Collection Time:

Sample Depth: Sediment Description:

Collection Method: Analysis/Method:

Sample Container: 250 mL PE Preservative: N/A

SURFACE WATER SAMPLE

Sample ID: Sample Collection Time:

Sample Depth: JAB Collection Method:

Analysis/Method: Sample Container: 250 mL PE

Preservative: N/A Water Quality (circle one): Clear Cloudy Turbid Other

GROUNDWATER SAMPLE (GRAB) (No Sample Collected)

Sample ID: ~~MALMS01-003-GW~~ Sample Collection Time:

Sample Depth: Collection Method: ~~bailer~~

Analysis/Method: ~~EPA 537~~ Sample Container: 250 mL PE

Preservative: N/A Water Quality (circle one): Clear ~~Cloudy~~ Turbid Other

COMMENTS:

* Water level @ 33.0' BTOC, very little water in the well. Attempted to sample MALMS01 - MW003, there was not enough water in the well to recover with a bailer so no sample was collected

Location description: Same as the location description for boring MALMS01-003

AerostarSES LLC

SAMPLE COLLECTION LOG
SEDIMENT AND SURFACE WATER

Project Name: AFFF SI OMAHA DISTRICT

ASL Project No: M2027.0003

Installation: ~~WRIGHT PATTERSON AFB~~ Malmstrom AFB

Date: 5/2/17

Sample Technician(s): Jody Barker / Brian Odom

Station ID: MALMS03-MW001

Location Description: Same as the location description for boring MALMS03-001

Type(s) of Sample (circle all that apply):	Sediment	Surface Water	(Ground Water)
Sample Collected from (circle one):	Channel/Ditch	Holding Pond/Lagoon	Lake/Pond
	River/Stream	Trench	(Other monitoring well)

SEDIMENT SAMPLE

Sample ID: JAB Sample Collection Time:

Sample Depth: Sediment Description:

Collection Method: Analysis/Method:

Sample Container: Preservative:

SURFACE WATER SAMPLE

Sample ID: Sample Collection Time:

Sample Depth: JAB Collection Method:

Analysis/Method: Sample Container:

Preservative: Water Quality (circle one): (Clear) Cloudy Turbid Other

GROUND WATER SAMPLE

Sample ID: MALMS 03-001-GW-025 Sample Collection Time: 1615

Sample Depth: 25' Collection Method: bailer

Analysis/Method: EPA 537 Sample Container: 250 ml HDPE

Preservative: none Water Quality (circle one): (Clear) Cloudy Turbid Other

COMMENTS:

water level @ 17.27 'btoc

AerostarSES LLC

SAMPLE COLLECTION LOG
SEDIMENT AND SURFACE WATER

Project Name: AFFF SI OMAHA DISTRICT

ASL Project No: M2027.0003

Installation: ~~WRIGHT PATTERSON AEB~~ Malmstrom AFB

Date: 5/2/17

Sample Technician(s): Jody Barker / Brian Odom

Station ID: MALMS03-MW002 (Monitoring well installed 10/16 in boring location MALMS03-002)

Location Description: same as the location description for boring MALMS03-002

Type(s) of Sample (circle all that apply): Sediment | Surface Water | (Ground Water)

Sample Collected from (circle one): Channel/Ditch | Holding Pond/Lagoon | Lake/Pond | River/Stream | Trench | (Other monitoring well)

SEDIMENT SAMPLE

Sample ID: JAB

Sample Collection Time:

Sample Depth:

Sediment Description:

Collection Method:

Analysis/Method:

Sample Container:

Preservative:

SURFACE WATER SAMPLE

Sample ID: JAB

Sample Collection Time:

Sample Depth:

Collection Method:

Analysis/Method:

Sample Container:

Preservative:

Water Quality (circle one): Clear Cloudy Turbid Other

GROUND WATER SAMPLE

Sample ID: MALMS03-002-GW-030

Sample Collection Time: 1525

Sample Depth: 30'

Collection Method: bailer

Analysis/Method: EPA 537

Sample Container: 250 ml HDPE

Preservative: None

Water Quality (circle one): (Clear) Cloudy Turbid Other

COMMENTS:

Water level at 22.32' BTOC

AerostarSES LLC

SAMPLE COLLECTION LOG
SEDIMENT AND SURFACE WATER

Project Name: AFFF SI OMAHA DISTRICT

ASL Project No: M2027.0003

Installation: ~~WRIGHT PATTERSON AFB~~ Malmstrom AFB

Date: 5/2/17

Sample Technician(s): Jody Barker / Brian Colon

Station ID: M4LMS03-MW003

Location Description: Same as the location description for boring M4LMS03-003

Type(s) of Sample (circle all that apply):	Sediment	Surface Water	(Ground Water)
Sample Collected from (circle one):	Channel/Ditch	Holding Pond/Lagoon	Lake/Pond
	River/Stream	Trench	(Other) monitor well

SEDIMENT SAMPLE

Sample ID: _____ Sample Collection Time: _____

Sample Depth: _____ Sediment Description: _____

Collection Method: _____ Analysis/Method: _____

Sample Container: _____ Preservative: _____

JAB

SURFACE WATER SAMPLE

Sample ID: _____ Sample Collection Time: _____

Sample Depth: _____ Collection Method: _____

Analysis/Method: _____ Sample Container: _____

Preservative: _____ Water Quality (circle one): Clear Cloudy Turbid Other

JAB

GROUND WATER SAMPLE

Sample ID: M4LMS03-003-GW-920 Sample Collection Time: 1600

Sample Depth: 20' Collection Method: bailer

Analysis/Method: EPA 537 Sample Container: 250 ml HDPE

Preservative: none Water Quality (circle one): (Clear) Cloudy Turbid Other

COMMENTS:

Water level at 16.90' btoc

AerostarSES LLC

SAMPLE COLLECTION LOG
SEDIMENT AND SURFACE WATER

Project Name: AFFF SI OMAHA DISTRICT

ASL Project No: M2027.0003

Installation: ~~WRIGHT PATTERSON AFB~~ Malmstom AFB

Date: 5/2/17

Sample Technician(s): Jody Barker / Brian Odom

Station ID: MALMS03-MW003

Location Description: Same as the location description for boring MALMS03-003

Type(s) of Sample (circle all that apply):	Sediment	Surface Water	(Ground Water)
Sample Collected from (circle one):	Channel/Ditch	Holding Pond/Lagoon	Lake/Pond
	River/Stream	Trench	(Other) Monitoring well

SEDIMENT SAMPLE

Sample ID: _____ Sample Collection Time: _____

Sample Depth: _____ Sediment Description: _____

Collection Method: _____ Analysis/Method: _____

Sample Container: _____ Preservative: _____

JAB

SURFACE WATER SAMPLE

Sample ID: _____ Sample Collection Time: _____

Sample Depth: _____ Collection Method: _____

Analysis/Method: _____ Sample Container: _____

Preservative: _____ Water Quality (circle one): Clear Cloudy Turbid Other

JAB

GROUND WATER SAMPLE

Sample ID: MALMS03-003-GW-020 Sample Collection Time: 1600

Sample Depth: 20' Collection Method: bailer

Analysis/Method: EPA 537 Sample Container: 250 ml HDPE

Preservative: none Water Quality (circle one): (Clear) Cloudy Turbid Other

COMMENTS:

Water level @ 16.90' btoc

AerostarSES LLC

SAMPLE COLLECTION LOG
SEDIMENT AND SURFACE WATER

Project Name: AFFF SI OMAHA DISTRICT

ASL Project No: M2027.0003

Installation: ~~WRIGHT PATTERSON AFB~~ Malmstrom AFB

Date: 5/2/17

Sample Technician(s): Jacky Barker / Brian Odom

Station ID: MALMS05-MW001 (Boring location MALMS05-001 monitoring well installed 10/16)

Location Description: Same as the location description for boring MALMS05-001

Type(s) of Sample (circle all that apply): Sediment | Surface Water | (Ground Water)

Sample Collected from (circle one): Channel/Ditch | Holding Pond/Lagoon | Lake/Pond | River/Stream | Trench | (Other Monitoring well)

SEDIMENT SAMPLE

Sample ID: _____ Sample Collection Time: _____

Sample Depth: _____ Sediment Description: _____

Collection Method: _____ Analysis/Method: _____

Sample Container: _____ Preservative: _____

SURFACE WATER SAMPLE

Sample ID: _____ Sample Collection Time: _____

Sample Depth: _____ Collection Method: _____

Analysis/Method: _____ Sample Container: _____

Preservative: _____ Water Quality (circle one): Clear Cloudy Turbid Other

GROUND WATER SAMPLE

Sample ID: MALMS05-001-GW-017 Sample Collection Time: 1505

Sample Depth: 17' Collection Method: bailer

Analysis/Method: EPA 537 Sample Container: 250 ml HDPE

Preservative: none Water Quality (circle one): (Clear) Cloudy Turbid Other

COMMENTS:

Water level 10.34' BTOC

AerostarSES LLC

SAMPLE COLLECTION LOG
SEDIMENT AND SURFACE WATER

Project Name: AFFF SI OMAHA DISTRICT

ASL Project No: M2027.0003

Installation: ~~WRIGHT PATTERSON AFB~~ Malmstrom AFB

Date: 5/2/17

Sample Technician(s): Jody Barker / Brian Odom

Station ID: M4LMS05-MW001 (Boring location M4LMS05-001 monitory well installed 10/16)

Location Description: Same as the location description for boring M4LMS05-001

Type(s) of Sample (circle all that apply): Sediment | Surface Water | (Ground Water)

Sample Collected from (circle one): Channel/Ditch | Holding Pond/Lagoon | Lake/Pond | River/Stream | Trench | (Other Monitor well)

SEDIMENT SAMPLE

Sample ID: _____ Sample Collection Time: _____

Sample Depth: _____ Sediment Description: _____

Collection Method: _____ Analysis/Method: _____

Sample Container: _____ Preservative: _____

JAD

SURFACE WATER SAMPLE

Sample ID: _____ Sample Collection Time: _____

Sample Depth: _____ Collection Method: _____

Analysis/Method: _____ Sample Container: _____

Preservative: _____ Water Quality (circle one): Clear Cloudy Turbid Other

JAB

GROUND WATER SAMPLE

Sample ID: M4LMS05-001-GW-017MS/MSD Sample Collection Time: 1505

Sample Depth: 17' Collection Method: bailer

Analysis/Method: EPA 537 Sample Container: 250 ml HDPE

Preservative: none Water Quality (circle one): (Clear) Cloudy Turbid Other

COMMENTS:

Water level 10.34' BTOC

AerostarSES LLC

SAMPLE COLLECTION LOG
SEDIMENT AND SURFACE WATER

Project Name: AFFF SI OMAHA DISTRICT

ASL Project No: M2027.0003

Installation: ~~WRIGHT PATTERSON AFB~~ Malmstrom AFB

Date: 5/2/17

Sample Technician(s): Jody Barker / Brian Odom

Station ID: MALMS05-MW002 (boring location MALMS05-002 installed 10/17)

Location Description: Same as the location description for boring MALMS05-002

Type(s) of Sample (circle all that apply):	Sediment	Surface Water	(Ground Water)
Sample Collected from (circle one):	Channel/Ditch	Holding Pond/Lagoon	Lake/Pond
	River/Stream	Trench	Other mon. bunwell

SEDIMENT SAMPLE

Sample ID: JAB Sample Collection Time:

Sample Depth: Sediment Description:

Collection Method: Analysis/Method:

Sample Container: Preservative:

SURFACE WATER SAMPLE

Sample ID: Sample Collection Time:

Sample Depth: JAB Collection Method:

Analysis/Method: Sample Container: JB

Preservative: Water Quality (circle one): (Clear) Cloudy Turbid Other

GROUND WATER SAMPLE

Sample ID: MALMS05-002-GW-925 Sample Collection Time: 1425

Sample Depth: 25' btoc Collection Method: bailer

Analysis/Method: EPA 537 Sample Container: 250 ml HDPE

Preservative: none Water Quality (circle one): (Clear) Cloudy Turbid Other

COMMENTS:

Water level 18.54' BTOC

AerostarSES LLC

SAMPLE COLLECTION LOG
SEDIMENT AND SURFACE WATER

Project Name: AFFF SI OMAHA DISTRICT

ASL Project No: M2027.0003

Installation: ~~WRIGHT PATTERSON AFB~~ Malmstrom AFB

Date: 5/2/17

Sample Technician(s): Jody Barker / Brian Odom

Station ID: MALMS05-MW002

Location Description: Same as the location description for boring MALMS05-002

Type(s) of Sample (circle all that apply): Sediment | Surface Water | (Ground Water)

Sample Collected from (circle one): Channel/Ditch | Holding Pond/Lagoon | Lake/Pond | River/Stream | Trench | Other monitoring well

SEDIMENT SAMPLE

Sample ID: JAB

Sample Collection Time:

Sample Depth:

Sediment Description:

Collection Method:

Analysis/Method:

Sample Container:

Preservative:

SURFACE WATER SAMPLE

Sample ID:

Sample Collection Time:

Sample Depth: JAB

Collection Method:

Analysis/Method:

Sample Container: SB

Preservative:

Water Quality (circle one): (Clear) Cloudy Turbid Other

GROUND WATER SAMPLE

Sample ID: MALMS05-002-GW-025

Sample Collection Time: 1425

Sample Depth: 25'

Collection Method: bailer

Analysis/Method: EPA 537

Sample Container: HDPE 250 mL

Preservative: none

Water Quality (circle one): (Clear) Cloudy Turbid Other

COMMENTS:

Water level 18.54' BTOC

Appendix D

New Monitoring Wells Construction Details

Table D-1 Monitoring Well Construction Details

AFFF Area	Well Identification	Northing (feet)	Easting (feet)	Top of Casing Elevation (feet)	Ground Surface Elevation (feet)	Total Boring Depth (feet bgs)	Approximate Depth Groundwater Encountered During Drilling (feet bgs)	Wellhead Completion Type	Total Well Depth (feet bgs)	Screen Interval (feet bgs)	Screen Length (feet)
FT01 Historical FTA AFFF Area 1	MALMS01-MW001	1189069.815	1552828.318	3475.197	3473.69	55	Dry boring	Stick-up	36	15-35	20
	MALMS01-MW002	1188961.540	1552954.157	3474.255	3471.35	35	Dry boring	Stick-up	31	20-30	10
	MALMS01-MW003	1189302.890	1553207.947	3469.759	3466.85	35	Dry boring	Stick-up	31	20-30	10
Outfall 1 AFFF Area 3	MALMS03-MW001	1196653.551	1549481.707	3410.538	3411.02	60	Dry boring	Flush-mounted	26	15-25	10
	MALMS03-MW002	1196563.284	1549373.192	3413.301	3413.90	30	Dry boring	Flush--mounted	30	9.6-29.6	20
	MALMS03-MW003	1196644.162	1549313.383	3410.244	3410.76	30	Dry boring	Flush-mounted	21	10.3-20.3	10
Outfall 3 AFFF Area 4	MALMS04-MW001	1197074.899	1555146.577	3394.493	3391.85	15	5	Stick-up	15	4.6-14.6	10
	MALMS04-MW002	1196961.839	1555120.367	3395.430	3393.70	15	3	Stick-up	14	3-13	10
Hangar 1440 AFFF Area 5	MALMS05-MW001	1192968.402	1550979.317	3469.795	3470.04	20	8	Flush-mounted	18.5	7-17	10
	MALMS05-MW002	1192604.548	1550713.045	3472.552	3473.09	30	Dry boring	Flush-mounted	26	5-25	20
	ST05-MW5[1]	1193095.274	1550723.951	3467.98	Unknown	20	Unknown	Flush-mounted	18	3-18	15

AFFF Area	Well Identification	Northing (feet)	Easting (feet)	Top of Casing Elevation (feet)	Ground Surface Elevation (feet)	Total Boring Depth (feet bgs)	Approximate Depth Groundwater Encountered During Drilling (feet bgs)	Wellhead Completion Type	Total Well Depth (feet bgs)	Screen Interval (feet bgs)	Screen Length (feet)
Fire Station (Building 349) AFFF Area 6	PH3-MW1[2]	1193256.508	1551921.453	3473.03	Unknown	20	Unknown	Unknown[3]	20	5-20	15
	PH3-MW2[2]	1193189.620	1551878.013	3472.65	Unknown	20	Unknown	Unknown[3]	20	5-20	15
	PH3-MW4[2]	1193206.423	1551842.799	3473.27	Unknown	20	Unknown	Unknown[3]	20	5-20	15
	PH3-MW5[2]	1193172.902	1551807.736	3473.65	Unknown	20	Unknown	Unknown[3]	20	5-20	15
	ST05-MW04[1]	1193414.015	1551837.635	3462.32	Unknown	20	Unknown	Flush-mounted	18	3-18	15

[1]Initial Remedial Investigation Report Final IRP Site ST05 - Former Fuel Supply Lines, Malmstrom Air Force Base, Cascade County, Montana.
[2]Existing well data is from the Initial Remedial Investigation Report, Final Revision 1, IRP Site ST04 - Former Pumphouse 3, Malmstrom Air Force Base, Cascade County, Montana.
[3]At the time of the SI, the wellhead surface completions were not finished.
Northing and easting coordinates were recorded in US survey feet using the US State Plane 1983 coordinate system, Montana 2500. Elevations were recorded referenced to the North American Vertical Datum 1988.
AFFF = aqueous film forming foam bgs = below ground surface btoc = below top of casing ft = foot/feet
FTA = fire training area ID = identification

Appendix E
Data Validation Report and
Laboratory Data Tables

DATA VALIDATION REPORT

M2027.0003 (Omaha) Malmstrom AFB

SAMPLE DELIVERY GROUP: B6M4692, B6M8709, B791810

Prepared for

Aerostar SES LLC

December 28, 2016

July 10, 2017

MEC^X, Inc.
8864 Interchange Drive
Houston, Texas 77054

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ACRONYMS AND ABBREVIATIONS

°C	Celsius
%	Percent
%D	percent difference
B	blank contamination
CB	calibration blank
CCAL	continuing calibration
CCB	continuing calibration blank
CCV	continuing calibration verification
COC	chain of custody
CLP	Contract Laboratory Program
EPA	US Environmental Protection Agency
ER	equipment rinsate
FB	field blank
FD	field duplicate
ICAL	initial calibration
ICB	initial calibration blank
ICL	instrument calibration limit
ICV	initial calibration verification
IS	internal standard
J	estimated value
LCS	laboratory control sample
LOD	limit of detection
LOQ	limit of quantification
MB	method blank
MDL	method detection limit
MS	matrix spike
MSD	matrix spike duplicate
ND	nondetect
PARCC	precision, accuracy, representativeness, comparability, completeness
PFC	perfluorinated compound
QAPP	Quality Assurance Program Plan
QC	quality control
QSM	Quality Systems Manual
R	Rejected
RL	reporting limit
RPD	relative percent difference
RRF	relative response factor
RSD	relative standard deviation
SDG	sample delivery group
TB	trip blank
U	not detected
UJ	not detected; associated value is an estimate

I. INTRODUCTION

Task Order Title: M2027.0003 (Omaha) Malmstrom AFB

Contract: W9128F-15-D-0051

MEC^X Project No.: 1529.001H.00

Sample Delivery Groups: B6M4692, B6M8709, B791810

Project Manager: Jenny Vance

Matrix: Soil/Water

QC Level: Stage 2B, Stage 4

No. of Samples: 72

Laboratory: Maxxam Laboratories Mississauga, Ontario, Canada

TABLE 1 - SAMPLE IDENTIFICATION

Sample Name	Lab Sample Name	Matrix	Collection	Method	Validation Level
MALMS01-001-SO-021	DGR819	SO	13/10/16 12:20	E537M	4
MALMS01-001-SO-921	DGR820	SO	13/10/16 12:20	E537M	2B
MALMS01-001-SS-001	DGR817	SO	13/10/16 10:20	E537M	4
MALMS01-001-SS-901	DGR818	SO	13/10/16 10:20	E537M	2B
MALMS01-002-SO-005	DGR822	SO	14/10/16 11:00	E537M	2B
MALMS01-002-SS-001	DGR821	SO	14/10/16 8:15	E537M	2B
MALMS01-003-SO-011	DGR824	SO	14/10/16 16:05	E537M	2B
MALMS01-003-SS-001	DGR823	SO	14/10/16 14:30	E537M	2B
MALMS01-RS-005	DGR826	WG	15/10/16 8:55	E537M	2B
MALMS02-001-SO-020	DGR807	SO	12/10/2016 10:05	E537M	2B
MALMS02-001-SO-920	DGR829	SO	12/10/2016 10:00	E537M	2B
MALMS02-001-SS-001	DGR804	SO	11/10/2016 16:30	E537M	2B
MALMS02-001-SS-901	DGR805	SO	11/10/2016 16:30	E537M	2B
MALMS02-002-SO-020	DGR809	SO	12/10/2016 13:35	E537M	2B
MALMS02-002-SS-001	DGR808	SO	12/10/2016 10:38	E537M	2B
MALMS02-003-SO-006	DGR827	SO	15/10/16 10:55	E537M	2B
MALMS02-003-SS-001	DGR825	SO	15/10/16 9:10	E537M	2B
MALMS02-004-SD-001	DGR812	SO	12/10/2016 16:30	E537M	2B

Sample Name	Lab Sample Name	Matrix	Collection	Method	Validation Level
MALMS02-004-SD-901	DGR813	SO	12/10/2016 16:30	E537M	2B
MALMS02-004-SW-001	DGR814	WG	12/10/2016 16:30	E537M	4
MALMS02-004-SW-901	DGR815	WG	12/10/2016 16:30	E537M	2B
MALMS02-005-SD-001	DGR810	SO	12/10/2016 16:00	E537M	2B
MALMS02-005-SW-001	DGR811	WG	12/10/2016 16:00	E537M	2B
MALMS02-RS-001	DGR806	WG	11/10/2016 16:15	E537M	2B
MALMS02-SB-001	DGR816	WG	13/10/16 9:30	E537M	2B
MALMS05-001-SO-007	DGR840	SO	16/10/16 12:20	E537M	2B
MALMS05-001-SS-001	DGR839	SO	16/10/16 11:04	E537M	2B
MALMS05-002-SO-011	DGR843	SO	17/10/16 10:45	E537M	2B
MALMS05-002-SS-001	DGR841	SO	17/10/16 8:11	E537M	2B
MALMS05-ST05MW4-009	DGR835	WG	13/10/16 14:06	E537M	2B
MALMS05-ST05MW5-002	DGR836	WG	13/10/16 15:36	E537M	2B
MALMS06-PH3MW1-019	DGR838	WG	14/10/16 10:50	E537M	4
MALMS06-PH3MW2-009	DGR832	WG	13/10/16 10:26	E537M	2B
MALMS06-PH3MW4-009	DGR833	WG	13/10/16 11:41	E537M	2B
MALMS06-PH3MW5-008	DGR834	WG	13/10/16 12:33	E537M	2B
MALMS-RS-002	DGR830	WG	12/10/2016 14:40	E537M	2B
MALMS-RS-003	DGR831	WG	13/10/16 10:55	E537M	2B
MALMS-RS-004	DGR837	WG	14/10/16 10:35	E537M	2B
MALMS-RS-006	DGR828	WG	16/10/16 11:00	E537M	2B
MALMS-RS-007	DGR842	WG	17/10/16 9:53	E537M	2B
MALMS03-001-SO-020	DHK769	SO	19/10/16 13:18	E537M	2B
MALMS03-002-SO-020	DHK772	SO	20/10/16 15:20	E537M	2B
MALMS03-003-SO-009	DHK771	SO	19/10/16 16:25	E537M	2B
MALMS03-004-SD-001	DHK775	SO	21/10/16 8:05	E537M	4
MALMS03-004-SW-001	DHK776	WG	21/10/16 8:07	E537M	2B
MALMS04-001-GW-005	DHK802	WG	21/10/16 14:14	E537M	4
MALMS04-001-SO-002	DHK768	SO	18/10/16 13:05	E537M	2B

Sample Name	Lab Sample Name	Matrix	Collection	Method	Validation Level
MALMS04-001-SO-004	DHK766	SO	18/10/16 9:58	E537M	2B
MALMS04-001-SS-001	DHK765	SO	18/10/16 9:20	E537M	2B
MALMS04-002-GW-004	DHK799	WG	21/10/16 13:13	E537M	2B
MALMS04-002-GW-904	DHK800	WG	21/10/16 13:13	E537M	2B
MALMS04-002-SS-001	DHK767	SO	18/10/16 12:57	E537M	2B
MALMS04-003-SD-001	DHK797	SO	21/10/16 15:15	E537M	2B
MALMS04-003-SW-001	DHK796	WG	21/10/16 15:20	E537M	2B
MALMS04-004-SD-001	DHK798	SO	21/10/16 15:30	E537M	2B
MALMS04-004-SW-001	DHK795	WG	21/10/16 15:35	E537M	2B
MALMS-IDWSOIL-001	DHK777	SO	21/10/16 9:45	E537M	2B
MALMS-IDWWATER-001	DHK803	WG	21/10/16 15:00	E537M	2B
MALMS-RS-008	DHK764	WG	18/10/16 8:44	E537M	2B
MALMS-RS-009	DHK770	WG	19/10/16 10:40	E537M	2B
MALMS-RS-010	DHK773	WG	20/10/16 13:47	E537M	2B
MALMS-RS-011	DHK774	WG	21/10/16 7:45	E537M	2B
MALMS01-001-GW-035	EII840	WG	2017-05-02 16:55	E537M	4
MALMS01-002-GW-030	EII841	WG	2017-05-02 17:00	E537M	2B
MALMS03-001-GW-025	EII839	WG	2017-05-02 16:15	E537M	2B
MALMS03-002-GW-030	EII835	WG	2017-05-02 15:25	E537M	2B
MALMS03-003-GW-020	EII837	WG	2017-05-02 16:00	E537M	2B
MALMS03-003-GW-920	EII838	WG	2017-05-02 16:00	E537M	2B
MALMS05-001-GW-017	EII834	WG	2017-05-02 15:05	E537M	2B
MALMS05-002-GW-025	EII832	WG	2017-05-02 14:25	E537M	2B
MALMS05-002-GW-925	EII833	WG	2017-05-02 14:25	E537M	2B
MALMS-RS-012	EII836	WQ	2017-05-02 15:46	E537M	2B

II. SAMPLE MANAGEMENT

According to the case narratives and the chains-of-custody (COCs) provided by the laboratory for sample delivery groups (SDGs) B6M4692 and B6M8709, and B791810:

- The case narrative for all SDGs noted no shipping problems were encountered.
- Field and laboratory personnel signed and dated the COCs.
- Sample IDs for four samples in SDG B6M8709 were updated per client request, to correct "-S0-" or "-SS-" to "SO."

MEC^X noted anomalies regarding sample management identified below:

- Most corrections to the COCs were initialed but not dated.

TABLE 2 - DATA QUALIFIER REFERENCE

Qualifier	Definition
R	The sample results are rejected because of serious deficiencies in the ability to analyze the sample and to meet quality control (QC) criteria. The presence or absence of the analyte cannot be verified.
U	The analyte was analyzed for but was nondetect (ND) above the reported sample quantification limit.
B	The reported concentration is less than 5 times the concentration reported in an associated field or lab blank.
J	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample. J- denotes a low bias for the sample results and J+ for a high bias.
UJ	The material was analyzed for but was ND. The associated value is an estimate and may be inaccurate or imprecise.

TABLE 3 - REASON CODE REFERENCE

Reason Code	Definition
01	Sample received outside of 4+/-2 degrees Celsius (°C)
01A	Improper sample preservation
02	Holding time exceeded
02A	Extraction
02B	Analysis
03	Instrument performance – outside criteria
03A*	Bromofluorobenzene (BFB)
03B*	Decafluorotriphenylphosphine (DFTPP)
03C*	dichlorodiphenyltrichloroethane (DDT) and/or endrin % breakdown exceeds criteria
03D	Retention time windows
03E	Resolution
04	ICAL results outside specified criteria
04A	Compound mean RRF QC criteria not met
04B	Individual % RSD criteria not met
04C	Correlation coefficient >0.995
04D	ICAL % Recovery
05	Continuing calibration results outside specified criteria

Reason Code	Definition
05A	Compound mean RRF QC criteria not met
05B	Compound % Difference QC criteria not met
06	Result qualified as a result of the 5x/10x blank correction
06A	Method or preparation blank
06B	ICB or CCB
06C	ER
06D	TB
06E	FB
07	Surrogate recoveries outside control limits
07A	Sample
07B	Associated MB or LCS
08	MS/MSD/Duplicate results outside criteria
08A	MS and/or MSD recovery not within control limits (accuracy)
08B	% RPD outside acceptance criteria (precision)
09*	Post digestion spike outside criteria graphite furnace atomic absorption (GFAA)
10	Internal standards outside specified control limits
10A	Recovery
10B	Retention time
11	LCS recoveries outside specified limits
11A	Recovery
11B	% RPD (if run in duplicate)
12*	Interference check standard
13*	Serial dilution
14*	Tentatively identified compounds
15	Quantification
16	Multiple results available; alternate analysis preferred
17	Field duplicate RPD criteria is exceeded
18*	Percent difference between original and second column exceeds QC criteria
19	Professional judgment was used to qualify the data
20*	Pesticide clean-up checks
21	Target compound identification

Reason Code	Definition
22*	Radiological calibration
23*	Radiological quantification
24	Reported result and/or lab qualifier revised to reflect validation findings

* Indicates that this code is not expected to apply to the evaluation of PFAS analyses

III. METHOD ANALYSIS – PERFLUORINATED COMPOUNDS BY MODIFIED EPA METHOD 537 (E537M)

L. Calvin of MEC[X] reviewed the SDGs on December 23, 2016, January 17, 2017, January 19, 2017

III.1. HOLDING TIMES

SDGs B6M4692, B6M8709, and B791810
Extraction and analytical holding times were met. The soil and water samples were extracted within 14 days of collection. All analyses were performed within 28 days of extraction.

III.2. CALIBRATION

Calibration criteria were met.

III.2.1. *INITIAL CALIBRATION*

All recoveries were within 70-130% for the lowest level of each initial calibration and 75-125% for the remaining levels. All correlation coefficient r values were within the control limit of ≥0.995, with exceptions affecting sample data noted below. Results for the outliers were qualified as estimated (J or UJ) in the affected samples. The calculated peak asymmetry factors were within the control range of 0.8-1.5. The initial calibration verification (ICV) recoveries were within the control limits of 75-125%. It should be noted that the laboratory utilized a weighted (1/X) linear internal standard curve which was not forced through zero as the calibration method.

Table 4-Initial Calibration

SDGs B6M4692, B6M8709

ICAL date / instrument	Analyte	r Value	Affected Samples
11/02/2016 / LCMS03	PFDS	0.994	MALMS01-001-SS-001
10/27/2016 / LCMS03	6:2 FTS PFDoA	0.990 0.993	MALMS03-004-SW-001, MALMS04-001-GW-005, MALMS04-002-GW-004, MALMS04-002-GW-904, MALMS04-004-SW-001
	PFDoA	0.993	MALMS04-003-SW-001, MALMS-IDWWATER-001

SDG B791810
Initial calibration criteria were met.

III.2.2. *CONTINUING CALIBRATION*

SDGs B6M4692, B6M8709, and B791810
Continuing calibration verification (CCV) recoveries were within the control limits of 75-125%.

III.3. QUALITY CONTROL SAMPLES

III.3.1. *METHOD BLANKS*

SDGs B6M4692, B6M8709, AND B791810
Seven method blanks were associated with the analyses of the soil samples and five were associated with the water samples. The method blanks had no target analyte detects above the respective soil and water detection limits (DLs).

III.3.2. *LABORATORY CONTROL SAMPLES*

SDGs B6M4692, B6M8709, and B791810

Recoveries were within the control limits of 70-130%, and RPDs for LCS/LCSD pairs were within the control limit of ≤30%.

III.3.3. *SURROGATE RECOVERY*

Surrogate standard recoveries were within the QAPP control limits of 80-140% for soils and 70-130% for waters, with exceptions listed in the table below. Nondetected results associated with the low recoveries were qualified as estimated (UJ) and detects were qualified as estimated (J). Detects associated with high recoveries were qualified as estimated (J). Nondetects were not qualified for high recoveries.

Table 5-Surrogate Recoveries

SDGs B6M4692, B6M8709

Surrogate	Samples	% Recovery	Affected Target Analytes
13C4-perfluorooctanesulfonate	MALMS02-002-SS-001	79%	All sulfonate analytes
	MALMS02-005-SD-001	72%	
	MALMS02-004-SD-001	74%	
	MALMS02-004-SD-901	59%	
	MALMS03-001-SO-020	70%	
	MALMS03-002-SO-020	77%	
	MALMS03-004-SD-001	59%	
	MALMS04-001-SO-002	61%	
	MALMS04-002-SS-001	77%	
	MALMS04-004-SD-001	66%	
13C4-perfluorooctanoic acid	MALMS02-005-SD-001	77%	All acid analytes
	MALMS02-004-SD-001	72%	
	MALMS02-004-SD-901	61%	
	MALMS03-004-SD-001	69%	
	MALMS04-001-SO-002	67%	
	MALMS04-004-SD-001	74%	
13C8-perfluorooctanesulfonamide	MALMS02-001-SO-020	78%	PFOSA
	MALMS02-002-SS-001	66%	
	MALMS02-002-SO-020	78%	
	MALMS02-005-SD-001	72%	
	MALMS02-004-SD-001	52%	
	MALMS02-004-SD-901	73%	
	MALMS01-001-SO-921	70%	
	MALMS01-002-SS-001	73%	
	MALMS01-003-SS-001	73%	
	MALMS01-003-SO-011	70%	
	MALMS02-003-SO-006	73%	
	MALMS02-001-SO-920	76%	
	MALMS05-001-SS-001	71%	
	MALMS05-001-SO-007	69%	
	MALMS06-PH3MW1-019	67%	
	MALMS03-003-SO-009	75%	

Surrogate	Samples	% Recovery	Affected Target Analytes
	MALMS03-004-SD-001	58%	
	MALMS04-001-SO-002	63%	
	MALMS04-001-SO-004	61%	
	MALMS04-001-SS-001	76%	
	MALMS04-003-SD-001	61%	
	MALMS04-004-SD-001	53%	
	MALMS-IDWSOIL-001	64%	

SDG B791810

Surrogate	Samples	% Recovery	Affected Target Analytes
13C4-perfluorooctanesulfonate	MALMS05-001-GW-017	159%	All sulfonate analyte detects
	MALMS03-002-GW-030	149%	
13C4-perfluorooctanoic acid	MALMS05-001-GW-017	131%	All acid analyte detects
	MALMS03-002-GW-030	138%	
13C8-perfluorooctanesulfonamide	MALMS03-003-GW-920	67%	PFOSA

III.3.4. *MATRIX SPIKE/MATRIX SPIKE DUPLICATE*

MS/MSD analyses were performed on soil samples MALMS01-001-SS-001, MALMS01-001-SO-021, MALMS04-001-SO-004, and MALMS02-004-SD-001 and on water samples MALMS02-004-SW-001 MALMS04-002-GW-004, and MALMS05-001-GW-017. MS/MSD recoveries and RPDs were reported as not calculated (NC) by the laboratory for analytes present in the parent sample at concentrations >4× the spike amount. Remaining recoveries and RPDs were within the control limits of 70-130% and ≤30%, respectively, with exceptions affecting sample data noted below. Qualifications were not assigned for single recovery outliers not present in both the MS and MSD. Detects in the parent sample associated with both recovery outliers and RPD outliers were qualified as estimated (J).

