Emerging Contaminants Sampling
Scope of Work
for the
Knolls Laboratory

Knolls Atomic Power Laboratory
Knolls Laboratory
Niskayuna, New York

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List of Acronyms and Abbreviations

ASP	Analytical Service Protocol
AFFF	Aqueous Film-Forming Foam
AOC	Area of Concern
CA	Corrective Action
CVOC	Chlorinated Volatile Organic Compound
EC	Emerging Contaminants
EDD	Electronic Data Deliverable
ELAP	Environmental Laboratory Approval Program
FRB	Field Reagent Blank
HDPE	High Density Polyethylene
HYA	High Yard Area
ICM	Interim Corrective Measure
IDW	Investigation-Derived Waste
KAPL	Knolls Atomic Power Laboratory
LDA	Land Disposal Area
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PCE	Tetrachloroethene
PFAS	Per- and Polyfluoroalkyl Substances
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctanesulfonic Acid
PID	Photoionization Detector
PPE	Personal Protective Equipment
ppb	Parts Per Billion
ppt	Parts Per Trillion
QA	Quality Assurance
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SAR	Sampling and Analysis Report
SDG	Sample Delivery Group

SIM	Selected Ion Monitoring
SOW	Scope of Work
SWMU	Solid Waste Management Unit
TCA	Trichloroethane
TCE	Trichloroethene
UCMR3	Third Unregulated Contaminant Monitoring Rule
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

1.0 INTRODUCTION

This Scope of Work (SOW) has been developed to evaluate the groundwater at the Knolls Atomic Power Laboratory (KAPL) – Knolls Laboratory (Site) for the presence of emerging contaminants (EC), per- and polyfluoroalkyl substances (PFAS) and 1,4-dioxane, as identified by the United States Environmental Protection Agency (USEPA) and New York State Department of Environmental Conservation (NYSDEC).

This SOW was prepared in accordance with the reference (1) NYSDEC Guidance for Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances and includes the sampling objectives, methods, analytical parameters, and quality assurance/quality control (QA/QC) elements for completion of the sampling. The SOW objective, a Site description, evaluation of onsite EC usage, the selection of representative groundwater sampling locations, and SOW steps are provided herein.

1.1 SOW Objective

The objective of the SOW is to evaluate for the presence of EC in groundwater at the Site. In order to achieve the SOW objective and determine representative groundwater sampling locations, a Site evaluation was performed that consisted of a review of:

(1) past uses of potential EC containing items;
(2) available groundwater chlorinated volatile organic compound (CVOC) analytical results for potential 1,4-dioxane indicator CVOCs (as described in reference (2) and Section 3.0); and
(3) local groundwater flow patterns.

2.0 SITE DESCRIPTION

As shown on Figure 1, the Site is located in the Town of Niskayuna, Schenectady County, New York, on the south bank of the Mohawk River. The Site is comprised of approximately 170 acres, most of which are located on a bluff approximately 115 to 120 feet above the Mohawk River surface (referred to as the upper level). Along the northern margin of the Site, the land surface slopes steeply to a natural bench (referred to as the lower level) approximately 15 to 20 feet above the river surface. The Site fronts approximately 4,200 feet of the Mohawk River. The Site is bounded to the north by the Mohawk River; to the east by a mixture of open land, parks, and the Town of Niskayuna closed municipal landfill; to the south by a low-density suburban residential area; and to the west by the General Electric Global Research Center.

Construction of the Site began in 1948 and Site operations began in 1949. The principal function of the Site is research and development in the design and operation of Naval nuclear propulsion plants. Facilities at the Site include administrative offices, machine shops, a sewage pumping station, wastewater treatment facilities, a boiler house, oil storage facilities, cooling towers, waste storage facilities, and chemistry, physics, and metallurgical laboratories. The buildings and support facilities occupy approximately 60 acres of the property. The remainder of the Site (approximately 110 acres) consists of undeveloped woods and fields.

2.1 Geology

The Site is located in the Mohawk River Valley within the Hudson-Mohawk Lowlands Geomorphic Province. Bedrock underlying the Site consists of essentially horizontal shales and sandstones of the Upper-Middle Ordovician aged Schenectady Formation. The Schenectady Formation is comprised of a series of alternating beds of graywacke, sandstone, siltstone and shale about 2,000 feet thick, dipping gently to the west and southwest. These rocks are characteristically non-porous and impermeable, and form poor aquifers. The Schenectady Formation is underlain by the Canajoharie shale, which is a dark gray to black, thinly bedded fissile shale. Depth to bedrock at the Site generally ranges between 10 and 70 feet below grade, with shallower depths occurring along the lower level and deeper depths more central to the Site. Rock outcrops are visible on both banks of the Mohawk River in the vicinity of the Site.

The bedrock at the Site is overlain mainly by glacial deposits, most of which consist of thick (up to 70 feet) glacial till. Directly overlying the bedrock is the Mohawk Till, a grayish-blue, dense, compact till, commonly referred to as the gray till. The gray till extends from the bedrock typically to within 10 to 15 feet of the ground surface, where the gray till transitions into a yellowish-brown till commonly referred to as the brown till. Evidence suggests that the brown till is the weathered surface of the gray till and not a separate depositional sequence. Occasional lenses of graded material, usually fine to medium sand, exist within the till. Based on drilling records, it is believed that these lenses are small in size and isolated from one another. The gray till is almost entirely impermeable except for the occasional lenses of fine sand which are capable of transmitting small quantities of water. However, the water is rapidly depleted from these small isolated sand lenses with little or no recharge. The brown till also is relatively impermeable; however, perched water at the brown till/gray till contact indicates that water does infiltrate into and percolate through the brown till.

Glacial lake (lacustrine) silts and clays and discontinuous ice-contact deposits (sand and gravel) are found on top of the till mostly in the southern and southeast portions of the Site property. The silt and clay deposits also are relatively impermeable. The ice-contact deposits are capable of transmitting water, but their limited extent diminishes the potential for yielding useable water volumes.

2.2 Groundwater

The groundwater resources at the Site are limited due to the limited extent of sand and gravel deposits and the low permeability of the bedrock and silt and clay deposits. Consequently, there are no principal or primary bedrock or overburden aquifers underlying the Site for development as commercial or public water supplies.

The direction of groundwater flow at the Site is predominantly northeast toward the Mohawk River. Based on the relatively low permeability of the bedrock and overlying glacial till at the Site, groundwater movement, overall, is generally relatively slow. Local variations in groundwater flow direction and velocities occur within less compact and more permeable material associated with natural geologic deposits, fill areas, and backfill along utility trenches and building foundations.

3.0 EMERGING CONTAMINANTS EVALUATION

This section includes an EC chemical background and the Site EC evaluation that was performed to determine representative EC groundwater sampling locations.

3.1 EC Chemical Background

PFAS are a large group of highly soluble, stable, synthetic chemicals that have been used since the 1940s in a wide variety of industrial and consumer products, such as carpet and clothing treatments, industrial surfactants, emulsifiers, and fire-fighting aqueous film-forming foam (AFFF) as described in reference (3). Two PFAS, perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) have been produced in the largest amounts within the United States and are the most widely studied of the PFAS chemicals. In industry, PFAS were released to the air, water, and soil in and around manufacturing facilities. PFAS can readily move through soil and into groundwater. They are resistant to typical natural degradation processes and as a result are often found in the environment.

1,4-dioxane is often found at sites contaminated with certain CVOCs, primarily 1,1,1-trichloroethane (TCA), because of its wide use as a stabilizer for this solvent as described in reference (2). 1,4-dioxane has also been found at sites contaminated with other CVOCs such as tetrachloroethene (PCE) and trichloroethene (TCE), although no definitive connection with these CVOCs has been established. 1,4-dioxane typically migrates rapidly in groundwater, is resistant to biodegradation, and is therefore often detected ahead of other contaminants in groundwater plumes.

3.2 Site EC Background

The Site EC evaluation consisted of a review of usage of potential EC containing items, specifically AFFF, the occurrence of certain indicator CVOCs (e.g., 1,1,1-TCA, PCE, and TCE) in Site groundwater, and local groundwater flow patterns to determine representative groundwater sampling locations. Also, based on discussions with NYSDEC, the Site’s closed landfill will be included in follow-on groundwater sampling for EC. For completeness, EC groundwater sampling will consist of both PFAS and 1,4-dioxane analysis. The Site evaluation is described below.

The presence of PFAS in groundwater has not been previously assessed at the Site and 1,4-dioxane in groundwater has not been evaluated at the lower concentration that is now thought to represent a potential health concern. The principal potential PFAS containing item evaluated for usage at the Site is AFFF. A review of historical operations and interviews with site emergency personnel indicate that AFFF was never used to fight a fire onsite, nor was it used during any training exercises conducted onsite. According to the interviews, AFFF, though not used, was stored in poly containers onsite in Building Z3, which is located north of the existing High Yard and central to the Site. There is no record of any leaks from these containers while in storage and there is no other known storage locations onsite. The containers/material stored in Building Z3 were subsequently disposed of off-site circa 2009.

The occurrence of potential indicator CVOCs (including breakdown products) and 1,4-dioxane in Site groundwater was evaluated. A review of available groundwater data indicate that 1,4-dioxane was not detected at or above the higher laboratory reporting limit during past groundwater monitoring. The occurrence of the indicator CVOCs in groundwater was noted in areas of the Site that have been or are currently being investigated as part of the Resource Conservation and Recovery Act (RCRA) Corrective Action (CA) Program. Upon review of available groundwater volatile organic compound (VOC) analytical results, areas with indicator CVOCs in groundwater consist of the Land Disposal Area (LDA), Q3 Yard, High Yard Area (HYA), and the Hillside Area. Groundwater will be sampled for EC at these four general areas and the Site's Closed Sanitary Landfill. CVOCs have been noted in past Landfill monitoring events. These general areas are shown on Figure 2.

