DRAFT

FIELD SAMPLING PLAN

WEST LAKE LANDFILL SUPERFUND SITE OPERABLE UNIT 1

Prepared For:

The United States Environmental Protection Agency Region VII

Prepared on Behalf of:

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ATTACHMENTS

LIST OF ACRONYMS

ACRONYM	Definition
ABS	acrylonitrile butadiene styrene
ACM	Asbestos-Containing Materials
ASAOC	Administrative Settlement Agreement and Order on Consent
ASTM	American Society for Testing & Materials
B2005GS	Below 2005 Ground Surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	Chain of Custody
cpm	counts per minute
DIO	Design Investigation Objectives
DIWP	Design Investigation Work Plan
DM	Data Manager
DMP	Data Management Plan
DO	dissolved oxygen
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
EM	Electromagnetic Induction
FRP	fiberglass reinforced plastic
FSP	Field Sampling Plan
GIS	Geographic Information System
GPR	Ground-Penetrating Radar
GPS	Global Positioning System
GSMO	Geostatistical Modeling Objective
GWMP	Groundwater Monitoring Plan
HASP	Health and Safety Plan
HEPA	High-Efficiency Particulate Air
HPT	Health Physics Technician
IDW	Investigation-Derived Waste
MDNR	Missouri Department of Natural Resources
NRC	Nuclear Regulatory Commission
NTU	Nephelometric Turbidity Units
ORP	oxidation-reduction potential, millivolts
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
OVM	organic vapor monitor
PB	perimeter boring
pCi/g	picoCurie/gram
PID	photoionization detector
PLS	professional land surveyor
PPE	personal protective equipment
PSHEP	Project Safety, Health, and Environmental Plan
PVC	polyvinyl chloride
QAPP	Quality Assurance Project Plan
QA/QC	Quality assurance/quality control
RA	Remedial Action
RCRA	Resource Conservation and Recovery Act
RCT	Radiological Control Technician
Respondents	West Lake Landfill OU-1 Respondents
RIM	Radiologically Impacted Material
RODA	Record of Decision Amendment
RSO	Radiation Safety Officer
RSP	Radiation Safety Plan
SOP	Standard Operating Procedure
SOW	Statement of Work
SPT	Standard Penetration Testing
μR	Micro Roentgen
USCS	Unified Soil Classification System
USEPA	United State Environmental Protection Agency

1.0 INTRODUCTION

1.1 Project Description

This Field Sampling Plan (FSP) has been prepared on behalf of West Lake Landfill OU-1 Respondents Bridgeton Landfill, LLC, Cotter Corporation (N.S.L), and the U.S. Department of Energy (DOE) (collectively, Respondents) for the upcoming design investigation for the selected Amended Remedy for Operable Unit-1 (OU-1) of the Site. The Site is a United States Environmental Protection Agency (USEPA) Superfund Site (ID # MOD079900932), located in Bridgeton, Missouri. A Record of Decision Amendment (RODA) for OU-1 was issued by USEPA on 27 September 2018 (USEPA 2018). The Respondents entered into a Third Amendment to the Administrative Settlement Agreement and Order on Consent (ASAOC) with USEPA (Docket No. VII-93-F-0005) to perform the design of the Amended Remedy selected in the RODA for OU-1 on 6 May 2019 (USEPA 2019). USEPA is the lead agency for the Site, and the Missouri Department of Natural Resources (MDNR) is the supporting agency.

The Site is located east of the Missouri River in the western portion of the St. Louis metropolitan area in northwestern St. Louis County, with a physical address of 13570 St. Charles Rock Road, Bridgeton, Missouri. The Site consists of an approximately 200-acre parcel of land that includes six inactive waste disposal areas, or units. The six units include Radiological Area 1 (Area 1) and Radiological Area 2 (Area 2) (that collectively comprise the majority of OU-1), a closed demolition landfill, an inactive sanitary landfill, and the North Quarry and the South Quarry areas. The North Quarry and the South Quarry are part of the permitted Bridgeton Landfill, a former active sanitary landfill. These six identified units were used for solid and industrial waste disposal at the Site from approximately the 1950s through 2004.

The Site is composed of three Operable Units. OU-1 contains the radiologically contaminated Areas 1 and 2, the Buffer Zone (a 1.78-acre parcel of land adjacent to Area 2), and Lot 2A2 of the Crossroads Industrial Park. OU-2 contains areas not identified as containing radiological contamination and is comprised of the closed demolition landfill, the inactive sanitary landfill, the North Quarry, and the South Quarry. The site-wide groundwater regime has been designated OU-3. While this scope of work is targeting OU-1, there may be overlap with OU-3, since OU-3 wells have been identified for use in the OU-1 groundwater monitoring network.

1.2 Project Objectives

The objective of the design investigation is to collect additional information necessary to design the Amended Remedy selected in the RODA (USEPA 2018) by conducting the field investigations as proposed in the Design Investigation Work Plan (DIWP).

The purpose of this FSP is to standardize the field procedures to be performed during the design investigation activities for OU-1 in accordance with the RODA (USEPA 2018) and the Remedial Design Statement of Work (SOW) attached to the ASAOC. This FSP has been developed in accordance with applicable federal and state guidance documents for remedial design for hazardous waste sites (USEPA 1995a, 1995b).

1.3 Scope of Work

The field sampling plan presented for this design investigation was developed in concurrence with Section 3.6 of the statement of work (SOW) attached to the Third Amendment to the ASAOC received from the USEPA. The design investigation scope of work is summarized below:

- Delineate the extent of waste/RIM along the Area 1 and Area 2 boundaries.
- Further characterize RIM greater than 52.9 pCi/g as related to geostatistical modeling objectives.
- Assess statistically valid background concentrations for the Buffer Zone and Lot 2A2 of the Crossroads Industrial Park.
- Evaluate the extent of RIM above statistically valid background concentrations for the Buffer Zone and Lot 2A2 of the Crossroads Industrial Park.
- Evaluate potential impacts to site drainage areas including the northern surface water body and Earth City Flood Control Channel via sediment sampling of historical sample locations and additional proposed sample locations, in addition to the performance of a bathymetric survey of the Northern Surface Water Body.
- Collect geotechnical data needed to further design objectives, such as waste density, moisture content, and soil properties in areas projected to be beneath starter berms and future drainage structures.
- Collect data for site infrastructure assessment and removal.
- Collect data to characterize materials related to waste acceptance criteria of potential waste disposal facilities.
- Evaluate liquid levels within the potential excavation footprint and previously identified seeps.
- Evaluate characteristics of potential leachate that may be present and estimate characteristics/ treatment requirements of water that may contact waste/RIM.
- Assess the impact of the Remedial Action (RA) on wildlife attractiveness.
- Perform a detailed topographic survey of Areas 1 and 2.
- Develop and implement a groundwater monitoring regime to determine current groundwater quality beneath Areas 1 and 2, and quantify impacts of the selected remedy on site groundwater.

2.0 DESIGN INVESTIGATION FIELD ACTIVITIES

Various field activities will be conducted during the design investigation to collect necessary information for design of the Amended Remedy selected in the RODA (USEPA 2018). Field activities are anticipated to include:

- Siting and drill rig access construction.
- Drilling operations.
- Soil (surface, subsurface) sampling.
- Water (groundwater, surface water, leachate) sampling.
- Surveying (topographical and geophysical).

2.1 Mobilization

The Parsons Field Team Leader will notify off-site laboratories associated with this FSP of upcoming sampling events so that the laboratories can prepare the appropriate type and number of sample containers. The anticipated number of samples, sampling media, list of parameters to be analyzed, and number/type of quality control / quality assurance (QC/QA) samples needed shall be specified to the laboratory managers.

Equipment to be used during sampling will be inspected by the Site Supervisor prior to sampling. Field instrumentation to be used during sampling (i.e., photoionization detector (PID), pH, temperature, water level, specific conductance meters, etc.) will be checked for proper calibration and precision response (see Section 2.7).

Forms to be used in the field (including field logbooks, chain-of-custody sheets and seals, etc.) will be provided to sampling personnel.

New sample containers, pre-preserved where applicable, will be provided by the laboratories and shipped to the Site or other designated location in coolers or insulated sample “shuttles.” Sample containers will be examined by sampling personnel upon receipt, and containers will be “pre-labeled” during the preliminary phase of each sampling event to reduce confusion in the field. Sample identification information (e.g., project name/location, well/borehole number or sample point ID, preservative, analytes, etc.) will be pre-printed on sample labels (or entered using indelible marker) affixed to empty containers. See the Data Management Plan (DMP) for sample identification nomenclature. Other information (e.g., sample time and date, samplers’ names/initials, etc.) may be added to a label after the sample is collected.

2.1.1 Site Preparation and Subsurface Clearance

Parsons’ policy requires that the Parsons Project Manager follow all local, state, and federal laws applying to intrusive subsurface work, where appropriate under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), i.e., inform agencies, obtain utility clearances, etc. The Parsons Project Manager shall review, as available, current and historical site drawings and plans from the client, facility owner or tenant, utility providers, municipal government offices (i.e., city engineer or building department) and third parties as appropriate.

The Pre-Drilling/Subsurface Checklist for Intrusive Fieldwork (Attachment 1) shall be completed prior to initiating fieldwork. It is the responsibility of the Parsons Project Manager to require that the Pre-Drilling/Subsurface Checklist for Intrusive Fieldwork and Utility Clearance Variance Request form is followed. If a variance is sought, it is the responsibility of the Parsons Project Manager to gain written approval of the appropriate Parsons Sector Leader and/or Health and Safety Manager.

The Parsons Project Manager will be responsible for fulfilling the objectives of this protocol by requiring that the procedures are carried out by Parsons employees, subcontractors, and any other person acting on behalf of Parsons. The Parsons Project Manager will require that individuals working on drilling and other subsurface exploration projects are adequately trained and supervised. Parsons will practice sound investigation and work practices and employ necessary measures to avoid damage to subsurface systems and structures. The Parsons Sector Leader will be contacted and advised in advance of beginning field work in the event that a variance to this protocol is requested by the Parsons Project Manager or designee.

In addition to clearing proposed boring locations shown on **Figure 1** (Area 1) and **Figure 2** (Area 2), there are known on-site utilities that will be located and defined using the geophysical methods detailed below. Utilities to be investigated include a known sewage holding tank, an old fuel UST (as shown on **Figure 3**), and a suspected storm sewer lateral that may extend near or possibly into Radiological Area 1. Underground cable from an electrical panel located inside Area 2 feeds power to air sampling stations located around the Area 2 perimeter, the job trailer located at the main entrance Area 2, and the Conex shipping containers located west of the Area 2 main entrance. Additional details pertaining to infrastructure/utility location data needs can be found in the DIWP. A full utility markout will be completed prior to commencement of intrusive operations.

2.1.2 Pre-Clearance Tasks

The objectives of these tasks include compiling relevant information needed to identify accessibility improvement needs at the planned borehole locations. The following information will be evaluated to meet these objectives:

Obtain Site Plans – Obtain available as-built drawings and/or existing site plans. NOTE: As-built drawings may not accurately depict the locations of improvements and the most-recent subsurface features and should therefore not be solely relied upon to determine subsurface conditions.

Utility Markouts – Outside the landfill area, Parsons project staff will request a utility mark-out via the local utility locating one-call system for the work site and document efforts to locate subsurface utilities (electrical, gas, communications, sewer, water, cable, etc.). The Parsons Project Manager must be notified of the status of locating underground utilities before fieldwork begins. If locating utilities becomes problematic, the Parsons Project Manager should update the client and discuss potential alternative methods for locating or reducing risk of damage to underground utilities/structures (i.e., subcontract a private locating service, re-evaluate risk/reward of specific locations or utilize intrusive non-destructive methods). Site plans will be updated as appropriate to include utility mark-out information. Detailed coordination with the site owner's representatives for mark-outs, review of as-builts, and other informational reviews will be conducted prior to the start of intrusive work.

Parsons will obtain information needed to prepare a vicinity map of the area that may include significant neighboring addresses, land use, surface water bodies, and other natural as well as manmade features of note, as appropriate. A site visit/walkover will be scheduled concurrent with, or soon after the utility mark-out. The walkover will include inspections and notations of the locations of utility mark-outs and above-ground utilities/ structures, including:

- Light standards
- Communication lines (phone, fiber optic)
- Sewer lines
- Site infrastructure (e.g., landfill gas monitoring piping)

- Overhead lines
- Water lines and spigots/hydrants
- Catch basins
- Manholes
- Junction boxes
- Natural gas lines
- Other utilities
- Observe paving scars such as areas of new pavement or saw cuts

2.1.3 Property Systems

The Parsons Field Team Lead will consult with someone having historical site knowledge to gain information about the site (locations of former tanks, lines, etc.), as well as visually inspect the location of above-ground components and note the locations of well manholes, tank risers, etc.

The information collected will be utilized in combination with regulatory requirements and investigation objectives to identify conflicts in planned borehole locations. It is recommended that alternate proximal drilling locations be pre-determined in case utility/infrastructure conflicts exist or obstructions are encountered in the initial planned locations. The effort to investigate a specific proposed drilling location should be to clear utilities within a minimum 25-foot radius around the boring locations proposed inside the waste mass. Proposed borings along the Area 1 and Area 2 perimeter should have all utilities within a 100-foot offset of the area boundary located in the event that additional “step out” borings are necessary.

Boring locations will be located using GPS and staked in the field, and on-site personnel familiar with the locations of underground utilities or infrastructure will inspect the locations to verify the absence of utilities or infrastructure. The proposed drilling locations and a cleared radius of 25 feet will be approved by the client and EPA prior to the commencement of drilling. Should refusal be encountered, the boring will be relocated as necessary within the 25-foot radius. If relocation of a boring beyond the cleared 25-foot radius is deemed necessary by the Parsons Field Team Lead and Project Manager, the client and EPA will be contacted for approval prior to proceeding. Client and EPA approval must be documented. Verbal approval is acceptable if followed up with written approval. Documentation may include a notation in the field book, email or written correspondence.

Gravel access paths and drilling pads will be constructed to the boring locations as necessary. Removal of above-ground portions of vegetation growing within the work area around a borehole location or along the planned route of the access path to it will be required.

Vegetation will be cut near but above the ground surface using a “brush hog” and/or a skid steer with a forestry cutter/grinder attachment. This attachment can cut and grind woody vegetation without disturbing the underlying ground surface or vegetation roots. The vegetation cuttings will be chipped and placed on the ground surface. Significantly sized woody vegetation of more than approximately 1-inch in diameter that needs to be removed will be cut with tree shears and chipped in a wood chipper. The woody vegetation will be moistened with a water cannon prior to grinding, if necessary, to minimize chipping dust. The chipped woody vegetation will be placed on the road paths prior to geotextile deployment. A geotextile will be laid on top of the cleared area and chipped vegetation, over which approximately 8 inches of road base material will be placed. It is anticipated that placement of the geotextile and road base material will generally occur the same day as the vegetation removal activities, but should be completed within two days of the vegetation clearing in any particular area. Adherence to these procedures will eliminate, or at the very least greatly minimize, the potential for erosion of the soil beneath the access roads and drill pads. A water truck will be made available during the entire clearing operation to add moisture, if needed, to the vegetation.

Vegetation clearing and road/drill pad construction activities will not be scheduled during periods when severe thunderstorms or major precipitation events (rainfall rate of more than ½-inch per hour) are forecast for the site area or when observations by on-site personnel indicate a potential for a severe thunderstorm or major precipitation event. Additionally, on days when precipitation is forecast or anticipated based on observation of site weather conditions, placement of geotextile and road base will be coordinated to closely follow the vegetation clearing activities and the vegetation clearing will be closely monitored and/or suspended as necessary so that the geotextile and sufficient road base material necessary to anchor the geotextile can be placed prior to the occurrence of thunderstorms.

Particular attention will be paid to activities associated with the few locations with a possible potential for erosion to occur including those borings located on the northern edge/slope of Area 2. Clearing of vegetation and construction of roads and drill pads will not be performed in or around drilling locations that, based on field observations by on-site personnel at the time of surveying of the drilling locations or during the site preparation work, indicate a potential for soil erosion during periods of significant precipitation events. Additional geotextile material will be available to temporarily cover exposed areas should a significant precipitation event occur after the vegetation had been cut but before placement of the geotextile and associated road base material. Lastly, hay bales will be placed adjacent to the perimeter drainage such that they can be rapidly installed across the perimeter drainage to restrict erosional transport of soil during an unanticipated precipitation event.

2.1.4 Subsurface Clearance

Parsons staff must assess that no subsurface utilities, structures, or improvements exist where intrusive subsurface activities will occur. Locations will be cleared using results of historical data research and with geophysical methods (see below for details) at a zone 25 feet in radius around the proposed boring location. Additionally, proposed perimeter borings should be cleared of utilities and other site structures within a 100-foot offset of the area boundary, in the event that step-out borings are necessary.

Unless deemed necessary by project staff, intrusive clearance (e.g., hand clearing, air/water knife, or similar techniques) will not be performed. Site knowledge by project staff, non-invasive clearance techniques, and close monitoring of drilling rates will be employed to avoid contact with utilities and anomalies as further detailed below.

The methods used to investigate and delineate subsurface obstructions should be compatible with the inherent risks associated with work at the type of facility/property to be investigated and the location of the drilling work. Proactive investigative methods to clear specific drilling locations will include non-invasive geophysical remote sensing. Multiple appropriate instruments (ground penetrating radar, electromagnetic detector, magnetometer, metal detector) can be used for this work. Survey an area around the location to a distance of 25 feet using geophysical methods to identify potential subsurface utilities or facilities. All utilities and any associated site infrastructure should be located prior to drilling operations using remote sensing techniques in the event that borings are relocated, or that step off borings are required. Examples of geophysical methods are provided below:

- Ground Penetrating Radar (GPR) - GPR is similar to other radar systems, in that as the GPR antenna is moved across the surface, it transmits electromagnetic signals into the subsurface and receives reflections from interfaces in the path of the signal at which changes in the electrical properties (dielectric constant) of the subsurface materials occur. The signals are then amplified, processed, and displayed on the field device screen, in addition to being recorded for potential additional post processing. GPR provides a continuous profile of the subsurface.
    - GPR surveys should be conducted in concurrence with the methods described in the American Society for Testing & Materials (*ASTM) D6432 – Standard Guide for Using the Surface Ground Penetrating Radar Method for Subsurface Investigation.*

  - GPR is commonly used in conjunction with other geophysical techniques such as magnetic, electromagnetic induction, and seismic refraction. GPR uses high-frequency electromagnetic waves to provide detailed subsurface cross sections.
  - GPR emits microwaves into the subsurface which are then reflected back to the receiver. Different materials produce varying electrical results, which are then displayed and interpreted by the operator. Metallic objects produce the strong results, and often allow for determination of precise location, depth, and size. GPR is capable of differentiating between material densities, and as such is useful for delineating the boundaries of landfills, excavations, or other areas where there is a distinct material density difference.
  - GPR can also be used in conjunction with higher-frequency antennas (typically 900 to 1,500 MHz) to survey concrete slabs, to locate rebar, electrical conduits, or other pipes prior to core drilling or saw cutting.

- Electromagnetic Induction (EM) – The EM (a.k.a., Terrain Conductivity) method measures the conductivity of earth materials, buried objects, and backfill utilizing electromagnetic induction. EM allows for the rapid collection and interpretation of large quantities of data and can be used to detect and locate both metal objects and zones of conductive contamination. It is the only widely available geophysical technique that is sensitive to the presence of both ferrous and non-ferrous metal objects. EM complements both magnetics and GPR.

  - EM measures the apparent conductivity of the subsurface, including effects of the soil, bedrock fractures, contaminants, metal objects, and groundwater. Variations in conductivity may indicate changes in composition, layer thickness, or moisture content, the presence of buried metal such as drums, or the presence of contamination.
  - Data are acquired at single stations and/or continuously along lines. EM surveys may not be suitable for examining highly industrialized or urbanized areas where cultural features such as buildings, pipelines and power lines may interfere with the collection of accurate data. By comparing in-phase and quadrature EM data, or EM and magnetic contour maps, ferrous and non-ferrous sources of elevated conductivity (such as drums versus landfill leachate) can be differentiated. EM survey should be performed in concurrence with the methods described in *ASTM D6639 – Standard Guide for Using the Frequency Domain Electromagnetic Method for Subsurface Site Characterization.*
  - Important note: A combination of two or more non-invasive instruments may be required to properly clear a subsurface area. For example, a ferrous metal detector may not detect metals pipes embedded in concrete duct banks, polyvinyl chloride (PVC) pipes, fiberglass reinforced plastic (FRP) pipes, or other non-ferrous materials.
  - Subsurface clearance may be performed on multiple sampling points prior to mobilization of the drill rig. To minimize confusion in the field, a survey stake will mark the drilling location as proposed in the DIWP. The survey stake should include the sample point ID, written in black marker. Upon clearing the 5-foot radius using the above techniques, the stake shall be spray painted with pink paint.
  - Significant anomalies detected by the GPR or EM justifies the relocation of the sample point. Should the point need to be moved the original stake will be painted red and a new stake painted pink will mark the successfully cleared alternative location. The alternative sample point ID should relate to the original sample point ID and new coordinates should be collected on the alternative sample point. Any relocation of sample points shall be communicated to the Parsons Project Manager. Upon approval of the relocation, maps and lists of drilling points will be updated.

- o The final list and map of drilling points, with GPS coordinates and whether the original point had been moved or not, shall be provided to the drilling team for their reference. The supervisor of the drilling team shall acknowledge through documentation that the cleared (pink) sample point and, if applicable, the original, relocated point have been positively identified.

2.1.5 Event Notification

If any portion of a tank, pipe, utility or other subsurface structure is encountered, or if there is any doubt it has been encountered, the work is to cease in that area and the Parsons Project Manager notified immediately. If there is reason to believe that the structure has been damaged, any emergency shut-off switches should be activated (if applicable) and the appropriate municipality and client notified immediately. The Parsons Project Manager, in consultation with the client, will decide if additional uncovering by hand is required. If it is confirmed that a UST system has been encountered, a tightness test(s) should be considered. Under no circumstances is the area to be backfilled without notifying the Parsons Project Manager, unless risk of personal injury or damage warrants temporary backfilling.

In case of refusal or if an unknown subsurface object is encountered during intrusive subsurface activities, then the following specified resolution process must take place.

- If the cause CAN be readily and correctly defined as not destructive or hazardous, drilling may proceed ONLY after consultation with the Project Manager.
- Otherwise, drilling MUST STOP so that location re-evaluation can take place. The client, the utility owner (if applicable) and, if required, the appropriate regulatory agency, must be advised of the situation and consulted to determine if (1) the location is necessary, which may require additional effort to clear a new location, or (2) the location is not necessary, and can be deleted from the program.

2.2 Soil Boring Installation

Soil borings will be advanced to facilitate evaluations of site stratigraphy, the presence/absence of waste, the collection of subsurface soil samples for chemical/radiological and geotechnical analyses, hydrologic conditions, and downhole gamma logging. A Parsons on-site representative will be responsible for overseeing boring installation activities. This representative will monitor that the work is performed with due caution and will be alert for warning signs that could indicate the presence of underground tanks, lines, or other hazards or structures.

Drilling equipment will be in proper working order and inspected to determine if it meets safety requirements, with inspection documentation to be provided by the drilling contractor. Field Personnel will be briefed on potential hazards including working around moving equipment, physical hazards, biota, and risks associated with radiological or chemical exposures. Health and Safety Protocol/Procedures pertaining to general and radiological aspects of drilling in potentially impacted areas are included in the Project Safety, Health, and Environmental Plan (PSHEP) and the Radiation Safety Plan.

It is anticipated that all work will be completed in modified Occupational Safety and Health Administration (OSHA) level D personal protective equipment (PPE), as required by the Radiation Safety Officer (RSO) or his on-site designee. Respirators for protection from radionuclide exposure will not be routinely required but will be made available to workers participating in their employer's respiratory protection program. Respirators for protection from dust inhalation may be used by approved workers if there are continuous plumes of visible dust from the borehole or soil cores; however, this condition is not anticipated to occur. Application of water during drilling or core examination should alleviate this potential situation. A decision to require use of respirators may be made by the RSO if conditions warrant.

Radiologically impacted soils generated during drilling and sampling operations will be archived and stored at an onsite lay-down area for potential sampling while non-radiologically impacted soils generated during the collection of geotechnical samples and determination of waste extent will be disposed of in accordance with Section 2.9.

Once the data collection needs of the borehole, including laboratory sample collection and downhole measurements, have been met, the borehole will be decommissioned consistent with the methods described in ASTM D5299 and Section 2.2.2 below.

2.2.1 Drilling Methods

Depending on site-specific objectives and/or drilling conditions, soil borings may be advanced using direct-push, sonic drilling, or conventional hollow-stem auger drilling methods. Drill tooling and equipment will be decontaminated as outlined in Section 2.8.2. Each boring will be located using a total station global positioning system (GPS) device that can provide coordinates with sub-inch accuracy, and will be performed with a Missouri-licensed professional land surveyor (PLS).

Borings will be installed to specific depths as detailed in Table 1 and Table 2. These target depths are derived from the data needs outlined in the Geostatistical Modeling Objectives (GSMOs) and Design Investigation Objectives (DIOs) as described in the Quality Assurance Project Plan (QAPP). General boring target depth guidelines can be summarized as:

- Borings fulfilling GSMO #1-5 and GSMO #7 will be installed to 16 feet Below the 2005 Ground Surface elevation (B2005GS).
- Borings fulfilling GSMO #6 will be installed to 20 feet B2005GS.
- Perimeter borings along the southeastern edge of Area 2 will be installed through the full extent of waste plus five feet into the underlying alluvium (approximately 60 feet B2005GS).
- Perimeter borings adjacent to the North Quarry will be installed through the full extent of fill/waste plus five feet into the underlying alluvium (approximately 100 feet B2005GS).
- Remaining perimeter borings will generally be installed to depths of 25 feet B2005GS.

Drilling methods may vary based on boring location, basis for installation, and expected substrate. Borings installed within the Area 1 and Area 2 boundaries will typically be installed using a sonic rig, while borings installed along the perimeter will most likely be installed using conventional means, i.e., a hollow-stem auger rig equipped for split-spoon sampling.

If refusal is encountered during drilling operations the Parsons Field Team Lead will evaluate the soils previously collected from the location in question for evidence of the cause of refusal. The Parsons Field Team Lead will also consider observed penetration rates, blow counts (where measured), as well as input from the Field Geologist and Lead Driller. This information will be discussed with the Parsons Project Manager to determine if the borehole should be abandoned and relocated, or if drilling operations should cease and data collection (soil sampling, downhole measurements, etc.) should move forward.

Parsons will employ the necessary means to prevent damaging subsurface utilities, product lines, tanks, or other structures. When the Parsons Field Team Lead believes that drilling operations may be in contact with an unexpected underground anomaly due to a decrease in penetration rate, or other indicators, work in that specific area will cease. The Parsons Field Team lead will then contact the Parsons Project Manager, or designee, to discuss alternatives. Should the boring location be abandoned or relocated, the borehole will be properly decommissioned as discussed in Section 2.2.2.

Once the data collection needs of the borehole, including laboratory sample collection and downhole measurements, have been met, the borehole will be decommissioned via procedures described in Section 2.2.2, and consistent with the methods included in ASTM D5299 and in accordance with Missouri state regulations (Attachment 7).

Once decommissioned the boring location will be surveyed by a Missouri-licensed PLS for the development of an as-drilled topographic survey.

2.2.1.1 Direct Push Method

Direct push methods may be applied at the site in order to investigate overburden thickness and potentially aid in identifying the 2005 ground surface.

Direct push drilling, if utilized, will be conducted in accordance with ASTM Method D6282, which provides guidance and discussion about the technique summarized below.