Table 6-MS/MSD Recoveries

SDG B6M4692

Parent Sample	Analyte	MS/MSD Recoveries
MALMS01-001-SO-021	6:2 FTS	229% / 276%
	PFHxS	136% / 172%
	PFOS	186% / 245%

SDGs B791810

Parent Sample	Analyte	MS/MSD Recoveries	RPD outliers
MALMS05-001-GW-017	PFBS	32%/ acceptable	98%
	PFHxA	acceptable	34%
	PFPeA	47% / acceptable	57%

III.4. FIELD QC SAMPLES

MEC^X evaluated field QC samples, and if necessary, qualified based on method blanks and other laboratory QC results affecting the usability of the field QC data. MEC^X used the remaining detects

to evaluate the associated site samples. Findings associated with field QC samples are summarized below.

III.4.1. *FIELD BLANKS AND EQUIPMENT BLANKS*

Sample MALMS-SB-001 was identified as the field blank associated with this SDG, and samples MALMS02-RS-001, MALMS-RS-002, MALMS-RS-003, MALMS-RS-004, MALMS-RS-005, MALMS-RS-006, MALMS-RS-007, MALMS-RS008, MALMS-RS009, MALMS-RS010, MALMS-RS011, and MALMS-RS012 were identified as the equipment blanks associated with the site samples. The field blank and several equipment blanks had trace level detects below the LOQ for one or more target analytes present at concentrations considered insufficient to qualify soil site sample results. The table below lists the field blank and equipment blank detects. The equipment blanks were associate with samples collected from the previous rinsate to the date and time of the subsequent rinsate. No qualifications were assigned.

Table 7-FB/EB Detects

SDGs B6M4692, B6M8709

Field or Equipment Blank	Detects	Concentration
MALMS-SB-001	PFOS	0.0062 µg/L
MALMS02-RS-001	PFUnA	0.0037 µg/L
MALMS-RS-002	none	--
MALMS-RS-003	PFUnA	0.0039 µg/L
MALMS-RS-004	none	--
MALMS-RS-005	none	--
MALMS-RS-006	PFOS	0.0046 µg/L
MALMS-RS-007	none	--
MALMS-RS-008	8:2 FTS perfluorobutanoic acid PFOS	0.0062 µg/L 0.0070 µg/L 0.017 µg/L
MALMS-RS-009	PFOS perfluorotridecanoic acid	0.0060 µg/L 0.0060 µg/L
MALMS-RS-010	perfluorobutanoic acid PFHpA perfluorotridecanoic acid	0.0068 µg/L 0.0053 µg/L 0.0065 µg/L
MALMS-RS-011	PFHpA perfluorotridecanoic acid	0.0053 µg/L 0.0062 µg/L

SDGs B791810

Field or Equipment Blank	Detects	Concentration
MALMS-RS-012	none	--

FIELD DUPLICATES

The following were identified as soil field duplicate pairs: MALMS02-004-SD-001 / MALMS02-004-SD-901, MALMS01-001-SO-021 / MALMS01-001-SO-921, MALMS01-001-SS-001 / MALMS01-001-SS-901. Water samples MALMS02-004-SW-001 / MALMS02-004-SW-901, MALMS04-002-GW-004 / MALMS04-002-GW-904, MALMS03-003-GW-020, MALMS03-003-GW-920, and MALMS05-002-GW-025 / MALMS05-002-GW-925 were identified as field duplicate pairs. RPDs for detects above the

LOQ were within the control limit of ≤30%, and detects below the LOQ were within the reasonable control limit of ±LOQ, with exceptions noted in the table below. Results for the RPD outliers were qualified as estimated (J) in both samples of the pair.

Table 8-FD RPDs

SDGs B6M4692, B6M8709

Field Duplicate Pair	Analyte	RPD outliers
MALMS02-004-SD-001 / MALMS02-004-SD-901	PFHxS PFNA PFOA PFOS	69% 78% 71% 98%
MALMS01-001-SO-021 / MALMS01-001-SO-921	6:2 FTS	37%
MALMS01-001-SS-001 / MALMS01-001-SS-901	6:2 FTS	33%

SDGs B791810

Field Duplicate Pair	Analyte	RPD outliers
MALMS03-003-GW-020 / MALMS03-003-GW-920	NA	none
MALMS05-002-GW-025 / MALMS05-002-GW-925	PFBS	59%

III.5. INTERNAL STANDARDS PERFORMANCE

The labeled internal standard recoveries were within the control limits of ±50% of the average peak areas of the initial calibration, with one exception noted in the table below. Results for the associated target compounds were qualified as estimated (UJ and J, respectively,) in the affected samples.

Table 9-Internal Standards Percent Recovery

SDGs B6M4692, B6M8709

Internal Standard	% Recovery	Affected Sample	Associated Target Analytes
MPFBA	49% 21% 41%	MALMS05-ST05MW4-009 MALMS06-PH3MW1-019 MALMS06-PH3MW4-009	PFBA
MPFTeDA	49% 42%	MALMS02-004-SW-001 MALMS04-004-SW-001	PFTeDA and PFTrDA

SDG B791810

Internal Standard	% Recovery	Affected Samples	Associated Target Analyte(s)
M2-6:2-FTS	197%	MALMS03-002-GW-030	6:2-FTS
M2-8:2-FTS	159%	MALMS03-002-GW-030	8:2-FTS
MPFBA	33% 32% 35% 26% 23% 28% 30%	MALMS05-002-GW-025 MALMS05-002-GW-925 MALMS05-001-GW-017 MALMS03-003-GW-020 MALMS03-003-GW-920 MALMS03-001-GW-025 MALMS01-001-GW-035	PFBA

Internal Standard	% Recovery	Affected Samples	Associated Target Analyte(s)
MPFOS	159%	MALMS05-001-GW-017	PFOS
MPFPeA	45%	MALMS03-002-GW-030	PFPeA
MPFHxS	152%	MALMS03-002-GW-030	PFHxS

III.6. COMPOUND IDENTIFICATION

SDGs B6M4692, B6M8709, B791810

Compound identification was verified for a representative number of samples. The laboratory analyzed for 18 perfluorinated compounds by Modified EPA Method 537. Review of retention times and the ion chromatograms indicated no issues with compound identification.

III.7. COMPOUND QUANTIFICATION AND REPORTED DETECTION LIMITS

SDGs B6M4692, B6M8709

Calculations were verified and the sample results reported on the sample result summaries were verified against the raw data for the following samples: soil samples MALMS01-001-SO-021, MALMS01-001-SS-001, MALMS03-004-SD-001, and MALMS05-001-SO-007, and water samples MALMS02-004-SW-001, MALMS04-001-GW-005, and MALMS06-PH3MW1-019. Quantitation verification was limited based upon the significant figures presented in the raw data and were therefore estimations of the actual sample amounts. The reviewer considered the concentration verified within that limitation. The laboratory calculated and reported compound-specific detection limits. Detects below the LOQ were qualified as estimated (J). Nondetects are valid to the MDL.

Soil samples MALMS06-PH3MW2-009, MALMS01-001-SS-001, MALMS01-001-SS-901, MALMS01-002-SO-005, and MALMS01-003-SS-001 were initially analyzed at dilutions and were reanalyzed at further dilutions for concentrations of PFOS above the linear range of the calibration in the initial dilutions. Water samples MALMS06-PH3MW2-009, MALMS06-PH3MW4-009, MALMS06-PH3MW5-008, MALMS04-001-GW-005, MALMS04-003-SW-001, and MALMS-IDWWATER-001 were analyzed at initial dilutions or analyzed undiluted and reanalyzed at dilutions for one or more target analytes detected above the linear range of the calibration. Remaining analytes were reported from the undiluted or least dilute analyses of the samples.

SDG B791810

Sample MALMS01-002-GW-030 was analyzed at 2× and 20× dilutions to report several target compounds within the linear range of the calibration. Although nondetects in the previous SDGs were reported to the MDL, nondetects in SDG B791810 were reported to the LOD, per DoD QSM v. 5.1 guidelines.

III.8. SYSTEM PERFORMANCE

SDGs B6M4692, B6M8709, and B791810

No issues were noted with system performance.

IV. SUMMARY AND CONCLUSIONS

MEC^X evaluated a total of 1062 data records from field samples during the validation and qualified 226 records (21.3% of the data) as estimated values (J/UJ). The qualification was required for initial calibration outliers, MS/MSD recovery and RPD outliers, surrogate recovery outliers, internal standard recovery outliers and field duplicate precision outliers. Nondetect compounds were flagged (U) to indicate that the compound was analyzed for but not detected above the laboratory detection limit (MDL). Specific qualification were discussed in the text above.

Overall, the quality of the data was acceptable. The precision (97.6%) and accuracy (79.6%) were acceptable to the project. Other data quality indicators (DQI) (representativeness, comparability and completeness) met the project objectives. Each of these DQIs is discussed below.

IV.1. PRECISION

Precision is a measure of the agreement between duplicate sample measurements of the same quantity and is reflected in the relative percent difference (RPD) between spikes and the RPD for the field duplicate pair analysis. Precision was measured at 97.6%. Precision was considered acceptable for the project.

IV.2. ACCURACY

Accuracy is measured by the results from the recovery of known amounts of compounds or elements from method blanks, laboratory control samples (LCS), matrix spikes (MS), internal standards and surrogate recoveries. The accuracy was 79.6%. The lower precision value was largely due to the number of surrogate outliers primarily in the soil samples.

IV.3. REPRESENTATIVENESS

The measures of representativeness – sample handling, analytical blank analysis, were met. Designated analytical protocols were followed. The laboratory did utilize a weighted 1/X calibration curve which was not forced through zero. Although this is a deviation from Method 537, it is acceptable on DoD projects and was considered acceptable by the reviewer. Holding times were met for the analyses. No analytical problems were noted which would impact data representativeness.

IV.4. COMPARABILITY

The samples were analyzed using appropriate approved methods of analysis. All data were reported correctly using standard units.

IV.5. COMPLETENESS

Completeness is the amount of validated data compared to the planned amount of data and is expressed as a percentage of the usable data divided by the total number of data points. Of the 1062 data points, no data points were rejected, resulting in a completeness of 100%.

V. REFERENCES

Aerostar, 2016. Final Quality Assurance Project Plan for Site Inspection of Aqueous Film Forming Foam Areas, Multiple Sites United States Air Force Installations, March 2016.

Aerostar, 2016a. Final Uniform Federal Policy (UFP) Quality Assurance Project Plan (QAPP) for Site Inspection of Aqueous Film Forming Foam Areas, Multiple Sites, United States Air Force Installations, Addendum 4, Field Sampling Plan for Malmstrom Air Force Base Great Falls, Montana, September 2016.

Department of Defense (DOD), 2013. *DoD Quality Systems Manual for Environmental Laboratories,* Version 5.0. July 2013.

EPA, 2009. *Determination of Selected Perfluorinated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS),* Version 1.1, September 2009. EPA Document #: EPA/600/R-08/092.

EPA, 2014. *EPA Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review*, EPA/540-R-014-002.

EPA (U.S. Environmental Protection Agency), January 2009. OSWER 9200-1-85. *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use.* EPA-540/R-08-005.

Validated Sample Result Forms: B6M4692

Analysis Method EPA 537 m

Sample Name MALMS01-001-SO-021 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: DGR819 **Sample Date/Time:** 2016-10-13 12:20 **Validation Level:** Stage 4

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	29	1.0	0.25	ug/kg		J	08A;17
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.21	1.0	0.21	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	375-73-5	0.38	1.0	0.25	ug/kg	J	J	
PERFLUOROBUTANOIC ACID	375-22-4	0.39	1.0	0.23	ug/kg	J	J	
PERFLUORODECANE SULFONATE	335-77-3	<0.20	1.0	0.20	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.28	1.0	0.28	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.24	1.0	0.24	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.63	1.0	0.18	ug/kg	J	J	
PERFLUOROHEXANE SULFONATE	108427-53-8	9.9	1.0	0.19	ug/kg		J	08A
PERFLUOROHEXANOIC ACID	307-24-4	2.0	1.0	0.21	ug/kg			
PERFLUORONONANOIC ACID	375-95-1	0.15	1.0	0.14	ug/kg	J	J	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	0.74	1.0	0.17	ug/kg	J	J	
PERFLUOROOCTANE SULFONATE	1763-23-1	19	1.0	0.16	ug/kg		J	08A
PERFLUOROOCTANOIC ACID	335-67-1	7.1	1.0	0.12	ug/kg			
PERFLUOROPENTANOIC ACID	2706-90-3	1.4	1.0	0.21	ug/kg			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.22	1.0	0.22	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.25	1.0	0.25	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.26	1.0	0.26	ug/kg	U	U	

Analysis Method EPA 537 m

Sample Name MALMS01-001-SO-921 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: DGR820 **Sample Date/Time:** 2016-10-13 12:20 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	20	0.94	0.24	ug/kg		J	17
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.20	0.94	0.20	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	375-73-5	<0.24	0.94	0.24	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	0.26	0.94	0.22	ug/kg	J	J	
PERFLUORODECANE SULFONATE	335-77-3	<0.19	0.94	0.19	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.26	0.94	0.26	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.23	0.94	0.23	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.17	0.94	0.17	ug/kg	J	J	
PERFLUOROHEXANE SULFONATE	108427-53-8	8.1	0.94	0.18	ug/kg			
PERFLUOROHEXANOIC ACID	307-24-4	1.8	0.94	0.20	ug/kg			
PERFLUORONONANOIC ACID	375-95-1	<0.13	0.94	0.13	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	0.29	0.94	0.16	ug/kg	J	J	07A
PERFLUOROOCTANE SULFONATE	1763-23-1	16	0.94	0.15	ug/kg			
PERFLUOROOCTANOIC ACID	335-67-1	6.1	0.94	0.11	ug/kg			
PERFLUOROPENTANOIC ACID	2706-90-3	1.2	0.94	0.20	ug/kg			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.21	0.94	0.21	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.24	0.94	0.24	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.24	0.94	0.24	ug/kg	U	U	

Analysis Method EPA 537 m

Sample Name MALMS01-001-SS-001 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: DGR817 **Sample Date/Time:** 2016-10-13 10:20 **Validation Level:** Stage 4

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	100	9.7	2.4	ug/kg		J	17
8:2 FLUOROTELOMER SULFONATE	39108-34-4	25	9.7	2.0	ug/kg			
PERFLUOROBUTANE SULFONATE	375-73-5	4.3	9.7	2.4	ug/kg	J	J	
PERFLUOROBUTANOIC ACID	375-22-4	4.3	9.7	2.2	ug/kg	J	J	
PERFLUORODECANE SULFONATE	335-77-3	<1.9	9.7	1.9	ug/kg	U	UJ	04C
PERFLUORODECANOIC ACID	335-76-2	<2.7	9.7	2.7	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<2.3	9.7	2.3	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	3.9	9.7	1.7	ug/kg	J	J	
PERFLUOROHEXANE SULFONATE	108427-53-8	47	9.7	1.8	ug/kg			
PERFLUOROHEXANOIC ACID	307-24-4	13	9.7	2.0	ug/kg			
PERFLUORONONANOIC ACID	375-95-1	3.5	9.7	1.4	ug/kg	J	J	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	26	9.7	1.6	ug/kg			
PERFLUOROOCTANE SULFONATE	1763-23-1	890	97	16	ug/kg			
PERFLUOROOCTANOIC ACID	335-67-1	26	9.7	1.2	ug/kg			
PERFLUOROPENTANOIC ACID	2706-90-3	9.7	9.7	2.0	ug/kg	J	J	
PERFLUOROTETRADECANOIC ACID	376-06-7	<2.1	9.7	2.1	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<2.4	9.7	2.4	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<2.5	9.7	2.5	ug/kg	U	U	

Analysis Method EPA 537 m

Sample Name MALMS01-001-SS-901 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: DGR818 **Sample Date/Time:** 2016-10-13 10:20 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	72	9.3	2.3	ug/kg		J	17
8:2 FLUOROTELOMER SULFONATE	39108-34-4	21	9.3	2.0	ug/kg			
PERFLUOROBUTANE SULFONATE	375-73-5	3.7	9.3	2.3	ug/kg	J	J	
PERFLUOROBUTANOIC ACID	375-22-4	3.7	9.3	2.1	ug/kg	J	J	
PERFLUORODECANE SULFONATE	335-77-3	<1.9	9.3	1.9	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<2.6	9.3	2.6	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<2.2	9.3	2.2	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	3.4	9.3	1.7	ug/kg	J	J	
PERFLUOROHEXANE SULFONATE	108427-53-8	35	9.3	1.8	ug/kg			
PERFLUOROHEXANOIC ACID	307-24-4	11	9.3	2.0	ug/kg			
PERFLUORONONANOIC ACID	375-95-1	3.2	9.3	1.3	ug/kg	J	J	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	16	9.3	1.6	ug/kg			
PERFLUOROOCTANE SULFONATE	1763-23-1	800	93	15	ug/kg			
PERFLUOROOCTANOIC ACID	335-67-1	20	9.3	1.1	ug/kg			
PERFLUOROPENTANOIC ACID	2706-90-3	8.1	9.3	2.0	ug/kg	J	J	
PERFLUOROTETRADECANOIC ACID	376-06-7	<2.0	9.3	2.0	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<2.3	9.3	2.3	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<2.4	9.3	2.4	ug/kg	U	U	

Analysis Method EPA 537 m

Sample Name MALMS01-002-SO-005 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: DGR822 **Sample Date/Time:** 2016-10-14 11:00 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	1500	100	25	ug/kg			
8:2 FLUOROTELOMER SULFONATE	39108-34-4	3100	100	21	ug/kg			
PERFLUOROBUTANE SULFONATE	375-73-5	<25	100	25	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<23	100	23	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	69	100	20	ug/kg	J	J	
PERFLUORODECANOIC ACID	335-76-2	<28	100	28	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	28	100	24	ug/kg	J	J	
PERFLUOROHEPTANOIC ACID	375-85-9	25	100	18	ug/kg	J	J	
PERFLUOROHEXANE SULFONATE	108427-53-8	280	100	19	ug/kg			
PERFLUOROHEXANOIC ACID	307-24-4	75	100	21	ug/kg	J	J	
PERFLUORONONANOIC ACID	375-95-1	38	100	14	ug/kg	J	J	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	380	100	17	ug/kg			
PERFLUOROOCTANE SULFONATE	1763-23-1	11000	1000	160	ug/kg			
PERFLUOROOCTANOIC ACID	335-67-1	110	100	12	ug/kg			
PERFLUOROPENTANOIC ACID	2706-90-3	66	100	21	ug/kg	J	J	
PERFLUOROTETRADECANOIC ACID	376-06-7	<22	100	22	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<25	100	25	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	27	100	26	ug/kg	J	J	

Analysis Method EPA 537 m

Sample Name MALMS01-002-SS-001 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: DGR821 **Sample Date/Time:** 2016-10-14 08:15 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.28	1.1	0.28	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.23	1.1	0.23	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	375-73-5	1.4	1.1	0.28	ug/kg			
PERFLUOROBUTANOIC ACID	375-22-4	2.8	1.1	0.25	ug/kg			
PERFLUORODECANE SULFONATE	335-77-3	<0.22	1.1	0.22	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	0.33	1.1	0.31	ug/kg	J	J	
PERFLUORODODECANOIC ACID	307-55-1	<0.26	1.1	0.26	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.88	1.1	0.20	ug/kg	J	J	
PERFLUOROHEXANE SULFONATE	108427-53-8	12	1.1	0.21	ug/kg			
PERFLUOROHEXANOIC ACID	307-24-4	3.2	1.1	0.23	ug/kg			
PERFLUORONONANOIC ACID	375-95-1	1.9	1.1	0.15	ug/kg			
PERFLUOROOCTANE SULFONAMIDE	754-91-6	0.27	1.1	0.19	ug/kg	J	J	07A
PERFLUOROOCTANE SULFONATE	1763-23-1	30	1.1	0.18	ug/kg			
PERFLUOROOCTANOIC ACID	335-67-1	3.1	1.1	0.13	ug/kg			
PERFLUOROPENTANOIC ACID	2706-90-3	6.0	1.1	0.23	ug/kg			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.24	1.1	0.24	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.28	1.1	0.28	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	0.29	1.1	0.29	ug/kg	J	J	

Analysis Method EPA 537 m

Sample Name MALMS01-003-SO-011 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: DGR824 **Sample Date/Time:** 2016-10-14 16:05 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	15	0.97	0.24	ug/kg		J	07A
8:2 FLUOROTELOMER SULFONATE	39108-34-4	0.66	0.97	0.20	ug/kg	J	J	07A
PERFLUOROBUTANE SULFONATE	375-73-5	4.4	0.97	0.24	ug/kg		J	07A
PERFLUOROBUTANOIC ACID	375-22-4	3.8	0.97	0.22	ug/kg		J	07A
PERFLUORODECANE SULFONATE	335-77-3	<0.19	0.97	0.19	ug/kg	U	UJ	07A
PERFLUORODECANOIC ACID	335-76-2	<0.27	0.97	0.27	ug/kg	U	UJ	07A
PERFLUORODODECANOIC ACID	307-55-1	<0.23	0.97	0.23	ug/kg	U	UJ	07A
PERFLUOROHEPTANOIC ACID	375-85-9	4.3	0.97	0.17	ug/kg		J	07A
PERFLUOROHEXANE SULFONATE	108427-53-8	21	0.97	0.18	ug/kg		J	07A
PERFLUOROHEXANOIC ACID	307-24-4	22	0.97	0.20	ug/kg		J	07A
PERFLUORONONANOIC ACID	375-95-1	0.58	0.97	0.14	ug/kg	J	J	07A
PERFLUOROOCTANE SULFONAMIDE	754-91-6	0.30	0.97	0.16	ug/kg	J	J	07A
PERFLUOROOCTANE SULFONATE	1763-23-1	29	0.97	0.16	ug/kg		J	07A
PERFLUOROOCTANOIC ACID	335-67-1	9.2	0.97	0.12	ug/kg		J	07A
PERFLUOROPENTANOIC ACID	2706-90-3	13	0.97	0.20	ug/kg		J	07A
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.21	0.97	0.21	ug/kg	U	UJ	07A
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.24	0.97	0.24	ug/kg	U	UJ	07A
PERFLUOROUNDECANOIC ACID	2058-94-8	0.27	0.97	0.25	ug/kg	J	J	07A

Analysis Method EPA 537 m

Sample Name MALMS01-003-SS-001 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: DGR823 **Sample Date/Time:** 2016-10-14 14:30 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	1.1	0.92	0.23	ug/kg			
8:2 FLUOROTELOMER SULFONATE	39108-34-4	2.9	0.92	0.19	ug/kg			
PERFLUOROBUTANE SULFONATE	375-73-5	0.72	0.92	0.23	ug/kg	J	J	
PERFLUOROBUTANOIC ACID	375-22-4	2.4	0.92	0.21	ug/kg			
PERFLUORODECANE SULFONATE	335-77-3	2.4	0.92	0.18	ug/kg			
PERFLUORODECANOIC ACID	335-76-2	2.0	0.92	0.26	ug/kg			
PERFLUORODODECANOIC ACID	307-55-1	0.47	0.92	0.22	ug/kg	J	J	
PERFLUOROHEPTANOIC ACID	375-85-9	1.0	0.92	0.17	ug/kg			
PERFLUOROHEXANE SULFONATE	108427-53-8	7.9	0.92	0.17	ug/kg			
PERFLUOROHEXANOIC ACID	307-24-4	2.2	0.92	0.19	ug/kg			
PERFLUORONONANOIC ACID	375-95-1	2.2	0.92	0.13	ug/kg			
PERFLUOROOCTANE SULFONAMIDE	754-91-6	4.5	0.92	0.16	ug/kg		J	07A
PERFLUOROOCTANE SULFONATE	1763-23-1	110	9.2	1.5	ug/kg			
PERFLUOROOCTANOIC ACID	335-67-1	3.8	0.92	0.11	ug/kg			
PERFLUOROPENTANOIC ACID	2706-90-3	3.0	0.92	0.19	ug/kg			
PERFLUOROTETRADECANOIC ACID	376-06-7	0.22	0.92	0.20	ug/kg	J	J	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.23	0.92	0.23	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	0.97	0.92	0.24	ug/kg			

Analysis Method EPA 537 m

Sample Name MALMS01-RS-005 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: DGR826 **Sample Date/Time:** 2016-10-15 08:55 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.0065	0.020	0.0065	ug/L	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.0055	0.020	0.0055	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	375-73-5	<0.0019	0.020	0.0019	ug/L	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.0066	0.020	0.0066	ug/L	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.0043	0.020	0.0043	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.0066	0.020	0.0066	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.0057	0.020	0.0057	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.0047	0.020	0.0047	ug/L	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.0040	0.020	0.0040	ug/L	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.0046	0.020	0.0046	ug/L	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.0046	0.020	0.0046	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.0058	0.020	0.0058	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.0033	0.020	0.0033	ug/L	U	U	
PERFLUOROOCTANOIC ACID	335-67-1	<0.0053	0.020	0.0053	ug/L	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.0036	0.020	0.0036	ug/L	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.0052	0.020	0.0052	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.0032	0.020	0.0032	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.0037	0.020	0.0037	ug/L	U	U	

Analysis Method EPA 537 m

Sample Name MALMS02-001-SO-020 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: DGR807 **Sample Date/Time:** 2016-10-12 10:05 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.25	1.0	0.25	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.21	1.0	0.21	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	375-73-5	<0.25	1.0	0.25	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.23	1.0	0.23	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.20	1.0	0.20	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.28	1.0	0.28	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	0.30	1.0	0.24	ug/kg	J	J	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.18	1.0	0.18	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.19	1.0	0.19	ug/kg	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.21	1.0	0.21	ug/kg	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.14	1.0	0.14	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.17	1.0	0.17	ug/kg	U	UJ	07A
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.16	1.0	0.16	ug/kg	U	U	
PERFLUOROOCTANOIC ACID	335-67-1	<0.12	1.0	0.12	ug/kg	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.21	1.0	0.21	ug/kg	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.22	1.0	0.22	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.25	1.0	0.25	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	0.27	1.0	0.26	ug/kg	J	J	

Analysis Method EPA 537 m

Sample Name MALMS02-001-SO-920 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: DGR829 **Sample Date/Time:** 2016-10-12 10:00 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.28	1.1	0.28	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.23	1.1	0.23	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	375-73-5	<0.28	1.1	0.28	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.25	1.1	0.25	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.22	1.1	0.22	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.31	1.1	0.31	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.26	1.1	0.26	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.20	1.1	0.20	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.21	1.1	0.21	ug/kg	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.23	1.1	0.23	ug/kg	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.15	1.1	0.15	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.19	1.1	0.19	ug/kg	U	UJ	07A
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.18	1.1	0.18	ug/kg	U	U	
PERFLUOROOCTANOIC ACID	335-67-1	<0.13	1.1	0.13	ug/kg	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.23	1.1	0.23	ug/kg	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.24	1.1	0.24	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.28	1.1	0.28	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	0.29	1.1	0.29	ug/kg	J	J	

Analysis Method EPA 537 m

Sample Name MALMS02-001-SS-001 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: DGR804 **Sample Date/Time:** 2016-10-11 16:30 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.24	0.97	0.24	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.20	0.97	0.20	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	375-73-5	0.42	0.97	0.24	ug/kg	J	J	
PERFLUOROBUTANOIC ACID	375-22-4	<0.22	0.97	0.22	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.19	0.97	0.19	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.27	0.97	0.27	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.23	0.97	0.23	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.17	0.97	0.17	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	0.90	0.97	0.18	ug/kg	J	J	
PERFLUOROHEXANOIC ACID	307-24-4	0.60	0.97	0.20	ug/kg	J	J	
PERFLUORONONANOIC ACID	375-95-1	<0.14	0.97	0.14	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.16	0.97	0.16	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	0.43	0.97	0.16	ug/kg	J	J	
PERFLUOROOCTANOIC ACID	335-67-1	<0.12	0.97	0.12	ug/kg	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	3.1	0.97	0.20	ug/kg			
PERFLUOROTETRADECANOIC ACID	376-06-7	0.24	0.97	0.21	ug/kg	J	J	
PERFLUOROTRIDECANOIC ACID	72629-94-8	0.36	0.97	0.24	ug/kg	J	J	
PERFLUOROUNDECANOIC ACID	2058-94-8	0.29	0.97	0.25	ug/kg	J	J	

Analysis Method EPA 537 m

Sample Name MALMS02-001-SS-901 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: DGR805 **Sample Date/Time:** 2016-10-11 16:30 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.25	1.0	0.25	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.21	1.0	0.21	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	375-73-5	<0.25	1.0	0.25	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.23	1.0	0.23	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.20	1.0	0.20	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.28	1.0	0.28	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.24	1.0	0.24	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.18	1.0	0.18	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	1.2	1.0	0.19	ug/kg			
PERFLUOROHEXANOIC ACID	307-24-4	0.53	1.0	0.21	ug/kg	J	J	
PERFLUORONONANOIC ACID	375-95-1	<0.14	1.0	0.14	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.17	1.0	0.17	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.16	1.0	0.16	ug/kg	U	U	
PERFLUOROOCTANOIC ACID	335-67-1	<0.12	1.0	0.12	ug/kg	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	2.3	1.0	0.21	ug/kg			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.22	1.0	0.22	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.25	1.0	0.25	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	0.28	1.0	0.26	ug/kg	J	J	

Analysis Method EPA 537 m

Sample Name MALMS02-002-SO-020 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: DGR809 **Sample Date/Time:** 2016-10-12 13:35 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.25	1.0	0.25	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.21	1.0	0.21	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	375-73-5	<0.25	1.0	0.25	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.23	1.0	0.23	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.20	1.0	0.20	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.28	1.0	0.28	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.24	1.0	0.24	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.18	1.0	0.18	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.19	1.0	0.19	ug/kg	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.21	1.0	0.21	ug/kg	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.14	1.0	0.14	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.17	1.0	0.17	ug/kg	U	UJ	07A
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.16	1.0	0.16	ug/kg	U	U	
PERFLUOROOCTANOIC ACID	335-67-1	<0.12	1.0	0.12	ug/kg	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.21	1.0	0.21	ug/kg	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.22	1.0	0.22	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.25	1.0	0.25	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	0.26	1.0	0.26	ug/kg	J	J	

Analysis Method EPA 537 m

Sample Name MALMS02-002-SS-001 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: DGR808 **Sample Date/Time:** 2016-10-12 10:38 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.25	1.0	0.25	ug/kg	U	UJ	07A
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.21	1.0	0.21	ug/kg	U	UJ	07A
PERFLUOROBUTANE SULFONATE	375-73-5	<0.25	1.0	0.25	ug/kg	U	UJ	07A
PERFLUOROBUTANOIC ACID	375-22-4	0.55	1.0	0.23	ug/kg	J	J	
PERFLUORODECANE SULFONATE	335-77-3	<0.20	1.0	0.20	ug/kg	U	UJ	07A
PERFLUORODECANOIC ACID	335-76-2	<0.28	1.0	0.28	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.24	1.0	0.24	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.34	1.0	0.18	ug/kg	J	J	
PERFLUOROHEXANE SULFONATE	108427-53-8	1.0	1.0	0.19	ug/kg		J	07A
PERFLUOROHEXANOIC ACID	307-24-4	0.55	1.0	0.21	ug/kg	J	J	
PERFLUORONONANOIC ACID	375-95-1	0.38	1.0	0.14	ug/kg	J	J	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.17	1.0	0.17	ug/kg	U	UJ	07A
PERFLUOROOCTANE SULFONATE	1763-23-1	1.9	1.0	0.16	ug/kg		J	07A
PERFLUOROOCTANOIC ACID	335-67-1	0.45	1.0	0.12	ug/kg	J	J	
PERFLUOROPENTANOIC ACID	2706-90-3	0.61	1.0	0.21	ug/kg	J	J	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.22	1.0	0.22	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.25	1.0	0.25	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	0.28	1.0	0.26	ug/kg	J	J	

Analysis Method EPA 537 m

Sample Name MALMS02-003-SO-006 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: DGR827 **Sample Date/Time:** 2016-10-15 10:55 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	0.39	0.94	0.24	ug/kg	J	J	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.20	0.94	0.20	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	375-73-5	0.50	0.94	0.24	ug/kg	J	J	
PERFLUOROBUTANOIC ACID	375-22-4	0.62	0.94	0.22	ug/kg	J	J	
PERFLUORODECANE SULFONATE	335-77-3	<0.19	0.94	0.19	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.26	0.94	0.26	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.23	0.94	0.23	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.77	0.94	0.17	ug/kg	J	J	
PERFLUOROHEXANE SULFONATE	108427-53-8	1.4	0.94	0.18	ug/kg			
PERFLUOROHEXANOIC ACID	307-24-4	1.5	0.94	0.20	ug/kg			
PERFLUORONONANOIC ACID	375-95-1	<0.13	0.94	0.13	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.16	0.94	0.16	ug/kg	U	UJ	07A
PERFLUOROOCTANE SULFONATE	1763-23-1	1.1	0.94	0.15	ug/kg			
PERFLUOROOCTANOIC ACID	335-67-1	1.1	0.94	0.11	ug/kg			
PERFLUOROPENTANOIC ACID	2706-90-3	2.1	0.94	0.20	ug/kg			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.21	0.94	0.21	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	0.35	0.94	0.24	ug/kg	J	J	
PERFLUOROUNDECANOIC ACID	2058-94-8	0.26	0.94	0.24	ug/kg	J	J	

Analysis Method EPA 537 m

Sample Name MALMS02-003-SS-001 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: DGR825 **Sample Date/Time:** 2016-10-15 09:10 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	0.39	1.0	0.25	ug/kg	J	J	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.21	1.0	0.21	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	375-73-5	<0.25	1.0	0.25	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	0.46	1.0	0.23	ug/kg	J	J	
PERFLUORODECANE SULFONATE	335-77-3	<0.20	1.0	0.20	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.28	1.0	0.28	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.24	1.0	0.24	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.39	1.0	0.18	ug/kg	J	J	
PERFLUOROHEXANE SULFONATE	108427-53-8	3.0	1.0	0.19	ug/kg			
PERFLUOROHEXANOIC ACID	307-24-4	0.54	1.0	0.21	ug/kg	J	J	
PERFLUORONONANOIC ACID	375-95-1	0.48	1.0	0.14	ug/kg	J	J	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.17	1.0	0.17	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	6.3	1.0	0.16	ug/kg			
PERFLUOROOCTANOIC ACID	335-67-1	2.3	1.0	0.12	ug/kg			
PERFLUOROPENTANOIC ACID	2706-90-3	0.68	1.0	0.21	ug/kg	J	J	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.22	1.0	0.22	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.25	1.0	0.25	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.26	1.0	0.26	ug/kg	U	U	

Analysis Method EPA 537 m

Sample Name MALMS02-004-SD-001 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: DGR812 **Sample Date/Time:** 2016-10-12 16:30 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.35	1.4	0.35	ug/kg	U	UJ	07A
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.29	1.4	0.29	ug/kg	U	UJ	07A
PERFLUOROBUTANE SULFONATE	375-73-5	<0.35	1.4	0.35	ug/kg	U	UJ	07A
PERFLUOROBUTANOIC ACID	375-22-4	0.54	1.4	0.32	ug/kg	J	J	07A
PERFLUORODECANE SULFONATE	335-77-3	0.73	1.4	0.28	ug/kg	J	J	07A
PERFLUORODECANOIC ACID	335-76-2	0.51	1.4	0.39	ug/kg	J	J	07A
PERFLUORODODECANOIC ACID	307-55-1	<0.34	1.4	0.34	ug/kg	U	UJ	07A
PERFLUOROHEPTANOIC ACID	375-85-9	0.90	1.4	0.25	ug/kg	J	J	07A
PERFLUOROHEXANE SULFONATE	108427-53-8	3.3	1.4	0.27	ug/kg		J	07A;17
PERFLUOROHEXANOIC ACID	307-24-4	0.33	1.4	0.29	ug/kg	J	J	07A
PERFLUORONONANOIC ACID	375-95-1	3.2	1.4	0.20	ug/kg		J	07A;17
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.24	1.4	0.24	ug/kg	U	UJ	07A
PERFLUOROOCTANE SULFONATE	1763-23-1	160	14	2.2	ug/kg		J	07A;17
PERFLUOROOCTANOIC ACID	335-67-1	2.3	1.4	0.17	ug/kg		J	07A;17
PERFLUOROPENTANOIC ACID	2706-90-3	0.62	1.4	0.29	ug/kg	J	J	07A
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.31	1.4	0.31	ug/kg	U	UJ	07A
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.35	1.4	0.35	ug/kg	U	UJ	07A
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.36	1.4	0.36	ug/kg	U	UJ	07A