The EC evaluation and proposed groundwater sampling locations in these areas are described below and on Table 1. Well locations and local groundwater flow patterns/direction are also shown on area-specific figures to provide perspective on monitoring well selection rationale. Representative downgradient sampling locations are included and, where possible, a companion upgradient well location was also selected. Furthermore, downgradient locations were selected based on the presence of CVOCs in past groundwater monitoring events.

3.3 EC Evaluation and Sampling Location Rationale

3.3.1 LDA

The LDA, which consists of a number of solid waste management units (SWMUs), has undergone various phases of investigation pursuant to the RCRA CA program, including a RCRA Facility Investigation (RFI) as documented in reference (4). The LDA is located east of the secure portion of the facility and is shown on Figures 2 and 3. The RFI findings have identified VOCs (including CVOCs) in groundwater and defined the nature and extent of the VOCs. The reference (4) report describes the nature and extent of CVOCs in groundwater and describes the presence of a groundwater divide resulting in two separate VOC groundwater plumes that flow to the north and south. The groundwater divide and north-south oriented groundwater flow patterns are shown on Figure 3. The occurrence of PCE was noted primarily in groundwater flowing to the north, while TCE (and breakdown products) was noted in both the northern and southern flowing groundwater. Chlorinated alkanes were noted in both northern and southerly flowing groundwater. In preparation for a follow-on Corrective Measure for the LDA, many of the investigation monitoring wells were decommissioned; however, one well (LMW-142) positioned downgradient of the northerly flowing groundwater and one well (LMW-103) positioned downgradient of the southerly flowing groundwater were selected for EC groundwater sampling prior to decommissioning activities. Various combinations of CVOCs have been detected in these wells as described in reference (4). These well locations are shown on Figure 3 and described on Table 1.

3.3.2 Q3 Yard

The Q3 Yard, Area of Concern (AOC) – 005, has been subject to several phases of investigation including an RFI, which is currently ongoing. The Q3 Yard is located on the eastern portion of the Site’s secure area and is shown on Figures 2 and 4. Prior to the RFI, during implementation of a Sampling and Analysis Plan, CVOCs were identified throughout the Q3 Yard as documented in the reference (5) Sampling and Analysis Report (SAR). The most notable occurrence of CVOCs is in the southern portion of the Q3 Yard. PCE, TCE, and associated breakdown products have been detected in groundwater samples collected from monitoring wells in the southern portion of the Q3 Yard. CVOCs, primarily chlorinated alkanes such as 1,1,1-TCA and 1,1-dichloroethane, have been detected in groundwater samples collected from wells situated in the northern portion of the Q3 Yard. Overall groundwater flow in the Q3 Yard is to the east. Therefore, the wells described below have been selected for EC groundwater sampling in locations with notable occurrences of chlorinated alkanes and chlorinated alkenes and are also situated in downgradient locations of the Q3 Yard. Groundwater samples collected from monitoring well Q3-MW34, located in the southern portion of the Q3 Yard, exhibited the most notable concentrations of CVOCs (i.e., PCE and TCE). Various CVOCs (i.e., PCE and TCE) have been detected at trace concentrations in groundwater samples collected from Q3-MW23. Chlorinated alkanes have been detected in trace concentrations in Q3-MW19 with the most notable occurrence of 1,1,1-TCA detected in a groundwater sample collected from this location as described in reference (5). Additionally, corresponding Q3 Yard upgradient wells Q3-MW03 (upgradient of Q3-MW23 and Q3-MW34) and Q3-MW103 (upgradient of Q3-MW19) were also selected for EC groundwater sampling. The well locations are shown on Figure 4 and are described on Table 1.

3.3.3 HYA

The HYA, SWMU-023, has been subject to various phases of investigation and was remediated in 2015 to address polychlorinated biphenyls and VOCs in soil as part of an Interim Corrective Measure (ICM) as described in reference (6). The HYA is located in the central portion of the Site's secure area as shown on Figures 2 and 5. Post-remediation groundwater monitoring is currently being performed in the HYA on a quarterly basis and the results are provided to NYSDEC in an annual report. Overall, groundwater flow is to the north-northwest as shown on Figure 5. A groundwater cut-off wall, installed for the ICM, is located to the south and east of the HYA and restricts groundwater flow in this area of the HYA. CVOCs (e.g., TCE and breakdown products) have been detected in groundwater samples collected from various HYA wells at concentrations below groundwater standards. CVOCs have been detected most commonly in downgradient monitoring well MW-6R. Given the occurrence of CVOCs in this well and its downgradient location, MW-6R is selected for EC sampling and is shown on Figure 5 and described on Table 1.

3.3.4 Hillside Area

The Hillside Area, AOC-001, as shown on Figures 2 and 6, has been subject to various phases of investigation, including an RFI. The RFI identified three distinct areas where VOCs are present in the shallow soil and groundwater: 1) the D3-D6 Area; 2) the G1-D4 Alleyway; and 3) the H2-G2 Area. These areas have a history of chlorinated solvent usage as part of historical site operations. Two of these locations, the D3-D6 area and the G1-D4 Alleyway have been subject to separate ICMs to address VOCs in soil. Groundwater monitoring has been ongoing and is currently being conducted in these two areas to assess the effectiveness of the ICMs. The H2-G2 area will be subject to an ICM and currently has no groundwater monitoring network.

CVOCs (i.e., PCE, TCE and breakdown products) are routinely detected in samples collected from groundwater monitoring wells situated in the D3-D6 area. Further description of groundwater flow and VOC presence in this area is described in reference (7). Groundwater samples collected from monitoring wells adjacent to Building D3 (i.e., MW-45 and MW-46) have routinely detected CVOCs at concentrations above applicable groundwater criteria. Given its location and CVOC detection history, MW-45 is selected for EC sampling. The groundwater flow in this area is generally toward the structural fill storm sewer bedding adjacent to Buildings D3 and D6 and flows northward following the path of the existing storm sewer and along the abandoned storm sewer that is situated directly adjacent to Building D6 as shown on Figure 6. Monitoring wells, specifically MW-51, have been installed downgradient and within the bedding of the former storm sewer to effectively monitor for VOCs in downgradient groundwater. PCE, TCE, and breakdown products are also typically detected in this location. Given its downgradient location and presence of CVOCs, MW-51 is selected for EC groundwater sampling. Situated upgradient of the D3-D6 area and directly adjacent to the storm sewer line is monitoring well MW-40; CVOCs have not been detected in this location. Given its upgradient location and lack of any CVOC detections, MW-40 has been selected for EC groundwater sampling. EC groundwater sampling locations in this area are shown on Figure 6 and described on Table 1.

3.3.5 Closed Sanitary Landfill

The Site's Closed Sanitary Landfill, SWMU-001, as shown on Figures 2 and 7, was closed in 1993 in accordance with a closure plan that was approved by NYSDEC in 1991. Since that time groundwater monitoring has been performed utilizing a network of wells shown on Figure 7. Overall, local groundwater flow is radial and generally north-northeast. During the early phases of the landfill post-closure groundwater monitoring program, Freon 12, a CVOC, has been sporadically detected in downgradient monitoring well NTH-5A. Based on its downgradient location and historical presence of CVOCs, NTH-5A has been selected for EC groundwater sampling. Given the radial groundwater flow pattern at the landfill an additional downgradient monitoring well, NTH-2A will also be sampled for EC. Upgradient monitoring well NTH-1A will also be subject to EC groundwater sampling. Monitoring well locations are shown on Figure 7 and described on Table 1.

4.0 SCOPE OF WORK

The SOW will consist of the collection of groundwater samples across the Site from the 14 identified monitoring wells as described in Section 3 (Figure 2) and on Table 1. Groundwater samples will be submitted to the Eurofins TestAmerica Laboratory in Sacramento, California for the analysis of PFAS in accordance with modified USEPA Method 537 and to the Eurofins TestAmerica Laboratory in Edison, New Jersey for analysis of 1,4-dioxane by USEPA Method 8270 selected ion monitoring (SIM). Both analytical laboratories are New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP) certified for the methods and analytes subject to this SOW. In the event these laboratories are unavailable for sample analysis, equivalent NYSDOH ELAP certified laboratories will be selected for this SOW. The sample collection, handling, analysis, validation and investigation-derived waste (IDW) management procedures for the SOW are provided below.

4.1 Groundwater Sampling

Groundwater samples will be collected from the selected monitoring wells using the process detailed below. Any existing dedicated groundwater sampling equipment that is within the selected wells will be removed prior to the start of the EC groundwater sampling event. Persons involved with the sampling program will be technically competent and familiar with the sampling procedures described herein.

4.1.1 Water Level Measurements

Prior to conducting groundwater sampling activities, the depth to groundwater will be measured in the monitoring well and compared to a previously determined well depth to calculate the volume of water to be purged during sampling activities. The water level measurements will be obtained in accordance with the procedures below.

Carefully remove the protective well cover and well cap to avoid having any foreign material enter the well. Screen for organic vapors with a photoionization detector (PID) at the well head. The depth to groundwater levels will be measured using an electronic water level indicator probe graduated in 0.01 feet increments. Read the depth to groundwater, to the nearest 0.01 feet, from the graduated cable using the marked measuring point on the monitoring well casing as a reference. Remove the probe from the monitoring well and clean the probe and cable as described in Section 4.6. Information to record on the field form should include the monitoring well identification, date and time of the water level measurement, depth to water, and PID reading.

4.1.2 Purging Procedures

Groundwater monitoring wells will be purged prior to sample collection. In rapidly recharging monitoring wells, purging will be accomplished by removal of a minimum of three well volumes of water. In slowly recharging monitoring wells, the well should be purged to dryness for a minimum of one well volume. Monitoring well purging and sampling will be conducted while wearing appropriate personal protective equipment (PPE) and using sampling equipment as outlined in Attachment 1. Additional PFAS-related precautions will be taken during the sampling to minimize sample contamination, as also outlined in Attachment 1 and in the PFAS Pre-Sampling Checklist provided as Attachment 2.