This drilling method is typically used to collect shallow overburden soil samples and to create boreholes for temporary or permanent (using pre-pack screens) monitoring well installations. This method is advantageous in that it typically allows for the advancement of numerous borings in a relatively short period of time. The disadvantage of this method is that it is typically limited to shallow overburden soils (less than 50 feet below grade) that exhibit relatively low densities. Direct push rigs use percussion to drive downhole tooling into the subsurface. It is generally not appropriate for use in waste at landfills given the heterogeneity of the landfilled materials; drill rod refusal frequently occurs.

When used in deposits of granular or cohesive soils, subsurface samples are often collected continuously from the ground surface to the bottom of the boring using 4-foot long, MacroCore samplers with acetate liners installed in them.

2.2.1.2 Sonic Drilling

Sonic drilling conducted in accordance with ASTM D6914 may be used for the advancement of a continuous core. ASTM D6914 provides guidance and discussion about the technique summarized in this section.

Sonic drilling offers the benefit of significantly reduced drill cuttings and reduced fluid production. Furthermore, sonic drilling does not entail the use of drilling fluids such as air or water to circulate cuttings (water may be used to cool the downhole equipment and to pressurize the drill string) and therefore does not result in emissions at the ground surface. The continuous core sample recovered by the sonic drilling technique provides a representative lithological column for evaluation and sample collection. Applying vibration and rotational forces to the casing string eliminates the complication of backfill bridging common to other drilling methods and reduces the risk of casing lockup.

The cutting action of the sonic drilling bit passing through the subsurface may cause disturbance to the soil structure along the borehole wall, Disturbances to soil structure along the borehole wall are generally expected to be minimal and will be monitored when drilling through landfilled waste via the rates of penetration and recovery.

Soil and waste samples are extracted from the drill string/core barrel by vibrating the barrel and directing the core sample into a length of plastic sleeving. Minimal hydraulic pressure applied to the core barrel is occasionally utilized to facilitate core sample extraction without distortion.

Sonic drilling has been shown to penetrate construction and demolition debris, steel, and other durable waste components at the Site, although its effectiveness decreases with depth as energy dissipates along the drill string. Energy-absorbing materials such as rubber and wood also lessen the effectiveness of sonic drilling. Sonic drilling may require the use of pressurized water to remove drill cuttings from the face of the bit.

Some heat generation may occur within a borehole during use of sonic drilling at depth; water may be used to counteract potential heat generation. The use of water during drilling is not currently anticipated for design investigation boreholes.

2.2.1.3 Hollow-Stem Auger Drilling Methods

Hollow-stem augering (HSA) is a drilling method used to penetrate and sample overburden soils (natural deposits and fill) and create boreholes for monitoring well or piezometer installation. HSA methods will be used at the site in accordance with ASTM D6151/D6151M.

HSA drilling methods typically allow for the advancement of borings through most soil types including denser soils (e.g., glacial till), and when coupled with split spoon sampling conducted in accordance with ASTM D1586, can provide geotechnical information via standard penetration testing (SPT).

HSA drilling methods will be used at the Site in areas where geotechnical data collection is necessary, specifically at perimeter borings outside of the expected waste extent. Soil samples will be collected continuously from the ground surface to the bottom of the borings using split-barrel samplers in accordance with ASTM Method D1586. Based on the drilling conditions encountered in a given borehole, thin-walled samplers may be used (per ASTM D1587) or thick-walled 3-inch diameter samplers may be utilized (per ASTM D3550) to collect undisturbed samples. The following procedures will be followed by field personnel:

1. Soil samples will be collected continuously from the ground surface to the bottom of borings using 2-inch or 3-inch (if applicable) diameter split-barrel samples in accordance with ASTM D1586 and/or ASTM D3350.
2. The sampler will not be advanced more than two lengths (four feet) beyond the lead auger. Once the augers are led by two split spoons the augers should be advanced and split-spoon sampling may proceed.
3. Soil samples retrieved from the borehole will be described in accordance with Section 2.4.1 below, and will include percent recovery. Descriptive information will be recorded on a soil boring log form (Attachment 2)
4. Soils will be collected for laboratory analysis according to Section 2.4.3, and analyzed for the constituents described in Section 2.4.5, and in accordance with the DMP and QAPP.
5. Split spoons will be washed and rinsed between sampling intervals and prior to being used for another boring.

2.2.2 Borehole Decommissioning

Decommissioning techniques at the Site may vary based on specific data collection needs of each boring. This subsection describes the procedures for abandonment of boreholes that are not used for monitoring well installation. Abandonment of monitoring wells is addressed in Section 2.5.3

2.2.2.1 Borings for Soil Classification and Sampling

Borings installed to collect soil samples for laboratory and geotechnical analysis only do not require sheeting/casing following borehole advancement. Following collection of subsurface measurements (Section 2.3) and soil samples (Section 2.4) the borehole will be decommissioned with grout. Grout will consist of a mixture of Portland cement (Type 1) and bentonite, which will be tremied through the drill string as it is being removed.

2.2.2.2 Borings for Downhole Gamma Logging

Borings installed to collect downhole gamma data will be sheeted with 3-inch PVC or acrylonitrile butadiene styrene (ABS) following the collection of subsurface measurements and soil samples. Once downhole gamma readings have been recorded and the Parsons Field Team Lead provides authorization, the borehole will be decommissioned; the PVC or ABS casing will be pulled, and the borehole will be grouted. Grout will consist of a mixture of Portland cement (Type 1) and bentonite, which will then be tremied through the casing as it is removed. If the borehole sidewalls are stable and not subject to caving, the casing may be removed in its entirety and then the borehole will be grouted.

Proposed borings that require installation of monitoring well and piezometer will be constructed in accordance with Section 2.5.1 and decommissioned as per Section 2.5.3.

2.3 Subsurface Measurements

2.3.1 Standard Penetration Testing

Standard Penetration Testing (SPT) will be used at select perimeter borings installed outside of the extent of waste to provide geotechnical data for the design and implementation of the RA. This section is summarized from ASTM D1586.

2.3.1.1 Equipment and Supplies

- Hollow-stem continuous flight augers and rig
- Sampling rods
- Split-barrel sampler
- Hammer Drop System (automatic hammer)
- Sample containers and labels
- Field forms and/or field log book

2.3.1.3 Drilling Procedure

1. Advance borehole incrementally to continuous sampling using ASTM D1586 and/or ASTM D3350.
2. Casing may not be advanced below the sampling elevation prior to sampling.
3. While the use of drilling fluid is not currently anticipated, if subsurface conditions dictate its use, the fluid level within the borehole or HSA flight shall be maintained at or above the in-situ groundwater level during drilling, removal of drill rods, and sampling.

2.3.1.4 Standard Penetration Testing Procedure

1. Attach split-barrel sampler to the sampling rods and lower into borehole.
2. Attach anvil to sampling rods and move automatic hammer into position. The sampling assembly should be resting at the bottom of the borehole.
3. Mark drill rods in three successive half-foot increments so that the advancing sampler can be easily observed.
4. Drive the sampler with blows from the automatic hammer and count blows needed to advance the sampling assembly through each half-foot increment until one of the following occurs:
    - A total of 50 blows have been applied during any one half-foot increment.
    - A total of 100 blows have been applied over the full two-foot sampling interval.
    - There is no observed advance of the sampler after 100 blows.
    - The sampler is advanced through three complete half-foot increments.

5. Record the number of blows needed to advance the sampler through each increment. Per ASTM D1586, the sum of number of blows required to advance the sampler through the second and third half-foot increments will be taken and recorded as “standard penetration resistance” or “N-value.”
6. Refence **Section 2.2** in the event that refusal is encountered during drilling operations. Alternatives will be evaluated by the Parsons Field Team Lead and Project Manager in consultation with clients.

2.3.2 Downhole Gamma Logging

2.3.2.1 Sampling Strategy

In situ gamma data collection (i.e., downhole, or borehole, gamma logging) will be performed at each proposed boring within Area 1 and Area 2, shown on **Figure 1** and **Figure 2**, and to the specific depths detailed in **Table 1** and **Table 2**. *In situ* gamma data may not be collected at perimeter borings specifically proposed for geotechnical data collection outside the extent of waste.

2.3.2.2 Equipment and Supplies

- Portable ratemeter-scaler: Ludlum 2221 Model 2221, or equivalent
- Sodium iodide (NaI) detector: 2”x 2” Model 44-10, Ludlum Measurements, Inc. or equivalent
- Cables of sufficient length to reach the bottom of the deepest borehole, currently estimated to be 100 feet B2005GS
- Light rope or cable of sufficient strength and length to lower detector to the bottom of the deepest borehole and retrieve it. Rope should be clearly marked in 6-inch (15-cm) increments
- Clamp or tape to secure rope to detector
- Optional winch assembly for lowering and raising detector in deep boreholes
- Plastic (PVC or ABS) pipe, as required, of sufficient length and diameter to encase borehole to the desired logging depth
- One PVC pipe end cap for each planned borehole, plus at least two extra end caps for contingencies
- PVC pipe cement
- A saw or plastic pipe cutter to size pipe lengths
- Plastic bags large enough to cover detector assembly when down hole
- Record forms and pens

2.3.2.3 Instrument Assembly and Preparation

1. Assemble instrument/detector combination with long cable for which it is calibrated.
2. Perform daily instrument check on assembled unit, and document that equipment has undergone calibration in accordance with the Ameriphysics Radiation Control Procedures.
3. Securely attach support rope to detector. Use tape or wire ties to secure cable to support rope at approximately 1-meter intervals. Leave about 1 to 2 inches of slack in the cable between the top of the detector and the first piece of tape or wire tie binding the rope to the cable. *NOTE: The weight of the detector should always be supported by a rope or equivalent. The detector should NEVER be lifted or supported by the long instrument cable.*

2.3.2.4 Downhole Logging Procedure

1. The borehole will be cased with PVC or ABS pipe. The pipe diameter will be determined by the dimensions of the drill bit or soil probe. For example, a 3-inch internal diameter (ID) Schedule 40 PVC or ABS pipe is recommended for most applications involving a Model 44-2 sodium iodide (NaI) detector. This size pipe requires the installation of a 3.5-inch diameter, or larger, borehole.

2. Prior to inserting the detector down-hole, enclose the detector assembly in double plastic bags or tubular sheeting to protect detector against direct contact with water or soil from the borehole.
3. Set the scaler timer to accumulate counts over a period of 1 minute.
4. If using the winch assembly, place it over the borehole. Position the detector over the hole with bottom of the detector level with the ground surface.
5. Record this initial position as the zero centimeter or surface measurement. Collect the first timed measurement and record the results, in counts per minute (cpm), at this position.
6. Lower the detector slowly into the borehole, stopping at 6-inch intervals to collect and record 1-minute measurements in gross counts. Record the depths of these locations.
7. When the detector reaches the bottom of the borehole or borehole liner pipe record the last measurement and depth of the hole.
8. Raise the detector to the surface and inspect the detector for signs of water infiltration into the plastic cover. Clean the cover or replace it, as needed.

2.3.3 Field Density Measurements

Field density measurements will be performed in areas where waste material is being considered for off-site disposal or evaluated for rate of settlement.

2.3.3.1 Equipment and Supplies

- Drill tooling and rig
- Sampling rods
- Core or split-barrel sampler
- Tripod with hanging scale (pounds)
- Measuring tape (inches)
- Sample containers and labels
- Field forms and/or field log book

2.3.3.2 Field Density Measurement Assembly and Preparation

1. Advance borehole incrementally to permit continuous sampling using acceptable methods.
2. Casing may not be advanced below the sampling elevation prior to sampling.
3. The desired interval will be sampled in accordance with the methods outlined in Section 2.4.

2.3.3.3 Field Density Measurement Procedure

1. Once sampling rods have be advanced to the desired depth interval, the drill string will be retrieved, and the sample barrel weighed.
2. The difference between the weight of the full barrel and that of the empty barrel will be recorded as the “sample weight.”
3. After the weight of the full barrel has been measured, normal sample processing procedures may be performed in accordance with Section 2.4.
4. During sample processing the volume of the sample will be calculated by multiplying the length of recovery (in inches) by pi (π) and the inner radius of the sample barrel (in inches) squared.
5. The resulting density will be recorded as “sample density” in pounds per cubic inch.

2.4 Soil and Sediment Sampling

2.4.1 Soil Description

Site media consisting of soil and soil/waste mixtures are referred to as "soil" for the purposes of this FSP. Soil will be collected at the site using HSA or sonic drilling methods. Soils will be classified and described according to the methods and procedures outlined in the following sections.

2.4.1.1 Equipment and Supplies

- Digital camera or phone/tablet
- 1-gallon sealable bags
- Field forms and field logbook
- Scissors/knife
- Spray bottles with Alconox solution and water
- Gloves
- Permanent marker for labeling
- Soil screening instruments (alpha, beta, gamma detectors and PID)

2.4.1.2 Soil Description Methods

1. A core run will be vibrated out of the core barrel into a plastic sleeve. A health-physics technician (HPT) will scan the sleeve and record gamma activity.
2. Cores will be transported to a central processing location for logging and processing.
3. The sample processing crew will cut open the sleeve and photograph the entire core run and wash/rinse the knife used to cut the sleeve with the Alconox solution and water.
4. The processing geologist/field engineer will review the core samples and log the boring based upon the cores and the corresponding depths. Soil core and grab samples, split spoon, and/or sonic samples will be described using the Burmister Classification System and assigned a Unified Soil Classification System (USCS) designation. Descriptions will be entered on the attached boring log form. The Burmister Classification and USCS are based primarily on grain size. In addition, visual indication of contamination and field screening results are included in environmental soil descriptions. An example of the typical soil boring log form is provided in Attachment 2. The following sections are adapted from the Burmister and USCS systems.

2.4.1.3 Burmister Classification System

Samples described based on the Burmister Classification System (Burmister, 1970) include the following components and are reported in the order shown below.

Moisture content:

The relative moisture content of the soil at the time of sampling shall be designated as "dry," "moist," or "wet."

Consistency:

The consistency of the soil sample shall be described for fine grained soils (silts and clays) as "stiff," "medium stiff," or "soft" and state whether the soil is "plastic' or "non-plastic." Coarse grained soils (sands and gravels) shall be described as "loose," "medium dense," or "soft" and will include the degree of cementation. The description will also include the shape of the grains ("flat", "angular", "rounded") and the grading ("Well Graded, "Poorly Graded", or "Uniform").

When applicable, the penetration rate while conducting SPT with split spoons is also an indication of the compaction/density of the material. The table shown below is a penetration guide and will be used to determine the consistency of the material. The SPT values across the middle of the 2-foot split spoon will be used to select a consistency description from the penetration guide below. SPT values are typically recorded in 6-inch intervals, so for example: a 2-foot spoon has values (or blows) of four, three, six, eight for each 6-inch interval. The SPT value used to determine consistency is the sum of the last two values (6+8=14). If the material was sand the consistency from the table is "Medium Dense", if the material was clay the consistency is "Stiff." For materials that are predominantly silt the "clay" section of the guide will be used.

PENETRATION GUIDE			
SAND		CLAY	
Very Loose	0-4 Blows per foot	Very Soft	<2 Blows per foot
Loose	4-10 Blows per foot	Soft	2-4 Blows per foot
Medium Dense	10-30 Blows per foot	Medium Stiff	4-8 Blows per foot
Dense	30-50 Blows per foot	Stiff	8-15 Blows per foot
Very Dense	50+ Blows per foot	Very Stiff	15-30 Blows per foot
		Hard	30+ Blows per foot

<u>Color</u>:

The predominant color of the soil sample in the natural state shall be designated as "white," "brown," "yellow," "red," "gray," "blue," or "black," In some cases the sample may be "mottled" (a combination of colors such as red/gray, blue/gray, etc.)

Color codes and designations should follow those provided in Munsell soil color charts. Grain size description is listed in order of predominance starting with the most predominant.

First Entry: Most predominant grain size in the sample. The entry is fully capitalized (SAND, SILT, CLAY, and GRAVEL) if it comprises 50% or more of the sample. Otherwise the predominant fraction is listed first with only an initial capital.

Second Entry: The second, third, etc. most predominant grain size materials in order of predominance. The percentages of the constituents are indicated by the following descriptors:

- "and" 50-35%
- "some" 35-20%
- "little" 20-10%
- "trace" 10-1%

For example, a soil description may be SILT, some fine sand, trace clay (50% or more of silt with 20-35% fine sand, 1 to 10% of clay). Other common descriptions might be fine SAND, some silt and clay; SILT, trace of fine sand and clay; SILT, some coarse sand and gravel, trace clay.

Soils are predominantly classified based on grain size. The four main grain sizes are "gravel," "sand," "silt," and "clay." Sands are further described as coarse, medium, or fine and gravels are described as coarse or fine. The following table lists the breakdown of grain sizes and sieve numbers for each category (modified Burmister system).

GRAIN SIZE AND SIEVES				
SOIL	FROM SIEVE NUMBER	TO SIEVE NUMBER	FROM MM	TO MM
Gravel – coarse	3-inches	¾-inches	75	19.0
Gravel -fine	¾-inches	#4	19.0	4.75
Sand – coarse	#4	#10	4.75	2.0
Sand - medium	#10	#40	2.0	0.425
Sand - fine	#40	#200	0.420	0.075
Silt	#200	Material passing the No. 200 sieve which is usually non-plastic in character and exhibits little or no strength when air dried.		
Clay	#200	Material passing the No. 200 sieve which can be made to exhibit plasticity within a certain range of moisture contents and which exhibits considerable strength when air dried.		

<u>Vegetable Muck and Peat</u>

Vegetable mucks and peats are soil mixtures with varying percentages of organic and vegetable matter formed by decomposition of leaves, grasses, and other fibrous materials. The color ranges from light brown to black. The soil content of the mixture should be identified and an estimate should be made of the amount of vegetable material present. The vegetable matrix comprising the peat should be identified as “fibrous” or “woody.” The sample composition should be further described with respect to texture as “cake-like,” “spongy” or predominantly “granular.”

<u>Miscellaneous</u>:

Certain materials may be incorporated that do not fall under foregoing classifications and require further qualification for proper identification. Additional terms may be used, but should not replace the basic description. These additional terms may be used specifically to designate materials as “rock fragments,” “stones,” “cobbles,” “rock flour,” or other qualifying descriptions.

<u>Field Observations to Identify Silt and Clay Characteristics</u>:

The field test listed in the table below may be used to distinguish between structural characteristics of a silt or clay soil. For mixtures of silt and clay, the tests indicate the predominant constituent.

FIELD OBSERVATIONS OF SILT AND CLAY CHARACTERISTICS		
CHARACTERISTICS	SILT	CLAY
Plasticity in moist state	Very little or no plasticity	Plastic and sticky. Can be rolled.
Cohesiveness in dry state	Little or no cohesive strength in dry state and will slake readily	Has a high dried strength. Crumbles with difficulty, slakes slowly in water.
Visual inspection and feel	Coarse silt grains can be seen. Silt feels gritty when rubbed between fingers.	Clay grains cannot be observed by visual inspection. They feel smooth and greasy when rubbed between fingers.
Settlement in water	Will settle out of suspension within one hour.	Will stay in suspension in water for several days unless it flocculates.

FIELD OBSERVATIONS OF SILT AND CLAY CHARACTERISTICS		
CHARACTERISTICS	SILT	CLAY
Movement of water in the voids	When a small quantity of silt is shaken in the palm of a hand, water will appear in the surface of the soil. When shaking is stopped, water will gradually disappear.	When a small quantity is shaken in the palm of the hand it will show no signs of water moving out of the voids.

2.4.1.4 Unified Soil Classification System

The Unified Soil Classification System (USCS) is based on textural characteristics. Soils fall into one of fifteen groups, where each group is defined by a two-letter symbol. In general soils are classified as one of two broad categories:

- Coarse-grained soils: Group symbols start with either “G” for gravel or gravelly soils, or “S” for sand or sandy soils.
- Fine-grained soils: Group symbols start with “M” for non-plastic or low plasticity fines (inorganic silt), “C” for plastic fines (inorganic clays), “O” for organic silts and clays, or “Pt” for peat, muck, humus, swamp soils, and other highly organic soils.

A complete list of symbols is provided below:

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE-GRAINED SOILS (More than 50% of the material is LARGER than No. 200 sieve size).	GRAVELS (More than 50% of coarse fraction is LARGER than the No. 4 sieve size)	CLEAN GRAVELS (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.
			GP	Poorly graded gravels or gravel-sand mixture, little or no fines.
		GRAVELS WITH FINES (Appreciable amt. of fines)	GM	Silty gravels, gravel-sand-silt mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (More than 50% of coarse fraction is SMALLER than the No. 4 sieve size).	CLEAN SANDS (Little or no fines)	SW	Well-graded sands, gravelly sands little or no fines.
			SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amt. of fines)	SM	Silty sands, sand-silt mixtures.
			SC	Clayey sands, sand-clay mixtures.
FINE-GRAINED SOILS (More than 50% of material is SMALLER than the No. 200 sieve size).	SILTS AND CLAYS (Liquid limit LESS than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayed fine sands or clayey silts with slight plasticity.
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS (Liquid limit GREATER than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
			CH	Inorganic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS			Pt	Peat and other highly organic soils.
BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.				
PARTICLE SIZE LIMITS – see particle size limits in Burmister table (Section 2.4.1.3).				

2.4.1.5 Field Observations of Contamination, Putrescence or Site-Specific Characteristics

Environmental samples are also screened for visual evidence of contamination. Descriptions of these observations and screening results should be added to the physical descriptions of samples including:

Stain:

Stains are discoloration and coatings potentially of non-native materials on or in the sample. The stains can range from light tan to black. When handled, the staining material in the sample may transfer to fingers or gloves.

Sheens:

Sheens are films floating on the water in saturated samples. The films may have rainbow colors, an oily appearance, or a silvery appearance.

Odor:

Anthropogenic materials may have a distinctive odor. While describing the sample characteristics, note odors present in the sample. Understand that odor classification is a subjective measure; therefore avoid making conclusions about specific chemical character of the sample.

Putrescence:

During the sample logging process specific attention will be paid to the identification and description of artifacts indicating putrescence. These include:

- Presence of insects
- Small animal (e.g., rodent) remains
- Decomposing food wastes
- General indicators of putrefaction such as odors and decaying organic materials that may be attractive to wildlife/birds

Screening

Samples will be screened with alpha, beta, and gamma radiation detectors and/or a photoionization detector (PID).

2.4.1.6 Asbestos Inspection

MDNR and the St. Louis County Department of Health require notification of drilling activities and observation of the work by a state-certified asbestos inspector. If suspected asbestos-containing material (ACM) is encountered during drilling or other intrusive activities, the following protocols will be implemented at the direction of the state-certified asbestos inspector:

1. Identify and mark-off an exclusion zone. The exclusion zone will consist of a minimum 25-foot-square (25 feet x 25 feet) area with the borehole, etc. located at the center.
2. If work is to continue, all workers within the exclusion zone will wear Tyvek protective disposable suits and don half-face respirators with high-efficiency particulate air (HEPA) filters if trained, fit-tested, and authorized to do so in accordance with their employer’s Respiratory Protection Program. Those not so authorized must leave the exclusion zone immediately.
3. If drilling activities are to continue, a ½-inch stream of water will be added to the borehole continuously during the drilling process.
4. Plastic sheeting will be placed on the ground near the borehole and drilling debris exhumed from the hole will be placed on it. A sand or dirt berm approximately 18 inches high shall be erected on three sides of the plastic sheeting. Drilling debris placed on the plastic will be dampened and maintained wet.

Drilling debris temporarily placed on plastic sheeting must be relocated into a durable container and covered (secured tarp, hinged lid, etc.) prior to the end of the day's work.

5. All used PPE and drilling debris will be disposed of on-site in accordance with site procedures. All equipment coming into contact with ACM shall be pressure washed at a designated area before leaving the site.

2.4.1.6 Field Screening/Scanning of Site Samples

Cores will be scanned with detectors sensitive to alpha, beta, and gamma radiation. Concurrently with borehole gamma logging, core radioactivity will be measured in one-minute integrated gamma readings at six-inch intervals using the same type of sodium iodide (NaI) gamma detector used for downhole gamma logging, and consistent with the equipment used during previous investigations. Field radiological readings will be taken along the total length of the core(s). Core scanning and downhole gamma in conjunction with geological evaluation of the cores may be used to select depth intervals for sample collection.

2.4.1.7 Descriptions of Landfill Waste

Moisture Content Scale:

<15%	Dry Refuse	No trace of moisture. Rock, dirt; paper will be fuzzed up or brittle.
20-25%	Normal	Paper and cardboard, etc., still not noticeably wet. Normal moisture content of material consistent with prior to disposal.
25-35%	Damp	Paper shows dampness, lawn clipping and tree branches are stiff and hold together.
35-50%	Wet	Paper saturated but no free water present. Waste is beginning to get sloppy. Water emanates when squeezed.
>50%	Saturated	Mud or free water present.

Decomposition Scale:

▪ Little	▪ Printed material is readable. Refuse looks freshly buried.
▪ Some	▪ Material is at a state of decomposition between "little" and "moderate."
▪ Moderate	▪ Printed material is not legible, branches are intact.
▪ Much	▪ Material is at a state of decomposition between "moderate" and "severe."
▪ Severe	▪ Black/brown mucky material.

2.4.2 Surface Soil Sampling

2.4.2.1 Laboratory Analytical Sample Collection Strategy

Samples will be collected from locations in the Buffer Zone and Lot 2A2, as shown on **Figure 4** in order to delineate the presence of radionuclides above background, if any, in these areas. Additionally, a background study will be performed on samples collected from designated off-site reference units. Sample locations and placement strategy are described in the DIWP.

Surface soil samples in the Buffer Zone and Lot 2A2 will be collected from random-start systematic locations in survey units approximately 2,000 square meters in area. Each sample will be collected from a 6-inch interval located below the base of imported gravel, recycled asphalt or other fill material used for parking surfaces or the non-combustible cover, thereby approximating surface samples prior to subsequent development activities and obtaining a representation of concentrations in the potentially impacted areas. This approach is appropriate because migration of contaminants to the Buffer Zone and Lot 2A2 is thought to have occurred as a consequence of surface runoff from Area 2, and methods for investigating radiological surface contamination in open land areas usually consider the first 6-inches of soil. Location-specific details related to sample data needs are detailed in Table 4.

Samples will also be collected from background reference areas, shown on Figure 5. In application, four separate reference units of approximately 2,000 square meters in area were selected; each unit is strategically located to resemble site conditions in order to evaluate statistically valid background concentrations for the site. As shown in Table 5, 15 randomly selected locations will be sampled from each reference unit. As it is important that samples are representative of background conditions, samples will be obtained from zero to 6-inch and 6 to 12-inch intervals. Sampling the two intervals allows an opportunity to evaluate the surface of individual locations, reference units, and the entirety of the reference area for impacts from development or other activities.

A fifth reference area, further away from the site, will be identified and included in the background study.

Surface samples will be collected in accordance with the methods described below, and submitted to a laboratory for analysis as per Section 2.4.5.

2.4.2.2 Equipment and Supplies

- Digging implement: hand auger, garden trowel, disposable trowel, shovel, spoons, post-hole digger, etc.
- Sample containers
- Tape
- Indelible pen
- Labels and security seals
- Equipment cleaning supplies, as appropriate
- Record forms and/or logbook

2.4.2.3 Surface Soil Sampling Method

The soil at the selected sampling location will be loosened to the target depth using a trowel or other digging implement. Large rocks, vegetation, and foreign objects will be removed (these items may also be collected as separate samples, if appropriate). Samples should be collected immediately below the zone of grass cover and associated roots.

The remaining soil from each sampling interval (zero to 6 or 6 to 12-inches) will be homogenized in a stainless-steel mixing bowl and distributed to the appropriate sample containers. Subsequent depth intervals will be processed in the same manner for each interval collected. The field technician will record the sample identification, location, and other pertinent data on appropriate record forms, maps, drawings, and/or site logbook.

