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REVISION 1

GENERAL WORK PLAN
DOT&PF Statewide PFAS
VARIOUS SITES, ALASKA

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Submitted To: Alaska Department of Transportation & Public Facilities
2301 Peger Road
Fairbanks, Alaska 99709
Attn: Ms. Samantha Cummings

Subject: REVISION 1 GENERAL WORK PLAN, DOT&PF STATEWIDE PFAS,
VARIOUS SITES, ALASKA

The services proposed in this General Work Plan (GWP) will be conducted on behalf of the Alaska Department of Transportation & Public Facilities (DOT&PF). The scope of services for this GWP was specified in Shannon & Wilson's proposal dated December 27, 2019 and authorized on February 20, 2020 by DOT&PF under Professional Services Agreement Number 25-19-1-013 *Per- and Polyfluoroalkyl Substances (PFAS) Related Environmental & Engineering Services*. Information included in this GWP is general and intended to cover the generic aspects of water supply well sampling and site characterization. Site/project specific information will be defined in site-specific addendums to this GWP. This GWP will be reviewed annually; needed changes will be addressed in addendums. Additional funding to conduct field work, prepare site-specific addendums, implement addendums, prepare final reports, and update the GWP will be requested following Alaska Department of Environmental Conservation (DEC) approval of this GWP and subsequent submittals.

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Important Information

ACRONYMS

AAC	Alaska Administrative Code
AFFF	aqueous film forming foam
AKN	King Salmon Airport
ANI	Aniak Airport
ARFF	aircraft rescue and firefighting
BET	Bethel Airport
BTEX	benzene, toluene, ethylbenzene, and total xylenes
CDV	Merle K (Mudhole) Smith (Cordova) Airport
CFR	Code of Federal Regulations
COPC	contaminant of potential concern
CSM	Conceptual Site Model
CSP	Contaminated Sites Program
CUC	College Utilities Corporation
DEC	Alaska Department of Environmental Conservation
°C	degrees Celsius
DHSS	Alaska Department of Health & Social Services
DLG	Dillingham Airport
DNR	Alaska Department of Natural Resources
DO	dissolved oxygen
DoD	Department of Defense
DOT&PF	Alaska Department of Transportation & Public Facilities
DRO	diesel range organics
DVPP	Data-Validation Program Plan
EPA	U.S. Environmental Protection Agency
FAA	Federal Aviation Administration
FAI	Fairbanks International Airport
GAC	granulated activated carbon
GPS	global positioning system
GRO	gasoline range organics
GST	Gustavus Airport
GWP	General Work Plan
HCl	hydrochloric acid
IDA	isotope dilution analyte
IDW	investigative-derived waste
ILI	Iliamna Airport
LHA	Lifetime Health Advisory
MS	matrix spike
MSD	matrix spike duplicate
µg/L	micrograms per liter

ACRONYMS

μS	micro siemens
mg/kg	milligram per kilogram
mV	millivolt
MW	monitoring well
NPS	National Park Service
PAH	polycyclic aromatic hydrocarbons
PFAS	per- and polyfluoroalkyl substances
PFHpA	perfluoroheptanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PID	photoionization detector
PM	Project Manager
ppm	parts per million
ppt	part per trillion
PVC	polyvinyl chloride
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RPD	relative percent difference
RRO	residual range organics
SSHP	Site Safety and Health Plan
TWP	temporary well points
VDZ	Valdez Airport
VOC	volatile organic compound
WELTS	Well Log Tracking System
YAK	Yakutat Airport
YSI	multiprobe water quality meter

1 INTRODUCTION

The Alaska Department of Transportation & Public Facilities (DOT&PF) owns and operates 239 airports at various locations across Alaska. Of these airports, 29 are past or present Title 14, Code of Federal Regulations (CFR), Part 139 certificated airports and/or formerly known Department of Defense (DoD) sites (DOT&PF sites, Figure 1 and Table 1).

This General Work Plan (GWP) provides guidance for identifying and sampling potentially per- and polyfluoroalkyl substances (PFAS)-impacted water supply wells, quarterly/annual monitoring of PFAS-impacted water supply wells, and site characterization activities at DOT&PF sites. Site-specific information, as applicable, will be provided in the form of addendums to supplement this GWP. A GWP Addendum Template is included in Appendix A, for reference.

This GWP has been prepared in general accordance with the Alaska Department of Environmental Conservation's (DEC) March 2017 *Site Characterization Work Plan and Reporting Guidance for Investigation of Contaminated Sites*. Field activities will be conducted in general accordance with DEC's October 2019 *Field Sampling Guidance*, and the Site Safety and Health Plans (SSHPs) to be prepared on a site-specific basis. A SSHP template is included as an appendix to the GWP Addendum Template (Appendix A).

1.1 Background

Part 139 airports are those which meet the requirement for certification detailed in Title 14, CFR, Part 139. Part 139 certification is administered by the Federal Aviation Administration (FAA) and serves to ensure air transportation safety by requiring, among other things, the provision of aircraft rescue and firefighting (ARFF) services.

Aqueous film forming foam (AFFF) is an FAA approved extinguishing agent for ARFF response at Part 139 airports. AFFF is a surfactant which effectively and rapidly suppresses flammable liquid fires. AFFF is known to contain PFAS, an emerging contaminant of growing global concern. PFAS are persistent in the environment and in the human body, causing potential adverse human health effects. Historic use of AFFF at DOT&PF sites has led to PFAS contamination of environmental media at and near these locations and human exposure via contamination of water supply wells (Shannon & Wilson, Inc. 2018, 2019a, 2019b).

Perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) are two PFAS commonly found at sites where AFFF has been used. Due to their persistence, toxicity, and bioaccumulative potential, these compounds are of increasing concern to environmental and health agencies. In May 2016, the U.S. Environmental Protection Agency (EPA) published a Lifetime Health Advisory (LHA) level for PFOS and PFOA in drinking water of 70 parts per trillion (ppt) for the sum of PFOS and PFOA. The DEC Contaminated Sites Program (CSP) published soil and groundwater cleanup levels for PFOS and PFOA in November 2016, prior to which there were no state cleanup levels established for PFAS compounds. The groundwater cleanup level is 0.40 micrograms per liter ($\mu\text{g/L}$) for PFOS and PFOA and the migration to groundwater soil cleanup level is 0.0030 milligrams per kilogram (mg/kg) and 0.0017 mg/kg for PFOS and PFOA, respectively.

On August 20, 2018, the DEC published a Technical Memorandum outlining a new action level of 70 ppt for the sum of five PFAS (PFOS, PFOA, perfluorohexanesulfonic acid [PFHxS], perfluoroheptanoic acid [PFHpA], and perfluorononanoic acid [PFNA]) in drinking water. The action levels proposed in the Technical Memorandum were then submitted as proposed regulation, however, they were never formally adopted by the State of Alaska. Between August 2018 and March 2019, the DOT&PF used the proposed regulatory action level for PFAS related investigations.

On April 9, 2019, the DEC issued an update to the August 2018 Technical Memorandum rescinding the previous action levels and aligning with the EPA's LHA, requesting that testing for PFAS be for PFOS and PFOA only. A Technical Memorandum issued on October 2, 2019 amended this guidance to include new testing for PFAS report the full suite of PFAS compounds analyzed by the appropriate EPA method. Ongoing DOT&PF PFAS related investigations are reporting the full suite of PFAS compounds by the appropriate analytical EPA method. Although the full suite of PFAS are reported, only PFOS and PFOA will be compared to applicable action levels (e.g. DEC cleanup levels, EPA LHA, etc.). Communication with DEC since the latest Technical Memorandum clarified their position on which PFAS compounds should be sampled. Per DEC, the entire list of compounds available for the appropriate analytical EPA PFAS method should be reported.

Site-specific background information will be included in a GWP Addendum.

1.1.1 Previous Investigations

The following sections provide a brief summary of the previous PFAS investigations that have occurred at various DOT&PF sites. Additional site-specific information regarding previous water supply well activities (e.g. water supply well search, survey, sampling, quarterly and annual monitoring and criteria, and alternative drinking water sources, etc.) or site characterization activities (e.g. environmental media sample collection and analysis),

will be provided in a Water Supply Well Summary Report (Section 2.5.2.1), GWP Addendum (Section 2.5.2.3), and/or Site Characterization Report (Section 2.5.2.4).

1.1.1.1 Fairbanks International Airport

Water supply well sampling for the presence of PFAS at DOT&PF sites began with the Fairbanks International Airport (FAI) in 2017. The FAI encountered PFOS and PFOA above the respective DEC groundwater cleanup levels in several groundwater monitoring wells (MWs) on airport property. This led to off airport water supply well sampling. Beginning in November 2017, the FAI observed PFOS and PFOA above the applicable action level for drinking water in numerous water supply wells in neighborhoods downgradient of the airport. Interim alternative water has been provided to those who have PFAS-impacted water supply wells and those who have potentially PFAS-impacted water supply wells. Quarterly and annual monitoring of water supply wells for PFAS began in February 2018 and continued through February 2019 when FAI made the decision to offer PFAS-impacted water supply well owners a connection to College Utilities Corporation (CUC) water system. At this time, most of the water supply wells within the plume area are connected to CUC water system and negotiations are ongoing with the few remaining properties. PFAS site characterization work began in 2018 by FAI term contractors. Exceedances in the applicable DEC soil and groundwater cleanup levels were observed in samples collected from various locations at the airport. The FAI commenced decommissioning the former fire training pit in 2019 and anticipates completing the corrective action effort in 2020.

1.1.1.2 Gustavus Airport

In 2018, DEC informed DOT&PF that the Gustavus Airport (GST) terminal well and the National Park Service (NPS) Water System well that serves the school were at risk for potential PFAS contamination, due to the historic use of AFFF at the GST. DOT&PF sampled both wells for the presence of PFAS and analytical results showed the GST terminal well exceeded and the NPS well was below the applicable PFAS action level of 70 ppt for the sum of five PFAS compounds. Water supply wells adjacent to the GST were sampled and results showed PFAS detections above applicable action levels in numerous wells. Interim alternative bottled water has been provided to those who have PFAS-impacted water supply wells and a permanent long-term alternate water option is being investigated. Quarterly and annual monitoring of water supply wells is currently ongoing at the GST. Private wells are monitored based on guidance from DEC. Private wells with PFOS and PFOA concentrations exceeding 17.5 ppt are sampled on an annual basis and private wells with concentrations exceeding 35 ppt are sampled on a quarterly basis. Private wells within 500 feet of wells meeting the monitoring criteria are also sampled. Initial site characterization activities occurred in 2019 which involved installation of on airport and off airport MWs and the collection of groundwater and soil samples.

1.1.2 DEC PFAS Site Discovery Investigation

In late 2018, as part of a Cooperative Agreement with the EPA, the DEC's CSP conducted a limited PFAS Site Discovery Investigation. This included identification of potentially PFAS-impacted communities, prioritization of sampling identified communities, collecting water supply well samples for the analysis of PFAS, and reporting. The following DOT&PF sites were identified and sampled by DEC in late 2018 and early 2019 as a part of that project: King Salmon Airport (AKN), Dillingham Airport (DLG), Yakutat Airport (YAK), Merle K (Mudhole) Smith (Cordova) Airport (CDV), and Valdez Airport (VDZ). Additionally, in March and June of 2020, DEC sampled at the Aniak Airport (ANI) and the Iliamna Airport (ILI) as a continuation of the Cooperative Agreement with the EPA. PFAS was detected above applicable action levels in water supply wells associated with these sites, except for CDV, VDZ, ANI, and ILI. As a result, Shannon & Wilson, on behalf of DOT&PF, began identifying and sampling additional potentially PFAS-impacted water supply wells in ILI, DLG, and YAK. Although not above applicable action levels, the PFAS results for several samples collected for the ILI were reported within the monitoring range. DOT&PF has asked Shannon & Wilson to begin identifying and sampling additional potentially PFAS-impacted water supply wells in AKN. Quarterly and annual monitoring of water supply wells is currently ongoing at AKN, DLG, and YAK. Interim bottled water is being provided at these locations and permanent long-term alternate water options are being investigated.

1.1.3 Upcoming Investigations

In July of 2019, an aircraft caught fire after a crash landing at the Bethel Airport (BET). BET DOT&PF ARFF staff responded and released approximately 80 gallons of 3% Ansulite brand AFFF to extinguish the fire. DEC issued DOT&PF two letters regarding this release of AFFF. The first letter, a notification of hazardous substance liability, assigned the crash site a DEC contaminated sites file number of 2407.38.030. The second letter requested, at a minimum, characterization of the site to determine if any unacceptable risks to human health or the environment exist from PFAS assumed to be present in the AFFF used at the site. A final work plan for site characterization activities at the crash site has been prepared and approved by DEC. Site characterization activities are anticipated to begin summer 2020.

1.2 Site Prioritization

Shannon & Wilson will assist DOT&PF in prioritizing the sites listed in Table 1 to determine the order in which sites should be sampled for the presence of PFAS in water supply wells. DOT&PF sites for which PFAS concentrations are already known to exceed the LHA and/or the applicable action level at the time the water supply well was initially sampled will not

be ranked by priority. Shannon & Wilson is currently preparing a site prioritization submittal for DOT&PF which will be completed as a separate document.

In general, DOT&PF sites will be prioritized based on the following information, where available:

- Depth to groundwater and flow direction;
- Location of water supply wells, where known, and public water systems;
- Proximity of developed areas to known or suspected AFFF release site(s);
- Known or suspected use of AFFF;
- Current use of site;
- Results of initial sampling conducted by other parties (e.g. DEC, United States Military or Coast Guard, Alyeska Pipeline Service Co., etc.), where such information is available;
- Subsurface geology, including the presence or absence of confining layers;
- Employee interviews; and
- Additional information DOT&PF deems appropriate.

1.3 General Work Plan Objectives and Scope

The following sections outline the GWP's two main objectives and associated scopes and are listed in the general order of occurrence. However, depending on site specifics and/or phase of the project, water supply well activities and site characterization activities may occur individually or simultaneously, and these tasks may be repeated as site work progresses and analytical results are received.

The project/site-specific objectives and scope will be detailed in a GWP Addendum.

1.3.1 Water Supply Well Objective and Scope

The first objective of the GWP is to guide the identification and sampling of potentially PFAS-impacted water supply wells at and/or adjacent to DOT&PF sites (Figure 1 and Table 1) and to evaluate the potential for human exposure to PFAS in water supply wells. Where applicable, local governmental bodies and tribal entities will be contacted and provided information prior to the initiation of water supply well activities (including public meetings where they are deemed necessary). This objective will be achieved based on the following scope.

- Water Supply Well Search (Section 3.1.1)
 - In coordination with DOT&PF and DEC, identify and prioritize the well search area/s.

- Obtain parcel and owner information for properties located in the well search area, where available.
- In coordination with DOT&PF public relations office, prepare an advisory letter, to be mailed to property owner/occupants in the well search area providing project background information, a request for presence or absence confirmation of a water supply well on the property, and contact information for sample collection scheduling.
- Conduct a door-to-door search to verify property records and attempt to identify water supply wells in the well search area. The Alaska Department of Natural Resources (DNR) Well Log Tracking System (WELTS) will also be consulted as applicable to supplement information provided by the well owner.
- Re-evaluate and re-define the search area as needed based on analytical results.
- Water Supply Well Survey (Section 3.1.2)
 - Contact property owners/occupants from the well search area. This may be accomplished over the telephone or via email or may be combined with the well search during a door-to door visit.
 - Verify the presence or absence of a water supply well and obtain pertinent well related information (e.g. well depth, date of construction, etc.) using a Water Supply Well Inventory Survey Form (Appendix B).
 - Categorize the water supply well based on water usage as defined by the water supply well owner/user.
- Water Supply Well Sampling (Sections 3.1.3 and 4.1)
 - Collect samples from the water supply wells in the identified well search area.
 - Submit samples for the analysis of PFAS by the appropriate EPA analytical method.
 - Provide DEC with a data summary within 48 hours (2 business days) and a map and validated table of results within 72 hours (3 business days) of the receipt of water supply well data.
 - In coordination with DOT&PF, prepare a results letter detailing the analytical results, and any other information deemed pertinent.
- Water Supply Well Quarterly and Annual Monitoring (Sections 3.1.4 and 4.1.1)
 - Monitor PFAS concentrations in water supply wells which meet quarterly and annual monitoring criteria. The duration of monitoring is to be decided on a site-by-site basis in coordination with DOT&PF and DEC (see Section 3.1.4.2).
 - Submit samples for the analysis of PFAS by the appropriate EPA analytical method.
 - In coordination with DOT&PF, prepare a results letter detailing the analytical results, and any other information deemed pertinent to include.
- Data Reduction, Evaluation, and Reporting (Sections 2.5.2, 5.7, and Appendix C)
 - Review and validate analytical results in accordance with the Data-Validation Program Plan (DVPP) included in Appendix C.

- Report findings, as appropriate (see Section 2.5.2).

1.3.2 Site Characterization Objective and Scope

The second objective of this GWP is to guide site characterization efforts which will be used to evaluate the extent of PFAS contaminated soil, groundwater, sediment, and/or surface water associated with AFFF releases at DOT&PF sites and assess the threat to human health and the environment. This objective will be achieved through the following scope:

- GWP Addendum (Section 2.5.2.3 and Appendix A)
 - Prepare a GWP addendum using the GWP Addendum Template (Appendix A) to detail site and project specific background information and site investigation efforts for DOT&PF and DEC review and approval. GWP Addendum will include a preliminary Conceptual Site Model (CSM) and SSHP (Section 2.3). Subsequent GWP Addendums will include a revised CSM and SSHP.
- Soil Characterization (Sections 3.2.2, 4.2, 4.3, and 4.4)
 - Collect field screening and soil samples, as appropriate, and submit at the frequency and for the analyses prescribed in the GWP addendum.
- Groundwater Characterization (Sections 3.2.3, 4.5, and 4.6)
 - Collect groundwater samples, as appropriate, and submit at the frequency and for the analyses prescribed in the GWP addendum.
- Surface Water Characterization (Sections 3.2.4, 4.7, and 4.8)
 - Collect surface water, sediment, and pore water samples, as appropriate, and submit at the frequency and for the analyses prescribed in the GWP addendum.
- Data Reduction, Evaluation, and Reporting (Sections 2.5.2, 5.7, and Appendix C)
 - Review and validate analytical results in accordance with the DVPP included in Appendix C.
 - Report findings, as appropriate.

2 PROJECT DESCRIPTION

The following sections describe generalities related to projects to be covered under this GWP.

2.1 Potential Sources of Contamination

AFFF use across DOT&PF sites is varied, in terms of volume, frequency, duration, manner, and location of use. Additionally, the types and brands of AFFF used over time has not been consistent. These factors, combined with absent or inconsistent records on their use, makes it difficult to determine all the potential sources and areas of contamination at

DOT&PF sites. In general, common potential sources of PFAS contamination at DOT&PF sites include the following:

- Fire training areas where AFFF was used, including lined and unlined fire pits;
- AFFF equipment testing areas;
- Aircraft crash sites where AFFF was discharged, or other emergency uses of AFFF;
- AFFF storage areas;
- Other miscellaneous areas where AFFF was released based on information provided by DOT&PF.

Site-specific potential sources of contamination will be identified and described in GWP Addendums as they are developed.

2.2 Contaminants of Potential Concern and Regulatory Levels

The primary contaminants of potential concern (COPCs) for water supply wells are PFAS, specifically PFOS and PFOA. For site characterization, the primary COPCs are also PFAS, specifically PFOS and PFOA; however, Appendix F of DEC's *Field Sampling Guidance* (DEC 2019) identifies additional COPCs based on the type of site and/or product released (e.g. fire training facilities, emergency response efforts, or facilities where AFFF was used). The exact COPCs for site-specific characterization activities completed under this GWP will be identified in a GWP Addendum.

To evaluate water supply well samples, analytical results will be compared to the EPA's LHA of 70 ppt for the sum of PFOS and PFOA.

To evaluate soil sample concentrations, analytical results will be compared to the most stringent of the DEC soil cleanup levels in 18 Alaska Administrative Code (AAC) 75.341, Method Two, Tables B1 and B2 cleanup levels for the appropriate precipitation zone. To evaluate groundwater sample concentrations, analytical results will be compared to the DEC groundwater cleanup levels listed in 18 AAC 75.345 Table C. Exhibit 2-1 summarizes the current regulatory cleanup levels for the primary COPCs, PFOS and PFOA. Where additional COPC have been identified for site-specific characterization, their respective regulatory limits and applicable regulatory zone (i.e. arctic zone, under 40-inch zone, over 40-inch zone, and/or project specific) will be detailed in a site-specific GWP Addendum.

Exhibit 2-1: Primary COPCs and Regulatory Limits

Method	COPC	Soil Regulatory Level ^a (mg/kg)	Groundwater Regulatory Level ^b (µg/L)
PFAS Analytes			
Appropriate EPA Method ^c	PFOS	0.0030	0.40
	PFOA	0.0017	0.40

Notes:

- a. 18 AAC 75 Table B1. Method Two - Soil Cleanup Levels Table - Migration to Groundwater, unless otherwise specified
 - b. 18 AAC 75 Table C. Groundwater Cleanup Levels
 - c. The appropriate EPA method for PFAS analysis will be predicated on the type of samples to be collected (e.g. drinking water, groundwater, soil, etc.) and what EPA methods are available from the laboratory at the time of sampling. The appropriate methods to be used will be identified in the a site-specific GWP Addendum and/or a Water Supply Well Summary Report, as applicable
- AAC = Alaska Administrative Code, EPA = U.S. Environmental Protection Agency, GWP = General Work Plan, µg/L = microgram per liter; mg/kg = milligram per kilogram; PFAS = per- and polyfluoroalkyl substances, PFOA = perfluorooctanoic acid PFOS = perfluorooctanesulfonic acid

2.3 Conceptual Site Models and Site Safety and Health Plans

CSMs are a valuable tool used to evaluate contaminated sites. CSMs describe potential pathways between a contaminant source and possible receptors (e.g., people, animals, and plants) and are used to determine who may be at risk of exposure to those contaminants. Per DEC's 2018 guidance document *Procedures for Calculating Cumulative Risk*, a CSM must be prepared as part of the site characterization phase of a project. This information is used to guide and shape initial and ongoing site characterization efforts. CSMs will be prepared using DEC's *Human Health Conceptual Site Model Scoping Form and Standardized Graphic* on a project-specific basis. Preliminary CSMs will be prepared based on the initial understanding of site conditions and included with a GWP Addendum. Revised CSMs will be completed using analytical results for samples collected from the site and submitted as part of additional GWP Addendums and Site Characterization Reports (2.5.2.4).

SSHPs are used to protect the health and safety of field personnel from physical and chemical hazards associated with work at this site. SSHPs will also be prepared and included as an appendix to the GWP Addendum, as applicable. The GWP Addendum Template is provided in Appendix A.

2.4 Project Team

Site/project-specific project team members, their contact information, and project responsibilities will be identified in a GWP Addendum. Specifically, Shannon & Wilson Project Managers (PMs), DOT&PF, DEC, Alaska Department of Health & Social Services (DHSS), subcontractors, including analytical laboratory PMs, and other essential team members will be detailed.

Kristen Freiburger will serve as Shannon & Wilson’s PM for this GWP. She will be responsible for assigning PMs to DOT&PF sites, maintaining consistency between DOT&PF sites, and coordinating with other team members and PMs. Ms. Freiburger, along with other PFAS PMs, meet the requirements of a qualified environmental professional as defined in 18 AAC 75.333(b). Ms. Freiburger will serve as the primary point of contact (POC) for Shannon & Wilson. Chris Darrah will be the Contract Manager responsible for Shannon & Wilson's overall compliance with the contract terms and conditions. See Exhibit 2-2 below for contact information for Ms. Freiburger and Mr. Darrah.

Exhibit 2-2: Key Shannon & Wilson Team Members

Responsibility	Representative	Contact Number
Principal-in-Charge - Contract Manager	Chris Darrah, Vice President	(907) 458-3143
Project Manager - Primary Point of Contact	Kristen Freiburger, Associate	(907) 458-3146

2.5 Project Schedule and Submittals

The following sections describe the general schedule and submittals for water supply well activities and site characterization activities for sites covered under this GWP.

2.5.1 Project Schedule

Below is a generalized project schedule for water supply well and site characterization activities in general order of occurrence, as determined to be appropriate on a site-specific basis. Depending on site-specifics and/or phase of the project, water supply well activities and site characterization activities may occur individually or simultaneously, and these tasks may be repeated as site work progresses and analytical results are received. Site-specific project schedules will be outlined in a Water Supply Well Summary Report and/or a GWP Addendum.

1. Water Supply Well Activities (Section 3.1)
 - a. Water supply well search (Section 3.1.1);
 - b. Water supply well survey (Section 3.1.2);
 - c. Water supply well sampling (Section 3.1.3 and 4.1);
 - d. Provide interim water to owners and/or tenants of PFAS-impacted water supply wells (task not addressed in this GWP);
 - e. Water supply well quarterly and annual monitoring (Section 3.1.4 and 4.1.1);
 - f. Data reduction, evaluation, and reporting (Section 5.7); and
 - g. Feasibility study to determine appropriate long-term water solutions (task not addressed in this GWP).

2. Site Characterization Activities
 - a. Preparation of GWP Addendum (Section 2.5.2.3 and Appendix A);
 - b. Environmental media sample collection (e.g. soil, groundwater, surface water, and sediment, Sections 3.2 and 4); and
 - c. Data reduction, evaluation, and reporting (Sections 2.5.2.4, 5.7, and Appendix C).

2.5.2 Submittals

The following sections describe the general submittals that will accompany water supply well and site characterization activities.

2.5.2.1 Water Supply Well Summary Report

Implemented site-specific water supply well activities will be summarized in a Water Supply Well Summary Report. Generally, this report will include a summary of the sampling and/or monitoring effort(s), laboratory data reports, DEC laboratory data-review checklists, copies of chain-of-custody (COC) records and field notes, monitoring criteria, information provided to well owners/users, alternative water source information, and recommendations for future work. Generally, these reports will be prepared and submitted after four monitoring events have occurred (three quarterly events and one combined quarterly/annual event). However, site-specific reporting needs will dictate the actual reporting schedule for each site.

2.5.2.2 Other Water Supply Well Submittals

- Search Area Map - this map will be prepared during the water supply well search and will be submitted to DOT&PF for review and approval.
- Advisory Letters - these letters will be prepared, in coordination with DOT&PF and will be mailed to property owner/occupants in the well search area in advance of sampling water supply wells, as contact information is available. These letters will serve as a notification of the water supply well search and sampling efforts prior to arriving in a community. Advisory letters will provide project background information, a request for presence or absence confirmation of a water supply well on the property, and contact information for sample collection scheduling.
- Results Table and Map - a map of color-coded relative PFAS concentrations for water supply well samples will be prepared along with a table of analytical results and submitted to DOT&PF for review and distributed to DEC and DHSS.
- Results Letters - these letters will be prepared, in coordination with DOT&PF, and mailed to the sampled water supply well owner/user after analytical results are received, reviewed, and validated. These letters will detail the analytical results, and any other information deemed pertinent to include.

2.5.2.3 GWP Addendum

Project-specific site characterization efforts will be described using addendums to the GWP prior to implementation. A GWP Addendum Template is included in Appendix A. Generally, addendums will include background information, COPCs regulatory information, field activities, deviations from the GWP, project schedule, reporting information, a preliminary or revised CSM as appropriate, and a SSHP. The GWP addendum will be reviewed by DOT&PF and submitted to DEC for approval prior to implementation.

2.5.2.4 Site Characterization Report

Implemented site characterization efforts will be summarized in a Site Characterization Report in accordance with DEC's March 2017 *Site Characterization Work Plan and Reporting Guidance for Investigation of Contamination Sites*. Generally, this report will include summarized field observations, analytical results and discussion of data quality, photo documentation, copies of original field notes and forms, figures showing sample locations, description of deviations from the approved GWP Addendum, if any, and conclusions and recommendations. The report will also include an updated CSM based on received analytical results.

3 FIELD ACTIVITIES

The following sections describe the general water supply well and site characterization field activities to be conducted under this GWP. Sampling procedures and analytical methods are described in Section 4. A Quality Assurance Program Plan (QAPP) is included in Section 5. Depending on site-specifics and/or phase of the project, water supply well activities and site characterization activities occur individually or simultaneously, and these tasks may need to be repeated as site work progresses and analytical results are received.

3.1 Water Supply Well Activities

Water supply well field activities are outlined in the following sections in their general order of occurrence.

3.1.1 Water Supply Well Search

Shannon & Wilson will begin the water supply well search by gathering information about the site, including but not limited to groundwater flow direction, surface water flow direction (specifically for areas where well depths are known to be shallow [less than 40 feet deep]), suspected source area locations, previously collected sample results, well depths

(area may need to be larger for communities known to have multiple well depths), and other relevant information available for the site to identify potentially PFAS-impacted wells. Based on this information and in coordination with DOT&PF and DEC, a well search area will be defined and documented on a map, with an estimate of the number of suspected wells present and submitted to DOT&PF and DEC for approval.

Shannon & Wilson will then attempt to obtain a list of parcels within the defined search along with owner information of those properties from available property records (e.g. Borough, City, State property databases or airport leasing). DNR WELTS and subsurface water rights files listed on the DNR Water Estate Map will also be consulted.

In consultation with DOT&PF public relations office, advisory letters will be prepared and mailed by Shannon & Wilson. The letter will include project background information, a request for properties to confirm presence or absence of a water supply well on the property, and contact information for sample collection scheduling. A similar letter will be prepared and mailed to applicable airport tenants. These letters will serve as a notification of the water supply well search and sampling efforts prior to arriving in a community. In consultation with DOT&PF and DEC, Shannon & Wilson will determine if a public meeting should be held prior to beginning well survey activities. If such a meeting is deemed necessary, the date, time and location of the meeting will be included in the advisory letter. Where applicable, local governmental bodies and tribal entities will be contacted and provided information prior to the initiation of water supply well activities or public meetings. A copy of the advisory letter will be retained and submitted with the Water Supply Well Report. Details regarding coordination with local governmental bodies and tribal entities, where applicable, will be included in the Water Supply Well Summary Report and/or a GWP Addendum, as appropriate.

Upon arriving in a community, a door-to-door well search effort will be conducted. Shannon & Wilson staff will visit each of the properties identified in the search area to verify available property records, schedule sampling with residents, and provide project specific information to residents, as needed. During the door-to-door effort a reasonable attempt will be made to contact each owner or occupant in the well search area. If occupants are not present at the time the property is visited, personalized door tags will be left in a location where it will be noticed. Where unable to make contact in person, public telephone and business records will be used, multiple visits to the property will be made, and/or neighbors will be asked for the owner/occupant contact information.

The well search area may be refined based on analytical results, and in coordination with DOT&PF and DEC. A modified advisory letter will be prepared and mailed to properties in

expanded areas prior to visiting the property. A copy of the modified advisory letter, if applicable, will be retained and submitted with the Water Supply Well Summary Report.

3.1.2 Water Supply Well Survey

A water supply well survey involves contacting owners/occupants from the well search area. This may be accomplished over the telephone or via email or may be combined with the original well search during a door-to door visit. Using a Water Supply Well Inventory Survey Form (Appendix B), Shannon & Wilson will verify the presence or absence of a water supply well on the property and obtain pertinent well related information (e.g. well depth, date of construction, etc.). A copy of completed Water Supply Well Inventory Survey Forms will be retained and submitted with the Water Supply Well Summary Report.

