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MEMORANDUM

To:	James Fish—Environmental Program Specialist, Alaska Department of Environmental Conservation
From:	Integral Consulting Inc.
Date:	Revised July 28, 2022
Subject:	Work Plan Technical Memorandum Addendum, Rev. 1—Groundwater, Williams Alaska Petroleum, Inc., Former North Pole Refinery, North Pole, Alaska
Project No.:	CF2052

On behalf of Williams Alaska Petroleum, Inc. (Williams), Integral Consulting Inc. (Integral) has prepared this Work Plan Technical Addendum in response to feedback from the Alaska Department of Environmental Conservation (ADEC) on the Site Characterization Report—Groundwater (Integral 2021) at the former Flint Hills Resources Alaska North Pole Refinery (Site; Figure 1). This addendum addresses comments and questions presented in the October 22, 2021, correspondence from ADEC to Williams and outlines additional site investigation activities proposed at the Site.

SOIL CHARACTERIZATION

To further characterize the extent of per- and polyfluoroalkyl substances (PFAS) onsite, a series of soil borings will be completed in areas of the facility where the 2020 groundwater investigation results identified elevated perfluorooctanoic acid and perfluorooctane sulfonic acid (PFOA and PFOS) concentrations in groundwater[1], as well as areas that

[1] Williams notes that the injunctive relief portion of the trial court's Judgment in the State's case against Williams is limited to PFOS and PFOA (the only "PFAS" substances at issue in the Judgment) and that this portion of the trial court's Judgment is on appeal to the Alaska Supreme Court. However, in an effort to work cooperatively with ADEC, Williams has agreed to sample, analyze for and report on the levels of 18 PFAS constituents as set forth in the September 24, 2020 Technical Memorandum and subsequent communications with ADEC. Williams does not admit liability to the State of Alaska, Flint Hills, or any other entity, nor does it waive any claims it may have against Flint Hills or any other entity regarding PFAS constituents on the North

correspond to use, incident (fire), and/or storage of aqueous film forming foam (AFFF). The areas generally correspond as follows:

- Former Crude Unit #2/Sulfolane Extraction Unit (fire, AFFF hose reel, storage of AFFF, and sumps): seven soil borings, including one downgradient boring location between the Sulfolane Unit and the firehouse
- Lagoons B and C (discharge from sumps): eight soil borings
- Former fire training area (AFFF): two soil borings
- Crude Unit #3 (AFFF storage, sumps): five soil borings
- Former truck and railcar loading areas (sumps, likely AFFF storage): four soil borings
- Former Firehouse (AFFF storage): four soil borings
- Containment Areas 2 and 5 (unknown source): four soil borings upgradient of monitoring wells O-18, O-34, MW-345-15, and O-10
- Maintenance Building (AFFF storage): five soil borings, including one downgradient boring location near Crude Unit #1.

Soil borings (Figure 2) will target the soil above the Water Table Zone, the groundwater interval containing the highest PFOA and PFOS concentrations.[2] All soil boring locations will be recorded in the field using a handheld global positioning system unit with sub-meter accuracy. Direct-push (Geoprobe® or equivalent) or hollow-stem auger drilling technologies will be used to advance soil borings to a depth of approximately 10–20 ft below ground surface or until the Water Table Zone is encountered. Where possible, direct-push drilling technology will be utilized to minimize the quantity of investigation-derived waste generated during field activities. A hollow-stem auger drill rig will be used to install borings in locations where direct-push cannot penetrate to the desired depth. All drilling locations will be cleared of buried utilities prior to drilling using ground penetrating radar and/or hand-clearing techniques in accordance with facility requirements at the Site.

A minimum of three soil samples will be collected from each boring in accordance with the 2022 *Field Sampling Guidance* (ADEC 2022) and modified to reduce/eliminate the potential for field-induced cross-contamination. One soil sample will be collected from

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Pole Refinery property or found beyond the property by cooperatively working with ADEC to sample for and report on PFAS constituents other than PFOS and PFOA.

[2] Locations may be adjusted based on access requirements from the current property owner Marathon Inc.

the surface (0–6 in. interval) to assess for surface discharges and/or surface runoff, one from the 6-in. interval corresponding to the midpoint of the soil boring, and one from the 6-in. interval above the seasonal water table observed at the time of sampling to determine whether PFOA and PFOS in the soil may be a source of groundwater contamination. Additional samples may be collected, as necessary, based on changes in lithology and other field observations to support horizontal and vertical delineation of PFOA and PFOS detected in soil.

Temporary well points will be installed at 10 select soil borings (Figure 2) in accordance with the *Monitoring Well Guidance* (ADEC 2013). One groundwater sample will be collected from each temporary well point in accordance with the 2022 *Field Sampling Guidance* (ADEC 2022), *ASTM D6001-05 - Standard Guide for Direct-Push Water Sampling for Geoenvironmental Investigations* (ASTM 2005), and the Interstate Technology and Regulatory Council Fact Sheet—*Site Characterization Considerations Sampling Precautions and Laboratory Analytical Methods for PFAS* (ITRC 2020). Temporary well installation and sampling methods will be modified, as necessary, to eliminate/reduce the potential for cross-contamination.

Soil and groundwater samples will be collected and shipped with completed chain-of-custody documentation to an ADEC-certified analytical testing laboratory. The samples will be submitted for analysis using U.S. Environmental Protection Agency (EPA) Method 537M by ID. In addition to PFAS analysis, soil samples may be selected for analysis of total organic carbon and/or grain size and potentially the synthetic precipitation leaching procedure (SPLP) to assess the potential for PFOA and PFOS to migrate to groundwater.

Sampling and reporting will follow the attached ADEC guidance *Minimum Quality Assurance Requirements for Sample Handling, Reports and Laboratory Data* (ADEC 2019; Attachment A). Field quality control samples will be collected at a minimum of 1 field duplicate per every 10 samples and 1 field equipment blank per sampling team/equipment per day per the ADEC guidance document referenced above.

Following completion of sampling activities, the excess soil will be returned to the borehole. Pending approval from the property owner, any residual soil that cannot be returned to the borehole will be spread on the surface adjacent to the boring. If the property owner does not permit the soil to remain onsite, excess soil cuttings will be containerized for characterization and proper disposal. Prior to transport or treatment, the Contaminated Media Transport and Treatment or Disposal Approval Form will be prepared and submitted to ADEC for approval.

ADDITIONAL GROUNDWATER PFOA AND PFOS EVALUATION

As described in Section 8 of the Site Characterization Report (Integral 2021), two monitoring wells are proposed to be installed south of MW-361-15, adjacent to the property boundary in the southeastern corner of the property, to complete horizontal delineation or identify potential source(s) of the impacts to groundwater (Figure 3). Soil samples will be collected from borings at the new monitoring wells, in the same manner described above.

In accordance with ADEC's October 2021 correspondence, groundwater samples will also be collected from monitoring wells MW-348-15, MW-337-20, MW-138-20, O-20, O-21, MW-116-15, O-1, and MW-179A-15. In accordance with ADEC's May 2022 correspondence, groundwater samples will also be collected from monitoring wells MW-359-35, MW-359-80, MW-358-20, MW-358-60, MW-360-35, and MW-364-30 to estimate the lineal extent of PFOS + PFOA groundwater concentrations at the property boundary.