Sampling tools will be cleaned, as necessary, according to the procedure outlined below in Section 2.8 before proceeding with further sampling.

2.4.3 Subsurface Sampling

2.4.3.1 Laboratory Analytical Sample Collection Strategy

Subsurface sampling strategies will be dictated by data needs outlined in the Geostatistical Modeling Objectives (GSMOs) and of the general Design Investigation Objectives (DIOs). Boring specific details are shown in Tables 1 and Table 2. Samples may be collected based on the results of core scanning, downhole gamma, and geological evaluation of the contents of the core(s). The sample collection strategy as dictated by GSMOs is summarized below:

- GSMO-1: Laboratory analytical samples collected from up to two depths per boring exhibiting a 40,000 – 500,000 cpm reading during core scanning. Samples will be collected during core logging from two depths with readings at the highest end of the specified range limits. A third sample will be collected from the archived cores based on the needs of the geostatistical model.
- GSMO-2: Laboratory analytical samples will be collected from each core run from zero to 16 feet from targeted gamma ranges, and/or peaks observed during alpha scanning.
- GSMO-4: This objective covers RIM delineation in multiple boring types; the sampling needs associated with each subset are described below:
  - In non-perimeter borings fulfilling GSMO-4, one laboratory analytical sample will be collected from each 4-foot core run from zero to 16 feet B2005GS based on elevated alpha, beta, and/or gamma readings during core scanning.
  - In perimeter borings for geotechnical sample collection (generally installed from zero to 25 feet B2005GS) one laboratory analytical sample will be collected from zero to one foot B2005GS, and a second sample will be collected from one to 25 feet B2005GS based on elevated alpha, beta, and/or gamma readings during core scanning.
  - In perimeter borings installed through waste and five feet into native alluvium (generally installed from zero to 60 feet B2005GS), one laboratory sample will be collected from zero to one foot B2005GS, and a second laboratory sample will be collected from one to 60 feet based on elevated alpha, beta, and/or gamma readings during core scanning.
  - In perimeter borings in the vicinity of the North Quarry (generally installed from zero to 100 feet B2005GS), up to three laboratory samples may be collected from intervals exhibiting elevated alpha, beta, and/or gamma during core scanning.
- GSMO-5: Laboratory analytical samples will be collected in one-foot intervals from zero to 16 feet B2005GS.
  - Proposed borings TH-125 and TH-127 are located along the expected RIM boundary of Area 2 and will also fulfill data collection needs associated with perimeter borings, specifically delineating RIM to 25 feet B2005GS. In addition to the laboratory analytical samples collected in one-foot intervals from zero to 16 feet B2005GS, an additional laboratory sample may be collected from these cores between 16 and 25 feet B2005GS, based on the results of field alpha, beta, and/or gamma readings during core scanning.
- GSMO-6: Two laboratory analytical samples will be collected from 16 to 20 feet B2005GS from the interval(s) exhibiting the highest readings observed during core scanning.
- GSMO-7: One laboratory sample will be collected per four-foot core run to a depth of 16 feet B2005GS. Samples should be collected from gamma ranging from 40,000 to 500,000 cpm where applicable, or from intervals exhibiting the highest readings observed during core scanning.
- Perimeter borings (PB): Up to two analytical laboratory samples will be collected from perimeter borings - one laboratory sample will be collected from zero to one-foot B2005GS, and a second laboratory sample may be collected at depth from an interval exhibiting elevated alpha, beta, and/or gamma readings during core scanning.

In addition to proposed borings that fulfill the above data-quality objectives, there are multiple locations that fulfill more than one data quality and design objective. The sampling strategy at these locations has been optimized to avoid unnecessary duplication of sampling intervals. The optimized sampling strategy is detailed in **Table 1** and **Table 2** and is summarized below:

- GSMO-2 and GSMO 5: In areas of thorium-driven excavation extents, laboratory analytical samples will be collected in one-foot intervals from zero to 16 feet B2005GS.
- GSMO-4 and GSMO-6: Two laboratory analytical samples will be collected from zero to 16 feet, and an additional two laboratory analytical samples will be collected from 16 to 20 feet B2005GS. Samples will be collected based on the results of alpha, beta, and/or gamma readings during core scanning.
- GSMO-1, GSMO-2, and GSMO-6: Three laboratory analytical samples will be collected from zero to 16 feet B2005GS, and an additional two laboratory analytical samples will be collected from 16 to 20 feet B2005GS. Samples will be collected based on the results of alpha, beta, and/or gamma readings during core scanning.

2.4.3.2 Geotechnical Sample Collection Strategy

Geotechnical samples will be collected from perimeter borings in soil to evaluate areas under consideration for construction of future drainage features as well as from proposed borings installed in waste to evaluate settlement and provide an understanding of behavior characteristics (e.g. moisture content and density). This information may prove useful when planning and implementing the remedial action, specifically for estimating trucking volumes.

A geotechnical sample may be collected from each perimeter boring installed in non-waste areas. See **Table 1** (Area 1) and **Table 2** (Area 2) for boring-specific sampling details. Samples will be submitted for the laboratory analyses listed in **Section 2.4.6.1**.

Up to two geotechnical samples may be collected from each perimeter borings installed in waste areas. See **Table 1** (Area 1) and **Table 2** (Area 2) for boring-specific sampling details. Samples will be submitted for the laboratory analyses listed in **Section 2.4.6.2**.

Up to two geotechnical samples may be collected from waste samples collected for waste disposal characterization. See **Table 1** (Area 1) and **Table 2** (Area 2) for boring-specific sampling details. Samples will be submitted for the laboratory analyses listed in **Section 2.4.6.**

During geotechnical sampling in waste, the sample density will be measured and recorded (see **Section 2.3.3.3**).

2.4.3.3 Equipment and Supplies

- Cooler with ice
- Digital camera or phone/tablet
- Vacuum sealer and vacuum bags
- 1-gallon sealable bags
- Notepad
- Scissors/knife
- Spray bottles with Alconox solution and water
- Gloves
- Permanent marker for labeling
- Tripod and hanging scale

2.4.3.4 Subsurface Sampling Method

1. A core run will be vibrated out of the core barrel into a plastic sleeve. A HPT will scan the sleeve and record gamma activity.
2. The core will be transferred to a central sample processing location, where the sample processing crew will cut open the sleeve and photograph the entire core run. The knife used to cut the sleeve should be washed and rinsed with Alconox solution and water prior to reuse.
3. The sample processing geologist/engineer will review the core samples and log the cores and the corresponding depths in accordance with Section 2.4.3. In addition, cores will be screened with an alpha, beta, and gamma detector and/or a PID to allow field measurements of radiation and volatile organics concentration of each core. Soils will be described in accordance with the Section 2.4.1 These screening measurements and soil description information will be recorded on a soil boring log form. An example of the typical soil boring log form is provided in Attachment 2.
4. When sampling, the associated interval of sample collected will be identified in the field notes for a given core run and the sample associated with that interval will be sent for analysis at the analytical laboratory. The depth of the sample will be determined by measuring from both the B2005GS and current day (2020) ground surface. Approximate variation between current day and 2005 ground surfaces is included in Table 3.
5. The volume of sample, type of sample container, and preservation requirements are provided in the QAPP. Samples will be analyzed via alpha and gamma spectroscopy for radiological constituents and waste acceptance criteria in accordance with the location specific data needs summarized in the DIWP. Laboratory analytical parameters including methods and detection limits are detailed in the QAPP.
6. Field duplicate samples and other laboratory QA/QC samples will be collected at a frequency of one for every 20 investigative samples or one sample per sampling event if less than 20 investigative samples are collected.
7. Once the requisite samples are collected and transported to the sample processing location, the driller can proceed with installing PVC or ABS casing for downhole gamma logging or abandon the borehole with bentonite/cement grout, depending on the location.

2.4.4 Sediment Sampling

Sediment samples will be collected from locations in and adjacent to the Northern Surface Water Body and Earth City Flood Control Channel, as shown on Figure 6, in order to evaluate the presence of radionuclides above background, if any, in these areas. Sample locations and placement strategy are described in the DIWP.

A bathymetric survey of the Northern Surface Water Body (approximately 1 acre in areal extent) will be performed during the design investigation, and will include the surveying of as-built sediment sampling locations.

2.4.4.1 Laboratory Analytical Sample Collection Strategy

Sediment samples from the Northern Surface Water Body will be collected from historically sampled locations (SED4, AC-SED-06, AC-SED-07, AC-SED-08, AC-SED-09, and AC-SED-10) and from newly proposed locations (NWB-SED-01 through NWB-SED-05). It is anticipated that historically sampled locations will be accessible by-foot and will be sampled in a manner consistent with previous investigations, while the newly proposed sediment locations in the Northern Surface Water Body may require access via jon boat. The precise methods of sample collection will depend upon water depth and sediment surface conditions (presence of macrophytes, woody debris, etc.). Proposed collection methods include hand coring, hand augering, and grab sampling via Ponar dredge. The Parsons Field Team Lead will make the final decision regarding sediment sample collection methodology at new locations based on visual inspection of water body conditions and approximate water depth measurements.

Sediment samples adjacent to the Earth City Flood Control Channel will be collected from historically sampled locations (SEDIMENT-2016-03-16A and SED-11). It is anticipated that these locations will be accessible by foot, and sampled using methods consistent with previous investigation, but the Parsons Field Team Lead will assess site conditions prior to the commencement of sampling. All sampling will be performed safely and in accordance with the PSHEP.

Sediment samples will be collected in zero to six-inch and six to 12-inch intervals, as measured below ground surface at historical locations, and as measured below sediment surface at proposed new locations.

Sediment samples will be collected in accordance with the methods described below, and submitted to a laboratory for analysis as per Section 2.4.5.

2.4.4.2 Equipment and Supplies

- Sediment sampler (lexan core tube, hand auger, Ponar dredge, Ekman dredge, or equivalent)
- Winch (if necessary)
- Boom arm (if necessary)
- PVC pipe greater than 4 inches in diameter
- Core catchers, liner caps, etc.
- Pounding block
- Sledge hammer
- Saw, knife, cutters to open or split core liners
- Sampling vessel or floating platform
- Propulsion method for sampling vessel or floating platform
- Containers, buckets, tubs
- Small trays
- Calibration bucket
- Wash box
- Glaswater
- Log book, indelible pens/markers
- Labels
- Coolers
- Duct table
- Spoons
- Gloves
- Meter wheel/measuring devise (tape measure, yard stick/meter stick)
- Hanna HI9025C portable meter with HI1230 and HI3230 probes, or equivalent
- Radiological survey detectors

2.4.4.3 Land-Based Sediment Soil Sampling Method

In areas where sediment sampling locations are accessible by foot, the sediment will be loosed to the target depth using a hand auger, Ekman dredge (if applicable), or other digging implement. Large rocks, vegetation, and foreign objects will be removed (these items may also be collected as separate samples, if appropriate). Samples should be collected immediately below any grass or root zones that may be present.

The remaining sediment from each interval will be homogenized in a stainless-steel mixing bowl and distributed to the appropriate sample containers. Subsequent depth intervals will be processed in the same manner for each interval collected. The sample identification, location, and other pertinent data will be recorded on appropriate record forms, maps, drawings, and/or site logbook.

Sampling tools will be cleaned, as necessary, according to the procedure outlined below in Section 2.8, and in the QAPP, before proceeding with further sampling.

2.4.4.4 Water-Based Sediment Soil Sampling Method (Hand Coring)

In areas where the total depth of the water body is less than eight feet, hand coring methods using lexan may be appropriate for sediment collection. The following procedure should be followed when collecting sediment samples via hand coring methods:

1. Navigate the sampling vessel to the target location; use anchors to maintain vessel position.
2. Position and anchor the vessel perpendicular to the current (if present).
3. Deploy lexan tube from upriver side of vessel down into sediment.
4. Once the water level has settled, using a permanent marker or ink pen mark the lexan at water level.
5. Measure 12 inches (desired sample interval) up from the previous mark and make an additional mark. This mark indicates the total depth of the sampling interval.
6. Apply a pounding block to the top of the lexan and strike repeatedly using a sledge hammer. This can be done relatively gently and care should be taken not to damage or break the top of the lexan tube.
7. Repeatedly strike the pounding block until the mark indicating the desired sample depth has been driven into the water level.
8. Remove the pounding block and fill the top of the lexan tube with water, then apply a core liner cap to the top of the lexan tube. Mark the top of the cap with the sample location, depth interval, and time of collection. Tape the seams cap to create an air-tight seal. This is necessary for creating a vacuum during core removal and maximizing recovery.
9. Once the top of the tube is sealed rock the core side to side and back to forth while attempting to rotate the lexan tube. This should shear the sediment sample from the surrounding sediment.
10. Slowly raise the lexan tube until sediment is visible in the bottom of the tube. Once the bottom of the tube is above the water level apply the bottom liner cap, and secure with tape.
11. Once the bottom of the tube has been sealed the excess lexan may be cut, drained, and removed to allow for easier handling and transportation of the sediment core. The core should be recapped once excess lexan is removed.
12. The sediment core should be transported to the processing location upright and with care taken to minimize any disturbance/jostling of the sample.
13. Record all required fields in the field database/on applicable sediment sampling forms (Attachment 12)

2.4.4.5 Water-Based Sediment Soil Sampling Method (Hand Auger through Casing)

In areas where the total depth of the water body is greater than eight feet, or if hand coring methods using lexan are unsuccessful, hand-augering through casing may be appropriate for sediment collection. The following procedure should be followed when collecting samples on the water using hand auger methods:

1. Navigate the sampling vessel to the target location; use anchors to maintain vessel position.
2. Position and anchor the vessel perpendicular to the current (if present).
3. Deploy PVC pipe from up-river side of vessel down into sediment. Prior to sampling, verify that PVC inner diameter is wider than the outer diameter of the hand-auger (generally four inches).
4. Using straps and/or clamps secure the PVC pipe to the side of the sampling vessel.
5. If necessary use a saw to cut PVC pipe to one foot above surface of water.
6. Manually advance sections of the hand auger into the PVC pipe until the sediment is encountered.

7. Mark the handle of the hand auger at the mouth of the PVC pipe. Measure six inches (zero to six-inch sampling interval) up from the first mark using a measuring tape and make a second mark with tape – this shows the depth of the first sampling interval.
8. Rotate the hand auger while applying downward force until the second tape mark is advanced to the mouth of the PVC.
9. Slowly raise the hand auger, disconnecting auger sections as necessary, until the sample is obtained.
10. Place contents of sampler into suitable container. Visually examine the sample to determine whether it is acceptable.
11. Pick large objects such as wood debris, vegetation, and living organisms (clams, etc.) from the sediment and discard.
12. Decontaminate the sampler using an Alconox wash and rinse until no visible sediment remains on the auger head.
13. Redeploy the hand auger until the second (six-inch) tape mark is flush with the mouth of the PVC pipe. Using a measuring tape, make an third tape mark six inches above the second tape mark, this is the second (six to 12-inch) sampling interval.
14. Rotate the hand auger while applying downward force until the third tape mark is flush with the mouth of the PVC.
15. Slowly raise the hand auger, disconnecting auger sections as necessary, until the six to 12 inch sample is obtained.
16. Place contents of sampler into suitable container. Visually examine the sample to determine whether it is acceptable.
17. Pick large objects such as wood debris, vegetation, and living organisms (clams etc.) from the sediment and discard.
18. Measure the pH and ORP of the sediment (if required) by inserting the instrument probe into the soft sediment. Record the readings in a field notebook and in the database after the meter has stabilized.
19. Record all required fields in the field database/on applicable sediment sampling forms (Attachment 12)
20. Once required sediment samples have been collected remove clamps/straps fastening the casing to the side of the sampling vessel and removal the PVC casing.
21. Decontaminate the sampler using an Alconox wash and rinse until no visible sediment remains on the auger head.
22. Transport the samples to the processing areas.

2.4.4.6 Water-Based Sediment Soil Sampling Method (Ponar Dredge)

If the bottom of the water body is relatively free of macrophytes and woody debris a Ponar dredge sampler may be used to secure sediment samples. Ponar dredges are generally used to collect samples from zero to seven-inches below sediment surface but it is possible to collect deeper samples by redeploying the dredge. Samples collected using the Ponar dredge are often significantly disturbed and the associated depth interval of the sample is often unable to be determined. The following procedure should be followed when utilizing a Ponar dredge for grab sample collection:

1. Navigate the sampling vessel to the target location; use anchors to maintain vessel position.
2. Securely attach a decontaminated Ponar dredge sampler to a winch with cable or line of sufficient strength to accommodate the weight of the sampler and sample.
3. Set the mechanism on the sampler so the jaws are held in the open position.
4. Slowly lower the sampler using a winch and boom arm through a moon pool or over the side of the vessel. Maintain tension on the sampler to keep the jaw mechanism from prematurely closing.
5. After the sampler contacts the sediments on the bottom, relax the tension on the sampler to allow the jaw locking mechanism to release.

6. Place tension on the cable/line and slowly lift. This should cause the sampler jaws to close trapping the sample inside.
7. Slowly and steadily retrieve the sampler.
8. Hang the sampler above a pre-cleaned container of suitable size and composition (an inert material that will not interfere with or cause cross contamination).
9. Siphon off free water from the top of the sediment sample in a manner that avoids loss of sediment.
10. Inspect volume of retrieved sediment; should the jaw mechanism become jammed open (i.e., via contact with debris/larger sediment causing it to incompletely close, the volume of retrieved sediment will be significantly less than expected based on the size of the Ponar. In the event that an incomplete sample is retrieved, material will be discarded and the sampling process will be repeated.
11. Once a sufficient volume of sample has been collected, manually homogenize the sediment with a large, long-handled, clean stainless steel spoon. The mixing should be done quickly to minimize oxidation within the sample.
12. Place contents of sampler into suitable container. Visually examine the sample to determine whether it is acceptable.
13. Pick large objects such as wood debris, vegetation, and living organisms (clams etc.) from the sediment and discard.
14. Measure the pH and ORP of the sediment (if required) by inserting the instrument probe into the soft sediment. Record the readings in a field notebook and in the database after the meter has stabilized.
15. Record all required fields in the field database/on applicable sediment sampling forms (Attachment 12)
16. Repeat the process until requisite soil volume is collected.
17. Transfer sediments to a sealed designated container and transport the samples to the processing areas.

2.4.5 Laboratory Analytical Constituents

2.4.5.1 Surface Sample Analytical Parameters (Buffer Zone/Lot 2A2)

Surface samples collected from the Buffer Zone and Lot 2A2, as well as the reference areas for the investigation, will be collected in accordance with the methods described in Section 2.4.2 and submitted to a laboratory for the following analyses, in accordance with Table 1 from the RODA:

Uranium Series	Actinium Series	Thorium Series
Uranium-238	Uranium-235	Thorium-232
Thorium-234	Thorium-231	Radium-224
Proactinium-234	Proactinium-231	Actinium-228
Uranium-234	Actinium-227	Radium-224
Thorium-230	Thorium-227	Lead-212
Radium-226	Radium-223	Bismuth-212
Lead-214	Lead-211	Thallium-208
Bismuth-214	Bismuth-211	

2.4.5.2 Subsurface Sample Analytical Parameters

Subsurface soil samples collected from proposed borings not related to the Buffer Zone and Lot 2A2 investigation will be collected in accordance with the methods described in Section 2.4.3 and submitted to a laboratory for the following analyses:

Radium-226
Radium-228
Thorium-230
Thorium-232

2.4.5.3 Sediment Sample Analytical Parameters

Sediment samples collected from the Northern Surface Water Body and the banks of the Earth City Flood Control Channel will be collected in accordance with the methods described in Section 2.4.4. Samples will be submitted to a laboratory for the following analyses:

Actinium-228	Lead-214	Thorium-232
Bismuth-214	Radium-226	Uranium-234
Potassium-40	Radium-228	Uranium-235
Proactinium-231	Thorium-234	Uranium-238
Lead-210	Thallium-208	
Lead-212	Thorium-230	

Analytes were selected for consistency with previous investigations, with the addition of Thorium 232.

2.4.6 Geotechnical Sample Constituents

2.4.6.1 Geotechnical Analyses in Non-Waste Areas

Subsurface samples from borings along the perimeter of Area 1 and Area 2 that are not in waste will be collected in accordance with Section 2.4.3.4 and submitted to a geotechnical laboratory for the following analyses:

Moisture Content – ASTM D2216
Grain-Size (Sieve Analysis) – ASTM D6913
Grain-Size (Hydrometer) – ASTM D7928
Atterberg Limits (if plastic) – ASTM D4318
Organic Content (loss on ignition) (if notable organics) – ASTM D2984 (Method C 440°C)

2.4.6.2 Geotechnical Analyses in Waste Areas

Subsurface samples from waste characterization borings, or from borings along the perimeter of Area 1 and Area 2 that are located within waste, will be collected in accordance with Section 2.4.3.4 and submitted to a geotechnical laboratory for the following analyses:

Moisture Content – ASTM D2216
Grain-Size (Sieve Analysis) – ASTM D6913
Grain-Size (Hydrometer) – ASTM D7928
Atterberg Limits (if plastic) – ASTM D4318
Organic Content (loss-on-ignition) – ASTM D2974 (Method C 440°C)
Specific Gravity – ASTM D854

2.4.7 Waste Acceptance Criteria

Subsurface samples will be collected from a small subset of proposed borings, as shown on Table 1 and Table 2, for laboratory submission and analysis for the following:

Radium-226	pH Screen	TCLP VOCs
Radium-228	Water Reactivity	TCLP SVOCs
Thorium-230 (no progeny)	Flammability Potential	TCLP Pesticides
Lead-210	Cyanide Screen	TCLP Herbicides
Potassium-40	Sulfides Screen	Physical Description
Uranium	TCLP Metals(+Hg)	
Paint Filter	PCBs	

2.5 Monitoring Wells

One of the design investigation objectives is to evaluate liquid levels within the proposed excavation area; therefore, seven monitoring wells will be installed at selected locations, as shown on Figure 5G of the DIWP.

Monitoring wells will be installed through the full extent of waste. During installation subsurface conditions will be monitored for moisture content and soils will be described according to Section 2.4.1. These monitoring wells will be installed with a filter pack and annular seal, and will be fully developed in accordance with Section 2.5.2.

Typical drilling methods used to collect shallow and deeper overburden soils and create boreholes for monitoring wells are discussed in Section 2.2 of this document. The drilling methods typically allow for the advancement of borings through most soil types including denser soils (e.g., glacial till), and, when coupled with split spoon sampling conducted in accordance with ASTM Method D1586 (or other appropriate methods), provide geotechnical information.

Drilling operations related to monitoring well installation at the site will be performed in accordance with 10 CSR 23-4.040 of the MDNR Monitoring Well Construction Code.

2.5.1 Monitoring Well Installation

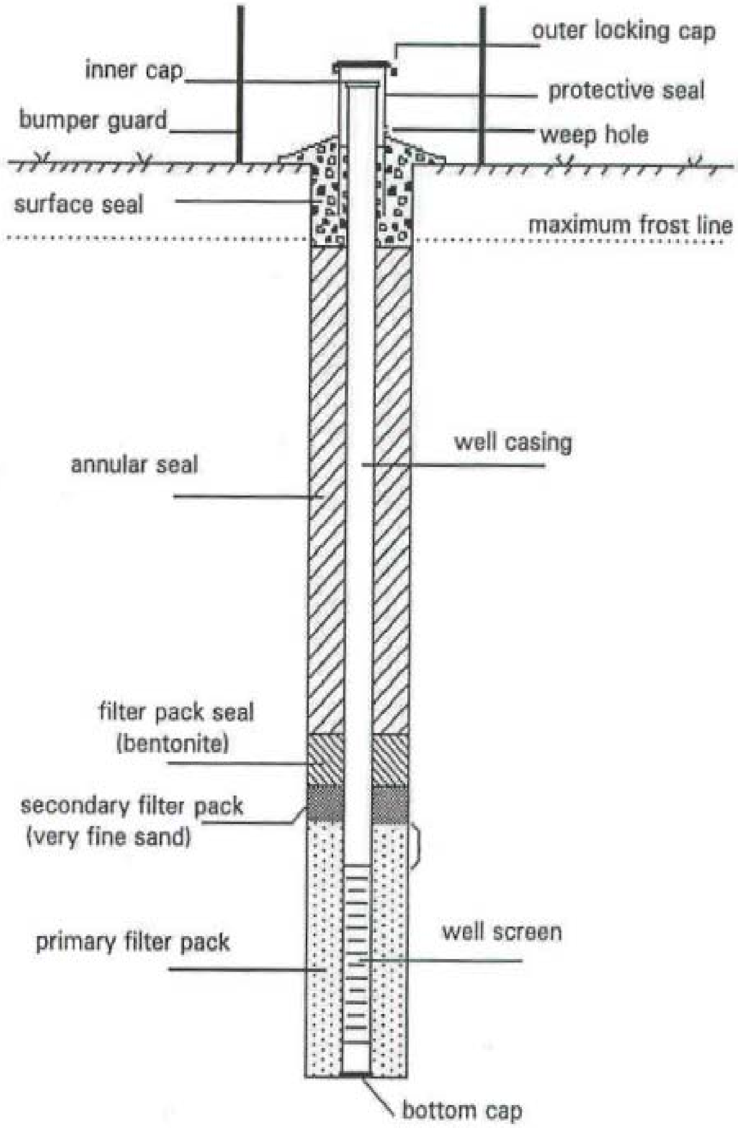
Monitoring wells will be installed in accordance with state and local well construction standards, including 10 CSR 23-4.060 from the MDNR Monitoring Well Construction Code.

Subsurface samples will be collected in accordance with Section 2.4.3. Shallow wells will be constructed of 2-inch diameter threaded PVC screen connected to flush joint PVC casing. The well screen will be factory slotted with 0.010-inch openings. The well screen will be 10 to 15 feet in length and will be set below the water table. In locations where there is a potential for lighter-than-water contaminants, monitoring wells will be installed with well screens spanning the water table.

Monitoring wells will be constructed in the following manner. The 2-inch- diameter PVC casing will be installed to a depth to be determined in the field, based upon observations of waste thickness and moisture content. At the termination depth, a 2-inch diameter PVC screen connected to flush joint PVC casing will be installed and a PVC cap will be installed at the bottom. The well screen will be factory slotted with 0.010-inch diameter openings. Each monitoring well will be properly labeled with an identification (ID) plate, painted ID number and/or ID tag.

A filter pack will be placed around the screened portion of the well up to a height of at least 2 feet above the screened section of casing. A minimum of two feet of bentonite will be placed above the filter pack. If the bentonite seal is placed above the water table, approximately 5 to 10 gallons of potable water will be added for hydration purposes. The well will then be grouted from the land surface to the top of the bentonite seal. To provide stability for the well casing, the uppermost three feet of grout below land surface will be a concrete or cement-type grout.

Monitoring wells will generally be completed with locking protective covers, concrete pads, and bollards. The bollards will be painted yellow to increase visibility. However, in locations where site-specific conditions directly related to business activities, such as vehicle traffic, would endanger the physical integrity of the well, a flush-mounted completion (completed in such a manner to preclude stormwater runoff or surficial contaminants from entering the well) may be installed. A diagram of an example cross-section of a monitoring well installation is shown below. Final installation details will depend upon site conditions, technical requirements and the direction of the onsite geologist.



Example Cross-Section of Monitoring Well Installation. Final installation details will depend upon site conditions and technical requirements. Piezometer installation will be similar, with longer well screen section.

During drilling, borings will be monitored with a radiological screening meter and/or an organic vapor meter to assess the presence of radioactivity and volatiles in the subsurface soil at each drilling location. Use and calibration of these devices is detailed in Section 2.7 of this document. Other monitoring equipment also may be used as required in the site-specific PSHEP.

