SUBMITTED TO:
Alaska Department of Administration, Division of Risk Management
P.O. Box 110218
Juneau, Alaska 9981

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

(907) 479-0600
www.shannonwilson.com

REPORT

Long-Term Alternate Water Feasibility Study

DILLINGHAM, ALASKA

SHANNON & WILSON

October 2020

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Subject: REPORT, LONG-TERM ALTERNATE WATER FEASIBILITY STUDY, DILLINGHAM, ALASKA

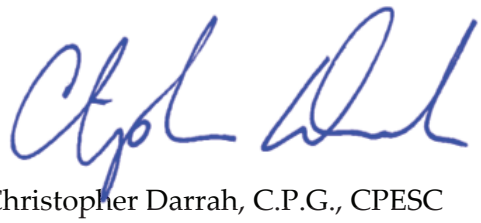
The effort summarized herein was conducted on behalf of the Alaska Department of Administration, Division of Risk Management (DRM), in accordance with Shannon & Wilson, Inc.'s approved scope of services dated October 15, 2019. This document has been revised in response to comments received from the Alaska Department of Transportation & Public Facilities (DOT&PF) and DRM.

Shannon & Wilson appreciates the opportunity to be of service to you on this project. If you have questions concerning this report, or we may be of further service, please contact us.

Sincerely,

SHANNON & WILSON, INC.

Marcy Nadel
Geologist
Role: Project Manager



Christopher Darrah, C.P.G., CPESC
Vice President
Role: Contract Manager

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ACRONYMS

Barr	Barr Engineering Co.
Choggiung	Choggiung, Ltd. Village Corporation
CDL	Commercial Driver's License
DEC	Alaska Department of Environmental Conservation
DOT&PF	Alaska Department of Transportation and Public Facilities
DRM	Alaska Department of Administration's Division of Risk Management
EPA	U.S. Environmental Protection Agency
GAC	granular activated carbon
gpm	gallons per minute
HDR	HDR Engineering, Inc.
LDRC	Laboratory Data Review Checklist
LHA	Lifetime Health Advisory
ng/L	nanograms per liter
O&M	operations and maintenance
PFAS	per- and polyfluoroalkyl substance
PFHpA	perfluoroheptanoic acid
PFHxS	perflurohexanesulfonic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFNA	perfluorononanoic acid
POET	Point-of-Entry Water Treatment
PWS	public water system
SGS	SGS North America, Inc.
TestAmerica	Eurofins TestAmerica Laboratories, Sacramento
QA	quality assurance

1 INTRODUCTION

Shannon & Wilson, Inc. is pleased to submit this Long-Term Alternate Water Feasibility Study Report (Report) summarizing potential water sources for water supply wells impacted by per- and polyfluoroalkyl substances (PFAS) in Dillingham, Alaska. These locations are shown in Figure 1, Highest Reported Water Supply Well Analytical Results. The Dillingham Airport is an active, Alaska Department of Environmental Conservation (DEC) listed contaminated site (File Number 2540.38.023, Hazard ID 26971).

1.1 Drinking Water Action Levels

The current DEC action level for drinking water samples aligns with the U.S. Environmental Protection Agency (EPA) lifetime health advisory (LHA) level of 70 nanograms per liter (ng/L) for the sum of two PFAS compounds, perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic acid (PFOA). The former DEC action level was 70 ng/L for the sum of five PFAS compounds: PFOS, PFOA, perfluoroheptanoic acid (PFHpA), perflurohexanesulfonic acid (PFHxS), and perfluorononanoic acid (PFNA). PFAS concentrations are compared to the applicable action level at the time each sample was collected (Figure 1).

1.2 Background

On behalf of the DRM and Alaska Department of Transportation and Public Facilities (DOT&PF), Shannon & Wilson conducted a water supply well search on and downgradient of Dillingham Airport property beginning in February 2019. To date, Shannon & Wilson has sampled 97 water supply wells, the majority of which are drinking-water wells. The water supply well search and initial sampling effort occurred primarily in February and June 2019. Resampling of select wells occurred in November 2019, February 2020, and September 2020, and is ongoing.

Seven wells are considered impacted by PFAS due to PFAS results above the applicable action level, five are off and two are on Dillingham Airport property (Figure 1). These seven wells serve 11 structures and represent a range of property types including single-family houses, an apartment building, a church serving as a community water source, a restaurant, and other commercial businesses. Many of these occupants are receiving interim bottled water deliveries. Exhibit 1-1, Impacted Properties, describes these properties.

Exhibit 1-1: Impacted Properties

Area	Well ID	Property Type	Description
Airport Tenants	191300	Commercial	Hangar
	191320	Commercial	[redacted]
Airport Spur Road	191700	Residential	House, 1 occupant
	191710	Residential rental	Apartment, 5 units with 4 to 10 occupants
	191710	Residential rental	House, 2 occupants
	191710	Residential rental	House, 1 occupant
	191710	Commercial rental	Office
	191720	Residential rental	House, 1 occupant
	191050	Church	[redacted]
Kanakanak Road / Windmill Hill	200150	Residential	House, up to 15 occupants

1.3 Purpose

The purpose of this Report is to summarize each long-term alternate water option, including estimated capital and operations and maintenance (O&M) costs, and advantages and disadvantages of the alternate water options. This information is meant to assist the DRM and DOT&PF in selecting a long-term water source for PFAS-impacted water supply wells in Dillingham. The preferred alternative may include a combination of these options.

Shannon & Wilson understands the DRM is responsible for alternate water planning for the five impacted off-airport properties, while DOT&PF is responsible for the two impacted on-airport properties. This feasibility study assumes O&M costs will be addressed by a one-time settlement to the property owner, system operator, or other entity. The settlements towards long-term costs included in this Report are based on conversations with the DRM. Shannon & Wilson assumes the DOT&PF will provide the same settlement as DRM.

1.4 Use of Report

This Report was prepared for the exclusive use of the DRM, DOT&PF, and their representatives for the purpose of long-term alternate water planning for impacted wells on and off Dillingham Airport property. This work presents Shannon & Wilson's professional judgment and is based on information obtained from individuals in Dillingham, Shannon & Wilson's contractors, and analytical sampling.

This Report should not be used for other purposes without Shannon & Wilson's approval or if any of the following occurs:

- Project details change, or new information becomes available such that Report findings may be affected.
- Conditions change due to natural forces or human activity at, under, or adjacent to the project site.
- Assumptions stated in this Report have changed.
- If ownership or land use of the site and/or impacted properties has changed.
- More than one year has passed since the date of this report.
- Regulations, laws, or cleanup levels change.
- If the site's regulatory status has changed.

If any of these occur, Shannon & Wilson should be retained to review the applicability of this Report. This Report should not be used for other purposes without Shannon & Wilson's review. If a service is not specifically indicated in this report, do not assume it was performed.

2 FEASIBILITY OF LONG-TERM WATER OPTIONS

Shannon & Wilson has prepared the following summary of four different options for providing long-term alternate water to PFAS-impacted properties in Dillingham, Alaska. These options included:

1. Water Storage Tanks and Deliveries (Section 2.1)
2. Municipal Water System Expansion (Section 2.2)
3. Individual Point-of-Entry Water Treatment (POET) Systems (Section 2.3)
4. Small-Scale Distribution Systems (Section 2.4)

HDR Engineering, Inc. (HDR) investigated the feasibility of municipal water system expansion and small-scale distribution systems. HDR's report is included in Appendix A. Barr Engineering Co. (Barr) prepared preliminary POET system designs, their report is included in Appendix B.

In November 2019, Shannon & Wilson field staff conducted site visits at impacted properties for planning purposes. This information was recorded on *PFAS Impacted Well Site Assessment Forms*, copies of which are include within Barr's report (Appendix B, Attachment 1). These forms were provided to HDR and Barr.

2.1 Water Storage Tanks and Deliveries

This option would provide water storage tanks to the impacted properties, which would be filled by periodic deliveries of municipal water. Water storage tanks are not a common water source in Dillingham, and currently there is no water delivery infrastructure. This option would involve construction of potable water tanks at each impacted property, purchase of a potable water trailer, and identifying a contractor to deliver water over the long term.

Appendix C, Water Storage Tank Supporting Information, includes specifications for fabricating two different insulated potable water tank trailers: a 2,000-gallon trailer to be towed by a 1-ton pickup truck and a 5,000-gallon tandem axle trailer to be towed by a semi-truck requiring a Commercial Driver's License (CDL). The trailer would be equipped with a pump and hose and has an anticipated 20 to 25 year lifespan considering rural Alaska wear-and-tear. Shannon & Wilson has identified several potential water delivery contractors, summarized in Exhibit 2-1 below. This is not a comprehensive list of potential water delivery contractors in Dillingham. Shannon & Wilson assumes DOT&PF and DRM will select a contractor by issuing a Request for Information (RFI) and/or Request for Proposal (RFP) to comply with state bidding requirements. After a contractor is identified, the trailer specifications would be modified for compatibility (gas vs. diesel, chassis and towing, heat trace for outdoor storage, etc.).

Exhibit 2-1: Summary of Potential Water Delivery Contractors

Contractor	Type	Staff Capacity	Equipment
[redacted]	Business	Driver and alternate available year-round, both hold CDLs	1-ton pickup and tandem axle semi-tractor
[redacted]	Government	6 year-round staff members, no CDL drivers	3/4-ton pickup, would need to purchase a larger vehicle
[redacted]	Business	2 or 3 drivers hold CDLs and may be available year-round, >6 drivers available in summer	Multiple 3/4-ton pickups and tandem axle semi-tractor
[redacted]	Individual	Driver and alternate available year-round, neither holds CDL	1/2-ton and 3/4-ton pickup

The City of Dillingham had operated a potable water delivery truck in the past, but their truck is no longer operational. Following a February 2020 meeting with the City Manager, Public Works Director, and Public Works staff, the City began preparing a cost estimate to purchase a truck and use City staff to deliver water. However, the City of Dillingham is facing a significant budget shortfall related to COVID-19 and has indicated they are unable

to provide deliveries for the foreseeable future. [redacted] has also indicated they not interested in supplying water deliveries.

[redacted] operates a potable water delivery truck during the salmon season, from approximately June to August. They use the truck to transfer water purchased from the City to their processing plant and employee lodging facility outside of town. The 1978 Walker semi-truck trailer is equipped with an approximately 6,500-gallon potable water tank. The [redacted] truck is used for six to eight hours each night. The company has declined to rent the delivery truck for year-round use, citing logistical challenges associated with sharing the vehicle each summer.

The ballpark capital cost for water storage tank and water trailer purchase, freight, design, and installation is approximately $820,000. This estimate assumes the water delivery contractor would supply their own vehicle/s and includes a 35 percent contingency. Shannon & Wilson assumes the tanks will be buried to help prevent freezing and UV degradation, tank capacity will range from 1,500 to 5,000 gallons. This assumes the [redacted] holding tank will be not be sized to supply water to the public. If this alternate water option is selected, storage tank size would be optimized during the design phase. This option has the second-lowest installation cost of the options reviewed. Please note, costs associated with water delivery and O&M could not be calculated without selection of the water delivery contractor. DEC has indicated the water delivery contractor would not need to be classified as a public water system (PWS) operator, therefore this estimate does not include preparing DEC Drinking Water Program submittals.

The primary advantage of water storage tanks is the limited and relatively simple construction needed to implement this option. A secondary advantage is it can be upscaled should the PFAS groundwater plume spread or regulatory standards change. The main disadvantage is that the selected water delivery contractor may not be able to continue this service long term.

2.2 Municipal Water System Expansion

This option involves extending the existing City of Dillingham municipal water system to serve the impacted properties. The City of Dillingham municipal water system currently provides water to 215 structures in downtown Dillingham, approximately two miles east of most PFAS-impacted wells. HDR developed preliminary water main routing to extend the municipal water system and estimated probable project costs (Appendix A). The preliminary design includes two possible routes for an 8-inch water main extension along Kanakanak Road. HDR's April 2020 report describes a main routed under the runway to connect Airport Spur Road to Kanakanak Road (Appendix A, Figure 2). HDR's July 2020

supplement to their report describes a main routed around the airport along Kanakanak Road (Appendix A, Figure 8). The summary tables and report text discuss the longer water main route (Exhibits 4-1 and 4-2).

City of Dillingham staff and at least one City Council member are encouraging selection of this option. The City of Dillingham water system is regulated by the DEC Drinking Water Program as a community public water system serving resident, transient, and non-transient populations (PWS ID No. AK2260197). Shannon & Wilson assumes the City of Dillingham would be administratively, physically, and financially responsible for regulatory compliance and O&M costs.

The estimated capital cost to expand the City of Dillingham water system is approximately $23 million, including design, easements and right-of-way planning, and construction. This Class 4, order-of-magnitude cost estimate assumes a single, dead-end water main is adequate for this project. Over one-half of the total cost is for water main installation and asphalt road reconstruction. HDR's report assumes a 10-foot burial depth, the same as other water lines in Dillingham. Trenching below 4 feet significantly increases the anticipated cost because trench stability control is required (sloping trench sides, trench box, etc.) for safety. Should hydraulic analysis determine a looped main is required, the cost would be considerably higher. This cost estimate also assumes connection to the municipal water system will not require mechanical or electrical upgrades to the impacted properties. The cost estimate assumes a settlement of $3,000 per property, regardless of the number of structures served. If possible, the settlement will be paid by DRM or DOT&PM to the City of Dillingham as a credit towards each property owner's account.

The main advantage of a municipal water expansion is reliability. This is the only option that involves use of an established long-term water source, and where the source is managed by a known entity with a proven track record. Should the PFAS groundwater plume spread or regulatory standards change, additional service line connections could be added. Furthermore, this option allows for non-PFAS-impacted property owners along Kanakanak Road to connect at their own expense. The primary disadvantage is the high overall cost, and high cost per impacted property, compared to the other options presented in this Report. Federal infrastructure grant and loan programs may be available as supplemental funding sources and should be investigated for their applicability to this option.

Please note, in March 2019 Shannon & Wilson collected pre- and post-treatment water samples at the City of Dillingham water plant. PFHxS was detected at an estimated concentration of 1.1 ng/L in the pre-treatment sample. PFOS, PFOA, and the three other reported PFAS were not detected in either sample.

2.3 Individual Point-of-Entry Water Treatment Systems

This option involves designing, installing, and maintaining individual POET systems for each impacted water supply well to reduce PFAS concentrations below applicable regulatory standards. Barr has developed preliminary treatment recommendations for six of the seven impacted locations (Appendix B). Well ID 191720 on Airport Spur Road is excluded because the owner initially declined to provide access for a site assessment. The assessment for this property was conducted in September 2020. Barr recommends POET systems consisting of the following elements, depending on the property:

- iron and manganese greensand filtration with continuous hypochlorite injection,
- particulate filtration,
- granular activated carbon (GAC) filtration, and
- UV disinfection.

Estimated capital costs for individual POET systems range from $30,000 for a business or single-family home to $135,000 for a system supplying up to four structures. The low-end estimate assumes two of the properties will be supplied with non-potable water, and outbuilding construction will be required. Metals pre-treatment and particulate filtration are necessary to treat PFAS to below applicable action levels. Barr's estimated annual O&M costs range from $15,000 to $30,000. Cost limitations for these class 5 cost estimates are described in Barr's report (Appendix B). Please note, a Class 5 cost estimate is less defined than a Class 4 estimate.

The two primary advantages of POET systems are their comparatively low cost, and that they are a standalone solution for properties located far from existing water-supply infrastructure. This option has the least expensive capital cost, equal to less than 5 percent of the anticipated municipal water expansion installation cost and two-thirds of the anticipated water storage tank installation cost. Depending on the settlement value selected, POET systems could have the least expensive total cost.

A major disadvantage is POET systems require ongoing maintenance, which is logistically challenging in rural communities. DRM, DOT&PF, or a local trust would be responsible for managing O&M of POET systems. Shannon & Wilson does not recommend leaving maintenance to home or business owners with impacted water supply wells. For comparison purposes the option summary tables include 5 years of O&M costs (Exhibits 4-1 and 4-2). Furthermore, if regulatory standards become more stringent, the POET systems may need to be supplemented or redesigned.

To implement this option, Shannon & Wilson would collect pre-installation water samples from Well IDs 191300 and 191700 to confirm treatment design assumptions, and work with property owners to determine the POET location and necessary piping modifications. The project team would prepare access and maintenance agreements for each property, construct POET outbuildings, and modify existing DEC Drinking Water Program permits for PWSs.

The [redacted] (PWS ID No. 2263018) is considered a non-transient non-community PWS serving approximately 530 people. [redacted] (PWS ID No. 2262733) is considered a non-community PWS because it rents the second story of the terminal to the [redacted]. DEC will require submittal of POET design drawings, breakthrough calculations, analytical results, material specifications, an O&M plan, and other information for these two properties prior to their use. The DEC Drinking Water Program consults the Contaminated Sites and Wastewater Divisions as part of their permitting process. DEC Contaminated Sites has indicated it may not approve discharge of untreated backwash water into private septic systems and/or the City of Dillingham sewer system, as they have for other projects. Backwash is required for GAC-based POET. If they do not approve discharge, additional costs would be incurred for disposal of backwash water or treatment system design modifications (i.e., additional treatment for backwash water or recirculation).

2.4 Small-Scale Distribution Systems

This option involves constructing one or more small-scale water distribution systems that supply alternate water to properties with PFAS-impacted wells using water from either an existing well or a new source. In Dillingham it is common for multiple properties to share a single well. Shannon & Wilson examined seven potential water sources as summarized in Exhibit 2-2, below, and further defined in this section. Preliminary piping route maps are included in Appendix A.

Exhibit 2-2: Summary of Small-Scale Distribution Systems

Option	Water Source (Well ID)	Water Source Owner	Locations Served
Existing, Untreated Source	[redacted] (191040)	[redacted]	Airport Spur Road
	[redacted] (200340)		Well ID 200150
	[redacted] (191210)	[redacted]	Airport Tenants
Existing, Treated Source	[redacted] (191050)	[redacted]	Airport Spur Road
	Well ID 191710	Private individual	Well ID 191720 and 191700
New Source	Drilled Well	N/A	Airport Tenants, Airport Spur Road
	Distribution Center	N/A	

2.4.1 Existing, Untreated Source

The following three small-scale distribution systems originate from existing wells not impacted by PFAS. These locations would not require PFAS treatment (i.e. a POET system).

2.4.1.1 [redacted]

The [redacted] is considered a transient non-community PWS serving approximately 220 people (PWS ID No. 2263071). This small-scale distribution system option would involve extending the [redacted] PWS to supply the [redacted] an apartment building, an office, and four houses (Appendix A, Figure 4). [redacted] the owner of the [redacted] well, has asked that expansion of their system only be pursued if other alternate water options are exhausted. Their primary concern is disruption of their current water use.

The [redacted] well is 62 feet deep, 6 inches in diameter, and screened from 56.5 to 59.5 feet. The well driller reports an estimated production of 50 gallons per minute (gpm), the pump reportedly draws at 40 gpm and is set at 59 feet. HDR recommends conducting a flow test to determine if the well has sufficient recovery to expand distribution. A February 2019 water sample collected from the [redacted] well was submitted for six PFAS; none were detected (Well ID 191040). Although regular PFAS water sampling is recommended, this study assumes water treatment will not be required. Available groundwater information indicated there are no PFAS-impacted wells greater than 50 feet deep within a half-mile of this well. However, Shannon & Wilson is unable to predict the likelihood of PFAS concentrations in the [redacted] well increasing due to the higher groundwater draw needed to implement this option.

The estimated capital cost for expansion of the [redacted] system is $1.9 million, including distribution system design, easements, well rehabilitation, and construction. HDR's cost estimate assumes fire suppression is not required, allowing for the installation of a 2-inch water main. The estimated annual O&M cost is $2,500 per year, including electrical, employee, and water testing costs. Shannon & Wilson assumes [redacted] would manage the system, and DRM would provide a one-time $5,000 settlement to cover O&M costs. This fee is applied to each untreated, small-scale distribution system.

For this option to be implemented, the project team would need to apply to re-classify the [redacted] PWS as a community system. DEC will require submittal of drawings and specifications, peak demand and service pressure calculations, and other pertinent information. [redacted] would also need to select a staff member to become a certified operator. It is unknown if redeveloping the existing well and/or installing a new pump would provide adequate capacity and pressure to the system's end point

approximately one-half mile away. Additionally, the project team would need to approach [redacted] and nearby property owners to obtain permission for piping rights-of-way.

2.4.1.2 [redacted]

The well at [redacted] is considered a resident community PWS serving several hundred people (PWS ID No. 2261460). The PWS currently serves five seasonally-occupied apartment buildings, a church, and four single-family homes. This option would extend piping from the existing distribution system to serve one additional home, Well ID 200150 (Appendix A, Figure 2). [redacted] is also the owner of this PWS and has not granted permission to expand the system.

In 2019, [redacted] installed a corrosion control system to mitigate lead and copper leaching. The [redacted] well is reportedly 32 feet deep, 4 inches in diameter, and produces water at 12 gpm. The corrosion control system is designed for a maximum treatment rate of 8 gpm.

Shannon & Wilson does not recommend this option without additional information because the [redacted] well has a maximum combined PFOS and PFOA concentrations greater than 10 percent of the applicable action level. Five PFAS were detected in a February 2019 water sample from the [redacted] Well ID 200340: PFOS at 7.2 ng/L, PFOA at an estimated 1.6 ng/L, PFHxS at 12 ng/L, and two other PFAS at lower concentrations. These sample results were consistent with the DEC water sample collected in December 2018.

The [redacted] well has a similar depth to nearby Well ID 200150 based on occupant-reported information. Well ID 200150 is considered impacted, with PFOS detected at a concentration nearly 10 times higher than the [redacted] well in samples collected between February and June 2019. As of summer 2020, the [redacted] well has been included in quarterly water supply well monitoring. Although Shannon & Wilson is unable to predict the likelihood of PFAS concentrations in Well ID 200340 increasing above the action level, if the [redacted] well draws from the same water source as nearby Well ID 200150 it is likely to increase.

The estimated capital cost for this option is $415,000. Estimated annual O&M costs are $2,500 per year, including the same items described in Section 2.4.1.1, above. [redacted] is a relatively new owner of this property and does not have a metering system in place to charge tenants for their water use. In addition to their caution over disrupting current tenant water use, they are concerned water metering would add cost and administrative burden during a time when their revenue streams are uncertain.

For this option to be implemented, the PWS permit would need to be updated to include additional distribution, but the permit type would not change. As part of DEC's October 2019 interim approval to operate [redacted] new corrosion control system, the drinking water program requested record drawings for the existing system and other information. To Shannon & Wilson's knowledge, these engineering drawings have not been provided. It is possible the absence of information pertaining to the existing system could delay approval of system expansion.

2.4.1.3 [redacted]

The main [redacted] (Well ID 191210) currently supplies two structures, the [redacted] and [redacted] This alternate water option would supply two additional nearby structures including a hangar, terminal, and the [redacted] (Appendix A, Figure 7).

The [redacted] well is 350 feet deep, 6 inches in diameter, produces at approximately 5 gpm, and is softened prior to use. [redacted] staff, airport tenants, and local drillers note groundwater within the airport lease area often has a high mineral content and sulfur odor. PFOS was detected at 5.0 ng/L in a February 2019 water sample from this well. The sample was analyzed for six PFAS compounds; the other five were not detected. [redacted] staff report the second, shallower [redacted] well used for filling fire trucks has higher iron concentrations than the main [redacted] well. Available well search information indicates the next-deepest groundwater well within a half-mile is 100 feet deep. Shannon & Wilson assumes, but cannot confirm, that the [redacted] well is hydrologically connected to other water-supply wells in the Airport lease area. Without further information on PFAS concentrations at this depth, it is not possible to predict the likelihood of concentrations in [redacted] well increasing due to the higher groundwater draw needed to provide water to additional buildings.

The estimated capital cost for this system is $625,000 and estimated annual O&M costs are $2,500 per year. For this option to be implemented, the project team would need to obtain a PWS permit for the [redacted] well. DEC Drinking Water permitting is required because the well would supply the [redacted] (PWS ID No. 2262733). Plan review is more extensive for a new system than an existing one. Depending on the PWS classification, DEC may require a DOT&PF employee to become a certified operator. Similar to the [redacted] it is unclear if this well has the capacity to supply an expanded system.

2.4.1.4 Advantages and Disadvantages

The advantages of untreated, small-scale distribution systems are logistical convenience and cost. The [redacted] (PWS ID No. 2261460) and [redacted] systems already supply multiple nearby structures with water from a single well. These options involve infrastructure modifications similar to those already in place, which may require less specialized materials and labor than the other alternate water options. The estimated total cost is less than 20 percent that of municipal water expansion. Assuming the [redacted] and [redacted] wells have sufficient capacity, these options could be further expanded to supply additional properties.

Shannon & Wilson assumes the property owner would physically, administratively, and financially manage the system. However, both [redacted] have indicated they would prefer a different option is selected. For this option to be feasible, the property owners would need to assume responsibility for system management including payment of water bills, ongoing water testing, and routine maintenance. A second disadvantage of these untreated systems is uncertainty in future PFAS concentrations in the source wells, or the potential for concentrations to change when groundwater draw is increased.

2.4.2 Existing, Treated Source

The following two small-scale distribution systems would require PFAS treatment (i.e. a POET system) of the source water. Distribution design and other considerations are included in Appendix A, while preliminary POET design information is included in Appendix B.

2.4.2.1 [redacted]

The [redacted] is considered a non-transient non-community PWS serving approximately 530 people (PWS ID No. 2263018). The well currently supplies the [redacted] buildings. Until the discovery of PFAS, an outdoor spigot served as a community water source for homes and businesses without water or whose water was unpalatable due to a high mineral content. This option includes installation of a POET system in the [redacted] building and an extension of this treated water to supply a nearby apartment building, office, and four single-family houses (Appendix A, Figure 5). Appendix B refers to this POET system as Combined System 1.

The [redacted] well is an estimated 45 feet deep and is currently untreated. The well diameter, production rate, and other details are unknown. It was drilled over 50 years ago and a driller's well log is not available. It is unknown if this well has sufficient capacity to supply adequate pressure at the system end point. HDR recommends conducting a flow

test and/or rehabilitating the well to meet peak demand requirements. Barr further recommends reviewing pressure head loss and hydraulic residence time.

The estimated total capital cost for this option is approximately $1.3 million. HDR's order-of-magnitude cost estimate for expanding distribution to nearby structures is approximately $1.2 million and includes system design, well rehabilitation, easements, and construction. If well redevelopment or a new pump are not required, the cost will be lower (Appendix A). Barr's estimated POET system capital cost is $135,000. This study assumes an outbuilding is required to accommodate the larger system. The anticipated capital cost for this option is lower than expanding the untreated [redacted] system; however, Barr's estimated annual O&M cost is approximately $30,000.

For this option to be implemented, the project team would need to apply for modification of the system's PWS permit. DEC will require supplying the items listed in both Sections 2.3 for POET systems and 2.4.1.1 for small-scale distribution. Barr assumes the treatment backwash water can be discharged to the [redacted] septic system without treatment. Shannon & Wilson recommends evaluating the septic system capacity to determine if it can accommodate backwash from the larger, combined POET system. Additionally, as noted in Section 2.3, the DEC Contaminated Sites program may not approve the discharge of untreated backwash water.

2.4.2.2 Well ID 191710

Of the impacted properties, Well ID 191710 is currently one of the highest water users. The well supplies four structures: an apartment building, an office, and two houses. Appendix B refers to it as Combined System 2. This option includes installation of a POET system and extension of the treated water to supply two additional, nearby homes (Appendix A, Figure 6).

The estimated total capital cost for this option is approximate $745,000. HDR's order-of-magnitude capital cost for expanding distribution is approximately $605,000 of the overall cost and Barr's estimated POET system is approximately $140,000. Shannon & Wilson assumes an outbuilding is required to accommodate the larger system. The estimated costs for this option POET are similar to Barr's proposed POET costs for Well ID 191710 without the two additional properties. Annual O&M costs are estimated at approximately $30,000.

The Well ID 191710 system is not currently a PWS and DEC's Drinking Water Program has indicated the expansion described above would not trigger PWS classification. The well is reportedly 70 feet deep and water is softened prior to use. The production rate is unknown, but water is supplied by a submersible 220-volt pump set at approximately 60 feet. Barr

recommends conducting a flow test and reviewing pressure head loss and hydraulic residence time for this option. The requirements for an existing, operational system may be less stringent than obtaining a DEC Drinking Water Program PWS permit. Shannon & Wilson also recommends reviewing septic system capacity, but note the current configuration is likely larger than the [redacted] system. The project team would need to work with the property owner to determine the POET outbuilding location, necessary piping modifications, and system management details.

2.4.2.3 Advantages and Disadvantages

The primary advantage of treated, small-scale distribution systems compared to individual POET systems is lower maintenance costs and less maintenance liability. The estimated O&M cost for the [redacted] system described above (Section 2.4.2.1) is less than half the combined O&M cost for individual systems. However, the anticipated capital cost is higher than individual POET systems. Additionally, the estimated total cost is approximately 15 percent that of municipal water expansion.

The disadvantages of this option include ongoing maintenance, inability to expand easily, and potential system management challenges. Should additional properties become impacted, the distribution system could be expanded relatively easily but the POET system would need to be reevaluated.

2.4.3 Drilled Well

Shannon & Wilson reviewed the possibility of constructing a small-scale distribution system supplied by a new water source. This option is not recommended by HDR given the lack of hydrologic information in the vicinity of the Dillingham Airport. If selected, this option would delay implementation of a long-term solution until after the first phase of site characterization, assuming characterization is conclusive. Shannon & Wilson does not recommend drilling a new water-supply well unless a location and depth can be selected that is upgradient or cross-gradient from PFAS source areas and samples report PFAS concentrations less than 10 percent of action levels. This study assumes the well would be drilled on Airport property, west of the runway and within one-half mile of the airport lease area.

This option would serve the Airport Spur Road and airport tenants only. The seventh impacted well, located off Kanakanak Road on Windmill Hill, is excluded due to its distance from the other impacted properties. The ballpark capital cost is $7.7 million. This study assumes distribution system design, easements, well rehabilitation, and construction will cost three times that of the [redacted] system. If the well can be located closer to the impacted properties, this would be an overestimate. Shannon & Wilson further

assumes the well would be no more than 100 feet deep, the location will be accessible by road, a 2-inch water main is sufficient, and water treatment would not be required. This cost estimate does not include environmental permitting, including but not limited to obtaining a wetland fill permit. Extending this water main to Kanakanak Road or a required increase in the water main diameter would increase the cost.

Depth, screen length and size, pump specifications, and other factors can be controlled when installing a new well and assist in providing adequate capacity for impacted properties. A second advantage of this option is the cost compared to expanding the City of Dillingham water system. The primary disadvantage of this option is uncertainty in future PFAS concentrations in the water-supply well. The source well would need to be located in an area unimpacted by the PFAS groundwater plume, currently and in the future. Shannon & Wilson is unable to predict the likelihood of PFAS concentrations increasing in a newly drilled well over time without aquifer testing information from PFAS site characterization activities.

For this option to be implemented, the project team would need to select a system manager. DOT&PF has indicated they are not interested in operating a PWS, however, it is unlikely another entity would be interested. It is possible the City of Dillingham could serve this role. The project team would need to obtain a PWS permit for the system. DEC's plan review would include engineering drawings, material specifications, peak demand and service pressure calculations, and other information, as requested.

2.4.4 Distribution Center

The City of Dillingham proposed trucking treated municipal water from their downtown water plant to a distribution center on airport property, then piping this water to the impacted properties. The distribution center would include a large holding tank or aboveground standpipe.

This option was considered as an alternative to drilling a new well. However, it is no longer considered feasible due to City of Dillingham's budget and staffing projections. This option is not included in Exhibits 4-1 and 4-2.

3 LOCAL PREFERENCES

In conversations with residents during Shannon & Wilson's November 2019 site visits, we noted owners and occupants of impacted properties have varied preferences for long-term alternate water sources. This diverse group includes business and homes, owners and renters, long-term community members and newcomers. Their water use and current water

system upkeep and maintenance costs also vary widely, depending on the quality of their water. The owner of Well ID 191300, who do not use their water for drinking or cooking, initially expressed reluctance at replacing their well with an alternative source. The owners of Well IDs 191050 and 200150 expressed a preference for POET systems because they are concerned other options will not allow them to maintain their water usage.

Shannon & Wilson noted many impacted-property owners consider the State of Alaska to be responsible for providing alternate water in perpetuity. Some residents may not find the settlement value agreeable and may choose to negotiate their claims with DRM.

Numerous residents expressed disappointment over the loss of the community water spigot at the church. The [redacted] is their preferred location for filling potable water containers, compared to filling containers at the downtown Dillingham Senior Center, due to convenience and reported water quality. Some community members report the City of Dillingham water can taste or smell of chlorine, however City staff note the water quality has improved considerably in the last few years.

During the summer fishing season many Dillingham residents are out of communication for long periods of time. This may make alternate water planning and/or construction challenging.

4 OPTION SUMMARY

The following exhibits compare order-of-magnitude costs, advantages, and disadvantages of the four long-term alternate water options. Exhibit 4-1 summarizes each option individually, while Exhibit 4-2 summarizes them by area. Water holding tanks and expansion of the municipal water system are excluded from Exhibit 4-2 because Shannon & Wilson assumes these options would only be selected if they can be enacted for all impacted properties. Drilling a new well to supply a small-scale distribution system would serve only the Airport Spur Road and airport lease areas. This option is also excluded from Exhibit 4-2.

HDR, Barr, and Shannon & Wilson cost estimates included herein vary in precision but are considered approximate, order-of-magnitude values. Once an option or combination of options is selected, the anticipated costs can be refined. These estimates should not be used by contractors to prepare bids. The project team does not have control over the cost of labor, materials, equipment, or work furnished by others; the contractor's actual or proposed construction methods or pricing; competitive bidding; or market conditions. Shannon & Wilson cannot guarantee that proposals, bids, or actual cost will be similar to the enclosed estimates. Shannon & Wilson is not a construction cost estimator or contractor. These

opinions of probable cost should not be considered equivalent to the nature and extent of services a construction cost estimator or contractor would provide.

Exhibit 4-1: Cost Summary by Option

Option	Capital Cost	Settlement Towards Long-Term Costs	Total Cost	Advantages	Disadvantages
Holding Tanks and Deliveries	$820,000	Unknown	Unknown	Simple construction, easily upscaled	Lack of water delivery infrastructure
Municipal Water System Expansion	$23,005,000	$20,000 [1]	$23,025,000	Reliability, easily upscaled	Most expensive option
Individual POET Systems	$460,000	$640,000 [2]	$1,100,000	Standalone solution for properties far from infrastructure, least expensive feasible option	Requires ongoing maintenance, redesign if regulatory standards change
Small-Scale Distribution Systems					
Exiting, Untreated Source [3]	$2,920,000	$15,000	$2,935,000	Logistical convenience, somewhat easily upscaled	Owner permission not granted, potential for PFAS concentrations in source wells to increase
Existing, Treated Source [4]	$2,340,000	$150,000 [2]	$2,490,000	Less ongoing maintenance than individual POET systems	Requires ongoing maintenance, not easily upscaled
Drilled Well [5]	$7,680,000	$5,000	$7,685,000	Easily upscaled	Potential for PFAS concentrations in source well to increase

NOTES:

Costs are considered approximate, rounded to the nearest $5,000.

1 Settlement of $3,000 per property, regardless of the property type or number of structures served. The City of Dillingham charges both metered and non-metered water rates by property type (i.e., single-family, multifamily, commercial).

2 Assumes settlement equal to 5 years of O&M costs for comparison purposes only. The settlement value has not been determined.

3 Includes combined costs of small-scale [redacted] systems.

4 Includes combined costs of small-scale [redacted] systems. [redacted] and [redacted] systems are untreated, there are no treated options for these areas.

5 Small-scale distribution system supplied by a drilled well would serve only the Airport Spur Road and airport lease areas.

Exhibit 4-2: Cost Summary by Area

Area	Option	Capital Cost	Settlement Towards Long-Term Costs	Total Cost	Advantages	Disadvantages
Airport Tenants	Individual POET Systems	$105,000	$165,000	$270,000	Standalone solution for properties far from infrastructure, least expensive feasible option	Requires ongoing maintenance, redesign if regulatory standards change
	Small-Scale Distribution from [redacted]	$625,000	$5,000	$630,000	Logistical convenience, somewhat easily upscaled	Potential for PFAS concentrations in source wells to increase
Airport Spur Road	Individual POET Systems	$200,000	$285,000	$485,000	Standalone solution for properties far from infrastructure, least expensive feasible option	Requires ongoing maintenance, redesign if regulatory standards change
	Small-Scale Distribution from [redacted]	$1,880,000	$5,000	$1,885,000	Logistical convenience, somewhat easily upscaled	Owner permission not granted, potential for PFAS concentrations in source wells to increase
	Small-Scale Distribution from [redacted]	$1,305,000	$140,000	$1,445,000	Less ongoing maintenance than individual POET systems	Requires ongoing maintenance, not easily upscaled
	Individual POET for [redacted] and Small-Scale Distribution from Property 191710	$785,000	$210,000	$995,000	Less ongoing maintenance than individual POET systems	Requires ongoing maintenance, not easily upscaled
Windmill Hill / Kanakanak Road	Individual POET System	$45,000	$70,000	$115,000	Standalone solution for properties far from infrastructure, least expensive feasible option	Requires ongoing maintenance, redesign if regulatory standards change
	Small-Scale Distribution from [redacted]	$415,000	$5,000	$420,000	Logistical convenience, somewhat easily upscaled	Owner permission not granted, potential for PFAS concentrations in source wells to increase

NOTES:

Costs are considered approximate, rounded to the nearest $5,000.

5 DISCUSSION

Shannon & Wilson reviewed numerous options for providing long-term alternate water to PFAS-impacted properties near the Dillingham Airport and was unable to identify a single preferred option.

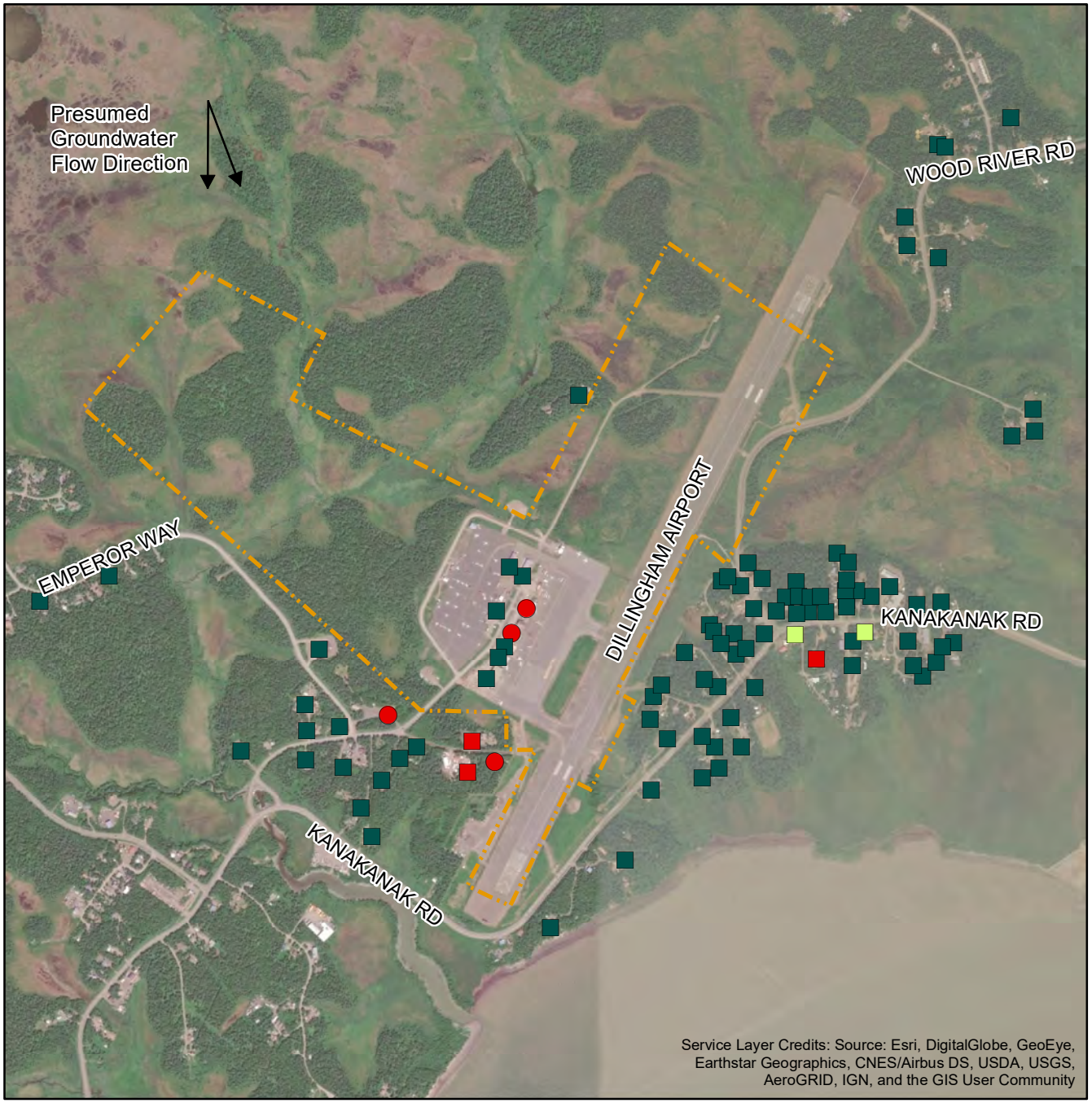
DRM and DOT&PF have expressed a preference for water storage tanks and deliveries (Section 2.1) with a reliable, long-term water delivery contractor. Municipal water system expansion (Section 2.2) has a considerably higher anticipated cost than the other options. Individual POET systems (Section 2.3) and small-scale distribution supplied by a treated water source (Section 2.4.2) require ongoing maintenance to remain effective. Small-scale distribution supplied by an existing, untreated water source (Section 2.4.1) or drilled well (Section 2.4.3) have the potential for PFAS concentrations in source wells to increase, and owner permission has not been granted.

Following your review of this feasibility study, Shannon & Wilson will schedule a follow up meeting to select a preferred option or combination of options.

Shannon & Wilson's assessment is based on:

- Shannon & Wilson's understanding of the project and information provided by the DOT&PF, DRM, HDR, Barr, City of Dillingham, impacted property owners and occupants, and other contacts in Dillingham.
- Site conditions Shannon & Wilson observed during visits to impacted properties as they existed in November 2019 and February 2020. These observations are specific to the locations and dates these visits occurred and may not be applicable to all areas of the site.
- The results of testing performed on water samples Shannon & Wilson collected from the water supply wells on, near, and downgradient from the Dillingham Airport.
- Shannon & Wilson's previous experience at and near the Dillingham Airport.
- Publicly available literature reviewed for this Report.
- The limitations of Shannon & Wilson's approved scope, schedule, and budget described in the October 15, 2019 scope of services.

Shannon & Wilson has prepared the enclosed document "*Important Information about Your Environmental Report*" to help you and others understand the use and limitations of this report. Regulatory agencies may reach different conclusions than Shannon & Wilson.



LEGEND

- Sum of PFOS + PFOA ≤ 17 nanograms per liter (ng/L)
- 18 to 69 ng/L
- ≥ 70 ng/L (over EPA advisory)
- Property considered affected before April 2019, compared to former DEC action level*
- Airport Boundary

0 0.25 0.5

Miles

N

*Sum of PFOS, PFOA, PFHxS, PFHpA, and PFNA

Dillingham Airport
Dillingham, Alaska

HIGHEST REPORTED WATER SUPPLY WELL ANALYTICAL RESULTS

October 2020 102786

SHANNON & WILSON, INC. GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

Figure 1

APPENDIX A: HDR REPORT

Appendix A

HDR, Inc. Alternative Water Supply Study

Memo

Date:	April 28, 2020
Project:	Dillingham PFAS Contamination - Alternative Water Supply Study
To:	Marcy Nadel, Shannon & Wilson, Inc.
From:	Anson Moxness, PE, Wescott Bott, PE, HDR
Subject:	Dillingham PFAS Contamination - Alternative Water Supply Study

HDR was contracted by Shannon & Wilson, Inc. (S&W) to examine the feasibility of alternative means to provide reliable and regulatory-compliant drinking water to properties served by wells that have been found to have per- and polyfluoroalkyl substance (PFAS) levels exceeding the US Enviornmental Protection Agency (EPA) lifetime health advisory (LHA) or former State of Alaska Department of Environmental Conservation (DEC) action level. This memorandum provides the analysis, potential advantages, disadvantages, challenges, and opinions of probable project cost of these alternatives. Referenced figures are attached at the end of the report.

Background Information

The following section provides general background information on the properties where water wells have been found to have PFAS levels above the applicable action level at the time of sampling, regulatory criteria and planning criteria, and methods used in the evaluation of alternative drinking water sources.

The current DEC action level and EPA LHA level are both 70 ppt for the sum of two PFAS compounds, perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA). The former DEC action level was 70 ppt for the sum of five PFAS compounds: PFOS, PFOA, perfluoroheptanoic acid (PFHpA), perflurohexanesulfonic acid (PFHxS), and perfluorononanoic acid (PFNA). Wells considered affected are compared to the action level at the time the sample was collected. The wells discussed in this report were all initially sampled at the time when the former DEC action level was in effect.

Study Areas

Based on the maps and GIS information provided by S&W of the wells tested for PFAS levels, the tested properties were separated into three areas. Figure 1 shows the project area map with these areas noted.

- Windmill Hill
  - One well serving a large group housing building
- Airport Spur
  - Four wells serving six homes and cabins, one apartment building, a small office, the [redacted] and a community water spigot
- Airport

- Two wells serving the [redacted] terminal, and an airport restaurant

Well logs for some of the wells in the area were found in the State of Alaska's Well Log Tracking System (WELTS); additional well logs were obtained from property owners. Not all well logs for area wells were available and some wells in the WELTS system did not have adequate location data. An examination of the available well logs showed no distinct correlation between the measured PFAS levels and well parameters such as total well depth, casing depth, and static water level. As there is no reliable technique to determine the location of the PFAS contamination in the groundwater without sampling the specific location, there is no guarantee that drilling a new well would provide uncontaminated water.

Water Demand

Water demand for the properties being evaluated has been developed based on estimates provided by property owners and EPA guidelines for water use. In general, there is significant variation of water demand between individuals and institutions. Without water meter records it is difficult to estimate exact water demand. The water demands presented in Table 1 are an estimate of summer period water use in each area when use may be highest. Actual water use may differ from the provided data. A summary of building types and their estimated water use is attached in Appendix A.

Table 1: Estimated per capita daily water use.

Use Type	Daily Water Demand (gal per capita/day, gpcd)
Single Family Home	100
Apartment	75
Office	15
Restaurant	8*

*per customer

Windmill Hill

The property on Windmill Hill is a large single family home with up to 15 residents. While technically this is a single family residence, for the purposes of this analysis, residents in this group housing are considered to use a similar amount of water as an apartment resident. The estimated summer water demand for this property is 1,125 gallons per day based on 15 residents.

Airport Spur

The properties in the Airport Spur include 6 privately owned cabins or single family homes, a business office, a 5-unit apartment building, the [redacted], and a community water supply spigot located on [redacted]. While not all cabins, homes, and apartments are occupied at all times, for the purposes of developing water demand estimates it is assumed that there are 13 cabin/house/rectory residents and 10 apartment residents. The [redacted] estimates that during the summer, the water demand for the community water supply spigot can be up to 400 gallons per day. The total estimated summer water demand for the Airport Spur properties is 2,095 gallons per day.

Airport
The properties at the airport include a hanger with approximately 2 employees, a terminal with approximately 9 employees, and a restaurant with up to 20 customers per day. The estimated summer water demand for the Airport properties is 325 gallons per day.

The properties at Windmill Hill, Airport Spur, and at the Airport are estimated to require a combined 3,950 gallons per day of water during the summer months.

Existing Municipal Water System

Properties in the City of Dillingham town site surrounding the harbor have water service provided by the City utility. Figure 1 shows the extent of the water system and the 3 areas discussed in this memorandum. GIS mapping data of the parcel lines, roads, and water system mains and other components were provided by the City of Dillingham Planning Department and their GIS contractor, Alaska Map Company on Nov 13, 2019. Water well PFAS sampling data was provided by S&W.

Opinions of Probable Project Cost

The City of Dillingham Planning Department provided bid results from a recent water system upgrade and road construction projects to aid the development of these opinions. Opinions of probable project cost (OPCC) are based on these bids, quotes from well drillers with experience in Dillingham, recent water master plan documentation, and bid tabs from the Municipality of Anchorage, factored to account for remote Alaska construction. The OPCCs provided below are conceptual rough order of magnitude values that would generally be considered Class 4 level of accuracy under AACE guidelines (AACE 18R-97). As such the OPCCs below include a 35 percent contingency cost on the construction subtotal to account for the current limited level of design. This contingency factor is based on HDR's professional judgment and is within the guidance provided by AACE 18R-97 for a Class 4 estimate.

Alternatives Analysis

This memorandum examines two alternatives to address the stated project objective. These alternatives are

1. Municipal Water System Extension
2. Small-Scale Water Distribution Systems

There are other possible solutions not examined by this report. These include alternatives such as point-of-entry and point-of-source treatment, or water delivery service and onsite storage. These alternatives were not included for analysis in the scope of this contract, but are referenced for potential use in combination with the two presented alternatives.

Alternative 1: Municipal Water System Extension

This alternative would extend the existing municipal water distribution system from the City of Dillingham town site to serve the properties. Approximately 11,100 linear feet of 8-inch water main and approximately 1,150 linear feet of water service lines would be required to connect municipal water service to the properties. The water main would be routed under the Dillingham Airport runway. Existing wells would be abandoned and water service lines would connect with existing private water service piping near the location of the wells and from there, water would flow to the buildings.

It is assumed that this municipal water system extension alternative would include fire protection capability, because the rest of Dillingham's municipal water system includes fire protection. However, after discussions with the State Fire Marshal's office and after review of the pertinent fire codes and City of Dillingham municipal code, it is HDR's understanding that the decision on whether or not to include fire protection capability in the design is up to the local authority having jurisdiction, in this case the City of Dillingham. The assumption of including fire protection adds costs due to the need for larger pipes and the need for fire hydrants.

The International Fire Code section 507.2 and Appendix C give guidance for spacing of fire hydrants depending on fire prevention needs. Specific placement of hydrants and the number required would need to be confirmed by the City Fire Chief during design. Twelve fire hydrants are included in the opinion of probable project cost. A map of the proposed alignment of the water system extension is provided in Figure 2.

Advantages

The community water wells serving the City of Dillingham water system are located a considerable distance from the presumed source of PFAS (the airport). Therefore, city water provided from these community wells should provide clean water to the properties under consideration in this study. Customers served by the City of Dillingham water system would benefit from the reliability and safety of a managed, treated, and regulated public water system.

While the initial construction of the water main and service lines would only provide water service to the buildings shown on Figure 1, this alternative would allow for possible future expansion to serve other properties. Should properties with moderate levels of PFAS continue

to see increasing levels of PFAS, this alternative would allow the future construction of additional service connections to provide city water.

The extension of the water system will traverse the heavily developed Windmill Hill area. There is an opportunity to add connections to additional properties. Approximately 100 properties would be within close proximity of the conceptual water main and could be added to the water system. An 8-inch water main is sufficiently sized to provide water service to the adjacent properties. These properties include six zoned apartment parcels, several commercial properties, and at least 85 residential properties. With a current City of Dillingham residential fee of $57.79 per month for water service and higher fees for commercial and apartment users, there is up to $7,000 of potential monthly revenue should all users connect to water service. While many property owners may elect to continue using well water, some may choose to connect to the water system.

Installation of the water main and associated fire hydrants will allow improved fire service to these areas. This alternative would increase the fire protection for many residents of Dillingham, could decrease homeowners' insurance premiums for residents, and boost firefighting capacity at the airport. A hydraulic analysis of the entire Dillingham water system would be necessary to accurately estimate the available fire flow to the residential areas and increase in firefighting capacity at the airport.

Disadvantages

This alternative has a large initial capital cost compared to other alternatives. The cost per connection is high if service is only provided to properties with tested PFAS levels above 70 ppt. Annual operations and maintenance costs of this alternative would be relatively low. Fire hydrants and valves would need to be routinely inspected and tested, but very little other maintenance would be necessary.

The construction of this alternative may have a large impact on the community. The installation of the water main beneath the airport runway may require that the runway be shut down during construction. Directional drilling may be possible to mitigate these impacts, but would drive up construction cost to mobilize the specialized equipment. The Dillingham Airport serves as a hub for the local area and receives, on average, 139 operations per day based on 2018 FAA airport records. Disruption to the airport should be avoided as there is only one runway and closure of the runway would result in closure of the airport. During design, it would be necessary to carefully evaluate design alternatives and construction timing to minimize airport impacts.

Extension of the water main would place additional water demand on the city water system. The 2015 City of Dillingham Water Master Plan prepared by Michael L Foster & Associates (Master Plan) indicates that there is 290,000 gallons per day (gpd) of water production capacity. One water supply well can produce up to 218,000 gpd and another can produce 72,000 gpd. The maximum observed daily demand as stated in the Master Plan was 200,000 gpd. The Master Plan states that on the highest demand days, contractors were requested to not fill water trucks to reduce total system demand. While the additional 3,950 gallons per day of demand would keep the total system demand under the total system supply, addition of a significant number of other properties would require additional water supply, treatment, and storage capacity.

Additional water supply wells and a treated water storage tank are noted as recommended projects in the Master Plan.

The Master Plan notes some water quality issues and proposes looping projects to improve this. The long length of larger diameter pipe in this alternative would result in high water age at end points of the system. High water age can result in water quality issues. Several methods to decrease water age include line flushing and water distribution pipe looping. These water age mitigation methods were not considered in the development of the opinion of probable project cost below. However, water quality and potential high water age should be considered during project design.

Opinion of Probable Project Cost

The opinion of probable project cost for this alternative was based on bids of recent work in the City of Dillingham and in other Alaskan communities. The cost of mobilization and demobilization, basic re-vegetation, and other civil work is not separately enumerated but is included within the unit cost of the water mains.

Item	Quantity	Units	Unit Cost	Cost
8" Water Main	10,500	LF	$450	$4,725,000
8" Water Main - Directional Drilling Under Runway	600	LF	$2,500	$1,500,000
Service Line	1,150	LF	$300	$345,000
Fire Hydrant	12	EACH	$16,000	$192,000
Asphalt Road Reconstruction	6,500	LF	$450	$2,925,000
Service Connection	7	EACH	$5,000	$35,000
Well Abandonment	7	EACH	$5,000	$35,000
	Subtotal			**$9,722,000**
	Contingency (35%)			$3,402,700
	Engineering and Construction Management (25%)			$2,430,500
	Administration and Legal (5%)			$486,100
	Total			**$16,041,300**

Alternative 2: Small-Scale Water Distribution System

This alternative would connect multiple buildings in close proximity to share an uncontaminated or treated water well. As each area of buildings has a unique layout and unique challenges, each area will be examined separately.

Alternative 2 was developed assuming the installation of 2-inch service connection lines for water distribution rather than the 8-inch water mains required for Alternative 1. The larger water mains are only necessary to transmit fire flows over long distances. As it would not be necessary to install fire hydrants in these smaller water distribution systems, the larger water mains are not necessary.

Area Summaries

Below, each area is summarized and proposed small-scale distribution system described.

WINDMILL HILL

On Windmill Hill, one well has a PFAS level above the EPA advisory level of 70 ppt. The [redacted] located 500 ft to the east of the property is served by an existing transient community Public Water System (ID AK261460). The public water system is managed by [redacted]. In order to create a small scale distribution system from this well, approximately 600 ft of water supply pipe would need to be installed. Installation of the water pipe would occur over several private properties and will require easements. A map of a proposed alignment can be seen in Figure 3.

AIRPORT SPUR

In the Airport Spur area there are four wells with PFAS levels above the EPA advisory level. The nearest non-privately owned, uncontaminated well is at the [redacted]. The [redacted] well has an existing transient non-community Public Water System (ID AK2263071) and is managed by the [redacted] the land is owned by the City of Dillingham. This alternative would involve likely rehabilitating the existing well and installing a new pump. In order to create a small-scale distribution system utilizing this well, approximately 2,900 linear feet of water supply pipe would need to be installed. Installation of the water pipe would occur either within the road easement or on the [redacted] property. An easement would have to be obtained on the [redacted] property for the water supply pipe. A map of a proposed alignment can be seen in Figure 4.

Another option for this area would be to implement a PFAS treatment system at the [redacted] well to serve a small scale distribution system serving the [redacted] community water spigot, and the three properties along Airport Spur Road. A new well or utilization of the existing well is possible for this option. In order to create this system, approximately 1,700 linear feet of water supply pipe would need to be installed. Installation of the water supply pipe would occur within the road right of way and require obtaining approval from the owner of the right of way. An opinion of probable project cost for this alignment is included but is not complete as the costs for a PFAS treatment system of this size is unknown at this time and an owner and manager of the system has not been identified. The water system at the [redacted] has an existing Non-Transient Non-community public water system (ID AK2263018) managed by [redacted]. Consultation with DEC during design and construction is advised to ensure that construction

and management complies with regulations. A map of a proposed alignment can be seen in Figure 5.

A final option for this area would be to implement a PFAS treatment system at one of the wells at a property along Airport Spur road, which could supply other nearby properties. A new well or utilization of one the existing wells is possible for this option. A proposed alignment can be seen in Figure 6. This alignment would require 750 linear feet of water supply pipe. The alignment would require PFAS treatment at one of the properties along Airport Spur Road. Installation of the water supply pipe would occur within the road right of way and require obtaining approval from the owner of the right of way. An opinion of probably project cost for this alignment is included, but is not complete as the costs of PFAS treatment system is not included and an owner and manager of the system has not been identified. This water system may be small enough to not be regulated by Alaska Department of Environmental Conservation (DEC) regulations for community water systems, though consultation with DEC is advised to ensure that construction and management complies with regulations

AIRPORT

The Airport area contains two wells with PFAS levels above the EPA advisory level. These wells provide water to a hangar, airport terminal, and an airport restaurant. The Alaska Department of Transportation (DOT) owns an unaffected well near the property. A small-scale distribution system consisting of approximately 825 linear feet of water supply pipe could serve this area as the two properties could connect to the existing DOT well. As the well is already publically owned, this could simplify operating a small-scale distribution system. Easements or right-of-ways would still need to be obtained for any pipes in roads. An owner and manager of the system has not been identified.