Groundwater samples will be collected no sooner than 2 weeks from completion of new well development in accordance with the 2022 *Field Sampling Guidance* (ADEC 2022), modified as necessary to eliminate/reduce the potential for cross-contamination. Prior to sampling, water level measurements will be collected from each of the wells using an electronic water level sounder and measured from the top of the well casing. Groundwater samples will be collected using methods included in the ITRC (2020) Fact Sheet. Samples will be analyzed by an ADEC-certified analytical laboratory using EPA Method 537M by ID (Certified by SOP MS014). Sampling will also follow the attached ADEC guidance *Minimum Quality Assurance Requirements for Sample Handling, Reports and Laboratory Data* (ADEC 2019). Quality assurance and quality control (QA/QC) protocols for water sample collection will include 1 field duplicate per every 10 samples and 1 field equipment blank per sampling team/equipment per day (ADEC 2019).

All monitoring well development and purge water will be containerized and disposed of using methods consistent with the 2020 field investigation. Prior to transport or treatment, the Contaminated Media Transport and Treatment or Disposal Approval Form will be prepared and submitted for approval to ADEC. It is anticipated that the NRC/US-Ecology Viking Road Facility will be the final receiving location. Soil cuttings generated as part of well installation activities are anticipated to be free of contamination because no known release to the surface has occurred in this area, and pending approval from the property owner, the cuttings will be spread on the surface adjacent to the boring.

NORTH AND SOUTH GRAVEL PIT CHARACTERIZATION

Surface water samples will be collected from six locations in the North Gravel Pit and two locations from the South Gravel Pit. The samples will be collected from the surface of each pond, from mid-depth and from the interval directly above the base of the pond at each sampling location (18 total surface water samples from the North Gravel Pit and 6 total samples from the South Gravel Pit). The depth samples will be collected to assess present-condition groundwater discharge to the ponds. Surface water sampling will be conducted in accordance with ADEC's *Field Sampling Guidance* (ADEC 2022), ensuring that protocols are incorporated to reduce/eliminate the potential for cross-contamination. Surficial simple grab samples with be collected from the air-water interface or top 0–6 in. at each sampling location. Mid-depth and near-bottom depth integrated samples will be collected using weighted sample bottles and Van Dorn or Kemmerer samplers. Samples will be transferred to the appropriate bottleware, preserved, and shipped to an ADEC-certified analytical laboratory for analysis via EPA Method 537M by ID (Certified by SOP MS014). Field parameters will be collected at each location, including temperature. In addition, up to 12 measurements will be collected to determine the depth of each of the ponds.

In addition to surface water, sediment samples will be collected from each of the eight surface water sample locations. Sediment grab samples will be conducted in accordance with ADEC's *Field Sampling Guidance* (ADEC 2022), ensuring that protocols are incorporated into sampling to reduce/eliminate the potential for cross-contamination. Briefly, an HDPE or stainless-steel sediment grab sampler will be used to collect a sufficient volume of surficial sediments at each co-located surface water/sediment sampling location. The collected sediment will be transferred to the appropriate lab-provided bottleware prior to shipment. Samples will be analyzed by an ADEC-certified analytical laboratory, if possible, using methods for the analysis of PFAS in solid (sediment/soil) materials.

In conjunction with the surface water and sediment sampling, the field team will also set minnow traps in each pond as part of the initial assessment to determine whether resident fish are present in each pond. Three minnow traps will be placed in the North Gravel Pit and one in the South Gravel Pit and left for 24 hours. If any fish are found within the trap, they will be released. No fish will be sampled at this time.

Following surface water, sediment, and resident fish assessment, the ecological site conceptual model will be updated and an assessment for additional ecological scoping will be discussed with ADEC.

Sampling will also follow the attached ADEC guidance *Minimum Quality Assurance Requirements for Sample Handling, Reports and Laboratory Data* (ADEC 2019). QA/QC protocols for water sample collection will include 1 field duplicate per every 10 samples and 1 field equipment blank per sampling team/equipment per day (ADEC 2019).

PRELIMINARY ECOLOGICAL CONCEPTUAL SITE MODEL

A preliminary ecological conceptual site model (CSM) was prepared outlining potential exposure pathways and ecological receptors of the North and South Gravel Pits. The preliminary ecological CSM for PFOA and PFOS at the Site is included as Attachment B. Following completion of the sampling activities in the North Gravel Pit and South Gravel Pit, it is likely that the next step will be a preliminary screening evaluation (ADEC 2018) to assess the need for a more formal ecological risk assessment at the North and South Gravel Pits.

REPORTING AND RECOMMENDATIONS

After implementation of investigation activities described herein (anticipated completion summer 2022), a meeting with ADEC will be scheduled to present the results on the nature and extent of PFOA and PFOS concentrations onsite. This meeting will also include a discussion regarding the need for any further evaluations or actions either onsite or offsite, including characterization of offsite surface water bodies.

Integral will also prepare a report summarizing the findings of this work consistent with 18 AAC 75.335. Soil and groundwater analytical results will be compared to the ADEC cleanup levels for PFOA and PFOA. The final report will include completed ADEC Laboratory Data Review Checklists (Attachment C) and a QA/QC assessment of both soil and groundwater sample results.

REFERENCES

ADEC. 2013. Monitoring Well Guidance. Alaska Department of Environmental Conservation Division of Spill Prevention and Response Contaminated Sites Program. September.

ADEC. 2018. Risk assessment procedures manual. Alaska Department of Environmental Conservation. February.

ADEC. 2019. Minimum quality assurance requirements for sample handling, reports and laboratory data. Alaska Department of Environmental Conservation Division of Spill Prevention and Response Contaminated Sites Program. October.

ADEC. 2022. Field sampling guidance. Alaska Department of Environmental Conservation Division of Spill Prevention and Response Contaminated Sites Program. January.

ASTM. 2005. ASTM D6001-05 - Standard Guide for Direct-Push Water Sampling for Geoenvironmental Investigations. ASTM International.

Integral. 2021. Site characterization report—Groundwater, Williams Alaska Petroleum, Inc., Former North Pole Refinery, North Pole, AK. Integral Consulting Inc. August 25.

ITRC. 2020. Site characterization considerations, sampling precautions, and laboratory analytical methods for per- and polyfluoroalkyl substances (PFAS). Interstate Technology and Regulatory Council. April.