Prior to purging the well, calculate the volume of water to be purged from the well. The selected monitoring wells may be purged using peristaltic pump (e.g., Geotech Geopump^{TM}, or equivalent) with dedicated, high-density polyethylene (HDPE) tubing. The tubing will be connected to the pump and a discharge hose directed into a container.

Water quality parameters will be measured after each well volume is purged using a groundwater multi-parameter device equipped with an in-line flow through cell equipped with temperature, conductivity, pH, oxidation-reduction potential and dissolved oxygen probes (e.g., YSI® Model 8260 with flow through cell and accessories or equivalent). Groundwater turbidity will also be measured prior to the flow through cell via an in-line bypass valve. Visual observations will also be noted at the start and end of purging.

Purging information will be recorded on the field form and should include well identification, date and time of purging, type of purging equipment, depth to water, well diameter, computed volume of water in well, appearance of purge water, volume of water purged, and field parameter readings.

4.2 Groundwater Sample Collection

Subsequent to purging activities, groundwater samples will be collected and submitted for laboratory analysis. If possible, groundwater samples will be collected within three hours after purging is completed. If recharge is sufficient, then samples will be collected immediately following well purging. For slowly recharging wells, groundwater samples will be collected after a sufficient volume of water for sampling is available in the well. During sampling, take care to prevent the tubing from coming in contact with any objects other than the riser of the well. Prior to sample collection, a new pair of nitrile gloves will be donned by sampling personnel. The groundwater sample for PFAS analysis will be collected first by direct filling the polypropylene or HDPE laboratory-provided containers. The sample for 1,4-dioxane analysis will be collected after the PFAS sample collection has been completed (including collection of any QC samples for PFAS analysis). The 1,4-dioxane samples will also be direct-filled into laboratory-provided containers. The sample container type, preservation and relative hold time are provided on Table 2. After collecting the sample, record the sample identification, project name, date and time of sample collection and sample analysis required onto the sample containers and on the field form. Record the sample information on to a laboratory provided chain of custody and place the sample containers in a cooler containing regular ice for transportation to the laboratory. Close and lock (if applicable) the monitoring well.

Groundwater sampling information will be recorded on the field form. Information to record should include date and time of sampling, well identification, sample identification, method of sample collection, appearance of sample, type of sample container, analytical method requested, and identification of QC samples.

4.3 Quality Assurance/Quality Control Samples

Field duplicate samples will be collected at a rate of one per 19 environmental samples (not including the field duplicate) or, if less than 19 samples and practical, one per sample delivery group (SDG) per analysis (i.e., PFAS, 1,4-dioxane). Matrix spike/matrix spike duplicate (MS/MSD) sample pairs will also be collected at a rate of one per 19 environmental samples or, if less than 19 samples and practical, one per SDG per analysis. Equipment blanks will be collected for each SDG or 20 field samples, whichever occurs first. Equipment blanks will include each type of sampling equipment used including single use, pre-cleaned sampling equipment. Equipment blanks will be collected by pouring laboratory provided water over sampling equipment and into laboratory provided containers. Equipment blanks will be subject to the same analyses as the associated environmental samples.

In addition, one field reagent blank (FRB) will be collected on each day samples for PFAS analysis are collected and/or at least one FRB per sample area. FRBs are collected in the field by transferring laboratory supplied PFAS-free water in one sample container into an empty laboratory-supplied container at the same general location and time as the collection of the environmental samples. FRBs are for PFAS analysis only and are not applicable to samples collected for 1,4-dioxane analysis.

Table 1 provides a summary of the QC samples and analytical methods.

4.4 Sample Identification and Labeling

Sample labels should be prepared at the time of sample collection with the information described above. The collected samples will be assigned a unique sample identification code based on the sampling location. Generally, for groundwater samples, the sample identification code will include the field location number and date of collection. MS/MSD samples will be identified as MS/MSD samples on the chain-of-custody.

Blind field duplicate samples will be labeled X-1, X-2, etc. The field notes will identify the blind field duplicate samples, as well as where they were obtained.

4.5 Laboratory Analysis and Data Validation

The groundwater and QC samples will be analyzed for 21 PFAS by modified USEPA Method 537. This method was originally developed for use with the Third Unregulated Contaminant Monitoring Rule (UCMR3), which included six PFAS. The UCMR3 list of six PFAS and NYSDEC's current list of 21 PFAS analytes both include PFOS and PFOA, which are currently the only two PFAS for which USEPA has drinking water health advisories and for which NYSDOH recently established drinking water standards. The groundwater and QC samples will be analyzed for 1,4-dioxane by USEPA SW-846 Method 8270 with SIM which also has a NYSDOH established drinking water standard. Table 3 lists the analytical laboratory method detection limits and practical quantitation limits for the 21 PFAS and 1,4-dioxane.

The analytical laboratories will provide Analytical Service Protocol (ASP) Category B analytical data packages that document sample preparation, extraction, and analysis for the samples. EQuIS^{TM} 4-file electronic data deliverables (EDDs) will also be provided by the analytical laboratory.

Following receipt of the analytical data packages, the analytical data will be validated by an independent data validator in accordance with this SOW and with guidance from the following documents as appropriate:

- NYSDEC. 2021. Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs, January 2021, reference (1).
- USEPA. 2018. USEPA Data Review and Validation Guidelines for Perfluoroalkyl Substances (PFASs) Analyzed Using EPA Method 537, EPA 910-R-18-001, November 2018, reference (8).
- USEPA. 2017. USEPA Contract Laboratory Program (CLP) National Functional Guidelines for Organic Superfund Methods Data Review, January 2017, reference (9).

The validated analytical data will be evaluated by comparison of the detected PFAS concentrations to the lifetime health advisories issued by USEPA in May 2016 [70 parts per trillion (ppt)] for PFOA and PFOS, individually and combined and the drinking water standards established by NYSDOH in August 2020 [10 ppt for PFOA, 10 ppt for PFOS, and 1 part per billion (ppb) for 1,4-dioxane]. With the exception of the above water standards, there are no federal or state ambient groundwater quality standards for 1,4-dioxane or any PFAS (including PFOA and PFOS). Further assessment may be warranted if either of the following additional NYSDEC screening levels are met:

- Any other individual PFAS (excluding PFOA or PFOS) is detected in water at or above 100 ppt; or
- Total concentration of PFAS (including PFOA and PFOS) is detected in water at or above 500 ppt.

4.6 Equipment Cleaning

All non-dedicated sampling equipment will be cleaned between each use. Equipment will be cleaned using a spray bottle with laboratory provided water, followed by a 1,4-dioxane free soap (e.g., Seventh Generation™)/laboratory provided water mix. A secondary rinse with the laboratory provided water should then be used and the equipment wiped with paper towels. Cleaning fluids will be returned to ground surface near each sampling location, absent of any visual or olfactory evidence of contamination.

4.7 IDW Management

IDW may include, but not necessarily be limited to, PPE and disposable sampling materials (e.g., tubing, paper towels), and purged groundwater.

PPE and sampling materials will be appropriately containerized and disposed of in accordance with KAPL waste management procedures. At this time, it is assumed that PPE and purged groundwater will be non-hazardous.

Purge water will be returned to the ground within the same general area from which it was generated, absent of any visual or olfactory evidence of gross contamination.

5.0 IMPLEMENTATION SCHEDULE AND REPORTING

This SOW will be implemented by a subcontractor experienced in PFAS and 1,4-dioxane sampling, under KAPL-Environmental Remediation oversight during the 2nd Quarter 2021. NYSDEC will be kept apprised of the fieldwork schedule as it develops.

Results of the PFAS and 1,4-dioxane analyses will be provided to NYSDEC in a report that will include the data validation report. The ASP Category B data packages will be uploaded to NYSDEC's File Transfer Service, and the validated analytical data will also be submitted to NYSDEC in an EDD-format compliant with NYSDEC's Environmental Information Management System requirements. A schedule for submitting the monitoring report to NYSDEC will be provided within 30 days of receiving the final validated data.

6.0 REFERENCES

1) NYSDEC. 2021. Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs, January 2021
2) USEPA. 2017. USEPA Technical Fact Sheet – 1,4-Dioxane, EPA 505-F-17-011, November 2017
3) USEPA. 2017. USEPA Technical Fact Sheet – Perfluorooctane Sulfonate (PFOS) and Perfluorooctanoic Acid (PFOA), EPA 505-F-17-001, November 2017
4) KAPL. 2016. RCRA Facility Investigation Report for the Land Disposal Area, KAPL – Knolls Site. October 2011, Revised July 2016 and November 2016
5) KAPL. 2012. KAPL, Knolls Site – RCRA Sampling and Analysis Report for the Q3 Yard (AOC-005), March 2012, Revision 1.
6) KAPL. 2017. Interim Corrective Measure Report for the High Yard Area (SWMU-023). February 2017
7) KAPL. 2019. Interim Corrective Measure Report for the Hillside Area (AOC-001) G1-D4 Alleyway. December 2019.
8) USEPA. 2018. USEPA Data Review and Validation Guidelines for Perfluoroalkyl Substances (PFASs) Analyzed Using EPA Method 537, EPA 910-R-18-001, November 2018
9) USEPA. 2017. USEPA Contract Laboratory Program (CLP) National Functional Guidelines for Organic Superfund Methods Data Review, January 2017

Tables

Table 1

Sample Schedule and Analytical Methods/Quality Control Summary

Knolls Atomic Power Laboratory
Knolls Laboratory
Emerging Contaminants Sampling Scope of Work

Well ID	*Location/Sampling Rationale*	*Analytical Method*	
		21 PFAS by modified EPA Method 537	*1,4-Dioxane by EPA Method 8270 SIM*
LDA Wells:			
LMW-103	Downgradient of GW divide with detections of CVOCs	1	1
LMW-142	Downgradient of GW divide and trace concentrations of 1,1,1-TCA	1	1
Q3 Yard Wells:			
Q3-MW03	Upgradient Well in Q3 Yard	1	1
Q3-MW103	Upgradient Well in Q3 Yard	1	1
Q3-MW19	Downgradient wells and historical detections of 1,1,1-TCA, 1,1-DCA or other CVOCS	1	1
Q3-MW23		1	1
Q3-MW34		1	1
High Yard Area Well:			
MW-6R	Downgradient monitoring well with historical detections of CVOCs	1	1
Hillside Area Wells:			
MW-40	Upgradient monitoring well	1	1
MW-45	Downgradient wells with historical detections of CVOCs	1	1
MW-51		1	1
Closed Landfill Wells:			
NTH-1A	Upgradient of landfill	1	1
NTH-2A	Downgradient of landfill	1	1
NTH-5A	Downgradient of landfill	1	1
	Estimated Environmental Samples	14	14
	Field Duplicate	1	1
	MS	1	1
	MSD	1	1
	Equipment Blank	1	1
	Field Reagent Blank*	5	0
	Total	**23**	**18**

Notes:

PFAS = Per and polyfluoroalkyl substances; EPA = United States Environmental Protection Agency;
SIM = selected ion monitoring; MS = matrix spike; MSD matrix spike duplicate
TCA - trichloroethane, DCA - dichloroethane, DCE - dichloroethene,
CVOC - chlorinated volatile organic compound, LDA - Land Disposal Area
* Field reagent blanks will be collected for PFAS analysis only.