Analysis Method EPA 537 m

Sample Name MALMS02-004-SD-901 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: DGR813 **Sample Date/Time:** 2016-10-12 16:30 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.28	1.1	0.28	ug/kg	U	UJ	07A
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.23	1.1	0.23	ug/kg	U	UJ	07A
PERFLUOROBUTANE SULFONATE	375-73-5	<0.28	1.1	0.28	ug/kg	U	UJ	07A
PERFLUOROBUTANOIC ACID	375-22-4	0.61	1.1	0.25	ug/kg	J	J	07A
PERFLUORODECANE SULFONATE	335-77-3	0.53	1.1	0.22	ug/kg	J	J	07A
PERFLUORODECANOIC ACID	335-76-2	0.41	1.1	0.31	ug/kg	J	J	07A
PERFLUORODODECANOIC ACID	307-55-1	<0.26	1.1	0.26	ug/kg	U	UJ	07A
PERFLUOROHEPTANOIC ACID	375-85-9	0.52	1.1	0.20	ug/kg	J	J	07A
PERFLUOROHEXANE SULFONATE	108427-53-8	1.6	1.1	0.21	ug/kg		J	07A;17
PERFLUOROHEXANOIC ACID	307-24-4	0.63	1.1	0.23	ug/kg	J	J	07A
PERFLUORONONANOIC ACID	375-95-1	1.4	1.1	0.15	ug/kg		J	07A;17
PERFLUOROOCTANE SULFONAMIDE	754-91-6	0.25	1.1	0.19	ug/kg	J	J	07A
PERFLUOROOCTANE SULFONATE	1763-23-1	55	1.1	0.18	ug/kg		J	07A;17
PERFLUOROOCTANOIC ACID	335-67-1	1.1	1.1	0.13	ug/kg		J	07A;17
PERFLUOROPENTANOIC ACID	2706-90-3	0.65	1.1	0.23	ug/kg	J	J	07A
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.24	1.1	0.24	ug/kg	U	UJ	07A
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.28	1.1	0.28	ug/kg	U	UJ	07A
PERFLUOROUNDECANOIC ACID	2058-94-8	0.34	1.1	0.29	ug/kg	J	J	07A

Analysis Method EPA 537 m

Sample Name MALMS02-004-SW-001 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: DGR814 **Sample Date/Time:** 2016-10-12 16:30 **Validation Level:** Stage 4

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	0.011	0.020	0.0065	ug/L	J	J	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	0.0090	0.020	0.0055	ug/L	J	J	
PERFLUOROBUTANE SULFONATE	375-73-5	0.0081	0.020	0.0019	ug/L	J	J	
PERFLUOROBUTANOIC ACID	375-22-4	0.019	0.020	0.0066	ug/L	J	J	
PERFLUORODECANE SULFONATE	335-77-3	<0.0043	0.020	0.0043	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.0066	0.020	0.0066	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.0057	0.020	0.0057	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.067	0.020	0.0047	ug/L			
PERFLUOROHEXANE SULFONATE	108427-53-8	0.095	0.020	0.0040	ug/L		J	17
PERFLUOROHEXANOIC ACID	307-24-4	0.051	0.020	0.0046	ug/L			
PERFLUORONONANOIC ACID	375-95-1	0.024	0.020	0.0046	ug/L		J	17
PERFLUOROOCTANE SULFONAMIDE	754-91-6	0.0084	0.020	0.0058	ug/L	J	J	
PERFLUOROOCTANE SULFONATE	1763-23-1	0.39	0.020	0.0033	ug/L		J	17
PERFLUOROOCTANOIC ACID	335-67-1	0.090	0.020	0.0053	ug/L		J	17
PERFLUOROPENTANOIC ACID	2706-90-3	0.057	0.020	0.0036	ug/L			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.0052	0.020	0.0052	ug/L	U	UJ	10A
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.0032	0.020	0.0032	ug/L	U	UJ	10A
PERFLUOROUNDECANOIC ACID	2058-94-8	0.0042	0.020	0.0037	ug/L	J	J	

Analysis Method EPA 537 m

Sample Name MALMS02-004-SW-901 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: DGR815 **Sample Date/Time:** 2016-10-12 16:30 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	0.014	0.020	0.0065	ug/L	J	J	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	0.020	0.020	0.0055	ug/L	J	J	
PERFLUOROBUTANE SULFONATE	375-73-5	0.0090	0.020	0.0019	ug/L	J	J	
PERFLUOROBUTANOIC ACID	375-22-4	0.019	0.020	0.0066	ug/L	J	J	
PERFLUORODECANE SULFONATE	335-77-3	<0.0043	0.020	0.0043	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.0066	0.020	0.0066	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.0057	0.020	0.0057	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.069	0.020	0.0047	ug/L			
PERFLUOROHEXANE SULFONATE	108427-53-8	0.092	0.020	0.0040	ug/L		J	17
PERFLUOROHEXANOIC ACID	307-24-4	0.048	0.020	0.0046	ug/L			
PERFLUORONONANOIC ACID	375-95-1	0.024	0.020	0.0046	ug/L		J	17
PERFLUOROOCTANE SULFONAMIDE	754-91-6	0.0066	0.020	0.0058	ug/L	J	J	
PERFLUOROOCTANE SULFONATE	1763-23-1	0.43	0.020	0.0033	ug/L		J	17
PERFLUOROOCTANOIC ACID	335-67-1	0.092	0.020	0.0053	ug/L		J	17
PERFLUOROPENTANOIC ACID	2706-90-3	0.058	0.020	0.0036	ug/L			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.0052	0.020	0.0052	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.0032	0.020	0.0032	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.0037	0.020	0.0037	ug/L	U	U	

Analysis Method EPA 537 m

Sample Name MALMS02-005-SD-001 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: DGR810 **Sample Date/Time:** 2016-10-12 16:00 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.48	1.9	0.48	ug/kg	U	UJ	07A
8:2 FLUOROTELOMER SULFONATE	39108-34-4	1.2	1.9	0.40	ug/kg	J	J	07A
PERFLUOROBUTANE SULFONATE	375-73-5	<0.48	1.9	0.48	ug/kg	U	UJ	07A
PERFLUOROBUTANOIC ACID	375-22-4	<0.44	1.9	0.44	ug/kg	U	UJ	07A
PERFLUORODECANE SULFONATE	335-77-3	1.5	1.9	0.38	ug/kg	J	J	07A
PERFLUORODECANOIC ACID	335-76-2	0.99	1.9	0.53	ug/kg	J	J	07A
PERFLUORODODECANOIC ACID	307-55-1	<0.46	1.9	0.46	ug/kg	U	UJ	07A
PERFLUOROHEPTANOIC ACID	375-85-9	0.74	1.9	0.34	ug/kg	J	J	07A
PERFLUOROHEXANE SULFONATE	108427-53-8	1.8	1.9	0.36	ug/kg	J	J	07A
PERFLUOROHEXANOIC ACID	307-24-4	0.75	1.9	0.40	ug/kg	J	J	07A
PERFLUORONONANOIC ACID	375-95-1	2.4	1.9	0.27	ug/kg		J	07A
PERFLUOROOCTANE SULFONAMIDE	754-91-6	0.75	1.9	0.32	ug/kg	J	J	07A
PERFLUOROOCTANE SULFONATE	1763-23-1	46	1.9	0.30	ug/kg		J	07A
PERFLUOROOCTANOIC ACID	335-67-1	2.0	1.9	0.23	ug/kg		J	07A
PERFLUOROPENTANOIC ACID	2706-90-3	0.83	1.9	0.40	ug/kg	J	J	07A
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.42	1.9	0.42	ug/kg	U	UJ	07A
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.48	1.9	0.48	ug/kg	U	UJ	07A
PERFLUOROUNDECANOIC ACID	2058-94-8	0.64	1.9	0.49	ug/kg	J	J	07A

Analysis Method EPA 537 m

Sample Name MALMS02-005-SW-001 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: DGR811 **Sample Date/Time:** 2016-10-12 16:00 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	0.017	0.020	0.0065	ug/L	J	J	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	0.026	0.020	0.0055	ug/L			
PERFLUOROBUTANE SULFONATE	375-73-5	0.0086	0.020	0.0019	ug/L	J	J	
PERFLUOROBUTANOIC ACID	375-22-4	0.018	0.020	0.0066	ug/L	J	J	
PERFLUORODECANE SULFONATE	335-77-3	<0.0043	0.020	0.0043	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.0066	0.020	0.0066	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.0057	0.020	0.0057	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.070	0.020	0.0047	ug/L			
PERFLUOROHEXANE SULFONATE	108427-53-8	0.092	0.020	0.0040	ug/L			
PERFLUOROHEXANOIC ACID	307-24-4	0.048	0.020	0.0046	ug/L			
PERFLUORONONANOIC ACID	375-95-1	0.021	0.020	0.0046	ug/L			
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.0058	0.020	0.0058	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	0.47	0.020	0.0033	ug/L			
PERFLUOROOCTANOIC ACID	335-67-1	0.080	0.020	0.0053	ug/L			
PERFLUOROPENTANOIC ACID	2706-90-3	0.057	0.020	0.0036	ug/L			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.0052	0.020	0.0052	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.0032	0.020	0.0032	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.0037	0.020	0.0037	ug/L	U	U	

Analysis Method EPA 537 m

Sample Name MALMS02-RS-001 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: DGR806 **Sample Date/Time:** 2016-10-11 16:15 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.0065	0.020	0.0065	ug/L	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.0055	0.020	0.0055	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	375-73-5	<0.0019	0.020	0.0019	ug/L	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.0066	0.020	0.0066	ug/L	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.0043	0.020	0.0043	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.0066	0.020	0.0066	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.0057	0.020	0.0057	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.0047	0.020	0.0047	ug/L	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.0040	0.020	0.0040	ug/L	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.0046	0.020	0.0046	ug/L	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.0046	0.020	0.0046	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.0058	0.020	0.0058	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.0033	0.020	0.0033	ug/L	U	U	
PERFLUOROOCTANOIC ACID	335-67-1	<0.0053	0.020	0.0053	ug/L	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.0036	0.020	0.0036	ug/L	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.0052	0.020	0.0052	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.0032	0.020	0.0032	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	0.0037	0.020	0.0037	ug/L	J	J	

Analysis Method EPA 537 m

Sample Name MALMS02-SB-001 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: DGR816 **Sample Date/Time:** 2016-10-13 09:30 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.0065	0.020	0.0065	ug/L	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.0055	0.020	0.0055	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	375-73-5	<0.0019	0.020	0.0019	ug/L	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.0066	0.020	0.0066	ug/L	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.0043	0.020	0.0043	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.0066	0.020	0.0066	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.0057	0.020	0.0057	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.0047	0.020	0.0047	ug/L	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.0040	0.020	0.0040	ug/L	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.0046	0.020	0.0046	ug/L	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.0046	0.020	0.0046	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.0058	0.020	0.0058	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	0.0062	0.020	0.0033	ug/L	J	J	
PERFLUOROOCTANOIC ACID	335-67-1	<0.0053	0.020	0.0053	ug/L	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.0036	0.020	0.0036	ug/L	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.0052	0.020	0.0052	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.0032	0.020	0.0032	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.0037	0.020	0.0037	ug/L	U	U	

Analysis Method EPA 537 m

Sample Name MALMS05-001-SO-007 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: DGR840 **Sample Date/Time:** 2016-10-16 12:20 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.30	1.2	0.30	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.25	1.2	0.25	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	375-73-5	<0.30	1.2	0.30	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	0.45	1.2	0.28	ug/kg	J	J	
PERFLUORODECANE SULFONATE	335-77-3	<0.24	1.2	0.24	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.34	1.2	0.34	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.29	1.2	0.29	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.22	1.2	0.22	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.23	1.2	0.23	ug/kg	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	0.29	1.2	0.25	ug/kg	J	J	
PERFLUORONONANOIC ACID	375-95-1	<0.17	1.2	0.17	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.20	1.2	0.20	ug/kg	U	UJ	07A
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.19	1.2	0.19	ug/kg	U	U	
PERFLUOROOCTANOIC ACID	335-67-1	<0.14	1.2	0.14	ug/kg	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.25	1.2	0.25	ug/kg	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.26	1.2	0.26	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.30	1.2	0.30	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.31	1.2	0.31	ug/kg	U	U	

Analysis Method EPA 537 m

Sample Name MALMS05-001-SS-001 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: DGR839 **Sample Date/Time:** 2016-10-16 11:04 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.25	1.0	0.25	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.21	1.0	0.21	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	375-73-5	<0.25	1.0	0.25	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	0.89	1.0	0.23	ug/kg	J	J	
PERFLUORODECANE SULFONATE	335-77-3	<0.20	1.0	0.20	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.28	1.0	0.28	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.24	1.0	0.24	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.18	1.0	0.18	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	1.4	1.0	0.19	ug/kg			
PERFLUOROHEXANOIC ACID	307-24-4	0.51	1.0	0.21	ug/kg	J	J	
PERFLUORONONANOIC ACID	375-95-1	1.2	1.0	0.14	ug/kg			
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.17	1.0	0.17	ug/kg	U	UJ	07A
PERFLUOROOCTANE SULFONATE	1763-23-1	12	1.0	0.16	ug/kg			
PERFLUOROOCTANOIC ACID	335-67-1	1.1	1.0	0.12	ug/kg			
PERFLUOROPENTANOIC ACID	2706-90-3	0.84	1.0	0.21	ug/kg	J	J	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.22	1.0	0.22	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.25	1.0	0.25	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	0.28	1.0	0.26	ug/kg	J	J	

Analysis Method EPA 537 m

Sample Name MALMS05-002-SO-011 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: DGR843 **Sample Date/Time:** 2016-10-17 10:45 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.28	1.1	0.28	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.23	1.1	0.23	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	375-73-5	<0.28	1.1	0.28	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.25	1.1	0.25	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.22	1.1	0.22	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.31	1.1	0.31	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.26	1.1	0.26	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.20	1.1	0.20	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	0.80	1.1	0.21	ug/kg	J	J	
PERFLUOROHEXANOIC ACID	307-24-4	0.30	1.1	0.23	ug/kg	J	J	
PERFLUORONONANOIC ACID	375-95-1	<0.15	1.1	0.15	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.19	1.1	0.19	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	1.1	1.1	0.18	ug/kg	J	J	
PERFLUOROOCTANOIC ACID	335-67-1	<0.13	1.1	0.13	ug/kg	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.23	1.1	0.23	ug/kg	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.24	1.1	0.24	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.28	1.1	0.28	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.29	1.1	0.29	ug/kg	U	U	

Analysis Method EPA 537 m

Sample Name MALMS05-002-SS-001 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: DGR841 **Sample Date/Time:** 2016-10-17 08:11 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.25	1.0	0.25	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.21	1.0	0.21	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	375-73-5	<0.25	1.0	0.25	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	0.74	1.0	0.23	ug/kg	J	J	
PERFLUORODECANE SULFONATE	335-77-3	<0.20	1.0	0.20	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.28	1.0	0.28	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.24	1.0	0.24	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.28	1.0	0.18	ug/kg	J	J	
PERFLUOROHEXANE SULFONATE	108427-53-8	0.78	1.0	0.19	ug/kg	J	J	
PERFLUOROHEXANOIC ACID	307-24-4	0.40	1.0	0.21	ug/kg	J	J	
PERFLUORONONANOIC ACID	375-95-1	0.47	1.0	0.14	ug/kg	J	J	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.17	1.0	0.17	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	4.1	1.0	0.16	ug/kg			
PERFLUOROOCTANOIC ACID	335-67-1	0.87	1.0	0.12	ug/kg	J	J	
PERFLUOROPENTANOIC ACID	2706-90-3	0.59	1.0	0.21	ug/kg	J	J	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.22	1.0	0.22	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.25	1.0	0.25	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	0.28	1.0	0.26	ug/kg	J	J	

Analysis Method EPA 537 m

Sample Name MALMS06-ST05MW4-009 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: DGR835 **Sample Date/Time:** 2016-10-13 14:06 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.0065	0.020	0.0065	ug/L	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.0055	0.020	0.0055	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	375-73-5	0.047	0.020	0.0019	ug/L			
PERFLUOROBUTANOIC ACID	375-22-4	0.021	0.020	0.0066	ug/L		J	10A
PERFLUORODECANE SULFONATE	335-77-3	<0.0043	0.020	0.0043	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.0066	0.020	0.0066	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.0057	0.020	0.0057	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.019	0.020	0.0047	ug/L	J	J	
PERFLUOROHEXANE SULFONATE	108427-53-8	0.33	0.020	0.0040	ug/L			
PERFLUOROHEXANOIC ACID	307-24-4	0.13	0.020	0.0046	ug/L			
PERFLUORONONANOIC ACID	375-95-1	<0.0046	0.020	0.0046	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.0058	0.020	0.0058	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	0.23	0.020	0.0033	ug/L			
PERFLUOROOCTANOIC ACID	335-67-1	0.16	0.020	0.0053	ug/L			
PERFLUOROPENTANOIC ACID	2706-90-3	0.035	0.020	0.0036	ug/L			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.0052	0.020	0.0052	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.0032	0.020	0.0032	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.0037	0.020	0.0037	ug/L	U	U	

Analysis Method EPA 537 m

Sample Name MALMS05-ST05MW5-002 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: DGR836 **Sample Date/Time:** 2016-10-13 15:36 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.0065	0.020	0.0065	ug/L	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.0055	0.020	0.0055	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	375-73-5	0.025	0.020	0.0019	ug/L			
PERFLUOROBUTANOIC ACID	375-22-4	0.027	0.020	0.0066	ug/L			
PERFLUORODECANE SULFONATE	335-77-3	<0.0043	0.020	0.0043	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.0066	0.020	0.0066	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.0057	0.020	0.0057	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.031	0.020	0.0047	ug/L			
PERFLUOROHEXANE SULFONATE	108427-53-8	0.25	0.020	0.0040	ug/L			
PERFLUOROHEXANOIC ACID	307-24-4	0.051	0.020	0.0046	ug/L			
PERFLUORONONANOIC ACID	375-95-1	<0.0046	0.020	0.0046	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.0058	0.020	0.0058	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	0.19	0.020	0.0033	ug/L			
PERFLUOROOCTANOIC ACID	335-67-1	0.053	0.020	0.0053	ug/L			
PERFLUOROPENTANOIC ACID	2706-90-3	0.046	0.020	0.0036	ug/L			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.0052	0.020	0.0052	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.0032	0.020	0.0032	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.0037	0.020	0.0037	ug/L	U	U	

Analysis Method EPA 537 m

Sample Name MALMS06-PH3MW1-019 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: DGR838 **Sample Date/Time:** 2016-10-14 10:50 **Validation Level:** Stage 4

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.0065	0.020	0.0065	ug/L	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.0055	0.020	0.0055	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	375-73-5	0.18	0.020	0.0019	ug/L			
PERFLUOROBUTANOIC ACID	375-22-4	0.13	0.020	0.0066	ug/L		J	10A
PERFLUORODECANE SULFONATE	335-77-3	<0.0043	0.020	0.0043	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.0066	0.020	0.0066	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.0057	0.020	0.0057	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.047	0.020	0.0047	ug/L			
PERFLUOROHEXANE SULFONATE	108427-53-8	0.98	0.020	0.0040	ug/L			
PERFLUOROHEXANOIC ACID	307-24-4	0.71	0.020	0.0046	ug/L			
PERFLUORONONANOIC ACID	375-95-1	<0.0046	0.020	0.0046	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.0058	0.020	0.0058	ug/L	U	UJ	07A
PERFLUOROOCTANE SULFONATE	1763-23-1	0.022	0.020	0.0033	ug/L			
PERFLUOROOCTANOIC ACID	335-67-1	0.29	0.020	0.0053	ug/L			
PERFLUOROPENTANOIC ACID	2706-90-3	0.17	0.020	0.0036	ug/L			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.0052	0.020	0.0052	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.0032	0.020	0.0032	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.0037	0.020	0.0037	ug/L	U	U	

Analysis Method EPA 537 m

Sample Name MALMS06-PH3MW2-009 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: DGR832 **Sample Date/Time:** 2016-10-13 10:26 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.065	0.20	0.065	ug/L	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.055	0.20	0.055	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	375-73-5	0.80	0.20	0.019	ug/L			
PERFLUOROBUTANOIC ACID	375-22-4	0.32	0.20	0.066	ug/L			
PERFLUORODECANE SULFONATE	335-77-3	<0.043	0.20	0.043	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.066	0.20	0.066	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.057	0.20	0.057	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.32	0.20	0.047	ug/L			
PERFLUOROHEXANE SULFONATE	108427-53-8	14	1.0	0.20	ug/L			
PERFLUOROHEXANOIC ACID	307-24-4	1.5	0.20	0.046	ug/L			
PERFLUORONONANOIC ACID	375-95-1	<0.046	0.20	0.046	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.058	0.20	0.058	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	0.93	0.20	0.033	ug/L			
PERFLUOROOCTANOIC ACID	335-67-1	2.9	0.20	0.053	ug/L			
PERFLUOROPENTANOIC ACID	2706-90-3	0.58	0.20	0.036	ug/L			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.052	0.20	0.052	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.032	0.20	0.032	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	0.037	0.20	0.037	ug/L	J	J	

Analysis Method EPA 537 m

Sample Name MALMS06-PH3MW4-009 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: DGR833 **Sample Date/Time:** 2016-10-13 11:41 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.0065	0.020	0.0065	ug/L	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.0055	0.020	0.0055	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	375-73-5	0.60	0.020	0.0019	ug/L			
PERFLUOROBUTANOIC ACID	375-22-4	0.26	0.020	0.0066	ug/L		J	10A
PERFLUORODECANE SULFONATE	335-77-3	<0.0043	0.020	0.0043	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.0066	0.020	0.0066	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.0057	0.020	0.0057	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.25	0.020	0.0047	ug/L			
PERFLUOROHEXANE SULFONATE	108427-53-8	2.9	0.20	0.040	ug/L			
PERFLUOROHEXANOIC ACID	307-24-4	1.5	0.20	0.046	ug/L			
PERFLUORONONANOIC ACID	375-95-1	<0.0046	0.020	0.0046	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.0058	0.020	0.0058	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	0.021	0.020	0.0033	ug/L			
PERFLUOROOCTANOIC ACID	335-67-1	0.54	0.020	0.0053	ug/L			
PERFLUOROPENTANOIC ACID	2706-90-3	0.66	0.020	0.0036	ug/L			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.0052	0.020	0.0052	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.0032	0.020	0.0032	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.0037	0.020	0.0037	ug/L	U	U	

Analysis Method EPA 537 m

Sample Name MALMS06-PH3MW5-008 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: DGR834 **Sample Date/Time:** 2016-10-13 12:33 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.065	0.20	0.065	ug/L	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.055	0.20	0.055	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	375-73-5	1.0	0.20	0.019	ug/L			
PERFLUOROBUTANOIC ACID	375-22-4	0.29	0.20	0.066	ug/L			
PERFLUORODECANE SULFONATE	335-77-3	<0.043	0.20	0.043	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.066	0.20	0.066	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.057	0.20	0.057	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.46	0.20	0.047	ug/L			
PERFLUOROHEXANE SULFONATE	108427-53-8	13	1.0	0.20	ug/L			
PERFLUOROHEXANOIC ACID	307-24-4	1.9	0.20	0.046	ug/L			
PERFLUORONONANOIC ACID	375-95-1	<0.046	0.20	0.046	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.058	0.20	0.058	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	0.23	0.20	0.033	ug/L			
PERFLUOROOCTANOIC ACID	335-67-1	5.5	0.20	0.053	ug/L			
PERFLUOROPENTANOIC ACID	2706-90-3	0.56	0.20	0.036	ug/L			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.052	0.20	0.052	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.032	0.20	0.032	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.037	0.20	0.037	ug/L	U	U	

Analysis Method EPA 537 m

Sample Name MALMS-RS-002 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: DGR830 **Sample Date/Time:** 2016-10-12 14:40 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.0065	0.020	0.0065	ug/L	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.0055	0.020	0.0055	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	375-73-5	<0.0019	0.020	0.0019	ug/L	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.0066	0.020	0.0066	ug/L	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.0043	0.020	0.0043	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.0066	0.020	0.0066	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.0057	0.020	0.0057	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.0047	0.020	0.0047	ug/L	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.0040	0.020	0.0040	ug/L	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.0046	0.020	0.0046	ug/L	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.0046	0.020	0.0046	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.0058	0.020	0.0058	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.0033	0.020	0.0033	ug/L	U	U	
PERFLUOROOCTANOIC ACID	335-67-1	<0.0053	0.020	0.0053	ug/L	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.0036	0.020	0.0036	ug/L	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.0052	0.020	0.0052	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.0032	0.020	0.0032	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.0037	0.020	0.0037	ug/L	U	U	

Analysis Method EPA 537 m

Sample Name MALMS-RS-003 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: DGR831 **Sample Date/Time:** 2016-10-13 10:55 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.0065	0.020	0.0065	ug/L	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.0055	0.020	0.0055	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	375-73-5	<0.0019	0.020	0.0019	ug/L	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.0066	0.020	0.0066	ug/L	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.0043	0.020	0.0043	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.0066	0.020	0.0066	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.0057	0.020	0.0057	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.0047	0.020	0.0047	ug/L	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.0040	0.020	0.0040	ug/L	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.0046	0.020	0.0046	ug/L	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.0046	0.020	0.0046	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.0058	0.020	0.0058	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.0033	0.020	0.0033	ug/L	U	U	
PERFLUOROOCTANOIC ACID	335-67-1	<0.0053	0.020	0.0053	ug/L	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.0036	0.020	0.0036	ug/L	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.0052	0.020	0.0052	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.0032	0.020	0.0032	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	0.0039	0.020	0.0037	ug/L	J	J	

Analysis Method EPA 537 m

Sample Name MALMS-RS-004 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: DGR837 **Sample Date/Time:** 2016-10-14 10:35 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.0065	0.020	0.0065	ug/L	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.0055	0.020	0.0055	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	375-73-5	<0.0019	0.020	0.0019	ug/L	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.0066	0.020	0.0066	ug/L	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.0043	0.020	0.0043	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.0066	0.020	0.0066	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.0057	0.020	0.0057	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.0047	0.020	0.0047	ug/L	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.0040	0.020	0.0040	ug/L	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.0046	0.020	0.0046	ug/L	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.0046	0.020	0.0046	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.0058	0.020	0.0058	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.0033	0.020	0.0033	ug/L	U	U	
PERFLUOROOCTANOIC ACID	335-67-1	<0.0053	0.020	0.0053	ug/L	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.0036	0.020	0.0036	ug/L	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.0052	0.020	0.0052	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.0032	0.020	0.0032	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.0037	0.020	0.0037	ug/L	U	U	

Analysis Method EPA 537 m

Sample Name MALMS-RS-006 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: DGR828 **Sample Date/Time:** 2016-10-16 11:00 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.0065	0.020	0.0065	ug/L	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.0055	0.020	0.0055	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	375-73-5	<0.0019	0.020	0.0019	ug/L	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.0066	0.020	0.0066	ug/L	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.0043	0.020	0.0043	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.0066	0.020	0.0066	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.0057	0.020	0.0057	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.0047	0.020	0.0047	ug/L	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.0040	0.020	0.0040	ug/L	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.0046	0.020	0.0046	ug/L	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.0046	0.020	0.0046	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.0058	0.020	0.0058	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	0.0046	0.020	0.0033	ug/L	J	J	
PERFLUOROOCTANOIC ACID	335-67-1	<0.0053	0.020	0.0053	ug/L	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.0036	0.020	0.0036	ug/L	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.0052	0.020	0.0052	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.0032	0.020	0.0032	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.0037	0.020	0.0037	ug/L	U	U	

Analysis Method EPA 537 m

Sample Name MALMS-RS-007 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: DGR842 **Sample Date/Time:** 2016-10-17 09:53 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.0065	0.020	0.0065	ug/L	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.0055	0.020	0.0055	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	375-73-5	<0.0019	0.020	0.0019	ug/L	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.0066	0.020	0.0066	ug/L	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.0043	0.020	0.0043	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.0066	0.020	0.0066	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.0057	0.020	0.0057	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.0047	0.020	0.0047	ug/L	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.0040	0.020	0.0040	ug/L	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.0046	0.020	0.0046	ug/L	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.0046	0.020	0.0046	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.0058	0.020	0.0058	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.0033	0.020	0.0033	ug/L	U	U	
PERFLUOROOCTANOIC ACID	335-67-1	<0.0053	0.020	0.0053	ug/L	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.0036	0.020	0.0036	ug/L	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.0052	0.020	0.0052	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.0032	0.020	0.0032	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.0037	0.020	0.0037	ug/L	U	U	

Validated Sample Result Forms: B6M8709

Analysis Method *EPA 537 m*

Sample Name MALMS03-001-SO-020 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: DHK769 **Sample Date/Time:** 2016-10-19 13:18 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.24	0.95	0.24	ug/kg	U	UJ	07A
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.20	0.95	0.20	ug/kg	U	UJ	07A
PERFLUOROBUTANE SULFONATE	375-73-5	<0.24	0.95	0.24	ug/kg	U	UJ	07A
PERFLUOROBUTANOIC ACID	375-22-4	<0.22	0.95	0.22	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.19	0.95	0.19	ug/kg	U	UJ	07A
PERFLUORODECANOIC ACID	335-76-2	<0.27	0.95	0.27	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.23	0.95	0.23	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.17	0.95	0.17	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.18	0.95	0.18	ug/kg	U	UJ	07A
PERFLUOROHEXANOIC ACID	307-24-4	<0.20	0.95	0.20	ug/kg	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.13	0.95	0.13	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.16	0.95	0.16	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	0.36	0.95	0.15	ug/kg	J	J	07A
PERFLUOROOCTANOIC ACID	335-67-1	<0.11	0.95	0.11	ug/kg	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.20	0.95	0.20	ug/kg	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.21	0.95	0.21	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.24	0.95	0.24	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.25	0.95	0.25	ug/kg	U	U	

Analysis Method EPA 537 m

Sample Name MALMS03-002-SO-020 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: DHK772 **Sample Date/Time:** 2016-10-20 15:20 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.24	0.94	0.24	ug/kg	U	UJ	07A
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.20	0.94	0.20	ug/kg	U	UJ	07A
PERFLUOROBUTANE SULFONATE	375-73-5	<0.24	0.94	0.24	ug/kg	U	UJ	07A
PERFLUOROBUTANOIC ACID	375-22-4	0.45	0.94	0.22	ug/kg	J	J	
PERFLUORODECANE SULFONATE	335-77-3	<0.19	0.94	0.19	ug/kg	U	UJ	07A
PERFLUORODECANOIC ACID	335-76-2	<0.26	0.94	0.26	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.23	0.94	0.23	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.17	0.94	0.17	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.18	0.94	0.18	ug/kg	U	UJ	07A
PERFLUOROHEXANOIC ACID	307-24-4	<0.20	0.94	0.20	ug/kg	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.13	0.94	0.13	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.16	0.94	0.16	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	0.32	0.94	0.15	ug/kg	J	J	07A
PERFLUOROOCTANOIC ACID	335-67-1	<0.11	0.94	0.11	ug/kg	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.20	0.94	0.20	ug/kg	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.21	0.94	0.21	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.24	0.94	0.24	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.24	0.94	0.24	ug/kg	U	U	

Analysis Method EPA 537 m

Sample Name MALMS03-003-SO-009 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: DHK771 **Sample Date/Time:** 2016-10-19 16:25 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.30	1.2	0.30	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.25	1.2	0.25	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	375-73-5	<0.30	1.2	0.30	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.28	1.2	0.28	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.24	1.2	0.24	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.34	1.2	0.34	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.29	1.2	0.29	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.22	1.2	0.22	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.23	1.2	0.23	ug/kg	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.25	1.2	0.25	ug/kg	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.17	1.2	0.17	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.20	1.2	0.20	ug/kg	U	UJ	07A
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.19	1.2	0.19	ug/kg	U	U	
PERFLUOROOCTANOIC ACID	335-67-1	<0.14	1.2	0.14	ug/kg	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.25	1.2	0.25	ug/kg	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.26	1.2	0.26	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.30	1.2	0.30	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.31	1.2	0.31	ug/kg	U	U	

Analysis Method EPA 537 m

Sample Name MALMS03-004-SD-001 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: DHK775 **Sample Date/Time:** 2016-10-21 08:05 **Validation Level:** Stage 4

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.30	1.2	0.30	ug/kg	U	UJ	07A
8:2 FLUOROTELOMER SULFONATE	39108-34-4	0.88	1.2	0.25	ug/kg	J	J	07A
PERFLUOROBUTANE SULFONATE	375-73-5	<0.30	1.2	0.30	ug/kg	U	UJ	07A
PERFLUOROBUTANOIC ACID	375-22-4	<0.28	1.2	0.28	ug/kg	U	UJ	07A
PERFLUORODECANE SULFONATE	335-77-3	<0.24	1.2	0.24	ug/kg	U	UJ	07A
PERFLUORODECANOIC ACID	335-76-2	<0.34	1.2	0.34	ug/kg	U	UJ	07A
PERFLUORODODECANOIC ACID	307-55-1	<0.29	1.2	0.29	ug/kg	U	UJ	07A
PERFLUOROHEPTANOIC ACID	375-85-9	<0.22	1.2	0.22	ug/kg	U	UJ	07A
PERFLUOROHEXANE SULFONATE	108427-53-8	0.62	1.2	0.23	ug/kg	J	J	07A
PERFLUOROHEXANOIC ACID	307-24-4	<0.25	1.2	0.25	ug/kg	U	UJ	07A
PERFLUORONONANOIC ACID	375-95-1	<0.17	1.2	0.17	ug/kg	U	UJ	07A
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.20	1.2	0.20	ug/kg	U	UJ	07A
PERFLUOROOCTANE SULFONATE	1763-23-1	4.8	1.2	0.19	ug/kg		J	07A
PERFLUOROOCTANOIC ACID	335-67-1	0.28	1.2	0.14	ug/kg	J	J	07A
PERFLUOROPENTANOIC ACID	2706-90-3	<0.25	1.2	0.25	ug/kg	U	UJ	07A
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.26	1.2	0.26	ug/kg	U	UJ	07A
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.30	1.2	0.30	ug/kg	U	UJ	07A
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.31	1.2	0.31	ug/kg	U	UJ	07A