Figures

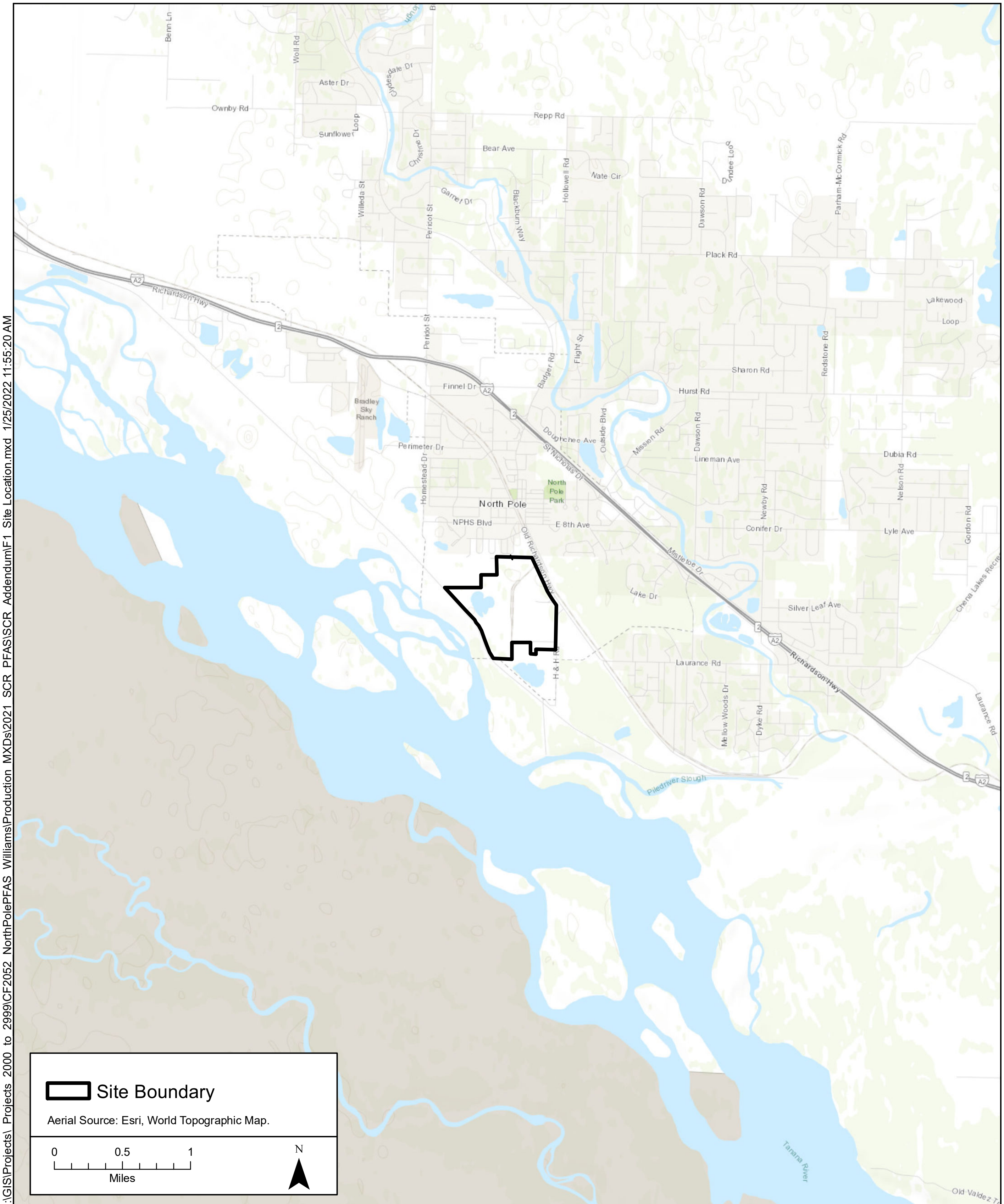

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Figure 1.
Site Location

Former North Pole Refinery
North Pole, AK

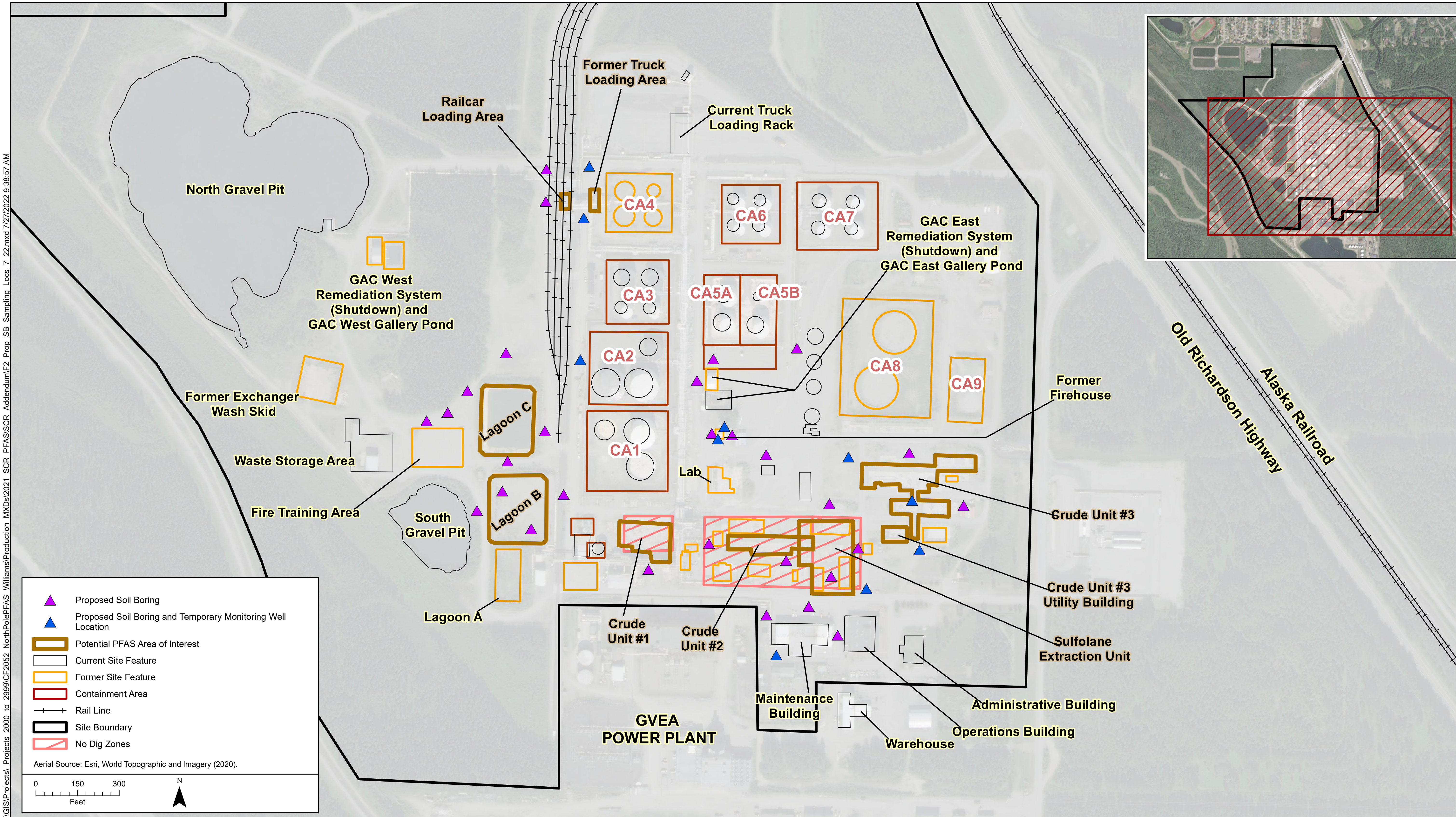

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Figure 2.
Proposed Soil Boring Sampling Locations