Table 2

Sample Container, Preservation, and Holding Times

Knolls Atomic Power Laboratory
Knolls Laboratory
Emerging Contaminants Sampling Scope of Work

Matrix	Parameter	Sample Containers	Preservation	Holding Time
Water	PFAS	2 x 250 mL HDPE containers	$\leq 6\ ^{o}C$	14 days
	1,4-dioxane	2 x 250 mL amber glass containers	$\leq 6\ ^{o}C$	7 days

Notes:

PFAS = Per- and polyfluoroalkyl substances; mL = milliliters; HDPE = High Density Polyethylene

^{o}C = degrees Celsius

Holding times begin from the date of sample collection.

Extra sample volume will be collected for matrix spike/matrix spike duplicate samples, as needed.

Source of information: Eurofins Test America Laboratories in Sacramento, California (PFAS) and Edison, New Jersey (1,4-dioxane).

Table 3

Laboratory Method Detection Limits and Practical Quantitation Limits

Knolls Atomic Power Laboratory
Knolls Laboratory
Emerging Contaminants Sampling Scope of Work

PFAS Chemical Name	CASRN	Groundwater MDL (ng/L)	Groundwater PQL (ng/L)
Perfluorobutane sulfonic acid	375-73-5	0.200	2.00
Perfluorohexane sulfonic acid	355-46-4	0.570	2.00
Perfluoroheptane sulfonic acid	375-92-8	0.190	2.00
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.540	2.00
Perfluorodecane sulfonic acid	335-77-3	0.320	2.00
Perfluorobutanoic acid	375-22-4	2.40	5.00
Perfluoropentanoic acid	2706-90-3	0.490	2.00
Perfluorohexanoic acid	307-24-4	0.580	2.00
Perfluoroheptanoic acid	375-85-9	0.250	2.00
Perfluorooctanoic acid (PFOA)	335-67-1	0.850	2.00
Perfluorononanoic acid	375-95-1	0.270	2.00
Perfluorodecanoic acid	335-76-2	0.310	2.00
Perfluoroundecanoic acid	2058-94-8	1.10	2.00
Perfluorododecanoic acid	307-55-1	0.550	2.00
Perfluorotridecanoic acid	72629-94-8	1.30	2.00
Perfluorotetradecanoic acid	376-06-7	0.730	2.00
1H, 1H, 2H, 2H-Perfluorooctane sulfonic acid	27619-97-2	2.50	5.00
1H, 1H, 2H, 2H-Perfluorodecanesulfonic acid	39108-34-4	0.460	2.00
Perfluorooctane sulfonamide	754-91-6	0.980	2.00
N-Methylperfluorooctane sulfonamido acetic acid	2355-31-9	1.20	5.00
N-Ethylperfluorooctane sulfonamido acetic acid	2991-50-6	1.30	2.00
Chemical Name	**CASRN**	**MDL (µg/L)**	**PQL (µg/L)**
1,4-Dioxane	123-91-1	0.0160	0.200

Notes:

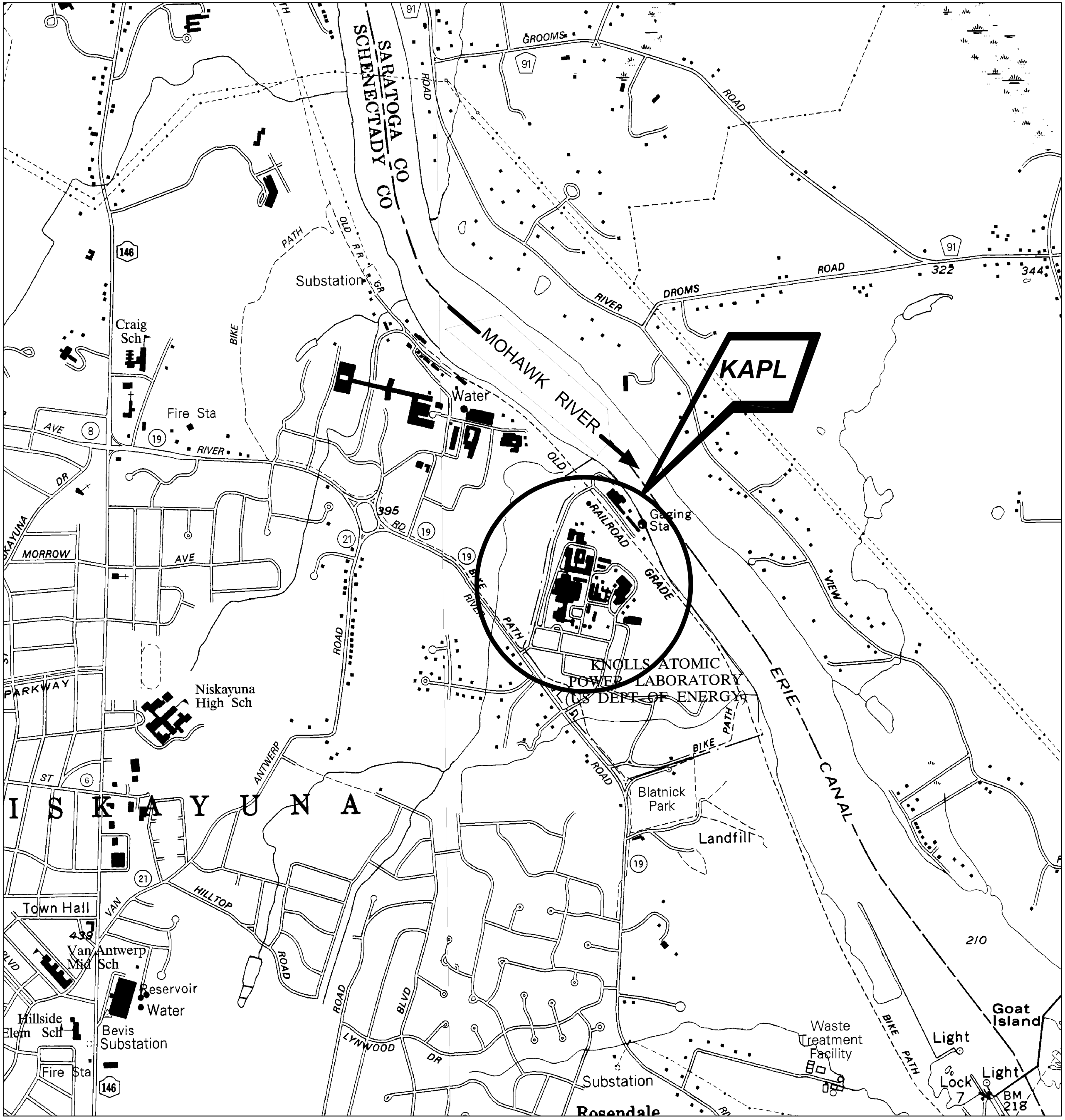
PFAS = Per- and polyfluoroalkyl substances; CASRN = Chemical Abstracts Service Registry Number; MDL = method detection limit; PQL = practical quantitation limit; ng/L = nanograms per liter or parts per trillion; µg/L - micrograms per liter or parts per billion.

Source of PFAS analytes list: New York State Department of Environmental Conservation. Sampling, Analysis, and Assessment of PFAS, Appendix G, January 2021.

Source of MDLs and PQLs: Eurofins Test America Laboratories in Sacramento, California (PFAS) and Edison, New Jersey (1,4-dioxane). MDL and PQL values may vary based on the overall analyte concentration in the sample and potential matrix interferences.