Grout will be allowed to cure for at least 72 hours in monitoring wells prior to development. Preliminary development necessary during monitoring well installation will take place prior to grouting. New monitoring wells will be developed after construction using bailing, pumping, air surging, air-lift pumping, jetting and/or mechanical surge block techniques. Development shall continue until clear, sediment-free water is consistently produced. If possible, the well should be developed until the turbidity is less than 5 Nephelometric Turbidity Units (NTUs). Development parameter measurements as specified in Section 2.5.2 will be documented.

After development, new monitoring wells will be accurately land-surveyed for elevation control. Horizontal locations will be determined by direct measurement from physical locations (i.e., benchmarks) at the facility. To reduce the effects of chemical changes caused by formation damage that occurs during drilling operation, monitoring wells will not be sampled until at least 24 hours after installation and development.

2.5.2 Monitoring Well Development

After installation, monitoring wells will be developed to remove the fine material which may have settled within the filter pack, and to improve/restore hydraulic communication with the surrounding formation. Monitoring well development should be performed or overseen by a field geologist, and in concurrence with the methods described in *ASTM D5521 – Standard Guide for Development of Groundwater Monitoring Wells in Granular Aquifers*.

- Development will be performed by surging and purging the well, as appropriate, using a submersible pump and surge block. Prior to surging the well will be pumped to observe that the well yields water.
- Water quality parameters will be recorded before, during, and after well development. Parameters will include turbidity, pH, temperature, and specific conductance.
- Total well depth and water depth will be measured before, during, and after development. Depths will be measured to the nearest 0.01 foot prior to development.
- Monitoring wells will be developed until the water discharge from the well has stabilized below naturally occurring turbidity levels (generally less than 50 NTU) and below 5 NTUs if possible, or until the development water quality parameters (pH, temperature, and specific conductivity) stabilize, or until a maximum of 10 borehole volumes of water have been removed. If the well goes dry during development, it will be allowed to recharge to 80% of initial water level and pumped again. The well will be considered developed after pumping the well dry three times.
- Well development information will be recorded on a Well Development Log. An example of the Well Development Log is provided as Attachment 5.
- Ideally, dedicated and/or disposable equipment will be used for well development. However, if non-dedicated well-development equipment is used, it will be decontaminated after use in accordance with Section 2.8.
- Development water will be staged in a tote on-site and sampled in accordance with Section 2.9.
- Following development, the monitoring wells will be allowed to equilibrate for a minimum of 24 hours prior to groundwater sampling.

2.5.3 Monitoring Well Decommissioning

Certain monitoring wells that are located within Areas 1 and 2 will need to be abandoned prior to RA. Information from this section is modified from *ASTM D5299 – Standard Guide for Decommissioning of Groundwater Wells, Vadose Zone Monitoring Devices, Boreholes, and other Devices for Environmental Activities*. Monitoring well abandonment will be performed in accordance with 10 CSR 23-4.080 of the MDNR Monitoring Well Construction Code.

2.5.3.1 Equipment and Supplies

- Drilling rig with hydraulic lift and/or winch
- Portland cement (Type 1)
- Bentonite hole plug
- Tremie pipe (enough length to reach maximum borehole depth)
- Drum or bucket to mix grout

- Cement mixer
- Clean potable water
- Accelerators (calcium chloride) and retarders (sodium chloride) as necessary

2.5.3.2 Field Procedure

1. Monitoring wells and piezometers should be decommissioned once the data collection needs have been fulfilled.
2. Decommissioning work performed at the site should be completed by competently trained and licensed drillers under the direction of a geological or engineering professional who is qualified to certify that the decommissioning is completed according to planned procedures and is consistent with applicable regulations.
3. Remove casing from the ground by either pulling or overdrilling (ASTM D5781, D5782, D5784, D5872, D6167, D6286) using hollow-stem auger or sonic drilling methods.
4. If the casing, filter pack and annular seal materials cannot be removed, it may be necessary to leave the casing in place. The casing left in place may require perforation or puncturing to allow proper placement of sealing materials and eliminate potential flow paths through the annular space (additional discussion in ASTM D5299). Attempts should be made to verify the integrity of grout sealing through depth measurements and volumetric considerations of materials and water used. Once verified that the annular space is sealed, the casing may be cut at the surface.
5. Cuttings extracted during creation of a temporary boring or temporary piezometer may be used to backfill the boring, provided that the boring is not to be used for installation of a monitoring well. However, cuttings that exhibit “gross” contamination, as evidenced by screening measurement (radiological or PID), waste materials, staining, presence of free-phase product, or any visual or olfactory observations will be managed in accordance with Section 2.9. In this event, a cement/bentonite grout will be used to backfill the borehole. The grout will be tremied through the auger string as the auger string is removed, or similar state-approved practice.
6. The project geologist will provide final technical direction on abandonment methods.

2.6 Water Sampling and Hydrologic Measurements

It is currently anticipated that groundwater sampling related to the Groundwater Monitoring Plan (GWMP) tasks will be performed by OU-3 contractors, while monitoring wells installed to evaluate leachate, if encountered, will be sampled as a part of the OU-1 design investigation.

2.6.1 Groundwater Sampling

2.6.1.1 Equipment and Supplies

- Clean/new sample bottles and preservatives will be provided by the analytical laboratory
- Dedicated and disposable tubing
- Peristaltic pump and dedicated bladder pump
- Dedicated/disposable bailers
- Nylon rope
- Water quality meter (calibrated) and flow cell
- Water level indicator
- Calibrated flow rate measurement device (graduated measuring cup)
- Disposable nitrile gloves and PPE in accordance with the PSHEP

- Decontamination chemicals and supplies
- Dedicated, clean cooler with water ice
- Sample logs
- Tape
- Indelible pen
- Labels and security seals
- Field notes and forms
- Stopwatch, or timekeeping device
- Digital camera

2.6.1.2 Groundwater Sampling Method

Groundwater samples will be obtained using low-flow groundwater sampling techniques. However, if necessary, conventional well sampling methods (e.g., three well volume purging) may also be used. The standard procedures to be used for obtaining and handling groundwater samples are described below.

For wells less than 25 feet deep being sampled for non-VOC constituents, the following procedures may be used:

1. Chemically inert tubing will be placed into the well water column to the midpoint of the screened interval. This tubing will be connected to flexible chemically inert tubing through the peristaltic pump head.
2. Water will then be removed from the well with the peristaltic pump into a bottom-filling flow through cell that houses the field parameter probes.
3. The following parameters will be measured until stabilization:
   - Elapsed time (min)
   - Depth to water (ft)
   - Temperature (°C)
   - pH
   - Conductivity (ms/cm)
   - Oxygen Reduction Potential (ORP)
   - Dissolved Oxygen (mg/L)
   - Turbidity (NTU)
   - Flow Rate (mL/min)
4. Field stabilization will be achieved once three successive measurements are observed to be within the following thresholds:
   - Temperature – 10%
   - pH – 0.1
   - Conductivity – 3%
   - ORP – 10mV
   - Dissolved Oxygen – 10%
   - Turbidity – 10%
5. To provide a representative sample, the water intake position at the midpoint of the screened interval will remain constant throughout the sampling process. Sampling flow rate will not exceed purging flow rate.
6. Once field parameter stabilization has been achieved, the sample containers will be filled directly from the pump discharge tubing.
   - It is possible that ORP may not stabilize due to setting within a landfill. The Parsons Field Team Lead will make a judgement based decision on whether sampling should be completed in the event that ORP does not stabilize. Generally if all other parameters are stable sampling may proceed.

7. If the well becomes dry during purging activities, it will be noted in the logbook, and samples will be collected as quickly as recharge will allow, preferably within the next 24 hours.

For wells greater than 25 feet deep, the following procedure may be used:

1. Chemically inert tubing will be attached to a dedicated bladder pump. The pump will then be placed into the well water column to the midpoint of the screened interval.
2. Water will be pumped from the well into a bottom-filling flow through cell that houses the field parameter (pH, temperature and conductivity) probes.
3. The following field parameters will be measured until stabilization:
   - Elapsed time (min)
   - Depth to water (ft)
   - Temperature (°C)
   - pH
   - Conductivity (ms/cm)
   - Oxygen Reduction Potential (ORP)
   - Dissolved Oxygen (mg/L)
   - Turbidity (NTU)
   - Flow Rate (mL/min)
4. Field stabilization will be achieved once three successive measurements are observed to be within the following thresholds:
   - Temperature – 10%
   - pH – 0.1
   - Conductivity – 3%
   - ORP – 10mV
   - Dissolved Oxygen – 10%
   - Turbidity – 10%
5. To provide a representative sample, the water intake position at the midpoint of the screened interval will remain constant throughout the sampling process. Sampling flow rate will not exceed purging flow rate, when possible.
6. Once field parameter stabilization has been achieved, the sample containers will be filled directly from the pump discharge tubing.
   - It is possible that ORP may not stabilize due to setting within a landfill. The Parsons Field Team Lead will make a judgement based decision on whether sampling should be completed in the event that ORP does not stabilize. Generally if all other parameters are stable sampling may proceed.
7. If the well becomes dry during purging activities, it will be noted in the logbook, and samples will be collected as quickly as recharge will allow, preferably within the next 24 hours.
8. Unless dedicated, the submersible pump and other non-disposable sampling equipment will be decontaminated.

Groundwater samples may also be collected using hand-bailing techniques as follows:

1. A disposable bailer will be lowered using new cord/string into the well until the bailer reaches the bottom.
2. The bailer will be allowed to fill and then will be removed from the well and emptied into a waste container.
3. This will be repeated until three well bore volumes have been purged from the well or until the well is dry. Field parameters will be collected after one half of a well volume has been removed.

4. Sample containers will then be filled directly from the bailer. If the well has been purged dry, it will be allowed to recharge before samples are collected. Wells with a slow recharge will be noted in the log and sampled as quickly as recharge will allow.
5. Regardless of sampling method used, individual sample aliquots will be collected in the following order: volatile organics, semi-volatile organics, and inorganics. The analytical laboratory will supply the necessary sample containers with appropriate preservatives along with shipping containers. Samples will be shipped in coolers packed with wet ice (if necessary) so that temperature preservation requirements are met.
6. Any non-dedicated equipment will be decontaminated prior to use at each location as described in Section 2.8.

2.6.2 Surface Water Sampling

At this time, the Standard Operating Procedure (SOP) for surface water sampling is included for review in case it is necessary in the future. Surface water samples from site drainage areas may be collected during heavy precipitation events, if deemed necessary by the Parsons Project Manager and subject to USEPA approval.

2.6.2.1 Equipment and Supplies

- Clean/new sample bottles (and preserved if necessary) will be provided by the analytical laboratory
- Dedicated or decontaminated containers to collect (sample cup) and composite sample water (bucket or large sampling cup)
- Peristaltic pump and inert tubing
- Nitrile gloves and PPE in accordance with the PSHEP
- Water quality meter with probe cage/cover for protection of probes when placing meter probes into a bucket
- Decontamination chemicals and supplies
- Dedicated, clean cooler with water ice
- Sample logs
- Tape
- Indelible pen
- Labels and security seals
- Field notes and forms
- Digital camera

2.6.2.2 Surface Water Sampling Method

Surface water sampling activities near the water source will be performed in a manner to prevent disturbance of sediment, shoreline soil or other variables that could affect water quality of the water being sampled.

- Decontamination of equipment that might contact sampled water will be performed.
- Fill a decontaminated large cup or bucket with surface water using a sample collection cup (or sampling cup on an extension rod).
- Use a sampling cup to fill jars/bottles.
- To prevent possible cross-contamination, after water samples are collected into sample containers, water quality measurements can be measured. These measurements can be taken in the water body if it can be done without affecting water quality, or they will be collected on the water remaining in the large cup or bucket after sample collection. The following water quality parameters will be collected during surface water sampling:

- o Temperature (°C)
- o pH
- o Conductivity (ms/cm)
- o Oxygen Reduction Potential (ORP)
- o Dissolved Oxygen (mg/L)
- o Turbidity (NTU)

- All other sampling and sample handling procedures will follow those for Groundwater Sampling in Section 2.6.1 above.

2.6.3 Leachate Sampling

Leachate samples will be obtained from monitoring wells installed during the design investigation. Sampling techniques will mirror the groundwater sampling procedures (Section 2.6.1). However, analyses, safety precautions, and sample handling will relate to the contaminants of concern and may not be related to the groundwater investigations. Leachate analytical parameters are discussed further in the QAPP and DIWP.

2.6.4 Laboratory Analytical Parameters

2.6.4.1 Groundwater Analytical Constituents

Groundwater samples will be collected in accordance with the methods described in Section 2.6.1., and submitted to a laboratory for the following analyses. A description of specific analytes and methods is included in the QAPP. It is anticipated that these will be conducted under OU-3.

Radium-226 (Dissolved and Total)	Ammonia as Nitrogen	Total Dissolved Solids (TDS)
Radium-228 (Dissolved and Total)	Chemical Oxygen Demand (COD)	Sulface
Thorium-228, -230, -232 (Total)	Chloride	Total Organic Carbon (TOC)
Uranium-234, -235, -238 (Total)	Fluoride	Metals
VOCs	Hardness (Total)	Field Parameters
SVOCs	Nitrate+Nitrite as Nitrogen	
Alkalinity (Total)	Phosphorus (Total)	

2.6.4.2 Leachate Analytical Constituents

Leachate samples will be collected in accordance with the methods described in Section 2.6.3 and submitted to a laboratory for the following analyses:

Gross Alpha	Uranium-234, -235, -238	Oil Grease
Gross Beta	Total Dissolved Solids	Total Phenol
Gross Gamma (incl. Bi-212 and U-235)	Total Suspended Solids	Iron
Radium-226	Tritium	Manganese
Radium-228	Ammonia	COD
Total Uranium by KPA	BOD	

2.6.5 Hydraulic Conductivity Testing

Monitoring wells installed within the waste extent of Area 1 and Area 2 to evaluate liquid levels within the proposed excavation may be tested to measure hydraulic conductivity and recharge rates in order to approximate the volume of liquid requiring treatment/disposal during the implementation of the remedy.

2.6.5.1 Equipment and Supplies

- Well gauging and sampling logs
- Project plans
- PPE in accordance with the Project Safety, Health, and Environmental Plan (PSHEP)
- Water level probe
- Slug made of inert material
- Pressure transducer(s) and cables
- Rugged reader or laptop
- Rope/bailing twine
- Graduated 5-gallon buckets
- Decontamination supplies
- Plastic sheeting
- Clear tape, duct tape

2.6.5.2 Testing Procedures

These tests involve observing the recovery of water levels toward an equilibrium level after an initial perturbation. The perturbation may be either a sudden rise or fall in water level. During a slug test an inert rod of known volume will be quickly introduced into the well to cause a water level rise. Following equilibration of the water level the slug is removed, thereby lowering the water level. Procedures and equipment requirements may vary depending on the rate of the water level recovery. Each well will be tested in accordance with the following procedures:

- Determine the type of test to be performed based on the following:
  - If the screened interval of the well straddles the water table, only use a rising head test.
  - If the screened interval of the well is submerged within the water, then both a rising head and falling head test will be conducted.
  - Record appropriate data on the K-Test Log. An example is provided in Attachment 10.
  - Clean the downhole equipment (e.g. pressure transducer, associated cable, bailer/slug, and associated line) following the decontamination procedures provided in Section 2.8 before initiating test(s) at each well.
  - Measure and record the static water level in the well. Only wells which have fully recovered to static level conditions after drilling and development should be tested.
  - Connect the pressure transducer to the data logger and lower the transducer into the well to a depth that will not interfere with the insertion of the slug but does not exceed the operating range of the transducer. Secure the position of the transducer by clamping the transducer cable to the well casing using a rubber-covered clamp. If the edges of the well casing are sharp, cover them with cloth or duct tape to protect the transducer cable.
  - Quickly create the water level perturbation by inserting the slug into the well. While there is no fixed requirement for the magnitude of the change in water level, it is suggested that a minimum of 20% instantaneous hydraulic head differential be created to allow collection of suitable data points.
  - If another test is to be performed, allow the well to re-equilibrate prior to performing the next test. Repeat the procedures, change settings as appropriate.

2.7 Field Meter Calibration

The Site Supervisor is responsible for documenting that QC and the approach to calibrating adhere to the procedures described below. Site workers are responsible for following the procedures. Field measurement equipment will be calibrated according to the manufacturers' recommended guidelines. If a meter exhibits unacceptable error (according to manufacturer specifications), it will be recalibrated. If after recalibration, the meter still exhibits unacceptable error, it will be replaced. Field equipment will be supplied and maintained by a manufacturer-approved supplier.

2.7.1 Calibration of Radiological Survey Equipment

Instruments to be used for quantitative measurements shall be calibrated per the Ameriphysics Radiation Control Procedures. Calibration is to be performed with standards traceable to the National Institute of Standards and Technology (NIST) or other industry-recognized standards organizations. The Radiation Control Supervisor is responsible for maintaining, calibrating and performing quality control checks on radiological equipment used in monitoring site conditions, personnel monitoring, and scanning of boreholes and environmental media. Calibration documentation detailing the calibration and maintenance history shall be maintained at the onsite project office.

2.7.2 Calibration of Organic Vapor Monitors

The purpose of this guideline is to provide general standards for the use and calibration of air quality monitoring equipment, designated as organic vapor monitors (OVMs), used to detect and quantify specific organic vapors. These instruments can be used for headspace gas analysis of collected soil samples as well as for site safety.

Proper implementation of these guidelines relies upon the following special considerations, requirements and equipment. The OVMs will be charged nightly prior to field use the next day. Instrument life span between charges is approximately eight hours. The instruments will be turned off between readings to conserve battery life. Operating instructions issued by the manufacturer will be used, as they are regularly updated.

The field instrument will be calibrated daily in accordance with the manufacturers operating instructions and procedures. Organic vapor monitors should be calibrated using a two-point calibration system consisting of both zero and span gasses, and will then be compared to an ambient air baseline. Instrument calibration readings will be recorded in field notes an on a record of calibration. Calibration documentation will be maintained in an onsite project office.

2.7.3 Calibration of Water Quality Meter

The purpose of this guideline is to provide general standards for the use and calibration of the water quality meter, which is used to take field measurements of turbidity, dissolved oxygen (DO), pH, specific conductivity, oxidation-reduction potential (ORP), and temperature.

Proper implementation of these guidelines relies upon the following special considerations, requirements and equipment. Operating instructions and procedures issued and updated by the manufacturer will be used for field calibration. Instrument sensors (except temperature) will be calibrated daily and recorded in field notes. Calibrated parameters should read within the manufactures specification. If calibrated values do not fall within the manufacturer-specified threshold troubleshooting will be performed as outlined in the equipment manual or the equipment will be replaced. Calibration documentation detailing the calibration and maintenance history will be maintained at the on-site project office.

Prior to calibration, instrument probes should be cleaned and decontaminated in accordance with Section 2.8 below.

2.8 Decontamination

To prevent cross-contamination of the sample locations, field instruments to be re-used (electronic water level indicator, submersible pump, slug, etc.) will be thoroughly decontaminated after use at each location. Drilling equipment (i.e., hollow stem augers, sonic drill rods) will be decontaminated by steam cleaning and/or pressure washing after use at each sample location. Decontamination activities will be performed over a temporary pad for rinse water collection. Rinse water from the decontamination activities will be collected, drained into drums, and labeled for appropriate waste management.

Field instruments will be decontaminated in the following manner:

1. Tap water rinse
2. Scrub with tap water containing non-phosphate detergent (i.e. Alconox)
3. Tap water rinse
4. De-ionized water rinse (for in-situ monitoring equipment)
5. Air dry

Disposable equipment (e.g., bailers, tubing, and soil sampler liners) will not be reused.

The potential to spread contamination will be mitigated by establishing readily identifiable areas around activities having the potential to encounter radiological materials. Access to these areas will be controlled and limited to properly trained individuals who have read, understood, and signed the daily Radiation Work Permit governing activities in an area or areas. Equipment and personnel leaving these Permitted Areas will be surveyed as described below. If contamination is identified, the contamination will be removed by decontamination and the equipment rechecked. This is an iterative process that will continue until equipment and personnel meet exit criteria as established in the Radiation Safety Plan (RSP).

2.8.1 Radiological Surveys

Surveys will be used to monitor and control exposures and the potential spread of contamination. The following subsections describe the surveys to be used and their requirements.

2.8.1.1 Baseline Entry Survey – Equipment

Vehicles and large equipment entering Area 1 for the Design Investigation will be surveyed by the HPT for fixed alpha and beta contamination before their initial entrance into OU-1. The survey will be conducted using a Ludlum Model 2360 scaler/ratemeter with a Model 43-93 alpha/beta detector probe (or equivalent), as described in the RSP.

2.8.1.2 Permitted Area Exit Survey - Personnel

Personnel exiting a Permitted Area will have soles of their boots and clothing scanned upon leaving the area, as described Section 5.2 of the RSP. A reading over two times the ambient background level will require decontamination before leaving the area.

2.8.1.3 Permitted Area Exit Survey - Equipment

Heavy equipment working inside a Permitted Area will be surveyed by the Radiological Control Technician (RCT) before leaving the area. Surfaces in contact with soil will be scanned for alpha and beta-gamma surface activity with a Ludlum Model 12 survey meter coupled to a Model 44-9 alpha/beta/gamma pancake detector (or equivalent) as described in Section 5.2 of the RSP. A reading of over two times the ambient background level will require the equipment to be decontaminated and resurveyed before it leaves the Permitted Area.

Sections of the downhole drilling equipment will be sampled with a swipe between sampling locations to detect removable activity on the surface of the tool string. The swipe samples will be screened in the field with a Ludlum Model 12 survey meter coupled to a Model 43-5 alpha detector, or equivalent. Alpha and beta activity on the smear will be measured using a Ludlum Model 2929 scaler coupled to a Ludlum Model 43-10-1 alpha/beta counter or a low-background alpha/beta counter such as an XLB-5 before the equipment may leave the permitted area.

2.8.1.4 Final Release Survey - Equipment

Equipment working inside a Permitted Area and equipment that might inadvertently contact RIM outside a cleared easement will be surveyed by the HPT before leaving OU-1. Surfaces in contact with soil will be scanned for alpha and beta contamination with a Ludlum Model 2360 scaler/ratemeter coupled with a Model 43-93 probe (or equivalent) as described in the RSP.

Sampling for removable contamination will be performed by swiping 100-square-centimeter areas on parts of the equipment that were in contact with soil surfaces as described in Section 5.2 of the RSP. These smear samples will be counted with a Ludlum Model 2929 scaler coupled to a Ludlum 43-10-1 detector.

If contamination is found, the vehicle will be decontaminated until it meets final release standards listed in Table 3 of the RSP (*Acceptable Surface Contamination Levels for Uncontrolled Release of Equipment*). The equipment identification and the final results will be recorded on the appropriate equipment release form and the equipment will be unconditionally released from OU-1.

2.8.2 Equipment Decontamination

All equipment (including but not limited to the drill rig) will be surveyed. If radioactive contamination is detected, the equipment will be decontaminated. A phased approach to decontamination will be employed to minimize the generation of solid waste and wastewater.

2.8.2.1 Dry Decontamination

It is expected that contamination will be associated with loose, removable dirt and mud that may attach to equipment surfaces during operations. If contamination is detected on equipment after operations are completed in a boring location, the equipment will be decontaminated before moving from one radiological area to the other. Visual patches of dirt and mud will be removed from the contaminated surfaces of the equipment using damp wipes, brushes, and scrapers. Used decontamination supplies will be placed in marked containers or bags. The remainder of material removed during dry decontamination will be placed in a separate container with hard plastic or metal sides and staged for retrieval and sampling. Solid radioactive waste generated will be packaged and characterized for handling as discussed in the waste management plan.

2.8.2.2 Wet Decontamination of Equipment

If dry decontamination is not sufficient to meet release levels, the equipment will be moved to the radiological decontamination pad. Contaminated surfaces will be scrubbed with brushes and soapy water until they are visually clean. The equipment will be surveyed again for both alpha and beta surface activity. If fixed or removable activity exceeding the release limits is found, the contaminated surface will be decontaminated using more aggressive methods such as pressure washing or abrasive blasting until the release criteria are met.

2.8.2.3 Waste/Water Management

Water used to decontaminate equipment will be placed in marked holding tanks and/or drums, sampled, and packaged and shipped to a licensed, managed disposal site. Decontamination water will be evaluated for off-site disposal. If the gross alpha results are greater than 15 pCi/L, then the sample(s) will be analyzed further for Radium-226 and isotopic thorium. Analytical methods and minimum detectable amounts (MDAs) are included in the QAPP. Additional analyses may be performed in accordance with the off-site disposal facility's requirements.

Any solid radioactive waste generated will be collected, sampled, and stored on site until the implementation of the remedy where it will be assessed for disposal.

2.8.2.4 Final Housekeeping Wash-down

Any equipment released from OU-1 will be washed with water to remove visible dirt from its surfaces prior to its removal from the project. This final housekeeping can be performed in an uncontrolled area and any water generated from this final cleaning of previously released equipment will be considered unimpacted.

2.9 Management of Investigation-Derived Waste

Field activities may generate waste materials that will require management. This section describes management procedures for investigation-derived waste (IDW).

Generally waste will be managed in a manner consistent with historical site operations as described in the *Revised Work Plan for Additional Characterization of Extent of Radiologically-Impacted Material in Areas 1 and 2* (EMSI 2015) for solids and consistent with the *Core Sampling (Phase 1B, 1C, and 2) Work Plan-Revision 1* (FEI 2014) for liquids.

Evaluation of site-derived waste management procedures will be ongoing, in particular with regard to potential waste generated during hollow-stem auger drilling operations in areas where RIM may be present. Generally soils generated during the design investigation will be archived for potential future sampling; any drill beyond soils being archived will be evaluated and stored onsite for disposal consideration during the RA.

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3.0 SAMPLE MANAGEMENT

3.1 Field Sampling Records

Information will be recorded in field notebooks to document the procedures used and the prevailing conditions during the field investigation. Previous field records will be reviewed at each Site visit, and any unusual site conditions encountered during the field investigation will be described. Field documentation of activities will be comprehensively recorded. For example, when sampling is conducted, the following types of information will be recorded:

- Name of sampler
- Purpose of sampling
- Date and time of sampling
- Sample type
- Sampling location description and/or grid coordinates (including photographs, if needed)
- Sampling method, sample containers, and preservatives used
- Sample weight or volume (if applicable)
- Number of samples taken
- Unique sample identification number (Location ID on Tables 1 through 3)
- Amount of water purged (for groundwater sampling)
- Field observations (prevailing weather conditions and other relevant factors that might influence sample integrity)
- Field measurements conducted
- Name/initials of person responsible for observation

The sample nomenclature system for the Site was developed in the DMP to provide consistency in field sample ID. Three identification labels will be associated with field samples:

- Chain of Custody (COC) Number (#)
- Location ID
- Field Sample ID

3.1.1 COC

The COC # is a numeric designation that will be assigned by the Data Manager (DM) and provided to field team in advance of field operations

3.1.2 Location ID

The Location ID represents the physical location where samples are collected, and are shown on **Figure 1, Figure 2**, **Figure 4, Figure 5,** and **Figure 6**; as well as listed in **Table 1**, **Table 2**, and **Table 4, Table 5,** and **Table 6**. Each unique field sample will be associated with a Location ID and identified on the chain-of-custody form at the time of sample collection. The Location ID consists of a description of the area (Area ID), the sample location type (such as well or boring), and a three-digit sample location number:

A # - * * # # #

Area ID - Location type Location number

For Buffer Zone and Lot 2A2 locations, instead of an Area ID, a survey unit number will be assigned (1,2,3 etc.).