Due to the number of restaurant patrons served in addition to the airport workers, this water system would likely be classified as a transient non-community water system. This designation necessitates a public water system review and approval from the Alaska DEC as well as regular water quality testing. A map of a proposed alignment can be seen in Figure 7.

Potential Challenges to Development

There are several potential overarching challenges with developing small-scale distribution systems in the affected areas. The following sections briefly discuss each of these challenges.

SYSTEM MANAGEMENT

Depending on the size and number of residents served, small-scale water distribution systems could be categorized as “community”, “transient non-community”, or “non-transient” water systems per Alaska DEC guidelines (18 AAC 80). Water systems which provide water to at least 25 people or 15 residences for over 60 days per year will have a state classification. In addition to water supply regulations, a legal framework would need to be developed in order to direct the responsibilities of ownership and maintenance of the water supply and water distribution network. Options include, but are not limited to, a private co-operative agreement, a private utility wholly owned by the landowner where the well is located, or a city-managed utility. Whether private water supply pipes can be located within public right-of-ways must also be

addressed prior to construction. These legal and logistical issues are outside of the scope of this technical memorandum.

WELL SELECTION

A challenge with using walls is identifying one free of PFAS contamination. While several wells around the study area properties have tested below PFAS detection or action levels, many of these are privately owned wells. Beyond the utility management aspects discussed above, permission to use a privately owned well, originally designed for a single home, as a source of water for other properties must be negotiated. In this analysis, it is assumed that either a new well can be drilled, or the use of a commercially or publically owned well is available. In the case of alternatives that would involve drilling a new well, there is no guarantee that it will be free of PFAS contamination. There is no discernible pattern of PFAS contamination with regard to well construction, depth, or casing, and no exhaustive groundwater modelling has been performed. Therefore, it is impossible to predict if a new well will be free of PFAS contamination.

EXISTING WELL DEVELOPMENT

The limited information from well logs make it difficult to determine the yield of many wells in the area. A well flow test must be performed in order to determine if the existing well has sufficient supply and recovery rate for the additional buildings that would be connected. The installation of a new, higher capacity well pump may be necessary if the well recovery rate is sufficient but the existing well pump is inadequate to provide the necessary flow or pressure to the system.

Additionally, the increase in flow from a single well could draw a larger plume of contaminated groundwater, which could result in increased PFAS levels in that well. Without additional groundwater or contaminant modelling, there is no definitive way of determining the extent of possible future contamination issues.

Opinions of Probable Project Cost

The following tables present opinions of probable project cost for the proposed alignments in each affected area. These opinions assume that no new wells will need to be drilled. The cost of a new well installation would vary depending on the depth of wells. Including the well pump and well pump installation, the average cost of a new well drilled would be approximately $25,000. This cost would be added to the subtotal of any alternative opinion of probable project cost. Well rehabilitation and new well pump installation was assumed to be equal to new well development. The final cost could be lower if the existing well is found to be adequate and only a limited amount of rehabilitation work is necessary.

Opinions below do not enumerate costs such as mobilization and demobilization which can be quite high in rural areas. Instead, these costs are included within the unit cost of the water distribution lines assuming that multiple small-scale distribution systems are installed within one construction season. Costs such as re-seeding and re-vegetation are including within the unit cost of water distribution lines. However if extensive site work is necessary, extra costs would be incurred.

WINDMILL HILL

This opinion of probable project cost includes water distribution system utilizing the well at the [redacted] to serve the property on Windmill Hill, see Figure 3. As the proposed

routing goes through a forested area, additional vegetation costs were necessary. As the proposed supply well has an existing public water supply ID and utility, limited work would have to be performed to certify and update the well.

Item	Quantity	Units	Unit Cost	Cost
2" Water Distribution Line	600	LF	$350	$210,000
Additional Re-vegetation	1	LS	$20,000	$20,000
Service Connection	1	EACH	$5,000	$5,000
Well Abandonment	1	EACH	$5,000	$5,000
Utility Formation and Easement Acquisition	1	LS	$10,000	$10,000
	Subtotal			**$250,000**
	Contingency (35%)			$87,500
	Engineering and Construction Management (25%)			$62,500
	Administration and Legal (5%)			$12,500
	Total			**$412,500**

AIRPORT SPUR AND [redacted]

This opinion of probable project cost includes water distribution system utilizing the well at the [redacted] serving the [redacted] and the properties along Airport Spur Road, see Figure 4.

Item	Quantity	Units	Unit Cost	Cost
2" Water Distribution Line	2,900	LF	$350	$1,015,000
Service Connection	4	EACH	$5,000	$20,000
Well Abandonment	4	EACH	$5,000	$20,000
Well Rehab and New Pump Installation	1	EACH	$25,000	$25,000
Utility Formation and Easement Acquisition	1	LS	$60,000	$60,000
	Subtotal			**$1,140,000**
	Contingency (35%)			$399,000
	Engineering and Construction Management (25%)			$285,000
	Administration and Legal (5%)			$57,000
	Total			**$1,881,000**

AIRPORT SPUR AND [redacted] SOURCE

This opinion of probable project cost includes water distribution system utilizing the well at the [redacted] serving the [redacted] and the properties along Airport Spur Road, see Figure 5. This opinion of probable project costs does not include the cost of a PFAS treatment system at the [redacted] sized to treat sufficient water volume for all connections.

Item	Quantity	Units	Unit Cost	Cost
2" Water Distribution Line	1,700	LF	$350	$595,000
Service Connection	3	EACH	$5,000	$15,000
Well Abandonment	3	EACH	$5,000	$15,000
New Well or Well Rehab, Pump Install, Certification	1	EACH	$25,000	$25,000
Utility Formation and Easement Acquisition	1	LS	$60,000	$60,000
	Subtotal			**$710,000**
	Contingency (35%)			$248,500
	Engineering and Construction Management (25%)			$177,500
	Administration and Legal (5%)			$35,500
	Total			**$1,171,500**

AIRPORT SPUR LOCAL TREATMENT

This opinion of probable project cost includes water distribution system utilizing a well along Airport Spur to serve the other nearby properties with the [redacted] utilizing a local PFAS treatment, see Figure 6. This opinion of probable project costs does not include the cost of PFAS treatment systems at the supply well.

Item	Quantity	Units	Unit Cost	Cost
2" Water Distribution Line	750	LF	$350	$262,500
Service Connection	2	EACH	$5,000	$10,000
Well Abandonment	2	EACH	$5,000	$10,000
New Well or Well Rehab, Pump Install, Certification	1	EACH	$25,000	$25,000
Utility Formation and Easement Acquisition	1	LS	$60,000	$60,000
	Subtotal			**$367,500**
	Contingency (35%)			$128,625
	Engineering and Construction Management (25%)			$91,875
	Administration and Legal (5%)			$18,375
	Total			**$606,375**

AIRPORT

This opinion of probable project cost includes a water distribution system utilizing a well owned by Alaska DOT, see Figure 7. A certification process will be necessary to convert the private well into a public water system.

Item	Quantity	Units	Unit Cost	Cost
2" Water Distribution Line	825	LF	$350	$288,750
Service Connection	2	EACH	$5,000	$10,000
Well Abandonment	2	EACH	$5,000	$10,000
New Well or Well Rehab, Pump Install, Certification	1	EACH	$40,000	$40,000
Utility Formation and Easement Acquisition	1	LS	$30,000	$30,000
	Subtotal			**$378,750**
	Contingency (35%)			$132,563
	Engineering and Construction Management (25%)			$94,688
	Administration and Legal (5%)			$18,938
	Total			**$624,938**

Opinion of Probable Operations and Maintenance Costs

In order to fully capture the estimated costs of the small-scale water distribution system, operations and maintenance (O&M) costs were estimated. Items included in the rough opinion of probable O&M cost are: additional pump electrical costs, part-time employees for administrative, testing, and maintenance work, water testing costs, and other costs for items such as repairs, insurance, and general overhead. The Opinion of Probable O&M costs apply to each small scale distribution system and do not include additional costs for operating any proposed PFAS treatment system.

PUMP ELECTRICAL COSTS

Electricity costs approximately $0.44/kWh for residential and small commercial customers according to Nushtel Cooperative publications. While pump selection and anticipated water flow would affect the total power demand by the well supply pump, an estimate of $100 per month was calculated for the area with the highest water demand (Airport Spur).

EMPLOYEE COSTS

In order to manage billing, utility payment, utility management, perform required water quality testing, and make any repairs or maintenance necessary to the systems, a part-time employee is necessary. It was estimated this work would average one 8-hour work day per week. Including a multiplier for overhead and benefit costs, at a wage of $25/hour, the employee would cost approximately $1,600 per month.

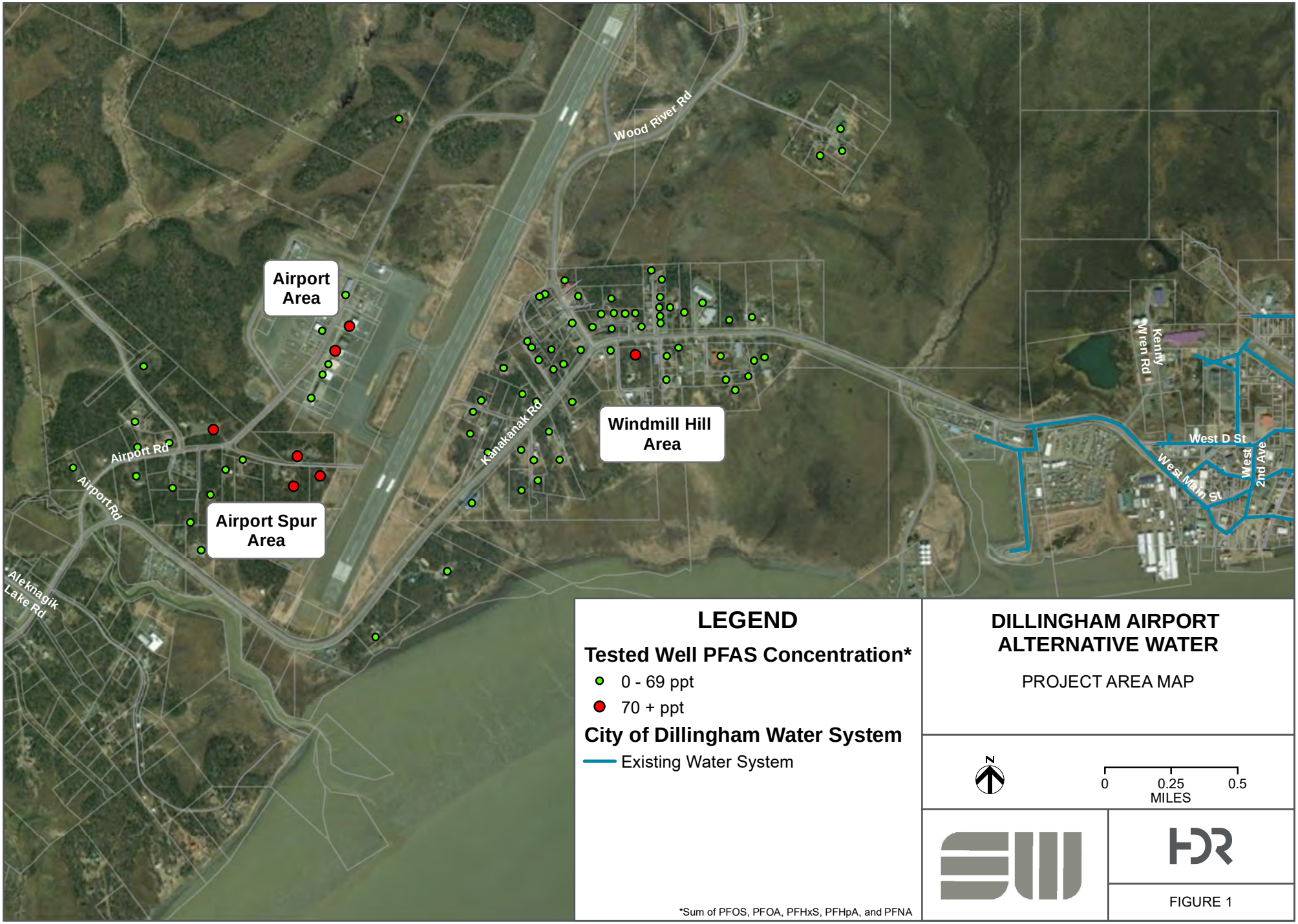
WATER TESTING

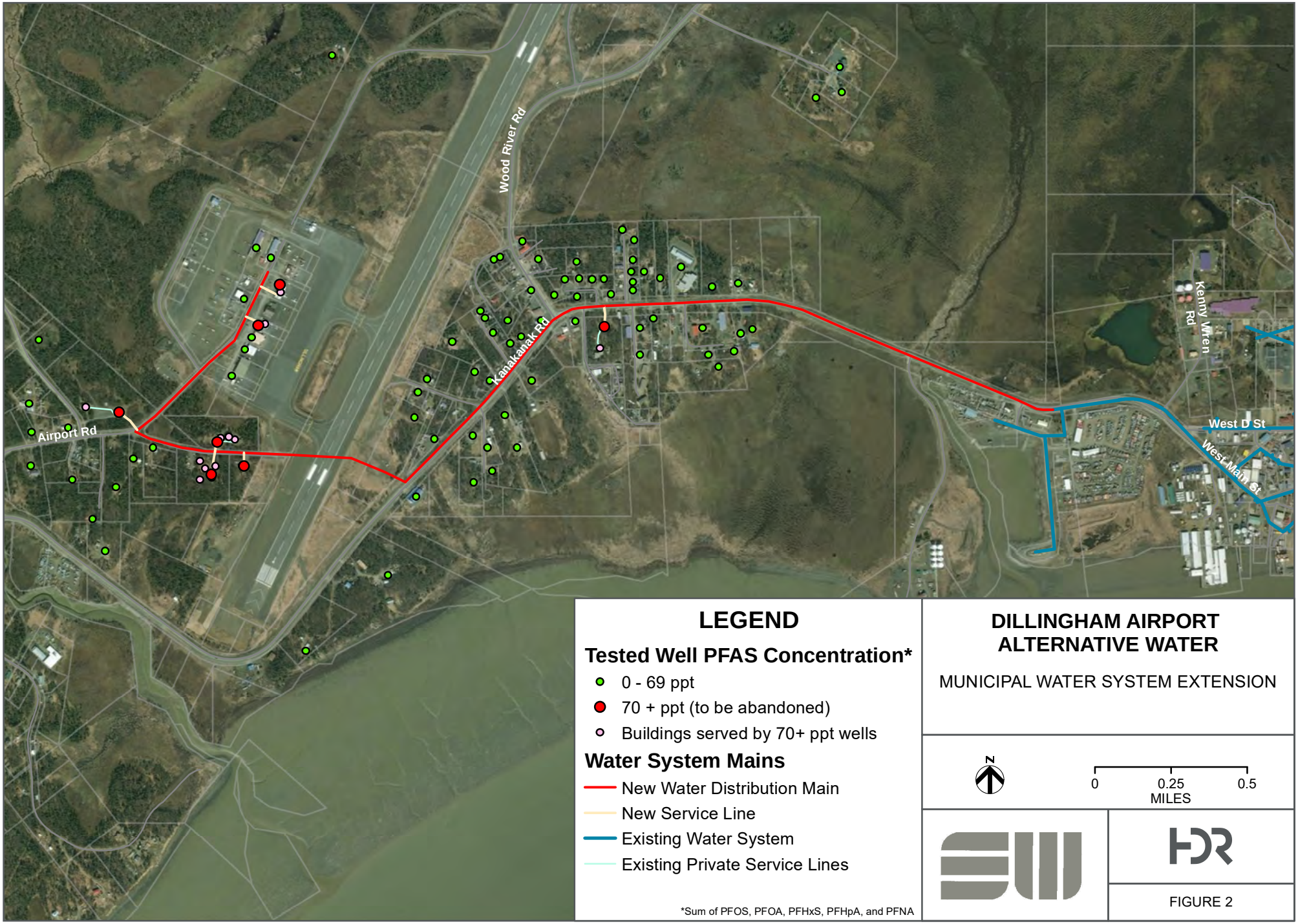
All registered water supply systems are required to go through regular water testing. Monthly tests for coliform are generally required along with lead and copper testing and other tests at longer intervals. In addition, regular PFAS testing is recommended to monitor the levels of contamination in the supply wells. These costs were estimated to be $400 per month.

OVERHEAD

Other overhead costs such as parts for repairs and maintenance, and insurance were bundled and estimated at $400 per month.

Item	Cost
Pump Electrical Costs	$100
Administration/Maintenance (assume 0.2 FTE @ $25/hr)	$1,600
Testing (DEC Required & PFAS)	$400
Other Overhead Costs (Insurance, Repairs, etc)	$400
Total	$2,500


Airport Area
Windmill Hill Area
Airport Spur Area
Wood River Rd
Kanakanak Rd
Airport Rd
Airport Rd
Aleknagik Lake Rd
Wren Rd
Kenny
West D St
West Main St
West 2nd Ave
LEGEND
Tested Well PFAS Concentration*
0 - 69 ppt
70 + ppt
City of Dillingham Water System
Existing Water System
*Sum of PFOS, PFOA, PFHxS, PFHpA, and PFNA
DILLINGHAM AIRPORT ALTERNATIVE WATER
PROJECT AREA MAP
N
0
0.25
0.5
MILES
FIGURE 1



LEGEND

Tested Well PFAS Concentration*

- 0 - 69 ppt
- 70 + ppt (to be abandoned)
- Buildings served by 70+ ppt wells

Water System Mains

- New Water Distribution Main
- New Service Line
- Existing Water System
- Existing Private Service Lines

*Sum of PFOS, PFOA, PFHxS, PFHpA, and PFNA

DILLINGHAM AIRPORT ALTERNATIVE WATER

MUNICIPAL WATER SYSTEM EXTENSION

N

0 0.25 0.5
MILES

FIGURE 2

LEGEND

Tested Well PFAS Concentration*

- 0 - 69 ppt
- 70 + ppt (to be abandonned)
- Buildings served by 70+ ppt wells

Small-Scale Distribution System

- New Distribution Pipe
- Existing Private Service Lines

*Sum of PFOS, PFOA, PFHxS, PFHpA, and PFNA

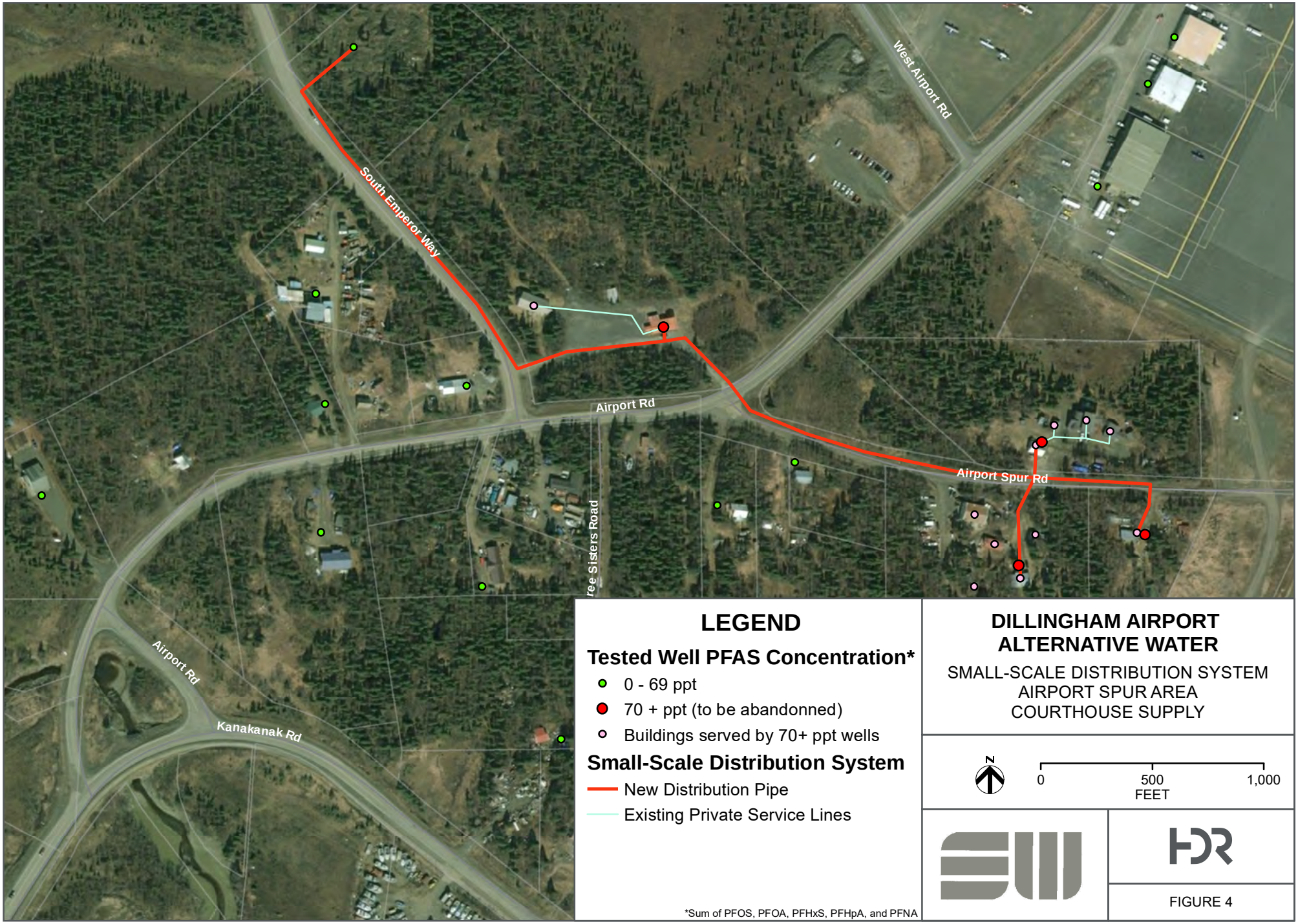
DILLINGHAM AIRPORT ALTERNATIVE WATER

SMALL-SCALE DISTRIBUTION SYSTEM
WINDMILL HILL AREA

N

0 250 500
FEET

FIGURE 3



LEGEND

Tested Well PFAS Concentration*

- 0 - 69 ppt
- 70 + ppt (to be abandonned)
- Buildings served by 70+ ppt wells

Small-Scale Distribution System

- New Distribution Pipe
- Existing Private Service Lines

*Sum of PFOS, PFOA, PFHxS, PFHpA, and PFNA

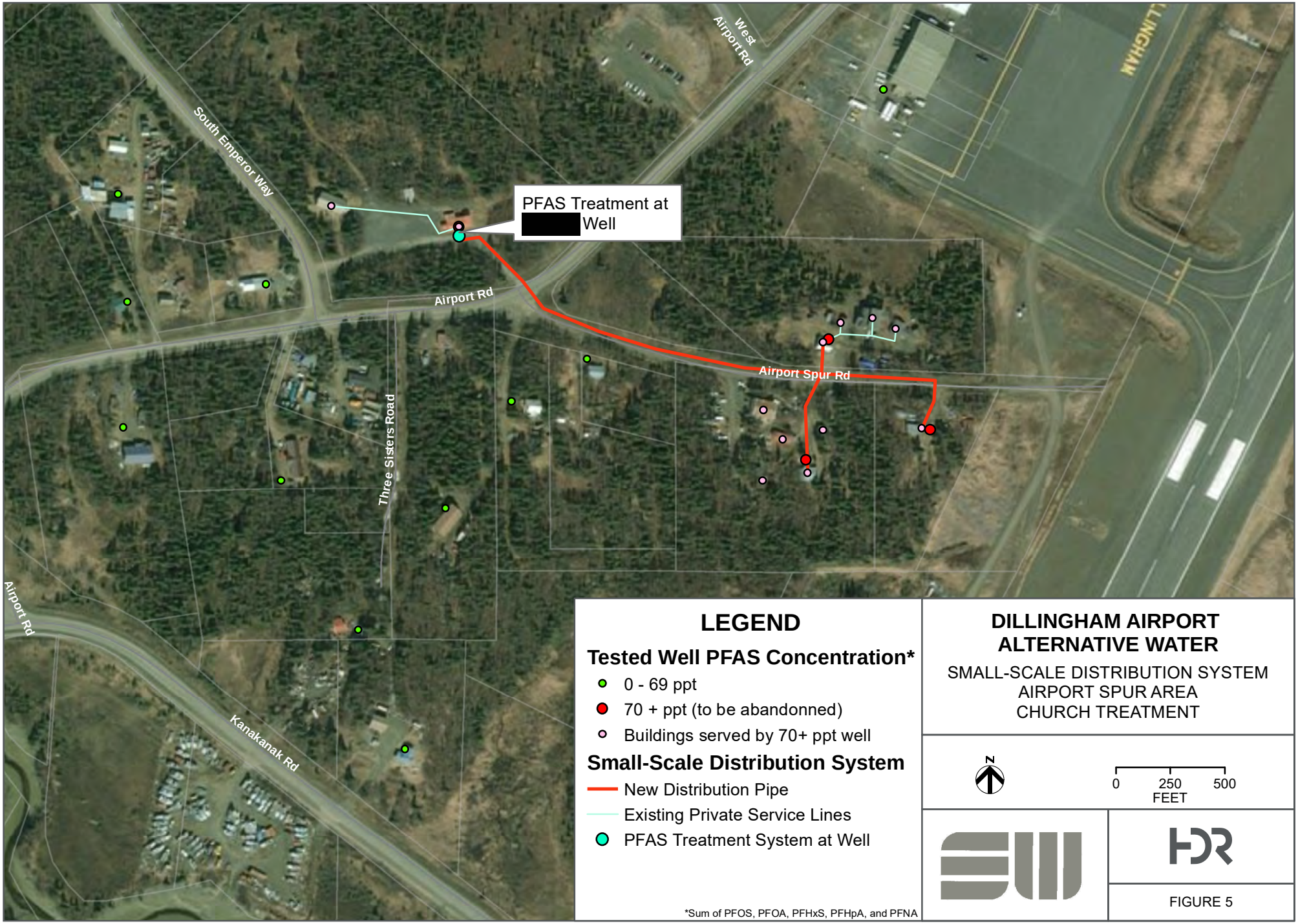
DILLINGHAM AIRPORT ALTERNATIVE WATER

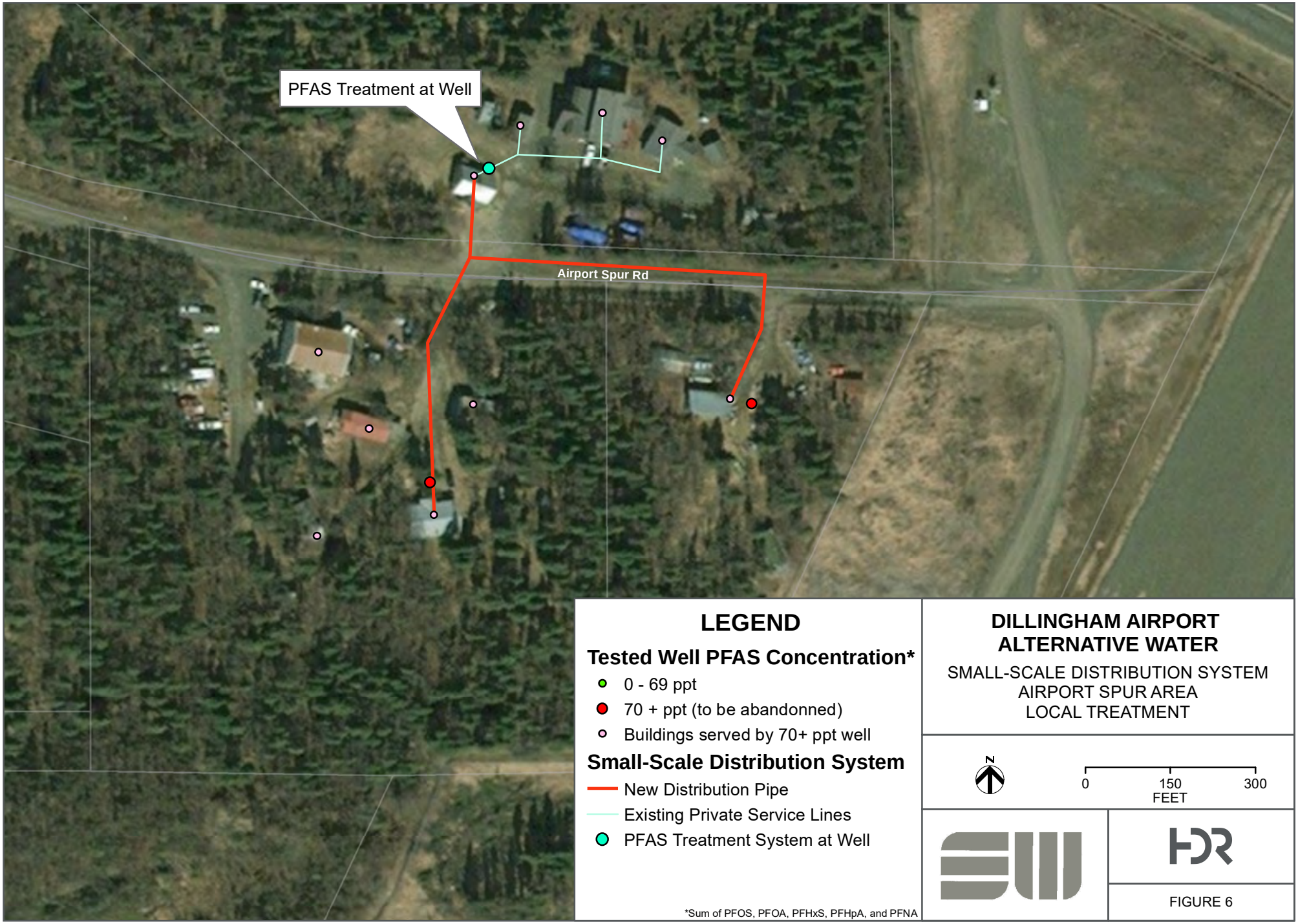
SMALL-SCALE DISTRIBUTION SYSTEM
AIRPORT SPUR AREA
COURTHOUSE SUPPLY

N

0 500 1,000
FEET

FIGURE 4


PFAS Treatment at [redacted] Well
South Emperor Way
West Airport Rd
Airport Rd
Airport Spur Rd
Three Sisters Road
Kanakanak Rd
Airport Rd
LEGEND
Tested Well PFAS Concentration*
0 - 69 ppt
70 + ppt (to be abandonned)
Buildings served by 70+ ppt well
Small-Scale Distribution System
New Distribution Pipe
Existing Private Service Lines
PFAS Treatment System at Well
*Sum of PFOS, PFOA, PFHxS, PFHpA, and PFNA
DILLINGHAM AIRPORT ALTERNATIVE WATER
SMALL-SCALE DISTRIBUTION SYSTEM
AIRPORT SPUR AREA
CHURCH TREATMENT
N
0
250
500
FEET
FIGURE 5



LEGEND

Tested Well PFAS Concentration*

- 0 - 69 ppt
- 70 + ppt (to be abandonned)
- Buildings served by 70+ ppt well

Small-Scale Distribution System

- New Distribution Pipe
- Existing Private Service Lines
- PFAS Treatment System at Well

*Sum of PFOS, PFOA, PFHxS, PFHpA, and PFNA

DILLINGHAM AIRPORT ALTERNATIVE WATER

SMALL-SCALE DISTRIBUTION SYSTEM
AIRPORT SPUR AREA
LOCAL TREATMENT

N

0 150 300
FEET

FIGURE 6


West Airport
Airport
West Airport
LEGEND
Tested Well PFAS Concentration*
0 - 69 ppt
70 + ppt (to be abandonned)
Buildings served by 70+ppt wells
Small-Scale Distribution System
New Distribution Pipe
*Sum of PFOS, PFOA, PFHxS, PFHpA, and PFNA
DILLINGHAM AIRPORT
ALTERNATIVE WATER
SMALL-SCALE DISTRIBUTION SYSTEM
AIRPORT AREA
N
0
250
500
FEET
FIGURE 7

Appendix A

Water Demand Calculations

Development Area	Sample ID	Address	Description	People	gpcd	Gal/day (gpd)	Total (gpd)
Airport							325
	191300	[redacted]	Hangar	2	15	30	
	191320		Airport Terminal	9	15	135	
			Restaurant	20	8	160	
Airport Spur							2,095
	191700		House	2	100	200	
	191710		Apartment	10	75	750	
	191710		House	2	100	200	
	191710		House	2	100	200	
	191710		Office	3	15	45	
	191720		Cabin	2	100	200	
	191050		Rectory	1	100	100	
	191050		Community Spigot	1	400	400	
Windmill Hill							1,125
	200150		Group Housing	15	75	1,125	
						Total (gpd)	3,545

Memo

Date:	July 24, 2020
Project:	Supplement to Dillingham PFAS Contamination - Alternative Water Supply Study
To:	Marcy Nadel, Shannon & Wilson, Inc.
From:	Anson Moxness, PE, Wescott Bott, PE, HDR
Subject:	Municipal Water Expansions Pipe Routes

During development of the alternative of extending the City of Dillingham municipal water system to serve the affected properties, both pipe routing under the Dillingham Airport runway and around the runway were considered. Only the route under the airport was included in the initial report. Below is a brief comparison of the two pipe routes. Figure 8 shows the pipe route around the airport.

Route Around the Airport

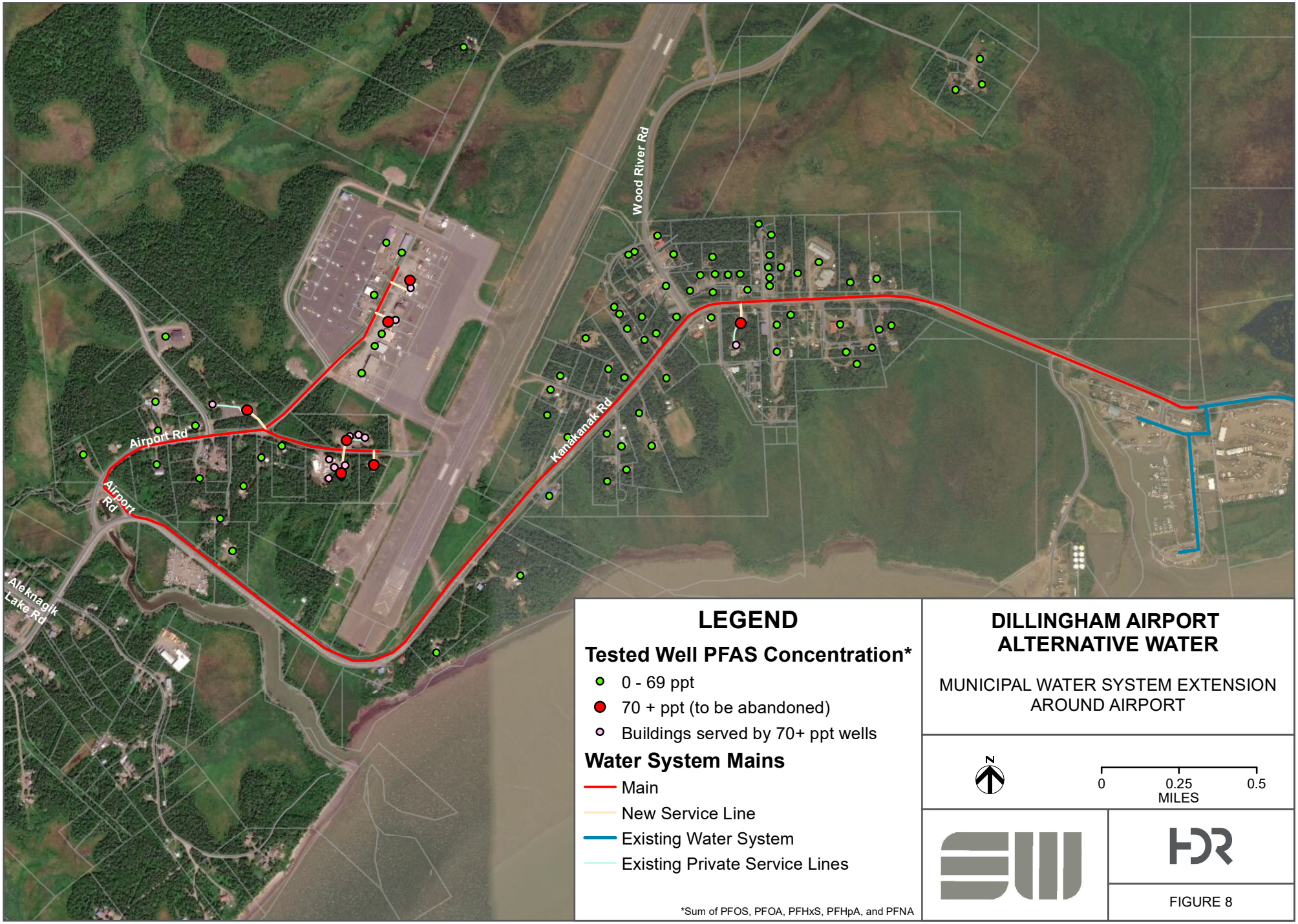
This route uses traditional trenching techniques to construct a 16,500 pipe following Kanakanak Road around the airport from the existing municipal water system and terminates at the airport. Traditional trenching techniques have been used in prior water line construction in Dillingham. However, the additional length of pipe and asphalt road needing reconstruction adds significant cost to the project compared to the routing under the airport. Additionally, this alternative may impede traffic trying to access homes and business east of the airport during construction.

Below is the opinion of probable project cost of routing the pipe around the airport:

Item	Quantity	Units	Unit Cost	Cost
8" Water Main	16,500	LF	$450	$7,425,000
Service Line	1,150	LF	$300	$345,000
Fire Hydrant	18	EACH	$16,000	$288,000
Asphalt Road Reconstruction	13,000	LF	$450	$5,850,000
Service Connection	7	EACH	$5,000	$35,000
Well Abandonment	7	EACH	$5,000	$35,000
	Subtotal			**$13,943,000**
	Contingency (35%)			$4,880,050
	Engineering and Construction Management (25%)			$3,485,750
	Administration and Legal (5%)			$697,150
	Total			**$23,005,950**

Route Under the Airport

This route utilizes the trenchless technology of horizontal directional drilling under the runway, which shortens the overall pipe length needed to serve affected properties and limits the impact to traffic along Kanakanak Road during construction. This method has been used under other active airports in the past and the Air Force has issued a technical letter giving guidance for using trenchless technology under Air Force pavements. Use of HDPE pipe reduces the risk of pipe breaks due to corrosion which would limit the long term effects to the runway pavement. To our knowledge, this technology has not been used in Dillingham for prior water line construction. Due to the lower pipe length, the project cost would likely be significantly lower than the alternative of routing around the airport.



LEGEND

Tested Well PFAS Concentration*

- 0 - 69 ppt
- 70 + ppt (to be abandoned)
- Buildings served by 70+ ppt wells

Water System Mains

- Main
- New Service Line
- Existing Water System
- Existing Private Service Lines

*Sum of PFOS, PFOA, PFHxS, PFHpA, and PFNA

DILLINGHAM AIRPORT ALTERNATIVE WATER

MUNICIPAL WATER SYSTEM EXTENSION AROUND AIRPORT

N

0 0.25 0.5
MILES

FIGURE 8

APPENDIX B: BARR REPORT AND SUPPORTING INFORMATION

Appendix B

Barr Engineering Co. Feasibility Report and Supporting Information

CONTENTS

B.1 Analytical Sampling..... ii

Enclosures

- Barr Engineering Co. Dillingham Airport PFAS Point-of-Entry Treatment Feasibility Report
- SGS North America, Inc. (SGS) Lab Report 1199948 and Laboratory Data Review Checklist (LDRC)
- Eurofins TestAmerica Laboratories, Sacramento (TestAmerica) Lab Report 320-56436 and LDRC
- Residential Well Sampling Logs

APPENDIX B: BARR REPORT AND SUPPORTING INFORMATION

B.1 ANALYTICAL SAMPLING

On November 14 and 15, 2020, Shannon & Wilson, Inc. field staff collected groundwater samples from four impacted water supply wells (Well IDs 191050, 191320, 191710, and 200150) to inform Barr's treatment recommendations. Copies of completed *Residential Well Sampling Logs* are enclosed. The analytical water samples were submitted for determination of total suspended solids, metals, petroleum compounds, pH, organic carbon, and PFAS by SGS North America, Inc. and Eurofins TestAmerica. SGS North America, Inc. subcontracted determination of arsenite, arsenate, dimethylarsinic acid (DMA), and monomethylarsonic acid (MMA) to Brooks Applied Labs. An analytical results summary table is included within Barr's report.

Shannon & Wilson reviewed the analytical results for laboratory quality control samples and conducted a quality assurance (QA) assessment for this project. These QA review procedures allowed Shannon & Wilson to document the accuracy and precision of the analytical data, as well as check the analyses were sufficiently sensitive to detect analytes at levels below regulatory standards. The results are presented in the appended SGS North America, Inc. report 1199948, Eurofins TestAmerica report 320-56436, and associated DEC Laboratory Data Review Checklists (LDRCs).

Shannon & Wilson considers the samples collected for this project to be representative of site conditions at the locations and times they were obtained. Based on this QA review, no samples were rejected as unusable due to quality control failures. In general, the quality of the analytical data for this project does not appear to have been compromised by analytical irregularities and is adequate for the purposes of this assessment.

APPENDIX B: BARR REPORT AND SUPPORTING INFORMATION

BARR'S POINT-OF-ENTRY TREATMENT FEASIBILITY REPORT

resourceful. naturally.
engineering and environmental consultants

BARR

Technical Memorandum

To: Scott Jordan, Alaska Department of Administration (DOA)
From: Andy McCabe, Katie Wolohan, Bryan Oakley and Brian Angerman, Barr Engineering Co. (Barr)
Subject: Dillingham Airport PFAS Point-of-Entry Treatment Feasibility Report
Date: April 23, 2020
Project: Shannon & Wilson, Inc., Dillingham Feasibility Report
c: Kristen Freiburger, Shannon & Wilson, Inc.

1.0 Background

Shannon & Wilson, Inc. (S&W) began collecting per- and polyfluoroalkyl substances (PFAS) samples from private wells near and downgradient of the Dillingham Airport in February 2019. Prior to the first mobilization, the Alaska Department of Environmental Conservation (DEC) had sampled nine wells and encountered a public water source that exceeded the former DEC action level for drinking water. S&W's initial well search and sampling effort occurred in February and March 2019. The well search area was expanded in response to detections of PFAS east of the Dillingham Airport in June 2019. To date, nearly 100 private wells have been sampled between February 26 and November 16, 2019.

On April 9, 2019, the DEC action level for drinking water was aligned with the U.S. Environmental Protection Agency (EPA) lifetime health advisory (LHA) level of 70 parts per trillion (ppt) for the sum of two PFAS compounds, perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA). Prior to April 2019, the DEC action level was 70 ppt for the sum of five PFAS compounds: PFOS, PFOA, perfluoroheptanoic acid (PFHpA), perflurohexanesulfonic acid (PFHxS), and perfluorononanoic acid (PFNA). Wells considered affected are compared to the action level at the time the sample was collected. Seven of the private wells sampled in Dillingham are impacted by PFAS. Those who use their wells for drinking or cooking are currently receiving interim bottled water deliveries.

S&W partnered with Barr Engineering Co. (Barr) to evaluate feasibility of point-of-entry treatment (POET) systems for PFAS at the impacted properties. This memorandum includes recommendations for PFAS water treatment along with related pre- and post-treatment for water treatment systems that will be installed at the impacted properties if water treatment is selected. Table 1 summarizes the properties addressed in this memorandum. Each property has one well. Note property 191720 (cabins on Airport Spur Road) has been excluded from this report because the property owner declined to provide access for a site assessment in February 2020.

Table 1 Summary of properties addressed in this memorandum

Property ID number	Property Description	Address
191050	Church, rectory, and community water spigot	509 Airport Rd
191300	Hangar	ADA-09029 Block 500, Lot 5B 720 Airport Rd
191320	Airport terminal and restaurant	ADA-09024 Block 500, Lot 7B, 750 Airport Rd
191700	House	2531 Airport Spur Rd
191710	Apartment Building, two houses (House A and B), and office	Multiple addresses on Airport Spur Road
200150	Group housing	1629 Kanakanak Rd

2.0 Site Assessment Summary – Dillingham, AK

On November 14 and 15, 2019, a representative from S&W visited the properties listed in Table 1 to collect details on current water use, available space, and, if present, existing treatment systems. Water samples were also collected to assess the water quality at the site to inform potential pretreatment. Daily water use estimates based on the site visits are summarized in Table 2. The complete site visit reports for the water supplies at these properties are provided in Attachment 1.

Water pressure-related concerns were noted at property 191300 (commercial hangar), specifically when severe iron fouling is observed. No water pressure-related concerns were noted at any of the other properties. The pressure recorded at the bladder tanks were all greater than 100 pounds per square inch (PSI). Concerns related to water odors and staining were noted at properties 191300, 191320, 191700, 191710, and 200150.

Table 2 Summary of site occupancy and estimate daily water use

Property ID Number	Property Description[1]	Number of People[2]	Est. Daily Water Use (gpd)[3]
191050	Rectory, outdoor spigot serves as community water source	1 person, plus outdoor community use	400-500
	Church	<10 people	
191300	Hangar	2 people	30
191320	Airport terminal (ground floor)	Approximately 9 people	135
	Restaurant (second floor)	20 people assumed for treatment design purposes	160
191700	House	1 person	200 (non-potable use only)
191710	House A	2 people	200
	Apartment Building, 5 units	4 to 8 people (10 max)	750
	House B	1 to 2 people	200
	Office	3 people	45
200150	Group housing, fish processing	1 person in winter; 15 people in summer	1,125

(1) Separate buildings or multi-residential buildings at each property are shown in separate rows.
(2) Assume year-round residency or occupancy unless noted.
(3) Gallons per day, from HDR Dillingham PFAS Contamination - Alternative Water Supply Study (April 2020).

3.0 Design Basis

3.1 Treatment Requirements

The minimum treatment requirements for the water treatment systems include:

- <70 nanograms per liter (ng/L) PFOS and PFOA (EPA LHA and DEC action level as of April 2019)

In addition to the treatment requirements, treatment goals for the water treatment systems include:

- <10 micrograms per liter (µg/L) arsenic (National Primary Drinking Water Regulation [NPDWR] Maximum Contaminant Level [MCL])
- <70 ng/L sum of five PFAS: PFOA, PFOS, PFHpA, PFNA, and PFHxS (DEC action level prior to April 2019)

Secondary treatment goals for the water treatment systems include:

- <300 µg/L iron (National Secondary Drinking Water Regulation [NSDWR] Secondary Maximum Contaminant Level [SMCL] and protective of the PFAS water treatment process to prevent iron fouling)
- <50 µg/L manganese (NSDWR SMCL and protective of the PFAS water treatment process to prevent manganese fouling)

3.2 Water Quality

Water quality results are summarized in Attachment 2. General water chemistry at four of the properties are summarized in Table 3. General water chemistry data for properties 191300 and 191700 were not available at the time this feasibility report was prepared. Based on the November 2019 sampling results, of the four properties with data, none exceed the primary arsenic treatment target, and arsenic treatment will not be necessary.

Iron and manganese pretreatment is not required to meet secondary treatment targets at properties 191050 or 200150. Iron and manganese concentrations are relatively high at properties 191320 and 191710 and will require pretreatment to meet secondary treatment targets and targets that are protective of the PFAS water treatment processes.

While general water chemistry data were not available for properties 191300 and 191700, concentration ranges for iron and arsenic species were assumed at these two properties to facilitate preliminary treatment system design and cost estimating. Based on the data available for arsenic species, it is assumed that concentrations at properties 191300 and 191700 are similarly below the primary arsenic treatment target. For purposes of this feasibility report, arsenic treatment is not considered. However, samples should be collected to verify this assumption. If arsenic exceeds 10 µg/L at properties 191300 and 191700, arsenic treatment will be required.

Based on proximity of property 191300 to property 191320, it is assumed that the iron concentration at property 191300 will exceed the secondary treatment target. Likewise, based on the proximity of property 191700 to property 191710, it is assumed that the iron concentration at property 191700 will exceed the secondary iron treatment target. These assumptions are consistent with water quality observations during S&W site visits. For purposes of this feasibility report, both properties 191300 and 191700 are assumed to exceed 10,000 µg/L iron, thus requiring iron pretreatment.

Table 3 Summary of general water chemistry

Parameter	Units	Property ID Number					
		191050	191300	191320	191700	191710	200150
pH	pH units	6.6	na	6.4	na	6.5	6.6
Conductivity	µmhos/cm	87.0	na	315	na	257	262
Hardness, as $CaCO_3$	mg/L	31.7	na	115	na	87.9	64.3
Iron	µg/L	123 J	Assumed Fe + Mn >10,000(1)	46,000	Assumed Fe + Mn >10,000(1)	36,800	<125
Manganese	µg/L	1.79		1,420		1,340	7.40
Arsenite (III)	µg/L	<0.0400	assumed Arsenite + Arsenate <10(1)	1.9	assumed Arsenite + Arsenate <10(1)	3.6	<0.0400
Arsenate (V)	µg/L	0.0590 J		0.461		0.993	<0.0400

na - not available.

J - Estimated concentration, detected greater than the method detection limit (MDL) and less than the reporting limit (RL). Flag applied by the laboratory.

(1) Approximate concentration ranges were assumed to facilitate preliminary treatment system design and cost estimating.

PFAS data for each property are summarized in Table 4. The PFAS sample results shown were collected during four sampling events between December 2018 and November 2019. Where multiple sample results are available, concentration ranges are provided. Detailed PFAS sample results are provided in Attachment 2.

Table 4 Summary of PFAS concentrations

Parameter	Units	Property ID Number					
		191050	191300	191320	191700	191710	200150
# of Samples	--	3	1	3	1	2	3
PFOA	ppt	4.2 – 5.2	36	1.7 J – 13	15	22 – 25	5.1 – 5.5
PFOS	ppt	37 – 42	2.7	ND – 43	37	58 – 64	58 – 73
PFHpA	ppt	2.8 – 3.4	39	9.3 – 13	16	23 – 24	2.4 – 2.6
PFNA	ppt	ND	ND	ND – 2.8	ND	ND	ND
PFHxS	ppt	140 – 170	7.6	6.5 – 15	88	110 – 140	53 – 59
LHA(1) Combined (PFOS + PFOA)	ppt	42 – 46	39	1.7 J(3) – 56	52	**80** – **89**	64 – **78**
Sum of Five Combined PFAS(2)	ppt	**186**(3) – **220**(3)	**85**(3)	18(3) – **87**	**156**(3)	**213**(3) – **253**(3)	**121**(3) – **140**(3)

ppt - parts per trillion, equivalent to nanograms per liter (ng/L). ND - non-detection value below the method detection limit (MDL). Data ranges shown for properties where more than one sample dataset is available. Data from field duplicates (labeled DUP in the attachment table) are not included in the range shown.

J - Estimated concentration, detected greater than the MDL and less than the reporting limit (RL). Flag applied by the laboratory.

(1) EPA's LHA level is 70 ppt for PFOS and PFOA combined. **Bold** values indicate combined values that are above the LHA level.

(2) The combined sum of five PFAS include: PFOA, PFOS, PFHpA, PFNA, and PFHxS. **Bold** values indicate concentrations above the treatment goal.

(3) Minimum concentration, the LHA combined or sum of five combined PFAS action level concentration includes one or more results that is not detected greater than the MDL.

3.3 Water Demand

For the purposes of this feasibility report, peak demand estimates were made following guidance provided in DEC's document of best management practice recommendations for private water systems[1] (see Appendix A, Tables 2 through 4 in the cited reference; Table 2 is consistent with the Uniform Plumbing Code fixture count method).

Peak demand estimates were made in two ways; the first was based on assigning a typical peak demand according to the category of each property or building, and the second was based on a plumbing fixture count. Peak demand estimates are provided in Table 5 and additional details are provided in Attachment 3. The categorization of the properties and fixture counts were completed based on information from the site visits. A detailed fixture count was not available. If additional well capacity and/or plumbing fixture information is obtained, the peak flow estimates will be refined.

[1] State of Alaska, Department of Environmental Conservation, Drinking Water Program. Best Management Practices for Private Drinking Water Systems.

Table 5 Summary of peak water demand estimates for individual properties

Property ID Number	Categorical Peak Demand Estimate (gpm)	Fixture Count Peak Demand Estimate (gpm)	Design Flow Rate (gpm)
191050	11	21	16
191300	1	7	8
191320	25	25	24
191700	8	10	8
191710	32	39	32
200150	14	23	16

The estimates made using the fixture count method are all higher than those made based on assigning property categories, except for property 191300 (commercial hangar) which has both a low expected number of water users and low count of plumbing fixtures. It is expected that plumbing fixtures were overcounted, thus the peak demands based on fixture counts provide upper-level estimates. At this stage of design, to estimate capital and operating expenses, it is assumed that peak flows based on property category are more accurate than those based on fixture counts. Peak demand estimates may change at a later stage of design. Design flow rates were selected based on the nearest 8 gpm increment, which is constrained by the size and target empty bed contact time (EBCT) of the granular activated carbon (GAC) vessels for typical residential PFAS treatment.

Additionally, two alternative treatment scenarios were considered using combined systems. Under these two scenarios, one treatment system would service multiple properties using 2-inch service connection lines. Note that these two combined treatment systems are exclusive of each other. If a combined treatment system is selected, only one, not both, would be installed. As previously noted, property 191720 (cabins on Airport Spur Road) was excluded from this report because the property owner declined site access, thus it was excluded from the combined system evaluation.

Combined System 1: System would be sited at property 191050 and be sized to also provide water to properties 191710 and 191700.

Combined System 2: System would be sited at property 191710 and be sized to also provide water for property 191700.

Peak demand estimates for the combined treatment systems are summarized in Table 6. The peak demand estimates included in Table 6 are slightly less than estimates taken as the sums of the peak demands included in Table 5. This occurs because as the number of residences served increases, the peaking factor decreases.

Table 6 Summary of peak water demand estimates for combined systems

Combined System Scenarios	Categorical Peak Demand Estimate (gpm)	Fixture Count Peak Demand Estimate (gpm)	Design Flow Rate (gpm)
Combined System 1 191050, 191700, 191710	45	45	48
Combined System 2 191700, 191710	37	41	40

Additional Design Considerations for Combined Systems

In evaluating the feasibility of these two combined scenarios, it will be necessary to review the well capacities, pressure head loss through the service lines, and the average hydraulic residence time of the distribution system.

- The well capacities at the sited property should be reviewed to verify the well and well pump are appropriately sized to supply the total peak demand of all properties served. If the pump capacity is not known, a pumping test will be required to verify well capacity.
- The pressure head loss of the service connection lines should be reviewed to verify all properties will have adequate water pressure.
    - For Combined System 1, it is estimated that approximately 1,700 feet of service connection lines will be required. Assuming the longest length of the connection line is 1,400 feet (between properties 191050 and 191710) and 2-inch HDPE is used, the pressure drop at peak flow in the distribution system (assumed to be 40 gpm) is estimated to be 22 pounds per square inch (psi). Thus, to provide a minimum water pressure of 35 psi at 191700, the water pressure to the treatment system must be 75-95 psi depending on how fouled the filters and treatment units are. This may require more frequent replacement of filtration units to maintain adequate pressure at the remote properties.
    - For Combined System 2, approximately 500 feet of connecting service lines are needed and a flow of 8 gpm, the pressure head loss is estimated to be less than 1 psi.
- The average hydraulic residence time in the service lines should be reviewed to verify the water will not become stagnant during periods of low use.
    - For Combined System 1, assuming a total daily flow of 1,395 gallons per day (gpd) for properties 191700 and 191710 and 1,700 feet of service line, the average hydraulic residence time will be less than 5 hours.

- For Combined System 2, assuming a total daily flow of 200 gpd for property 191700 and 500 feet of service line, the hydraulic residence time will be 9 hours.

In addition, disinfection requirements will need to be evaluated for the combined systems. If either of the combined systems are categorized as Public Water Systems (PWS) by the State, certain disinfection requirements may need to be met as outlined in 18 Alaska Administrative Code Chapter 80. There are three categories of PWS and designations are made based on the expected number of people served:

- Community Water System
  - expects to serve, year round, at least 25 individuals; or
  - expects to serve, year round, at least 15 residential service connections
- Non-Transient Non Community Water System (NTNCWS)
  - regularly serves the same 25 or more individuals for at least 6 months of the year
- Transient Non Community Water System (TNCWS)
  - is not a CWS or NTNCWS, and
  - regularly serves at least 25 individuals each day for at least 60 days of the year

Based on the number of people served at each property as provided in HDR's Dillingham PFAS Contamination – Alternative Water Supply Study[2], Combined System 1 is expected to serve a maximum of 21 people and Combined System 2 is expected to serve a maximum of 19 people. While presently, neither system is expected to serve 25 people, the state may evaluate the combined systems based on the number of people that could be served.

If either of the combined systems are categorized as a PWS, disinfection requirements will need to be met. Disinfection options could include chlorination to achieve a target residual concentration or installation of ultraviolet (UV) disinfection units at the points of use.

3.4 Available Space and System Siting

Responses from the site visit surveys indicated that the property owners preferred the water treatment systems to be located indoors using existing space. Depending on space constraints, the water treatment systems may need to be constructed inside an insulated Conex box or similar outbuilding. Existing infrastructure, including piping and appurtenances, will need to be evaluated prior to selection of a treatment system location. A general arrangement CAD drawing will be prepared to evaluate space and equipment clearances once treatment system sizing and process flow has been finalized.

[2] HDR. Dillingham PFAS Contamination – Alternative Water Supply Study Memorandum, April 2020.

Space availability for the water treatment systems at each property are summarized below in Table 7 based on information gathered during the site visits. Space availability and system locations will be confirmed once designs have been finalized.

In estimating the available space at a given property, it is assumed that existing water softeners will be replaced, unused water treatment equipment will be removed, existing bladder pressure tanks will remain, and appliances (e.g., water heaters and washing machines) will remain. It is assumed that each PFAS treatment vessel requires approximately 4 square feet. The total space for the vessels is doubled to allow for working areas, process piping, and valves in the treatment space requirements. Other treatment equipment (e.g., particulate filters and UV units) can be wall mounted, and do not require significant floor space. Existing space configuration, access, and other limitations may affect the actual space required for treatment systems.