Information gathered during the water supply well survey will be used to designate a well category based on use, as follows:

- Category 1: water supply wells used for drinking or cooking, as reported by owners or occupants.
- Category 2: water supply wells used for dish washing, bathing, and other domestic purposes. Homes or businesses where the occupants report they do not drink the water, but where the water supply wells lead to kitchen or bathroom faucets, are considered possible future drinking water wells.
- Category 3: water supply wells used for vegetable gardening and are not plumbed to indoor faucets or spigots. The well water is not accessed by outdoor plumbing, but the well may be located underneath or inside the structure. These wells are considered non-drinking water wells.
- Category 4: water supply wells used for outdoor purposes only, such as irrigation or vehicle washing. These wells are considered non-drinking water wells.
- Category 5: water supply wells currently not in use. Wells that have been abandoned in place, are inoperable, disconnected, or intended for future use, are considered non-drinking water wells.

Water supply wells are categorized in this way to allow for easy sorting of wells by use and provide a consistent way wells are sorted between sites.

Properties where a water supply well was formerly present but the well has since been removed or decommissioned are not considered to have a well. For properties where contact with owners or occupants was not made during the initial well search, the well will be classified in one of the following ways:

- Unknown – Probable Well

- Unknown – Improbable Well

These parcels may appear unoccupied or abandoned. Properties where contact attempts have been made multiple times without responses are considered passive refusals.

3.1.3 Water Supply Well Sampling

The water supply wells identified during the well search will be sampled following the procedures outlined in Section 4.1. Water supply well samples will be submitted for PFAS analysis by the appropriate EPA analytical method, as identified in the Water Supply Well Summary Report. Special precautions for PFAS sampling will be taken into account as detailed in Section 4.10. After sampling is complete Shannon & Wilson will provide DEC with a data summary within 48 hours (2 business days) and a map and validated table of results within 72 hours (3 business days) of the receipt of water supply well data. In coordination with DOT&PF, Shannon & Wilson will prepare and mail a results letter detailing the analytical results, and other information deemed pertinent to include to water supply well owners/users. Water supply well sampling efforts will be described in a Water Supply Well Summary Report.

3.1.4 Water Supply Well Quarterly and Annual Monitoring

The following sections generally describe the minimum quarterly and annual water supply well monitoring criteria, as applicable. Site-specific conditions may allow an alternative to these criteria (e.g. analytical results, groundwater gradient, flow direction, soil type, well depths, application of alternative water or permanent water solution, etc.). Any alternative to the minimum quarterly and annual monitoring criteria noted in this GWP will be in coordination with DOT&PF and DEC. It is important to note that the monitoring criteria currently used at DOT&PF sites where monitoring is ongoing (e.g. AKN, DLG, and YAK) is variable, and the criteria outlined in this GWP will not alter any ongoing water supply well monitoring activities.

Water supply well quarterly and annual monitoring sample collection procedures are outlined in Section 4.1.1. Water supply well samples will be submitted for PFAS analysis by the appropriate EPA analytical method. Special precautions for PFAS sampling will be taken into account as detailed in Section 4.10. Water supply well monitoring efforts and analytical results will be described in a Water Supply Well Summary Report.

3.1.4.1 Water Supply Well Monitoring Criteria

- As practicable, four individual quarterly events will occur, where one quarterly event is combined with the annual event. Quarterly monitoring samples will be collected from water supply wells whose:

- sum of PFOS and PFOA concentration was greater than or equal to 35 ppt during one of the previous sampling events, excluding locations that have detections exceeding the applicable action limit; and
 - located within 500 lateral feet from a water supply well meeting the above PFOS and PFOA concentration criteria. Please note, some locations may use a lesser or greater distance depending on site specifics. The criteria will be defined in the GWP Addendum.
- As practicable, one annual event will occur in combination with a quarterly monitoring event. Annual monitoring samples will be collected from waters supply wells whose:
- sum of PFOS and PFOA concentration was greater than or equal to 17.5 ppt during one of the previous sampling events, excluding locations that have detections exceeding the applicable action limit; and
 - located within 500 lateral feet from a water supply well meeting the above PFOS and PFOA concentration criteria. Please note, some locations may use a lesser or greater distance depending on site specifics. The criteria will be defined in the GWP Addendum.

Lateral distance will be measured using global positioning system (GPS) points. These points will be collected during the initial visit or other applicable methods (georeferenced parcel information). The method for obtaining GPS points will be documented in the Well Supply Summary Report.

3.1.4.2 Monitoring Duration

At a minimum, quarterly and annual monitoring will include four quarterly events and one annual event. Monitoring beyond that point will depend on site-specific conditions, including but not limited to, detected PFAS concentrations and implementation of a permanent alternative water source. The need for additional sampling will be evaluated after the first year of monitoring in coordination with DOT&PF and DEC.

3.2 Site Characterization Activities

Site characterization activities are carried out to identify source areas and determine the extent of contamination at DOT&PF sites. Site characterization activities will be coordinated with DOT&PF and DEC. Factors such as depth of groundwater, presence of a confining layer (aquitard or permafrost), and extent of AFFF use will be considered when determining the scope and timeline for site characterization investigations. Site-specific characterization activities will be described in a GWP Addendum, and may include sample collection from soil borings, test pits, TWPs, permanent MWs, surface water and sediment. Additionally, the specific number of samples by media type and analytical methods for project samples will be described in a GWP Addendum.

The following sections outline the general pre-investigation, soil, groundwater, surface water and sediment site characterization activities to be conducted, as appropriate.

3.2.1 Pre-Investigation Tasks

Pre-investigation tasks may include, but are not limited to, obtaining site access, acquiring site/airport specific permitting, and beginning utility locates. Site-specific pre-investigations tasks will be identified in a GWP Addendum.

Implementation of site characterization activities at airports requires careful consideration of airport operations. Equipment heights, above ground MWs, soil borings, etc. could impact operations at an airport. As such, site characterization activities will be approved by DOT&PF prior to implementation. The need for site/airport-specific permitting (e.g. Land Acquisition Review Committee approval, Building Permit, FAA required authorizations, etc.) will be discussed with DOT&PF on a site-specific basis. Proper authorizations will be obtained, and appropriate badging/training acquired (if required) prior to initiating site characterization activities.

3.2.2 Soil Characterization

Soil samples may be collected from surface or subsurface, depending on site-specific conditions. Spacing of the soil samples will depend on site conditions and constraints. The specific number, type, and location of field screening (where viable, see 3.2.1.1 below) and soil samples to be collected will be identified in a GWP Addendum. Field personnel will document field activities with field notes and photographs as well as applicable field forms (Appendix B), as detailed in Section 5.2. Analytical laboratories and methods employed as a part of this GWP for site characterization activities are identified in Section 4.11. Site-specific analyses will be listed in the site-specific GWP Addendum. Soil sampling and field screening procedures, as appropriate, are presented in Section 4.3 and 4.4, respectively.

3.2.2.1 Field Screening

Field screening is a valuable tool used during site characterization to guide analytical sample collection, delineation, and segregation of excavated materials. Currently, there is no field screening method for PFAS contaminants. For the purposes of this GWP, where additional volatile COPCs (e.g. BTEX [benzene, toluene, ethylbenzene, and total xylenes], VOCs [volatile organic compounds], etc.) have been identified for site-specific characterization, their respective field screening will consist of the use of a photoionization detector (PID) to determine the relative concentration of volatile contaminants in field screening samples. Additionally, soil with PID results greater than 20 parts per million (ppm) will be considered potentially contaminated with volatiles, and soil with PID results

greater than 100 ppm will be considered likely contaminated with volatiles. PID field screening will only occur where additional volatile COPCs have been identified in the GWP addendum. The need for PID field screening and frequency and location of field screening samples will be defined in a site-specific GWP Addendum. Field screening samples will be collected as described in Section 4.3.

3.2.2.2 Surface Soil

Surface soil samples will be collected to determine the horizontal extent of soil contamination. Surface soil samples may also be used to screen an area for potential unknown/undocumented past uses of AFFF, or other PFAS-containing sources.

3.2.2.3 Test Pits

A test pit is a small excavation dug for the purpose of collecting subsurface soil samples and observing conditions to depths of up to 10-12 feet below ground surface. Because test pits are dug using equipment often available at rural communities (e.g., backhoes and excavators), test pits may be a cost-saving exploration technique for sites where drilling is not needed. Test pits will generally be directed outward radially from the location of a potential source of contamination or a known AFFF release area. Test pits will be backfilled as described in Section 4.2.2.

3.2.2.4 Soil Borings

Shannon & Wilson will retain the services of a drilling contractor whose crew has Hazardous Waste Operations and Emergency Response training to perform subsurface soil sampling. Soil borings will be advanced at/near potential sources of PFAS contamination to determine the vertical contamination profile. Soil borings will be backfilled as described in Section 4.2.3. The drilling contractor will be identified in a GWP Addendum.

3.2.3 Groundwater Characterization

Groundwater samples will be collected from temporary well points (TWPs) or MWs. TWPs provide short-term access to groundwater to determine if groundwater quality is impaired. If long-term monitoring is necessary, MWs will be installed. The specific number, type, and location of MWs and/or TWPs to be installed at a site will depend on site conditions and constraints and be identified in a GWP Addendum. Field personnel will document field activities with field notes and photographs as well as applicable field forms (Appendix B), as detailed in Section 5.2. Analytical laboratories and methods employed as a part of this GWP for site characterization activities are identified in Section 4.11. Site-specific analyses will be listed in the site-specific GWP Addendum. TWP and MW installation, development, and sampling procedures, are presented in Section 4.5 and 4.6, respectively.

Where groundwater analytical results indicate the potential for off-site PFAS impacts, TWPs or MWs will be installed and sampled, as appropriate, to investigate off-site migration of contaminants. This task is separate from initial water supply well identification and sampling.

3.2.3.1 Temporary Well Points

TWPs are used for a one-time sampling and are not intended to be used for repeated sample collection. TWPs may have the capacity to enable two successive sampling events if properly maintained; however, they are not a replacement for MWs if groundwater monitoring over several seasons is anticipated. If TWPs are left in the ground to be sampled again later, they will be protected with a temporary monument and clearly marked. Approval by DOT&PF and DEC will be required to leave TWPs in place.

3.2.3.2 Monitoring Wells

MWs may be installed when repeat monitoring events are anticipated for a site, as evidenced by detected contamination during field efforts and/or results indicating the need for long-term monitoring. MWs allow repeat collection of groundwater samples at a specific area, to evaluate changes in groundwater concentrations over time.

3.2.4 Surface Water Characterization

Surface water samples will be collected when it is present near or immediately adjacent to potential sources of PFAS contamination. Surface water bodies may include ponds, drainage areas, sloughs, rivers, etc. Site-specific surface water bodies to be sampled will be identified in a GWP Addendum. Field personnel will document field activities with field notes and photographs as well as applicable field forms (Appendix B), as detailed in Section 5.2. Analytical laboratories and methods employed as a part of this GWP for site characterization activities are identified in Section 4.11. Site-specific analyses will be listed in the site-specific GWP Addendum. Surface water sampling procedures are included in Section 4.7.

3.2.4.1 Sediment Sampling

Collecting sediment samples in conjunction with surface-water samples will provide useful information regarding contaminant partitioning and interfaces. Where PFAS is suspected to be discovered in a surface water sample, sediment samples may also be collected, as practicable. Sediment sampling procedures are included in Section 4.8.

3.2.4.2 Pore Water Sampling

At locations where groundwater is hydrologically connected to surface water, pore water sampling may be more informative than sediment sampling alone. As practicable, at sites where there is a known hydrological connection between surface water bodies and groundwater, pore water samples will be collected. Pore water sample collection procedures are described in Section 4.9.

4 SAMPLING AND ANALYSIS PLAN

This section describes the analytical sampling approach for investigating contamination at DOT&PF sites. The specific number and type of samples to be collected will depend on site conditions and constraints; this information will be identified in the GWP Addendum. A DEC-qualified sampler will collect and handle the samples for projects covered under this GWP and collect required quality control (QC) samples in accordance with DEC's *Field Sampling Guidance*. Field personnel will document field activities with field notes and photographs as well as applicable field forms (Appendix B), as detailed in Section 5.2. Special considerations for PFAS sampling are summarized in Section 4.10. Analytical laboratories and methods employed as a part of this GWP for site characterization activities are identified in Section 4.11. Site-specific analyses will be listed in the GWP Addendum. Sample containers, preservation methods, and holding times are included in Section 4.12. Sample custody, storage, and transport will be followed as described in Section 4.13. Equipment decontamination procedures are outlined in Section 4.14. Investigative-derived waste (IDW) management is described in Section 4.15.

4.1 Water Supply Well Sampling

Water supply well samples will be collected upstream of any treatment system (e.g. carbon filters, softeners, etc.) that may be installed in the plumbing, assuming well-pump systems are operational. Screens, hoses, and aerators will be removed from the faucet, if possible, before sampling. For the purposes of the GWP, small (i.e., less than 18 inches in height) particulate filters are not considered to be treatment systems.

Systems will be purged prior to sampling by allowing the water to run until water parameters stabilize and the water appears clear. These parameters will be measured using a multiprobe water quality meter (YSI or equivalent); pH, temperature, and conductivity will be recorded approximately every three minutes until sample collection. The following parameters will be used to indicate stability for a minimum of three consecutive readings:

- pH: ± 0.1 pH units

- Temperature: ± 0.5 degrees Celsius ($^{\circ}\text{C}$)
- Percent conductivity: ± 3 percent

Purge water will be discharged to an indoor sink or to the ground surface. In some cases, indoor plumbing leads to a sewer system; in other cases, it leads to a septic system.

Following parameter stabilization, water supply well grab samples will be collected by placing the mouth of the sample bottle into the water stream from the faucet or valve. Pertinent sampling information (e.g. samples collected downstream of water softeners or other in-home treatment systems, time and date of sample collection, etc.) will be documented using the Water Supply Well Sampling Log (Appendix B).

4.1.1 Quarterly and Annual Water Supply Well Monitoring

Water supply wells meeting the quarterly and/or annual monitoring criteria detailed in Section 3.1.4.1 will be sampled using the methods described in Section 4.1 above to monitor PFAS concentrations. Pertinent sampling information, including the time and date of sample collection, will be documented on the Water Supply Well Sampling Log (Appendix B).

4.2 Methods for Soil Sample Retrieval

Soil samples will be retrieved from the surface and subsurface using the methods described in the following sections, as appropriate. Soil retrieval methods to be used at a specific site along with the need for field screening will be identified in a GWP Addendum.

For projects where additional volatile COPCs (e.g. BTEX, VOCs, etc.) have been identified, field screening will occur as described in Section 4.3. For projects where PFAS is the only COPC, field screening will not occur as currently there is no field screening method for PFAS.

4.2.1 Hand Tools

New, clean, stainless-steel spoons or trowels will be used for the collection of surface soil samples. Surface soil samples will be collected just below vegetation for PFAS samples, and at least 6 inches below the ground surface for volatile analyses (where additional volatile COPCs have been identified). Other hand tools, such as a hand auger may be used to collect subsurface soil samples.

Hand tools may also be used to collect soil samples from other sampling points (i.e. drill rig spoons, excavator buckets, etc.) as described in the following sections. Hand tools will be

decontaminated between each sample point following procedures outlined in in Section 4.14.

4.2.2 Test Pits

Soil samples will be collected from test pits using hand tools, as noted in Section 4.2.1. Samples will be collected directly from the bucket of the excavator or backhoe, or from the excavation (excavations shallower than 4 feet).

Shannon & Wilson's experienced field professional will observe and log the test pit excavations, collect field screening and analytical samples for laboratory analysis, as applicable, and prepare a descriptive log of soil conditions encountered during sample retrieval. Soil descriptions will be summarized on the Field Log of Boring (Appendix B).

In general, upon completion of the excavation and analytical sample collection, test pit excavations will be backfilled as follows:

- Where additional volatile COPCs have been identified (as defined in the site-specific GWP Addendum), the contractor will backfill the test pit with the excavated soil if field screening does not indicate potential contamination (PID reading of 20 ppm or less). If field screening results indicate potential contamination (PID reading of greater than 20 ppm), the soil will be managed as described in Section 4.15 and the excavation will be filled with clean soil.
- For projects where additional volatile COPCs have not been identified (as defined in the site-specific GWP Addendum), the contractor will backfill the test pit with the excavated soil.

4.2.3 Soil Borings

A drilling subcontractor will be retained to drill soil borings and install TWP's and MW's. Shannon & Wilson's experienced field professional will observe soil borings, collect analytical samples (as applicable), and prepare a descriptive log of soil conditions encountered during sample retrieval. Soil descriptions will be summarized on the Field Log of Boring (Appendix B).

In general, if borings are not being completed as either TWP's or MW's, the driller will fill the borehole with clean sand or pea gravel, sealed above the groundwater table with grout, bentonite chips, or equivalent to two feet below the ground surface, and topped with clean cuttings, sand, pea gravel, or topsoil. If the boring penetrates asphalt, cold patch will be applied and compacted it using hand tools or vehicle tires.

Where additional volatile COPCs have been identified (as defined in the site-specific GWP Addendum), cuttings will only be used if field screening does not indicate potential

contamination (PID reading of 20 ppm or less). If field screening results indicate potential contamination (PID reading of greater than 20 ppm), the soil will be managed as described in Section 4.15 and the excavation will be filled with clean soil.

Excess soil cuttings will be managed as described in Section 4.15. The final disposition of excess soil cuttings will be detailed in a site-specific GWP Addendum.

4.2.3.1 Direct-Push

The drilling contractor will use their drill rig to obtain subsurface soil samples from borings. Direct-push tooling typically consists of a Macro-Core® liner, which is a solid barrel (2.125-inch outside diameter) direct-push device for collecting continuous core samples (1.5-inch-diameter) of unconsolidated materials at depth. The Geoprobe Macro-Core system advances 5-foot-long polyvinyl chloride (PVC)-lined samplers for continuous soil sampling. Drilling contractor personnel will cut open the PVC liner to allow examination, field screening, and analytical sampling of the soil core. A new, clean Macro-Core® liner will be used for each section of the boring to prevent cross contamination.

4.2.3.2 Hollow-Stem Auger

In some situations, direct push technology may not be possible or available. The drilling contractor will advance hollow-stem auger borings using continuous-flight hollow-stem augers and an automatic hammer, to drive 3-inch outside diameter split-spoon samplers. A split-spoon sampler is driven by the drill rig to collect representative subsurface soil samples. The steel sampler is advanced by blows from a hammer dropped from the drill rig mast. The number of blows per length interval indicates relative soil density. Drilling contractor personnel will open the sampler to allow examination, field screening, and sampling of the soil core. Samples will be collected from the split-spoon sampler using hand tools, as described in Section 4.2.1. The split-spoon sampler will be decontaminated between samples using procedures outlined in Section 4.14.

4.3 Field Screening

Where additional volatile COPCs have been identified, field screening will consist of the use of a PID to determine the relative concentration of volatile contaminants in field screening samples. Currently there is no field screening method for PFAS. Shannon & Wilson's field personnel will utilize a hand-held MiniRae 2000 Portable VOC Monitor (Model PGM 7600) PID manufactured by Rae Systems, Inc., or equivalent, as the field screening tool. The MiniRae provides a three-second response time up to 10,000 ppm. The detector will be calibrated daily, or more often as needed, to a 100-ppm isobutylene standard according to manufacturer's instructions. Shannon & Wilson field personnel are trained and experienced

in calibration, operation, routine maintenance, and troubleshooting of the PID, as well as interpretation of PID results.

Initial field screening of the soil will be performed by moving the probe of the PID slowly above and along the exposed test-pit soil/core/split-spoon sample (at about one foot per five seconds), noting locations of elevated readings. Field screening may also be conducted by collecting headspace samples from freshly uncovered soil using a clean, stainless-steel spoon to place the soil in a clean, sealable plastic bag, filling it one-third to one-half full, quickly sealing it closed. Field staff will allow the headspace to develop in the bag by warming it to at least 40° Fahrenheit for 10 minutes to one hour, shaking for 15 seconds at the beginning and end of the period to assist volatilization. Field staff will open the bag just enough to allow insertion of the PID probe about one-half the headspace depth, taking care to avoid uptake of water droplets and soil particles. Shannon & Wilson will record the highest PID reading obtained, noting any erratic meter response at high organic vapor concentrations or conditions of elevated headspace moisture.

Following screening, the headspace samples will be emptied onto the ground surface in the location they were collected. Field observations (i.e., location of permanent features), PID results, and the approximate locations of field screening samples will be recorded on a Sample Collection Log (Appendix B).

4.4 Soil Sampling

Soil sample locations, frequency, and analytical methods will be described in a site-specific GWP Addendums.

Field personnel will change nitrile gloves before collecting each sample to prevent cross-contamination and exposure. For projects where additional volatile COPCs have been identified (as defined in the site-specific GWP Addendum), soil analytical samples will be collected after field screening and from locations with the highest PID readings. Samples for volatile analyses will be collected before the collection of samples for non-volatile analyses.

Samples will be collected using a new stainless-steel spoon, quickly placing the soil into new, laboratory-supplied jars appropriate for the analysis to be performed. PFAS samples will be collected in individual jars. Where additional COPCs have been identified, as applicable, soil to be analyzed for gasoline range organics (GRO) and BTEX can be placed in the same jar. Soil to be analyzed for diesel range organics (DRO) and residual range organics (RRO) can be placed in the same jar. Polycyclic aromatic hydrocarbon (PAH) samples will be collected in individual jars. VOC samples will be collected in individual jars. If there is not sufficient soil volume to fill each of the jars, the available soil will be divided among the jars.

Sample jars will be labeled in the field, using permanent waterproof ink, including the following information: unique sample number, date and time of sampling, initials of collector, laboratory analysis, and preservation method. Where additional volatile COPCs have been identified, no additional label may be added to volatile sample jars because they are pre-weighed at the analytical laboratory. For every volatile sample collected, one additional 4-ounce sample jar of soil without methanol will be collected for the laboratory to perform moisture-content analysis. For volatile analysis, an aliquot of methanol (provided by the laboratory) will be placed in the pre-weighed sample jar with the appropriate amount of soil. Field staff will make sure the jar rims and threads are free of soil particles to ensure a good seal.

4.5 Temporary Well Point Groundwater Sampling

TWP installation, measurement, development and groundwater sampling are discussed in the following sections.

4.5.1 Temporary Well Point Installation

The drilling contractor will install TWPs using a direct-push drill rig so that the screened interval intercepts the groundwater table or is set to the desired depth. This information will be included in a GWP Addendum. The TWPs will be installed as described in the 2013 DEC *Monitoring Well Guidance*. TWP installation information will be recorded on the Monitoring Well Construction Details form (Appendix B).

4.5.2 Temporary Well Point Water Level Measurement

Prior to and after development, the depth to groundwater in each TWP will be measured using an electronic water level indicator. The water level indicator probe will be decontaminated prior to each use and between each TWP (Section 4.14). Decontamination fluids will be managed as described in Section 4.15. Following decontamination, the probe will be slowly lowered down the well until it produces the distinct tone indicating contact with the water-surface interface. Shannon & Wilson will measure the depth to groundwater from the top of the TWP and the height of the TWP above the ground surface to the nearest 0.01 foot.

4.5.3 Temporary Well Point Development

TWPs will be developed prior to sampling to remove sediment. A battery-operated peristaltic pump and new silicone tubing will be used for development and sampling. The tubing will be slowly lowered into the TWP to near the midpoint of the screened interval, so it does not agitate the water. The tubing will be threaded through the peristaltic pump and the pumping rate regulated for minimum agitation of groundwater. Development will

consist of removing small volumes of water until parameters (pH, temperature, conductivity, dissolved oxygen (DO), and redox potential) have stabilized.

Groundwater parameters will be measured with a multiprobe water quality meter, (YSI model 600XL or equivalent), to determine when development is complete and sampling can begin. Field parameters will be collected using a “flow-through cell” attached to the pump-discharge line. The measuring device will be placed in the flow-through cell; readings for each parameter will be recorded approximately once per TWP volume. Measurements will be recorded on the Monitoring Well Sampling Log (Appendix B). Shannon & Wilson will also document odor, color, sheen, or other apparent physical characteristics of the groundwater on the form.

Shannon & Wilson will continue developing each TWP until the water clarity has become “clear” and three consecutive readings of pH, conductivity (micro siemens [μS]), DO (percent O_2), and redox potential (millivolts [mV]) have stabilized. The following values are used to indicate stability:

- ± 0.1 pH;
- ± 3 percent conductivity;
- $\pm 10\text{mV}$ redox; and
- ± 10 percent DO.

Total volume of development water will be recorded on the Monitoring Well Sampling Log (Appendix B). Development water will be managed according to Section 4.15.

4.5.4 Temporary Well Point Sampling

Each TWP will be sampled immediately after development, or as soon as practicable, using a peristaltic pump. New tubing will be used to collect each sample. Shannon & Wilson will collect groundwater samples into laboratory-provided containers, some bottles may contain hydrochloric acid (HCl) as a preservative, depending on the analysis. Where additional volatile COPCs have been identified, volatile analytes will be collected before the collection of samples for non-volatile analyses. Methods for collecting volatile samples will be identified in a GWP addendum.

Following collection of samples for volatile analysis, groundwater samples for the remaining analyses will be collected, filling the sample bottles to the shoulder and taking care not to displace preservative. Sample bottles will be filled directly from the pump-discharge line. When identified as additional COPCs, petroleum analytes (e.g. DRO), PAH, BTEX, and VOC samples will be collected within one foot of the groundwater table, unless

another depth of the water column is the desired target. This information will be identified in the GWP addendum.

After sampling, the pump will be shut off and the tubing removed from the well. Pertinent information will be recorded, including time and date of sample collection, on the Monitoring Well Sampling Log (Appendix B). Shannon & Wilson will also document any odor, color, sheen, or other apparent physical characteristics of the groundwater on the form.

TWPs may be left in the ground to sample again at a later time. In this case, the TWP will be well marked and protected. Otherwise, following sample collection, TPWs will be removed and the hole backfilled with clean sand or pea gravel, sealed with grout, bentonite chips, or equivalent above the groundwater table to two feet below the ground surface, and topped with clean cuttings, sand, pea gravel, or topsoil. If the boring penetrates asphalt, cold patch will be applied and compacted it using hand tools or vehicle tires.

4.6 Monitoring Well Groundwater Sampling

MW installation, measurement, development, and groundwater sampling are discussed in the following sections.

4.6.1 Monitoring Well Construction and Installation

MWs will be drilled and installed by the drilling contractor following the guidelines in the DEC *Monitoring Well Guidance*. MWs will be constructed with 2-inch inside-diameter schedule 40 PVC material and have a 5-foot or 10-foot section of 0.010-inch or 0.020-inch slotted screen and threaded end caps. The filter pack around the screened intervals will be 10/20 rounded silica sand. The sand pack will be two feet above the top of the screen using 10/20 silica sand. The grout seal above the sand pack will be bentonite chips, hydrated in place. The wells will be completed as flush-mount, constructed steel monument encased in concrete. In areas where traffic is not an issue, and the location will not be obstructed with materials or equipment, aboveground monuments may be installed.

Wells installed at the water table will be completed with a 10-foot-long screen set to span the water table. Wells installed at depths deeper than the water table will be completed with a 5-foot-long screen.

Shannon & Wilson field staff will measure groundwater depth, develop the wells, and collect groundwater samples using the procedures described below. Well construction and installation information will be recorded on the Monitoring Well Construction Details form (Appendix B).

4.6.2 Monitoring Well Development

Before and after development, the total well depth and water level will be measured using the procedures in 4.5.2. MWs will be developed prior to sampling to remove sediment, and to ensure proper hydraulic connection to the aquifer. To allow time for annular-seal materials to set within the newly installed wells, development will begin no sooner than 24 hours after installation is complete.

MWs will be developed using a Waterra inertial pump or equivalent, with a combination of surging and purging. Development water will be treated and disposed of in accordance with Section 4.15. Specific well development equipment to be used will be identified a GWP addendum.

4.6.3 Monitoring Well Sampling

MWs will be sampled using the same procedures for sampling TWP (Section 4.5.4), except that a submersible pump will be used. New tubing will be used to collect each sample.

Following sample collection, the pump will be shut off and the tubing will be removed from the well. The submersible pump will be decontaminated according to the procedure described in 4.13. Shannon & Wilson will record pertinent information, including time and date of sample collection, on the Monitoring Well Sampling Log (Appendix B). Shannon & Wilson will also document odor, color, sheen, or other apparent physical characteristics of the groundwater on the form.

4.7 Surface Water Sampling

Surface water samples will be collected at least 72 hours after a rain event, if possible, to prevent potential dilution effects from the rain event. For larger bodies of surface water, sampling locations may be accessed by boat. Samples will be collected as close to the center of water body cross section as possible using a peristaltic pump or a new, PFAS-free disposable transfer container. New tubing will be used to collect each sample. Samplers may enter shallow water bodies to collect the samples. Prior to entering a water body, samplers will verify they are not wearing PFAS-containing clothing or gear. Care will be taken to prevent disturbance of the sediment below; samples will be collected once disturbed solids have settled to the bottom or have moved down stream. Surface water samples will be collected as close to the surface of the water body as possible, unless site-specific objectives require sampling at another depth. Sampling details will be recorded on a Surface Water Sample Log (Appendix B).

4.8 Sediment Sampling

Where PFAS is suspected to be discovered in a surface water sample, sediment samples may also be collected. Sediment samples will be collected from shore using an Eckman dredge or equivalent. Site-specific sediment sampling details, as applicable, will be provided in a GWP addendum. The dredge will be lowered to the bottom of the water body and a sediment sample will be collected by scraping material from the soil/water interfaces. Shannon & Wilson will drain away excess water from the sample and place the remaining solid material in a laboratory-provided sampling container. Sample containers will be labeled with a unique identifier, date, and time, and placed immediately in a cooler with ice-substitute.

4.9 Pore Water Sampling

There are a variety of methods available for collecting pore water samples (e.g. extraction, equilibrium-based methods, etc.). As applicable, the method used to sample pore water will be determined as site conditions warrant, following the pore water sampling guidance detailed in DEC's *Field Sampling Guidance*, and will be identified in site-specific GWP Addendum.

4.10 Special Considerations for PFAS Sampling

Because PFAS is found in numerous everyday items, the following special precautions will be taken during sampling activities:

- No use of Teflon®-containing materials (e.g., Teflon® tubing, bailers, tape, sample container lid liners, or plumbing paste).
- No Tyvek® clothing will be worn on-site.
- Clothes treated with stain-, flame-, or rain-resistant coatings will be avoided or go through several washings prior to use on-site.
- No Post-It® notes will be brought on-site.
- No fast food wrappers, disposable cups, or microwave popcorn will be brought on-site.
- After handling the above items, field personnel will wash their hands thoroughly with soap and water prior to sampling activities.
- No use of foil.
- No use of chemical (blue) ice packs.
- Change nitrile gloves between each sample location.
- No preservative, other than chilling is required for PFAS analysis.

- Label jars using permanent, waterproof ink.

4.11 Analytical Laboratories and Methods

Samples will be shipped for analysis via air courier to a DEC approved lab for the analyses being requested. The laboratory to be used will be identified in a GWP Addendum. Upon receipt of the samples, authorized laboratory personnel will store and prepare the samples for analysis, taking into consideration sample holding times for the analysis. A summary of laboratory methods, preservation methods, sample containers, and holding times is presented in Exhibit 4-1, below. Analytical deliverables will be provided as described in Section 5.6.