Analysis Method EPA 537 m

Sample Name MALMS03-004-SW-001 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: DHK776 **Sample Date/Time:** 2016-10-21 08:07 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	0.16	0.020	0.0065	ug/L		J	04C
8:2 FLUOROTELOMER SULFONATE	39108-34-4	0.031	0.020	0.0055	ug/L			
PERFLUOROBUTANE SULFONATE	375-73-5	0.057	0.020	0.0019	ug/L			
PERFLUOROBUTANOIC ACID	375-22-4	0.046	0.020	0.0066	ug/L			
PERFLUORODECANE SULFONATE	335-77-3	<0.0043	0.020	0.0043	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.0066	0.020	0.0066	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.0057	0.020	0.0057	ug/L	U	UJ	04C
PERFLUOROHEPTANOIC ACID	375-85-9	0.057	0.020	0.0047	ug/L			
PERFLUOROHEXANE SULFONATE	108427-53-8	0.35	0.020	0.0040	ug/L			
PERFLUOROHEXANOIC ACID	307-24-4	0.15	0.020	0.0046	ug/L			
PERFLUORONONANOIC ACID	375-95-1	0.0061	0.020	0.0046	ug/L	J	J	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	0.0067	0.020	0.0058	ug/L	J	J	
PERFLUOROOCTANE SULFONATE	1763-23-1	0.46	0.020	0.0033	ug/L			
PERFLUOROOCTANOIC ACID	335-67-1	0.10	0.020	0.0053	ug/L			
PERFLUOROPENTANOIC ACID	2706-90-3	0.15	0.020	0.0036	ug/L			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.0052	0.020	0.0052	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	0.0062	0.020	0.0032	ug/L	J	J	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.0037	0.020	0.0037	ug/L	U	U	

Analysis Method EPA 537 m

Sample Name MALMS04-001-GW-005 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: DHK802 **Sample Date/Time:** 2016-10-21 14:14 **Validation Level:** Stage 4

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.0065	0.020	0.0065	ug/L	U	UJ	04C
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.0055	0.020	0.0055	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	375-73-5	0.17	0.020	0.0019	ug/L			
PERFLUOROBUTANOIC ACID	375-22-4	0.059	0.020	0.0066	ug/L			
PERFLUORODECANE SULFONATE	335-77-3	<0.0043	0.020	0.0043	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.0066	0.020	0.0066	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.0057	0.020	0.0057	ug/L	U	UJ	04C
PERFLUOROHEPTANOIC ACID	375-85-9	0.067	0.020	0.0047	ug/L			
PERFLUOROHEXANE SULFONATE	108427-53-8	1.0	0.10	0.020	ug/L			
PERFLUOROHEXANOIC ACID	307-24-4	0.28	0.020	0.0046	ug/L			
PERFLUORONONANOIC ACID	375-95-1	<0.0046	0.020	0.0046	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.0058	0.020	0.0058	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	0.010	0.020	0.0033	ug/L	J	J	
PERFLUOROOCTANOIC ACID	335-67-1	0.45	0.020	0.0053	ug/L			
PERFLUOROPENTANOIC ACID	2706-90-3	0.095	0.020	0.0036	ug/L			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.0052	0.020	0.0052	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.0032	0.020	0.0032	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.0037	0.020	0.0037	ug/L	U	U	

Analysis Method EPA 537 m

Sample Name MALMS04-002-SO-002 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: DHK768 **Sample Date/Time:** 2016-10-18 13:05 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.24	0.94	0.24	ug/kg	U	UJ	07A
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.20	0.94	0.20	ug/kg	U	UJ	07A
PERFLUOROBUTANE SULFONATE	375-73-5	<0.24	0.94	0.24	ug/kg	U	UJ	07A
PERFLUOROBUTANOIC ACID	375-22-4	<0.22	0.94	0.22	ug/kg	U	UJ	07A
PERFLUORODECANE SULFONATE	335-77-3	<0.19	0.94	0.19	ug/kg	U	UJ	07A
PERFLUORODECANOIC ACID	335-76-2	<0.26	0.94	0.26	ug/kg	U	UJ	07A
PERFLUORODODECANOIC ACID	307-55-1	<0.23	0.94	0.23	ug/kg	U	UJ	07A
PERFLUOROHEPTANOIC ACID	375-85-9	<0.17	0.94	0.17	ug/kg	U	UJ	07A
PERFLUOROHEXANE SULFONATE	108427-53-8	0.52	0.94	0.18	ug/kg	J	J	07A
PERFLUOROHEXANOIC ACID	307-24-4	<0.20	0.94	0.20	ug/kg	U	UJ	07A
PERFLUORONONANOIC ACID	375-95-1	<0.13	0.94	0.13	ug/kg	U	UJ	07A
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.16	0.94	0.16	ug/kg	U	UJ	07A
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.15	0.94	0.15	ug/kg	U	UJ	07A
PERFLUOROOCTANOIC ACID	335-67-1	0.23	0.94	0.11	ug/kg	J	J	07A
PERFLUOROPENTANOIC ACID	2706-90-3	<0.20	0.94	0.20	ug/kg	U	UJ	07A
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.21	0.94	0.21	ug/kg	U	UJ	07A
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.24	0.94	0.24	ug/kg	U	UJ	07A
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.24	0.94	0.24	ug/kg	U	UJ	07A

Analysis Method EPA 537 m

Sample Name MALMS04-001-SO-004 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: DHK766 **Sample Date/Time:** 2016-10-18 09:58 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.24	0.95	0.24	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.20	0.95	0.20	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	375-73-5	<0.24	0.95	0.24	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.22	0.95	0.22	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.19	0.95	0.19	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.27	0.95	0.27	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.23	0.95	0.23	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.32	0.95	0.17	ug/kg	J	J	
PERFLUOROHEXANE SULFONATE	108427-53-8	3.9	0.95	0.18	ug/kg			
PERFLUOROHEXANOIC ACID	307-24-4	0.51	0.95	0.20	ug/kg	J	J	
PERFLUORONONANOIC ACID	375-95-1	0.26	0.95	0.13	ug/kg	J	J	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.16	0.95	0.16	ug/kg	U	UJ	07A
PERFLUOROOCTANE SULFONATE	1763-23-1	7.8	0.95	0.15	ug/kg			
PERFLUOROOCTANOIC ACID	335-67-1	1.4	0.95	0.11	ug/kg			
PERFLUOROPENTANOIC ACID	2706-90-3	<0.20	0.95	0.20	ug/kg	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.21	0.95	0.21	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.24	0.95	0.24	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.25	0.95	0.25	ug/kg	U	U	

Analysis Method EPA 537 m

Sample Name MALMS04-001-SS-001 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: DHK765 **Sample Date/Time:** 2016-10-18 09:20 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.25	1.0	0.25	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.21	1.0	0.21	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	375-73-5	0.39	1.0	0.25	ug/kg	J	J	
PERFLUOROBUTANOIC ACID	375-22-4	0.52	1.0	0.23	ug/kg	J	J	
PERFLUORODECANE SULFONATE	335-77-3	<0.20	1.0	0.20	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.28	1.0	0.28	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.24	1.0	0.24	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.70	1.0	0.18	ug/kg	J	J	
PERFLUOROHEXANE SULFONATE	108427-53-8	11	1.0	0.19	ug/kg			
PERFLUOROHEXANOIC ACID	307-24-4	1.9	1.0	0.21	ug/kg			
PERFLUORONONANOIC ACID	375-95-1	<0.14	1.0	0.14	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.17	1.0	0.17	ug/kg	U	UJ	07A
PERFLUOROOCTANE SULFONATE	1763-23-1	3.3	1.0	0.16	ug/kg			
PERFLUOROOCTANOIC ACID	335-67-1	2.1	1.0	0.12	ug/kg			
PERFLUOROPENTANOIC ACID	2706-90-3	0.92	1.0	0.21	ug/kg	J	J	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.22	1.0	0.22	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.25	1.0	0.25	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.26	1.0	0.26	ug/kg	U	U	

Analysis Method EPA 537 m

Sample Name MALMS04-002-GW-004 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: DHK799 **Sample Date/Time:** 2016-10-21 13:13 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	0.010	0.020	0.0065	ug/L	J	J	04C
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.0055	0.020	0.0055	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	375-73-5	0.046	0.020	0.0019	ug/L			
PERFLUOROBUTANOIC ACID	375-22-4	0.035	0.020	0.0066	ug/L			
PERFLUORODECANE SULFONATE	335-77-3	<0.0043	0.020	0.0043	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.0066	0.020	0.0066	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.0057	0.020	0.0057	ug/L	U	UJ	04C
PERFLUOROHEPTANOIC ACID	375-85-9	0.042	0.020	0.0047	ug/L			
PERFLUOROHEXANE SULFONATE	108427-53-8	0.49	0.020	0.0040	ug/L			
PERFLUOROHEXANOIC ACID	307-24-4	0.11	0.020	0.0046	ug/L			
PERFLUORONONANOIC ACID	375-95-1	<0.0046	0.020	0.0046	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.0058	0.020	0.0058	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	0.036	0.020	0.0033	ug/L			
PERFLUOROOCTANOIC ACID	335-67-1	0.21	0.020	0.0053	ug/L			
PERFLUOROPENTANOIC ACID	2706-90-3	0.069	0.020	0.0036	ug/L			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.0052	0.020	0.0052	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	0.0059	0.020	0.0032	ug/L	J	J	
PERFLUOROUNDECANOIC ACID	2058-94-8	0.0055	0.020	0.0037	ug/L	J	J	

Analysis Method EPA 537 m

Sample Name MALMS04-002-GW-904 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: DHK800 **Sample Date/Time:** 2016-10-21 13:13 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.0065	0.020	0.0065	ug/L	U	UJ	04C
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.0055	0.020	0.0055	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	375-73-5	0.045	0.020	0.0019	ug/L			
PERFLUOROBUTANOIC ACID	375-22-4	0.033	0.020	0.0066	ug/L			
PERFLUORODECANE SULFONATE	335-77-3	<0.0043	0.020	0.0043	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.0066	0.020	0.0066	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.0057	0.020	0.0057	ug/L	U	UJ	04C
PERFLUOROHEPTANOIC ACID	375-85-9	0.038	0.020	0.0047	ug/L			
PERFLUOROHEXANE SULFONATE	108427-53-8	0.49	0.020	0.0040	ug/L			
PERFLUOROHEXANOIC ACID	307-24-4	0.11	0.020	0.0046	ug/L			
PERFLUORONONANOIC ACID	375-95-1	<0.0046	0.020	0.0046	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.0058	0.020	0.0058	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	0.039	0.020	0.0033	ug/L			
PERFLUOROOCTANOIC ACID	335-67-1	0.19	0.020	0.0053	ug/L			
PERFLUOROPENTANOIC ACID	2706-90-3	0.063	0.020	0.0036	ug/L			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.0052	0.020	0.0052	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	0.0060	0.020	0.0032	ug/L	J	J	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.0037	0.020	0.0037	ug/L	U	U	

Analysis Method EPA 537 m

Sample Name MALMS04-002-SS-001 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: DHK767 **Sample Date/Time:** 2016-10-18 12:57 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.23	0.93	0.23	ug/kg	U	UJ	07A
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.20	0.93	0.20	ug/kg	U	UJ	07A
PERFLUOROBUTANE SULFONATE	375-73-5	<0.23	0.93	0.23	ug/kg	U	UJ	07A
PERFLUOROBUTANOIC ACID	375-22-4	<0.21	0.93	0.21	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.19	0.93	0.19	ug/kg	U	UJ	07A
PERFLUORODECANOIC ACID	335-76-2	<0.26	0.93	0.26	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.22	0.93	0.22	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.17	0.93	0.17	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	1.8	0.93	0.18	ug/kg		J	07A
PERFLUOROHEXANOIC ACID	307-24-4	0.23	0.93	0.20	ug/kg	J	J	
PERFLUORONONANOIC ACID	375-95-1	<0.13	0.93	0.13	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.16	0.93	0.16	ug/kg	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	0.46	0.93	0.15	ug/kg	J	J	07A
PERFLUOROOCTANOIC ACID	335-67-1	0.67	0.93	0.11	ug/kg	J	J	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.20	0.93	0.20	ug/kg	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.20	0.93	0.20	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.23	0.93	0.23	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.24	0.93	0.24	ug/kg	U	U	

Analysis Method EPA 537 m

Sample Name MALMS04-003-SD-001 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: DHK797 **Sample Date/Time:** 2016-10-21 15:15 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	0.29	0.97	0.24	ug/kg	J	J	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	1.1	0.97	0.20	ug/kg			
PERFLUOROBUTANE SULFONATE	375-73-5	<0.24	0.97	0.24	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.22	0.97	0.22	ug/kg	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.19	0.97	0.19	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.27	0.97	0.27	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.23	0.97	0.23	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.17	0.97	0.17	ug/kg	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	1.2	0.97	0.18	ug/kg			
PERFLUOROHEXANOIC ACID	307-24-4	0.35	0.97	0.20	ug/kg	J	J	
PERFLUORONONANOIC ACID	375-95-1	<0.14	0.97	0.14	ug/kg	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	4.3	0.97	0.16	ug/kg		J	07A
PERFLUOROOCTANE SULFONATE	1763-23-1	10	0.97	0.16	ug/kg			
PERFLUOROOCTANOIC ACID	335-67-1	0.20	0.97	0.12	ug/kg	J	J	
PERFLUOROPENTANOIC ACID	2706-90-3	0.25	0.97	0.20	ug/kg	J	J	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.21	0.97	0.21	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.24	0.97	0.24	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.25	0.97	0.25	ug/kg	U	U	

Analysis Method EPA 537 m

Sample Name MALMS04-003-SW-001 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: DHK796 **Sample Date/Time:** 2016-10-21 15:20 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	1.1	0.10	0.033	ug/L			
8:2 FLUOROTELOMER SULFONATE	39108-34-4	0.27	0.020	0.0055	ug/L			
PERFLUOROBUTANE SULFONATE	375-73-5	0.14	0.020	0.0019	ug/L			
PERFLUOROBUTANOIC ACID	375-22-4	0.23	0.020	0.0066	ug/L			
PERFLUORODECANE SULFONATE	335-77-3	0.0057	0.020	0.0043	ug/L	J	J	
PERFLUORODECANOIC ACID	335-76-2	0.0084	0.020	0.0066	ug/L	J	J	
PERFLUORODODECANOIC ACID	307-55-1	<0.0057	0.020	0.0057	ug/L	U	UJ	04C
PERFLUOROHEPTANOIC ACID	375-85-9	0.38	0.020	0.0047	ug/L			
PERFLUOROHEXANE SULFONATE	108427-53-8	1.1	0.10	0.020	ug/L			
PERFLUOROHEXANOIC ACID	307-24-4	0.71	0.020	0.0046	ug/L			
PERFLUORONONANOIC ACID	375-95-1	0.034	0.020	0.0046	ug/L			
PERFLUOROOCTANE SULFONAMIDE	754-91-6	0.19	0.020	0.0058	ug/L			
PERFLUOROOCTANE SULFONATE	1763-23-1	1.2	0.10	0.017	ug/L			
PERFLUOROOCTANOIC ACID	335-67-1	0.49	0.020	0.0053	ug/L			
PERFLUOROPENTANOIC ACID	2706-90-3	0.83	0.020	0.0036	ug/L			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.0052	0.020	0.0052	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.0032	0.020	0.0032	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	0.0057	0.020	0.0037	ug/L	J	J	

Analysis Method EPA 537 m

Sample Name MALMS04-004-SD-001 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: DHK798 **Sample Date/Time:** 2016-10-21 15:30 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.38	1.5	0.38	ug/kg	U	UJ	07A
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.32	1.5	0.32	ug/kg	U	UJ	07A
PERFLUOROBUTANE SULFONATE	375-73-5	<0.38	1.5	0.38	ug/kg	U	UJ	07A
PERFLUOROBUTANOIC ACID	375-22-4	<0.35	1.5	0.35	ug/kg	U	UJ	07A
PERFLUORODECANE SULFONATE	335-77-3	<0.30	1.5	0.30	ug/kg	U	UJ	07A
PERFLUORODECANOIC ACID	335-76-2	<0.42	1.5	0.42	ug/kg	U	UJ	07A
PERFLUORODODECANOIC ACID	307-55-1	<0.36	1.5	0.36	ug/kg	U	UJ	07A
PERFLUOROHEPTANOIC ACID	375-85-9	<0.27	1.5	0.27	ug/kg	U	UJ	07A
PERFLUOROHEXANE SULFONATE	108427-53-8	2.6	1.5	0.29	ug/kg		J	07A
PERFLUOROHEXANOIC ACID	307-24-4	<0.32	1.5	0.32	ug/kg	U	UJ	07A
PERFLUORONONANOIC ACID	375-95-1	<0.21	1.5	0.21	ug/kg	U	UJ	07A
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.26	1.5	0.26	ug/kg	U	UJ	07A
PERFLUOROOCTANE SULFONATE	1763-23-1	2.1	1.5	0.24	ug/kg		J	07A
PERFLUOROOCTANOIC ACID	335-67-1	1.3	1.5	0.18	ug/kg	J	J	07A
PERFLUOROPENTANOIC ACID	2706-90-3	<0.32	1.5	0.32	ug/kg	U	UJ	07A
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.33	1.5	0.33	ug/kg	U	UJ	07A
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.38	1.5	0.38	ug/kg	U	UJ	07A
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.39	1.5	0.39	ug/kg	U	UJ	07A

Analysis Method EPA 537 m

Sample Name MALMS04-004-SW-001 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: DHK795 **Sample Date/Time:** 2016-10-21 15:35 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	0.010	0.020	0.0065	ug/L	J	J	04C
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.0055	0.020	0.0055	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	375-73-5	0.065	0.020	0.0019	ug/L			
PERFLUOROBUTANOIC ACID	375-22-4	0.061	0.020	0.0066	ug/L			
PERFLUORODECANE SULFONATE	335-77-3	<0.0043	0.020	0.0043	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.0066	0.020	0.0066	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.0057	0.020	0.0057	ug/L	U	UJ	04C
PERFLUOROHEPTANOIC ACID	375-85-9	0.086	0.020	0.0047	ug/L			
PERFLUOROHEXANE SULFONATE	108427-53-8	0.75	0.020	0.0040	ug/L			
PERFLUOROHEXANOIC ACID	307-24-4	0.20	0.020	0.0046	ug/L			
PERFLUORONONANOIC ACID	375-95-1	<0.0046	0.020	0.0046	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	0.013	0.020	0.0058	ug/L	J	J	
PERFLUOROOCTANE SULFONATE	1763-23-1	0.057	0.020	0.0033	ug/L			
PERFLUOROOCTANOIC ACID	335-67-1	0.32	0.020	0.0053	ug/L			
PERFLUOROPENTANOIC ACID	2706-90-3	0.16	0.020	0.0036	ug/L			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.0052	0.020	0.0052	ug/L	U	UJ	10A
PERFLUOROTRIDECANOIC ACID	72629-94-8	0.0068	0.020	0.0032	ug/L	J	J	10A
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.0037	0.020	0.0037	ug/L	U	U	

Analysis Method EPA 537 m

Sample Name MALMS-IDWSOIL-001 **Matrix Type:** S **Result Type:** TRG

Lab Sample Name: DHK777 **Sample Date/Time:** 2016-10-21 09:45 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.28	1.1	0.28	ug/kg	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.23	1.1	0.23	ug/kg	U	U	
PERFLUOROBUTANE SULFONATE	375-73-5	<0.28	1.1	0.28	ug/kg	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	0.26	1.1	0.25	ug/kg	J	J	
PERFLUORODECANE SULFONATE	335-77-3	<0.22	1.1	0.22	ug/kg	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.31	1.1	0.31	ug/kg	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.26	1.1	0.26	ug/kg	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.42	1.1	0.20	ug/kg	J	J	
PERFLUOROHEXANE SULFONATE	108427-53-8	6.1	1.1	0.21	ug/kg			
PERFLUOROHEXANOIC ACID	307-24-4	0.85	1.1	0.23	ug/kg	J	J	
PERFLUORONONANOIC ACID	375-95-1	0.16	1.1	0.15	ug/kg	J	J	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.19	1.1	0.19	ug/kg	U	UJ	07A
PERFLUOROOCTANE SULFONATE	1763-23-1	6.4	1.1	0.18	ug/kg			
PERFLUOROOCTANOIC ACID	335-67-1	1.8	1.1	0.13	ug/kg			
PERFLUOROPENTANOIC ACID	2706-90-3	<0.23	1.1	0.23	ug/kg	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.24	1.1	0.24	ug/kg	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.28	1.1	0.28	ug/kg	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.29	1.1	0.29	ug/kg	U	U	

Analysis Method EPA 537 m

Sample Name MALMS-IDWWATER-001 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: DHK803 **Sample Date/Time:** 2016-10-21 15:00 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	1.5	0.10	0.033	ug/L			
8:2 FLUOROTELOMER SULFONATE	39108-34-4	0.37	0.020	0.0055	ug/L			
PERFLUOROBUTANE SULFONATE	375-73-5	0.23	0.020	0.0019	ug/L			
PERFLUOROBUTANOIC ACID	375-22-4	0.36	0.020	0.0066	ug/L			
PERFLUORODECANE SULFONATE	335-77-3	<0.0043	0.020	0.0043	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.0066	0.020	0.0066	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.0057	0.020	0.0057	ug/L	U	UJ	04C
PERFLUOROHEPTANOIC ACID	375-85-9	0.48	0.020	0.0047	ug/L			
PERFLUOROHEXANE SULFONATE	108427-53-8	2.3	0.10	0.020	ug/L			
PERFLUOROHEXANOIC ACID	307-24-4	2.5	0.10	0.023	ug/L			
PERFLUORONONANOIC ACID	375-95-1	0.023	0.020	0.0046	ug/L			
PERFLUOROOCTANE SULFONAMIDE	754-91-6	0.81	0.020	0.0058	ug/L			
PERFLUOROOCTANE SULFONATE	1763-23-1	0.62	0.020	0.0033	ug/L			
PERFLUOROOCTANOIC ACID	335-67-1	2.1	0.10	0.027	ug/L			
PERFLUOROPENTANOIC ACID	2706-90-3	1.0	0.10	0.018	ug/L			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.0052	0.020	0.0052	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.0032	0.020	0.0032	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.0037	0.020	0.0037	ug/L	U	U	

Analysis Method EPA 537 m

Sample Name MALMS-RS-008 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: DHK764 **Sample Date/Time:** 2016-10-18 08:44 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.0065	0.020	0.0065	ug/L	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	0.0062	0.020	0.0055	ug/L	J	J	
PERFLUOROBUTANE SULFONATE	375-73-5	<0.0019	0.020	0.0019	ug/L	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	0.0070	0.020	0.0066	ug/L	J	J	
PERFLUORODECANE SULFONATE	335-77-3	<0.0043	0.020	0.0043	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.0066	0.020	0.0066	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.0057	0.020	0.0057	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.0047	0.020	0.0047	ug/L	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.0040	0.020	0.0040	ug/L	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.0046	0.020	0.0046	ug/L	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.0046	0.020	0.0046	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.0058	0.020	0.0058	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	0.017	0.020	0.0033	ug/L	J	J	
PERFLUOROOCTANOIC ACID	335-67-1	<0.0053	0.020	0.0053	ug/L	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.0036	0.020	0.0036	ug/L	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.0052	0.020	0.0052	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.0032	0.020	0.0032	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.0037	0.020	0.0037	ug/L	U	U	

Analysis Method EPA 537 m

Sample Name MALMS-RS-009 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: DHK770 **Sample Date/Time:** 2016-10-19 10:40 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.0065	0.020	0.0065	ug/L	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.0055	0.020	0.0055	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	375-73-5	<0.0019	0.020	0.0019	ug/L	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.0066	0.020	0.0066	ug/L	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.0043	0.020	0.0043	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.0066	0.020	0.0066	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.0057	0.020	0.0057	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.0047	0.020	0.0047	ug/L	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.0040	0.020	0.0040	ug/L	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.0046	0.020	0.0046	ug/L	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.0046	0.020	0.0046	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.0058	0.020	0.0058	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	0.0060	0.020	0.0033	ug/L	J	J	
PERFLUOROOCTANOIC ACID	335-67-1	<0.0053	0.020	0.0053	ug/L	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.0036	0.020	0.0036	ug/L	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.0052	0.020	0.0052	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	0.0060	0.020	0.0032	ug/L	J	J	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.0037	0.020	0.0037	ug/L	U	U	

Analysis Method EPA 537 m

Sample Name MALMS-RS-010 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: DHK773 **Sample Date/Time:** 2016-10-20 13:47 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.0065	0.020	0.0065	ug/L	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.0055	0.020	0.0055	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	375-73-5	<0.0019	0.020	0.0019	ug/L	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	0.0068	0.020	0.0066	ug/L	J	J	
PERFLUORODECANE SULFONATE	335-77-3	<0.0043	0.020	0.0043	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.0066	0.020	0.0066	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.0057	0.020	0.0057	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.0053	0.020	0.0047	ug/L	J	J	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.0040	0.020	0.0040	ug/L	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.0046	0.020	0.0046	ug/L	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.0046	0.020	0.0046	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.0058	0.020	0.0058	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.0033	0.020	0.0033	ug/L	U	U	
PERFLUOROOCTANOIC ACID	335-67-1	<0.0053	0.020	0.0053	ug/L	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.0036	0.020	0.0036	ug/L	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.0052	0.020	0.0052	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	0.0065	0.020	0.0032	ug/L	J	J	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.0037	0.020	0.0037	ug/L	U	U	

Analysis Method EPA 537 m

Sample Name MALMS-RS-011 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: DHK774 **Sample Date/Time:** 2016-10-21 07:45 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	RDL	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.0065	0.020	0.0065	ug/L	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.0055	0.020	0.0055	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	375-73-5	<0.0019	0.020	0.0019	ug/L	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.0066	0.020	0.0066	ug/L	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.0043	0.020	0.0043	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.0066	0.020	0.0066	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.0057	0.020	0.0057	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.0053	0.020	0.0047	ug/L	J	J	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.0040	0.020	0.0040	ug/L	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.0046	0.020	0.0046	ug/L	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.0046	0.020	0.0046	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.0058	0.020	0.0058	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.0033	0.020	0.0033	ug/L	U	U	
PERFLUOROOCTANOIC ACID	335-67-1	<0.0053	0.020	0.0053	ug/L	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.0036	0.020	0.0036	ug/L	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.0052	0.020	0.0052	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	0.0062	0.020	0.0032	ug/L	J	J	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.0037	0.020	0.0037	ug/L	U	U	

Validated Sample Result Forms: B791810

Analysis Method EPA 537 m

Sample Name MALMS01-001-GW-035 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: EII840 **Sample Date/Time:** 2017-05-02 16:55 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	0.41	0.0032	0.010	0.020	ug/L			
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.0036	0.0036	0.010	0.020	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	0.056	0.0048	0.010	0.020	ug/L			
PERFLUOROBUTANOIC ACID	375-22-4	<0.0066	0.0066	0.014	0.020	ug/L	U	UJ	10A
PERFLUORODECANE SULFONATE	335-77-3	<0.0046	0.0046	0.010	0.020	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.0040	0.0040	0.010	0.020	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.0028	0.0028	0.010	0.020	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.083	0.0033	0.010	0.020	ug/L			
PERFLUOROHEXANE SULFONATE	108427-53-8	0.26	0.0034	0.010	0.020	ug/L			
PERFLUOROHEXANOIC ACID	307-24-4	0.74	0.0029	0.010	0.020	ug/L			
PERFLUORONONANOIC ACID	375-95-1	<0.0046	0.0046	0.010	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.0036	0.0036	0.010	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	0.067	0.0026	0.010	0.020	ug/L			
PERFLUOROOCTANOIC ACID	335-67-1	0.20	0.0046	0.010	0.020	ug/L			
PERFLUOROPENTANOIC ACID	2706-90-3	0.46	0.0027	0.010	0.020	ug/L			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.0038	0.0038	0.010	0.020	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.0033	0.0033	0.010	0.020	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.0043	0.0043	0.010	0.020	ug/L	U	U	

Analysis Method EPA 537 m

Sample Name MALMS01-002-GW-030 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: EII841 **Sample Date/Time:** 2017-05-02 17:00 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	8.3	0.064	0.20	0.40	ug/L			
8:2 FLUOROTELOMER SULFONATE	39108-34-4	0.85	0.0072	0.020	0.040	ug/L			
PERFLUOROBUTANE SULFONATE	29420-43-3	0.13	0.0096	0.020	0.040	ug/L			
PERFLUOROBUTANOIC ACID	375-22-4	0.25	0.013	0.028	0.040	ug/L			
PERFLUORODECANE SULFONATE	335-77-3	<0.0092	0.0092	0.020	0.040	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.0080	0.0080	0.020	0.040	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.0056	0.0056	0.020	0.040	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.24	0.0066	0.020	0.040	ug/L			
PERFLUOROHEXANE SULFONATE	108427-53-8	2.2	0.068	0.20	0.40	ug/L			
PERFLUOROHEXANOIC ACID	307-24-4	1.7	0.0058	0.020	0.040	ug/L			
PERFLUORONONANOIC ACID	375-95-1	0.023	0.0092	0.020	0.040	ug/L	J	J	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	0.057	0.0072	0.020	0.040	ug/L			
PERFLUOROOCTANE SULFONATE	1763-23-1	1.9	0.052	0.20	0.40	ug/L			
PERFLUOROOCTANOIC ACID	335-67-1	1.3	0.0092	0.020	0.040	ug/L			
PERFLUOROPENTANOIC ACID	2706-90-3	1.4	0.0054	0.020	0.040	ug/L			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.0076	0.0076	0.020	0.040	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.0066	0.0066	0.020	0.040	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.0086	0.0086	0.020	0.040	ug/L	U	U	

Analysis Method EPA 537 m

Sample Name MALMS03-001-GW-025 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: EII839 **Sample Date/Time:** 2017-05-02 16:15 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.0032	0.0032	0.010	0.020	ug/L	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.0036	0.0036	0.010	0.020	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	0.020	0.0048	0.010	0.020	ug/L	J	J	
PERFLUOROBUTANOIC ACID	375-22-4	<0.0066	0.0066	0.014	0.020	ug/L	U	UJ	10A
PERFLUORODECANE SULFONATE	335-77-3	<0.0046	0.0046	0.010	0.020	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.0040	0.0040	0.010	0.020	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.0028	0.0028	0.010	0.020	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.015	0.0033	0.010	0.020	ug/L	J	J	
PERFLUOROHEXANE SULFONATE	108427-53-8	0.027	0.0034	0.010	0.020	ug/L			
PERFLUOROHEXANOIC ACID	307-24-4	0.048	0.0029	0.010	0.020	ug/L			
PERFLUORONONANOIC ACID	375-95-1	<0.0046	0.0046	0.010	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.0036	0.0036	0.010	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.0026	0.0026	0.010	0.020	ug/L	U	U	
PERFLUOROOCTANOIC ACID	335-67-1	0.017	0.0046	0.010	0.020	ug/L	J	J	
PERFLUOROPENTANOIC ACID	2706-90-3	0.054	0.0027	0.010	0.020	ug/L			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.0038	0.0038	0.010	0.020	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.0033	0.0033	0.010	0.020	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.0043	0.0043	0.010	0.020	ug/L	U	U	

Analysis Method EPA 537 m

Sample Name MALMS03-002-GW-030 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: EII835 **Sample Date/Time:** 2017-05-02 15:25 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.0032	0.0032	0.010	0.020	ug/L	U	UJ	10A
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.0036	0.0036	0.010	0.020	ug/L	U	UJ	10A
PERFLUOROBUTANE SULFONATE	29420-43-3	0.022	0.0048	0.010	0.020	ug/L		J	07
PERFLUOROBUTANOIC ACID	375-22-4	<0.0066	0.0066	0.014	0.020	ug/L	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.0046	0.0046	0.010	0.020	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.0040	0.0040	0.010	0.020	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.0028	0.0028	0.010	0.020	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.027	0.0033	0.010	0.020	ug/L		J	07
PERFLUOROHEXANE SULFONATE	108427-53-8	0.25	0.0034	0.010	0.020	ug/L		J	07;10A
PERFLUOROHEXANOIC ACID	307-24-4	0.13	0.0029	0.010	0.020	ug/L		J	07
PERFLUORONONANOIC ACID	375-95-1	<0.0046	0.0046	0.010	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.0036	0.0036	0.010	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	0.024	0.0026	0.010	0.020	ug/L		J	07
PERFLUOROOCTANOIC ACID	335-67-1	0.070	0.0046	0.010	0.020	ug/L		J	07
PERFLUOROPENTANOIC ACID	2706-90-3	0.051	0.0027	0.010	0.020	ug/L		J	07;10A
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.0038	0.0038	0.010	0.020	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.0033	0.0033	0.010	0.020	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.0043	0.0043	0.010	0.020	ug/L	U	U	

Analysis Method EPA 537 m

Sample Name MALMS03-003-GW-020 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: EII837 **Sample Date/Time:** 2017-05-02 16:00 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.0032	0.0032	0.010	0.020	ug/L	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.0036	0.0036	0.010	0.020	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	0.031	0.0048	0.010	0.020	ug/L			
PERFLUOROBUTANOIC ACID	375-22-4	<0.0066	0.0066	0.014	0.020	ug/L	U	UJ	10A
PERFLUORODECANE SULFONATE	335-77-3	<0.0046	0.0046	0.010	0.020	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.0040	0.0040	0.010	0.020	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.0028	0.0028	0.010	0.020	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.011	0.0033	0.010	0.020	ug/L	J	J	
PERFLUOROHEXANE SULFONATE	108427-53-8	0.013	0.0034	0.010	0.020	ug/L	J	J	
PERFLUOROHEXANOIC ACID	307-24-4	0.067	0.0029	0.010	0.020	ug/L			
PERFLUORONONANOIC ACID	375-95-1	<0.0046	0.0046	0.010	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.0036	0.0036	0.010	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	0.033	0.0026	0.010	0.020	ug/L			
PERFLUOROOCTANOIC ACID	335-67-1	0.021	0.0046	0.010	0.020	ug/L			
PERFLUOROPENTANOIC ACID	2706-90-3	0.038	0.0027	0.010	0.020	ug/L			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.0038	0.0038	0.010	0.020	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.0033	0.0033	0.010	0.020	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.0043	0.0043	0.010	0.020	ug/L	U	U	

Analysis Method EPA 537 m

Sample Name MALMS03-003-GW-920 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: EII838 **Sample Date/Time:** 2017-05-02 16:00 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	0.0083	0.0032	0.010	0.020	ug/L	J	J	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.0036	0.0036	0.010	0.020	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	0.030	0.0048	0.010	0.020	ug/L			
PERFLUOROBUTANOIC ACID	375-22-4	<0.0066	0.0066	0.014	0.020	ug/L	U	UJ	10A
PERFLUORODECANE SULFONATE	335-77-3	<0.0046	0.0046	0.010	0.020	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.0040	0.0040	0.010	0.020	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.0028	0.0028	0.010	0.020	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.012	0.0033	0.010	0.020	ug/L	J	J	
PERFLUOROHEXANE SULFONATE	108427-53-8	0.014	0.0034	0.010	0.020	ug/L	J	J	
PERFLUOROHEXANOIC ACID	307-24-4	0.068	0.0029	0.010	0.020	ug/L			
PERFLUORONONANOIC ACID	375-95-1	<0.0046	0.0046	0.010	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.0036	0.0036	0.010	0.020	ug/L	U	UJ	07
PERFLUOROOCTANE SULFONATE	1763-23-1	0.029	0.0026	0.010	0.020	ug/L			
PERFLUOROOCTANOIC ACID	335-67-1	0.022	0.0046	0.010	0.020	ug/L			
PERFLUOROPENTANOIC ACID	2706-90-3	0.030	0.0027	0.010	0.020	ug/L			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.0038	0.0038	0.010	0.020	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.0033	0.0033	0.010	0.020	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.0043	0.0043	0.010	0.020	ug/L	U	U	