Table 7 Treatment system space requirements

Property ID Number	Approximate Space Available	Approximate Treatment System Requirements
191050	40 square feet (sq ft) near the existing pressure tank	32 sq ft
191300	5-10 sq ft near existing pressure tank	24 sq ft
191320	10 sq ft near existing pressure tank	72 sq ft
191700	5-10 sq ft near existing pressure tank (requires removal of existing treatment system)	24 sq ft
191710	House A - no space available Apartment Building - 60 sq ft in garage and 15 sq ft in utility room House B and Office - 40 sq ft	Option 1 - 96 sq ft Option 2: • 8 gpm system - 24 sq ft • 32 gpm system - 96 sq ft
200150	16 sq ft in laundry room	32 sq ft
Combined System 1 191050, 191700, 191710	System sited at 191050	96 sq ft
Combined System 2 191700, 191710	System sited at 191710	120 sq ft

Based on the high level review of treatment system sizing and space availability, property 191050 and the 8 gpm system associated with Option 2 at property 191710 appear to have sufficient, existing indoor space for a treatment system. As mentioned, space constraints will be further evaluated at a later stage of design using CAD general arrangements.

Because there are multiple buildings on property 191710, two designs have been considered. Currently, water is distributed directly to the Apartment Building and to the Office from the well. From the Apartment Building, water is directed to House A. From the Office, water is directed to House B. Refer to

Figure 1 for the approximate location of the distribution piping. One design includes a single treatment system located in an outbuilding near the groundwater well (Option 1). The second design includes two separate systems, one located in the Apartment Building which would also serve House A, and one located in the Office which would also serve House B (Option 2).

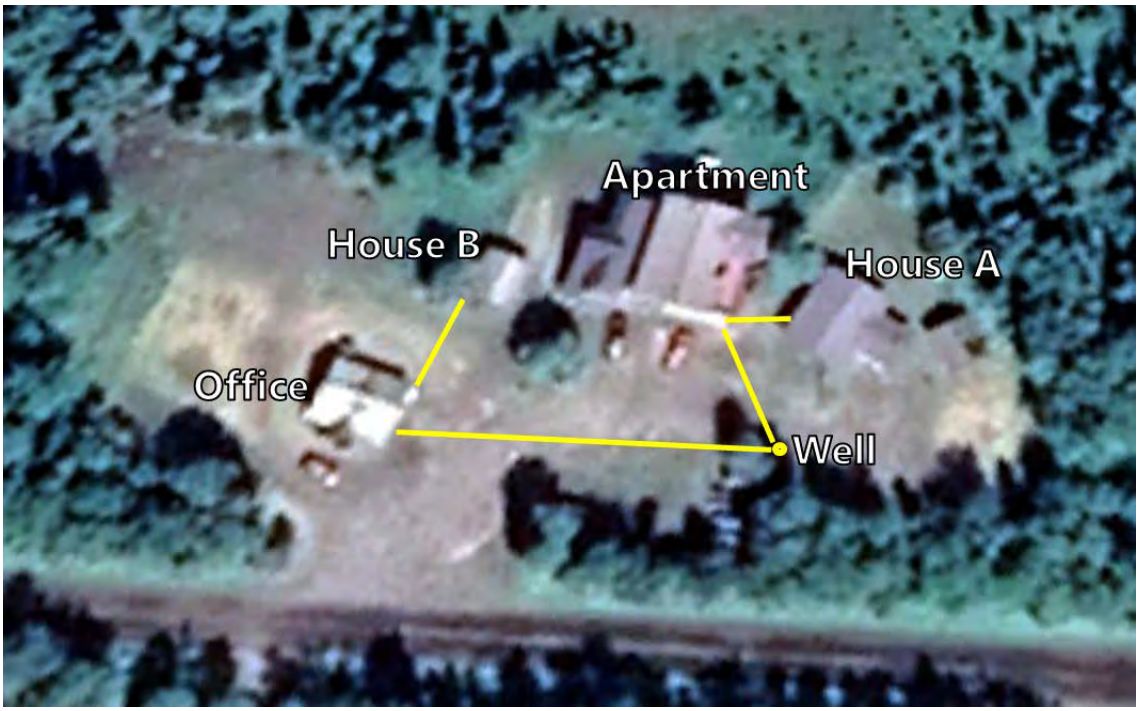


Figure 1 Approximate location of distribution piping at property 191710

Peak flow demand estimates used to size the individual treatment systems for these two options are summarized in Table 8.

Table 8 Peak flow demand estimates for treatment system siting options for 191710

Treatment System Siting Options for 191710	Description	Categorical Peak Demand Estimate (gpm)	Fixture Count Peak Demand Estimate (gpm)	Design Flow Rate (gpm)
Option 1	System sited in an outbuilding and serves all buildings	32	39	32
Option 2	System sited in the Apartment Building and also serves House A	25	35	32
	System sited in the Office and also serves House B	7	10	8

An alternative to Option 1 would be to have a single treatment system located in the Apartment Building which would not require an outbuilding near the well. However, this alternative would likely include substantial plumbing costs to revise the existing water distribution piping to each of the buildings. The current distribution consists of:

- 1-inch copper piping connecting the well to the Apartment Building and the well to the Office.
- ¾-inch copper piping connecting House A to the Apartment Building and likewise House B to the Office.

The maximum flow through ¾-inch copper piping will be 12 to 15 gpm, so there should be adequate capacity to furnish water from the Apartment Building to House A and from the Office to House B. The maximum flow through 1-inch copper piping will be 21 to 26 gpm. It's likely that there would not be significantly reduced flow or pressure with Option 2 because the distribution would be unchanged. After confirming well capacity, it may be feasible to remove one of the treatment trains for this option and reduce the design flow to 24 gpm. Option 1 would likely require upsizing the copper piping from the well to the Apartment Building from 1-inch to 1.25-inch to supply the additional water demand from the Office and House B. An outbuilding would continue to use the existing distribution piping. By putting the system in the Apartment Building, the cost of the outbuilding would be saved, but part of that savings would be offset by additional plumbing costs.

4.0 Process design

4.1 Unit Process Descriptions

The treatment systems installed at these properties will be on-demand, point-of-entry treatment (POET) systems. Water will be pumped through iron and manganese pretreatment (if necessary), particulate filtration, granular activated carbon (GAC) vessels in a lead/lag configuration, and UV disinfection. The water treatment system will include flow meters and flow restrictors as necessary. A diverter line post-GAC will also be included to allow forward flow during low-flow periods. General process flow diagrams for the proposed water treatment systems are included in Attachment 4.

Due to uncertainty associated with performance and to ensure adequate pretreatment for PFAS removal, existing water softening systems at properties 191320 and 191710 will be removed and replaced with iron filters. Properties 191050 and 200150 do not currently have water softening systems and iron filtration is not necessary based on the November 2019 sample results. Iron staining was noted at property 200150 during the site visit; however, as such, water softening may be desired for aesthetic reasons. This estimate does not include a water softener or metals filtration at this property.

4.1.1 Pretreatment – Iron Removal and Particulate Filtration

GAC is susceptible to iron and manganese fouling causing less effective PFAS treatment when concentrations are greater than approximately 1,000 µg/L (1.0 mg/L) total. At elevated concentrations,

precipitate formation can cause physical blockage of GAC adsorption sites. Pretreatment should be considered when concentrations are greater than the SMCLs. Due to the high background iron and manganese concentrations at properties 191320 and 191710, pretreatment is necessary and will be designed to meet the SMCLs. While general chemistry is not available for properties 191300 and 191700, for purposes of this feasibility report, it is assumed that these two properties also exceed the SMCLs.

At concentrations lower than approximately 10,000 µg/L (10 mg/L) total iron and manganese, ion exchange water softening is commonly used in Alaska for iron and manganese removal. However, because concentrations of iron exceed 10,000 µg/L at properties 191320 and 191710, continuous injection greensand iron filters with hypochlorite is recommended instead of water softening systems. Because of the proximity of property 191300 to 191320 and property 191700 to 191710, it is assumed that both 191300 and 191700 exceed 10,000 µg/L. Thus, continuous injection greensand is also recommended for these two properties. The backwash from these systems will include PFAS at concentrations similar to the influent. DEC has previously allowed regeneration flows to be discharged without PFAS treatment if they support operation of a PFAS removal system. Iron filters will produce less backwash flow than similarly sized softeners; however, the existing septic systems should be evaluated for capacity to treat the backwash flow and solids load. Properties 191300 and 191320 are connected to the municipal sewer system.

Particulate filtration is recommended following iron and manganese pretreatment to remove large particles that could impact the downstream GAC vessels. Particulates can cause physical blockage of GAC adsorption sites and fill pore space in the GAC vessels that could cause an increase in vessel pressure and impact PFAS removal effectiveness. Ten-micron filtration or smaller is recommended. Particulate filtration is also recommended in treatment systems that do not have iron and manganese filters, to remove organic debris, dirt, and sand from the groundwater. Particulate filtration will consist of bag or cartridge filtration, depending on space constraints. Each filter housing will include a pressure gauge for pressure monitoring to inform filter change-out.

4.1.2 PFAS Treatment

The recommended technology for PFAS water treatment is GAC media adsorption. This is considered one of the best available technologies for PFAS water treatment and is the most mature of the PFAS water treatment technologies. PFAS adsorbs to GAC when an adequate EBCT is provided. EBCT is a measure of the approximate time water is in contact with the GAC media inside an individual vessel.

PFAS treatment will consist of lead and lag GAC vessels with approximately 2 cubic feet of media in each vessel. An EBCT of 2 minutes for the lead vessel will be targeted, a total 4 minutes EBCT between the lead and lag vessels at a flow rate of 8 gpm. This EBCT has successfully demonstrated PFAS removal in POET systems and is approved by regulators at other residential and commercial applications in multiple states,

including New York, Vermont, and Alaska[3,4]. While a 4-minute EBCT across each lead/lag vessel system (train) is maintained at up to the flow-restricted 8 gpm per train, the typical operational flow rate will be less than the flow-restricted amount resulting in longer EBCT.

12x40 reagglomerated, bituminous coal-based GAC is typically used in PFAS water treatment and is recommended for this application for use in both the lead and the lag vessel of each train. GAC that is NSF certified (or equivalent) for drinking water use will be used. Due to the remote nature of the site, using the same size and type of GAC vessel at all applicable properties will make operations and maintenance more efficient.

Spent GAC requires offsite disposal by a regulated waste-disposal company. This service will be provided by the selected water treatment maintenance contractor under an operation and maintenance contract.

4.1.3 Post-treatment – UV Disinfection

UV disinfection is recommended as the final, post-PFAS-treatment step in order to inactivate any bacteria in the treated water prior to distribution and use. UV disinfection is only required if the water is intended for potable use. UV disinfection will consist of either a single reactor or multiple reactors that contain UV bulbs. As treated water passes over and is exposed to the UV light, bacteria and viruses are inactivated.

4.2 Instrumentation and Controls

Instrumentation and controls for the water treatment systems consist of the following:

- Pressure gauges – one per well, one per particulate filtration housing, one per GAC vessel
- Treated effluent flow meter – displays instantaneous flow, records totalized flow
- Treated effluent flow restrictors – one per train

Greensand filters will be programmed to backwash periodically to remove solids. During low-flow periods, water will be automatically pumped through GAC filters to prevent water stagnation. Based on owner-provided information, it is assumed that all treatment systems will operate year-round, except for property 200150. Because property 200150 has high occupancy during summer months and low occupancy during the winter, it is recommended that one of the two GAC trains and one of the two UV reactors are taken offline during the winter.

[3] Example POET Operation, Maintenance and Monitoring (OM&M) for installations in Bennington, Vermont, approved by State of Vermont Department of Environmental Conservation: https://anrweb.vt.gov/PubDocs/DEC/PFOA/Corrective%20Action%20Plan%20OUB/Final-CAP-OUB-2018-0509.pdf

[4] Shannon & Wilson, Inc. and Barr Engineering Co. Gustavus Inn PFAS Water Treatment Action Plan. Submitted to Alaska Department of Environmental Conservation, February 2019.

5.0 Project Costs

5.1 Capital Costs

The estimated total capital cost for each water treatment system is summarized in Table 9. For purposes of this feasibility report, costs are based on equipment from Arctic Home Living of Fairbanks, Alaska (AHL). AHL has experience installing similar treatment systems in Alaska and understands regional logistics necessary for equipment transport and maintenance. However, alternative equipment vendors could be selected at later stages of design.

Detailed capital costs and assumptions are summarized in Attachment 5. Costs are provided for required treatment equipment. Additional options are provided as separate line items. These additional options include:

- Treatment system outbuildings: Based on the information gathered during the site visits, only property 191050 has sufficient indoor space for the required treatment system. The capital costs for the outbuildings were determined assuming $60 per square foot. Siting other treatment systems in existing indoor space may be possible following a more detailed review of the treatment system general arrangements.
- Greensand filters: At this phase of design, greensand filters are considered optional for properties 191300 and 191700. Iron and manganese data are not currently available for these properties. However, based on proximity of these two properties to other properties with iron and manganese data, it is likely that greensand filtration will be necessary.
- UV Disinfection: UV Disinfection is considered optional for properties for 191300 and 191700 because it was reported that these properties do not currently use well water for drinking. UV disinfection is only required for treatment systems where the water is intended to be used as drinking water. Further review of intended property-specific uses may be necessary at later stages of design to determine if UV disinfection is necessary.

Building modifications and site preparation activities have not been included in the cost estimate for any of the treatment systems and will need to be evaluated on a site-specific basis.

Table 9 Total capital cost estimates for individual treatment systems

Property ID Number	Required Treatment System Cost	Estimated Costs for Additional Options			Treatment System Cost with Additional Options[(1)]
		Outbuilding	Greensand Filter	UV Disinfection	
191050	$40,800	--	--	--	--
191300	$20,900	$1,500	$3,600	$900	$27,800
191320	$74,300	$4,400	--	--	$79,400
191700	$20,900	$1,500	$3,600	$900	$27,800
191710 – Option 1	$100,800	$5,800	--	--	$107,500
191710 – Option 2	$126,400	$5,800	--	--	$133,100
200150	$40,800	$2,000	--	--	$43,100

ENRCCI = 11496 Jan 2020
This is a Class 5 cost estimate with a +50/-30% uncertainty as applicable for projects at less than 2% of full project definition per AACE International 17R-97.
(1) Includes a 15% contingency of subtotal capital costs for the additional options.

Capital cost estimates for the combined treatment system scenarios are summarized in Table 10. Note that these estimates do not include capital expenses associated with the service connection lines that will be required to connect each property. That being said, differences in estimated total project costs between the combined systems and the individual systems as shown likely represent maximum cost differences. For the combined systems to be economically viable, the capital costs of the service connection lines likely need to be below these differences. The estimated cost difference between combined system 1 and individual systems for properties 19050, 191700, and 191710 (Option 2) is $68,200, and the estimated difference between combined system 2 and individual systems for properties 191700 and 191710 (Option 2) is $22,000. If additional combined systems are evaluated in the future, scenarios that could eliminate iron/manganese pretreatment should be emphasized because it is expected that these scenarios will have the greatest cost benefit.

Table 10 Total capital cost estimates for combined treatment systems

Property ID Number	Required Treatment System Cost	Estimated Costs for Additional Options – Outbuilding	Treatment System Cost with Additional Options[(1)]
Combined System 1 191050, 191700, 191710	$126,800	$5,800	$133,500
Combined System 2 191700, 191710	$130,600	$7,200	$138,900

Estimates do not include capital expenses associated with service connection lines between properties.

ENRCCI = 11496 Jan 2020

This is a Class 5 cost estimate with a +50/-30% uncertainty as applicable for projects at less than 2% of full project definition per AACE International 17R-97.

(1) This cost estimate includes a 15% contingency of the subtotal for the capital costs of the additional options.

5.2 Operation and Maintenance Costs

Estimated annual operation and maintenance (O&M) costs for individual water treatment systems are summarized in Table 11. Additional details are provided in Attachment 5. O&M costs include:

- Annual replacement of GAC in the lead vessel of each train
- Quarterly sampling and analysis for PFAS
- Miscellaneous maintenance and equipment replacement (e.g., outbuildings, UV lamps)
- Greensand media replacement (if applicable; estimated to be every 5 years)
- Hypochlorite use (if applicable)
- Power
- O&M contractor labor
- Administrative labor

Where applicable, O&M costs for additional options (e.g., treatment outbuildings, greensand filters, UV disinfection reactors) have been shown as separate line items in Attachment 5.

Table 11 Annual O&M costs for individual treatment systems

Property ID Number	Est. Annual Maintenance Cost for Required Equipment	Est. Annual Maintenance Cost with Additional Options(1)
191050	$13,800	--
191300	$10,500	$12,700
191320	$20,000	$20,300
191700	$10,500	$12,700
191710 – Option 1	$23,500	$23,800
191710 – Option 2	$30,200	$30,500
200150	$13,800	$14,000

ENRCCI = 11496 Jan 2020
O&M costs are based on a Class 5 capital cost estimate with a +50/-30% uncertainty as applicable for projects at less than 2% of full project definition per AACE International 17R-97. O&M Costs are also expected to have a +50/-30% uncertainty.
(1) In addition to annual maintenance costs for additional options, this cost estimate includes a 15% contingency of the subtotal for the capital costs of the additional options.

O&M costs associated in combined treatment systems are summarized in Table 12. Note, these estimates do not include operation and maintenance expenses associated with the connection service lines between properties which are deemed to be low.

Table 12 Annual O&M costs for combined treatment systems

Property ID Number	Est. Annual Maintenance Cost for Required Equipment	Est. Annual Maintenance Cost with Additional Options(1)
Combined System 1 191050, 191700, 191710	$27,300	$27,600
Combined System 2 191700, 191710	$27,300	$27,700

ENRCCI = 11496 Jan 2020
O&M costs are based on a Class 5 capital cost estimate with a +50/-30% uncertainty as applicable for projects at less than 2% of full project definition per AACE International 17R-97. O&M Costs are also expected to have a +50/-30% uncertainty.
(1) In addition to annual maintenance costs for additional options, this cost estimate includes a 15% contingency of the subtotal for the capital costs of the additional options.

The following could result in an increase in O&M costs:

- Additional water treatment equipment
- Additional parameters for sampling and analysis
- More frequent sampling requirements
- Higher PFAS loading to the system
- Faster PFAS breakthrough
- Higher water usage
- Higher iron loading

6.0 Project Implementation

6.1 Equipment Lead Times and Schedule

Based on quotes from AHL, equipment lead times for shipment to Dillingham from Anchorage are expected to be 60 to 90 days from order submittal.

6.2 Permitting and Permissions

Properties 191050 and 191320 operate drinking water supplies that are currently permitted by DEC. Installation and operation of the water treatment system will comply with applicable building codes. Permitting needs associated with the installation of a water treatment system for drinking water supply will be evaluated by S&W.

Any access agreements required for operations and maintenance and routine monitoring will be obtained by S&W ahead of water treatment system start-up.

6.3 Process Safety Overview

A process safety overview with property owners, managers, and/or residents will be completed after installation and before start-up of the water treatment systems. The objective of the process safety overview is for personnel involved in system use, operation, and monitoring to understand safety considerations associated with the water treatment equipment and associated chemicals. If any additional safety concerns are identified during the process safety overview, these will be addressed and mitigated prior to system start-up.

6.4 Pre-start-up Activities and Treatment Verification

The complete treatment system will be disinfected by the vendor after assembly and prior to delivery. All system components will be flushed with a chlorine solution, except the treatment media itself and the interior of some equipment once filled with media (iron filter, if applicable; GAC vessels, etc.).

During installation of the PFAS water treatment system, the well pump will be shut down for a short duration (anticipated to last less than 8 hours) while the new treatment system equipment is installed. Tap water for drinking water use or otherwise will not be available during this time.

GAC vessels will be filled with water from the onsite wells after system delivery and before installation, and a 24-hour GAC soak will start in order to hydrate the carbon and loosen fines. Following installation, the system will be backwashed at the design flow rate (8 gpm) for 15 minutes to remove fines. A 30-minute flush at the design flow rate will follow the soak in order to remove air and remaining fines from the GAC vessels after installation of the system. Flush water will be directed to an exterior drainage area and not to the septic system or municipal sewer. This procedure is subject to change based on vendor recommendations.

Treated water samples will be collected for PFAS analytical evaluation after the 30-minute flush, before continuous operation and treated water distribution for drinking water purposes. A minimum of one confirmatory sample will be collected to demonstrate treatment system effectiveness. The treatment system can be used for non-drinking water uses until sample results are received confirming treatment goals are being achieved.

The water treatment maintenance contractor and the property owner will receive training by the water treatment system vendor within one week of treatment system pre-start-up activities and treatment verification, prior to continuous operation of the system.

6.5 System Start-up and Continuous Operation

After pre-start-up sample results are received and reviewed, if all treatment requirements outlined in Section 3.1 are met, continuous operation and monitoring will start. If the water treatment system was intentionally shut down after pre-start-up activities for more than 24-hours, treated water will be diverted to an exterior drainage area for approximately 30 minutes following start-up to adequately flush the system.

6.6 Operation, Monitoring, and Maintenance

An Owner's Manual with equipment information and troubleshooting guidance will be provided to the property owners prior to start-up of the water treatment system. The Owner's Manual will include directions to only use drinking water from taps that supply water treated through the system for PFAS removal.

Additionally, an O&M Manual will be prepared and provided to the selected water treatment maintenance contractor. The O&M Manual will cover start-up testing, routine monitoring (including sample collection), particulate filter replacement, GAC vessel change-out, and UV lamp cleaning and replacement.

Initially, quarterly monitoring of the water treatment system is recommended, which includes flow tracking, differential pressure monitoring, and analytical sampling locations. Monitoring will verify the system's efficacy and determine when the GAC vessels need to be replaced. Once a lead-vessel breakthrough curve has been established, the frequency of analytical sampling may be reduced.

Depending on solids loading, the particulate filters may require more frequent replacement than on a quarterly basis. This replacement can be done by property owners when the pressure drop across the filter exceeds the set-point discussed during training.

If applicable, the water treatment maintenance contractor will be responsible for maintaining the chlorine dosing system for the greensand filters. Depending rate of use, homeowners may also be responsible for refilling the hypochlorite feed tank. Greensand media replacement is expected to be infrequent, likely requiring replacement every 5 to 8 years.

The frequency of GAC replacement will depend on water usage, PFAS loading, and the final operational set-points (e.g., differential pressure recommendations for particulate filters). If quarterly monitoring results indicate that the sum of five PFAS: PFOS, PFOA, PFHxS, PFNA, and PFHpA is >35 ng/L at the midpoint sample point (after the lead GAC vessels but prior to the lag GAC vessels), GAC vessel change-out will occur. GAC replacement will be scheduled to occur after quarterly monitoring results for the installed system have been received, but before the next quarterly sampling event. For this feasibility report, one GAC vessel replacement is assumed per year per train. However, GAC media may need to be replaced more frequently than on a yearly basis because short-chain PFAS, such as PFHxS and PFHpA, are present in the wells and may break through more quickly than long-chain PFAS, such as PFOA and PFOS.

Routine GAC vessel change-out will be conducted as follows:

- Remove the lead GAC vessel;
- Disconnect the lag GAC vessel and install in the lead position; and
- Install a replacement GAC vessel in the lag position.

The UV lamp will be replaced as indicated by the manufacturer's recommendation and anticipated to be on a 12-month basis. Cleaning of the UV quartz sleeve is dependent on water hardness. Cleaning should be conducted based on the manufacturer's recommendation, but at least on an annual basis.

6.7 Residuals Management

Water treatment residuals include the following:

- Iron and manganese greensand filter backwash (or water softener regeneration solution, if applicable)
- Spent particulate filters
- Spent GAC
- Spent UV disinfection lamps

This report assumes filter backwash can be discharged to the existing onsite septic system or municipal sewer. This will need to be confirmed with DEC.

Spent particulate filters should be collected for disposal in a waste container that will be emptied when the selected water treatment system maintenance contractor services the GAC vessels. The frequency of filter replacement will depend on the amount of sediment produced in the water supply well.

The selected water treatment maintenance contractor will facilitate spent GAC change-out. It is assumed that each property will have one vessel on standby for each train in the event that routine PFAS monitoring results indicates change-out is required. The selected vendor will collect individual vessels for servicing, which includes transport of vessels to and from the servicing location, removal of spent GAC

from the vessels, rinsing and decontamination of empty vessels, and refilling virgin GAC into the vessels. The selected vendor will transport spent GAC along with the particulate filters to the nearest appropriate disposal facility that will accept PFAS-impacted GAC/materials.

Spent UV lamps will be handled per the manufacturers recommendations and will be managed by the selected water treatment maintenance contractor.

Attachments

Attachment 1 – Site Visit Reports

Attachment 2 – Water Quality Tables

Attachment 3 – Peak Water Demand Estimates

Attachment 4 – Process Flow Diagrams

Attachment 5 – Capital and O&M Cost Details

Attachment 1 – Site Visit Reports

Site visit field notes contain personal information. This content has been removed for confidentiality.

Attachment 2 – Water Quality Tables

Attachment 2 - Dillingham Airport - Summary of Affected Property Private Well PFAS Analytical Results from December 2018 through June 2019

			Analyte	Perluoro-butane sulfonic acid (PFBS)	Perfluoro-heptanoic acid (PFHpA)	Perfluoro-nonanoic acid (PFNA)	Perfluoro-hexane sulfonic acid (PFHxS)	Perfluoro-octanoic acid (PFOA)	Perfluoro-octane sulfonate (PFOS)	LHA Combined (PFOS + PFOA)
			Action Level	2,000					70†	70†
Sample Name	Address	Sample Date	Well Category	ppt	ppt	ppt	ppt	ppt	ppt	ppt
191050 (DIL-05)	[redacted]	12/17/2018	1	51	3.3	<1.8	**140**	5.2	37	42
191050 (DIL-06)		12/17/2018	1	54	3.3	<1.7	**130**	4.8	36	41
191050		2/26/2019	1	57	3.4	<2.0	**170**	4.2	42	46
291050		2/26/2019	1	54	3.2	<2.0	**160**	3.8	42	46
191300		2/27/2019	2	1.9 J I	39	<2.0	7.6	36	2.7	39
191320 (DIL-10)		12/17/2018	1	11	9.7	<1.8	7.0	1.9	<1.8	1.9 ‡
191320		2/26/2019	1	10 J*	13	2.8	15	13	43	56
291320		2/26/2019	1	14 J*	13	2.9	15	12	38	50
191700		2/28/2019	2	34	16	<2.0	**88**	15	37	52
191710		2/27/2019	1	48	24	<2.0	**140**	25	64	**89**
191720		2/28/2019	2	47	22	<2.0	**140**	22	58	**80**
200150		2/28/2019	1	7.9	2.4	<2.0	53	5.1	60	**65**
200150		6/11/2019	1	7.6	2.6	<2.0	59	5.3	**73**	**78**
300150		6/11/2019	1	7.5	2.9	<2.0	61	5.5	**72**	**78**

ppt parts per trillion, equivalent to nanograms per liter
LHA U.S. Environmental Protection Agency Lifetime Health Advisory
† LHA level is 70 ppt for PFOS and PFOA combined.
Bold Concentration exceeds action level.
DUP Field-duplicate sample
< Analyte not detected; listed as less than the reporting limit (RL) unless otherwise flagged due to quality-control (QC) failures.
J Estimated concentration, detected greater than the method detection limit (MDL) and less than the RL. Flag applied by the laboratory.
‡ Minimum concentration, the Combined concentration includes one or more result that is not detected greater than the MDL.

Attachment 2 - November 2019 Dillingham Point-of-Entry Water Treatment Design Analytical Results

Analytical Method	Analyte	Units	Sample Name: 191050	191320	191710	200150
		Well Category	1	1	1	1
			11/15/19	11/14/19	11/15/19	11/15/19
EPA 537	Perfluoro-octanoic acid (PFOA)	ppt	4.3	1.7 J	22	5.5
	Perfluoro-octane sulfonate (PFOS)	ppt	40	<1.9	58	58
	Perluoro-butane sulfonic acid (PFBS)	ppt	50	12	34	6.9
	Perfluoro-heptanoic acid (PFHpA)	ppt	2.8	9.3	23	2.4
	Perfluoro-nonanoic acid (PFNA)	ppt	<1.9	<1.9	<1.8	<1.8
	Perfluoro-hexane sulfonic acid (PFHxS)	ppt	140	6.5	110	56
	4,8- Dioxa-3H-perfluorononanoic acid (ADONA)	ppt	<1.9	<1.9	<1.8	<1.8
	N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	ppt	<19	<19	<18	<18
	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	ppt	<1.9	<1.9	<1.8	<1.8
	Perfluoro-tridecanoic acid (PFTriA)	ppt	<1.9	<1.9	<1.8	<1.8
	Perfluoro-tetradecanoic acid (PFTeA)	ppt	<1.9	<1.9	<1.8	<1.8
	Hexafluoropropylene oxide dimer acid (HFPO-DA)	ppt	<3.8	<3.8	<3.7	<3.7
	Perfluorodecanoic acid (PFDA)	ppt	<1.9	<1.9	<1.8	<1.8
	N-ehtylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	ppt	<19	<19	<18	<18
	9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	ppt	<1.9	<1.9	<1.8	<1.8
	Perfluorohexanoic acid (PFHxA)	ppt	37	59	110	16
	Perfluoroundecanoic acid (PFUnA)	ppt	<1.9	<1.9	<1.8	<1.8
	Perfluoro-dodecanoic acid (PFDoA)	ppt	<1.9	<1.9	<1.8	<1.8
	Perfluorobutanoic acid (PFBA)	ppt	8.4	23	21	1.5 J
	Perfluorodecanesulfonic acid (PFDS)	ppt	<1.9	<1.9	<1.8	<1.8
	Perfluorododecanoic acid (PFDoA)	ppt	<1.9	<1.9	<1.8	<1.8
	Perfluorooctane Sulfonamide (FOSA)	ppt	<1.9	0.87 J	0.78 J	1.1 J
	Perfluoropentanoic acid (PFPeA)	ppt	11	70	71	4.0
	6:2 FTS	ppt	<19	<19	40	<18
	8:2 FTS	ppt	<19	<19	<18	<18
	4:2 FTS	ppt	<19	<19	<18	<18
	10:2 FTS	ppt	<1.9	<1.9	<1.8	<1.8
	Perfluorononanesulfonic acid (PFNS)	ppt	<1.9	<1.9	<1.8	<1.8
	Perfluoro-n-hexadecanoic acid (PFHxDA)	ppt	<1.9	<1.9	<1.8	<1.8
	HFPO-DA (GenX)	ppt	<3.8	<3.8	<3.7	<3.7
	ADONA	ppt	<2.0	<2.0	<1.9	<1.9
AK101	Gasoline Range Organics	mg/L	<0.0500	<0.0500	<0.0500	<0.0500
AK102	Diesel Range Organics	mg/L	<0.705 B*	<0.916 B*	<0.566 B*	<0.566 B*
AK103	Residual Range Organics	mg/L	<0.537 B*	<0.586 B*	<0.236	<0.236
SW8021B	Benzene	µg/L	<0.250	<0.250	<0.250	<0.250
	Ethylbenzene	µg/L	<0.500	<0.500	<0.500	<0.500
	o-Xylene	µg/L	<0.500	<0.500	<0.500	<0.500
	P & M -Xylene	µg/L	<1.00	<1.00	<1.00	<1.00
	Toluene	µg/L	<0.500	<0.500	<0.500	<0.500
	Total Xylenes	µg/L	<1.50	<1.50	<1.50	<1.50
EPA 1664B	Oil & Grease, Total	mg/L	1.91 J	1.58 J	1.53 J	1.62 J
SM 5310B	Total Organic Carbon	mg/L	0.597 J	11.3	1.99	0.847 J
SM21 2540C	Total Dissolved Solids	mg/L	65.0	237	175	148
SM21 2540D	Total Suspended Solids	mg/L	<0.500	74.4	35.6	<0.500
SM21 4500-H B	pH	pH units	6.6	6.4	6.5	6.6
SM21 2340B	Hardness as CaCO3	mg/L	31.7	115	87.9	64.3
SM21 2510B	Conductivity	umhos/cm	87.0	315	257	262
SM21 4500-N D	Nitrogen Kjeldahl	mg/L	<0.500	2.09	0.608J	<0.500
SM21 4500NO3-F	Nitrate + Nitrite	mg/L	<0.200 B*	<0.200 B*	<0.200 B*	1.80
SM23 4500S D	Sulfide	mg/L	<0.0500	0.0800 J	<0.0500	<0.0500
EPA 300.0	Chloride	mg/L	3.92	15.9	8.57	38.2
	Fluoride	mg/L	0.126 J	0.182 J	0.163 J	0.0970 J
	Sulfate	mg/L	1.36	3.44	1.58	7.14
EP200.8	Calcium	µg/L	8,620	30,400	21,600	18,000
	Chromium	µg/L	<1.00	1.94 J	<1.00	<1.00
	Iron	µg/L	123 J	46,000	36,800	<125
	Magnesium	µg/L	2,470	9,450	8250	4,710
	Manganese	µg/L	1.79	1,420	1,340	7.40
	Potassium	µg/L	527	1,480	2,830	1,120
	Sodium	µg/L	4,600	6,920	9,190	24,200
SOP BAL - 4100	As(III) Arsenite	µg/L	<0.0400	1.9	3.6	<0.0400
	AS(V) Arsenate	µg/L	0.0590 J	0.461	0.993	<0.0400
	Dimethylarsinic acid (DMAs)	µg/L	<0.0500	<0.0500	<0.0500	<0.0500
	Monomethylarsonic acid (MMAs)	µg/L	<0.0900	<0.0900	<0.0900	<0.0900

ppt	parts per trillion, equivalent to nanograms per liter
µg/L	micrograms per liter
umhos/cm	micromhos per centimeter
mg/L	milligram per liter
†	Environmental Protection Agency (EPA) Lifetime Health Advisory (LHA) level is 70 ppt for PFOS and PFOA combined.
<	Analyte not detected; listed as less than the reporting limit (RL) unless otherwise flagged due to quality-control (QC) failures.
Bold	Concentration exceeds LHA level.
DUP	Field-duplicate sample
J	Estimated concentration, detected greater than the method detection limit (MDL) and less than the RL. Flag applied by the laboratory.
B*	Result is considered not detected due to quality control failures. Flag applied by Shannon & Wilson, Inc. (*)
‡	Minimum concentration, the LHA Combined oconcentration includes one or more result that is not detected greater than the MDL.

Attachment 3 – Peak Water Demand Estimates

Attachment 3 Peak Demand Estimates

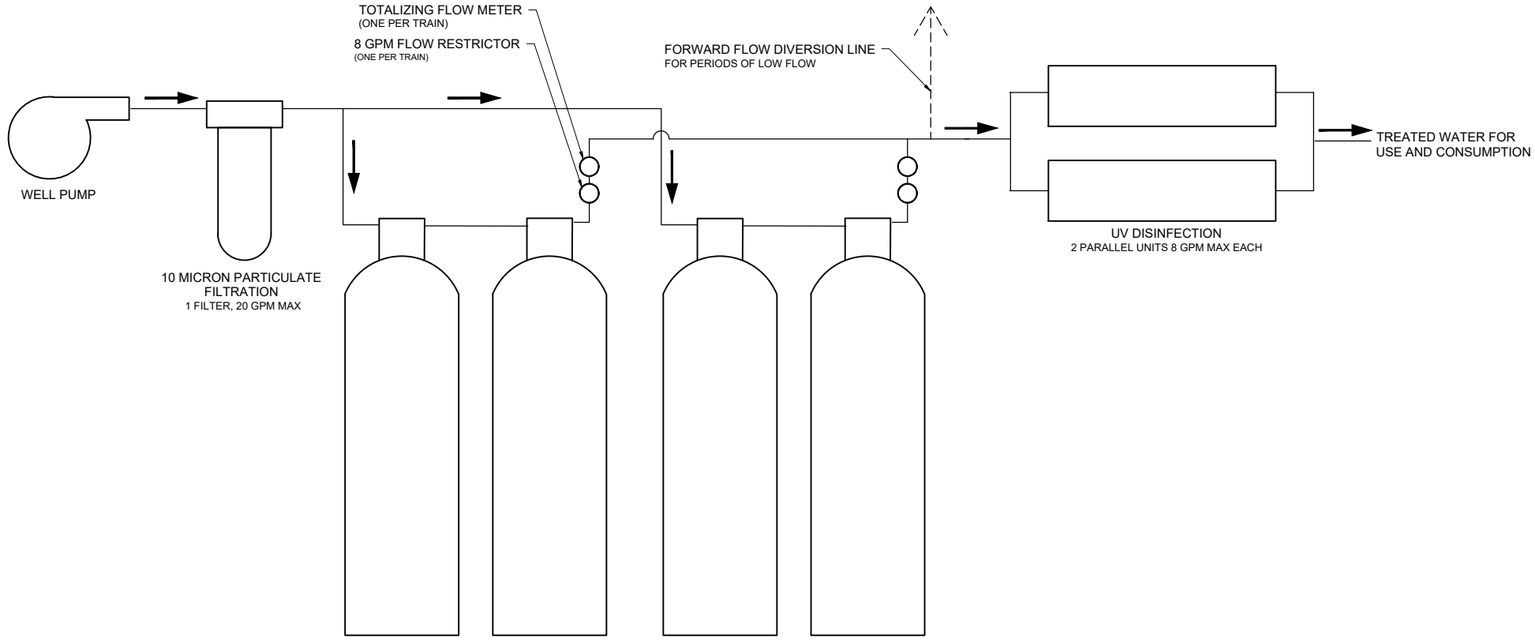
Sample ID Number	Description[1]	Number of People[2]	Categorical Method			Fixture Count Method		
			Area Category	Peak Flow Estimate per use or building (gpm)	Total Peak Demand Estimate per property (gpm)	Approx. Fixture Count (fixture units)	Peak Flow Estimate per use or building (gpm)	Total Peak Demand Estimate per property (gpm)
191050	Rectory and community water spigot	1 person, plus outdoor community use	Residential, 0-5 Residences Served (8 gpm per residence)	8	11	32.5	N/A	21
	Church	<10 people	Other Establishment (0.3 gpm per person)	3				
191300	Hangar	2 people	Industrial (0.5 gpm per employee)	1	1	6.5	6.5	7
191320	Airport Terminal (ground floor)	Approximately 9 people	Industrial (0.5 gpm per employee)	4.5	25	42	N/A	25
	Restaurant (second floor)	20 people assumed for treatment design purposes	Restaurant (1 gpm per seat)	20				
191700	House	1 person (2 people max)	Residential, 0-5 Residences Served (8 gpm per residence)	8	8	11.5	11.5	10
191710	House A (white/gray single-story)	2 people	Residential, 6-10 Residences Served (5 gpm per residence)	5	32	17	13	39
	Apartment Building, 5 units	4 to 8 people (10 max)		20		51.5	29	
	House B (green single-story)	1 to 2 people		5		7	7	
	Office (brown single-story)	3 people	Office Building (0.4 gpm per 100 SF)	2.4		5	6	
200150	Group housing, fish processing	1 person in winter; 15 people in summer	Residential, 0-5 Residences Served (8 gpm per residence)	8 (assume 6 gpm additional during winter)	14	35	N/A	23

(1) Separate buildings or multi-residential buildings at each property are shown in separate rows.

(2) Assume year-round residency or occupancy unless noted.

N/A = not available or not applicable.

Attachment 4 – Process Flow Diagrams



1 - PFAS WATER TREATMENT SYSTEM PROCESS FLOW DIAGRAM

JANUARY 24, 2020
REVISED MARCH 16, 2020
DRAFT

NO.	BY	CHK.	APP.	DATE	REVISION DESCRIPTION

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

PRINTED NAME _____

SIGNATURE _____

DATE _____ LICENSE # _____

	RELEASED TO/FOR	A	B	C	0	1	2	3
CLIENT								
BID								
CONSTRUCTION								
	DATE RELEASED							

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Project Office:
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4300 MARKETPOINTE DRIVE
Suite 200
MINNEAPOLIS, MN 55435
Ph: 1-800-632-2277
Fax: (952) 832-2601
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Corporate Headquarters:
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Ph: 1-800-632-2277

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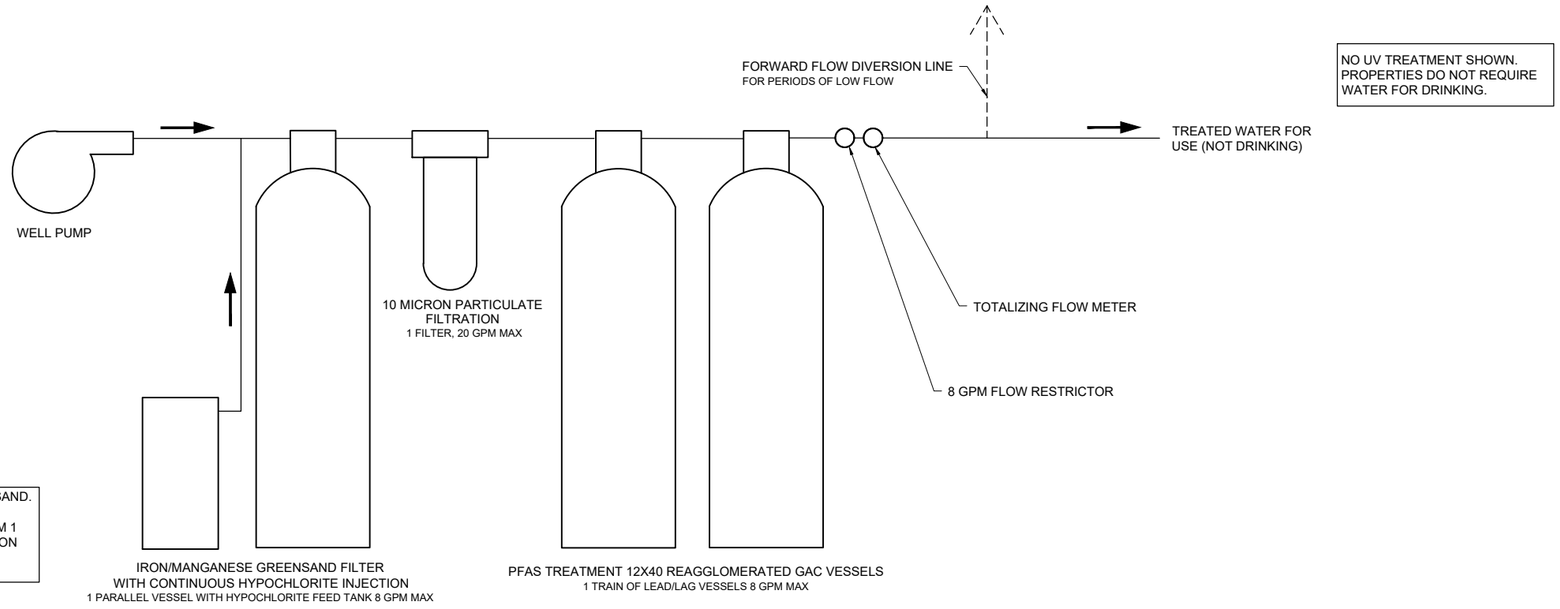
SHANNON & WILSON
FAIRBANKS AK

DILLINGHAM FEASIBILITY REPORT
DILLINGHAM, ALASKA

INDIVIDUAL SYSTEMS FOR PROPERTIES 191050 AND 200150
16 GPM EACH NO IRON PRETREATMENT

BARR PROJECT No. 02081001.03
CLIENT PROJECT No.
DWG. No. EXH 1
REV. No.



1 PFAS WATER TREATMENT SYSTEM PROCESS FLOW DIAGRAM

MARCH 16, 2020
DRAFT

NO.	BY	CHK.	APP.	DATE	REVISION DESCRIPTION

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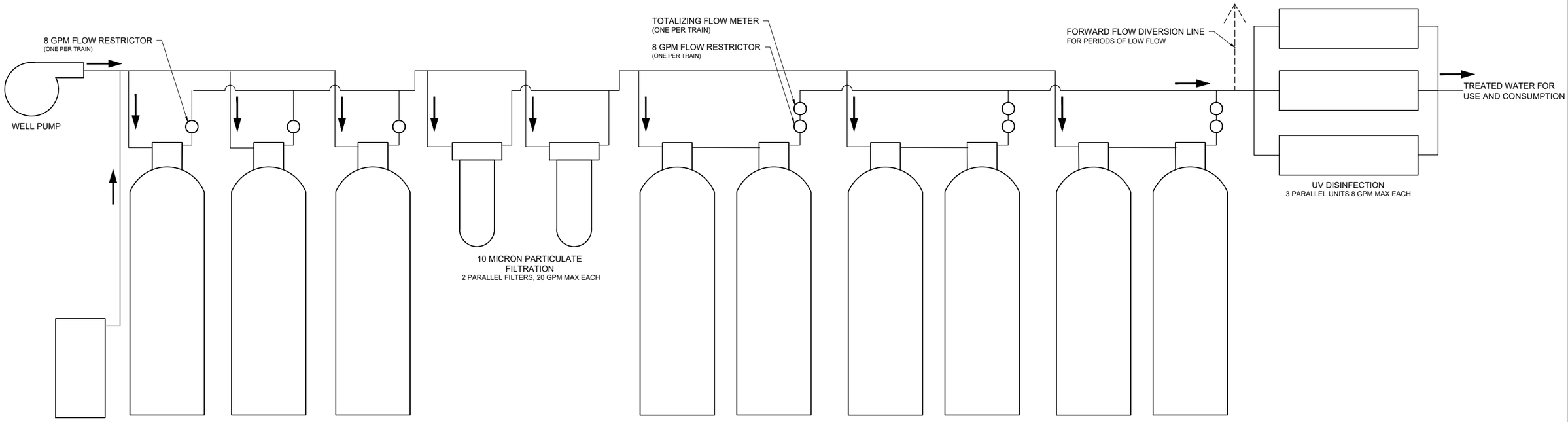
SHANNON & WILSON
FAIRBANKS AK

DILLINGHAM FEASIBILITY REPORT
DILLINGHAM, ALASKA

INDIVIDUAL SYSTEMS FOR PROPERTIES 191300 AND 191700
8 GPM EACH IRON PRETREATMENT SHOWN

BARR PROJECT No. 02081001.03
CLIENT PROJECT No.
DWG. No. EXH 2
REV. No.



1 PFAS WATER TREATMENT SYSTEM PROCESS FLOW DIAGRAM

January 24, 2020
Revised March 16, 2020
DRAFT

NO.	BY	CHK.	APP.	DATE	REVISION DESCRIPTION

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

PRINTED NAME _____

SIGNATURE _____

DATE _____ LICENSE # _____

CLIENT								
BID								
CONSTRUCTION								
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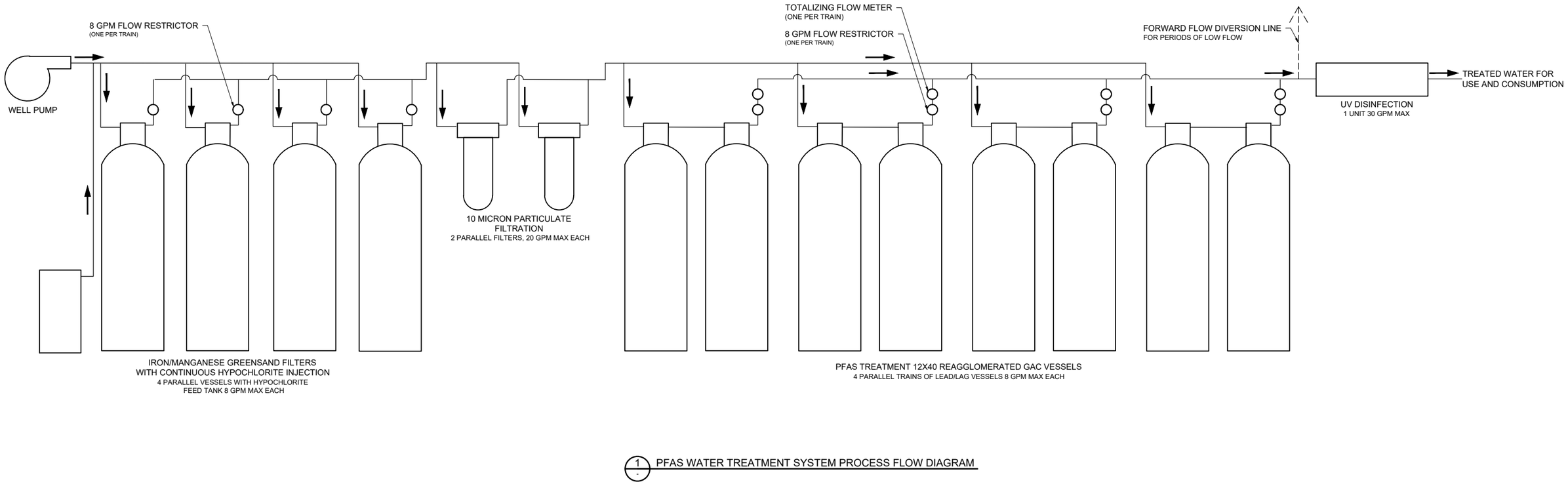
DILLINGHAM FEASIBILITY REPORT
DILLINGHAM, ALASKA

INDIVIDUAL TREATMENT SYSTEM FOR PROPERTY 191320
24 GPM SYSTEM WITH IRON PRETREATMENT

BARR PROJECT No. 02081001.03
CLIENT PROJECT No.
DWG. No. EXH 2
REV. No.



1 PFAS WATER TREATMENT SYSTEM PROCESS FLOW DIAGRAM

January 24, 2020
Revised March 16, 2020
DRAFT

NO.	BY	CHK.	APP.	DATE	REVISION DESCRIPTION

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PRINTED NAME _____

SIGNATURE _____

DATE _____ LICENSE # _____

CLIENT							
BID							
CONSTRUCTION							
RELEASED TO/FOR	A	B	C	0	1	2	3
DATE RELEASED							

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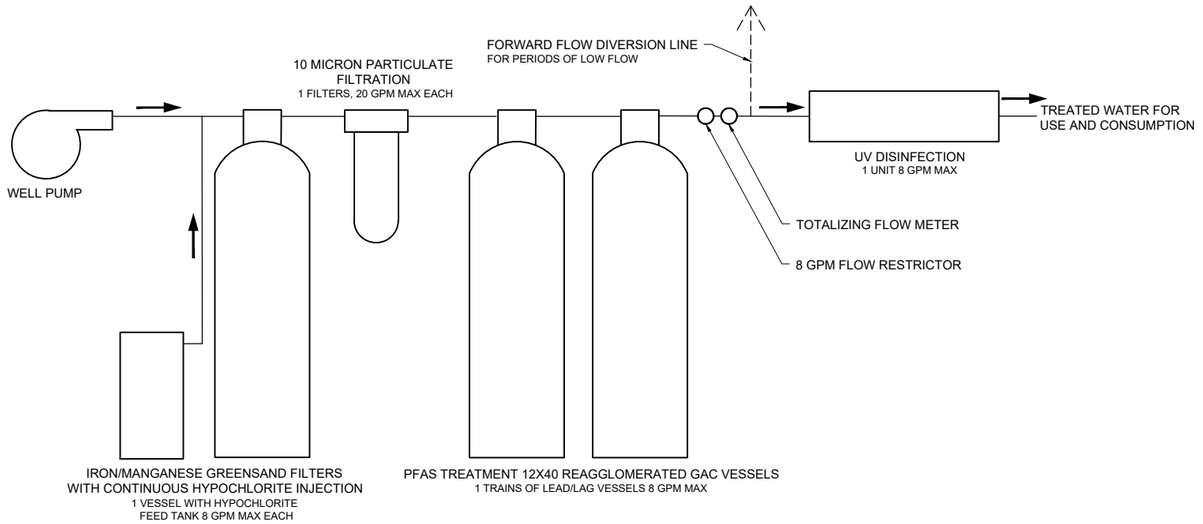
FAIRBANKS AK

DILLINGHAM FEASIBILITY REPORT
DILLINGHAM, ALASKA

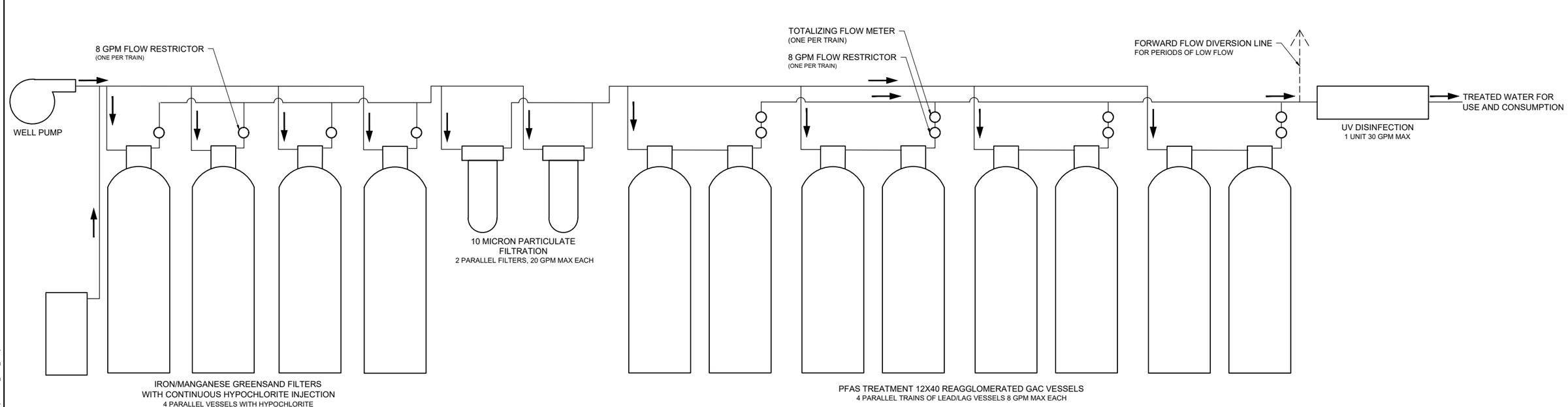
INDIVIDUAL TREATMENT SYSTEM FOR PROPERTY 191710
OPTION 1 - SINGLE SYSTEM 32 GPM WITH IRON PRETREATMENT

BARR PROJECT No. 02081001.03
CLIENT PROJECT No.
DWG. No. EXH 4
REV. No.



1 - PFAS WATER TREATMENT SYSTEM PROCESS FLOW DIAGRAM

TREATMENT SYSTEM SITED IN THE OFFICE AND ALSO SERVES HOUSE B



2 - PFAS WATER TREATMENT SYSTEM PROCESS FLOW DIAGRAM

TREATMENT SYSTEM SITED IN THE APARTMENT BUILDING AND ALSO SERVES HOUSE A

January 24, 2020
Revised March 16, 2020 Revised April 9, 2020
DRAFT

NO.	BY	CHK.	APP.	DATE	REVISION DESCRIPTION

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

PRINTED NAME _____

SIGNATURE _____

DATE _____ LICENSE # _____

	RELEASED TO/FOR	A	B	C	0	1	2	3
CLIENT								
BID								
CONSTRUCTION								
	DATE RELEASED							

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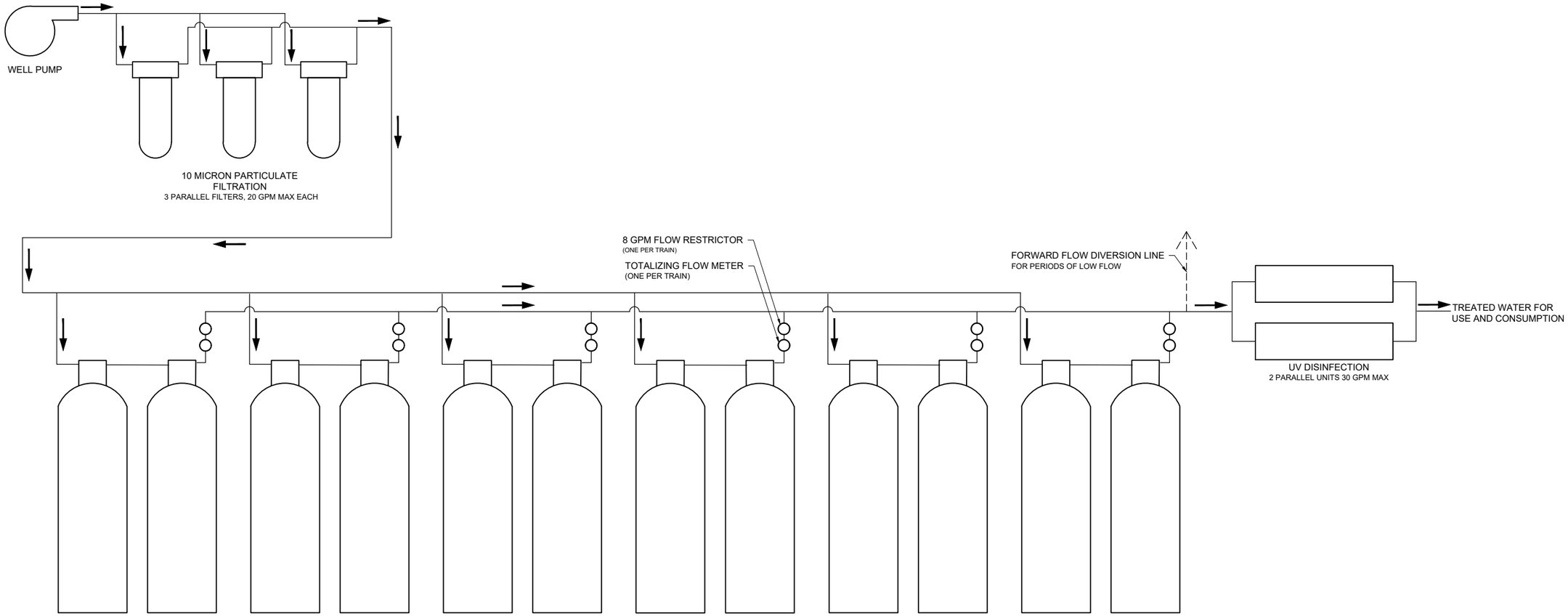
Date	
Drawn	
Checked	
Designed	
Approved	

SHANNON & WILSON
FAIRBANKS AK

DILLINGHAM FEASIBILITY REPORT
DILLINGHAM, ALASKA

INDIVIDUAL TREATMENT SYSTEM FOR PROPERTY 191710
OPTION 2 - TWO SYSTEMS 8 AND 32 GPM WITH IRON PRETREATMENT

BARR PROJECT No. 02081001.03
CLIENT PROJECT No.
DWG. No. EXH 5
REV. No.