4.12 Sample Containers, Preservation, and Holding Times

Prior to field sampling efforts, Shannon & Wilson will request necessary sample containers and laboratory prepared trip blanks (Section 5.4.3) from the laboratory. The containers will not be opened until samples are to be collected.

Sample containers, preservation, and holding times are shown in Exhibit 4-1 for soil and water samples for the primary COPCs (PFAS). Where additional COPCs have been identified for site-specific characterization, their respective sample containers, preservation methods, and holding times will be detailed in a site-specific GWP Addendum. Chemical preservatives will be added to the sample containers by the laboratory performing the analyses. Samples will be placed in an insulated cooler containing frozen ice-substitute immediately after collection.

Exhibit 4-1: Sample Containers, Preservation, and Holding Time Requirements

Analyte	Method	Media	Container and Sample Volume	Preservation	Holding Time
PFAS	Appropriate EPA Method ¹	Water Soil	Dependent on selected method ¹	Dependent on selected method ¹	Dependent on selected method ¹

NOTES:

¹ The appropriate EPA method for PFAS analysis will be predicated on the type of samples to be collected (e.g. drinking water, groundwater, soil, etc.) and what EPA methods are available from the laboratory at the time of sampling. The exact method or methods to be used will be identified in the site-specific addendum.

EPA = U.S. Environmental Protection Agency, PFAS = per- and polyfluoroalkyl substances

4.13 Sample Custody, Storage, and Transport

After collection, samples will be wrapped in bubble wrap and placed in a hard-plastic cooler with adequate quantities of frozen gel ice to maintain sample temperatures between 0 °C and 6°C until the samples reach the laboratory, using packing material as necessary to prevent bottle breakage. A temperature blank (Section 5.4.6) will be packed with the

samples in each cooler. Custody of the samples will be maintained at all times prior to being submitted to the laboratory for analysis. At the end of each field day, if not transported to the laboratory, field personnel will transfer the samples to the designated sample refrigerator in a secure area at Shannon & Wilson's Fairbanks office or at the jobsite.

Shannon & Wilson will complete COC records (Appendix B) at the time each cooler is packed; COC records will be placed in plastic bags taped to the inside lid of the cooler. The COC records document sample possession from the point of collection to the time of receipt by the laboratory sample-control center. A copy of the COC records will be kept to allow sample accountability between field and laboratory.

4.14 Equipment Decontamination

All reusable equipment introduced into sample collection must be decontaminated prior to use and reuse. Decontamination procedures will be as follows:

- non-phosphate detergent wash;
- tap water rinse;
- distilled-water rinse; and
- PFAS-free water rinse (only when PFAS samples are being collected).

The driller will decontaminate their drilling tools using high-pressure steam or hot water and contain their decontamination fluids. Decontamination fluids will be collected in buckets or drums and manage it as described in Section 4.15. Following decontamination of a TWP or MW sampling pump, equipment rinsate samples will be collected as described in Section 5.4.4.

4.15 Investigative-Derived Waste Management

Field investigation activities may generate IDW in the form of excess soil from borings and development or purge water from MWs and TWPs. These IDWs will be handled as outlined below.

- Soil: Cuttings, excess soil, and test pit excavated materials not selected for laboratory analysis will be used to backfill the soil boring where it was collected or dispersed on the ground near the boring/MW well, unless evidence of contamination is observed or suspected. If evidence of soil contamination is observed (a PID reading of 20 ppm or higher, sheen, or petroleum odor or staining) or suspected (fire training areas, training, etc.), soil will be placed in a drum for temporary storage at the site until analytical results are transport and disposal has been arranged.

- Water: Development and purge water from TWP and MWs, and decontamination fluids will be filtered using granulated activated carbon (GAC) filter, then discharged to the ground surface of the site.
- Other IDW: This will primarily consist of disposable sampling equipment (nitrile gloves and used pump tubing) and will be disposed at the nearest landfill.

The following IDW will require characterization sampling before disposal can be arranged:

- contaminated soil from soil borings and test pits; and
- spent GAC used to treat the decontamination fluids and TWP/MW development water.

A DEC Contaminated Media Transport and Treatment or Disposal form will be submitted to DEC and approval obtained prior to the removal of contaminated media from the site.

4.16 Deviations and Modifications to the General Work Plan

Deviations from the procedures discussed in this GWP may be required due to circumstances that may arise during a given sampling event. Deviations can be either planned or unplanned. Planned deviations and rational will be described in a GWP addendum, as applicable. Unplanned deviations and rational for the deviation will be clearly documented in field logs (Appendix B) and reported to the appropriate PMs and detailed in the Site Characterization Report. Modifications to this GWP will be submitted for review and approval by the DOT&PF and DEC.

5 QUALITY ASSURANCE PROJECT PLAN

This Quality Assurance Project Plan (QAPP) presents the quality assurance (QA) and QC activities designed to achieve data quality goals for this project. The QAPP is intended to guide activities during assessment and review of resulting data. Shannon & Wilson will be responsible for conducting data reduction, evaluation, and reporting under this QAPP. Additionally, a DVPP which describes the procedures for qualifying analytical data in a consistent manner, has been prepared, and is included in Appendix C.

QA is defined as the total integrated program for assuring reliability of screening and measuring data. QC is defined as the routine use of procedures to effectively achieve defined goals and standards for sampling and analysis. The following sections describe specific procedures to be followed during sampling at each site, so sampling and documentation are effective, laboratory data are usable, and the information acquired is of high quality and reliable.

5.1 Quality Assurance Objectives

For measurement data, the QA objective is to assure environmental-monitoring data are of known and acceptable quality. For analytical data, the objective is to meet acceptable QA standards of precision, accuracy, representativeness, comparability, and completeness.

These terms are defined below:

- Precision: is a measure of agreement among replicate or duplicate results of the same analyte. The laboratory objective for precision is to equal or exceed the precision demonstrated for similar samples and shall be within the established control limits for the methods as published by the EPA. Precision will be measured as the relative percent difference (RPD) between project and duplicate samples.
- Accuracy: is a measure of bias in a measurement system. Accuracy will be expressed as the percent recovery of an analyte from a surrogate or matrix spike (MS) sample, or a standard reference material. The laboratory objective for accuracy is to equal or exceed accuracy demonstrated for these analytical methods on similar samples and shall be within the established control limits for the methods as published by the EPA.
- Representativeness: is a quality characteristic attributable to the type and number of samples to be taken to be representative of the medium/environment (e.g., soil or water). Sample locations will be selected in the field to be representative of the soils or water at that location, within the constraints of sample-location guidelines in the regulations.
- Comparability: is a qualitative parameter expressing the confidence with which one data set can be compared to another. The sampling method employed, methods used for the transfer of samples to the analytical laboratory, and analytical techniques implemented at the laboratory shall be performed in a uniform manner.
- Completeness: is a measure of the number of valid measurements obtained in relation to the total number of measurements planned. The objective of completeness is to generate an adequate database to successfully achieve the goals of the investigation.

Numeric QA objectives for the primary COPCs (PFAS), are presented in Exhibit 5-1 below. Where additional COPCs have been identified for site-specific characterization, their QA objectives will be detailed in a site-specific GWP Addendum. The rationale for the QA program is to obtain data that are representative of environmental conditions at the project site. Comparability among samples will be maintained by consistency in sampling procedures, sample-preservation methods, analytical methods, and data-reporting units. Analytical reporting-limit goals for this project will be less than the applicable DEC cleanup and/or action levels.

Exhibit 5-1: Quality Assurance Objectives for Analytical Samples

Analyte	Method	Matrix	Precision	Accuracy	Completeness
PFAS	Appropriate EPA Method ¹	Water	±30%	(analyte dependent)	85%
		Soil	±50%	(analyte dependent)	85%

NOTES:

1 The appropriate EPA method for PFAS analysis will be predicated on the type of samples to be collected (e.g. drinking water, groundwater, soil, etc.) and what EPA methods are available from the laboratory at the time of sampling. The exact method or methods to be used will be identified in the site-specific addendum.

EPA = U.S. Environmental Protection Agency, PFAS = per- and polyfluoroalkyl substances

5.2 Field Documentation

A combination of field forms (Appendix B) and a field notebook will be used to record field documentation, including, but not limited to, the following:

- field screening and sampling personnel;
- names and affiliations of pertinent field contacts;
- weather and other salient observations;
- documentation of instrument calibration;
- location of activity and site conditions;
- field measurements, observations and comments;
- Unusual/unexpected problems, including observations of leaks, releases, signs of soil contamination, or other unusual items;
- changes to sampling protocol;
- sample ID;
- sample date and time;
- site photographs;
- site sketches;
- location of sampling points; and
- distances to nearest permanent site features.

Information will be recorded in permanent ink. Deletions will be crossed out with one line, initialed, and dated.

Sample identification numbers (sample ID) will consist of unique identification numbers. Field personnel will enter the sample ID and corresponding sample location (boring, monitoring well number, etc.) in the Sample Collection Log (Appendix B) to indicate where the samples were collected.

COC records will accompany samples to the laboratory. The forms will be signed by persons collecting, handling, or delivering samples to the laboratory; delivery dates and times will also be recorded. The laboratory personnel receiving the samples will sign the forms and record the date and time. The original forms will accompany the shipment and a copy will be retained in project records.

5.3 Field Instrument Calibration

Equipment and instrument calibration assure accurate and reliable measurements are obtained. Calibration will be conducted using the manufacturer's recommended calibration procedures. The PID and YSI (or equivalent) will be calibrated each day they will be used, where practicable, and adjust them to operate within manufacturer specifications, prior to use in the field. Calibration results, as well as any instrument maintenance and error messages, will be recorded in a designated logbook kept with the instrument. The PID battery will be charged prior to use and the lamp cleaned regularly, in accordance with manufacturer instructions. Shannon & Wilson will charge the YSI (or equivalent) battery prior to use and check probe membranes regularly, in accordance with manufacturer instructions.

5.4 Field Quality Control Samples

The field QA/QC program includes the collection of the following QA/QC samples as described below.

5.4.1 Field Duplicate Samples

Duplicate samples will be collected at a minimum rate of 10% of the samples submitted per analysis, i.e., a minimum of one per every 10 field samples for each matrix sampled, and for each target analyte. For sampling occurring over multiple days, the goal is to collect a minimum of one field duplicate per day. If possible, duplicates will be collected from locations most likely to be contaminated based on PID results, field observations, and/or site-specific information, as applicable, since calculation of duplicate precision is not possible for samples with contaminants below detection limits. Duplicates will be assigned a separate sample number and submit them "blind" to the laboratory. Duplicate sample results will be used to test the comparability of analytical data.

QC field duplicate samples will be collected from the same location and using the same procedure as the primary sample. Two complete sets of sample containers will be filled, and the field duplicate samples will be submitted using a unique, "blind" identifier to the laboratory. The duplicate location and identifier will be identified on the sampling log

(Appendix B). Duplicates will be analyzed using the same analytical method used for the primary sample.

5.4.2 Matrix Spike/Matrix Spike Duplicate Samples

The MS and MS duplicate (MSD) samples are used to determine the presence of matrix interferences and evaluate the analytical accuracy for a given method and matrix. MS/MSD samples will be collected in accordance with the same procedures used to collect project samples, as noted in the appropriate sections above. The number of MS/MSD samples by media type and methods for analysis will be identified in a GWP Addendum.

5.4.3 Trip Blank Samples

Trip blank samples are used to detect and quantify potential volatile analyte cross-contamination between samples or contamination originating from an outside source. Where additional volatile COPCs have been identified, trip blanks will be required. The laboratory will create one trip blank set for each matrix (soil, water, etc.) for the volatile analyses. Field personnel will transport trip blanks to the sampling location and return them to the laboratory in the same cooler as their associated project samples. The laboratory will analyze the trip blank for volatile parameters using the same analytical method as project samples. The concentration of any volatile artifacts found in the trip blank will be noted and compared to the project-sample results.

5.4.4 Equipment Blank Samples

The purpose of the equipment rinsate sample is to determine the effectiveness of the decontamination procedures for sampling equipment. Samples will be collected by pouring distilled and/or certified PFAS free water over and/or through a piece of decontaminated sampling equipment or by pumping distilled and/or certified PFAS free water through the decontaminated submersible pump. The laboratory will analyze equipment blank samples using the same analytical method as project samples. The concentration of any detections found in the equipment blank will be noted and compared to the project-sample results. Equipment blank samples will be collected at a frequency of at least one sample per day, at a rate of 5% of the primary samples.

5.4.5 Field Blank Samples

Field blanks are used to assess whether airborne, particulate PFAS may be contaminating samples during collection. Field blank samples will be collected immediately after collecting a project sample, without changing gloves, by pouring certified PFAS-free water into a sample bottle. The concentration of any detections found in the field blank sample will be noted and compared to the project-sample results. The frequency of field blank

collection for a given site will be described in site-specific addendums. Field blank samples are anticipated to be needed for areas with potential for PFAS-containing particulate matter to enter samples (i.e. high-contamination areas, windy/dusty conditions, etc.)

5.4.6 Temperature Blank Samples

Temperature blanks enable the receiving laboratory to estimate the samples' temperature on their arrival at the laboratory. Each sample cooler will be submitted to the laboratory with a temperature blank. Temperature blanks will consist of a jar filled with water and packed with the other samples in each cooler. Artificial ice will be added as necessary to maintain an interior cooler temperature within the range of 0 °C to 6 °C. The water temperature in the blank will be measured at the laboratory upon arrival. The laboratory will document sample and cooler conditions, including temperature, and whether any sample containers are broken.

5.5 Laboratory Quality Control Samples

The analytical laboratory will perform QC measurements to determine the precision and accuracy of the entire measurement system, including initial and continuing calibration checks, analysis of method blanks, analysis of spiked samples, duplicate analyses, and evaluation of surrogate and/or isotope dilution analyte (IDA) recoveries.

5.6 Laboratory Data Deliverables

Analytical data obtained from projects covered under this GWP will be reviewed and validated by conducting what the EPA refers to as a Stage 2a Validation (EPA 2009), the specifics of which are described in the DVPP included in Appendix C. Accordingly, Shannon & Wilson will request Stage 2a laboratory data deliverables and electronic data deliverables. These deliverables generally include the following items.

- A Cover Sheet, Table of Contents, and Laboratory Case Narrative;
- Sample results forms, COC and supporting records, and laboratory receipt checklist; and
- QC data and QC acceptance criteria linked to corresponding field samples (e.g. method blanks, matrix duplicates, surrogates, etc.).

5.7 Data Reduction, Evaluation, and Reporting

Laboratory tests will be validated by the laboratory supervisor or other responsible party and include evaluation for precision and accuracy of the data set. The laboratory QC officer or other responsible party will review and sign analytical data before release. Data reporting will be completed in the laboratory reports submitted to Shannon & Wilson. Individual

laboratory reports will be included with the final report. Shannon & Wilson will check analytical data generated by the laboratory for precision, accuracy, and completeness.

The site-specific PM will review field data, including sample descriptions and pertinent observations. Data-evaluation procedures will include QA checks to see holding times have been met, duplicate samples have been collected, and checks for other QA parameters have been performed. The Shannon & Wilson PM will also review the parameter field data during preparation of a final report.

Analytical data validation will occur in accordance with the DVPP, included in Appendix C. Shannon & Wilson will complete the DEC laboratory data-review checklists as part of the data-review process. The DVPP was prepared to align Shannon & Wilson's data review process with EPA guidance for data validation of PFAS. The DVPP is not intended to be retroactive, rather PFAS data review moving forward will occur in accordance with the DVPP.

Implemented site-specific water supply well activities will be summarized in a Water Supply Well Monitoring Summary Report. Generally, this report will include a summary of the sampling and/or monitoring effort(s), laboratory data reports, DEC laboratory data-review checklists, copies of COC records and field notes, monitoring criteria, information provided to well owners/users, alternative water source information, and recommendations for future work. Generally, these reports will be prepared and submitted after four monitoring events have occurred (three quarterly events and one combined quarterly/annual event). However, site-specific reporting needs will dictate the actual reporting schedule for each site.

Implemented site characterization efforts will be summarized in a Site Characterization Report. Generally, this report will include summarized field observations, analytical results and discussion of data quality, photo documentation, figures showing sample locations, description of unplanned deviations from the approved GWP Addendum, if any, and conclusions and recommendations. The report will also include an updated CSM based on received analytical results.

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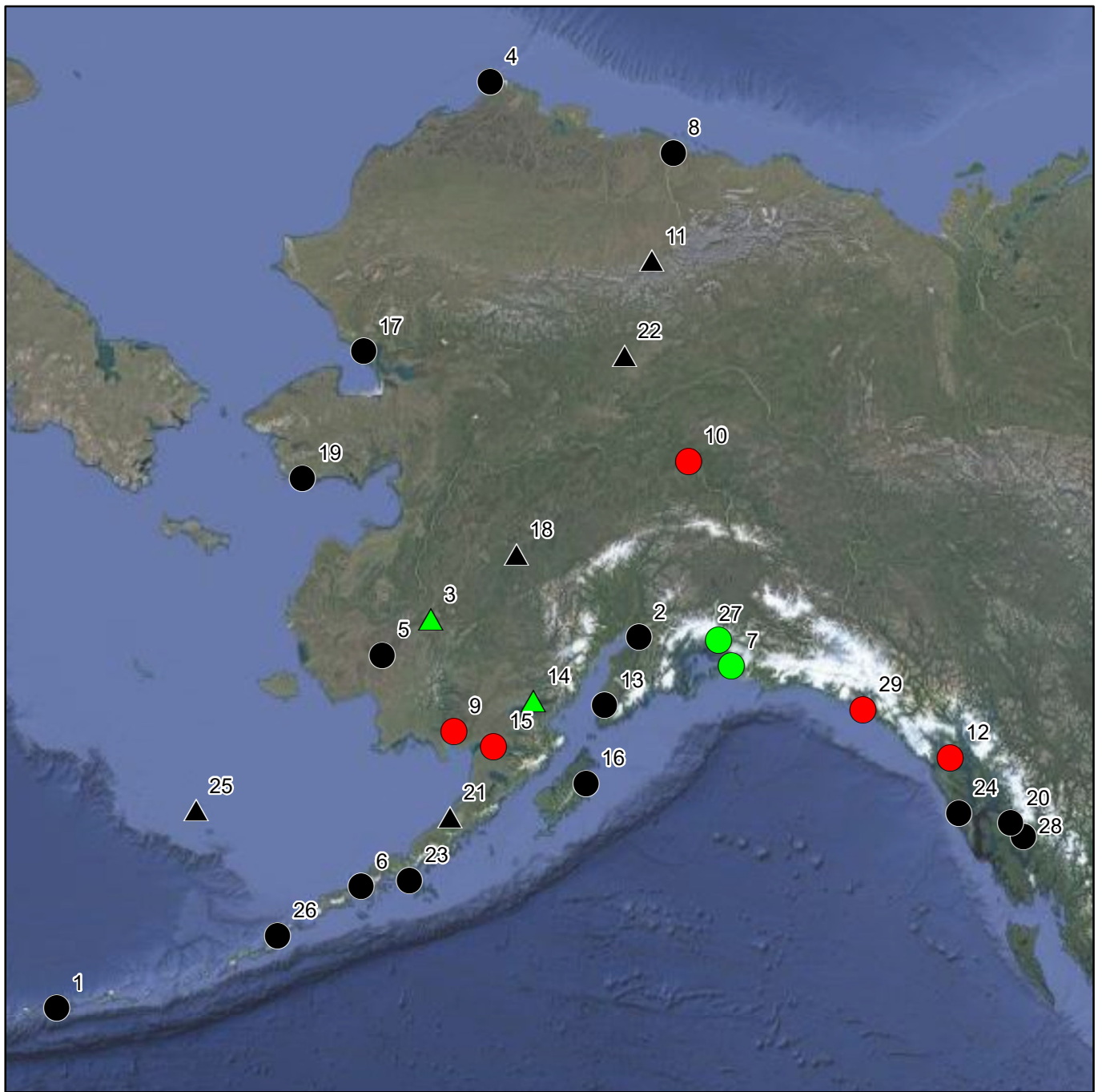
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Table 1 - DOT&PF Sites Covered Under this GWP¹

Site Number	Airport Name	Airport Location	Airport Code	DOT&PF Region ²	Site Type	DEC CSP File Number
1	Adak	Adak	ADK	Southcoast	Part 139	N/A ⁸
2	Ted Stevens Anchorage International	Anchorage	ANC	Central ⁷	Part 139	2100.38.028.038 ⁴ 2100.38.028.39 ^{4,6}
3	Aniak	Aniak	ANI	Central	FP139 or FDoD	N/A ⁸
4	Wiley Post-Will Rogers Memorial	Barrow	BRW	Northern	Part 139	310.38.036 ³
5	Bethel	Bethel	BET	Central	Part 139	2407.38.031 ⁴ 2407.38.030 ⁶
6	Cold Bay	Cold Bay	CDB	Southcoast	Part 139	N/A ⁸
7	Merle K (Mudhole) Smith	Cordova	CDV	Northern	Part 139	2215.38.033 ^{4,5}
8	Deadhorse	Deadhorse	SCC	Northern	Part 139	N/A ⁸
9	Dillingham	Dillingham	DLG	Central	Part 139	2540.38.023 ⁴
10	Fairbanks International	Fairbanks	FAI	Northern ⁷	Part 139	100.38.277 ⁴
11	Galbraith Lake	Galbraith Lake	GBH	Northern	FP139 ⁹	N/A ⁸
12	Gustavus	Gustavus	GST	Southcoast	Part 139	1507.38.017 ⁴
13	Homer	Homer	HOM	Central	Part 139	N/A ⁸
14	Iliamna	Iliamna	ILI	Southcoast	FP139 or FDoD	N/A ⁸
15	King Salmon	King Salmon	AKN	Southcoast	Part 139	2569.38.023 ⁴
16	Kodiak	Kodiak	ADQ	Southcoast	Part 139	N/A ⁸
17	Ralph Wien Memorial	Kotzebue	OTZ	Northern	Part 139	N/A ⁸
18	McGrath	McGrath	MCG	Central	FP139 or FDoD	N/A ⁸
19	Nome	Nome	OME	Northern	Part 139	400.38.056 ⁵
20	Petersburg James Johnson	Petersburg	PSG	Southcoast	Part 139	N/A ⁸
21	Port Heiden	Port Heiden	PTH	Southcoast	FP139 or FDoD	N/A ⁸
22	Prospect Creek	Prospect Creek	PPC	Northern	FP139 ⁹	N/A ⁸
23	Sand Point	Sand Point	SDP	Southcoast	Part 139	N/A ⁸
24	Sitka Rocky Gutierrez	Sitka	SIT	Southcoast	Part 139	N/A ⁸
25	St. Paul	St. Paul	SNP	Southcoast	FP139 or FDoD	N/A ⁸
26	Unalaska	Unalaska	DUT	Southcoast	Part 139	N/A ⁸
27	Valdez	Valdez	VDZ	Northern	Part 139	2264.38.045 ^{4,5}
28	Wrangell	Wrangell	WRG	Southcoast	Part 139	N/A ⁸
29	Yakutat	Yakutat	YAK	Southcoast	Part 139	1530.38.022 ⁴

NOTES:

- 1 Current list as of May 2020
 - 2 DOT&PF region responsible for the airport
 - 3 As they relate to either DEC sitewide PFAS sites or individual PFAS related events for which DOT&PF is the responsible party
 - 4 Sitewide PFAS CSP Site
 - 5 Information status only CSP Site
 - 6 Site specific PFAS related CSP Site (e.g. aircraft crash site, fire pit, etc.) or other
 - 7 Fairbanks and Anchorage International Airports are part of DOT&PF Northern and Central Regions, respectively. However, they are separate from their respective regions as they are also part of the Alaska International Airport System
 - 8 As of May 2020, no DOT&PF specific PFAS related contaminated site is included in the DEC Contaminated Sites Database
 - 9 Former Alyeska Part 139 airport
- CSP = Contaminated Sites Program, DEC = Alaska Department of Environmental Conservation, DOT&PF = Alaska Department of Transportation & Public Facilities, PFAS = per- and polyfluoroalkyl substances



Map adapted from aerial imagery provided by Google Earth Pro, reproduced by permission granted by Google Earth™ Mapping Service.

LEGEND

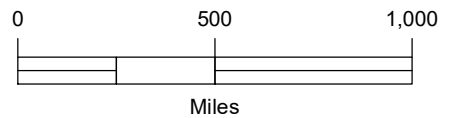
Color

- Private well sampling not yet complete.
- Private well sampling performed. PFAS results below former DEC action level or EPA LHA.
- Private well sampling performed. PFAS results above former DEC action level or EPA LHA.

Airport Type

- Part 139 Airport
- △ Former Part 139 or DoD Sites

See Table 1 for site associations.



DOT&PF Statewide PFAS General Work Plan

DOT&PF SITES

July 2020

102219-002

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

Figure 1

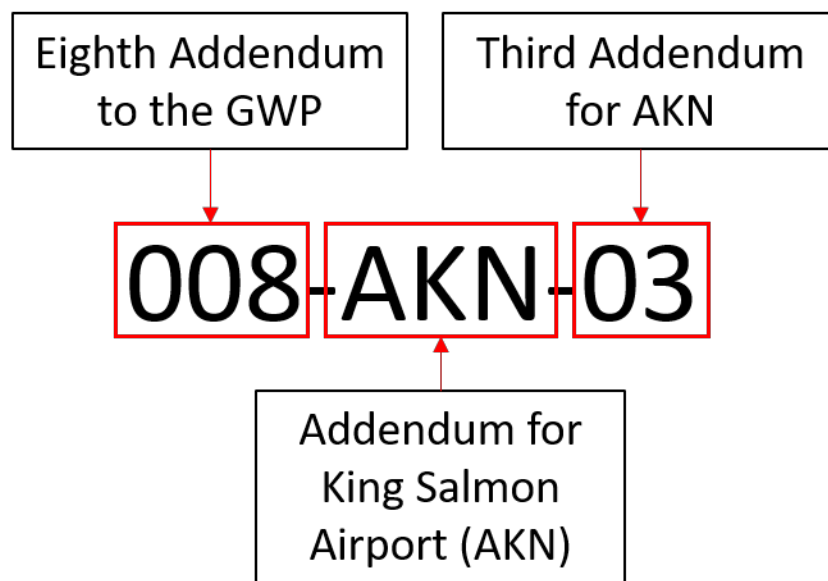
Appendix A

GWP Addendum Template

The GWP Addendum Template is meant to be a general outline for planning site-specific characterization activities at DOT&PF sites. The GWP Addendum Template includes some standard language to be used in the GWP Addendums; highlighted portions (grey) indicate information that will require review and modification, as appropriate for the site.

GWP Addendums will be prepared prior to the commencement of site characterization activities. The GWP Addendums will be submitted to DOT&PF for review and DEC for approval.

A numbering system, XXX-ABC-YY for the GWP Addendums will follow sequential arrangement. The 'XXX' will be a consecutive number to identify overall number of addendums to the GWP (first being 001, second being 002, etc.). The following three-letter code will correspond to the given airport code (Fairbanks International Airport is FAI, Gustavus is GST, etc.). The 'YY' will be a successive number to identify the overall number of addendums for each site. See example below:



SUBMITTED TO:
Alaska Department of
Transportation & Public
Facilities
2301 Peger Road
Fairbanks, Alaska 99709

BY:
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Fairbanks, Alaska 99709

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DRAFT

GENERAL WORK PLAN ADDENDUM
DOT&PF Statewide PFAS
Addendum XXX-ABC-YY
Project Name
CITY, ALASKA

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Submitted To: Alaska Department of Transportation & Public Facilities
2301 Peger Road
Fairbanks, Alaska 99709
Attn: Contact Name

Subject: DRAFT GENERAL WORK PLAN ADDENDUM, DOT&PF STATEWIDE PFAS
ADDENDUM XXX-ABC-YY
PROJECT NAME, CITY, ALASKA

Shannon & Wilson prepared this Work Plan Addendum on behalf of the Alaska Department of Transportation & Public Facilities (DOT&PF). This Addendum is a supplement to the *DOT&PF Statewide PFAS General Work Plan (GWP)*, submitted DATE. The services proposed in this GWP Addendum, XXX-ABC-YY, describes the DOT&PF planned activities for site characterization associated with per- and polyfluorinated substances (PFAS) for the City Airport (ABC).

The scope of services was specified in the proposal dated DATE and authorized on DATE by DOT&PF under Professional Services Agreement Number 25-19-013 *Per- and Polyfluorinated Substances (PFAS) Related Environmental & Engineering Services*. Additional funding to implement this Work Plan Addendum will be requested following the Alaska Department of Environmental Conservation (DEC) approval.

This GWP Addendum was prepared and reviewed by:

DRAFT

NAME

Title, Addendum Preparer

DRAFT

NAME

Title, Environmental Lead

DRAFT

Christopher Darrah, CPG, CPESC
Vice President, Contract Manager

DRAFT

Kristen Freiburger
Associate, Project Manager

XXX:KRF/CBD/xxx

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[Add Exhibits as needed.]

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[Add Tables as needed.]

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Figure 1: CITY Airport Property Boundaries and Site Map

[Add Figures as needed]

Appendices

Appendix A: Conceptual Site Model

Appendix B: Site Safety and Health Plan

Important Information

[Add Appendices as needed]

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ACRONYMS

AAC	Alaska Administrative Code
AFFF	aqueous film forming foam
BTEX	benzene, toluene, ethylbenzene, and total xylenes
COPC	contaminant of potential concern
CSM	Conceptual Site Model
DEC	Alaska Department of Environmental Conservation
DOT&PF	Alaska Department of Transportation & Public Facilities
DRO	diesel range organics
DVPP	Data-Validation Program Plan
EPA	U.S. Environmental Protection Agency
GRO	gasoline range organics
GWP	General Work Plan
IDW	investigative-derived waste
LOD	limit of detection
mg/kg	milligram per kilogram
mg/L	milligram per liter
PAH	polycyclic aromatic hydrocarbons
PFAS	per- and polyfluoroalkyl substances
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
POC	point of contact
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RL	reporting limit
RRO	residual range organics
SSHP	Site Safety and Health Plan

[Revise/add acronyms as needed.]

1 INTRODUCTION

This Addendum, XXX-ABC-YY, is a supplement to the DOT&PF Statewide PFAS General Work Plan (GWP). This Addendum, in collaboration with the GWP provides guidance for per- and polyfluoroalkyl substances (PFAS) site characterization activities near the CITY Airport (ABC) in CITY, Alaska (Figure 1, Exhibit 1-1).

Shannon & Wilson has prepared GWP and this Addendum in accordance with Alaska Department of Environmental Conservation’s (DEC) March 2017 *Site Characterization Work Plan and Reporting Guidance for Investigation of Contaminated Sites*, with DEC’s October 2019 *Field Sampling Guidance* document, and the Site Safety and Health Plan (SSHP). If additional site characterization activities are required that are not covered in the GWP or deviations are made to the GWP, they will be described in this addendum.

Exhibit 1-1: Airport Information

Airport Name:	CITY Airport
Airport Code:	ABC
DEC File No. / Hazard ID:	1234.56.789 / 0123
Airport Address:	ADDRESS, CITY, Alaska 99XXX
DOT&PF Region:	Northern, Central, Southcoast
DOT&PF Regional POC:	POC
DOT&PF PFAS POC:	Sammy Cummings
Airport Type:	Current Part 139 Airport, Former Part 139 Airport, Former DoD
Airport Coordinates (Lat/Long):	LAT, -LONG

POC = point of contact

[Revise this section as needed.]