For groundwater locations, an aquifer code (A for Alluvial, S for St Louis Bedrock) and an "S" (for shallow), an "I" (for intermediate), or a "D" (for deep) will be added to the end of the Location ID.

A # - * * # # # - * *

Area ID - Location type Location number

For example: An alluvial shallow well located on A1 = A1-MW001-AS. A soil boring located on A1 = A1-SB014. A list of valid Area IDs, Location Types, and Location Numbers will be available to the field team from the DM.

3.1.3 Field Sample ID

The Field Sample ID is the unique label assigned to each individual sample. For groundwater samples, the Field Sample ID will consist of the Location ID, 6 digit date (MMDDYY), and an N or D added to the end for normal or field dup sample.

A # - * * # # # - * * - M M D D Y Y *

Location ID- Date sample type

For soil samples, the Field Sample ID will consist of the Location ID, sample depth interval (d1-d2) and an N or D added to the end for normal or field dup sample.

A # - * * # # # - d 1 - d 2 *

Location ID- Depth sample type

For blanks, the Field Sample ID will consist of the sample type (TB, EB, FB), 6 digit date, and a cooler number. For example, a trip blank collected on 02/26/2020 for cooler 1 would be TB-022620-1.

Upon collection of the sample(s), a field team member will affix an identification label to the sample container(s). A label provided by the laboratory may be used or any other label that includes the information provided herein.

3.2 Sample Handling

Samples will be collected into the laboratory-supplied pre-preserved sample containers. Each individual sample container will be sealed according to laboratory specifications after sampling. Clean, disposable nitrile gloves will be worn during the handling of all samples and sampling devices.

3.2.1 Preservation of Samples

Each containerized sample will be labeled and placed as soon as possible into an insulated sample cooler. The cooler will serve as a shipping container and should be provided by the laboratory along with the appropriate sample containers. Wet ice will be placed directly in contact with the sample containers within a heavy-duty polyethylene bag. Samples will be maintained at a cool temperature (optimum 4°C ± 2°C) from the time of collection until the coolers arrive at the laboratory (if required). Plastic "bubble wrap" and/or polystyrene foam will be used to protect glass sample jars during shipping.

3.2.2 Field Custody Procedures

The custody of samples collected during the field investigation will be traceable at all times. Prior to shipment of the samples to the laboratory, a chain-of-custody (COC) form will be completed by the field sample custodian. Sample locations, sample identification numbers, description of samples, number of samples collected, and specific laboratory analyses to be run on each sample will be recorded on the sample COC form. The field sample custodian will sign and date the sample COC form and will retain a copy for the project records (if available). The sample COC form will record possession of the samples from the time of collection until disposing or archiving the sample. A sample is considered under custody if:

- It is in the investigator's possession.
- It is in the investigator's view after possession has been established.
- The investigator locks up the sample after possession.
- It is in a designated secure area.

The sample COC must be maintained at all times prior to analysis.

Prior to shipment by a registered courier, the sample shipping container (cooler, box, etc.) will be sealed with signed sample COC inside. The authorized laboratory custodian that receives the samples will sign the sample COC forms, thus terminating custody of the field sample custodian.

3.2.3 Sample Shipment Preparation

3.2.3.1 Required Paperwork

Packaging samples containing potentially radioactive materials always requires the following components, as per the Nuclear Regulatory Commission (NRC):

- UN Identification number (generally UN2910)
- Proper shipping name
- Hazard Class (Class 7 for radioactive material)
- Total activity contained in each package
  - If unknown, refer to U.S. Department of Transportation (DOT) guidance 49 CFR 172, or summarized "… a material for which the hazard class is uncertain and must be determined by testing may be assigned a tentative proper shipping name, hazard class, identification number, and packing group, if applicable, based on the shipper's tentative determination according to the defining criteria contained in 49 CFR and the shippers knowledge of the material."
- Number and type of packages

3.2.3.2 Shipping Preparation Procedure

Based on historical investigations it is expected that all coolers will be below 500 microroentgen (μR) per hour. If a cooler has an exposure level greater than 500 μR/hr the site HPT and Parsons Field Team Lead will be contacted. Generally, splitting the shipment into multiple coolers will sufficiently decrease the exposure levels.

The following process will be followed for preparing samples for transportation:

1. Samples will be placed inside a lined sturdy container, typically a standard cooler.
2. The outside of the container will be scanned with a Ludlum Model 19 miroR exposure meter. At the area of maximum response, the detector will be held 30 centimeters (11.8 inches) from the container, and the maximum exposure level will be recorded on the sample COC.
3. This measurement will be compared to exposure rate action levels in the RSP, generally 500 μR/hr.

4. The cooler lining will be marked with the UN identification number UN2910 using a black marker, and a “radioactive” label will be placed above cooler contents.
5. The cooler will be packed such that samples are secure and immobilized to the extent practicable, and adequate absorbent material used to soak up liquid samples in the event a sample container/jar breaks.
6. The inner liner will be sealed.
7. The signed COC will be placed inside the cooler, and the cooler will be sealed.

3.2.4 Laboratory Custody Procedures

Sample custody at the analytical laboratory is maintained through systematic sample control procedures composed of the following items:

- Sample receipt
- Sample log-in
- Sample storage
- Sample archival/disposal

As samples are received by the laboratory, they will be entered into a sample management system. The following minimum information will be provided:

- Laboratory sample number/identification
- Field sample designation
- List of analyses requested for each sample container

Immediately after receipt, samples will be transferred to a secure storage area with appropriate temperature control to await preparation and analysis. The laboratory’s COC procedures are documented in the laboratory’s quality assurance plan, which will be provided upon request.

3.2.5 Quality Control Checks

Equipment blanks, method/preparation blanks, field duplicates, matrix spike/matrix spike duplicates (MS/MSD)/replicate (REP) samples, and laboratory control samples (LCS) will be analyzed to assess the quality of the data resulting from the field sampling and analytical programs. The QAPP dictates the frequency of duplicate and blank collection.

Field QA/QC samples are handled, transported, and analyzed in the same manner as the actual field samples. If possible, the QA/QC samples should not be held on site for more than four calendar days. If sample preservation includes cooling, the temperature of the blanks, except the trip blanks, must be maintained at 4°C while on site and during shipment. The trip blank is not shipped to the Site on ice but must be maintained at 4°C when accompanying collected samples requiring cooling. Holding times for individual parameters are dictated by the specific analytical method used.

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TABLES

Table 1
Area 1 Proposed Boring Sample Collection Detail

Area	Location ID	GSMO-1	GSMO-2	GSMO-3	GSMO-4	GSMO-5	GSMO-6	GSMO-7	GSMO-7 (Secondary)	Geotech - Starter Berm and Pond Lithology	Geotech - Settlement Evaluation and Waste Classification	Waste Characterization	Estimated Total Boring Depth (feet B2005GS)	Total Laboratory Analytical Samples	Total Geotech Samples	Core Scan Inteval (feet)	Downhole Gamma Interval (feet)
1	A1-SB-052				X				X				16	4	0	0 - 16	0 - 16
1	A1-SB-053				X				X				16	4	0	0 - 16	0 - 16
1	A1-SB-054				X				X				16	4	0	0 - 16	0 - 16
1	A1-SB-055				X				X				16	4	0	0 - 16	0 - 16
1	A1-SB-056				X				X				16	4	0	0 - 16	0 - 16
1	A1-SB-057				X				X				16	4	0	0 - 16	0 - 16
1	A1-SB-058				X				X				16	4	0	0 - 16	0 - 16
1	A1-SB-059	X	X				X		X			X	20	5	2	0 - 20	0 - 20
1	A1-SB-060				X				X				16	4	0	0 - 16	0 - 16
1	A1-SB-061				X				X				16	4	0	0 - 16	0 - 16
1	A1-SB-062				X				X				16	4	0	0 - 16	0 - 16
1	A1-SB-063				X				X				16	4	0	0 - 16	0 - 16
1	A1-SB-064				X				X				16	4	0	0 - 16	0 - 16
1	A1-SB-065				X				X				16	4	0	0 - 16	0 - 16
1	A1-SB-066							X					16	4	0	0 - 16	0 - 16
1	A1-SB-067							X					16	4	0	0 - 16	0 - 16
1	A1-SB-068				X				X				16	4	0	0 - 16	0 - 16
1	A1-SB-069				X				X				16	4	0	0 - 16	0 - 16
1	A1-SB-070	X	X				X		X			X	20	5	2	0 - 20	0 - 20
1	A1-SB-071				X				X				16	4	0	0 - 16	0 - 16
1	A1-SB-072				X				X				16	4	0	0 - 16	0 - 16
1	A1-SB-073				X				X				16	4	0	0 - 16	0 - 16
1	A1-SB-074				X				X				16	4	0	0 - 16	0 - 16
1	A1-SB-075				X				X				16	4	0	0 - 16	0 - 16
1	A1-SB-076				X				X				16	4	0	0 - 16	0 - 16
1	A1-SB-081						X		X				20	3	0	0 - 20	0 - 20
1	A1-TH-082		X										16	16	0	0 - 16	0 - 16
1	A1-SB-083							X					16	4	0	0 - 16	0 - 16
1	A1-TH-084		X			X			X				16	16	0	0 - 16	0 - 16
1	A1-TH-085		X			X			X				16	16	0	0 - 16	0 - 16
1	A1-TH-086		X			X			X				16	16	0	0 - 16	0 - 16
1	A1-TH-087		X			X			X				16	16	0	0 - 16	0 - 16
1	A1-TH-088		X			X			X				16	16	0	0 - 16	0 - 16
1	A1-TH-089		X			X			X				16	16	0	0 - 16	0 - 16
1	A1-TH-090		X			X			X				16	16	0	0 - 16	0 - 16
1	A1-SB-128							X					16	4	0	0 - 16	0 - 16
1	A1-SB-129							X					16	4	0	0 - 16	0 - 16
1	A1-SB-140				X				X				16	2	0	0 - 16	0 - 16
1	A1-SB-141				X				X				16	2	0	0 - 16	0 - 16
1	A1-SB-142				X				X				16	2	0	0 - 16	0 - 16
1	A1-SB-143				X				X				16	2	0	0 - 16	0 - 16
1	A1-SB-144				X				X				16	2	0	0 - 16	0 - 16
1	A1-SB-145				X				X				16	2	0	0 - 16	0 - 16
1	A1-PB-101									X			25	2	1	0 - 25	0
1	A1-PB-102									X			25	2	1	0 - 25	0
1	A1-PB-103				X					X			25	2	1	0 - 25	0
1	A1-PB-104									X			25	2	1	0 - 25	0
1	A1-PB-105									X			25	2	1	0 - 25	0
1	A1-PB-106									X			25	2	1	0 - 25	0
1	A1-PB-107									X			25	2	1	0 - 25	0
1	A1-PB-108									X			25	2	1	0 - 25	0
1	A1-PB-109									X			25	2	1	0 - 25	0
1	A1-PB-110									X			25	2	1	0 - 25	0
1	A1-PB-111									X			25	2	1	0 - 25	0
1	A1-PB-112									X			25	2	1	0 - 25	0
1	A1-PB-113									X			25	2	1	0 - 25	0
1	A1-PB-114									X			25	2	1	0 - 25	0

Table 1
Area 1 Proposed Boring Sample Collection Detail

Area	Location ID	GSMO-1	GSMO-2	GSMO-3	GSMO-4	GSMO-5	GSMO-6	GSMO-7	GSMO-7 (Secondary)	Geotech - Starter Berm and Pond Lithology	Geotech - Settlement Evaluation and Waste Classification	Waste Characterization	Estimated Total Boring Depth (feet B2005GS)	Total Laboratory Analytical Samples	Total Geotech Samples	Core Scan Inteval (feet)	Downhole Gamma Interval (feet)
1	A1-PB-115									X			25	2	1	0 - 25	0
1	A1-PB-116									X			25	2	1	0 - 25	0
1	A1-PB-117				X								100	3	0	0 - 100	0 - 100
1	A1-PB-118				X								100	3	0	0 - 100	0 - 100

Table 2
Area 2 Proposed Boring Sample Collection Detail

Area	Location ID	GSMO-1	GSMO-2	GSMO-3	GSMO-4	GSMO-5	GSMO-6	GSMO-7	GSMO-7 (Secondary)	Geotech - Starter Berm and Pond Lithology	Geotech - Settlement Evaluation and Waste Classification	Waste Acceptance Criteria	Estimated Total Boring Depth (feet B2005GS)	Total Laboratory Analytical Samples	Total Geotech Samples	Core Scan Interval (feet)	Downhole Gamma Interval (feet)
2	A2-SB-001				X				X				16	4	0	0 - 16	0 - 16
2	A2-SB-002	X	X				X		X			X	20	5	2	0 - 20	0 - 20
2	A2-SB-003	X	X				X		X			X	20	5	2	0 - 20	0 - 20
2	A2-SB-004	X	X				X		X			X	20	5	2	0 - 20	0 - 20
2	A2-SB-005	X	X				X		X			X	20	5	2	0 - 20	0 - 20
2	A2-SB-006				X				X				16	4	0	0 - 16	0 - 16
2	A2-SB-007				X				X				16	4	0	0 - 16	0 - 16
2	A2-SB-008				X				X				16	4	0	0 - 16	0 - 16
2	A2-SB-009				X				X				16	4	0	0 - 16	0 - 16
2	A2-SB-010				X				X				16	4	0	0 - 16	0 - 16
2	A2-SB-011				X				X				16	4	0	0 - 16	0 - 16
2	A2-SB-012				X				X				16	4	0	0 - 16	0 - 16
2	A2-SB-013				X				X				16	4	0	0 - 16	0 - 16
2	A2-SB-014				X				X				16	4	0	0 - 16	0 - 16
2	A2-SB-015	X	X				X		X			X	20	5	2	0 - 20	0 - 20
2	A2-SB-016				X				X				16	4	0	0 - 16	0 - 16
2	A2-SB-017				X				X				16	4	0	0 - 16	0 - 16
2	A2-SB-018				X				X				16	4	0	0 - 16	0 - 16
2	A2-SB-019				X				X				16	4	0	0 - 16	0 - 16
2	A2-SB-020				X				X				16	4	0	0 - 16	0 - 16
2	A2-SB-021				X				X				16	4	0	0 - 16	0 - 16
2	A2-SB-022				X				X				16	4	0	0 - 16	0 - 16
2	A2-SB-023				X				X				16	4	0	0 - 16	0 - 16
2	A2-SB-024				X				X				16	4	0	0 - 16	0 - 16
2	A2-SB-025				X				X				16	4	0	0 - 16	0 - 16
2	A2-SB-026				X				X				16	4	0	0 - 16	0 - 16
2	A2-SB-027				X				X				16	4	0	0 - 16	0 - 16
2	A2-SB-028				X				X				16	4	0	0 - 16	0 - 16
2	A2-SB-029				X				X				16	4	0	0 - 16	0 - 16
2	A2-SB-030				X				X				16	4	0	0 - 16	0 - 16
2	A2-SB-031	X	X				X		X			X	20	5	2	0 - 20	0 - 20
2	A2-SB-032	X	X				X		X			X	20	5	2	0 - 20	0 - 20
2	A2-SB-033	X	X				X		X			X	20	5	2	0 - 20	0 - 20
2	A2-SB-034				X				X				16	4	0	0 - 16	0 - 16
2	A2-SB-035				X				X				16	4	0	0 - 16	0 - 16
2	A2-SB-036				X		X		X				16	4	0	0 - 16	0 - 16
2	A2-SB-037				X		X		X				16	4	0	0 - 16	0 - 16
2	A2-SB-038				X		X		X				16	4	0	0 - 16	0 - 16
2	A2-SB-039				X				X				16	4	0	0 - 16	0 - 16
2	A2-SB-040				X				X				16	4	0	0 - 16	0 - 16
2	A2-SB-041				X				X				16	4	0	0 - 16	0 - 16
2	A2-SB-042				X				X				16	4	0	0 - 16	0 - 16
2	A2-SB-043				X				X				16	4	0	0 - 16	0 - 16
2	A2-SB-044				X				X				16	4	0	0 - 16	0 - 16
2	A2-SB-045				X				X				16	4	0	0 - 16	0 - 16
2	A2-SB-046				X				X				16	4	0	0 - 16	0 - 16
2	A2-SB-047				X				X				16	4	0	0 - 16	0 - 16
2	A2-SB-048				X				X				16	4	0	0 - 16	0 - 16
2	A2-TH-049		X										16	4	0	0 - 16	0 - 16
2	A2-TH-050		X										16	4	0	0 - 16	0 - 16
2	A2-SB-051	X										X	16	3	2	0 - 16	0 - 16
2	A2-TH-077		X										16	4	0	0 - 16	0 - 16
2	A2-SB-078				X				X				16	4	0	0 - 16	0 - 16
2	A2-SB-079							X					16	4	0	0 - 16	0 - 16
2	A2-SB-080							X					16	4	0	0 - 16	0 - 16
2	A2-TH-091		X			X			X				16	16	0	0 - 16	0 - 16
2	A2-TH-092		X			X			X				16	16	0	0 - 16	0 - 16

Table 2
Area 2 Proposed Boring Sample Collection Detail

Area	Location ID	GSMO-1	GSMO-2	GSMO-3	GSMO-4	GSMO-5	GSMO-6	GSMO-7	GSMO-7 (Secondary)	Geotech - Starter Berm and Pond Lithology	Geotech - Settlement Evaluation and Waste Classification	Waste Acceptance Criteria	Estimated Total Boring Depth (feet B2005GS)	Total Laboratory Analytical Samples	Total Geotech Samples	Core Scan Interval (feet)	Downhole Gamma Interval (feet)
2	A2-TH-093		X			X			X				16	16	0	0 - 16	0 - 16
2	A2-TH-094		X			X			X				16	16	0	0 - 16	0 - 16
2	A2-TH-095		X			X			X				16	16	0	0 - 16	0 - 16
2	A2-TH-096		X			X			X				16	16	0	0 - 16	0 - 16
2	A2-TH-097		X			X			X				16	16	0	0 - 16	0 - 16
2	A2-TH-098		X			X			X				16	16	0	0 - 16	0 - 16
2	A2-TH-099		X			X			X				16	16	0	0 - 16	0 - 16
2	A2-TH-100		X			X			X				16	16	0	0 - 16	0 - 16
2	A2-TH-101		X			X			X				16	16	0	0 - 16	0 - 16
2	A2-TH-102		X			X			X				16	16	0	0 - 16	0 - 16
2	A2-TH-103		X			X			X				16	16	0	0 - 16	0 - 16
2	A2-TH-104		X			X			X				16	16	0	0 - 16	0 - 16
2	A2-TH-105		X			X			X				16	16	0	0 - 16	0 - 16
2	A2-TH-106		X			X			X				16	16	0	0 - 16	0 - 16
2	A2-TH-107		X			X			X				16	16	0	0 - 16	0 - 16
2	A2-TH-108		X			X			X				16	16	0	0 - 16	0 - 16
2	A2-TH-109		X			X			X				16	16	0	0 - 16	0 - 16
2	A2-TH-110		X			X			X				16	16	0	0 - 16	0 - 16
2	A2-TH-111		X			X			X				16	16	0	0 - 16	0 - 16
2	A2-TH-112		X			X			X				16	16	0	0 - 16	0 - 16
2	A2-TH-113		X			X			X				16	16	0	0 - 16	0 - 16
2	A2-TH-114		X			X			X				16	16	0	0 - 16	0 - 16
2	A2-TH-115		X			X			X				16	16	0	0 - 16	0 - 16
2	A2-TH-116		X			X			X				16	16	0	0 - 16	0 - 16
2	A2-TH-117		X			X			X				16	16	0	0 - 16	0 - 16
2	A2-TH-118		X			X			X				16	16	0	0 - 16	0 - 16
2	A2-TH-119		X			X			X				16	16	0	0 - 16	0 - 16
2	A2-TH-120		X			X			X				16	16	0	0 - 16	0 - 16
2	A2-TH-121		X			X			X				16	16	0	0 - 16	0 - 16
2	A2-TH-122		X			X			X				16	16	0	0 - 16	0 - 16
2	A2-TH-123		X			X			X				16	16	0	0 - 16	0 - 16
2	A2-TH-124		X			X			X				16	16	0	0 - 16	0 - 16
2	A2-TH-125		X			X			X	X			25	17	1	0 - 25	0 - 16
2	A2-TH-126		X			X			X				16	16	0	0 - 16	0 - 16
2	A2-TH-127		X			X			X	X			25	17	1	0 - 25	0 - 16
2	A2-SB-130				X				X				16	2	0	0 - 16	0 - 16
2	A2-SB-131				X				X				16	2	0	0 - 16	0 - 16
2	A2-SB-132				X				X				16	2	0	0 - 16	0 - 16
2	A2-SB-133				X				X				16	2	0	0 - 16	0 - 16
2	A2-SB-134				X				X				16	2	0	0 - 16	0 - 16
2	A2-SB-135				X				X				16	2	0	0 - 16	0 - 16
2	A2-SB-136				X				X				16	2	0	0 - 16	0 - 16
2	A2-SB-137				X				X				16	2	0	0 - 16	0 - 16
2	A2-SB-138				X				X				16	2	0	0 - 16	0 - 16
2	A2-SB-139				X				X				16	2	0	0 - 16	0 - 16
2	A2-PB-119									X			25	2	1	0 - 25	0
2	A2-PB-120									X			25	2	1	0 - 25	0
2	A2-PB-121									X			25	2	1	0 - 25	0
2	A2-PB-122												25	2	1	0 - 25	0
2	A2-PB-123									X			25	2	1	0 - 25	0
2	A2-PB-124									X			25	2	1	0 - 25	0
2	A2-PB-125									X			25	2	1	0 - 25	0
2	A2-PB-126									X			25	2	1	0 - 25	0
2	A2-PB-127									X			25	2	1	0 - 25	0
2	A2-PB-128									X			25	2	1	0 - 25	0
2	A2-PB-129									X			25	2	1	0 - 25	0
2	A2-PB-130				X					X			25	2	1	0 - 25	0
2	A2-PB-131												25	2	0	0 - 60*	0

Table 2
Area 2 Proposed Boring Sample Collection Detail

Area	Location ID	GSMO-1	GSMO-2	GSMO-3	GSMO-4	GSMO-5	GSMO-6	GSMO-7	GSMO-7 (Secondary)	Geotech - Starter Berm and Pond Lithology	Geotech - Settlement Evaluation and Waste Classification	Waste Acceptance Criteria	Estimated Total Boring Depth (feet B2005GS)	Total Laboratory Analytical Samples	Total Geotech Samples	Core Scan Interval (feet)	Downhole Gamma Interval (feet)
2	A2-PB-132				X								25	2	0	0 - 60*	0
2	A2-PB-133									X			25	2	2	0 - 60*	0
2	A2-PB-134				X						X		25	2	2	0 - 60*	0
2	A2-PB-135									X			25	2	2	0 - 60*	0
2	A2-PB-136				X					X			25	2	2	0 - 60*	0
2	A2-PB-137				X					X			25	2	2	0 - 60*	0
2	A2-PB-138				X					X			25	2	2	0 - 60*	0
2	A2-PB-139				X						X		60	2	2	0 - 60*	0
2	A2-PB-140				X						X		60	2	2	0 - 60*	0
2	A2-PB-141				X						X		60	2	2	0 - 25	0
2	A2-PB-142				X						X		60	2	2	0 - 25	0
2	A2-PB-143				X						X		60	2	2	0 - 25	0
2	A2-PB-144				X						X		60	2	2	0 - 25	0
2	A2-PB-145				X						X		60	2	2	0 - 25	0
2	A2-PB-146				X						X		60	2	2	0 - 25	0
2	A2-PB-147				X						X		60	2	2	0 - 25	0
2	A2-PB-148				X						X		60	2	2	0 - 25	0
2	A2-PB-149				X						X		60	2	2	0 - 25	0
2	A2-PB-150				X						X		60	2	2	0 - 60*	0
2	A2-PB-151				X						X		60	2	2	0 - 60*	0
2	A2-PB-152				X						X		60	2	2	0 - 60*	0
2	A2-PB-153				X						X		60	2	2	0 - 60*	0
2	A2-PB-154				X						X		60	2	2	0 - 60*	0
2	A2-PB-155				X						X		60	2	2	0 - 60*	0

Table 3

Comparison of 2005 - 2019 Ground Surface Elevation

Proposed Location	2005 Ground Elevation (feet)	2019 Ground Elevation (feet)	Overburden Thickness (feet)
A1-SB-052	465.11	462.57	-2.54
A1-SB-053	469.59	466.14	-3.45
A1-SB-054	471.15	466.78	-4.37
A1-SB-055	462.39	461.63	-0.76
A1-SB-056	463.99	462.57	-1.43
A1-SB-057	466.51	464.65	-1.85
A1-SB-058	458.75	459.48	0.73
A1-SB-059	466.69	465.39	-1.30
A1-SB-060	467.18	470.07	2.89
A1-SB-061	468.39	473.20	4.81
A1-SB-062	467.65	465.32	-2.32
A1-SB-063	468.65	478.52	9.86
A1-SB-064	463.28	464.46	1.17
A1-SB-065	467.35	466.29	-1.06
A1-SB-066	456.99	456.52	-0.47
A1-SB-067	460.38	463.93	3.55
A1-SB-068	467.83	466.19	-1.65
A1-SB-069	472.91	470.38	-2.53
A1-SB-070	466.92	465.49	-1.43
A1-SB-071	470.90	468.73	-2.17
A1-SB-072	458.42	457.84	-0.58
A1-SB-073	457.84	458.97	1.12
A1-SB-074	468.91	476.06	7.15
A1-SB-075	467.23	465.92	-1.31
A1-SB-076	467.60	467.32	-0.28
A1-SB-081	466.88	465.58	-1.31
A1-TH-082	461.73	462.44	0.70
A1-SB-083	462.40	464.44	2.04
A1-TH-084	471.00	477.91	6.91
A1-TH-085	469.88	470.71	0.83
A1-TH-086	465.47	464.92	-0.56
A1-TH-087	468.34	478.45	10.11
A1-TH-088	470.18	474.41	4.23
A1-TH-089	469.00	467.70	-1.30
A1-TH-090	458.75	458.63	-0.12
A1-SB-128	464.68	463.13	-1.55
A1-SB-129	466.44	463.93	-2.52
A1-SB-140	465.15	464.47	-0.69
A1-SB-141	465.04	464.42	-0.62
A1-SB-142	470.76	465.04	-5.72
A1-SB-143	462.89	461.94	-0.96
A1-SB-144	464.31	463.15	-1.17
A1-SB-145	463.64	465.31	1.66
A1-PB-101	459.49	463.01	3.52