1 PFAS WATER TREATMENT SYSTEM PROCESS FLOW DIAGRAM

March 16, 2020
DRAFT

NO.	BY	CHK.	APP.	DATE	REVISION DESCRIPTION

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

PRINTED NAME _____

SIGNATURE _____

DATE _____ LICENSE # _____

CLIENT	
BID	
CONSTRUCTION	
RELEASED TO/FOR	

A	B	C	0	1	2	3
DATE RELEASED						

BARR
Corporate Headquarters:
Minneapolis, Minnesota
Ph: 1-800-632-2277

Project Office:
BARR ENGINEERING CO.
4300 MARKETPOINTE DRIVE
Suite 200
MINNEAPOLIS, MN 55435
Ph: 1-800-632-2277
Fax: (952) 832-2601
www.barr.com

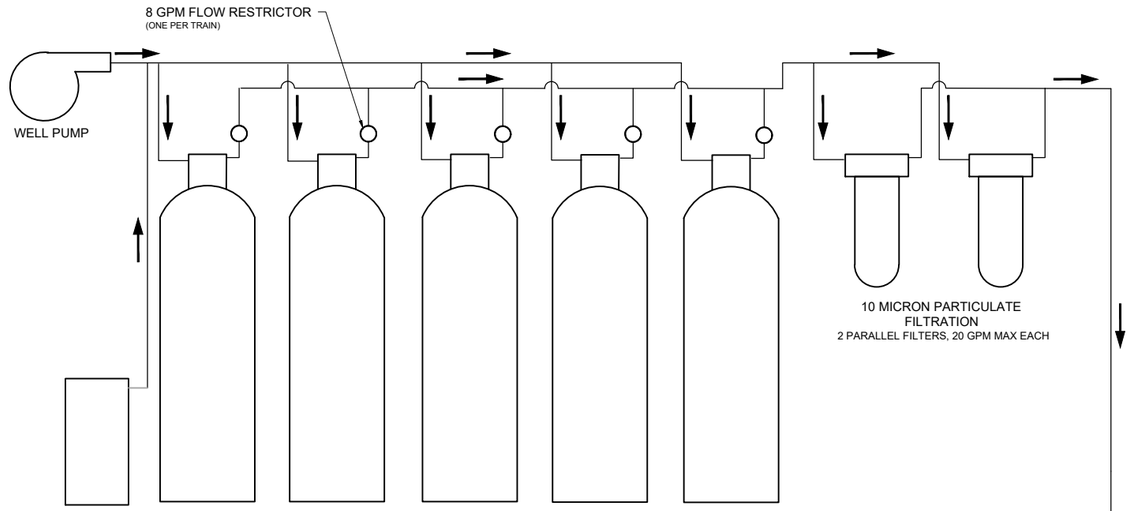
Scale	AS SHOWN
Date	
Drawn	
Checked	
Designed	
Approved	

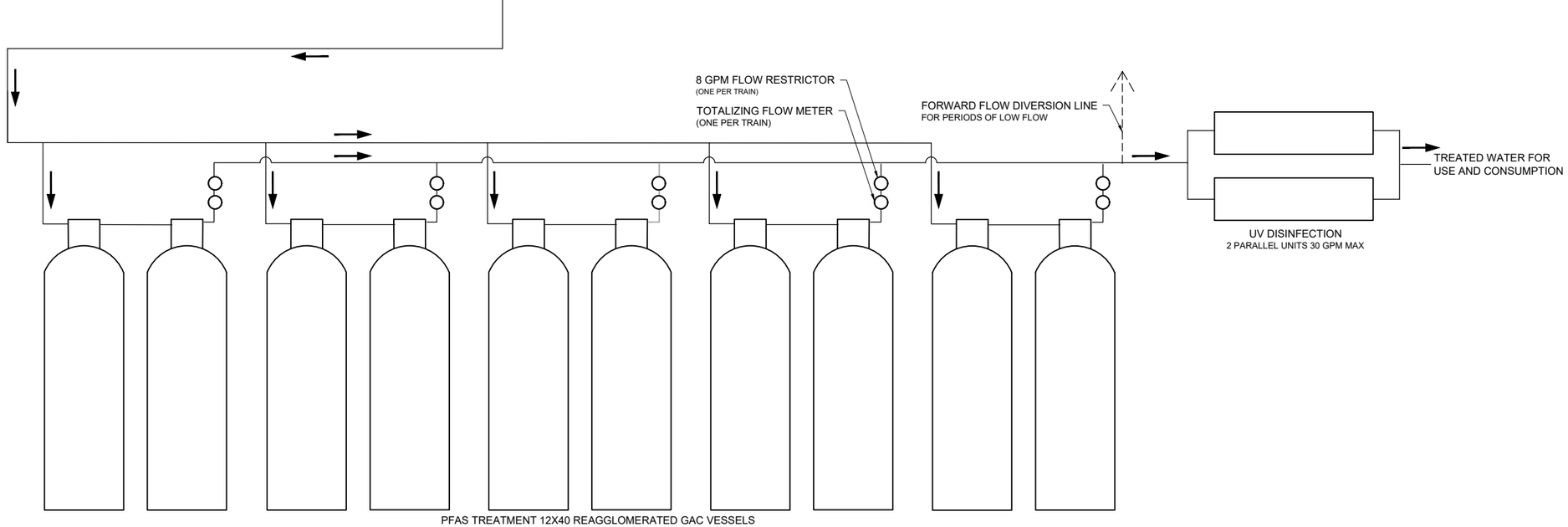
SHANNON & WILSON
FAIRBANKS AK

DILLINGHAM FEASIBILITY REPORT
DILLINGHAM, ALASKA

COMBINED TREATMENT SYSTEM 1 PROPERTIES 191050, 191700, AND 191710
SYSTEM SITED AT PROPERTY 191050 48 GPM SYSTEM NO IRON PRETREATMENT

BARR PROJECT No.	02081001.03
CLIENT PROJECT No.	
DWG. No.	EXH 6
REV. No.	





1 PFAS WATER TREATMENT SYSTEM PROCESS FLOW DIAGRAM

March 16, 2020
DRAFT

NO.	BY	CHK.	APP.	DATE	REVISION DESCRIPTION

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

PRINTED NAME _____

SIGNATURE _____

DATE _____ LICENSE # _____

	RELEASED TO/FOR	DATE RELEASED
CLIENT		
BID		
CONSTRUCTION		
	A	0
	B	1
	C	2
		3

BARR
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Fax: (952) 832-2601
www.barr.com

Scale	AS SHOWN
Date	
Drawn	
Checked	
Designed	
Approved	

SHANNON & WILSON
FAIRBANKS AK

DILLINGHAM FEASIBILITY REPORT
DILLINGHAM, ALASKA

COMBINED TREATMENT SYSTEM 2 PROPERTIES 191700 AND 191710
SYSTEM SITED AT PROPERTY 191710 40 GPM SYSTEM WITH IRON PRETREATMENT

BARR PROJECT No.	02081001.03
CLIENT PROJECT No.	
DWG. No.	EXH 6
REV. No.	

Attachment 5 – Capital and O&M Cost Details

Property: 191050
Peak Demand: 16 gpm

Item	Item Description	Unit	Quantity	Unit Cost	Item Cost	Notes
1	20 gpm 10 micron 20x4.5 Sediment Filter (housing, filter, bracket)	Ea	1	$ 225	$ 300	
2	8 gpm GAC vessels (2.5 cu ft per vessel)	Ea	6	$ 1,025	$ 6,200	Includes 1 spare per train
3	GAC Media (12x40 bituminous coal-based carbon, NSF certified)	cu ft	15	$ 188	$ 2,900	
4	8 gpm UV Disinfection Unit	Ea	2	$ 813	$ 1,700	
5	8 gpm flow restrictor	Ea	2	$ 150	$ 300	
6	Totalizing flow meter	Ea	2	$ 750	$ 1,500	
7	Sample Taps	Ea	4	$ 83	$ 400	
	Installation	hour	56	$ 150	$ 8,400	Hourly quote from AHL; 28 hours per 8 gpm system
	Plumbing, piping, fittings, valves	Ea	2	$ 2,400	$ 4,800	Quote from AHL per system
	Freight	Ea	2	$ 1,500	$ 3,000	$1,500 per 8 gpm system
	Equipment Subtotal				$ 29,500	
	Contingency			15% of subtotal	$ 4,500	
	Construction Subtotal				$ 34,000	
	Engineering, Legal, Administrative			20% of construction costs	$ 6,800	
	Estimated Required Treatment System Cost				$ 40,800	All item costs are rounded up to the nearest $100. ENRCCI = 11496 Jan 2020 This is a Class 5 cost estimate with a +50/-30% uncertainty as applicable for projects at less than 2% of full project definition per AACE International 17R-97.

Property: 191300
Peak Demand: 8 gpm

Item	Item Description	Unit	Quantity	Unit Cost	Item Cost	Notes
1	20 gpm 10 micron 20x4.5 Sediment Filter (housing, filter, bracket)	Ea	1	$ 225	$ 300	
2	8 gpm GAC vessels (2.5 cu ft per vessel)	Ea	3	$ 1,025	$ 3,100	Includes 1 spare per train
3	GAC Media (12x40 bituminous coal-based carbon, NSF certified)	cu ft	7.5	$ 188	$ 1,500	
4	8 gpm flow restrictor	Ea	2	$ 150	$ 300	
5	Totalizing flow meter	Ea	2	$ 750	$ 1,500	
6	Sample Taps	Ea	3	$ 83	$ 300	
	Installation	hour	28	$ 150	$ 4,200	Hourly quote from AHL; 28 hours per 8 gpm system
	Plumbing, piping, fittings, valves	Ea	1	$ 2,400	$ 2,400	Quote from AHL per system
	Freight	Ea	1	$ 1,500	$ 1,500	$1,500 per 8 gpm system
	Equipment Subtotal				$ 15,100	
	Contingency			15% of subtotal	$ 2,300	
	Construction Subtotal				$ 17,400	
	Engineering, Legal, Administrative			20% of construction costs	$ 3,500	
	Estimated Required Treatment System Cost				$ 20,900	All item costs are rounded up to the nearest $100. ENRCCI = 11496 Jan 2020 This is a Class 5 cost estimate with a +50/-30% uncertainty as applicable for projects at less than 2% of full project definition per AACE International 17R-97.

Additional Options

Item	Item Description	Unit	Quantity	Unit Cost	Item Cost	Notes
1	Treatment building	sq ft	24	$ 60	$ 1,500	Inclusion to be assessed after reviewing space constraints and preparing general arrangements.
2	8 gpm Iron Greensand Filter (5 cu ft per vessel)	Ea	1	$ 3,025	$ 3,100	Inclusion to be assessed after collecting additional analytical information.
3	Hypochlorite tank and pump	Ea	1	$ 487	$ 500	
4	8 gpm UV Disinfection Unit	Ea	1	$ 813	$ 900	Inclusion to be assessed after reviewing property-specific uses.
	Additional Options Subtotal				$ 6,000	
	Contingency			15% of subtotal	$ 900	
	Additional Options Construction Subtotal				$ 6,900	
	Estimated Treatment System Cost w/ Additional Options				$ 27,800	All item costs are rounded up to the nearest $100. ENRCCI = 11496 Jan 2020 This is a Class 5 cost estimate with a +50/-30% uncertainty as applicable for projects at less than 2% of full project definition per AACE International 17R-97.

Property: 191320
Peak Demand: 24 gpm

Item	Item Description	Unit	Quantity	Unit Cost	Item Cost	Notes
1	8 gpm Iron Greensand Filter (5 cu ft per vessel)	Ea	3	$ 3,025	$ 9,100	
2	Hypochlorite tank and pump	Ea	1	$ 487	$ 500	
3	20 gpm 10 micron 20x4.5 Sediment Filter (housing, filter, bracket)	Ea	2	$ 225	$ 500	
4	8 gpm GAC vessel (14x47, 2.5 cu ft per vessel)	Ea	9	$ 1,025	$ 9,300	Includes 1 spare per train
5	GAC Media (12x40 bituminous coal-based carbon, NSF certified)	cu ft	23	$ 188	$ 4,300	
6	8 gpm UV Disinfection Unit	Ea	3	$ 813	$ 2,500	
7	8 gpm flow restrictor	Ea	3	$ 150	$ 500	
8	Totalizing flow meter	Ea	3	$ 750	$ 2,300	
9	Sample Taps	Ea	6	$ 83	$ 500	
	Installation	hour	84	$ 150	$ 12,600	Hourly quote from AHL; 28 hours per 8 gpm system
	Plumbing, piping, fittings, valves	Ea	3	$ 2,400	$ 7,200	Quote from AHL per system
	Freight	Ea	3	$ 1,500	$ 4,500	$1,500 per 8 gpm system
	Equipment Subtotal				$ 53,800	
	Contingency			15% of subtotal	$ 8,100	
	Construction Subtotal				$ 61,900	
	Engineering, Legal, Administrative			20% of construction costs	$ 12,400	
	Estimated Required Treatment System Cost				$ 74,300	All item costs are rounded up to the nearest $100. ENRCCI = 11496 Jan 2020 This is a Class 5 cost estimate with a +50/-30% uncertainty as applicable for projects at less than 2% of full project definition per AACE International 17R-97.

Additional Options

Item	Item Description	Unit	Quantity	Unit Cost	Item Cost	Notes
1	Treatment building	sq ft	72	$ 60	$ 4,400	Inclusion to be assessed after reviewing space constraints and preparing general arrangements.
	Additional Options Subtotal				$ 4,400	
	Contingency			15% of subtotal	$ 700	
	Additional Options Construction Subtotal				$ 5,100	
	Estimated Treatment System Cost w/ Additional Options				$ 79,400	All item costs are rounded up to the nearest $100. ENRCCI = 11496 Jan 2020 This is a Class 5 cost estimate with a +50/-30% uncertainty as applicable for projects at less than 2% of full project definition per AACE International 17R-97.

Property: 191700
Peak Demand: 8 gpm

Item	Item Description	Unit	Quantity	Unit Cost	Item Cost	Notes
1	20 gpm 10 micron 20x4.5 Sediment Filter (housing, filter, bracket)	Ea	1	$ 225	$ 300	
2	8 gpm GAC vessels (2.5 cu ft per vessel)	Ea	3	$ 1,025	$ 3,100	Includes 1 spare per train
3	GAC Media (12x40 bituminous coal-based carbon, NSF certified)	cu ft	7.5	$ 188	$ 1,500	
4	8 gpm flow restrictor	Ea	2	$ 150	$ 300	
5	Totalizing flow meter	Ea	2	$ 750	$ 1,500	
6	Sample Taps	Ea	3	$ 83	$ 300	
	Installation	hour	28	$ 150	$ 4,200	Hourly quote from AHL; 28 hours per 8 gpm system
	Plumbing, piping, fittings, valves	Ea	1	$ 2,400	$ 2,400	Quote from AHL per system
	Freight	Ea	1	$ 1,500	$ 1,500	$1,500 per 8 gpm system
	Equipment Subtotal				$ 15,100	
	Contingency			15% of subtotal	$ 2,300	
	Construction Subtotal				$ 17,400	
	Engineering, Legal, Administrative			20% of construction costs	$ 3,500	
	Estimated Required Treatment System Cost				$ 20,900	All item costs are rounded up to the nearest $100. ENRCCI = 11496 Jan 2020 This is a Class 5 cost estimate with a +50/-30% uncertainty as applicable for projects at less than 2% of full project definition per AACE International 17R-97.

Additional Options

Item	Item Description	Unit	Quantity	Unit Cost	Item Cost	Notes
1	Treatment building	sq ft	24	$ 60	$ 1,500	Inclusion to be assessed after reviewing space constraints and preparing general arrangements.
2	8 gpm Iron Greensand Filter (5 cu ft per vessel)	Ea	1	$ 3,025	$ 3,100	Inclusion to be assessed after collecting additional analytical information.
3	Hypochlorite tank and pump	Ea	1	$ 487	$ 500	
4	8 gpm UV Disinfection Unit	Ea	1	$ 813	$ 900	Inclusion to be assessed after reviewing property-specific uses.
	Additional Options Subtotal				$ 6,000	
	Contingency			15% of subtotal	$ 900	
	Additional Options Construction Subtotal				$ 6,900	
	Estimated Treatment System Cost w/ Additional Options				$ 27,800	All item costs are rounded up to the nearest $100. ENRCCI = 11496 Jan 2020 This is a Class 5 cost estimate with a +50/-30% uncertainty as applicable for projects at less than 2% of full project definition per AACE International 17R-97.

Property: 191710 - Option 1 - Single System
Peak Demand: 32 gpm

Item	Item Description	Unit	Quantity	Unit Cost	Item Cost	Notes
1	8 gpm Iron Greensand Filter (5 cu ft per vessel)	Ea	4	$ 3,025	$ 12,100	
2	Hypochlorite tank and pump	Ea	1	$ 487	$ 500	
3	20 gpm 10 micron 20x4.5 Sediment Filter (housing, filter, bracket)	Ea	2	$ 225	$ 500	
4	8 gpm GAC vessel (14x47, 2.5 cu ft per vessel)	Ea	12	$ 1,025	$ 12,300	Includes 1 spare per train
5	GAC Media (12x40 bituminous coal-based carbon, NSF certified)	cu ft	30	$ 188	$ 5,700	
6	30 gpm UV Disinfection Unit	Ea	1	$ 4,700	$ 4,700	
7	8 gpm flow restrictor	Ea	8	$ 150	$ 1,200	
8	Totalizing flow meter	Ea	4	$ 750	$ 3,000	
9	Sample Taps	Ea	7	$ 83	$ 600	
	Installation	hour	112	$ 150	$ 16,800	Hourly quote from AHL; 28 hours per 8 gpm system
	Plumbing, piping, fittings, valves	Ea	4	$ 2,400	$ 9,600	Quote from AHL per system
	Freight	Ea	4	$ 1,500	$ 6,000	$1,500 per 8 gpm system
	Equipment Subtotal				$ 73,000	
	Contingency			15% of subtotal	$ 11,000	
	Construction Subtotal				$ 84,000	
	Engineering, Legal, Administrative			20% of construction costs	$ 16,800	
	Estimated Required Treatment System Cost				$ 100,800	All item costs are rounded up to the nearest $100. ENRCCI = 11496 Jan 2020 This is a Class 5 cost estimate with a +50/-30% uncertainty as applicable for projects at less than 2% of full project definition per AACE International 17R-97.

Additional Options

Item	Item Description	Unit	Quantity	Unit Cost	Item Cost	Notes
1	Treatment building	sq ft	96	$ 60	$ 5,800	Inclusion to be assessed after reviewing space constraints and preparing general arrangements.
	Additional Options Subtotal				$ 5,800	
	Contingency			15% of subtotal	$ 900	
	Additional Options Construction Subtotal				$ 6,700	
	Estimated Treatment System Cost w/ Additional Options				$ 107,500	All item costs are rounded up to the nearest $100. ENRCCI = 11496 Jan 2020 This is a Class 5 cost estimate with a +50/-30% uncertainty as applicable for projects at less than 2% of full project definition per AACE International 17R-97.

Property: 191710 - Option 2 - Two separate systems
Peak Demand: One 8 gpm systems and one 32 gpm system

Item	Item Description	Unit	Quantity	Unit Cost	Item Cost	Notes
1	8 gpm Iron Greensand Filter (5 cu ft per vessel)	Ea	5	$ 3,025	$ 15,200	
2	Hypochlorite tank and pump	Ea	2	$ 487	$ 1,000	
3	20 gpm 10 micron 20x4.5 Sediment Filter (housing, filter, bracket)	Ea	3	$ 225	$ 700	
4	8 gpm GAC vessel (14x47, 2.5 cu ft per vessel)	Ea	15	$ 1,025	$ 15,400	Includes 1 spare per train
5	GAC Media (12x40 bituminous coal-based carbon, NSF certified)	cu ft	38	$ 188	$ 7,100	
6	30 gpm UV Disinfection Unit	Ea	1	$ 4,700	$ 4,700	
7	8 gpm UV Disinfection Unit	Ea	1	$ 813	$ 900	
8	8 gpm flow restrictor	Ea	9	$ 150	$ 1,400	
9	Totalizing flow meter	Ea	5	$ 750	$ 3,800	
10	Sample Taps	Ea	9	$ 83	$ 800	
	Installation	hour	140	$ 150	$ 21,000	Hourly quote from AHL; 28 hours per 8 gpm system
	Plumbing, piping, fittings, valves	Ea	5	$ 2,400	$ 12,000	Quote from AHL per system
	Freight	Ea	5	$ 1,500	$ 7,500	$1,500 per 8 gpm system
	Equipment Subtotal				$ 91,500	
	Contingency			15% of subtotal	$ 13,800	
	Construction Subtotal				$ 105,300	
	Engineering, Legal, Administrative			20% of construction costs	$ 21,100	
	Estimated Required Treatment System Cost				$ 126,400	All item costs are rounded up to the nearest $100. ENRCCI = 11496 Jan 2020 This is a Class 5 cost estimate with a +50/-30% uncertainty as applicable for projects at less than 2% of full project definition per AACE International 17R-97.

Additional Options

Item	Item Description	Unit	Quantity	Unit Cost	Item Cost	Notes
1	Treatment building	sq ft	96	$ 60	$ 5,800	Inclusion to be assessed after reviewing space constraints and preparing general arrangements; Outbuilding sized for the 32 gpm system. The 8 gpm system is assumed to be sited in the Office.
	Additional Options Subtotal				$ 5,800	
	Contingency			15% of subtotal	$ 900	
	Additional Options Construction Subtotal				$ 6,700	
	Estimated Treatment System Cost w/ Additional Options				$ 133,100	All item costs are rounded up to the nearest $100. ENRCCI = 11496 Jan 2020 This is a Class 5 cost estimate with a +50/-30% uncertainty as applicable for projects at less than 2% of full project definition per AACE International 17R-97.

Property: 200150
Peak Demand: 16 gpm

Item	Item Description	Unit	Quantity	Unit Cost	Item Cost	Notes
1	20 gpm 10 micron 20x4.5 Sediment Filter (housing, filter, bracket)	Ea	1	$ 225	$ 300	
2	8 gpm GAC vessel (14x47, 2.5 cu ft per vessel)	Ea	6	$ 1,025	$ 6,200	Includes 1 spare per train
3	GAC Media (12x40 bituminous coal-based carbon, NSF certified)	cu ft	15	$ 188	$ 2,900	
4	8 gpm UV Disinfection Unit	Ea	2	$ 813	$ 1,700	
5	8 gpm flow restrictor	Ea	2	$ 150	$ 300	
6	Totalizing flow meter	Ea	2	$ 750	$ 1,500	
7	Sample Taps	Ea	4	$ 83	$ 400	
	Installation	hour	56	$ 150	$ 8,400	Hourly quote from AHL; 28 hours per 8 gpm system
	Plumbing, piping, fittings, valves	Ea	2	$ 2,400	$ 4,800	Quote from AHL per system
	Freight	Ea	2	$ 1,500	$ 3,000	$1,500 per 8 gpm system
	Equipment Subtotal				$ 29,500	
	Contingency		15% of subtotal		$ 4,500	
	Construction Subtotal				$ 34,000	
	Engineering, Legal, Administrative		20% of construction costs		$ 6,800	
	Estimated Required Treatment System Cost				$ 40,800	All item costs are rounded up to the nearest $100. ENRCCI = 11496 Jan 2020 This is a Class 5 cost estimate with a +50/-30% uncertainty as applicable for projects at less than 2% of full project definition per AACE International 17R-97.

Additional Options

Item	Item Description	Unit	Quantity	Unit Cost	Item Cost	Notes
1	Treatment building	sq ft	32	$ 60	$ 2,000	Inclusion to be assessed after reviewing space constraints and preparing general arrangements.
	Additional Options Subtotal				$ 2,000	
	Contingency		15% of subtotal		$ 300	
	Additional Options Construction Subtotal				$ 2,300	
	Estimated Treatment System Cost w/ Additional Options				$ 43,100	All item costs are rounded up to the nearest $100. ENRCCI = 11496 Jan 2020 This is a Class 5 cost estimate with a +50/-30% uncertainty as applicable for projects at less than 2% of full project definition per AACE International 17R-97.

Property: Combined System 1 (191050, 191700, 191710)
Peak Demand: 48 gpm

Item	Item Description	Unit	Quantity	Unit Cost	Item Cost	Notes
1	20 gpm 10 micron 20x4.5 Sediment Filter (housing, filter, bracket)	Ea	3	$ 225	$ 700	
2	8 gpm GAC vessel (14x47, 2.5 cu ft per vessel)	Ea	18	$ 1,025	$ 18,500	Includes 1 spare per train
3	GAC Media (12x40 bituminous coal-based carbon, NSF certified)	cu ft	45	$ 188	$ 8,500	
4	30 gpm UV Disinfection Unit	Ea	2	$ 4,700	$ 9,400	Assumes centralized UV disinfection
5	8 gpm flow restrictor	Ea	6	$ 150	$ 900	
6	Totalizing flow meter	Ea	6	$ 750	$ 4,500	
7	Sample Taps	Ea	8	$ 83	$ 700	
	Installation	hour	168	$ 150	$ 25,200	Hourly quote from AHL; 28 hours per 8 gpm system
	Plumbing, piping, fittings, valves	Ea	6	$ 2,400	$ 14,400	Quote from AHL per system
	Freight	Ea	6	$ 1,500	$ 9,000	$1,500 per 8 gpm system
	Equipment Subtotal				$ 91,800	
	Contingency		15% of subtotal		$ 13,800	
	Construction Subtotal				$ 105,600	
	Engineering, Legal, Administrative		20% of construction costs		$ 21,200	
	Estimated Required Treatment System Cost				$ 126,800	All item costs are rounded up to the nearest $100. ENRCCI = 11496 Jan 2020 This is a Class 5 cost estimate with a +50/-30% uncertainty as applicable for projects at less than 2% of full project definition per AACE International 17R-97.

Additional Options

Item	Item Description	Unit	Quantity	Unit Cost	Item Cost	Notes
1	Treatment building	sq ft	96	$ 60	$ 5,800	Inclusion to be assessed after reviewing space constraints and preparing general arrangements.
	Additional Options Subtotal				$ 5,800	
	Contingency		15% of subtotal		$ 900	
	Additional Options Construction Subtotal				$ 6,700	
	Estimated Treatment System Cost w/ Additional Options				$ 133,500	All item costs are rounded up to the nearest $100. ENRCCI = 11496 Jan 2020 This is a Class 5 cost estimate with a +50/-30% uncertainty as applicable for projects at less than 2% of full project definition per AACE International 17R-97.

Note: This cost estimate does not include capital expenses associated with service connection lines between properties.

Property: Combined System 2 (191700, 191710)
Peak Demand: 40 gpm

Item	Item Description	Unit	Quantity	Unit Cost	Item Cost	Notes
1	8 gpm Iron Greensand Filter (5 cu ft per vessel)	Ea	5	$ 3,025	$ 15,200	
2	Hypochlorite tank and pump	Ea	1	$ 487	$ 500	
3	20 gpm 10 micron 20x4.5 Sediment Filter (housing, filter, bracket)	Ea	2	$ 225	$ 500	
4	8 gpm GAC vessel (14x47, 2.5 cu ft per vessel)	Ea	15	$ 1,025	$ 15,400	Includes 1 spare per train
5	GAC Media (12x40 bituminous coal-based carbon, NSF certified)	cu ft	37.5	$ 188	$ 7,100	
6	30 gpm UV Disinfection Unit	Ea	2	$ 4,700	$ 9,400	Assumes centralized UV disinfection
7	8 gpm flow restrictor	Ea	10	$ 150	$ 1,500	
8	Totalizing flow meter	Ea	5	$ 750	$ 3,800	
9	Sample Taps	Ea	8	$ 83	$ 700	
	Installation	hour	140	$ 150	$ 21,000	Hourly quote from AHL; 28 hours per 8 gpm system
	Plumbing, piping, fittings, valves	Ea	5	$ 2,400	$ 12,000	Quote from AHL per system
	Freight	Ea	5	$ 1,500	$ 7,500	$1,500 per 8 gpm system
	Equipment Subtotal				$ 94,600	
	Contingency		15% of subtotal		$ 14,200	
	Construction Subtotal				$ 108,800	
	Engineering, Legal, Administrative		20% of construction costs		$ 21,800	
	Estimated Required Treatment System Cost				$ 130,600	All item costs are rounded up to the nearest $100. ENRCCI = 11496 Jan 2020 This is a Class 5 cost estimate with a +50/-30% uncertainty as applicable for projects at less than 2% of full project definition per AACE International 17R-97.

Additional Options

Item	Item Description	Unit	Quantity	Unit Cost	Item Cost	Notes
1	Treatment building	sq ft	120	$ 60	$ 7,200	Inclusion to be assessed after reviewing space constraints and preparing general arrangements.
	Additional Options Subtotal				$ 7,200	
	Contingency		15% of subtotal		$ 1,100	
	Additional Options Construction Subtotal				$ 8,300	
	Estimated Treatment System Cost w/ Additional Options				$ 138,900	All item costs are rounded up to the nearest $100. ENRCCI = 11496 Jan 2020 This is a Class 5 cost estimate with a +50/-30% uncertainty as applicable for projects at less than 2% of full project definition per AACE International 17R-97.

Note: This cost estimate does not include capital expenses associated with service connection lines between properties.

Property: 191050
Peak Demand: 16 gpm

Item	Item Description	Unit	Quantity	Unit Cost	Item Cost	Notes
1	GAC Replacement (per vessel)	Ea	2	$ 1,000	$ 2,000	Assume annual replacement of lead vessels
2	Analysis	Ea	16	$ 300	$ 4,800	Quarterly sampling; Influent, Effluent, between lead/lag vessels
3	Sampling	hour	24	$ 90	$ 2,200	Assume 4 hrs of travel per property for quarterly sampling plus 2 hrs for sample collection
4	Equipment Maintenance and Replacement	--	--	--	$ 900	3% of the equipment subtotal, including Freight
5	Power	kW-hr	500	$ 0.44	$ 300	
6	Labor	hour	8	$ 75	$ 600	
	Subtotal				$ 10,800	
	Contingency			15% of subtotal	$ 1,700	
	Annual Maintenance Cost Total				$ 12,500	
	Administrative			10% of annual maintenance cost	$ 1,300	
	Estimated Annual Cost Total				$ 13,800	All item costs are rounded up to the nearest $100. O&M costs are based on a Class 5 capital cost estimate with a +50/-30% uncertainty as applicable for projects at less than 2% of full project definition per AACE International 17R-97. O&M Costs are also expected to have a +50/-30% uncertainty.

Property: 191300
Peak Demand: 8 gpm

Item	Item Description	Unit	Quantity	Unit Cost	Item Cost	Notes
1	GAC Replacement (per vessel)	Ea	1	$ 1,000	$ 1,000	Assume annual replacement of lead vessels
2	Analysis	Ea	12	$ 300	$ 3,600	Quarterly sampling; Influent, Effluent, between lead/lag vessels
3	Sampling	hour	24	$ 90	$ 2,200	Assume 4 hrs of travel per property for quarterly sampling plus 2 hrs for sample collection
4	Equipment Maintenance and Replacement	--	--	--	$ 500	3% of the equipment subtotal, including Freight
5	Power	kW-hr	500	$ 0.44	$ 300	
6	Labor	hour	8	$ 75	$ 600	
	Subtotal				$ 8,200	
	Contingency			15% of subtotal	$ 1,300	
	Annual Maintenance Cost Total				$ 9,500	
	Administrative			10% of annual maintenance cost	$ 1,000	
	Estimated Annual Cost Total				$ 10,500	All item costs are rounded up to the nearest $100. O&M costs are based on a Class 5 capital cost estimate with a +50/-30% uncertainty as applicable for projects at less than 2% of full project definition per AACE International 17R-97. O&M Costs are also expected to have a +50/-30% uncertainty.

Additional Options

Item	Item Description	Unit	Quantity	Unit Cost	Item Cost	Notes
1	Hypochlorite Use	LS	1	$ 1,500	$ 1,500	Budgetary quote from AHL for NSF certified hypochlorite
2	Greensand Media Replacement	Ea	1	$ 120	$ 200	$600 per 5 years for media replacement
3	Equipment Maintenance and Replacement	--	--	--	$ 200	3% of the additional items subtotal
	Additional Options Subtotal				$ 1,900	
	Contingency			15% of subtotal	$ 300	
	Additional Options Construction Subtotal				$ 2,200	
	Estimated Treatment System Cost w/ Additional Options				$ 12,700	All item costs are rounded up to the nearest $100. O&M costs are based on a Class 5 capital cost estimate with a +50/-30% uncertainty as applicable for projects at less than 2% of full project definition per AACE International 17R-97. O&M Costs are also expected to have a +50/-30% uncertainty.

Property: 191320
Peak Demand: 24 gpm

Item	Item Description	Unit	Quantity	Unit Cost	Item Cost	Notes
1	GAC Replacement (per vessel)	Ea	3	$ 1,000	$ 3,000	Assume annual replacement of lead vessels
2	Analysis	Ea	20	$ 300	$ 6,000	Quarterly sampling; Influent, Effluent, between lead/lag vessels
3	Sampling	hour	24	$ 90	$ 2,200	Assume 4 hrs of travel per property for quarterly sampling plus 2 hrs for sample collection
4	Equipment Maintenance and Replacement	--	--	--	$ 1,700	3% of the equipment subtotal, including Freight
5	Greensand Media Replacement	Ea	3	$ 120	$ 400	$600 per 5 years for media replacement
6	Hypochlorite Use	LS	1	$ 1,500	$ 1,500	Budgetary quote from AHL for NSF certified hypochlorite
7	Power	kW-hr	500	$ 0.44	$ 300	
8	Labor	hour	8	$ 75	$ 600	
	Subtotal				$ 15,700	
	Contingency			15% of subtotal	$ 2,400	
	Annual Maintenance Cost Total				$ 18,100	
	Administrative			10% of annual maintenance cost	$ 1,900	
	Estimated Annual Cost Total				$ 20,000	All item costs are rounded up to the nearest $100. O&M costs are based on a Class 5 capital cost estimate with a +50/-30% uncertainty as applicable for projects at less than 2% of full project definition per AACE International 17R-97. O&M Costs are also expected to have a +50/-30% uncertainty.

Additional Options

Item	Item Description	Unit	Quantity	Unit Cost	Item Cost	Notes
1	Equipment Maintenance and Replacement	--	--	--	$ 200	3% of the additional items subtotal
	Additional Options Subtotal				$ 200	
	Contingency			15% of subtotal	$ 100	
	Additional Options Construction Subtotal				$ 300	
	Estimated Treatment System Cost w/ Additional Options				$ 20,300	All item costs are rounded up to the nearest $100. O&M costs are based on a Class 5 capital cost estimate with a +50/-30% uncertainty as applicable for projects at less than 2% of full project definition per AACE International 17R-97. O&M Costs are also expected to have a +50/-30% uncertainty.

Property: 191700
Peak Demand: 8 gpm

Item	Item Description	Unit	Quantity	Unit Cost	Item Cost	Notes
1	GAC Replacement (per vessel)	Ea	1	$ 1,000	$ 1,000	Assume annual replacement of lead vessels
2	Analysis	Ea	12	$ 300	$ 3,600	Quarterly sampling; Influent, Effluent, between lead/lag vessels
3	Sampling	hour	24	$ 90	$ 2,200	Assume 4 hrs of travel per property for quarterly sampling plus 2 hrs for sample collection
4	Equipment Maintenance and Replacement	--	--	--	$ 500	3% of the equipment subtotal, including Freight
5	Power	kW-hr	500	$ 0.44	$ 300	
6	Labor	hour	8	$ 75	$ 600	
	Subtotal				$ 8,200	
	Contingency			15% of subtotal	$ 1,300	
	Annual Maintenance Cost Total				$ 9,500	
	Administrative			10% of annual maintenance cost	$ 1,000	
	Estimated Annual Cost Total				$ 10,500	All item costs are rounded up to the nearest $100. O&M costs are based on a Class 5 capital cost estimate with a +50/-30% uncertainty as applicable for projects at less than 2% of full project definition per AACE International 17R-97. O&M Costs are also expected to have a +50/-30% uncertainty.

Additional Options

Item	Item Description	Unit	Quantity	Unit Cost	Item Cost	Notes
1	Hypochlorite Use	LS	1	$ 1,500	$ 1,500	Budgetary quote from AHL for NSF certified hypochlorite
2	Greensand Media Replacement	Ea	1	$ 120	$ 200	$600 per 5 years for media replacement
3	Equipment Maintenance and Replacement	--	--	--	$ 200	3% of the additional items subtotal
	Additional Options Subtotal				$ 1,900	
	Contingency			15% of subtotal	$ 300	
	Additional Options Construction Subtotal				$ 2,200	
	Estimated Treatment System Cost w/ Additional Options				$ 12,700	All item costs are rounded up to the nearest $100. O&M costs are based on a Class 5 capital cost estimate with a +50/-30% uncertainty as applicable for projects at less than 2% of full project definition per AACE International 17R-97. O&M Costs are also expected to have a +50/-30% uncertainty.

Property: 191710 - Option 1 - Single System
Peak Demand: 32 gpm

Item	Item Description	Unit	Quantity	Unit Cost	Item Cost	Notes
1	GAC Replacement (per vessel)	Ea	4	$ 1,000	$ 4,000	Assume annual replacement of lead vessels
2	Analysis	Ea	24	$ 300	$ 7,200	Quarterly sampling; Influent, Effluent, between lead/lag vessels
3	Sampling	hour	24	$ 90	$ 2,200	Assume 4 hrs of travel per property for quarterly sampling plus 2 hrs for sample collection
4	Equipment Maintenance and Replacement	--	--	--	$ 2,200	3% of the equipment subtotal, including Freight
5	Greensand Media Replacement	Ea	4	$ 120	$ 500	$600 per 5 years for media replacement
6	Hypochlorite Use	LS	1	$ 1,500	$ 1,500	Budgetary quote from AHL for NSF certified hypochlorite
7	Power	kW-hr	500	$ 0.44	$ 300	
8	Labor	hour	8	$ 75	$ 600	
	Subtotal				$ 18,500	
	Contingency			15% of subtotal	$ 2,800	
	Annual Maintenance Cost Total				$ 21,300	
	Administrative			10% of annual maintenance cost	$ 2,200	
	Estimated Annual Cost Total				$ 23,500	All item costs are rounded up to the nearest $100. O&M costs are based on a Class 5 capital cost estimate with a +50/-30% uncertainty as applicable for projects at less than 2% of full project definition per AACE International 17R-97. O&M Costs are also expected to have a +50/-30% uncertainty.

Additional Options

Item	Item Description	Unit	Quantity	Unit Cost	Item Cost	Notes
1	Equipment Maintenance and Replacement	--	--	--	$ 200	3% of the additional items subtotal
	Additional Options Subtotal				$ 200	
	Contingency			15% of subtotal	$ 100	
	Additional Options Construction Subtotal				$ 300	
	Estimated Annual Cost w/ Additional Options				$ 23,800	All item costs are rounded up to the nearest $100. O&M costs are based on a Class 5 capital cost estimate with a +50/-30% uncertainty as applicable for projects at less than 2% of full project definition per AACE International 17R-97. O&M Costs are also expected to have a +50/-30% uncertainty.

Property: 191710 - Option 2 - Two separate systems
Peak Demand: One 8 gpm system and one 32 gpm system

Item	Item Description	Unit	Quantity	Unit Cost	Item Cost	Notes
1	GAC Replacement (per vessel)	Ea	5	$ 1,000	$ 5,000	Assume annual replacement of lead vessels
2	Analysis	Ea	36	$ 300	$ 10,800	Quarterly sampling; Influent, Effluent, between lead/lag vessels
3	Sampling	hour	24	$ 90	$ 2,200	Assume 4 hrs of travel per property for quarterly sampling plus 2 hrs for sample collection
4	Equipment Maintenance and Replacement	--	--	--	$ 2,800	3% of the equipment subtotal, including Freight
5	Greensand Media Replacement	Ea	5	$ 120	$ 600	$600 per 5 years for media replacement
6	Hypochlorite Use	LS	1	$ 1,500	$ 1,500	Budgetary quote from AHL for NSF certified hypochlorite
7	Power	kW-hr	500	$ 0.44	$ 300	
8	Labor	hour	8	$ 75	$ 600	
	Subtotal				$ 23,800	
	Contingency			15% of subtotal	$ 3,600	
	Annual Maintenance Cost Total				$ 27,400	
	Administrative			10% of annual maintenance cost	$ 2,800	
	Estimated Annual Cost Total				$ 30,200	All item costs are rounded up to the nearest $100. O&M costs are based on a Class 5 capital cost estimate with a +50/-30% uncertainty as applicable for projects at less than 2% of full project definition per AACE International 17R-97. O&M Costs are also expected to have a +50/-30% uncertainty.

Additional Options

Item	Item Description	Unit	Quantity	Unit Cost	Item Cost	Notes
1	Equipment Maintenance and Replacement	--	--	--	$ 200	3% of the additional items subtotal
	Additional Options Subtotal				$ 200	
	Contingency			15% of subtotal	$ 100	
	Additional Options Construction Subtotal				$ 300	
	Estimated Annual Cost w/ Additional Options				$ 30,500	All item costs are rounded up to the nearest $100. O&M costs are based on a Class 5 capital cost estimate with a +50/-30% uncertainty as applicable for projects at less than 2% of full project definition per AACE International 17R-97. O&M Costs are also expected to have a +50/-30% uncertainty.

Property: 200150
Peak Demand: 16 gpm

Item	Item Description	Unit	Quantity	Unit Cost	Item Cost	Notes
1	GAC Replacement (per vessel)	Ea	2	$ 1,000	$ 2,000	Assume annual replacement of lead vessels
2	Analysis	Ea	16	$ 300	$ 4,800	Quarterly sampling; Influent, Effluent, between lead/lag vessels
3	Sampling	hour	24	$ 90	$ 2,200	Assume 4 hrs of travel per property for quarterly sampling plus 2 hrs for sample collection
4	Equipment Maintenance and Replacement	--	--	--	$ 900	3% of the equipment subtotal, including Freight
5	Power	kW-hr	500	$ 0.44	$ 220	
6	Labor	hour	8	$ 75	$ 600	
	Subtotal				$ 10,800	
	Contingency			15% of subtotal	$ 1,700	
	Annual Maintenance Cost Total				$ 12,500	
	Administrative			10% of annual maintenance cost	$ 1,300	
	Estimated Annual Cost Total				$ 13,800	All item costs are rounded up to the nearest $100. O&M costs are based on a Class 5 capital cost estimate with a +50/-30% uncertainty as applicable for projects at less than 2% of full project definition per AACE International 17R-97. O&M Costs are also expected to have a +50/-30% uncertainty.

Additional Options

Item	Item Description	Unit	Quantity	Unit Cost	Item Cost	Notes
1	Equipment Maintenance and Replacement	--	--	--	$ 100	3% of the additional items subtotal
	Additional Options Subtotal				$ 100	
	Contingency			15% of subtotal	$ 100	
	Additional Options Construction Subtotal				$ 200	
	Estimated Treatment System Cost w/ Additional Options				$ 14,000	All item costs are rounded up to the nearest $100. O&M costs are based on a Class 5 capital cost estimate with a +50/-30% uncertainty as applicable for projects at less than 2% of full project definition per AACE International 17R-97. O&M Costs are also expected to have a +50/-30% uncertainty.

Property: Combined System 1 (191050, 191700, 191710)
Peak Demand: 48 gpm

Item	Item Description	Unit	Quantity	Unit Cost	Item Cost	Notes
1	GAC Replacement (per vessel)	Ea	6	$ 1,000	$ 6,000	Assume annual replacement of lead vessels
2	Analysis	Ea	32	$ 300	$ 9,600	Quarterly sampling; Influent, Effluent, between lead/lag vessels
3	Sampling	hour	24	$ 90	$ 2,200	Assume 4 hrs of travel per property for quarterly sampling plus 2 hrs for sample collection
4	Equipment Maintenance and Replacement	--	--	--	$ 2,800	3% of the equipment subtotal, including Freight
5	Power	kW-hr	500	$ 0.44	$ 300	
6	Labor	hour	8	$ 75	$ 600	
	Subtotal				$ 21,500	
	Contingency			15% of subtotal	$ 3,300	
	Annual Maintenance Cost Total				$ 24,800	
	Administrative			10% of annual maintenance cost	$ 2,500	
	Estimated Annual Cost Total				$ 27,300	All item costs are rounded up to the nearest $100. O&M costs are based on a Class 5 capital cost estimate with a +50/-30% uncertainty as applicable for projects at less than 2% of full project definition per AACE International 17R-97. O&M Costs are also expected to have a +50/-30% uncertainty.

Additional Options

Item	Item Description	Unit	Quantity	Unit Cost	Item Cost	Notes
1	Equipment Maintenance and Replacement	--	--	--	$ 200	3% of the additional items subtotal
	Additional Options Subtotal				$ 200	
	Contingency			15% of subtotal	$ 100	
	Additional Options Construction Subtotal				$ 300	
	Estimated Treatment System Cost w/ Additional Options				$ 27,600	All item costs are rounded up to the nearest $100. O&M costs are based on a Class 5 capital cost estimate with a +50/-30% uncertainty as applicable for projects at less than 2% of full project definition per AACE International 17R-97. O&M Costs are also expected to have a +50/-30% uncertainty.

Note: This cost estimate does not include operation and maintenance expenses associated with the connection service lines.

Property: Combined System 2 (191700, 191710)
Peak Demand: 40 gpm

Item	Item Description	Unit	Quantity	Unit Cost	Item Cost	Notes
1	GAC Replacement (per vessel)	Ea	5	$ 1,000	$ 5,000	Assume annual replacement of lead vessels
2	Analysis	Ea	28	$ 300	$ 8,400	Quarterly sampling; Influent, Effluent, between lead/lag vessels
3	Sampling	hour	24	$ 90	$ 2,200	Assume 4 hrs of travel per property for quarterly sampling plus 2 hrs for sample collection
4	Equipment Maintenance and Replacement	--	--	--	$ 2,900	3% of the equipment subtotal, including Freight
5	Greensand Media Replacement	Ea	5	$ 120	$ 600	$600 per 5 years for media replacement
6	Hypochlorite Use	LS	1	$ 1,500	$ 1,500	Budgetary quote from AHL for NSF certified hypochlorite
7	Power	kW-hr	500	$ 0.44	$ 300	
8	Labor	hour	8	$ 75	$ 600	
	Subtotal				$ 21,500	
	Contingency			15% of subtotal	$ 3,300	
	Annual Maintenance Cost Total				$ 24,800	
	Administrative			10% of annual maintenance cost	$ 2,500	
	Estimated Annual Cost Total				$ 27,300	All item costs are rounded up to the nearest $100. O&M costs are based on a Class 5 capital cost estimate with a +50/-30% uncertainty as applicable for projects at less than 2% of full project definition per AACE International 17R-97. O&M Costs are also expected to have a +50/-30% uncertainty.

Additional Options

Item	Item Description	Unit	Quantity	Unit Cost	Item Cost	Notes
1	Equipment Maintenance and Replacement	--	--	--	$ 300	3% of the additional items subtotal
	Additional Options Subtotal				$ 300	
	Contingency			15% of subtotal	$ 100	
	Additional Options Construction Subtotal				$ 400	
	Estimated Annual Cost w/ Additional Options				$ 27,700	All item costs are rounded up to the nearest $100. O&M costs are based on a Class 5 capital cost estimate with a +50/-30% uncertainty as applicable for projects at less than 2% of full project definition per AACE International 17R-97. O&M Costs are also expected to have a +50/-30% uncertainty.

Note: This cost estimate does not include operation and maintenance expenses associated with the connection service lines.

APPENDIX B: BARR REPORT AND SUPPORTING INFORMATION

SGS LAB REPORT 1199948 AND LDRC

Laboratory Report of Analysis

To: Shannon & Wilson-Fairbanks
2355 Hill Rd
Fairbanks, AK 99707
(907)479-0600

Report Number: **1199948**

Client Project: **102786-003 DLG Alt. Water**

Dear Mary Nadel,

Enclosed are the results of the analytical services performed under the referenced project for the received samples and associated QC as applicable. The samples are certified to meet the requirements of the National Environmental Laboratory Accreditation Conference Standards. Copies of this report and supporting data will be retained in our files for a period of ten years in the event they are required for future reference. All results are intended to be used in their entirety and SGS is not responsible for use of less than the complete report. Any samples submitted to our laboratory will be retained for a maximum of fourteen (14) days from the date of this report unless other archiving requirements were included in the quote.

If there are any questions about the report or services performed during this project, please call Jennifer at (907) 562-2343. We will be happy to answer any questions or concerns which you may have.

Thank you for using SGS North America Inc. for your analytical services. We look forward to working with you again on any additional analytical needs.

Sincerely,
SGS North America Inc.

_____

Jennifer Dawkins Date
Project Manager
Jennifer.Dawkins@sgs.com

SGS North America Inc. 200 West Potter Drive, Anchorage, AK 99518
t 907.562.2343 f 907.561.5301 www.us.sgs.com

Case Narrative

SGS Client: Shannon & Wilson-Fairbanks

SGS Project: 1199948

Project Name/Site: 102786-003 DLG Alt. Water

Refer to sample receipt form for information on sample condition.

191050 **1199948001 PS**
Arsenic Speciation was analyzed by Brooks Applied of Bothell, WA.

XXX/42616] **1544387 MB**
AK102 - DRO is detect in the MB greater than one half the LOQ, but less than the LOQ.

WTI/5312] **1544666 MB**
2510B - Conductivity - Conducitivity of the MB was detected above the LOQ. Associated samples are greater than 10X the MB conductivity.

* QC comments may be associated with the field samples found in this report. When applicable, comments will be applied to the associated field samples.

Laboratory Qualifiers

Enclosed are the analytical results associated with the above work order. The results apply to the samples as received. All results are intended to be used in their entirety and SGS is not responsible for use of less than the complete report. This document is issued by the Company under its General Conditions of Service accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx>. Attention is drawn to the limitation of liability, indenmification and jurisdiction issues defined therein.

Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the context or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

SGS maintains a formal Quality Assurance/Quality Control (QA/QC) program. A copy of our Quality Assurance Plan (QAP), which outlines this program, is available at your request. The laboratory certification numbers are AK00971 (DW Chemistry & Microbiology) & 17-021 (CS) for ADEC and 2944.01 for DOD ELAP/ISO17025 (RCRA methods: 1020B, 1311, 3010A, 3050B, 3520C, 3550C, 5030B, 5035A, 6020A, 7470A, 7471B, 8015C, 8021B, 8082A, 8260C, 8270D, 8270D-SIM, 9040C, 9045D, 9056A, 9060A, AK101 and AK102/103). SGS is only certified for the analytes listed on our Drinking Water Certification (DW methods: 200.8, 2130B, 2320B, 2510B, 300.0, 4500-CN-C,E, 4500-H-B, 4500-NO3-F, 4500-P-E and 524.2) and only those analytes will be reported to the State of Alaska for compliance. Except as specifically noted, all statements and data in this report are in conformance to the provisions set forth by the SGS QAP and, when applicable, other regulatory authorities.

The following descriptors or qualifiers may be found in your report:

*	The analyte has exceeded allowable regulatory or control limits.
!	Surrogate out of control limits.
B	Indicates the analyte is found in a blank associated with the sample.
CCV/CVA/CVB	Continuing Calibration Verification
CCCV/CVC/CVCA/CVCB	Closing Continuing Calibration Verification
CL	Control Limit
DF	Analytical Dilution Factor
DL	Detection Limit (i.e., maximum method detection limit)
E	The analyte result is above the calibrated range.
GT	Greater Than
IB	Instrument Blank
ICV	Initial Calibration Verification
J	The quantitation is an estimation.
LCS(D)	Laboratory Control Spike (Duplicate)
LLQC/LLIQC	Low Level Quantitation Check
LOD	Limit of Detection (i.e., 1/2 of the LOQ)
LOQ	Limit of Quantitation (i.e., reporting or practical quantitation limit)
LT	Less Than
MB	Method Blank
MS(D)	Matrix Spike (Duplicate)
ND	Indicates the analyte is not detected.
RPD	Relative Percent Difference
U	Indicates the analyte was analyzed for but not detected.

Note: Sample summaries which include a result for "Total Solids" have already been adjusted for moisture content. All DRO/RRO analyses are integrated per SOP.