Analysis Method EPA 537 m

Sample Name MALMS05-001-GW-017 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: EII834 **Sample Date/Time:** 2017-05-02 15:05 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.0032	0.0032	0.010	0.020	ug/L	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.0036	0.0036	0.010	0.020	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	0.11	0.0048	0.010	0.020	ug/L		J	07;08B
PERFLUOROBUTANOIC ACID	375-22-4	0.15	0.0066	0.014	0.020	ug/L		J	07;10A
PERFLUORODECANE SULFONATE	335-77-3	<0.0046	0.0046	0.010	0.020	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.0040	0.0040	0.010	0.020	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.0028	0.0028	0.010	0.020	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.13	0.0033	0.010	0.020	ug/L		J	07
PERFLUOROHEXANE SULFONATE	108427-53-8	0.30	0.0034	0.010	0.020	ug/L		J	07
PERFLUOROHEXANOIC ACID	307-24-4	0.70	0.0029	0.010	0.020	ug/L		J	07;08B
PERFLUORONONANOIC ACID	375-95-1	<0.0046	0.0046	0.010	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.0036	0.0036	0.010	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	0.011	0.0026	0.010	0.020	ug/L	J	J	07;10A
PERFLUOROOCTANOIC ACID	335-67-1	0.036	0.0046	0.010	0.020	ug/L		J	07
PERFLUOROPENTANOIC ACID	2706-90-3	0.71	0.0027	0.010	0.020	ug/L		J	07;08B
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.0038	0.0038	0.010	0.020	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.0033	0.0033	0.010	0.020	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.0043	0.0043	0.010	0.020	ug/L	U	U	

Analysis Method EPA 537 m

Sample Name MALMS05-002-GW-025 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: EII832 **Sample Date/Time:** 2017-05-02 14:25 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.0032	0.0032	0.010	0.020	ug/L	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.0036	0.0036	0.010	0.020	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	0.044	0.0048	0.010	0.020	ug/L		J	17
PERFLUOROBUTANOIC ACID	375-22-4	<0.0066	0.0066	0.014	0.020	ug/L	U	UJ	10A
PERFLUORODECANE SULFONATE	335-77-3	<0.0046	0.0046	0.010	0.020	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.0040	0.0040	0.010	0.020	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.0028	0.0028	0.010	0.020	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.036	0.0033	0.010	0.020	ug/L			
PERFLUOROHEXANE SULFONATE	108427-53-8	0.088	0.0034	0.010	0.020	ug/L			
PERFLUOROHEXANOIC ACID	307-24-4	0.23	0.0029	0.010	0.020	ug/L			
PERFLUORONONANOIC ACID	375-95-1	<0.0046	0.0046	0.010	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.0036	0.0036	0.010	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	0.011	0.0026	0.010	0.020	ug/L	J	J	
PERFLUOROOCTANOIC ACID	335-67-1	0.018	0.0046	0.010	0.020	ug/L	J	J	
PERFLUOROPENTANOIC ACID	2706-90-3	0.22	0.0027	0.010	0.020	ug/L			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.0038	0.0038	0.010	0.020	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.0033	0.0033	0.010	0.020	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.0043	0.0043	0.010	0.020	ug/L	U	U	

Analysis Method EPA 537 m

Sample Name MALMS05-002-GW-925 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: EII833 **Sample Date/Time:** 2017-05-02 14:25 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.0032	0.0032	0.010	0.020	ug/L	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.0036	0.0036	0.010	0.020	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	0.081	0.0048	0.010	0.020	ug/L		J	17
PERFLUOROBUTANOIC ACID	375-22-4	<0.0066	0.0066	0.014	0.020	ug/L	U	UJ	10A
PERFLUORODECANE SULFONATE	335-77-3	<0.0046	0.0046	0.010	0.020	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.0040	0.0040	0.010	0.020	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.0028	0.0028	0.010	0.020	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	0.032	0.0033	0.010	0.020	ug/L			
PERFLUOROHEXANE SULFONATE	108427-53-8	0.081	0.0034	0.010	0.020	ug/L			
PERFLUOROHEXANOIC ACID	307-24-4	0.24	0.0029	0.010	0.020	ug/L			
PERFLUORONONANOIC ACID	375-95-1	<0.0046	0.0046	0.010	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.0036	0.0036	0.010	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	0.011	0.0026	0.010	0.020	ug/L	J	J	
PERFLUOROOCTANOIC ACID	335-67-1	0.018	0.0046	0.010	0.020	ug/L	J	J	
PERFLUOROPENTANOIC ACID	2706-90-3	0.21	0.0027	0.010	0.020	ug/L			
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.0038	0.0038	0.010	0.020	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.0033	0.0033	0.010	0.020	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.0043	0.0043	0.010	0.020	ug/L	U	U	

Analysis Method EPA 537 m

Sample Name MALMS-RS-012 **Matrix Type:** W **Result Type:** TRG

Lab Sample Name: EII836 **Sample Date/Time:** 2017-05-02 15:46 **Validation Level:** Stage 2B

Analyte	CAS No	Result Value	DL	LOD	LOQ	Result Units	Lab Qualifier	Validation Qualifier	Validation Reason Code
6:2 FLUOROTELOMER SULFONATE	27619-97-2	<0.0032	0.0032	0.010	0.020	ug/L	U	U	
8:2 FLUOROTELOMER SULFONATE	39108-34-4	<0.0036	0.0036	0.010	0.020	ug/L	U	U	
PERFLUOROBUTANE SULFONATE	29420-43-3	<0.0048	0.0048	0.010	0.020	ug/L	U	U	
PERFLUOROBUTANOIC ACID	375-22-4	<0.0066	0.0066	0.014	0.020	ug/L	U	U	
PERFLUORODECANE SULFONATE	335-77-3	<0.0046	0.0046	0.010	0.020	ug/L	U	U	
PERFLUORODECANOIC ACID	335-76-2	<0.0040	0.0040	0.010	0.020	ug/L	U	U	
PERFLUORODODECANOIC ACID	307-55-1	<0.0028	0.0028	0.010	0.020	ug/L	U	U	
PERFLUOROHEPTANOIC ACID	375-85-9	<0.0033	0.0033	0.010	0.020	ug/L	U	U	
PERFLUOROHEXANE SULFONATE	108427-53-8	<0.0034	0.0034	0.010	0.020	ug/L	U	U	
PERFLUOROHEXANOIC ACID	307-24-4	<0.0029	0.0029	0.010	0.020	ug/L	U	U	
PERFLUORONONANOIC ACID	375-95-1	<0.0046	0.0046	0.010	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONAMIDE	754-91-6	<0.0036	0.0036	0.010	0.020	ug/L	U	U	
PERFLUOROOCTANE SULFONATE	1763-23-1	<0.0026	0.0026	0.010	0.020	ug/L	U	U	
PERFLUOROOCTANOIC ACID	335-67-1	<0.0046	0.0046	0.010	0.020	ug/L	U	U	
PERFLUOROPENTANOIC ACID	2706-90-3	<0.0027	0.0027	0.010	0.020	ug/L	U	U	
PERFLUOROTETRADECANOIC ACID	376-06-7	<0.0038	0.0038	0.010	0.020	ug/L	U	U	
PERFLUOROTRIDECANOIC ACID	72629-94-8	<0.0033	0.0033	0.010	0.020	ug/L	U	U	
PERFLUOROUNDECANOIC ACID	2058-94-8	<0.0043	0.0043	0.010	0.020	ug/L	U	U	

AerostarSES LLC — **AIR**

1006 Floyd Culler Court
Oak Ridge, TN 37830
865-481-7837

Chain of Custody Record/ Analysis Request Number: 025 JAB

Page 1 of 34

Project Name: Site Inspection of Aqueous Film Forming Foam Areas, Multiple Sites, United States Air Force Installations

Job No.: M2027.0003 (Omaha)
Installation: MALMSTROM

Aerostar Project Manager: Brian Odom, BOdom@specproenv.com (478) 397-4906
Send Data to: Jenny Vance, jvance@aerostar.net (865) 483-7904

Sampler(s): Ash Willis / Jody Barker / Kaleb Brumbaugh

Laboratory Name/Address: Maxxam Analytics, Inc, 6740 Campobello Rd., Mississauga, Ontario L5N2L8

Laboratory Shipping Address: Maxxam Analytics, c/o FedEx Depot, 299 Cayuga Rd., Cheektowaga, NY 14225
Please indicate "HOLD FOR PICKUP"

Contact: Melissa DiGrazia
Phone: (905) 817-5700, ext. 5784
email: MDiGrazia@maxxam.ca

ANALYSIS

Sample Types:
N = Normal
FD = Field Duplicate
AB = Ambient Blank or Field Reagent Blank
EB = Equipment Rinsate

Matrix:
WG = Groundwater
SO = Soil
WP = Potable Water
SE = Sediment
WS = Surface Water
WQ = Field QC (AB, EB)

International Solid Sample
Heat Treat Required
High Risk material
Controlled Storage and Disposal

GK1 ENV-931
Melissa DiGrazia
B6M4692
18-Oct-16 14:52

MAXXAM use only	Sample ID	Date Collected	Time Collected	Sample Type	Matrix	PFAS (see list of 18 analytes below)	NOTES
	MALMS02-001-SS-001	10-11-16	1630	N	SO	1	
	MALMS02-001-SS-901	10-11-16	1630	N	SO	1	
	MALMS-RS-001	10-11-16	1615	EB	WQ	1	Associate w/ MALMS02-001-SS-001 SSPOON
	MALMS02-001-SD-020	10-12-16	1005	N	SO	1	
	MALMS02-002-SS-001	10-12-16	1038	N	SO	1	
	MALMS02-002-SO-020	10-12-16	1335	N	SO	1	
	MALMS02-005-SD-001	10-12-16	1600	N	SE	1	
	MALMS02-005-SW-001	10-12-16	1600	N	WS	1	
	MALMS02-004-SD-001	10-12-16	1630	N	SE	2	MS/MSD
	MALMS02-004-SD-801	10-12-16	1630	N	SE	1	
	MALMS02-004-SW-001	10-12-16	1630	N	WS	3	MS/MSD
	MALMS02-004-SW-901	10-12-16	1630	N	WS	1	
	MALMS-SB-001	10-13-16	0930	AB	WQ	1	
	MALMS01-001-SS-001	10-13-16	1020	N	SO	2	MS/MSD
	MALMS01-001-SS-901	10-13-16	1020	N	SO	1	
					Total # of Containers	19	

RELINQUISHED BY:		RECEIVED BY:	
Signature: [signature]	Date/Time: 10/17/16 /1600	Signature: [signature]	Date/Time: 2016/10/18 14:52
Printed Name: Ash Willis	Firm: Aerostar SES LLC	Printed Name: THAWUIK SRN44	Firm: 33/1-3/2-3/2-3/3-3/2-3
Signature:	Date/Time:	Signature:	Date/Time:
Printed Name:	Firm:	Printed Name:	Firm:

Analyte List:

ANALYTE	ERPIMS PAR CODE	CAS	Contaminant	ERPIMS PAR CODE	CAS
Perfluorooctanesulfonic acid	PFOS	1763-23-1	Perfluorotetradecanoic acid	PFTEA	376-06-7
Perfluorooctanoic acid	PFOA	335-67-1	Perfluorotridecanoic acid	PFTRIA	72629-94-8
Perfluorononanoic acid	PFNA	375-95-1	Perfluoroundecanoic acid	PFUNA	2058-94-8
Perfluorohexanesulfonic acid	PFHXSA	355-46-4	6:2 Fluorotelomer sulfonate	62FTS	27619-97-2
Perfluoroheptanoic acid	PFHPA	375-85-9	8:2 Fluorotelomer sulfonate	82FTS	39108-34-4
Perfluorobutanesulfonic acid	PFBSA	375-73-5	Perfluorobutanoic acid	PFBA	375-22-4
Perfluorodecanoic acid	PFDA	335-76-2	Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluorododecanoic acid	PFDOA	307-55-1	Perfluorooctane sulfonamide	FOSA	754-91-6
Perfluorohexanoic acid	PFHXA	307-24-4	Perfluoropentanoic Acid	PFPA	2706-90-3

AerostarSES LLC

1006 Floyd Culler Court
Oak Ridge, TN 37830
865-481-7837

Chain of Custody Record/ Analysis Request Number: 030 SAS

Page 2 of 4

Project Name: Site Inspection of Aqueous Film Forming Foam Areas, Multiple Sites, United States Air Force Installations

Job No.: M2027.0003 (Omaha)

Installation: MALMSTROM AFB

Aerostar Project Manager: Brian Odom, BOdom@specproenv.com (478) 397-4906
Send Data to: Jenny Vance, jvance@aerostar.net (865) 483-7904

Sampler(s): Ash Willis/Jody Barker/Kaleb Brubaugh

Laboratory Name/Address: Maxxam Analytics, Inc, 6740 Campobello Rd., Mississauga, Ontario L5N2L8

Laboratory Shipping Address: Maxxam Analytics, c/o FedEx Depot, 299 Cayuga Rd., Cheektowaga, NY 14225
Please indicate "HOLD FOR PICKUP"

Contact: Melissa DiGrazia
Phone: (905) 817-5700, ext. 5784
email: MDiGrazia@maxxam.ca

ANALYSIS

PFAS (see list of 18 analytes below)

Sample Types:
N = Normal
FD = Field Duplicate
AB = Ambient Blank or Field Reagent Blank
EB = Equipment Rinsate

Matrix:
WG = Groundwater
SO = Soil
WP = Potable Water
SE = Sediment
WS = Surface Water
WQ = Field QC (AB, EB)

MAXXAM use only	Sample ID	Date Collected	Time Collected	Sample Type	Matrix	PFAS	NOTES
	MALMS01-001-SO-021	10-13-16	1220	N	SO	2	MS/MSD
	MALMS01-001-SO-921	10-13-16	1220	N	SO	1	
	MALMS02-002-SS-001	10-14-16	0815	N	SO	1	
	MALMS02-002-SO-005	10-14-16	1100	N	SO	1	
	MALMS01-003-SS-001	10-14-16	1430	N	SO	1	
	MALMS01-003-SO-011	10-14-16	1605	N	SO	1	
	MALMS02-003-SS-001	10-15-16	0910	N	SO	1	
	MALMS-RS-005	10-15-16	0855	EB	WQ	1	Associated w/ MALMS02-003-SS-001 on SS Spoon
	MALMS02-003-SO-006	10-15-16	1055	N	SO	1	
	MALMS-RS-006	10-16-16	1100	EB	WQ	1	Associated w/ MALMS05-001-SS-001 on HAND AUGER
	MALM (RW)						
	MALMS02-001-SO-921	10-12-16	1005	N	SO	1	

Total # of Containers: 12

RELINQUISHED BY:
Signature: [signature] Date/Time: 10/17/16/1600
Printed Name: Ash Willis Firm: Aerostar SES LLC

RECEIVED BY:
Signature: [signature] Date/Time: 2016/10/18 14:52
Printed Name: TANVIR GILL Firm: 3-3/1-3/2-3/4-3/3-3/2-3

Signature: Date/Time:
Printed Name: Firm:

Signature: Date/Time:
Printed Name: Firm:

Analyte List:

ANALYTE	ERPIMS PAR CODE	CAS	Contaminant	ERPIMS PAR CODE	CAS
Perfluorooctanesulfonic acid	PFOS	1763-23-1	Perfluorotetradecanoic acid	PFTEA	376-06-7
Perfluorooctanoic acid	PFOA	335-67-1	Perfluorotridecanoic acid	PFTRIA	72629-94-8
Perfluorononanoic acid	PFNA	375-95-1	Perfluoroundecanoic acid	PFUNA	2058-94-8
Perfluorohexanesulfonic acid	PFHXSA	355-46-4	6:2 Fluorotelomer sulfonate	6:2FTS	27619-97-2
Perfluoroheptanoic acid	PFHPA	375-85-9	8:2 Fluorotelomer sulfonate	8:2FTS	39108-34-4
Perfluorobutanesulfonic acid	PFBSA	375-73-5	Perfluorobutanoic acid	PFBA	375-22-4
Perfluorodecanoic acid	PFDA	335-76-2	Perfluorooctanesulfonamide	PFOS	754-91-6
Perfluorododecanoic acid	PFDOA	307-55-1	Perfluorooctanesulfonamide	FOSA	754-91-6
Perfluorohexanoic acid	PFHXA	307-24-4	Perfluoropentanoic Acid	PFPA	2706-90-3

AerostarSES LLC

1006 Floyd Culler Court
Oak Ridge, TN 37830
865-481-7837

Chain of Custody Record/ Analysis Request Number: 026 JAB

Page 3 of 34

Project Name: Site Inspection of Aqueous Film Forming Foam Areas, Multiple Sites, United States Air Force Installations

Job No.: M2027.0003 (Omaha)
Installation: Malmstrom AFB

Aerostar Project Manager: Brian Odom, BOdom@specproenv.com (478) 397-4906
Send Data to: Jenny Vance, jvance@aerostar.net (865) 483-7904

Sampler(s): Jody Barker, Kaleb Brumbaugh, Ash Willis

Laboratory Name/Address: Maxxam Analytics, Inc 6740 Campobello Rd. Mississauga, Ontario L5N2L8

Laboratory Shipping Address: Maxxam Analytics c/o FedEx Depot 299 Cayuga Rd. Cheektowaga, NY 14225

Please indicate "HOLD FOR PICKUP"

Contact: Melissa DiGrazia
Phone: (905) 817-5700, ext. 5784
email: MDiGrazia@maxxam.ca

ANALYSIS: KB 10/16/16

Sample Types:
N = Normal
FD = Field Duplicate
AB = Ambient Blank or Field Reagent Blank
EB = Equipment Rinsate

Matrix:
WG = Groundwater
SO = Soil
WP = Potable Water
SE = Sediment
WS = Surface Water
WQ = Field QC (AB, EB)

MAXXAM use only	Sample ID	Date Collected	Time Collected	Sample Type	Matrix	PFAS (see list of 18 analytes below)	NOTES
	MALMS-RS-002	10/12/16	1440	EB	WQ	1	taken off GW level meter. Assoc. w/ MalmS06-PH3MW1
	MALMS-RS-003	10/13/16	1055	EB	WQ	1	taken off Mega Monsoon pump Assoc. w/ MALMS06-PH3MW4-009
	MALMS06-PH3MW2-009	10/13/16	1026	N	WG	1	
	MALMS06-PH3MW4-009	10/13/16	1141	N	WG	1	
	MALMS06-PH3MW5-008	10/13/16	1233	N	WG	1	
	MALMS06-ST05MW~~4~~-009	10/13/16	1406	N	WG	1	
	MALMS05-ST05MW5-002	10/13/16	1536	N	WG	1	
	MALMS-RS-004	10/14/16	1035	EB	WQ	1	taken off a bailer associated with MALMS06-PH3MW1-019
	MALMS06-PH3MW1-019	10/14/16	1050	N	WG	1	
	MALMS05-001-SS-001	10/16/16	1104	N	SO	1	Rinsate MALMS-RS-006 off Hand Auger assoc. w/ sample
	MALMS05-001-SO-007	10/16/16	1220	N	SO	1	
	~~MALMS05-002-SO-011~~	~~10/17/16~~	~~1045~~	~~N~~	~~SO~~	~~1~~ (TZ)	
	KB 10/16/16						
					Total # of Containers	11	

RELINQUISHED BY:		RECEIVED BY:	
Signature: [signature]	Date/Time: 10/17/16 / 1600	Signature: Tanvir Ash	Date/Time: 2016/10/18 14:52
Printed Name: Ash Willis	Firm: Aerostar SES LLC	Printed Name: TANVIRSCNYM	Firm: 3.3/13/2.3 4.3/3.3/2.3
Signature:	Date/Time:	Signature:	Date/Time:
Printed Name:	Firm:	Printed Name:	Firm:

Analyte List:

ANALYTE	ERPIMS PAR CODE	CAS	Contaminant	ERPIMS PAR CODE	CAS
Perfluorooctanesulfonic acid	PFOS	1763-23-1	Perfluorotetradecanoic acid	PFTEA	376-06-7
Perfluorooctanoic acid	PFOA	335-67-1	Perfluorotridecanoic acid	PFTRIA	72629-94-8
Perfluorononanoic acid	PFNA	375-95-1	Perfluoroundecanoic acid	PFUNA	2058-94-8
Perfluorohexanesulfonic acid	PFHXSA	355-46-4	6:2 Fluorotelomer sulfonate	6:2FTS	27619-97-2
Perfluoroheptanoic acid	PFHPA	375-85-9	8:2 Fluorotelomer sulfonate	8:2FTS	39108-34-4
Perfluorobutanesulfonic acid	PFBSA	375-73-5	Perfluorobutanoic acid	PFBA	375-22-4
Perfluorodecanoic acid	PFDA	335-76-2	Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluorododecanoic acid	PFDOA	307-55-1	Perfluorooctane sulfonamide	FOSA	754-91-6
Perfluorohexanoic acid	PFHXA	307-24-4	Perfluoropentanoic Acid	PFPA	2706-90-3

AerostarSES LLC

1006 Floyd Culler Court
Oak Ridge, TN 37830
865-481-7837

Chain of Custody Record/ Analysis Request Number: 027

Page 4 of 4

Project Name: Site Inspection of Aqueous Film Forming Foam Areas, Multiple Sites, United States Air Force Installations

Job No.: M2027.0003 (Omaha)

Installation: Malmstrom

Aerostar Project Manager: Brian Odom, BOdom@specproenv.com (478) 397-4906
Send Data to: Jenny Vance, jvance@aerostar.net (865) 483-7904

Sampler(s): Ash Willis / Jody Barker / Kaleb Brumbah

Laboratory Name/Address: Maxxam Analytics, Inc, 6740 Campobello Rd., Mississauga, Ontario L5N2L8

Laboratory Shipping Address: Maxxam Analytics, c/o FedEx Depot, 299 Cayuga Rd., Cheektowaga, NY 14225
Please indicate "HOLD FOR PICKUP"

Contact: Melissa DiGrazia
Phone: (905) 817-5700, ext. 5784
email: MDiGrazia@maxxam.ca

ANALYSIS

PFAS (see list of 18 analytes below)

Sample Types:
N = Normal
FD = Field Duplicate
AB = Ambient Blank or Field Reagent Blank
EB = Equipment Rinsate

Matrix:
WG = Groundwater
SO = Soil
WP = Potable Water
SE = Sediment
WS = Surface Water
WQ = Field QC (AB, EB)

MAXXAM use only	Sample ID	Date Collected	Time Collected	Sample Type	Matrix	PFAS (see list of 18 analytes below)	NOTES
	MALMS05-002-SS-001	10/17/16	0811	N	SO	1	
	MALMS_RS-007-	10/17/16	953	EB	WQ	1	Ryan's Off spoon associated MALMS05-002-SO-011
	MALMS05-002-SO-011	10/17/16	1045	N	SO	1	

Total # of Containers

RELINQUISHED BY:
Signature: Date/Time: 10/19/16 / 1600
Printed Name: Ash Willis Firm: Aerostar SES LLC
Signature: Date/Time:
Printed Name: Firm:

RECEIVED BY:
Signature: Date/Time: 2016/10/18/4:52
Printed Name: Firm:
Signature: Date/Time:
Printed Name: Firm:

Analyte List:

ANALYTE	ERPIMS PAR CODE	CAS	Contaminant	ERPIMS PAR CODE	CAS
Perfluorooctanesulfonic acid	PFOS	1763-23-1	Perfluorotetradecanoic acid	PFTEA	376-06-7
Perfluorooctanoic acid	PFOA	335-67-1	Perfluorotridecanoic acid	PFTRIA	72629-94-8
Perfluorononanoic acid	PFNA	375-95-1	Perfluoroundecanoic acid	PFUNA	2058-94-8
Perfluorohexanesulfonic acid	PFHXSA	355-46-4	6:2 Fluorotelomer sulfonate	6:2FTS	27619-97-2
Perfluoroheptanoic acid	PFHPA	375-85-9	8:2 Fluorotelomer sulfonate	8:2FTS	39108-34-4
Perfluorobutanesulfonic acid	PFBSA	375-73-5	Perfluorobutanoic acid	PFBA	375-22-4
Perfluorodecanoic acid	PFDA	335-76-2	Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluorododecanoic acid	PFDOA	307-55-1	Perfluorooctane sulfonamide	FOSA	754-91-6
Perfluorohexanoic acid	PFHXA	307-24-4	Perfluoropentanoic Acid	PFPA	2706-90-3

AerostarSES LLC

1006 Floyd Culler Court
Oak Ridge, TN 37830
865-481-7837

Chain of Cus / Analysis Req

22-Oct-16 13:15
Melissa DiGrazia
B6M8709

028
1 of 2

TSP ENV-1269

Project Name: Site Inspection of Aqueous Film Forming Foam Areas, Multiple Sites, United States Air Force Installations

Job No.: M2027.0003 (Omaha)

Installation: Malmstrom AFB

Aerostar Project Manager: Brian Odom, BOdom@specproenv.com (478) 397-4906
Send Data to: Jenny Vance, jvance@aerostar.net (865) 483-7904

Sampler(s): Kaleb Brumbaugh

Laboratory Name/Address:
Maxxam Analytics, Inc
6740 Campobello Rd.
Mississauga, Ontario
L5N2L8

Laboratory Shipping Address:
Maxxam Analytics
c/o FedEx Depot
299 Cayuga Rd.
Cheektowaga, NY 14225

Please indicate "HOLD FOR PICKUP"

Contact: Melissa DiGrazia
Phone: (905) 817-5700, ext. 5784
email: MDiGrazia@maxxam.ca

PFAS (see list of 18 analytes below)

KB 10/21/16

ple Types:
= Normal
FD = Field Duplicate
AB = Ambient Blank or Field Reagent Blank
EB = Equipment Rinsate

Matrix:
WG = Groundwater
SO = Soil
WP = Potable Water
SE = Sediment
WS = Surface Water
WQ = Field QC (AB, EB)

MAXXAM use only	Sample ID	Date Collected	Time Collected	Sample Type	Matrix		NOTES
	MALMS-RS-008	10/18/16	0844	EB	WQ	1	assoc w/ MALMS 04-001-SS-001 - SS-001 off spoon
	MALMS04-001-SS-001	10/18/16	0920	N	SO	1	MALMS-RS-008 assoc w/
	MALMS 04-001-SO-004	10/18/16	0958	N	SO	1	
	MALMS04-002-SS-001	10/18/16	1257	N	SO	1	
	MALMS04-002-SO-002	10/18/16	1305	N	SO	1	
	MALMS03-001-SO-020	10/19/16	1314	N	SO	1	
	MALMS-RS-009	10/19/16	1040	EQ	WQ	1	assoc w/ MALMS03-001-SO-020 takenoff spoon
	MALMS03-003-SO-009	10/19/16	1625	N	SO	1	KB 10/21/16
	MALMS03-002-SO-020	10/20/16	1520	N	SO	1	
	MALMS-RS-010	10/20/16	1347	EB	WQ	1	assoc. w/ MALMS03-002-SO-020 taken off spoon
	MALMS-RS-011	10/21/16	0745	EB	WQ	1	assoc. w/ MALMS03-004-SD-001 takenoff spoon
	MALMS03-004-SD-001	10/21/16	0805	N	SE	1	
	MALMS03-004-SW-001	10/21/16 KB 10/21/16	0807	N	WS	1	
	~~MALMS03~~						
	MALMS-IDW SOIL-001	10/21/16	0945	N	SO	1	

Total # of Containers

International Solid Sample
Heat Treat Required
High Risk material
Controlled Storage and Disposal

RELINQUISHED BY:		RECEIVED BY:	
Signature:	Date/Time: 10/21/16 1740	Signature:	Date/Time: 8/16/22 13.15
Printed Name: Kaleb Brumbaugh	Firm: ASL	Printed Name: DANNY MARAG	Firm: 2.1123/2.5
Signature:	Date/Time:	Signature:	Date/Time:
Printed Name:	Firm:	Printed Name:	Firm:

Analyte List:

ANALYTE	ERPIMS PAR CODE	CAS	Contaminant	ERPIMS PAR CODE	CAS
Perfluorooctanesulfonic acid	PFOS	1763-23-1	Perfluorotetradecanoic acid	PFTEA	376-06-7
Perfluorooctanoic acid	PFOA	335-67-1	Perfluorotridecanoic acid	PFTRIA	72629-94-8
Perfluorononanoic acid	PFNA	375-95-1	Perfluoroundecanoic acid	PFUNA	2058-94-8
Perfluorohexanesulfonic acid	PFHXSA	355-46-4	6:2 Fluorotelomer sulfonate	62FTS	27619-97-2
Perfluoroheptanoic acid	PFHPA	375-85-9	8:2 Fluorotelomer sulfonate	82FTS	39108-34-4
Perfluorobutanesulfonic acid	PFBSA	375-73-5	Perfluorobutanoic acid	PFBA	375-22-4
Perfluorododecanoic acid	PFDA	335-76-2	Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluorododecanoic acid	PFDOA	307-55-1	Perfluorooctane sulfonamide	FOSA	754-91-6
Perfluorohexanoic acid	PFHXA	307-24-4	Perfluoropentanoic Acid	PFPA	2706-90-3

AerostarSES LLC

1006 Floyd Culler Court
Oak Ridge, TN 37830
865-481-7837

Chain of Custody Record/ Analysis Request Number: 029

Page 2 of 2

Project Name: Site Inspection of Aqueous Film Forming Foam Areas, Multiple Sites, United States Air Force Installations

Job No.: M2027.0003 (Omaha)

Installation: MALMSTROM AFB

Aerostar Project Manager: Brian Odom, BOdom@specproenv.com (478) 397-4906
Send Data to: Jenny Vance, jvance@aerostar.net (865) 483-7904

Sampler(s): Kales Brumbaugh, Jody Barker

Laboratory Name/Address:
Maxxam Analytics, Inc
6740 Campobello Rd.
Mississauga, Ontario
L5N2L8

Laboratory Shipping Address:
Maxxam Analytics
c/o FedEx Depot
299 Cayuga Rd.
Cheektowaga, NY 14225

Please indicate "HOLD FOR PICKUP"

Contact: Melissa DiGrazia
Phone: (905) 817-5700, ext. 5784
email: MDiGrazia@maxxam.ca

ANALYSIS

PFAS (see list of 18 analytes below)

KB 10/21/16

Sample Types:
N = Normal
FD = Field Duplicate
AB = Ambient Blank or Field Reagent Blank
EB = Equipment Rinsate

Matrix:
WG = Groundwater
SO = Soil
WP = Potable Water
SE = Sediment
WS = Surface Water
WQ = Field QC (AB, EB)

MAXXAM use only	Sample ID	Date Collected	Time Collected	Sample Type	Matrix	PFAS
	MALMS04-004-SW-001	10/21/16	1535	N	WS	1
	MALMS04-003-SW-001	10/21/16	1520	N	WS	1
	MALMS04-003-SD-001	10/21/16	1515	N	SE	1
	MALMS04-004-SD-001	10/21/16	1530	N	SE	1
	MALMS04-002-GW-004	10/21/16	1313	N	WG	1
	MALMS04-002-GW-904	10/21/16	1313	N	WG	1
	MALMS04-002-GW-004 MS/MSD	10/21/16	1313	N	WG	1
	MALMS04-001-GW-005	10/21/16	1414	N	WG	1
	MALMSTDWATER-001	10/21/16	1500	N	WG	1

KB 10/21/16

KB 10/21/16

KB 10/21/16

NOTES

Total # of Containers 9

RELINQUISHED BY:
Signature: [signature] Date/Time: 10/21/16 1740
Printed Name: Kales Brumbaugh Firm: ASL

Signature: Date/Time:
Printed Name: Firm:

RECEIVED BY:
Signature: [signature] Date/Time: 2/6/2022 15:15
Printed Name: [illegible] Firm: [illegible]

Signature: Date/Time:
Printed Name: Firm:

Analyte List:

ANALYTE	ERPIMS PAR CODE	CAS	Contaminant	ERPIMS PAR CODE	CAS
Perfluorooctanesulfonic acid	PFOS	1763-23-1	Perfluorotetradecanoic acid	PFTEA	376-06-7
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Perfluoroheptanoic acid	PFHPA	375-85-9	8:2 Fluorotelomer sulfonate	8:2FTS	39108-34-4
Perfluorobutanesulfonic acid	PFBSA	375-73-5	Perfluorobutanoic acid	PFBA	375-22-4
Perfluorodecanoic acid	PFDA	335-76-2	Perfluorooctanesulfonic acid	PFOS	335-77-3
Perfluorododecanoic acid	PFDOA	307-55-1	Perfluorooctane sulfonamide	FOSA	754-91-6
Perfluorohexanoic acid	PFHXA	307-24-4	Perfluoropentanoic Acid	PFPA	2706-90-3

AerostarSES LLC **AIR**

1006 Floyd Culler Court
Oak Ridge, TN 37830
865-481-7837

Chain of Custody Record/ Analysis Request Number: 074

Page 1 of 1

Project Name: Site Inspection of Aqueous Film Forming Foam Areas, Multiple Sites, United States Air Force Installations

Job No.: M2027.0003 (Omaha)

Installation: MALMSTROM AFB

Aerostar Project Manager: Brian Odom, BOdom@specproenv.com (478) 397-4906
Send Data to: Jenny Vance, jvance@aerostar.net (865) 483-7904

Sampler(s): Jody Barker / Brian Odom

Laboratory Name/Address:
Maxxam Analytics, Inc
6740 Campobello Rd.
Mississauga, Ontario
L5N2L8

Laboratory Shipping Address:
Maxxam Analytics
c/o FedEx Depot
299 Cayuga Rd.
Cheektowaga, NY 14225

Please indicate "HOLD FOR PICKUP"

Contact: Melissa DiGrazia
Phone: (905) 817-5700, ext. 5784
email: MDiGrazia@maxxam.ca

ANALYSIS

PFAS (see list of 18 analytes below)

Sample Types:
N = Normal
FD = Field Duplicate
AB = Ambient Blank or Field Reagent Blank
EB = Equipment Rinsate

Matrix:
WG = Groundwater
SO = Soil
WP = Potable Water
SE = Sediment
WS = Surface Water
WQ = Field QC (AB, EB)

MAXXAM use only	Sample ID	Date Collected	Time Collected	Sample Type	Matrix	PFAS	NOTES
	MALMS05-002-GW-025	05/02/17	1425	N	WG	X	
	MALMS05-002-GW-925	05/02/17	1425	FD	WG	X	
	MALMS05-001-GW-017	05/02/17	1505	N	WG	X	
	MALMS05-001-GW-017 MS/MSD	05/02/17	1505	N	WG	X	
	MALMS03-002-GW-030	05/02/17	1525	N	WG	X	
	MALMS-RS-012	05/02/17	1546	EB	WQ	X	
	MALMS03-003-GW-020	05/02/17	1600	N	WG	X	
	MALMS03-003-GW-920	05/02/17	1600	FD	WG	X	
	MALMS03-001-GW-025	05/02/17	1615	N	WG	X	
	MALMS01-001-GW-035	05/02/17	1655	N	WG	X	
	MALMS01-002-GW-030	05/02/17	1700	N	WG	X	
				Total # of Containers			

05-May-17 17:25
Melissa DiGrazia
B791810
MAF ENV-589

RELINQUISHED BY:
Signature: Date/Time: 5/3/17 1550
Printed Name: Jody Barker Firm: ASL

Signature: Date/Time:
Printed Name: Firm:

RECEIVED BY:
Signature: Date/Time: 17:25 2017/05/04
Printed Name: Firm:

Signature: Date/Time:
Printed Name: Firm:

temps: 1.9/2.1/2.0

Analyte List:

ANALYTE	ERPIMS PAR CODE	CAS	Contaminant	ERPIMS PAR CODE	CAS
Perfluorooctanesulfonic acid	PFOS	1763-23-1	Perfluorotetradecanoic acid	PFTeA	376-06-7
Perfluorooctanoic acid	PFOA	335-67-1	Perfluorotridecanoic acid	PFTriA	72629-94-8
Perfluorononanoic acid	PFNA	375-95-1	Perfluoroundecanoic acid	PFUnA	2058-94-8
Perfluorohexanesulfonic acid	PFHxSA	355-46-4	6:2 Fluorotelomer sulfonate	62FTS	27619-97-2
Perfluoroheptanoic acid	PFHpA	375-85-9	8:2 Fluorotelomer sulfonate	82FTS	39108-34-4
Perfluorobutanesulfonic acid	PFBSA	375-73-5	Perfluorobutanoic acid	PFBA	375-22-4
Perfluorodecanoic acid	PFDA	335-76-2	Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluorododecanoic acid	PFDOA	307-55-1	Perfluorooctane sulfonamide	FOSA	754-91-6
Perfluorohexanoic acid	PFHxA	307-24-4	Perfluoropentanoic Acid	PFPA	2706-90-3

Rev 8/2014

CHAIN OF CUSTODY

Page 1 of 1

Company:

Project Contact: Brian Odom, Jenny Vance

Telephone: Brian (478) 397-4906, Jenny (865)-483-7901

Project Name: Site Insp. of AFFF Areas, Multiple Sites, USAF Installations

Project #: M2027.0003

Location: Malmstrom AFB MT

Sampled By: Jody Barho / Kaleb Brumbaugh

CT LABORATORIES

1230 Lange Court, Baraboo, WI 53913
608-356-2760 Fax 608-356-2766
www.ctlaboratories.com

Folder # 123109

Company MAXXAM ANALYTI

Project SITE INSPECTION OF AF

Logged By ELS PM ET

am:
RCRA SDWA NPDES
Waste Other _____

Report To: Jenny Vance
EMAIL: jvance@aerostar.net
Company: Aerostar SES
Address: 1006 Floyd Culler Ct Oak Ridge TN 37830

Invoice To:*
EMAIL:
Company: SAME as above
Address:

*Party listed is responsible for payment of invoice as per CT Laboratories' terms and conditions

Client Special Instructions

* ph & flashpoint added by yls

Matrix:
GW – groundwater SW - surface water WW - wastewater DW - drinking water
S - soil/sediment SL - sludge A - air M - misc/waste

Turnaround Time
Normal RUSH*
Date Needed: _____
Rush analysis requires prior CT Laboratories' approval
Surcharges:
24 hr 200%
2-3 days 100%
4-9 days 50%

Collection Date	Collection Time	Matrix	Grab/ Comp	Sample #	Sample ID Description	Filtered? Y/N	Tot+PH Soil	PH, Flashpoint, cyanide, Sulfide - Soil	VOC 8260 - Soil	Metals, SVOC, Nat. Herb. - Soil	PCBs, TPH-DRO/GRO Soil	Supp. Parameters Aqueous	TPH-DRO/GRO, PCB Aqueous	Metals Aqueous	Cyanide Aqueous	VOC Aqueous	TPH-GRO Aqueous	Sulfide Aqueous	Hydrazine	Total # Containers	Designated MS/MSD	CT Lab ID # (Lab use only)
							(MS)	Fill in Spaces with Bottles per Test												(MS)		
10/21/16	0945	S	Comp		MALMS-IDNSoil-001	NA	2	✓	✓	✓	✓	✓									5		752765/768
10/21/16	1027	S	Comp		MALMS01-004-SS-001		✓												✓		2		752769
10/21/16	1029	S	Comp		MALMS01-004-SO-021		✓												✓		2		752770
10/21/16	1032	S	Comp.		MALMS02-006-SS-001		✓												✓		2		752771
10/21/16	1035	S	Comp		MALMS02-006-SO-020		✓												✓		2		752772
10/21/16	1037	S	Comp.		MALMS03-005-SS-001		✓												✓		2		752773
10/21/16	1039	S	Comp.		MALMS03-005-SO-020		✓												✓		2		752774
10/21/16	1042	S	Comp		MALMS04-005-SS-001		✓												✓		2		752775
10/21/16	1044	S	Comp		MALMS04-005-SO-003		✓												✓		2		752776
10/21/16	1046	S	Comp		MALMS05-004-SS-001		✓												✓		2		752777
10/21/16	1048	S	Comp.		MALMS05-004-SO-010		✓												✓		2 (MS)		752778
10/21/16	1500	W	Comp.		MALMS-IDNWATER-001			*					✓	✓	✓	✓	✓	✓	✓		15		752780/781

Relinquished By: Kaleb Brumbaugh — Date/Time 10/21/16 1800

Received by: — Date/Time

Received By: — Date/Time

Received for Laboratory by: — Date/Time 10/24/16 0820

Lab Use Only
Ice Present (Yes) No
Temp 2.6, 3.2 IR Gun # 15
Cooler # 5830, maxxamcooler

10/22/16 1035 08

1.0 Project Narrative

Maxxam Analytics International
6740 Campobello Rd.
Mississauga, Ontario, Canada
L5N 2L8
1-800-668-0639
www.maxxamanalytics.com

Maxxam Job: B6M4692 – Soil Analysis

Sample Analysis

The following soil samples were initially analyzed on QC batch 4714833 (2016/10/28):

DGR819 *MALMS01-001-S0-021*
DGR820 *MALMS01-001-S0-921*

Due to inconsistencies in the results between native and matrix spiked DGR819 *(MALMS01-001-S0-021)*, this sample was re-extracted and re-analyzed on QC batch 4728222 (2016/11/02). Unfortunately data for all samples in this QC batch were rejected due to a potential sample mix-up. Sample DGR819 was further re-extracted, matrix spiked and re-analyzed on QC batch 4730053 (2016/11/03). Sample and matrix spike results satisfied all QC criteria.

The following soil sample was analyzed on QC batch 4718947 (2016/11/01):

DGR817 *MALMS01-001-SS-001*

The sample was initially pre-screened to determine if it contained elevated concentrations of target analytes. Due to estimated high concentrations, the sample was diluted 10x prior to analysis. Detection limits were adjusted accordingly. Additionally, the matrix spike which had been performed on this sample was not analyzed due to high concentrations, in order to prevent contamination of the analytical instrument.

All other soil samples were analyzed on QC batch 4718889 (2016/11/01), and initially pre-screened to identify samples containing elevated concentrations of target analytes. Estimated concentrations were obtained using the pre-screening process so that samples could be appropriately diluted for quantitative analysis. Due to high concentrations, the following samples required dilution:

DGR818	*MALMS01-001-SS-901*	*100x dilution for Perfluorooctanesulfonate (PFOS)* *10x dilution for all other analytes*
DGR822	*MALMS01-002-S0-005*	*1000x dilution for Perfluorooctanesulfonate (PFOS)* *100x dilution for all other analytes*
DGR823	*MALMS01-003-SS-001*	*1x dilution for Perfluorooctanesulfonate (PFOS)*

Detection limits were adjusted accordingly.

Inconsistencies were observed between diluted and undiluted results from the following sample on QC batch 4718889:

DGR812 *MALMS02-004-SD-001*

This sample was re-extracted and re-analyzed on QC batch 4728222 (2016/11/02), with an additional 10x dilution for Perfluorooctanesulfonate (PFOS) for confirmation of these results. Detection limit was adjusted accordingly for PFOS.

Internal Standard Responses

Isotopically labeled $^{13}C_8$-Perfluorooctane sulfonamide (MPFOSA) is used as an internal standard to quantify native Perfluorooctane sulfonamide (PFOSA). The instrument response observed for this labeled compound was below the defined lower control limit (LCL) for the following sample on QC batch 4731210:

Blank *(Matrix blank)*

The instrument response for the injection standard ($^{13}C_9$-Perfluorodecanoic acid, $^{13}C_9$-PFDA) fell within the required tolerance limits. This indicates that the response observed for this isotopically labeled internal standard was not a

result of poor or inconsistent sample introduction into the liquid chromatograph/tandem mass spectrometer (LC/MS/MS).

It has been noted in Section 13.2 of USEPA Method 537 that PFOSA is susceptible to low recoveries following evaporation due to volatility.

When quantifying analytes using isotope dilution techniques, the isotopically labeled standards differ from the native compounds only in the presence of the stable isotopes. The physical and chemical behavior of each labeled compound is virtually identical to its unlabeled or "native" analog. Any losses (or apparent gain) of the native compound that may occur during any of the sample preparation, extraction, cleanup or determinative steps will be mirrored by a similar loss (or apparent gain) of the labeled standard, and as such can be accounted for and corrected. Therefore, the quantification of these target compounds is not affected by the low (or high) recoveries, provided the instrument response for the native and labeled compounds is distinguishable from the instrument or background noise.

Quantitation of PFAS

Many PFAS (e.g. PFOS) have several isomeric forms that may show up as separate or partially-merged peaks in the analytical chromatograms. These peaks will be integrated and the areas summed such that the result represents the concentration of the sum of the linear and branched isomers, per USEPA (2009).

Instrumentation was calibrated using certified quantitative standards containing only the linear isomer for all target analytes, except PFOS, which was calibrated using a certified branched and linear isomer mixture, with the exception of the following samples:

DGR812 *MALMS02-004-SD-001 QC batch 4731210*
DGR819 *MALMS01-001-S0-021 QC batch 4730053*

These QC batches were calibrated using certified quantitative standards containing only the linear isomer for all target analytes, except Perfluorooctanesulfonate (PFOS) and Perfluorohexane sulfonate (PFHxS), which were calibrated using certified branched and linear isomer mixtures.

As additional certified reference materials containing branched and linear isomers become commercially available, they will be incorporated into the analytical method.

Data Qualifiers

In the Results of Analyses, U-flags are applied to results that are less than the DL (MDL). J-flags are applied to results that are less than the RDL (LOQ) but greater than the DL (MDL). Due to limitations in LIMS, the results cannot be J-flagged to the LOD. MDLs, LODs and LOQs for each analyte are presented in the tables below:

Parameter	MDL (ug/kg)	LOD (ug/kg)	LOQ (ug/kg)
Perfluorobutanoic acid (PFBA)	0.23	0.5	1.0
Perfluorobutane sulfonate (PFBS)	0.25	0.5	1.0
Perfluoropentanoic acid (PFPeA)	0.21	0.5	1.0
Perfluorohexanoic acid (PFHxA)	0.21	0.5	1.0
Perfluorohexane sulfonate (PFHxS)	0.19	0.5	1.0
Perfluoroheptanoic acid (PFHpA)	0.18	0.5	1.0
Perfluorooctanoic acid (PFOA)	0.12	0.4	1.0
Perfluorooctane sulfonate (PFOS)	0.16	0.5	1.0
Perfluorononanoic acid (PFNA)	0.14	0.5	1.0
Perfluorodecanoic acid (PFDA)	0.28	0.8	1.0

Perfluorodecanesulfonate (PFDS)	0.20	0.5	1.0
Perfluoroundecanoic acid (PFUnA)	0.26	0.8	1.0
Perfluorododecanoic acid (PFDoA)	0.24	0.5	1.0
Perfluorotridecanoic Acid (PFTrDA)	0.25	0.5	1.0
Perfluorotetradecanoic Acid (PFTeDA)	0.22	0.5	1.0
Perfluorooctane Sulfonamide (PFOSA)	0.17	0.5	1.0
6:2 Fluorotelomer Sulfonate (6:2 FTS)	0.25	0.5	1.0
8:2 Fluorotelomer Sulfonate (8:2 FTS)	0.21	0.5	1.0

Sin Chii Chia, B.Sc.
schia@maxxam.ca
Office 905 817 5700

PROJECT NARRATIVE

Maxxam Analytics
Client Project #: M2027.0003 (OMAHA)

Client: Aerostar SES LLC
Client Project: M2027.0003 (OMAHA)

I. SAMPLE RECEIPT/ANALYSIS

a) Sample Listing

Maxxam ID	Client Sample ID	Date Sampled	Date Received	Date Prepped	Date Run	Initial Calibration
PFOS and PFOA in soil						
DGR804	MALMS02-001-SS-001	2016/10/11	2016/10/18	2016/10/26	2016/11/01	2016/11/01
DGR805	MALMS02-001-SS-901	2016/10/11	2016/10/18	2016/10/26	2016/11/01	2016/11/01
DGR807	MALMS02-001-SO-020	2016/10/12	2016/10/18	2016/10/26	2016/11/01	2016/11/01
DGR808	MALMS02-002-SS-001	2016/10/12	2016/10/18	2016/10/26	2016/11/01	2016/11/01
DGR809	MALMS02-002-SO-020	2016/10/12	2016/10/18	2016/10/26	2016/11/01	2016/11/01
DGR810	MALMS02-005-SD-001	2016/10/12	2016/10/18	2016/10/26	2016/11/01	2016/11/01
DGR812	MALMS02-004-SD-001	2016/10/12	2016/10/18	2016/11/03	2016/11/04	2016/11/04
DGR813	MALMS02-004-SD-901	2016/10/12	2016/10/18	2016/10/26	2016/11/01	2016/11/01
DGR817	MALMS01-001-SS-001	2016/10/13	2016/10/18	2016/10/26	2016/11/02	2016/11/02
DGR818	MALMS01-001-SS-901	2016/10/13	2016/10/18	2016/10/26	2016/11/01	2016/11/01
DGR819	MALMS01-001-SO-021	2016/10/13	2016/10/18	2016/11/02	2016/11/03	2016/11/03
DGR820	MALMS01-001-SO-921	2016/10/13	2016/10/18	2016/10/24	2016/10/28	2016/10/28
DGR821	MALMS01-002-SS-001	2016/10/14	2016/10/18	2016/10/26	2016/11/01	2016/11/01
DGR822	MALMS01-002-SO-005	2016/10/14	2016/10/18	2016/10/26	2016/11/01	2016/11/01
DGR823	MALMS01-003-SS-001	2016/10/14	2016/10/18	2016/10/26	2016/11/01	2016/11/01
DGR824	MALMS01-003-SO-011	2016/10/14	2016/10/18	2016/10/26	2016/11/01	2016/11/01
DGR825	MALMS02-003-SS-001	2016/10/15	2016/10/18	2016/10/26	2016/11/01	2016/11/01
DGR827	MALMS02-003-SO-006	2016/10/15	2016/10/18	2016/10/26	2016/11/01	2016/11/01
DGR829	MALMS02-001-SO-920	2016/10/12	2016/10/18	2016/10/26	2016/11/01	2016/11/01
DGR839	MALMS05-001-SS-001	2016/10/16	2016/10/18	2016/10/26	2016/11/01	2016/11/01
DGR840	MALMS05-001-SO-007	2016/10/16	2016/10/18	2016/10/26	2016/11/01	2016/11/01
DGR841	MALMS05-002-SS-001	2016/10/17	2016/10/18	2016/10/26	2016/11/01	2016/11/01
DGR843	MALMS05-002-SO-011	2016/10/17	2016/10/18	2016/10/26	2016/11/01	2016/11/01

Run Date is defined as the date of injection of the last calibration standard (12 hours or less) prior to the samples analyzed within that run sequence. Therefore the time of calibration injection that defines the run date is always within 12 hours of the time of sample injection.

b) Shipping Problems: none encountered

c) Documentation Problems: Confirmaiton received that the sample number on the container (MALMS02-001-SO-920) is correct. Sample is a duplicate sample associated with MALMS02-001-SO-020. ID updated as per client confirmation.

II. SAMPLE PREP:

No problems encountered

III. SAMPLE ANALYSIS:

See also comments within the appropriate Certificate of Analysis

a) Hold Times: all within recommended hold times

b) Instrument Calibration: all within control limits

c) Quality Control: All applicable QC meets control criteria, except where otherwise noted.

d) All analytes requiring manual intergration(s) are noted on the sample chromatograms

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for other than the conditions detailed above.

In addition, I certify, that to the best of my knowledge and belief, the data as reported are true and accurate. Release of the data contained in this data package has been authorized by the cognizant laboratory official or his/her designee, as verified by this signature.

M Di Grazia

2016/12/07
Date

Maxxam Job: B6M4692 – Water Analysis

Sample Analysis

The following water sample was analyzed on QC batch 4712461 (2016/10/24):

DGR828 *MALMS-RS-006*

All other water samples were initially analyzed on QC batch 4708493 (2016/10/24) using a higher calibration range (high level analysis) for determination of samples containing elevated concentrations of target analytes. Because the ICV failed to meet acceptance criteria in this QC batch, all samples were re-extracted and re-analyzed by low level analysis on QC batch 4716732 (4716732).

Elevated concentrations of target analytes were identified by high level analysis of the following samples:

DGR832 *MALMS06-PH3MW2-009*
DGR834 *MALMS06-PH3MW5-008*

These samples were analyzed with 10x and 50x dilutions on QC batch 4716732. Results for all analytes were reported from the 10x diluted sample except for Perfluorohexanesulfonate (PFHxS) which required 50x dilution. Detection limits were adjusted accordingly.

High concentrations of Perfluorohexanoic acid (PFHxA) and Perfluorohexanesulfonate (PFHxS) were also detected in the following sample:

DGR833 *MALMS06-PH3MW4-009*

The sample was analyzed with an additional 10x dilution for this analyte on QC batch 4716732. Detection limits were adjusted accordingly.

Internal Standard Responses

Isotopically labeled $^{13}C_4$-Perfluorobutanoic acid (MPFBA) and $^{13}C_2$-Perfluorotetradecanoic acid (MPFTeDA) are used as internal standards to quantify native Perfluorobutanoic acid (PFBA) and Perfluorotridecanoic acid (PFTrDA) & Perfluorotetradecanoic acid (PFTeDA) respectively. The instrument responses observed for the specified labeled compounds were below the defined lower control limit (LCL) for the following samples on QC batch 4716732:

DGR814 *MALMS02-004-SW-001 (MPFTeDA)*
DGR833 *MALMS06-PH3MW4-009 (MPFBA)*
DGR835 *MALMS05-ST05MW4-009 (MPFBA)*
DGR838 *MALM06-PH3MW1-019 (MPFBA)*

The instrument responses for the injection standards ($^{13}C_6$-Perfluorohexanoic acid, $^{13}C_6$-PFHxA & $^{13}C_9$-Perfluorodecanoic acid, $^{13}C_9$-PFDA) fell within the required tolerance limits. This indicates that the responses observed for these isotopically labeled internal standards were not a result of poor or inconsistent sample introduction into the liquid chromatograph/tandem mass spectrometer (LC/MS/MS).

When quantifying analytes using isotope dilution techniques, the isotopically labeled standards differ from the native compounds only in the presence of the stable isotopes. The physical and chemical behavior of each labeled compound is virtually identical to its unlabeled or “native” analog. Any losses (or apparent gain) of the native compound that may occur during any of the sample preparation, extraction, cleanup or determinative steps will be mirrored by a similar loss (or apparent gain) of the labeled standard, and as such can be accounted for and corrected. Therefore, the quantification of these target compounds is not affected by the low (or high) recoveries, provided the instrument response for the native and labeled compounds is distinguishable from the instrument or background noise.

Quantitation of PFAS

Many PFAS (e.g. PFOS) have several isomeric forms that may show up as separate or partially-merged peaks in the analytical chromatograms. These peaks will be integrated and the areas summed such that the result represents the concentration of the sum of the linear and branched isomers, per USEPA (2009). Instrumentation is calibrated using certified quantitative standards containing only the linear isomer for all target analytes, except PFOS, which is calibrated using a certified branched and linear isomer mixture. As additional certified reference materials containing branched and linear isomers become commercially available, they will be incorporated into the analytical method.

Data Qualifiers

In the Results of Analyses, U-flags are applied to results that are less than the DL (MDL). J-flags are applied to results that are less than the RDL (LOQ) but greater than the DL (MDL). Due to limitations in LIMS, the results cannot be J-flagged to the LOD. MDLs, LODs and LOQs for each analyte are presented in the tables below:

Parameter	MDL (ug/L)	LOD (ug/L)	LOQ (ug/L)
Perfluorobutanoic acid (PFBA)	0.0066	0.014	0.02
Perfluorobutane sulfonate (PFBS)	0.0019	0.007	0.02
Perfluoropentanoic acid (PFPeA)	0.0036	0.010	0.02
Perfluorohexanoic acid (PFHxA)	0.0046	0.010	0.02
Perfluorohexane sulfonate (PFHxS)	0.0040	0.010	0.02
Perfluoroheptanoic acid (PFHpA)	0.0047	0.010	0.02
Perfluorooctanoic acid (PFOA)	0.0053	0.014	0.02
Perfluorooctane sulfonate (PFOS)	0.0033	0.010	0.02
Perfluorononanoic acid (PFNA)	0.0046	0.010	0.02
Perfluorodecanoic acid (PFDA)	0.0066	0.014	0.02
Perfluorodecanesulfonate (PFDS)	0.0043	0.010	0.02
Perfluoroundecanoic acid (PFUnA)	0.0037	0.010	0.02
Perfluorododecanoic acid (PFDoA)	0.0057	0.014	0.02
Perfluorotridecanoic Acid (PFTrDA)	0.0032	0.010	0.02
Perfluorotetradecanoic Acid (PFTeDA)	0.0052	0.014	0.02
Perfluorooctane Sulfonamide (PFOSA)	0.0058	0.014	0.02
6:2 Fluorotelomer Sulfonate (6:2 FTS)	0.0065	0.014	0.02
8:2 Fluorotelomer Sulfonate (8:2 FTS)	0.0055	0.014	0.02

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PROJECT NARRATIVE

Maxxam Analytics
Client Project #: M2027.0003 (OMAHA)

Client: Aerostar SES LLC
Client Project: M2027.0003 (OMAHA)

I. SAMPLE RECEIPT/ANALYSIS

a) Sample Listing

Maxxam ID	Client Sample ID	Date Sampled	Date Received	Date Prepped	Date Run	Initial Calibration
PFOS and PFOA in water						
DGR806	MALMS02-RS-001	2016/10/11	2016/10/18	2016/10/25	2016/10/27	2016/10/27
DGR811	MALMS02-005-SW-001	2016/10/12	2016/10/18	2016/10/25	2016/10/27	2016/10/27
DGR814	MALMS02-004-SW-001	2016/10/12	2016/10/18	2016/10/25	2016/10/27	2016/10/27
DGR815	MALMS02-004-SW-901	2016/10/12	2016/10/18	2016/10/25	2016/10/27	2016/10/27
DGR816	MALMS02-SB-001	2016/10/13	2016/10/18	2016/10/25	2016/10/27	2016/10/27
DGR826	MALMS01-RS-005	2016/10/15	2016/10/18	2016/10/25	2016/10/27	2016/10/27
DGR828	MALMS-RS-006	2016/10/16	2016/10/18	2016/10/21	2016/10/24	2016/10/24
DGR830	MALMS-RS-002	2016/10/12	2016/10/18	2016/10/25	2016/10/27	2016/10/27
DGR831	MALMS-RS-003	2016/10/13	2016/10/18	2016/10/25	2016/10/27	2016/10/27
DGR832	MALMS06-PH3MW2-009	2016/10/13	2016/10/18	2016/10/25	2016/10/27	2016/10/27
DGR833	MALMS06-PH3MW4-009	2016/10/13	2016/10/18	2016/10/25	2016/10/27	2016/10/27
DGR834	MALMS06-PH3MW5-008	2016/10/13	2016/10/18	2016/10/25	2016/10/27	2016/10/27
DGR835	MALMS0c-ST05MW4-009	2016/10/13	2016/10/18	2016/10/25	2016/10/27	2016/10/27
DGR836	MALMS05-ST05MW5-002	2016/10/13	2016/10/18	2016/10/25	2016/10/27	2016/10/27
DGR837	MALMS-RS-004	2016/10/14	2016/10/18	2016/10/25	2016/10/27	2016/10/27
DGR838	MALMS06-PH3MW1-019	2016/10/14	2016/10/18	2016/10/25	2016/10/27	2016/10/27
DGR842	MALMS-RS-007	2016/10/17	2016/10/18	2016/10/25	2016/10/27	2016/10/27

Run Date is defined as the date of injection of the last calibration standard (12 hours or less) prior to the samples analyzed within that run sequence. Therefore the time of calibration injection that defines the run date is always within 12 hours of the time of sample injection.

b) Shipping Problems: none encountered

c) Documentation Problems: {I·YLJtŜ L5 Ŧ2Ŋ 5Dwyop dzLJŘI·űŜ ű2 a ! [a {лcπ{¢лp a ² ппллф I·ă LJŜŊ ŎťʎŜyű ŊŜIjdzŜăűφ

II. SAMPLE PREP:

No problems encountered

III. SAMPLE ANALYSIS:

See also comments within the appropriate Certificate of Analysis

a) Hold Times: all within recommended hold times

b) Instrument Calibration: all within control limits

c) Quality Control: All applicable QC meets control criteria, except where otherwise noted.

d) All analytes requiring manual intergration(s) are noted on the sample chromatograms

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for other than the conditions detailed above.

In addition, I certify, that to the best of my knowledge and belief, the data as reported are true and accurate. Release of the data contained in this data package has been authorized by the cognizant laboratory official or his/her designee, as verified by this signature.

M Di Grazia

201тклнкмт
Date

1.0 Project Narrative

Maxxam Analytics International
6740 Campobello Rd.
Mississauga, Ontario, Canada
L5N 2L8
1-800-668-0639
www.maxxamanalytics.com

Maxxam Job: B6M8709 – Soil Analysis

Sample Analysis

Soil samples were analyzed on QC batches 4725776 (2016/11/02) and 4731205 (2016/11/04). No analytical difficulties were encountered.

Quantitation of PFAS

Many PFAS (e.g. PFOS) have several isomeric forms that may show up as separate or partially-merged peaks in the analytical chromatograms. These peaks will be integrated and the areas summed such that the result represents the concentration of the sum of the linear and branched isomers, per USEPA (2009).

Instrumentation was calibrated using certified quantitative standards containing only the linear isomer for all target analytes, except PFOS, which was calibrated using a certified branched and linear isomer mixture, with the exception of the following sample:

DHK797 *MALMS04-003-SD-001* *QC batch 4731205*

This QC batch was calibrated using certified quantitative standards containing only the linear isomer for all target analytes, except Perfluorooctanesulfonate (PFOS) and Perfluorohexane sulfonate (PFHxS), which were calibrated using certified branched and linear isomer mixtures.

As additional certified reference materials containing branched and linear isomers become commercially available, they will be incorporated into the analytical method.

Data Qualifiers

In the Results of Analyses, U-flags are applied to results that are less than the DL (MDL). J-flags are applied to results that are less than the RDL (LOQ) but greater than the DL (MDL). Due to limitations in LIMS, the results cannot be J-flagged to the LOD. MDLs, LODs and LOQs for each analyte are presented in the tables below:

Parameter	MDL (ug/kg)	LOD (ug/kg)	LOQ (ug/kg)
Perfluorobutanoic acid (PFBA)	0.23	0.5	1.0
Perfluorobutane sulfonate (PFBS)	0.25	0.5	1.0
Perfluoropentanoic acid (PFPeA)	0.21	0.5	1.0
Perfluorohexanoic acid (PFHxA)	0.21	0.5	1.0
Perfluorohexane sulfonate (PFHxS)	0.19	0.5	1.0
Perfluoroheptanoic acid (PFHpA)	0.18	0.5	1.0
Perfluorooctanoic acid (PFOA)	0.12	0.4	1.0
Perfluorooctane sulfonate (PFOS)	0.16	0.5	1.0
Perfluorononanoic acid (PFNA)	0.14	0.5	1.0
Perfluorodecanoic acid (PFDA)	0.28	0.8	1.0
Perfluorodecanesulfonate (PFDS)	0.20	0.5	1.0
Perfluoroundecanoic acid (PFUnA)	0.26	0.8	1.0
Perfluorododecanoic acid (PFDoA)	0.24	0.5	1.0
Perfluorotridecanoic Acid (PFTrDA)	0.25	0.5	1.0
Perfluorotetradecanoic Acid (PFTeDA)	0.22	0.5	1.0
Perfluorooctane Sulfonamide (PFOSA)	0.17	0.5	1.0
6:2 Fluorotelomer Sulfonate (6:2 FTS)	0.25	0.5	1.0
8:2 Fluorotelomer Sulfonate (8:2 FTS)	0.21	0.5	1.0

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Maxxam Job: B6M8709 – Water Analysis

Sample Analysis

Water samples were initially analyzed on QC batch 4719253 (2016/10/27). The concentrations of selected analytes exceeded the upper calibration range for the following samples:

DHK796	*MALMS04-003-SW-001*	*Perfluorohexanesulfonate (PFHxS), Perfluorooctanesulfonate (PFOS), 6:2 Fluorotelomersulfonate (6:2FTS)*
DHK802	*MALMS04-001-GW-005*	*Perfluorohexanesulfonate (PFHxS)*
DHK803	*MALMS-IDWWATER-001*	*Perfluoropentanoic acid (PFPeA), Perfluorohexanoic acid (PFHxA), Perfluorohexanesulfonate (PFHxS), Perfluorooctanoic acid (PFOA), 6:2 Fluorotelomersulfonate (6:2FTS)*

Samples were re-extracted and re-analyzed with 5x dilutions for these compounds on QC batches 4722786 (2016/10/28) and 4726420 (2016/11/01). Detection limits were adjusted accordingly.

Internal Standard Responses

Isotopically labeled $^{13}C_2$-Perfluorotetradecanoic acid (MPFTeDA) is used as an internal standard to quantify native Perfluorotridecanoic acid (PFTrDA) & Perfluorotetradecanoic acid (PFTeDA). The instrument response observed for this labeled compound was below the defined lower control limit (LCL) for the following sample:

DHK795 *MALMS04-004-SW-001*

The instrument response for the injection standard ($^{13}C_9$-Perfluorodecanoic acid, $^{13}C_9$-PFDA) fell within the required tolerance limits. This indicates that the response observed for this isotopically labeled internal standard was not a result of poor or inconsistent sample introduction into the liquid chromatograph/tandem mass spectrometer (LC/MS/MS).

When quantifying analytes using isotope dilution techniques, the isotopically labeled standards differ from the native compounds only in the presence of the stable isotopes. The physical and chemical behavior of each labeled compound is virtually identical to its unlabeled or “native” analog. Any losses (or apparent gain) of the native compound that may occur during any of the sample preparation, extraction, cleanup or determinative steps will be mirrored by a similar loss (or apparent gain) of the labeled standard, and as such can be accounted for and corrected. Therefore, the quantification of these target compounds is not affected by the low (or high) recoveries, provided the instrument response for the native and labeled compounds is distinguishable from the instrument or background noise.

Quantitation of PFAS

Many PFAS (e.g. PFOS) have several isomeric forms that may show up as separate or partially-merged peaks in the analytical chromatograms. These peaks will be integrated and the areas summed such that the result represents the concentration of the sum of the linear and branched isomers, per USEPA (2009). Instrumentation is calibrated using certified quantitative standards containing only the linear isomer for all target analytes, except PFOS, which is calibrated using a certified branched and linear isomer mixture. As additional certified reference materials containing branched and linear isomers become commercially available, they will be incorporated into the analytical method.

Data Qualifiers

In the Results of Analyses, U-flags are applied to results that are less than the DL (MDL). J-flags are applied to results that are less than the RDL (LOQ) but greater than the DL (MDL). Due to limitations in LIMS, the results cannot be J-flagged to the LOD. MDLs, LODs and LOQs for each analyte are presented in the tables below:

Parameter	MDL (ug/L)	LOD (ug/L)	LOQ (ug/L)
Perfluorobutanoic acid (PFBA)	0.0066	0.014	0.02
Perfluorobutane sulfonate (PFBS)	0.0019	0.007	0.02
Perfluoropentanoic acid (PFPeA)	0.0036	0.010	0.02
Perfluorohexanoic acid (PFHxA)	0.0046	0.010	0.02
Perfluorohexane sulfonate (PFHxS)	0.0040	0.010	0.02
Perfluoroheptanoic acid (PFHpA)	0.0047	0.010	0.02
Perfluorooctanoic acid (PFOA)	0.0053	0.014	0.02
Perfluorooctane sulfonate (PFOS)	0.0033	0.010	0.02
Perfluorononanoic acid (PFNA)	0.0046	0.010	0.02
Perfluorodecanoic acid (PFDA)	0.0066	0.014	0.02
Perfluorodecanesulfonate (PFDS)	0.0043	0.010	0.02
Perfluoroundecanoic acid (PFUnA)	0.0037	0.010	0.02
Perfluorododecanoic acid (PFDoA)	0.0057	0.014	0.02
Perfluorotridecanoic Acid (PFTrDA)	0.0032	0.010	0.02
Perfluorotetradecanoic Acid (PFTeDA)	0.0052	0.014	0.02
Perfluorooctane Sulfonamide (PFOSA)	0.0058	0.014	0.02
6:2 Fluorotelomer Sulfonate (6:2 FTS)	0.0065	0.014	0.02
8:2 Fluorotelomer Sulfonate (8:2 FTS)	0.0055	0.014	0.02

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PROJECT NARRATIVE

Maxxam Analytics
Client Project #: M2027.0003 (OMAHA)

Client: Aerostar SES LLC
Client Project: M2027.0003 (OMAHA)

I. SAMPLE RECEIPT/ANALYSIS

a) Sample Listing

Maxxam ID	Client Sample ID	Date Sampled	Date Received	Date Prepped	Date Run	Initial Calibration
PFOS and PFOA in soil						
DHK765	MALMS04-001-SS-001	2016/10/18	2016/10/22	2016/10/31	2016/11/02	2016/11/02
DHK766	MALMS04-001-SO-004	2016/10/18	2016/10/22	2016/10/31	2016/11/02	2016/11/02
DHK767	MALMS04-002-SS-001	2016/10/18	2016/10/22	2016/10/31	2016/11/02	2016/11/02
DHK768	MALMS04-00н-SO-002	2016/10/18	2016/10/22	2016/10/31	2016/11/02	2016/11/02
DHK769	MALMS03-001-SO-020	2016/10/19	2016/10/22	2016/10/31	2016/11/02	2016/11/02
DHK771	MALMS03-003-SO-009	2016/10/19	2016/10/22	2016/10/31	2016/11/02	2016/11/02
DHK772	MALMS03-002-SO-020	2016/10/20	2016/10/22	2016/10/31	2016/11/02	2016/11/02
DHK775	MALMS03-004-SD-001	2016/10/21	2016/10/22	2016/10/31	2016/11/02	2016/11/02
DHK777	MALMS-IDWSOIL-001	2016/10/21	2016/10/22	2016/10/31	2016/11/02	2016/11/02
DHK797	MALMS04-003-SD-001	2016/10/21	2016/10/22	2016/11/01	2016/11/04	2016/11/04
DHK798	MALMS04-004-SD-001	2016/10/21	2016/10/22	2016/10/31	2016/11/02	2016/11/02
PFOS and PFOA in water						
DHK764	MALMS-RS-008	2016/10/18	2016/10/22	2016/10/26	2016/10/27	2016/10/27
DHK770	MALMS-RS-009	2016/10/19	2016/10/22	2016/10/26	2016/10/27	2016/10/27
DHK773	MALMS-RS-010	2016/10/20	2016/10/22	2016/10/26	2016/10/27	2016/10/27
DHK774	MALMS-RS-011	2016/10/21	2016/10/22	2016/10/26	2016/10/27	2016/10/27
DHK776	MALMS03-004-SW-001	2016/10/21	2016/10/22	2016/10/26	2016/10/27	2016/10/27
DHK795	MALMS04-004-SW-001	2016/10/21	2016/10/22	2016/10/26	2016/10/27	2016/10/27
DHK796	MALMS04-003-SW-001	2016/10/21	2016/10/22	2016/10/28	2016/10/28	2016/10/28
DHK799	MALMS04-002-GW-004	2016/10/21	2016/10/22	2016/10/26	2016/10/27	2016/10/27
DHK800	MALMS04-002-GW-904	2016/10/21	2016/10/22	2016/10/26	2016/10/27	2016/10/27
DHK802	MALMS04-001-GW-005	2016/10/21	2016/10/22	2016/10/26	2016/10/27	2016/10/27
DHK803	MALMS-IDWWATER-001	2016/10/21	2016/10/22	2016/10/28	2016/10/28	2016/10/28

Run Date is defined as the date of injection of the last calibration standard (12 hours or less) prior to the samples analyzed within that run sequence. Therefore the time of calibration injection that defines the run date is always within 12 hours of the time of sample injection.

b) Shipping Problems: none encountered

c) Documentation Problems: The following IDs were updated as per client request:
MALMS04-001-S0-004 should be MALMS04-001-SO-004
MALMS04-001-SS-002 should be MALMS04-001-SO-002
MALMS03-001-S0-020 should be MALMS03-001-SO-020
MALMS03-003-S0-009 should be MALMS03-003-SO-009
MALMS03-002-S0-020 should be MALMS03-002-SO-020
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II. SAMPLE PREP:

No problems encountered

III. SAMPLE ANALYSIS:

See also comments within the appropriate Certificate of Analysis

a) Hold Times: all within recommended hold times

b) Instrument Calibration: all within control limits

c) Quality Control: All applicable QC meets control criteria, except where otherwise noted.

d) All analytes requiring manual intergration(s) are noted on the sample chromatograms

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for other than the conditions detailed above.