1.1 Background

General background information relating to sites covered under the GWP is included in Section 1.1 of the GWP. Background information specific to the ABC is detailed below.

[Add pertinent background information about the site to be investigated here, for example, type of DOT&PF site, ownership history, aqueous film forming foam (AFFF) use information, etc. Revise this section as needed.]

1.1.1 Previous Investigations

[Add site-specific information regarding previous investigations as they relate to PFAS. Include the following, as applicable: previous water supply well activities (e.g. water supply well search, survey, sampling, quarterly and annual monitoring and criteria, and alternative drinking water sources, etc.), site characterization activities (e.g. environmental media sample collection and analysis), and/or other pertinent information regarding previous investigations at the site. Revise this section as needed.]

1.2 Project Objectives and Scope

[Add language concerning the objective and scope of the project. Revise this section as needed.]

2 SITE AND PROJECT DESCRIPTION

The following sections provide a site and project description.

2.1 Site Location and Boundaries

The ABC is located at ADDRESS in CITY, Alaska. CITY is located near GENERAL DESCRIPTION OF LOCATION. Figure 1 shows the property boundaries for land owned by the DOT&PF. The geographic coordinates of the ABC terminal are latitude LAT, longitude LONG.

[Add other language as applicable detailing the site location and boundaries. Revise this section as needed.]

2.2 Potential Sources of Contamination

General information regarding potential sources of contamination at Alaska Department of Transportation & Public Facilities (DOT&PF) sites to be covered under GWP is included in Section 2.1 of the GWP. Specific potential sources of contamination at the ABC to be investigated as a part of this Addendum are listed below.

[Add information summarizing the potential sources of contamination at the site. Revise this section as needed.]

2.3 Contaminants of Potential Concern and Regulatory Levels

General information regarding contaminants of potential concern (COPCs) and regulatory levels is included in Section 2.2 of the GWP. The primary COPCs for this project, are PFAS, BENZENE, TOLUENE, ETHYLBENZENE, AND TOTAL XYLENES (BTEX), GASOLINE RANGE ORGANICS (GRO), DIESEL RANGE ORGANICS (DRO), RESIDUAL RANGE ORGANICS (RRO), AND POLYCYCLIC AROMATIC HYDROCARBONS (PAHS). The current cleanup levels and analytical reporting limits for these site COPCs are summarized below in Exhibit 2-1.

CITY, Alaska has an annual average precipitation of XX inches per year. To evaluate analytical data, soil results be will compared to 18 Alaska Administrative Code (AAC) 75.341 Tables B1 Method Two – Migration to Groundwater and B2, Method Two – ARCTIC, OR UNDER/OVER 40-INCH Zone Migration to Groundwater. Groundwater and surface water samples will be compared to Alaska’s 18 AAC 75.341 Table C, Groundwater Human Health Cleanup Level. The current cleanup levels and analytical reporting limits for the site COPCs are summarized below in Exhibit 2-1.

[For initial site investigations, refer to Appendix F of the DEC Field Sampling Guidance (2019) for COPCs and consider the following language, as applicable. For additional site investigations, use the most recent conceptual site model (CSM) and COPCs to populate this section. Revise this section and Exhibit 2-1 as needed.]

Exhibit 2-1: COPCs, Regulatory and Laboratory Reporting Limits

Method	Analyte	Soil Limit ^a (mg/kg)	Water Limit ^b (mg/L)	Laboratory LODs/RLs ^c	
				Soil (mg/kg)	Water (mg/L)
PFAS Analytes					
METHOD ^d	PFOS				
	PFOA				

[Revise as needed based on site-specifics.]

Notes:

- a. 18 AAC 75 Table B2. Method Two - Petroleum Hydrocarbon Soil Cleanup Levels – ZONE Migration to Groundwater or Table B1. Method Two - Soil Cleanup Levels Table - Migration to Groundwater.
- b. 18 AAC 75 Table C. Groundwater Cleanup Levels.
- c. CURRENT LODs from SGS North America, Inc. for petroleum and PAH analyses. CURRENT RLs from Eurofins TestAmerica, Inc. for PFAS analyses.
- d. All available PFAS analytes will be requested for analytical reports. However, only PFOS and PFOA have DEC Cleanup Levels and are reported in this table.

EPA = U.S. Environmental Protection Agency, LOD = limit of detection, mg/kg = milligram per kilogram; mg/L = milligram per liter, PFAS = per- and polyfluoroalkyl substances, PFOA = perfluorooctanoic acid, PFOS = perfluorooctanesulfonic acid, RL = reporting limit,

2.4 Conceptual Site Models and Site Safety and Health Plans

A conceptual site model (CSM) describes potential pathways between a contaminant source and possible receptors (i.e., people, animals, and plants) and is used to determine who may be at risk of exposure to those contaminants. A DEC *Human Health Conceptual Site Model Graphic Form and Human Health Conceptual Site Model Scoping Form* was completed based on the preliminary understanding of site conditions. These forms are included in APPENDIX A of this Addendum and the Site Safety and Health Plan (SSHP) is provided in APPENDIX B.

[Using the site-specific CSM, describe the potentially affected media, possible receptors, and exposure pathways. Be sure to include soils, groundwater, surface water, biota, and air, as applicable. Revise this section as needed and include in subsequent Addendums and in Site Characterization Reports.]

2.5 Project Team

Chris Darrah will be Shannon & Wilson’s Principal-in-Charge and NAME will serve as the Project Manager. Shannon & Wilson’s project team also includes other State of Alaska Qualified Environmental Professionals to support the various field and reporting tasks required to achieve the project objectives. The project team and their associated responsibilities are summarized in Exhibit 2-2 below.

Exhibit 2-2: Project Team

Affiliation	Responsibility	Representative	Contact Number
DOT&PF	Client – Regional POC	POC	(907) XXX-XXXX
	Client – Statewide PFAS POC	Sammy Cummings	(907) 888-5671
DEC	Regulatory agency POC	POC	(907) XXX-XXXX
Shannon & Wilson	Principal-in-charge	Christopher Darrah	(907) 458-3143
	Project Manager	Kristen Freiburger	(907) 458-3146
Eurofins/ TestAmerica, Inc.	PFAS analytical laboratory services	David Alltucker	(916) 374-4383
SGS North America, Inc.	Additional analytical laboratory services	Jennifer Dawkins	(907) 474-8656
DRILLER	Soil-boring and monitoring well installations	POC	(907) XXX-XXXX
SURVEYOR	Surveyor subcontractor	POC	(907) XXX-XXXX

POC = point of contact

[Revise this section and the above Exhibit as needed.]

2.6 Project Schedule and Submittals

Section 2.5 of GWP provides general information regarding project schedules (i.e. the general order of occurrence of site characterization activities) and associated submittals.

Once DEC approval is received for the proposed scope of services outlined in this Addendum, Shannon & Wilson will coordinate with DOT&PF staff to collect samples of MEDIA TYPE. Field activities are anticipated to occur during NUMBER OF VISITS in SEASON YEAR. Laboratory analysis will be requested on a standard 14-day turn-around time. After field work is complete, a Site Characterization Report will be prepared documenting the results of the sampling event. The report will include summarized FIELD OBSERVATIONS, ANALYTICAL RESULTS AND DISCUSSION OF DATA QUALITY, PHOTO DOCUMENTATION, FIGURES SHOWING SAMPLE LOCATIONS, description of deviations from the approved Addendum, if any, and conclusions and recommendations. The report will also include an updated conceptual site model.

The following is the anticipated schedule:

- Work Plan Implementation (field activities) – SEASON YEAR
- Draft Report Submittal - within 60 days of receipt of analytical results
- Final Report Submittal - within 30 days of receiving DEC comments on the Draft Report

[Revise this section as needed.]

3 SITE CHARACTERIZATION ACTIVITIES

The following sections describe the site characterization activities to be conducted at ABC. Sampling procedures and analytical methods are described in Section 4. A Quality Assurance Program Plan (QAPP) is included in Section 5. General information regarding site characterization activities are described in Section 3.2 of the GWP.

3.1 Pre-investigation Activities

Pre-investigation tasks for this project are outlined in the following sections.

[Include information regarding any pre-investigation tasks and complete the following subsections, as appropriate, and provide reference to the GWP, where applicable.]

3.1.1 Site Access

[Revise this section as needed.]

3.1.2 Permitting

[Revise this section as needed.]

3.1.3 Utility Locates

[Revise this section as needed.]

3.2 Soil Characterization Activities

Soil characterization activities for this project include FIELD SCREENING AND SAMPLE COLLECTION FROM SOIL BORINGS, AND TEST PITS and are described in the following sections. General information regarding soil characterization activities are described in Section 3.2.2 of the GWP. Field personnel will document field activities with field notes and photographs as well as applicable field forms (Appendix B of GWP), as detailed in Section 5.2. Analytical laboratories and methods employed as a part of this Addendum are identified in Section 4.11. SOIL SAMPLING AND FIELD SCREENING PROCEDURES, AS APPROPRIATE, ARE PRESENTED IN SECTION 4.2 AND 4.3, RESPECTIVELY.

[Complete the following subsections, as appropriate; provide reference to the GWP, where applicable; and include specific information as appropriate (e.g. number, type, and location of field screening and analytical samples). Revise this section as needed.]

3.2.1 Field Screening

[Revise this section as needed.]

3.2.2 Surface Soil

[Revise this section as needed.]

3.2.3 Test Pits

[Revise this section as needed.]

3.2.4 Soil Borings

[Revise this section as needed.]

3.3 Groundwater Characterization

Groundwater characterization activities for this project include sample COLLECTION TEMPORARY WELL POINTS AND PERMANENT MWS and are described in the following sections. General information regarding groundwater characterization activities are described in Section 3.2.3 of the GWP. Field personnel will document field activities with field notes and photographs as well as applicable field forms (Appendix B of GWP), as detailed in Section 5.2. Analytical laboratories and methods employed as a part of this Addendum are identified in Section 4.11. TWP AND MW INSTALLATION, DEVELOPMENT, AND SAMPLING PROCEDURES, AS APPROPRIATE, ARE PRESENTED IN SECTION 4.4 AND 4.5, RESPECTIVELY.

[Complete the following subsections, as appropriate; provide reference to the GWP, where applicable; and include specific information as appropriate (e.g. number, type, and location of wells). Revise this section as needed.]

3.3.1 Temporary Well Points

[If applicable, identify the drilling contractor. Revise this section as needed.]

3.3.2 Monitoring Wells

[If applicable, identify the drilling contractor. Revise this section as needed.]

3.4 Surface Water Characterization

General information regarding surface water characterization and sediment sample collection activities are described in Section 3.2.4 of the GWP. Field personnel will document field activities with field notes and photographs as well as applicable field forms (Appendix B of GWP), as detailed in Section 5.2. Analytical laboratories and methods employed as a part of this Addendum are identified in Section 4.11. SURFACE WATER, SEDIMENT SAMPLING, AND PORE WATER SAMPLING PROCEDURES, AS APPROPRIATE, ARE PRESENTED IN SECTION 4.6, 4.7, AND 4.8, RESPECTIVELY.

As appropriate, include information regarding the surface water bodies to be sample, whether sediment samples or pore water samples will be collected, add reference to the GWP, and include specific information as appropriate (e.g. number, type, and location of water bodies). Revise this section as needed.]

3.4.1 Sediment Sampling

[If applicable, revise this section as needed.]

3.4.2 Pore Water Sampling

[If applicable, revise this section as needed.]

4 SAMPLING AND ANALYSIS PLAN

This section describes the analytical sampling approach for investigating contamination associated with the ABC. A DEC-qualified sampler will collect and handle the samples for projects covered under this GWP and collect required quality control (QC) samples in accordance with DEC's *Field Sampling Guidance*. A general Sampling and Analysis Plan is included as Section 4 of the GWP. Field personnel will document field activities with field notes and photographs as well as applicable field forms (Appendix B of GWP), as detailed in Section 5.2. Analytical laboratories and methods employed as a part of this Addendum are identified in Section 4.11. Sample containers, preservation methods, and holding times are included in Section 4.12. Sample custody, storage, and transport will be followed as described in Section 4.13. Equipment decontamination procedures are outlined in Section 4.13. Investigative-derived waste management is described in Section 4.15.

[Complete the following subsections, as appropriate; provide reference to the GWP, where applicable; and include specific information as stated in the GWP. Revise this section as needed]

4.1 Methods for Soil Sample Retrieval

Soil sample retrieval methods for this project include HAND TOOLS, TEST PITS, AND SOIL BORINGS and are described in the following sections. General information regarding methods for soil sample retrieval are described in Section 4.2 of the GWP

[Complete the following subsections, as appropriate; provide reference to the GWP, where applicable; and include specific information as stated in the GWP.]

4.1.1 Hand Tools

[Revise this section as needed.]

4.1.2 Soil Borings

[If applicable, identify the drilling contractor. Revise this section as needed.]

4.1.2.1 Direct-Push

[Revise this section as needed.]

4.1.2.2 Hollow-Stem Auger

[Revise this section as needed.]

4.2 Field Screening

Field screening procedures are described in Section 4.3 of the GWP.

[If applicable, detail the sample locations and frequency of field screening samples.]

4.3 Soil Sampling

Soil sampling procedures are outlined in Section 4.4 of the GWP.

[As applicable, detail soil sample locations, frequency, etc.]

4.4 Temporary Well Point Groundwater Sampling

Temporary well point groundwater sampling is described in Section 4.5.4 of the GWP. TWP INSTALLATION, MEASUREMENT, DEVELOPMENT AND GROUNDWATER SAMPLING ARE DISCUSSED IN THE FOLLOWING SECTIONS.

[Complete the following subsections, as appropriate; provide reference to the GWP, where applicable; and include specific information as stated in the GWP.]

4.4.1 Temporary Well Point Installation

[Revise this section as needed.]

4.4.2 Temporary Well Point Water Level Measurement

[Revise this section as needed.]

4.4.3 Temporary Well Point Development

[Revise this section as needed.]

4.4.4 Temporary Well Point Sampling

[Revise this section as needed.]

4.5 Monitoring Well Groundwater Sampling

Monitoring well groundwater sampling is described in Section 4.6 of the GWP.

[Complete the following subsections, as appropriate; provide reference to the GWP, where applicable; and include specific information as stated in the GWP.]

4.5.1 Monitoring Well Construction and Installation

MW well construction and installation procedures are described in Section 4.6.1 of the GWP.

[Revise this section as needed.]

4.5.2 Monitoring Well Development

MW well development procedures are described in Section 4.6.2 of the GWP.

[Describe specific well development equipment to be used will be identified a GWP addendum. Revise this section as needed.]

4.5.3 Monitoring Well Sampling

MW sampling procedures are described in Section 4.6.3 of the GWP.

[Describe specific well sampling equipment to be used will be identified a GWP addendum. Revise this section as needed.]

4.6 Surface Water Sampling

Surface water sampling procedures are detailed in Section 4.7 of the GWP.

[Revise this section as needed.]

4.7 Sediment Sampling

Sediment sampling procedures are detailed in Section 4.8 of the GWP.

[Revise this section as needed.]

4.8 Pore Water Sampling

[Revise this section as needed.]

4.9 Analytical Sample Summary

An analytical sample summary is detailed in Exhibit 4-1 below.

[Revise the following Exhibit and section to match site-specific analytical sample collection]

Exhibit 4-1: Analytical Sample Summary

Number of Samples	Matrix	PFAS (Method)	Additional	Analytes	As	Necessary
	Groundwater					
	Surface Soil					
	Subsurface Soil					
	Surface Water					
	Sediment					

Notes:

EPA = U.S. Environmental Protection Agency, PFAS = per- and polyfluoroalkyl substances,

4.10 Special Considerations for PFAS Sampling

Special considerations for PFAS sampling are outlined in Section 4.10 of the GWP.

[Revise this section as needed.]

4.11 Analytical Laboratories and Methods

[Describe the laboratories and methods to be used for this project here. Revise this section as needed.]

4.12 Sample Containers, Preservation, and Holding Times

General information regarding sample containers, preservation, and holding times described in Section 4.12 of the GWP. This information is provided in Exhibit 4-1, below, for the analytical methods employed for this project.

[Revise the following Exhibit and section to match site-specifics methods]

Exhibit 4-2: Sample Containers, Preservation, and Holding Time Requirements

Analyte	Method	Media	Container and Sample Volume	Preservation	Holding Time
PFAS	Method ¹	Water Soil	Dependent on selected method ¹	Dependent on selected method ¹	Dependent on selected method ¹

NOTES:

¹ The appropriate EPA method for PFAS analysis will be predicated on the type of samples to be collected (e.g. drinking water, groundwater, soil, etc.) and what EPA methods are available from the laboratory at the time of sampling. The exact method or methods to be used will be identified in the site-specific addendum.

EPA = U.S. Environmental Protection Agency, PFAS = per- and polyfluoroalkyl substances,

4.13 Sample Custody, Storage, and Transport

Sample custody, storage, and transport procedures are described in Section 4.13 of the GWP.

[Revise this section as needed.]

4.14 Equipment Decontamination

Equipment decontamination procedures are described in Section 4.14 of the GWP.

[Revise this section as needed.]

4.15 Investigative-Derived Waste Management

[Provide information regarding investigation-derived waste. Consider how the following media will be disposed of. Revise this section as needed.]

Other investigative-derived waste (IDW) will primarily consist of disposable sampling equipment (nitrile gloves, pump tubing, etc.). These items will be disposed of at dumpsters onsite and ultimately be disposed of at the CITY/BOROUGH Landfill.

4.16 Deviations from the General Work Plan

[As applicable, describe any planned deviations from the GWP along with rationale for the deviation here. If not applicable, state that no deviations to the GWP are planned at this time. Revise this section as needed.]

5 QUALITY ASSURANCE PROJECT PLAN

The QAPP is intended to guide activities during assessment and review of resulting data. Shannon & Wilson will be responsible for conducting data reduction, evaluation, and reporting under this QAPP. A general QAPP is provided as Section 5 of the GWP. Additionally, a Data-Validation Program Plan (DVPP) which describes the procedures for qualifying analytical data in a consistent manner, has been prepared, and is included as Appendix C to the GWP. The following sections describe specific procedures to be followed during sampling at the ABC, so sampling and documentation are effective, laboratory data are usable, and the information acquired is of high quality and reliable.

[Complete the following subsections, as appropriate; provide reference to the GWP, where applicable; and include specific information as stated in the GWP. Revise this section as needed]

5.1 Quality Assurance Objectives

Data quality objectives are detailed in Section 5.1 of the GWP. Numeric QA objectives for this project are presented in Exhibit 5-1 below.

[Revise this Exhibit and section as needed.]

Exhibit 5-1: Quality Assurance Objectives for Analytical Samples¹

Analyte	Method	Matrix	Precision	Accuracy	Completeness
PFAS	METHOD ²	Water	±30%	(analyte dependent)	85%
		Soil	±50%	(analyte dependent)	85%

NOTES:

1 The appropriate EPA method for PFAS analysis will be predicated on the type of samples to be collected (e.g. drinking water, groundwater, soil, etc.) and what EPA methods are available from the laboratory at the time of sampling. The exact method or methods to be used will be identified in the site-specific addendum.

EPA = U.S. Environmental Protection Agency, GRO = gasoline range organics, PFAS = per- and polyfluoroalkyl substances, PFOA = perfluorooctanoic acid PFOS = perfluorooctanesulfonic acid

5.2 Field Documentation

Field documentation is described in Section 5.2 of the GWP. Field forms to be used for this project are included in Appendix B of GWP.

[Revise this section as needed.]

5.3 Field Instrument Calibration

Field instrument calibration is discussed in Section 5.3 of the GWP.

[Revise this section as needed.]

5.4 Field Quality Control Samples

The field quality assurance (QA)/QC program for this project includes the collection of the following QA/QC samples as described below.

[Revise this section as needed.]

5.4.1 Field Duplicate Sample

Field duplicate sample collection procedures are described in Section 5.4.1 of the GWP.

[Revise this section as needed.]

5.4.2 Matrix Spike/Matrix Spike Duplicate Samples

MS/MSD sample collection procedures are described in Section 5.4.2 of the GWP.

[Indicate how many MS/MSD samples will be collected from which media and indicate which methods will be used to analyze the samples. Revise this section as needed.]

5.4.3 Trip Blank Samples

Trip blank samples are described in Section 5.4.3 of the GWP.

[Revise this section as needed.]

5.4.4 Equipment Blank Samples

Equipment blank sample collection procedures are described in Section 5.4.4 of the GWP.

[Revise this section as needed.]

5.4.5 Field Blank Samples

Field blank sample collection procedures are described in Section 5.4.5 of the GWP.

[Revise this section as needed.]

5.4.6 Temperature Blank Samples

Temperature blanks are described in Section 5.4.6 of the GWP.

[Revise this section as needed.]

5.5 Laboratory Quality Control Samples

Laboratory quality control samples are described in Section 5.5 of the GWP.

[Revise this section as needed.]

5.6 Laboratory Data Deliverables

Laboratory data deliverables are described in Section 5.6 of the GWP.

[Revise this section as needed.]

5.7 Data Reduction, Evaluation, and Reporting

Data reduction, evaluation, and reporting are discussed in Section 5.7 of the GWP.

[Revise this section as needed.]

6 REFERENCES

Alaska Department of Environmental Conservation (DEC), 2019a, 18 AAC 75, Oil and Other Hazardous Substances Pollution Control: Juneau, Alaska, Alaska Administrative Code (AAC), Title 18, Chapter 75, January available:
<http://dec.alaska.gov/commish/regulations/>.

Alaska Department of Environmental Conservation (DEC), 2019b, 18 AAC 75.345, Groundwater Cleanup Levels: Juneau, Alaska, Alaska Administrative Code (AAC), Title 18, Chapter 75, Section 341, January, available:
<http://dec.alaska.gov/commish/regulations/>.

Alaska Department of Environmental Conservation (DEC), 2019c, 18 AAC 75.341, Soil Cleanup Levels: Juneau, Alaska, Alaska Administrative Code (AAC), Title 18, Chapter 75, Section 341, January, available:
<http://dec.alaska.gov/commish/regulations/>.

Alaska Department of Environmental Conservation (DEC), 2019d, Field Sampling Guidance for Contaminated Sites and Leaking Underground Storage Tanks: Juneau, Alaska, DEC Division of Spill Prevention and Response, Contaminated Sites Program, October, available:
http://dec.alaska.gov/spar/csp/guidance_forms/csguidance.htm.

Alaska Department of Environmental Conservation (DEC), 2017, Site Characterization Work Plan and Reporting Guidance for Investigation of Contaminated Sites: Juneau, Alaska, DEC Division of Spill Prevention and Response, Contaminated Sites Program, March, available:
http://dec.alaska.gov/spar/csp/guidance_forms/csguidance.htm.

[Revise this section as needed.]

Appendix A

Conceptual Site Model

Scoping and Graphics Forms

CONTENTS

- Human Health Conceptual Site Model Scoping Form and Standardized Graphic
- Human Health Conceptual Site Model Graphic Form

APPENDIX A: CONCEPTUAL SITE MODEL

APPENDIX HEADING

Body Text

Appendix B

Site Safety and Health Plan

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 - B.1.2 Physical Hazards 1
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SITE SAFETY AND HEALTH PLAN

Shannon & Wilson prepared this Site Safety and Health Plan (SSHP) for the initial site characterization activities at the CITY Airport (ABC). The purpose of this SSHP is to protect the health and safety of field personnel from physical and chemical hazards associated with work at this site.

The provisions of this plan apply to Shannon & Wilson personnel who will potentially be exposed to safety and/or health hazards during this investigation. Shannon & Wilson employees are covered under its Corporate Safety and Health Program. General safety and health requirements described in that program will be met. Each Shannon & Wilson employee on the site will complete the personal acknowledgement form documenting they have read and understand this SSHP and agree to abide by its requirements. A copy of this SSHP will be kept on-site throughout the duration of sampling operations.

B.1. SITE HAZARD ANALYSIS

There are two categories of hazards that may occur during the field work: potential chemical exposure hazards and physical hazards associated with site characterization activities. These hazards are discussed below.

B.1.1 Chemical-Exposure Hazards

Contaminated soil and water may be encountered during site exploration activities. PFAS are believed to be the primary contaminants of potential concern and may be encountered in soils and water at unknown concentrations.

Shannon & Wilson personnel will implement skin protection when they are to contact potentially contaminated soil or water. Field personnel will wear work gloves or nitrile gloves as needed, and Level D personal protective equipment. Field personnel will not require respiratory protection based on the current understanding of site conditions and scope of services.

B.1.2 Physical Hazards

Primary physical hazards associated with site characterization activities include drilling equipment; temperature stress; lifting, slipping, tripping, falling; and risk of eye injuries. In addition, wildlife may be a hazard in forested areas around the airport. The best means of protection against accidents related to physical hazards are careful control of equipment

activities in the planned work area and use of experienced and safety- and health-trained field personnel.

Field personnel will not enter confined spaces for site characterization activities, nor will they enter trenches or excavations greater than four feet in depth.

B.1.2.1 Drilling Activities

Drill rigs have lots of moving parts and are very loud. Field personnel will wear proper PPE including appropriate hearing protection. A safe distance will be kept from the drill rig and field personnel will be aware of drill rig operations and crew movements. Practice good housekeeping around the work areas. Know where the drill rig's emergency shut-off switch(es) are located in order to shut the rig down in an emergency situation.

Underground utilities are present at the site. Utility locates will be requested by Shannon & Wilson prior to conducting any ground penetrating work.

B.1.2.2 Temperature Stress

Wearing PPE may put a worker at risk of developing heat stress; however, since the field screening activities will be conducted in Level D PPE the risk of heat stress is considered low. Cold stress or injury due to hypothermia will be guarded against by wearing appropriate clothing, having warm shelter available, scheduling rest periods, adequate hydration, and self-monitoring physical and mental conditions.

B.1.2.1 Lifting Hazards

Moving coolers of soil samples or other heavy objects presents a lifting hazard. Personnel will use proper lifting techniques and obtain assistance when lifting objects weighing more than 40 pounds.

B.1.2.2 Slips, Trips, and Falls

The most common hazards on a job site are typically slips, trips, and falls. These hazards will be reduced through the following practices:

- Personnel will stay alert.
- All access-ways will be kept free of materials, supplies, and obstructions at all times.
- Tools and other materials will be located so as not to cause tripping or other hazards.
- Personnel should be aware of potential tripping hazards associated with vegetation, debris, and uneven ground.

- Personnel should be aware of limitations imposed by work clothing and personal protective equipment (PPE).

The project site may be inherently hazardous due to the potential presence of rain, snow, and ice, which can alter the character of the ground surface. The risk for slips, trips, and falls by site workers is increased due to wet or icy surfaces; therefore, workers will use caution when walking at the site.

B.1.2.3 Insects and Animals

During the summer months in Alaska, mosquitoes and other insects are common in areas predominantly covered with vegetation. Wearing PPE should be sufficient to protect site workers. Animals such as moose and bears are also commonly seen in Alaska. If a large animal approaches the site, workers should keep their distance or seek shelter in their vehicles.

B.1.2.4 Congested Areas

The site investigation may at times require field personnel to work adjacent to or in roadways. Field personnel will observe the speed and frequency of traffic proximal to the work site. Appropriate cones, barricades, or signs to secure the work area will be used when required.

B.1.3 Other Hazards

Biological, ionizing radiation, and other hazards are not expected to be present. However, be aware of the surroundings and maintain safe work practices in accordance with Shannon & Wilson's Corporate Health & Safety Plan.

B.2. PERSONAL RESPONSIBILITIES, TRAINING, AND MEDICAL SURVEILLANCE

Below is a summary of the assignment of responsibilities, training requirements, and medical surveillance information for Shannon & Wilson personnel.

B.2.1 Assignment of Responsibilities

Shannon & Wilson is responsible for understanding and complying with the requirements of this SSHP. Following is a list of responsibilities of all Shannon & Wilson personnel working on the site:

- Review and follow this SSHP.

- Attend and participate in safety meetings.
- Take appropriate action as described in this SSHP regarding accidents, fires, or other emergency situations.
- Take all reasonable precautions to prevent injury to themselves and their fellow workers.
- Perform only those tasks they believe they can do safely, and immediately report any accidents or unsafe conditions to Shannon & Wilson's Project Manager or Office Health and Safety Manager.
- Halt work, by themselves or by others, when they observe an unsafe act or potentially unsafe working condition.
- Report accidents, illnesses, and near-misses to the local contact and to Shannon & Wilson's Fairbanks office Health and Safety Manager.

B.2.2 Personal Training

Shannon & Wilson personnel performing activities on this site and under this plan have completed the appropriate training requirements specified in 29 CFR 1910.120(e). Each individual has completed an annual eight-hour refresher-training course and/or initial 40-hour training course within the last year.

A personal acknowledgement form will be completed by field personnel prior to commencing field activities. This acknowledgment form will document that they have read and understand this SSHP.

B.2.3 Medical Surveillance Program

All field personnel performing activities on this site covered by this SSHP have undergone baseline and annual physical/medical examinations as part of Shannon & Wilson's Corporate Health and Safety Program. All field personnel are active participants in Shannon & Wilson's Medical Monitoring Program or in a similar program, which complies with 29 CFR 1910.120(f).

B.3. PERSONAL PROTECTIVE EQUIPMENT

PPE will be required during the course of the field work. PPE selection will be based primarily on work-task requirements and potential exposure. Field personnel will use Level D protective equipment during normal work activities. Personnel are trained in the use of PPE that is, or may be, required. All personnel shall wear Level D PPE as a minimum:

- standard work clothes or cotton overalls;
- reflective, high-visibility safety vest;
- safety-toe boots;
- safety glasses;
- hearing protection;
- gloves; and,
- hard hat.

Disposable nitrile gloves will be worn during any activity that may require dermal contact with potentially contaminated media.

B.4. DECONTAMINATION PROCEDURES

Equipment decontamination procedures are necessary for any reusable equipment that comes into contact with contaminated soil and/or water. Decontamination procedures will consist of a rinse with non-phosphate-based detergent, a second rinse with plain tap water, and a final rinse with distilled water. Sampling equipment and PPE that is expendable will be disposed of at the site or in a landfill off-site.

Shannon & Wilson will conduct all site characterization activities in Level D PPE. For this reason, personnel will not be decontaminated when leaving the work site unless gross visual contamination of protective clothing is present.

When decontamination is necessary, it will consist of the following:

- A decontamination station, just outside the work site, will be placed where personnel routinely enter/exit the work site. When exiting the work site, personnel will remove overboots, chemical resistant boots, coveralls, and outer gloves at the specified decontamination area.
- Personnel shall be instructed in proper decontamination technique. This entails removal of protective equipment in an “inside-out” manner. Removal of contaminants from protective clothing or equipment by blowing, shaking, or other means that may disperse material into the air is prohibited.
- Personnel protective clothing that has been removed shall remain at the decontamination station pending personnel redonning the clothing. At the conclusion of site work each day, PPE will be placed in trash bags for off-site disposal.

- Personnel will not exit the work site until contaminated clothing and equipment have been removed and employees have washed their hands and face with soap and water. A washtub with soap and water will be available to personnel as they exit the work site.
- Employees will wash their hands and face with soap and water before eating, drinking, smoking, or applying cosmetics. These activities will be restricted to designated rest area(s).
- Decontaminated items will be visually inspected for residual contamination to determine if decontamination procedures are effective.