Table 3
Comparison of 2005 - 2019 Ground Surface Elevation

Proposed Location	2005 Ground Elevation (feet)	2019 Ground Elevation (feet)	Overburden Thickness (feet)
A1-PB-102	460.80	460.85	0.05
A1-PB-103	459.62	459.58	-0.04
A1-PB-104	458.46	456.87	-1.59
A1-PB-105	458.54	458.89	0.35
A1-PB-106	459.03	459.66	0.63
A1-PB-107	458.92	459.77	0.85
A1-PB-108	458.97	459.64	0.67
A1-PB-109	460.52	460.84	0.32
A1-PB-110	458.10	458.56	0.46
A1-PB-111	455.13	454.86	-0.27
A1-PB-112	452.99	453.14	0.16
A1-PB-113	448.44	450.42	1.98
A1-PB-114	449.67	450.11	0.44
A1-PB-115	461.40	460.95	-0.46
A1-PB-116	472.58	471.32	-1.26
A1-PB-117	528.53	523.83	-4.69
A1-PB-118	507.01	499.74	-7.27
A2-SB-001	475.92	476.69	0.77
A2-SB-002	475.70	475.57	-0.13
A2-SB-003	476.21	475.02	-1.18
A2-SB-004	475.79	477.17	1.38
A2-SB-005	473.55	474.43	0.88
A2-SB-006	474.24	476.23	2.00
A2-SB-007	483.91	487.08	3.17
A2-SB-008	474.79	476.52	1.73
A2-SB-009	472.11	473.49	1.37
A2-SB-010	464.20	466.82	2.62
A2-SB-011	473.57	473.52	-0.05
A2-SB-012	459.32	457.05	-2.27
A2-SB-013	488.40	487.51	-0.89
A2-SB-014	474.73	475.34	0.61
A2-SB-015	475.84	475.44	-0.40
A2-SB-016	471.71	471.50	-0.21
A2-SB-017	468.97	468.48	-0.49
A2-SB-018	470.59	470.64	0.05
A2-SB-019	460.97	463.18	2.20
A2-SB-020	465.96	463.72	-2.24
A2-SB-021	463.92	463.48	-0.44
A2-SB-022	467.58	474.34	6.76
A2-SB-023	468.45	467.48	-0.97
A2-SB-024	468.09	466.38	-1.71
A2-SB-025	461.12	461.07	-0.05
A2-SB-026	463.61	463.91	0.30
A2-SB-027	465.68	466.57	0.89

Table 3
Comparison of 2005 - 2019 Ground Surface Elevation

Proposed Location	2005 Ground Elevation (feet)	2019 Ground Elevation (feet)	Overburden Thickness (feet)
A2-SB-028	459.28	459.12	-0.16
A2-SB-029	458.99	456.65	-2.34
A2-SB-030	463.91	462.71	-1.20
A2-SB-031	467.95	467.69	-0.26
A2-SB-032	467.18	467.66	0.48
A2-SB-033	467.42	467.13	-0.30
A2-SB-034	465.69	465.21	-0.47
A2-SB-035	468.44	469.18	0.73
A2-SB-036	484.64	484.46	-0.18
A2-SB-037	478.58	495.46	16.88
A2-SB-038	477.03	474.79	-2.24
A2-SB-039	480.48	480.84	0.36
A2-SB-040	467.22	470.17	2.96
A2-SB-041	463.41	467.30	3.89
A2-SB-042	463.62	460.71	-2.91
A2-SB-043	464.32	471.79	7.46
A2-SB-044	462.86	462.99	0.13
A2-SB-045	463.22	462.81	-0.41
A2-SB-046	465.70	465.40	-0.30
A2-SB-047	470.16	469.98	-0.18
A2-SB-048	460.77	463.90	3.14
A2-TH-049	459.65	458.37	-1.28
A2-TH-050	469.41	469.33	-0.08
A2-SB-051	475.89	475.52	-0.38
A2-TH-077	469.36	471.26	1.90
A2-SB-078	469.97	472.33	2.36
A2-SB-079	472.79	485.25	12.46
A2-SB-080	483.40	482.79	-0.61
A2-TH-091	474.73	474.99	0.26
A2-TH-092	470.35	472.23	1.88
A2-TH-093	457.07	457.05	-0.02
A2-TH-094	468.56	467.19	-1.37
A2-TH-095	469.79	469.68	-0.12
A2-TH-096	470.83	471.63	0.80
A2-TH-097	469.61	469.71	0.10
A2-TH-098	469.16	468.73	-0.43
A2-TH-099	468.87	468.45	-0.41
A2-TH-100	470.82	470.44	-0.37
A2-TH-101	469.55	471.10	1.56
A2-TH-102	469.59	470.60	1.01
A2-TH-103	446.58	445.58	-1.00
A2-TH-104	469.49	469.98	0.49
A2-TH-105	470.41	470.65	0.24
A2-TH-106	469.23	468.92	-0.30

Table 3
Comparison of 2005 - 2019 Ground Surface Elevation

Proposed Location	2005 Ground Elevation (feet)	2019 Ground Elevation (feet)	Overburden Thickness (feet)
A2-TH-107	469.35	469.84	0.50
A2-TH-108	447.44	449.53	2.09
A2-TH-109	450.28	461.06	10.78
A2-TH-110	462.19	462.50	0.31
A2-TH-111	468.79	468.84	0.06
A2-TH-112	467.27	465.67	-1.60
A2-TH-113	460.62	458.39	-2.23
A2-TH-114	459.06	459.12	0.06
A2-TH-115	460.25	460.75	0.50
A2-TH-116	464.00	463.33	-0.67
A2-TH-117	458.68	456.03	-2.65
A2-TH-118	459.44	458.00	-1.44
A2-TH-119	465.30	463.88	-1.42
A2-TH-120	458.68	455.55	-3.13
A2-TH-121	460.79	460.70	-0.10
A2-TH-122	460.56	461.60	1.05
A2-TH-123	459.78	458.17	-1.61
A2-TH-124	462.18	462.95	0.78
A2-TH-125	446.90	443.31	-3.59
A2-TH-126	459.20	456.46	-2.74
A2-TH-127	451.83	449.26	-2.56
A2-SB-130	472.55	473.99	1.44
A2-SB-131	485.09	485.12	0.03
A2-SB-132	473.23	472.84	-0.38
A2-SB-133	471.93	472.12	0.20
A2-SB-134	466.40	466.05	-0.35
A2-SB-135	461.47	461.45	-0.02
A2-SB-136	466.52	471.73	5.21
A2-SB-137	462.63	465.62	2.99
A2-SB-138	461.69	461.07	-0.62
A2-SB-139	462.17	461.30	-0.88
A2-PB-119	448.48	449.99	1.51
A2-PB-120	448.77	450.17	1.41
A2-PB-121	447.82	448.42	0.60
A2-PB-122	446.37	446.73	0.37
A2-PB-123	450.83	449.01	-1.81
A2-PB-124	443.27	444.87	1.60
A2-PB-125	451.46	453.69	2.22
A2-PB-126	450.30	452.45	2.16
A2-PB-127	444.67	445.15	0.47
A2-PB-128	453.70	454.81	1.11
A2-PB-129	446.68	445.01	-1.67
A2-PB-130	446.03	445.68	-0.35
A2-PB-131	445.42	448.68	3.26

Table 3
Comparison of 2005 - 2019 Ground Surface Elevation

Proposed Location	2005 Ground Elevation (feet)	2019 Ground Elevation (feet)	Overburden Thickness (feet)
A2-PB-132	447.67	447.85	0.17
A2-PB-133	445.85	445.02	-0.83
A2-PB-134	444.21	448.09	3.89
A2-PB-135	442.19	449.26	7.07
A2-PB-136	445.14	446.66	1.52
A2-PB-137	462.60	463.58	0.99
A2-PB-138	463.46	462.70	-0.75
A2-PB-139	462.28	463.37	1.10
A2-PB-140	468.12	467.87	-0.26
A2-PB-141	470.43	469.99	-0.44
A2-PB-142	477.16	476.53	-0.64
A2-PB-143	481.65	481.24	-0.41
A2-PB-144	473.39	473.53	0.14
A2-PB-145	473.98	474.70	0.72
A2-PB-146	479.99	479.32	-0.67
A2-PB-147	492.12	492.17	0.05
A2-PB-148	492.01	492.77	0.76
A2-PB-149	493.40	492.39	-1.01
A2-PB-150	492.77	492.66	-0.11
A2-PB-151	496.45	494.96	-1.49
A2-PB-152	490.48	488.08	-2.39
A2-PB-153	490.27	489.86	-0.41
A2-PB-154	468.88	468.68	-0.20
A2-PB-155	486.66	486.34	-0.32

Note: Negative thicknesses indicate a decrease in elevation from 2005, positive thicknesses indicate an increase in elevation from 2005.

Table 4
Buffer Zone and Lot 2A2 Proposed Surface Sample Summary

Survey Unit	Location ID	Sampling Interval (inches)*	Core Scan Interval (inches)*
BZ1	**1-BZ-001**	**0 - 6**	**0 - 6**
BZ1	1-BZ-002	0 - 6	0 - 6
BZ1	1-BZ-003	0 - 6	0 - 6
BZ1	1-BZ-004	0 - 6	0 - 6
BZ1	1-BZ-005	0 - 6	0 - 6
BZ1	1-BZ-006	0 - 6	0 - 6
BZ1	1-BZ-007	0 - 6	0 - 6
BZ1	1-BZ-008	0 - 6	0 - 6
BZ1	1-BZ-009	0 - 6	0 - 6
BZ1	1-BZ-010	0 - 6	0 - 6
BZ1	1-BZ-011	0 - 6	0 - 6
BZ1	1-BZ-012	0 - 6	0 - 6
BZ1	1-BZ-013	0 - 6	0 - 6
BZ1	1-BZ-014	0 - 6	0 - 6
BZ1	1-BZ-015	0 - 6	0 - 6
BZ1	1-BZ-016	0 - 6	0 - 6
BZ1	1-BZ-017	0 - 6	0 - 6
BZ1	1-BZ-018	0 - 6	0 - 6
BZ1	1-BZ-019	0 - 6	0 - 6
BZ1	1-BZ-020	0 - 6	0 - 6
BZ1	1-BZ-021	0 - 6	0 - 6
BZ2	**2-BZ-022**	**0 - 6**	**0 - 6**
BZ2	2-BZ-023	0 - 6	0 - 6
BZ2	2-BZ-024	0 - 6	0 - 6
BZ2	2-BZ-025	0 - 6	0 - 6
BZ2	2-BZ-026	0 - 6	0 - 6
BZ2	2-BZ-027	0 - 6	0 - 6
BZ2	2-BZ-028	0 - 6	0 - 6
BZ2	2-BZ-029	0 - 6	0 - 6
BZ2	2-BZ-030	0 - 6	0 - 6
BZ2	2-BZ-031	0 - 6	0 - 6
BZ2	2-BZ-032	0 - 6	0 - 6
BZ2	2-BZ-033	0 - 6	0 - 6
BZ2	2-BZ-034	0 - 6	0 - 6
BZ2	2-BZ-035	0 - 6	0 - 6
BZ2	2-BZ-036	0 - 6	0 - 6
BZ2	2-BZ-037	0 - 6	0 - 6
BZ2	2-BZ-038	0 - 6	0 - 6
BZ2	2-BZ-039	0 - 6	0 - 6
BZ2	2-BZ-040	0 - 6	0 - 6
BZ2	2-BZ-041	0 - 6	0 - 6
BZ2	2-BZ-042	0 - 6	0 - 6
BZ3	**3-BZ-043**	**0 - 6**	**0 - 6**

*Samples to be collected from interval below gravel/asphalt layer as described in DIWP, FSP, and QAPP.
Emboldened rows indicate randomly selected starting locations.

Table 4
Buffer Zone and Lot 2A2 Proposed Surface Sample Summary

Survey Unit	Location ID	Sampling Interval (inches)*	Core Scan Interval (inches)*
BZ3	3-BZ-044	0 - 6	0 - 6
BZ3	3-BZ-045	0 - 6	0 - 6
BZ3	3-BZ-046	0 - 6	0 - 6
BZ3	3-BZ-047	0 - 6	0 - 6
BZ3	3-BZ-048	0 - 6	0 - 6
BZ3	3-BZ-049	0 - 6	0 - 6
BZ3	3-BZ-050	0 - 6	0 - 6
BZ3	3-BZ-051	0 - 6	0 - 6
BZ3	3-BZ-052	0 - 6	0 - 6
BZ3	3-BZ-053	0 - 6	0 - 6
BZ3	3-BZ-054	0 - 6	0 - 6
BZ3	3-BZ-055	0 - 6	0 - 6
BZ3	3-BZ-056	0 - 6	0 - 6
BZ3	3-BZ-057	0 - 6	0 - 6
BZ3	3-BZ-058	0 - 6	0 - 6
BZ3	3-BZ-059	0 - 6	0 - 6
BZ3	3-BZ-060	0 - 6	0 - 6
BZ3	3-BZ-061	0 - 6	0 - 6
BZ3	3-BZ-062	0 - 6	0 - 6
2A2_1	**1-2A2-001**	**0 - 6**	**0 - 6**
2A2_1	1-2A2-002	0 - 6	0 - 6
2A2_1	1-2A2-003	0 - 6	0 - 6
2A2_1	1-2A2-004	0 - 6	0 - 6
2A2_1	1-2A2-005	0 - 6	0 - 6
2A2_1	1-2A2-006	0 - 6	0 - 6
2A2_1	1-2A2-007	0 - 6	0 - 6
2A2_1	1-2A2-008	0 - 6	0 - 6
2A2_1	1-2A2-009	0 - 6	0 - 6
2A2_1	1-2A2-010	0 - 6	0 - 6
2A2_1	1-2A2-011	0 - 6	0 - 6
2A2_1	1-2A2-012	0 - 6	0 - 6
2A2_1	1-2A2-013	0 - 6	0 - 6
2A2_1	1-2A2-014	0 - 6	0 - 6
2A2_1	1-2A2-015	0 - 6	0 - 6
2A2_1	1-2A2-016	0 - 6	0 - 6
2A2_1	1-2A2-017	0 - 6	0 - 6
2A2_1	1-2A2-018	0 - 6	0 - 6
2A2_1	1-2A2-019	0 - 6	0 - 6
2A2_1	1-2A2-020	0 - 6	0 - 6
2A2_2	**2-2A2-021**	**0 - 6**	**0 - 6**
2A2_2	2-2A2-022	0 - 6	0 - 6
2A2_2	2-2A2-023	0 - 6	0 - 6
2A2_2	2-2A2-024	0 - 6	0 - 6

*Samples to be collected from interval below gravel/asphalt layer as described in DIWP, FSP, and QAPP.
Emboldened rows indicate randomly selected starting locations.

Table 4

Buffer Zone and Lot 2A2 Proposed Surface Sample Summary

Survey Unit	Location ID	Sampling Interval (inches)*	Core Scan Interval (inches)*
2A2_2	2-2A2-025	0 - 6	0 - 6
2A2_2	2-2A2-026	0 - 6	0 - 6
2A2_2	2-2A2-027	0 - 6	0 - 6
2A2_2	2-2A2-028	0 - 6	0 - 6
2A2_2	2-2A2-029	0 - 6	0 - 6
2A2_2	2-2A2-030	0 - 6	0 - 6
2A2_2	2-2A2-031	0 - 6	0 - 6
2A2_2	2-2A2-032	0 - 6	0 - 6
2A2_2	2-2A2-033	0 - 6	0 - 6
2A2_2	2-2A2-034	0 - 6	0 - 6
2A2_2	2-2A2-035	0 - 6	0 - 6
2A2_2	2-2A2-036	0 - 6	0 - 6
2A2_2	2-2A2-037	0 - 6	0 - 6
2A2_2	2-2A2-038	0 - 6	0 - 6
2A2_2	2-2A2-039	0 - 6	0 - 6
2A2_2	2-2A2-040	0 - 6	0 - 6
2A2_3	**3-2A2-041**	**0 - 6**	**0 - 6**
2A2_3	3-2A2-042	0 - 6	0 - 6
2A2_3	3-2A2-043	0 - 6	0 - 6
2A2_3	3-2A2-044	0 - 6	0 - 6
2A2_3	3-2A2-045	0 - 6	0 - 6
2A2_3	3-2A2-046	0 - 6	0 - 6
2A2_3	3-2A2-047	0 - 6	0 - 6
2A2_3	3-2A2-048	0 - 6	0 - 6
2A2_3	3-2A2-049	0 - 6	0 - 6
2A2_3	3-2A2-050	0 - 6	0 - 6
2A2_3	3-2A2-051	0 - 6	0 - 6
2A2_3	3-2A2-052	0 - 6	0 - 6
2A2_3	3-2A2-053	0 - 6	0 - 6
2A2_3	3-2A2-054	0 - 6	0 - 6
2A2_3	3-2A2-055	0 - 6	0 - 6
2A2_3	3-2A2-056	0 - 6	0 - 6
2A2_3	3-2A2-057	0 - 6	0 - 6
2A2_3	3-2A2-058	0 - 6	0 - 6
2A2_3	3-2A2-059	0 - 6	0 - 6
2A2_3	3-2A2-060	0 - 6	0 - 6
2A2_3	3-2A2-061	0 - 6	0 - 6
2A2_3	3-2A2-062	0 - 6	0 - 6
2A2_4	**4-2A2-063**	**0 - 6**	**0 - 6**
2A2_4	4-2A2-064	0 - 6	0 - 6
2A2_4	4-2A2-065	0 - 6	0 - 6
2A2_4	4-2A2-066	0 - 6	0 - 6
2A2_4	4-2A2-067	0 - 6	0 - 6

*Samples to be collected from interval below gravel/asphalt layer as described in DIWP, FSP, and QAPP.

Emboldened rows indicate randomly selected starting locations.

Table 4
Buffer Zone and Lot 2A2 Proposed Surface Sample Summary

Survey Unit	Location ID	Sampling Interval (inches)*	Core Scan Interval (inches)*
2A2_4	4-2A2-068	0 - 6	0 - 6
2A2_4	4-2A2-069	0 - 6	0 - 6
2A2_4	4-2A2-070	0 - 6	0 - 6
2A2_4	4-2A2-071	0 - 6	0 - 6
2A2_4	4-2A2-072	0 - 6	0 - 6
2A2_4	4-2A2-073	0 - 6	0 - 6
2A2_4	4-2A2-074	0 - 6	0 - 6
2A2_4	4-2A2-075	0 - 6	0 - 6
2A2_4	4-2A2-076	0 - 6	0 - 6
2A2_4	4-2A2-077	0 - 6	0 - 6
2A2_4	4-2A2-078	0 - 6	0 - 6
2A2_4	4-2A2-079	0 - 6	0 - 6
2A2_4	4-2A2-080	0 - 6	0 - 6
2A2_4	4-2A2-081	0 - 6	0 - 6
2A2_4	4-2A2-082	0 - 6	0 - 6
2A2_5	**5-2A2-083**	**0 - 6**	**0 - 6**
2A2_5	5-2A2-084	0 - 6	0 - 6
2A2_5	5-2A2-085	0 - 6	0 - 6
2A2_5	5-2A2-086	0 - 6	0 - 6
2A2_5	5-2A2-087	0 - 6	0 - 6
2A2_5	5-2A2-088	0 - 6	0 - 6
2A2_5	5-2A2-089	0 - 6	0 - 6
2A2_5	5-2A2-090	0 - 6	0 - 6
2A2_5	5-2A2-091	0 - 6	0 - 6
2A2_5	5-2A2-092	0 - 6	0 - 6
2A2_5	5-2A2-093	0 - 6	0 - 6
2A2_5	5-2A2-094	0 - 6	0 - 6
2A2_5	5-2A2-095	0 - 6	0 - 6
2A2_5	5-2A2-096	0 - 6	0 - 6
2A2_5	5-2A2-097	0 - 6	0 - 6
2A2_5	5-2A2-098	0 - 6	0 - 6
2A2_5	5-2A2-099	0 - 6	0 - 6
2A2_5	5-2A2-100	0 - 6	0 - 6
2A2_5	5-2A2-101	0 - 6	0 - 6
2A2_5	5-2A2-102	0 - 6	0 - 6
2A2_6	**6-2A2-103**	**0 - 6**	**0 - 6**
2A2_6	6-2A2-104	0 - 6	0 - 6
2A2_6	6-2A2-105	0 - 6	0 - 6
2A2_6	6-2A2-106	0 - 6	0 - 6
2A2_6	6-2A2-107	0 - 6	0 - 6
2A2_6	6-2A2-108	0 - 6	0 - 6
2A2_6	6-2A2-109	0 - 6	0 - 6
2A2_6	6-2A2-110	0 - 6	0 - 6

*Samples to be collected from interval below gravel/asphalt layer as described in DIWP, FSP, and QAPP.
Emboldened rows indicate randomly selected starting locations.

Table 4
Buffer Zone and Lot 2A2 Proposed Surface Sample Summary

Survey Unit	Location ID	Sampling Interval (inches)*	Core Scan Interval (inches)*
2A2_6	6-2A2-111	0 - 6	0 - 6
2A2_6	6-2A2-112	0 - 6	0 - 6
2A2_6	6-2A2-113	0 - 6	0 - 6
2A2_6	6-2A2-114	0 - 6	0 - 6
2A2_6	6-2A2-115	0 - 6	0 - 6
2A2_6	6-2A2-116	0 - 6	0 - 6
2A2_6	6-2A2-117	0 - 6	0 - 6
2A2_6	6-2A2-118	0 - 6	0 - 6
2A2_6	6-2A2-119	0 - 6	0 - 6
2A2_6	6-2A2-120	0 - 6	0 - 6
2A2_6	6-2A2-121	0 - 6	0 - 6
2A2_6	6-2A2-122	0 - 6	0 - 6
2A2_7	**7-2A2-123**	**0 - 6**	**0 - 6**
2A2_7	7-2A2-124	0 - 6	0 - 6
2A2_7	7-2A2-125	0 - 6	0 - 6
2A2_7	7-2A2-126	0 - 6	0 - 6
2A2_7	7-2A2-127	0 - 6	0 - 6
2A2_7	7-2A2-128	0 - 6	0 - 6
2A2_7	7-2A2-129	0 - 6	0 - 6
2A2_7	7-2A2-130	0 - 6	0 - 6
2A2_7	7-2A2-131	0 - 6	0 - 6
2A2_7	7-2A2-132	0 - 6	0 - 6
2A2_7	7-2A2-133	0 - 6	0 - 6
2A2_7	7-2A2-134	0 - 6	0 - 6
2A2_7	7-2A2-135	0 - 6	0 - 6
2A2_7	7-2A2-136	0 - 6	0 - 6
2A2_7	7-2A2-137	0 - 6	0 - 6
2A2_7	7-2A2-138	0 - 6	0 - 6
2A2_7	7-2A2-139	0 - 6	0 - 6
2A2_7	7-2A2-140	0 - 6	0 - 6
2A2_7	7-2A2-141	0 - 6	0 - 6
2A2_7	7-2A2-142	0 - 6	0 - 6
2A2_8	**8-2A2-143**	**0 - 6**	**0 - 6**
2A2_8	8-2A2-144	0 - 6	0 - 6
2A2_8	8-2A2-145	0 - 6	0 - 6
2A2_8	8-2A2-146	0 - 6	0 - 6
2A2_8	8-2A2-147	0 - 6	0 - 6
2A2_8	8-2A2-148	0 - 6	0 - 6
2A2_8	8-2A2-149	0 - 6	0 - 6
2A2_8	8-2A2-150	0 - 6	0 - 6
2A2_8	8-2A2-151	0 - 6	0 - 6
2A2_8	8-2A2-152	0 - 6	0 - 6
2A2_8	8-2A2-153	0 - 6	0 - 6

*Samples to be collected from interval below gravel/asphalt layer as described in DIWP, FSP, and QAPP.
Emboldened rows indicate randomly selected starting locations.

Table 4
Buffer Zone and Lot 2A2 Proposed Surface Sample Summary

Survey Unit	Location ID	Sampling Interval (inches)*	Core Scan Interval (inches)*
2A2_8	8-2A2-154	0 - 6	0 - 6
2A2_8	8-2A2-155	0 - 6	0 - 6
2A2_8	8-2A2-156	0 - 6	0 - 6
2A2_8	8-2A2-157	0 - 6	0 - 6
2A2_8	8-2A2-158	0 - 6	0 - 6
2A2_8	8-2A2-159	0 - 6	0 - 6
2A2_8	8-2A2-160	0 - 6	0 - 6
2A2_8	8-2A2-161	0 - 6	0 - 6
2A2_8	8-2A2-162	0 - 6	0 - 6
2A2_8	8-2A2-163	0 - 6	0 - 6

*Samples to be collected from interval below gravel/asphalt layer as described in DIWP, FSP, and QAPP.

Emboldened rows indicate randomly selected starting locations.