Sample Summary

Client Sample ID	Lab Sample ID	Collected	Received	Matrix
191050	1199948001	11/15/2019	11/20/2019	Water (Surface, Eff., Ground)
191320	1199948002	11/14/2019	11/20/2019	Water (Surface, Eff., Ground)
200150	1199948003	11/15/2019	11/20/2019	Water (Surface, Eff., Ground)
191710	1199948004	11/15/2019	11/20/2019	Water (Surface, Eff., Ground)
Trip Blank	1199948005	11/14/2019	11/20/2019	Water (Surface, Eff., Ground)

Method	Method Description
AK101	AK101/8021 Combo.
SW8021B	AK101/8021 Combo.
SM21 2510B	Conductivity SM2510B
AK102	DRO/RRO Low Volume Water
AK103	DRO/RRO Low Volume Water
SM21 2340B	Hardness as CaCO3 by ICP-MS
EPA 300.0	Ion Chromatographic Analysis (W)
EP200.8	Metals in Water by 200.8 ICP-MS
SM21 4500NO3-F	Nitrate/Nitrite Flow injection Pres.
EPA 1664B	Oil & Grease HEM by EPA 1664
SM21 4500-H B	pH Analysis
SM23 4500S D	Sulfide by Colorimetric
SM21 4500-N D	TKN by Phenate (W)
SM21 2540C	Total Dissolved Solids SM18 2540C
SM 5310B	Total Organic Carbon
SM21 2540D	Total Suspended Solids SM20 2540D

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200 West Potter Drive, Anchorage, AK 99518
t 907.562.2343 f 907.561.5301 www.us.sgs.com

Detectable Results Summary

Client Sample ID: **191050**
Lab Sample ID: 1199948001

	Parameter	Result	Units
Metals by ICP/MS	Calcium	8620	ug/L
	Hardness as CaCO3	31700	ug/L
	Iron	123J	ug/L
	Magnesium	2470	ug/L
	Manganese	1.79	ug/L
	Potassium	527	ug/L
	Sodium	4600	ug/L
Semivolatile Organic Fuels	Diesel Range Organics	0.705	mg/L
	Residual Range Organics	0.537	mg/L
Waters Department	Chloride	3920	ug/L
	Conductivity	87.0	umhos/cm
	Fluoride	126J	ug/L
	Oil & Grease HEM	1910J	ug/L
	pH	6.6	pH units
	Sulfate	1360	ug/L
	Total Dissolved Solids	65000	ug/L
	Total Nitrate/Nitrite-N	118J	ug/L
	Total Organic Carbon	597J	ug/L

Client Sample ID: **191320**
Lab Sample ID: 1199948002

	Parameter	Result	Units
Metals by ICP/MS	Calcium	30400	ug/L
	Chromium	1.94J	ug/L
	Hardness as CaCO3	115000	ug/L
	Iron	46000	ug/L
	Magnesium	9450	ug/L
	Manganese	1420	ug/L
	Potassium	1480	ug/L
	Sodium	6920	ug/L
Semivolatile Organic Fuels	Diesel Range Organics	0.916	mg/L
	Residual Range Organics	0.586	mg/L
Waters Department	Chloride	15900	ug/L
	Conductivity	315	umhos/cm
	Fluoride	182J	ug/L
	Oil & Grease HEM	1580J	ug/L
	pH	6.4	pH units
	Sulfate	3440	ug/L
	Sulfide	80.0J	ug/L
	Total Dissolved Solids	237000	ug/L
	Total Kjeldahl Nitrogen	2090	ug/L
	Total Nitrate/Nitrite-N	71.8J	ug/L
	Total Organic Carbon	11300	ug/L
	Total Suspended Solids	74400	ug/L

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200 West Potter Drive, Anchorage, AK 99518
t 907.562.2343 f 907.561.5301 www.us.sgs.com

Detectable Results Summary

Client Sample ID: **200150**
Lab Sample ID: 1199948003

	Parameter	Result	Units
Metals by ICP/MS	Calcium	18000	ug/L
	Hardness as CaCO3	64300	ug/L
	Magnesium	4710	ug/L
	Manganese	7.40	ug/L
	Potassium	1120	ug/L
	Sodium	24200	ug/L
Semivolatile Organic Fuels	Diesel Range Organics	0.212J	mg/L
Waters Department	Chloride	38200	ug/L
	Conductivity	262	umhos/cm
	Fluoride	97.0J	ug/L
	Oil & Grease HEM	1620J	ug/L
	pH	6.6	pH units
	Sulfate	7140	ug/L
	Total Dissolved Solids	148000	ug/L
	Total Nitrate/Nitrite-N	1800	ug/L
	Total Organic Carbon	847J	ug/L

Client Sample ID: **191710**
Lab Sample ID: 1199948004

	Parameter	Result	Units
Metals by ICP/MS	Calcium	21600	ug/L
	Hardness as CaCO3	87900	ug/L
	Iron	36800	ug/L
	Magnesium	8250	ug/L
	Manganese	1340	ug/L
	Potassium	2830	ug/L
	Sodium	9190	ug/L
Semivolatile Organic Fuels	Diesel Range Organics	0.253J	mg/L
Waters Department	Chloride	8570	ug/L
	Conductivity	257	umhos/cm
	Fluoride	163J	ug/L
	Oil & Grease HEM	1530J	ug/L
	pH	6.5	pH units
	Sulfate	1580	ug/L
	Total Dissolved Solids	175000	ug/L
	Total Kjeldahl Nitrogen	608J	ug/L
	Total Nitrate/Nitrite-N	58.6J	ug/L
	Total Organic Carbon	1990	ug/L
	Total Suspended Solids	35600	ug/L

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200 West Potter Drive, Anchorage, AK 99518
t 907.562.2343 **f** 907.561.5301 www.us.sgs.com

Results of **191050**

Client Sample ID: **191050**
Client Project ID: **102786-003 DLG Alt. Water**
Lab Sample ID: 1199948001
Lab Project ID: 1199948

Collection Date: 11/15/19 09:05
Received Date: 11/20/19 09:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Metals by ICP/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Calcium	8620		500	150	ug/L	1		12/05/19 17:14
Chromium	1.00	U	2.00	0.800	ug/L	1		12/05/19 17:14
Iron	123	J	250	78.0	ug/L	1		12/05/19 17:14
Magnesium	2470		50.0	15.0	ug/L	1		12/05/19 17:14
Manganese	1.79		1.00	0.350	ug/L	1		12/05/19 17:14
Potassium	527		500	150	ug/L	1		12/05/19 17:14
Sodium	4600		500	150	ug/L	1		12/05/19 17:14

Batch Information

Analytical Batch: MMS10696
Analytical Method: EP200.8
Analyst: ACF
Analytical Date/Time: 12/05/19 17:14
Container ID: 1199948001-B

Prep Batch: MXX33025
Prep Method: E200.2
Prep Date/Time: 12/02/19 09:48
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Hardness as CaCO3	31700		5000	5000	ug/L	1		12/05/19 17:14

Batch Information

Analytical Batch: MMS10696
Analytical Method: SM21 2340B
Analyst: ACF
Analytical Date/Time: 12/05/19 17:14
Container ID: 1199948001-B

Prep Batch: MXX33025
Prep Method: E200.2
Prep Date/Time: 12/02/19 09:48
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Results of **191050**

Client Sample ID: **191050**
Client Project ID: **102786-003 DLG Alt. Water**
Lab Sample ID: 1199948001
Lab Project ID: 1199948

Collection Date: 11/15/19 09:05
Received Date: 11/20/19 09:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Semivolatile Organic Fuels**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Diesel Range Organics	0.705		0.577	0.173	mg/L	1		11/25/19 17:00
Surrogates								
5a Androstane (surr)	92.6		50-150		%	1		11/25/19 17:00

Batch Information

Analytical Batch: XFC15482
Analytical Method: AK102
Analyst: DSD
Analytical Date/Time: 11/25/19 17:00
Container ID: 1199948001-E

Prep Batch: XXX42616
Prep Method: SW3520C
Prep Date/Time: 11/21/19 09:43
Prep Initial Wt./Vol.: 260 mL
Prep Extract Vol: 1 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Residual Range Organics	0.537		0.481	0.144	mg/L	1		11/25/19 17:00
Surrogates								
n-Triacontane-d62 (surr)	89.2		50-150		%	1		11/25/19 17:00

Batch Information

Analytical Batch: XFC15482
Analytical Method: AK103
Analyst: DSD
Analytical Date/Time: 11/25/19 17:00
Container ID: 1199948001-E

Prep Batch: XXX42616
Prep Method: SW3520C
Prep Date/Time: 11/21/19 09:43
Prep Initial Wt./Vol.: 260 mL
Prep Extract Vol: 1 mL

Results of **191050**

Client Sample ID: **191050**
Client Project ID: **102786-003 DLG Alt. Water**
Lab Sample ID: 1199948001
Lab Project ID: 1199948

Collection Date: 11/15/19 09:05
Received Date: 11/20/19 09:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Volatile Fuels**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Gasoline Range Organics	0.0500 U		0.100	0.0310	mg/L	1		11/26/19 12:52
Surrogates								
4-Bromofluorobenzene (surr)	85.7		50-150		%	1		11/26/19 12:52

Batch Information

Analytical Batch: VFC15049
Analytical Method: AK101
Analyst: ST
Analytical Date/Time: 11/26/19 12:52
Container ID: 1199948001-H

Prep Batch: VXX35282
Prep Method: SW5030B
Prep Date/Time: 11/26/19 08:00
Prep Initial Wt./Vol.: 5 mL
Prep Extract Vol: 5 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Benzene	0.250 U		0.500	0.150	ug/L	1		11/26/19 12:52
Ethylbenzene	0.500 U		1.00	0.310	ug/L	1		11/26/19 12:52
o-Xylene	0.500 U		1.00	0.310	ug/L	1		11/26/19 12:52
P & M -Xylene	1.00 U		2.00	0.620	ug/L	1		11/26/19 12:52
Toluene	0.500 U		1.00	0.310	ug/L	1		11/26/19 12:52
Xylenes (total)	1.50 U		3.00	0.930	ug/L	1		11/26/19 12:52
Surrogates								
1,4-Difluorobenzene (surr)	93.4		77-115		%	1		11/26/19 12:52

Batch Information

Analytical Batch: VFC15049
Analytical Method: SW8021B
Analyst: ST
Analytical Date/Time: 11/26/19 12:52
Container ID: 1199948001-H

Prep Batch: VXX35282
Prep Method: SW5030B
Prep Date/Time: 11/26/19 08:00
Prep Initial Wt./Vol.: 5 mL
Prep Extract Vol: 5 mL

Results of **191050**

Client Sample ID: **191050**
Client Project ID: **102786-003 DLG Alt. Water**
Lab Sample ID: 1199948001
Lab Project ID: 1199948

Collection Date: 11/15/19 09:05
Received Date: 11/20/19 09:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Waters Department**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Oil & Grease HEM	1910	J	4260	1060	ug/L	1		11/26/19 08:38

Batch Information

Analytical Batch: THOG1311
Analytical Method: EPA 1664B
Analyst: EWW
Analytical Date/Time: 11/26/19 08:38
Container ID: 1199948001-J

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Chloride	3920		200	50.0	ug/L	1		12/09/19 19:03
Fluoride	126	J	200	50.0	ug/L	1		12/09/19 19:03
Sulfate	1360		200	50.0	ug/L	1		12/09/19 19:03

Batch Information

Analytical Batch: WIC6002
Analytical Method: EPA 300.0
Analyst: DMM
Analytical Date/Time: 12/09/19 19:03
Container ID: 1199948001-M

Prep Batch: WXX13139
Prep Method: METHOD
Prep Date/Time: 12/09/19 10:45
Prep Initial Wt./Vol.: 10 mL
Prep Extract Vol: 10 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Organic Carbon	597	J	1000	400	ug/L	1		12/03/19 16:06

Batch Information

Analytical Batch: WTC2974
Analytical Method: SM 5310B
Analyst: BMZ
Analytical Date/Time: 12/03/19 16:06
Container ID: 1199948001-A

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Conductivity	87.0		1.00	0.477	umhos/cm	1		11/21/19 14:15

Print Date: 12/12/2019 8:12:05AM

J flagging is activated

Results of **191050**

Client Sample ID: **191050**
Client Project ID: **102786-003 DLG Alt. Water**
Lab Sample ID: 1199948001
Lab Project ID: 1199948

Collection Date: 11/15/19 09:05
Received Date: 11/20/19 09:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Waters Department**

Batch Information

Analytical Batch: WTI5312
Analytical Method: SM21 2510B
Analyst: EWW
Analytical Date/Time: 11/21/19 14:15
Container ID: 1199948001-M

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Dissolved Solids	65000		10000	3100	ug/L	1		11/20/19 17:49

Batch Information

Analytical Batch: STS6557
Analytical Method: SM21 2540C
Analyst: DMM
Analytical Date/Time: 11/20/19 17:49
Container ID: 1199948001-M

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Suspended Solids	500 U		1000	310	ug/L	1		11/20/19 15:11

Batch Information

Analytical Batch: STS6556
Analytical Method: SM21 2540D
Analyst: EWW
Analytical Date/Time: 11/20/19 15:11
Container ID: 1199948001-D

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
pH	6.6		0.100	0.100	pH units	1		11/21/19 14:15

Batch Information

Analytical Batch: WTI5311
Analytical Method: SM21 4500-H B
Analyst: EWW
Analytical Date/Time: 11/21/19 14:15
Container ID: 1199948001-M

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed

Results of **191050**

Client Sample ID: **191050**
Client Project ID: **102786-003 DLG Alt. Water**
Lab Sample ID: 1199948001
Lab Project ID: 1199948

Collection Date: 11/15/19 09:05
Received Date: 11/20/19 09:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Waters Department**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Kjeldahl Nitrogen	500	U	1000	310	ug/L	1		12/04/19 17:30

Batch Information

Analytical Batch: WDA4697
Analytical Method: SM21 4500-N D
Analyst: DMM
Analytical Date/Time: 12/04/19 17:30
Container ID: 1199948001-C

Prep Batch: WXX13134
Prep Method: METHOD
Prep Date/Time: 12/04/19 10:52
Prep Initial Wt./Vol.: 25 mL
Prep Extract Vol: 25 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Nitrate/Nitrite-N	118	J	200	50.0	ug/L	2		12/02/19 13:53

Batch Information

Analytical Batch: WFI2848
Analytical Method: SM21 4500NO3-F
Analyst: EWW
Analytical Date/Time: 12/02/19 13:53
Container ID: 1199948001-C

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Sulfide	50.0	U	100	31.0	ug/L	1		11/21/19 12:25

Batch Information

Analytical Batch: WAT11457
Analytical Method: SM23 4500S D
Analyst: EWW
Analytical Date/Time: 11/21/19 12:25
Container ID: 1199948001-L

Results of **191320**

Client Sample ID: **191320**
Client Project ID: **102786-003 DLG Alt. Water**
Lab Sample ID: 1199948002
Lab Project ID: 1199948

Collection Date: 11/14/19 17:45
Received Date: 11/20/19 09:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Metals by ICP/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Calcium	30400		500	150	ug/L	1		12/05/19 17:17
Chromium	1.94	J	2.00	0.800	ug/L	1		12/05/19 17:17
Iron	46000		250	78.0	ug/L	1		12/05/19 17:17
Magnesium	9450		50.0	15.0	ug/L	1		12/05/19 17:17
Manganese	1420		1.00	0.350	ug/L	1		12/05/19 17:17
Potassium	1480		500	150	ug/L	1		12/05/19 17:17
Sodium	6920		500	150	ug/L	1		12/05/19 17:17

Batch Information

Analytical Batch: MMS10696
Analytical Method: EP200.8
Analyst: ACF
Analytical Date/Time: 12/05/19 17:17
Container ID: 1199948002-B

Prep Batch: MXX33025
Prep Method: E200.2
Prep Date/Time: 12/02/19 09:48
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Hardness as CaCO3	115000		5000	5000	ug/L	1		12/05/19 17:17

Batch Information

Analytical Batch: MMS10696
Analytical Method: SM21 2340B
Analyst: ACF
Analytical Date/Time: 12/05/19 17:17
Container ID: 1199948002-B

Prep Batch: MXX33025
Prep Method: E200.2
Prep Date/Time: 12/02/19 09:48
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Results of **191320**

Client Sample ID: **191320**
Client Project ID: **102786-003 DLG Alt. Water**
Lab Sample ID: 1199948002
Lab Project ID: 1199948

Collection Date: 11/14/19 17:45
Received Date: 11/20/19 09:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Semivolatile Organic Fuels**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Diesel Range Organics	0.916		0.682	0.205	mg/L	1		11/25/19 17:10
Surrogates								
5a Androstane (surr)	94		50-150		%	1		11/25/19 17:10

Batch Information

Analytical Batch: XFC15482
Analytical Method: AK102
Analyst: DSD
Analytical Date/Time: 11/25/19 17:10
Container ID: 1199948002-E

Prep Batch: XXX42616
Prep Method: SW3520C
Prep Date/Time: 11/21/19 09:43
Prep Initial Wt./Vol.: 220 mL
Prep Extract Vol: 1 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Residual Range Organics	0.586		0.568	0.170	mg/L	1		11/25/19 17:10
Surrogates								
n-Triacontane-d62 (surr)	93.4		50-150		%	1		11/25/19 17:10

Batch Information

Analytical Batch: XFC15482
Analytical Method: AK103
Analyst: DSD
Analytical Date/Time: 11/25/19 17:10
Container ID: 1199948002-E

Prep Batch: XXX42616
Prep Method: SW3520C
Prep Date/Time: 11/21/19 09:43
Prep Initial Wt./Vol.: 220 mL
Prep Extract Vol: 1 mL

Results of **191320**

Client Sample ID: **191320**
Client Project ID: **102786-003 DLG Alt. Water**
Lab Sample ID: 1199948002
Lab Project ID: 1199948

Collection Date: 11/14/19 17:45
Received Date: 11/20/19 09:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Volatile Fuels**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Gasoline Range Organics	0.0500 U		0.100	0.0310	mg/L	1		11/26/19 13:10
Surrogates								
4-Bromofluorobenzene (surr)	84.4		50-150		%	1		11/26/19 13:10

Batch Information

Analytical Batch: VFC15049
Analytical Method: AK101
Analyst: ST
Analytical Date/Time: 11/26/19 13:10
Container ID: 1199948002-H

Prep Batch: VXX35282
Prep Method: SW5030B
Prep Date/Time: 11/26/19 08:00
Prep Initial Wt./Vol.: 5 mL
Prep Extract Vol: 5 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Benzene	0.250 U		0.500	0.150	ug/L	1		11/26/19 13:10
Ethylbenzene	0.500 U		1.00	0.310	ug/L	1		11/26/19 13:10
o-Xylene	0.500 U		1.00	0.310	ug/L	1		11/26/19 13:10
P & M -Xylene	1.00 U		2.00	0.620	ug/L	1		11/26/19 13:10
Toluene	0.500 U		1.00	0.310	ug/L	1		11/26/19 13:10
Xylenes (total)	1.50 U		3.00	0.930	ug/L	1		11/26/19 13:10
Surrogates								
1,4-Difluorobenzene (surr)	92.8		77-115		%	1		11/26/19 13:10

Batch Information

Analytical Batch: VFC15049
Analytical Method: SW8021B
Analyst: ST
Analytical Date/Time: 11/26/19 13:10
Container ID: 1199948002-H

Prep Batch: VXX35282
Prep Method: SW5030B
Prep Date/Time: 11/26/19 08:00
Prep Initial Wt./Vol.: 5 mL
Prep Extract Vol: 5 mL

Print Date: 12/12/2019 8:12:05AM

J flagging is activated

Results of **191320**

Client Sample ID: **191320**
Client Project ID: **102786-003 DLG Alt. Water**
Lab Sample ID: 1199948002
Lab Project ID: 1199948

Collection Date: 11/14/19 17:45
Received Date: 11/20/19 09:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Waters Department**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Oil & Grease HEM	1580	J	4210	1050	ug/L	1		11/26/19 08:38

Batch Information

Analytical Batch: THOG1311
Analytical Method: EPA 1664B
Analyst: EWW
Analytical Date/Time: 11/26/19 08:38
Container ID: 1199948002-J

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Chloride	15900		200	50.0	ug/L	1		12/09/19 19:41
Fluoride	182	J	200	50.0	ug/L	1		12/09/19 19:41
Sulfate	3440		200	50.0	ug/L	1		12/09/19 19:41

Batch Information

Analytical Batch: WIC6002
Analytical Method: EPA 300.0
Analyst: DMM
Analytical Date/Time: 12/09/19 19:41
Container ID: 1199948002-M

Prep Batch: WXX13139
Prep Method: METHOD
Prep Date/Time: 12/09/19 10:45
Prep Initial Wt./Vol.: 10 mL
Prep Extract Vol: 10 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Organic Carbon	11300		1000	400	ug/L	1		12/03/19 16:25

Batch Information

Analytical Batch: WTC2974
Analytical Method: SM 5310B
Analyst: BMZ
Analytical Date/Time: 12/03/19 16:25
Container ID: 1199948002-A

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Conductivity	315		1.00	0.477	umhos/cm	1		11/21/19 14:22

Print Date: 12/12/2019 8:12:05AM

J flagging is activated

Results of **191320**

Client Sample ID: **191320**
Client Project ID: **102786-003 DLG Alt. Water**
Lab Sample ID: 1199948002
Lab Project ID: 1199948

Collection Date: 11/14/19 17:45
Received Date: 11/20/19 09:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Waters Department**

Batch Information

Analytical Batch: WTI5312
Analytical Method: SM21 2510B
Analyst: EWW
Analytical Date/Time: 11/21/19 14:22
Container ID: 1199948002-M

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Dissolved Solids	237000		10000	3100	ug/L	1		11/20/19 17:49

Batch Information

Analytical Batch: STS6557
Analytical Method: SM21 2540C
Analyst: DMM
Analytical Date/Time: 11/20/19 17:49
Container ID: 1199948002-M

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Suspended Solids	74400		4000	1240	ug/L	1		11/20/19 15:11

Batch Information

Analytical Batch: STS6556
Analytical Method: SM21 2540D
Analyst: EWW
Analytical Date/Time: 11/20/19 15:11
Container ID: 1199948002-D

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
pH	6.4		0.100	0.100	pH units	1		11/21/19 14:22

Batch Information

Analytical Batch: WTI5311
Analytical Method: SM21 4500-H B
Analyst: EWW
Analytical Date/Time: 11/21/19 14:22
Container ID: 1199948002-M

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed

Results of **191320**

Client Sample ID: **191320**
Client Project ID: **102786-003 DLG Alt. Water**
Lab Sample ID: 1199948002
Lab Project ID: 1199948

Collection Date: 11/14/19 17:45
Received Date: 11/20/19 09:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Waters Department**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Kjeldahl Nitrogen	2090		1000	310	ug/L	1		12/04/19 17:32

Batch Information

Analytical Batch: WDA4697
Analytical Method: SM21 4500-N D
Analyst: DMM
Analytical Date/Time: 12/04/19 17:32
Container ID: 1199948002-C

Prep Batch: WXX13134
Prep Method: METHOD
Prep Date/Time: 12/04/19 10:52
Prep Initial Wt./Vol.: 25 mL
Prep Extract Vol: 25 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Nitrate/Nitrite-N	71.8 J		200	50.0	ug/L	2		12/02/19 13:54

Batch Information

Analytical Batch: WFI2848
Analytical Method: SM21 4500NO3-F
Analyst: EWW
Analytical Date/Time: 12/02/19 13:54
Container ID: 1199948002-C

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Sulfide	80.0 J		100	31.0	ug/L	1		11/21/19 12:25

Batch Information

Analytical Batch: WAT11457
Analytical Method: SM23 4500S D
Analyst: EWW
Analytical Date/Time: 11/21/19 12:25
Container ID: 1199948002-L

Results of **200150**

Client Sample ID: **200150**
Client Project ID: **102786-003 DLG Alt. Water**
Lab Sample ID: 1199948003
Lab Project ID: 1199948

Collection Date: 11/15/19 11:50
Received Date: 11/20/19 09:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Metals by ICP/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Calcium	18000		500	150	ug/L	1		12/05/19 17:20
Chromium	1.00	U	2.00	0.800	ug/L	1		12/05/19 17:20
Iron	125	U	250	78.0	ug/L	1		12/05/19 17:20
Magnesium	4710		50.0	15.0	ug/L	1		12/05/19 17:20
Manganese	7.40		1.00	0.350	ug/L	1		12/05/19 17:20
Potassium	1120		500	150	ug/L	1		12/05/19 17:20
Sodium	24200		500	150	ug/L	1		12/05/19 17:20

Batch Information

Analytical Batch: MMS10696
Analytical Method: EP200.8
Analyst: ACF
Analytical Date/Time: 12/05/19 17:20
Container ID: 1199948003-B

Prep Batch: MXX33025
Prep Method: E200.2
Prep Date/Time: 12/02/19 09:48
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Hardness as CaCO3	64300		5000	5000	ug/L	1		12/05/19 17:20

Batch Information

Analytical Batch: MMS10696
Analytical Method: SM21 2340B
Analyst: ACF
Analytical Date/Time: 12/05/19 17:20
Container ID: 1199948003-B

Prep Batch: MXX33025
Prep Method: E200.2
Prep Date/Time: 12/02/19 09:48
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Results of **200150**

Client Sample ID: **200150**
Client Project ID: **102786-003 DLG Alt. Water**
Lab Sample ID: 1199948003
Lab Project ID: 1199948

Collection Date: 11/15/19 11:50
Received Date: 11/20/19 09:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Semivolatile Organic Fuels**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Diesel Range Organics	0.212	J	0.566	0.170	mg/L	1		11/25/19 17:20
Surrogates								
5a Androstane (surr)	82.9		50-150		%	1		11/25/19 17:20

Batch Information

Analytical Batch: XFC15482
Analytical Method: AK102
Analyst: DSD
Analytical Date/Time: 11/25/19 17:20
Container ID: 1199948003-E

Prep Batch: XXX42616
Prep Method: SW3520C
Prep Date/Time: 11/21/19 09:43
Prep Initial Wt./Vol.: 265 mL
Prep Extract Vol: 1 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Residual Range Organics	0.236	U	0.472	0.142	mg/L	1		11/25/19 17:20
Surrogates								
n-Triacontane-d62 (surr)	79.9		50-150		%	1		11/25/19 17:20

Batch Information

Analytical Batch: XFC15482
Analytical Method: AK103
Analyst: DSD
Analytical Date/Time: 11/25/19 17:20
Container ID: 1199948003-E

Prep Batch: XXX42616
Prep Method: SW3520C
Prep Date/Time: 11/21/19 09:43
Prep Initial Wt./Vol.: 265 mL
Prep Extract Vol: 1 mL

Results of **200150**

Client Sample ID: **200150**
Client Project ID: **102786-003 DLG Alt. Water**
Lab Sample ID: 1199948003
Lab Project ID: 1199948

Collection Date: 11/15/19 11:50
Received Date: 11/20/19 09:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Volatile Fuels**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Gasoline Range Organics	0.0500 U		0.100	0.0310	mg/L	1		11/26/19 13:27
Surrogates								
4-Bromofluorobenzene (surr)	83.4		50-150		%	1		11/26/19 13:27

Batch Information

Analytical Batch: VFC15049
Analytical Method: AK101
Analyst: ST
Analytical Date/Time: 11/26/19 13:27
Container ID: 1199948003-H

Prep Batch: VXX35282
Prep Method: SW5030B
Prep Date/Time: 11/26/19 08:00
Prep Initial Wt./Vol.: 5 mL
Prep Extract Vol: 5 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Benzene	0.250 U		0.500	0.150	ug/L	1		11/26/19 13:27
Ethylbenzene	0.500 U		1.00	0.310	ug/L	1		11/26/19 13:27
o-Xylene	0.500 U		1.00	0.310	ug/L	1		11/26/19 13:27
P & M -Xylene	1.00 U		2.00	0.620	ug/L	1		11/26/19 13:27
Toluene	0.500 U		1.00	0.310	ug/L	1		11/26/19 13:27
Xylenes (total)	1.50 U		3.00	0.930	ug/L	1		11/26/19 13:27
Surrogates								
1,4-Difluorobenzene (surr)	93.4		77-115		%	1		11/26/19 13:27

Batch Information

Analytical Batch: VFC15049
Analytical Method: SW8021B
Analyst: ST
Analytical Date/Time: 11/26/19 13:27
Container ID: 1199948003-H

Prep Batch: VXX35282
Prep Method: SW5030B
Prep Date/Time: 11/26/19 08:00
Prep Initial Wt./Vol.: 5 mL
Prep Extract Vol: 5 mL

Results of **200150**

Client Sample ID: **200150**
Client Project ID: **102786-003 DLG Alt. Water**
Lab Sample ID: 1199948003
Lab Project ID: 1199948

Collection Date: 11/15/19 11:50
Received Date: 11/20/19 09:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Waters Department**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Oil & Grease HEM	1620 J		4040	1010	ug/L	1		11/26/19 08:38

Batch Information

Analytical Batch: THOG1311
Analytical Method: EPA 1664B
Analyst: EWW
Analytical Date/Time: 11/26/19 08:38
Container ID: 1199948003-J

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Chloride	38200		2000	500	ug/L	10		12/10/19 07:48
Fluoride	97.0 J		200	50.0	ug/L	1		12/09/19 20:00
Sulfate	7140		200	50.0	ug/L	1		12/09/19 20:00

Batch Information

Analytical Batch: WIC6002
Analytical Method: EPA 300.0
Analyst: DMM
Analytical Date/Time: 12/10/19 07:48
Container ID: 1199948003-M

Prep Batch: WXX13139
Prep Method: METHOD
Prep Date/Time: 12/09/19 10:45
Prep Initial Wt./Vol.: 10 mL
Prep Extract Vol: 10 mL

Analytical Batch: WIC6002
Analytical Method: EPA 300.0
Analyst: DMM
Analytical Date/Time: 12/09/19 20:00
Container ID: 1199948003-M

Prep Batch: WXX13139
Prep Method: METHOD
Prep Date/Time: 12/09/19 10:45
Prep Initial Wt./Vol.: 10 mL
Prep Extract Vol: 10 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Organic Carbon	847 J		1000	400	ug/L	1		12/03/19 16:39

Batch Information

Analytical Batch: WTC2974
Analytical Method: SM 5310B
Analyst: BMZ
Analytical Date/Time: 12/03/19 16:39
Container ID: 1199948003-A

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed

Results of **200150**

Client Sample ID: **200150**
Client Project ID: **102786-003 DLG Alt. Water**
Lab Sample ID: 1199948003
Lab Project ID: 1199948

Collection Date: 11/15/19 11:50
Received Date: 11/20/19 09:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Waters Department**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Conductivity	262		1.00	0.477	umhos/cm	1		11/21/19 14:29

Batch Information

Analytical Batch: WTI5312
Analytical Method: SM21 2510B
Analyst: EWW
Analytical Date/Time: 11/21/19 14:29
Container ID: 1199948003-M

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Dissolved Solids	148000		10000	3100	ug/L	1		11/20/19 17:49

Batch Information

Analytical Batch: STS6557
Analytical Method: SM21 2540C
Analyst: DMM
Analytical Date/Time: 11/20/19 17:49
Container ID: 1199948003-M

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Suspended Solids	500 U		1000	310	ug/L	1		11/20/19 15:11

Batch Information

Analytical Batch: STS6556
Analytical Method: SM21 2540D
Analyst: EWW
Analytical Date/Time: 11/20/19 15:11
Container ID: 1199948003-D

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
pH	6.6		0.100	0.100	pH units	1		11/21/19 14:29

Results of **200150**

Client Sample ID: **200150**
Client Project ID: **102786-003 DLG Alt. Water**
Lab Sample ID: 1199948003
Lab Project ID: 1199948

Collection Date: 11/15/19 11:50
Received Date: 11/20/19 09:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Waters Department**

Batch Information

Analytical Batch: WTI5311
Analytical Method: SM21 4500-H B
Analyst: EWW
Analytical Date/Time: 11/21/19 14:29
Container ID: 1199948003-M

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Kjeldahl Nitrogen	500	U	1000	310	ug/L	1		12/04/19 17:33

Batch Information

Analytical Batch: WDA4697
Analytical Method: SM21 4500-N D
Analyst: DMM
Analytical Date/Time: 12/04/19 17:33
Container ID: 1199948003-C

Prep Batch: WXX13134
Prep Method: METHOD
Prep Date/Time: 12/04/19 10:52
Prep Initial Wt./Vol.: 25 mL
Prep Extract Vol: 25 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Nitrate/Nitrite-N	1800		200	50.0	ug/L	2		12/02/19 13:56

Batch Information

Analytical Batch: WFI2848
Analytical Method: SM21 4500NO3-F
Analyst: EWW
Analytical Date/Time: 12/02/19 13:56
Container ID: 1199948003-C

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Sulfide	50.0	U	100	31.0	ug/L	1		11/21/19 12:25

Batch Information

Analytical Batch: WAT11457
Analytical Method: SM23 4500S D
Analyst: EWW
Analytical Date/Time: 11/21/19 12:25
Container ID: 1199948003-L

Results of **191710**

Client Sample ID: **191710**
Client Project ID: **102786-003 DLG Alt. Water**
Lab Sample ID: 1199948004
Lab Project ID: 1199948

Collection Date: 11/15/19 16:51
Received Date: 11/20/19 09:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Metals by ICP/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Calcium	21600		500	150	ug/L	1		12/05/19 17:26
Chromium	1.00	U	2.00	0.800	ug/L	1		12/05/19 17:26
Iron	36800		250	78.0	ug/L	1		12/05/19 17:26
Magnesium	8250		50.0	15.0	ug/L	1		12/05/19 17:26
Manganese	1340		1.00	0.350	ug/L	1		12/05/19 17:26
Potassium	2830		500	150	ug/L	1		12/05/19 17:26
Sodium	9190		500	150	ug/L	1		12/05/19 17:26

Batch Information

Analytical Batch: MMS10696
Analytical Method: EP200.8
Analyst: ACF
Analytical Date/Time: 12/05/19 17:26
Container ID: 1199948004-B

Prep Batch: MXX33025
Prep Method: E200.2
Prep Date/Time: 12/02/19 09:48
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Hardness as CaCO3	87900		5000	5000	ug/L	1		12/05/19 17:26

Batch Information

Analytical Batch: MMS10696
Analytical Method: SM21 2340B
Analyst: ACF
Analytical Date/Time: 12/05/19 17:26
Container ID: 1199948004-B

Prep Batch: MXX33025
Prep Method: E200.2
Prep Date/Time: 12/02/19 09:48
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Results of **191710**

Client Sample ID: **191710**
Client Project ID: **102786-003 DLG Alt. Water**
Lab Sample ID: 1199948004
Lab Project ID: 1199948

Collection Date: 11/15/19 16:51
Received Date: 11/20/19 09:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Semivolatile Organic Fuels**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Diesel Range Organics	0.253	J	0.566	0.170	mg/L	1		11/25/19 17:30
Surrogates								
5a Androstane (surr)	86.6		50-150		%	1		11/25/19 17:30

Batch Information

Analytical Batch: XFC15482
Analytical Method: AK102
Analyst: DSD
Analytical Date/Time: 11/25/19 17:30
Container ID: 1199948004-E

Prep Batch: XXX42616
Prep Method: SW3520C
Prep Date/Time: 11/21/19 09:43
Prep Initial Wt./Vol.: 265 mL
Prep Extract Vol: 1 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Residual Range Organics	0.236	U	0.472	0.142	mg/L	1		11/25/19 17:30
Surrogates								
n-Triacontane-d62 (surr)	83.1		50-150		%	1		11/25/19 17:30

Batch Information

Analytical Batch: XFC15482
Analytical Method: AK103
Analyst: DSD
Analytical Date/Time: 11/25/19 17:30
Container ID: 1199948004-E

Prep Batch: XXX42616
Prep Method: SW3520C
Prep Date/Time: 11/21/19 09:43
Prep Initial Wt./Vol.: 265 mL
Prep Extract Vol: 1 mL

Results of **191710**

Client Sample ID: **191710**
Client Project ID: **102786-003 DLG Alt. Water**
Lab Sample ID: 1199948004
Lab Project ID: 1199948

Collection Date: 11/15/19 16:51
Received Date: 11/20/19 09:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Volatile Fuels**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Gasoline Range Organics	0.0500 U		0.100	0.0310	mg/L	1		11/26/19 13:44
Surrogates								
4-Bromofluorobenzene (surr)	87.4		50-150		%	1		11/26/19 13:44

Batch Information

Analytical Batch: VFC15049
Analytical Method: AK101
Analyst: ST
Analytical Date/Time: 11/26/19 13:44
Container ID: 1199948004-H

Prep Batch: VXX35282
Prep Method: SW5030B
Prep Date/Time: 11/26/19 08:00
Prep Initial Wt./Vol.: 5 mL
Prep Extract Vol: 5 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Benzene	0.250 U		0.500	0.150	ug/L	1		11/26/19 13:44
Ethylbenzene	0.500 U		1.00	0.310	ug/L	1		11/26/19 13:44
o-Xylene	0.500 U		1.00	0.310	ug/L	1		11/26/19 13:44
P & M -Xylene	1.00 U		2.00	0.620	ug/L	1		11/26/19 13:44
Toluene	0.500 U		1.00	0.310	ug/L	1		11/26/19 13:44
Xylenes (total)	1.50 U		3.00	0.930	ug/L	1		11/26/19 13:44
Surrogates								
1,4-Difluorobenzene (surr)	93.1		77-115		%	1		11/26/19 13:44

Batch Information

Analytical Batch: VFC15049
Analytical Method: SW8021B
Analyst: ST
Analytical Date/Time: 11/26/19 13:44
Container ID: 1199948004-H

Prep Batch: VXX35282
Prep Method: SW5030B
Prep Date/Time: 11/26/19 08:00
Prep Initial Wt./Vol.: 5 mL
Prep Extract Vol: 5 mL

Results of **191710**

Client Sample ID: **191710**
Client Project ID: **102786-003 DLG Alt. Water**
Lab Sample ID: 1199948004
Lab Project ID: 1199948

Collection Date: 11/15/19 16:51
Received Date: 11/20/19 09:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Waters Department**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Oil & Grease HEM	1530	J	4080	1020	ug/L	1		11/26/19 08:38

Batch Information

Analytical Batch: THOG1311
Analytical Method: EPA 1664B
Analyst: EWW
Analytical Date/Time: 11/26/19 08:38
Container ID: 1199948004-J

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Chloride	8570		200	50.0	ug/L	1		12/09/19 20:19
Fluoride	163	J	200	50.0	ug/L	1		12/09/19 20:19
Sulfate	1580		200	50.0	ug/L	1		12/09/19 20:19

Batch Information

Analytical Batch: WIC6002
Analytical Method: EPA 300.0
Analyst: DMM
Analytical Date/Time: 12/09/19 20:19
Container ID: 1199948004-M

Prep Batch: WXX13139
Prep Method: METHOD
Prep Date/Time: 12/09/19 10:45
Prep Initial Wt./Vol.: 10 mL
Prep Extract Vol: 10 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Organic Carbon	1990		1000	400	ug/L	1		12/03/19 16:55

Batch Information

Analytical Batch: WTC2974
Analytical Method: SM 5310B
Analyst: BMZ
Analytical Date/Time: 12/03/19 16:55
Container ID: 1199948004-A

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Conductivity	257		1.00	0.477	umhos/cm	1		11/21/19 14:36

Print Date: 12/12/2019 8:12:05AM

J flagging is activated

Results of **191710**

Client Sample ID: **191710**
Client Project ID: **102786-003 DLG Alt. Water**
Lab Sample ID: 1199948004
Lab Project ID: 1199948

Collection Date: 11/15/19 16:51
Received Date: 11/20/19 09:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Waters Department**

Batch Information

Analytical Batch: WTI5312
Analytical Method: SM21 2510B
Analyst: EWW
Analytical Date/Time: 11/21/19 14:36
Container ID: 1199948004-M

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Dissolved Solids	175000		10000	3100	ug/L	1		11/20/19 17:49

Batch Information

Analytical Batch: STS6557
Analytical Method: SM21 2540C
Analyst: DMM
Analytical Date/Time: 11/20/19 17:49
Container ID: 1199948004-M

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Suspended Solids	35600		2000	620	ug/L	1		11/20/19 15:11

Batch Information

Analytical Batch: STS6556
Analytical Method: SM21 2540D
Analyst: EWW
Analytical Date/Time: 11/20/19 15:11
Container ID: 1199948004-D

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
pH	6.5		0.100	0.100	pH units	1		11/21/19 14:36

Batch Information

Analytical Batch: WTI5311
Analytical Method: SM21 4500-H B
Analyst: EWW
Analytical Date/Time: 11/21/19 14:36
Container ID: 1199948004-M

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed

Results of **191710**

Client Sample ID: **191710**
Client Project ID: **102786-003 DLG Alt. Water**
Lab Sample ID: 1199948004
Lab Project ID: 1199948

Collection Date: 11/15/19 16:51
Received Date: 11/20/19 09:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Waters Department**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Kjeldahl Nitrogen	608	J	1000	310	ug/L	1		12/04/19 17:34

Batch Information

Analytical Batch: WDA4697
Analytical Method: SM21 4500-N D
Analyst: DMM
Analytical Date/Time: 12/04/19 17:34
Container ID: 1199948004-C

Prep Batch: WXX13134
Prep Method: METHOD
Prep Date/Time: 12/04/19 10:52
Prep Initial Wt./Vol.: 25 mL
Prep Extract Vol: 25 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Total Nitrate/Nitrite-N	58.6	J	200	50.0	ug/L	2		12/02/19 13:58

Batch Information

Analytical Batch: WFI2848
Analytical Method: SM21 4500NO3-F
Analyst: EWW
Analytical Date/Time: 12/02/19 13:58
Container ID: 1199948004-C

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Sulfide	50.0	U	100	31.0	ug/L	1		11/21/19 12:25

Batch Information

Analytical Batch: WAT11457
Analytical Method: SM23 4500S D
Analyst: EWW
Analytical Date/Time: 11/21/19 12:25
Container ID: 1199948004-L

Results of **Trip Blank**

Client Sample ID: **Trip Blank**
Client Project ID: **102786-003 DLG Alt. Water**
Lab Sample ID: 1199948005
Lab Project ID: 1199948

Collection Date: 11/14/19 17:45
Received Date: 11/20/19 09:16
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by **Volatile Fuels**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Gasoline Range Organics	0.0500 U		0.100	0.0310	mg/L	1		11/26/19 12:35
Surrogates								
4-Bromofluorobenzene (surr)	82.7		50-150		%	1		11/26/19 12:35

Batch Information

Analytical Batch: VFC15049
Analytical Method: AK101
Analyst: ST
Analytical Date/Time: 11/26/19 12:35
Container ID: 1199948005-B

Prep Batch: VXX35282
Prep Method: SW5030B
Prep Date/Time: 11/26/19 08:00
Prep Initial Wt./Vol.: 5 mL
Prep Extract Vol: 5 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Benzene	0.250 U		0.500	0.150	ug/L	1		11/26/19 12:35
Ethylbenzene	0.500 U		1.00	0.310	ug/L	1		11/26/19 12:35
o-Xylene	0.500 U		1.00	0.310	ug/L	1		11/26/19 12:35
P & M -Xylene	1.00 U		2.00	0.620	ug/L	1		11/26/19 12:35
Toluene	0.500 U		1.00	0.310	ug/L	1		11/26/19 12:35
Xylenes (total)	1.50 U		3.00	0.930	ug/L	1		11/26/19 12:35
Surrogates								
1,4-Difluorobenzene (surr)	93.5		77-115		%	1		11/26/19 12:35

Batch Information

Analytical Batch: VFC15049
Analytical Method: SW8021B
Analyst: ST
Analytical Date/Time: 11/26/19 12:35
Container ID: 1199948005-B

Prep Batch: VXX35282
Prep Method: SW5030B
Prep Date/Time: 11/26/19 08:00
Prep Initial Wt./Vol.: 5 mL
Prep Extract Vol: 5 mL

Method Blank

Blank ID: MB for HBN 1802652 [MXX/33025]
Blank Lab ID: 1545306

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1199948001, 1199948002, 1199948003, 1199948004

Results by **EP200.8**

Parameter	Results	LOQ/CL	DL	Units
Calcium	250U	500	150	ug/L
Chromium	1.00U	2.00	0.800	ug/L
Iron	125U	250	78.0	ug/L
Magnesium	25.0U	50.0	15.0	ug/L
Manganese	0.500U	1.00	0.350	ug/L
Potassium	250U	500	150	ug/L
Sodium	250U	500	150	ug/L

Batch Information

Analytical Batch: MMS10696
Analytical Method: EP200.8
Instrument: Perkin Elmer Nexlon P5
Analyst: ACF
Analytical Date/Time: 12/5/2019 5:48:48PM

Prep Batch: MXX33025
Prep Method: E200.2
Prep Date/Time: 12/2/2019 9:48:19AM
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

SGS North America Inc.
200 West Potter Drive Anchorage, AK 95518
t 907.562.2343 **f** 907.561.5301 www.us.sgs.com

Blank Spike Summary

Blank Spike ID: LCS for HBN 1199948 [MXX33025]
Blank Spike Lab ID: 1545307
Date Analyzed: 12/05/2019 16:17

Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1199948001, 1199948002, 1199948003, 1199948004

Results by **EP200.8**

Blank Spike (ug/L)

Parameter	Spike	Result	Rec (%)	CL
Calcium	10000	9990	100	(85-115)
Chromium	400	417	104	(85-115)
Iron	5000	5240	105	(85-115)
Magnesium	10000	10800	108	(85-115)
Manganese	500	509	102	(85-115)
Potassium	10000	10700	107	(85-115)
Sodium	10000	10700	107	(85-115)

Batch Information

Analytical Batch: **MMS10696**
Analytical Method: **EP200.8**
Instrument: **Perkin Elmer Nexion P5**
Analyst: **ACF**

Prep Batch: **MXX33025**
Prep Method: **E200.2**
Prep Date/Time: **12/02/2019 09:48**
Spike Init Wt./Vol.: 10000 ug/L Extract Vol: 50 mL
Dupe Init Wt./Vol.: Extract Vol:

SGS North America Inc.
200 West Potter Drive Anchorage, AK 95518
t 907.562.2343 f 907.561.5301 www.us.sgs.com

Matrix Spike Summary

Original Sample ID: 1545310
MS Sample ID: 1545311 MS
MSD Sample ID:

Analysis Date: 12/05/2019 16:20
Analysis Date: 12/05/2019 16:23
Analysis Date:
Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1199948001, 1199948002, 1199948003, 1199948004

Results by **EP200.8**

		Matrix Spike (ug/L)				Spike Duplicate (ug/L)					
Parameter	Sample	Spike	Result	Rec (%)		Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Calcium	250U	10000	9720	97					70-130		
Chromium	0.857J	400	429	107					70-130		
Iron	125U	5000	5470	109					70-130		
Magnesium	285	10000	10900	106					70-130		
Manganese	3.16	500	528	105					70-130		
Potassium	380J	10000	10700	103					70-130		
Sodium	193000	10000	250U	0	*				70-130		

Batch Information

Analytical Batch: MMS10696
Analytical Method: EP200.8
Instrument: Perkin Elmer Nexlon P5
Analyst: ACF
Analytical Date/Time: 12/5/2019 4:23:47PM

Prep Batch: MXX33025
Prep Method: DW Digest for Metals on ICP-MS
Prep Date/Time: 12/2/2019 9:48:19AM
Prep Initial Wt./Vol.: 20.00mL
Prep Extract Vol: 50.00mL

Print Date: 12/12/2019 8:12:16AM

Method Blank

Blank ID: MB for HBN 1802386 [STS/6556]
Blank Lab ID: 1544292

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1199948001, 1199948002, 1199948003, 1199948004

Results by **SM21 2540D**

Parameter	Results	LOQ/CL	DL	Units
Total Suspended Solids	500U	1000	310	ug/L

Batch Information

Analytical Batch: STS6556
Analytical Method: SM21 2540D
Instrument:
Analyst: EWW
Analytical Date/Time: 11/20/2019 3:11:54PM

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Duplicate Sample Summary

Original Sample ID: 1199948002
Duplicate Sample ID: 1544295
QC for Samples:
1199948001, 1199948002, 1199948003, 1199948004

Analysis Date: 11/20/2019 15:11
Matrix: Water (Surface, Eff., Ground)

Results by **SM21 2540D**

NAME	Original	Duplicate	Units	RPD (%)	RPD CL
Total Suspended Solids	74400	76800	ug/L	3.20	(< 5)

Batch Information

Analytical Batch: STS6556
Analytical Method: SM21 2540D
Instrument:
Analyst: EWW

Print Date: 12/12/2019 8:12:24AM

Duplicate Sample Summary

Original Sample ID: 1199948004
Duplicate Sample ID: 1544296
QC for Samples:
1199948003, 1199948004

Analysis Date: 11/20/2019 15:11
Matrix: Water (Surface, Eff., Ground)

Results by **SM21 2540D**

NAME	Original	Duplicate	Units	RPD (%)	RPD CL
Total Suspended Solids	35600	35600	ug/L	0.00	(< 5)

Batch Information

Analytical Batch: STS6556
Analytical Method: SM21 2540D
Instrument:
Analyst: EWW

Print Date: 12/12/2019 8:12:24AM

Blank Spike Summary

Blank Spike ID: LCS for HBN 1199948 [STS6556]
Blank Spike Lab ID: 1544293
Date Analyzed: 11/20/2019 15:11

Spike Duplicate ID: LCSD for HBN 1199948 [STS6556]
Spike Duplicate Lab ID: 1544294
Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1199948001, 1199948002, 1199948003, 1199948004

Results by **SM21 2540D**

	Blank Spike (ug/L)			Spike Duplicate (ug/L)					
Parameter	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Total Suspended Solids	25000	25400	102	25000	25100	100	(75-125)	1.20	(< 5)

Batch Information

Analytical Batch: **STS6556**
Analytical Method: **SM21 2540D**
Instrument:
Analyst: **EWW**

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Method Blank

Blank ID: MB for HBN 1802403 [STS/6557]
Blank Lab ID: 1544358

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1199948001, 1199948002, 1199948003, 1199948004

Results by **SM21 2540C**

Parameter	Results	LOQ/CL	DL	Units
Total Dissolved Solids	5000U	10000	3100	ug/L

Batch Information

Analytical Batch: STS6557
Analytical Method: SM21 2540C
Instrument:
Analyst: DMM
Analytical Date/Time: 11/20/2019 5:49:01PM

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Duplicate Sample Summary

Original Sample ID: 1196946001
Duplicate Sample ID: 1544361
Analysis Date: 11/20/2019 17:49
Matrix: Water (Surface, Eff., Ground)

QC for Samples:

1199948001, 1199948002, 1199948003, 1199948004

Results by **SM21 2540C**

NAME	Original	Duplicate	Units	RPD (%)	RPD CL
Total Dissolved Solids	78000	81000	ug/L	3.80	(< 5)

Batch Information

Analytical Batch: STS6557
Analytical Method: SM21 2540C
Instrument:
Analyst: DMM

Print Date: 12/12/2019 8:12:31AM

Blank Spike Summary

Blank Spike ID: LCS for HBN 1199948 [STS6557]
Blank Spike Lab ID: 1544359
Date Analyzed: 11/20/2019 17:49

Spike Duplicate ID: LCSD for HBN 1199948 [STS6557]
Spike Duplicate Lab ID: 1544360
Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1199948001, 1199948002, 1199948003, 1199948004

Results by **SM21 2540C**

	Blank Spike (ug/L)			Spike Duplicate (ug/L)					
Parameter	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Total Dissolved Solids	333000	287000	86	333000	291000	87	(75-125)	1.40	(< 5)

Batch Information

Analytical Batch: **STS6557**
Analytical Method: **SM21 2540C**
Instrument:
Analyst: **DMM**

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Method Blank

Blank ID: MB for HBN 1802553 [THOG/1311]
Blank Lab ID: 1544908

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1199948001, 1199948002, 1199948003, 1199948004

Results by **EPA 1664B**

Parameter	Results	LOQ/CL	DL	Units
Oil & Grease HEM	2000U	4000	1000	ug/L

Batch Information

Analytical Batch: THOG1311
Analytical Method: EPA 1664B
Instrument:
Analyst: EWW
Analytical Date/Time: 11/26/2019 8:38:12AM

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1199948 [THOG1311]
Blank Spike Lab ID: 1544909
Date Analyzed: 11/26/2019 08:38

Spike Duplicate ID: LCSD for HBN 1199948 [THOG1311]
Spike Duplicate Lab ID: 1544910
Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1199948001, 1199948002, 1199948003, 1199948004

Results by **EPA 1664B**

	Blank Spike (ug/L)			Spike Duplicate (ug/L)					
Parameter	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Oil & Grease HEM	40000	32500	81	40000	32000	80	(78-114)	1.60	(< 18)

Batch Information

Analytical Batch: **THOG1311**
Analytical Method: **EPA 1664B**
Instrument:
Analyst: **EWW**

Matrix Spike Summary

Original Sample ID: 1544911
MS Sample ID: 1544964 MS
MSD Sample ID:

Analysis Date: 11/26/2019 8:38
Analysis Date: 11/26/2019 8:38
Analysis Date:
Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1199948001, 1199948002, 1199948003, 1199948004

Results by **EPA 1664B**

		Matrix Spike (ug/L)			Spike Duplicate (ug/L)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Oil & Grease HEM	7640	44900	45200	84				78-114		

Batch Information

Analytical Batch: THOG1311
Analytical Method: EPA 1664B
Instrument:
Analyst: EWW
Analytical Date/Time: 11/26/2019 8:38:12AM

Print Date: 12/12/2019 8:12:39AM

Method Blank

Blank ID: MB for HBN 1802620 [VXX/35282]
Blank Lab ID: 1545165

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1199948001, 1199948002, 1199948003, 1199948004, 1199948005

Results by **AK101**

Parameter	Results	LOQ/CL	DL	Units
Gasoline Range Organics	0.0500U	0.100	0.0310	mg/L
Surrogates				
4-Bromofluorobenzene (surr)	82.4	50-150		%

Batch Information

Analytical Batch: VFC15049
Analytical Method: AK101
Instrument: Agilent 7890 PID/FID
Analyst: ST
Analytical Date/Time: 11/26/2019 10:51:00AM

Prep Batch: VXX35282
Prep Method: SW5030B
Prep Date/Time: 11/26/2019 8:00:00AM
Prep Initial Wt./Vol.: 5 mL
Prep Extract Vol: 5 mL

Blank Spike Summary

Blank Spike ID: LCS for HBN 1199948 [VXX35282]
Blank Spike Lab ID: 1545168
Date Analyzed: 11/26/2019 11:43

Spike Duplicate ID: LCSD for HBN 1199948 [VXX35282]
Spike Duplicate Lab ID: 1545169
Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1199948001, 1199948002, 1199948003, 1199948004, 1199948005

Results by **AK101**

	Blank Spike (mg/L)			Spike Duplicate (mg/L)					
Parameter	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Gasoline Range Organics	1.00	1.00	100	1.00	1.04	104	(60-120)	3.30	(< 20)
Surrogates									
4-Bromofluorobenzene (surr)	0.0500	94.3	94	0.0500	99.1	99	(50-150)	4.90	

Batch Information

Analytical Batch: **VFC15049**
Analytical Method: **AK101**
Instrument: **Agilent 7890 PID/FID**
Analyst: **ST**

Prep Batch: **VXX35282**
Prep Method: **SW5030B**
Prep Date/Time: **11/26/2019 08:00**
Spike Init Wt./Vol.: 1.00 mg/L Extract Vol: 5 mL
Dupe Init Wt./Vol.: 1.00 mg/L Extract Vol: 5 mL

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Method Blank

Blank ID: MB for HBN 1802620 [VXX/35282]
Blank Lab ID: 1545165

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1199948001, 1199948002, 1199948003, 1199948004, 1199948005

Results by **SW8021B**

Parameter	Results	LOQ/CL	DL	Units
Benzene	0.250U	0.500	0.150	ug/L
Ethylbenzene	0.500U	1.00	0.310	ug/L
o-Xylene	0.500U	1.00	0.310	ug/L
P & M -Xylene	1.00U	2.00	0.620	ug/L
Toluene	0.500U	1.00	0.310	ug/L
Xylenes (total)	1.50U	3.00	0.930	ug/L
Surrogates				
1,4-Difluorobenzene (surr)	93.4	77-115		%

Batch Information

Analytical Batch: VFC15049
Analytical Method: SW8021B
Instrument: Agilent 7890 PID/FID
Analyst: ST
Analytical Date/Time: 11/26/2019 10:51:00AM

Prep Batch: VXX35282
Prep Method: SW5030B
Prep Date/Time: 11/26/2019 8:00:00AM
Prep Initial Wt./Vol.: 5 mL
Prep Extract Vol: 5 mL

Print Date: 12/12/2019 8:12:46AM

Blank Spike Summary

Blank Spike ID: LCS for HBN 1199948 [VXX35282]
Blank Spike Lab ID: 1545166
Date Analyzed: 11/26/2019 11:25

Spike Duplicate ID: LCSD for HBN 1199948 [VXX35282]
Spike Duplicate Lab ID: 1545167
Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1199948001, 1199948002, 1199948003, 1199948004, 1199948005

Results by **SW8021B**

	Blank Spike (ug/L)			Spike Duplicate (ug/L)					
Parameter	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Benzene	100	101	101	100	102	102	(80-120)	0.35	(< 20)
Ethylbenzene	100	101	101	100	102	102	(75-125)	0.55	(< 20)
o-Xylene	100	99.5	100	100	100	100	(80-120)	0.64	(< 20)
P & M -Xylene	200	202	101	200	203	101	(75-130)	0.15	(< 20)
Toluene	100	100	100	100	102	102	(75-120)	1.70	(< 20)
Xylenes (total)	300	302	101	300	303	101	(79-121)	0.31	(< 20)
Surrogates									
1,4-Difluorobenzene (surr)	50	100	100	50	102	102	(77-115)	2.10	

Batch Information

Analytical Batch: **VFC15049**
Analytical Method: **SW8021B**
Instrument: **Agilent 7890 PID/FID**
Analyst: **ST**

Prep Batch: **VXX35282**
Prep Method: **SW5030B**
Prep Date/Time: **11/26/2019 08:00**
Spike Init Wt./Vol.: 100 ug/L Extract Vol: 5 mL
Dupe Init Wt./Vol.: 100 ug/L Extract Vol: 5 mL

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Method Blank

Blank ID: MB for HBN 1802465 [WAT/11457]
Blank Lab ID: 1544602

Matrix: Drinking Water

QC for Samples:
1199948001, 1199948002, 1199948003, 1199948004

Results by **SM23 4500S D**

Parameter	Results	LOQ/CL	DL	Units
Sulfide	50.0U	100	31.0	ug/L

Batch Information

Analytical Batch: WAT11457
Analytical Method: SM23 4500S D
Instrument:
Analyst: EWW
Analytical Date/Time: 11/21/2019 12:25:00PM

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1199948 [WAT11457]
Blank Spike Lab ID: 1544603
Date Analyzed: 11/21/2019 12:25

Matrix: Drinking Water

QC for Samples: 1199948001, 1199948002, 1199948003, 1199948004

Results by **SM23 4500S D**

Blank Spike (ug/L)

Parameter	Spike	Result	Rec (%)	CL
Sulfide	499	540	108	(75-125)

Batch Information

Analytical Batch: **WAT11457**
Analytical Method: **SM23 4500S D**
Instrument:
Analyst: **EWW**

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Matrix Spike Summary

Original Sample ID: 1199948001
MS Sample ID: 1544604 MS
MSD Sample ID: 1544605 MSD

Analysis Date: 11/21/2019 12:25
Analysis Date: 11/21/2019 12:25
Analysis Date: 11/21/2019 12:25
Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1199948001, 1199948002, 1199948003, 1199948004

Results by **SM23 4500S D**

		Matrix Spike (ug/L)			Spike Duplicate (ug/L)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Sulfide	50.0U	499	570	114	499	580	116	75-125	1.70	(< 25)

Batch Information

Analytical Batch: WAT11457
Analytical Method: SM23 4500S D
Instrument:
Analyst: EWW
Analytical Date/Time: 11/21/2019 12:25:00PM

Print Date: 12/12/2019 8:12:55AM

Method Blank

Blank ID: MB for HBN 1802691 (WFI/2848)
Blank Lab ID: 1545498

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1199948001, 1199948002, 1199948003, 1199948004

Results by **SM21 4500NO3-F**

Parameter	Results	LOQ/CL	DL	Units
Nitrate-N	100U	200	50.0	ug/L
Nitrite-N	100U	200	50.0	ug/L
Total Nitrate/Nitrite-N	50.6J	200	50.0	ug/L

Batch Information

Analytical Batch: WFI2848
Analytical Method: SM21 4500NO3-F
Instrument: Astoria segmented flow
Analyst: EWW
Analytical Date/Time: 12/2/2019 1:26:54PM

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Method Blank

Blank ID: MB for HBN 1802691 (WFI/2848)
Blank Lab ID: 1545500

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1199948001, 1199948002, 1199948003, 1199948004

Results by **SM21 4500NO3-F**

Parameter	Results	LOQ/CL	DL	Units
Nitrate-N	100U	200	50.0	ug/L
Nitrite-N	100U	200	50.0	ug/L
Total Nitrate/Nitrite-N	100U	200	50.0	ug/L

Batch Information

Analytical Batch: WFI2848
Analytical Method: SM21 4500NO3-F
Instrument: Astoria segmented flow
Analyst: EWW
Analytical Date/Time: 12/2/2019 2:12:24PM

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Method Blank

Blank ID: MB for HBN 1802691 (WFI/2848)
Blank Lab ID: 1545502

Matrix: Water (Surface, Eff., Ground)

QC for Samples:

Results by **SM21 4500NO3-F**

Parameter	Results	LOQ/CL	DL	Units
Nitrate-N	100U	200	50.0	ug/L
Nitrite-N	100U	200	50.0	ug/L
Total Nitrate/Nitrite-N	52.2J	200	50.0	ug/L

Batch Information

Analytical Batch: WFI2848
Analytical Method: SM21 4500NO3-F
Instrument: Astoria segmented flow
Analyst: EWW
Analytical Date/Time: 12/2/2019 2:57:53PM

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1199948 [WFI2848]
Blank Spike Lab ID: 1545497
Date Analyzed: 12/02/2019 13:25

Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1199948001, 1199948002, 1199948003, 1199948004

Results by **SM21 4500NO3-F**

Blank Spike (ug/L)

Parameter	Spike	Result	Rec (%)	CL
Nitrate-N	2500	2490	100	(70-130)
Nitrite-N	2500	2510	101	(90-110)
Total Nitrate/Nitrite-N	5000	5000	100	(90-110)

Batch Information

Analytical Batch: **WFI2848**
Analytical Method: **SM21 4500NO3-F**
Instrument: **Astoria segmented flow**
Analyst: **EWW**

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1199948 [WFI2848]
Blank Spike Lab ID: 1545499
Date Analyzed: 12/02/2019 14:10

Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1199948001, 1199948002, 1199948003, 1199948004

Results by **SM21 4500NO3-F**

Blank Spike (ug/L)

Parameter	Spike	Result	Rec (%)	CL
Nitrate-N	2500	2400	96	(70-130)
Nitrite-N	2500	2460	99	(90-110)
Total Nitrate/Nitrite-N	5000	4860	97	(90-110)

Batch Information

Analytical Batch: **WFI2848**
Analytical Method: **SM21 4500NO3-F**
Instrument: **Astoria segmented flow**
Analyst: **EWW**

Print Date: 12/12/2019 8:13:00AM

Blank Spike Summary

Blank Spike ID: LCS for HBN 1199948 [WFI2848]
Blank Spike Lab ID: 1545501
Date Analyzed: 12/02/2019 14:56

Matrix: Water (Surface, Eff., Ground)

QC for Samples:

Results by **SM21 4500NO3-F**

Blank Spike (ug/L)

Parameter	Spike	Result	Rec (%)	CL
Nitrate-N	2500	2230	89	(70-130)
Nitrite-N	2500	2450	98	(90-110)
Total Nitrate/Nitrite-N	5000	4680	94	(90-110)

Batch Information

Analytical Batch: **WFI2848**
Analytical Method: **SM21 4500NO3-F**
Instrument: **Astoria segmented flow**
Analyst: **EWW**

Print Date: 12/12/2019 8:13:00AM

Matrix Spike Summary

Original Sample ID: 1196933003
MS Sample ID: 1545454 MS
MSD Sample ID: 1545455 MSD

Analysis Date: 12/02/2019 13:30
Analysis Date: 12/02/2019 13:32
Analysis Date: 12/02/2019 13:33
Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1199948001, 1199948002, 1199948003, 1199948004

Results by **SM21 4500NO3-F**

		Matrix Spike (ug/L)			Spike Duplicate (ug/L)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Total Nitrate/Nitrite-N	3610	5000	9160	111 *	5000	9030	108	90-110	1.40	(< 25)

Batch Information

Analytical Batch: WFI2848
Analytical Method: SM21 4500NO3-F
Instrument: Astoria segmented flow
Analyst: EWW
Analytical Date/Time: 12/2/2019 1:32:08PM