In addition, I certify, that to the best of my knowledge and belief, the data as reported are true and accurate. Release of the data contained in this data package has been authorized by the cognizant laboratory official or his/her designee, as verified by this signature.

M Di Grazia

201TKLHKMT

Date

Appendix F
Investigative Derived Waste Manifests

Veh # 526397

691702135457-002 SC PPW 1/4/2017

Please print or type. (Form designed for use on elite (12-pitch) typewriter.) Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator ID Number: MT8571924556
2. Page 1 of: 3
3. Emergency Response Phone: (800) 483-3718
4. Manifest Tracking Number: 010314696 FLE

GENERATOR

5. Generator's Name and Mailing Address
Malmstrom AFB
39 78th Street North
Malmstrom AFB, MT 59402
Generator's Phone:

Generator's Site Address (if different than mailing address)
21 77th Street N
Malmstrom AFB,MT 59402

6. Transporter 1 Company Name: Clean Harbors Environmental Service, Inc.
U.S. EPA ID Number: MAD039322250

7. Transporter 2 Company Name: Clean Harbors Environmental Services Inc
U.S. EPA ID Number: MAD039322250

8. Designated Facility Name and Site Address
Clean Harbors Deer Park, LLC
2027 Independence Parkway South
La Porte, TX 77571
Facility's Phone: (281) 930-2300
U.S. EPA ID Number: TXD055141378

9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes
	1. NON HAZARDOUS, NON D.O.T. REGULATED, (SOIL)	022	Dm	11000	P	OUTS4091
	2.					
	3.					
	4.					

14. Special Handling Instructions and Additional Information
1.CH1379266 22x55dm

15. **GENERATOR'S/OFFEROR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent.
I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.

Generator's/Offeror's Printed/Typed Name: Frank A Carpenter
Signature:
Month: 05 Day: 03 Year: 17

INT'L

16. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter signature (for exports only): Date leaving U.S.:

TRANSPORTER

17. Transporter Acknowledgment of Receipt of Materials
Transporter 1 Printed/Typed Name: Anthony C-Romero
Signature:
Month: 05 Day: 03 Year: 17
Transporter 2 Printed/Typed Name: Cathy Hoff
Signature: Cathy Hoff
Month: 5 Day: 15 Year: 17

DESIGNATED FACILITY

18. Discrepancy
18a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection
Manifest Reference Number:
18b. Alternate Facility (or Generator) U.S. EPA ID Number
Facility's Phone:
18c. Signature of Alternate Facility (or Generator) Month Day Year

19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

1.	2.	3.	4.
H141			

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a
Printed/Typed Name: Sandy Beach
Signature: Sandy Beach
Month: 5 Day: 31 Year: 17

EPA Form 8700-22 (Rev. 3-05) Previous editions are obsolete.

DESIGNATED FACILITY TO DESTINATION STATE (IF REQUIRED)

Please print or type. (Form designed for use on elite (12-pitch) typewriter.) Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST (Continuation Sheet)

21. Generator ID Number: MT8571924550

22. Page: 2 of 3

23. Manifest Tracking Number: 010314696 FLE

24. Generator's Name: Malmstrom

25. Transporter 3 Company Name: TSMT — U.S. EPA ID Number: MAD 095038998

26. Transporter 4 Company Name: CleanHarborsEnvSvcsInc — U.S. EPA ID Number: MAD039322250

27a. HM	27b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	28. Containers No.	28. Containers Type	29. Total Quantity	30. Unit Wt./Vol.	31. Waste Codes

RQ

32. Special Handling Instructions and Additional Information

TRANSPORTER

33. Transporter 3 Acknowledgment of Receipt of Materials
Printed/Typed Name: Domonique Byrd — Signature: Domonique Byrd — Month: 05 Day: 19 Year: 17

34. Transporter 4 Acknowledgment of Receipt of Materials
Printed/Typed Name: JessicaEggli — Signature: JessicaEggli — Month: 5 Day: 20 Year: 17

DESIGNATED FACILITY

35. Discrepancy

36. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

EPA Form 8700-22A (Rev. 3-05) Previous editions are obsolete.

DESIGNATED FACILITY TO DESTINATION STATE (IF REQUIRED)

Please print or type. (Form designed for use on elite (12-pitch) typewriter.) Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST (Continuation Sheet)

21. Generator ID Number: MT8571924556 | 22. Page: 3 | 23. Manifest Tracking Number: 010314696 FLE

24. Generator's Name: Malmstrom AFB

25. Transporter 65 KB Company Name: Clean Harbors Environmental | U.S. EPA ID Number: MAD039333350

26. Transporter 5 KB Company Name: Action | U.S. EPA ID Number: VAR000007237

27a. HM	27b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	28. Containers No.	28. Containers Type	29. Total Quantity	30. Unit Wt./Vol.	31. Waste Codes

TPO

32. Special Handling Instructions and Additional Information

TRANSPORTER

33. Transporter 6 KB Acknowledgment of Receipt of Materials
Printed/Typed Name: Kristen Baxendale | Signature: KBaxendale | Month: 5 | Day: 27 | Year: 17

34. Transporter 5 KB Acknowledgment of Receipt of Materials
Printed/Typed Name: Daniel Lopez | Signature: | Month: 5 | Day: 25 | Year: 17

DESIGNATED FACILITY

35. Discrepancy

36. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

Job # 640

69 1702135457-002 SC PPW 1/4/2017

Please print or type. (Form designed for use on elite (12-pitch) typewriter.) Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST	1. Generator ID Number	2. Page 1 of	3. Emergency Response Phone	4. Manifest Tracking Number
	MT8571924556	1	(800) 483-3718	010314695 FLE

GENERATOR

5. Generator's Name and Mailing Address
Malmstrom AFB
39 78th Street North
Malmstrom AFB, MT 59402
Generator's Phone:

Generator's Site Address (if different than mailing address)
21 77th Street N
Malmstrom AFB,MT 59402

6. Transporter 1 Company Name
Clean Harbors Environmental Service, Inc.
U.S. EPA ID Number
MAD039322250

7. Transporter 2 Company Name
Chris
U.S. EPA ID Number
MAD039322252

8. Designated Facility Name and Site Address
Clean Harbors Aragonite LLC
11600 North Aptus Road
Grantsville, UT 84029
Facility's Phone: (435) 884-8100
U.S. EPA ID Number
UTD981552177

9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes
	1. NON HAZARDOUS, NON D.O.T. REGULATED LIQUID, (WATER)	006	PM	00330	G	
	2.					
	3.					
	4.					

14. Special Handling Instructions and Additional Information
1.CH1379269 64-85dm

15. **GENERATOR'S/OFFEROR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent.
I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.

Generator's/Offeror's Printed/Typed Name: Frank A Carpenter
Signature:
Month 05 Day 03 Year 17

INT'L

16. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter signature (for exports only): Date leaving U.S.:

TRANSPORTER

17. Transporter Acknowledgment of Receipt of Materials
Transporter 1 Printed/Typed Name: Anthony C. Romero
Signature:
Month 05 Day 03 Year 17

Transporter 2 Printed/Typed Name: Nate Weaver
Signature:
Month 5 Day 15 Year 17

DESIGNATED FACILITY

18. Discrepancy
18a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection
Manifest Reference Number:

18b. Alternate Facility (or Generator)
U.S. EPA ID Number
Facility's Phone:

18c. Signature of Alternate Facility (or Generator)
Month Day Year

19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

1.	2.	3.	4.
H040			

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a
Printed/Typed Name: Haley Lyst
Signature:
Month 5 Day 24 Year 17

EPA Form 8700-22 (Rev. 3-05) Previous editions are obsolete.

DESIGNATED FACILITY TO DESTINATION STATE (IF REQUIRED)

9/27/2017

M2027.0003

Appendix G

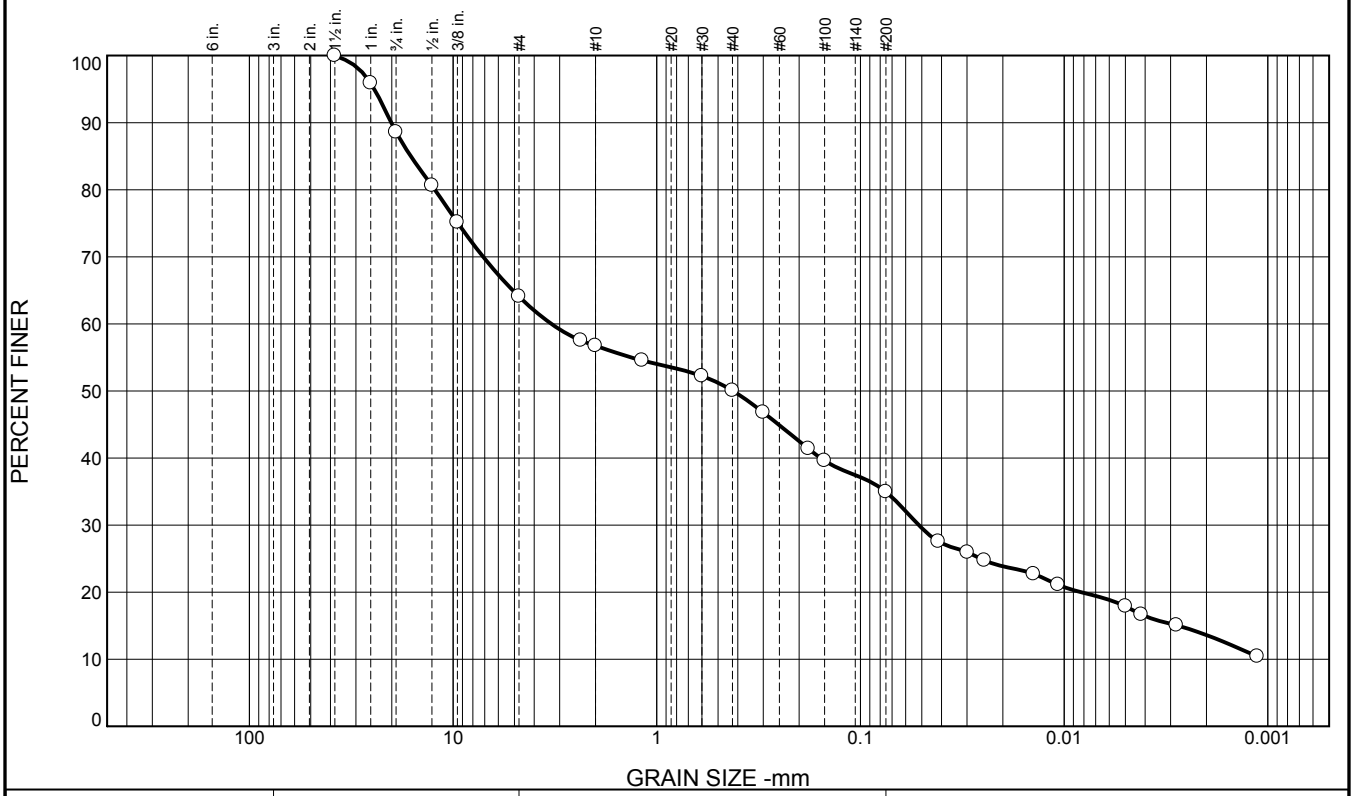
Physiochemical Sample Results

Table G-1 Physiochemical Sample Results

AFFF Area	Sample ID	Media[a]	pH	TOC (mg/kg)	% Passing #4 Sieve	% Passing #200 Sieve	% Solids	USCS Classification
1	MALMS01-004-SS-001	SS	7.65	4540	64.1	34.9	75.1	GM
1	MALMS01-004-SO-021	SO	7.62	4620	94.9	71.6	75.4	CL
2	MALMS02-006-SS-001	SS	7.68	7290	76.4	43.7	82.8	SC/SM
2	MALMS02-006-SO-020	SO	7.66	2240	99.0	73.7	73.8	CL
3	MALMS03-005-SS-001	SS	8.12	5960	82.9	42.1	84.8	SC/SM
3	MALMS03-005-SO-020	SO	7.76	872	99.4	75.4	86.7	CL
4	MALMS04-005-SS-001	SS	7.53	6870	99.6	46.9	75.2	SC/SM
4	MALMS04-005-SO-003	SO	7.96	1380	100	19.7	84.5	SM
5	MALMS05-004-SS-001	SS	8.1	6190	99.8	56.5	86.0	CL
5	MALMS05-004-SO-010	SO	7.64	1840	87.9	72.4	83.2	CL

[a] SS=surface soil, SO=subsurface soil
AFB=Air Force Base
AFFF = aqueous film forming foam
ID = identification
mg/kg = milligrams per kilogram
pH = potential of hydrogen
TOC = total organic carbon

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	11.4	24.5	7.4	6.6	15.2	17.0	17.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1	95.9		
3/4	88.6		
1/2	80.6		
3/8	75.1		
#4	64.1		
#8	57.5		
#10	56.7		
#16	54.5		
#30	52.2		
#40	50.1		
#50	46.8		
#80	41.4		
#100	39.6		
#200	34.9		

* (no specification provided)

Material Description

Brown Sandy Fine to Coarse Gravel, Some Silt and Clay

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 20.1197 D_{85}= 16.1571 D_{60}= 3.2929
D_{50}= 0.4222 D_{30}= 0.0517 D_{15}= 0.0028
D_{10}= C_u= C_c=

Classification

USCS= GM AASHTO=

Remarks

Sample Number: MALMS01-004-SS-001

Date: 11/8/16

CGC,Inc.

Client: CT Laboratories
Project: Site Insp of AFFF Areas - Malmstrom AFB
PO# 123109 CGC
Project No: C15013-22 **Figure**

Tested By: DRW **Checked By:** AJB

Particle Size Distribution Report

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	5.1	2.0	3.9	17.4	32.6	39.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4	100.0		
1/2	98.3		
3/8	97.4		
#4	94.9		
#8	93.2		
#10	92.9		
#16	91.9		
#30	90.5		
#40	89.0		
#50	86.1		
#80	79.2		
#100	77.0		
#200	71.6		

* (no specification provided)

Material Description

Brown Lean Clay, Some Sand, Little Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.5169 D_{85}= 0.2745 D_{60}= 0.0437
D_{50}= 0.0188 D_{30}= 0.0021 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO=

Remarks

* - Visual Classification Only. No Atterberg Limits Performed

Sample Number: MALMS01-004-SO-021

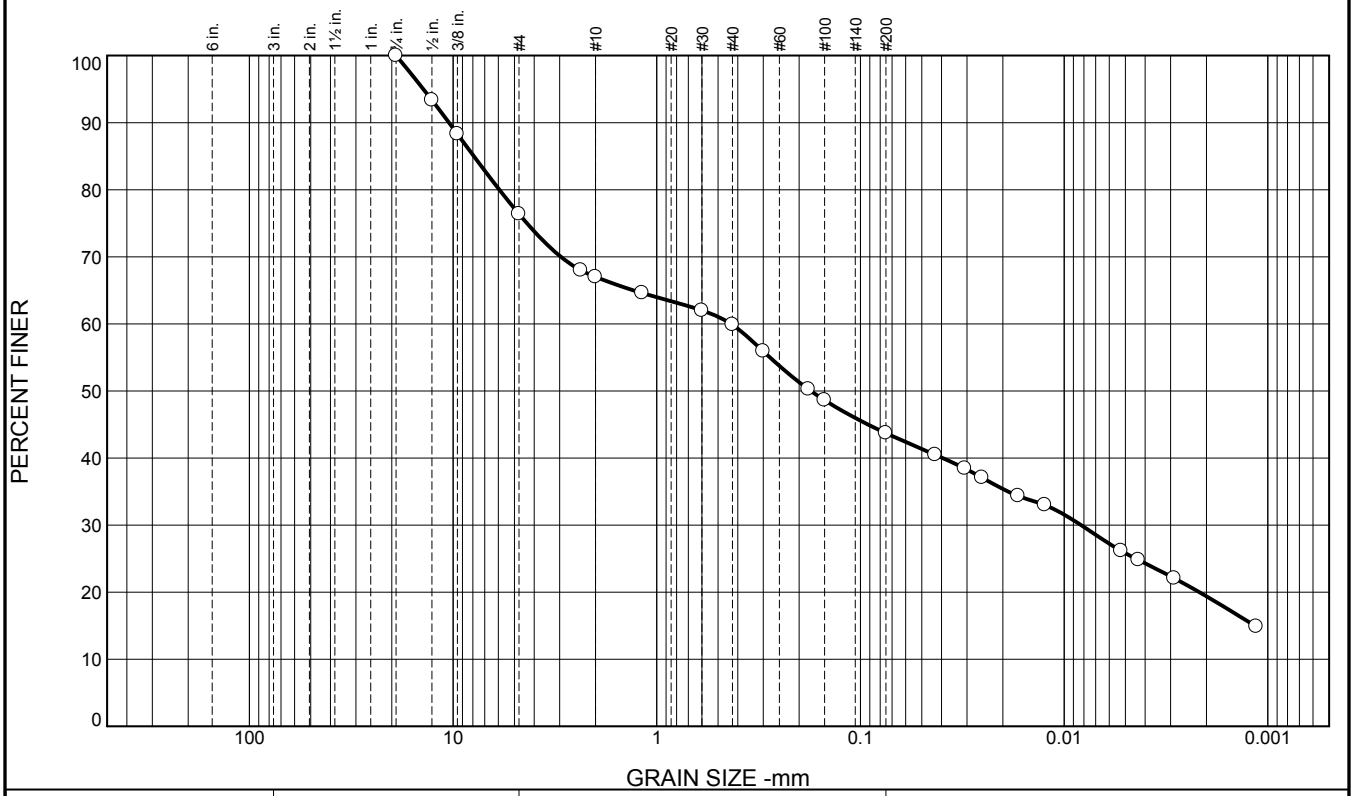
Date: 11/8/16

CGC,Inc.

Client: CT Laboratories
Project: Site Insp of AFFF Areas - Malmstrom AFB
PO# 123109 CGC
Project No: C15013-22 **Figure**

Tested By: DRW **Checked By:** AJB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	23.6	9.4	7.1	16.2	17.9	25.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4	100.0		
1/2	93.4		
3/8	88.3		
#4	76.4		
#8	68.0		
#10	67.0		
#16	64.6		
#30	62.0		
#40	59.9		
#50	55.9		
#80	50.3		
#100	48.6		
#200	43.7		

* (no specification provided)

Material Description

Brown Clayey to Silty Fine to Coarse Sand, Some Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 10.4750 D_{85}= 7.9113 D_{60}= 0.4318
D_{50}= 0.1752 D_{30}= 0.0083 D_{15}= 0.0012
D_{10}= C_u= C_c=

Classification

USCS= SC/SM AASHTO=

Remarks

* - Visual Classification Only. No Atterberg Limits Performed

Sample Number: MALMS02-006-SS-001

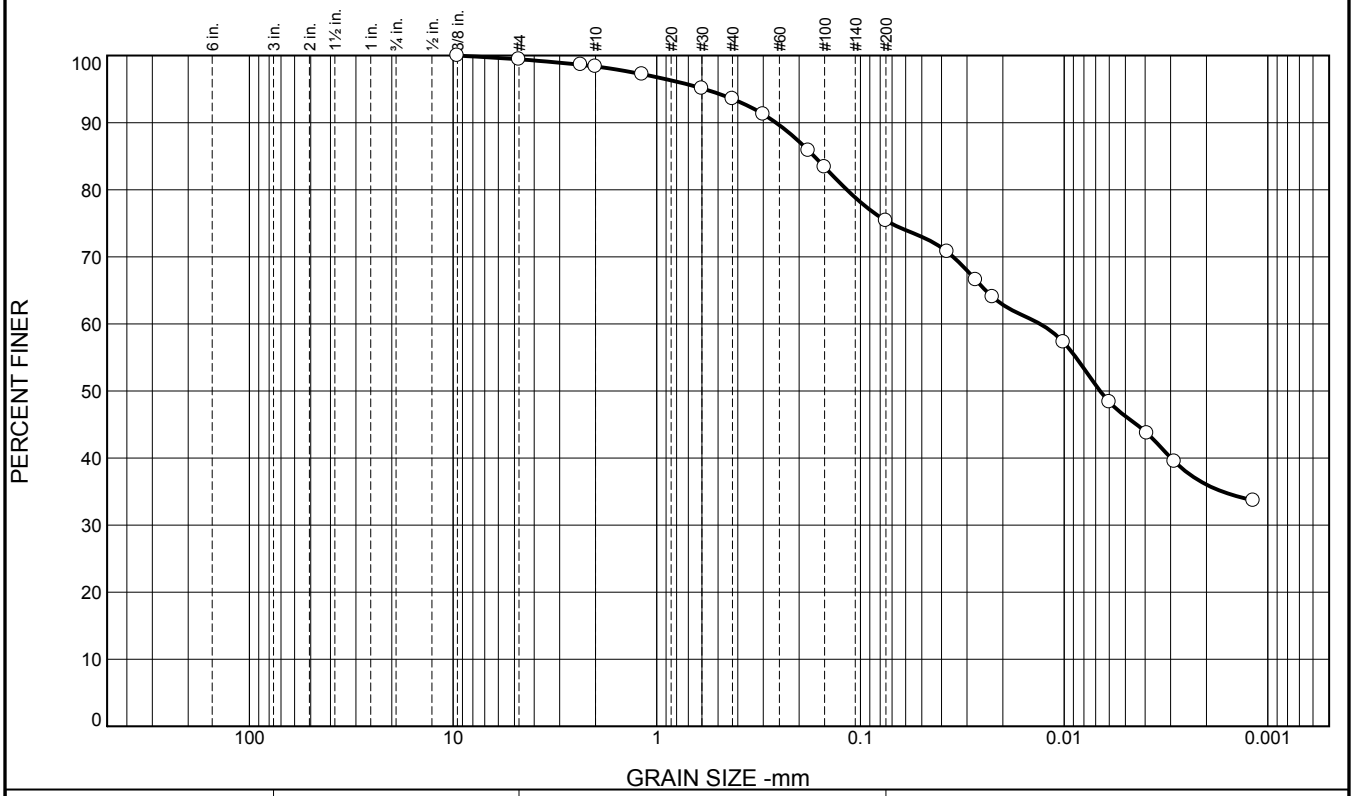
Date: 11/8/16

CGC,Inc.

Client: CT Laboratories
Project: Site Insp of AFFF Areas - Malmstrom AFB
PO# 123109 CGC
Project No: C15013-22 **Figure**

Tested By: DRW **Checked By:** AJB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.6	1.0	4.9	18.1	29.2	46.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8	100.0		
#4	99.4		
#8	98.6		
#10	98.4		
#16	97.2		
#30	95.1		
#40	93.5		
#50	91.3		
#80	85.9		
#100	83.4		
#200	75.4		

* (no specification provided)

Material Description

Brown Lean Clay, Some Sand, Trace Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.2598 D_{85}= 0.1689 D_{60}= 0.0131
D_{50}= 0.0067 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO=

Remarks

* - Visual Classification Only. No Atterberg Limits Performed

Sample Number: MALMS03-005-SO-020

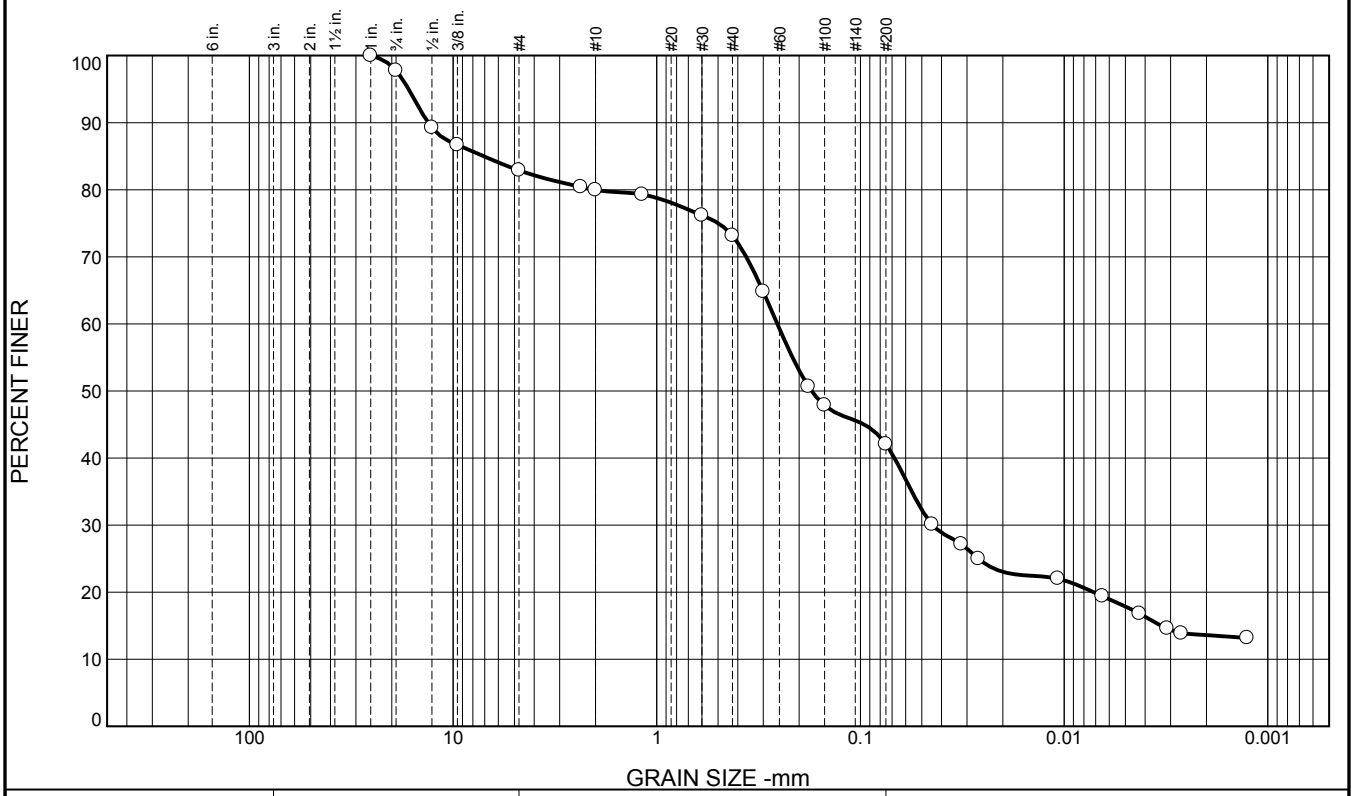
Date: 11/8/16

CGC,Inc.

Client: CT Laboratories
Project: Site Insp of AFFF Areas - Malmstrom AFB
PO# 123109 CGC
Project No: C15013-22 **Figure**

Tested By: DRW **Checked By:** AJB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	2.2	14.9	2.9	6.9	31.0	24.3	17.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
3/4	97.8		
1/2	89.3		
3/8	86.7		
#4	82.9		
#8	80.4		
#10	80.0		
#16	79.3		
#30	76.2		
#40	73.1		
#50	64.8		
#80	50.7		
#100	47.9		
#200	42.1		

* (no specification provided)

Material Description

Brown Silty to Clayey Fine to Medium Sand, Some Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 13.2475 D_{85}= 7.0849 D_{60}= 0.2559
D_{50}= 0.1739 D_{30}= 0.0442 D_{15}= 0.0033
D_{10}= C_u= C_c=

Classification

USCS= SC/SM AASHTO=

Remarks

* - Visual Classification Only. No Atterberg Limits Performed

Sample Number: MALMS03-005-SS-001

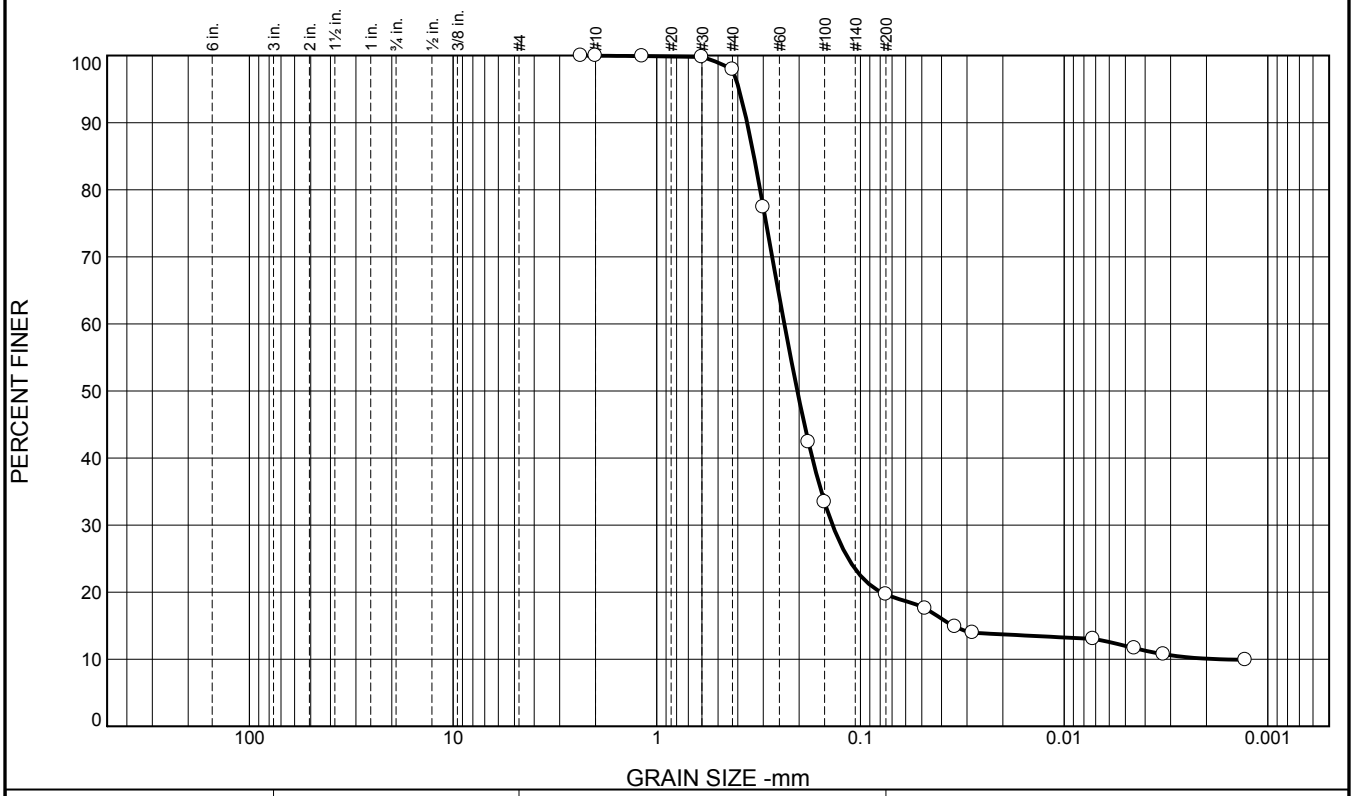
Date: 11/8/16

CGC,Inc.

Client: CT Laboratories
Project: Site Insp of AFFF Areas - Malmstrom AFB
PO# 123109 CGC
Project No: C15013-22 **Figure**

Tested By: DRW **Checked By:** AJB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	2.1	78.2	7.7	12.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#8	100.0		
#10	100.0		
#16	99.9		
#30	99.8		
#40	97.9		
#50	77.4		
#80	42.4		
#100	33.4		
#200	19.7		

* (no specification provided)

Material Description

Brown Fine Sand, Some Silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.3599 D_{85}= 0.3334 D_{60}= 0.2364
D_{50}= 0.2041 D_{30}= 0.1371 D_{15}= 0.0352
D_{10}= 0.0017 C_u= 138.78 C_c= 46.67

Classification

USCS= SM AASHTO=

Remarks

Sample Number: MALMS04-005-SO-003

Date: 11/8/16

CGC,Inc.

Client: CT Laboratories

Project: Site Insp of AFFF Areas - Malmstrom AFB
PO# 123109 CGC

Project No: C15013-22 **Figure**

Tested By: DRW **Checked By:** AJB

Particle Size Distribution Report

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.4	0.4	1.4	50.9	10.6	36.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8	100.0		
#4	99.6		
#8	99.2		
#10	99.2		
#16	98.9		
#30	98.5		
#40	97.8		
#50	91.2		
#80	68.6		
#100	60.3		
#200	46.9		

* (no specification provided)

Material Description

Brown Clayey to Silty Fine Sand, Trace Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.2891 D_{85}= 0.2542 D_{60}= 0.1490
D_{50}= 0.1034 D_{30}= 0.0020 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC/SM AASHTO=

Remarks

* - Visual Classification Only. No Atterberg Limits Performed

Sample Number: MALMS04-005-SS-001

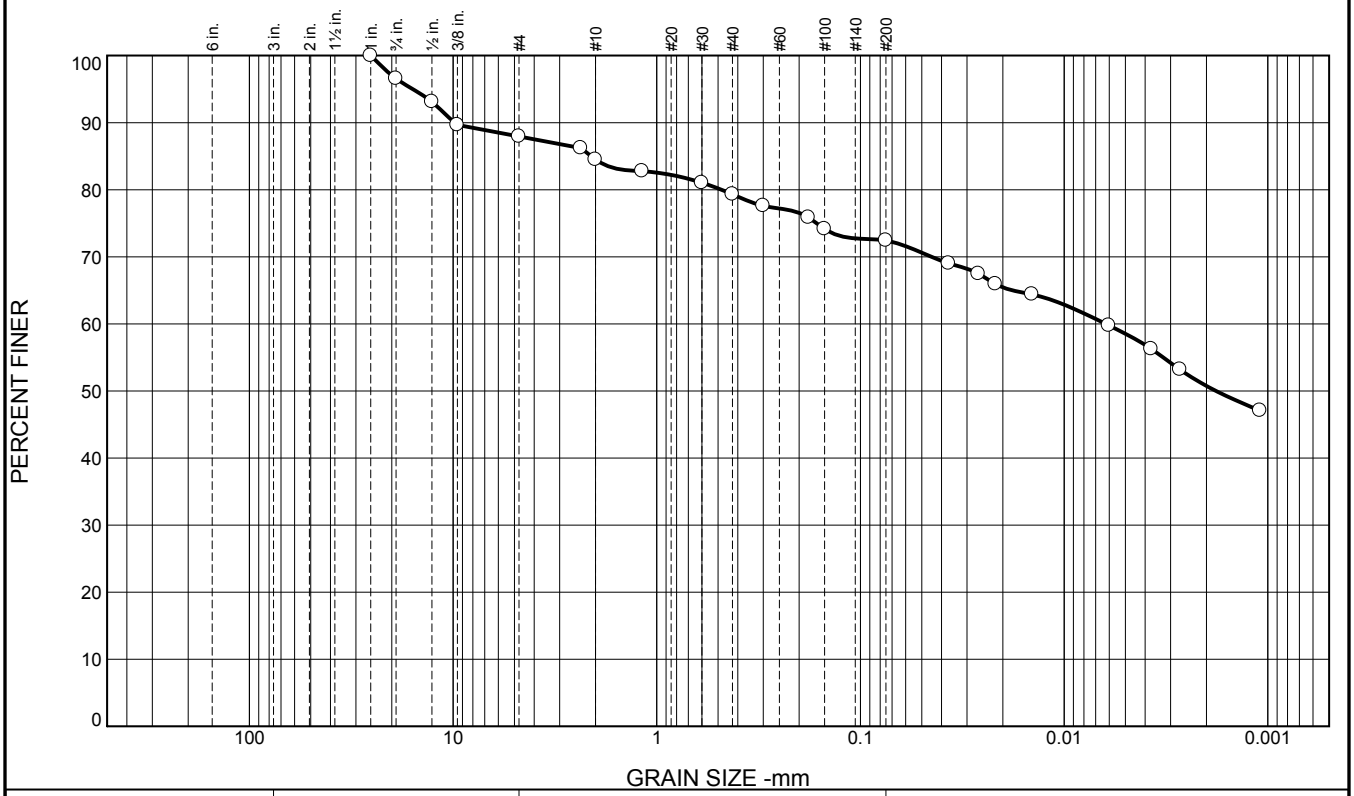
Date: 11/8/16

CGC,Inc.