B.5. ACCIDENTS AND EMERGENCIES

Shannon & Wilson field personnel are current in first aid and cardiopulmonary resuscitation (CPR) training. At a minimum, the following site safety equipment and first aid supplies shall be available in the field:

- PPE and clothing specialized for known site hazards;
- first aid kit, including first aid booklet;
- portable eye wash;
- clean water in portable containers; and
- other decontamination supplies.

The primary emphasis of any health and safety plan is accident prevention. If an injury or illness occurs during the course of field work, the severity of the problem will dictate the level of response. Minor injuries or illness will be addressed with basic first aid measures as recommended by a registered nurse through Shannon & Wilson's corporate Medcor service (1-800-775-5866). More serious injuries will require assistance from the medical staff at the CLINIC/ HOSPITAL, located at the intersection of STREETS in CITY, Alaska. The telephone number for the CLINIC/HOSPITAL is (907) XXX-XXXX. Field phones will be kept easily accessible in the case of an emergency.

Exhibit B-1: Map Showing CLINIC/HOSPITAL.

Shannon & Wilson's Corporate Health and Safety Program requires accident reporting when there is a site-related accident, near-miss incident, or medical emergency. If an employee is treated by medical personnel, the medical attendant will complete an Incident Medical Treatment Documentation form. Completion of an Alaska Department of Labor Report of Occupational Injury or Illness is also required within 10 days for any work-related injury or illness.

B.6. GENERAL SITE SAFETY REQUIREMENTS

The following measures are designed to augment the specific health and safety guidelines provided in this plan:

- Field personnel should avoid contact with potentially contaminated surfaces such as: walking through puddles or pools of liquid; kneeling on the ground; or leaning, sitting, or placing equipment on contaminated soil or containers.
- Field personnel will be familiar with procedures for initiating an emergency response.
- Hazard assessment is a continual process; personnel must be aware of their surroundings and any chemical/physical hazards present.
- Personnel in the exclusion area shall be the minimum number necessary to perform work tasks in a safe and efficient manner.
- The use of contact lenses is prohibited; soft lenses may absorb irritants, and all lenses concentrate irritants.
- Equipment contacting potentially contaminated soil or water must be decontaminated or properly discarded before leaving the site.

Field personnel will be familiar with the physical characteristics of the work site including wind direction, site access, and location of communication devices and safety equipment.

SITE SAFETY AND HEALTH PLAN PERSONAL ACKNOWLEDGEMENT FORM

DOT&PF STATEWIDE GENERAL WORK PLAN
ADDENDUM XXX-ABC-YY: CITY INITIAL SITE CHARACTERIZATION

I have reviewed this document and understand its contents and requirements. A copy of the above-referenced document has been made available to me. I agree to abide by the requirements of this Site Safety and Health Plan.

Signature

Name (printed)

Date

Representing

APPENDIX B: SITE SAFETY AND HEALTH PLAN

Important Information

About Your Geotechnical/Environmental Report

IMPORTANT INFORMATION

CONSULTING SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND FOR SPECIFIC CLIENTS.

Consultants prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your consultant prepared your report expressly for you and expressly for the purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the consultant. No party should apply this report for any purpose other than that originally contemplated without first conferring with the consultant.

THE CONSULTANT'S REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.

A geotechnical/environmental report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. Depending on the project, these may include the general nature of the structure and property involved; its size and configuration; its historical use and practice; the location of the structure on the site and its orientation; other improvements such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask the consultant to evaluate how any factors that change subsequent to the date of the report may affect the recommendations. Unless your consultant indicates otherwise, your report should not be used (1) when the nature of the proposed project is changed (for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one, or chemicals are discovered on or near the site); (2) when the size, elevation, or configuration of the proposed project is altered; (3) when the location or orientation of the proposed project is modified; (4) when there is a change of ownership; or (5) for application to an adjacent site. Consultants cannot accept responsibility for problems that may occur if they are not consulted after factors that were considered in the development of the report have changed.

SUBSURFACE CONDITIONS CAN CHANGE.

Subsurface conditions may be affected as a result of natural processes or human activity. Because a geotechnical/environmental report is based on conditions that existed at the time of subsurface exploration, construction decisions should not be based on a report whose adequacy may have been affected by time. Ask the consultant to advise if additional tests are desirable before construction starts; for example, groundwater conditions commonly vary seasonally.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes, or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical/environmental report. The consultant should be kept apprised of any such events and should be consulted to determine if additional tests are necessary.

MOST RECOMMENDATIONS ARE PROFESSIONAL JUDGMENTS.

Site exploration and testing identifies actual surface and subsurface conditions only at those points where samples are taken. The data were extrapolated by your consultant, who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent

such situations, you and your consultant can work together to help reduce their impacts. Retaining your consultant to observe subsurface construction operations can be particularly beneficial in this respect.

A REPORT'S CONCLUSIONS ARE PRELIMINARY.

The conclusions contained in your consultant's report are preliminary, because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Actual subsurface conditions can be discerned only during earthwork; therefore, you should retain your consultant to observe actual conditions and to provide conclusions. Only the consultant who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations based on those conclusions are valid and whether or not the contractor is abiding by applicable recommendations. The consultant who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

THE CONSULTANT'S REPORT IS SUBJECT TO MISINTERPRETATION.

Costly problems can occur when other design professionals develop their plans based on misinterpretation of a geotechnical/environmental report. To help avoid these problems, the consultant should be retained to work with other project design professionals to explain relevant geotechnical, geological, hydrogeological, and environmental findings, and to review the adequacy of their plans and specifications relative to these issues.

BORING LOGS AND/OR MONITORING WELL DATA SHOULD NOT BE SEPARATED FROM THE REPORT.

Final boring logs developed by the consultant are based upon interpretation of field logs (assembled by site personnel), field test results, and laboratory and/or office evaluation of field samples and data. Only final boring logs and data are customarily included in geotechnical/environmental reports. These final logs should not, under any circumstances, be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process.

To reduce the likelihood of boring log or monitoring well misinterpretation, contractors should be given ready access to the complete geotechnical engineering/environmental report prepared or authorized for their use. If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared, and that developing construction cost estimates was not one of the specific purposes for which it was prepared. While a contractor may gain important knowledge from a report prepared for another party, the contractor should discuss the report with your consultant and perform the additional or alternative work believed necessary to obtain the data specifically appropriate for construction cost estimating purposes. Some clients hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes that aggravate them to a disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY.

Because geotechnical/environmental engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, consultants have developed a number of clauses for use in their contracts, reports, and other documents. These responsibility clauses are not exculpatory clauses designed to transfer the consultant's liabilities to other parties; rather, they are definitive clauses that identify where the consultant's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

The preceding paragraphs are based on information provided by the ASFE/Association of Engineering Firms Practicing in the Geosciences, Silver Spring, Maryland

Appendix B Field Forms

CONTENTS

- Water Supply Well Inventory Survey Form
- Field Activities Daily Log
- Water Supply Well Sampling Log
- Field Log of Boring
- Sample Collection Log
- Monitoring Well Construction Details
- Monitoring Well Sampling Log
- Surface Water Sampling Form
- Chain-of-Custody Records

Water Supply Well Inventory Survey Form

Date: _____

Parcel: _____

Name (Owner): _____

Name (Occupant): _____

Physical Address: _____

Mailing Address: _____

Email Address (optional): _____

Contact Phone Number: (owner) _____ (occupant) _____

Number of persons residing at this location: Adults (18 and over) _____
 Teenagers (13 to 17) _____
 Children (12 and under) _____

Years at this residence: _____ Full-Time Seasonal

1) From where do you obtain your drinking water?

- a) Water Supply Utility b) Well Water
 c) Water Delivery d) Other

2) If you have a water well, please answer the following questions:

- a) Where is the well located on the property? _____
 b) Is the well in use? Yes No
 c) If yes, please check all that apply regarding the usage of your well water:
 Drinking Cooking Gardening Pets Other _____
 d) If no, is the well usable, unusable, or properly abandoned?
 Usable Unusable Abandoned Method _____
 e) When was the well installed? _____
 f) What is the well depth? _____ Do you have the well log? Yes No
 g) What is the well diameter? _____
 h) What is the well type? Dug Well Driven
 Drilled Unknown
 i) Do you have any treatment on your well (e.g. water softener)? Please describe. _____

3) Sample Permission

Does the Alaska Department of Transportation & Public Facilities (DOT&PF) have permission to sample your private water well? Yes No

 Signature

 Date

MONITORING WELL CONSTRUCTION DETAILS

Monitoring Well No. _____ Project Name _____ Project Number _____	Date Installed _____ Logged By _____ Driller _____
---	--

I. TOP SECTION (CASING)

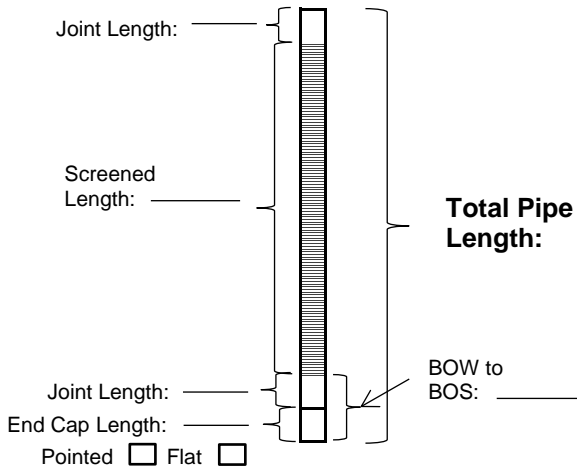
Initial Pipe Length _____
 Cutoff Length _____
 Add-on Length _____
Total Length _____

II. MID SECTION (CASING)

Number of Blank Sections _____
 Length of Section(s): _____

Sum of Lengths: _____

III. SCREENED SECTION(S)



IV. WELL DATA

Pipe Type: PVC SS Other _____
 Diameter: 2" 4" Other _____
 Slot Size: 0.01 0.02 Other _____
 Joint Pin End: Up Down Type _____

V. BACKFILL

	Depth Below GS	
	Bottom	Top
CEM (No Pipe)	_____	_____
CEM_PB	_____	_____
*SLUF_PB/FIL_PB	_____	_____
BCH_PB	_____	_____
*SLUF_PB/FIL_PB	_____	_____
BGR_PB	_____	_____
*SLUF_PB/FIL_PB	_____	_____
*SLUF_PS/FIL_PS	_____	_____
*SLUF/FIL (No Pipe)	_____	_____
*SLUF_PB/FIL_PB	_____	_____
Filter Pack Type or Gradation	_____	

VI. MONUMENTS

Stickup Flushmount
 TOM to GS _____
 TOM to TOC _____
 ^TOC to GS _____
 Lock type _____

VII. MOISTURE CONTENT

Depth to Water Below GS _____

	Frozen Soil Below GS	
	Bottom	Top
Seasonal 1	_____	_____
Seasonal 2	_____	_____
Permafrost 1	_____	_____
Permafrost 2	_____	_____

VIII. CALCULATIONS BELOW GROUND SURFACE

- BCH = Bentonite Chips (gINT code)
- BGR = Bentonite Grout (gINT code)
- bgs = Below Ground Surface
- BOS = Bottom of Screen
- BOW = Bottom of Well
- CEM = Cement (gINT code)
- FIL = Sand Pack (gINT code)
- GS = Ground Surface
- SLUF = Natural Collapse/ Pea Gravel (gINT code)
- SS = Stainless Steel
- TOC = Top of Casing
- TOM = Top of Monument
- TOS = Top of Screen
- PB = Blank Pipe (gINT code)
- PS = Slotted Pipe (gINT code)
- * Circle filter-pack type
- ^ Flushmount = Negative Number
- Stickup = Positive Number

TOC to BOW _____
 - BOW to BOS _____
= TOC to BOS _____
 TOC to BOS _____
 - Screened Length _____
= TOC to TOS _____

TOC to BOW	_____
- TOC to GS	_____
BOW bgs	_____
TOC to TOS	_____
- TOC to GS	_____
TOS bgs	_____
TOC to BOS	_____
- TOC to GS	_____
BOS bgs	_____

MONITORING WELL SAMPLING LOG

Owner/Client _____	Project No. _____
Location _____	Date _____
Sampling Personnel _____	Well _____
Weather Conditions _____	Time started _____
Air Temp. (°F) _____	Time completed _____

Sample No. _____	Time _____
Duplicate _____	Time _____
Equipment Blank _____	Time _____

Pump _____	Diameter and Type of Casing _____
Purging Method <u>portable / dedicated pump</u>	Approximate Total Depth of Well Below MP (ft.) _____
Pumping Start _____	Measured Total Depth of Well Below MP (ft.) _____
Purge Rate (gal./min.) _____	Depth to Water Below MP (ft.) _____
Pumping End _____	Depth to Ice (if frozen) Below MP (ft.) _____
Pump Set Depth Below MP (ft.) _____	Feet of Water in Well _____
KuriTec Tubing (ft.) _____	Gallons per foot _____
TruPoly Tubing (ft.) _____	Gallons in Well _____
	Purge Water Volume (gal.) _____
	Purge Water Disposal _____

Monument Condition _____

Casing Condition _____

Wiring Condition _____
(dedicated pumps) _____

Measuring Point (MP) Top of Casing (TOC) Monument type: Stickup / Flushmount
Measurement method: Rod & level / Tape measure

Top-of-casing to monument (ft.) _____	Datalogger type <u>n/a</u>
Monument to ground surface (ft.) _____	Datalogger serial # <u>n/a</u>
	Measured cable length (ft.) <u>n/a</u>

- Lock present and operational
- Well name legible on outside of well
- Evidence of frost-jacking _____

Notes _____

WELL CASING VOLUMES

Diameter of Well [ID-inches]	CMT	1¼	2	3	4	6	8
Gallons per lineal foot	0.000253	0.08	0.17	0.38	0.66	1.5	2.6

Well No. _____

CHAIN-OF-CUSTODY RECORD

Laboratory _____

Attn: _____

400 N. 34th Street, Suite 100
Seattle, WA 98103
(206) 632-8020

2043 Westport Center Drive
St. Louis, MO 63146-3564
(314) 699-9660

303 Wellsian Way
Richland, WA 99352
(509) 946-6309

2355 Hill Road
Fairbanks, AK 99709
(907) 479-0600

5430 Fairbanks Street, Suite 3
Anchorage, AK 99518
(907) 561-2120

2255 S.W. Canyon Road
Portland, OR 97201-2498
(503) 223-6147

1200 17th Street, Suite 1024
Denver, Co 80202
(303) 825-3800

Analysis Parameters/Sample Container Description
(include preservative if used)

Sample Identity	Lab No.	Time	Date Sampled	Analysis Parameters/Sample Container Description (include preservative if used)						Remarks/Matrix
				Comp.	Grab					

Project Information		Sample Receipt	
Project Number:		Total Number of Containers	
Project Name:		COC Seals/Intact? Y/N/NA	
Contact:		Received Good Cond./Cold	
Ongoing Project? Yes <input type="checkbox"/> No <input type="checkbox"/>		Delivery Method:	
Sampler:		(attach shipping bill, if any)	

Instructions	
Requested Turnaround Time:	
Special Instructions:	

Distribution: White - w/shipment - returned to Shannon & Wilson w/ laboratory report
 Yellow - w/shipment - for consignee files
 Pink - Shannon & Wilson - Job File

Relinquished By: 1.		Relinquished By: 2.		Relinquished By: 3.	
Signature:	Time: _____	Signature:	Time: _____	Signature:	Time: _____
Printed Name:	Date: _____	Printed Name:	Date: _____	Printed Name:	Date: _____
Company:		Company:		Company:	
Received By: 1.		Received By: 2.		Received By: 3.	
Signature:	Time: _____	Signature:	Time: _____	Signature:	Time: _____
Printed Name:	Date: _____	Printed Name:	Date: _____	Printed Name:	Date: _____
Company:		Company:		Company:	

Appendix C

Data-Validation Program Plan

APPENDIX C: DATA-VALIDATION PROGRAM PLAN

SUBMITTED TO:
Alaska Department of
Transportation & Public
Facilities
2301 Peger Road
Fairbanks, Alaska 99709

BY:
Shannon & Wilson, Inc.
2355 Hill Road
Fairbanks, Alaska 99709

(907) 479-0600
www.shannonwilson.com

FINAL

DATA-VALIDATION PROGRAM PLAN
DOT&PF Statewide PFAS
VARIOUS SITES, ALASKA

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Submitted To: Alaska Department of Transportation & Public Facilities
2301 Peger Road
Fairbanks, Alaska 99709
Attn: Samantha Cummings

Subject: FINAL DATA-VALIDATION PROGRAM PLAN, DOT&PF STATEWIDE PFAS,
VARIOUS SITES, ALASKA

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Appendices

Appendix A: SGS Bottle Guide

Appendix B: Surrogate and Isotope Dilution Analyte Associations

ACRONYMS

AAC	Alaska Administrative Code
CCV	continuing calibration verification
COC	chain-of-custody
°C	degrees Celsius
CSP	Contaminated Sites Program
DEC	Alaska Department of Environmental Conservation
DQO	data quality objective
DVPP	Data-Validation Program Plan
EB	equipment blank
EDD	electronic data deliverable
EPA	U.S. Environmental Protection Agency
FB	field blank
GRO	gasoline range organics
ICV	initial calibration verification
IDA	isotope dilution analyte
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LOD	limit of detection
LOQ	limit of quantitation
MB	method blank
mm	millimeter
MRL	method reporting limit
MS	matrix spike
MSD	matrix spike duplicate
%R	percent recovery
PFAS	per- and polyfluoroalkyl substances
PQL	practical quantitation limit
QAPP	quality assurance program plan
QA	quality assurance
QC	quality control
RPD	relative percent difference
SDG	sample delivery group
SGS	SGS North America, Inc.
SOP	standard operating procedure
SRF	sample receipt form
TB	trip blank
USACE	US Army Corps of Engineers
VOA	volatile organic analysis
VOC	volatile organic compound
WO	work order

Exhibit 1-1: Definition of Flags

Flag	Displayed as	Description
U	< [reporting limit]	The analyte was not detected; the result is listed as less than the reporting limit.
UJ	< [reporting limit] J*	The analyte was not detected; the listed reporting limit may not represent the true reporting limit due to sample-handling or laboratory quality-control (QC) failures (i.e., the listed reporting limit may be inaccurate or imprecise).
UB	< [LOQ or reported concentration] B*	The analyte is considered not detected due to sample-contamination identified in a blank; the result is listed as less than the limit of quantitation (LOQ) or the concentration originally reported in the sample (higher of the two values).
J	[Result] J – Flag applied by laboratory [Result] J* – Flag applied by reviewer	The result is an estimated quantity. The analyte was detected below the LOQ or was affected by QC failures.
JL	[Result] JL*	The result is an estimated quantity and may be biased low due to QC failures.
JH	[Result] JH*	The result is an estimated quantity and may be biased high due to QC failures.
JN	[Result] JN*	The analyte was tentatively identified, and the result is an estimated quantity.
R	R*	The results are unusable. The sample results are rejected due to severe QC deficiencies. The analyte may or may not be present in the sample.

NOTES:

* Flag applied by reviewer.

LOQ = limit of quantitation, QC = quality control

1 INTRODUCTION

This Data-Validation Program Plan (DVPP) was prepared to describe the procedures used by Shannon & Wilson staff for reviewing and qualifying analytical data in an objective and consistent manner.

This DVPP describes the process for qualifying analytical data based on quality assurance/quality control (QA/QC) review of Level II laboratory reports and electronic data deliverables (EDDs). This DVPP is intended to provide guidance for generally conducting what the U.S. Environmental Protection Agency (EPA) refers to as a Stage 2a Validation (EPA 2009). A more critical level of validation is beyond the scope of this DVPP, but the DVPP does present guidance for determining whether additional review should be conducted, based on information received from the laboratory. This DVPP also assesses the quality of the analytical data using PARCCS parameters (precision, accuracy, representativeness, comparability, completeness, and sensitivity).

This DVPP provides information about references used during the data-validation process and presents data qualifiers used to “flag” analytical data. The standard set of flags used to validate analytical data along with their definitions are presented in Exhibit 1-1. Methods for applying data qualifiers are referenced primarily from the following EPA guidance documents:

- EPA National Functional Guidelines for Organic Methods Data Review, January 2017 (EPA 2017b);
- EPA National Functional Guidelines for Inorganic Methods Data Review, January 2017 (EPA 2017a); and
- EPA Data Review and Validation Guidelines for Perfluoroalkyl Substances (PFASs) Analyzed Using EPA Method 537, November 2018 (EPA 2018a)

In some cases, the following US Army Corps of Engineers (USACE) guidance document is also referenced to formulate opinions when EPA guidance documents recommend exercising professional judgment:

- USACE Engineering Manual 200-1-10, Guidance for Evaluating Performance-Based Chemical Data, June 2005 (USACE 2005).

Additional references are listed in Section 12.0 and cited throughout the text.

In general, most data-review guidelines presented in this DVPP are drawn from federal guidance documents. However, in some cases federal guidance is not consistent, is outdated, or does not account for specific issues addressed in this DVPP; in these cases, the guidance presented in the DVPP is based on standard industry practice or site-specific

considerations, which are based on Shannon & Wilson chemists’ years of professional experience and discussions with the Alaska Department of Environmental Conservation (DEC).

Most quality assurance program plans (QAPPs) specify data quality objectives (DQOs) for items such as laboratory control sample (LCS) recovery and target reporting limits. This document does not present such limits, but instead defers to internal laboratory control limits that are statistically derived, frequently updated, and within the requirements of the laboratory’s national certification, and thus compliant with federal requirements.

2 LABORATORY CERTIFICATION AND DELIVERABLES

2.1 Laboratory Certification

The DEC Contaminated Sites Program (CSP) has an approval process for laboratories conducting analytical testing of various analytes; other DEC programs have their own laboratory certification programs. When using a new laboratory or analytical method, the DEC website is checked to verify that the laboratory analyzing project samples is certified as “approved.” Laboratory certification is not required in cases where DEC does not list an analytical method. The websites do not appear to be updated frequently and laboratories may be certificated without being listed on the website. Certifications can be requested from the laboratory.

In cases where the original laboratory subcontracts analysis to a network or referral laboratory (“ref lab”), the referral laboratory shall also be verified for DEC approval, where applicable. This information may be found in the following websites listed in Exhibit 2-1, below:

Exhibit 2-1: Links to DEC-Approved Laboratories

DEC-Approval Authority	Website
Contaminated Sites Program	https://dec.alaska.gov/spar/csp/lab-approval/list-of-approved-labs
Drinking Water Program - Chemical Laboratories	https://dec.alaska.gov/eh/lab/chem-lab-cert-status.aspx
Drinking Water Program - Microbiological Laboratories	https://dec.alaska.gov/eh/lab/micro-lab-cert-status.aspx

2.2 Laboratory Deliverables

Laboratory Level II reports and EDDs are obtained directly from the laboratory via e-mail or laboratory data websites. The laboratory reports and EDDs are reviewed for completeness and revised reports are requested where there is missing or incorrect information.

Laboratory reports are provided in Adobe Acrobat (.pdf) format, while EDDs are provided in extensible markup language (.xml) format, or another similar format. It may be necessary to engage with the laboratory regarding a database compatible EDD format.

Laboratory reports and EDDs are grouped by the work order (WO) number assigned when the laboratory receives the sample delivery group (SDG). SDGs are determined by the samples and analyses listed on the chain-of-custody (COC) record.

3 CHAIN-OF-CUSTODY

Evidence of sample custody from the time of collection to the time of receipt by the laboratory is documented via the COC record. A COC contains the signatures of individuals collecting, shipping, and receiving each sample. The COC is reviewed to verify it is signed and dated by the sampler, the local receiving staff (unless shipped directly), and the laboratory's receiving staff. Carriers who are only involved in the transport of sealed coolers (e.g., Lynden Transport, Inc.) are not required to sign the COC. A sample is considered to be in custody if it is:

- in a person's actual possession;
- in view, after being in physical possession;
- sealed so no one can tamper with it, after having been in physical custody; or
- in a secured area, restricted to authorized personnel.

If the COC record is not complete and accurate (e.g., signatures missing, date/time discrepancies, lack of custody seals), professional judgment must be used as to whether to qualify the data. The reviewer should consider rejecting data and recollecting the samples, if possible, if it is suspected that custody was intentionally breached, and the samples may have been tampered with. If instead there is a simple omission or minor discrepancy, the data may be usable without qualification if the source of the omission or discrepancy is known and accounted for.

The COC also provides the requested analyses for each documented sample. COCs are reviewed to verify the correct analyses were requested, and that sample names match those on the sample-collection logs. Where discrepancies are noted, the laboratory will coordinate with the sampling team to confirm the correct sample names are used in reporting the results.

4 SAMPLE HANDLING, CONDITION, PRESERVATION, AND HOLDING TIMES

Evidence of sample condition is documented on the laboratory's sample receipt form (SRF) upon delivery. SRFs document QC non-conformance issues during sample handling, where such information exists. In some cases, samples are delivered to a local sample-receiving office prior to transport to the analytical laboratory; SRFs are completed at each location.

The following sections generally apply to soil and water. For sample-handling requirements for other media besides soil and water samples, reference to the individual EPA sampling and analysis methods and/or laboratory sampling guides will be made. In general, data qualification based on sample-handling failures is the same for other media as for soil and water samples; however, the sample-handling requirements may be different and must be assessed on a method-specific basis.

4.1 Acceptable Temperatures

SRFs are reviewed to verify samples are received within the acceptable temperature range. Temperature of the coolers and/or temperature blanks should be documented at each receiving location. Samples are considered to be within the acceptable temperature range if received between 0 degrees Celsius (°C) and 6 °C, where temperature preservation is required. This range is referenced in multiple guidance (e.g. EPA 2017a, 2017b, 2018b) noting that water samples received below this cutoff are acceptable in the absence of ice.

Data qualification based on temperatures outside the acceptable criteria may vary for different analyses and sample matrices. For example, PFAS analysis for samples exceeding 6 °C is unlikely to have the same reduction in concentration as a sample submitted for volatile organic compound (VOC) analysis. Another notable exception to the temperature range criteria is for samples that collected frozen (<-7 °C). These samples may be maintained frozen until sub-sampled and preserved, if allowed by the project work plan (DEC 2019a).

Exhibit 4-1 provides general guidelines for qualifying results for samples received outside the acceptable temperature range; however, the individual extraction or analytical methods should be consulted, and professional judgment used.

Exhibit 4-1: Sample-Temperature Actions

Matrix	Criteria	Action	
		Detected Analytes	Analytes Not Detected
Water	0 °C – 6 °C		No qualification
	0 °C – 6 °C; ice in samples	J	UJ
	< 0 °C; no ice in samples		No qualification
	< 0 °C; ice in samples	J	UJ
	> 6 °C	JL	UJ ¹
Soil	0 °C – 6 °C		No qualification
	< 0 °C		No qualification ²
	> 6 °C	JL	UJ ¹
PFAS Impacted Soil and Water	0 °C – 10 °C ³		No qualification
	< 0 °C		No qualification ²
	> 10 °C	JL	UJ

NOTES:

- 1 Use professional judgment when qualifying sample results based on temperature exceedance, considering the volatility of the analyte. If temperatures are higher than 10 °C or are suspected to have been above 6 °C for an extended period (e.g., over 24 hours), reviewer should consider rejecting sample results for volatile analytes that were not detected.
- 2 Use professional judgment and refer to method-specific requirements for non-standard analyses and matrices.
- 3 Samples shall be protected from light and refrigerated at ≤ 6°C (but not frozen) from the time sample collection until receipt at the laboratory.

°C = degrees Celsius, PFAS = per- and polyfluoroalkyl substances

4.2 Sample Preservation

Some analyses require addition of sample preservatives in addition to maintaining the samples within the acceptable temperature range. Various guidance documents (EPA 2018b; USACE 2005) and individual EPA extraction methods list sample-preservation requirements for individual methods and matrices. SGS North America, Inc. (SGS) has condensed this information into one concise table including bottle type and volume requirements; this bottle guide table is included in Appendix A. The laboratory SRF documents whether samples were received with proper preservative and within relevant pH limits.

Not all data are affected the same way by failure to properly preserve samples, therefore, individual extraction or analytical methods should be consulted, and professional judgement used. For example:

- If the pH is outside method requirements for inorganic analytes in aqueous samples and the laboratory adjusts the pH immediately upon receipt at the laboratory within the method-specified holding time, allowing time for the sample to equilibrate prior to digestion, the sample results are not affected (EPA 2017a).

- In the case where one analyte is the degradation byproduct of another analyte, the degraded species may increase in a sample following storage with inadequate preservation (USACE 2005); the same may occur if holding times are exceeded (see Section 4.3, below).
- For metals speciation (e.g., Fe²⁺ vs. Fe³⁺), acidification can result in an increase in the reduced form and a decrease in the oxidized form. Professional judgment should be used for qualifying data for any samples with preservation issues.

In most cases where sample preservation is inadequate, sample results should be considered estimated and qualified using the criteria listed in Exhibit 4-2 below.

Exhibit 4-2: Preservation Actions

Criteria	Action	
	Detected Analytes	Analytes Not Detected
Adequate Preservation ^{1,2}	No qualification	
Inadequate Preservation ^{1,2}	JL	UJ

NOTES:

- 1 Per regulatory guidance and/or method specific or preservation requirements.
- 2 Use professional judgment and refer to method-specific requirements for non-standard analyses and matrices.

4.3 Holding Times

Samples are required to be extracted and/or analyzed within method-specific holding times. The holding time begins immediately following sample collection. Holding times are also presented on the SGS bottle guide included in Appendix A for standard analyses. Holding times are calculated on a per-day basis, except for short-holding-time analyses where the holding time is measured in hours (typically for analyses listed with a holding time of 72 hours or less).

Holding times are evaluated based on the matrix and method. Certain methods list a collection-to-analysis holding time (e.g., analysis of volatile organic compounds in soil, where extraction occurs in the field at the time of collection), while others list separate holding times for collection to extraction and for extraction to analysis.

In general, where holding times are exceeded, sample results shall be qualified using the criteria listed in Exhibit 4-3.

Exhibit 4-3: Holding-Time Actions

Analysis	Criteria	Action	
		Detected Analytes	Analytes Not Detected
PFAS	$t \leq HT$	No qualification	
	$t > HT$	J	UJ
	$t > 2x HT$ (gross exceedance)	J	R
All Others ¹	$t \leq HT$	No qualification	
	$HT < t \leq 2 \times HT$ (marginal exceedance)	JL	UJ
	$t > 2x HT$ (gross exceedance)	JL	R

NOTES:

1 Use professional judgment and refer to method-specific requirements for non-standard analyses and matrices.

HT = method (technical) holding time; t = actual holding time

As with sample preservation, professional judgment must be used when qualifying data based on holding-time exceedance, as there can be situations where certain analytes are affected differently than others (such as in the case of analytes that are degradation products of one another). Also, preservation failures coupled with a marginal holding-time exceedance may warrant rejection of results for analytes that were not detected.