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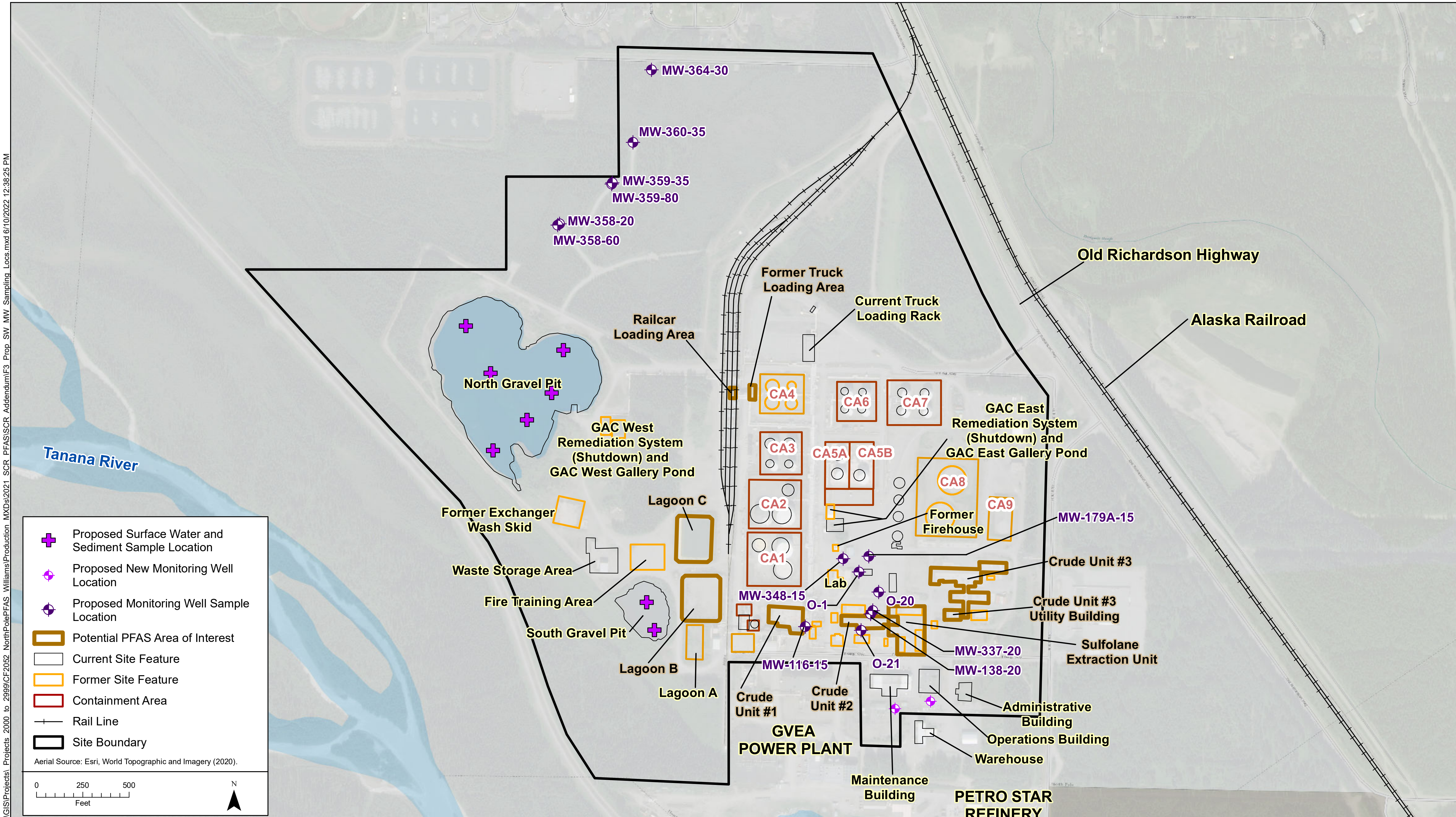

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Figure 3.
Proposed Surface Water, Sediment, and Monitoring Well Sampling Locations

Attachment A

ADEC Minimum Quality Assurance Requirements for Sample Handling, Reports, and Laboratory Data

ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION DIVISION OF SPILL PREVENTION AND RESPONSE CONTAMINATED SITES PROGRAM

Technical Memorandum Date: October 2019

Minimum Quality Assurance Requirements for Sample Handling, Reports, and Laboratory Data

Background

The Alaska Department of Environmental Conservation (DEC) has developed cleanup regulations for oil and other hazardous substances under the site cleanup rules, 18 AAC 75 Article 3. DEC also regulates Leaking Underground Storage Tanks (LUST) and their associated site cleanup under 18 AAC 78. *The Underground Storage Tanks Procedures Manual* (the UST Procedures Manual), adopted by reference in 18 AAC 78.007 and 18 AAC 75.355, contains specific requirements for laboratory quality assurance (QA). Other QA requirements are discussed in DEC's *Field Sampling Guidance.*

Purpose

The Contaminated Sites (CS) Program oversees characterization and cleanup of sites under both 18 AAC 75 & 78. As such, the CS Program has received work plans and reports with different levels of laboratory and field data quality and varying degrees of quality assurance depending on the regulations being applied at the site. The QA guidelines described in this memorandum below are necessary to meet requirements of 18 AAC 75.335; 75.355; 75.360(2) and 18 AAC 78.007. In order to ensure consistency in quality assurance across the CS Program and acquire data sufficient to make defensible environmental decisions, this technical memorandum spells out the following requirements:

1. Summarizes the minimum requirements for laboratory data packages that must be included in all reports containing analytical data submitted to the CS Program.
2. Requires the completion of CS data review checklists for each laboratory data package.
3. Requires a narrative summary of data quality and usability for each report submitted to CS Program.
4. Specifies the protocols for sample shipping and receipt.

1.**Minimum Requirements for Laboratory Data Reports for Samples**

The complete analytical laboratory report(s) shall be included as part of all submittals to DEC for which environmental samples have been collected, analyzed and reported. The laboratory reports shall contain, at a minimum, the following information:

(1) laboratory name, address, telephone number, email address (if available), CS Lab Approval Number, and the name of the person authorizing release of laboratory data; (normally a cover page containing this information)

(2) report date;

(3) a case narrative summary report documenting all discrepancies with the data contained in the report, including but not limited to, sample receipt, holding time(s), documentation and discussion of all quality control (QC) discrepancies and resulting corrective action, a discussion

of all matrix interferences including low surrogate recoveries, analyte identifications as appropriate, etc.

(4) product type (e.g. gasoline, diesel, etc.);

(5) the preparation and analytical method used and method number (see Appendix D-F of the Field Sampling Guidance);

(6) the type of matrix;

(7) the field sample number;

(8) the laboratory sample number;

(9) the date sampled;

(10) the date received;

(11) the date sample was prepared;

(12) the date analyzed;

(13) the site or project name (from the Chain of Custody);

(14) the concentrations of analyte(s) and limit(s) of detection

a. all solids must be reported on a dry weight basis, for all analytical methods

b. Alaska petroleum method results (AK101, AK102 and AK103) must be reported in milligrams per liter (mg/L) for liquids and milligrams per kilogram (mg/kg) for solids

c. All other analytical methods must include the applicable reporting units and limit(s) of detection

(15) the dilution factor;

(16) the analyst's name, signature or initials, and date signed;

(17) definitions of any characters used to qualify data;

(18) method blank results per matrix, method and analytical batch;

(19) precision and accuracy values for each sample set, with at least one precision and accuracy evaluation for each set of 20 samples. For all organic analyses this will include, at a minimum, surrogate recoveries and laboratory control sample/duplicate (LCS/LCSD) recoveries and relative percent difference (RPD);

(20) a sample receipt form documenting the condition of the samples and the ambient temperature of the interior of the shipping container adjacent to the sample container (or temperature blank) at the time it was received by the laboratory;

(21) a copy of the Chain of Custody (COC) for each sample or group of samples,

including COC for samples transferred to alternate locations. For more on COCs, see the section below on "Sample Shipment and Receipt by Laboratories."

*Note: The "raw" analytical data, e.g. bench sheets, chromatograms, calibration data, etc., are not required submittals, however, must be retained on file by the laboratory for at least ten years after the analysis date and made available to DEC if requested.