Print Date: 12/12/2019 8:13:01AM

Matrix Spike Summary

Original Sample ID: 1196958001
MS Sample ID: 1545456 MS
MSD Sample ID: 1545457 MSD

Analysis Date: 12/02/2019 14:15
Analysis Date: 12/02/2019 14:17
Analysis Date: 12/02/2019 14:19
Matrix: Drinking Water

QC for Samples: 1199948001, 1199948002, 1199948003, 1199948004

Results by **SM21 4500NO3-F**

		Matrix Spike (ug/L)			Spike Duplicate (ug/L)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Total Nitrate/Nitrite-N	200U	5000	5850	117 *	5000	5890	118 *	90-110	0.68	(< 25)

Batch Information

Analytical Batch: WFI2848
Analytical Method: SM21 4500NO3-F
Instrument: Astoria segmented flow
Analyst: EWW
Analytical Date/Time: 12/2/2019 2:17:39PM

Print Date: 12/12/2019 8:13:01AM

Matrix Spike Summary

Original Sample ID: 1197002001
MS Sample ID: 1545458 MS
MSD Sample ID: 1545459 MSD

Analysis Date: 12/02/2019 13:19
Analysis Date: 12/02/2019 13:21
Analysis Date: 12/02/2019 13:23
Matrix: Drinking Water

QC for Samples:

Results by **SM21 4500NO3-F**

		Matrix Spike (ug/L)			Spike Duplicate (ug/L)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Total Nitrate/Nitrite-N	9490	20000	30100	103	20000	29300	99	90-110	2.50	(< 25)

Batch Information

Analytical Batch: WFI2848
Analytical Method: SM21 4500NO3-F
Instrument: Astoria segmented flow
Analyst: EWW
Analytical Date/Time: 12/2/2019 1:21:39PM

Print Date: 12/12/2019 8:13:01AM

Method Blank

Blank ID: MB for HBN 1802754 [WTC/2974]
Blank Lab ID: 1545700

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1199948001, 1199948002, 1199948003, 1199948004

Results by **SM 5310B**

Parameter	Results	LOQ/CL	DL	Units
Total Organic Carbon	500U	1000	400	ug/L

Batch Information

Analytical Batch: WTC2974
Analytical Method: SM 5310B
Instrument: TOC Analyzer
Analyst: BMZ
Analytical Date/Time: 12/3/2019 11:44:56AM

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1199948 [WTC2974]
Blank Spike Lab ID: 1545698
Date Analyzed: 12/03/2019 11:29

Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1199948001, 1199948002, 1199948003, 1199948004

Results by **SM 5310B**

Blank Spike (ug/L)

Parameter	Spike	Result	Rec (%)	CL
Total Organic Carbon	75000	79400	106	(80-120)

Batch Information

Analytical Batch: **WTC2974**
Analytical Method: **SM 5310B**
Instrument: **TOC Analyzer**
Analyst: **BMZ**

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Matrix Spike Summary

Original Sample ID: 1196939001
MS Sample ID: 1545706 MS
MSD Sample ID: 1545707 MSD

Analysis Date: 12/03/2019 12:15
Analysis Date: 12/03/2019 12:31
Analysis Date: 12/03/2019 12:46
Matrix: Drinking Water

QC for Samples: 1199948001, 1199948002, 1199948003, 1199948004

Results by **SM 5310B**

		Matrix Spike (ug/L)			Spike Duplicate (ug/L)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Total Organic Carbon	1000U	10000	9370	94	10000	10700	107	75-125	13.50	(< 25)

Batch Information

Analytical Batch: WTC2974
Analytical Method: SM 5310B
Instrument: TOC Analyzer
Analyst: BMZ
Analytical Date/Time: 12/3/2019 12:31:30PM

Print Date: 12/12/2019 8:13:07AM

Duplicate Sample Summary

Original Sample ID: 1196838001
Duplicate Sample ID: 1544659
Analysis Date: 11/21/2019 12:29
Matrix: Drinking Water

QC for Samples:

1199948001, 1199948002, 1199948003, 1199948004

Results by **SM21 4500-H B**

NAME	Original	Duplicate	Units	RPD (%)	RPD CL
pH	7.6	7.70	pH units	1.30	(< 5)

Batch Information

Analytical Batch: WTI5311
Analytical Method: SM21 4500-H B
Instrument: Titration
Analyst: EWW

Print Date: 12/12/2019 8:13:09AM

Duplicate Sample Summary

Original Sample ID: 1196924002
Duplicate Sample ID: 1544660
QC for Samples:
1199948001, 1199948002, 1199948003, 1199948004

Analysis Date: 11/21/2019 13:51
Matrix: Water (Surface, Eff., Ground)

Results by **SM21 4500-H B**

NAME	Original	Duplicate	Units	RPD (%)	RPD CL
pH	7.0	6.90	pH units	1.40	(< 5)

Batch Information

Analytical Batch: WTI5311
Analytical Method: SM21 4500-H B
Instrument: Titration
Analyst: EWW

Print Date: 12/12/2019 8:13:09AM

Duplicate Sample Summary

Original Sample ID: 1544662
Duplicate Sample ID: 1544663
QC for Samples:
1199948001, 1199948002, 1199948003, 1199948004

Analysis Date: 11/21/2019 17:26
Matrix: Water (Surface, Eff., Ground)

Results by **SM21 4500-H B**

NAME	Original	Duplicate	Units	RPD (%)	RPD CL
pH	9.1	9.10	pH units	0.00	(< 5)

Batch Information

Analytical Batch: WTI5311
Analytical Method: SM21 4500-H B
Instrument: Titration
Analyst: EWW

Print Date: 12/12/2019 8:13:09AM

Blank Spike Summary

Blank Spike ID: LCS for HBN 1199948 [WTI5311]
Blank Spike Lab ID: 1544656
Date Analyzed: 11/21/2019 11:00

Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1199948001, 1199948002, 1199948003, 1199948004

Results by **SM21 4500-H B**

Blank Spike (pH units)

Parameter	Spike	Result	Rec (%)	CL
pH	6.99	7.00	100	(99-101)

Batch Information

Analytical Batch: **WTI5311**
Analytical Method: **SM21 4500-H B**
Instrument: **Titration**
Analyst: **EWW**

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1199948 [WTI5311]
Blank Spike Lab ID: 1544661
Date Analyzed: 11/21/2019 14:57

Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1199948001, 1199948002, 1199948003, 1199948004

Results by **SM21 4500-H B**

Blank Spike (pH units)

Parameter	Spike	Result	Rec (%)	CL
pH	6.99	6.97	100	(99-101)

Batch Information

Analytical Batch: **WTI5311**
Analytical Method: **SM21 4500-H B**
Instrument: **Titration**
Analyst: **EWW**

Print Date: 12/12/2019 8:13:11AM

Method Blank

Blank ID: MB for HBN 1802483 [WTI/5312]
Blank Lab ID: 1544666

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1199948001, 1199948002, 1199948003, 1199948004

Results by **SM21 2510B**

Parameter	Results	LOQ/CL	DL	Units
Conductivity	1.10*	1.00	0.477	umhos/cm

Batch Information

Analytical Batch: WTI5312
Analytical Method: SM21 2510B
Instrument: Titration
Analyst: EWW
Analytical Date/Time: 11/21/2019 11:47:28AM

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Duplicate Sample Summary

Original Sample ID: 1196838001
Duplicate Sample ID: 1544667
QC for Samples:
1199948001, 1199948002, 1199948003, 1199948004

Analysis Date: 11/21/2019 12:29
Matrix: Drinking Water

Results by **SM21 2510B**

NAME	Original	Duplicate	Units	RPD (%)	RPD CL
Conductivity	336	337	umhos/cm	0.15	(< 20)

Batch Information

Analytical Batch: WTI5312
Analytical Method: SM21 2510B
Instrument: Titration
Analyst: EWW

Print Date: 12/12/2019 8:13:15AM

Blank Spike Summary

Blank Spike ID: LCS for HBN 1199948 [WTI5312]
Blank Spike Lab ID: 1544664
Date Analyzed: 11/21/2019 10:01

Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1199948001, 1199948002, 1199948003, 1199948004

Results by **SM21 2510B**

Blank Spike (umhos/cm)

Parameter	Spike	Result	Rec (%)	CL
Conductivity	10.3	10.9	106	(90-110)

Batch Information

Analytical Batch: **WTI5312**
Analytical Method: **SM21 2510B**
Instrument: **Titration**
Analyst: **EWW**

Print Date: 12/12/2019 8:13:17AM

Method Blank

Blank ID: MB for HBN 1802833 [WXX/13134]
Blank Lab ID: 1545950

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1199948001, 1199948002, 1199948003, 1199948004

Results by **SM21 4500-N D**

Parameter	Results	LOQ/CL	DL	Units
Total Kjeldahl Nitrogen	500U	1000	310	ug/L

Batch Information

Analytical Batch: WDA4697
Analytical Method: SM21 4500-N D
Instrument: Discrete Analyzer 2
Analyst: DMM
Analytical Date/Time: 12/4/2019 5:07:26PM

Prep Batch: WXX13134
Prep Method: METHOD
Prep Date/Time: 12/4/2019 10:52:00AM
Prep Initial Wt./Vol.: 25 mL
Prep Extract Vol: 25 mL

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1199948 [WXX13134]
Blank Spike Lab ID: 1545951
Date Analyzed: 12/04/2019 17:08

Spike Duplicate ID: LCSD for HBN 1199948 [WXX13134]
Spike Duplicate Lab ID: 1545952
Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1199948001, 1199948002, 1199948003, 1199948004

Results by **SM21 4500-N D**

	Blank Spike (ug/L)			Spike Duplicate (ug/L)					
Parameter	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Total Kjeldahl Nitrogen	4000	3730	93	4000	3900	98	(75-125)	4.40	(< 25)

Batch Information

Analytical Batch: **WDA4697**
Analytical Method: **SM21 4500-N D**
Instrument: **Discrete Analyzer 2**
Analyst: **DMM**

Prep Batch: **WXX13134**
Prep Method: **METHOD**
Prep Date/Time: **12/04/2019 10:52**
Spike Init Wt./Vol.: 4000 ug/L Extract Vol: 25 mL
Dupe Init Wt./Vol.: 4000 ug/L Extract Vol: 25 mL

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Matrix Spike Summary

Original Sample ID: 1198801012
MS Sample ID: 1545948 MS
MSD Sample ID: 1545949 MSD

Analysis Date: 12/04/2019 17:11
Analysis Date: 12/04/2019 17:15
Analysis Date: 12/04/2019 17:16
Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1199948001, 1199948002, 1199948003, 1199948004

Results by **SM21 4500-N D**

		Matrix Spike (ug/L)			Spike Duplicate (ug/L)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Total Kjeldahl Nitrogen	1000U	4000	3670	92	4000	3940	99	75-125	7.30	(< 25)

Batch Information

Analytical Batch: WDA4697
Analytical Method: SM21 4500-N D
Instrument: Discrete Analyzer 2
Analyst: DMM
Analytical Date/Time: 12/4/2019 5:15:13PM

Prep Batch: WXX13134
Prep Method: Distillation TKN by Phenate (W)
Prep Date/Time: 12/4/2019 10:52:00AM
Prep Initial Wt./Vol.: 25.00mL
Prep Extract Vol: 25.00mL

Print Date: 12/12/2019 8:13:23AM

Method Blank

Blank ID: MB for HBN 1802910 [WXX/13139]
Blank Lab ID: 1546353

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1199948001, 1199948002, 1199948003, 1199948004

Results by **EPA 300.0**

Parameter	Results	LOQ/CL	DL	Units
Chloride	100U	200	50.0	ug/L
Fluoride	100U	200	50.0	ug/L
Sulfate	100U	200	50.0	ug/L

Batch Information

Analytical Batch: WIC6002
Analytical Method: EPA 300.0
Instrument: 930 Metrohm compact IC flex
Analyst: DMM
Analytical Date/Time: 12/9/2019 6:04:17PM

Prep Batch: WXX13139
Prep Method: METHOD
Prep Date/Time: 12/9/2019 10:45:00AM
Prep Initial Wt./Vol.: 10 mL
Prep Extract Vol: 10 mL

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1199948 [WXX13139]
Blank Spike Lab ID: 1546354
Date Analyzed: 12/09/2019 18:25

Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1199948001, 1199948002, 1199948003, 1199948004

Results by **EPA 300.0**

Blank Spike (ug/L)

Parameter	Spike	Result	Rec (%)	CL
Chloride	5000	5390	108	(90-110)
Fluoride	5000	5010	100	(90-110)
Sulfate	5000	5260	105	(90-110)

Batch Information

Analytical Batch: **WIC6002**
Analytical Method: **EPA 300.0**
Instrument: **930 Metrohm compact IC flex**
Analyst: **DMM**

Prep Batch: **WXX13139**
Prep Method: **METHOD**
Prep Date/Time: **12/09/2019 10:45**
Spike Init Wt./Vol.: 5000 ug/L Extract Vol: 10 mL
Dupe Init Wt./Vol.: Extract Vol:

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Matrix Spike Summary

Original Sample ID: 1546357
MS Sample ID: 1546358 MS
MSD Sample ID:

Analysis Date: 12/09/2019 19:03
Analysis Date: 12/09/2019 19:22
Analysis Date:
Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1199948001, 1199948002, 1199948003, 1199948004

Results by **EPA 300.0**

		Matrix Spike (ug/L)			Spike Duplicate (ug/L)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Chloride	3920	5000	8860	99				90-110		
Fluoride	126J	5000	5050	99				90-110		
Sulfate	1360	5000	6310	99				90-110		

Batch Information

Analytical Batch: WIC6002
Analytical Method: EPA 300.0
Instrument: 930 Metrohm compact IC flex
Analyst: DMM
Analytical Date/Time: 12/9/2019 7:22:05PM

Prep Batch: WXX13139
Prep Method: EPA 300.0 Extraction Waters/Liquids
Prep Date/Time: 12/9/2019 10:45:00AM
Prep Initial Wt./Vol.: 10.00mL
Prep Extract Vol: 10.00mL

Print Date: 12/12/2019 8:13:29AM

Matrix Spike Summary

Original Sample ID: 1546356
MS Sample ID: 1546359 MS
MSD Sample ID:

Analysis Date: 12/09/2019 23:48
Analysis Date: 12/10/2019 0:06
Analysis Date:
Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1199948001, 1199948002, 1199948003, 1199948004

Results by **EPA 300.0**

		Matrix Spike (ug/L)				Spike Duplicate (ug/L)					
Parameter	Sample	Spike	Result	Rec (%)		Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Chloride	15400	5000	19400	81	*				90-110		
Fluoride	94.0J	5000	4820	95					90-110		
Sulfate	4820	5000	9410	92					90-110		

Batch Information

Analytical Batch: WIC6002
Analytical Method: EPA 300.0
Instrument: 930 Metrohm compact IC flex
Analyst: DMM
Analytical Date/Time: 12/10/2019 12:06:59AM

Prep Batch: WXX13139
Prep Method: EPA 300.0 Extraction Waters/Liquids
Prep Date/Time: 12/9/2019 10:45:00AM
Prep Initial Wt./Vol.: 10.00mL
Prep Extract Vol: 10.00mL

Print Date: 12/12/2019 8:13:29AM

Method Blank

Blank ID: MB for HBN 1802416 [XXX/42616]
Blank Lab ID: 1544387

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1199948001, 1199948002, 1199948003, 1199948004

Results by **AK102**

Parameter	Results	LOQ/CL	DL	Units
Diesel Range Organics	0.360J	0.600	0.180	mg/L
Surrogates				
5a Androstane (surr)	93.3	60-120		%

Batch Information

Analytical Batch: XFC15482
Analytical Method: AK102
Instrument: Agilent 7890B F
Analyst: DSD
Analytical Date/Time: 11/25/2019 11:52:00AM

Prep Batch: XXX42616
Prep Method: SW3520C
Prep Date/Time: 11/21/2019 9:43:37AM
Prep Initial Wt./Vol.: 250 mL
Prep Extract Vol: 1 mL

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1199948 [XXX42616]
Blank Spike Lab ID: 1544388
Date Analyzed: 11/25/2019 12:11

Spike Duplicate ID: LCSD for HBN 1199948 [XXX42616]
Spike Duplicate Lab ID: 1544389
Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1199948001, 1199948002, 1199948003, 1199948004

Results by **AK102**

	Blank Spike (mg/L)			Spike Duplicate (mg/L)					
Parameter	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Diesel Range Organics	20	18.6	93	20	18.5	93	(75-125)	0.32	(< 20)
Surrogates									
5a Androstane (surr)	0.4	98.7	99	0.4	99.6	100	(60-120)	0.91	

Batch Information

Analytical Batch: **XFC15482**
Analytical Method: **AK102**
Instrument: **Agilent 7890B F**
Analyst: **DSD**

Prep Batch: **XXX42616**
Prep Method: **SW3520C**
Prep Date/Time: **11/21/2019 09:43**
Spike Init Wt./Vol.: 20 mg/L Extract Vol: 1 mL
Dupe Init Wt./Vol.: 20 mg/L Extract Vol: 1 mL

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Method Blank

Blank ID: MB for HBN 1802416 [XXX/42616]
Blank Lab ID: 1544387

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1199948001, 1199948002, 1199948003, 1199948004

Results by **AK103**

Parameter	Results	LOQ/CL	DL	Units
Residual Range Organics	0.162J	0.500	0.150	mg/L
Surrogates				
n-Triacontane-d62 (surr)	90	60-120		%

Batch Information

Analytical Batch: XFC15482
Analytical Method: AK103
Instrument: Agilent 7890B F
Analyst: DSD
Analytical Date/Time: 11/25/2019 11:52:00AM

Prep Batch: XXX42616
Prep Method: SW3520C
Prep Date/Time: 11/21/2019 9:43:37AM
Prep Initial Wt./Vol.: 250 mL
Prep Extract Vol: 1 mL

Blank Spike Summary

Blank Spike ID: LCS for HBN 1199948 [XXX42616]
Blank Spike Lab ID: 1544388
Date Analyzed: 11/25/2019 12:11

Spike Duplicate ID: LCSD for HBN 1199948 [XXX42616]
Spike Duplicate Lab ID: 1544389
Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1199948001, 1199948002, 1199948003, 1199948004

Results by **AK103**

	Blank Spike (mg/L)			Spike Duplicate (mg/L)					
Parameter	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Residual Range Organics	20	17.6	88	20	17.7	89	(60-120)	0.74	(< 20)
Surrogates									
n-Triacontane-d62 (surr)	0.4	83.1	83	0.4	88.1	88	(60-120)	5.90	

Batch Information

Analytical Batch: **XFC15482**
Analytical Method: **AK103**
Instrument: **Agilent 7890B F**
Analyst: **DSD**

Prep Batch: **XXX42616**
Prep Method: **SW3520C**
Prep Date/Time: **11/21/2019 09:43**
Spike Init Wt./Vol.: 20 mg/L Extract Vol: 1 mL
Dupe Init Wt./Vol.: 20 mg/L Extract Vol: 1 mL

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1199948

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CHAIN-OF-CUSTODY RECORD

Page 1 of 2

Laboratory SGS
Attn: J. Dawkins

Profile: 350732

Turn Around Time:	Quote No:	J-Flags:
[X] Normal [ ] Rush		[X] Yes [ ] No
Please Specify		

Analytical Methods (include preservative if used)

Sample Identity	Lab No. 11/20/19	Time	Date Sampled	TOC	Metals 200.8 + hardness	NO2,NO3, TKN	TSS	DRO/RRO	GRO/BTEX 8021	Oil + Grease	Total Number of Containers	Remarks/Matrix Composition/Grab? Sample Containers
191050	(1) A-K	0905	11/19/19	X	X	X	X	X	X	X	14	groundwater
191320	(2) A-K	1745	11/14/19	X	X	X	X	X	X	X		
200150	(3) A-K	1150	11/15/19	X	X	X	X	X	X	X		
191710	(4) A-K	1651	11/15/19	X	X	X	X	X	X	X		
	(5) A-C					X		X				

Project Information		Sample Receipt	
Number:	102786-003	Total No. of Containers:	
Name:	DLG Alt. Water	COC Seals/Intact? Y/N/NA	
Contact:	MDN	Received Good Cond./Cold	
Ongoing Project?	Yes [X] No [ ]	Temp:	5.6, 5.3
Sampler:	ARM, RLW	Delivery Method:	

Notes:
7 day hold time
Breaks 11/21/19 & 11/22/19.
Arsenate & Arsenite
Ca, Cr, Fe, Mg, Mn, K, Na

Relinquished By: 1.	Relinquished By: 2.	Relinquished By: 3.
Signature:	Signature:	Signature:
Time: 1410	Time: 1500	Time:
Printed Name: A. Masters	Printed Name: Jen Dawkins	Printed Name:
Date: 11/19/19	Date: 11-19-19	Date:
Company: Shannon + Wilson	Company: SGS	Company:

Received By: 1.	Received By: 2.	Received By: 3.
Signature:	Signature:	Signature:
Time: 1110	Time:	Time: 0916
Printed Name: Jen Dawkins	Printed Name:	Printed Name: Nicole Warner
Date: 11-19-19	Date:	Date: 11/20/19
Company: SGS	Company:	Company: SGS

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

TB: 4.3 D45, 1.8 D62

No. 411414

1199948

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CHAIN-O[illegible] ECORD

Laboratory _____
Attn: _____

Turn Around Time: ☒ Normal ☐ Rush — Please Specify

Quote No:

J-Flags: ☒ Yes ☐ No

Analytical Methods (include preservative if used)

Sample Identity	Lab No.	Time	Date Sampled	Sulfide	Cl, F, pH, TDS cond., SO4	Speciated arsenic					Total Number of Containers	Remarks/Matrix Composition/Grab? Sample Containers
191050	(1) LN	0905	11/15/19	X	X	X					1 unpres. 1 H2SO4	groundwater
191320	(2) LN	1745	11/14/19	X	X	X						
200150	(3) LN	1150	11/15/19	X	X	X						
191710	(4) LN	1651	11/15/19	X	X	X						

Project Information	
Number:	
Name:	
Contact:	
Ongoing Project? Yes ☐ No ☐	
Sampler:	

Sample Receipt	
Total No. of Containers:	
COC Seals/Intact? Y/N/NA	
Received Good Cond./Cold	
Temp:	
Delivery Method:	

Notes:

See page 1

Relinquished By: 1.	Relinquished By: 2.	Relinquished By: 3.
Signature: Time: 11:10	Signature: Time: 1500	Signature: Time:
Printed Name: A. Masters Date: 11/19/19	Printed Name: Jen Dawkins Date: 11-19-19	Printed Name: Date:
Company: Shannon + Wilson, Inc.	Company: SGS	Company:

Received By: 1.	Received By: 2.	Received By: 3.
Signature: Time: 1110	Signature: Time:	Signature: Time: 0916
Printed Name: Jen Dawkins Date: 11/19/19	Printed Name: Date:	Printed Name: Nicole Wanner Date: 11/20/19
Company: SGS	Company:	Company: SGS

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

TB: 4.3 DYS,

No. 411411

SGS

e-Sample Receipt Form

SGS Workorder #: 1199948

1 1 9 9 9 4 8

Review Criteria	Condition (Yes, No, N/A)	Exceptions Noted below
Chain of Custody / Temperature Requirements	N/A	Exemption permitted if sampler hand carries/delivers.
Were Custody Seals intact? Note # & location	Yes	1F, 1B
COC accompanied samples?	Yes	
DOD: Were samples received in COC corresponding coolers?	N/A	
N/A **Exemption permitted if chilled & collected <8 hours ago, or for samples where chilling is not required		
Temperature blank compliant* (i.e., 0-6 °C after CF)?	Yes	Cooler ID: 1 @ 4.3 °C Therm. ID: D45
	Yes	Cooler ID: 2 @ 1.8 °C Therm. ID: D62
If samples received without a temperature blank, the "cooler temperature" will be documented instead & "COOLER TEMP" will be noted to the right. "ambient" or "chilled" will be noted if neither is available.		Cooler ID: @ °C Therm. ID:
		Cooler ID: @ °C Therm. ID:
		Cooler ID: @ °C Therm. ID:
*If >6°C, were samples collected <8 hours ago?	N/A	
If <0°C, were sample containers ice free?	N/A	
Note: Identify containers received at non-compliant temperature . Use form FS-0029 if more space is needed.		
Holding Time / Documentation / Sample Condition Requirements		Note: Refer to form F-083 "Sample Guide" for specific holding times.
Were samples received within holding time?	Yes	
Do samples **match COC**** (i.e.,sample IDs,dates/times collected)?	Yes	
**Note: If times differ <1hr, record details & login per COC.		
***Note: If sample information on containers differs from COC, SGS will default to COC information		
Were analytical requests clear? (i.e., method is specified for analyses with multiple option for analysis (Ex: BTEX, Metals)	Yes	
	Yes	***Exemption permitted for metals (e.g,200.8/6020A).
Were proper containers (type/mass/volume/preservative***)used?	Yes	
Volatile / LL-Hg Requirements		
Were Trip Blanks (i.e., VOAs, LL-Hg) in cooler with samples?	Yes	
Were all water VOA vials free of headspace (i.e., bubbles ≤ 6mm)?	Yes	
Were all soil VOAs field extracted with MeOH+BFB?	N/A	

Note to Client: Any "No", answer above indicates non-compliance with standard procedures and may impact data quality.

Additional notes (if applicable):

e-Sample Receipt Form FBK

SGS Workorder #:	**1199948**	1199948

Review Criteria	Condition (Yes, No, N/A)	Exceptions Noted below
Chain of Custody / Temperature Requirements	Yes	Exemption permitted if sampler hand carries/delivers.
Were Custody Seals intact? Note # & location	N/A	
COC accompanied samples?	Yes	
DOD: Were samples received in COC corresponding coolers?	N/A	
☐ **Exemption permitted if chilled & collected <8 hours ago, or for samples where chilling is not required		
Temperature blank compliant* (i.e., 0-6 °C after CF)?	Yes	Cooler ID: 1 @ 5.6 °C Therm. ID: D64
	Yes	Cooler ID: 2 @ 5.3 °C Therm. ID: D65
If samples received without a temperature blank, the "cooler temperature" will be documented instead & "COOLER TEMP" will be noted to the right. "ambient" or "chilled" will be noted if neither is available.		Cooler ID: @ °C Therm. ID:
		Cooler ID: @ °C Therm. ID:
*If >6°C, were samples collected <8 hours ago?		
If <0°C, were sample containers ice free?		
Note: Identify containers received at non-compliant temperature . Use form FS-0029 if more space is needed.		
Holding Time / Documentation / Sample Condition Requirements		Note: Refer to form F-083 "Sample Guide" for specific holding times.
Do samples **match COC**** (i.e.,sample IDs,dates/times collected)?	N/C	
**Note: If times differ <1hr, record details & login per COC.		
***Note: If sample information on containers differs from COC, SGS will default to COC information		
Were samples in good condition (no leaks/cracks/breakage)?	Yes	
Were analytical requests clear? (i.e., method is specified for analyses with multiple option for analysis (Ex: BTEX, Metals)	Yes	
Were Trip Blanks (i.e., VOAs, LL-Hg) in cooler with samples?	Yes	
Were all water VOA vials free of headspace (i.e., bubbles ≤ 6mm)?	N/C	
Were all soil VOAs field extracted with MeOH+BFB?	N/A	
For Rush/Short Hold Time, was RUSH/Short HT email sent?	Yes	**Earliest Sulfide, TDS, TSS break hold 11/21**

Note to Client: Any "No", answer above indicates non-compliance with standard procedures and may impact data quality.

Additional notes (if applicable):

SGS Profile #	**350732**	350732

Sample Containers and Preservatives

Container Id	Preservative	Container Condition
1199948001-A	HCL to pH < 2	OK
1199948001-B	HNO3 to pH < 2	OK
1199948001-C	H2SO4 to pH < 2	OK
1199948001-D	No Preservative Required	OK
1199948001-E	HCL to pH < 2	OK
1199948001-F	HCL to pH < 2	OK
1199948001-G	HCL to pH < 2	OK
1199948001-H	HCL to pH < 2	OK
1199948001-I	HCL to pH < 2	OK
1199948001-J	HCL to pH < 2	OK
1199948001-K	HCL to pH < 2	OK
1199948001-L	NaOH to pH > 10	OK
1199948001-M	No Preservative Required	OK
1199948001-N	No Preservative Required	OK
1199948002-A	HCL to pH < 2	OK
1199948002-B	HNO3 to pH < 2	OK
1199948002-C	H2SO4 to pH < 2	OK
1199948002-D	No Preservative Required	OK
1199948002-E	HCL to pH < 2	OK
1199948002-F	HCL to pH < 2	OK
1199948002-G	HCL to pH < 2	OK
1199948002-H	HCL to pH < 2	OK
1199948002-I	HCL to pH < 2	OK
1199948002-J	HCL to pH < 2	OK
1199948002-K	HCL to pH < 2	OK
1199948002-L	NaOH to pH > 10	OK
1199948002-M	No Preservative Required	OK
1199948002-N	No Preservative Required	OK
1199948003-A	HCL to pH < 2	OK
1199948003-B	HNO3 to pH < 2	OK
1199948003-C	H2SO4 to pH < 2	OK
1199948003-D	No Preservative Required	OK
1199948003-E	HCL to pH < 2	OK
1199948003-F	HCL to pH < 2	OK
1199948003-G	HCL to pH < 2	OK
1199948003-H	HCL to pH < 2	OK
1199948003-I	HCL to pH < 2	OK
1199948003-J	HCL to pH < 2	OK
1199948003-K	HCL to pH < 2	OK
1199948003-L	NaOH to pH > 10	OK
1199948003-M	No Preservative Required	OK
1199948003-N	No Preservative Required	OK
1199948004-A	HCL to pH < 2	OK
1199948004-B	HNO3 to pH < 2	OK
1199948004-C	H2SO4 to pH < 2	OK
1199948004-D	No Preservative Required	OK
1199948004-E	HCL to pH < 2	OK
1199948004-F	HCL to pH < 2	OK
1199948004-G	HCL to pH < 2	OK
1199948004-H	HCL to pH < 2	OK
1199948004-I	HCL to pH < 2	OK
1199948004-J	HCL to pH < 2	OK
1199948004-K	HCL to pH < 2	OK
1199948004-L	NaOH to pH > 10	OK
1199948004-M	No Preservative Required	OK
1199948004-N	No Preservative Required	OK
1199948005-A	HCL to pH < 2	OK
1199948005-B	HCL to pH < 2	OK
1199948005-C	HCL to pH < 2	OK

Container Id	Preservative	Container Condition	Container Id	Preservative	Container Condition

Container Condition Glossary

Containers for bacteriological, low level mercury and VOA vials are not opened prior to analysis and will be assigned condition code OK unless evidence indicates than an inappropriate container was submitted.

OK - The container was received at an acceptable pH for the analysis requested.
BU - The container was received with headspace greater than 6mm.
DM - The container was received damaged.
FR - The container was received frozen and not usable for Bacteria or BOD analyses.
IC - The container provided for microbiology analysis was not a laboratory-supplied, pre-sterilized container and therefore was not suitable for analysis.
NC- The container provided was not preserved or was under-preserved. The method does not allow for additional preservative added after collection.
PA - The container was received outside of the acceptable pH for the analysis requested. Preservative was added upon receipt and the container is now at the correct pH. See the Sample Receipt Form for details on the amount and lot # of the preservative added.
PH - The container was received outside of the acceptable pH for the analysis requested. Preservative was added upon receipt, but was insufficient to bring the container to the correct pH for the analysis requested. See the Sample Receipt Form for details on the amount and lot # of the preservative added.
QN - Insufficient sample quantity provided.

BROOKS APPLIED LABS
18804 North Creek Parkway, Ste 100, Bothell, WA 98011 • USA • T: 206 632 6206 F: 206 632 6017 • info@brooksapplied.com

December 11, 2019

SGS Environmental
ATTN: Julie Shumway
200 West Potter Drive
Anchorage AK 99518
julie.shumway@sgs.com

RE: Project SGS-AN1803 Client Project ID: 1199948

Dear Julie Shumway,

On November 26, 2019, Brooks Applied Labs (BAL) received four (4) water samples in a sealed cooler. The samples were logged-in for dissolved arsenite [*(As(III)*], arsenate [*As(V)*], monomethylarsonic acid [*MMAs*], and dimethylarsinic acid [*DMAs*]. The samples were filtered in the field by the client. All samples were received, prepared, analyzed, and stored according to BAL SOPs and EPA methodology.

Arsenic speciation was preformed using ion chromatography inductively coupled plasma collision reaction cell mass spectrometry (IC-ICP-CRC-MS). Arsenic species are chromatographically separated on an ion exchange column and then quantified using inductively coupled plasma collision reaction cell mass spectrometry (ICP-CRC-MS)

If the native sample result and/or the DUP result is not detected (ND) above the MDL, then the associated RPD is not calculated (N/C).

All data was reported without qualification (aside from concentration qualifiers) and all associated quality control sample results met the acceptance criteria. BAL, an accredited laboratory, certifies that the reported results of all analyses for which BAL is NELAP accredited meet all NELAP requirements. For more information please see the *Report Information* page in your report.

Sincerely,

Amanda Royal
Senior Project Manager
amanda@brooksapplied.com

Project ID: SGS-AN1803
PM: Amanda Royal

Client PM: Julie Shumway
Client Project: 1199948

Report Information

Laboratory Accreditation

BAL is accredited by the *National Environmental Laboratory Accreditation Program* (NELAP) through the State of Florida Department of Health, Bureau of Laboratories (E87982) and is certified to perform many environmental analyses. BAL is also certified by many other states to perform environmental analyses. For a current list of our accreditations/certifications, please visit our website at <http://www.brooksapplied.com/resources/certificates-permits/>. Results reported relate only to the samples listed in the report.

Field Quality Control Samples

Please be notified that certain EPA methods require the collection of field quality control samples of an appropriate type and frequency; failure to do so is considered a deviation from some methods and for compliance purposes should only be done with the approval of regulatory authorities. Please see the specific EPA methods for details regarding required field quality control samples.

Common Abbreviations

AR	as received
BAL	Brooks Applied Labs
BLK	method blank
BS	blank spike
CAL	calibration standard
CCB	continuing calibration blank
CCV	continuing calibration verification
COC	chain of custody record
D	dissolved fraction
DUP	duplicate
IBL	instrument blank
ICV	initial calibration verification
MDL	method detection limit
MRL	method reporting limit
MS	matrix spike
MSD	matrix spike duplicate
ND	non-detect
NR	non-reportable
N/C	not calculated
PS	post preparation spike
REC	percent recovery
RPD	relative percent difference
SCV	secondary calibration verification
SOP	standard operating procedure
SRM	reference material
T	total fraction
TR	total recoverable fraction

Definition of Data Qualifiers

(Effective 9/23/09)

E	An estimated value due to the presence of interferences. A full explanation is presented in the narrative.
H	Holding time and/or preservation requirements not met. Please see narrative for explanation.
J	Detected by the instrument, the result is > the MDL but ≤ the MRL. Result is reported and considered an estimate.
J-1	Estimated value. A full explanation is presented in the narrative.
M	Duplicate precision (RPD) was not within acceptance criteria. Please see narrative for explanation.
N	Spike recovery was not within acceptance criteria. Please see narrative for explanation.
R	Rejected, unusable value. A full explanation is presented in the narrative.
U	Result is ≤ the MDL or client requested reporting limit (CRRL). Result reported as the MDL or CRRL.
X	Result is not BLK-corrected and is within 10x the absolute value of the highest detectable BLK in the batch.
	Result is estimated.

These qualifiers are based on those previously utilized by Brooks Applied Labs, those found in the EPA SOW ILM03.0, Exhibit B, Section III, pg. B-18, and the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review; USEPA; January 2010. These supersede all previous qualifiers ever employed by BAL.

18804 North Creek Parkway, Suite 100, Bothell, WA 98011 · P(206) 632-6206 · F(206) 632-6017 · info@brooksapplied.com · www.brooksapplied.com

Project ID: SGS-AN1803
PM: Amanda Royal

Client PM: Julie Shumway
Client Project: 1199948

Sample Information

Sample	Lab ID	Report Matrix	Type	Sampled	Received
191050	1948020-01	Water	Sample	11/15/2019	11/26/2019
191320	1948020-02	Water	Sample	11/14/2019	11/26/2019
200150	1948020-03	Water	Sample	11/15/2019	11/26/2019
191710	1948020-04	Water	Sample	11/15/2019	11/26/2019

Batch Summary

Analyte	Lab Matrix	Method	Prepared	Analyzed	Batch	Sequence
As(III)	Water	SOP BAL-4100	12/03/2019	12/04/2019	B193484	1901574
As(V)	Water	SOP BAL-4100	12/03/2019	12/04/2019	B193484	1901574
DMAs	Water	SOP BAL-4100	12/03/2019	12/04/2019	B193484	1901574
MMAs	Water	SOP BAL-4100	12/03/2019	12/04/2019	B193484	1901574

Project ID: SGS-AN1803
PM: Amanda Royal

Client PM: Julie Shumway
Client Project: 1199948

Sample Results

Sample	Analyte	Report Matrix	Basis	Result	Qualifier	MDL	MRL	Unit	Batch	Sequence
191050										
1948020-01	As(III)	Water	D	≤ 0.040	U	0.040	0.200	µg/L	B193484	1901574
1948020-01	As(V)	Water	D	0.059	J	0.040	0.200	µg/L	B193484	1901574
1948020-01	DMAs	Water	D	≤ 0.050	U	0.050	0.210	µg/L	B193484	1901574
1948020-01	MMAs	Water	D	≤ 0.090	U	0.090	0.230	µg/L	B193484	1901574
191320										
1948020-02	As(III)	Water	D	1.90		0.040	0.200	µg/L	B193484	1901574
1948020-02	As(V)	Water	D	0.461		0.040	0.200	µg/L	B193484	1901574
1948020-02	DMAs	Water	D	≤ 0.050	U	0.050	0.210	µg/L	B193484	1901574
1948020-02	MMAs	Water	D	≤ 0.090	U	0.090	0.230	µg/L	B193484	1901574
200150										
1948020-03	As(III)	Water	D	≤ 0.040	U	0.040	0.200	µg/L	B193484	1901574
1948020-03	As(V)	Water	D	≤ 0.040	U	0.040	0.200	µg/L	B193484	1901574
1948020-03	DMAs	Water	D	≤ 0.050	U	0.050	0.210	µg/L	B193484	1901574
1948020-03	MMAs	Water	D	≤ 0.090	U	0.090	0.230	µg/L	B193484	1901574
191710										
1948020-04	As(III)	Water	D	3.60		0.040	0.200	µg/L	B193484	1901574
1948020-04	As(V)	Water	D	0.993		0.040	0.200	µg/L	B193484	1901574
1948020-04	DMAs	Water	D	≤ 0.050	U	0.050	0.210	µg/L	B193484	1901574
1948020-04	MMAs	Water	D	≤ 0.090	U	0.090	0.230	µg/L	B193484	1901574

Project ID: SGS-AN1803
PM: Amanda Royal

Client PM: Julie Shumway
Client Project: 1199948

Accuracy & Precision Summary

Batch: B193484
Lab Matrix: Water
Method: SOP BAL-4100

Sample	Analyte	Native	Spike	Result	Units	REC & Limits	RPD & Limits
B193484-BS1	**Blank Spike, (1936017)**						
	As(III)		5.000	4.831	µg/L	97% 75-125	
	As(V)		5.000	4.925	µg/L	99% 75-125	
	DMAs		5.210	5.115	µg/L	98% 75-125	
B193484-BS2	**Blank Spike, (1911013)**						
	MMAs		4.870	5.068	µg/L	104% 75-125	
B193484-DUP3	**Duplicate, (1948020-04)**						
	As(III)	3.604		3.697	µg/L		3% 25
	As(V)	0.993		0.990	µg/L		0.4% 25
	DMAs	ND		ND	µg/L		N/C 25
	MMAs	ND		ND	µg/L		N/C 25
B193484-MS3	**Matrix Spike, (1948020-04)**						
	As(III)	3.604	10.45	13.81	µg/L	98% 75-125	
	As(V)	0.993	9.710	10.62	µg/L	99% 75-125	
	DMAs	ND	10.20	10.10	µg/L	99% 75-125	
	MMAs	ND	10.00	9.864	µg/L	99% 75-125	
B193484-MSD3	**Matrix Spike Duplicate, (1948020-04)**						
	As(III)	3.604	10.45	14.09	µg/L	100% 75-125	2% 25
	As(V)	0.993	9.710	10.76	µg/L	101% 75-125	1% 25
	DMAs	ND	10.20	10.12	µg/L	99% 75-125	0.3% 25
	MMAs	ND	10.00	9.987	µg/L	100% 75-125	1% 25

Project ID: SGS-AN1803
PM: Amanda Royal

Client PM: Julie Shumway
Client Project: 1199948

Method Blanks & Reporting Limits

Batch: B193484
Matrix: Water
Method: SOP BAL-4100
Analyte: As(III)

Sample	Result	Units
B193484-BLK1	0.00	µg/L
B193484-BLK2	0.00	µg/L
B193484-BLK3	0.00	µg/L
B193484-BLK4	0.00	µg/L

Average: 0.000
Limit: 0.020

MDL: 0.004
MRL: 0.020

Analyte: As(V)

Sample	Result	Units
B193484-BLK1	0.001	µg/L
B193484-BLK2	0.001	µg/L
B193484-BLK3	0.001	µg/L
B193484-BLK4	0.0008	µg/L

Average: 0.001
Limit: 0.020

MDL: 0.004
MRL: 0.020

Analyte: DMAs

Sample	Result	Units
B193484-BLK1	0.00	µg/L
B193484-BLK2	0.00	µg/L
B193484-BLK3	0.00	µg/L
B193484-BLK4	0.00	µg/L

Average: 0.000
Limit: 0.021

MDL: 0.005
MRL: 0.021

Project ID: SGS-AN1803
PM: Amanda Royal

Client PM: Julie Shumway
Client Project: 1199948

Method Blanks & Reporting Limits

Analyte: MMAs

Sample	Result	Units
B193484-BLK1	0.00	µg/L
B193484-BLK2	0.00	µg/L
B193484-BLK3	0.00	µg/L
B193484-BLK4	0.00	µg/L

Average: 0.000
Limit: 0.023

MDL: 0.009
MRL: 0.023

Project ID: SGS-AN1803
PM: Amanda Royal

Client PM: Julie Shumway
Client Project: 1199948

Sample Containers

Lab ID: 1948020-01
Sample: 191050
Report Matrix: Water
Sample Type: Sample
Collected: 11/15/2019
Received: 11/26/2019

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Bottle HDPE As-SP	125mL	19-0120	none	n/a	4	Styrofoam Cooler - 1948020

Lab ID: 1948020-02
Sample: 191320
Report Matrix: Water
Sample Type: Sample
Collected: 11/14/2019
Received: 11/26/2019

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Bottle HDPE As-SP	125mL	19-0120	none	n/a	4	Styrofoam Cooler - 1948020

Lab ID: 1948020-03
Sample: 200150
Report Matrix: Water
Sample Type: Sample
Collected: 11/15/2019
Received: 11/26/2019

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Bottle HDPE As-SP	125mL	19-0120	none	n/a	4	Styrofoam Cooler - 1948020

Lab ID: 1948020-04
Sample: 191710
Report Matrix: Water
Sample Type: Sample
Collected: 11/15/2019
Received: 11/26/2019

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Bottle HDPE As-SP	125mL	19-0120	none	n/a	4	Styrofoam Cooler - 1948020

Shipping Containers

Styrofoam Cooler - 1948020

Received: November 26, 2019 10:07
Tracking No: 1ZA8619W0166292256 via UPS
Coolant Type: Blue Ice
Temperature: 5.5 °C

Description: Styrofoam Cooler
Damaged in transit? No
Returned to client? No
Comments: IR # 19

Custody seals present? Yes
Custody seals intact? Yes
COC present? Yes

JULIE SHUMWAY
(907) 562-2343
SGS ENVIRONMENTAL SERVICES INC
200 W POTTER DR
ANCHORAGE AK 99518-1605

11 LBS

1 OF 1

DWT: 16,10,10

SHIP TO:
SAMPLE RECEIVING
(206) 632-6206
BROOKS APPLIED LABS
SUITE 100
18804 NORTH CREEK PARKWAY
BOTHELL WA 98011

WA 982 9-36

UPS NEXT DAY AIR

1

TRACKING #: 1Z A86 19W 01 6629 2256

BILLING: P/P

W6 21.0.23 Zebra ZP 450 20.0A 10/2018

SEE NOTICE ON REVERSE regarding UPS Terms, and notice of limitation of liability. Where allowed by law, shipper authorizes UPS to act as forwarding agent for export control and customs purposes. If exported from the US, shipper certifies that the commodities, technology or software were exported from the US in accordance with the Export Administration Regulations. Diversion contrary to law is prohibited.

Sample Receipt Checklist

Container Type:

- ☐ Cooler
- ☐ Cardboard box
- ☒ Styrofoam cooler
- ☐ Other (Specify):

- ☒ Custody Seal Present?
- ☒ Custody Seal Intact?

if not why:

- ☒ Chain of Custody Present?

Coolant Type: IR#: 19

- ☐ None
- ☒ Blue Ice: 5.5 °C
- ☐ Ice: °C
- ☐ Dry Ice: °C
- ☒ Temp Blank: 2.1 °C

Corrected Temp: °C

Bottle Type:

- ☐ Client Provided
- ☒ Other: 250mL FLPE MeHg
  - Size / Type:
  - Lot: 19-0191
  - Preservation: pH1 2mL 6N HCl
  - Preservative Lot: 1941001
- ☒ Other: As Spec (HPLC)
  - Size / Type: 125mL HDPE
  - Lot: 19-0120
  - Preservation: 10mL EDTA (PP)
  - Preservative Lot: 194402
- ☒ Other: TRIP BLANK
  - Size / Type: 250mL FLPE
  - Lot: 19-0129
  - Preservation: 1mL HCl (PP)
  - Preservative Lot: 1914139

Initial/date:

ADN 11/26/19

SGS North America Inc.
CHAIN OF CUSTODY RECORD

Locations Nationwide

Alaska	Florida
New Jersey	Colorado
Texas	North Carolina
Virginia	Louisiana

www.us.sgs.com

CLIENT:	SGS North America Inc. - Alaska Division	SGS Reference:	**Brooks Applied**
CONTACT:	Julie Shumway	PHONE NO:	(907) 562-2343
PROJECT NAME:	1199948	PWSID#:	
		NPDL#:	
REPORTS TO:	Julie Shumway	E-MAIL:	Julie.Shumway@sgs.com; Env.Alaska.RefLabTeam@sgs.com
INVOICE TO:	SGS - Alaska	QUOTE #:	
		P.O. #:	1199948

Additional Comments: All soils report out in dry weight unless

Page 1 of 1

RESERVED for lab use	SAMPLE IDENTIFICATION	DATE mm/dd/yy	TIME HHMM	MATRIX/ MATRIX CODE	# CONTAINERS	Preservative Used:	Arsenic Speciation				MS	MSD	SGS lab #	Location ID
						NONE								
						TYPE C = COMP G = GRAB MI = Multi Incremental Soils								
	191050	11/15/2019	09:05:00	Water	1		X						1199948001	
	191320	11/14/2019	17:45:00	Water	1		X						1199948002	
	200150	11/15/2019	11:50:00	Water	1		X						1199948003	
	191710	11/15/2019	16:51:00	Water	1		X						1199948004	

Relinquished By: (1)	Date	Time	Received By:	DOD Project?	NO
	11/25/19	0951		Report to DL (J Flags)? If J- Report as DL/LOD/LOQ.	YES
Relinquished By: (2)	Date	Time	Received By:	Cooler ID:	
	11/26/19	1007			
Relinquished By: (3)	Date	Time	Received By:		
Relinquished By: (4)	Date	Time	Received For Laboratory By:		

Data Deliverable Requirements: QC2 + SGS EDD in XML

Requested Turnaround Time and-or Special Instructions:

Arsenate + Arsenite Requested

Temp Blank °C: _____ or Ambient [ ]

Chain of Custody Seal: (Circle) INTACT BROKEN ABSENT

Laboratory Data Review Checklist

Completed By:

Brittany Blood

Title:

Environmental Professional I

Date:

12/17/2019

Consultant Firm:

Shannon and Wilson, Inc.

Laboratory Name:

SGS North America, Inc.

Laboratory Report Number:

1199948

Laboratory Report Date:

12/12/2019

CS Site Name:

ADOT&PF Dillingham Airport Sitewide PFAS

ADEC File Number:

2540.38.023

Hazard Identification Number:

26971

1199948

Laboratory Report Date:

12/12/2019

CS Site Name:

ADOT&PF Dillingham Airport Sitewide PFAS

Note: Any N/A or No box checked must have an explanation in the comments box.

1. Laboratory

   a. Did an ADEC CS approved laboratory receive and perform all of the submitted sample analyses?

   Yes☒ No☐ N/A☐ Comments:

TOC, Metals 200.8 + hardness, nitrogen, TSS, DRO, RRO, GRO, BTEX8021, Sulfide, Cl, F, pH, TDS, conductivity, and sulfide analyses were all performed by the SGS laboratory in Anchorage, AK. The laboratory is certified by the ADEC CSP for these requested analyses.

Speciated arsenic analysis was subcontracted to Brooks Applied Labs of Bothell Washington.

   b. If the samples were transferred to another "network" laboratory or sub-contracted to an alternate laboratory, was the laboratory performing the analyses ADEC CS approved?

   Yes☐ No☒ N/A☐ Comments:

Samples were transferred to Brooks Applied Labs for the analysis of speciated arsenic. Brooks Applied Labs is not an ADEC CSP approved lab for the requested analysis.

2. Chain of Custody (CoC)

   a. CoC information completed, signed, and dated (including released/received by)?

   Yes☒ No☐ N/A☐ Comments:

   b. Correct analyses requested?

   Yes☒ No☐ N/A☐ Comments:

3. Laboratory Sample Receipt Documentation

   a. Sample/cooler temperature documented and within range at receipt (0° to 6° C)?

   Yes☒ No☐ N/A☐ Comments:

1199948

Laboratory Report Date:

12/12/2019

CS Site Name:

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b. Sample preservation acceptable – acidified waters, Methanol preserved VOC soil (GRO, BTEX, Volatile Chlorinated Solvents, etc.)?

Yes☒ No☐ N/A☐ Comments:

c. Sample condition documented – broken, leaking (Methanol), zero headspace (VOC vials)?

Yes☒ No☐ N/A☐ Comments:

d. If there were any discrepancies, were they documented? For example, incorrect sample containers/preservation, sample temperature outside of acceptable range, insufficient or missing samples, etc.?

Yes☐ No☐ N/A☒ Comments:

Not Applicable, no discrepancies were noted upon sample login.

e. Data quality or usability affected?

Comments:

Data quality and/or usability was not affected; see above.

4. Case Narrative

a. Present and understandable?

Yes☒ No☐ N/A☐ Comments:

b. Discrepancies, errors, or QC failures identified by the lab?

Yes☐ No☐ N/A☐ Comments:

The case narrative notes that arsenic speciation was analyzed by Brooks Applied Labs of Bothell, WA.

The case narrative notes that AK102 DRO was detected in the method blank at greater than one half the LOQ, but less than the LOQ.

Conductivity of the method blank was detected above the LOQ, however associated samples are greater than 10X the MB conductivity.

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c. Were all corrective actions documented?

Yes☐ No☐ N/A☒ Comments:

Corrective action not required.

d. What is the effect on data quality/usability according to the case narrative?

Comments:

Case narrative does not specify an effect on data quality, it only discusses discrepancies. Any notable data quality issues mentioned in the case narrative are discussed above in 4b or elsewhere within this ADEC checklist.

5. Samples Results

a. Correct analyses performed/reported as requested on COC?

Yes☒ No☐ N/A☐ Comments:

b. All applicable holding times met?

Yes☒ No☐ N/A☐ Comments:

c. All soils reported on a dry weight basis?

Yes☐ No☐ N/A☒ Comments:

All samples submitted within this work order were water samples.

d. Are the reported LOQs less than the Cleanup Level or the minimum required detection level for the project?

Yes☒ No☐ N/A☐ Comments:

e. Data quality or usability affected?

Data quality and/or usability were not affected.

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6. QC Samples

a. Method Blank

i. One method blank reported per matrix, analysis and 20 samples?

Yes☒ No☐ N/A☐ Comments:

ii. All method blank results less than limit of quantitation (LOQ) or project specified objectives?

Yes☐ No☒ N/A☐ Comments:

No method blank results were above the LOQ, however, DRO, RRO, conductivity, total nitrate/nitrite-N, and arsenic (V) were detected in method blank samples below the LOQ.

Arsenic (V) and conductivity concentrations in associated samples were greater than ten times the detection in the method blank. No data qualification required.

DRO, RRO, and total nitrate/nitrite-N were detected within five times the concentrations detected in the method blank samples in the following associated project samples:
DRO - *191050, 191320, 200150, and 191710*
RRO – *191050 and 191320*
Total nitrate/nitrite – N – *191050, 191320, 191710*.

These analytes in the noted samples have been flagged B* and are considered non-detect as a result of potential laboratory cross contamination.

iii. If above LOQ or project specified objectives, what samples are affected?

Comments:

See above.

iv. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?

Yes☒ No☐ N/A☐ Comments:

See above.

v. Data quality or usability affected?

Comments:

Data quality and/or usability were not affected; see above.

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b. Laboratory Control Sample/Duplicate (LCS/LCSD)

i. Organics – One LCS/LCSD reported per matrix, analysis and 20 samples? (LCS/LCSD required per AK methods, LCS required per SW846)

Yes☒ No☐ N/A☐ Comments:

An LCS/LCSD was submitted for methods AK101, AK102, AK103, SW8021B, and EPA 1664B.

ii. Metals/Inorganics – one LCS and one sample duplicate reported per matrix, analysis and 20 samples?

Yes☒ No☐ N/A☐ Comments:

An LCS sample was submitted for methods SM23 4500S D, SM21 4500- H B, SM21 2510B, SM21 4500NO3-F, SM 5310B, EPA 300.0, EPA 200.8, and speciated arsenic.

An LCS/ LCSD was submitted for methods SM21 2540C, SM21 2540D, and SM21 4500-N D.

iii. Accuracy – All percent recoveries (%R) reported and within method or laboratory limits and project specified objectives, if applicable? (AK Petroleum methods: AK101 60%-120%, AK102 75%-125%, AK103 60%-120%; all other analyses see the laboratory QC pages)

Yes☒ No☐ N/A☐ Comments:

iv. Precision – All relative percent differences (RPD) reported and less than method or laboratory limits and project specified objectives, if applicable? RPD reported from LCS/LCSD, and or sample/sample duplicate. (AK Petroleum methods 20%; all other analyses see the laboratory QC pages)

Yes☒ No☐ N/A☐ Comments:

All relative percent differences were reported and less than method or laboratory limits for samples reported with both and LCS and LCSD.

v. If %R or RPD is outside of acceptable limits, what samples are affected?

Comments:

Not applicable, see above.

vi. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?

Yes☐ No☐ N/A☒ Comments:

No samples required data qualification.

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vii. Data quality or usability affected? (Use comment box to explain.)

Comments:

Data quality and/or usability were not affected; see above.

c. Matrix Spike/Matrix Spike Duplicate (MS/MSD)

Note: Leave blank if not required for project

i. Organics – One MS/MSD reported per matrix, analysis and 20 samples?

Yes☒ No☐ N/A☐ Comments:

An MS/MSD was submitted for analytical methods SM 5310B, and an MS was submitted for EPA 1664B.

ii. Metals/Inorganics – one MS and one MSD reported per matrix, analysis and 20 samples?

Yes☒ No☐ N/A☐ Comments:

An MS/MSD was submitted for analytical methods SM21 4500NO3-F, SM21 4500-N D, SM23 4500-S D, and speciated arsenic. An MS was submitted for EPA 200.8 and EPA 300.0.

iii. Accuracy – All percent recoveries (%R) reported and within method or laboratory limits and project specified objectives, if applicable? (AK Petroleum methods: AK101 60%-120%, AK102 75%-125%, AK103 60%-120%; all other analyses see the laboratory QC pages)

Yes☐ No☒ N/A☐ Comments:

The MS and/or MSD recoveries for total nitrate/nitrite, chloride, and sodium were outside of QC criteria. However, the MS/MSD samples used were not project sample. No qualification of data is required.

iv. Precision – All relative percent differences (RPD) reported and less than method or laboratory limits and project specified objectives, if applicable? RPD reported from MS/MSD, and or sample/sample duplicate. (AK Petroleum methods 20%; all other analyses see the laboratory QC pages)

Yes☒ No☐ N/A☐ Comments:

v. If %R or RPD is outside of acceptable limits, what samples are affected?

Comments:

Not applicable, see above.

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vi. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?

Yes☐ No☐ N/A☒ Comments:

See above.

vii. Data quality or usability affected? (Use comment box to explain.)

Comments:

Data quality and/or usability were not affected; see above.

d. Surrogates – Organics Only or Isotope Dilution Analytes (IDA) – Isotope Dilution Methods Only

i. Are surrogate/IDA recoveries reported for organic analyses – field, QC and laboratory samples?

Yes☒ No☐ N/A☐ Comments:

ii. Accuracy – All percent recoveries (%R) reported and within method or laboratory limits and project specified objectives, if applicable? (AK Petroleum methods 50-150 %R; all other analyses see the laboratory report pages)

Yes☒ No☐ N/A☐ Comments:

iii. Do the sample results with failed surrogate/IDA recoveries have data flags? If so, are the data flags clearly defined?

Yes☐ No☐ N/A☒ Comments:

See above.

iv. Data quality or usability affected?

Comments:

Data quality and/or usability were not affected; see above.

e. Trip Blanks

i. One trip blank reported per matrix, analysis and for each cooler containing volatile samples? (If not, enter explanation below.)

Yes☒ No☐ N/A☐ Comments:

A trip blank was submitted for analytical methods AK101 and SW8021B.

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ii. Is the cooler used to transport the trip blank and VOA samples clearly indicated on the COC? (If not, a comment explaining why must be entered below)

Yes☒ No☐ N/A☐ Comments:

iii. All results less than LOQ and project specified objectives?

Yes☒ No☐ N/A☐ Comments:

iv. If above LOQ or project specified objectives, what samples are affected?

Comments:

Not applicable, no analytes were detected in the trip blank sample.

v. Data quality or usability affected?

Comments:

Data quality and/or usability were not affected; see above.

f. Field Duplicate

i. One field duplicate submitted per matrix, analysis and 10 project samples?

Yes☐ No☐ N/A☒ Comments:

A field duplicate was not submitted as a part of this work order; however, the appropriate number of duplicates were submitted for the overall project.

ii. Submitted blind to lab?