Client: CT Laboratories
Project: Site Insp of AFFF Areas - Malmstrom AFB
PO# 123109 CGC
Project No: C15013-22 **Figure**

Tested By: DRW **Checked By:** AJB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	3.4	8.7	3.4	5.2	6.9	13.9	58.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
3/4	96.6		
1/2	93.1		
3/8	89.7		
#4	87.9		
#8	86.2		
#10	84.5		
#16	82.8		
#30	81.0		
#40	79.3		
#50	77.6		
#80	75.9		
#100	74.1		
#200	72.4		

* (no specification provided)

Material Description

Brown Lean Clay, Some Sand and Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 9.8349 D_{85}= 2.1050 D_{60}= 0.0063
D_{50}= 0.0018 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO=

Remarks

* - Visual Classification Only. No Atterberg Limits Performed

Sample Number: MALMS05-004-SO-010

Date: 11/8/16

CGC,Inc.

Client: CT Laboratories
Project: Site Insp of AFFF Areas - Malmstrom AFB
PO# 123109 CGC
Project No: C15013-22 **Figure**

Tested By: DRW **Checked By:** AJB

Particle Size Distribution Report

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.2	1.2	7.0	35.1	22.4	34.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8	100.0		
#4	99.8		
#8	98.7		
#10	98.6		
#16	97.1		
#30	94.0		
#40	91.6		
#50	85.3		
#80	68.8		
#100	63.0		
#200	56.5		

* (no specification provided)

Material Description

Brown Sandy Lean Clay, Trace Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.3774 D_{85}= 0.2963 D_{60}= 0.1300
D_{50}= 0.0353 D_{30}= 0.0031 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO=

Remarks

* - Visual Classification Only. No Atterberg Limits Performed

Sample Number: MALMS05-004-SS-001

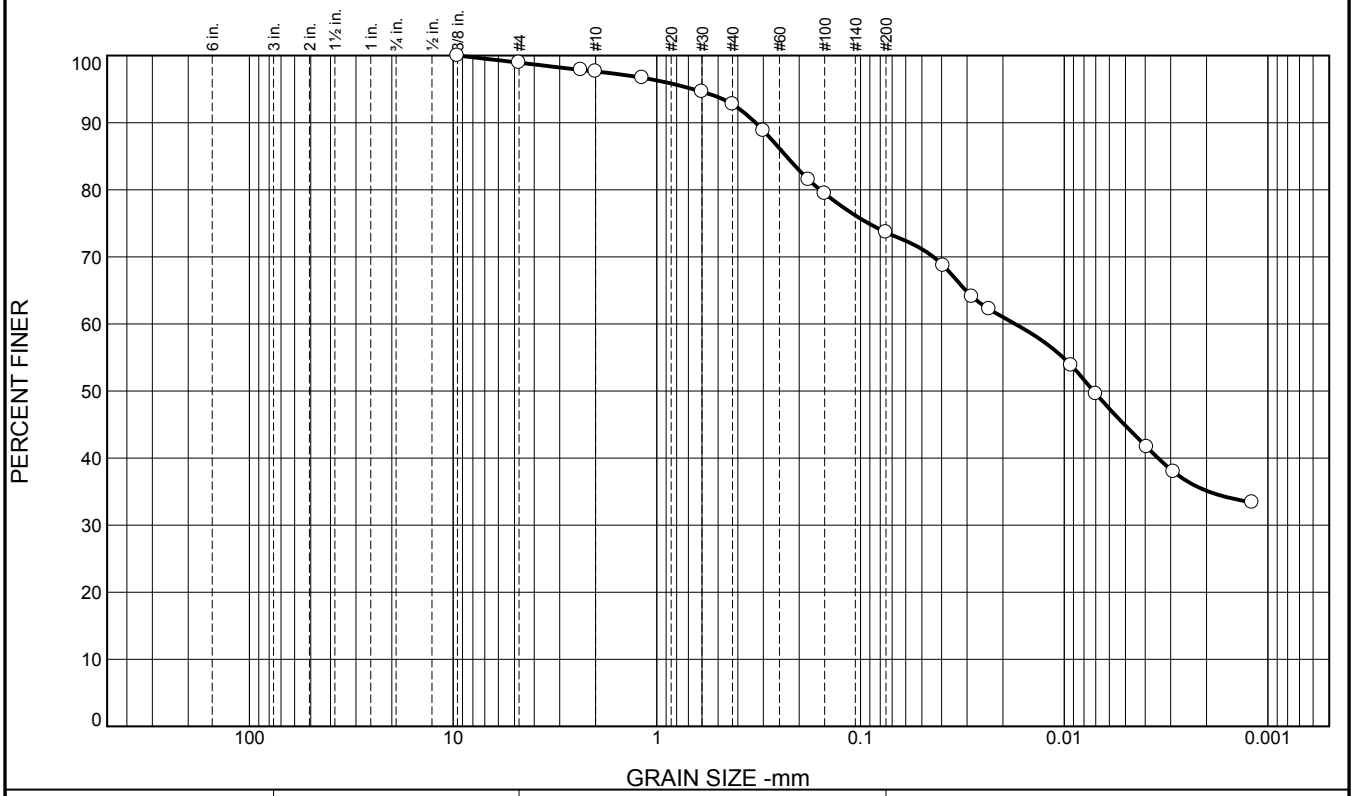
Date: 11/8/16

CGC,Inc.

Client: CT Laboratories
Project: Site Insp of AFFF Areas - Malmstrom AFB
PO# 123109 CGC
Project No: C15013-22 **Figure**

Tested By: DRW **Checked By:** AJB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.0	1.4	4.9	19.0	28.9	44.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8	100.0		
#4	99.0		
#8	97.9		
#10	97.6		
#16	96.7		
#30	94.6		
#40	92.7		
#50	88.8		
#80	81.5		
#100	79.4		
#200	73.7		

* (no specification provided)

Material Description

Brown Lean Clay, Some Sand, Trace Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.3275 D_{85}= 0.2312 D_{60}= 0.0174
D_{50}= 0.0072 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO=

Remarks

* - Visual Classification Only. No Atterberg Limits Performed

Sample Number: MALMS02-006-SO-020

Date: 11/8/16

CGC,Inc.

Client: CT Laboratories
Project: Site Insp of AFFF Areas - Malmstrom AFB
PO# 123109 CGC
Project No: C15013-22 **Figure**

Tested By: DRW **Checked By:** AJB

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INORGANIC ANALYSIS DATA SHEET

Sample Description

MALMS01-004-SO-001

Lab Name:	CT Laboratories	Contract:	MAXXAM ANALYTICS-SITE INSP OF AFFF AREAS
Matrix (soil/water):	SOIL	SDG No.:	123109
% Solids:	75.4	Lab Sample ID:	792769
Analytical Method:	EPA 8000C	Date Received:	10/24/2016
Dilution Factor:	1.00	TCLP/SPLP Extraction Date/time:	
Analytical Run #:	131961	Analysis Date/Time	10/28/2016 11:26
Analytical Prep Batch #:		Prep. Date/Time:	
ICAL Calibration #:		Concentration Units:	%

CAS #	Analyte	Concentration	Qualifiers	DL	LOD	LOQ	RL
SOLID	Solids, Percent	75.4		0.1	0.1	0.1	0.1

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INORGANIC ANALYSIS DATA SHEET

Sample Description

MALMS01-004-SO-001

Lab Name:	CT Laboratories	Contract:	MAXXAM ANALYTICS-SITE INSP OF AFFF AREAS
Matrix (soil/water):	SOIL	SDG No.:	123109
% Solids:	75.4	Lab Sample ID:	792769
Analytical Method:	L-Kahn/9060A	Date Received:	10/24/2016
Dilution Factor:	1.00	TCLP/SPLP Extraction Date/time:	
Analytical Run #:	132306	Analysis Date/Time	11/04/2016 12:15
Analytical Prep Batch #:		Prep. Date/Time:	
ICAL Calibration #:	ICAL TOC0105	Concentration Units:	mg/kg

CAS #	Analyte	Concentration	Qualifiers	DL	LOD	LOQ	RL
TOC	Total Organic Carbon	4620	Y	48	99	200	200

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INORGANIC ANALYSIS DATA SHEET

Sample Description

MALMS01-004-SO-001

Lab Name:	CT Laboratories	Contract:	MAXXAM ANALYTICS-SITE INSP OF AFFF AREAS
Matrix (soil/water):	SOIL	SDG No.:	123109
% Solids:	75.4	Lab Sample ID:	792769
Analytical Method:	EPA 9045D	Date Received:	10/24/2016
Dilution Factor:	1	TCLP/SPLP Extraction Date/time:	
Analytical Run #:	131837	Analysis Date/Time	10/25/2016 14:30
Analytical Prep Batch #:		Prep. Date/Time:	
ICAL Calibration #:		Concentration Units:	S.U.

CAS #	Analyte	Concentration	Qualifiers	DL	LOD	LOQ	RL
PH	pH	7.62		0.1	0.1	0.1	0.1

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INORGANIC ANALYSIS DATA SHEET

Sample Description

MALMS01-004-SS-021

Lab Name:	CT Laboratories	Contract:	MAXXAM ANALYTICS-SITE INSP OF AFFF AREAS
Matrix (soil/water):	SOIL	SDG No.:	123109
% Solids:	75.1	Lab Sample ID:	792770
Analytical Method:	EPA 8000C	Date Received:	10/24/2016
Dilution Factor:	1.00	TCLP/SPLP Extraction Date/time:	
Analytical Run #:	131961	Analysis Date/Time	10/28/2016 11:26
Analytical Prep Batch #:		Prep. Date/Time:	
ICAL Calibration #:		Concentration Units:	%

CAS #	Analyte	Concentration	Qualifiers	DL	LOD	LOQ	RL
SOLID	Solids, Percent	75.1		0.1	0.1	0.1	0.1

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INORGANIC ANALYSIS DATA SHEET

Sample Description

MALMS01-004-SS-021

Lab Name:	CT Laboratories	Contract:	MAXXAM ANALYTICS-SITE INSP OF AFFF AREAS
Matrix (soil/water):	SOIL	SDG No.:	123109
% Solids:	75.1	Lab Sample ID:	792770
Analytical Method:	L-Kahn/9060A	Date Received:	10/24/2016
Dilution Factor:	1.00	TCLP/SPLP Extraction Date/time:	
Analytical Run #:	132306	Analysis Date/Time	11/04/2016 12:23
Analytical Prep Batch #:		Prep. Date/Time:	
ICAL Calibration #:	ICAL TOC0105	Concentration Units:	mg/kg

CAS #	Analyte	Concentration	Qualifiers	DL	LOD	LOQ	RL
TOC	Total Organic Carbon	4540		48	100	200	200

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INORGANIC ANALYSIS DATA SHEET

Sample Description

MALMS01-004-SS-021

Lab Name:	CT Laboratories	Contract:	MAXXAM ANALYTICS-SITE INSP OF AFFF AREAS
Matrix (soil/water):	SOIL	SDG No.:	123109
% Solids:	75.1	Lab Sample ID:	792770
Analytical Method:	EPA 9045D	Date Received:	10/24/2016
Dilution Factor:	1	TCLP/SPLP Extraction Date/time:	
Analytical Run #:	131837	Analysis Date/Time	10/25/2016 14:30
Analytical Prep Batch #:		Prep. Date/Time:	
ICAL Calibration #:		Concentration Units:	S.U.

CAS #	Analyte	Concentration	Qualifiers	DL	LOD	LOQ	RL
PH	pH	7.65		0.1	0.1	0.1	0.1

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INORGANIC ANALYSIS DATA SHEET

Sample Description

MALMS02-006-SS-001

Lab Name:	CT Laboratories	Contract:	MAXXAM ANALYTICS-SITE INSP OF AFFF AREAS
Matrix (soil/water):	SOIL	SDG No.:	123109
% Solids:	82.8	Lab Sample ID:	792771
Analytical Method:	EPA 8000C	Date Received:	10/24/2016
Dilution Factor:	1.00	TCLP/SPLP Extraction Date/time:	
Analytical Run #:	131961	Analysis Date/Time	10/28/2016 11:26
Analytical Prep Batch #:		Prep. Date/Time:	
ICAL Calibration #:		Concentration Units:	%

CAS #	Analyte	Concentration	Qualifiers	DL	LOD	LOQ	RL
SOLID	Solids, Percent	82.8		0.1	0.1	0.1	0.1

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INORGANIC ANALYSIS DATA SHEET

Sample Description

MALMS02-006-SS-001

Lab Name:	CT Laboratories	Contract:	MAXXAM ANALYTICS-SITE INSP OF AFFF AREAS
Matrix (soil/water):	SOIL	SDG No.:	123109
% Solids:	82.8	Lab Sample ID:	792771
Analytical Method:	L-Kahn/9060A	Date Received:	10/24/2016
Dilution Factor:	1.00	TCLP/SPLP Extraction Date/time:	
Analytical Run #:	132306	Analysis Date/Time	11/04/2016 12:29
Analytical Prep Batch #:		Prep. Date/Time:	
ICAL Calibration #:	ICAL TOC0105	Concentration Units:	mg/kg

CAS #	Analyte	Concentration	Qualifiers	DL	LOD	LOQ	RL
TOC	Total Organic Carbon	7290		43	91	180	180

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INORGANIC ANALYSIS DATA SHEET

Sample Description

MALMS02-006-SS-001

Lab Name:	CT Laboratories	Contract:	MAXXAM ANALYTICS-SITE INSP OF AFFF AREAS
Matrix (soil/water):	SOIL	SDG No.:	123109
% Solids:	82.8	Lab Sample ID:	792771
Analytical Method:	EPA 9045D	Date Received:	10/24/2016
Dilution Factor:	1	TCLP/SPLP Extraction Date/time:	
Analytical Run #:	131837	Analysis Date/Time	10/25/2016 14:30
Analytical Prep Batch #:		Prep. Date/Time:	
ICAL Calibration #:		Concentration Units:	S.U.

CAS #	Analyte	Concentration	Qualifiers	DL	LOD	LOQ	RL
PH	pH	7.68		0.1	0.1	0.1	0.1

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INORGANIC ANALYSIS DATA SHEET

Sample Description

MALMS03-005-SO-020

Lab Name:	CT Laboratories	Contract:	MAXXAM ANALYTICS-SITE INSP OF AFFF AREAS
Matrix (soil/water):	SOIL	SDG No.:	123109
% Solids:	86.7	Lab Sample ID:	792774
Analytical Method:	EPA 8000C	Date Received:	10/24/2016
Dilution Factor:	1.00	TCLP/SPLP Extraction Date/time:	
Analytical Run #:	131961	Analysis Date/Time	10/28/2016 11:26
Analytical Prep Batch #:		Prep. Date/Time:	
ICAL Calibration #:		Concentration Units:	%

CAS #	Analyte	Concentration	Qualifiers	DL	LOD	LOQ	RL
SOLID	Solids, Percent	86.7		0.1	0.1	0.1	0.1

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INORGANIC ANALYSIS DATA SHEET

Sample Description

MALMS03-005-SO-020

Lab Name:	CT Laboratories	Contract:	MAXXAM ANALYTICS-SITE INSP OF AFFF AREAS
Matrix (soil/water):	SOIL	SDG No.:	123109
% Solids:	86.7	Lab Sample ID:	792774
Analytical Method:	L-Kahn/9060A	Date Received:	10/24/2016
Dilution Factor:	1.00	TCLP/SPLP Extraction Date/time:	
Analytical Run #:	132306	Analysis Date/Time	11/04/2016 12:50
Analytical Prep Batch #:		Prep. Date/Time:	
ICAL Calibration #:	ICAL TOC0105	Concentration Units:	mg/kg

CAS #	Analyte	Concentration	Qualifiers	DL	LOD	LOQ	RL
TOC	Total Organic Carbon	872		42	87	170	170

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INORGANIC ANALYSIS DATA SHEET

Sample Description

MALMS03-005-SO-020

Lab Name:	CT Laboratories	Contract:	MAXXAM ANALYTICS-SITE INSP OF AFFF AREAS
Matrix (soil/water):	SOIL	SDG No.:	123109
% Solids:	86.7	Lab Sample ID:	792774
Analytical Method:	EPA 9045D	Date Received:	10/24/2016
Dilution Factor:	1	TCLP/SPLP Extraction Date/time:	
Analytical Run #:	131837	Analysis Date/Time	10/25/2016 14:30
Analytical Prep Batch #:		Prep. Date/Time:	
ICAL Calibration #:		Concentration Units:	S.U.

CAS #	Analyte	Concentration	Qualifiers	DL	LOD	LOQ	RL
PH	pH	7.76		0.1	0.1	0.1	0.1

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INORGANIC ANALYSIS DATA SHEET

Sample Description

MALMS03-005-SS-001

Lab Name:	CT Laboratories	Contract:	MAXXAM ANALYTICS-SITE INSP OF AFFF AREAS
Matrix (soil/water):	SOIL	SDG No.:	123109
% Solids:	84.8	Lab Sample ID:	792773
Analytical Method:	EPA 8000C	Date Received:	10/24/2016
Dilution Factor:	1.00	TCLP/SPLP Extraction Date/time:	
Analytical Run #:	131961	Analysis Date/Time	10/28/2016 11:26
Analytical Prep Batch #:		Prep. Date/Time:	
ICAL Calibration #:		Concentration Units:	%

CAS #	Analyte	Concentration	Qualifiers	DL	LOD	LOQ	RL
SOLID	Solids, Percent	84.8		0.1	0.1	0.1	0.1

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INORGANIC ANALYSIS DATA SHEET

Sample Description

MALMS03-005-SS-001

Lab Name:	CT Laboratories	Contract:	MAXXAM ANALYTICS-SITE INSP OF AFFF AREAS
Matrix (soil/water):	SOIL	SDG No.:	123109
% Solids:	84.8	Lab Sample ID:	792773
Analytical Method:	L-Kahn/9060A	Date Received:	10/24/2016
Dilution Factor:	1.00	TCLP/SPLP Extraction Date/time:	
Analytical Run #:	132306	Analysis Date/Time	11/04/2016 12:44
Analytical Prep Batch #:		Prep. Date/Time:	
ICAL Calibration #:	ICAL TOC0105	Concentration Units:	mg/kg

CAS #	Analyte	Concentration	Qualifiers	DL	LOD	LOQ	RL
TOC	Total Organic Carbon	5960		42	88	180	180

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INORGANIC ANALYSIS DATA SHEET

Sample Description

MALMS03-005-SS-001

Lab Name:	CT Laboratories	Contract:	MAXXAM ANALYTICS-SITE INSP OF AFFF AREAS
Matrix (soil/water):	SOIL	SDG No.:	123109
% Solids:	84.8	Lab Sample ID:	792773
Analytical Method:	EPA 9045D	Date Received:	10/24/2016
Dilution Factor:	1	TCLP/SPLP Extraction Date/time:	
Analytical Run #:	131837	Analysis Date/Time	10/25/2016 14:30
Analytical Prep Batch #:		Prep. Date/Time:	
ICAL Calibration #:		Concentration Units:	S.U.

CAS #	Analyte	Concentration	Qualifiers	DL	LOD	LOQ	RL
PH	pH	8.12		0.1	0.1	0.1	0.1

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INORGANIC ANALYSIS DATA SHEET

Sample Description

MALMS04-005-SO-003

Lab Name:	CT Laboratories	Contract:	MAXXAM ANALYTICS-SITE INSP OF AFFF AREAS
Matrix (soil/water):	SOIL	SDG No.:	123109
% Solids:	84.5	Lab Sample ID:	792776
Analytical Method:	EPA 8000C	Date Received:	10/24/2016
Dilution Factor:	1.00	TCLP/SPLP Extraction Date/time:	
Analytical Run #:	131961	Analysis Date/Time	10/28/2016 11:26
Analytical Prep Batch #:		Prep. Date/Time:	
ICAL Calibration #:		Concentration Units:	%

CAS #	Analyte	Concentration	Qualifiers	DL	LOD	LOQ	RL
SOLID	Solids, Percent	84.5		0.1	0.1	0.1	0.1

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INORGANIC ANALYSIS DATA SHEET

Sample Description

MALMS04-005-SO-003

Lab Name:	CT Laboratories	Contract:	MAXXAM ANALYTICS-SITE INSP OF AFFF AREAS
Matrix (soil/water):	SOIL	SDG No.:	123109
% Solids:	84.5	Lab Sample ID:	792776
Analytical Method:	L-Kahn/9060A	Date Received:	10/24/2016
Dilution Factor:	1.00	TCLP/SPLP Extraction Date/time:	
Analytical Run #:	132306	Analysis Date/Time	11/04/2016 13:07
Analytical Prep Batch #:		Prep. Date/Time:	
ICAL Calibration #:	ICAL TOC0105	Concentration Units:	mg/kg

CAS #	Analyte	Concentration	Qualifiers	DL	LOD	LOQ	RL
TOC	Total Organic Carbon	1380		43	89	180	180

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INORGANIC ANALYSIS DATA SHEET

Sample Description

MALMS04-005-SO-003

Lab Name:	CT Laboratories	Contract:	MAXXAM ANALYTICS-SITE INSP OF AFFF AREAS
Matrix (soil/water):	SOIL	SDG No.:	123109
% Solids:	84.5	Lab Sample ID:	792776
Analytical Method:	EPA 9045D	Date Received:	10/24/2016
Dilution Factor:	1	TCLP/SPLP Extraction Date/time:	
Analytical Run #:	131837	Analysis Date/Time	10/25/2016 14:30
Analytical Prep Batch #:		Prep. Date/Time:	
ICAL Calibration #:		Concentration Units:	S.U.

CAS #	Analyte	Concentration	Qualifiers	DL	LOD	LOQ	RL
PH	pH	7.96		0.1	0.1	0.1	0.1

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INORGANIC ANALYSIS DATA SHEET

Sample Description

MALMS04-005-SS-001

Lab Name:	CT Laboratories	Contract:	MAXXAM ANALYTICS-SITE INSP OF AFFF AREAS
Matrix (soil/water):	SOIL	SDG No.:	123109
% Solids:	75.2	Lab Sample ID:	792775
Analytical Method:	EPA 8000C	Date Received:	10/24/2016
Dilution Factor:	1.00	TCLP/SPLP Extraction Date/time:	
Analytical Run #:	131961	Analysis Date/Time	10/28/2016 11:26
Analytical Prep Batch #:		Prep. Date/Time:	
ICAL Calibration #:		Concentration Units:	%

CAS #	Analyte	Concentration	Qualifiers	DL	LOD	LOQ	RL
SOLID	Solids, Percent	75.2		0.1	0.1	0.1	0.1

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INORGANIC ANALYSIS DATA SHEET

Sample Description

MALMS04-005-SS-001

Lab Name:	CT Laboratories	Contract:	MAXXAM ANALYTICS-SITE INSP OF AFFF AREAS
Matrix (soil/water):	SOIL	SDG No.:	123109
% Solids:	75.2	Lab Sample ID:	792775
Analytical Method:	L-Kahn/9060A	Date Received:	10/24/2016
Dilution Factor:	1.00	TCLP/SPLP Extraction Date/time:	
Analytical Run #:	132306	Analysis Date/Time	11/04/2016 12:59
Analytical Prep Batch #:		Prep. Date/Time:	
ICAL Calibration #:	ICAL TOC0105	Concentration Units:	mg/kg

CAS #	Analyte	Concentration	Qualifiers	DL	LOD	LOQ	RL
TOC	Total Organic Carbon	6870		48	100	200	200

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INORGANIC ANALYSIS DATA SHEET

Sample Description

MALMS04-005-SS-001

Lab Name:	CT Laboratories	Contract:	MAXXAM ANALYTICS-SITE INSP OF AFFF AREAS
Matrix (soil/water):	SOIL	SDG No.:	123109
% Solids:	75.2	Lab Sample ID:	792775
Analytical Method:	EPA 9045D	Date Received:	10/24/2016
Dilution Factor:	1	TCLP/SPLP Extraction Date/time:	
Analytical Run #:	131837	Analysis Date/Time	10/25/2016 14:30
Analytical Prep Batch #:		Prep. Date/Time:	
ICAL Calibration #:		Concentration Units:	S.U.

CAS #	Analyte	Concentration	Qualifiers	DL	LOD	LOQ	RL
PH	pH	7.53		0.1	0.1	0.1	0.1

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INORGANIC ANALYSIS DATA SHEET

Sample Description

MALMS05-004-SO-010

Lab Name:	CT Laboratories	Contract:	MAXXAM ANALYTICS-SITE INSP OF AFFF AREAS
Matrix (soil/water):	SOIL	SDG No.:	123109
% Solids:	83.2	Lab Sample ID:	792778
Analytical Method:	EPA 8000C	Date Received:	10/24/2016
Dilution Factor:	1.00	TCLP/SPLP Extraction Date/time:	
Analytical Run #:	131961	Analysis Date/Time	10/28/2016 11:26
Analytical Prep Batch #:		Prep. Date/Time:	
ICAL Calibration #:		Concentration Units:	%

CAS #	Analyte	Concentration	Qualifiers	DL	LOD	LOQ	RL
SOLID	Solids, Percent	83.2		0.1	0.1	0.1	0.1

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Sample Description

MALMS05-004-SO-010

INORGANIC ANALYSIS DATA SHEET

Lab Name:	CT Laboratories	Contract:	MAXXAM ANALYTICS-SITE INSP OF AFFF AREAS
Matrix (soil/water):	SOIL	SDG No.:	123109
% Solids:	83.2	Lab Sample ID:	792778
Analytical Method:	L-Kahn/9060A	Date Received:	10/24/2016
Dilution Factor:	1.00	TCLP/SPLP Extraction Date/time:	
Analytical Run #:	132306	Analysis Date/Time	11/04/2016 13:34
Analytical Prep Batch #:		Prep. Date/Time:	
ICAL Calibration #:	ICAL TOC0105	Concentration Units:	mg/kg

CAS #	Analyte	Concentration	Qualifiers	DL	LOD	LOQ	RL
TOC	Total Organic Carbon	1840		43	90	180	180

CT LABORATORIES
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INORGANIC ANALYSIS DATA SHEET

Sample Description

MALMS05-004-SO-010

Lab Name:	CT Laboratories	Contract:	MAXXAM ANALYTICS-SITE INSP OF AFFF AREAS
Matrix (soil/water):	SOIL	SDG No.:	123109
% Solids:	83.2	Lab Sample ID:	792778
Analytical Method:	EPA 9045D	Date Received:	10/24/2016
Dilution Factor:	1	TCLP/SPLP Extraction Date/time:	
Analytical Run #:	131837	Analysis Date/Time	10/25/2016 14:30
Analytical Prep Batch #:		Prep. Date/Time:	
ICAL Calibration #:		Concentration Units:	S.U.

CAS #	Analyte	Concentration	Qualifiers	DL	LOD	LOQ	RL
PH	pH	7.64		0.1	0.1	0.1	0.1

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INORGANIC ANALYSIS DATA SHEET

Sample Description

MALMS05-004-SS-001

Lab Name:	CT Laboratories	Contract:	MAXXAM ANALYTICS-SITE INSP OF AFFF AREAS
Matrix (soil/water):	SOIL	SDG No.:	123109
% Solids:	86.0	Lab Sample ID:	792777
Analytical Method:	EPA 8000C	Date Received:	10/24/2016
Dilution Factor:	1.00	TCLP/SPLP Extraction Date/time:	
Analytical Run #:	131961	Analysis Date/Time	10/28/2016 11:26
Analytical Prep Batch #:		Prep. Date/Time:	
ICAL Calibration #:		Concentration Units:	%

CAS #	Analyte	Concentration	Qualifiers	DL	LOD	LOQ	RL
SOLID	Solids, Percent	86.0		0.1	0.1	0.1	0.1

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INORGANIC ANALYSIS DATA SHEET

Sample Description

MALMS05-004-SS-001

Lab Name:	CT Laboratories	Contract:	MAXXAM ANALYTICS-SITE INSP OF AFFF AREAS
Matrix (soil/water):	SOIL	SDG No.:	123109
% Solids:	86.0	Lab Sample ID:	792777
Analytical Method:	L-Kahn/9060A	Date Received:	10/24/2016
Dilution Factor:	1.00	TCLP/SPLP Extraction Date/time:	
Analytical Run #:	132306	Analysis Date/Time	11/04/2016 13:14
Analytical Prep Batch #:		Prep. Date/Time:	
ICAL Calibration #:	ICAL TOC0105	Concentration Units:	mg/kg

CAS #	Analyte	Concentration	Qualifiers	DL	LOD	LOQ	RL
TOC	Total Organic Carbon	6190		42	87	170	170

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INORGANIC ANALYSIS DATA SHEET

Sample Description

MALMS05-004-SS-001

Lab Name:	CT Laboratories	Contract:	MAXXAM ANALYTICS-SITE INSP OF AFFF AREAS
Matrix (soil/water):	SOIL	SDG No.:	123109
% Solids:	86.0	Lab Sample ID:	792777
Analytical Method:	EPA 9045D	Date Received:	10/24/2016
Dilution Factor:	1	TCLP/SPLP Extraction Date/time:	
Analytical Run #:	131837	Analysis Date/Time	10/25/2016 14:30
Analytical Prep Batch #:		Prep. Date/Time:	
ICAL Calibration #:		Concentration Units:	S.U.

CAS #	Analyte	Concentration	Qualifiers	DL	LOD	LOQ	RL
PH	pH	8.10		0.1	0.1	0.1	0.1

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INORGANIC ANALYSIS DATA SHEET

Sample Description

MALMS02-006-SO-020

Lab Name:	CT Laboratories	Contract:	MAXXAM ANALYTICS-SITE INSP OF AFFF AREAS
Matrix (soil/water):	SOIL	SDG No.:	123109
% Solids:	73.8	Lab Sample ID:	792772
Analytical Method:	EPA 8000C	Date Received:	10/24/2016
Dilution Factor:	1.00	TCLP/SPLP Extraction Date/time:	
Analytical Run #:	131961	Analysis Date/Time	10/28/2016 11:26
Analytical Prep Batch #:		Prep. Date/Time:	
ICAL Calibration #:		Concentration Units:	%

CAS #	Analyte	Concentration	Qualifiers	DL	LOD	LOQ	RL
SOLID	Solids, Percent	73.8		0.1	0.1	0.1	0.1

CT LABORATORIES
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INORGANIC ANALYSIS DATA SHEET

Sample Description

MALMS02-006-SO-020

Lab Name:	CT Laboratories	Contract:	MAXXAM ANALYTICS-SITE INSP OF AFFF AREAS
Matrix (soil/water):	SOIL	SDG No.:	123109
% Solids:	73.8	Lab Sample ID:	792772
Analytical Method:	L-Kahn/9060A	Date Received:	10/24/2016
Dilution Factor:	1.00	TCLP/SPLP Extraction Date/time:	
Analytical Run #:	132306	Analysis Date/Time	11/04/2016 12:37
Analytical Prep Batch #:		Prep. Date/Time:	
ICAL Calibration #:	ICAL TOC0105	Concentration Units:	mg/kg

CAS #	Analyte	Concentration	Qualifiers	DL	LOD	LOQ	RL
TOC	Total Organic Carbon	2240		49	100	200	200

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INORGANIC ANALYSIS DATA SHEET

Sample Description

MALMS02-006-SO-020

Lab Name:	CT Laboratories	Contract:	MAXXAM ANALYTICS-SITE INSP OF AFFF AREAS
Matrix (soil/water):	SOIL	SDG No.:	123109
% Solids:	73.8	Lab Sample ID:	792772
Analytical Method:	EPA 9045D	Date Received:	10/24/2016
Dilution Factor:	1	TCLP/SPLP Extraction Date/time:	
Analytical Run #:	131837	Analysis Date/Time	10/25/2016 14:30
Analytical Prep Batch #:		Prep. Date/Time:	
ICAL Calibration #:		Concentration Units:	S.U.

CAS #	Analyte	Concentration	Qualifiers	DL	LOD	LOQ	RL
PH	pH	7.66		0.1	0.1	0.1	0.1

Appendix H
Groundwater Elevation Data

Table H-1 Groundwater Level Measurements

AFFF Area	Well ID	TOC Elevation Feet (amsl)	Depth to Water (feet)	GW Elevation Feet (amsl)	Date Measured
1	MALMS01-MW001	3475.19	36.20	3438.99	5/2/2017
1	MALMS01-MW002	3474.25	31.29	3442.96	5/2/2017
1	MALMS01-MW003	3469.75	dry	unknown	5/2/2017
3	MALMS03-MW001	3410.53	17.27	3393.26	5/2/2017
3	MALMS03-MW002	3413.29	22.32	3390.97	5/2/2017
3	MALMS03-MW003	3410.24	16.90	3393.34	5/2/2017
4	MALMS04-MW001	3394.49	5.38	3389.11	10/21/2016
4	MALMS04-MW002	3395.42	4.32	3391.10	10/21/2016
5	MALMS05-MW001	3469.79	10.34	3459.45	5/2/2017
5	MALMS05-MW002	3472.55	18.54	3454.01	5/2/2017
5	[1]ST05-MW5	3467.98	0.92	3467.06	5/2/2017
6	[1]PH3-MW1	3473.03	19.76	3453.27	10/14/2016
6	[1]PH3-MW2	3472.65	9.00	3463.65	10/13/2016
6	[1]PH3-MW4	3473.27	9.00	3464.27	10/13/2016
6	[1]PH3-MW5	3473.65	7.73	3465.92	10/13/2016
6	[1]ST05-MW04	3462.32	9.56	3452.76	10/13/2016

[1]Top of casing elevations taken from *Initial Remedial Investigation Report, Final, IRP Site ST05 – Former Fuel Supply Lines, Malmstrom Air Force Base – Cascade County, Montana* (EMR, Inc., October 2016).
amsl = above mean sea level GW = groundwater
ID = identification