2. Laboratory Data Review Checklists

All reports submitted to DEC containing analytical laboratory sample results shall contain a completed Laboratory Data Review Checklist in the final report. The Laboratory Data Review Checklist is located online at http://dec.alaska.gov/spar/csp/guidance-forms/ and must be completed, signed and dated by the firm submitting the report to DEC. It is not to be completed by the analytical laboratory that performed the sample analysis. One Laboratory Data Review Checklist must be submitted for each laboratory data packet submitted to DEC. The purpose of the Laboratory Data Review Checklist is to verify the data and document that quality control measures were evaluated; it is not intended to be used for a data quality or usability assessment.

3. Data Quality Assurance Assessment and Reporting

QA assessment is a two-step process. The first step is to assess the quality of the data generated and to identify and summarize any quality control problems noted after the data and field notes are reviewed. The second step is to determine whether or not the quality of the data is sufficient for the intended purpose. This two-step process should be discussed and summarized in each report submitted to the CS Program. Furthermore, a QA assessment narrative summary must be included as a specific text section of the final report. All laboratory results, including laboratory quality control (QC) sample results, must be reviewed and evaluated for quality and usability. The QA assessment summary must include a discussion of any effects on data quality and/or usability due to field sampling and laboratory quality control discrepancies.

The assessment of data quality, at a minimum, will describe the following five (5) parameters for all analytical results with respect to the impact that any discrepancies have on the quality of the data.

1. Precision
    a. Field duplicate(s) - minimum of 1 per every 10 field samples for each matrix sampled, for each target analyte.
    b. Laboratory sample duplicates and/or spike duplicates (Laboratory control samples or matrix spikes).

2. Accuracy
    a. Laboratory QC samples percent recoveries– spikes (laboratory control samples and/or Matrix Spikes).
    b. Surrogate percent recoveries.

3. Representativeness
    a. Degree to which data characterizes actual site conditions.
    b. Consistency with conceptual site model (CSM) and project objectives in the approved work plan.

4. Comparability (if applicable)
    a. Field screening vs. laboratory data correlation.
    b. Standard methods, procedures, quantitation units, and reporting formats between lab reports and between laboratories, if more than one used.

5. Sensitivity and Quantitation Limits
    a. Analytes with limits of detection (LOD) or limits of quantitation (LOQ) greater than the regulatory cleanup levels and/or project required goals.
    b. Blank results (trip blank and method blanks) less than LOD or LOQ.

Once the quality of the data is determined, the data should be evaluated for usability by considering whether data meets project objectives defined in the work plan. Furthermore, the usability assessment should provide an evaluation of suitability of the data for decision making purposes. All types of data (e.g. sampling, on-site analytical, off-site laboratory) are relevant to the usability assessment. During this evaluation, the percentage of data that is usable or non-rejected versus the total number of results is quantified. There is an 85% minimum goal for usable data.

The usability assessment, should be discussed in the QA assessment summary. Laboratory analytical results that have been qualified or rejected should be reported in the following way:

- Biased or rejected should be identified and discussed in the QA assessment summary.
- Laboratory data that is rejected should not be shown in report tables or discussed in the report results.
- Laboratory data that is qualified should be listed with a qualifying flag in the report tables and narrative.

Additionally, analytes that are not detected, but have laboratory quantitation limits greater than the CS program-approved cleanup levels should also be identified in the report tables and text. If corrective actions were taken to address the usability of the data, this should be explained in the QA assessment summary.

4.**<u>Sample Shipping and Receipt by Laboratories</u>**
Sample transport and receipt by laboratories must be performed and documented in a standardized and appropriate way in order to ensure the laboratory data generated is representative of environmental site conditions. This section provides the requirements for sample shipping and receipt by laboratories.

<u>Chains of Custody</u>
It’s essential that within any data collection phase involving physical samples, the handling of sample media by all parties be documented. A chain of custody form should be shipped along with the samples and document the “chain of custody” (i.e. the date and person responsible for the various sample handling steps associated with each sample). A chain of custody seal is used to ensure the integrity of samples in a container when the container is outside the possession of the sampler or the analytical laboratory. If a chain of custody seal must be broken, the breaker must:

- Identify the need for breaking the seal;
- Document the condition of the contents (such as whether or not the gel ice is still frozen);
- Note anything added to or removed from the container (such as gel ice or paperwork);
- Leave the broken seal on the container;
- Re-seal the container with a new chain of custody seal; and
- Document the breaking and re-sealing on the chain of custody form

Samples that are continuously under the sampler’s direct control until hand-delivered to the laboratory are not required to have Chain of Custody seals. However, hand-delivered samples must be documented on the chain of custody. Improper chain of custody documentation may result in sample results being rejected by CS Program.

Sample Receipt Forms

The analytical laboratory shall have a written sample acceptance policy and provide sample receipt forms that document quality control failures. These failures include (but are not limited to):

- Cooler temperature outside acceptable range
- Exceedance of holding times
- Missing temperature blank
- Sample vials leaking
- Headspace in volatile organic assessment (VOA) water vials
- Incorrect preservation used
- Other deviations from sample receipt standard operating procedures
- Mislabeled samples or samples without a unique identification and label
- Use of inappropriate sample containers

For questions and more information contact:
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Attachment B

Conceptual Site Model

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MEMORANDUM

To:	James Fish—Environmental Program Specialist, Alaska Department of Environmental Conservation
From:	Integral Consulting Inc.
Date:	May 2022
Subject:	Preliminary Ecological Conceptual Site Model for Perfluorooctane Sulfonate and Perfluorooctanoic Acid at the Former North Pole Refinery, North Pole, Alaska
Project No.:	CF2052

INTRODUCTION

Integral Consulting Inc. (Integral) has prepared this technical memorandum (tech memo) on behalf of Williams Alaska Petroleum, Inc. to provide a preliminary ecological conceptual site model (CSM) for perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) in aquatic habitats at the former Flint Hills Resources Alaska (FHRA) North Pole Refinery (Site). PFOS and PFOA are constituents of the aqueous film forming foam (AFFF) that was historically stored, used, and released at the facility as part of various fire-prevention activities. The CSM is a key step in evaluating a contaminated site. It is prepared during the initial stages of the site characterization phase in support of an ecological risk assessment (ERA) (ADEC 2017).

Integral performed a focused site characterization in December 2020 to assess the horizontal and vertical extent of PFOA and PFOS in groundwater at the Site, and in surface water at the North and South Gravel Pits (Integral 2021). This work yielded a large groundwater data set as well as one surface water sample for analysis from the North Gravel Pit. A surface water sample could not be collected from the South Gravel Pit at that time because this water body was frozen when the sampling event occurred. Also, no sediment samples were obtained from either gravel pit for PFOA and PFOS analysis during the 2020 site investigation, nor are any historical sediment data available for these two compounds. The biological conditions of the two gravel pits are also largely unknown. The single-sample surface water data set, lack of sediment data, and limited knowledge of the biological conditions of the two gravel pits represent important data gaps. As a result, the preliminary ecological CSM makes conservative assumptions to avoid missing important aspects that ought to be considered in a future ERA (ADEC 2017).

This tech memo provides supporting text about the potential PFOA and PFOS sources, the major transport pathways at the Site, the affected media, the potential exposure pathways, and the potential ecological receptor groups for the North and South Gravel Pits.

SITE DESCRIPTION

The 240-acre former refinery is located within the city limits of North Pole in the Fairbanks North Star Borough, Alaska, about 13 miles southeast of Fairbanks (Figure 1). The Site is currently a bulk storage and terminal facility owned and operated by Marathon Petroleum. Historically, three crude oil processing units were present in the southern portion of the Site and several tank farms were located in the western and central portions of the Site. FHRA demolished these structures in 2016. The loading and unloading areas included a truck rack located to the north of the tank farm area and a rail car loading area located to the west. A truck rack was also located between the rail car loading area and the tank farm.