Yes☐ No☐ N/A☒ Comments:

See above.

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iii. Precision – All relative percent differences (RPD) less than specified project objectives? (Recommended: 30% water, 50% soil)

RPD (%) = Absolute value of: $\frac{(R_1-R_2)}{((R_1+R_2)/2)} \times 100$

Where R_1 = Sample Concentration
R_2 = Field Duplicate Concentration

Yes☐ No☐ N/A☒ Comments:

See above.

iv. Data quality or usability affected? (Use the comment box to explain why or why not.)

Comments:

g. Decontamination or Equipment Blank (If not applicable, a comment stating why must be entered below)?

Yes☐ No☐ N/A☒ Comments:

Reusable equipment was not used for sampling; therefore an equipment blank was not required.

i. All results less than LOQ and project specified objectives?

Yes☐ No☐ N/A☒ Comments:

See above.

ii. If above LOQ or project specified objectives, what samples are affected?

Comments:

Not applicable, see above.

iii. Data quality or usability affected?

Comments:

Data quality and/or usability were not affected; see above.

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7. Other Data Flags/Qualifiers (ACOE, AFCEE, Lab Specific, etc.)

   a. Defined and appropriate?

      Yes☐ No☐ N/A☒ Comments:

APPENDIX B: BARR REPORT AND SUPPORTING INFORMATION

TESTAMERICA LAB REPORT 320-56436 AND LDRC

eurofins | Environment Testing TestAmerica

ANALYTICAL REPORT

Eurofins TestAmerica, Sacramento
880 Riverside Parkway
West Sacramento, CA 95605
Tel: (916)373-5600

Laboratory Job ID: 320-56436-1
Client Project/Site: DLG Alt. Water

For:
Shannon & Wilson, Inc
2355 Hill Rd.
Fairbanks, Alaska 99709-5244

Attn: Marcy Nadel

Authorized for release by:
12/9/2019 2:15:32 PM

David Alltucker, Project Manager I
(916)374-4383
david.alltucker@testamericainc.com

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Definitions/Glossary

Client: Shannon & Wilson, Inc
Project/Site: DLG Alt. Water

Job ID: 320-56436-1

Qualifiers

LCMS

Qualifier	Qualifier Description
*	Isotope Dilution analyte is outside acceptance limits.
B	Compound was found in the blank and sample.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Job ID: 320-56436-1

Laboratory: Eurofins TestAmerica, Sacramento

Narrative

Job Narrative
320-56436-1

Receipt
The samples were received on 11/20/2019 10:10 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 0.5º C.

LCMS
Method 537 (modified): Due to a shortage in the marketplace for 13C3-PFBS, the target analyte PFBS and/or Perfluoropentanesulfonic acid (PFPeS) could not be quantitated against 13C3-PFBS (its labeled variant) as listed in the SOP. PFBS and Perfluoropentanesulfonic acid (PFPeS) was quantitated versus 18O2-PFHxS instead.

Method 537 (modified): Several Isotope Dilution Analyte (IDA) recoveries are above the method recommended limit for the following samples: 200150 (320-56436-1) and 191320 (320-56436-3). Quantitation by isotope dilution generally precludes any adverse effect on data quality due to elevated IDA recoveries.

Method 537 (modified): Isotope Dilution Analyte (IDA) recovery is above the method recommended limit for M2-4:2 FTS in following sample: 191050 (320-56436-4). Quantitation by isotope dilution generally precludes any adverse effect on data quality due to elevated IDA recoveries.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Organic Prep
Method 3535: Insufficient sample volume was available to perform a matrix spike/matrix spike duplicate (MS/MSD) associated with preparation batch 320-341272.

Method 3535: The following samples were preserved with Trizma: 200150 (320-56436-1), 191710 (320-56436-2), 191320 (320-56436-3) and 191050 (320-56436-4). Thus, the MB, LCS and LCSD also contain Trizma.

Method 3535: the following samples contain a thin layer of orange sediment at the bottom of the bottle prior to extraction: 191710 (320-56436-2) and 191320 (320-56436-3)

Method 3535: During the solid phase extraction process, the following samples have non-settable particulates which clogged the extraction columns: 191710 (320-56436-2) and 191320 (320-56436-3).

Method 3535: The following sample is yellow after extraction: 191320 (320-56436-3).

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Detection Summary

Client: Shannon & Wilson, Inc
Project/Site: DLG Alt. Water

Job ID: 320-56436-1

Client Sample ID: 200150 — Lab Sample ID: 320-56436-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Perfluorobutanoic acid (PFBA)	1.5	J	1.8	0.32	ng/L	1		537 (modified)	Total/NA
Perfluoropentanoic acid (PFPeA)	4.0		1.8	0.45	ng/L	1		537 (modified)	Total/NA
Perfluorohexanoic acid (PFHxA)	16		1.8	0.54	ng/L	1		537 (modified)	Total/NA
Perfluoroheptanoic acid (PFHpA)	2.4		1.8	0.23	ng/L	1		537 (modified)	Total/NA
Perfluorooctanoic acid (PFOA)	5.5		1.8	0.79	ng/L	1		537 (modified)	Total/NA
Perfluorobutanesulfonic acid (PFBS)	6.9		1.8	0.18	ng/L	1		537 (modified)	Total/NA
Perfluoropentanesulfonic acid (PFPeS)	14		1.8	0.28	ng/L	1		537 (modified)	Total/NA
Perfluorohexanesulfonic acid (PFHxS)	56	B	1.8	0.16	ng/L	1		537 (modified)	Total/NA
Perfluoroheptanesulfonic Acid (PFHpS)	1.2	J	1.8	0.18	ng/L	1		537 (modified)	Total/NA
Perfluorooctanesulfonic acid (PFOS)	58		1.8	0.50	ng/L	1		537 (modified)	Total/NA
Perfluorooctanesulfonamide (FOSA)	1.1	J	1.8	0.32	ng/L	1		537 (modified)	Total/NA

Client Sample ID: 191710 — Lab Sample ID: 320-56436-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Perfluorobutanoic acid (PFBA)	21		1.8	0.32	ng/L	1		537 (modified)	Total/NA
Perfluoropentanoic acid (PFPeA)	71		1.8	0.45	ng/L	1		537 (modified)	Total/NA
Perfluorohexanoic acid (PFHxA)	110		1.8	0.54	ng/L	1		537 (modified)	Total/NA
Perfluoroheptanoic acid (PFHpA)	23		1.8	0.23	ng/L	1		537 (modified)	Total/NA
Perfluorooctanoic acid (PFOA)	22		1.8	0.78	ng/L	1		537 (modified)	Total/NA
Perfluorobutanesulfonic acid (PFBS)	34		1.8	0.18	ng/L	1		537 (modified)	Total/NA
Perfluoropentanesulfonic acid (PFPeS)	34		1.8	0.28	ng/L	1		537 (modified)	Total/NA
Perfluorohexanesulfonic acid (PFHxS)	110	B	1.8	0.16	ng/L	1		537 (modified)	Total/NA
Perfluoroheptanesulfonic Acid (PFHpS)	2.9		1.8	0.18	ng/L	1		537 (modified)	Total/NA
Perfluorooctanesulfonic acid (PFOS)	58		1.8	0.50	ng/L	1		537 (modified)	Total/NA
Perfluorooctanesulfonamide (FOSA)	0.78	J	1.8	0.32	ng/L	1		537 (modified)	Total/NA
6:2 FTS	40		18	1.8	ng/L	1		537 (modified)	Total/NA

Client Sample ID: 191320 — Lab Sample ID: 320-56436-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Perfluorobutanoic acid (PFBA)	23		1.9	0.33	ng/L	1		537 (modified)	Total/NA
Perfluoropentanoic acid (PFPeA)	70		1.9	0.46	ng/L	1		537 (modified)	Total/NA
Perfluorohexanoic acid (PFHxA)	59		1.9	0.54	ng/L	1		537 (modified)	Total/NA
Perfluoroheptanoic acid (PFHpA)	9.3		1.9	0.23	ng/L	1		537 (modified)	Total/NA
Perfluorooctanoic acid (PFOA)	1.7	J	1.9	0.80	ng/L	1		537 (modified)	Total/NA
Perfluorobutanesulfonic acid (PFBS)	12		1.9	0.19	ng/L	1		537 (modified)	Total/NA
Perfluoropentanesulfonic acid (PFPeS)	4.3		1.9	0.28	ng/L	1		537 (modified)	Total/NA
Perfluorohexanesulfonic acid (PFHxS)	6.5	B	1.9	0.16	ng/L	1		537 (modified)	Total/NA
Perfluorooctanesulfonamide (FOSA)	0.87	J	1.9	0.33	ng/L	1		537 (modified)	Total/NA

Client Sample ID: 191050 — Lab Sample ID: 320-56436-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Perfluorobutanoic acid (PFBA)	8.4		1.9	0.33	ng/L	1		537 (modified)	Total/NA
Perfluoropentanoic acid (PFPeA)	11		1.9	0.46	ng/L	1		537 (modified)	Total/NA
Perfluorohexanoic acid (PFHxA)	37		1.9	0.55	ng/L	1		537 (modified)	Total/NA
Perfluoroheptanoic acid (PFHpA)	2.8		1.9	0.24	ng/L	1		537 (modified)	Total/NA
Perfluorooctanoic acid (PFOA)	4.3		1.9	0.80	ng/L	1		537 (modified)	Total/NA

This Detection Summary does not include radiochemical test results.

Eurofins TestAmerica, Sacramento

Client Sample ID: 191050 (Continued)

Lab Sample ID: 320-56436-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Perfluorobutanesulfonic acid (PFBS)	50		1.9	0.19	ng/L	1		537 (modified)	Total/NA
Perfluoropentanesulfonic acid (PFPeS)	50		1.9	0.28	ng/L	1		537 (modified)	Total/NA
Perfluorohexanesulfonic acid (PFHxS)	140	B	1.9	0.16	ng/L	1		537 (modified)	Total/NA
Perfluoroheptanesulfonic Acid (PFHpS)	3.3		1.9	0.18	ng/L	1		537 (modified)	Total/NA
Perfluorooctanesulfonic acid (PFOS)	40		1.9	0.51	ng/L	1		537 (modified)	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample ID: 200150
Date Collected: 11/15/19 11:50
Date Received: 11/20/19 10:10

Lab Sample ID: 320-56436-1
Matrix: Water

Method: 537 (modified) - Fluorinated Alkyl Substances

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorobutanoic acid (PFBA)	**1.5**	**J**	1.8	0.32	ng/L		11/25/19 06:35	12/02/19 23:58	1
Perfluoropentanoic acid (PFPeA)	**4.0**		1.8	0.45	ng/L		11/25/19 06:35	12/02/19 23:58	1
Perfluorohexanoic acid (PFHxA)	**16**		1.8	0.54	ng/L		11/25/19 06:35	12/02/19 23:58	1
Perfluoroheptanoic acid (PFHpA)	**2.4**		1.8	0.23	ng/L		11/25/19 06:35	12/02/19 23:58	1
Perfluorooctanoic acid (PFOA)	**5.5**		1.8	0.79	ng/L		11/25/19 06:35	12/02/19 23:58	1
Perfluorononanoic acid (PFNA)	ND		1.8	0.25	ng/L		11/25/19 06:35	12/02/19 23:58	1
Perfluorodecanoic acid (PFDA)	ND		1.8	0.29	ng/L		11/25/19 06:35	12/02/19 23:58	1
Perfluoroundecanoic acid (PFUnA)	ND		1.8	1.0	ng/L		11/25/19 06:35	12/02/19 23:58	1
Perfluorododecanoic acid (PFDoA)	ND		1.8	0.51	ng/L		11/25/19 06:35	12/02/19 23:58	1
Perfluorotridecanoic acid (PFTriA)	ND		1.8	1.2	ng/L		11/25/19 06:35	12/02/19 23:58	1
Perfluorotetradecanoic acid (PFTeA)	ND		1.8	0.27	ng/L		11/25/19 06:35	12/02/19 23:58	1
Perfluoro-n-hexadecanoic acid (PFHxDA)	ND		1.8	0.82	ng/L		11/25/19 06:35	12/02/19 23:58	1
Perfluorobutanesulfonic acid (PFBS)	**6.9**		1.8	0.18	ng/L		11/25/19 06:35	12/02/19 23:58	1
Perfluoropentanesulfonic acid (PFPeS)	**14**		1.8	0.28	ng/L		11/25/19 06:35	12/02/19 23:58	1
Perfluorohexanesulfonic acid (PFHxS)	**56**	**B**	1.8	0.16	ng/L		11/25/19 06:35	12/02/19 23:58	1
Perfluoroheptanesulfonic Acid (PFHpS)	**1.2**	**J**	1.8	0.18	ng/L		11/25/19 06:35	12/02/19 23:58	1
Perfluorooctanesulfonic acid (PFOS)	**58**		1.8	0.50	ng/L		11/25/19 06:35	12/02/19 23:58	1
Perfluorononanesulfonic acid (PFNS)	ND		1.8	0.15	ng/L		11/25/19 06:35	12/02/19 23:58	1
Perfluorodecanesulfonic acid (PFDS)	ND		1.8	0.30	ng/L		11/25/19 06:35	12/02/19 23:58	1
Perfluorooctanesulfonamide (FOSA)	**1.1**	**J**	1.8	0.32	ng/L		11/25/19 06:35	12/02/19 23:58	1
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	ND		18	1.8	ng/L		11/25/19 06:35	12/02/19 23:58	1
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	ND		18	2.9	ng/L		11/25/19 06:35	12/02/19 23:58	1
4:2 FTS	ND		18	4.8	ng/L		11/25/19 06:35	12/02/19 23:58	1
6:2 FTS	ND		18	1.8	ng/L		11/25/19 06:35	12/02/19 23:58	1
8:2 FTS	ND		18	1.8	ng/L		11/25/19 06:35	12/02/19 23:58	1
10:2 FTS	ND		1.8	0.18	ng/L		11/25/19 06:35	12/02/19 23:58	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	ND		1.8	0.17	ng/L		11/25/19 06:35	12/02/19 23:58	1
HFPO-DA (GenX)	ND		3.7	1.4	ng/L		11/25/19 06:35	12/02/19 23:58	1
ADONA	ND		1.9	0.18	ng/L		11/25/19 06:35	12/02/19 23:58	1
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	ND		1.8	0.22	ng/L		11/25/19 06:35	12/02/19 23:58	1
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	ND		1.8	0.30	ng/L		11/25/19 06:35	12/02/19 23:58	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C4 PFBA	*74*		*25 - 150*	*11/25/19 06:35*	*12/02/19 23:58*	*1*
13C5 PFPeA	*95*		*25 - 150*	*11/25/19 06:35*	*12/02/19 23:58*	*1*
13C2 PFHxA	*91*		*25 - 150*	*11/25/19 06:35*	*12/02/19 23:58*	*1*
13C4 PFHpA	*97*		*25 - 150*	*11/25/19 06:35*	*12/02/19 23:58*	*1*
13C4 PFOA	*104*		*25 - 150*	*11/25/19 06:35*	*12/02/19 23:58*	*1*
13C5 PFNA	*103*		*25 - 150*	*11/25/19 06:35*	*12/02/19 23:58*	*1*
13C2 PFDA	*101*		*25 - 150*	*11/25/19 06:35*	*12/02/19 23:58*	*1*
13C2 PFUnA	*96*		*25 - 150*	*11/25/19 06:35*	*12/02/19 23:58*	*1*

Client: Shannon & Wilson, Inc
Project/Site: DLG Alt. Water

Job ID: 320-56436-1

Client Sample ID: 200150
Date Collected: 11/15/19 11:50
Date Received: 11/20/19 10:10

Lab Sample ID: 320-56436-1
Matrix: Water

Method: 537 (modified) - Fluorinated Alkyl Substances (Continued)

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C2 PFDoA	98		25 - 150	11/25/19 06:35	12/02/19 23:58	1
13C2 PFTeDA	89		25 - 150	11/25/19 06:35	12/02/19 23:58	1
18O2 PFHxS	113		25 - 150	11/25/19 06:35	12/02/19 23:58	1
13C4 PFOS	103		25 - 150	11/25/19 06:35	12/02/19 23:58	1
13C8 FOSA	90		25 - 150	11/25/19 06:35	12/02/19 23:58	1
M2-6:2 FTS	170	*	25 - 150	11/25/19 06:35	12/02/19 23:58	1
M2-8:2 FTS	153	*	25 - 150	11/25/19 06:35	12/02/19 23:58	1
d5-NEtFOSAA	123		25 - 150	11/25/19 06:35	12/02/19 23:58	1
d3-NMeFOSAA	116		25 - 150	11/25/19 06:35	12/02/19 23:58	1
M2-4:2 FTS	170	*	25 - 150	11/25/19 06:35	12/02/19 23:58	1
13C2 PFHxDA	56		25 - 150	11/25/19 06:35	12/02/19 23:58	1
13C3 HFPO-DA	74		25 - 150	11/25/19 06:35	12/02/19 23:58	1

Client Sample ID: 191710
Date Collected: 11/15/19 16:51
Date Received: 11/20/19 10:10

Lab Sample ID: 320-56436-2
Matrix: Water

Method: 537 (modified) - Fluorinated Alkyl Substances

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorobutanoic acid (PFBA)	**21**		1.8	0.32	ng/L		11/25/19 06:35	12/03/19 00:14	1
Perfluoropentanoic acid (PFPeA)	**71**		1.8	0.45	ng/L		11/25/19 06:35	12/03/19 00:14	1
Perfluorohexanoic acid (PFHxA)	**110**		1.8	0.54	ng/L		11/25/19 06:35	12/03/19 00:14	1
Perfluoroheptanoic acid (PFHpA)	**23**		1.8	0.23	ng/L		11/25/19 06:35	12/03/19 00:14	1
Perfluorooctanoic acid (PFOA)	**22**		1.8	0.78	ng/L		11/25/19 06:35	12/03/19 00:14	1
Perfluorononanoic acid (PFNA)	ND		1.8	0.25	ng/L		11/25/19 06:35	12/03/19 00:14	1
Perfluorodecanoic acid (PFDA)	ND		1.8	0.29	ng/L		11/25/19 06:35	12/03/19 00:14	1
Perfluoroundecanoic acid (PFUnA)	ND		1.8	1.0	ng/L		11/25/19 06:35	12/03/19 00:14	1
Perfluorododecanoic acid (PFDoA)	ND		1.8	0.51	ng/L		11/25/19 06:35	12/03/19 00:14	1
Perfluorotridecanoic acid (PFTriA)	ND		1.8	1.2	ng/L		11/25/19 06:35	12/03/19 00:14	1
Perfluorotetradecanoic acid (PFTeA)	ND		1.8	0.27	ng/L		11/25/19 06:35	12/03/19 00:14	1
Perfluoro-n-hexadecanoic acid (PFHxDA)	ND		1.8	0.82	ng/L		11/25/19 06:35	12/03/19 00:14	1
Perfluorobutanesulfonic acid (PFBS)	**34**		1.8	0.18	ng/L		11/25/19 06:35	12/03/19 00:14	1
Perfluoropentanesulfonic acid (PFPeS)	**34**		1.8	0.28	ng/L		11/25/19 06:35	12/03/19 00:14	1
Perfluorohexanesulfonic acid (PFHxS)	**110**	**B**	1.8	0.16	ng/L		11/25/19 06:35	12/03/19 00:14	1
Perfluoroheptanesulfonic Acid (PFHpS)	**2.9**		1.8	0.18	ng/L		11/25/19 06:35	12/03/19 00:14	1
Perfluorooctanesulfonic acid (PFOS)	**58**		1.8	0.50	ng/L		11/25/19 06:35	12/03/19 00:14	1
Perfluorononanesulfonic acid (PFNS)	ND		1.8	0.15	ng/L		11/25/19 06:35	12/03/19 00:14	1
Perfluorodecanesulfonic acid (PFDS)	ND		1.8	0.30	ng/L		11/25/19 06:35	12/03/19 00:14	1
Perfluorooctanesulfonamide (FOSA)	**0.78**	**J**	1.8	0.32	ng/L		11/25/19 06:35	12/03/19 00:14	1
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	ND		18	1.8	ng/L		11/25/19 06:35	12/03/19 00:14	1
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	ND		18	2.9	ng/L		11/25/19 06:35	12/03/19 00:14	1
4:2 FTS	ND		18	4.8	ng/L		11/25/19 06:35	12/03/19 00:14	1
6:2 FTS	**40**		18	1.8	ng/L		11/25/19 06:35	12/03/19 00:14	1
8:2 FTS	ND		18	1.8	ng/L		11/25/19 06:35	12/03/19 00:14	1
10:2 FTS	ND		1.8	0.18	ng/L		11/25/19 06:35	12/03/19 00:14	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	ND		1.8	0.17	ng/L		11/25/19 06:35	12/03/19 00:14	1
HFPO-DA (GenX)	ND		3.7	1.4	ng/L		11/25/19 06:35	12/03/19 00:14	1
ADONA	ND		1.9	0.18	ng/L		11/25/19 06:35	12/03/19 00:14	1
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	ND		1.8	0.22	ng/L		11/25/19 06:35	12/03/19 00:14	1
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	ND		1.8	0.30	ng/L		11/25/19 06:35	12/03/19 00:14	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C4 PFBA	*62*		*25 - 150*	*11/25/19 06:35*	*12/03/19 00:14*	*1*
13C5 PFPeA	*77*		*25 - 150*	*11/25/19 06:35*	*12/03/19 00:14*	*1*
13C2 PFHxA	*70*		*25 - 150*	*11/25/19 06:35*	*12/03/19 00:14*	*1*
13C4 PFHpA	*74*		*25 - 150*	*11/25/19 06:35*	*12/03/19 00:14*	*1*
13C4 PFOA	*79*		*25 - 150*	*11/25/19 06:35*	*12/03/19 00:14*	*1*
13C5 PFNA	*79*		*25 - 150*	*11/25/19 06:35*	*12/03/19 00:14*	*1*
13C2 PFDA	*76*		*25 - 150*	*11/25/19 06:35*	*12/03/19 00:14*	*1*
13C2 PFUnA	*71*		*25 - 150*	*11/25/19 06:35*	*12/03/19 00:14*	*1*

Client: Shannon & Wilson, Inc
Project/Site: DLG Alt. Water

Job ID: 320-56436-1

Client Sample ID: 191710
Date Collected: 11/15/19 16:51
Date Received: 11/20/19 10:10

Lab Sample ID: 320-56436-2
Matrix: Water

Method: 537 (modified) - Fluorinated Alkyl Substances (Continued)

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C2 PFDoA	70		25 - 150	11/25/19 06:35	12/03/19 00:14	1
13C2 PFTeDA	63		25 - 150	11/25/19 06:35	12/03/19 00:14	1
18O2 PFHxS	91		25 - 150	11/25/19 06:35	12/03/19 00:14	1
13C4 PFOS	81		25 - 150	11/25/19 06:35	12/03/19 00:14	1
13C8 FOSA	71		25 - 150	11/25/19 06:35	12/03/19 00:14	1
M2-6:2 FTS	120		25 - 150	11/25/19 06:35	12/03/19 00:14	1
M2-8:2 FTS	101		25 - 150	11/25/19 06:35	12/03/19 00:14	1
d5-NEtFOSAA	81		25 - 150	11/25/19 06:35	12/03/19 00:14	1
d3-NMeFOSAA	83		25 - 150	11/25/19 06:35	12/03/19 00:14	1
M2-4:2 FTS	127		25 - 150	11/25/19 06:35	12/03/19 00:14	1
13C2 PFHxDA	59		25 - 150	11/25/19 06:35	12/03/19 00:14	1
13C3 HFPO-DA	51		25 - 150	11/25/19 06:35	12/03/19 00:14	1

Client: Shannon & Wilson, Inc
Project/Site: DLG Alt. Water

Job ID: 320-56436-1

Client Sample ID: 191320
Date Collected: 11/14/19 17:45
Date Received: 11/20/19 10:10

Lab Sample ID: 320-56436-3
Matrix: Water

Method: 537 (modified) - Fluorinated Alkyl Substances

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorobutanoic acid (PFBA)	**23**		1.9	0.33	ng/L		11/25/19 06:35	12/03/19 00:22	1
Perfluoropentanoic acid (PFPeA)	**70**		1.9	0.46	ng/L		11/25/19 06:35	12/03/19 00:22	1
Perfluorohexanoic acid (PFHxA)	**59**		1.9	0.54	ng/L		11/25/19 06:35	12/03/19 00:22	1
Perfluoroheptanoic acid (PFHpA)	**9.3**		1.9	0.23	ng/L		11/25/19 06:35	12/03/19 00:22	1
Perfluorooctanoic acid (PFOA)	**1.7**	**J**	1.9	0.80	ng/L		11/25/19 06:35	12/03/19 00:22	1
Perfluorononanoic acid (PFNA)	ND		1.9	0.25	ng/L		11/25/19 06:35	12/03/19 00:22	1
Perfluorodecanoic acid (PFDA)	ND		1.9	0.29	ng/L		11/25/19 06:35	12/03/19 00:22	1
Perfluoroundecanoic acid (PFUnA)	ND		1.9	1.0	ng/L		11/25/19 06:35	12/03/19 00:22	1
Perfluorododecanoic acid (PFDoA)	ND		1.9	0.52	ng/L		11/25/19 06:35	12/03/19 00:22	1
Perfluorotridecanoic acid (PFTriA)	ND		1.9	1.2	ng/L		11/25/19 06:35	12/03/19 00:22	1
Perfluorotetradecanoic acid (PFTeA)	ND		1.9	0.27	ng/L		11/25/19 06:35	12/03/19 00:22	1
Perfluoro-n-hexadecanoic acid (PFHxDA)	ND		1.9	0.84	ng/L		11/25/19 06:35	12/03/19 00:22	1
Perfluorobutanesulfonic acid (PFBS)	**12**		1.9	0.19	ng/L		11/25/19 06:35	12/03/19 00:22	1
Perfluoropentanesulfonic acid (PFPeS)	**4.3**		1.9	0.28	ng/L		11/25/19 06:35	12/03/19 00:22	1
Perfluorohexanesulfonic acid (PFHxS)	**6.5**	**B**	1.9	0.16	ng/L		11/25/19 06:35	12/03/19 00:22	1
Perfluoroheptanesulfonic Acid (PFHpS)	ND		1.9	0.18	ng/L		11/25/19 06:35	12/03/19 00:22	1
Perfluorooctanesulfonic acid (PFOS)	ND		1.9	0.51	ng/L		11/25/19 06:35	12/03/19 00:22	1
Perfluorononanesulfonic acid (PFNS)	ND		1.9	0.15	ng/L		11/25/19 06:35	12/03/19 00:22	1
Perfluorodecanesulfonic acid (PFDS)	ND		1.9	0.30	ng/L		11/25/19 06:35	12/03/19 00:22	1
Perfluorooctanesulfonamide (FOSA)	**0.87**	**J**	1.9	0.33	ng/L		11/25/19 06:35	12/03/19 00:22	1
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	ND		19	1.8	ng/L		11/25/19 06:35	12/03/19 00:22	1
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	ND		19	2.9	ng/L		11/25/19 06:35	12/03/19 00:22	1
4:2 FTS	ND		19	4.9	ng/L		11/25/19 06:35	12/03/19 00:22	1
6:2 FTS	ND		19	1.9	ng/L		11/25/19 06:35	12/03/19 00:22	1
8:2 FTS	ND		19	1.9	ng/L		11/25/19 06:35	12/03/19 00:22	1
10:2 FTS	ND		1.9	0.18	ng/L		11/25/19 06:35	12/03/19 00:22	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	ND		1.9	0.17	ng/L		11/25/19 06:35	12/03/19 00:22	1
HFPO-DA (GenX)	ND		3.8	1.4	ng/L		11/25/19 06:35	12/03/19 00:22	1
ADONA	ND		2.0	0.18	ng/L		11/25/19 06:35	12/03/19 00:22	1
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	ND		1.9	0.23	ng/L		11/25/19 06:35	12/03/19 00:22	1
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	ND		1.9	0.30	ng/L		11/25/19 06:35	12/03/19 00:22	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C4 PFBA	*47*		*25 - 150*	*11/25/19 06:35*	*12/03/19 00:22*	*1*
13C5 PFPeA	*77*		*25 - 150*	*11/25/19 06:35*	*12/03/19 00:22*	*1*
13C2 PFHxA	*71*		*25 - 150*	*11/25/19 06:35*	*12/03/19 00:22*	*1*
13C4 PFHpA	*83*		*25 - 150*	*11/25/19 06:35*	*12/03/19 00:22*	*1*
13C4 PFOA	*93*		*25 - 150*	*11/25/19 06:35*	*12/03/19 00:22*	*1*
13C5 PFNA	*89*		*25 - 150*	*11/25/19 06:35*	*12/03/19 00:22*	*1*
13C2 PFDA	*96*		*25 - 150*	*11/25/19 06:35*	*12/03/19 00:22*	*1*
13C2 PFUnA	*86*		*25 - 150*	*11/25/19 06:35*	*12/03/19 00:22*	*1*
13C2 PFDoA	*93*		*25 - 150*	*11/25/19 06:35*	*12/03/19 00:22*	*1*

Client Sample ID: 191320
Date Collected: 11/14/19 17:45
Date Received: 11/20/19 10:10

Lab Sample ID: 320-56436-3
Matrix: Water

Method: 537 (modified) - Fluorinated Alkyl Substances (Continued)

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C2 PFTeDA	74		25 - 150	11/25/19 06:35	12/03/19 00:22	1
18O2 PFHxS	103		25 - 150	11/25/19 06:35	12/03/19 00:22	1
13C4 PFOS	96		25 - 150	11/25/19 06:35	12/03/19 00:22	1
13C8 FOSA	85		25 - 150	11/25/19 06:35	12/03/19 00:22	1
M2-6:2 FTS	228	*	25 - 150	11/25/19 06:35	12/03/19 00:22	1
M2-8:2 FTS	178	*	25 - 150	11/25/19 06:35	12/03/19 00:22	1
d5-NEtFOSAA	105		25 - 150	11/25/19 06:35	12/03/19 00:22	1
d3-NMeFOSAA	106		25 - 150	11/25/19 06:35	12/03/19 00:22	1
M2-4:2 FTS	198	*	25 - 150	11/25/19 06:35	12/03/19 00:22	1
13C2 PFHxDA	42		25 - 150	11/25/19 06:35	12/03/19 00:22	1
13C3 HFPO-DA	43		25 - 150	11/25/19 06:35	12/03/19 00:22	1

Client: Shannon & Wilson, Inc
Project/Site: DLG Alt. Water

Job ID: 320-56436-1

Client Sample ID: 191050
Date Collected: 11/15/19 09:05
Date Received: 11/20/19 10:10

Lab Sample ID: 320-56436-4
Matrix: Water

Method: 537 (modified) - Fluorinated Alkyl Substances

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorobutanoic acid (PFBA)	**8.4**		1.9	0.33	ng/L		11/25/19 06:35	12/03/19 00:30	1
Perfluoropentanoic acid (PFPeA)	**11**		1.9	0.46	ng/L		11/25/19 06:35	12/03/19 00:30	1
Perfluorohexanoic acid (PFHxA)	**37**		1.9	0.55	ng/L		11/25/19 06:35	12/03/19 00:30	1
Perfluoroheptanoic acid (PFHpA)	**2.8**		1.9	0.24	ng/L		11/25/19 06:35	12/03/19 00:30	1
Perfluorooctanoic acid (PFOA)	**4.3**		1.9	0.80	ng/L		11/25/19 06:35	12/03/19 00:30	1
Perfluorononanoic acid (PFNA)	ND		1.9	0.26	ng/L		11/25/19 06:35	12/03/19 00:30	1
Perfluorodecanoic acid (PFDA)	ND		1.9	0.29	ng/L		11/25/19 06:35	12/03/19 00:30	1
Perfluoroundecanoic acid (PFUnA)	ND		1.9	1.0	ng/L		11/25/19 06:35	12/03/19 00:30	1
Perfluorododecanoic acid (PFDoA)	ND		1.9	0.52	ng/L		11/25/19 06:35	12/03/19 00:30	1
Perfluorotridecanoic acid (PFTriA)	ND		1.9	1.2	ng/L		11/25/19 06:35	12/03/19 00:30	1
Perfluorotetradecanoic acid (PFTeA)	ND		1.9	0.27	ng/L		11/25/19 06:35	12/03/19 00:30	1
Perfluoro-n-hexadecanoic acid (PFHxDA)	ND		1.9	0.84	ng/L		11/25/19 06:35	12/03/19 00:30	1
Perfluorobutanesulfonic acid (PFBS)	**50**		1.9	0.19	ng/L		11/25/19 06:35	12/03/19 00:30	1
Perfluoropentanesulfonic acid (PFPeS)	**50**		1.9	0.28	ng/L		11/25/19 06:35	12/03/19 00:30	1
Perfluorohexanesulfonic acid (PFHxS)	**140**	**B**	1.9	0.16	ng/L		11/25/19 06:35	12/03/19 00:30	1
Perfluoroheptanesulfonic Acid (PFHpS)	**3.3**		1.9	0.18	ng/L		11/25/19 06:35	12/03/19 00:30	1
Perfluorooctanesulfonic acid (PFOS)	**40**		1.9	0.51	ng/L		11/25/19 06:35	12/03/19 00:30	1
Perfluorononanesulfonic acid (PFNS)	ND		1.9	0.15	ng/L		11/25/19 06:35	12/03/19 00:30	1
Perfluorodecanesulfonic acid (PFDS)	ND		1.9	0.30	ng/L		11/25/19 06:35	12/03/19 00:30	1
Perfluorooctanesulfonamide (FOSA)	ND		1.9	0.33	ng/L		11/25/19 06:35	12/03/19 00:30	1
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	ND		19	1.8	ng/L		11/25/19 06:35	12/03/19 00:30	1
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	ND		19	2.9	ng/L		11/25/19 06:35	12/03/19 00:30	1
4:2 FTS	ND		19	4.9	ng/L		11/25/19 06:35	12/03/19 00:30	1
6:2 FTS	ND		19	1.9	ng/L		11/25/19 06:35	12/03/19 00:30	1
8:2 FTS	ND		19	1.9	ng/L		11/25/19 06:35	12/03/19 00:30	1
10:2 FTS	ND		1.9	0.18	ng/L		11/25/19 06:35	12/03/19 00:30	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	ND		1.9	0.17	ng/L		11/25/19 06:35	12/03/19 00:30	1
HFPO-DA (GenX)	ND		3.8	1.4	ng/L		11/25/19 06:35	12/03/19 00:30	1
ADONA	ND		2.0	0.18	ng/L		11/25/19 06:35	12/03/19 00:30	1
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	ND		1.9	0.23	ng/L		11/25/19 06:35	12/03/19 00:30	1
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	ND		1.9	0.30	ng/L		11/25/19 06:35	12/03/19 00:30	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C4 PFBA	*84*		*25 - 150*	*11/25/19 06:35*	*12/03/19 00:30*	*1*
13C5 PFPeA	*97*		*25 - 150*	*11/25/19 06:35*	*12/03/19 00:30*	*1*
13C2 PFHxA	*91*		*25 - 150*	*11/25/19 06:35*	*12/03/19 00:30*	*1*
13C4 PFHpA	*96*		*25 - 150*	*11/25/19 06:35*	*12/03/19 00:30*	*1*
13C4 PFOA	*99*		*25 - 150*	*11/25/19 06:35*	*12/03/19 00:30*	*1*
13C5 PFNA	*93*		*25 - 150*	*11/25/19 06:35*	*12/03/19 00:30*	*1*
13C2 PFDA	*95*		*25 - 150*	*11/25/19 06:35*	*12/03/19 00:30*	*1*
13C2 PFUnA	*94*		*25 - 150*	*11/25/19 06:35*	*12/03/19 00:30*	*1*
13C2 PFDoA	*89*		*25 - 150*	*11/25/19 06:35*	*12/03/19 00:30*	*1*

Client Sample ID: 191050
Date Collected: 11/15/19 09:05
Date Received: 11/20/19 10:10

Lab Sample ID: 320-56436-4
Matrix: Water

Method: 537 (modified) - Fluorinated Alkyl Substances (Continued)

Isotope Dilution	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C2 PFTeDA	91		25 - 150	11/25/19 06:35	12/03/19 00:30	1
18O2 PFHxS	112		25 - 150	11/25/19 06:35	12/03/19 00:30	1
13C4 PFOS	99		25 - 150	11/25/19 06:35	12/03/19 00:30	1
13C8 FOSA	90		25 - 150	11/25/19 06:35	12/03/19 00:30	1
M2-6:2 FTS	147		25 - 150	11/25/19 06:35	12/03/19 00:30	1
M2-8:2 FTS	126		25 - 150	11/25/19 06:35	12/03/19 00:30	1
d5-NEtFOSAA	112		25 - 150	11/25/19 06:35	12/03/19 00:30	1
d3-NMeFOSAA	106		25 - 150	11/25/19 06:35	12/03/19 00:30	1
M2-4:2 FTS	151	*	25 - 150	11/25/19 06:35	12/03/19 00:30	1
13C2 PFHxDA	48		25 - 150	11/25/19 06:35	12/03/19 00:30	1
13C3 HFPO-DA	57		25 - 150	11/25/19 06:35	12/03/19 00:30	1

Isotope Dilution Summary

Client: Shannon & Wilson, Inc
Project/Site: DLG Alt. Water

Job ID: 320-56436-1

Method: 537 (modified) - Fluorinated Alkyl Substances

Matrix: Water **Prep Type: Total/NA**

		Percent Isotope Dilution Recovery (Acceptance Limits)							
Lab Sample ID	Client Sample ID	PFBA (25-150)	PFPeA (25-150)	PFHxA (25-150)	PFHpA (25-150)	PFOA (25-150)	PFNA (25-150)	PFDA (25-150)	PFUnA (25-150)
320-56436-1	200150	74	95	91	97	104	103	101	96
320-56436-2	191710	62	77	70	74	79	79	76	71
320-56436-3	191320	47	77	71	83	93	89	96	86
320-56436-4	191050	84	97	91	96	99	93	95	94
LCS 320-341272/2-A	Lab Control Sample	101	106	99	109	104	107	106	94
LCSD 320-341272/3-A	Lab Control Sample Dup	91	97	89	96	98	97	95	90
MB 320-341272/1-A	Method Blank	98	103	97	104	99	105	104	96

		Percent Isotope Dilution Recovery (Acceptance Limits)							
Lab Sample ID	Client Sample ID	PFDoA (25-150)	PFTDA (25-150)	PFHxS (25-150)	PFOS (25-150)	PFOSA (25-150)	M262FTS (25-150)	M282FTS (25-150)	-NEtFOSA (25-150)
320-56436-1	200150	98	89	113	103	90	170 *	153 *	123
320-56436-2	191710	70	63	91	81	71	120	101	81
320-56436-3	191320	93	74	103	96	85	228 *	178 *	105
320-56436-4	191050	89	91	112	99	90	147	126	112
LCS 320-341272/2-A	Lab Control Sample	99	99	119	108	97	139	145	123
LCSD 320-341272/3-A	Lab Control Sample Dup	91	88	107	99	84	134	136	111
MB 320-341272/1-A	Method Blank	98	91	115	104	94	144	132	122

		Percent Isotope Dilution Recovery (Acceptance Limits)			
Lab Sample ID	Client Sample ID	-NMeFOSA (25-150)	M242FTS (25-150)	PFHxDA (25-150)	HFPODA (25-150)
320-56436-1	200150	116	170 *	56	74
320-56436-2	191710	83	127	59	51
320-56436-3	191320	106	198 *	42	43
320-56436-4	191050	106	151 *	48	57
LCS 320-341272/2-A	Lab Control Sample	114	140	57	71
LCSD 320-341272/3-A	Lab Control Sample Dup	113	128	65	88
MB 320-341272/1-A	Method Blank	115	125	71	76

Surrogate Legend

PFBA = 13C4 PFBA
PFPeA = 13C5 PFPeA
PFHxA = 13C2 PFHxA
PFHpA = 13C4 PFHpA
PFOA = 13C4 PFOA
PFNA = 13C5 PFNA
PFDA = 13C2 PFDA
PFUnA = 13C2 PFUnA
PFDoA = 13C2 PFDoA
PFTDA = 13C2 PFTeDA
PFHxS = 18O2 PFHxS
PFOS = 13C4 PFOS
PFOSA = 13C8 FOSA
M262FTS = M2-6:2 FTS
M282FTS = M2-8:2 FTS
d5-NEtFOSAA = d5-NEtFOSAA
d3-NMeFOSAA = d3-NMeFOSAA
M242FTS = M2-4:2 FTS
PFHxDA = 13C2 PFHxDA
HFPODA = 13C3 HFPO-DA

Method: 537 (modified) - Fluorinated Alkyl Substances

Lab Sample ID: MB 320-341272/1-A
Matrix: Water
Analysis Batch: 342729

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 341272

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Perfluorobutanoic acid (PFBA)	ND		2.0	0.35	ng/L		11/25/19 06:35	12/02/19 22:45	1
Perfluoropentanoic acid (PFPeA)	ND		2.0	0.49	ng/L		11/25/19 06:35	12/02/19 22:45	1
Perfluorohexanoic acid (PFHxA)	ND		2.0	0.58	ng/L		11/25/19 06:35	12/02/19 22:45	1
Perfluoroheptanoic acid (PFHpA)	ND		2.0	0.25	ng/L		11/25/19 06:35	12/02/19 22:45	1
Perfluorooctanoic acid (PFOA)	ND		2.0	0.85	ng/L		11/25/19 06:35	12/02/19 22:45	1
Perfluorononanoic acid (PFNA)	ND		2.0	0.27	ng/L		11/25/19 06:35	12/02/19 22:45	1
Perfluorodecanoic acid (PFDA)	ND		2.0	0.31	ng/L		11/25/19 06:35	12/02/19 22:45	1
Perfluoroundecanoic acid (PFUnA)	ND		2.0	1.1	ng/L		11/25/19 06:35	12/02/19 22:45	1
Perfluorododecanoic acid (PFDoA)	ND		2.0	0.55	ng/L		11/25/19 06:35	12/02/19 22:45	1
Perfluorotridecanoic acid (PFTriA)	ND		2.0	1.3	ng/L		11/25/19 06:35	12/02/19 22:45	1
Perfluorotetradecanoic acid (PFTeA)	ND		2.0	0.29	ng/L		11/25/19 06:35	12/02/19 22:45	1
Perfluoro-n-hexadecanoic acid (PFHxDA)	ND		2.0	0.89	ng/L		11/25/19 06:35	12/02/19 22:45	1
Perfluorobutanesulfonic acid (PFBS)	ND		2.0	0.20	ng/L		11/25/19 06:35	12/02/19 22:45	1
Perfluoropentanesulfonic acid (PFPeS)	ND		2.0	0.30	ng/L		11/25/19 06:35	12/02/19 22:45	1
Perfluorohexanesulfonic acid (PFHxS)	0.313	J	2.0	0.17	ng/L		11/25/19 06:35	12/02/19 22:45	1
Perfluoroheptanesulfonic Acid (PFHpS)	ND		2.0	0.19	ng/L		11/25/19 06:35	12/02/19 22:45	1
Perfluorooctanesulfonic acid (PFOS)	ND		2.0	0.54	ng/L		11/25/19 06:35	12/02/19 22:45	1
Perfluorononanesulfonic acid (PFNS)	ND		2.0	0.16	ng/L		11/25/19 06:35	12/02/19 22:45	1
Perfluorodecanesulfonic acid (PFDS)	ND		2.0	0.32	ng/L		11/25/19 06:35	12/02/19 22:45	1
Perfluorooctanesulfonamide (FOSA)	ND		2.0	0.35	ng/L		11/25/19 06:35	12/02/19 22:45	1
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	ND		20	1.9	ng/L		11/25/19 06:35	12/02/19 22:45	1
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	ND		20	3.1	ng/L		11/25/19 06:35	12/02/19 22:45	1
4:2 FTS	ND		20	5.2	ng/L		11/25/19 06:35	12/02/19 22:45	1
6:2 FTS	ND		20	2.0	ng/L		11/25/19 06:35	12/02/19 22:45	1
8:2 FTS	ND		20	2.0	ng/L		11/25/19 06:35	12/02/19 22:45	1
10:2 FTS	ND		2.0	0.19	ng/L		11/25/19 06:35	12/02/19 22:45	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	ND		2.0	0.18	ng/L		11/25/19 06:35	12/02/19 22:45	1
HFPO-DA (GenX)	ND		4.0	1.5	ng/L		11/25/19 06:35	12/02/19 22:45	1
ADONA	ND		2.1	0.19	ng/L		11/25/19 06:35	12/02/19 22:45	1
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	ND		2.0	0.24	ng/L		11/25/19 06:35	12/02/19 22:45	1
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	ND		2.0	0.32	ng/L		11/25/19 06:35	12/02/19 22:45	1

Isotope Dilution	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C4 PFBA	*98*		*25 - 150*	*11/25/19 06:35*	*12/02/19 22:45*	*1*
13C5 PFPeA	*103*		*25 - 150*	*11/25/19 06:35*	*12/02/19 22:45*	*1*
13C2 PFHxA	*97*		*25 - 150*	*11/25/19 06:35*	*12/02/19 22:45*	*1*
13C4 PFHpA	*104*		*25 - 150*	*11/25/19 06:35*	*12/02/19 22:45*	*1*
13C4 PFOA	*99*		*25 - 150*	*11/25/19 06:35*	*12/02/19 22:45*	*1*
13C5 PFNA	*105*		*25 - 150*	*11/25/19 06:35*	*12/02/19 22:45*	*1*
13C2 PFDA	*104*		*25 - 150*	*11/25/19 06:35*	*12/02/19 22:45*	*1*
13C2 PFUnA	*96*		*25 - 150*	*11/25/19 06:35*	*12/02/19 22:45*	*1*
13C2 PFDoA	*98*		*25 - 150*	*11/25/19 06:35*	*12/02/19 22:45*	*1*

Method: 537 (modified) - Fluorinated Alkyl Substances (Continued)

Lab Sample ID: MB 320-341272/1-A
Matrix: Water
Analysis Batch: 342729

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 341272

Isotope Dilution	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C2 PFTeDA	91		25 - 150	11/25/19 06:35	12/02/19 22:45	1
18O2 PFHxS	115		25 - 150	11/25/19 06:35	12/02/19 22:45	1
13C4 PFOS	104		25 - 150	11/25/19 06:35	12/02/19 22:45	1
13C8 FOSA	94		25 - 150	11/25/19 06:35	12/02/19 22:45	1
M2-6:2 FTS	144		25 - 150	11/25/19 06:35	12/02/19 22:45	1
M2-8:2 FTS	132		25 - 150	11/25/19 06:35	12/02/19 22:45	1
d5-NEtFOSAA	122		25 - 150	11/25/19 06:35	12/02/19 22:45	1
d3-NMeFOSAA	115		25 - 150	11/25/19 06:35	12/02/19 22:45	1
M2-4:2 FTS	125		25 - 150	11/25/19 06:35	12/02/19 22:45	1
13C2 PFHxDA	71		25 - 150	11/25/19 06:35	12/02/19 22:45	1
13C3 HFPO-DA	76		25 - 150	11/25/19 06:35	12/02/19 22:45	1

Lab Sample ID: LCS 320-341272/2-A
Matrix: Water
Analysis Batch: 342729

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 341272

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Perfluorobutanoic acid (PFBA)	40.0	41.5		ng/L		104	76 - 136
Perfluoropentanoic acid (PFPeA)	40.0	36.9		ng/L		92	71 - 131
Perfluorohexanoic acid (PFHxA)	40.0	38.9		ng/L		97	73 - 133
Perfluoroheptanoic acid (PFHpA)	40.0	36.8		ng/L		92	72 - 132
Perfluorooctanoic acid (PFOA)	40.0	38.8		ng/L		97	70 - 130
Perfluorononanoic acid (PFNA)	40.0	40.4		ng/L		101	75 - 135
Perfluorodecanoic acid (PFDA)	40.0	39.2		ng/L		98	76 - 136
Perfluoroundecanoic acid (PFUnA)	40.0	40.1		ng/L		100	68 - 128
Perfluorododecanoic acid (PFDoA)	40.0	40.3		ng/L		101	71 - 131
Perfluorotridecanoic acid (PFTriA)	40.0	40.5		ng/L		101	71 - 131
Perfluorotetradecanoic acid (PFTeA)	40.0	35.6		ng/L		89	70 - 130
Perfluoro-n-hexadecanoic acid (PFHxDA)	40.0	43.5		ng/L		109	76 - 136
Perfluorobutanesulfonic acid (PFBS)	35.4	32.1		ng/L		91	67 - 127
Perfluoropentanesulfonic acid (PFPeS)	37.5	33.1		ng/L		88	66 - 126
Perfluorohexanesulfonic acid (PFHxS)	36.4	31.1		ng/L		85	59 - 119
Perfluoroheptanesulfonic Acid (PFHpS)	38.1	37.9		ng/L		100	76 - 136
Perfluorooctanesulfonic acid (PFOS)	37.1	35.7		ng/L		96	70 - 130
Perfluorononanesulfonic acid (PFNS)	38.4	39.6		ng/L		103	75 - 135
Perfluorodecanesulfonic acid (PFDS)	38.6	38.9		ng/L		101	71 - 131
Perfluorooctanesulfonamide (FOSA)	40.0	40.2		ng/L		101	73 - 133
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	40.0	40.1		ng/L		100	76 - 136

Method: 537 (modified) - Fluorinated Alkyl Substances (Continued)

Lab Sample ID: LCS 320-341272/2-A
Matrix: Water
Analysis Batch: 342729

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 341272

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	40.0	43.2		ng/L		108	76 - 136
4:2 FTS	37.4	43.9		ng/L		117	79 - 139
6:2 FTS	37.9	40.4		ng/L		107	59 - 175
8:2 FTS	38.3	38.1		ng/L		100	75 - 135
10:2 FTS	38.6	37.8		ng/L		98	64 - 142
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	37.7	38.5		ng/L		102	79 - 139
HFPO-DA (GenX)	40.0	52.8		ng/L		132	51 - 173
ADONA	39.5	40.3		ng/L		102	79 - 139
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	37.3	35.4		ng/L		95	75 - 135
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	37.7	30.4		ng/L		81	54 - 114

Isotope Dilution	*LCS %Recovery*	*LCS Qualifier*	*Limits*
13C4 PFBA	*101*		*25 - 150*
13C5 PFPeA	*106*		*25 - 150*
13C2 PFHxA	*99*		*25 - 150*
13C4 PFHpA	*109*		*25 - 150*
13C4 PFOA	*104*		*25 - 150*
13C5 PFNA	*107*		*25 - 150*
13C2 PFDA	*106*		*25 - 150*
13C2 PFUnA	*94*		*25 - 150*
13C2 PFDoA	*99*		*25 - 150*
13C2 PFTeDA	*99*		*25 - 150*
18O2 PFHxS	*119*		*25 - 150*
13C4 PFOS	*108*		*25 - 150*
13C8 FOSA	*97*		*25 - 150*
M2-6:2 FTS	*139*		*25 - 150*
M2-8:2 FTS	*145*		*25 - 150*
d5-NEtFOSAA	*123*		*25 - 150*
d3-NMeFOSAA	*114*		*25 - 150*
M2-4:2 FTS	*140*		*25 - 150*
13C2 PFHxDA	*57*		*25 - 150*
13C3 HFPO-DA	*71*		*25 - 150*

Lab Sample ID: LCSD 320-341272/3-A
Matrix: Water
Analysis Batch: 342729

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 341272

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Perfluorobutanoic acid (PFBA)	40.0	42.6		ng/L		106	76 - 136	3	30
Perfluoropentanoic acid (PFPeA)	40.0	36.7		ng/L		92	71 - 131	1	30
Perfluorohexanoic acid (PFHxA)	40.0	38.7		ng/L		97	73 - 133	0	30
Perfluoroheptanoic acid (PFHpA)	40.0	40.1		ng/L		100	72 - 132	9	30
Perfluorooctanoic acid (PFOA)	40.0	37.5		ng/L		94	70 - 130	3	30
Perfluorononanoic acid (PFNA)	40.0	41.6		ng/L		104	75 - 135	3	30
Perfluorodecanoic acid (PFDA)	40.0	42.6		ng/L		107	76 - 136	8	30

Method: 537 (modified) - Fluorinated Alkyl Substances (Continued)

Lab Sample ID: LCSD 320-341272/3-A
Matrix: Water
Analysis Batch: 342729

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 341272

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Perfluoroundecanoic acid (PFUnA)			40.0	38.2		ng/L		96	68 - 128	5	30
Perfluorododecanoic acid (PFDoA)			40.0	42.1		ng/L		105	71 - 131	4	30
Perfluorotridecanoic acid (PFTriA)			40.0	41.0		ng/L		102	71 - 131	1	30
Perfluorotetradecanoic acid (PFTeA)			40.0	34.4		ng/L		86	70 - 130	4	30
Perfluoro-n-hexadecanoic acid (PFHxDA)			40.0	40.3		ng/L		101	76 - 136	8	30
Perfluorobutanesulfonic acid (PFBS)			35.4	33.8		ng/L		96	67 - 127	5	30
Perfluoropentanesulfonic acid (PFPeS)			37.5	35.9		ng/L		96	66 - 126	8	30
Perfluorohexanesulfonic acid (PFHxS)			36.4	31.3		ng/L		86	59 - 119	1	30
Perfluoroheptanesulfonic Acid (PFHpS)			38.1	37.8		ng/L		99	76 - 136	0	30
Perfluorooctanesulfonic acid (PFOS)			37.1	37.0		ng/L		100	70 - 130	4	30
Perfluorononanesulfonic acid (PFNS)			38.4	38.7		ng/L		101	75 - 135	2	30
Perfluorodecanesulfonic acid (PFDS)			38.6	37.5		ng/L		97	71 - 131	3	30
Perfluorooctanesulfonamide (FOSA)			40.0	41.0		ng/L		103	73 - 133	2	30
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)			40.0	42.1		ng/L		105	76 - 136	5	30
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)			40.0	38.6		ng/L		96	76 - 136	11	30
4:2 FTS			37.4	44.1		ng/L		118	79 - 139	1	30
6:2 FTS			37.9	39.0		ng/L		103	59 - 175	4	30
8:2 FTS			38.3	38.1		ng/L		99	75 - 135	0	30
10:2 FTS			38.6	36.8		ng/L		95	64 - 142	3	30
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)			37.7	39.1		ng/L		104	79 - 139	2	30
HFPO-DA (GenX)			40.0	43.1		ng/L		108	51 - 173	20	30
ADONA			39.5	41.0		ng/L		104	79 - 139	2	30
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid			37.3	37.3		ng/L		100	75 - 135	5	30
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid			37.7	31.5		ng/L		84	54 - 114	3	30

Isotope Dilution	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
13C4 PFBA	*91*		*25 - 150*
13C5 PFPeA	*97*		*25 - 150*
13C2 PFHxA	*89*		*25 - 150*
13C4 PFHpA	*96*		*25 - 150*
13C4 PFOA	*98*		*25 - 150*
13C5 PFNA	*97*		*25 - 150*
13C2 PFDA	*95*		*25 - 150*
13C2 PFUnA	*90*		*25 - 150*
13C2 PFDoA	*91*		*25 - 150*

Method: 537 (modified) - Fluorinated Alkyl Substances (Continued)

Lab Sample ID: LCSD 320-341272/3-A
Matrix: Water
Analysis Batch: 342729

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 341272

Isotope Dilution	LCSD %Recovery	LCSD Qualifier	Limits
13C2 PFTeDA	88		25 - 150
18O2 PFHxS	107		25 - 150
13C4 PFOS	99		25 - 150
13C8 FOSA	84		25 - 150
M2-6:2 FTS	134		25 - 150
M2-8:2 FTS	136		25 - 150
d5-NEtFOSAA	111		25 - 150
d3-NMeFOSAA	113		25 - 150
M2-4:2 FTS	128		25 - 150
13C2 PFHxDA	65		25 - 150
13C3 HFPO-DA	88		25 - 150

QC Association Summary

Client: Shannon & Wilson, Inc
Project/Site: DLG Alt. Water

Job ID: 320-56436-1

LCMS

Prep Batch: 341272

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-56436-1	200150	Total/NA	Water	3535	
320-56436-2	191710	Total/NA	Water	3535	
320-56436-3	191320	Total/NA	Water	3535	
320-56436-4	191050	Total/NA	Water	3535	
MB 320-341272/1-A	Method Blank	Total/NA	Water	3535	
LCS 320-341272/2-A	Lab Control Sample	Total/NA	Water	3535	
LCSD 320-341272/3-A	Lab Control Sample Dup	Total/NA	Water	3535	

Analysis Batch: 342729

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
320-56436-1	200150	Total/NA	Water	537 (modified)	341272
320-56436-2	191710	Total/NA	Water	537 (modified)	341272
320-56436-3	191320	Total/NA	Water	537 (modified)	341272
320-56436-4	191050	Total/NA	Water	537 (modified)	341272
MB 320-341272/1-A	Method Blank	Total/NA	Water	537 (modified)	341272
LCS 320-341272/2-A	Lab Control Sample	Total/NA	Water	537 (modified)	341272
LCSD 320-341272/3-A	Lab Control Sample Dup	Total/NA	Water	537 (modified)	341272

Lab Chronicle

Client: Shannon & Wilson, Inc
Project/Site: DLG Alt. Water

Job ID: 320-56436-1

Client Sample ID: 200150
Date Collected: 11/15/19 11:50
Date Received: 11/20/19 10:10

Lab Sample ID: 320-56436-1
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3535			270.3 mL	10.0 mL	341272	11/25/19 06:35	MTN	TAL SAC
Total/NA	Analysis	537 (modified)		1			342729	12/02/19 23:58	S1M	TAL SAC

Client Sample ID: 191710
Date Collected: 11/15/19 16:51
Date Received: 11/20/19 10:10

Lab Sample ID: 320-56436-2
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3535			271 mL	10.0 mL	341272	11/25/19 06:35	MTN	TAL SAC
Total/NA	Analysis	537 (modified)		1			342729	12/03/19 00:14	S1M	TAL SAC

Client Sample ID: 191320
Date Collected: 11/14/19 17:45
Date Received: 11/20/19 10:10

Lab Sample ID: 320-56436-3
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3535			266.2 mL	10.0 mL	341272	11/25/19 06:35	MTN	TAL SAC
Total/NA	Analysis	537 (modified)		1			342729	12/03/19 00:22	S1M	TAL SAC

Client Sample ID: 191050
Date Collected: 11/15/19 09:05
Date Received: 11/20/19 10:10

Lab Sample ID: 320-56436-4
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3535			264 mL	10.0 mL	341272	11/25/19 06:35	MTN	TAL SAC
Total/NA	Analysis	537 (modified)		1			342729	12/03/19 00:30	S1M	TAL SAC

Laboratory References:

TAL SAC = Eurofins TestAmerica, Sacramento, 880 Riverside Parkway, West Sacramento, CA 95605, TEL (916)373-5600

Accreditation/Certification Summary

Client: Shannon & Wilson, Inc
Project/Site: DLG Alt. Water

Job ID: 320-56436-1

Laboratory: Eurofins TestAmerica, Sacramento

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
Alaska (UST)	State	17-020	01-20-21
ANAB	Dept. of Defense ELAP	L2468	01-20-21
ANAB	Dept. of Energy	L2468.01	01-20-21
ANAB	ISO/IEC 17025	L2468	01-20-21
Arizona	State	AZ0708	08-11-20
Arkansas DEQ	State	19-042-0	06-17-20
California	State	2897	01-31-20
Colorado	State	CA0004	08-31-20
Connecticut	State	PH-0691	06-30-21
Florida	NELAP	E87570	06-30-20
Georgia	State	4040	01-29-20
Hawaii	State	<cert No.>	01-29-20
Illinois	NELAP	200060	03-17-20
Kansas	NELAP	E-10375	10-31-20 *
Louisiana	NELAP	01944	06-30-20
Maine	State	2018009	04-14-20
Michigan	State	9947	01-29-20
Michigan	State Program	9947	01-31-20
Nevada	State	CA000442020-1	07-31-20
New Hampshire	NELAP	2997	04-18-20
New Jersey	NELAP	CA005	06-30-20
New York	NELAP	11666	04-01-20
Oregon	NELAP	4040	01-29-20
Pennsylvania	NELAP	68-01272	03-31-20
Texas	NELAP	T104704399-19-13	05-31-20
US Fish & Wildlife	US Federal Programs	58448	07-31-20
USDA	US Federal Programs	P330-18-00239	07-31-21
Utah	NELAP	CA000442019-01	02-29-20
Vermont	State	VT-4040	04-16-20
Virginia	NELAP	460278	03-14-20
Washington	State	C581	05-05-20
West Virginia (DW)	State	9930C	12-31-19
Wyoming	State Program	8TMS-L	01-28-19 *

* Accreditation/Certification renewal pending - accreditation/certification considered valid.