Figures

FIGURE 1

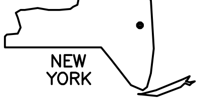


ADAPTED FROM: NISKAYUNA & SCHENECTADY QUAD., N.Y. STATE U.S.G.S. 7.5 MIN. QUAD

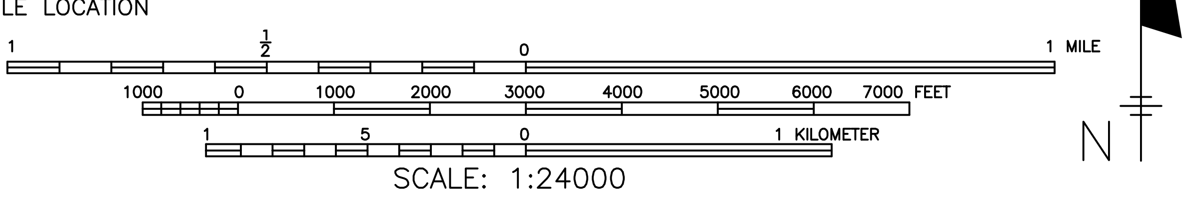
KNOLLS ATOMIC POWER LABORATORY – KNOLLS LABORATORY

NISKAYUNA, NEW YORK

EMERGING CONTAMINANTS SAMPLING SCOPE OF WORK SITE LOCATION MAP



QUADRANGLE LOCATION



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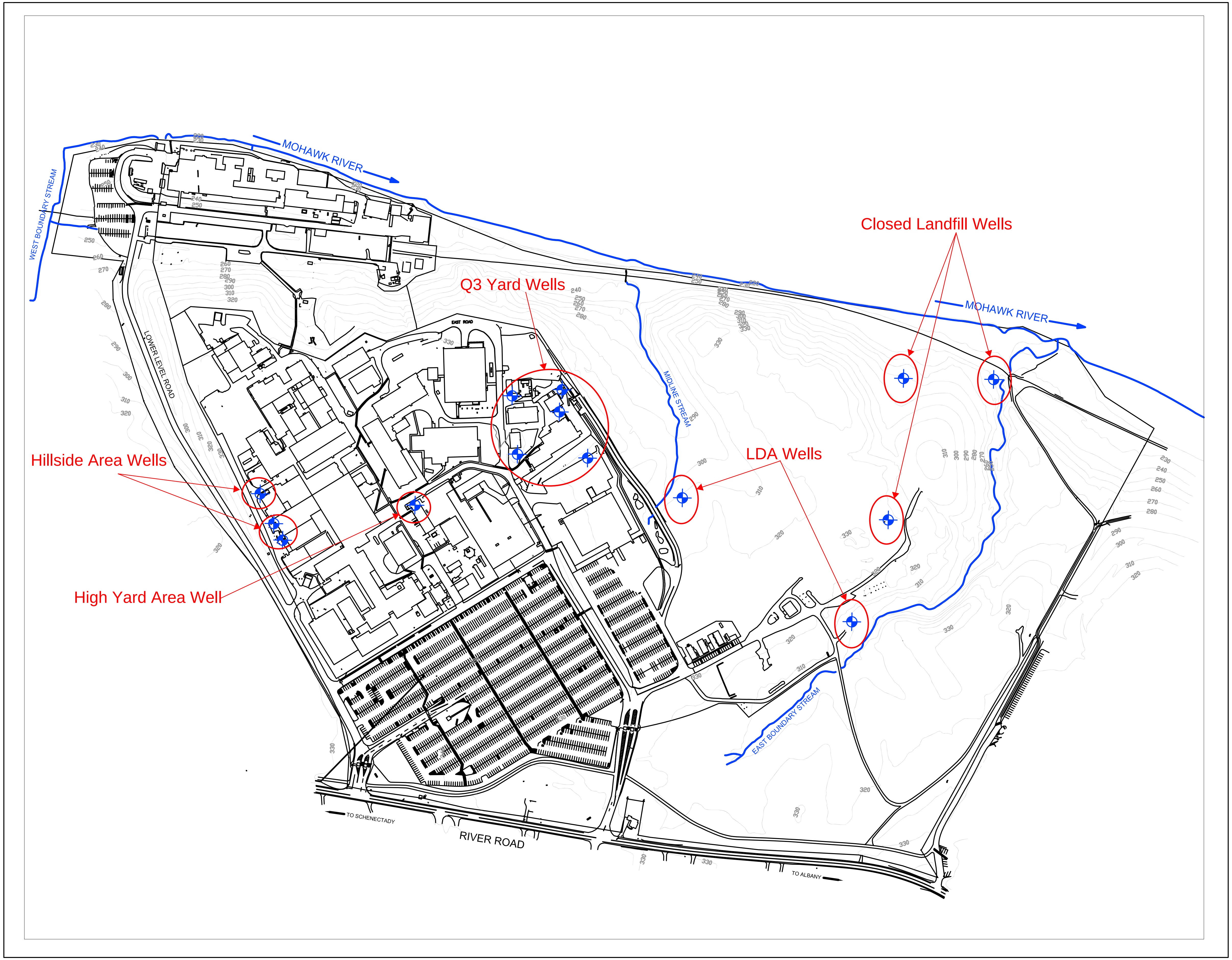


N

LEGEND

⌖ PROPOSED SAMPLE LOCATION

Note:
1. Vertical datum of topographic contours is National Geodetic Vertical Datum of 1929 (NGVD 29).

KNOLLS ATOMIC POWER
LABORATORY -
KNOLLS LABORATORY
NISKAYUNA, NEW YORK

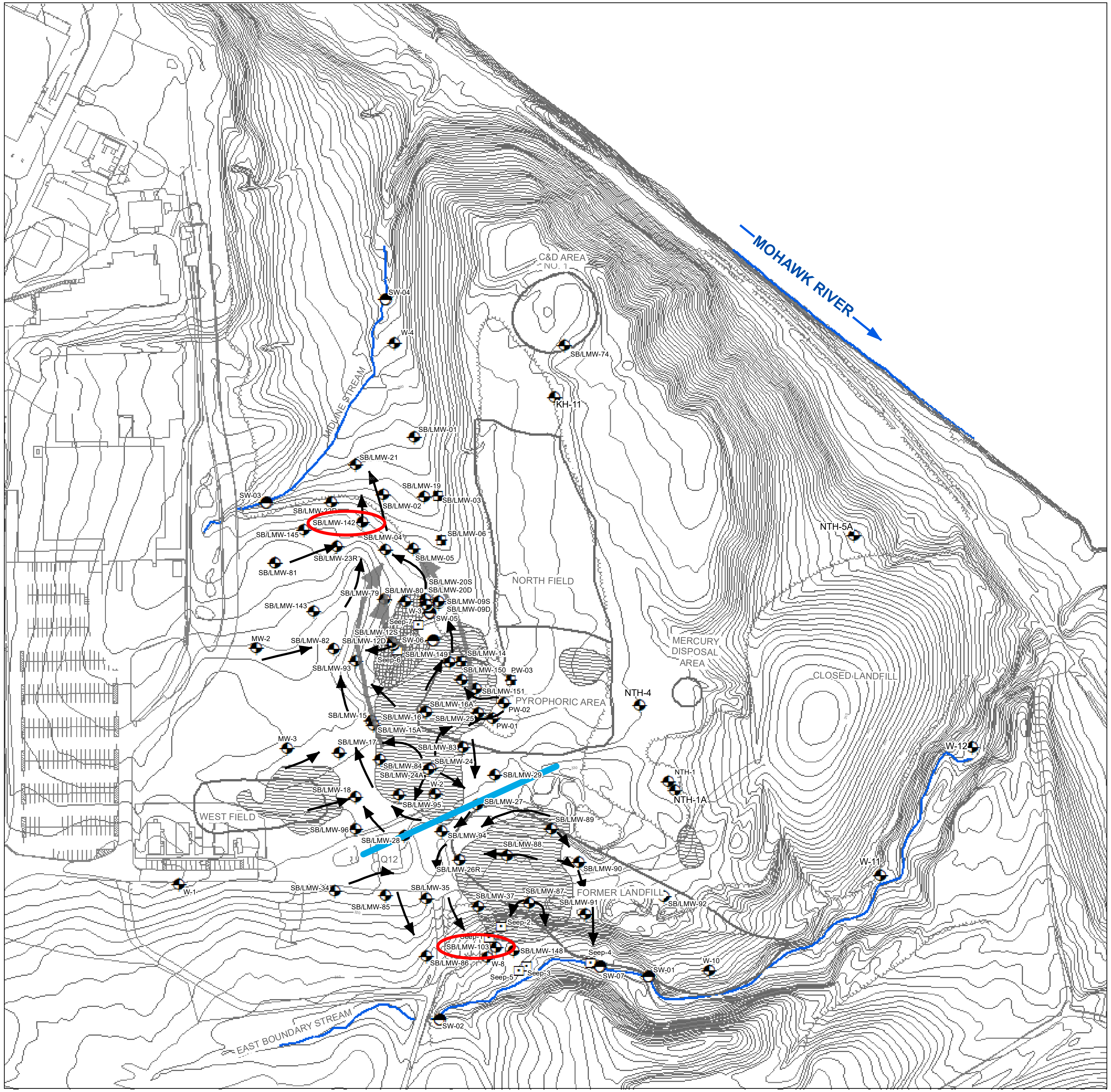
EMERGING CONTAMINANTS
SAMPLING SCOPE OF WORK

FIGURE 2

PROPOSED SAMPLE
LOCATIONS

0 375 750

SCALE IN FEET



N

Legend

⭕ Groundwater Monitoring Well and Identification Number selected for EC Sampling

SB/LMW-12S ⊕ Monitoring Well Location Used for Contouring

Well ID Prefix Designator

W, MW, KH, NTH - Pre-LDA RCRA Corrective Action Site Wells

PW - SPRU Well

SB/LMW - LDA Sampling Visit and RFI Boring/Well

SB/LMW-06 ⊞ Former Well Location

SW-03 ◓ Surface Water Sampling Location

Seep-1 ⊡ Seep Sampling Location

➡ Groundwater Flow Direction

➡ Northern Sub-Plume

— Groundwater Divide

— Topographic Contour (2-Foot Interval)

▤ Area Containing Possible Buried Metal Objects

▨ Area Containing Possible Conductive Soil or Groundwater

Note:
1. This figure adaped from Figures 19, 20, and 31 of the *RCRA Facility Investigation Report for the Land Disposal Area*, October 2011, Revised July 2016 and November 2016.