Three wastewater treatment lagoons, several storage areas, and a fire training area (FTA) were also present. In addition, the facility supported a firehouse and several administrative and warehouse buildings. Two gravel pits, known as the North Gravel Pit and South Gravel Pit, are found in the southwestern portion of the Site.

The Petro Star, Inc. Refinery and the Golden Valley Electric Association power plant are located immediately to the south of the Site. Residential properties, the North Pole High School, and the city’s wastewater treatment plant are found immediately north of the Site. The Tanana River is located to the west and flows to the northwest towards Fairbanks. The area east of the site includes residential and undeveloped parcels, the Old Richardson Highway, and the Alaska Railroad. Figure 1 show current and historical Site and surrounding features.

POTENTIAL SOURCES OF PFOA AND PFOS CONTAMINATION

The information presented below was obtained from Section 2.3 in Integral (2021).

The historical use and storage of AFFF at the Site is as follows:

- **Hot work:** Facility staff used AFFF from the mid-1990s through 2011when performing “hot work”, such as welding, brazing, annealing, and soldering. AFFF was applied to flat surfaces in containment areas next to the hot work to prevent accidentally igniting residual petroleum hydrocarbons that might be present in nearby sumps, troughs, or concrete pads. The concentrations of AFFF reportedly used during these activities ranged from 10 to 50 percent of a water-based solution, with volumes varying (Arcadis 2013). Arcadis (2013) could not confirm where hot work historically might have occurred at the former refinery.
- **Fire Training:** Live fire training exercises involving AFFF were reportedly held three times per year at the onsite FTA. These activities stopped in 2009. Engineering drawings show that the FTA was lined with a synthetic liner, which was confirmed when the FTA was excavated in 2015 (Arcadis 2015). Arcadis (2013) also reported that the refinery’s fire brigade and other local fire departments conducted eight large-scale, joint-response field exercises between 1989 and 2006. However, the use of AFFF at those events was not documented.
- **Fire Response:** According to Arcadis (2013), AFFF was not used at the facility in response to an actual fire/incident. FHRA could not confirm anecdotal employee recollections of two potential incidents, and no incident reports were found.
- **Storage and Staging:** AFFF was stored onsite in bulk totes from the mid-1990s through 2016 when the facility was dismantled. Storage occurred at several locations, including the chemical storage pad just west of the FTA, the Blend Building located next to the Fire Hall, and the welding shop (but only during the winter months). Purchasing records from the facility show that the amounts of AFFF bought from the mid-1990s to 2004 were “relatively small.” FHRA increased its AFFF inventory between 2004 and 2007, with 13,750 gallons of AFFF purchased from National Foam to manage worst-case fire scenarios. In addition, the three crude units had fire foam stations containing up to around 50 gallons of AFFF each. The facility also maintained two fire trucks with foam storage tanks (Arcadis 2013).

MAJOR TRANSPORT PATHWAYS

AFFF intentionally used or accidentally spilled at the Site in the past released PFOA and PFOS to surface and subsurface soil. Thence, over time, these two compounds leached downward through the soil column until they intersected the local groundwater table, which moves in a general northeastern direction at the Site (Integral 2021).

EXPOSURE MEDIA POTENTIALLY AFFECTED BY PFOA AND PFOS

PFOA and PFOS have potentially affected the following exposure media.

- **Surface soil:** The preliminary ecological CSM does not evaluate surface soil because the focus of a future ERA will be on the two aquatic habitats at the Site. Therefore, this exposure medium is not considered further in this tech memo.
- **Surface water:** The 2020 site characterization measured detectable levels of PFOA and PFOS in the single surface water sample collected from the North Gravel Pit (Integral 2021). Hence, this medium is known to be affected in that aquatic habitat. A surface water sample was not collected from the South Gravel Pit because the pond was already frozen. However, a groundwater sample collected at that time from well MW-109-15, located just to the east and within 100 ft of the South Gravel Pit, had detectable levels of PFOA and PFOS (see Figure 7 in Integral 2021). Therefore, this preliminary ecological CSM assumes that the surface water from the South Gravel Pit also contains detectable levels of PFOA and PFOS that would require further evaluation in a future ERA.
- **Sediment:** No sediment analytical data are available from either the North or South Gravel Pits. However, the surface water in both pits is believed to be a direct expression of the local groundwater table, and the groundwater in the immediate vicinity of both pits is contaminated with PFOA and PFOS. Therefore, this preliminary ecological CSM assumes that the recharging groundwater emerging through the substrate in both gravel pits has contaminated the biologically active zone of the sediment with varying amounts of PFOA and PFOS.
- **Groundwater:** This exposure medium will be evaluated as surface water in the two gravel pits in a future ERA.
- **Air:** This exposure medium will not be evaluated in a future ERA because PFOA and PFOS are not considered to be volatile compounds.

ECOLOGICAL RECEPTOR GROUPS POTENTIALLY EXPOSED TO PFOA AND PFOS

This preliminary ecological CSM focuses specifically on the North and South Gravel Pits. ADEC (2020) stated that the Agency is aware of the presence of fish in the North Gravel Pit (but the quantity and species composition are unreported) and of osprey nesting near this pit's shoreline. No biological information appears to be available for the South Gravel Pit. Depending on the outcome of the initial ERA, a biological investigation of both pits could be envisioned to determine if they serve as fully-functioning aquatic habitats capable of supporting both a complete aquatic community as well as a full range of wildlife species, or if they serve instead only as attractive "nuisance habitats" for a few transitory wildlife species (e.g., dabbling ducks or geese). Until proven otherwise, the CSM conservatively assumes that both pits provide fully-functioning aquatic habitats:

- **Aquatic vegetation** represents a broad group of plants, including phytoplankton, multicellular algae, and rooted semi-aquatic, emergent, or submerged vascular plants. All are primary producers that generate their nutritional needs via photosynthesis, thereby forming the base of all aquatic food webs. They provide forage for both invertebrate and vertebrate species and also supply habitat (e.g., hiding places for the early life stages of fish and amphibians, or nesting places for semi-aquatic bird species). Aquatic vegetation can be exposed to PFOA and PFOS in the two gravel pits by direct contact to sediment (e.g., rooted vascular plants) or direct contact to surface water (e.g., phytoplankton and algae).
- **Aquatic invertebrates** form a central link in all aquatic ecosystems where they play a key role in nutrient and energy transfers. They also process and assimilate organic material, feed on other invertebrates, and are themselves consumed by fish, birds, and mammals. Benthic macroinvertebrates (BMIs) reside and forage in and on aquatic substrates. As such, they are in direct contact with and have the greatest potential for exposure to sediment-based PFOA and PFOS. Key BMIs in the two gravel pits may include amphipods, annalids, freshwater mussels, snails, crayfish, and the aquatic life stages of various insect species.

  Aquatic habitats may also support water-column invertebrates. These life forms, which spend part of or their entire life-cycle in the water column, are in direct contact with and have the greatest potential for exposure to PFOA and PFOS present in surface water. Examples of water-column invertebrates include cladocerans, rotifers, and various BMI larvae. PFOA and PFOS can also be transferred from the surface water or sediment into the tissue of aquatic invertebrates and up the food web via bioconcentration or bioaccumulation, thereby exposing higher trophic-level receptors when they forage in the two gravel pits. Significant alterations in invertebrate communities from exposure to PFOA and PFOS could also affect the energy cycling at the base of aquatic food web.