Table 5
Buffer Zone and Lot 2A2 Background Study Sampling Detail

Reference Unit	Location ID	Sampling Interval (inches)	Core Scan Interval (inches)
1	1-RU-001	0 - 6 , 6 - 12	0 - 12
1	1-RU-002	0 - 6 , 6 - 12	0 - 12
1	1-RU-003	0 - 6 , 6 - 12	0 - 12
1	1-RU-004	0 - 6 , 6 - 12	0 - 12
1	1-RU-005	0 - 6 , 6 - 12	0 - 12
1	1-RU-006	0 - 6 , 6 - 12	0 - 12
1	1-RU-007	0 - 6 , 6 - 12	0 - 12
1	1-RU-008	0 - 6 , 6 - 12	0 - 12
1	1-RU-009	0 - 6 , 6 - 12	0 - 12
1	1-RU-010	0 - 6 , 6 - 12	0 - 12
1	1-RU-011	0 - 6 , 6 - 12	0 - 12
1	1-RU-012	0 - 6 , 6 - 12	0 - 12
1	1-RU-013	0 - 6 , 6 - 12	0 - 12
1	1-RU-014	0 - 6 , 6 - 12	0 - 12
1	1-RU-015	0 - 6 , 6 - 12	0 - 12
1	1-RU-016	0 - 6 , 6 - 12	0 - 12
1	1-RU-017	0 - 6 , 6 - 12	0 - 12
1	1-RU-018	0 - 6 , 6 - 12	0 - 12
2	2-RU-001	0 - 6 , 6 - 12	0 - 12
2	2-RU-002	0 - 6 , 6 - 12	0 - 12
2	2-RU-003	0 - 6 , 6 - 12	0 - 12
2	2-RU-004	0 - 6 , 6 - 12	0 - 12
2	2-RU-005	0 - 6 , 6 - 12	0 - 12
2	2-RU-006	0 - 6 , 6 - 12	0 - 12
2	2-RU-007	0 - 6 , 6 - 12	0 - 12
2	2-RU-008	0 - 6 , 6 - 12	0 - 12
2	2-RU-009	0 - 6 , 6 - 12	0 - 12
2	2-RU-010	0 - 6 , 6 - 12	0 - 12
2	2-RU-011	0 - 6 , 6 - 12	0 - 12
2	2-RU-012	0 - 6 , 6 - 12	0 - 12
2	2-RU-013	0 - 6 , 6 - 12	0 - 12
2	2-RU-014	0 - 6 , 6 - 12	0 - 12
2	2-RU-015	0 - 6 , 6 - 12	0 - 12
2	2-RU-016	0 - 6 , 6 - 12	0 - 12
2	2-RU-017	0 - 6 , 6 - 12	0 - 12
2	2-RU-018	0 - 6 , 6 - 12	0 - 12
3	3-RU-001	0 - 6 , 6 - 12	0 - 12
3	3-RU-002	0 - 6 , 6 - 12	0 - 12

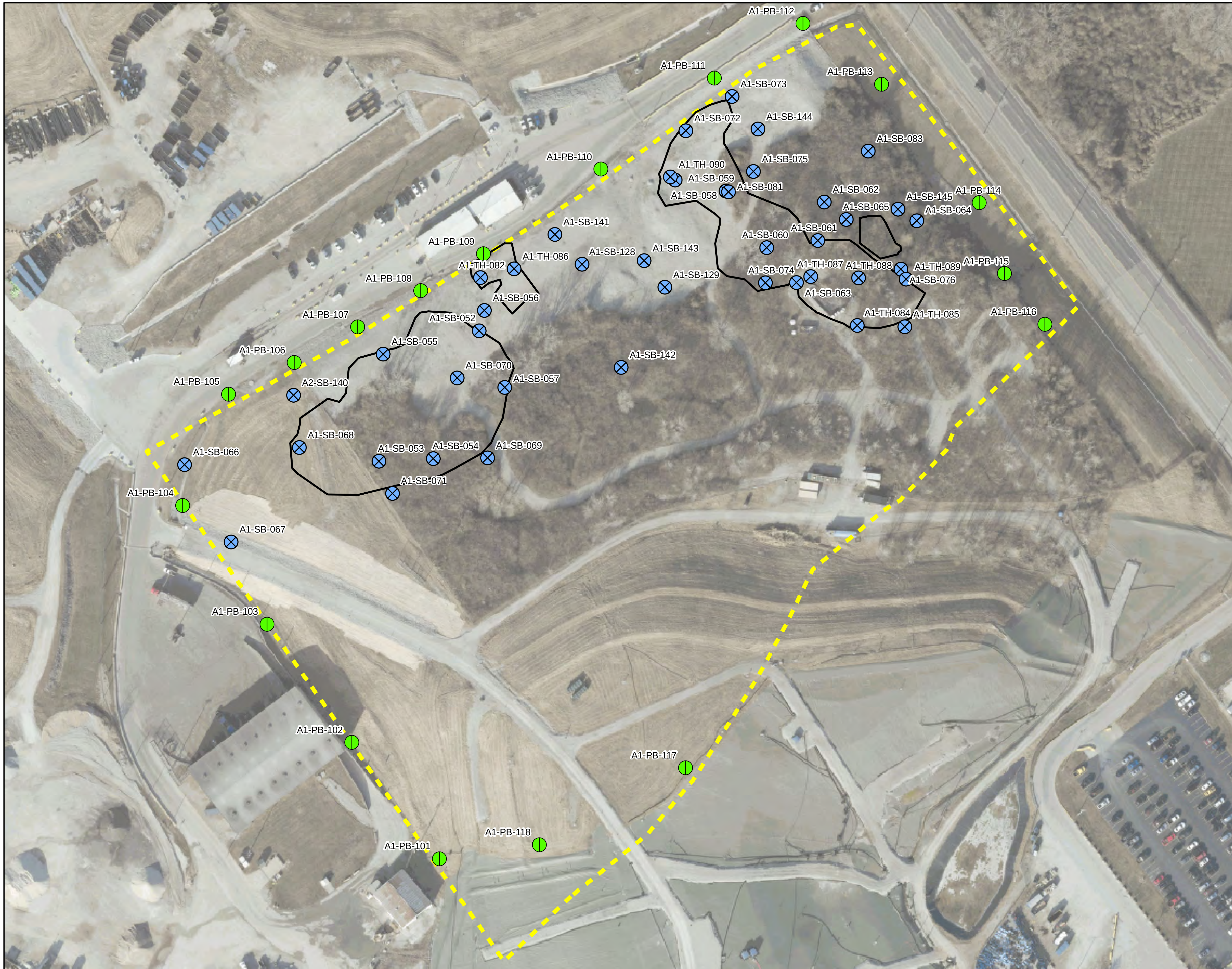
Table 5
Buffer Zone and Lot 2A2 Background Study Sampling Detail

Reference Unit	Location ID	Sampling Interval (inches)	Core Scan Interval (inches)
3	3-RU-003	0 - 6 , 6 - 12	0 - 12
3	3-RU-004	0 - 6 , 6 - 12	0 - 12
3	3-RU-005	0 - 6 , 6 - 12	0 - 12
3	3-RU-006	0 - 6 , 6 - 12	0 - 12
3	3-RU-007	0 - 6 , 6 - 12	0 - 12
3	3-RU-008	0 - 6 , 6 - 12	0 - 12
3	3-RU-009	0 - 6 , 6 - 12	0 - 12
3	3-RU-010	0 - 6 , 6 - 12	0 - 12
3	3-RU-011	0 - 6 , 6 - 12	0 - 12
3	3-RU-012	0 - 6 , 6 - 12	0 - 12
3	3-RU-013	0 - 6 , 6 - 12	0 - 12
3	3-RU-014	0 - 6 , 6 - 12	0 - 12
3	3-RU-015	0 - 6 , 6 - 12	0 - 12
3	3-RU-016	0 - 6 , 6 - 12	0 - 12
3	3-RU-017	0 - 6 , 6 - 12	0 - 12
3	3-RU-018	0 - 6 , 6 - 12	0 - 12
4	4-RU-001	0 - 6 , 6 - 12	0 - 12
4	4-RU-002	0 - 6 , 6 - 12	0 - 12
4	4-RU-003	0 - 6 , 6 - 12	0 - 12
4	4-RU-004	0 - 6 , 6 - 12	0 - 12
4	4-RU-005	0 - 6 , 6 - 12	0 - 12
4	4-RU-006	0 - 6 , 6 - 12	0 - 12
4	4-RU-007	0 - 6 , 6 - 12	0 - 12
4	4-RU-008	0 - 6 , 6 - 12	0 - 12
4	4-RU-009	0 - 6 , 6 - 12	0 - 12
4	4-RU-010	0 - 6 , 6 - 12	0 - 12
4	4-RU-011	0 - 6 , 6 - 12	0 - 12
4	4-RU-012	0 - 6 , 6 - 12	0 - 12
4	4-RU-013	0 - 6 , 6 - 12	0 - 12
4	4-RU-014	0 - 6 , 6 - 12	0 - 12
4	4-RU-015	0 - 6 , 6 - 12	0 - 12
4	4-RU-016	0 - 6 , 6 - 12	0 - 12
4	4-RU-017	0 - 6 , 6 - 12	0 - 12
4	4-RU-018	0 - 6 , 6 - 12	0 - 12

Table 6
Drainage Area Sediment Sample Collection Detail

Area	Location ID	Sampling Interval (inches)	Core Scan Interval (inches)
Historical Area 2	AC-SED-06	0 - 6 ; 6 - 12	0 - 12
Historical Area 2	SEDIMENT 2016-03-16A	0 - 6 ; 6 - 12	0 - 12
Historical Area 1	SEDIMENT 2016-03-16B	0 - 6 ; 6 - 12	0 - 12
Historical Area 1	SED1	0 - 6 ; 6 - 12	0 - 12
Historical Area 1	SED2	0 - 6 ; 6 - 12	0 - 12
Historical Area 2	SED4	0 - 6 ; 6 - 12	0 - 12
Historical Area 2	AC-SED-8	0 - 6 ; 6 - 12	0 - 12
Historical Area 2	AC-SED-7	0 - 6 ; 6 - 12	0 - 12
Historical Area 2	AC-SED-6	0 - 6 ; 6 - 12	0 - 12
Historical Area 2	AC-SED-9	0 - 6 ; 6 - 12	0 - 12
Historical Area 2	AC-SED-10	0 - 6 ; 6 - 12	0 - 12
Historical Area 2	AC-SED-11	0 - 6 ; 6 - 12	0 - 12
NWB	NWB-SED-01	0 - 6 ; 6 - 12	0 - 12
NWB	NWB-SED-02	0 - 6 ; 6 - 12	0 - 12
NWB	NWB-SED-03	0 - 6 ; 6 - 12	0 - 12
NWB	NWB-SED-04	0 - 6 ; 6 - 12	0 - 12
NWB	NWB-SED-05	0 - 6 ; 6 - 12	0 - 12

FIGURES



Proposed Perimeter Borings

Proposed Borings

Maximum extent of RIM >52.9 pCi/g 0-16 ft B2005GS

OU-1 Area

PRELIMINARY DRAFT - For Discussion Purposes Only

0 75 150 300 Feet

N

Figure 1

Area 1
Proposed Boring Location and IDs

PARSONS
301 PLAINFIELD ROAD, SUITE 350, SYRACUSE, NY 13212 * 315-451-9560

Plot Date: 3/11/2020 Plotted By: CS

Document Path: P:\West Lake\10.0 Technical Categories\10.19 Geodata\ArcMap Data\Geostat figures.mxd

Proposed Borings

Proposed Perimeter Borings

Maximum extent of RIM >52.9 pCi/g 0-16 ft B2005GS

OU-1 Area Boundary

PRELIMINARY DRAFT - For Discussion Purposes Only

0 112.5 225 450 Feet

N

Figure 2

Area 2
Proposed Boring Location

PARSONS

301 PLAINFIELD ROAD, SUITE 350, SYRACUSE, NY 13212 * 315-451-9560

Plot Date: 3/27/2020 Plotted By: CS

Document Path: P:\West Lake\10.0 Technical Categories\10.19 Geodata\ArcMap Data\Boring Summary.mxd

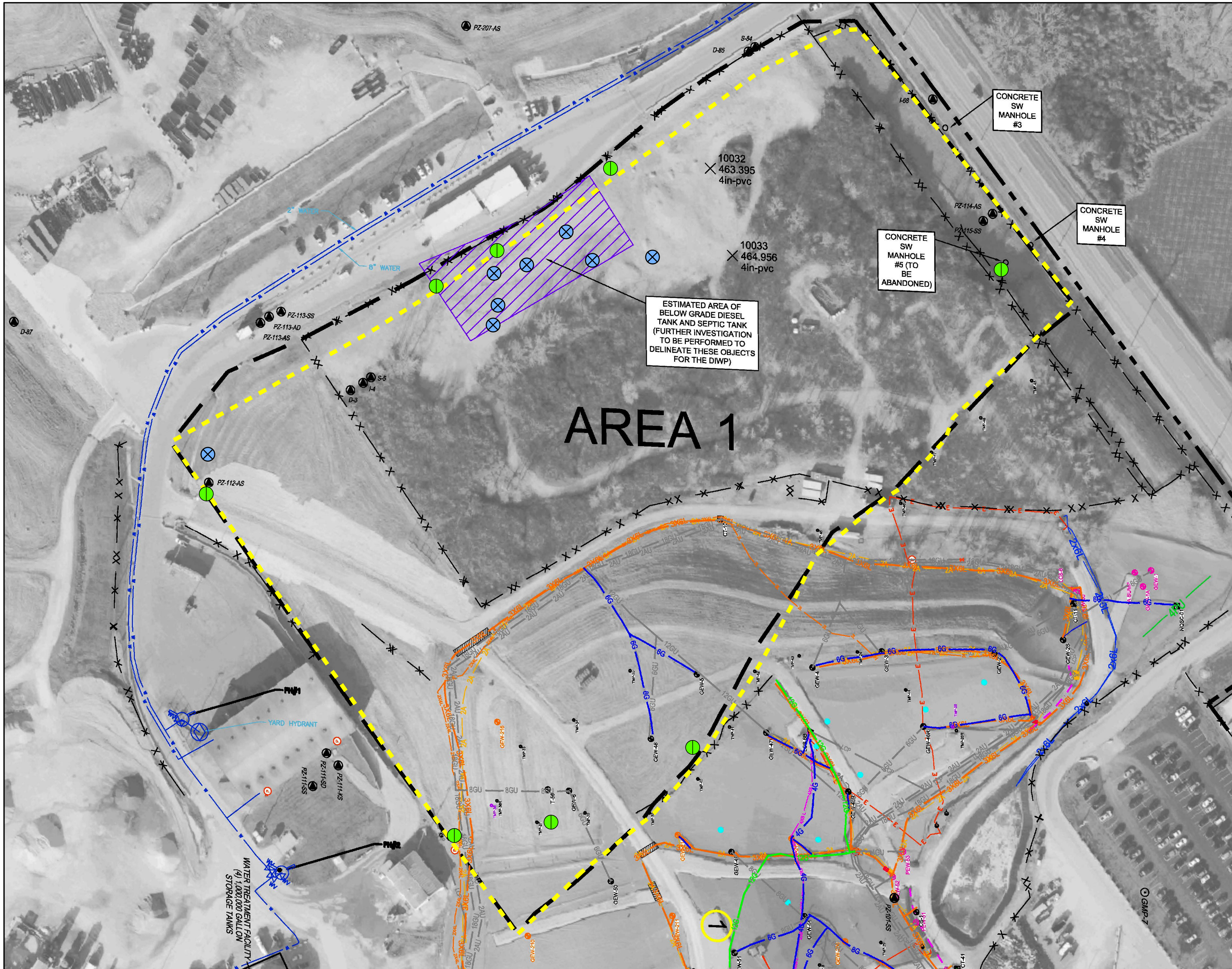


Figure 3

Areas 1 Utilities Overlay (with Proposed Borings Adjacent to Utitlities)

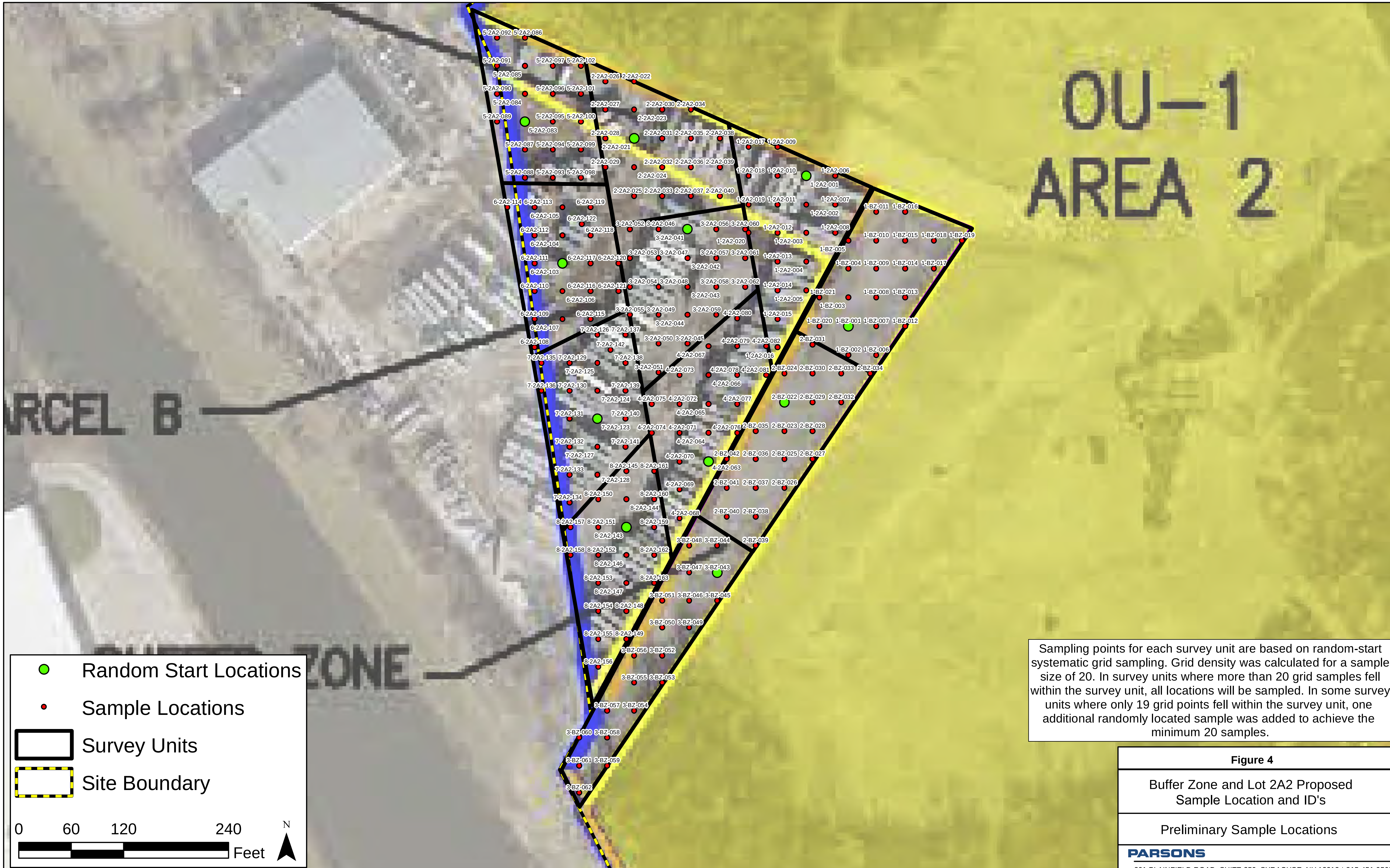
PARSONS

301 PLAINFIELD ROAD, SUITE 350, SYRACUSE, NY 13212 * 315-451-9560

Plotted By: CS

Plot Date: 3/3/2020

Document Path: P:\West Lake\10.0 Technical Categories\10.19 Geodata\ArcMap Data\Geostat figures.mxd



Sampling points for each survey unit are based on random-start systematic grid sampling. Grid density was calculated for a sample size of 20. In survey units where more than 20 grid samples fell within the survey unit, all locations will be sampled. In some survey units where only 19 grid points fell within the survey unit, one additional randomly located sample was added to achieve the minimum 20 samples.

Figure 4

Buffer Zone and Lot 2A2 Proposed Sample Location and ID's

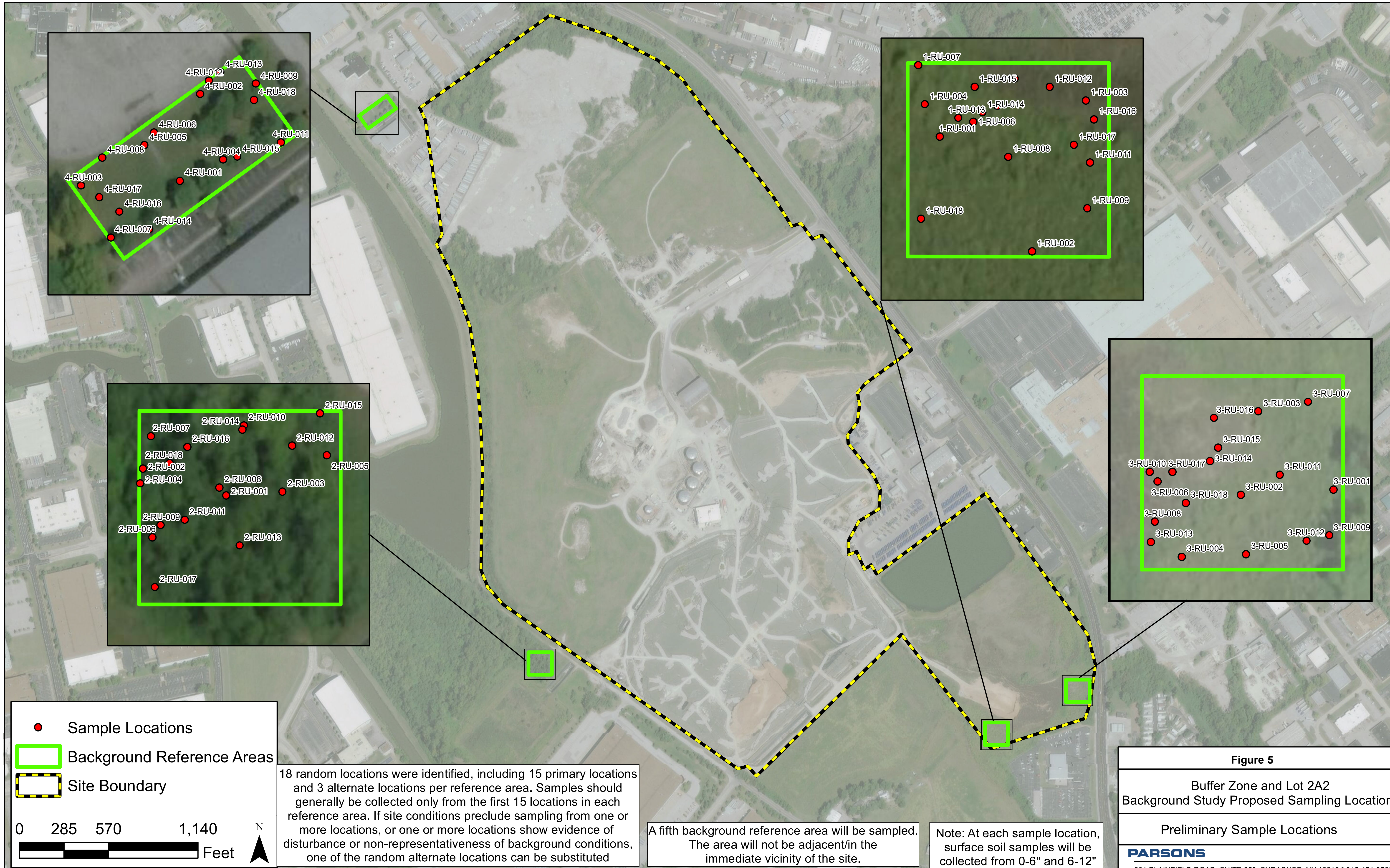
Preliminary Sample Locations

PARSONS

301 PLAINFIELD ROAD, SUITE 350, SYRACUSE, NY 13212 * 315-451-9560

Plot Date: 3/11/2020 Plotted By: CS

Document Path: P:\West Lake\10.0 Technical Categories\10.19 Geodata\ArcMap Data\Buffer Zone and Lot 2A2\Sample Areas 2A2 and Buffer.mxd



18 random locations were identified, including 15 primary locations and 3 alternate locations per reference area. Samples should generally be collected only from the first 15 locations in each reference area. If site conditions preclude sampling from one or more locations, or one or more locations show evidence of disturbance or non-representativeness of background conditions, one of the random alternate locations can be substituted

A fifth background reference area will be sampled. The area will not be adjacent/in the immediate vicinity of the site.

Note: At each sample location, surface soil samples will be collected from 0-6" and 6-12"

Figure 5

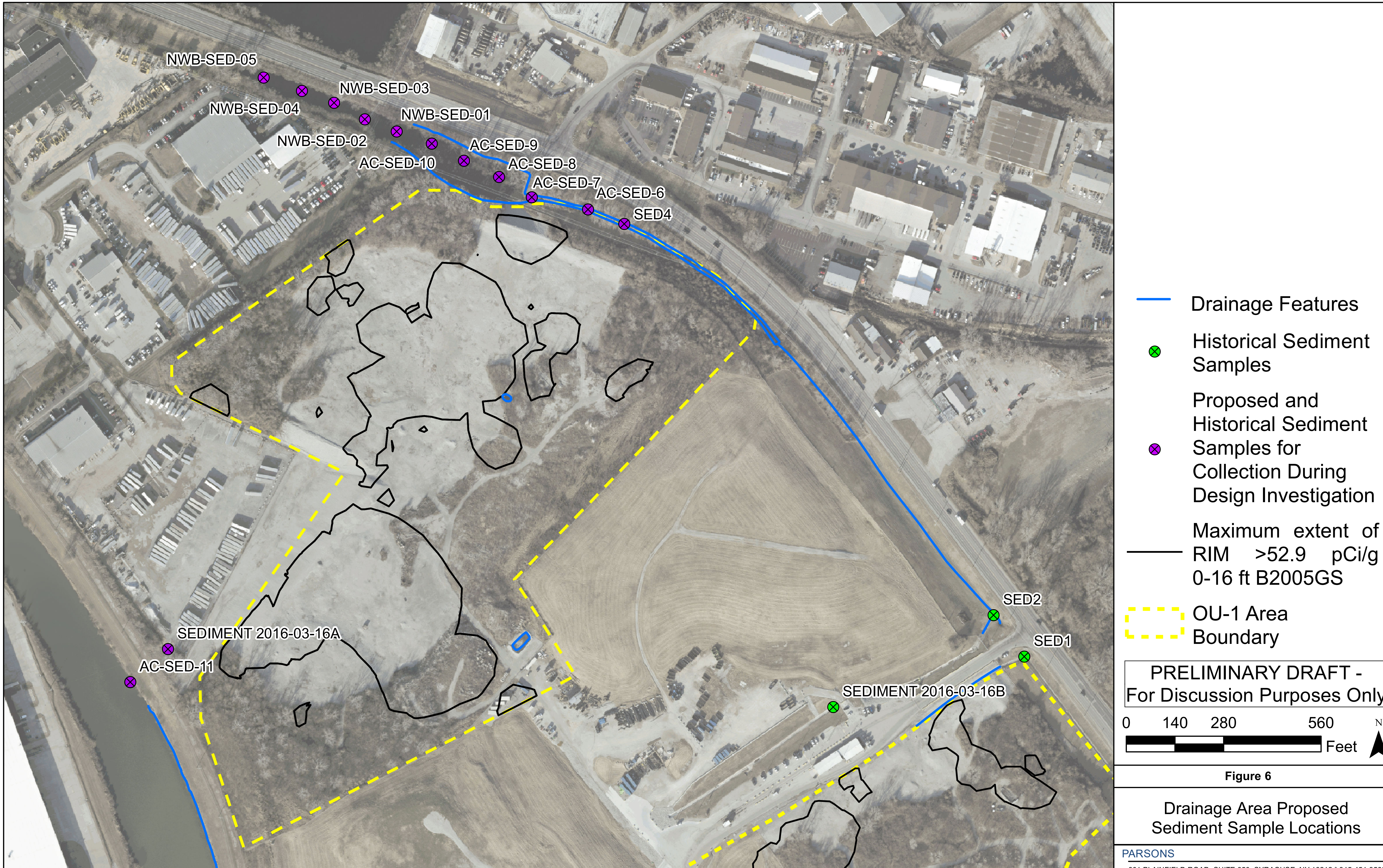
Buffer Zone and Lot 2A2
Background Study Proposed Sampling Locations

Preliminary Sample Locations

PARSONS
301 PLAINFIELD ROAD, SUITE 350, SYRACUSE, NY 13212 * 315-451-9560

Plot Date: 3/30/2020 Plotted By: CS

Document Path: C:\Users\p002737e\Documents\West Lake\ArcMap Data\Buffer Zone and Lot 2A2\Sample Areas.mxd



Plotted By: CS

Plot Date: 3/25/2020

Figure 6

Drainage Area Proposed Sediment Sample Locations

PARSONS

301 PLAINFIELD ROAD, SUITE 350, SYRACUSE, NY 13212 * 315-451-9560

Document Path: P:\West Lake\10.0 Technical Categories\10.19 Geodata\ArcMap Data\Sediment Samples.mxd

ATTACHMENT 1 – PRE-SAMPLING CHECKLIST

PREDRILLING/SUBSURFACE CHECKLIST FOR INTRUSIVE FIELDWORK

Site Name: ______________________ **Job Number:** ____________
Site Phone Number: ______________________
Site Address: ______________________ **County:** ____________
Client Proj. Mgr.: ______________________ **Phone:** ____________
Site Manager Contacted Date: ______________________ **By:** ____________
Site Drawings (yes / no / NA) ________ (please attach) **Historical Drawings (yes / no / NA)** ________
Third Party Construction/Redevelopment Plans (Yes/No/NA)

*****ATTACH SITE FIGURE WITH PROPOSED BORING LOCATIONS**

Subcontractor's (drillers, concrete, etc…) **Company** ______________________
Subcontractor's Contact Person ______________________ **Phone** ____________
Meeting / Start Date ______________________ **Time** ____________

1) **Health and Safety Signoff Form Completed? (Yes/No)** **Date** ____________

2) **Utility Protection Services (Minimum 48 Hrs. Advance Notice, State Specific Notification Period Supercedes)**
Called: Date ________ **Time** ________ **Initials** ________
Reference # ______________________
Proposed Drilling Locations Premarked for Locating Service. **Y / N**

3) **Private or In-House Utility Locating Service Performed?** **Y / N** ________
Called: Date ________ **Time** ________ **Initials** ________
Name of Locating Service: ______________________
Telephone #/ contact: ______________________
Name of Supplier Locating Technician: ______________________
Type of sensing equipment used: ______________________
Proposed Drilling Locations Premarked **Y / N**

4) **Other Potential Underground Structures**
Name of City Engineer/Utility Representative: ______________________
Telephone #: ______________________
Date Notified ______________________ **Maps:** **Y / N**
Cleared: **Y / N**

5) **COMPLETED SITE WALKOVER W/ SITE MANAGER/DESIGNEE OR OWNER/TENANT REP.** **Y / N**
Name of Site Manager: ______________________
Name of Property Owner/Tenant Representative:______________________
Cleared: **Yes / No**
Building Utility Service Line Connections Identified: **Y / N**
(Hand sketch on site map w/proposed boring locations and most likely utility trench locations)

6) **Utility Inventory:** **Y / N**

Utility	Name	Depth (ft) (If Available)	Phone	Notified - Date		Marked
Above Ground Services						
Electric		NA		Y / N		Y / N
Telephone		NA		Y / N		Y / N
Cable		NA		Y / N		Y / N
Overhead Supports		NA		Y / N		Y / N
Traffic light cables		NA		Y / N		Y / N

PREDRILLING/SUBSURFACE CHECKLIST FOR INTRUSIVE FIELDWORK

6) Utility Inventory Continued:

Below Ground Services:

Electric				Y / N		Y / N
Telephone				Y / N		Y / N
Cable				Y / N		Y / N
Gas				Y / N		Y / N
Water				Y / N		Y / N
UST System				Y / N		Y / N
Storm				Y / N		Y / N
Sanitary				Y / N		Y / N
Steam				Y / N		Y / N
Pipeline Companies				Y / N		Y / N

Other:

				Y / N		Y / N
				Y / N		Y / N
				Y / N		Y / N

7) Site-Specific Emergency Contingency Plan Incorporated in Health & Safety Plan Y / N

8) Drilling Locations Approved by Client Project Manager Named Above? Y / N

9) Signature of Parsons' Project Mgr. (required to begin fieldwork):

Name of Project Manager **Signature of Project Manager**

Name of Parsons Field Personnel **Signature of Field Personnel**

(This document to be included with the site H&S Plan and should be available upon request.)