4.4 Sample Condition

Sample condition is documented on the laboratory’s SRFs. Professional judgment should be used to determine if qualification of analytical results is necessary for cases where sample condition is compromised. Some common circumstances that may affect sample results are listed below:

1. **Broken Container:** Sometimes 1-L bottle lids crack upon tightening, but no liquid is lost. As long as the lid is replaced prior to sample shipment (may be replaced by the laboratory sample-receiving office), results are not considered affected. Most water analyses require at least one duplicate bottle to be filled. If only one of the bottles is broken and the analysis is performed with the intact bottle, no qualification is required other than noting the broken container on the data-review checklist (DEC 2019b). However, if the sample with the broken container was used for analysis, the analytes in question could oxidize, volatilize, degrade, or react, causing the concentration to at least be considered estimated ; professional judgment should be used to determine if the analyses are affected by the addition of air. Affected sample results shall be qualified using the criteria listed in Exhibit 4-4.

2. **Leaking methanol** (soil volatile organic analysis [VOA]): When collecting soil samples for volatile analysis, 25 mL of methanol is added to the sample container to perform the sample extraction and preserve the target analytes in the sample. If the methanol leaks out, it leads to a low bias in the calculated soil mass. The overall concentration of the analyte is determined by dividing the mass of the analyte by the mass of the soil, thus imparting a high bias to the sample result (see calculation below). The results for samples with leaking shall be qualified using the criteria listed in Exhibit 4-4. Professional judgment shall be used to determine if results should be rejected due to severely compromised sample integrity (e.g. complete loss of methanol, etc.)

$$\text{Mass}_{\text{soil}} = \text{Mass}_{\text{total}} - \text{Mass}_{\text{MeOH}} - \text{Mass}_{\text{jar}}$$

$$\text{Concentration}_{\text{analyte}} = \text{Mass}_{\text{analyte}} / \text{Mass}_{\text{soil}}$$

3. **Headspace in VOA vial:** For the analysis of gasoline range organics (GRO) and VOCs in water samples, the absence of headspace is necessary to prevent volatile analytes from partitioning out of the aqueous phase. As noted in the VOC method 5021A, “it is possible for the sample to generate some headspace during storage. This headspace will appear in the form of microbubbles and should not exceed 5-6 millimeters (mm)... Studies conducted by the EPA indicate that [bubbles not exceeding 6 mm in diameter] did not adversely affect volatiles data.” This assessment is applied to the VOC analyses; bubbles larger than 6 mm in diameter are considered an unacceptable level of headspace. When unacceptable headspace is present, results shall be qualified using the criteria listed in Exhibit 4-4.
4. **Soil analysis reported using “wet weight”:** When collecting soil samples an additional jar is provided for the laboratory to determine the percent solids. In the absence of the additional percent-solids jar, the laboratory may report soil concentrations using the “wet weight.” The overall concentration of the analyte is determined by dividing the mass of the analyte by the mass of the soil. In cases where a dry weight was not determined, the concentration may be reported using a wet weight. The results for samples reported using the wet weight shall be qualified using the criteria listed in Exhibit 4-4.

Other sample-condition anomalies than those listed above may occur. These anomalies should be addressed using available guidance, individual extraction or analytical methods, and the reviewer’s professional judgement.

Exhibit 4-4: Sample Condition Actions

Criteria	Action	
	Detected Analytes	Analytes Not Detected
Broken Container	JL	UJ ¹
Leaking Methanol (soil VOA)	JH ²	No qualification ³
Headspace in VOA Vial ≤ 6 mm	JL	UJ
Headspace in VOA Vial > 6 mm	JL	R
Soil Analysis Reporting "Wet Weight"	JL	UJ

NOTES:

- 1 Use professional judgement and consider rejecting data depending on how much sample leaked or the volatility of the analyte.
 - 2 Use professional judgement and consider rejecting data if the sample integrity has been severely compromised (e.g. complete loss of methanol, etc.)
 - 3 Not detected analytes are not considered affected if there is sufficient methanol to run the analysis.
- mm = millimeter; VOA = volatile organic analysis

5 ANALYTICAL SENSITIVITY

Analytical sensitivity refers to the amount of analyte necessary to produce a detector response that can be reliably detected or quantified (USACE 2005). Analytical sensitivity is evaluated by comparing the appropriate reporting limit (generally the limit of detection [LOD]) for not-detected results to the relevant cleanup level or action limit, where such standards exist. Where LODs are not available, limits of quantitation (LOQs), practical quantitation limits (PQLs), or method reporting limits (MRLs) may be used. It is important to note the LOQ, PQL and MRL are interchangeable terms and depends on the laboratory for which term is used in reporting the results. For the purposes of this DVPP, the LOQ is referenced.

In general, regulatory limits used to check analytical sensitivity are listed in Chapter 75 of Title 18 of the Alaska Administrative Code (18 AAC 75) for soil and water; analytes without regulatory limits are compared to the relevant, project-specific or analyte-specific action limit at the time of comparison.

In cases where the reporting limit (LOD, LOQ, PQL, etc.) exceeds the regulatory limit, a note will be added to the DEC data-review checklist (DEC 2019) and associated results tables noting the reporting limit is elevated. Reporting limits that exceed regulation limits should be identified using the following criteria listed in Exhibit 5-1.

Exhibit 5-1: Elevated Reporting Limit Actions

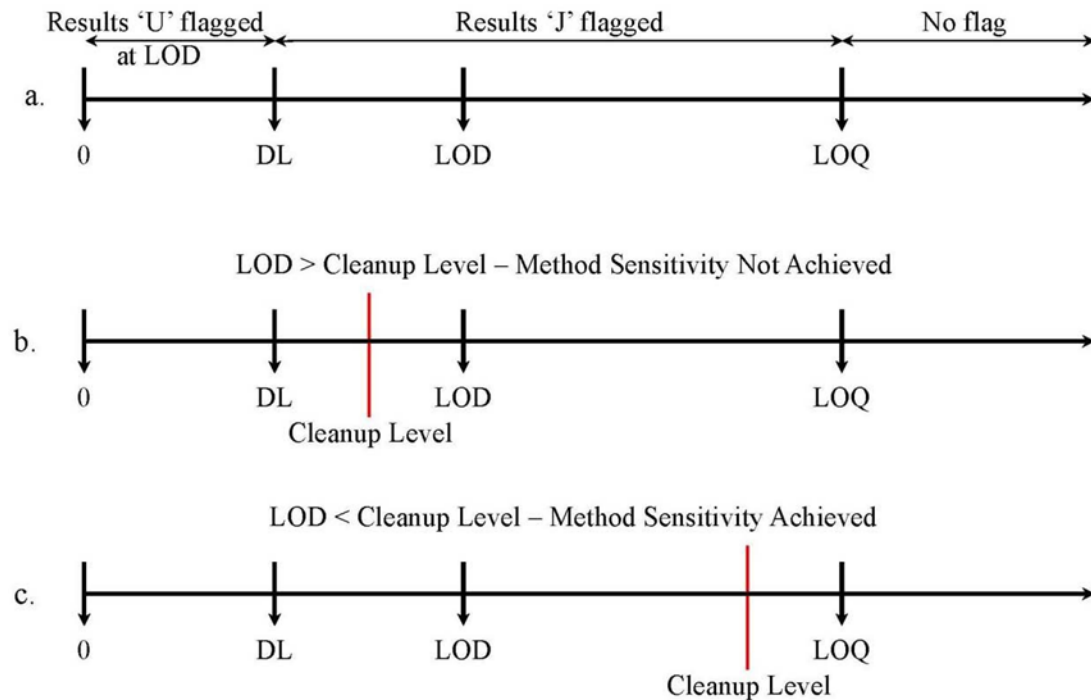
Criteria	Action
Reporting Limit ¹ ≤ Cleanup Level / Action Level	No note
Reporting Limit ¹ > Cleanup Level / Action Level	Note should be added to the Checklist and Results Tables

NOTES:

1 The reporting limit used for the analytical sensitivity comparison should be described in the DEC data-review checklist.

Exhibit 5-2 illustrates the relationship between the DL, LOD, and LOQ, with a summary of laboratory result flags applied to each range and an example of acceptable and unacceptable (elevated) reporting limits.

Exhibit 5-2: Relationship between DL, LOD, LOQ, and Corresponding Laboratory Result Flags and Cleanup Levels.



NOTES:

- a. Results flagged "J" by laboratory where analyte is detected above the DL, but below the LOQ.
- b. Unacceptable LOD-to-cleanup-level relationship.
- c. Acceptable LOD-to-cleanup-level relationship.

Note that these are example scenarios; not all data are compared using the LOD, and therefore this figure does not apply to data received from all laboratories.

DL = detection limit; LOD = limit of detection; LOQ = limit of quantitation.

6 BLANK SAMPLES

Blank samples are analyzed to check for possible contributions to the analytical results from cross-contamination between samples, or from sample-contamination from an outside source. Typically, the following blank samples are reviewed in conjunction with project samples, where appropriate:

- method blanks;
- trip blanks (volatile analytes only);
- field blanks; and
- equipment blanks.

Each of these blanks check for sample-contamination issues at various steps between sample collection and analysis. Detections in one blank can cause related detections in other blank samples. For example, a detection in a method blank can cause detections in corresponding trip blanks or equipment blanks. Therefore, it is important to investigate blank detections to determine at what step sample-contamination was first introduced; data-qualification should proceed beginning at this level.

For the purposes of this DVPP (Level II data review), blank detection evaluation should proceed using the following hierarchy:

1. method blank;
2. trip blank;
3. field blank; and
4. equipment blank

Additional details regarding these types of blanks are provided in sections 6.1 through 6.4 below.

Additional blanks collected or analyzed by the lab for method-specific requirements should be evaluated on a case-by-case basis.

Data-qualification procedures are identical between blank types within a given matrix; however, the list of affected project samples vary. Exhibit 6-1 presents data-qualification criteria for samples affected by detections in a blank sample; these criteria are generally consistent with those presented in EM 200-1-10 (USACE 2005).

Exhibit 6-1: Actions for Blank Detections

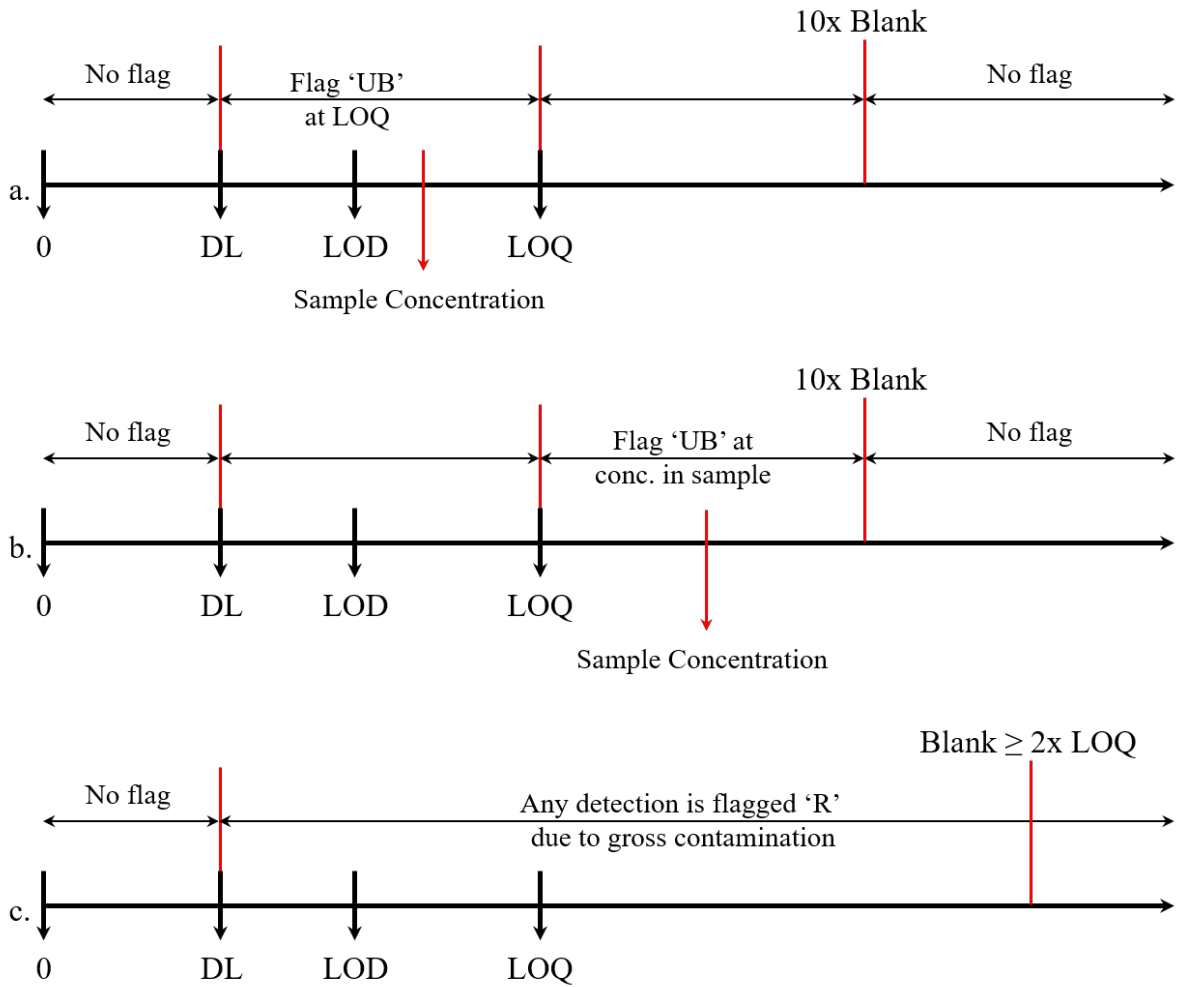
Analysis	Concentration in blank (y)	Concentration in corresponding project sample (z)	Action
PFAS	DL < y < 2x LOQ	z = Not Detected	No qualification
		z < LOQ	UB at the LOQ
		LOQ ≤ z < 10y	UB at the detected result (z)
		z ≥ 10y	No qualification
	y ≥ 2x LOQ ² (gross contamination)	z = Not Detected	No qualification
		z = Detect	R
All Others ¹	DL < y < 2x LOQ	z = Not detected	No qualification
		z < LOQ	UB at the LOQ
		LOQ ≤ z < 5y	UB at the detected result (z)
		5y ≤ z < 10y	JH
	y ≥ 2x LOQ ² (gross contamination)	10y ≤ z	No qualification
		z = Not Detected	No qualification
		z = Detect	R

NOTES:

- 1 Use professional judgment and refer to method-specific requirements for non-standard analyses and matrices.
 - 2 Use professional judgment to assess the reported LOQ. If elevated, reference a typical LOQ for a non-detect result.
- DL = detection limit, LOQ = limit of quantitation (also known as PQL or MRL), y = concentration in blank, z = concentration in corresponding sample

Exhibits 6-2 and 6-3 presents a visual example of flagging criteria for a blank detection for PFAS and all other analyses, respectively.

Exhibit 6-2: Example Qualification Criteria for PFAS Blank Detections



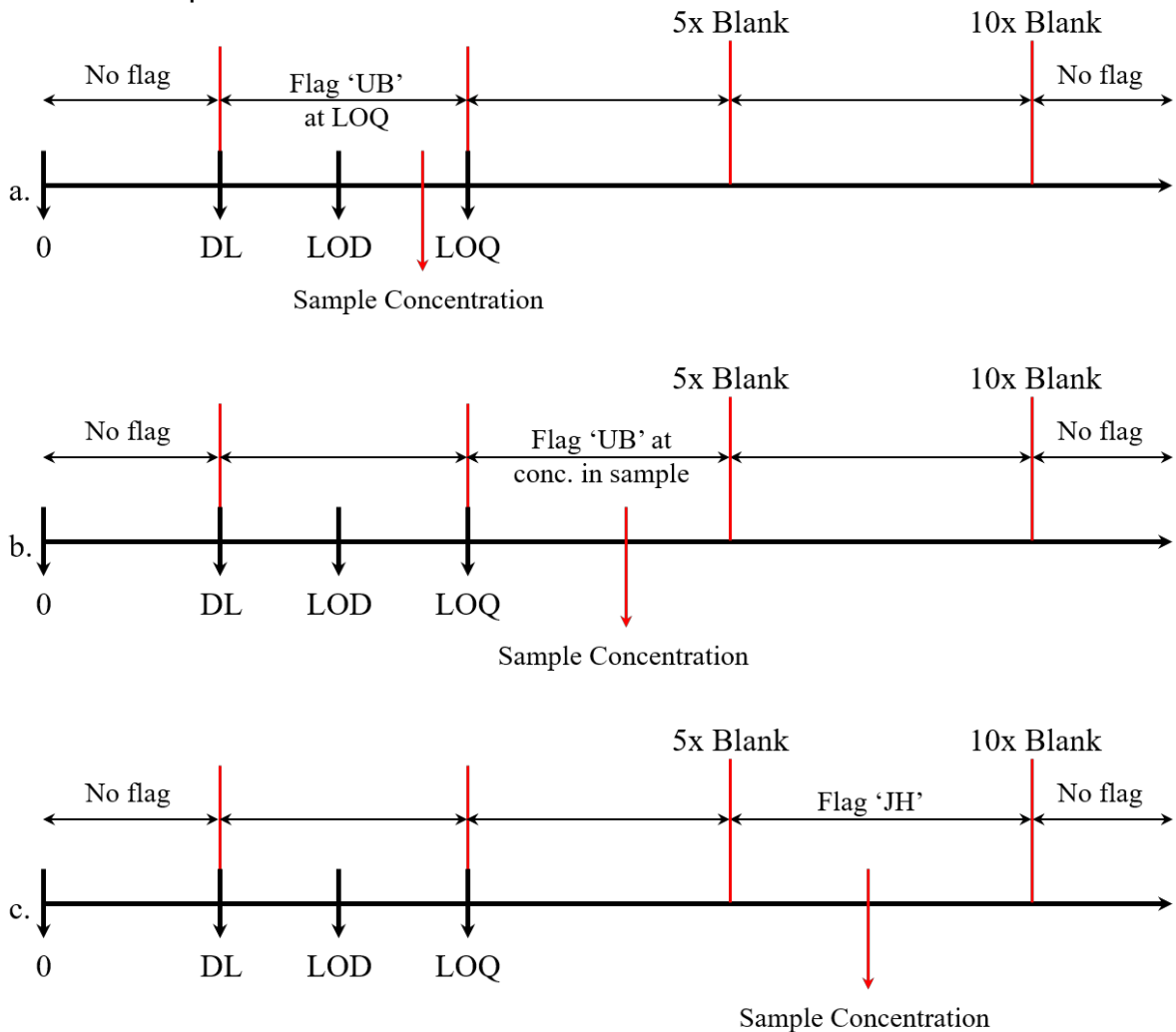
NOTES:

Project-sample results would be qualified as follows:

- a) Flag 'UB' at the LOQ.
- b) Flag 'UB' at the concentration detected in the sample.
- c) Flag 'R' for any detection in the sample.

DL = detection limit; LOD = limit of detection; LOQ = limit of quantitation (also known as PQL or MRL).

Exhibit 6-3: Example Qualification Criteria for Non-PFAS Blank Detections



NOTES:

Project-sample results would be qualified as follows:

- a) Flag 'UB' at the LOQ.
- b) Flag 'UB' at the concentration detected in the sample.
- c) Flag 'JH' at the concentration detected in the sample.

DL = detection limit; LOD = limit of detection; LOQ = limit of quantitation (also known as PQL or MRL).

6.1 Method Blanks

Method blank (MB) samples are prepared by the laboratory with every preparatory batch, at a minimum rate of one MB per 20 samples. MBs are samples of clean media (soil, water, etc.) that are subjected to the same procedures as project samples to extract a given analyte(s). MBs are evaluated to determine if the method of extraction, cleanup, or analysis introduces any contamination during the process.

The reviewer will check that MBs were prepared and analyzed by the laboratory at the required frequency, and that no analytes were reported in the MBs. If an analyte is reported in an MB, all samples in the corresponding preparatory batch should be evaluated for that analyte. Data qualifiers should be applied according to Exhibit 6-1, above.

6.2 Trip Blanks

Trip blank (TB) samples are prepared by the laboratory and one TB should always accompany each cooler containing samples for volatile analysis and stay with the samples. A TB is not required for semi-volatile or non-volatile analytes. TBs serve to check for cross-contamination or contamination from an outside source during sample collection, storage, transportation, and processing by the laboratory.

The reviewer will check that TBs were prepared, transported, and analyzed with any samples analyzed for VOCs, and that no analytes were reported in the TB. A minimum of one TB per cooler is required; the cooler containing the TB and samples for VOC analysis should be clearly identified on the COC. If an analyte is reported in a TB, all samples in the corresponding cooler should be evaluated for the detected analyte and, if necessary, qualified based on the criteria presented in Exhibit 6-1, above. If the sampler did not document which cooler contained the TB, and there is more than one cooler containing samples for VOC analysis, all VOC samples in the work order should be considered potentially affected.

6.3 Field Blanks

Field blank (FB) samples are collected in the field by sample personnel. The sampler opens a sample bottle in the same air space as the corresponding project sample and collects the field blank by filling the bottle with laboratory provided deionized water. The FB is used to assess for possible contamination from the sampling site. If an analyte is reported in the FB, the corresponding sample should be evaluated for the detected analytes and, if necessary, qualified based on the criteria presented in Exhibit 6-1, above.

6.4 Equipment Blanks

Equipment blank (EB) samples are collected in the field by the sampling personnel. The EB is used to determine if decontamination of reusable sampling equipment between sampling locations is sufficient. The reviewer will check that EBs were collected at the required frequency, and that no analytes were reported in the EBs. If an analyte is reported in an EB, all samples collected using the same sampling equipment on the same day will be evaluated (determined based on field sampling logs, and if necessary, qualify based on the criteria presented in Exhibit 6-1, above).

7 ACCURACY

Accuracy is evaluated at multiple levels throughout the analytical process, using a variety of techniques. It is assessed at the preparatory batch level using recovery information from LCS and laboratory control sample duplicates (LCSDs), matrix spike samples (MSs) and matrix spike duplicates (MSDs), and surrogates or isotope dilution analytes (IDAs). MS/MSD and surrogate or IDA recovery information are used to determine whether there is interference from the sample matrix that affects the accuracy of the reported results. The following sections discuss these QC samples in association with the preparatory batch. However, note that there are some analytical methods for inorganics that do not require a preparatory batch and the LCS, LCSD, MS, and MSD QC sample are assessed at the analytical-batch level. Accuracy is also assessed at the analytical-batch level using recovery information from initial calibration verification (ICV) and continuing calibration verification (CCV) samples, where information is available in the Level II data deliverable.

7.1 Laboratory Control Samples

LCSs (also referred to as blank spikes) are prepared by the laboratory with every preparatory batch, at a minimum of one LCS per 20 samples, where required. In some cases, analytical protocol requires the laboratory also analyze an LCSD to assess laboratory precision (see Section 8.1 for assessment of laboratory precision). LCSs and LCSDs are prepared using the same extraction method that is applied to the project samples using laboratory-grade, blank-matrix samples spiked with a known concentration of analyte(s). The laboratory reports a percent recovery (%R) of the spiked amount for each analyte added to the blank sample. The laboratory maintains acceptance limits for LCS/LCSD recovery; these limits are reported in the Level II laboratory report for comparison.

The reviewer will check that LCSs were reported at the required frequency, and that LCS/LCSD recoveries are within laboratory control limits. An LCS or LCSD recovery failure affects all corresponding samples in the same preparatory batch for the affected analyte(s). The following guidelines in Exhibit 7-1 will be used for qualifying sample results associated with LCS/LCSD-recovery failures.

Exhibit 7-1: Actions for LCS/LCSD and MS/MSD Recovery Failures

Analysis	LCS/LCSD or MS/MSD Results	Action	
		Detected Analytes	Analytes Not Detected
PFAS	%R < 10%	JL	R
	10% ≤ %R < LCL	JL	UJ
	%R > UCL ²	JH	No qualification
All Others ¹	%R < Control Limits ²	JL	UJ
	%R within Control Limits	No qualification	
	%R > Control Limits ²	JH	No qualification

NOTES:

- 1 Use professional judgment and refer to method-specific requirements for non-standard analyses and matrices.
- 2 If LCS/LCSD recovery is grossly outside control limits (recoveries less than 10% or greater than 250%) the reviewer should use professional judgment when qualifying the data. The reviewer should consider rejecting results for analytes not detected where the recovery was below 10% (USACE 2005).

LCL = lower control limit, %R = percent recovery, UCL = upper control limit

7.2 Matrix Spike Samples

For certain methods, the laboratory analyzes an MS/MSD in addition to the LCS. MS/MSDs are prepared and analyzed on a preparatory batch basis and are analyzed with every 20 samples when used. They consist of project (native) samples spiked with a known concentration of analyte(s) and prepared using the same method that is applied to project samples to extract the analyte(s). The MS and MSD are used to determine the presence of matrix interferences and evaluate the analytical accuracy for a given method and matrix, expressed as a %R of the spiked amount added to the field sample.

The reviewer will check to make sure that MS/MSDs were analyzed at the frequency required by analytical methods or project-specific requirements. Some methods may require the analysis of an MS/MSD pair, but insufficient sample volume may prevent the laboratory from providing these QC samples. The laboratory’s standard operating procedures (SOPs) may allow for an LCSD instead of an MS/MSD for these cases.

The reviewer will check that %R for each analyte is within laboratory control limits. If there is a recovery failure, only the field sample utilized for the MS/MSD (the parent sample) is typically considered affected; however, the reviewer should use professional judgment whether other samples in the same preparatory batch have sufficiently similar matrices to be considered affected as well. For example, if an MS/MSD recovery failure is reported for one of two field duplicate samples, it should be assumed there were similar matrix effects in the duplicate, and corresponding results should also be qualified.

Before MS/MSD recovery is evaluated, two important factors must be considered:

1. Verify that the field sample chosen for the MS/MSD is part of the project-sample set currently being reviewed. The laboratory may run samples from other projects in the same preparatory batch and it is possible that the original sample selected for the MS/MSD may not be from the work order reviewed. In this case, it cannot be confirmed that the parent sample matrix is similar to the matrix in the project samples and the recovery failures do not affect data quality for the project-sample set.
2. Verify that the spiking concentration is high relative to the native concentration of the analyte. In accordance with EM 200-1-10 (USACE 2005):

If the native concentration of a target analyte is high relative to the spiking concentration, then this may contribute a significant uncertainty to the recovery calculations; the MS recovery may not be representative of actual method performance for the matrix. In the absence of other guidance, evaluate the MS recovery when the spiking concentration is at least two times greater than the native analyte concentration (USACE 2005).

If the above criteria are met, then results associated with the failures in the original project sample should be qualified using the criteria listed in Exhibit 7-1.

For metals analysis where MS/MSD recovery failures occur, different criteria are used. For metals analysis using most analytical methods, if a matrix spike recovery failure occurs and the sample concentration is greater than the spike concentration, the laboratory is required to conduct a post-digestion spike. A post-digestion spike is where the original sample is spiked at twice the native concentration so that recovery can be evaluated. In this case, refer to the data-qualification criteria in the spiked sample analysis section in the National Functional Guidelines for Inorganic Methods Data Review (EPA 2017a) under the relevant analytical technique.

7.3 Surrogates and Isotope Dilution Analytes

Surrogates are organic compounds that are similar to the analytes being evaluated by a given method (often a deuterated version of the one of the analytes). They are used to identify matrix interferences and inefficiencies in sample extraction for organic analyses. The surrogates are introduced into a field- or laboratory-QC sample prior to sample preparation and analysis. Accuracy is expressed as a %R of the spiked amount added to the sample.

Some methods require analysis using an isotope-dilution method, which uses IDAs instead of a surrogate, and corrects raw data of the associated analyte concentration based on the recovery of the IDA.

The reviewer will check that surrogates and/or IDAs were analyzed for each sample for each organic analysis (including laboratory QC samples), and that recoveries were reported within laboratory-control limits. If there is a reported recovery failure, it is considered to affect only the analytes associated with the surrogate/IDA (see Appendix B for a surrogate/IDA association list) for the corresponding project with the reported failure. However, there are a few special considerations when qualifying data based on surrogate-recovery failures:

1. Matrix interference: Recovery failures due to matrix interference (coelution of an interfering analyte or other matrix interactions) are considered to affect data quality, and results should be qualified as described in Exhibit 7-2. The laboratory typically documents in the case narrative whether a surrogate/IDA recovery failure was due to matrix interference.
2. Dilution: Recovery failures may be observed due to dilution of the surrogates and are not considered to affect the data (USACE 2005). The laboratory typically documents surrogate failures due to dilution in the case narrative. Refer to number 4 for IDA recovery failure assessments.
3. Surrogate/IDA recovery failures in laboratory QC samples: Surrogate/IDA failures in an LCS, LCSD, MS, or MSD are not considered to affect the project sample data as long as the recovery of individual analytes associated with that surrogate/IDA are within the laboratory control limits for the LCS/LCSD/MS/MSD sample. However, gross or systematic surrogate/IDA recovery failures should be considered along with all other QC information for the preparatory batch and the results evaluated according to professional judgment.
4. IDA recovery in project samples: As part of the analytical procedure for isotope-dilution methods, a given analyte concentration is corrected based on the recovery of the associated IDA. Therefore, recovery inefficiencies are somewhat self-correcting and one would expect less inaccuracy due to slight matrix effects. However, recovery outside the recovery limits may indicate there are significant matrix effects that the method is unable to adequately correct for. Results should be qualified as described in Exhibit 7-2.

Excluding the exceptions listed above, data affected by surrogate/IDA recovery failures should be qualified using the following criteria listed in Exhibit 7-2.

Exhibit 7-2: Actions for Surrogate or Isotope Dilution Analyte Recovery Failures

Type	Criteria	Action	
		Detected Analytes	Analytes Not Detected
IDA	%R < 10%	J	R
	10% ≤ %R < LCL	J	UJ
	%R < LCL (diluted sample)	Use professional judgement	N/A ¹
	%R > UCL	J	No qualification
	%R within range	No qualification	
Surrogate	%R < range	JL ²	UJ ³
	%R within range	No qualification	
	%R > range	JH ²	No qualification

NOTES:

- 1 Non-detects should be reported from the undiluted analysis.
- 2 Use professional judgment when the bias is poorly defined. Only impart a bias to the qualified data if the bias is well defined (i.e., if there is more than one surrogate in the analysis, where recovery failures are in the same direction). Otherwise, it may be more conservative to simply qualify the results as estimated ('J'; USACE 2005).
- 3 Use professional judgment when evaluating gross recovery failures. The reviewer should consider rejecting the results where analytes are not detected if the associated surrogate recovery is below 20% (USACE 2005).

LCL = lower control limit, %R = percent recovery, UCL = upper control limit

7.4 Calibration Verification Samples

Calibration verification samples are not typically reported in the Level II data reports provided by the laboratory (aside from appearing in the EDD), and review of such samples is outside the scope of this DVPP. The laboratory may have requirements to re-calibrate the instrument if calibration verification fails or other corrective action. However, this is not always possible, and occasionally calibration verification failures occur and are reported in the case narrative of the Level II laboratory report. Calibration verification samples are described briefly below.

ICV samples are clean extraction solvent spiked with a known analyte concentration, using a different source than that of the primary calibration standards, and analyzed immediately following instrument calibration. Similarly, CCV samples are calibration standards that are analyzed at the beginning of each analytical batch and periodically throughout the run.

The laboratory evaluates ICV and CCV recovery information based on their internal acceptance criteria; in some cases, they also evaluate relative percent difference between CCVs to determine if drift is occurring. As stated above, calibration-level data review is beyond the scope of this DVPP and may be conducted as part of a Level IV data-validation, if calibration issues are identified in the case narrative. Professional judgment should dictate whether any samples in an analytical batch with unresolved CCV failures should be

considered preliminary pending further investigation. For these circumstances, contact the laboratory for more direction and ask the Senior Laboratory Analyst to provide justification for using the data and any bias resulting from these QC failures. Request that the laboratory report be revised to include the justification.