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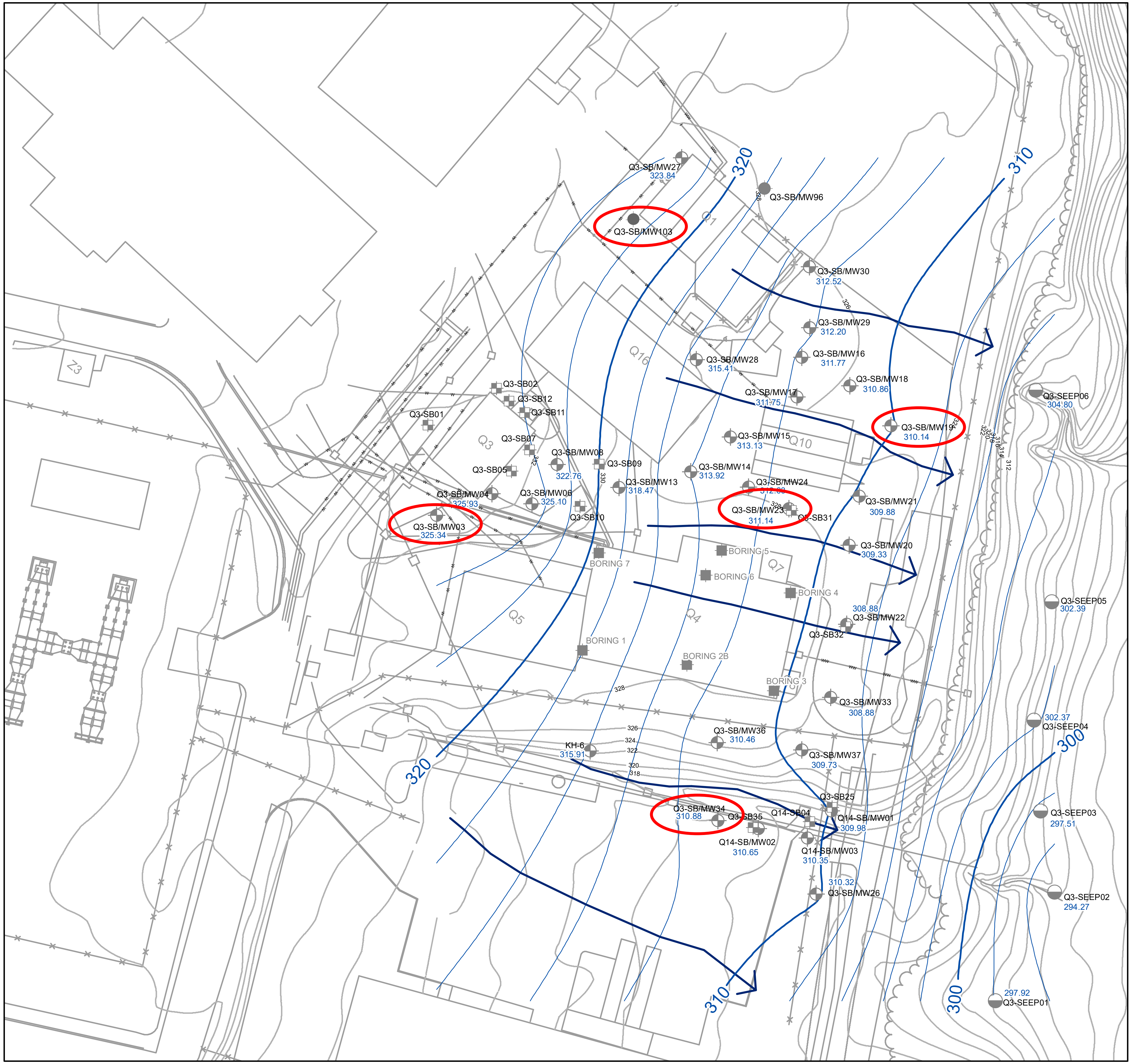
LABORATORY - KNOLLS LABORATORY
NISKAYUNA, NEW YORK

EMERGING CONTAMINANTS SAMPLING
SCOPE OF WORK

FIGURE 3
LAND DISPOSAL AREA PROPOSED SAMPLE LOCATION MAP

0 200 400
Feet

Source: KAPL Land Disposal Area Focused Corrective Measures Study Report, May 2018, Figure 6



N

Legend

- ● RFI Soil Boring/Monitoring Well Location
- ⊕ 2010 Soil Boring/Monitoring Well Location
- ▣ 2010 Soil Boring Location
- ◒ 2010 Seep Location
- ■ Early Site Construction Geotechnical Boring
- — Groundwater Elevation Contour (2-Foot Interval)
- 312.52 Groundwater Elevation (Feet Above Mean Sea Level)
- → Groundwater Flow Direction
- ⬭ Groundwater Monitoring Well and Identification Number selected for EC Sampling

Notes:

1. 2010 soil and groundwater sample locations surveyed by Richard Rybinski Land Surveying, December 2010.
2. RFI groundwater sample location surveyed by CT Male Associates, October 2019.
2. Ground elevation contour interval is 2 feet.
3. Early site construction geotechnical boring locations not surveyed. Locations are approximate.

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NISKAYUNA, NEW YORK

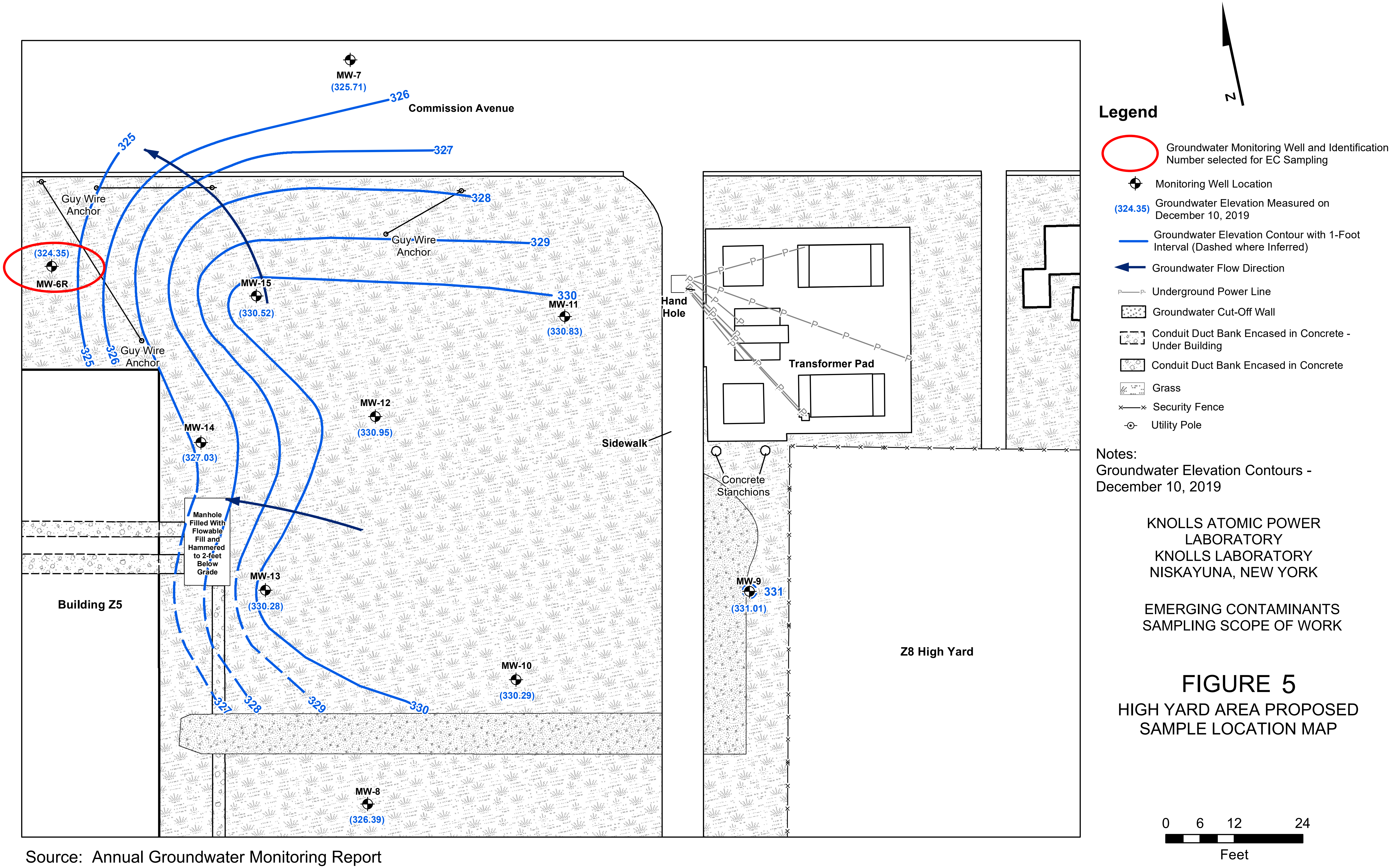
EMERGING CONTAMINANTS
SAMPLING SCOPE OF WORK