Method Summary

Client: Shannon & Wilson, Inc
Project/Site: DLG Alt. Water

Job ID: 320-56436-1

Method	Method Description	Protocol	Laboratory
537 (modified)	Fluorinated Alkyl Substances	EPA	TAL SAC
3535	Solid-Phase Extraction (SPE)	SW846	TAL SAC

Protocol References:

EPA = US Environmental Protection Agency

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL SAC = Eurofins TestAmerica, Sacramento, 880 Riverside Parkway, West Sacramento, CA 95605, TEL (916)373-5600

Sample Summary

Client: Shannon & Wilson, Inc
Project/Site: DLG Alt. Water

Job ID: 320-56436-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received	Asset ID
320-56436-1	200150	Water	11/15/19 11:50	11/20/19 10:10	
320-56436-2	191710	Water	11/15/19 16:51	11/20/19 10:10	
320-56436-3	191320	Water	11/14/19 17:45	11/20/19 10:10	
320-56436-4	191050	Water	11/15/19 09:05	11/20/19 10:10	

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS
2355 Hill Road
Fairbanks, AK 99709
(907) 479-0600
www.shannonwilson.com

CHAIN-OF-CUSTODY RECORD

Page 1 of 1

Laboratory Test America
Attn: D. Alltucker

Turn Around Time: [X] Normal [ ] Rush — Please Specify

Quote No:

J-Flags: [X] Yes [ ] No

Analytical Methods (include preservative if used)

Sample Identity	Lab No.	Time	Date Sampled	DRO/GRO + 24 (see attached)	Total Number of Containers	Remarks/Matrix Composition/Grab? Sample Containers
200150		1150	11/15/19	X	2	groundwater
191710		1651	11/15/19	X	2	1
191320		1745	11/14/19	X	2	
191050		0905	11/15/19	X	2	

320-56436 Chain of Custody

Project Information	
Number:	102786-003
Name:	DLG Alt. Water
Contact:	MDN
Ongoing Project?	Yes [X] No [ ]
Sampler:	ARM, RLW

Sample Receipt	
Total No. of Containers:	8
COC Seals/Intact? Y/N/NA	NA
Received Good Cond./Cold	
Temp:	
Delivery Method:	

Notes:

Relinquished By: 1.	Relinquished By: 2.	Relinquished By: 3.
Signature: Rachel Willis Time: 1130	Signature: Time:	Signature: Time:
Printed Name: Rachel Willis Date: 11/19/19	Printed Name: Date:	Printed Name: Date:
Company: Shannon + Wilson, Inc.	Company:	Company:

Received By: 1.	Received By: 2.	Received By: 3.
Signature: Time:	Signature: Time:	Signature: Time:
Printed Name: Jennifer Carlson Date: 20NOV19	Printed Name: Date:	Printed Name: Date:
Company: ETAWSC	Company:	Company:

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

0.7°C/0.5°C

No. 35981

DOD LC/MS/MS list QSM 5.1 Table B-15

Name	CAS Number
Perfluorobutyric acid (PFBA)	375-22-4
Perfluoropentanoic acid (PFPA)	2706-90-3
Perfluorohexanoic acid (PFHxA)	307-24-4
Perfluoroheptanoic acid (PFHpA)	375-85-9
Perfluorooctanoic acid (PFOA)	335-67-1
Perfluorononanoic acid (PFNA)	375-95-1
Perfluorodecanoic acid (PFDA)	335-76-2
Perfluoroundecanoic acid (PFUDA)	2058-94-8
Perfluorododecanoic acid (PFDoDA)	307-55-1
Perfluorotridecanoic acid (PFTriA)	72629-94-8
Perfluorotetradecanoic acid (PDTeA)	376-06-7
Perfluorobutane Sulfonic Acid (PFBS)	375-73-5
Perfluoropentane Sulfonic acid (PFPS)	2706-91-4
Perfluorohexane Sulfonic Acid (PFHxS)	355-46-4
Perfluoroheptane Sulfonic Acid (PFHpS)	375-92-8
Perfluorooctane Sulfonic Acid (PFOS)	1763-23-1
Perfluorononane Sulfonic acid (PFNS)	68259-12-1
Perfluorodecane Sulfonic Acid (PFDS)	335-77-3
Perfluorooctane Sulfonamide (FOSA)	754-91-6
N-Methyl perfluorooctanesulfon amidoacetic acid (MeFOSAA)	2355-31-9
N-Ethyl perfluorooctanesulfon amidacetic acid (EtFOSAA)	2991-50-6
4:2 Fluorotelomer sulfonate (4:2 FTS)	757124-72-4
6:2 Fluorotelomer sulfonate (6:2 FTS)	27619-97-2
8:2 Fluorotelomer sulfonate (8:2 FTS)	39108-34-4
10:2 Fluorotelomer sulfonate (10:2 FTS)	
Ammonium perfluoro-2-methyl-3-oxahexanoate (HPFO-DA, GenX)	13252-13-6
Ammonium 4,8-dioxa-3H-perfluorononanoate (ADONA)	919005-14-4
Perfluorohexadecanoic acid (PFHxDA)	
4,8-Dioxa-3H-perfluorononanoic acid (DONA)	
Perfluoro-2-propoxypropionic acid (GenX Parent Acid)	

Add missing compounds from EPA 537.1

11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	763051-92-9
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid	756426-58-1
4,8-dioxa-3H-perfluorononanoic acid	919005-14-4

Login Sample Receipt Checklist

Client: Shannon & Wilson, Inc

Job Number: 320-56436-1

Login Number: 56436
List Number: 1
Creator: Her, David A

List Source: Eurofins TestAmerica, Sacramento

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	Seal present with no number.
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Laboratory Data Review Checklist

Completed By:

Brittany Blood

Title:

Environmental Professional I

Date:

12/11/2019

Consultant Firm:

Shannon and Wilson, Inc.

Laboratory Name:

TestAmerica Laboratories, Inc.

Laboratory Report Number:

320-56436-1

Laboratory Report Date:

12/9/2019

CS Site Name:

ADOT&PF Dillingham Airport Sitewide PFAS

ADEC File Number:

2540.38.023

Hazard Identification Number:

26971

320-56436-1

Laboratory Report Date:

12/9/2019

CS Site Name:

ADOT&PF Dillingham Airport Sitewide PFAS

Note: Any N/A or No box checked must have an explanation in the comments box.

1. Laboratory

   a. Did an ADEC CS approved laboratory receive and perform all of the submitted sample analyses?

   Yes☒ No☐ N/A☐ Comments:

   The ADEC certified the Eurofins TestAmerica Laboratories West Sacramento, CA location for the analysis of perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) on February 6, 2018. These compounds were included in the ADEC's Contaminated Sites Laboratory Approval 17-020.

   b. If the samples were transferred to another "network" laboratory or sub-contracted to an alternate laboratory, was the laboratory performing the analyses ADEC CS approved?

   Yes☐ No☐ N/A☒ Comments:

   Analyses were performed by Eurofins TestAmerica Laboratories, Inc. in West Sacramento, CA.

2. Chain of Custody (CoC)

   a. CoC information completed, signed, and dated (including released/received by)?

   Yes☒ No☐ N/A☐ Comments:

   b. Correct analyses requested?

   Yes☒ No☐ N/A☐ Comments:

3. Laboratory Sample Receipt Documentation

   a. Sample/cooler temperature documented and within range at receipt (0° to 6° C)?

   Yes☒ No☐ N/A☐ Comments:

   b. Sample preservation acceptable – acidified waters, Methanol preserved VOC soil (GRO, BTEX, Volatile Chlorinated Solvents, etc.)?

   Yes☒ No☐ N/A☐ Comments:

320-56436-1

Laboratory Report Date:

12/9/2019

CS Site Name:

ADOT&PF Dillingham Airport Sitewide PFAS

c. Sample condition documented – broken, leaking (Methanol), zero headspace (VOC vials)?

Yes☒ No☐ N/A☐ Comments:

d. If there were any discrepancies, were they documented? For example, incorrect sample containers/preservation, sample temperature outside of acceptable range, insufficient or missing samples, etc.?

Yes☐ No☐ N/A☒ Comments:

No discrepancies were noted by the laboratory.

e. Data quality or usability affected?

Comments:

Data quality and/or usability were not affected; see above.

4. Case Narrative

a. Present and understandable?

Yes☒ No☐ N/A☐ Comments:

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Laboratory Report Date:

12/9/2019

CS Site Name:

ADOT&PF Dillingham Airport Sitewide PFAS

b. Discrepancies, errors, or QC failures identified by the lab?

Yes☒ No☐ N/A☐ Comments:

Due to a shortage in the marketplace for 13C3-PFBS, the target analyte PFBS and/or Perfluoropentanesulfonic acid (PFPeS) could not be quantitated against 13C3-PFBS (its labeled variant) as listed in the SOP. PFBS and Perfluoropentanesulfonic acid (PFPeS) was quantitated versus 18O2-PFHxS instead.

Several Isotope Dilution Analyte (IDA) recoveries are above the method recommended limit for the following samples: *200150, 191320, and 191050*. Quantitation by isotope dilution generally precludes any adverse effect on data quality due to elevated IDA recoveries.

Insufficient sample volume was available to perform a matrix spike/matrix spike duplicate (MS/MSD) associated with preparation batch 320-341272.

The following samples were preserved with Trizma: *200150, 191710, 191320, and 191050*. Thus, the MB, LCS and LCSD also contain Trizma.

The following samples contain a thin layer of orange sediment at the bottom of the bottle prior to extraction: *191710 and 191320.*

During the solid phase extraction process, the following samples have non-settable particulates which clogged the
extraction columns: *191710 and 191320.*

Sample *191320* was yellow after extraction.

c. Were all corrective actions documented?

Yes☒ No☐ N/A☐ Comments:

See above.

d. What is the effect on data quality/usability according to the case narrative?

Comments:

The case narrative does not note an affect on data quality and/or usability.

320-56436-1

Laboratory Report Date:

12/9/2019

CS Site Name:

ADOT&PF Dillingham Airport Sitewide PFAS

5. Samples Results

a. Correct analyses performed/reported as requested on COC?

Yes☒ No☐ N/A☐ Comments:

b. All applicable holding times met?

Yes☒ No☐ N/A☐ Comments:

c. All soils reported on a dry weight basis?

Yes☐ No☐ N/A☒ Comments:

All samples in this work order are water samples.

d. Are the reported LOQs less than the Cleanup Level or the minimum required detection level for the project?

Yes☒ No☐ N/A☐ Comments:

e. Data quality or usability affected?

Data quality and/or usability were not affected; see above.

6. QC Samples

a. Method Blank

i. One method blank reported per matrix, analysis and 20 samples?

Yes☒ No☐ N/A☐ Comments:

ii. All method blank results less than limit of quantitation (LOQ) or project specified objectives?

Yes☒ No☐ N/A☐ Comments:

All method blank results were less than the LOQ, however, PFHxS was detected in the method blank sample below the LOQ.

320-56436-1

Laboratory Report Date:

12/9/2019

CS Site Name:

ADOT&PF Dillingham Airport Sitewide PFAS

iii. If above LOQ or project specified objectives, what samples are affected?

Comments:

No samples were affected, as associated samples were greater than 10 times the concentration detected in the method blank sample.

iv. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?

Yes☐ No☐ N/A☒ Comments:

No project samples were affected, see above.

v. Data quality or usability affected?

Comments:

No data quality or usability was affected

b. Laboratory Control Sample/Duplicate (LCS/LCSD)

i. Organics – One LCS/LCSD reported per matrix, analysis and 20 samples? (LCS/LCSD required per AK methods, LCS required per SW846)

Yes☒ No☐ N/A☐ Comments:

ii. Metals/Inorganics – one LCS and one sample duplicate reported per matrix, analysis and 20 samples?

Yes☐ No☐ N/A☒ Comments:

Metals and inorganics were not analyzed as a part of this work order.

iii. Accuracy – All percent recoveries (%R) reported and within method or laboratory limits and project specified objectives, if applicable? (AK Petroleum methods: AK101 60%-120%, AK102 75%-125%, AK103 60%-120%; all other analyses see the laboratory QC pages)

Yes☒ No☐ N/A☐ Comments:

320-56436-1

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12/9/2019

CS Site Name:

ADOT&PF Dillingham Airport Sitewide PFAS

iv. Precision – All relative percent differences (RPD) reported and less than method or laboratory limits and project specified objectives, if applicable? RPD reported from LCS/LCSD, and or sample/sample duplicate. (AK Petroleum methods 20%; all other analyses see the laboratory QC pages)

Yes☒ No☐ N/A☐ Comments:

v. If %R or RPD is outside of acceptable limits, what samples are affected?

Comments:

Not applicable, all %Rs and RPDs were within acceptable limits.

vi. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?

Yes☐ No☐ N/A☒ Comments:

See above.

vii. Data quality or usability affected? (Use comment box to explain.)

Comments:

Data quality and/or usability was not affected; see above.

c. Matrix Spike/Matrix Spike Duplicate (MS/MSD)

Note: Leave blank if not required for project

i. Organics – One MS/MSD reported per matrix, analysis and 20 samples?

Yes☐ No☒ N/A☐ Comments:

There was insufficient sample volume to perform a MS/MSD associated with the samples in this work order.

ii. Metals/Inorganics – one MS and one MSD reported per matrix, analysis and 20 samples?

Yes☐ No☐ N/A☒ Comments:

Metals and inorganics were not analyzed as a part of this work order.

320-56436-1

Laboratory Report Date:

12/9/2019

CS Site Name:

ADOT&PF Dillingham Airport Sitewide PFAS

iii. Accuracy – All percent recoveries (%R) reported and within method or laboratory limits and project specified objectives, if applicable? (AK Petroleum methods: AK101 60%-120%, AK102 75%-125%, AK103 60%-120%; all other analyses see the laboratory QC pages)

Yes☐ No☐ N/A☒ Comments:

There was insufficient sample volume to perform a MS/MSD associated with the samples in this work order.

iv. Precision – All relative percent differences (RPD) reported and less than method or laboratory limits and project specified objectives, if applicable? RPD reported from MS/MSD, and or sample/sample duplicate. (AK Petroleum methods 20%; all other analyses see the laboratory QC pages)

Yes☐ No☐ N/A☒ Comments:

There was insufficient sample volume to perform a MS/MSD associated with the samples in this work order.

v. If %R or RPD is outside of acceptable limits, what samples are affected?

Comments:

Not applicable, there was insufficient sample volume to perform a MS/MSD associated with the samples in this work order.

vi. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?

Yes☐ No☐ N/A☒ Comments:

See above.

vii. Data quality or usability affected? (Use comment box to explain.)

Comments:

Data quality and/or usability were not affected.

d. Surrogates – Organics Only or Isotope Dilution Analytes (IDA) – Isotope Dilution Methods Only

i. Are surrogate/IDA recoveries reported for organic analyses – field, QC and laboratory samples?

Yes☒ No☐ N/A☐ Comments:

320-56436-1

Laboratory Report Date:

12/9/2019

CS Site Name:

ADOT&PF Dillingham Airport Sitewide PFAS

ii. Accuracy – All percent recoveries (%R) reported and within method or laboratory limits and project specified objectives, if applicable? (AK Petroleum methods 50-150 %R; all other analyses see the laboratory report pages)

Yes☐ No☒ N/A☐ Comments:

Recovery of IDAs M2-4:2FTS, M2-6:2FTS, and M2-8:2FTS in samples *200150* and *191320* were reported above laboratory limits. Recovery of IDA M2-4:2FTS in sample *191050* was above the QC limits.

iii. Do the sample results with failed surrogate/IDA recoveries have data flags? If so, are the data flags clearly defined?

Yes☐ No☐ N/A☒ Comments:

The sample results with failed IDA recoveries were not qualified as all analytes with IDA failures were not detected within the samples.

iv. Data quality or usability affected?

Comments:

Data quality and/or usability was not affected.

e. Trip Blanks

i. One trip blank reported per matrix, analysis and for each cooler containing volatile samples? (If not, enter explanation below.)

Yes☐ No☐ N/A☒ Comments:

A trip blank is not required for the analysis of PFAS as PFAS is not a volatile compound.

ii. Is the cooler used to transport the trip blank and VOA samples clearly indicated on the COC? (If not, a comment explaining why must be entered below)

Yes☐ No☐ N/A☒ Comments:

A trip blank is not required.

iii. All results less than LOQ and project specified objectives?

Yes☐ No☐ N/A☒ Comments:

See above.

iv. If above LOQ or project specified objectives, what samples are affected?

Comments:

Not applicable, see above.

320-56436-1

Laboratory Report Date:

12/9/2019

CS Site Name:

ADOT&PF Dillingham Airport Sitewide PFAS

v. Data quality or usability affected?

Comments:

Data quality and/or usability were not affected.

f. Field Duplicate

i. One field duplicate submitted per matrix, analysis and 10 project samples?

Yes☐ No☐ N/A☒ Comments:

A field duplicate was not submitted as a part of this work order, however, the appropriate number of duplicate samples were submitted for the overall project.

ii. Submitted blind to lab?

Yes☐ No☐ N/A☒ Comments:

See above.

iii. Precision – All relative percent differences (RPD) less than specified project objectives? (Recommended: 30% water, 50% soil)

RPD (%) = Absolute value of: $\frac{(R_1-R_2)}{((R_1+R_2)/2)} \times 100$

Where R_1 = Sample Concentration
R_2 = Field Duplicate Concentration

Yes☐ No☐ N/A☒ Comments:

See above.

iv. Data quality or usability affected? (Use the comment box to explain why or why not.)

Comments:

Data quality and/or usability were not affected; see above.

g. Decontamination or Equipment Blank (If not applicable, a comment stating why must be entered below)?

Yes☐ No☐ N/A☒ Comments:

Reusable equipment was not used to collect samples on this work order.

320-56436-1

Laboratory Report Date:

12/9/2019

CS Site Name:

ADOT&PF Dillingham Airport Sitewide PFAS

i. All results less than LOQ and project specified objectives?

Yes☐ No☐ N/A☒ Comments:

See above.

ii. If above LOQ or project specified objectives, what samples are affected?

Comments:

Not applicable, see above.

iii. Data quality or usability affected?

Comments:

Data quality and/or usability were not affected; see above.

7. Other Data Flags/Qualifiers (ACOE, AFCEE, Lab Specific, etc.)

a. Defined and appropriate?

Yes☐ No☐ N/A☒ Comments:

APPENDIX B: BARR REPORT AND SUPPORTING INFORMATION

RESIDENTIAL WELL SAMPLING LOG

Water supply well field notes contain personal information.
This content has been removed for confidentiality.

APPENDIX C: WATER STORAGE TANK SUPPORTING INFORMATION

Appendix C

Water Storage Tank Supporting Information

CONTENTS

C.1 Cost Estimates..... ii

Enclosures

- West-Mark 2,000-gallon and 5,000-gallon trailer specifications and quote
- Greer Tanks polyethylene tank brochure
- Alaska Marine Lines shipping quote

APPENDIX C: WATER STORAGE TANK SUPPORTING INFORMATION

C.1 COST ESTIMATES

This appendix contains supporting information used to prepare the ballpark capital cost estimate for water storage tanks. Enclosed please find cost estimates from several contractors.

Exhibit C.1-1: Impacted Properties

Item		Units	Unit Cost	Total Cost
1,500-gallon tank and freight	17	tanks	$6,324	$107,508
Materials (pump, piping, fittings, insulation, etc.) at single-tank locations	7	locations	$5,500	$38,500
Materials at multiple-tank locations	3	locations	$8,250	$24,750
Installation at single-tank locations	7	locations	$9,000	$63,000
Installation at multiple-tank locations	3	locations	$13,500	$40,500
Plane flights, lodging for out-of-town plumber		-	-	$3,691
Well abandonment	7	wells	$5,000	$35,000
Engineering and design, includes site visits	10	locations	$20,000	$200,000
Potable water trailer, 5,000-gallon	-		-	$94,900
			Subtotal	$607,849
			Contingency (35%)	$212,747
			Total	$820,596

APPENDIX C: WATER STORAGE TANK SUPPORTING INFORMATION

WEST-MARK 2,000 GALLON AND 5,000 GALLON TRAILER SPECIFICATIONS AND QUOTE

SALESMAN: Scott Vincent

Quote for:
DILLINGHAM, ALASKA

P.O.BOX 100 **PHONE: (209) 537-4747**
CERES, CA 95307 **TOLL FREE: (800) 692-5844**
www.west-mark.com **FAX: (209) 537-1753**

GENERAL
The following equipment shall be a new West-Mark tandem-axle water trailer.

OVERAL DIEMENSION REQUIREMENTS:
Length: 25 feet (prox.) measured from rear of trailer to lunette eye
Width: Maximum 8 feet

Unit shall be capable of transporting a minimum of 2,000 gallons of water over improved roads at sustained speeds of 55 MPH and off-road at sustained speeds of 15 MPH.

PRODUCT: Potable water.
PRODUCT WEIGHT: 8.35 lbs./gallon.
TANK OPERATING TEMPERATURE: 125° F maximum
INTENDED AREA OF OPERATION: State of Alaska.
INTENDED USE: Highway and Unimproved roads.

TANK/ MANHOLES/ VENTING
- Barrel, 2,000 Gallons T-304 stainless steel 10GA oval, straight.
- Head(s), stainless steel 10GA, dished and flanged.
- Baffle(s), one (1) 10GA stainless steel, dished and flanged.
- Tank mounted directly to trailer decking.
- Wings, Bolsters, and Sidefillers, Stainless Steel.
- Weld Finish, interior to be W-2 with all longitudinal seams to be W-3. Exterior weld finish to be W-0.
- Manhole(s), one (1) 20", T-304 stainless steel with a single lug, EPDM gasket and provisions for a padlock; located top of tank at front.
- Venting, one (1) with anti-splash deflector, synthetic filter media, w/ mesh screen.
- Insulation, Polystyrene foam sheets, fiberglass at heads, ring tape at all rings.
- Jacketing, belly wrapped stainless steel with lapped seams. Jacket heads to be 20 Gauge stainless steel, lock seamed to jacket.
- Sight Gauge(s), one (1) acrylic liquid level gauge sight tube assembly with shutoff valve and drain cock at bottom. Red ball installed inside tube. Gauge to be located at rear head.
- Tank Cleanout, one (1) 1-1/2" drain shall be located at the bottom of the tank, near the rear. Outlet shall have a cam-lock adapter with tethered cap.

LIGHTS AND WIRING
- Trailer Lighting, L.E.D. lighting to meet all D.O.T. requirements w/ rear license plate lamp.
- Reflectors, per D.O.T.
- Conspicuity Striping, per D.O.T.
- Electrical Plug, 7-way male RV type.
- Cabinet Dome Light(s), two (2) L.E.D. with switch.

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PLUMBING
- Cabinet(s), one (1) stainless steel non- insulated double door with stainless steel hardware and lockable latch located at rear.
- Pump and Engine Assembly, one (1) stainless steel pump with diesel engine. Engine to have cold weather start package Installed.
- Meter installed in cabinet for “resale” of water.
- Hose reel installed in cabinet with 1” x 50’ of potable water hose with ball valve at end.
- Fuel Tank, to be remotely mounted in an easy access location for tank fill.
- Battery, in plastic enclosure
- Flow Diagram, flow chart with valving instructions for various pumping functions.

UNDERCARRIAGE
- Trailer, 26,000 LB GVWR tandem-axle trailer
- Frame, heavy-duty channel style
- Tow Bar, ridged and extend to minimize the threat of early jackknifing at any turning angle.
- Platform, one (1) 2' X 4' (minimum) platform with kick plate, slip resistant floor, and safety railing shall be installed at the front of the tank for access to manhole. Slip resistant steps with safety railing installed for access to platform.
- Grab Handle, one (1) to assist when accessing rear platform.
- Decking, carbon steel diamond plate.
- Jack, one (1) heavy-duty landing gear assembly located a minimum of 50" from Lunette eye.
- Axles, two (2) 12,000 lb. 3” round with electric brakes.
- Springs, four (4) each multi-leaf
- Wheel(s), nine (9) steel
- Tire(s), nine (9) commercial grade radial.
- Brake System, electric brakes for a tandem axle trailer.
- Break-Away Kit, An electric brake, kit consisting of a break-away switch, trickle charger, and a battery
- Bumper, carbon steel end cap.
- Hitch, one (1) Lunette eye with multi-height adjustability.
- Safety Chain, two (2) with hook.
- Cabinet, one (1) powder coated with lift-up door on tongue of trailer.
- Tire Carrier, installed on tongue of trailer.
- Ten (10) lengths of 2” x 10’ of potable water hose with stainless steel fittings installed in the hose trays.

OPTIONAL ITEMS
- Tie Down Points, aid in the securing of the unit when transporting.
- Two (2) stainless steel hose trays installed to carry the potable water hose.

MISC.
- Severe Service Undercoating (SSU) applied to the frame package.
- Heat trace package installed to cover plumbing package. Connects for wiring to be at front of frailer
- Paint, all carbon steel fabricated parts.
- Paint Preparation, all steel chassis components shall be properly prepared prior to painting (Example: shot blast, sand blast, hot power washed with chemical, and/or any other method accepted in the industry) to ensure the surfaces are lightly etched and all contaminants/rust/oils are removed prior to the application of paint.
- Operator Training Guide in each manual containing detailed operating instructions of all functions with photos.
- Operation and maintenance manual(s) in paper format and on CD-ROM complete with:
  - Operator & maintenance manual
  - Calibration chart (if applicable)
  - Equipment parts list
  - Misc. vendor literature / manuals

Quote for:
DILLINGHAM, ALASKA

Any and all Brand Name parts mentioned in specifications above are subject to substitution of an equal part that is of a different brand. Other substitutions may also be made if said substitution does not affect the intended function of the vehicle's mission and is equivalent or an upgrade as determined by West-Mark. All specified dimensions are nominal and may vary slightly.

Tank and all fabricated parts warranty good for one (1) year.

Salesman: Scott Vincent

Quote for
DILLINGHAM, ALASKA

P.O.BOX 100
CERES, CA 95307
www.west-mark.com

PHONE: (209) 537-4747
TOLL FREE: (800) 692-5844
FAX: (209) 537-1753

GENERAL

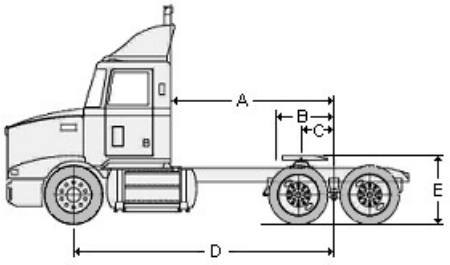
The following equipment shall be a new West-Mark tandem axle semi trailer.

OVERALL LENGTH: Approximately 32'.
PRODUCT: Non-potable water.
PRODUCT WEIGHT: 8.35 lbs./gallon.
VESSEL CODE: Non-Spec.
OPERATING PRESSURE: Atmosphere.
VACUUM RATING: None (0 in./Hg).
TANK OPERATING TEMPERATURE: One hundred twenty-five degrees Fahrenheit (125° F) maximum.
INTENDED AREA OF OPERATION: State of Alaska.
INTENDED USE: Gravel roads.

PASSIVATION:
None. (Available as option upon request and may be recommended for the product specified herein)

TRACTOR

TRACTOR:
Customer supplied.



A= BACK OF CAB TO TRUNION
B= FIFTH WHEEL SLIDE LENGTH
C= FIFTH WHEEL OFFSET
D= WHEELBASE
E= FIFTH WHEEL HEIGHT

FRONT AXLE WT. LBS F TANDEM AXLE WT. LBS G
(Note: weights are based on tractor full of fuel and with driver.)

A=____ D=____ G=____
B=____ E=____
C=____ F=____

Quote for
DILLINGHAM, ALASKA

(Customer to supply chassis info. at time of order.)

If information is not supplied at time of order, West-Mark will use its standard typical setup. Any information supplied after engineering package has been released to production, that requires set-up changes, will be done at additional charge to customer.

TANK / MANHOLES / VENTING

BARREL:
5000 Gallons round, straight barrel, with slope to rear. The barrel shall be made from 12 gauge T-304 stainless steel, 2B finish material.

Capacity does not include head outage.

HEADS: Two (2) each stainless steel, T-304 2B, 12 gauge, West-Mark air-dished and flanged.
HEAD FINISH: No polishing on interior or exterior of heads.

HEAD FINISH: No polishing on interior or exterior of heads.
BAFFLES: None. (Available as option upon request)
RINGS: Stainless steel channel sections, fully welded to shell.

WINGS AND BOLSTERS: Shall be made of stainless steel.

SIDE FILLERS: Stainless steel with coupler plate adjustment rails.

WELD FINISH:
INTERIOR: Weld finish to be W-2 inside. All Longitudinal seams to be W-3.
EXTERIOR: Weld finish to be W-2 outside.

MANHOLE:
One (1) each, 20", T-316 stainless steel with a single lug, EPDM gasket and a hinge stop for keeping the lid off the shell when open. Located:_____ Hinged:_____

CLEANOUT(S):
None. (Available as option upon request)

VENTING:
One (1) Each NAFCO 2" filter (or equal) with stainless steel element, installed over a RUNO pagoda with a stainless steel sleeve, on a 3" stainless steel Camlock and cap. Located in top of tank, forward of manhole.

INSULATION:
2” Styrene insulation installed with fiberglass at heads. Ring tape installed on all rings.

JACKET:
Stainless steel jacket (belly wrapped) installed with lock seamed stainless steel jacket heads

HEAT:
Heat trace package installed to cover plumbing package. Connection for package located at front of trailer.

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DILLINGHAM, ALASKA

C.I.P.:
None. (Available as option upon request)

LIQUID LEVEL GAUGE:
None. (Available as option upon request)

LADDERS / WALKWAYS / SPILLDAMS

SPILLDAM:
One (1) Each non-insulated, stainless steel box style, with drain hoses each side.

LADDER:
One (1) aluminum tubular, multi-purpose ladder assembly, with West-Mark heavy duty slip resistant steps located at curbside of unit. Step will be between 18” and 22” from the ground. No grab rails installed (available as option upon request).

SPILLDAM WALKWAY:
12" Wide aluminum non-slip platform walkway, full length of spilldam; located between ladder and spilldam.

LIGHTS AND WIRING

ELECTRICAL SYSTEM:
System shall be 12-volt, 7-way, and vapor proof. All lamps to be L.E.D. type and locations shall meet all D.O.T. requirements.

STOP/ TAIL/ TURN: Four (4) each model 44 type in 2-hole, stainless steel boxes; 2 red each side.
CENTER ID: One (1) each Truck-Lite model 15 stainless steel I.D. shall be mounted at rear per D.O.T.
MID TURN/ MARKER: One (1) each amber model 60 oval turn/ marker light shall be mounted @ center of unit (approx.) each side if required by D.O.T.
FRONT MARKERS: One (1) each amber model 30 light shall be mounted to the front corner of the trailer at 45° on each side of unit.
REAR MARKERS: One (1) each red model 30 marker lamp located at end of each light box.

SECURITY RINGS / MOUNT COVERS: None. (Available as option upon request)

REFLECTORS:
To be mounted per D.O.T. specifications.

CONSPICUITY STRIPING:
To be installed at sides and rear per D.O.T. specifications.

FRONT RECEPTICAL:
Truck-Lite 7-way nosebox (model #50806) with 15 amp circuit breakers and front access to cable hookup, mounted on a stainless steel bracket between glad hands.

PLUMBING

REAR OUTLET:
3" Stainless steel split pipe out rear head.

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OUTLET PLUMBING:
Plumb from sump to a 3” butterfly valve with stainless steel disc and stem and lever lock handle.

Plumbing to end in 3" stainless steel male camlock adapter and lockable brass cap with chain.

APRON:
Stainless steel splash pan to be installed under valve at rear of trailer.

TOP FILL:
None. (Available as option upon request)

PUMP PACKAGE:
One (1) Each Thomsen # 8 stainless steel 3" x 2" pump with 11hp diesel engine with electric start. Install meter (for resale) and hose reel (1” x 50’) for potable water service.

UNDERCARRIAGE

APRON:
Stainless steel splash pan to be installed under valve at rear of trailer.

KICK PLATE:
To be installed at front of unit and to be of stainless steel construction.

KING PIN PLATE:
Adjustable upper coupler, mild steel.
48" Ride height, unless noted otherwise in tractor spec's above.
King Pin to be located: _____

WEAR PAD:
None. (Available as option upon request)

LANDING GEAR FRAME:
Frame to be stainless steel construction.

LANDING LEG SUPPORTS:
Stainless steel pipe style from legs up to crossmember and to rear of subframe with lower leg supports for aluminum landing legs.

LANDING GEAR:
JOST Aluminum square leg, 2-speed, steel sand shoes, 55,000 lb. lift capacity.
Crank located on curbside.

REAR SUBFRAME:
Stainless steel construction for a tandem axle suspension.

SUSPENSION:
Two (2) HENDRICKSON TURNER INTRAAX AANT 23K air ride integration system
17" ride height, weld-on wing style hangers, front shock absorbers

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DILLINGHAM, ALASKA

AXLES:
Two (2) 23K, 5-3/4" round 71-1/2" track
10 stud on 11.25" centers ConMet Preset aluminum hubs with HUB piloted mounting
HP spindles (same inner and outer bearings)
Chevron Delo semi fluid grease

BRAKES:
16-1/2" X 7", 28 spline S-Cam, balanced fused drums
16.5" x 7" HXS Abex 3030-197 non-asbestos brake lining
Hendrickson's standard chambers and automatic slacks
Tone rings for ABS system.

DUST SHIELDS:
None. (Available as option upon request)

WHEELS:
OUTER: Four (4) Each Alcoa 22.5 x 8.25 Aluminum machine finish, 10-hole, 11-1/4" bolt circle, hub piloted.
INNER: Four (4) Each Alcoa 22.5 x 8.25 Aluminum machine finish, 10-hole, 11-1/4" bolt circle, hub piloted.

TIRES:
Eight (8) Each 295/75R 22.5 CONTINENTAL HT3.

HEIGHT CONTROL (SUSPENSION SPECIFIC):
One (1) Each height control valve.

DUMP VALVE:
Manual dump valve to be installed.

TIRE INFLATION SYSTEM:
One (1) each Hendrickson Turner TIREMAAX PRO tire inflation system. System provides constant pressure with active inflation, deflation and equalization. Control box located at front of rear subframe.

BUMPER:
Stainless steel non-code, 3" x 2" x 66" long.
(If underidement bumper is required, this item may be eliminated.)

BRAKE SYSTEM:
To be built to D.O.T. specifications, WABCO 4S/2M ABS with ROLL STABILITY system and Aluminum air tank(s). ABS malfunction/ operation light located on front fender bracket of roadside rear fender, facing forward, per D.O.T.

HOSE TRAYS:
Two (2) Stainless steel hose trays installed to support 100' of food grade hose. Trays to include cover to protect hoses.

HOSE:
Ten (10) lengths of 2" x 10' potable water hose with stainless steel fittings (potable service). Hose to be stored in the hose trays.

Quote for
DILLINGHAM, ALASKA

FRONT FENDERS:
Aluminum contour, ribs down.
Stainless steel fender pipe mounting
Mudflaps at rear of front fenders to be WHITE, poly, anti-spray type.

REAR FENDERS:
Aluminum contour, ribs down.
Stainless steel fender pipe mounting
Mudflaps at rear of unit to be WHITE, poly, anti-spray type. Mudflap mounting to meet SAEJ682 standard.

MISC. ITEMS

TRANSPORT SECURITY SYSTEM:
Lugs for padlock/seal tab security system at all openings.

CERTIFICATE HOLDER:
Betts PS-1 (#820012) document holder with spring.
Mounted on landing leg subframe (roadside).

PAINT:
None. (Available as option upon request)

DECALS:
The following decals shall be installed on each side of Water Tank:

4" Decals to read: "POTABLE WATER".

MANUALS:
One (1) each operation and maintenance manual(s) on CD-ROM shall be supplied and shipped with unit; complete with the following:

- Operator & maintenance manual
- Calibration chart (if applicable)
- Equipment parts list
- Misc. vendor literature / manuals

CALIBRATION:
Theoretical, in 1/4" increments, complete with charts.

CERTIFIED TANK WASH:
None. West-Mark does not supply a certified wash to unit before initial customer use.

WARRANTY:
Unit shall be guaranteed to be free from defects in material and workmanship, while under normal use and service by the original purchaser, for a period of ONE (1) year from the date unit is delivered.

WEST MARK

NO:

P.O. BOX 100

PHONE: (209) 537-4747

QUOTATION: ☒

CERES, CA 95307

TOLL FREE: (800) 692-5844

ORDER ☐

www.west-mark.com

FAX: (209) 692-5844

TO: SHANNON & WILSON
ATTN: MARCY & AMBER

DATE: 10-01-20

F.O.B.	TERMS:	EST SHIPPING DATE
TACOMA, WA	20% DEP, NET ON COMP	TBD

QTY	DESCRIPTION	PRICE	AMOUNT
1	2021 WEST-MARK 2,000 GALLON, STAINILESS STEEL TANDEM AXLE SEMI PER ATTACHED SPECIFICATIONS.		$91,500.00
1	2021 WEST-MARK 5,000 GALLON, STAINLESS STEEL TANDEM AXLE SEMI PER ATTACHED SPECIFICATIONS. FET IS NOT INCLUDED (IF APPLICABLE) BUDGET PRICING ONLY.		$94,900.00
		TOTAL:	

Due to continued volatility of raw materials and vendor supplied parts, all units are subject to price increases. Prices include 12% FET (if applicable). Local fees and sales taxes are not included. Customer agrees to authorize credit verification.

SALESMAN:	Scott Vincent	ACCEPTED BY:	
APPROVED BY:	Scott Vincent	DATE ACCEPTED:	

GENERAL TERMS AND CONDITIONS OF SALE

1. **ACCEPTANCE AND FULFILLMENT OF ORDERS** All orders are subject to acceptance in writing by Seller at its home office, and no local agent or employee is authorized to contractually bind Seller. The acceptance and fulfillment of orders and agreements by Seller are contingent upon and subject to accidents, breakdowns, strikes, sabotage, riots, insurrection, war, delays, interruptions in or failure of sources to supply materials and equipment, labor transportation, acts of God, or other cause and conditions, whether of like or different nature, affecting Seller, and to orders, contracts, priorities, directives, requisitions or assumed and Seller shall not be liable for loss, damage, delay or failure of delivery resulting from such causes.
2. **PRICE** Because of the relatively long delivery time and the resultant uncertainties in Seller's costs, Seller and Buyer after that the price to be paid by Buyer for the equipment described on the front side hereof (hereinafter referred to as the "Equipment") shall be that contained in or delivered from the Seller's price list in effect 30 days prior to delivery of the Equipment. If there is no such price list then covering the Equipment, the price may be adjusted for cost increases experienced by Seller, which may increase the total price from that stated on the front hereof. The price is also subject to adjustment by Seller for any change made by Buyer and approved by Seller in any of the specifications or other terms of this contract.
3. **TAXES, FEES AND CHARGES** The price is F.O.B. Seller's plant and includes federal excise tax, but does not include any other manufacturers, sales, use or other excise taxes, charges or duties, and the amount of any thereof which Seller is required to pay or collect will be invoiced to Buyer. Buyer shall pay all such taxes, charges and duties arising by reason of this contract and all other taxes, charges and duties of whatever nature assessed upon the Equipment. The amount, if any, shown on the front of this contract for freight shall also be adjusted to reflect any change in freight rates. Buyer shall also pay any collection fees and reasonable attorney's fees incurred by Seller in collecting payment of the purchase price and another amounts for which Buyer is liable under the terms and conditions hereof.
4. **PAYMENT** Payment terms are as specified on the front hereof.
5. **DELIVERY** The delivery date specified on the front hereof is approximate and Seller may ship or deliver Equipment before or after the specified date.
6. **SHIPMENT; RISK OF LOSS; TITLE** Unless otherwise specified by Buyer, Seller shall place the Equipment in the possession of such a carrier of Seller's choice and make such a contract for its transportation as may be reasonable, having regard for the nature of the Equipment and good commercial standards. Buyer shall bear all expenses paid or incurred by Seller in delivering the Equipment. Risk of loss of the Equipment shall pass to Buyer at the time it is tendered for shipment. Title to the Equipment shall remain with Seller until payment is received by Seller.
7. **WARRANTY, DISCLAIMERS AND LIMITATION OF LIABILITY** (A) Seller warrants the Equipment manufactured by it to be free from defects in material and workmanship under normal use and service and to be in compliance with the pertinent provisions of the ASME Boiler and Pressure Vessel Code, if applicable. For a period of six months from date of delivery (12) months in the case of an inner tank only), Seller shall correct by repair or replacement any defect in material or workmanship in any part of a product manufactured by it subject to the following conditions: (a) Written notice of any such claimed defect must be given to Seller during the warranty period; (b) Seller shall have the right to inspect the claimed defective Equipment at such time and place as it reasonably requests; (c) The Equipment must be delivered for repair within 15 days after Seller notifies Buyer of the repair procedure, but shall not be returned before such notification is given; (d) Unauthorized repairs shall void this warranty; (e) This warranty does not apply to parts requiring replacement because of natural wear and tear, or to products, accessories, parts or attachments which were not manufactured by Seller…Seller receives warranties on certain components purchased by it and its obligation with respect to such components shall be limited to the extent of the warranties, if any, given and honored by its suppliers; (f) This warranty shall not apply if parts and/or labor are required due to accident, abuse or improper or neglected maintenance, and applies only to the original purchaser from Seller; (g) When alterations are made or parts or attachments are installed by Buyer or for him by others, this warranty shall be void and Seller shall not be responsible for such alterations or installations, or for the operation of the Equipment thereafter; (h) This warranty shall be void when tanks are subjected to weight loads or pressures, or are used to contain, or are cleaned with, materials having corrosive temperature or other characteristics for which the tank was not designed; (i) Seller shall not be obligated to furnish "loaners" or any compensation for rented, loaned or borrowed equipment while repair is being made under this warranty; (j) All repairs under this warranty shall be made at Seller's plant in Ceres, California, or at such other place designated by Seller, and Buyer must bear the risk and expense of transporting the Equipment to Seller's plant or such other designated place. (B) The description of the front hereof does not create any warranty, express or implied. Seller may substitute without notice any comparable component in the Equipment, and Equipment with such substituted components shall be considered in conformance with Seller's obligations under this contract. (C) THE FOREGOING WARRANTY IS IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARANTY OR MERCHANTIBILITY OR FITNESS FOR A PARTICULAR PURPOSE, AND IS IN LIEU OF ANY AND ALL OTHER OBLIGATIONS OR LIABILITY ON SELLER'S PART. Under no circumstances will Seller be liable for any incidental or consequent damages, or for any other loss, damage or expense of any kind, including, but not limited to, personal injury, labor costs or loss of profits, arising in connection with this contract or with the use of or inability to use the Equipment sold hereunder. Seller's maximum liability shall not exceed, and Buyer's remedy is limited to, correction, by repair or replacement, of defects to which the foregoing warranty applies.
8. **PATENT INDEMNITY** (A) In the event the Equipment furnished hereunder is claimed to infringe any United States patent issued at the time of delivery, Seller agrees, at its option; (1) to procure for Buyer the right to use the Equipment, or (2) to modify or replace the Equipment so as to avoid infringement, or (3) to accept redelivery of the Equipment and reimburse Buyer for the purchase price and any reasonable transportation expenses incurred by Buyer. Should any litigation be instituted against Buyer based on a claim that the Equipment in the condition received from Seller infringes any such United States patent, Seller will undertake the defense thereof on Buyer's behalf and pay any damages and costs awarded therein against Buyer, provided Seller is given written notice and is furnished with copies of all demands, process and pleadings; and provided Buyer cooperates fully in giving Seller authority, information and assistance at Seller's expense for such defense, as well as control over the defense and any negotiations with regard to settlement. (B) THE FOREGOING REPRESENTS SELLER'S ENTIRE AND EXCLUSIVE OBLIGATION WITH RESPECT TO ANY CHARGE OR PATENT INFRINGEMENT AND IS IN LIEU OF ANY STATUTORY WARRANTY RELATING TO INFRINGEMENT. SELLER SHALL HAVE NO RESPONSIBILITY INSOFAR AS THE EQUIPMENT IS MODIFIED BY BUYER OR IS MADE OR MODIFIED BY SELLER IN ACCORDANCE WITH BUYER'S ORDER, AND BUYER SHALL WHOLLY INDEMNIFY SELLER FOR ALL DAMAGES, COSTS OR EXPENSES,
INCLUDING ATTORNEYS FEES, PAID OR INCURRED BY SELLER IN CONNECTION WITH ANY CLAIM OF INFRINGEMENT OF A PATENT, COPYRIGHT OR TRADEMARK, TRADE SECRET OR OTHER PROPRIETARY RIGHT, WHICH ARISES OUT OF SELLER'S COMPLIANCE WITH BUYER'S SPECIFICATIONS OR ANY MODIFICATION BY BUYER. SELLER SHALL ALSO HVE NO RESPONSIBILITY WITH REGARD TO ANY SETTLEMENT, ADMISSION OR PROMISE MADE BY BUYER WITHOUT SELLER'S PRIOR WRITTEN CONSENT, NOR SHALL SELLER BE LIABLE FOR ANY INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES OF ANY NATURE WHATSOEVER, INCLUDING LOSS PROFITS CLAIMED TO HAVE BEEN SUSTAINED BY BUYER OR ANY USER OF THE EQUIPMENT ARISING OUT OF ANY CLAIM OR INFRINGEMENT. (C) Seller may be entitled to indemnity from certain of its suppliers, and the rights and options vested in Seller shall extend to such suppliers and may be exercised by them.
9. **TRADEMARKS** Buyer warrants that any trademark Buyer requests Seller to affix to the Equipment is owned or authorized for use by Buyer.
10. **CANCELLATION, MODIFICATION, SUSPENSION** Cancellation, modification, suspension or delay in shipment of Buyer's order will not be accepted on terms which will not fully indemnify and reimburse Seller against loss; such indemnity to include recovery of all direct costs incurred, normal indirect and overhead charges, and a normal profit. No change proposed by Buyer in any specifications, terms or conditions shall be valid or binding upon Seller unless approved in writing by Seller's chief executive officer or general sales manager.
11. **CONTRARY TERMS; ENTIRE AGREEMENT** Buyer's order is accepted only on the terms and conditions herein, and the provisions of any purchase order or other writing inconsistent are herewith rejected and shall not constitute a part of the contract of sale. If any of the terms and conditions hereof are not acceptable to Buyer, Seller must be notified promptly. This writing is intended by the parties to be a final expression of their agreement and is intended also as a complete and exclusive statement of the terms and conditions thereof.
12. **NOTICE** Any notice shall be considered given when deposited in the United States mail, postage prepaid, addressed to the other arty at the addresses given herein.
13. **WAIVER** No claim or right arising out of a breach of this agreement can be discharged in whole or part by a waiver or renunciation of the claim or right unless the waiver or renunciation is supported by consideration and is in writing signed by the aggrieved party.
14. **SETOFF** Seller may set off any amount due from Buyer hereunder against any amount, which may be due to Buyer whether or not under this agreement.
15. **ASSIGNMENT** Buyer shall not assign its rights under this agreement or any interest therein without Seller's prior written consent.
16. **CONTROLLING LAW** This transaction shall be governed by, and this agreement shall be construed and enforced in accordance with the internal laws of the State of California. If any provision, clause or part, or the application thereof under certain circumstances is held invalid, the remainder of this agreement or the application of such provision, clause or part under other circumstances shall not be affected thereby.
17. **SECURITY INTEREST** If financing is involved or under other circumstances if Seller so chooses, Buyer agrees to execute such further documents as Seller requests to reflect Buyer's obligation to pay the deferred portion of the price and perfect a security interest in the Equipment and/or other collateral as security for payment thereof. The Equipment shall at all times be considered personal property and shall not be deemed a fixture or a part of or an appurtenance to building, real estate or vehicle, even though attached thereto. Damage to or loss or destruction of the Equipment shall not release Buyer from its payment obligation.
18. **TRADE-IN** If a trade-in is involved, Buyer shall be responsible for maintaining the equipment to be traded in the same condition as when inspected by Seller in determining the trade-in allowance. The trade-in allowance shall be adjusted, or eliminated, for any subsequent change in condition of the equipment to be traded.

GREER TANKS POLETHYLENE TANK BROCHURE

APPENDIX C: WATER STORAGE TANK SUPPORTING INFORMATION

ATV Trailer
$1,316

Top width	40-1/2″
Bottom width	31″
Top length	65 1/2″
Bottom length	55″
Height	22″
Total length	94″
Total weight	180 lbs
Tire size	22x11-8
Rating per tire	247 lbs

Lid can hold 50 lbs and should be included in the 247 lbs rating per tire.

Inside wheel width	24″
Outside wheel width	43″

Not to be used as a floatation device such as a boat or raft.
Water resistant but not water proof.

Polyethylene Products

Made in Alaska
by Alaskans
for Alaskans

MADE IN ALASKA

www.greertank.com

GREER

Steel ▪ Tanks ▪ Welding ▪ Waterjet Cutting

907-243-2455 www.greertank.com

Pricing Current As Of 4/01/20

Prices Subject to Change

2921 W Int'l Airport Rd,
Anchorage, AK 99502

907-243-2455
800-770-8265

Underground Water Tanks

10' Maximum Burial Depth

Capacity	Length	Width	Height	Weight	Price
1000	102"	78"	59"	480 lbs	$1,734
1250	102"	78"	68"	540 lbs	$2,234
1500	102"	78"	77"	580 lbs	$2,699

Septic Tanks

10' Maximum Burial Depth

Capacity	Length	Width	Height	Weight	Price
1000	102"	78"	59"	510 lbs	$2,107
1250	102"	78"	68"	590 lbs	$2,341
1500	102"	78"	77"	670 lbs	$2,784

Aboveground Water Tanks

Rectangular

105 gallon tank has 1 1/2" Bulkhead Fitting & 4" Manway
150 & 200 gallon tanks have 1 1/2" Bulkhead Fitting & 8" Manway

Capacity	Length	Width	Height	Weight	Price
105	24"	24"	48"	44 lbs	$366
150	48"	36"	26"	60 lbs	$382
200	48"	40"	30"	72 lbs	$415

Pickup Bed Water Tank

1 1/2" Bulkhead Fitting & 8" Manway w/ vent

Capacity	Diameter	Height	Weight	Price
325	62"	34"	84 lbs	$547

Aboveground Water Tanks

Vertical Cylindrical

1 1/2" Bulkhead Fitting & 16" Manway w/ vent
2500 has 2" Bulkhead Fitting & 16" Manway w/ vent

Capacity	Diameter	Height	Weight	Price
200	31"	67"	58 lbs	$427
300	36"	77"	80 lbs	$520
500	62"	45"	120 lbs	$750
500	48"	78"	125 lbs	$780
1000	63"	79"	180 lbs	$1,540
1550	87"	65"	235 lbs	$1,910
2500	95"	89"	400 lbs	$2,420

Water Wagon

1 1/2" & 2" Bulkhead Fittings & 4" Manway w/ vent

Capacity	Length	Width	Height	Weight	Price
200	48"	36"	30"	85 lbs	$496
300	52"	48"	30"	110 lbs	$623
400	68"	48"	30"	135 lbs	$709
450	84"	48"	30"	160 lbs	$835
1000	125"	64"	34"	400 lbs	$2170

ALASKA MARINE LINES SHIPPING QUOTE

APPENDIX C: WATER STORAGE TANK SUPPORTING INFORMATION

Date: 04/24/2020

Quote W200424058-01

Requested by:	Phone:	Origin:	Destination:
Marcy Nadel	(907) 458-3150	Anchorage, AK	Dillingham, AK
Company:	**Fax/Email:**	**Ship date:**	**Bid Date:**
Shannon & Wilson, Inc	mdn@shanwil.com		
Address:	**Prepared by:**	**Preparer phone:**	**Preparer email:**
2355 Hill Road	Courtney Atkinson	206-892-2641	courtney@Lynden.com
City, state, zip:	**Description:**		
Fairbanks, AK	Water Tanks		

					Ship date:							
Origin: Anchorage, AK		**POL: ANCHORAGE**	**POD: DILLINGHAM**		**Destination: Dillingham, AK**				**Dock to Dock**			
Qty	**Item No.**	**Pkg. Type**	**Description**		**Length**	**Width**	**Height**	**Weight**	**Min Qty**	**Rated As**	**Rate**	**Basis**	**Estimate**	**Ttl. Weight**
1	1690-000	EACH	LCL - Water Tanks (1,500 gallon capacity)		7' 11"	7' 11"	7' 5"	400	1	464.83	$7.42	CFT	$3,449.04	400
1	1690-000	EACH	LCL - Water Tanks (2,500 gallon capacity)		8' 6"	6' 6"	6' 5"	580	1	354.52	$5.29	CFT	$1,875.41	580
1	1690-000	EACH	LCL - Water Tanks (5,025 gallon capacity)		17' 7"	8' 6"	6' 1"	1,900	1	909.20	$4.85	CFT	$4,409.62	1,900
Fuel Surcharge: Rates are subject to Carrier's applicable fuel surcharge in effect at the time of shipment.														
					SFT: 267.38 / CFT: 1728.55					SUBTOTAL:			$9,734.07	2,880
					SFT: 267.38 / CFT: 1728.55						**TOTAL ESTIMATE:**		**$9,734.07**	**2,880**

Carrier's liability shall be limited as outlined in Alaska Marine Lines's STB AKMR RULES TARIFF 100 (available online at www.lynden.com); cargo valued at $75,000 or greater will be assessed an additional charge of 2% of the total value as declared on the bill of lading.

CREDIT: Until you have been approved for credit with Alaska Marine Lines, you will be required to pay your freight charges in full before release of your cargo at the destination port.

For the hub ports of Dutch Harbor, Naknek, Dillingham, Bethel, Nome, and Kotzebue, Alaska Marine Lines' equipment must be made available at the dock by 30 calendar days (including weekends and holidays) following initial delivery or prior to our next barge arrival. Alaska Marine Lines equipment destined for Western Alaska villages must be made available at the traditional barge landing by 45 days (including weekends and holidays) following initial delivery. If the equipment is not available, the Bill-to Party will be responsible for demurrage charges of $6.00 per day for 20' equipment and $9.00 per day for 40' equipment which will accrue until the equipment is picked up by the Carrier on the next subsequent arrival.

Rates herein are valid for 30 days from the date shown above.

Cargo is transported on open deck barge. Shipper is responsible to sufficiently pack or prepare goods to withstand the normal rigors of barge transportation. Please visit our website for packaging instructions, available at http://www.lynden.com/aml/tools/tariffs-and-forms.html.

FOR SHIPMENTS FROM ANCHORAGE TO WESTERN ALASKA: Please deliver cargo to 660 Western Drive, Anchorage, AK 99501. Toll-Free: 1-800-426-3113

All services are subject to the standard terms and conditions of our Surface Transportation Board tariff (available at http://www.lynden.com/terms-conditions.html) and the bill of lading published therein. Any bill of lading or other shipping document issued shall not be effective to the extent it conflicts with our terms and conditions. By shipping with Alaska Marine Lines, you are acknowledging acceptance of our terms and conditions.

Please make a Booking with Customer Service and reference quote number to ensure proper rating.

Estimate is based on current rates. Actual freight charges shall be subject to increases and surcharges in effect at the time of shipment.

Rates and charges stated herein are estimates based on the shipment specifications provided, including, but not limited to, cargo description, dimensions, and weight, as well as requested origin and destination points, and shall not be construed as a tariff. Freight charges shall be assessed based on the actual weight, dimensions and services provided as verified when cargo is received.

Consolidation charges are applied as a flat charge per 20' container ($285.00) or 20' platform ($415.00), which includes consolidation and physical transfer of the cargo from Shipper's vehicle, plus an additional per bill of lading charge of $21 for non-hazardous cargo or $62 for hazardous cargo; charges are not subject to fuel surcharge.

Carrier's liability under the Extended Liability program shall be subject to a maximum limitation of $75,000 per Package (as that term is defined in section 2 of Carrier's bill of lading) or, for Goods not deemed a Package, $75,000 for all Goods identified on any single bill of lading issued by Carrier. The charge for any excess valuation declaration shall be two percent (2%) of the value so declared and inserted in the bill of lading.

IMPORTANT INFORMATION

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 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

IMPORTANT INFORMATION

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.

IMPORTANT INFORMATION

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

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