8 PRECISION

Precision refers to the repeatability of measurements (USACE 2005). Precision is evaluated using laboratory QA/QC and field-duplicate samples. The following sections describe the duplicate-sample information that is commonly used to assess precision. However, this is not an exhaustive list and the laboratory may occasionally analyze other duplicate samples that should also be considered. For most analyses, at least one laboratory QC-sample duplicate must be analyzed; this can include a LCSD, MSD, or a laboratory duplicate.

Each type of duplicate is evaluated in the same manner (LCS/LCSD, MS/MSD, laboratory duplicate and field duplicates). A relative percent difference (RPD) is calculated between the duplicate results for a given analyte using the following equation presented in Exhibit 8-1.

Exhibit 8-1: RPD Calculation

Equation	Variable and Definition	
$RPD = \frac{ R_1 - R_2 }{(R_1 + R_2)/2} \times 100\%$	RPD	Relative Percent Difference
	R1	Primary Result
	R2	Duplicate Result

The resulting RPD is compared to laboratory control limits (for laboratory QC samples), or project or regulatory DQOs for field duplicates. For purposes of this DVPP, the DEC-recommended water-sample DQO of 30% and soil-sample DQO of 50% are used.

The guidelines presented in Exhibit 8-2 will be used for qualifying sample results associated with duplicate-sample RPD failures. The treatment of a failure is the same across types of duplicate samples, but the samples that are affected vary. Refer to the following sections for details.

Exhibit 8-2: Actions for Duplicate-Sample RPD Failures

Criteria	Action	
	Detected Analytes	Analytes Not Detected
RPD ≤ Control Limit or DQO	No qualification	
RPD > Control Limit or DQO	J	UJ

DQO = data quality objective, RPD = relative percent difference

8.1 Laboratory Control Sample Duplicates

Precision can be evaluated between LCS and LCSD results for a given analyte. The laboratory calculates the RPD using the equation presented in Exhibit 8-1 for each analyte. The reviewer will check that each RPD is within the laboratory control limits. RPD failures for specific analytes in the LCS/LCSD are considered to affect the precision of that analyte in each corresponding project sample in the same preparatory batch. Affected results should be flagged according to the criteria presented in Exhibit 8-2.

8.2 Matrix Spike Duplicates

Precision can be evaluated between the MS and the MSD results for a given analyte. The laboratory calculates the RPD for each analyte. The reviewer will check that each RPD is within the laboratory control limits. RPD failures for specific analytes in the MS/MSD are considered to affect the precision of that analyte in the parent sample spiked for the MS/MSD. Professional judgment should be used to determine whether additional samples should be qualified (based on similarity of sample matrix).

RPD failures should be considered to affect the data regardless of the concentration spiked, as long as the laboratory calculates the RPD based on the total analyte concentration quantified in the MS/MSD. If the laboratory calculates the RPD based only on what was recovered of the spike, it should be treated as for MS/MSD recovery, with failures only considered to affect data quality if the spiking concentration is at least double the native concentration of the analyte. Affected results should be flagged according to the criteria presented in Exhibit 8-2.

8.3 Laboratory Duplicates

For select analyses, or when insufficient volume is submitted for analysis of an MS and MSD, the laboratory may analyze a project sample twice (referred to as a laboratory duplicate). The laboratory calculates an RPD between the original result and the duplicate-sample result for each analyte. The reviewer will check that each RPD is within the laboratory control limits. As with MS/MSDs, laboratory duplicate RPD failures are considered to affect the precision of the affected analyte only in the parent sample used for the duplicate analysis. Affected results should be flagged according to the criteria presented in Exhibit 8-2.

8.4 Field-Duplicate Samples

Field-duplicate samples are duplicate samples collected from the same location and submitted to the laboratory performing the requested analysis. The duplicate sample will

have a “dummy” sample number and submitted to the laboratory as a regular sample (i.e., the duplicate is submitted “blind”). These field duplicates are used to determine the reproducibility of the sampling technique, as well as the subsequent laboratory analysis. Sample homogeneity is necessary to obtain acceptable values for the RPD and any heterogeneity should be noted during sampling.

For field-duplicate pairs, the reviewer will calculate an RPD using the equation presented in Exhibit 8-1. An RPD will only be calculated if both sample results are detected above the detection limit. The calculated RPD will be compared to the standard DQOs of 30% for water or 50% for soil. Field-duplicate RPD failures are considered to affect only the results of the duplicate pair; affected data will be qualified based on the criteria in Exhibit 8-2.

In the event that one of the results is above the LOQ but the other result is below the detection limit (not detected) and J-flag detections are reported for the project, the reviewer should use professional judgment and consider qualifying the detected and non-detect result as estimated even though an RPD cannot be calculated. This may be evidence of samples having been mislabeled (in the field or the laboratory), sample heterogeneity, or some other issue; further investigation may be warranted.

9 REPRESENTATIVENESS

Representativeness is defined in Chapter One of the EPA SW-846 Update V Revision 2 (EPA 2014) as the degree to which data accurately and precisely represents a characteristic of a population for a sampling point. Representativeness is dependent on proper execution of the approved sampling program, which is agreed upon by the DEC, DOT&PF, and Shannon & Wilson. To assess sample representativeness, sample-log sheets will be reviewed to ensure the samples were collected according to the approved sampling program and the results therefore represent the location and depth sampled. In addition, where possible, the analytical result for each sample will be compared to the historical results to check that the result is consistent with the broader data set for that location.

There are instances where sample collection procedures deviate from the sampling program and may affect the sample representativeness. Professional judgement is used to assess the data usability based on these deviations. Some of these infrequent instances are presented in Exhibit 9-1 along with qualifications to the data.

Exhibit 9-1: Actions for Deviations from Sampling Program

Sampling Type	Description of Deviation	Action	
		Detected Analytes	Analytes Not Detected
Monitoring Well/ Residential Sampling	Purging/stabilization criteria not met	J	UJ
Residential Sampling – Organic Analyses	Sample collected post treatment (especially for collection post carbon filter)	JL	UJ ¹
Residential Sampling – Inorganic Analyses	Sample collected post treatment (especially iron analyses collected post sediment filter)	JL	UJ

NOTES:

- 1 Use professional judgment. The reviewer should consider rejecting the results where organic analytes are not detected and samples were collected post carbon filter. At minimum, the non-detect results should be considered estimated and flagged 'UJ' to identify the sample collection discrepancy.

10 LABORATORY APPLIED FLAGS

The laboratory is required to qualify data that does not meet laboratory QC standards. The data qualifiers, flagging criteria, and flagging procedures are detailed in the laboratory's SOPs. The lab does not interpret the impact of an applied flag on the data, rather the flags are meant to draw the attention of the reviewer to an area where laboratory QC criteria is not met. When data is reviewed and validated, the information the laboratory reported is taken and evaluated to determine the effect of the QC deficiency on the data and apply appropriate flags as defined in this document.

In some cases, laboratory applied flags are not needed and may be removed for reporting. For example:

When an MS and/or MSD sample has a %R failure, but the spiking concentration is not high relative to the native parent sample concentration, then the %R failure is not applicable. The flag the lab applies to the data is therefore not necessary and is removed the analytical reporting table.

In some cases, laboratory applied flags are overwritten by flags applied by Shannon & Wilson. For example:

When a sample result exceeds the calibration range, the lab may flag the affected data with an 'E'. Calibration exceedances are flagged with a 'J' in the analytical reporting table overwriting the 'E' flag.

In either case listed above, laboratory applied flags are maintained in the laboratory report for reference.

See Exhibit 10-1 for common laboratory applied flags that are either overwritten by a S&W applied flag or are removed from the analytical reporting tables because they are deemed unnecessary after the data-validation process. The flags remain in the laboratory report for reference.

Exhibit 10-1: Actions for Common Laboratory Applied Flags

Laboratory Applied Flag ¹	Flag Description	Shannon & Wilson Applied Flag
I	Value is the estimated maximum possible concentration. Case Narrative flag description: The "I" qualifier means the transition mass ratio for the indicated analyte was outside of the established ratio limits. The qualitative identification of the analyte has some degree of uncertainty. However, analyst judgement was used to positively identify the analyte.	J
E	Result exceeded calibration range.	J
B	Compound was found in the blank sample	See Exhibit 6-1 for flagging criteria
*	LCS or LCSD is outside acceptance limits.	See Exhibit 7-1 for flagging criteria
*	Isotope dilution analyte is outside acceptance limits	See Exhibit 7-2 for flagging criteria
4	MS, MSD: The analyte present in the original sample is greater than 4 times the matrix spike concentration; therefore, control limits are not applicable.	See Exhibit 7-2 for flagging criteria
F1	MS and/or MSD recovery is outside acceptance limits.	See Exhibit 7-2 for flagging criteria
F2	MS/MSD RPD exceeds control limits	See Exhibit 8-2 for flagging criteria

NOTES:

1 This is not meant to be a comprehensive list of flags applied by the laboratory, but rather a list of the most encountered laboratory flags that are often not applicable after data-validation. Labs do not always use identical flags for the same QC failure; therefore, this information will be extrapolated to address the specific flags used by each laboratory and applied to each data set on a case-by-case basis.

LCS = laboratory control sample, LCSD = laboratory control sample duplicate, MS = matrix spike, MSD = matrix spike duplicate, RPD = relative percent difference.

11 COMPARABILITY

Chapter One of the EPA SW-846 Update V Revision 2 (EPA 2014) defines comparability as the expression of the degree of confidence with which one data set can be compared to another. Per the EPA SW-846 Update V Revision 2, a measurement is considered to be valid if they are unqualified or qualified as estimated data during validation. The reviewer and data users should qualitatively assess the comparability between historical and current data sets and use caution in combining data sets if the quality of the data is uncertain. For example, current analytical methods may not be comparable to historical methods where the MRL was elevated.

12 COMPLETENESS

Chapter One of the EPA SW-846 Update V Revision 2 (EPA 2014) defines completeness as the measure of valid data collected compared to the amount planned. The SW-846 defines a valid datum as a measurement that is “unqualified or qualified as estimated [biased high, low, or no direction] during (data) validation.” The overall data set from a sampling event will be evaluated to determine if the completeness goal of 85-percent useable data was achieved. Completeness is calculated by comparing the amount of useable (valid) data to the overall number of samples planned. A completeness value below 85- percent may be cause for collecting additional analytical samples.

13 DATA-VALIDATION PLAN UPDATES

This DVPP will be reviewed annually and updated as dictated by DOT&PF’s schedule and funding.

14 REFERENCES

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U.S. Army Corps of Engineers (USACE), 2005, Engineering Manual (EM) 200-1-10, Guidance for Evaluating Performance-Based Chemical Data,, USACE, June.

U.S. Environmental Protection Agency (EPA), 2009, Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use, OSWER No. 9200.1-85 EPA 540-R-08-005: Washington, DC, UPA Office of Solid Waste and Emergency Response, January.

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- U.S. Environmental Protection Agency (EPA), 2016, National Functional Guidelines for High Resolution Superfund Methods Data Review, EPA EPA-542-B-16-001. April .
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Appendix A
SGS Bottle Guide

APPENDIX A: SGS BOTTLE GUIDE



Parameter	Method	Matrix	Recommended Container/Size	Preservative	Holding Time *	Other Notes
1,4-Dioxane	SW 8270	water	2x250 ml amber glass	0-6° C	7 days	(Ref Lab)
1,4-Dioxane	EPA 522	DW	?	?	28 days	(Ref Lab)
1,4-Dioxane	SW 8260C SIM	water	3x40 ml VOA vials	HCl; 0-6° C	14 days	
1,4-Dioxane	SW 8260C SIM	soil	1x4 oz prew't'd amber (2nd 4 oz unpreserve % solids jar if no other analyses)	MeOH+BFB; 0-6° C	14 days	
Acidity as CaCO3	SM 2310B	water	1x250 ml HDPE	0-6° C	14 days	should be analyzed in the field
Acute Whole Effluent Toxicity (AWET)	(depends on permit)	water	1x2-8 gallon plastic (see permit)	0-6° C	24 hrs	(Ref Lab) need permit #/etc.
Alcohols: see Glycols or Alcohols						
Alkalinity as CaCO3 (Total or Full)	SM 2320B	water	1x250 ml HDPE	0-6° C	14 days	should be analyzed in the field
Ammonia	SM 4500-NH3-G modified	soil	1x4 oz glass	4° C	28 days	
Ammonia	SM 4500NH3-G	water	1x125 ml HDPE	H2SO4; 0-6° C	28 days	
Anion/Cation Balance	SM 1030E	water	1x60 ml Nalgene for NO2+NO3 1x250 ml HDPE for metals 1x500 ml HDPE for other analyses	H2SO4 HNO3 unpreserved	ASAP	field-filter for dissolved metals; other container unpreserved for alkalinity and anion analyses.
Asbestos	PCM or TEM	air	cartridge	none	n/s	(Ref Lab)
Asbestos	PLM or TEM	solids	any	none	n/s	(Ref Lab)
Asbestos	TEM	DW	2x1 L amber glass	0-6° C	48 hrs or ozonate	(Ref Lab) leave 20% headspace
Biochemical Oxygen Demand (BOD)	SM 5210B	water	1x1 L HDPE (depending on matrix)	0-6° C 1.25 ml 5% EDA	48 hrs	
Bromate	EPA 300.1	water	125 ml HDPE (special order)	0-6° C	28 days	(Ref Lab)
Bromide	EPA 300.0/SW 9056A	soil	1x4 oz glass	0-6° C	28 days	
Bromide	EPA 300.0/SW 9056A	water	1x60 ml Nalgene	0-6° C	28 days	
BTEX	SW 8021B/8260C	soil	1x4 oz prew't'd amber (2nd 4 oz unpreserve % solids jar if no other analyses)	MeOH+BFB; 0-6° C	28 days for AK101 (14 days for BTEX)	field-preservation required; use 50 g soil & 25 ml MeOH (can combo with GRO) TB required
BTEX	SW 8021B/8260C	water	3x40 ml amber VOA vials w/ septa	HCl; 0-6° C	14 days	(can combo with GRO) allow no headspace; TB required
CAN (Total Coliform, Arsenic, Nitrate)	SM 9223B, EPA 200.8, SM 4500NO3	DW	sterile 120 ml container for coli 1x120 mL Nalgene for metals 60 ml Nalgene for NO2+NO3	Na2S2O3 for coli; HNO3 for metals; H2SO4 for NOx; chill recommended	30 hrs for coli	
CAN (Total Coliform, Arsenic, Nitrate)	SM 9223B, EPA 200.8, SM 4500NO4	DW with PWSID	sterile 120 ml container for coli 1x120 mL Nalgene for metals 60 ml Nalgene for NO2+NO4	Na2S2O3 for coli; HNO3 for metals; H2SO4 for NOx; 2-6° C	30 hrs for coli	
Carbamates	EPA 531.1	DW	3x40 ml amber VOA vials w/ septa (special order)	Na2S2O3; Monochloroacetic Acid; 0-6° C	7 days	(Ref Lab)
Carbamates	EPA 531.1	DW with PWSID	3x40 ml amber VOA vials w/ septa (special order)	Na2S2O3; Monochloroacetic Acid; 2-6° C	7 days	(Ref Lab)
Chemical Oxygen Demand (COD)	EPA 410.4	water	1x125 ml HDPE	H2SO4; 0-6° C	28 days	
Chlorate	EPA 300.1	water	1x125 ml HDPE (special order)	1.25 ml 5% EDA 0-6° C	28 days	(Ref Lab)
Chloride	EPA 300.0/SW 9056A	soil	1x4 oz glass	0-6° C	28 days	
Chloride	EPA 300.0/SW 9056A	water	1x60 ml Nalgene	0-6° C	28 days	
Chlorite	EPA 300.1	water	1x125 ml HDPE (special order)	1.25 ml 5% EDA 0-6° C	14 days	(Ref Lab)
Chlorophyll a	SM 10200H	water	1x1 L amber glass (special order filters)	freeze filter ASAP	21 days	(Ref Lab) use 4.25 cm GF-B filter; field-filter & freeze
Chromium, Hexavalent	SM 3500Cr or SW 7196	water	1x125 ml HDPE	0-6° C	24 hrs	
Chromium, Hexavalent	SW 7196	soil	1x4 oz amber glass	0-6° C	28 days	(Ref Lab)
Chronic Whole Effluent Toxicity (CWET)	(depends on permit)	water	1x2-8 gallon plastic (see permit)	0-6° C	24 hrs	(Ref Lab) need permit specs
Coliform, Fecal (MF)	SM 9222D	water	sterile 120 ml container filled to 100 ml mark	Na2S2O3; 0-8° C	8 hrs	

Parameter	Method	Matrix	Recommended Container/Size	Preservative	Holding Time *	Other Notes
Coliform, Total (MF)	SM 9222B	water	sterile 120 ml container filled to 100 ml mark	Na2S2O3; chill recommended	30 hrs	(Ref Lab) for quantification of Total coliform colonies, use method 9223B Quantitray
Coliform, Total (P/A or Quantitray)	SM 9223B	DW, DW with PWSID, water	sterile 120 ml container filled to 100 ml mark	Na2SO3; chill recommended	30 hrs	(Contact SGS PM to make arrangements if hold time is other than 30 hours.)
E. coli (LT2 Quantitray)	SM 9223B	DW, DW with PWSID	sterile 120 ml container filled to 100 ml mark	Na2S2O3; <10° C	30 hrs	(Contact SGS PM to make arrangements if hold time is other than 30 hours.)
Color, True or Apparent	SM 2120B	water	1x250 ml HDPE	0-6° C	48 hrs	
Conductivity	SM 2510B	water	1x250 ml HDPE	0-6° C	28 days	
Corrosivity (see pH)						
Cryptosporidia	EPA 1623	water	1x10 L cubitainer	0-6° C	24 hrs	(Ref Lab) (can combo with Giardia)
Cyanide, Total	SM 4500CN-C,E	DW/W	1x125ml amber HDPE	(Sodium Arsenite if chlorinated) NaOH; 0-6° C	14 days	
Cyanide, Total	SM 4500CN-C,E	DW with PWSID	1x125ml amber HDPE	(Sodium Arsenite if chlorinated) NaOH; 2-6° C	14 days	
Cyanide, Weak Acid Dissociable	SM 4500CN-I	water	1x125ml amber HDPE	NaOH; 0-6° C	14 days	
Diesel Range Organics (DRO)	AK102	oil	1x20 ml scintillation vial	none	n/s	can combo with RRO
Diesel Range Organics (DRO)	AK102/8015C	soil	1x4 oz amber glass	0-6° C	14/40 days (*)	can combo with RRO
Diesel Range Organics (DRO)	AK102/8015C	water	2x1 L amber glass	HCl; 0-6° C	14/40 days (*)	can combo with RRO
Diesel Range Organics (DRO)-Low Vol.	AK102/8015C	water	2x250 ml amber glass	HCl; 0-6° C	14/40 days (*)	
Dioxins	EPA 1613	DW	2x1 L amber glass	Na2S2O3; 0-6° C	28 days	(Ref Lab)
Dioxins	EPA 1613	DW with PWSID	2x1 L amber glass	Na2S2O3; 2-6° C	28 days	(Ref Lab)
Dioxins	SW 8280B or 8290A	soil	1x4 oz amber	0-6° C	n/s	(Ref Lab)
Dioxins	SW 8280B or 8290A	water	2x1 L amber glass	0-6° C	n/s	(Ref Lab)
Diquat/Paraquat	EPA 549.2	DW	1x1 Liter amber poly	Na2S2O3; 0-6° C	7 days	(Ref Lab)
Diquat/Paraquat	EPA 549.2	DW with PWSID	1x1 Liter amber poly	Na2S2O3; 2-6° C	7 days	(Ref Lab)
Dissolved Metals (see Metals, Dissolved)						
Dissolved Organic Carbon (DOC)	SM 5310B	water	1x125 ml amber glass	HCl; 0-6° C	28 days	field-filter; unpres. if lab-filtered (should be field-filtered)
Dissolved Oxygen	SM 4500O2-G	water	BOD bottle w/ stopper	0-6° C	15 minutes (ASAP)	should be analyzed in the field; allow no headspace
EDB/DBCP/1,2,3-TCP	SW 8260C SIM	water	3x40 ml amber VOA vials w/ septa	HCl; 0-6° C	14 days	TB required, allow no headspace
EDB/DBCP/1,2,3-TCP	SW 8260C SIM	soil	1x4 oz prew'd amber (2nd 4 oz unpreserve % solids jar if no other analyses)		14 days	TB required
EDB/DBCP/1,2,3-TCP	EPA 504.1	DW	3x40 ml amber VOA vials w/ septa	0-6° C	14 days	(Ref Lab) TB required allow no headspace
EDB/DBCP/1,2,3-TCP	EPA 504.1	DW with PWSID	3x40 ml amber VOA vials w/ septa	2-6° C	14 days	(Ref Lab) TB required allow no headspace
EDB/DBCP/1,2,3-TCP	SW 8011	soil	1x4 oz amber	0-6° C	14 days	(Ref Lab) allow no headspace
EDB/DBCP/1,2,3-TCP	SW 8011	water	3x40 ml amber VOA vials w/ septa	0-6° C	14 days	(Ref Lab) TB required allow no headspace
Endothall	EPA 548.1	DW	1x125 ml amber glass	Na2S2O3; 0-6° C	7 days	(Ref Lab)
Endothall	EPA 548.1	DW with PWSID	1x125 ml amber glass	Na2S2O3; 2-6° C	7 days	(Ref Lab)
Enterococci	Enterolert	water	sterile 120 ml container filled to 100 ml mark	Na2S2O3; 0-6° C	8 hrs	
EPH	NW-EPH	soil	1x4 oz amber glass	0-6° C	14/40 days (*)	(Ref Lab)
EPH	NW-EPH	water	2x500 ml amber (special order)	HCl; 0-6° C	7/40 days (*)	(Ref Lab)
Explosives	SW 8330A	soil	1x4 oz amber glass	0-6° C	7 days	(Ref Lab)
Explosives	SW 8330A	water	2x1 L amber glass	0-6° C	7 days	(Ref Lab)
Fluoride	EPA 300.0/SW 9056A	water	1x60 ml Nalgene	0-6° C	28 days	
Fluoride	EPA 300.0/SW 9056A	soil	1x4 oz glass	0-6° C	28 days	
Gasoline Range Organics (GRO)	AK101/8015C	oil	1x20 ml scintillation vial	none	n/s	(can combo with BTEX)

Parameter	Method	Matrix	Recommended Container/Size	Preservative	Holding Time *	Other Notes
Gasoline Range Organics (GRO)	AK101/8015C	soil	1x4 oz prew'd amber (2nd 4 oz unpreserve % solids jar if no other analyses)	MeOH+BFB; chill recommended	28 days for AK101 (14 days for BTEX)	field-preservation required; use 50 g soil & 25 ml MeOH (can combo with BTEX) TB required
Gasoline Range Organics (GRO)	AK101/8015C	water	3x40 ml amber VOA vials w/ septa	HCl; 0-6° C	14 days	(can combo with BTEX) allow no headspace; TB required
Giardia	EPA 1623	water	1x10 L cubitainer	0-6° C	24 hrs	(Ref Lab) (can combo with Crypto)
Glycols or Alcohols	SW 8015 modified	water	3x40 ml VOA vials	0-6° C	14 days	(Ref Lab) specify each compound
Glycols or Alcohols	SW 8015 modified	liquid	1x120 ml amber glass	n/a	14 days	(Ref Lab) specify each compound
Glycols or Alcohols	SW 8015 modified	solid	1x4 oz glass	0-6° C	14 days	(Ref Lab) specify each compound
Glyphosate	EPA 547	DW	1x125 ml amber glass	Na2S2O3; 0-6° C	7 days	(Ref Lab)
Glyphosate	EPA 547	DW with PWSID	1x125 ml amber glass	Na2S2O3; 2-6° C	7 days	(Ref Lab)
Gross Alpha &/or Gross Beta	EPA 900	water	1x1 L HDPE	HNO3 (preserved at lab)	none	(Ref Lab)
Gross Heating Value	ASTM D 240	oil	1x20 ml scintillation vial	none	n/s	
Haloacetic Acids Formation Potential	SM 5710/6251B	DW/W	2x1 Liter	0-6° C	ASAP/14 days	(Ref Lab)
Haloacetic Acids Formation Potential	SM 5710/6251B	DW/W with PWSID	2x1 Liter	2-6° C	ASAP/14 days	(Ref Lab)
Haloacetic Acids	EPA 552.3	DW/W	1 x 250 ml narrow mouth amber glass	NH4Cl; 0-6° C	14 days	(Ref Lab)
Haloacetic Acids	EPA 552.3	DW/W with PWSID	1 x 250 ml narrow mouth amber glass	NH4Cl; 2-6° C	14 days	(Ref Lab)
Hardness	SM 2340B	water	1x250 ml HDPE	HNO3	180 days	
Herbicides	EPA 515.4	DW	2x125 ml amber glass	Sodium Sulfite; 0-6° C	14 days	(Ref Lab)
Herbicides	EPA 515.4	DW with PWSID	2x125 ml amber glass	Sodium Sulfite; 2-6° C	14 days	(Ref Lab)
Herbicides	EPA 555	DW	2x1 L amber glass	Na2S2O3; 0-6° C	7/40 days (*)	(Ref Lab)
Herbicides	EPA 555	DW with PWSID	2x1 L amber glass	Na2S2O3; 2-6° C	7/40 days (*)	(Ref Lab)
Herbicides	SW 8151A	soil	1x4 oz amber	0-6° C	14/40 days (*)	(Ref Lab)
Herbicides	SW 8151A	water	2x1 L amber glass	0-6° C	7/40 days (*)	(Ref Lab)
Heterotrophic Plate Count (Pour Plate)	SM 9215B	water	sterile 120 ml container filled to 100 ml mark	Na2S2O3; chill recommended	30 hrs for Pool/Spa 8 hrs for Drinking & Reagent Water	(Contact SGS PM to make arrangements if hold time is other than 30 hours.)
Ignitability, Seta Flash	SW 1020B	oil	1x4 oz glass	none	n/s	
Inorganic Contaminants, Primary	EPA 200.8 and 300.0, SM 4500CN-C,E, 4500NO3-F	DW	1x250 ml HDPE for metals; 1x120 ml Nalgene for cyanide; 1x60 ml Nalgene for NO2+NO3; 1x60 ml Nalgene for anions	HNO3 for metals; NaOH for CN; H2SO4 for NOx; none for F; 0-6° C	28/180 days; 14 days; 28 days; 28 days	If samples for metals are not acid preserved they must be received by the lab within 14 days of sampling
Inorganic Contaminants, Primary	EPA 200.8 and 300.0, SM 4500CN-C,E, 4500NO3-F	DW with PWSID	1x250 ml HDPE for metals; 1x120 ml Nalgene for cyanide; 1x60 ml Nalgene for NO2+NO3; 1x60 ml Nalgene for anions	HNO3 for metals; NaOH for CN; H2SO4 for NOx; none for F; 2-6° C	28/180 days; 14 days; 28 days; 28 days	If samples for metals are not acid preserved they must be received by the lab within 14 days of sampling
Karl Fisher Water Content	ASTM D 1744	oil	1x20 ml scintillation vial	none	n/s	
Kjeldahl Nitrogen: see Total Kjeldahl N						
Langlier Index	SM 2330B	DW	1x250 ml HDPE for metals 1x500 ml HDPE for other analyses	HNO3 for metals; 0-6° C for others	ASAP	(req's pH, TDS, Alkalinity & Hardness)
Langlier Index	SM 2330B	DW with PWSID	1x250 ml HDPE for metals 1x500 ml HDPE for other analyses	HNO3 for metals; 2-6° C for others	ASAP	(req's pH, TDS, Alkalinity & Hardness)
Lead in Paint	SW 6020A	solid	any	none	6 months	
Lead/Copper Rule	EPA 200.8	DW	1x1 L HDPE (No substitution)	HNO3	6 months	"First Draw" collection required If samples for metals are not acid preserved they must be received by the lab within 14 days of sampling
MBAS: see Surfactants						
Mercury, Dissolved	EPA 200.8/245.1 or SW 6020A/7470A	Water	1x250 mL HDPE	HNO3	28 days	field-filter; unpres. if lab-filtered (should be field-filtered) If samples for metals are not acid preserved they must be received by the lab within 14 days of sampling
Mercury, Methyl-	EPA 1630	Water	1x250 ml Teflon (special order)	HCl	90 days	(Ref Lab)
Mercury, Total	EPA 200.8/245.1 or SW 6020A/7470A	Water	1x250 mL HDPE	HNO3	28 days	If samples for metals are not acid preserved they must be received by the lab within 14 days of sampling
Mercury, Total	SW 6020A/7470A/7471B	soil	1x4 oz glass	none; 0-6° C	28 days	