FIGURE 4

Q3 YARD PROPOSED SAMPLE LOCATION MAP

GROUNDWATER ELEVATION CONTOURS NOVEMBER 29, 2010

0 70 140
Feet



Notes:
Groundwater Elevation Contours -
December 10, 2019

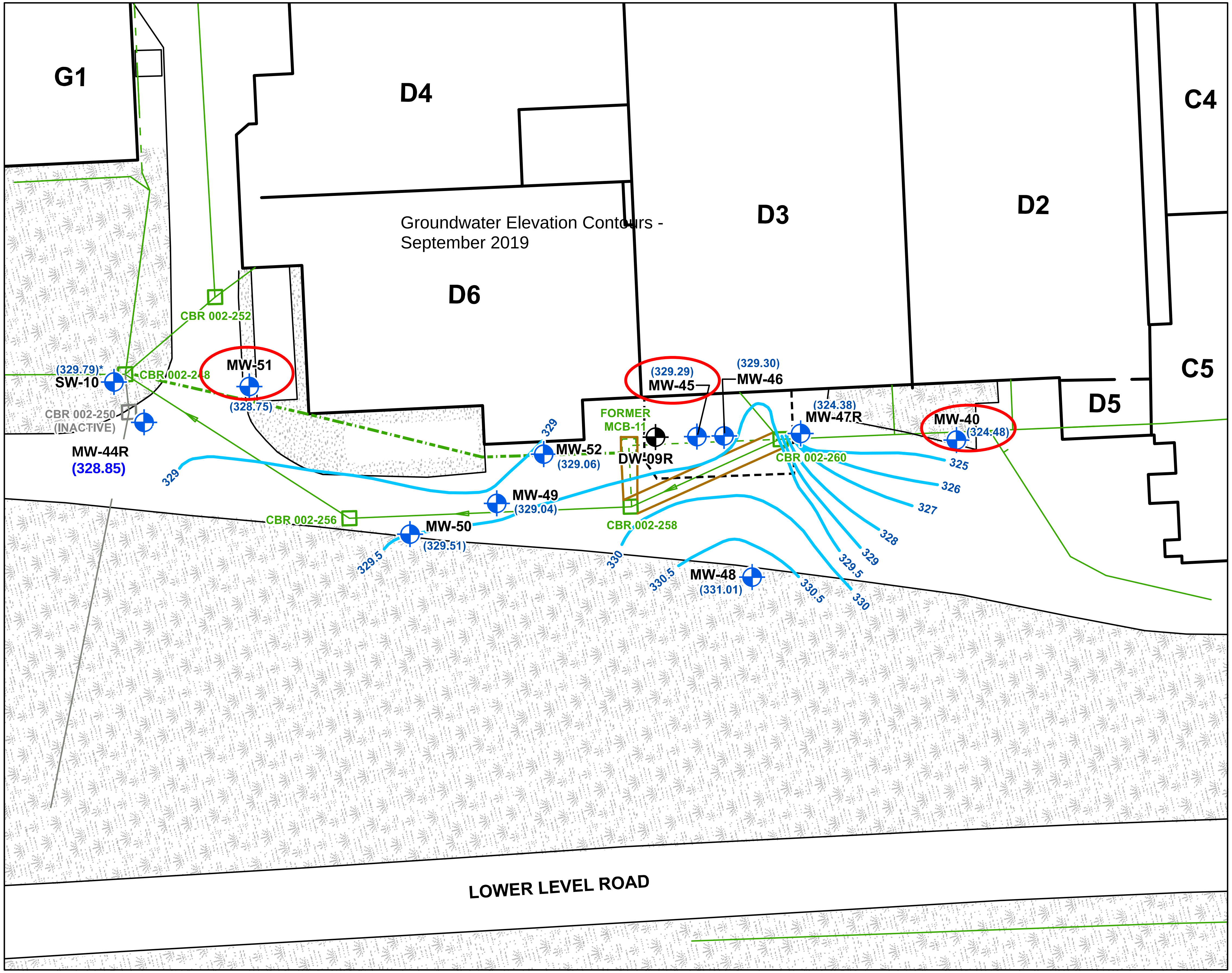
KNOLLS ATOMIC POWER
LABORATORY
KNOLLS LABORATORY
NISKAYUNA, NEW YORK

EMERGING CONTAMINANTS
SAMPLING SCOPE OF WORK

FIGURE 5

HIGH YARD AREA PROPOSED
SAMPLE LOCATION MAP

Source: Annual Groundwater Monitoring Report
for the High Yard Area (SWMU-023), March 2020



Source: Interim Corrective Measure Report for the Hillside Area (AOC-001) G1-D4 Alleyway, Attachment 1, December 2019

Legend

N

- ⊕ Monitoring Well Location
- ⊕ Monitoring Well Location - Damaged
- (331.01) Water Elevation Measured on September 18, 2019
- Groundwater Elevation Contour with 0.5-Foot Interval
- Storm Sewer Line
- ☐ Catch Basin
- Flowable Fill Boundary
- Abandoned Storm Sewer Line or Catch Basin
- 24-inch Bell and Spigot Concrete Storm Sewer Pipe Segment Removed in 1996
- Foundation Drain
- ICM Excavation Area Limit
- ▨ Grass Cover
- ▨ Gravel Cover
- ○ Groundwater Monitoring Well and Identification Number selected for EC Sampling

Note:
1. "*" indicates water elevation was not used in contouring.

Groundwater Elevation Contours -
September 2019

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KNOLLS LABORATORY
NISKAYUNA, NEW YORK

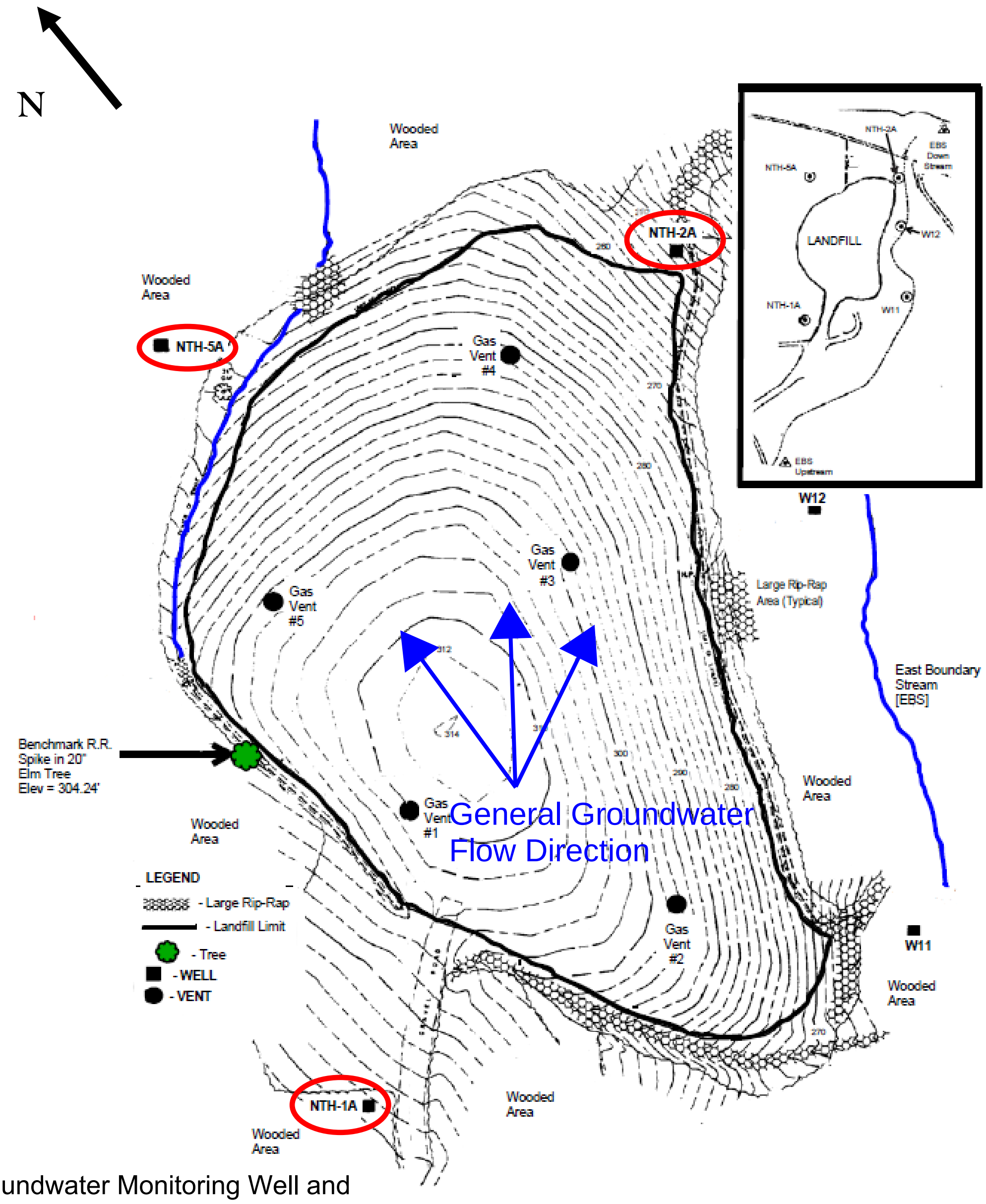
EMERGING CONTAMINANTS SAMPLING
SCOPE OF WORK

FIGURE 6

HILLSIDE AREA PROPOSED SAMPLE LOCATION MAP

0 15 30 60
Feet

FIGURE 7
CLOSED LANDFILL - PROPOSED SAMPLE LOCATION MAP



Groundwater Monitoring Well and Identification Number selected for EC Sampling

Source: Annual 2020 Post-Closure Landfill Monitoring Report for the KAPL - Knolls Laboratory, August 2020

Attachment 1

Attachment 1. Summary of Prohibited and Acceptable Items for PFAS Sampling

Prohibited	Acceptable
Field Equipment	
Materials and equipment containing the following: - Polytetrafluoroethylene (PTFE), including the trademarks Teflon® and Hostaflon® - Fluorinated ethylene propylene (FEP), including the trademarks Teflon® FEP, Hostaflon® FEP, and Neoflon® - Polyvinylidene fluoride (PVDF), including the trademark Kynar® - Polychlorotrifluoroethylene (PCTFE), including the trademark Neoflon® - Ethylene-tetrafluoroethylene (ETFE), including the trademark Tefzel® - Trademarks Viton®, Gore-Tex®, and Decon 90®	Materials and equipment containing the following: - Silicone - Acetate - Stainless steel - Polypropylene - Polyurethane - Polyvinylchloride (PVC) - Neoprene - Nylon
Low density polyethylene (LDPE) materials, unless certified by the manufacturer as PFAS-free	High density polyethylene (HDPE) materials
Waterproof field books, waterproof paper and waterproof sample bottle labels	Loose-leaf, non-waterproof paper and non-waterproof sample labels
Plastic clipboards, binders, or spiral hard cover notebooks	Aluminum field clipboards or with Masonite
Waterproof/permanent markers, including the trademark Sharpies®	Ball point pens or pencils
Aluminum foil	LDPE storage bags, including Ziploc®, that do not come into direct contact with sample media
Post-It Notes®, or similar	
Chemical (blue) ice packs	Double-bagged water ice
Field Clothing and PPE	
New cotton clothing or synthetic water resistant, waterproof, or stain-treated clothing, including: - Any Teflon® fabric protectors (e.g., Gore-Tex™, Repel Teflon® and Ultra Release Teflon®) - Any Scotchgard™ fabric protectors - Bionic Finish® - GreenShield® - High-Performance Release Teflon® and Ultra Release Teflon® - Lurotex Protector FL ECO® - Resists Spills™ and Releases Stains™ - RUCO®, RUCO-COAT®, RUCO-GUARD®, RUCO-PROTECT®, RUCOSTAR®, RUCOTEC®, and Rucostar® EEE6 - NK Guard S series - Oleophobol CP® - Repellan KFC® - Unidyne™	Clothing made from: - Fabric made of synthetic or natural fibers (preferably cotton) that are well-laundered (more than six times with no fabric softener) - Fabric made from or treated with neoprene, polyurethane, or PVC - Wax-coated fabrics - PVC-coated fabrics
Clothing laundered using fabric softener	No fabric softener
Clothing chemically treated for insect resistance or ultraviolet (UV) protection	
Boots containing Gore-Tex™ or treated with water-resistant spray	Boots made with polyurethane and PVC
Coated (i.e., yellow) Tyvek®	Non-coated (i.e., white)Tyvek®