ADDITIONAL COMMENTS / NOTES:

ATTACHMENT 2 – BORING/WELL CONSTRUCTION

PARSONS

DRILLING RECORD

BORING/ WELL NO. Pg ____ of ____

Contractor: ______________________

Driler: ______________ **Oversight:** ______________

Rig Type:

PROJECT NAME:

PROJECT Location:

Location Description:

GROUNDWATER OBSERVATIONS

Depth to Water during Drilling:		ft bls
Measured Static Water Level:		ft bls
Final Depth of Hole/Well Casing:		ft bls
Additional Comments:		

Date/Time Start:

Date/Time Finish:

Location Map

Sample Type	SPT	Run #	Recovery (%)	Alpha Scan (cpm)	Beta Scan (cpm)	Gamma Scan (uR/hr)	USCS Symbol	Depth (ft bls)	FIELD DESCRIPTION/ID OF MATERIAL	GRAPHIC LOG / WELL SCHEMATIC (not to scale)	COMMENTS
								0.5			
								1.0			
								1.5			
								2.0			
								2.5			
								3.0			
								3.5			
								4.0			
								4.5			
								5.0			
								5.5			
								6.0			
								6.5			
								7.0			
								7.5			
								8.0			
								8.5			
								9.0			
								9.5			
								10.0			
								10.5			
								11.0			
								11.5			
								12.0			
								12.5			
								13.0			
								13.5			
								14.0			
								14.5			
								15.0			
								15.5			
								16.0			
								16.5			
								17.0			
								17.5			
								18.0			
								18.5			
								19.0			
								19.5			
								20.0			
								20.5			
								21.0			
								21.5			

SAMPLE TYPE

HC = Hand Cleared (post hole or auger)

MC = Macro Core SC = Sonic Core

SS = Split Spoon ST = Shelby Tube

SPT = Standard Penetration Test

Enter number of blows to advance 6 inches (for SS sampling only)

COMMENTS:

ATTACHMENT 3 – CORE LOG

File: Corelog.xls

CORE LOG

		Hole No.:	Job No.:
		Sheet 1 of 1	Date Started:
Project:	Drilling Contractor: Parratt-Wolff		Date Finished:
Client:	Driller: Glenn Lansing		Total Depth:
Purpose:	Geologist:		Ground Elev.:
Location:	Length of Casing:		S.W.L.:
Hole Location:	Casing Size:	Core Size: HQ	Inclination/Bearing: NA

Formation Member Unit			Run No. Depth	Pen. Rate (min. per foot)	Depth Scale	Lithologic Description (include in order: ROCK TYPE, color, grain size, texture, bedding, fracture & minerals.)	Core Recovery Length	Core Recovery Percent	RQD

ATTACHMENT 4 – MISSOURI WELL INSTALLATION FORM

MISSOURI DEPARTMENT OF NATURAL RESOURCES
GEOLOGICAL SURVEY PROGRAM

MONITORING WELL CERTIFICATION REPORT

OFFICE USE ONLY	DATE RECEIVED		
REFERENCE NO.	CHECK NO.		
STATE WELL NO.	REVENUE NO.		
ENTERED	APPROVED	DATE	ROUTE / /

NOTE: This form is not to be used for nested wells

OWNER AND SITE INFORMATION

PROPERTY OWNER NAME WHERE WELL IS LOCATED	PRIMARY PHONE NUMBER WITH AREA CODE	WELL NUMBER	**WELL COMPLETION DATE**
PROPERTY OWNER MAILING ADDRESS	CITY	STATE	ZIP CODE
PHYSICAL ADDRESS OF PROPERTY WHERE WELL IS LOCATED	CITY	COUNTY	
NAME OF SITE, BUSINESS, OR CLEANUP PROJECT	DNR/EPA PROJECT NUMBER OR REGULATORY SITE ID NUMBER (IF APPLICABLE)	VARIANCE NUMBER (IF ISSUED)	
PRIMARY CONTRACTOR NAME (PLEASE PRINT)	PERMIT NUMBER	Section 256.607(3), RSMo, requires all primary contractors to comply with all rules and regulations promulgated pursuant to Sections 256.600 to 256.640 RSMo.	

SURFACE COMPLETION

TYPE	LENGTH AND DIAMETER OF SURFACE COMPLETION	DIAMETER AND DEPTH OF THE HOLE SURFACE COMPLETION WAS PLACED	SURFACE COMPLETION GROUT
☐ Above Ground ☐ Flush Mount	Length ________ FT. Diameter ________ IN.	Diameter ________ IN. Length ________ FT.	☐ Concrete ☐ Other ____________

LOCATION OF WELL (D/M/S FORMAT ONLY)

Latitude ________ ° ________ ' ________ "

Longitude ________ ° ________ ' ________ "

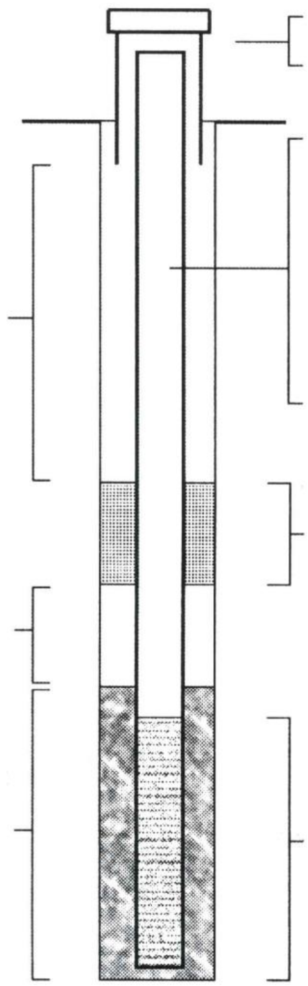
SMALLEST LARGEST

______ ¼ ______ ¼ ______ ¼

Section ________ Township ________ North

Range ________ ☐ E ☐ W

☐ Locking Cap
☐ Weep Hole



SURFACE COMPLETION

☐ Steel ☐ Aluminum ☐ Plastic

Elevation ____________ FT.

ANNULAR SEAL

Length ____________ FT.

☐ Slurry ☐ Chips
☐ Pellets ☐ Granular
☐ Cement/Slurry

IF CEMENT/BENTONITE MIX:

Bags of Cement Used ________
% of Bentonite Used ________
Water Used Per Bag ________ GAL.

RISER OR CASING (IF OPEN HOLE COMPLETION)

Riser/Casing Diameter ________ IN.
Riser/Casing Length ________ FT.
Diameter Of Drill Hole ________ IN.
Weight Or SDR# ________

MATERIAL

☐ Steel ☐ Thermoplastic (PVC)
☐ Other ____________

BENTONITE SEAL

Length ____________
☐ Chips ☐ Pellets ☐ Granular
☐ Saturated Zone ☐ Hydrated

TYPE OF WELL (CHECK ONE)

☐ Direct Push ☐ Extraction ☐ Inclinometer
☐ Gas Migration ☐ Injection ☐ Lysimeter
☐ Observation ☐ Open Hole ☐ Other (specify)
☐ Piezometer ☐ Standard ____________

MONITORING FOR (CHECK ALL THAT APPLY)

☐ Explosives ☐ Metals
☐ Pesticides/Herbicides ☐ Petroleum
☐ Radionuclides ☐ SVOCS
☐ VOCS (non-petroleum) ☐ Geotechnical Data

DEPTH FROM	DEPTH TO	FORMATION DESCRIPTION (OR ATTACH BORING LOG*)

TOTAL DEPTH: ________ FT. ☐ *Boring Log Attached

STATIC WATER LEVEL ________ FT. **PUMP INSTALLED** ☐ Yes ☐ No

SECONDARY FILTER PACK LENGTH

____________ FT.

DEPTH TO TOP OF PRIMARY FILTER PACK

____________ FT.

LENGTH OF PRIMARY FILTER PACK

____________ FT.

SCREEN

Screen Diameter ________ IN.
Screen Length ________ FT.
Diameter Of Drill Hole ________ IN.
Depth To Top ________ FT.

SCREEN MATERIAL

☐ Steel ☐ Thermoplastic (PVC)
☐ Other ____________

For cased wells, submit additional as-built diagrams showing well construction details including type and size of all casing, hole diameter and grout used.

I hereby certify that the monitoring well herein described was constructed in accordance with Missouri Department of Natural Resources requirements.

MONITORING WELL INSTALLATION CONTRACTOR	PERMIT NUMBER	DATE	MONITORING WELL INSTALLATION CONTRACTOR APPRENTICE (IF APPLICABLE)	PERMIT NUMBER

 SEND COMPLETED FORM ALONG WITH $100 CERTIFICATION FEE TO: MISSOURI DEPARTMENT OF NATURAL RESOURCES, MISSOURI GEOLOGICAL SURVEY, WELL INSTALLATION SECTION, PO BOX 250, ROLLA, MO 65402 PHONE: 573-368-2165 FAX: 573-368-2317 EMAIL: welldrillers@dnr.mo.gov
RECORD (AND FEE) MAY BE SUBMITTED ONLINE: dnr.mo.gov/mowells

ATTACHMENT 5 – WELL DEVELOPMENT LOG

WELL DEVELOPMENT LOG

Well ID:

Date ____ Field Personnel ____ Weather ____
Site Name ____ Contractor ____ Project No. ____
Site Location ____ Evacuation Method ____ ____

Well information:

Depth to Bottom (Initial) * ____ ft. Date(s) Installed ____ Date(s) Developed ____
Depth to Bottom (Final)* ____ ft. Driller ____ Development Time Start:
Depth to Water (Initial)* ____ ft. Well Diameter ____ in. Stop:
Depth to Water (Final)* ____ ft. Casing Volume ____ gal. Total:

* Measuring point ____ Pump setting* (intake) ____

Well Volumes	Volume of Water Removed (Gallons)	Temperature ^{o}C	pH s.u	Conductivity mS/cm	Turbidity (NTU)	Approximate Flow Rate (gal/min)	Depth to Water (ft.)	Appearance of Water
Start								
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

Development Water Characteristics:

Total volume of Development water removed: ____

Physical appearance at start
Color ____
Odor ____
Sheen/Free Product ____

Physical appearance at end
Color ____
Odor ____
Sheen/Free Product ____

NOTES:

Geologist Signature:

ATTACHMENT 6 – WELL DECOMMISSIONING RECORD

FIGURE 3

WELL DECOMMISSIONING RECORD

Site Name:	Well I.D.:
Site Location:	Driller:
Drilling Co.:	Inspector:
	Date:

DECOMMISSIONING DATA
(Fill in all that apply)

OVERDRILLING

Interval Drilled	
Drilling Method(s)	
Borehole Dia. (in.)	
Temporary Casing Installed? (y/n)	
Depth temporary casing installed	
Casing type/dia. (in.)	
Method of installing	

CASING PULLING

Method employed	
Casing retrieved (feet)	
Casing type/dia. (in)	

CASING PERFORATING

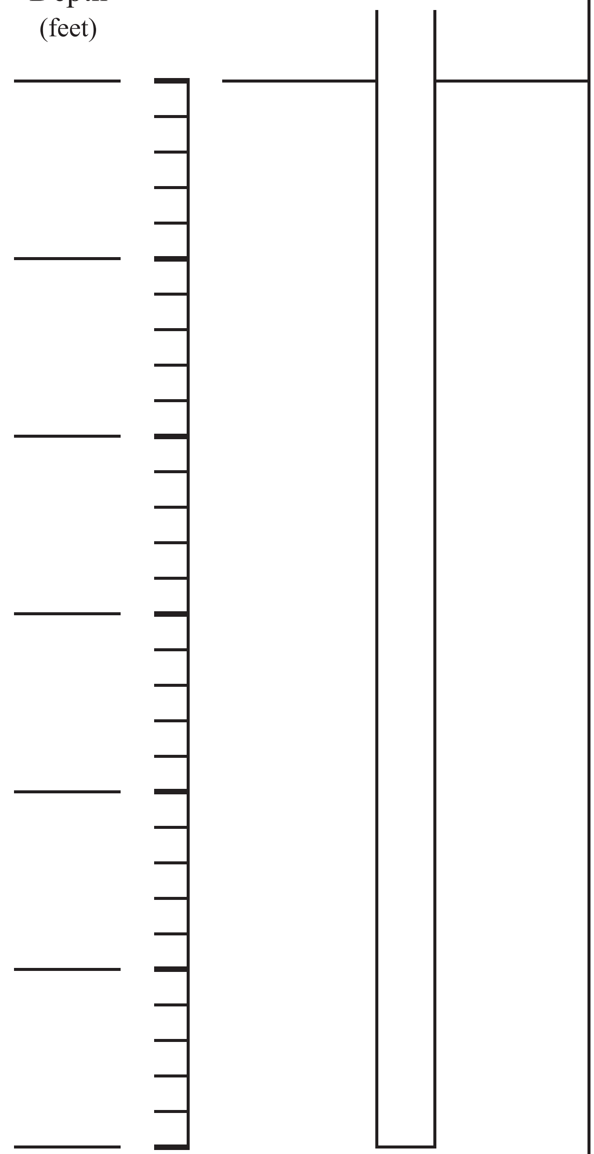
Equipment used	
Number of perforations/foot	
Size of perforations	
Interval perforated	

GROUTING

Interval grouted (FBLS)	
# of batches prepared	
For each batch record:	
Quantity of water used (gal.)	
Quantity of cement used (lbs.)	
Cement type	
Quantity of bentonite used (lbs.)	
Quantity of calcium chloride used (lbs.)	
Volume of grout prepared (gal.)	
Volume of grout used (gal.)	

WELL SCHEMATIC*

Depth (feet)



COMMENTS:

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stickup, etc.

Drilling Contractor

Department Representative

ATTACHMENT 7 – MISSOURI WELL ABANDONMENT FORM

MISSOURI DEPARTMENT OF NATURAL RESOURCES
GEOLOGICAL SURVEY PROGRAM

MONITORING WELL/TEST HOLE/SOIL AND GEOTECHNICAL BORING PLUGGING REGISTRATION REPORT

FOR OFFICE USE ONLY	
REF NO.	DATE RECEIVED
CR NO.	CHECK NO.

ROUTE	APPROVED	DATE	ENTERED	STATE CERT NO.	REVENUE NO.
/ /					

OWNER AND SITE INFORMATION

PROPERTY OWNER NAME WHERE WELL IS LOCATED		PRIMARY PHONE NUMBER WITH AREA CODE	
PROPERTY OWNER MAILING ADDRESS	CITY	STATE	ZIP CODE
PHYSICAL ADDRESS OF PROPERTY WHERE WELL IS LOCATED		CITY	
NAME OF SITE, BUSINESS, OR CLEANUP PROJECT	DNR/EPA PROJECT NUMBER OR REGULATORY SITE ID NUMBER (IF APPLICABLE)	VARIANCE NUMBER (IF ISSUED)	
PRIMARY CONTRACTOR NAME (PLEASE PRINT)	PERMIT NUMBER	Section 256.607(3), RSMo, requires all primary contractors to comply with all rules and regulations promulgated pursuant to Sections 256.600 to 256.640 RSMo.	

LOCATION INFORMATION

Latitude ______° ______' ______" Longitude ______° ______' ______"	COUNTY	______ ¼ ______ ¼ ______ ¼ Section ______ Township ______N Range ______ ☐ E ☐ W

MONITORING WELL INFORMATION

DATE WELL PLUGGED	ORIGINAL DRILLER (IF KNOWN)	DATE ORIGINALLY DRILLED (IF KNOWN)	REFERENCE NUMBER (IF KNOWN)	WELL NUMBER

DEPTH OF WELL	STATIC WATER LEVEL	LENGTH OF RISER AND SCREEN	DIAMETER OF RISER AND SCREEN	RISER AND SCREEN PLUGGED IN PLACE	PUMP OR SAMPLING EQUIPMENT REMOVED	CASING REMOVED
ft.	ft.	ft.	in.	☐ Yes ☐ No (Removed)	☐ Yes ☐ No ☐ N/A	☐ Yes ☐ No ☐ N/A

TEMPORARY MONITORING WELL/SOIL BORING/GEOTECHNICAL BORING INFORMATION

Quantity	Depth of Well or Boring (ft.)	Diameter (in.)	Total Depth (Linear Feet) of All Wells or Borings		
				TOTAL NUMBER OF WELLS/BORINGS	
				AVERAGE DEPTH OF ALL WELLS/BORINGS	
				DATE FIRST WELL/BORING WAS PLUGGED	DATE LAST WELL/BORING WAS PLUGGED

TEST HOLE INFORMATION

DATE TEST HOLE PLUGGED	DEPTH OF WELL	LENGTH OF GROUT PLUG	DAVIS FORMATION REACHED	MECHANICAL PACKER (IF USED)	AMOUNT OF CLEAN FILL (IF USED)	CASING REMOVED (CHOOSE ONE)
	ft.	Bottom ______ ft. Top ______ ft.	☐ Yes ☐ No	☐ Yes, Depth ______ft. ☐ No	______ Tons or ______ Cubic Yards	☐ Yes, Diameter of Remaining Borehole ______ in. ☐ No, Diameter of Casing ______ in.

PLUGGING INFORMATION (This section is required in addition to one of the well, soil boring or test hole sections above.)

WELL REMOVED BY EXCAVATION	GROUT INSTALLATION METHOD	GROUT MATERIAL USED	NUMBER OF SACKS OF GROUT USED	NUMBER OF GALLONS OF WATER USED PER SACK	GROUT HYDRATED TO SATURATION
☐ Yes ☐ No	☐ Gravity ☐ Tremie ☐ Pressure	CEMENT: ☐ Type I ☐ Type III BENTONITE: ☐ Chips ☐ Granular ☐ Pellets ☐ Slurry ☐ Other	______ LBS PER SACK ______	______	☐ Yes ☐ No

FINISHED SURFACE MATERIAL	SURFACE MATERIAL DEPTH	DRILLER NOTES
☐ Asphalt ☐ Concrete ☐ Soil ☐ Other	______ ft. ______ in.	

I hereby certify that the monitoring well herein described was plugged in accordance with the Department of Natural Resources requirements.

MONITORING WELL INSTALLATION CONTRACTOR	PERMIT NUMBER	DATE
MONITORING WELL INSTALLATION CONTRACTOR APPRENTICE (IF APPLICABLE)	PERMIT NUMBER	DATE

SEND COMPLETED FORM ALONG WITH $50 REGISTRATION FEE TO: MISSOURI DEPARTMENT OF NATURAL RESOURCES, MISSOURI GEOLOGICAL SURVEY, WELL INSTALLATION SECTION, PO BOX 250, ROLLA, MO 65402 PHONE: 573-368-2165 FAX: 573-368-2317 EMAIL: welldrillers@dnr.mo.gov
SUBMIT RECORD AND FEE WITHIN 60 DAYS AFTER WELL PLUGGING OR WITHIN 180 DAYS AFTER THE PLUGGING OF TEMPORARY WELLS
RECORD (AND FEE) MAY BE SUBMITTED ONLINE: dnr.mo.gov/mowells

ATTACHMENT 8 – STANDARD GROUNDWATER/ LEACHATE SAMPLING LOG

Standard Ground Water Sampling Log

Date ____________

Site Name ____________ Weather ____________

Location ____________ Well # ____________

Project No. ____________ Evacuation Method ____________

Personnel ____________ Sampling Method ____________

Well Information:

Depth of Well * ____________ ft.

Depth to Water * ____________ ft.

Length of Water Column ____________ ft.

Volume of Water in Well ____________ gal.(s)

3X Volume of Water in Well ____________ gal.(s)

Water Volume /ft. for:
- ____ 2" Diameter Well = 0.163 X LWC
- ____ 4" Diameter Well = 0.653 X LWC
- 6" Diameter Well = 1.469 X LWC

Volume removed before sampling ____________ gal.(s)

Did well go dry? ____________

* Measurements taken from [ ] Well Casing [ ] Protective Casing [ ] ____________ (Other, Specify)

Instrument Calibration:

pH Buffer Readings		Conductivity Standard Readings	
4.0 Standard		84 S Standard	
7.0 Standard		1413 S Standard	
10.0 Standard			

Water parameters:

Gallons Removed	Temperature Readings	pH Readings	Conductivity Readings uS/cm	Turbidity Readings Ntu
initial	initial	initial	initial	initial

Water Sample:

Time Collected ____________

Physical Appearance at Start		Physical Appearance at Sampling	
Color		Color	
Odor		Odor	
Turbidity (> 100 NTU)		Turbidity (> 100 NTU)	
Sheen/Free Product		Sheen/Free Product	

Samples collected:

Container Size	Container Type	# Collected	Field Filtered	Preservative	Container pH

Notes:

ATTACHMENT 9 – LOW-FLOWS GROUNDWATER/ LEACHATE SAMPLING LOG

Low Flow Ground Water Sampling Log

Date ______________ Personnel ______________ Weather ______________

Site Name ______________ Evacuation Method ______________ Well # ______________

Site Location ______________ Sampling Method ______________ Project # ______________

Well information:

Depth of Well * ______________ ft.

Depth to Water * ______________ ft.

Length of Water Column ______________ ft.

Depth to Intake * ______________ ft.

* Measurements taken from

☐ Top of Well Casing

☐ Top of Protective Casing

☐ (Other, Specify)

Start Purge Time: ______________

		10.0%	0.1	3%	10 mV	10%	10%	100-500 ml/min
Elapsed Time (min)	**Depth To Water (ft)**	**Temperature (celsius)**	**pH**	**Conductivity (ms/cm)**	**Oxidation Reduction Potential**	**Dissolved Oxygen (mg/l)**	**Turbidity (NTU)**	**Flow Rate (ml/min).**

End Purge Time: ______________

Water sample:

Time collected: __________ Total volume of purged water removed: ______________

Physical appearance at start

Color ______________

Odor ______________

Sheen/Free Product ______________

Physical appearance at sampling

Color ______________

Odor ______________

Sheen/Free Product ______________

Field Test Results:

Dissolved ferrous iron: ______________

Dissolved total iron: ______________

Dissolved total manganese: ______________

Analytical Parameters:

Sample	Container Type	# Collected	Field Filtered	Preservative	Container pH

ATTACHMENT 10 – K-TEST LOG

Manually conducted K-Test:

Falling Test				Rising Test			
Date/Time	ET	Depth (ft)	Drawdown	Date/Time	ET	Depth (ft)	Drawdown

ATTACHMENT 11 –SURFACE WATER/SEEP SAMPLING RECORD

PARSONS
SURFACE WATER/SEEP SAMPLING RECORD

SITE NAME: ______________________
PROJECT NUMBER: ______________________
SAMPLING DATE / TIME: ______________________
WEATHER: ______________________
SAMPLERS: __________ of __________
__________ of __________

SAMPLE ID: ______________________
SAMPLING METHOD: ______________________
DEPTH OF SAMPLE: ______________________

DESCRIPTION OF SAMPLING POINT

LOCATION: ______________________
PHYSICAL APPEARANCE: ______________________
DEPTH TO BOTTOM: ______________________
DRAINAGE DIRECTION: ______________________
UPSTREAM FROM: ______________________
DOWNSTREAM FROM: ______________________

SAMPLE DESCRIPTION

COLOR: ______________________
ODOR: ______________________
SUSPENDED MATTER: ______________________
OTHER: ______________________

FIELD TESTS

TEMPERATURE: __________ REDOX: __________
pH: __________ DISSOLVED O2: __________
CONDUCTIVITY: __________ OTHER: __________

SAMPLE ANALYSIS / QA/QC / CHAIN OF CUSTODY

ANALYZE FOR: ______________________
QA/QC SAMPLE ID: ______________________
ANALYZE QA/QC SAMPLES FOR: ______________________
DATE/TIME REFRIGERATED: ______________________
CHAIN OF CUSTODY NUMBER: ______________________
SHIPPED VIA: ______________________
LABORATORY: ______________________

COMMENTS / MISCELLANEOUS

____

ATTACHMENT 12 – SEDIMENT SAMPLING RECORD

PARSONS
SEDIMENT SAMPLING RECORD

SITE NAME: __________
PROJECT NUMBER: __________
SAMPLING DATE / TIME: __________
WEATHER: __________
SAMPLERS: __________ of __________
__________ of __________

SAMPLE ID: __________
SAMPLING METHOD: __________
DEPTH OF SAMPLE: __________

DESCRIPTION OF SAMPLING POINT

LOCATION: __________
PHYSICAL APPEARANCE: __________
DEPTH OF WATER: __________
DRAINAGE DIRECTION: __________
UPSTREAM FROM: __________
DOWNSTREAM FROM: __________

SAMPLE DESCRIPTION

TEXTURE: __________
COLOR: __________
ODOR: __________
OTHER: __________

FIELD TESTS

TEMPERATURE:		REDOX:	
pH:		DISSOLVED O2:	
CONDUCTIVITY:		OTHER:	

SAMPLE ANALYSIS / QA/QC / CHAIN OF CUSTODY

ANALYZE FOR: __________
QA/QC SAMPLE ID: __________
ANALYZE QA/QC SAMPLES FOR: __________
DATE/TIME REFRIGERATED: __________
CHAIN OF CUSTODY NUMBER: __________
SHIPPED VIA: __________
LABORATORY: __________

COMMENTS / MISCELLANEOUS __________

ATTACHMENT 13 – SURFACE SOIL SAMPLING RECORD

PARSONS
SURFACE SOIL SAMPLING RECORD

SITE NAME: ____________________
PROJECT NUMBER: ____________________
SAMPLING DATE / TIME: ____________________
WEATHER: ____________________
SAMPLERS: __________ of __________
__________ of __________

SAMPLE ID: ____________________
SAMPLING METHOD: ____________________
DEPTH OF SAMPLE: ____________________

DESCRIPTION OF SAMPLING POINT

LOCATION: ____________________
PHYSICAL APPEARANCE: ____________________
VEGETATION: ____________________
DRAINAGE DIRECTION: ____________________

SAMPLE DESCRIPTION

TEXTURE: ____________________
COLOR: ____________________
ODOR: ____________________
OTHER: ____________________

FIELD TESTS

TEMPERATURE: __________ REDOX: __________
pH: __________ DISSOLVED O2: __________
CONDUCTIVITY: __________ OTHER: __________

SAMPLE ANALYSIS / QA/QC / CHAIN OF CUSTODY

ANALYZE FOR: ____________________
QA/QC SAMPLE ID: ____________________
ANALYZE QA/QC SAMPLES FOR: ____________________
DATE/TIME REFRIGERATED: ____________________
CHAIN OF CUSTODY NUMBER: ____________________
SHIPPED VIA: ____________________
LABORATORY: ____________________

COMMENTS / MISCELLANEOUS ____________________