Parameter	Method	Matrix	Recommended Container/Size	Preservative	Holding Time *	Other Notes
Mercury, Trace by CVAf (Low Level)	EPA 1631E	water	1x500 ml FLPE, Teflon or amber glass	HCl	90 days	TB recommended
Metals, Dissolved (other than Hex.Cr)	EPA 200.8	water	1x250 ml HDPE	HNO3	28 days for Hg 180 days for metals	field-filter; unpres. if lab-filtered (should be field-filtered) If samples for metals are not acid preserved they must be received by the lab within 14 days of sampling
Metals, Dissolved (other than Hex.Cr)	SW 6020A	water	1x250 ml HDPE	HNO3	28 days for Hg 180 days for metals	field-filter; unpres. if lab-filtered(should be field-filtered) If samples for metals are not acid preserved they must be received by the lab within 14 days of sampling
Metals, Total (other than Hex.Cr)	EPA 200.8	water	1x250 ml HDPE	HNO3	28 days for Hg 180 days for metals	
Metals, Total (other than Hex.Cr)	SW 6020A	soil	1x4 oz glass	0-6° C	28 days for Hg 180 days for metals	
Metals, Total (other than Hex.Cr)	SW 6020A	oil	1x20 ml scintillation vial	n/a	28 days for Hg 180 days for metals	
Metals, Wipes	SW 6020A	wipes	premoistened "Ghost Wipe"	n/a	28 days for Hg 180 days for metals	wipe 10x10 cm area
Methane/Light Gases	RSK 175	water	3x40 ml amber VOA vials w/ septa	HCl; 0-6° C	14 days	(Ref Lab) allow no headspace
Nitrate+Nitrite, Total	SM 4500NO3-F	DW/W	1x60 ml Nalgene	H2SO4; chill recommended	28 days	
Nitrate+Nitrite, Total	SM 4500NO3-F	DW with PWSID	1x60 ml Nalgene	H2SO4;2-6°C	28 days	
Nitrate	EPA 300.0/SW 9056A	DW/W	1x60 ml Nalgene	0-6° C	48 hrs	
Nitrate	EPA 300.0/SW 9056A	DW with PWSID	1x60 ml Nalgene	2-6°C	48 hrs	
Nitrate	EPA 300.0/SW 9056A	soil	1x4 oz glass	0-6° C	28 days	
Nitrite	EPA 300.0/SW 9056A	DW/W	1x60 ml Nalgene	0-6° C	48 hrs	
Nitrite	EPA 300.0/SW 9056A	DW with PWSID	1x60 ml Nalgene	2-6° C	48 hrs	
Nitrite	EPA 300.0/SW 9056A	soil	1x4 oz glass	0-6° C	28 days	
Odor	SM 2150B	DW	1x1L amber glass	0-6° C	48 hrs	(Ref Lab)
Odor	SM 2150B	DW with PWSID	1x1L amber glass	2-6° C	24 hrs	(Ref Lab)
Oil & Grease, HEM	EPA 1664A	water	2x1L amber glass	HCl; 0-6° C	28 days	
Oil Burn Specs (OBS)	40 CFR 279.11 (PCBs, As, Cd, Cr, Pb, Total Halogens & Ignitability)	oil	1x4 oz glass	none	n/s	
Ortho-Phosphate	SM4500P-E	water	1x60 ml Nalgene	0-6° C	48 hrs	
PAH	EPA 525.2	DW	2x1 L amber glass	Sodium Sulfite; HCl; 0-6° C	14 days	(Ref Lab * verify cmpd list *)
PAH	EPA 525.2	DW with PWSID	2x1 L amber glass	Sodium Sulfite; HCl; 2-6° C	14 days	(Ref Lab * verify cmpd list *)
PAH	EPA 625M-SIM; SW 8270D-SIM	soil	1x4 oz amber glass	0-6° C	14/40 days (*)	
PAH	EPA 625M-SIM; SW 8270D-SIM	water	2x250 ml amber glass	0-6° C	7/40 days (*)	
PAH Trace	EPA 625M-SIM; SW 8270D-SIM	water	2x1 L amber glass	0-6° C	7/40 days (*)	
PCB Wipes	SW 8082A	wipes	1 gauze wipe w/ 4 oz glass (septa lid)	Hexane	n/s	wipe 10x10 cm area
PCBs	EPA 508	DW	2x1 L amber glass	Na2S2O3; 0-6° C	1 year (*)	(Ref Lab; can combo with Pest)
PCBs	EPA 508	DW with PWSID	2x1 L amber glass	Na2S2O3; 2-6° C	1 year (*)	(Ref Lab; can combo with Pest)
PCBs	EPA 608	water	2x1 L amber glass	0-6° C	1 year (*)	(Ref Lab; can combo with Pest)
PCBs	SW 8082A	oil	1x20 ml scintillation vial	none	n/s	
PCBs	SW 8082A	soil	1x4 oz glass	0-6° C	n/s	
PCBs	SW 8082A	water	2x1 L amber glass	0-6° C	n/s	
PCBs in Transformer Oil	SW 8082A	oil	1x20 ml scintillation vial	none	n/s	
Percent Solids (Moisture Content)	SM 2540G (modified)	soil	1x4 oz amber glass	0-6° C	14 days	
Pesticides	EPA 508	DW	2x1 L amber glass	Na2S2O3; 0-6° C	7/40 days (*)	(Ref Lab; can combo with PCBs)
Pesticides	EPA 508	DW with PWSID	2x1 L amber glass	Na2S2O3; 2-6° C	7/40 days (*)	(Ref Lab; can combo with PCBs)
Pesticides	EPA 608	water	2x1 L amber glass	0-6° C	7/40 days (*)	(Ref Lab; can combo with PCBs)
Pesticides	SW 8270D-SIM	oil	1x20 ml scintillation vial	none	n/s	
Pesticides	SW 8270D-SIM	soil	1x4 oz amber glass	0-6° C	14/40 days (*)	

Parameter	Method	Matrix	Recommended Container/Size	Preservative	Holding Time *	Other Notes
Pesticides	SW 8270D-SIM	water	2x1 L amber glass	0-6° C	7/40 days (*)	
PFAs (Polyfluorochemicals)	PFAs	water	1x1 L polycarbonate (special order)	0-6° C w/Trizma	14 days	(Ref Lab) should include temp blank in same type bottle
PFAs (Polyfluorochemicals)	537	DW	2x250 ml polycarbonate (special order)	0-6° C w/Trizma	14 days	(Ref Lab) should include temp blank in same type bottle
PFAs (Polyfluorochemicals)	PFAs	Soil	1 x 4 oz polycarbonate (special order)	0-6° C	14 days	(Ref Lab) should include temp blank in same type bottle
PFAs (Polyfluorochemicals)	PFAs	Product	2x250 ml polycarbonate (special order)	0-6° C	14 days	(Ref Lab) should include temp blank in same type bottle
pH	SM 4500H-B	water	1x250 ml Nalgene	0-6° C	ASAP/7 days	should be field analyzed
pH Corrosivity	SW 9040C	liquid	1x4 oz glass	none	ASAP/7 days	
pH Corrosivity	SW 9045D	solid	1x4 oz glass	none	ASAP/7 days	
Phase II Inorganics	EPA 200.8; EPA 300.0	DW	1x250 ml HDPE for metals; 1x60 ml Nalgene for anions	HNO3 for metals, unpreserved for fluoride; 0-6° C	6 months; 28 days	If samples for metals are not acid preserved they must be received by the lab within 14 days of sampling
Phase II Inorganics	EPA 200.8; EPA 300.0	DW with PWSID	1x250 ml HDPE for metals; 1x60 ml Nalgene for anions	HNO3 for metals, unpreserved for fluoride; 2-6° C	6 months; 28 days	If samples for metals are not acid preserved they must be received by the lab within 14 days of sampling
Phase V Inorganics	EPA 200.8; SM 4500CN-C,E	DW	1x250 ml HDPE for metals; 1x125 ml Nalgene for cyanide	HNO3 for metals, NaOH for CN; 0-6° C	6 months; 14 days	(dechlorinate before collecting for cyanide if applicable) If samples for metals are not acid preserved they must be received by the lab within 14 days of sampling
Phase V Inorganics	EPA 200.8; SM 4500CN-C,E	DW with PWSID	1x250 ml HDPE for metals; 1x125 ml Nalgene for cyanide	HNO3 for metals, NaOH for CN; 2-6° C	6 months; 14 days	(dechlorinate before collecting for cyanide if applicable) If samples for metals are not acid preserved they must be received by the lab within 14 days of sampling
Phenols	EPA 420.1 or SW9065	water	1 x 500 ml HDPE	H2SO4; 0-6° C	28 days	(Ref Lab)
Phosphorus, Total	SM4500P-B,E	water	1x125 ml HDPE	H2SO4; 0-6° C	28 days	
PIWA (Private Individual Water Analysis)	SM 9223B, 2320B, 2510B, 2540C, 4500-H B, EPA 200.8, 300.0	water	sterile 120 ml container for coli 60 ml Nalgene for NO2+NO3 1x120 mL Nalgene for metals 1x500 ml HDPE for other analyses	Na2S2O3 for coli; HNO3 for metals; H2SO4 for NOx; chill recommended	30 hrs for coli	
Radiological Test Bank (i.e., Gross Alpha, Radium 226/228, Uranium)	EPA 900 EPA 903.1/904 EPA 200.8	DW	8x1 L HDPE (Note: Collect 2x1-L each quarter, then composite at the end of the year.)	HNO3 (preserved at lab)	180 days	(Ref Lab)
Radium 226/228	EPA 903.1/904	water	3x1 L HDPE	HNO3 (preserved at lab)	6 months	(Ref Lab)
Radon in DW	EPA 913 or SM 7500	water	3x40 ml amber VOA with septa	0-6° C	72 hrs	(Ref Lab)
Residual Chlorine, Free	SM 4500CL-F	water	1x60 ml Nalgene	0-6° C	15 minutes	should be field analyzed
Residual Chlorine, Total	SM 4500CL-G	water	1x60 ml Nalgene	0-6° C	15 minutes	should be field analyzed
Residual Range Organics (RRO)	AK103	oil	1x20 ml scintillation vial	none	n/s	(can combo with DRO)
Residual Range Organics (RRO)	AK103	soil	1x4 oz amber glass	0-6° C	14/40 days (*)	(can combo with DRO)
Residual Range Organics (RRO)	AK103	water	2x1 L amber glass	HCl; 0-6° C	14/40 days (*)	(can combo with DRO)
Residue, Filterable (TDS)	SM 2540C	water	1x125 mL HDPE	0-6° C	7 days	
Residue, Non-Filterable (TSS)	SM 2540D	water	1x1 L HDPE (entire volume required)	0-6° C	7 days	requires 1 full Liter
Residue, Settleable (SS or SM)	SM 2540F	water	1x1 L HDPE (entire volume required)	0-6° C	48 hrs	requires 1 full Liter
Residue, Suspended Volatile (SVS)	SM 2540E	water	1x1 L HDPE (entire volume required)	0-6° C	7 days	requires 1 full Liter
Residue, Total (TS)	SM 2540B	water	1x125 ml HDPE	0-6° C	7 days	
Residue, Total Volatile (TVS)	SM 2540E	water	1x125 ml HDPE	0-6° C	7 days	
Resistivity	SM 2510B	water	1x125 ml HDPE	0-6° C	28 days	
Salinity by Chloride	EPA 300.0	water	1x60 ml Nalgene	0-6° C	28 days	
Secondary Inorganic Contaminants	EPA 200.8, 300, SM 4500H-B, 2120B, 2330B, 2150B, 2320B, 2540C, 5540C	DW	1x250 mL HDPE for metals; 1x250 ml amber glass for MBAS; 1x1 L amber glass for odor; 1x1 L HDPE for other analyses	HNO3 for metals; none for others; 0-6° C	48 hrs for anions, pH, MBAS, odor, Alkalinity, etc.	(MBAS requires Ref Lab) If samples for metals are not acid preserved they must be received by the lab within 14 days of sampling
Secondary Inorganic Contaminants	EPA 200.8, 300, SM 4500H-B, 2120B, 2330B, 2150B, 2320B, 2540C, 5540C	DW with PWSID	1x250 mL HDPE for metals; 1x500 ml amber glass for MBAS; 1x1 L amber glass for odor; 1x1 L HDPE for other analyses	HNO3 for metals; none for others; 2-6° C	48 hrs for anions, pH, MBAS, odor, Alkalinity, etc.	(MBAS requires Ref Lab) If samples for metals are not acid preserved they must be received by the lab within 14 days of sampling
Semivolatile Organic Cmpds (SVOC)	EPA 525.2	DW	2x1 L amber glass	Sodium Sulfite; HCl; 0-6° C	14/40 days (*)	(Ref Lab * verify cmpd list *)
Semivolatile Organic Cmpds (SVOC)	EPA 525.2	DW with PWSID	2x1 L amber glass	Sodium Sulfite; HCl; 2-6° C	14/40 days (*)	(Ref Lab * verify cmpd list *)
Semivolatile Organic Cmpds (SVOC)	EPA 625	water	2x1 L amber glass	0-6° C	7/40 days (*)	
Semivolatile Organic Cmpds (SVOC)	SW 8270D	soil	1x4 oz amber glass	0-6° C	14/40 days (*)	

Parameter	Method	Matrix	Recommended Container/Size	Preservative	Holding Time *	Other Notes
Semivolatile Organic Cmpds (SVOC)	SW 8270D	water	2x1 L amber glass	0-6° C	7/40 days (*)	
Settleable Matter (SS or SM): see Residue, Settleable						
Solids, Total (TS): see Residue, Total						
Solids, Volatile (VS): see Residue, Volatile						
Specific Gravity	Lab SOP	liquid	1x125 ml amber glass	none	n/s	
SPLP ... (see TCLP methods)	SW 1312...					
Sulfate	EPA 300.0/SW 9056A	soil	1x4 oz glass	0-6° C	28 days	
Sulfate	EPA 300.0/SW 9056A	water	1x60 ml Nalgene	0-6° C	28 days	
Sulfide, Total	SM 4500S-D	water	1x125 mL HDPE	NaOH+ZnAc; 0-6° C	7 days	
Sulfite	EPA 377.1	water	1x500 ml HDPE	5ml 2.5% EDTA	15 minutes	(Ref Lab)
Sulfolane	EPA 1625/SW8270D	soil	1x8 oz amber glass	0-6° C	14/40 days (*)	
Sulfolane	EPA 1625/SW8270D	water	2x1 L amber glass	0-6° C	7/40 days (*)	
Sulfur, Total	ASTM D 2622	oil	1x120 ml amber glass	none	n/s	(Ref Lab)
Surfactants (MBAS)	SM 5540C	water	1x500 mL amber glass	0-6° C	48 hrs	(Ref Lab)
Suspended Solids (SS or SM): see Residue, Settleable						
TAH	EPA 602 by 624/SW 8260B	water	3x40 ml amber VOA vials w/ septa	HCl; 0-6° C	14 days	allow no headspace
TAqH	EPA 625M-SIM; SW 8270D-SIM	water	2x250 ml amber glass	0-6° C	7/40 days (*)	
TAqH Trace	EPA 625M-SIM; SW 8270D-SIM	water	2x1 L amber glass	0-6° C	7/40 days (*)	
Tannin/Lignin	HACH	water	1x250 ml amber glass	0-6° C	28 days	(Ref Lab)
TCLP Herbicides	SW 1311/8151A	water	1x1 L amber glass	none	14/7/40 days	(Ref Lab)
TCLP Herbicides	SW 1311/8151A	oil	1x20 ml scintillation vial	none	14/7/40 days	(Ref Lab)
TCLP Herbicides	SW 1311/8151A	solid	1x8 oz amber glass	none	14/7/40 days	(Ref Lab)
TCLP Metals	SW 1311/6000/7000	water	1x500 mL or 1Liter HDPE	none	14/28 days (for Hg) 14/180 days (other)	
TCLP Metals	SW 1311/6000/7000	oil	1x20 ml scintillation vial	none	14/28 days (for Hg) 14/180 days (other)	
TCLP Metals	SW 1311/6000/7000	solid	1x8 oz amber glass	none	14/28 days (for Hg) 14/180 days (other)	
TCLP Pesticides	SW 1311/8270D-SIM	water	1x1 L amber glass	none	14/7/40 days	
TCLP Pesticides	SW 1311/8270D-SIM	oil	1x20 ml scintillation vial	none	14/7/40 days	
TCLP Pesticides	SW 1311/8270D-SIM	solid	1x8 oz amber glass	none	14/7/40 days	
TCLP Semivolatiles	SW 1311/8270D	water	1x1 L amber glass	none	14/7/40 days	
TCLP Semivolatiles	SW 1311/8270D	oil	1x20 ml scintillation vial	none	14/7/40 days	
TCLP Semivolatiles	SW 1311/8270D	solid	1x8 oz amber glass	none	14/7/40 days	
TCLP Volatiles	SW 1311/8260C	water	3x40 ml amber VOA vial w/ septa	none	14/14 days	
TCLP Volatiles	SW 1311/8260C	oil	1x20 ml scintillation vial	none	14/14 days	
TCLP Volatiles	SW 1311/8260C	solid	1x4 oz amber glass	none	14/14 days	
Thiocyanate	SM4500CN-M	water	1x125ml HDPE	HNO3; 0-6° C	28 days	(Ref Lab) Clean aqueous matrix only
Total Dissolved Solids (TDS): see Residue, Filterable						
Total Halogens	SW 5050/9056A	oil	1x60 ml amber glass	none	n/s	
Total Kjeldahl Nitrogen (TKN)	EPA 4500N-D	water	1x125 mL HDPE	H2SO4; 0-6° C	28 days	
Total Nitrogen (see: NO2/NO3, TKN and Ammonia)						
Total Organic Carbon (TOC)	TOC-SGS SOP	soil	1x4 oz amber	0-6° C	28 days	HT extended if frozen
Total Organic Carbon (TOC)	SM 5310B/SW 9060A	water	1x125 ml amber glass	HCl; 0-6° C	28 days	
Total Organic Halides (TOX)	SW 9020	soil	1x4 oz amber	0-6° C	28 days	(Ref Lab)
Total Organic Halides (TOX)	SW 9020	water	2x40 ml VOA or larger bottle	0-6° C	28 days	(Ref Lab)
Total Petroleum Hydrocarbons, HEM-SG	EPA 1664 SG	water	2x1 L amber glass	HCl; 0-6° C	28 days	
Total Solids: see Residue, Total						
Total Suspended Solids: see Residue, Non-Filterable						
Toxicity, SPP (for drilling mud)	40 CFR ...	solid	1 Liter	0-6° C	90 days	(Ref Lab)

Parameter	Method	Matrix	Recommended Container/Size	Preservative	Holding Time *	Other Notes
TPH by 8015B: See GRO or DRO						
Trihalomethane Formation Potential	SM 5710/EPA 551.1	DW/W	1 Liter	0-6° C	ASAP/14 days	(Ref Lab)
Trihalomethane Formation Potential	SM 5710/EPA 551.1	DW with PWSID	1 Liter	2-6° C	ASAP/14 days	(Ref Lab)
Trihalomethanes (TTHM)	EPA 524.2	DW/W	3x40 ml amber VOA vials w/ septa	Ascorbic Acid/ HCl; 0-6° C	14 days	allow no headspace; TB required
Trihalomethanes (TTHM)	EPA 524.2	DW with PWSID	3x40 ml amber VOA vials w/ septa	Ascorbic Acid/ HCl; 2-6° C	14 days	allow no headspace; TB required
Turbidity	SM 2130B	water	1x60 ml Nalgene	0-6° C	48 hrs	
Turbidity	SM 2130B	DW with PWSID	1x60 ml Nalgene	2-6° C	48 hrs	
Uranium, Total	EPA 200.8	DW	1x250 ml HDPE	0-6° C	6 months	If samples for metals are not acid preserved they must be received by the lab within 14 days of sampling
Uranium, Total	EPA 200.8	DW with PWSID	1x250 ml HDPE	2-6° C	6 months	If samples for metals are not acid preserved they must be received by the lab within 14 days of sampling
UV 254	SM 5910B	DW	1x250 mL amber glass	0-6° C	48 hrs	(Ref Lab)
UV 254	SM 5910B	DW with PWSID	1x250 mL amber glass	2-6° C	48 hrs	(Ref Lab)
VOC: Volatile Organic Compounds	EPA 524.2	DW	3x40 ml amber VOA vials w/ septa	(Ascorbic Acid if chlorinated) HCl; 0-6° C	14 days	allow no headspace; TB required
VOC: Volatile Organic Compounds	EPA 524.2	DW with PWSID	3x40 ml amber VOA vials w/ septa	(Ascorbic Acid if chlorinated) HCl; 2-6° C	14 days	allow no headspace; TB required
VOC: Volatile Organic Compounds	EPA 624	water	3x40 ml amber VOA vials w/ septa	HCl; 0-6° C	14 days	allow no headspace; TB required
VOC: Volatile Organic Compounds	SW 8260C	oil	1x20 vial or 1x40 ml VOA w/ septa	0-6° C	14 days	allow no headspace
VOC: Volatile Organic Compounds - Low Level Halogens	SW 8260C	soil	1x4 oz prewt'd amber (2nd 4 oz unpreserve % solids jar if no other analyses)	MeOH+BFB; 0-6° C	14 days	field-preservation required; use 50 g soil & 25 ml MeOH (can combo with BTEX) TB required
VOC: Volatile Organic Compounds	SW 8260C	soil	1x4 oz prewt'd amber (2nd 4 oz unpreserve % solids jar if no other analyses)	MeOH+BFB; 0-6° C	14 days	field-preservation required; use 50 g soil & 25 ml MeOH (can combo with BTEX) TB required
VOC: Volatile Organic Compounds	SW 8260C	water	3x40 ml amber VOA vials w/ septa	HCl; 0-6° C	14 days	allow no headspace; TB required
VOC: Volatile Organic Compounds Low Level (5035A FROZEN)	SW 8260C Low Level	soil	2x40 ml VOA w/ septa; 5-ml DI water & stir bar (also provide jars for medium level VOC and % solids)	freeze w/in 48 hrs: -7 to -20° C	14 days	field-preservation required; 5 g soil in 5 ml DI water & freeze on side immediately. TB required
VPH	NW-VPH	soil	1x4 oz prewt'd amber (2nd 4 oz unpreserve % solids jar if no other analyses)	MeOH+BFB; 0-6° C	14 days	(Ref Lab) TB required; field-preservation required; use 50 g soil & 25 ml MeOH
VPH	NW-VPH	water	3x40 ml amber VOA vials w/ septa	HCl; 0-6° C	14 days	(Ref Lab) TB required; allow no headspace

* - Methods requiring semivolatle extraction by SW 3520/3550 have a hold time for extraction followed by a hold time for analysis of the extract.

Appendix B

Surrogate and Isotope Dilution Analyte Associations

Table 1 - Surrogate and Isotope Dilution Analyte Association

Analytical Method	Surrogate/ IDA	Surrogate/ IDA CAS No.	Associated Analyte	Associated Analyte CAS No.
AK101	4-Bromofluorobenzene <surr>	460-00-4	Gasoline Range Organics	GRO
AK102	5a Androstane <surr>	438-22-2	Diesel Range Organics	DRO
AK103	n-Triacontane-d62 <surr>	93952-07-9	Residual Range Organics	RRO
SW8260B (VOCs)	1,2-Dichloroethane-D4 <surr>	17060-07-0	1,1,1-Trichloroethane	71-55-6
			1,1-Dichloroethane	75-34-3
			1,1-Dichloroethene	75-35-4
			1,1-Dichloropropene	563-58-6
			1,2-Dichloroethane	107-06-2
			1,2-Dichloropropane	78-87-5
			2,2-Dichloropropane	594-20-7
			2-Butanone (MEK)	78-93-3
			4-Methyl-2-pentanone (MIBK)	108-10-1
			Benzene	71-43-2
			Bromochloromethane	74-97-5
			Bromodichloromethane	75-27-4
			Bromomethane	74-83-9
			Carbon disulfide	75-15-0
			Carbon tetrachloride	56-23-5
			Chloroethane	75-00-3
	Chloroform	67-66-3		
	Chloromethane	74-87-3		
	cis-1,2-Dichloroethene	156-59-2		
	cis-1,3-Dichloropropene	10061-01-5		
	Dibromomethane	74-95-3		
	Dichlorodifluoromethane	75-71-8		
	Methylene chloride	75-09-2		
	Methyl-t-butyl ether	1634-04-4		
	trans-1,2-Dichloroethene	156-60-5		
	Trichloroethene	79-01-6		
	Trichlorofluoromethane	75-69-4		
	Vinyl chloride	75-01-4		
	4-Bromofluorobenzene <surr>	460-00-4	1,1,2,2-Tetrachloroethane	79-34-5
			1,2,3-Trichlorobenzene	87-61-6
			1,2,3-Trichloropropane	96-18-4
			1,2,4-Trimethylbenzene	95-63-6
1,2-Dibromo-3-chloropropane			96-12-8	
1,2-Dichlorobenzene			95-50-1	
1,3,5-Trimethylbenzene			108-67-8	
1,3-Dichlorobenzene			541-73-1	
1,4-Dichlorobenzene			106-46-7	
2-Chlorotoluene			95-49-8	

Table 1 - Surrogate and Isotope Dilution Analyte Association

Analytical Method	Surrogate/ IDA	Surrogate/ IDA CAS No.	Associated Analyte	Associated Analyte CAS No.
SW8260B (VOCs)	4-Bromofluorobenzene <surr>	460-00-4	4-Chlorotoluene	106-43-4
			4-Isopropyltoluene	99-87-6
			Bromobenzene	108-86-1
			Hexachlorobutadiene	87-68-3
			Naphthalene	91-20-3
			n-Butylbenzene	104-51-8
			n-Propylbenzene	103-65-1
			sec-Butylbenzene	135-98-8
			tert-Butylbenzene	98-06-6
			1,1,1,2-Tetrachloroethane	630-20-6
	1,1,2-Trichloroethane	79-00-5		
	1,2-Dibromoethane	106-93-4		
	1,3-Dichloropropane	142-28-9		
	2-Hexanone	591-78-6		
	Bromoform	75-25-2		
	Chlorobenzene	108-90-7		
	Dibromochloromethane	124-48-1		
	Toluene-d8 <surr>	2037-26-5	Ethylbenzene	100-41-4
			Isopropylbenzene (Cumene)	98-82-8
			o-Xylene	95-47-6
			P & M -Xylene	P & M -Xylene
			Styrene	100-42-5
			Tetrachloroethene	127-18-4
			Toluene	108-88-3
			trans-1,3-Dichloropropene	10061-02-6
			Xylenes (total)	1330-20-7
	SW8270D SIM (PAH)	2-Methylnaphthalene-d10 <surr>	7297-45-2	1-Methylnaphthalene
2-Methylnaphthalene				91-57-6
Acenaphthene				83-32-9
Acenaphthylene				208-96-8
Anthracene				120-12-7
Fluorene		86-73-7		
Naphthalene		91-20-3		
Phenanthrene		85-01-8		
Fluoranthene-d10 (surr)		93951-69-0	Benzo(a)Anthracene	56-55-3
			Benzo[a]pyrene	50-32-8
			Benzo[b]Fluoranthene	205-99-2
			Benzo[g,h,i]perylene	191-24-2
			Benzo[k]fluoranthene	207-08-9
Chrysene		218-01-9		
Dibenzo[a,h]anthracene		53-70-3		

Table 1 - Surrogate and Isotope Dilution Analyte Association

Analytical Method	Surrogate/ IDA	Surrogate/ IDA CAS No.	Associated Analyte	Associated Analyte CAS No.	
SW8270D SIM (PAH)	Fluoranthene-d10 (surr)	93951-69-0	Fluoranthene	206-44-0	
			Indeno[1,2,3-c,d] pyrene	193-39-5	
			Pyrene	129-00-0	
	18O2-PFHxS	---	Perfluorohexansulfonic acid (PFHxS)	355-46-4	
	13C2-PFHxA	---	Perfluorohexanoic acid (PFHxA)	307-24-4	
	13C4-PFHpA	---	Perfluoroheptanoic acid (PFHpA)	375-85-9	
	13C5-PFNA	---	Perfluorononanoic acid (PFNA)	375-95-1	
	13C3-PFBS	---	Perfluorobutanesulfonic acid (PFBS)	375-73-5	
	13C2-PFDA	---	Perfluorodecanoic acid (PFDA)	335-76-2	
	13C2-PFUdA	---	Perfluoroundecanoic acid (PFUnA)	2058-94-8	
	13C2-PFDoA	---	Perfluorododecanoic acid (PFDoA)	307-55-1	
	Modified EPA 537 (PFAS)	13C2-PFTrDA	---	Perfluorotridecanoic acid (PFTrDA)	72629-94-8
				Perfluorotetradecanoic acid (PFTeA)	376-06-7
13C3-HFPO-DA		---	Hexafluoropropylene oxide dimer acid (HFPO-DA)	13252-13-6	
			Perfluorooctanesulfonic acid (PFOS)	1763-23-1	
13C4-PFOS		---	4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	919005-14-4	
			9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS)	756426-58-1	
			11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)	83329-89-9	
d3-MeFOSAA		---	N-Methyl perfluorooctane sulfonamidoacetic acid (N-MeFOSAA)	2355-31-9	
d5-EtFOSAA		---	N-Ethyl perfluorooctane sulfonamidoacetic acid (N-EtFOSAA)	2991-50-6	
13C4-PFOA		---	Perfluorooctanoic acid (PFOA)	335-67-1	

NOTES:

Surrogate associations for GRO, DRO, RRO, VOCs, and PAHs are based on information received February 2020 from SGS North America, Inc. and may not be representative of all labs

Surrogate associations for PFAS are based on information received February 2020 from Eurofins TestAmerica, Inc. and may not be representative of all laboratories.

PFAS analytes are associated with isotope dilution standards.

CAS No. = Chemical Abstract Service Number; DRO = diesel range organics; GRO = gasoline range organics; PAH = polynuclear aromatic hydrocarbons; PFAS = per- and poly-fluorinated alkyl substances; RRO = residual range organics; VOC = volatile organic compounds

Important Information

About Your Environmental Report

IMPORTANT INFORMATION

CONSULTING SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND FOR SPECIFIC CLIENTS.

Consultants prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your consultant prepared your report expressly for you and expressly for the purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the consultant. No party should apply this report for any purpose other than that originally contemplated without first conferring with the consultant.

THE CONSULTANT'S REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.

A geotechnical/environmental report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. Depending on the project, these may include: the general nature of the structure and property involved; its size and configuration; its historical use and practice; the location of the structure on the site and its orientation; other improvements such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask the consultant to evaluate how any factors that change subsequent to the date of the report may affect the recommendations. Unless your consultant indicates otherwise, your report should not be used: (1) when the nature of the proposed project is changed (for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one, or chemicals are discovered on or near the site); (2) when the size, elevation, or configuration of the proposed project is altered; (3) when the location or orientation of the proposed project is modified; (4) when there is a change of ownership; or (5) for application to an adjacent site. Consultants cannot accept responsibility for problems that may occur if they are not consulted after factors which were considered in the development of the report have changed.

SUBSURFACE CONDITIONS CAN CHANGE.

Subsurface conditions may be affected as a result of natural processes or human activity. Because a geotechnical/environmental report is based on conditions that existed at the time of subsurface exploration, construction decisions should not be based on a report whose adequacy may have been affected by time. Ask the consultant to advise if additional tests are desirable before construction starts; for example, groundwater conditions commonly vary seasonally.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes, or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical/environmental report. The consultant should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

MOST RECOMMENDATIONS ARE PROFESSIONAL JUDGEMENTS.

Site exploration and testing identifies actual surface and subsurface conditions only at those points where samples are taken. The data were extrapolated by your consultant, who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your consultant can work together to help reduce their impacts. Retaining your consultant to observe subsurface construction operations can be particularly beneficial in this respect.

A REPORT'S CONCLUSIONS ARE PRELIMINARY.

The conclusions contained in your consultant's report are preliminary because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Actual subsurface conditions can be discerned only during earthwork; therefore, you should retain your consultant to observe actual conditions and to provide conclusions. Only the consultant who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations based on those conclusions are valid and whether or not the contractor is abiding by applicable recommendations. The consultant who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

THE CONSULTANT'S REPORT IS SUBJECT TO MISINTERPRETATION.

Costly problems can occur when other design professionals develop their plans based on misinterpretation of a geotechnical/environmental report. To help avoid these problems, the consultant should be retained to work with other project design professionals to explain relevant geotechnical, geological, hydrogeological, and environmental findings, and to review the adequacy of their plans and specifications relative to these issues.

BORING LOGS AND/OR MONITORING WELL DATA SHOULD NOT BE SEPARATED FROM THE REPORT.

Final boring logs developed by the consultant are based upon interpretation of field logs (assembled by site personnel), field test results, and laboratory and/or office evaluation of field samples and data. Only final boring logs and data are customarily included in geotechnical/environmental reports. These final logs should not, under any circumstances, be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process.

To reduce the likelihood of boring log or monitoring well misinterpretation, contractors should be given ready access to the complete geotechnical engineering/environmental report prepared or authorized for their use. If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared, and that developing construction cost estimates was not one of the specific purposes for which it was prepared. While a contractor may gain important knowledge from a report prepared for another party, the contractor should discuss the report with your consultant and perform the additional or alternative work believed necessary to obtain the data specifically appropriate for construction cost estimating purposes. Some clients hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes that aggravate them to a disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY.

Because geotechnical/environmental engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, consultants have developed a number of clauses for use in their contracts, reports, and other documents. These responsibility clauses are not exculpatory clauses designed to transfer the consultant's liabilities to other parties; rather, they are definitive clauses that identify where the consultant's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

The preceding paragraphs are based on information provided by the ASFE/Association of Engineering Firms Practicing in the Geosciences, Silver Spring, Maryland