  The two gravel pits should be able to support a diverse community of BMIs consisting of epibenthic species (e.g., crayfish, amphipods), burrowing species with a direct connection to surface water (e.g., freshwater clams and mussels), and burrowing species with direct contact to bulk sediment (e.g., annalids). Exposure by aquatic invertebrates is assessed based on direct contact to PFOA and PFOS in surface water and sediment. Additional exposure might also occur via ingestion of sediment or contaminated food items but those two routes cannot be quantified in this group of organisms, and are therefore omitted. Finally, exposure via surface water ingestion is not expected to occur in these freshwater organisms; they do not actively drink because their body fluids are highly hypertonic to the surrounding water.

- **Fish** are an integral link to healthy, functioning aquatic habitats. They prey upon invertebrates and other fish or graze on aquatic plants. When consumed by wildlife, they effectively transfer energy from aquatic habitats to terrestrial habitats. Functioning fish communities are visible symbols of healthy aquatic ecosystems. The two gravel pits should be able to support healthy and sustainable freshwater fish communities. These habitats should also provide a diverse food base, suitable feeding and spawning areas, refuges for juvenile fish, and other essential environmental services. The presence of PFOA and PFOS in surface water may affect the local fish community in two general ways: a) mortality of sensitive early-life stages directly exposed to these compounds in the water column, or b) high concentrations in aquatic biota via food consumption, which could affect reproduction and the long-term survival of the exposed fish. PFOA and PFOS present in sediment or surface water can also be transferred into fish tissues via bioconcentration/bioaccumulation and up the food chain to semi-aquatic birds and mammals. Significant alterations of fish communities by exposure to these two compounds could also impact the energy cycling in aquatic food webs, thereby affecting the food base of semi-aquatic wildlife receptors.

  Exposure by freshwater fish is assessed based on direct contact to PFOA and PFOS in surface water. Additional exposure might also occur via ingestion of contaminated sediment or food items, but those two routes cannot be quantified in fish, and are therefore omitted. Finally, exposure via surface water ingestion is not expected to occur; freshwater fish do not actively drink because their body fluids are highly hypertonic to the surrounding water.

- **Amphibians** require healthy, functioning aquatic habitats for mating, reproduction, foraging, and shelter. The juvenile life stages of many amphibian species are both aquatic and gill breathing. They actively feed on algae, aquatic invertebrates, and/or juvenile fish until they undergo metamorphosis into air-breathing adults.

  Quantifying exposure to amphibians focuses only on the gill-breathing life stages and is assessed based on direct contact to PFOA and PFOS present in surface water. Additional exposures in both gill-breathing juveniles and air-breathing adults might also occur via ingestion of contaminated sediment or food items but those two routes cannot be quantified, and are therefore omitted. Finally, exposure of the gill-breathing juveniles via surface water ingestion is not expected to occur; they do not actively drink because their body fluids are highly hypertonic to the surrounding water. The air-breathing adults may drink fresh water, but that exposure cannot be quantified and is therefore omitted.

- **Semi-aquatic birds and mammal species** require healthy and functioning aquatic ecosystems for resting, foraging, nesting, and/or reproduction. Primary aquatic-dependent target wildlife indicator species for interior Alaska consist of the mallard and northern bog lemming (representative herbivores), the American dipper and common snipe (representative benthivores), and/or the belted kingfisher, mink, and river otter (representative piscivores) (ADEC, no date).

  Unlike with the community-level aquatic receptor groups discussed above, the uptake of PFOA and PFOS in wildlife species based on drinking surface water, the accidental ingestion of sediment, and the consumption of aquatic organisms can be readily quantified based on receptor-specific exposure factors and food web models in order to calculate a receptor-specific average daily dose.

SUMMARY AND CONCLUSION

Figure 2 presents the preliminary ecological CSM for the two gravel pits at the Site. As per ADEC (2017), this CSM is quite conservative due to the very limited understanding of the ecology in these aquatic habitats or the prevailing PFOA and PFOS concentrations in surface water, sediment, and biota. However, enough information is available to recommend proceeding with a preliminary screening evaluation (ADEC 2018) to assess the need for a more formal ERA at the North and South Gravel Pits.

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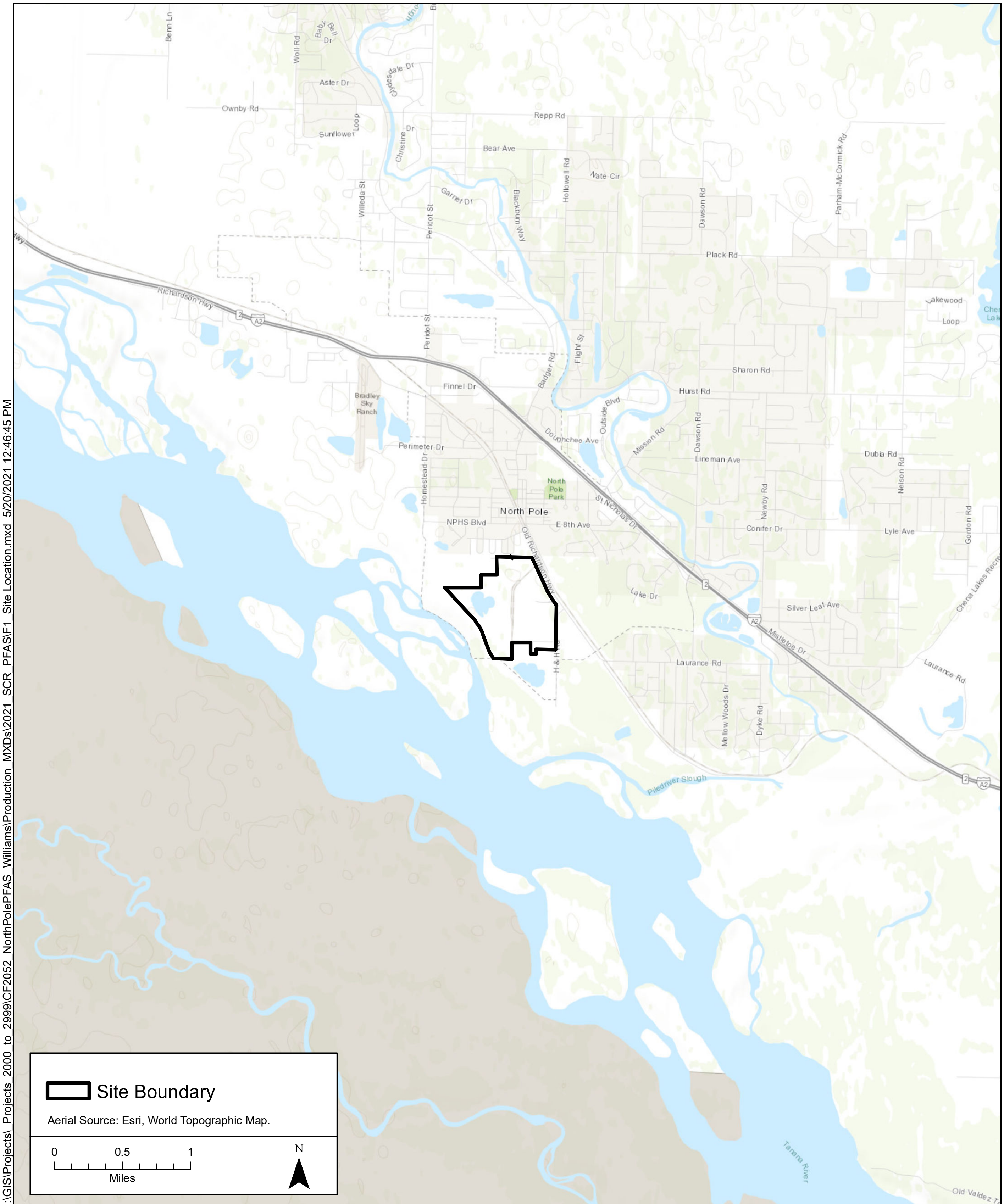