Attachment 1. Summary of Prohibited and Acceptable Items for PFAS Sampling

Prohibited	Acceptable
No cosmetics, moisturizers, hand cream, or other related products as part of personal cleaning/showering routine on the morning of sampling	
Sunscreens or insecticides, except as noted on right	Sunscreens - Alba Organics Natural Sunscreen - Aubrey Organics - Banana Boat for Men Triple Defense Continuous Spray SPF 30 - Banana Boat Sport Performance Coolzone Broad Spectrum SPF 30 - Banana Boat Sport Performance Sunscreen Stick SPF 50 and Lotion Broad Spectrum SPF 30 - Coppertone Sport High-Performance AccuSpray Sunscreen SPF 30 - Coppertone Sunscreen Lotion Ultra Guard Broad Spectrum SPF 50 - Coppertone Sunscreen Stick Kids SPF 55 - Jason Natural Sun Block - Kiss My Face - L'Oréal Silky Sheer Face Lotion 50+ - Meijer Clear Zinc Sunscreen Lotion Broad Spectrum SPF 15, 30 and 50 - Meijer Wet Skin Kids Sunscreen Continuous Spray Broad Spectrum SPF 70 - Neutrogena Beach Defense Water + Sun Barrier Lotion SPF 70 and Broad Spectrum SPF 30 - Neutrogena Pure & Free Baby Sunscreen Broad Spectrum SPF 60+ - Neutrogena Ultra-Sheer Dry-Touch Sunscreen Broad Spectrum SPF 30 - Yes To Cucumbers Insect Repellents - Baby Ganics - California Baby Natural Bug Spray - Jason Natural Quit Bugging Me - Herbal Armor - Repel Lemon Eucalyptus Insect repellant - Sawyer Permethrin Sunscreen and insect repellant - Avon Skin So Soft Bug Guard Plus - SPF 30
Sample Containers	
LDPE or glass containers	HDPE or polypropylene
Teflon®-lined caps	Unlined polypropylene caps
Rain Events	
Waterproof or resistant rain gear	Wet weather gear made of polyurethane and PVC only; field tents that are only touched or moved prior to and following sampling activities
Equipment Decontamination	
Decon 90®	Alconox®, Liquinox®, and Citranox® branded products
Water from an on-site well	
Potable water from untested public water supply	Laboratory supplied PFAS-free water

Attachment 1. Summary of Prohibited and Acceptable Items for PFAS Sampling	
Prohibited	**Acceptable**
Food Considerations	
All food and drink, with exceptions noted on right	Bottled water and hydration fluids (i.e., Gatorade® and Powerade®) to be brought and consumed only in the staging areas
Vehicle Considerations	
Vehicle fabrics, carpets and mats may contain PFAS	Avoid utilizing areas inside vehicle as sample staging areas

Attachment 2

RAMBOLL

ENVIRONMENT
& HEALTH

PFAS Pre-Sampling Checklist

Site Name: ______________________________

Task: ______________________________

Weather (temp/precip): ______________________________

Date: ______________________________

Pre-Mobilization:

- ☐ The QAPP or other site-specific field guidance has been consulted for sample locations, QC sampling requirements, and sample nomenclature

Field Clothing and PPE:

- ☐ Using white Tyvek®; not using yellow Tyvek®
- ☐ Clothing has not been most recently washed with fabric softeners or other treatments
- ☐ Clothing has not been permanently chemically treated for insect resistance or UV protection
- ☐ Clothing has not been treated with materials or formulations potentially containing PTFE or other PFAS products listed named in this checklist
- ☐ Any personal care products, if used, have been applied outside sampling zone, hands have been washed, and new nitrile gloves are being used
- ☐ Any use of sunscreens or insect repellants is consistent with the commercial products named in this checklist

Field Equipment:

- ☐ Subcontractor (e.g., driller) materials and equipment conform to the requirements of this checklist (as applicable)
- ☐ Sampling equipment is free of PTFE and other potentially PFAS-containing components listed in this checklist
- ☐ Sampling equipment is made from stainless steel, HDPE, acetate, silicon, HDPE, or nylon
- ☐ Waterproof field books, waterproof paper, and Post-It Notes® are not used
- ☐ Markers (e.g., Sharpies®) are used only in the staging area or are not used

Sample Containers:

- ☐ Water ice is in use only, not chemical (blue) ice packs
- ☐ Sample containers have been received and are made of HDPE or polypropylene
- ☐ Bottleware for non-drinking water samples do not contain preservative
- ☐ Caps are unlined and made of HDPE or polypropylene

Wet Weather (as applicable):

- ☐ Wet weather gear made of polyurethane and PVC only, or is being worn under white Tyvek® covering

Equipment Decontamination (as applicable):

- ☐ On-site or off-site public or private water, if to be used for equipment decontamination, has been analyzed and is "PFAS-free" (water that does not contain any site-specific target PFAS analytes above laboratory detection limits).
- ☐ Alconox®, Liquinox®, Seventh Generation™, and Citranox® are being used as decontamination cleaning agents; Decon 90® is not being used.

Food Considerations:

- ☐ Any pre-wrapped food or snacks, carry-out food, fast food, or other food items will remain in the staging area
- ☐ Any food items, will be consumed outside the sampling zone, hands will be washed, and new PPE and nitrile gloves will be used

Work Area and Vehicle Considerations:

- ☐ Work areas, including vehicle interiors if used for sample handling, are covered with HDPE or LDPE plastic to prevent contact with potentially PFAS-containing materials and surfaces

If any applicable boxes cannot be checked, describe deviations below and work with field personnel to address issues prior to commencement of that day's work. Materials present and identified as potentially containing PFAS through use of this checklist should be relocated to the support area or other area of the site away from the sampling locations and noted below.

____
Field Team Leader Name and Signature

____
Time

Field clothing and PPE to be **avoided** include:

- Clothing that has recently been washed with fabric softener.
- Coated (i.e., yellow) Tyvek®.
- Clothing chemically treated for insect resistance and ultraviolet protection.
- Clothing that has been treated with water and/or stain resistant coatings such as:
  - Any Teflon® fabric protectors (e.g., Gore Tex)
  - Any Scotchgard™ fabric protectors
  - Bionic Finish®
  - GreenShield®
  - High-Performance Release Teflon®
  - Lurotex Protector RL ECO®
  - Resists Spills™ and Releases Stains™
  - RUCO®
  - RUCO-COAT®
  - RUCO-GUARD®
  - RUCO-PROTECT®
  - RUCOSTAR®
  - NK Guard S series
  - Oleophobol CP®
  - Repel Teflon® fabric protector
  - Repellan KFC®
  - Rucostar® EEE6
  - RUCOTEC®
  - Ultra Release Teflon®
  - Unidyne™

If required, sun and biological protection products **preferred for use** (however, care should be taken to use these exact products because similar products from the same brand may contain PFAS) include:

- Alba Organics Natural Sunscreen
- Aubrey Organics
- Avon Skin So Soft Bug Guard-SPF 30
- Baby Ganics
- Banana Boat for Men Triple Defense Continuous Spray Sunscreen SPF 30
- Banana Boat Sport Performance Coolzone Broad Spectrum SPF 30
- Banana Boat Sport Performance Sunscreen Lotion Broad Spectrum SPF 30
- Banana Boat Sport Performance Sunscreen Stick SPF 50
- California Baby Natural Bug Spray

- Coppertone Sport High-Performance AccuSpray Sunscreen SPF 30
- Coppertone Sunscreen Lotion Ultra Guard Broad Spectrum SPF 50
- Coppertone Sunscreen Stick Kids SPF 55
- Herbal Armor
- Jason Natural Quit Bugging Me
- Jason Natural Sun Block
- Kiss My Face
- L'Oréal Silky Sheer Face Lotion 50+
- Meijer Clear Zinc Sunscreen Lotion Broad Spectrum SPF 15, 30 and 50
- Meijer Wet Skin Kids Sunscreen Continuous Spray Broad Spectrum SPF 70
- Neutrogena Beach Defense Water + Sun Barrier Lotion SPF 70
- Neutrogena Beach Defense Water + Sun Barrier Spray Broad Spectrum SPF 30
- Neutrogena Pure & Free Baby Sunscreen Broad Spectrum SPF 60+
- Neutrogena Ultra-Sheer Dry-Touch Sunscreen Broad Spectrum SPF 30
- Repel Lemon Eucalyptus
- Sawyer Permethrin
- Yes To Cucumbers

Sampling equipment and materials to be **avoided**, which include:

- Polytetrafluoroethylene (PTFE), including the trademarks Teflon® and Hostaflon®.
- Fluorinated ethylene propylene (FEP), including the trademarks Teflon® FEP, Hostaflon® FEP, and Neoflon®.
- Polyvinylidene fluoride (PVDF), including the trademark Kynar®.
- Polychlorotrifluoroethylene (PCTFE), including the trademark Neoflon®.
- Ethylene-tetrafluoroethylene (ETFE), including the trademark Tefzel®.
- Trademarks Viton®, Gore-Tex® and Decon 90® products with the term "fluoro" in the product name.
- Waterproof field notebooks.
- New clothing, as it may have fabric treatment applied.
- Post-It® notes or similar.
- Decon 90®.