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Figure 1.
Site Location

Former North Pole Refinery
North Pole, AK

Primary Sources	Release Mechanisms	Secondary Sources	Transport Pathways
Aqueous film-forming foam (AFFF) containing PFOA and PFOS →	Direct discharge during fire training; spills from storage areas; use during "hot work" →	Surface and subsurface soils →	Leaching down to groundwater table; groundwater transport →

Exposure Media	Exposure Route	Ecological Receptors: Aquatic Vegetation	Aquatic Invertebrates	Amphibians	Fish	Birds & Mammals
Surface soil	Direct contact & uptake	—	—	—	—	—
	Incidental ingestion	—	—	—	—	—
	Biota via food chain	—	—	—	—	—
Surface water	Absorption/ direct contact	•	•	•	•	—
	Ingestion	—	—	—	—	•
	Biota via food chain	—	*	*	*	•
Sediment	Absorption/ direct contact	•	•	*	*	—
	Ingestion	—	*	*	*	•
	Biota via food chain	—	*	*	*	•
Groundwater	Evaluated as surface water in North Gravel Pit Pond					
Air	Inhalation	—	—	—	—	—

Key:

• Complete exposure pathway

— Not applicable or minor exposure pathway

* Possible exposure pathway but cannot be quantified

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Figure 2.
Preliminary Ecological Conceptual Site Model for the Two Gravel Pits at the Former North Pole Refinery

Attachment C

ADEC Laboratory Data Review Checklists

Laboratory Data Review Checklist

Completed By:

Title:

Date:

CS Report Name:

Report Date:

Consultant Firm:

Laboratory Name:

Laboratory Report Number:

ADEC File Number:

Hazard Identification Number:

1. Laboratory

   a. Did an ADEC CS approved laboratory receive and perform all of the submitted sample analyses?

      ◯ Yes ◯ No Comments:

   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 Comments:

2. Chain of Custody (CoC)

   a. CoC information completed, signed, and dated (including released/received by)?

      ◯ Yes ◯ No Comments:

   b. Correct Analyses requested?

      ◯ Yes ◯ No Comments:

3. Laboratory Sample Receipt Documentation

   a. Sample/cooler temperature documented and within range at receipt (0° to 6° C)?

      ◯ Yes ◯ No Comments:

   b. Sample preservation acceptable – acidified waters, Methanol preserved VOC soil (GRO, BTEX, Volatile Chlorinated Solvents, etc.)?

      ◯ Yes ◯ No Comments:

   c. Sample condition documented – broken, leaking (Methanol), zero headspace (VOC vials)?

      ◯ Yes ◯ No 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 Comments:

e. Data quality or usability affected?

Comments:

4. Case Narrative

a. Present and understandable?

○ Yes ○ No Comments:

b. Discrepancies, errors, or QC failures identified by the lab?

○ Yes ○ No Comments:

c. Were all corrective actions documented?

○ Yes ○ No Comments:

d. What is the effect on data quality/usability according to the case narrative?

Comments:

5. Samples Results

a. Correct analyses performed/reported as requested on COC?

○ Yes ○ No Comments:

b. All applicable holding times met?

○ Yes ○ No Comments:

c. All soils reported on a dry weight basis?

◯ Yes ◯ No Comments:

d. Are the reported LOQs less than the Cleanup Level or the minimum required detection level for the project?

◯ Yes ◯ No Comments:

e. Data quality or usability affected?

◯ Yes ◯ No Comments:

6. <u>QC Samples</u>

a. Method Blank

i. One method blank reported per matrix, analysis and 20 samples?

◯ Yes ◯ No Comments:

ii. All method blank results less than limit of quantitation (LOQ)?

◯ Yes ◯ No Comments:

iii. If above LOQ, what samples are affected?

Comments:

iv. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?

◯ Yes ◯ No Comments:

v. Data quality or usability affected?

Comments:

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 Comments:

ii. Metals/Inorganics – one LCS and one sample duplicate reported per matrix, analysis and 20 samples?

◯ Yes ◯ No Comments:

iii. Accuracy – All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods: AK101 60%-120%, AK102 75%-125%, AK103 60%-120%; all other analyses see the laboratory QC pages)

◯ Yes ◯ No Comments:

iv. Precision – All relative percent differences (RPD) reported and less than method or laboratory limits? And project specified DQOs, if applicable. RPD reported from LCS/LCSD, MS/MSD, and or sample/sample duplicate. (AK Petroleum methods 20%; all other analyses see the laboratory QC pages)

◯ Yes ◯ No Comments:

v. If %R or RPD is outside of acceptable limits, what samples are affected?

Comments:

vi. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?

◯ Yes ◯ No Comments:

vii. Data quality or usability affected? (Use comment box to explain.)

Comments:

c. Surrogates – Organics Only

i. Are surrogate recoveries reported for organic analyses – field, QC and laboratory samples?

○ Yes ○ No Comments:

ii. Accuracy – All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods 50-150 %R; all other analyses see the laboratory report pages)

○ Yes ○ No Comments:

iii. Do the sample results with failed surrogate recoveries have data flags? If so, are the data flags clearly defined?

○ Yes ○ No Comments:

iv. Data quality or usability affected?

Comments:

d. Trip blank – Volatile analyses only (GRO, BTEX, Volatile Chlorinated Solvents, etc.): Water and Soil

i. One trip blank reported per matrix, analysis and for each cooler containing volatile samples?
(If not, enter explanation below.)

○ Yes ○ No Comments:

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 Comments:

iii. All results less than LOQ?

○ Yes ○ No Comments:

iv. If above LOQ, what samples are affected?

Comments:

v. Data quality or usability affected?

Comments:

e. Field Duplicate

i. One field duplicate submitted per matrix, analysis and 10 project samples?

○ Yes ○ No Comments:

ii. Submitted blind to lab?

○ Yes ○ No Comments:

iii. Precision – All relative percent differences (RPD) less than specified DQOs? (Recommended: 30% water, 50% soil)

$$\text{RPD (\%)} = \text{Absolute value of: } \frac{(R_1 - R_2)}{((R_1 + R_2)/2)} \times 100$$

Where R_1 = Sample Concentration
R_2 = Field Duplicate Concentration

○ Yes ○ No Comments:

iv. Data quality or usability affected? (Use the comment box to explain why or why not.)

Comments:

f. Decontamination or Equipment Blank (If not applicable, a comment stating why must be entered below).

○ Yes ○ No ○ Not Applicable

i. All results less than LOQ?

◯ Yes ◯ No Comments:

ii. If above LOQ, what samples are affected?

Comments:

iii. Data quality or usability affected?

Comments:

7. Other Data Flags/Qualifiers (ACOE, AFCEE, Lab Specific, etc.)

   a. Defined and appropriate?

◯ Yes ◯ No Comments: