

Special Remediation Branch

GUIDELINES FOR ADDRESSING PRE-REGULATORY LANDFILLS AND DUMPS

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Division of Waste Management
Superfund Section
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Pre-Regulatory Landfill Program:

<https://deq.nc.gov/about/divisions/waste-management/superfund-section/pre-regulatory-landfill-program>



Updates from May 2020 Version:

1. Title - Inactive Hazardous Sites Branch changed to Special Remediation Branch.
2. Definitions - new definition, "Inactive hazardous substance or waste disposal site or site" and removed the definition for "Site".
3. Removed comparison of analytical data to PSRGs and vapor screening levels. All analytical data must be entered into the DEQ risk calculator for evaluation.
4. Sample point GPS – one table with coordinates for all investigation sampling points is included as an appendix to the RI Summary Report.
5. No. 14 – ephemeral stream included on list and DWR stream ID number required.
6. Background Sample Collection – removed requirement to compare background samples to PSRGs. Collect enough samples (at least six) to statistically quantify background concentrations and enter values into risk calculator.
7. Waste Disposal Area Perimeter Delineation – surface waste characterization moved to this Section.
8. No. 30. – GPS coordinates for the center of the delineated WDA required.
9. No. 31 & 32 – characterize surface waste and provide a map.
10. Waste Characterization (Consolidation, Total Removal or Hot Spot Assessment) – the Unit will request waste characterization sampling when conditions support consolidation, total removal, or hot spot assessment. There are changes to native soil sample depth.
11. No. 39 & 40 – native soil beneath waste table and risk calculator results required.
12. Evaluation of WDA Existing Soil Cover for Use as the Permanent Cover System – new process, starting with two transects before grid sampling, new cover soil sample depth, and speciate chromium.
13. Landfill Gas Probe Installation and Monitoring – total number of probes may be adjusted if WDA is greater than 20 acres and based on the location of structures.
14. Methane Assessment – incorporated methodology and procedures used in the Brownfields Program.
15. Remedial Action Plan Design, No. 3 – alternatives required for the feasibility study.
16. Appendix A, No. 2(a)(i) – updated the notice plat title to Environmental Contamination or Restricted Use.
17. Appendix B, No. 12 (Landfill Gas Probe Installation) – reference to LADBS Site Testing Standards for Methane and gas probe construction criteria.
18. Appendix B, No. 13 (Landfill Gas Probe Samples) – sampling protocols.
19. Appendix C – updated information for friable and non-friable ACMs.
20. Appendix D – changes for hexavalent chromium analysis.
21. Appendix D – No. 4 (Initial analysis of gas samples) and No. 5 (sampling for 1,4-Dioxane).
22. Appendix D – Table 2 – Method 8270 SIM using d8 isotope analysis for 1,4-Dioxane required.
23. Appendix E – new introductory text to use for RI summary reports, modified section 8.0 (Risk Evaluation) to address the use of the DEQ risk calculator and removed section 9.0 (DEQ Risk Calculator Results). Section 9.0 information is not included in section 8.0.
24. Appendix F – updated the contact information for identifying sensitive environments.
25. Appendix G – risk calculator for evaluating borrow sources.
26. Appendix H – reduction of WDA cover material from 18 to 12 inches. 12 inches is the minimum cover thickness for all covers, both existing and installed.
27. Attachment 2, Report Symbols and Abbreviations – new symbology for soil gas probe (SGP), modified landfill gas probe to (LFGP), and modified water supply well to (PW-house #).

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DEFINITIONS

The following definitions apply to this guidance:

1. **Contamination:** a contaminant released into an environmental medium that has resulted in or has the potential to result in an increase in the concentration of the contaminant in the environmental medium in excess of unrestricted use standards.
2. **Disposal:** the discharge, deposit, injection, dumping, spilling, leaking, or placing of any solid waste into or on any land or water so that the solid waste or any constituent part of the solid waste may enter the environment or be emitted into the air or discharged into any waters, including groundwaters (Ref. North Carolina General Statute (NCGS) 130A-290(a) (6)).
3. **Hazardous waste:** a solid waste, or combination of solid wastes, which because of its quantity, concentration or physical, chemical, or infectious characteristics may:
 - a. cause or significantly contribute to an increase in mortality or an increase in serious irreversible or incapacitating reversible illness; or
 - b. pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed (Ref. NCGS 130A-290(a) (8)).
4. **Inactive Hazardous Substance or Waste Disposal Site or Site:** any facility as defined in CERCLA/SARA which includes any site or area where a hazardous substance has been deposited, stored, disposed of, or placed or otherwise come to be located. The site includes the waste disposal area and any area containing media impacted by the waste disposal area.
5. **Industrial solid waste:** solid waste generated by manufacturing or industrial processes that is not hazardous waste (Ref. NCGS 130A-290(a) (13b)).
6. **Municipal solid waste:** any solid waste resulting from the operation of residential, commercial, industrial, governmental, or institutional establishments that would normally be collected, processed, and disposed of through a public or private solid waste management service. Municipal solid waste does not include hazardous waste, sludge, industrial waste managed in a solid waste management facility owned and operated by the generator of the industrial waste for management of that waste, or solid waste from mining or agricultural operations (Ref. NCGS 130A-290(a) (18a)).
7. **Pre-1983 landfill:** any land area, whether publicly or privately owned, on which municipal solid waste disposal occurred prior to 1 January 1983 but not thereafter but does not include any landfill used primarily for the disposal of industrial solid waste (Ref. NCGS 130A-290(a) (22a)).
8. **Property/Properties:** the parcel(s) that include the site/waste disposal area and anywhere contamination from the pre-1983 landfill has come to be located.
9. **Waste disposal area:** the estimated or actual waste disposal footprint derived from investigation activities regardless of the number of properties on which it is located.

INTRODUCTION

The Pre-Regulatory Landfill Unit (Unit) was established in 2007 to address pre-1983 non-industrial landfills and dumps (landfills and dumps that ceased accepting waste prior to January 1, 1983). These landfills and dumps are unlined waste disposal areas (WDA) that are not subject to the North Carolina Division of Waste Management's 15A North Carolina Administrative Code (NCAC) 13B post-closure regulations administered by the Solid Waste Section. The legislation passed in 2007 established funding for contaminant assessment and risk based remedial measures at these sites. The contaminant assessment and risk based remedial measure work activities are completed by Professional Engineering firms (Contractors) under contract and by the direction of Unit Project Managers (PM).

The Unit also manages a Local Government Reimbursement Program for certain eligible activities. Local governments may conduct contaminant assessment activities in accordance with this guidance document including subsequent amendments and editions and request reimbursement of assessment expenses if the activities and costs are pre-approved by the Unit and comply with statutory requirements. *Guidelines for the Local Government Reimbursement Program* are outlined in Attachment 1.

Unit PMs will initiate the remedial investigation (RI) phase for each pre-1983 landfill by obtaining property access permission for DEQ staff, Contractor staff and U.S. Army Corp of Engineers (USACE) staff. Once property access permission has been obtained, an initial site visit is performed by the Unit PM, the Contractor PM, and Contractor staff personnel who will be performing field work.

The initial site visit allows the Contractor PM to gather site specific information such as physical obstacles above and below the ground surface that will be useful for preparing all work plans and cost estimates. The RI is usually separated into two phases, the first phase and the contaminant delineation phase. After the initial site visit, the first phase of the RI will be tasked by the Unit PM. The contaminant delineation phase will commence after the Unit PM reviews the information obtained from the first phase. Various reports may be requested by the Unit PM throughout the RI phase.

Typical RI first phase activities include collecting receptor information, identifying all potential sensitive environments, and performing a geophysical survey to delineate the edge of waste disposal. The RI contaminant delineation phase includes soil borings to confirm the extent of waste and media sampling (groundwater, surface water, soil, sediment, surface vapor screening and subsurface landfill and soil gas) to identify and delineate the extent of contaminants of concern. These assessment activities are planned based on historic information available in the Unit's records and the risks posed by current site conditions and any pending redevelopment. If needed, the Unit PM will obtain access permission from the North Carolina Department of Transportation (NCDOT) to install temporary borings in the NCDOT right-of-way.

Unit PMs will request a work plan, cost estimate and proposed schedule for all work activities from the Contractor PM. The Contractor PM must submit a separate work plan, cost estimate and proposed schedule for each request. All work plans and estimated costs must be pre-approved by the Unit PM prior to implementation. Additional information regarding general task order management protocol is available in the *Pre-Regulatory Landfill Program Contract Task Management Guidance*, which can be found in Attachment 2.

After the RI is complete, the next step is the remedial design (RD) phase. The Unit PM will meet with the Contractor PM to discuss the RI phase results and determine the appropriate risk based remedial measures. The Contractor PM will prepare a draft remedial action plan (RAP) based on the pre-1983 landfill contaminants of concern, topography, and sensitive environments for review by the Unit. The draft RAP will be made available for public comment prior to final approval and implementation. If significant public interest exists, a public meeting and/or informational session may be held. Contractors may need to provide technical and administrative support for public meetings and informational sessions.

Note: Due to the wide range of conditions encountered at pre-1983 landfill sites, these guidelines will not address every conceivable situation.

DOCUMENT FORMATTING AND SUBMITTAL REQUIREMENTS

All documents must be submitted electronically in PDF format unless otherwise specified by the Unit PM. The associated cover letters, appendices, and signed and notarized certifications should be included with the document as one PDF. Company logos may be used on the report cover page, but company logos and file names cannot be in the text of the report including headers/footers and figures. Documents may be e-mailed, but if they are large then a file-sharing system may be used. Electronic documents should not be password protected or encrypted. Any paper submissions to the Unit should be double-sided (except for figures, tables, and color photographs).

The Unit PM will review draft reports. The Contractor PM is expected to make all requested revisions as directed and submit an updated final report. The Contractor PM shall perform a complete review of all draft reports to identify all errors and omissions prior to submitting to the Unit PM for review. The Contractor PM should not make report revisions that are not requested by the Unit PM unless the Contractor identifies a reporting error.

All reports must be submitted in accordance with the following:

1. summarize methods and results and do not include conclusions or recommendations;
2. sequentially numbered sections that reflect each task in the task order;
3. letter size paper (8.5 x 11 inch) and ledger (11x17) if approved by the Unit PM;
4. font size 9 or greater for all text in documents, tables and figures;
5. font size must remain 9 or greater after conversion to PDF;
6. submittal date;
7. name of the pre-1983 landfill;
8. identification number of the pre-1983 landfill;
9. approved task order identification number;
10. summary of any required variances from the approved work plan (Contractor must seek Unit pre-approval); and
11. copies of all Contractor field notes and waste manifests.

Field notes include but are not limited to, soil boring logs, equipment calibration logs, and water sample collection field sheets. All abbreviations and symbols used for field notes must correspond to the requirements as outlined in the *Pre-Regulatory Landfill Program Contract Task Management Guidance*, which can be found in Attachment 2.

Report appendices should not include correspondence with the Unit relative to contracting and task orders, but may include the following:

1. photographs;
2. GPS coordinates;
3. site survey plat;
4. soil boring and well construction logs (digital and in diagram form);
5. field notes;
6. geophysical survey; and
7. laboratory analytical reports.

All site reports are stored with other site records electronically in an online document management system (Laserfiche). Instructions for accessing the Laserfiche system can be found at the following website: <http://deq.nc.gov/about/divisions/waste-management/superfund-section/sf-file-records>.

REPORT CERTIFICATION REQUIREMENTS

The following certification statement with the notarized signature of the Contractor PM, must be included on each RI report and remedial action (RA) report: “I certify that, to the best of my knowledge, after thorough investigation, the information contained in or accompanying this certification is true, accurate, and complete.”

Additional certification by relevant professionals is required if applicable. Any work that would constitute the “practice of engineering” as defined by NCGS 89C shall be performed under the responsible charge of, and signed and sealed by, a professional engineer licensed in the state of North Carolina. Any work that would constitute the “public practice of geology” as defined by NCGS 89E shall be performed under the responsible charge of, and signed and sealed by, a geologist licensed in the state of North Carolina.

SURVEY CERTIFICATION REQUIREMENTS

All surveys must comply with and be signed and sealed by a surveyor licensed in the state of North Carolina in accordance with NCGS 47-30 (plats and subdivisions; mapping requirements). In addition to NCGS 47-30, Appendix A, *Instructions for Preparing a Notice Plat for Recordation*, outlines the requirements for preparing a pre-1983 landfill Notice Plat and the associated recordation process.

REMEDIAL INVESTIGATION PHASE

A Unit PM will submit a request to the Contractor PM for a work plan, cost estimate, and proposed schedule to perform RI phase activities. The request from the Unit PM will include a scope of work outlining expectations and authorized activities. The request will include a task order number associated with a specific activity. Detailed work plans and cost estimates (identifying personnel and materials) addressing the scope of work are typically delivered to the Unit PM within ten business days of receipt. The work plan and cost estimate must be based on information gathered during the initial site visit. Prior to conducting RI activities, the proposed work plan and cost estimate must be pre-approved by the Unit PM. Each task order should be authorized, completed, and invoiced separately.

Generally, the pre-1983 landfills included in the Unit Inventory have location-receptor summary reports on file. Unit PMs will complete a file review to ensure completed work is not duplicated.

Note: certain activities may not be necessary based on developing results.

Required field procedures and sample collection techniques are outlined in Appendix B, *Field Procedures and Sample Collection Techniques*. Information pertaining to asbestos containing materials, required handling protocols and notification procedures are provided in Appendix C, *Asbestos Containing Material*.

All soil and water samples must be submitted to either a laboratory certified under 15A NCAC Subchapter 02H .0800 or a laboratory currently part of the US EPA Contract Laboratory Program and analyzed in accordance with the requirements outlined in Appendix D, *Laboratory Analytical Parameters*. Laboratories analyzing vapor samples should have NELAP certification.

Upon receipt of a laboratory analytical report, the Contractor PM must perform a quality assurance and quality control review (QA/QC) of the laboratory report to ensure that the sample results are valid and submit a statement that the data is valid for its intended purpose with the laboratory report to the Unit PM.

The lateral and vertical extent of contamination must be delineated in each area of concern for all contaminated media (soil, groundwater, sediment, surface water, and vapor). Unrestricted use standards must be used as delineation endpoints during the RI. However, at some sites, local natural background concentrations (metals only) and anthropogenic background concentrations (PAHs, PCB and/or Dioxins) or sample reporting limits may serve as delineation endpoints, provided that the laboratory's reporting limits are not elevated more than ten times the laboratory's MDLs, and/or published average MDLs for the particular method. Subsequent delineation work phases must include all CERCLA hazardous substances detected (including those with qualified estimated concentrations), unless the contaminant concentration is proven through sampling to be the result of a naturally occurring condition,

area wide anthropogenic background or the contaminant is a common laboratory contaminant detected in concentrations below that detected in the method blank. Final remediation goals should be based on acceptable risk and can be determined using the DEQ Risk Calculator and Risk Calculator User Guide available for download from the [DEQ Risk-Based Remediation website](#). The Unit PM will decide if the Site is one exposure unit or will consist of multiple exposure units. The Unit PM may also add multiple exposure units during the investigation to address potential exposure pathways.

Investigation-derived waste (IDW), such as drill cuttings and muds, sampling materials, and/or purge water generated as part of assessment activities, may be discharged or stored in the area of contamination and are not subject to RCRA permitting as long as the material:

1. stays on site and remains in the contaminated area (if not being transported off-site to a facility permitted to accept such waste);
2. is secured;
3. does not increase the spread of contamination or concentrations in a particular medium;
4. does not cause mobilization of contaminants; and
5. does not introduce contamination to uncontaminated soil.

In residential and public use areas, IDW will require off-property management unless it meets unrestricted use standards and disposal permission has been granted by the property owner. IDW cannot be transferred and discharged to another area of concern. All drummed waste and associated fencing must be removed from the site within 90 calendar days after completion of field activities.

The completion of the RI phase should establish the following:

1. lateral and vertical extent of contamination in each area of concern for all contaminated media (soil, groundwater, sediment, surface water and vapor);
2. potential exposure pathways and receptors currently or that may become exposed to contamination; and
3. site contaminant, geologic and use conditions sufficient to conduct a feasibility study of remedial alternatives to support the proposed RAP.

Once the Unit PM is satisfied that the RI phase is complete, the Contractor PM will receive a request to submit a RI summary report using the template in Appendix E, *Remedial Investigation Summary Report Template*.

Important: The Unit must be notified within 24 hours if contamination is detected in a potable well, spring, in indoor air or if newly discovered conditions require immediate mitigation, remediation, or other action to abate a direct contaminant exposure to workers, nearby communities, and/or the environment.

GENERAL REQUIREMENTS FOR RI AND RA WORK PLANS AND REPORTS

The following items may need to be included in RI and RA work plans and reports.

1. All work proposals for RI activities must include a description of:
 - a. equipment and personnel decontamination procedures; and
 - b. measures that assure the health and safety of nearby residential and business communities by demonstrating that they will not be adversely affected by activities related to the RI.
2. All work proposals, cost estimates, reports and other relevant correspondence submitted to the Unit PM must include the following:
 - a. name of the pre-1983 landfill;
 - b. pre-1983 landfill identification number;
 - c. task order number; and
 - d. date(s) samples collected.
3. Before task activities begin, current site conditions must be photographed. The photographic record must include areas or objects that may be disturbed or affected. Restoration efforts and noteworthy items encountered during task activities must be documented. After task activities are complete, a photograph is required to document restoration. If pre-disturbed conditions are not documented to support complete restoration, the Contractor will be held responsible for all associated restoration expenses. Photographs must be submitted with a point of reference description in the report for the particular task. Unit PMs may identify specific photographs to include in reports.
4. The Contractor PM must ensure all personnel, including subcontractor personnel, engaged in intrusive field activities at the site comply with OSHA required health and safety training for hazardous waste sites and site health and safety plans. The Contractor PM must also ensure that personnel in the field are qualified to identify contaminated material and landfill waste.
5. All GPS coordinates must be submitted in the following format:
 - a. latitude/longitude;
 - b. decimal degrees to the fifth order;
 - c. differentially corrected;
 - d. WGS84 format;
 - e. sample ID (i.e. monitoring well, soil gas probe, and etc.); and
 - f. tabulated as an appendix in the RI Summary Report.
6. All supporting figures and maps must be CAD drawn to scale and include, at a minimum, the following:
 - a. bar scale (in feet and miles);
 - b. legend with an explanation of all symbols;
 - c. north arrow; and
 - d. background topographic contours (light grey shading).

Note: Multiple maps or figures may be required to adequately display information.

7. All professional work (reports) must be signed and sealed by the appropriate State licensed professionals (geologist and engineers). A single document may require the signature and seal of more than one professional.

FIRST PHASE RI ACTIVITIES

The following items may be requested by the Unit PM. Data for each tasked item must be submitted to the Unit in a report.

RI HISTORICAL USE RESEARCH

8. Provide a summary of historical operations including, but not limited to:
 - a. a chronological listing of owners and operators;
 - b. written documentation and interviews with individuals who have historical knowledge to provide verification of time operated;
 - c. types of waste received;
 - d. other relevant information about disposal operations;
 - e. current site use;
 - f. surrounding property use;
 - g. street address of site;
 - h. records, if available, indicating large quantities of industrial waste (more than expected at a municipal solid waste landfill for the time period of operation); and
 - i. known or suspected areas of hazardous substance disposal (hot spots).

Important: If research indicates that paragraph 8(h) or 8(i) may be of concern at the WDA, contact the Unit. Waste characterization of exposed wastes or hot spots may be required prior to any other investigation activities.

9. Provide aerial photography and Sanborn Fire Insurance maps, if available, showing:
 - a. WDA conditions from pristine land;
 - b. WDA during the time period of active operation; and
 - c. WDA present conditions.
10. Provide copies of all non-financial encumbrances (easements and rights-of-way) and leases for the site.

RI SITE LOCATION

11. Collect geographic coordinates (GPS) for the following:
 - a. WDA entrance;
 - b. site entrance; and
 - c. points delineating the suspected perimeter of the WDA.

RI FIRST PHASE REPORT INFORMATION

12. Provide a map titled, “USGS Topographic Location Map,” using the current published United States Geological Survey topographic map for the subject area that includes the following:
 - a. WDA estimated perimeter;
 - b. 500-foot radius from the estimated WDA perimeter;
 - c. 1,000-foot radius from the estimated WDA perimeter; and
 - d. maximum scale: 1” = 1,000’.

13. Provide a map, titled “Vicinity Map,” that includes the following:
 - a. property owner name, zoning classification, and property boundaries of property/properties containing the WDA;
 - b. WDA estimated perimeter;
 - c. property owner name, zoning classification, and property boundaries of adjacent properties within 500 feet of the WDA perimeter;
 - d. roadways; and
 - e. easements.

14. Provide a map, titled “Surface Water Map,” that includes the following information pertaining to surface water bodies within 1,000 feet of the estimated WDA perimeter:
 - a. WDA estimated perimeter;
 - b. locations of surface water bodies:
 - i. streams (ephemeral, intermittent, and perennial);
 - ii. Division of Water Resources Index number;
 - iii. lakes;
 - iv. storm ditches;
 - c. name and class of each water feature; and
 - d. flow direction of each water feature.

15. Provide a map, titled “Water Supply Map,” that includes the following water supply sources within 1,000 feet of the estimated WDA perimeter:
 - a. WDA estimated perimeter;
 - b. water supply wells;
 - c. water supply springs;
 - d. surface water intakes; and
 - e. distance in feet to the WDA perimeter.

16. Provide a table, titled “Water Supply Table,” that includes the following information cross referenced to the “Water Supply Map”:
 - a. current water source owner;
 - b. current water source user (if other than water source owner); and
 - c. address and Parcel Identification Number (PIN) of water source.

Note: water sources should be identified using available maps, online resources, local utility offices and by visual inspection.

17. Provide a map, titled “Site Map,” (multiple maps may be used) that includes the following:
 - a. WDA estimated perimeter;
 - b. accessibility issues;
 - c. existing monitoring wells;
 - d. paved areas;
 - e. landscaped areas;
 - f. type and extent of ground cover;
 - g. general surface conditions;
 - h. on-site structures;
 - i. sumps;
 - j. septic systems;
 - k. storm water conduits;
 - l. above ground and underground utilities (electric, water, and sewer);
 - m. non-financial encumbrances (easements and rights-of-way);
 - n. leases; and
 - o. surface or exposed waste.

18. Provide a summary of a sensitive environment survey of the WDA and areas located within 500 feet of the estimated WDA perimeter. For each sensitive environment (as listed in Appendix F, *Sensitive Environment Survey*) identified, the following is required:
 - a. provide a brief summary of potential effects to sensitive environments identified for RA options (i.e. excavation or capping);
 - b. tabulate results to include the following:
 - i. contacts;
 - ii. responses; and
 - iii. dates and types of communication.

19. Provide a map, titled “Sensitive Environment Map,” that includes the delineated boundary of all sensitive environments across all properties containing, all or a portion of, the WDA and any additional property within 500 feet of the estimated WDA perimeter. The map should be prepared using the contacts provided in Appendix F.

20. Conduct and provide a summary of a geophysical survey delineating the horizontal extent of the WDA, including a 25-foot buffer beyond the estimated WDA perimeter using single frequency methods on a 100-foot grid. Describe any on-site features that may cause interference with the survey (i.e. railroad, electric fence, etc.).

21. Provide a map, titled “Geophysical Survey Results Map” that includes the following:
 - a. WDA perimeter determined visually and by the geophysical survey;
 - b. 25-foot buffer beyond the estimated WDA perimeter; and
 - c. point locations where survey grade GPS data delineating the WDA boundary were collected.

22. Provide a description of local/regional geologic and hydrogeologic conditions. Discuss naturally occurring inorganics in soil and groundwater that includes a range of concentrations for each inorganic constituent and provide reference information about the naturally occurring conditions.

23. The Unit PM will decide if the Site consists of two or more exposure units. At a minimum, there is a Site wide exposure unit and a perimeter exposure unit. The calculated risks associated with the Site wide exposure unit determine the imposed administrative controls and implemented remedial actions. The perimeter exposure unit consists of the outermost sampling points and its purpose is Site delineation. The Unit PM may also add multiple exposure units during the investigation to address potential exposure pathways. If needed, provide a map(s) titled “Exposure Units” that include the following:
- a. unique identifiers for each exposure unit;
 - b. the boundaries of individual exposure units located within estimated limits of the Site; and, if needed
 - c. a separate map showing the boundaries of individual exposure units located within 500 feet of the estimated limits of the Site.

CONTAMINANT DELINEATION RI ACTIVITIES

The following items may be requested by the Unit PM. Data for each tasked item must be submitted to the Unit in a report.

Prior to initiating invasive field work activities, the Contractor PM must contact the North Carolina One-Call Center (NC811) to request the identification of all publicly owned underground utilities. The Contractor PM must also ensure that publicly and privately-owned utilities are not damaged during invasive field work activities.

The clearing of vegetative material to enable access to proposed sampling points should be minimized. Hand tools must be used for clearing unless justification for use of heavy equipment is provided to and approved by the Unit PM.

All contaminant delineation work plans and reports must provide a summary of the planned and actual handling of investigation-derived wastes.

BACKGROUND SAMPLE COLLECTION

At some sites, local naturally occurring background concentrations (metals only) and/or anthropogenic background concentrations (PAHs, PCB, and/or Dioxins) can contribute to the site’s total contaminant concentrations and risk. Background contaminants can either be naturally occurring substances that are present in the environment in forms that have not been influenced by human activity, or anthropogenic substances that are present due to human activities not specifically related to the site. Background concentrations can serve as remedial goals for those contaminants, especially when conducting confirmation sampling in excavations and borrow source sampling. Sufficient sampling should take place to statistically quantify these potential contributions to site in a legally defensible manner. Statistics play a major role in establishing background concentration levels, and methods vary widely in their degree of complexity. The methodology used to establish naturally occurring compounds and determine cleanup levels should be well-documented. Site-specific soil, sediment, surface water, and groundwater samples must be collected and analyzed in accordance with Appendix B, *Field Procedures and Sample Collection Techniques* and Appendix D, *Laboratory Analytical Parameters* to establish natural metals concentrations and area-wide anthropogenic background. When collected, the minimum

number of background soil samples is six, but the final number of background soil samples will be determined by the Unit PM.

NATURAL SOIL METALS CONCENTRATIONS

24. Collect background soil samples at locations and depths designated by the Unit PM. When collected for comparison to cover soil samples, collection depth is 6 to 12 inches. When collected for comparison to confirmation samples, collection depth must be within the same soil horizon as the anticipated bottom of the excavation. All other samples must be collected away from roadways, railways, parking areas and other potential sources of contamination. Samples must be collected from depths and soil types that are representative of contaminated soils but should not be collected from topsoil (0-6 inches).

AREA-WIDE SOIL ANTHROPOGENIC BACKGROUND DUE TO AIRBORN RELEASES

25. Where Dioxin, PAH, and/or PCB contamination have been found in surface soils, background samples must be collected across an area between the outer edge of the landfill footprint and a 1,000-foot perimeter of that edge. Samples should not be collected on known contaminated sites or in drainage features. After any obvious outliers are removed, the upper end of the range of concentrations detected can be used as the anthropogenic level.

NATURAL GROUNDWATER METALS CONCENTRATION

26. Groundwater samples must be collected up gradient of the delineated WDA to establish natural background conditions. Install and sample monitoring wells in locations designated by the Unit PM.

SURFACE WATER AND SEDIMENT BACKGROUND CONCENTRATION

27. Surface water and sediment samples must be collected upstream of the delineated WDA if a perennial surface water feature crosses or adjoins site contaminated areas. If contamination is found upstream of the site in concentrations greater than the downstream concentrations, downstream delineation may not be necessary.

BACKGROUND SAMPLE RESULTS

28. Provide a map(s), titled "Background Sample Results Map" that depicts the location of all background samples and provide a table, titled "Background Sample Results Table," that summarizes the results of collected background soil, sediment, groundwater, and surface water samples. Identify the concentrations used for the DEQ risk calculator and show the output data from calculator. The results are not compared to any standards, but instead are used to establish the naturally occurring background concentrations at the site and to assist with establishing remediation goals.

WASTE DISPOSAL AREA DELINEATION/THICKNESS AND SURFACE WASTE CHARACTERIZATION

29. Determine the perimeter and thickness of the WDA by completing the following:
 - a. advance hollow stem auger (HSA) borings or other Unit approved methods around the perimeter of the WDA as depicted by the geophysical survey and/or historical information. The distance between borings is site specific taking into account property boundaries, utilities, steep slopes, and other items where a more accurately characterized Site boundary will enable a more effective remedial action plan;
 - b. if waste is not encountered in the initial boring, offset additional borings in the direction of the estimated WDA until waste is encountered;
 - c. if waste is encountered in the initial boring, offset additional borings in the direction away from the estimated WDA until no waste is encountered;
 - d. extend borings a minimum of ten feet below ground surface (bgs) unless waste is encountered (delineation of boundary);
 - e. extend a minimum of one boring every two acres through waste to determine the thickness of the WDA; and
 - f. collect GPS coordinates for the center of the delineated WDA.

30. Provide a map, titled “WDA Delineation,” that includes the following:
 - a. unique identifier for each boring;
 - b. locations of all borings;
 - c. perimeter of WDA based on borings;
 - d. location and approximate volume of surface waste;
 - e. location and approximate volume of buried waste;
 - f. parcels and PIN containing waste and/or contaminated media;
 - g. acres of waste determined by the delineated boundary; and
 - h. acres for all parcels containing waste and/or contaminated media.

31. Provide a table, titled “WDA Delineation,” that includes the following:
 - a. unique identifier for each boring;
 - b. total depth of each boring;
 - c. depth to waste from the surface;
 - d. waste type (if applicable); and
 - e. lithologic description based on Unified Soil Classification System.

32. Characterize surface waste by completing the following:
 - a. identify and describe the location, volume and type of surface waste related to each parcel containing the WDA;
 - b. list tires and white goods separately;
 - c. identify and describe the types of physical hazards found at the WDA; and
 - d. describe the potential mobility of surface waste related to erosional features, stormwater channels, streams, flooding etc.

33. Provide a map, titled “Location of Surface Waste,” that includes the location of surface waste on each parcel containing the WDA.

ABOVE GROUND VAPOR SURVEY

34. Evaluate the potential for above ground vapors by collecting landfill gas readings across the WDA on a 50-foot grid using field instrumentation. Reference the geophysical survey or the WDA delineation maps for the location and extent of the WDA. At each sampling point, collect measurements in accordance with the following:
- a. instruments must run for at least 30 seconds or as specified in the manufacturer’s instructions before recording the measurement;
 - b. collect measurements no more than six inches above the ground surface;
 - c. do not perform the above ground vapor evaluation on rainy or windy days or during a period of changing barometric pressure;
 - d. record background measurements upwind of, but in close proximity to the WDA;
 - e. collect the following parameters at each sampling point and report each parameter in the units as outlined in Appendix B:
 - i. methane;
 - ii. oxygen;
 - iii. carbon dioxide;
 - iv. hydrogen sulfide;
 - v. total volatile organic compounds; and
 - vi. mercury;
 - f. collect the following parameters hourly during the above ground vapor evaluation and report each parameter in the units as outlined in Appendix B:
 - i. barometric pressure;
 - ii. ambient temperature; and
 - iii. humidity;
 - g. place temporary flagging (i.e. wooden stakes) at all grid points with detectable concentrations of any of the contaminants listed in paragraph 34e;
 - h. recheck each of the grid points with detectable concentrations of any landfill gas before leaving the WDA;
 - i. collect GPS coordinate data for all sampling points; and
 - j. if any contaminants are detected, a second confirmation survey may need to be conducted on a later day.
35. Provide a map, titled “Above Ground Vapor Survey,” that includes the following:
- a. unique identifier for each sampling node;
 - b. locations of all above ground vapor sampling points;
 - c. locations of background sampling points; and
 - d. highlight, or otherwise designate, where contaminants of concern were detected.
36. Provide a table, titled “Above Ground Vapor Survey,” that includes the following:
- a. unique identifier for each sampling node; and
 - b. field measurement results for all survey events as outlined in Section 34.

Note: The Unit PM may adjust the sample grid spacing based on-site conditions. Alternatively, for larger sites with consistent terrain and no known hot spots, a larger grid spacing could be used.

Note: The Unit PM will request soil cover investigation for sites that meet specific criteria. Generally, if a site is relatively flat and currently does not have trees covering the WDA, the thickness and quality of the existing soil cover would be considered. If grubbing activities are needed, the existing soil cover thickness and quality may not be evaluated. Sections 37 and 38 below may be tasked alone, in sequence, conditionally, or at the same time depending on the size of the WDA.

Important: The soil cover evaluation process will begin with two perpendicular transects oriented to maximize the greatest surface area of the WDA to obtain preliminary information. If the results from the two transects show the existing quality and thickness are sufficient for use as the final cover, the next step is to sample according to the grid spacing outlined in Section 38. The grid pattern should include the sample locations from the previous field work. If the WDA is greater than 5 acres in size, the Unit PM may adjust the grid spacing or allow for composite sampling of non-VOC samples.

37. Determine preliminary quality and thickness of the existing WDA soil cover by completing the following using hand augers, direct push methods or HSA:
- a. install soil borings based on the transects provided by the Unit PM;
 - b. advance soil borings to a depth of 3 feet or until waste is encountered, whichever is first;
 - c. evaluate the soil in each soil boring using a PID prior to sample collection;
 - d. if the soil cover is greater than or equal to 12 inches, collect one sample from 0 to 6 inches bgs and one sample from 6 to 12 inches bgs;
 - e. Hexavalent chromium testing is required when evaluating existing cover soils for use as the permanent cover system.
 - f. soil cover samples must be collected in accordance with Appendix B, *Field Procedures and Sample Collection Techniques*; and
 - g. soil cover analysis must be conducted in accordance with Appendix D, *Laboratory Analytical Parameters*.
38. Collect soil cover samples for laboratory analysis according to the following:
- a. install soil borings based on a 100-foot grid across the delineated WDA;
 - b. if the soil cover is greater than or equal to 12 inches, collect one soil sample from 6 to 12 inches bgs;
 - c. Hexavalent chromium testing is required when evaluating existing cover soils for use as the permanent cover system.
 - d. soil cover samples must be collected in accordance with Appendix B, *Field Procedures and Sample Collection Techniques*; and
 - e. soil cover analysis must be conducted in accordance with Appendix D, *Laboratory Analytical Parameters*.

Important: Sample results must be entered into the DEQ risk calculator for final evaluation.

39. Provide a map, titled “Evaluation of WDA Existing Soil Cover for use as the Permanent Cover System,” that includes the following:
 - a. unique identifier for each soil cover sample;
 - b. locations of all soil cover samples;
 - c. provide soil cover thickness at each sample location; and
 - d. provide soil cover iso-thicknesses for the WDA.

40. Provide a table, titled “Evaluation of WDA Existing Soil Cover for use as the Permanent Cover System,” that includes the following:
 - a. unique identifier for each soil cover sample;
 - b. PID results;
 - c. Analytical results from all cover soil sampling events (detections only);
 - d. identify concentrations used for DEQ risk calculator; and
 - e. identify concentrations exceeding background sample results.

41. Provide a map, titled “Evaluation of WDA Existing Soil Cover for use as the Permanent Cover System DEQ Risk Calculator results,” that includes the following:
 - a. unique identifier for each soil cover sample;
 - b. locations of all soil cover samples;
 - c. sampling date; and
 - d. risk calculator results for each sample location or exposure unit, as determined by the Unit PM, that includes all the following:
 - i. resident carcinogenic risk;
 - ii. resident hazard index;
 - iii. non-resident carcinogenic risk; and
 - iv. non-resident hazard index.

SURFACE WATER/SEDIMENT/SEEP INVESTIGATION

42. Collect a surface water and sediment sample from the locations designated by the Unit PM according to the following:
 - a. if surface water features traverse or adjoin the WDA collect one set of samples in this order:
 - i. immediately downstream of the WDA;
 - ii. where the stream traverses or contacts the WDA;
 - iii. immediately upstream of the WDA;
 - b. surface water and sediment samples must be collected in accordance with Appendix B, *Field Procedures and Sample Collection Techniques*;
 - c. surface water and sediment sample analysis must be in accordance with Appendix D, *Laboratory Analytical Parameters*; and
 - d. samples must be collected in a downstream to upstream progression.

43. Collect one set of sediment and water samples from each seep location observed on-site or designated by the Unit PM.

44. Provide a map, titled “Surface Water/Sediment/Seep Investigation,” that includes the following:
- a. unique identifier for each surface water/sediment/seep sample;
 - b. location of surface water samples;
 - c. location of sediment samples;
 - d. location of seep samples;
 - e. unique identifier and boundary of each exposure unit (ponds, streams, seeps...);
 - f. risk calculator results for each sample location or exposure unit, as determined by the Unit PM, that includes all the following:
 - i. resident carcinogenic risk;
 - ii. resident hazard index;
 - iii. non-resident carcinogenic risk; and
 - iv. non-resident hazard index.
45. Provide a table, titled “Surface Water/Sediment/Seep Investigation,” that includes the following:
- a. unique identifier for each surface water/sediment/seep sample grouped by exposure unit;
 - b. analytical results compared to 15A NCAC 02B and upstream background for surface water;
 - c. identify concentrations used for DEQ risk calculator for each exposure unit; and
 - d. identify concentrations exceeding background sample results.

Important: If contamination is detected in any downstream sample above upstream conditions, additional surface water/sediment assessment will be needed. The downstream extent of contamination must be delineated to concentrations less than or equal to the 15A NCAC 02B standards for surface water or upstream concentrations whichever is higher.

GROUNDWATER INVESTIGATION

Important: If initial well sampling indicates hazardous substances are present in groundwater, additional groundwater assessment will be required. The lateral and vertical extent of all contaminant plumes, on-site and off-site, must be delineated to develop a conceptual site model, which may include complex hydrogeology such as fractured bedrock aquifers, complex contaminant behavior, and dense non-aqueous phase liquids. The lateral and vertical extent of the groundwater contaminant plumes must be defined to the 15A NCAC 02L standards. Where a contaminant does not have a standard, contact the Unit PM for an alternate number. In some situations, the US EPA Tap Water Numbers may be used. Large perennial surface water features may be used as investigation limits as determined by the Unit PM.

46. Temporary groundwater wells must be installed according to the following:
- a. advance soil borings outside of the delineated WDA to groundwater at locations designated by the Unit PM;
 - b. install a temporary groundwater well (may use pre-packs if applicable) in each boring; and
 - c. if groundwater is not encountered or if waste is encountered in borings, contact the Unit immediately.

47. Permanent groundwater monitoring wells must be installed according to the following:
- advance soil borings outside of the delineated WDA to groundwater at the locations designated by the Unit PM;
 - install a permanent groundwater monitoring well in each boring;
 - various drilling methods such as hollow stem auger, air rotary, sonic..., may be used depending on the depth to groundwater; and
 - flush mount versus stick up well covers will be determined by the Unit PM based on property usage.
48. In-waste permanent groundwater monitoring wells (used when there is a suspected hot spot) must be installed according to the following:
- advance soil borings within the WDA at locations designated by the Unit PM;
 - install a permanent Type III groundwater monitoring well in each boring, double case the well to the waste-soil interface;
 - various drilling methods such as hollow stem auger, air rotary, sonic..., may be used depending on the depth to groundwater; and
 - flush mount versus stick up well covers will be determined by the Unit PM based on property usage.
49. Bedrock surface permanent groundwater monitoring wells must be installed according to the following:
- advance soil borings outside of the delineated WDA to the top of bedrock;
 - install a 2-inch diameter permanent groundwater monitoring well in each boring; and
 - install ten feet of screen.
50. Provide the following for each permanent and temporary monitoring well:

Important: All borings must be logged in the field.

- boring log information must include but is not limited to:
 - top of ground elevation;
 - detailed soil description and lithology at depths;
 - depth of groundwater observed during drilling;
 - notable reaction of drill rig during advancement;
 - depth of competent rock encountered;
 - detailed notes/remarks;
- a well construction diagram;
- non-residential well construction record form GW-1;
- ground water elevation for each well;
- details of well development;
- details of well abandonment;
- water level measurements for all available groundwater wells;
- one groundwater sample from each well must be collected in accordance with Appendix B, *Field Procedures and Sample Collection Techniques*, and the groundwater sample analysis must be in accordance with Appendix D, *Laboratory Analytical Parameters*;
- well construction details in a table and including the following:

- i. installation date;
 - ii. top of casing elevation;
 - iii. ground surface elevation;
 - iv. total well depth;
 - v. well screen interval;
 - vi. depth to groundwater;
 - vii. groundwater elevation;
- j. groundwater contour and flow direction map showing:
 - i. land surface topography;
 - ii. surface water features; and
 - iii. monitoring well locations.

51. Provide a map, titled “Groundwater Investigation,” that includes the following:

- a. unique identifier for each monitoring well;
- b. location of temporary monitoring wells;
- c. location of permanent monitoring wells;
- d. location of bedrock permanent monitoring wells;
- e. if the Site contains separate exposure units, include unique identifiers and boundaries for each exposure unit;
- f. risk calculator results for each sample location or exposure unit, as determined by the Unit PM, that includes all the following:
 - i. resident carcinogenic risk;
 - ii. resident hazard index;
 - iii. non-resident carcinogenic risk; and
 - iv. non-resident hazard index.

52. Provide a table, titled “Groundwater Investigation,” that includes the following:

- a. unique identifier for each monitoring well grouped by exposure unit;
- b. analytical results compared to 15A NCAC 02L and upgradient background concentrations for groundwater;
- c. identify concentrations used for DEQ risk calculator for each exposure unit; and
- d. identify concentrations exceeding background sample results.

53. Monitoring well construction and abandonment documentation must be submitted to the NC Division of Water Resources and to the County Health Department responsible for the county in which the monitoring well is located and included in the report to the Unit.

Note: Subsequent monitoring well installation and sampling may only require analysis for contaminants previously detected and their degradation products.

Important: Well installation and abandonment must comply with the current codified edition of 15A NCAC 02C well construction standards.

POTABLE WATER SUPPLY WELL SAMPLING

54. Collect a potable water supply well sample from each potable water supply well that is within 1,000 feet of the delineated WDA boundary according to the procedure outlined in Appendix B, Section 8.
55. Provide a map, titled “Potable Water Supply Well Sampling,” that includes the following:
 - a. unique identifier for each potable water supply well;
 - b. location of each potable water supply well; and
 - c. analytical results detected above applicable Federal Maximum Contaminant Levels (MCL), 15A NCAC 02L standards or Interim Maximum Allowable Concentrations (IMAC) if final standards are not available.
56. Provide a table, titled “Potable Water Supply Well Sampling,” that includes the following:
 - a. unique identifier for each potable water supply well; and
 - b. analytical results compared to MCL, 15A NCAC 02L standards or IMAC if final standards not available.

LANDFILL GAS PROBE INSTALLATION AND MONITORING

57. Landfill Gas Probe Installation:

Landfill gas probes must be installed with a minimum spacing of one probe every two acres across the WDA. If the WDA is less than two (2) acres in size, install at least one probe. The Unit PM may request additional probes based on site conditions, such as when the WDA is within 500 feet of structures or the property boundary or if a passive venting system will need to be designed. The Unit PM may adjust the total number of probes based on the size of the WDA (greater than 20 acres) and the location of existing or future structures.

- a. install landfill gas probes within the WDA at locations designated by the Unit PM, according to the minimum requirements outlined in Section 12 of Appendix B.
- b. the Unit PM will specify landfill gas probe type and construction based on site conditions.
- c. if landfill gas probes cannot be constructed according to the approved work plan and minimum requirements (Appendix B), contact the Unit PM, and document any variances.

58. Landfill Gas Sample Collection:

Landfill Gas Sampling should be conducted in accordance with the NCDEQ DWM Vapor Intrusion Guidance including subsequent amendments and editions available for download for the Division’s website [DWM Vapor Intrusion Guidance \(March 2018\)](#)

Gas sample collection should also be conducted in accordance with Appendix B (*Field Procedures and Sample Collection Techniques*) and Appendix D (*Laboratory Analytical Parameters*).

The Unit PM will specify the location and sample method for gas sampling. The Unit PM may request the following sampling methods and parameter.

- a. Field Instrument Measurements (Appendix B – Section 15)
 - i. methane
 - ii. hydrogen sulfide
 - iii. oxygen
 - iv. carbon dioxide
 - v. ambient barometric pressure
 - vi. VOCs
 - vii. ambient temperature at time of screening
 - viii. relative humidity
- b. Summa Canister Sample Collection (Appendix B – Section 16)
 - i. VOCs
- c. Tedlar Bag Sample Collection
 - i. hydrogen sulfide
- d. Sorbent Tube Sample Collection
 - i. mercury
 - ii. other contaminants of concern
- e. Flux Chamber Installation and Sample Collection (Appendix B – Section 17)
 - i. VOCs
- f. Passive Soil Gas Sample Collection (Appendix B - Section 18)
 - i. VOCs

The Unit PM may also request the following actions:

- g. Landfill Gas Probe Inspection (Appendix B – Section 14)
- h. Landfill Gas Probe Gauging (Appendix B – Section 20)
- i. Landfill Gas Probe Static Pressure Measurements (Appendix B – Section 21)

The following should be included in reports to the Unit:

- j. a representative picture of the setup for each type (summa cans, sorbent tubes, etc.) of gas sampling (one per event);

59. Provide a map, titled “Landfill Gas Probe Results,” that includes the following:

- a. unique identifier for each landfill gas probe;
- b. location of landfill gas probes;
- c. unique identifiers and boundaries for each exposure unit;
- d. risk calculator results for each sample location or exposure unit, as determined by the Unit PM, that includes the following:
 - i. resident carcinogenic risk;
 - ii. resident hazard index;
 - iii. non-resident carcinogenic risk; and
 - iv. non-resident hazard index;
- e. identify the landfill gas probes with detections using field instruments in accordance with Appendix B, Section 4 (*Field Instrument Parameters and Equipment Requirements*).

60. Provide a table, titled “Landfill Gas Probe Results,” that includes the following:

- a. unique identifier for each gas probe grouped by exposure unit;
- b. field measurement results as outlined in Section 58;

- c. contaminant concentrations for all detected compounds in summa canister samples;
- d. identify concentrations used for DEQ risk calculator for each exposure unit; and
- e. risk calculator results for each sample location or exposure unit, as determined by the Unit PM, that includes the following:
 - i. resident carcinogenic risk;
 - ii. resident hazard index;
 - iii. non-resident carcinogenic risk; and
 - iv. non-resident hazard index;

METHANE ASSESSMENT

61. Methane assessment must be completed if methane is greater than 1.25% by volume (12,500 ppm of methane in air equals 1.25% by volume or 25% of the LEL) in any landfill or soil gas probe and if existing or future structures are located on or within 500 feet of the delineated WDA boundary. Delineate methane until the percent by volume is less than 1.25% in soil gas (or no more than global background).

STRUCTURAL VAPOR INTRUSION

Important: Once groundwater investigation and WDA landfill gas probe sampling is complete, a structural vapor intrusion investigation will be necessary if contaminants exceed the target risk in the DEQ risk calculator. The structural vapor intrusion investigation should evaluate current and future structures on or within 500 feet of the WDA perimeter and within 100 feet of the perimeter of groundwater volatile organic contaminant plumes.

62. Collect soil gas samples in locations designated by the Unit PM using batch-certified Summa canisters or passive soil gas samplers for VOC analysis in accordance with Appendix D, *Laboratory Analytical Parameters*. Sample collection must comply with the DWM Vapor Intrusion Guidance (in particular, collection protocols and Appendix B within the DWM Vapor Intrusion guidance). Soil gas samples should be collected ideally ten feet bgs. However, sampling in areas of elevated groundwater contamination (source area) and/or closer to the water table will provide a conservative screen.

Note: Samples should only be analyzed for VOC contaminants previously detected and their degradation products using Method TO-15.

Note: If land use restrictions will be employed at the property so that no structures will be allowed on the landfill, no further structural vapor intrusion evaluation is needed on the WDA.

63. Provide a map(s), titled "Soil Gas Probe Results," that includes the following:
- a. unique identifier for each soil gas probe;
 - b. location of soil gas probes;
 - c. unique identifiers and boundaries for each exposure unit;
 - d. risk calculator results for each sample location or exposure unit, as determined by the Unit PM, that includes the following:

- i. resident carcinogenic risk;
- ii. resident hazard index;
- iii. non-resident carcinogenic risk; and
- iv. non-resident hazard index.

64. Provide a table(s), titled “Soil Gas Probe Results,” that includes the following:
- a. unique identifier for each gas probe or passive sampler grouped by exposure unit;
 - b. sample date(s);
 - c. sample probe depth (if applicable);
 - d. contaminant concentrations for all detected compounds in summa canister or passive sampler analytical results;
 - e. concentrations used for DEQ risk calculator for each exposure unit; and
 - f. risk calculator results for each sample location or exposure unit, as determined by the Unit PM, that includes the following:
 - i. resident carcinogenic risk;
 - ii. resident hazard index;
 - iii. non-resident carcinogenic risk; and
 - iv. non-resident hazard index.

Important: The Unit PM will determine the exposure units, exposure scenarios, and sample locations to be used in the DEQ risk calculator.

65. Evaluate laboratory analysis data using the DEQ risk calculator and submit the results to the Unit PM.

Note: If the results of the soil gas testing exceed the DEQ risk calculator target risk, further vapor intrusion evaluation will be needed. Soil gas samples close to structures (current or potential future structures) may be the next step.

66. Collect crawlspace gas samples for laboratory analysis from buildings identified by the Unit PM in accordance with the following:
- a. samples must comply with the DWM Vapor Intrusion Guidance (in particular, collection protocols and Appendix B within the DWM Vapor Intrusion guidance);
 - b. survey the crawlspace for background sources;
 - c. if present, remove background sources 24 to 72 hours prior to sample collection;
 - d. document background sources that cannot be removed and collect photos;
 - e. screen for the following using field instrumentation to locate points of vapor entry and background sources to assist in determining sample locations, and report each parameter in the units as outlined in Appendix B:
 - i. methane;
 - ii. oxygen;
 - iii. carbon dioxide;
 - iv. barometric pressure;
 - v. hydrogen sulfide;
 - vi. volatile organic compounds (VOCs);
 - vii. temperature; and

- viii. humidity;
 - f. confirm that exhaust fans, clothes dryers, fireplaces, and other items that may induce short term pressure changes are inoperable during the sampling event;
 - g. collect samples using batch-certified Summa canisters and analyze for only contaminants detected at the site and their degradation products;
 - h. collect an exterior upwind background air sample initiated one hour prior to the collection of the crawlspace samples;
 - i. continuous supervision of the equipment by the consultant performing the test or secured access is required; and
 - j. before moving to indoor air sampling, evaluate laboratory analysis data using the DEQ risk calculator and submit the results to the Unit PM.
67. Collect indoor air samples for laboratory analysis for buildings and locations identified by the Unit PM in accordance with the following:
- a. samples must comply with the DWM Vapor Intrusion Guidance (in particular, collection protocols and Appendix B within the DWM Vapor Intrusion guidance);
 - b. survey the interior of the structure for background sources;
 - c. if present, remove background sources 24 to 72 hours prior to sample collection;
 - d. document background sources that cannot be removed and collect photos;
 - e. screen for the following using field instrumentation to locate points of vapor entry and background sources to assist in determining sample locations, and report each parameter in the units as outlined in Appendix B:
 - i. methane;
 - ii. oxygen;
 - iii. carbon dioxide;
 - iv. barometric pressure;
 - v. hydrogen sulfide;
 - vi. volatile organic compounds (VOCs);
 - vii. temperature; and
 - viii. humidity;
 - f. confirm that exhaust fans, clothes dryers, fireplaces, and other items that may induce short term pressure changes are inoperable during the sampling event;
 - g. collect samples using individually-certified Summa canisters and analyze for only contaminants detected at the site and their degradation products;
 - h. collect an exterior upwind background sample initiated one hour prior to the collection of the indoor air samples; and
 - i. continuous supervision of the equipment by the consultant performing the test or secured access is required.
68. Provide a table, titled “Structural Vapor Intrusion,” that includes the following:
- a. unique identifier for structures screened for vapor intrusion;
 - b. concentrations used for DEQ risk calculator for each exposure unit; and
 - c. risk calculator results for each sample location or exposure unit, as determined by the Unit PM, that includes the following:
 - i. resident carcinogenic risk;
 - ii. resident hazard index;

- iii. non-resident carcinogenic risk; and
- iv. non-resident hazard index.

Important: Contact the Unit PM immediately upon receipt of any indoor air samples that exceed the DEQ risk calculator target risk.

CONTAMINANT SOURCES AND IMPACTED RECEPTORS

- 69. Identify contaminant sources that maybe contributing to the potential and/or documented contamination at the pre-1983 landfill.
- 70. Provide a map, titled “Contaminant Sources and Impacted Receptors,” that includes the following:
 - a. unique identifier for points of contamination and impacted receptors;
 - b. location of each impacted receptor;
 - c. contaminants with associated concentrations impacting each receptor; and
 - d. iso-concentrations for each contaminant.
- 71. Provide a table, titled “Contaminant Sources and Impacted Receptors,” that includes the following:
 - a. unique identifier for points of contamination and impacted receptors; and
 - b. contaminants (including degradation products) in concentrations by media type.

WASTE CHARACTERIZATION (CONSOLIDATION, TOTAL REMOVAL OR HOT SPOT ASSESSMENT)

Important: The Unit PM will request waste characterization for sites that qualify for waste consolidation or removal. In addition to characterizing the waste, an estimated volume, reported in cubic yards, will be required. Generally, if the waste is to remain in place, characterization will not be required.

Note: After waste removal, native soils below removed waste must be sampled and the results compared to background soil concentrations. The analytical results must be entered into the DEQ risk calculator for final evaluation. Note that this comparison for soils is not required if contaminant concentrations are below natural background concentrations.

- 72. Characterize buried waste at the WDA by completing the following:
 - a. advance HSA borings or other Unit approved methods in the locations identified by the Unit PM;
 - b. continuously log each boring and characterize (describe) the waste/soil encountered;
 - c. provide boring logs with the following information:
 - i. ground elevation;
 - ii. soil cover thickness;
 - iii. waste description and soil lithology based on Unified Soil Classification System;
 - iv. soil contamination ranges;
 - v. top of waste elevation; and
 - vi. thickness of waste;

- d. collect solid media samples from each boring from intervals below ground surface provided by the Unit PM;
 - e. collect solid media samples from the highest readings recorded, using a PID instrument, for analysis and identify the sampled interval(s);
 - f. collect one sample from native soil 1-2 feet beneath waste;
 - g. provide a description of the buried waste; and
 - h. provide an estimated volume of buried waste and impacted soil in cubic yards to be removed to restore the area to unrestricted use.
73. Provide a map(s), titled “Waste Characterization Borings,” that includes the following:
- a. unique identifier for each waste characterization boring;
 - b. locations of all waste characterization borings;
 - c. soil cover iso-thickness contours;
 - d. waste iso-thickness contours; and
 - e. hazards requiring special management during removal (asbestos, high methane, high VOCs...)
74. Provide a table, titled “Waste Characterization Borings,” that includes the following:
- a. unique identifier for each waste characterization boring;
 - b. thickness of waste (reported in feet) in each waste characterization boring;
 - c. depth (reported in feet) to native soil below waste;
 - d. PID field screening results for each waste characterization boring; and
 - e. waste characterization analytical results compared to permitted receiving facility requirements.
75. Provide a table, titled “Native Soil Beneath Waste,” that includes the following:
- a. unique identifier for each native soil sample;
 - b. analytical results (detections only);
 - c. identify concentrations used for DEQ risk calculator;
 - d. provide the output data from the DEQ risk calculator;
 - e. identify concentrations exceeding background sample results; and
 - f. if analytical results exceed background sample results and pose a health risk, compare results to permitted receiving facility requirements.

RI SUMMARY REPORT

Once the Unit PM is satisfied the RI phase is complete the Contractor PM will receive authorization to draft the RI summary report according to the requirements outlined in Appendix E, *Remedial Investigation Summary Report Template*.

RECORDATION OF NOTICE PLATS

1. Notice Plats, approved by the Unit, may be recorded upon completion of the remedial investigation. A Notice may be recorded for all properties contaminated with physical waste and impacted by migrating contaminated groundwater and/or landfill gas.
2. A Notice Plat will not be required for a property where the remedial action plan will be to restore the property to unrestricted use standards.
3. Instructions for preparing a Notice Plat and recordation instructions are outlined in Appendix A, *Instructions for Preparing a Notice Plat for Recordation*.

REMEDIAL ACTION PHASE

RECORDATION OF LAND USE RESTRICTIONS

1. Land use restrictions, approved by the Unit, must be recorded prior to the Unit authorizing the implementation of the RAP. On properties contaminated by the site, but outside the WDA, a land use restriction instrument alone may be recorded depending on the nature of the contamination.
2. Land use restrictions will not be required for a property where the remedial action plan is to restore the property to unrestricted use standards.

REMEDIAL ACTION PLAN DESIGN

The Unit PM and Unit Supervisor will meet with the assigned Contractor PM to discuss a WDA remedy and any remedy for other contaminated media (i.e. groundwater, surface water, vapor or exposed contaminated soils) based on risks posed and determine the appropriate risk based remedial activities for the site. The Unit PM will authorize the RAP design phase after the review meeting. The Contractor PM is responsible for acquiring all applicable permits and approvals during the RAP design phase to ensure there is not a delay implementing the RAP.

Non-containment remedies may be evaluated at landfills with less than 5,000 cubic yards of waste. This is especially important at landfills having groundwater contamination and/or those having the potential for vapor intrusion into structures.

1. Elements of the remedy may include the following, but final remedy elements are determined by site specific conditions, risk, and cost:
 - a. removal and proper disposal of any exposed waste and/or surface debris;
 - b. excavation and removal of waste “hotspots” causing localized groundwater or vapor contamination;
 - c. consolidation of waste on to one property (minimal waste volume, absence of ACM, and property owner permission to consolidate);
 - d. additional efforts to stop leachate seepage;
 - e. excavation of waste in easements to clear utility corridors;
 - f. excavation of waste to create a buffer between the WDA and/or other receptors;
 - g. slope stabilization; and
 - h. installation of an engineered WDA cover system (containment remedies).

At a minimum, the RAP must include the following:

Note: This is not an exhaustive list of RAP criteria and the Unit may request additional items for consideration during the RAP design phase to address site specific conditions.

2. A summary of the results of the RI including media contaminated, contaminants of concern and the areal and vertical extent of contamination.
3. A brief evaluation of available risk-based remedial alternatives (soil cover with geotextile, soil cover with geoweb, or a combination of geotextile and geoweb) using the following feasibility study criteria:
 - a. protection of human health and the environment, including attainment of cleanup levels;
 - b. compliance with applicable federal, state and local regulations;
 - c. long-term effectiveness and permanence;
 - d. reduction of toxicity, mobility and volume;
 - e. short-term effectiveness (i.e., effectiveness at minimizing the impact of the site remedial action on the environment and the local community);
 - f. implementability (i.e., technical and logistical feasibility, including an estimate of time required for completion);
 - g. cost; and
 - h. community acceptance.
4. A detailed description and conceptual design of the proposed remedy, for each contaminated medium including an evaluation of the potential for the remedy to affect sensitive environments identified.
5. A description of well installation and abandonment, stormwater management and management of investigation and remedial action derived wastes (i.e. purge water and drill cuttings).
6. Mitigation measures pertaining to Waters of the United States (404/401 permits, buffer permitting and pre-construction notifications).
7. Planned erosion and sediment control (E&SC) measures must be designed to satisfy the regulatory requirements of the Division of Energy, Mineral & Land Resources (DEMLR). To

assist with the production of an approvable E&SC permit, the Contractor design engineer should consult with the Unit and the DEMLR prior to submittal.

8. A description of procedures and a schedule for construction, implementation, operation and maintenance, system monitoring and performance evaluation, and progress reporting. The construction schedule must include the total time needed to complete the remedy plus the average number of adverse weather days for the proposed time of year. The number of proposed adverse weather days per month is determined using 24-hour rain event volumes, averaged for the past three calendar years, and the impact of that volume to the on-site soil type. One-quarter inch of rain in 24 hours may be enough to impact a clay rich site, while one-inch of rain may be needed to impact a site consisting of mostly sand. The expectation is to develop a realistic construction schedule to include the average number of adverse weather days.

Important: The National Oceanic and Atmospheric Administration (NOAA) should be used to establish the number of proposed adverse weather days per month using the following website: <https://www.ncdc.noaa.gov/cdo-web/datatools/lcd>. Select the county corresponding to the location of the pre-1983 landfill and add the county station to the cart. Once added to the cart, select the file format, daily output and the date range for the requested report.

9. A description of procedures for post-remedial and confirmatory sampling for any areas of contaminated soil removal.
10. Identification of off-site borrow material that will be used for the engineered WDA cover system. Fill must be evaluated pursuant to the guidance outlined in Appendix G, *Borrow Soil Location and Sampling Procedure*.
11. An evaluation of the off-site borrow material analytical results using the DEQ risk calculator to ensure the material is acceptable for use in the engineered WDA cover system. The risk calculator results must be submitted to the Unit PM for review before any material is transported to the site.
12. An evaluation of surface preparation techniques and engineered WDA cover systems according to the guidance outlined in Appendix H, *Engineered Cover Systems*.
13. A description of procedures for establishing a vegetative cover as a component of the engineered WDA cover system.
14. A health and safety plan that assures that the health and safety of nearby residential and business communities will not be adversely affected by exposure to site contaminants and activities related to the remedial action. The plan should conform to all local, state, and federal regulations for health and safety.
15. Equipment and personnel decontamination procedures.
16. All professional work must be signed and sealed by the appropriate professionals, if necessary (e.g., licensed geologist, registered professional engineer, etc.). A single document may require the signature and seal of more than one professional.

PUBLIC COMMENT

1. All draft RAPs must be made available for public comment prior to final approval by the Unit and implementation.
2. Before the Unit approves the draft RAP, the Unit will distribute copies to the following:
 - a. impacted property owners (parcels containing the WDA and adjoining parcels);
 - b. local government officials (city/town manager or county manager depending on the location of the pre-1983 landfill);
 - c. the county health director; and
 - d. the public library closest to the site location.
3. Before the Unit approves each draft RAP, the Unit will give notice of the proposed plan by publishing weekly for a period of three consecutive weeks in a newspaper having general circulation in the county or counties where the site is located and by mail to persons that have requested to be on the mailing list for the site in accordance with NCGS 130A-310.4(c)(2).
4. The public comment period must remain open for 45 days after the three-week publication in a local newspaper to allow for receipt of written comments before the RAP is approved.
5. The Unit will conduct a hearing if there is significant public interest at the site:
 - a. the hearing date and time will be posted 30 calendar days in advance of the scheduled hearing; and
 - b. the public comment period will extend to 20 calendar days after the date of the scheduled hearing.
6. All public comments will be evaluated and considered before finalizing the draft RAP.

REMEDIAL ACTION IMPLEMENTATION

The RA phase is the implementation of the final RAP. The Contractor PM must submit a final RAP to the Unit based on applicable public comments, prior to commencement of RAP activities and include an updated implementation timeline.

WDA REMEDY

1. The Contractor PM will prepare a request for proposal (RFP) for advertisement, in accordance with NCGS Chapter 143, Articles 3D and 8, to select a sub-contractor to implement the construction components of the RAP.
2. A pre-bid meeting will be held for all interested parties at the WDA.
3. The RFP advertisement must be published for 15 calendar days and include the following:
 - a. WDA name and location;
 - b. location of bidding documents drafted by the Contractor (Contractor website);
 - c. contractor PM contact information (name, phone number and email); and
 - d. day, time and location when the sealed bids will be opened.

SOIL, GROUNDWATER AND WASTE HOT SPOT REMEDIATION

4. Active soil remediation will most often precede WDA remediation unless incorporated in the waste.

REMEDIAL ACTION PROGRESS REPORTS

Daily remedial action progress reports must be submitted to the Unit PM.

5. The daily progress report must include the following:
 - a. pre-1983 landfill name and identification number;
 - b. location;
 - c. date;
 - d. temperature (°F);
 - e. weather;
 - f. name, company affiliation and title for all personnel on-site;
 - g. equipment:
 - i. description;
 - ii. number on-site; and
 - iii. number in-use;
 - h. narrative outlining all activities for the day listed by applicable time the action occurred;
 - i. Operation and maintenance results, if needed;
 - j. Discussion of major problems, if encountered;
 - k. Attestation that a request for a cost adjustment is or is not required at this time;
 - l. signature of on-site Contractor representative; and
 - m. photographs documenting the daily activities.
6. The progress report must include the following:
 - a. operation and maintenance results; and
 - b. discussion of major problems encountered.

REMEDIAL ACTION COMPLETION REPORT

Remedial action completion reports must be submitted to the Unit within 30 calendar days of the Division of Energy, Mineral and Land Resources (DEMLR) closing the erosion and sedimentation control permit for the site.

7. The RA completion report must include the following:
 - a. results of the remedy;
 - b. final drawings (as-built plans and specifications);
 - c. summary of variances from the final design plans (approved work variances and change orders);
 - d. summary of any problems encountered during construction;
 - e. post remedy confirmation sampling;
 - f. monitoring requirements;
 - g. appropriate certification statements or forms;
 - h. verification DEMLR closed the erosion and sedimentation control permit and all erosion control measures have been removed from the site;

- i. photographic record of completed RAP;
- j. summary of remedial action operating experience and effectiveness in meeting design specifications; and
- k. discussion of criteria for remedial action completion.

8. For remedial action completion the following certification language must also be included in the report:

“I certify that, to the best of my knowledge, after thorough investigation, the information contained in or accompanying this certification is true, accurate, and complete.”

APPENDIX A: INSTRUCTIONS FOR PREPARING A NOTICE PLAT FOR RECORDATION

The following is a list of instructions to assist in the preparation and recordation of a survey plat that serves as a Notice of Environmental Contamination and institutional control (Notice Plat).

Populate/modify the italicized text within the brackets [*fill in*] to reflect site specific information.

1. The Notice Plat of the subject property must be prepared and certified by a professional land surveyor registered in North Carolina. Every notice plat should cover the entire property unless the property is extremely large or otherwise problematic to resurvey. The modification of an existing survey prepared by another surveyor is allowed if approved by the Unit PM.
2. The Notice Plat must meet the requirements of NCGS 47-30 for maps and plats (some, but not all are specified below) and any requirements of the Register of Deeds in the county where the site is located. The notice plat must be drawn in indelible ink on mylar (no sepia mylar). In certain circumstances as specified in NCGS 47-30 the plat may be submitted in the form of black line on white paper instead of transparent and archival, and include:
 - a. a title block located at one of the plat perimeters with the following:
 - i. Notice of Environmental Contamination or Notice of Restricted Use NCGS 130A-310.8;
 - ii. the name of the site and the PRLF identification number (precede with the phrase "A portion of the Site:" if the property is but one part of the overall contaminated site);
 - iii. the names of the current owner(s) exactly as they appear on the existing property deed;
 - iv. the property township, county and state, the date(s) of the survey, a scale, and name and address of surveyor or firm preparing the plat;
 - b. property lines with bearings and distances, a north arrow (specifying whether true or magnetic), datum used (NAD 83 or NAD 27) or references to previously recorded deed or plat bearings (if based on magnetic north or referenced to previously recorded deed or plat bearings, must include the date and source the index was originally determined);
 - c. identification of all adjacent property owners;
 - d. a vicinity map;
 - e. unique site features;
 - f. on-property structures;
 - g. a notes section including the following information:
 - i. the type, location, and quantity of hazardous substances known to exist on the site in each environmental medium (soil, groundwater, surface water, and sediment);
 - ii. the following language: "The contaminant information identified on this Notice Plat is based on the best available information at the time of filing";
 - iii. if the Notice Plat is being recorded in conjunction with the recordation of a Land Use Restrictions document, the following language: "A Land Use Restrictions document entitled "[*enter the appropriate title, e.g., Declaration of Perpetual Land-Use Restrictions*]" limiting the uses of this property, is being recorded concurrently with this Notice Plat";

iv. the following instructional language (shown in the box below):

When this property or any part of it is sold, leased, conveyed or transferred, North Carolina law requires that the following language be placed in the description section of the deed or other instrument of transfer in no smaller type than that used in the body of the deed:

Hazardous substances are present in environmental media at this property. A Notice Plat is recorded at the [fill in] County Register of Deed's office in Map Book [fill in], Page [fill in].

- h. with respect to a surveyed corner of the affected property, the location and dimensions of areas of the property where hazardous substances are known to have been disposed (only areas with distinct boundaries such as landfills, trenches, and open impoundments or pits; not spills or indistinct releases);
 - i. the location of areas exceeding unrestricted use standards (groundwater contaminant plume);
 - j. delineated waste disposal area;
 - k. with respect to a surveyed corner of the affected property, the location of on-site wells (potable, production, monitoring and any other type) where hazardous substances have been detected in groundwater, unless each hazardous substance detected has an associated 15A NCAC 2L groundwater standard and the concentration is below such standard; and
 - l. the surveyor's certification and seal (using a permanent ink stamp) which includes, but is not limited to, specification of the source of information for the plat, the ratio of precision, and the type of survey pursuant to NCGS 47-30 (f)(11).
3. In cases where a Notice Plat is needed on a nearby, non-source property because the property's groundwater is currently affected or could become affected by the source property contamination in the future, the notes section should include the following:
- a. the condition of groundwater at the property (e.g., current, predicted, or threat of groundwater contamination). In the latter case, the notes should state that the property is currently not affected by the identified source-property contamination, but based on the information collected to date, a threat of contamination may exist if a water supply well(s) are installed on the property;
 - b. the following language (shown in the box below):
- Pursuant to 15A North Carolina Administrative Code 02C .0107 (b)(1), the source of water for any water supply well shall not be from a water bearing zone or aquifer that is contaminated. Therefore, state law prohibits construction of a water supply well on this property. Further, pursuant to North Carolina General Statute 87-88(c) and 15A North Carolina Administrative Code 02C .0112(a), no well may be constructed or maintained in a manner whereby it could be a source or channel of contamination of the groundwater supply or any aquifer.
- c. reference to any local ordinances relating to groundwater use (water line connection requirements, well-installation prohibitions or groundwater-use restrictions, for example);

d. the following language positioned in the upper left corner of the plat:

Approved for the purposes of [fill in the appropriate statutory reference from the table].

[Enter the appropriate representative, e.g., Jim Bateson, LG]
[Chief, Superfund Section]
[Division of Waste Management]

NORTH CAROLINA
WAKE COUNTY

I, _____, a Notary Public of said County and State,
do hereby certify that _____ did personally
appear and sign before me this the _____ day of _____, ____.

Notary Public (signature)

My commission expires _____, _____. (official seal)

e. owner acknowledgement consisting of the printed name(s), title(s) and properly notarized (using a permanent ink stamp) signature(s) (signature(s) made in indelible ink) of individual(s) with authority to legally bind the property owner(s), with the following language:

This certifies that the undersigned is (are) the owner(s) of the property shown on this map.

[Owner or Owner's Representative signature]

[Owner or Owner's Representative Name]

[Owner or Owner's Representative Title and Organization]

[State]
[County]

I, _____, a Notary Public of said County and State, do
hereby certify that _____ did personally
appear and sign before me this the _____ day of _____, ____.

Notary Public (signature)

My commission expires _____, _____. (official seal)

4. The draft Notice Plat must be delivered directly to the Unit PM for review. After receiving approval from the Unit PM, the final Notice Plat must be delivered to the Unit PM at one of the addresses below (Do Not Fold Document):

Via Overnight Courier or Hand Delivery

NC Division of Waste Management
Pre-Regulatory Landfill Unit
DEQ Office Building
217 W. Jones Street
Raleigh, NC 27699

Or

Via US Mail

NC Division of Waste Management
Pre-Regulatory Landfill Unit
1646 Mail Service Center
Raleigh, NC 27699-1646

5. After the Unit approves and certifies the Notice Plat, the Contractor PM must, within fifteen days of receiving said approval:
 - a. file a certified copy of the Notice Plat in the site's county Register of Deeds' office; and
 - b. send the Unit PM, (1) an electronic version of the Notice Plat affixed with the seal of the Register of Deeds and reflecting the book and page number where recorded, and (2) an electronic copy of the page in the grantor index where the Notice Plat is referenced.

Important: If the Notice Plat is being recorded concurrently with a Declaration of Perpetual Land Use Restrictions (DPLUR) document, these documents must be recorded as follows: The Notice Plat must be recorded first and assigned book and page numbers. The book and page numbers where the Notice Plat is recorded must be handwritten in the designated blanks on the DPLUR document prior to the DPLUR document being recorded.

APPENDIX B: FIELD PROCEDURES AND SAMPLE COLLECTION TECHNIQUES

Sample collection and analyses must be performed by persons who are qualified by education, training, and experience. Field procedures relating to sample collection techniques, sample containers, sample preservation, sample holding times equipment decontamination and field measurement procedures, must comply with the most current version of the United States Environmental Protection Agency (USEPA) Region IV Science And Ecosystem Support Division (SESD) *Field Branches Quality System and Technical Procedures*. The technical procedures are available at the following website:

<https://www.epa.gov/quality/quality-system-and-technical-procedures-lsasd-field-branches>

In addition to the standard protocols outlined in the USEPA technical procedures referenced above, the following are required:

1. Collect GPS coordinates of all sample locations (soil, sediment, borings, gas probes, and monitoring wells) and if needed, stake and flag until the remedial investigation is complete.
2. Survey grade data is required for monitoring well(s) top of casing.
3. Field QC samples are required for each sampling event (field day) and each laboratory if different laboratories are utilized for the same sampling event. Include the following for each sampling event unless additional QA/QC testing is specified by the Unit PM:
 - a. one duplicate sample (for multi-point soil or monitoring well sampling events only):
 - i. per medium; and
 - ii. per container type;
 - b. one equipment rinsate blank collected prior to sample collection; and
 - c. trip blank.
4. Field Instrument Parameters and Equipment Requirements.

Portable field instrumentation must be capable of detecting the following parameters:

 - a. methane instruments must have an infrared sensor capable of detecting methane at 2,500 ppm or 0.25% by volume of air and 5% LEL. Methane must be reported in three formats:
 - i. percent of lower explosive limit (% LEL);
 - ii. percent by volume in air (% bv); and
 - iii. micrograms per cubic meter ($\mu\text{g}/\text{m}^3$);
 - b. oxygen as percent by volume in air (% bv);
 - c. carbon dioxide as percent by volume in air (% bv);
 - d. barometric pressure (inches Hg);
 - e. hydrogen sulfide instrumentation for ambient air measurements must have a gold film sensor or equivalent and instrumentation for subsurface measurements must have an attachment with an infrared sensor. Instrument detection limits must meet the IHSB residential vapor intrusion screening levels. Hydrogen sulfide must be reported in the following formats:
 - i. percent by volume in air;
 - ii. parts per million (ppm); and
 - iii. micrograms per cubic meter ($\mu\text{g}/\text{m}^3$);
 - f. volatile organic compounds (VOCs by PID) as micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) and parts per million (ppm);

- g. temperature as degrees Fahrenheit;
 - h. relative humidity as percent (%); and
 - i. mercury as $\mu\text{g}/\text{m}^3$, minimum detection limit of $25 \mu\text{g}/\text{m}^3$.
5. Field Instrument Calibration Data, Quality Assurance Data and Reporting Requirements.
Include all of the following in the landfill gas evaluation report:
- a. instrument manufacturer;
 - b. model number;
 - c. serial number;
 - d. date of factory calibration (annual) and maintenance parameters;
 - e. instrument detection limits (upper and lower);
 - f. field calibration data:
 - i. date and time of field calibration (must be same day as screening);
 - ii. bump test(s) to verify proper calibration and instrument accuracy is maintained before, during and after evaluation;
 - iii. type(s) of calibration gas and expiration dates; and
 - iv. additional field calibration if specified by the manufacturer due to changing weather conditions (such as barometric pressure, temperature, etc.);
 - g. field conditions:
 - i. name(s) of person conducting the evaluation;
 - ii. brief description of weather conditions and other possible impacts on data: windy, nearby exhaust from vehicles etc.;
 - iii. date and time began/end of field screening; and
 - iv. ambient temperature, humidity and barometric pressure readings (collected at least hourly during field sampling).
6. Field Instrument Landfill Gas Survey Results
Provide a table in the landfill gas evaluation report that includes the following:
- a. sample location;
 - b. instrument readings;
 - c. observations that may affect the results like a water trap, filters, increasing barometer pressure, significant change in the temperature, etc;
 - d. at least two (2) readings must be recorded and reported anywhere there is equal to or greater than 2% change in the reading; and
 - e. two readings must be recorded for the background locations and two other randomly selected monitoring points for all direct read instruments.

Note: Manufacturer calibration is not the same as field calibration.

7. Sampling must be planned so that required holding times for analytical methods are met.

8. Potable Water Supply Well Sampling

Potable water supply well sampling must comply with the following:

- a. record the location of each water supply well using a hand held GPS unit in accordance with the spatial data requirements outlined in this document;
- b. photograph each water supply well to document the following:

- i. well location related to the residence (view from driveway if both residence and well can be captured in the same frame showing house number);
 - ii. current condition of the wellhead; and
 - iii. sampling location (valve at wellhead or hose bib on residence);
 - c. record the sampling location and document if the sample is collected downstream of pressure tanks, filtration systems, or other devices (i.e. valve at wellhead or hose bib outside the house);
 - d. do not remove or alter insulation, heat tape or other site specific items that the homeowner has installed on their wellhead (document the current condition and sample the well as close to the wellhead as possible);
 - e. record site specific conditions that might impact the well (debris surrounding the well or industrial operations);
 - f. water supply well sampling steps (collect a total of 3 samples, pre-purge, 15-minute purge and additional 15-minute purge, and the sample with the lowest turbidity reading will be analyzed):
 - i. collect initial turbidity reading and sample if the well has been in use that day;
 - ii. purge tap for 15 minutes;
 - iii. collect additional turbidity, conductivity and pH (at least 3 sets) readings during purging;
 - iv. collect additional sample if the post-purge turbidity is lower than the pre-purge turbidity reading and discard the pre-purge sample;
 - v. if post-purge turbidity reading has increased, purge an additional 15 minutes and recheck turbidity;
 - vi. if turbidity is lower, follow the procedure in Section 8(f)(iv); and
 - vii. if turbidity is higher, collect and filter sample and analyze with initial unfiltered (pre-purge) sample at the site. Only analyze for contaminants detected in groundwater and their degradation products unless a groundwater investigation has not been conducted. In which case, only analyze for VOCs, but include all US EPA Target Compound List analytes;
 - g. record the amount of time the well was purged in minutes;
 - h. document the total volume of water purged;
 - i. prepare trip blanks for each sampling event (if more than one laboratory is used, each laboratory must have a trip blank for analysis);
 - j. for sites with a completed remedial investigation, include only contaminants identified including TICs (library search) if retained as contaminants of concern and the degradation product of the contaminants; and
 - k. samples collected for Volatile Organic Analysis (VOA) should be collected directly into sample containers without mixing. Composite samples are not permitted.

9. Groundwater Samples

The following must be considered when collecting groundwater samples:

- a. filtration of samples for metals analysis before acid digestion is not permitted (See exception for hexavalent chromium in water in Appendix D);
- b. if turbidity is a problem:
 - i. collect samples using low-flow purging and sampling techniques; or
 - ii. passive bag samplers;

- c. additional well development may be necessary; and
- d. rapid analysis is recommended to reduce contact time with the acid preservative.

10. Surface Water Samples

The following must be considered when collecting surface water samples:

- a. shallow surface waters (less than six inches deep) or highly turbid, samples may be collected in a separate collection container and then decanted into the sample container;
- b. samples for VOA must be decanted into the sample container immediately;
- c. samples for metals analysis may be allowed to settle for a few minutes prior to decanting; and
- d. all collection containers must be made of the same materials, be pre-cleaned and handled in the same manner as the sample container.

11. All soil, sediment and waste samples for VOA should be collected directly into sample containers without mixing.

12. Landfill Gas Probe Installation:

The Unit PM will specify landfill gas probe type and construction based on site conditions. The following minimum requirements should be considered during landfill gas probe construction:

- a. typical landfill gas probe construction configurations are shown as Figure 1 and the two options presented in the LADBS Site Testing Standards for Methane (January 2014) available for download from the [City of LA Department of Building and Safety](#);
- b. gas probes should be sealed at least five feet below ground surface (shallower depths may draw air from the surface) and the screened interval must be at least two feet above seasonal high groundwater (if encountered);
- c. the minimum screen length for probes constructed of PVC is two feet; but five feet of screen is optimal.
- d. an air-tight cap/seal and sampling port should be installed at the surface termination of the PVC casing and can consist of a slip-cap, stopper, or threaded fittings;
- e. the cap/seal should allow for tubing to extend to the screened interval of the PVC probe;
- f. PVC glues, caulking or other substances with the potential to off-gas VOCs should not be used during PVC probe construction;
- g. a two-way valve and tubing should be installed to the cap/seal to allow for sampling and the valve should remain in the closed position until sample tubing and instrumentation is connected;
- h. gas probes are not required to have a protective lockable casing unless in areas accessible to the public;
- i. where applicable, a permanently affixed identification plate should be included with the date of probe completion, total probe depth, screen length, and probe ID number.
- j. soil gas probes shall be allowed to equilibrate before sampling, dependent on the degree of disturbance caused by the installation method:
 - i. 2-hours for Direct Push Technology (DPT) installed probes and
 - ii. 48-hours for auger type installation methods.

13. Landfill Gas Probe Sampling:

Landfill Gas Sampling should be conducted in accordance with the NCDEQ DWM Vapor Intrusion Guidance including subsequent amendments and editions available for download for the Division's website [DWM Vapor Intrusion Guidance \(March 2018\)](#)

The following sampling sequence should be used when sampling landfill gas probes for the applicable sampling methods requested by the Unit PM:

- i. Landfill Gas Probe Inspection (Appendix B - Section 14)
- ii. Landfill Gas Probe Static Pressure Measurements, only if requested by the Unit PM (Appendix B - Section 23)
- iii. Purge at least 3 probe volumes (entire probe volume including stick-up)
** A GEM 5000+ can be used to purge (typically 0.55 L/min)
- iv. Field Instrument Measurements (Appendix B - Section 15)
- v. Summa Canister Sample Collection with Shut-in Test (Appendix B – Section 16 and 20)
- vi. Tedlar Bag Sample Collection (Appendix B – Section 17)
- vii. Sorbent Tube Sample Collection (Appendix B - Section 21)
- viii. Landfill Gas Probe Gauging, only if requested by the Unit PM (Appendix B – Section 22)

Note: Valves and fittings should be used and placed in closed positions when connecting/disconnecting sampling instrumentation to maintain a gas seal and minimize the potential for ambient air to enter the probe/sample train.

14. Landfill Gas Probe Inspection:

A Landfill Gas Probe Inspection should be conducted each time a landfill gas probe is to be sampled. The inspection should include the following:

- a. visually inspect the integrity of the probe including: the annular seal, cap/seal, tubing, and fittings;
- b. confirm that a seal is established on the probe (cap/seal intact and two-way valve in the closed position);
- c. visually inspect the stickup vault or manhole cover and concrete pad. Note if there are any deficiencies such as cracked concrete, damaged/missing gaskets, missing or stripped bolts, missing locks, or evidence of water intrusion or damage to the probe.

Note: If the integrity of a probe is in question during the inspection, the Unit PM should be notified to determine if sampling/analysis should proceed at that probe. Deficiencies should be noted in the field notes and documented with a photo as needed. The Unit PM may request to replace tubing and/or valves.

Note: If repairs, adjustments or alterations are made, the probe must be purged before sampling. If Landfill Gas Probe Static Pressure Measurements are being collected, the probe must equilibrate for at least 24-hours after a seal has been re-established.

15. Field Instrument Measurements:

The Unit PM may request for Field Instrument Measurements to be collected for screening purposes. They may request the items below shown by equipment type and parameter(s). Refer to Appendix B, Section 4, for the units of measurement to be reported:

- a. Landfill Gas Analyzer
 - i. methane
 - ii. hydrogen sulfide
 - iii. oxygen
 - iv. carbon dioxide
 - v. ambient barometric pressure
- b. Photoionization Detector (PID)
 - vi. VOCs
- c. Thermometer/Hygrometer
 - vii. ambient temperature at time of screening (or within 1 hour)
 - viii. relative humidity

Sampling equipment should be included in the approved work plan. Equipment and reporting must be in accordance with the *Field Instrument Parameters and Equipment Requirements* (Section 4 - Appendix B) and *Field Instrument Calibration Data, Quality Assurance Data and Reporting Requirements* (Section 5 - Appendix B).

Minimum requirements for field instrument measurements include:

- d. probe valves should be used and placed in closed positions when connecting/disconnecting sampling instrumentation to maintain a gas seal
- e. prior to field instrument measurements, purge at least 3 probe volumes (entire probe volume including stick-up)
** a Landtec GEM 5000+ can be used to purge (typically 0.55 L/min)
- f. record the stabilized readings from the Landfill Gas Analyzer and PID

16. Summa Canister Sample Collection (Soil Gas):

- a. prior to sampling, purge at least 3 probe volumes (entire probe including stick-up)
- b. a shut-in leak test (Section 19 – Appendix B) must be conducted directly before sample collection. The sample train must not be disassembled after passing the shut-in leak test.
- c. batch-certified Summa canisters must be used for all soil gas samples (excludes indoor air)
- d. analyze samples for all VOCs on the US EPA Target Compound List, unless otherwise specified by the Unit PM.

17. Tedlar Bag Sample Collection

- a. hold time for analysis is 72 hours.

18. Flux Chamber Installation and Sample Collection:

At sites where geologic conditions prevent construction of gas probes, flux chambers may be used (results from flux chambers are qualitative and not quantitative):

- a. recess the flux chamber (Figure 2) into the ground surface and seal with grout or hydrated bentonite;
- b. attach to the chamber air-tight fittings that allow connections to either field instruments and/or summa canisters;
- c. use water trap filters in the sample line when moisture or liquid is found in the flux chamber; and
- d. record the length of time a calibrated field instrument is connected to the flux chamber when taking a reading so the procedure may be duplicated if re-testing is needed.

19. Passive Soil Gas Sample Collection:

The Unit PM may request the use of passive soil gas (PSG) samples to evaluate landfill gas migration. The following should be considered for PSG sampling:

- a. understand the limitations of the sampler and ensure that proper detection limits can be obtained since there are different reporting limits for different sampling times;
- b. the reporting limits should be low enough for use during risk evaluation (below screening levels);
- c. samplers should be appropriate for the chemicals of concern being investigated since some compounds are less reliably detected with passive samplers due to unknown uptake rates.

20. Shut-in Test:

A shut-in test should be performed directly before summa sample collection. The shut-in test is performed by isolating the sampling train from the sample probe and applying a vacuum to the sampling train. The applied vacuum should hold steady (not decrease).

21. Sorbent Tube Screening

Sorbent tubes may be utilized to test for the presence of landfill gas contaminants (e.g. mercury). Sorbent Tubes shall be used in accordance with the manufacturers guidance and reporting limits must be adequately low.

22. Landfill Gas Probe Gauging:

The Unit PM may request for a landfill gas probe to be gauged with a decontaminated water level meter. The Unit PM will specify if gauging should be conducted before or after sample collection. The goal of gauging is to evaluate if there is water, sediment, debris, or other blockages in the probe.

Gauge depths should be recorded and compared to construction records to identify if the screened interval is accessible with tubing. The Unit PM should be contacted if water is encountered in the probe to determine if samples should be collected/analyzed for that probe.

Probes should be left in a condition to be sampled again, unless otherwise specified by the Unit PM. Notify the Unit PM if conditions exist where the integrity of the probe is in question or maintenance/repair is needed (i.e. cap/seal, manhole, tubing/fittings).

23. Landfill Gas Probe Static Pressure Measurements:

The Unit PM may request to collect Static Pressure Readings from the landfill gas probe. The pressure data can be used to assess whether and to what extent pressure gradients might influence soil gas flow.

General Considerations:

- a. Pressure readings should be collected prior to opening the gas probe valve. If a probe has not been properly sealed (valve closed or cap/seal is not installed), pressure readings should not be collected until at least 24-hours after the seal on the probe has been re-established
- b. A Landtec GEM 5000+ or digital manometer should be used. To the extent practical, the same type of manometer should be used for a given site. The type of manometer should be included in reporting with the static pressure reading (inches H₂O), date, time, ambient barometric pressure, and temperature
- c. If Field Instrument Measurements are requested by the Unit PM in conjunction with Static Pressure Readings, the measurements should be collected consecutively.

The sequence for Static Pressure Readings should include:

- 1) visually inspect the integrity of the cap/seal/tubing and confirm the two-way valve has been in the closed position for at least 24-hours.
- 2) with the two-way valve in the closed position, connect the GEM 5000+ (or manometer) to the probe tubing
- 3) zero the manometer
- 4) open the valve and record the stabilized reading (in inches H₂O)
- 5) close the valve and then remove the gauge from the tubing
- 6) proceed with other sample collection methods as requested by the Unit PM

Important: the probe should not be purged or sampled until pressure readings have been collected****

Figure 1: Landfill Gas Monitoring Probe

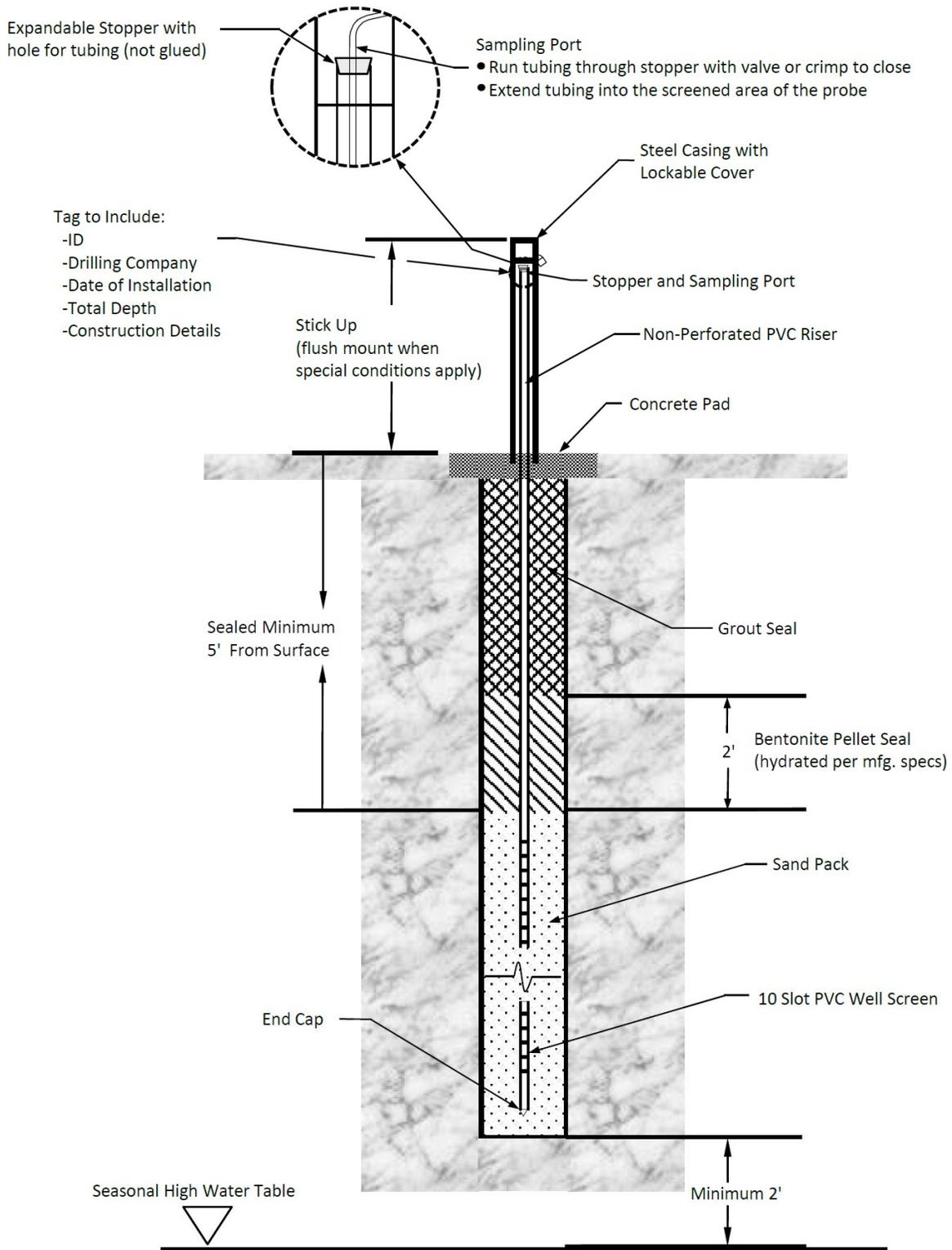
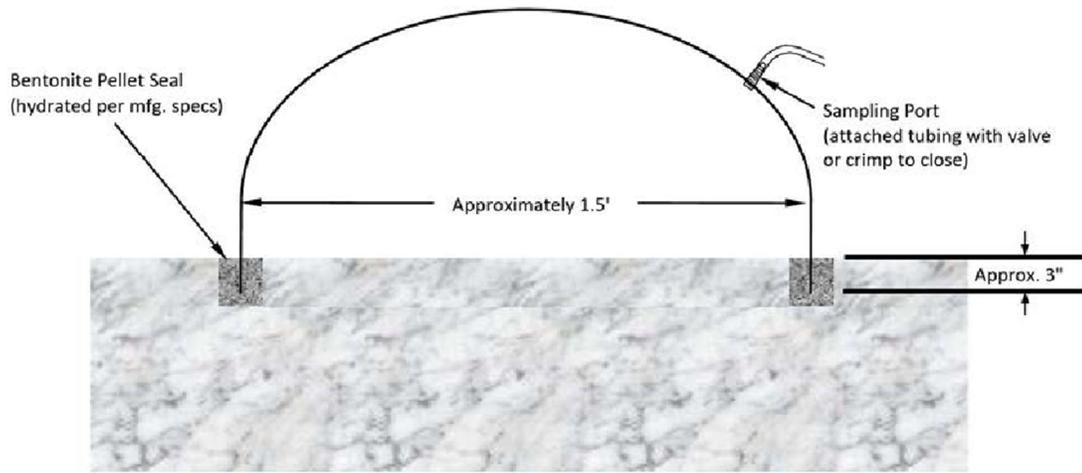
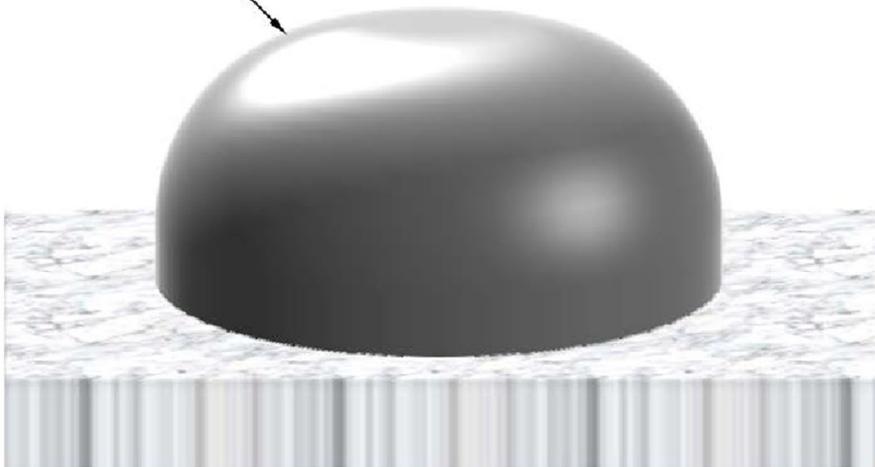


Figure 2: Flux Chamber



Constructed of Impermeable, Inert Material



APPENDIX C: ASBESTOS CONTAINING MATERIAL

1. The presence of asbestos containing materials (ACM) must be determined if waste material will be disturbed as part of the remedy (consolidation or removal). If any suspected ACM are observed (demolition debris would be considered suspect) during the site investigation phase, collect samples from the suspect materials for analysis to determine percent asbestos. Select five soil sample locations so that each location represents approximately 20% of the area to be disturbed. At each location determine the depth of waste and collect a composite sample that represents the thickness of waste in that area. Collect soil and any suspect ACMs identified in the cuttings. Analyze samples by EPA Method 600/R-93/116 or equivalent. No additional activities should take place in the suspect area until the presence and concentration of ACM is known. Any identified ACMs must be categorized as friable or non-friable.
2. Sites Containing Friable ACMs

Friable ACMs can be crumbled with hand pressure. Fibrous fluffy sprayed-on materials used for fireproofing, insulation, or sound proofing are considered to be friable as they readily release airborne fibers if disturbed. Also, concrete ACM is a non-friable ACM that can release fibers if broken. If encountered, a determination must be made if the material can be removed without breaking, or the material must be treated as a friable ACM. The following must be completed when friable ACMs will be disturbed:

 - a. all friable ACMs must be removed and disposed of at a permitted facility;
 - b. state and federal asbestos management guidelines must be reviewed and followed;
 - c. the RAP must contain an asbestos management plan. This plan must be sent to the NC DHHS Health Hazards Control Unit for review at least 45 days before the start of any land disturbing activities;
 - d. air monitoring will be conducted during removal; and
 - e. an accredited asbestos management planner will be on site.
3. Sites Containing Non-friable ACMs

Materials such as vinyl-asbestos floor tile or roofing felt are considered non-friable if intact and generally do not emit airborne fibers unless subjected to sanding, sawing and other aggressive operations. The following must be completed when non-friable ACMs will be disturbed:

 - a. non-friable ACMs may be excavated and relocated for disposal or consolidation like non-hazardous waste if the ACM is not subjected to sanding, sawing or other such aggressive operations;
 - b. state and federal asbestos management guidelines must be reviewed and followed;
 - c. the RAP must contain an asbestos management plan. This plan must be sent to the NC DHHS Health Hazards Control Unit for review at least 45 days before the start of any land disturbing activities;
 - d. the RAP must include an alternative plan that addresses the discovery of friable asbestos or exposures above the Permissible exposure limit (PEL). These discoveries should not result in work delays;
 - e. During waste disturbance, an accredited asbestos inspector must be on site;
 - f. Air monitoring must be conducted by an asbestos management planner during disturbance;
 - g. If air monitoring shows a result above the PEL, then all ACMs in the identified area will be handled as friable ACMs; and

APPENDIX D: LABORATORY ANALYTICAL PARAMETERS

GENERAL INSTRUCTION

1. All samples must be submitted to a certified laboratory under 15A NCAC Subchapter 02H .0800 or be a contract laboratory under the USEPA Contract Laboratory Program.
2. The Contractor PM must provide a copy of Appendix D to the laboratory to ensure appropriate analyte lists are used in the analysis of samples.
3. Initial analyses of all non-gas samples should include the parameters listed below:
 - a. Hazardous substance list metals (totals analysis) which include antimony, arsenic, barium, beryllium, cadmium, trivalent and hexavalent chromium, cobalt, copper, lead, manganese, mercury, nickel, selenium, silver, thallium, vanadium, and zinc. Hexavalent chromium is the most toxic of the chromium species. For groundwater, hexavalent chromium analyses is not needed as the 15A NCAC 02L groundwater standard is for total chromium, which is calculated using the toxicity of hexavalent chromium;
 - b. If coal ash is known or suspected to have been discharged at the site, the following additional toxic, non-hazardous substance metals should be included in the testing of groundwater: boron, molybdenum, and strontium;
 - c. Volatile and semi-volatile organic compounds:
 - i. use the most current USEPA Contract Laboratory Program Target Compound List;
 - ii. include a library search (using National Institute of Standards and Technology mass spectral library) to produce a list of tentatively identified compounds (TICs) for groundwater (monitoring wells only, not water supply wells) and when assessing existing soil cover for evaluation as the permanent cover system;
 - iii. the library search should identify TICs for the largest ten peaks in each analytical fraction having reasonable agreement with reference spectra (i.e. relative intensities of major ions agree within $\pm 20\%$); and
 - iv. the list of identified TICs should not include laboratory control sample compounds, surrogates, matrix spike compounds, internal standards, system monitoring compounds or target compounds;
 - d. Ammonia, nitrates, nitrites and sulfate; and
 - e. Iron is only analyzed when conducting background soil sampling and borrow source soil sampling.
4. Initial analyses of all gas samples should include the parameters listed below:
 - a. Volatile organic compounds - use the most current published USEPA Method TO-15 (Analysis of Volatile Organic Compounds in Air Contained in Canisters);
 - b. Methane;
 - c. Hydrogen Sulfide;
 - d. Mercury.
5. Sample for 1,4-Dioxane if chlorinated solvents such as 1,1,1-trichloroethane (TCA) or trichloroethylene (TCE) are present, or if it is a suspected contaminant of concern. It is often associated with certain chlorinated solvents because of its widespread use as a stabilizer. It is

also a by-product present in many goods and is used as a purifying agent in the manufacture of pharmaceuticals.

6. Pesticides, PCBs, dioxins, cyanide, formaldehyde, phosphorous and any other CERCLA hazardous substance or pollutants not mentioned here if suspected to have been discharged at the site;
 - a. If PCBs are a known or suspected contaminant of concern in soils that will remain exposed, first phase samples should be collected in the area of highest concentration and analyzed using both total PCB analysis and congener-specific analysis. The congener analysis should specify the dioxin-like PCB congeners. The sum of the dioxin-like PCB congener concentrations should be subtracted from the Total PCB analytical result. The resulting concentration must then be compared to the Branch's allowable concentrations for non-dioxin like PCBs. If concentrations detected are less than soil remedial goals for both the individual dioxin-like congeners and for the total non-dioxin like congeners, no additional PCB sampling is required. If concentrations exceed applicable remedial goals, more gross delineation can be performed using total PCB analyses and then the perimeter of the extent of contamination samples run for the dioxin-like congeners found at the site. In areas where PCBs are detected, soil samples should also be collected and analyzed for VOCs because they are commonly present as carriers for PCBs. Final confirmation samples must also be analyzed using congener specific analyses. Arochlor analyses should not be used unless trying to fingerprint manufacturer of PCB fluid. Groundwater samples should be analyzed for *Total* PCBs and the results compared to the 15A NCAC 02L standards; and
 - b. If cyanide is a known or suspected contaminant of concern, cyanide should be analyzed using total cyanide methods.
7. Any TICs that are hazardous substances, that have reasonable agreement with reference spectra (according to paragraph 3(c)(iii)), and are detected in more than one sample in an area of concern should be included in all subsequent analytical work unless the compound is a laboratory contaminant, naturally occurring, non-toxic or documented from an anthropogenic source. Check with the laboratory on possible procedures to quantify the TICs so that cleanup levels can be determined. A summary of the nature of any TICs eliminated from future analysis and reporting should be provided in the Remedial Investigation Report, including reasons for discounting the constituent.
8. If laboratory sample dilutions were performed on initial samples, subsequent phase samples must be analyzed for the entire analytical fraction previously diluted. Sample dilutions raise analytical detection limits and can mask the presence of other constituents at lower concentrations.
9. If a compound that is not a common laboratory contaminant is detected in both the blank and a sample, another phase of sampling is necessary to demonstrate the absence or presence of the contaminant.
10. After completing the first phase of sampling in source areas, subsequent samples must include all CERCLA hazardous substances detected (including those with qualified estimated concentrations), unless the contaminant concentration is proven through sampling to be the result

of a naturally occurring condition, area wide anthropogenic background or the contaminant is a common laboratory contaminant detected in concentrations below that detected in the method blank.

11. Subsequent sampling events would also need to include potential degradation compounds (which are also CERCLA hazardous substances) of those CERCLA hazardous substances detected at the site.
12. Dissolved methane in groundwater may be a concern at sites with methane migration. Concentrations greater than 28 mg/l could potentially cause flammable or explosive levels in confined spaces like crawl spaces, well houses or pipes.

ANALYTICAL METHODS

Table 1: Soil, Sediment and Waste Analytical Methods.

Volatile Organic Compounds ¹	SW-846 Method 8260
1,4-Dioxane ²	SW-846 Method 8270
Semi-volatile Organic Compounds ¹	SW-846 Method 8270
Metals ³ , Pesticides, Herbicides, PCB congeners, Dioxins, Cyanide, Phosphorous, Formaldehyde and any other analytes not covered by above methods	USEPA method or method published in <i>Standard Methods for the Examination of Water and Wastewater</i> having detection limits below unrestricted use remedial goals or having the lowest detection limit. For PCB congeners use USEPA Method 1668.
Hexavalent chromium	SW-846 Method 3060A ⁴ alkaline digestion coupled with a USEPA method or method published in <i>Standard Methods for the Examination of Water and Wastewater</i> having detection limits below unrestricted use remedial goals or otherwise having the lowest detection limit.
Ammonia	USEPA Method 350.1
Nitrate & Sulfate	USEPA Method 300.0 or 353.2

Table 2: Water Analytical Methods Including Groundwater, Surface Water and TCLP/SPLP Leachate.

Volatile Organic Compounds ¹	SW 846 Method 8260
1,4-Dioxane ²	SW 846 Method 8270 SIM using d8 isotope analysis
Semi-volatile Organic Compounds ¹	SW-846 Method 8270
Metals ^{3,5} , Pesticides, Herbicides, PCBs ⁶ , Dioxins, Cyanide ⁷ , Phosphorous, Formaldehyde and any other analytes not covered by above methods	USEPA method or method published in <i>Standard Methods for the Examination of Water and Wastewater</i> having the lowest detection limits or having detection limits below the 15A NCAC 02L standards
Hexavalent chromium (if total chromium exceeds 2 times the site-specific natural background concentrations and the applicable remedial goal for hexavalent chromium and chromium is a known or suspected contaminant at the site) ^{8,9}	USEPA Method 218.7 or Method 218.6 as modified by USEPA Region IV.
Ammonia	USEPA Method 350.1
Nitrate & Sulfate	USEPA Method 300.0 or 353.2
Dissolved methane ¹⁰	Method RSK 175

Table 3: Gas Analytical Methods.

Volatile Organic Compounds using batch-certified or individually certified (indoor air only) Summa canisters	Method TO-15 or TO-15 SIM (indoor air or crawlspace only)
--	---

Hydrogen Sulfide	USEPA Method 15
Mercury ¹¹	NIOSH 6009

References for Tables 1, 2 and 3:

1. *Analyses must include the USEPA Target Compound List plus a library search in certain cases as described in paragraph 3a, Appendix D.*
2. *1, 4-Dioxane samples should not be collected with passive or diffusive bag samplers. Also, avoid use of Alconox and Liquinox for precleaning of sampling equipment and containers. Methods 8260 and 8260 SIM is not recommended due to interference issues between 1,4-Dioxane and some chlorinated solvents, particularly TCE and 1,2-DCE.*
3. *SW-846 Method 6010 does not have detection limits below the unrestricted use standards/15A NCAC 02L standards for all of the hazardous substance list metals. Therefore, ICP-MS should be used instead of ICP when conducting first phase metals scans due to lower quantitation limits and less (metals) interference issues. However, ICP should be used for certain metals where interference issues exist.*
4. *SW-846 Method 3060A extraction for soil and sediment samples allows for a 30-day holding time prior to extraction.*
5. *Rapid analyses of samples are recommended to lessen the contact time with the acid preservative. Filtration of groundwater and surface water samples before digestion is not permitted. Highly turbid water samples for metals analysis should be collected in accordance with Appendix B.*
6. *Total PCBs - Groundwater samples should be analyzed for Total PCBs and the results compared to the 15A NCAC 2L standard.*
7. *Total Cyanide - Groundwater samples should be analyzed for Total Cyanide and the results compared to the 15A NCAC 2L standard. Note, the 15A NCAC 2L standard is based on the toxicity for Free Cyanide; no 15A NCAC 2L standard exists for other cyanide species and the 2L Standard would otherwise become the practical quantitation limit (PQL).*
8. **Hexavalent chromium**
 - a. *Hexavalent chromium analysis is not needed for groundwater samples as the 15A NCAC 02L standard for total chromium is based on the more toxic hexavalent chromium species. This level must be met for all chromium in groundwater. The listed methods can be used for surface water and for ecological assessment purposes.*
 - b. *Hexavalent chromium samples must be field filtered within 15 minutes of collection. Each sample must be collected in a separate pre-preserved container from those for other metals analyses. Method 218.7 or Method 218.6 as modified by USEPA Region IV should be used. Method 218.7 requires low turbidity and allows for a 14-day holding time. USEPA Region IV has developed a modification to Method 218.6 that allows for a 28-day holding time. Bottles must be pre-preserved as specified in the modification to the Method. Laboratories should contact the USEPA in Region IV for the methodology.*

Otherwise, any USEPA Method or Standard Method may be used. However, other methods have a 24-hour holding time. Selection of methods and pre-preservation of bottles should be discussed with the laboratory prior to sample collection.

9. *Dissolved methane in groundwater may be analyzed by Method RSK 175.*

10. *If any contaminants of concern are detected in landfill gas, always submit a sample for mercury analysis.*

LABORATORY DATA REPORTING

Important: The Unit will not approve payment for samples analyzed out of holding time or if the Contractor fails to comply with this guidance document including subsequent amendments and editions.

Laboratory reports submitted to the Unit must include the items listed below:

1. The laboratory report must state the name and address of the laboratory and that the laboratory is either certified for applicable parameters under 15A NCAC Subchapter 02H .0800 and provide its certification number, or that it is a contract laboratory under the US EPA's Contract Laboratory Program (CLP). Full US EPA CLP documentation packages are not required.
2. A signed statement from the laboratory that the samples were received in good condition, at the required temperature and that analysis of the samples complied with all procedures outlined in the analytical method, unless otherwise specified. Any deviation from the methods, additional sample preparation, sample dilution and unrectified analytical problems, must be justified in a narrative with the laboratory report (any quantitation limits exceeding ten times the MDL must be justified with supporting information).
3. Laboratory sheets for all analytical results, including sample identification, sampling dates, sample matrix description, sample filtration or preservation procedures, date samples were received by laboratory, extraction dates, analysis dates, dilution factors, sample preparation and analytical method name(s) and number(s) and results of the analysis (all estimated concentrations with data qualifiers must be reported).
4. Details of any known conditions or findings which may affect the validity of analytical data, including but not limited to equipment blank, trip blank, method blank, surrogate, spiked sample, or other quality control data.
5. Laboratory sheets for all laboratory quality control samples, including results for bias and precision and control limits used. The following minimum laboratory quality control sample reporting information must be provided:
 - a. at least one matrix spike and one matrix spike duplicate per sample delivery group or 14-day period, whichever is more frequent (control limits must be specified);
 - b. at least one method blank per sample delivery group or 12-hour period, whichever is less; and

- c. system monitoring compounds, surrogate recovery required by the method and laboratory control sample analysis (acceptance criteria must be specified). All samples that exceed control limits/acceptance criteria must be flagged in the laboratory report.
6. The results of any library search performed for “tentatively identified compounds.”
 7. The laboratory report should include the names of the individuals performing each analysis, the quality assurance officer reviewing the data and the laboratory manager.
 8. Data quality should be reviewed and validated by both the Contractor PM and the laboratory. Any quality control concerns, data qualifiers or flags should be evaluated and discussed in the associated report.
 9. Completed chain-of-custody with associated air bill (if applicable) attached.

APPENDIX E: REMEDIAL INVESTIGATION SUMMARY REPORT TEMPLATE

The following template must be used to draft a RI summary report. Populate/modify the text within the brackets [] to reflect site specific information.

REMEDIAL INVESTIGATION SUMMARY REPORT

[SITE NAME]

[SITE CITY], [SITE COUNTY], North Carolina

Site ID No. [SITE ID]

State Contract No. [N1#####S]

Task Order [TASK ORDER NUMBER]

Prepared By:

Submitted To:

North Carolina Department of Environmental Quality
Division of Waste Management
Superfund Section
Special Remediation Branch
Pre-Regulatory Landfill Unit
1646 Mail Service Center
Raleigh, North Carolina 27699-1646

[Name]
[Title]
[NC License #]

[Name]
[Title]
[NC License #]

Prepared By:
[Company Name]
[Address]
[Phone #]

[Company Logo]

[Date]

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1.0 INTRODUCTION

All RI summary reports should include the following introductory text:

Pre-regulatory landfills include any land area that was used for municipal solid waste disposal prior to January 1, 1983. These waste disposal areas were unlined and unregulated receiving facilities and could contain hazardous waste, medical waste, and/or asbestos-containing materials. Contaminated soils, exposed hazardous materials, contaminated groundwater, hazardous, and/or explosive vapors migrating to occupied structures are typical risks associated with PRLFs.

Environmental and human health risks posed by PRLFs are mitigated using a risk-based approach for assessment and remediation. There are three goals for the remedial investigation. One goal is to establish the lateral and vertical extent of contamination in each area of concern for all contaminated media, such as soil, groundwater, sediment, surface water, and vapor. The second goal is to determine if hazardous exposure risks are present within the Site. However, it is technically infeasible and cost prohibitive to identify all contaminants and the highest contaminant concentrations present within PRLF sites; therefore, the investigation may include limited waste characterization data. The third goal is to establish potential exposure pathways and receptors that are impacted or may become exposed to contamination. The investigation should also include the geologic conditions and site conditions to support a feasibility study of remedial alternatives. The typical risk-based remedial alternative for a PRLF includes a protective soil cover installed over the delineated footprint of the waste disposal area and recordation of land use restrictions and a notice of environmental contamination.

Provide the information required in the First Phase RI Activities for Sections 8 through 17:

2.0 SENSITIVE ENVIRONMENTS

Provide the information required in the First Phase RI Activities for Sections 18 and 19. Provide a narrative summarizing all activities that took place during the on-site investigation and the results of those field activities. Provide the information returned from contacted agencies from Appendix F.

If sensitive environments were not identified, state “No sensitive environments were identified in the site vicinity.”

3.0 GEOPHYSICAL SURVEY

Provide the information required in the First Phase RI Activities for Sections 20 and 21.

4.0 GEOLOGY AND HYDROGEOLOGY

Provide the information required in the First Phase RI Activities for Section 22.

5.0 NATURAL AND ANTHROPOGENIC BACKGROUND

Provide the information required in the Background Sample Collection for Sections 24 through 28.

6.0 WASTE DISPOSAL AREA

Provide the information required in the Contaminant Delineation RI Activities for Sections 29 through 33 and the following text for this section:

7.0 MEDIA CHARACTERIZATION

7.1 Above Ground Vapor Survey

Provide the information required in the Contaminant Delineation RI Activities for Sections 34 through 36.

If above ground vapors were not detected during the above ground vapor survey, state “No above ground vapors were detected at the ground surface.”

7.2 Evaluation of Existing Soil Cover for use as the Permanent Cover System

Provide the information required in the Contaminant Delineation RI Activities for Sections 37 through 41.

7.3 Surface Water/Sediment/Seep Investigation

Provide the information required in the Contaminant Delineation RI Activities for Sections 42 through 45.

7.4 Groundwater Investigation

Provide the information required in the Contaminant Delineation RI Activities for Sections 46 through 53.

7.5 Potable Water Supply Well Sampling

Provide the information required in the Contaminant Delineation RI Activities for Sections 54 through 56.

7.6 Landfill Gas Probe Installation and Monitoring

Provide the information required in the Contaminant Delineation RI Activities for Sections 57 through 60.

7.7 Methane Assessment

Provide the information required in the Contaminant Delineation RI Activities for Sections 61.

7.8 Structural Vapor Intrusion

Provide the information required in the Contaminant Delineation RI Activities for Sections 62 through 68.

7.9 Contaminant Sources and Impacted Receptors

Provide the information required in the Contaminant Delineation RI Activities for Sections 69 through 71.

7.10 Waste Characterization (Consolidation, Total Removal or Hot Spot Assessment)

If the Unit PM requested waste characterization, provide the information required in the Contaminant Delineation RI Activities for Sections 72 through 75.

8.0 RISK EVALUATION

Include the following text for this section:

This investigation has identified risks to human health and the environment and has delineated the approximate horizontal and vertical extent of these risks. Potential exposure pathways exist in the form of (*choose from the following*: surficial waste, subsurface waste, contaminated soil, contaminated groundwater, contaminated surface water, landfill gas). Due to the volume of waste, unknown contents, and nonregulated management practices, it is technically infeasible and cost prohibitive to fully characterize and thus identify all risks and magnitude of risk associated with the heterogenous waste.

8.1 Physical Risks

Discuss physical risks associated with the waste disposal area including slip, trip, and fall hazards, voids created by USTs or vehicles, sharps, oxygen displacement by hydrogen sulfide, and explosion/fire hazards associated with methane.

8.2 Chemical Risks

For each investigated media type, the data must be entered into the DEQ risk calculator, and the following statement must be included in the RI summary report with the risk calculator results: “The DEQ risk calculator was utilized to evaluate the risks of contaminants of concern identified in (*select each investigated media type*) and the results are outlined below.” Provide an explanation if a media type was not investigated.

Summarize the risk calculator results for each investigated media type for all receptors and pathways provided in the risk calculator and for each exposure unit, exposure scenarios, and sample locations as directed by the Unit PM.

9.0 SOLE USE STATEMENT AND CERTIFICATION

Suggested language: The report was prepared solely for the intended use of NCDEQ Special Remediation Branch, Pre-Regulatory Landfill Unit performed in the scope of work for Task Order [_____]. Use of this document for other purposes is at the sole risk of the user.

Report Certification

10.0 REFERENCES

APPENDIX F: SENSITIVE ENVIRONMENT SURVEY

1. Sensitive environment surveys must include the WDA and all areas within 500 feet of the delineated WDA perimeter.
2. The survey must also identify areas that likely serve as natural areas attractive to terrestrial ecological receptors and for the existence of stressed vegetation or stressed wildlife.
3. Establishing the presence of sensitive environments is necessary to determine if special sampling (such as aquatic toxicity testing) is required and if remediation activities would result in more harm than good (for example, excavation and destruction of a wetland versus leaving in place residual contamination which may not significantly impact the wetland environment).
4. Refer to the *Sensitive Environment Contact List* for agency information. These individuals must be contacted in order to identify specific sensitive environments.
5. Sensitive environments include the following:
 - a. State Parks;
 - b. Areas Important to Maintenance of Unique Natural Communities;
 - c. Sensitive Areas Identified Under the National Estuary Program;
 - d. Designated State Natural Areas;
 - e. State Seashore, Lakeshore and River Recreational Areas;
 - f. Rare Species (state and federal Threatened and Endangered);
 - g. Sensitive Aquatic Habitat;
 - h. State Wild and Scenic Rivers;
 - i. National Seashore, Lakeshore and River Recreational Areas;
 - j. National Parks or Monuments;
 - k. Federal Designated Scenic or Wild Rivers;
 - l. Designated and Proposed Federal Wilderness and Natural Areas;
 - m. National Preserves and Forests;
 - n. Federal Land designated for the protection of Natural Ecosystems;
 - o. State-Designated Areas for Protection or Maintenance of Aquatic Life;
 - p. State Preserves and Forests;
 - q. Terrestrial Areas Utilized for Breeding by Large or Dense Aggregations of Animals;
 - r. National or State Wildlife Refuges;
 - s. Marine Sanctuaries;
 - t. National and State Historical Sites;
 - u. Areas Identified Under Coastal Protection Legislation;
 - v. Coastal Barriers or Units of a Coastal Barrier Resources System;
 - w. Spawning Areas Critical for the Maintenance of Fish/Shellfish Species within River, Lake or Coastal Tidal Waters;
 - x. Migratory Pathways and Feeding Areas Critical for Maintenance of Anadromous Fish Species within River Reaches or Areas in Lakes or Coastal Tidal Waters in which such Fish Spend Extended Periods of Time;
 - y. State Lands Designated for Wildlife or Game Management; and
 - z. Wetlands.

SENSITIVE ENVIRONMENT CONTACT LIST

CONTACT	NAME & CONTACT INFORMATION	SENSITIVE ENVIRONMENT
<p>NC Division of Conservation, Planning, and Community Affairs – Natural Heritage Program</p>	<p>Visit the Natural Heritage Program’s interactive maps of Natural Heritage resources to search for records within 2 miles of your project area or the database search tool for record summaries by county and USGS 7.5-minute topo map. You can also download GIS shapefiles of our data; see the “GIS Download” page for details.</p> <p>Email inquiries to: natural.heritage@ncdenr.gov</p>	<p>State Parks</p> <p>Areas Important to Maintenance of Unique Natural Communities</p> <p>Sensitive Areas Identified Under the National Estuary Program</p> <p>Designated State Natural Areas</p> <p>State Seashore, Lakeshore and River Recreational Areas</p> <p>Rare species (state and federal Threatened and Endangered)</p> <p>Sensitive Aquatic Habitat</p> <p>State Wild & Scenic Rivers</p>
<p>National Park Service - Public Affairs Office</p>	<p>Anita Barnett</p> <p>Anita_Barnett@nps.gov (404) 507-5706</p> <p>http://www.nps.gov/rivers</p>	<p>National Seashore, Lakeshore and River Recreational Areas</p> <p>National Parks or Monuments</p> <p>Federal Designated Wild & Scenic Rivers</p>
<p>US Forest Service</p>	<p>Heather Luczak, Forest NEPA Coordinator</p> <p>Heather.luczak@usda.gov (828) 257- 4817</p>	<p>Designated and Proposed Federal Wilderness and Natural Areas</p> <p>National Preserves and Forests</p> <p>Federal Land Designated for the Protection of Natural Ecosystems</p>
<p>NC Division of Water Resources</p>	<p>Nora Dreamer, Basin Planner nora.deamer@ncdenr.gov (919) 707-9119</p> <p>Ian McMillan, Branch Supervisor Ian.Mcmillan@ncdenr.gov (919) 707-9026</p> <p>Ask for Clean Water Act 305b report</p>	<p>State-Designated Areas for Protection or Maintenance of Aquatic Life</p>

NC Forest Service	Craig Clarke, Director, Safety, Planning & Analysis Craig.clarke@ncagr.gov (919) 857-4820	State Preserves and Forests
US Fish & Wildlife Service	Pete Benjamin, Field Supervisor Pete_benjamin@fws.gov (919) 856-4520 x 11	Endangered Species
NC Department of Natural and Cultural Resources	Renee Gledhill-Earley, Environmental Review Coordinator (919) 814-6579 Renee.gledhill-earley@ncdcr.gov	National and State Historical Sites
NC Division of Coastal Management	Mike Lopazanski, Deputy Director mike.lopezanski@ncdenr.gov (252) 808-2808 ext. 223 http://dcm2.enr.state.nc.us	Areas Identified Under Coastal Protection Legislation Coastal Barriers or Units of a Coastal Barrier Resources System.
NC Wildlife Resources Commission	David Cox, Technical Guidance Supervisor David.Cox@ncwildlife.org (919) 707-0366	National or State Wildlife Refuges State lands designated for wildlife or game management Migratory pathways and feeding areas critical for maintenance of anadromous fish species within river reaches or lakes or coastal tidal waters. Spawning Areas Critical for the Maintenance of Fish/Shellfish Species within River, Lake or Coastal Tidal Waters.
US Army Corps of Engineers	Dorothy Harrington Dorothy.Harrington@usace.army.mil (919) 554-4884, x 28	Wetlands

APPENDIX G: BORROW SOIL LOCATION AND SAMPLING PROCEDURES

The following procedures are required to identify a borrow source that could be utilized as acceptable clean soil for an engineered WDA cover system and the associated sampling and testing requirements prior to purchase and transport to the Site. The quality of imported soil must meet unrestricted use standards.

OFF-SITE BORROW SOURCES

1. Preferred borrow sources for clean soil are those that were previously undeveloped or used solely for agricultural or residential purposes. The following list of sources are considered undesirable as soil fill material and shall not be utilized:
 - a. locations on or within 1,000 feet of a site that the Division of Waste Management (DWM) manages, permits, or has inventoried;
 - b. dredged material from a marine environment;
 - c. soils from below the groundwater table;
 - d. soils containing construction, demolition debris, and/or reclaimed asphalt pavement;
 - e. soils from recycling operations that collect, sort, reprocess, or manufacture new products;
 - f. soils from transfer stations that collect, consolidate, temporarily store, sort, or recover refuse or used materials from off site;
 - g. soils from a contaminant cleanup or removal;
 - h. commercial or industrial sites where hazardous materials were used, handled, or stored; and
 - i. coal and wood ash.
2. The history and location of the proposed borrow source must be established and documented. If the proposed borrow source is identified as acceptable clean soil based on the site history and location, the following procedure shall be used for verification sampling and testing.

IN-SITU MATERIAL

3. The borrow source site should be divided into five approximately equal-sized sections (the number of sections is independent of the total acreage).
4. A sample should be collected in each section from the surface to 0.5-foot bgs.

Note: No composites, the five samples are individual grab samples.

5. The next sampling interval should be collected from five feet bgs. If the desired fill material is from a shallower horizon, consult with the Unit PM prior to adjusting the sampling plan.

Note: No composites, the five samples are individual grab samples.

6. Sampling methodologies must be in accordance with U. S. Environmental Protection

Agency (US EPA) Region IV Science and Ecosystem Support Division (SESD) *Field Branches Quality System and Technical Procedures, Soil Sampling (SESDPROC-300-R3)* and these Guidelines.

7. All samples should be analyzed for the following parameters:
 - a. Volatile and Semi-Volatile Organic Compounds (USEPA Target Compound List plus 1,4 Dioxane): SW-846 Methods 8260/8270;
 - b. Metals: SW-846 Method 6020 (Antimony, Arsenic, Beryllium, Cadmium, Chromium, Cobalt, Copper, Iron, Lead, Manganese, Nickel, Selenium, Silver, Thallium and Zinc);
 - c. Mercury: Method 7471; and
 - d. Organochlorine Pesticides: Method 8081 (Include in analysis if the borrow source was used for agricultural purposes).

STOCKPILED MATERIAL

8. The owner of the stockpiled borrow source will be required to sign an affidavit, attesting that the stockpiled material originated from the same source location and not from a different off-site source. The stockpiled material that is sampled and tested, must be the same material that is purchased and imported for use as clean structural fill.

Sampling the stockpiled borrow source shall be in accordance with the following schedule:

<u>Volume of stockpile borrow source</u>	<u>Samples per Volume</u>
Up to 1,000 cubic yards	3 composite samples
1,000 to 5,000 cubic yards	2 composite samples for the first 1,000 cubic yards plus 1 composite sample for each additional 1,000 cubic yards
>5,000 cubic yards	5 composite samples for the first 5,000 cubic yards plus 1 composite sample for each additional 5,000 cubic yards

Note: Each composite sample contains three grab samples from three different depths. VOC samples can and should be composited for stockpiled borrow sources.

9. The soil analytical data must be entered into the DEQ risk calculator to confirm if the metals concentrations are below unrestricted use risk targets or naturally occurring background soil metals concentrations. Depending on the risk calculator results, TCLP or SPLP analysis may be required. The data packet, risk calculator results and a summary cover letter must be submitted to the Unit PM for review and approval prior to purchase and transport of fill material to the Site.

APPENDIX H: ENGINEERED COVER SYSTEMS

Engineered cover systems may be used at pre-1983 landfills to prevent dermal exposure to physical or chemical hazards created by the WDA or to prevent infiltration of precipitation at site with groundwater contamination: a soil cover with geotextile demarcation fabric, a matrix of soil filled high-density polyethylene (HDPE) expandable cells or a combination of both. All engineered cover systems must include manufacturing recommendations for products incorporated into the design and site specific conditions to ensure the implementation and success of a risk-based remediation.

Note: The WDA must be covered with a minimum of 12 inches of clean soil, aggregate, or a soil/aggregate mixture suitable for unrestricted use and must support vegetative growth regardless of the type of engineered cover system selected. The vegetative cover must consist of grasses appropriate for the physiographic province where the Site is located.

SOIL COVERS WITH GEOTEXTILE DEMARCATION FABRIC

1. The geotextile demarcation fabric (or equivalent) that may be used is listed in the following table:

Company Name	Product Name	Model Number	Description
TenCate Geosynthetics	Mirafi 140NL/O	Orange	Nonwoven geotextile composed of polypropylene fibers, which are formed into a stable network such that the fibers retain their relative position. The product is inert to biological degradation and resists naturally encountered chemicals.

2. Additional information pertaining to the NC Department of Transportation (NCDOT) approved geotextiles (1056-4) is available at the following website: <https://apps.ncdot.gov/vendor/approvedproducts/>. If other geotextiles are recommended for use, the Unit must approve the product before installation.

SOIL COVER WITH HIGH-DENSITY POLYETHYLENE EXPANDABLE CELLS

3. The high-density polyethylene expandable cells, four or six inches, are filled with soil, gravel, or a combination of both. Cells must be covered with a minimum of 2 inches of fill material.
4. The following are NCDOT approved products and may be used:

Company Name	Product Name	Model Number	Description
Presto Geosystems	Presto Geoweb	GW20V4, GW30V4, and GW40V4	Cell length ranges from 8.8 to 18.7 inches. Cellular confinement system for soil stabilization and slope protection.
Hanes Geo Components	TerraCell	140	Cellular confinement system for soil stabilization and slope protection.
Strata Systems, Inc.	Strataweb (4 inch height)	Styles 356 & 445	High performance three-dimensional cellular confinement system manufactured from extruded strips of

			HDPE, precision welded to form multiple cell heights and sizes. When filled with granular material, provides superior confinement and reinforcement.
Geo Products	EnviroGrid	EGA20 4 inch	Cellular confinement.

5. Additional information pertaining to the approved NCDOT geocells (1056-6) is available at the following website: <https://apps.ncdot.gov/vendor/approvedproducts/>
6. Research these products and be familiar with their characteristics (strength, flexibility, installation procedures, accessories, tools required for installation and etc.) and Site specific conditions (environmental, logistical and engineering challenges) before selecting a product for the cover system.
7. The product must be manufactured from high density polyethylene (HDPE), and chemical analysis of the specific material being installed must be submitted to the Unit for review and approval prior to installation.
8. Follow the manufacturer recommendations when anchoring the product to the ground surface. Anchors may include product specific anchors, cut rebar stakes, polyethylene strips, and/or installation of an anchor trench.

SURFACE PREPARATION

9. After grubbing activities are complete (if applicable) and the WDA has been graded for positive storm water runoff (if applicable), the WDA is covered with a geotextile demarcation fabric and/or the HDPE expandable cell system and filled with soil, aggregate, or a soil/aggregate mixture suitable for unrestricted use.
10. Refer to manufacturer installation recommendations and guidelines pertaining to the use of a geotextile between waste and the base of the cellular confinement system).
11. All daylighting tires and white goods must be removed prior to installation of the cellular confinement system and large individual pieces of daylighting waste that would result in a surface variation greater than 3 inches must be removed.
12. If stormwater infiltration has not created an exposure pathway, and is not ponding over the WDA, grading may not be necessary. If grading is not required, the cellular confinement system could be placed directly over non-denuded soil based on manufacturer recommendations.
13. Woody vegetation shall be cut to the surface and large stumps ground a minimum of six inches below the current surface elevation. Since additional material may be required to fill the cellular confinement system over a non-graded, non-denuded surface, a cost analysis would be required to compare this method to denuding and grading the Site.

14. The cellular confinement system is to be filled with material appropriate for site conditions. Examples of possible fill materials are:
 - a. soil as structural fill;
 - b. topsoil;
 - c. structural fill amended with organics;
 - d. angular gravel;
 - e. angular ballast stone;
 - f. sand; and
 - g. mix of two-parts soil and one-part stone.

15. The same fill material is to cover the top of the cellular confinement system with a minimum thickness of 2 inches and compacted with a vibratory roller. If the chosen fill material varies significantly from the WDA surface material, and sufficient surface compaction cannot be achieved, a non-woven geotextile may be required to maintain separation of the WDA surface and fill materials.

ATTACHMENT 1: GUIDELINES FOR THE LOCAL GOVERNMENT REIMBURSEMENT PROGRAM

The following guidelines pertain to local governments requesting approval to conduct contaminant assessment activities at pre-1983 landfills and participate in the reimbursement program.

INTRODUCTION

1. Local governments may conduct contaminant assessment phase activities in accordance with the current published edition of the *Guidelines for Addressing Pre-Regulatory Landfills and Dumps* guidance document including subsequent amendments and editions and seek reimbursement of assessment expenses if the activities were approved by the Unit.
2. Questions regarding the local government reimbursement program may be emailed to the PRLF Unit Supervisor, or by telephone at (919) 707-8333. PRLF Unit contact information may be found at the following website: [PRLF Unit](#).
3. NCGS 130A-310.6 (f) establishes the local government reimbursement program and outlines the four criteria necessary to qualify for reimbursement.

A unit of local government that voluntarily undertakes assessment or remediation of a pre-1983 landfill may request that the Department reimburse the costs of assessment of the pre-1983 landfill and implementation of measures necessary to remediate the site to eliminate an imminent hazard. The Department shall provide reimbursement under this subsection if the Department finds all of the following:

- (1) The unit of local government undertakes assessment and remediation under a plan approved by the Department.*
- (2) The unit of local government provides a certified accounting of costs incurred for assessment and remediation.*
- (3) Each contract for assessment and remediation complies with the requirements of Articles 3D and 8 of Chapter 143 of the NCGS.*
- (4) Remedial action is limited to measures necessary to abate the imminent hazard.*

LETTER OF INTEREST/REIMBURSEMENT ELIGIBILITY

4. To establish eligibility, the local government must submit a “Letter of Interest” to the North Carolina Division of Waste Management PRLF Unit stating the desire to voluntarily conduct an environmental assessment of a qualified pre-1983 landfill. The “Letter of Interest” should include the pre-1983 Landfill ID#, Landfill Name, and Landfill street address (including the City and County). Mail the “Letters of Interest” to:

PRLF Unit Supervisor
Local Government Reimbursement Program
Pre-Regulatory Landfill Unit
1646 Mail Service Center
Raleigh, NC 27699-1646

5. Prior to submittal of the initial work plan, the local government must provide a signed statement to the Unit confirming that the local government's consultant contract complies with Articles 3D (Procurement of Architectural, Engineering, and Surveying Services) and 8 (Public Contracts) of Chapter 143 of the NCGS to be eligible for reimbursement. A *Certification of Contracting Procedures Form* is provided in this document and must be completed to meet this requirement. The local government is required to provide, on official letterhead, its vendor and federal identification number to establish a reimbursement account with the Unit.
6. Once the completed *Certification of Contracting Procedures Form* has been received, the Unit will contact the local government to arrange a meeting with the local government to provide guidance on the work plan.
7. The local government's contractor must provide a work plan, cost proposal, and schedule for implementation once approved by the Unit.
8. Assessment work plans, cost proposals, and schedules require review and approval by the Unit. Reimbursement is subject to availability of funds and the Units review of the local government certified accounting of costs to ensure they are consistent with standard assessment costs. To ensure reimbursement, the local government should closely monitor costs and confirm the consultant complies with NCGS 130A-310.6 (f).

WORK PLAN/COST PROPOSAL PREPARATION

WORK PLAN

9. Work plans should include: an in-depth description of the proposed scope of work and methodologies that will be utilized and a proposed schedule for completing the scope of work.
10. The local government's contractor must comply with the current published edition of the *Guidelines for Addressing Pre-Regulatory Landfills and Dumps* guidance document including subsequent amendments and editions to develop and complete all work activities. Procedures outlined in work plans must also comply with the current published version of the US Environmental Protection Agency Region IV Science and Ecosystem Support Division "Field Branches Quality System and Technical Procedures."
11. Due to the wide range of conditions encountered at pre-1983 landfills, the guidance document will not address every conceivable situation. The local government's contractor may need to consider proposing additional analyses and sample collection based on existing site-specific conditions and future land use.

COST PROPOSAL

12. A cost proposal outlining the costs for completing the scope of work presented in the work plan, must be attached to each work plan for review and approval by the Unit. Cost proposals must be submitted to the Unit in accordance with the *Cost Proposal and Invoice Format Sheets* which an

example can be found in Attachment 4. **Costs not approved by the Unit are not eligible for reimbursement.**

13. Cost proposals are required to be prepared on a time and materials basis and should be broken out per task as outlined in the associated work plan. Labor costs per personnel level unit rates, subcontractor costs (i.e. driller, analytical, etc.), and expense details (i.e. mileage, instruments, etc.) should be provided for each task. Use the Personnel Qualifications and Task Descriptions reference sheet, which can be found in Attachment 3, to determine the labor costs for various personnel.

REIMBURSEMENT

14. The local government must pay the consultant in accordance with their contract and then submit a certified accounting of costs with the consultant invoice(s) to the Unit for reimbursement.
15. All invoices must be submitted to the Unit in accordance with the *Cost Proposal and Invoice Format Sheets* which can be found in Attachment 4. Invoices must be submitted in the same format as the cost proposal for reconciliation and each invoice submittal must include a completed *PRLF Invoice Check List Form* which can be provided by the Unit (example in Attachment 5).
16. Submit a cover letter on official local government letterhead to request reimbursement and include the following:
 - a. vendor/Federal ID number;
 - b. current mailing address;
 - c. invoice(s) from contractor in the same format as the proposal cost sheet;
 - d. copies of the check(s) used to pay the contractor;
 - e. dollar amount you are requesting for reimbursement; and
 - f. a statement verifying that certified accounting in accordance with NCGS 130A-310.6(f)(2) was conducted.
17. The invoice packet will be reviewed by the Unit and compared to the work plan and cost proposal. After the invoice review is complete, the invoice packet will be submitted to accounting for processing, or the Local Government representative will receive a response requesting additional invoicing details.

Important: To avoid delay in reimbursement and multiple requests for additional supporting documentation, the Local Government representative must submit invoices in the same format as the cost proposal with the completed *PRLF Invoicing Check List Form* (Attachment 5) and all receipts organized and numbered to reflect the order outlined in the approved work plan.

STATE OF NORTH CAROLINA
COUNTY OF _____ *[county]*

I, _____ *[name]*, a Notary Public, do hereby certify that
_____ *[name of authorized agent]* personally appeared before me on
this day, produced proper identification in the form of _____, was duly sworn
and or affirmed, and declared that he or she holds the title of _____ *[title]* of
_____ *[name of unit of local government]*, and declared that, to the
best of his or her knowledge and belief, that the information contained in the above
Certification is true and accurate, and he or she then signed this Certification in my presence.

WITNESS my hand and official seal this _____ *[date]* day of _____ *[month]*, *[year]*.

_____ *[name]*
Notary Public

My commission expires _____ *[date]*.

REQUEST FOR PROPOSAL (RFP) TEMPLATE

The following template may be used to draft a request for proposal (RFP). Populate/modify the italicized text within the brackets [] to reflect site specific information.

Request for Proposals (RFP): Pre-Regulatory Landfill Assessment

[North Carolina Local Government Name] is exploring the potential for re-use of a tract of land known as the *[Pre-Regulatory Landfill Site Name]*. In order to determine the feasibility of the re-use of this property, a detailed assessment of this closed landfill is needed. The landfill is located in *[City]*, *[County]*, North Carolina.

[North Carolina Local Government Name] is interested in contracting the services of an approved environmental consultant to perform and certify assessment services for this landfill in full cooperation of and under the guidance of the North Carolina Department of Environmental Quality (NC DEQ) Division of Waste Management, Special Remediation Branch, Pre-Regulatory Landfill Unit (Unit).

All environmental consultants interested in responding to this RFP should refer to the current published edition of the Unit's *Guidelines for Addressing Pre-Regulatory Landfills and Dumps* guidance document including subsequent amendments and editions when responding in order to adequately prepare for the effort required in work plan preparation, cost proposals and report submittal. All services proposed must be approved by the Unit following these guidelines and other regulations as determined by the Unit.

[North Carolina Local Government Name] is voluntarily undertaking the assessment of this pre-1983 landfill as defined in NCGS130A-290(a) (21a). The approved environmental consultant must be qualified to perform and will be responsible for compliance of all phases of this voluntary remedial investigation as directed by the Unit.

[North Carolina Local Government Name] will not be responsible for any activities, services or other costs associated with this RFP or subsequent contract work that is not pre-approved by the Unit. All work must comply with the requirements of NCGS 130A-310.6 (f) and designated by NC DEQ as reimbursable to the *[North Carolina Local Government Name]* under this statute. It is the sole responsibility of the approved environmental consultant to assure that all work performed as a result of this RFP is reimbursable to the *[North Carolina Local Government Name]* under this program administered by the Unit.

The property is known to the Unit and listed on the *Old Landfill Inventory* as: *[SITE NAME]*, *[IDENTIFICATION NUMBER]*. The landfill is located on a portion of *[County]* Parcel, PIN: *[number]*. Only the landfill and areas that may have been impacted by past landfill activities as outlined in the *Guidelines for Addressing Pre-Regulatory Landfills and Dumps* is to be considered for this RFP.

ATTACHMENT 2: PRE-REGULATORY LANDFILL PROGRAM CONTRACT TASK MANAGEMENT GUIDANCE

The following guidelines pertain to Professional Engineering firms (Contractors) awarded a contract to complete contaminant assessment and risk based remedial measures with the North Carolina Department of Environmental Quality's (NC DEQ) Pre-Regulatory Landfill Unit (Unit).

INTRODUCTION

Executed contracts are in accordance with Articles 3D and 8 of Chapter 143 of the North Carolina General Statutes. The statutory references can be found at the following websites, respectively:

https://www.ncleg.net/EnactedLegislation/Statutes/HTML/ByArticle/Chapter_143/Article_3D.html and
https://www.ncleg.net/EnactedLegislation/Statutes/HTML/ByArticle/Chapter_143/Article_8.html

The Contractor shall ensure that all documents and work plans comply with the Contractor's executed contract with the NC DEQ and the Inactive Hazardous Sites Response Act. All work activities shall be conducted in compliance with the current published editions of the following guidance documents including subsequent amendments and editions:

1. Guidelines for Addressing Pre-Regulatory Landfills and Dumps; and
2. Division of Waste Management: Vapor Intrusion Guidance.

The Contractor must assign a PM who will manage all RI and RA activities for the pre-1983 landfill. The Contractor PM is critical for maintaining communication and efficiently completing RI and RA activities assigned by the Unit PM. During the preparation of a remedial action plan (RAP), the Contractor PM may transition to an engineer PM due to engineering design components.

TASK ORDERS

All work activities must be performed on a task order not to exceed basis as outlined in the executed contract.

The Unit PM will provide pre-1983 landfill specific task order requests to the Contractor PM to develop work plans, cost proposals, schedules and reports. The Unit PM will provide deadlines for submittal of the requested work plans, cost proposals, schedules and reports. Task orders should contain all activities that will be completed at approximately the same time. If beneficial, subtasks can be used in a task order to separate events. Deadline extensions may be requested in writing on Contractor company letterhead only when unforeseen circumstances arise, otherwise all work is expected by the requested deadline.

Once the Unit PM confirms the work plan, cost proposal and schedule satisfy the requested task order, an approval authorization letter will be sent to the Contractor PM via e-mail. The Contractor PM must receive the task order approval authorization letter prior to commencement of any work activities.

Important: Work activities completed without prior authorization from the Unit will not be reimbursed.

Once the Unit PM confirms the work activities outlined in the approved task order are complete, the Unit PM will send the Contractor PM a task order completion letter. The Contractor PM must receive a task order completion letter for all task orders before submitting an invoice to the Unit.

The initial site visit and first phase RI activities are generally completed using a single task order. Contaminant delineation RI activities will most likely be tasked in multiple phases.

WORK PLANS, COST PROPOSALS AND SCHEDULES

Work plans, cost proposals and schedules must include a cover letter addressed to the attention of the assigned Unit PM and submitted via email. Include the pre-1983 landfill identification number and name along with the task order number exactly as listed in the task order request.

Only propose or address work activities requested by the Unit PM in work plans and cost proposals. Include a proposed schedule with all work plans that includes the task(s)/subtask(s) to be performed each day (field activities) and the Contractor personnel that will be on site based on the Personnel Qualifications and Task Descriptions as outlined in Attachment 3 (i.e. Staff Geologist, Technician, sub-contractor).

Figure 1 is an example of a field activities schedule outlining the number of weeks, the day of the week, associated task order/subtask number and quantity and classification of contractor personnel and sub-contractor personnel for each day.

Week 1 – Day 1	Subtask #(s)	Quantity of Staff	Personnel Classification
Week 1 – Day 2	Subtask #(s)	Quantity of Staff	Personnel Classification
Week 1 – Day 3	Subtask #(s)	Quantity of Staff	Personnel Classification
Week 1 – Day 4	Subtask #(s)	Quantity of Staff	Personnel Classification
Week 1 – Day 5	Subtask #(s)	Quantity of Staff	Personnel Classification
Week 1 – Day 6	Subtask #(s)	Quantity of Staff	Personnel Classification
Week 1 – Day 7	Subtask #(s)	Quantity of Staff	Personnel Classification

Figure 1: Field Activities Schedule

The week is the week that field work begins for the associated task(s)/subtask(s). Day 1 is the first day that field work begins, regardless of the day of the week. The task/subtask number(s) are the task/subtask(s) that will be performed on the listed day(s). The number of personnel for each day represents the number of staff in the field for that day.

Contractor field personnel must receive a copy of the approved work plan for reference during field activities.

If revisions to work plans, cost proposals and/or reports are required, provide the Unit PM, via email, a complete document with revisions including a new revision date. The work plan should not be modified without approval of the Unit.

Cost proposals must have numbered pages and conform to the formatting as shown in the *Cost Proposal and Invoice Format Sheets* which can be found in Attachment 4.

Unit rates must match with the corresponding Personnel Level description based on the type of work activity such as remedial investigation/design and active remedial oversight as outlined in the Fee Schedule of each executed contract.

Costs associated with the preparation of health and safety plans are part of the Contractor's responsibility to ensure the safety of field staff. When special site conditions exist that affect public safety, i.e. exclusion zones to protect the public, then costs associated with the health and safety plan may be included.

Activities exceeding \$3,000 require quotes to document the competitive bidding process. The Contractor must comply with paragraph K as outlined in the Scope of Work in each executed contract.

COST ADJUSTMENTS AND WORK VARIANCES

When the approved work plan, cost proposal or schedule will not be maintained or cannot be completed as planned, the Contractor PM must notify the respective Unit PM and explain the pending issues. The Contractor PM must request a cost adjustment (change order) when a specific activity will exceed the approved task order dollar amount or a work variance if there are significant changes to the approved work plan impacting itemized costs or the approved schedule.

In accordance with the terms of the executed contract, the Contractor PM must immediately contact the Unit PM and provide the details, cost proposal, and schedule for the requested change order. The Unit PM may provide verbal approval of the cost adjustment. If verbal approval is granted, the Contractor PM must submit a written request along with the itemized costs within 48 hours of the verbal approval. If the Unit PM does not receive the written request within 48 hours, the Contractor may not be paid for the work activities.

Note: Work activities completed without approval from the Unit will not be paid.

A variance from the approved work plan must also be requested when there are significant changes to work plan activities that will affect individual line-item costs (unit rates) but will not exceed the total approved cost of the task order. The Contractor PM must immediately contact the Unit PM when issues arise that will result in work not being completed in accordance with the work plan. Discuss the details, cost, and schedule for the work plan variances with the Unit PM. The Unit PM may provide verbal approval of the variance. If verbal approval is granted, the Contractor PM must submit a written request along with the new itemized costs within 48 hours of the verbal approval. If the Unit PM does not receive the written request within 48 hours, the Contractor may not be paid for the work activities.

INVOICES

After the Contractor PM provides notification that all work activities associated with a particular task order is complete and the Unit PM is satisfied with the deliverable, the Unit PM will send the Contractor PM a task order completion letter. Once the Contractor PM receives this letter the Contractor shall submit invoices.

Upon completion of each task order, including submittal of all approved related documents (including but not limited to written reports on technical progress, identification of problems, delays and cost

updates) and the associated certifications, the Contractor PM may submit an invoice for payment that complies with the authorized costs outlined for each task order.

The Contractor PM should submit invoices as soon as possible once task order(s) activities are complete but must submit the invoice and all associated verification documents within 30 days from the date when the Unit PM issued the task order completion letter.

All invoices must be submitted in the same format as the approved cost proposal with all costs identified and a completed *PRLF Invoice Check List Form* which can be found in Attachment 5. Each invoice packet must include numbering to identify the costs associated with quotes and supporting documentation. The numbering will assist both the Contractor PM and Unit PM with review and verification of all required documentation. The Contractor PM must initial and date all invoices submitted to the attention of the Unit PM assigned to the project.

Include approved cost adjustments and approved work variances with all invoice submittals. Identify the approved changes on the invoice checklist for review by the Unit PM.

CONTRACTOR INTERACTION WITH UNIT PM AND PROPERTY OWNERS

The Unit PM is the point of contact with the property owner(s). Whether at meetings on site or via telephone, the Unit PM will provide the property owner(s) with information associated with all activities. If approached by the property owner(s), the media, or general public, the Contractor PM should limit responses and defer to the Unit PM for official communication regarding the site and all associated activities.

If a property owner becomes uncooperative or if the Contractor PM or their staff must leave a site due to safety concerns, immediately report the situation to the Unit PM. The Unit will work to resolve any property access concerns or safety issues with the Contractor PM, property owner(s) and any other impacted parties.

The Contractor PM must communicate with the Unit PM on a frequency established by the Unit and based on the type of field activities and work phase. There may be the need for daily communication via telephone, email and/or written reports. Communication between the Contractor PM and Unit PM is critical for maintaining a transparent record of completed RI and RA phase work activities.

REPORT SYMBOLS AND ABBREVIATIONS

Display symbols and abbreviations on all figures and maps according to the following:

Note: Use the last four digits of the site identification number before the sample abbreviation.
 Example: 0730-TW-1

Description	Abbreviation		Symbol
Temporary Monitoring Well (less than 7 days)	TW-#		
Monitoring Well (more than 7 days)	MW-#		
Water Supply Well	PW-House number		 or 
Waste Characterization	WC-#		
Boring (no soil sample collected)	B-#		
Soil Boring (soil sample collected)	SB-#		
Surface Water/Sediment Sample	SW/SD-#		
Landfill Gas Probe	LFGP-#		
Soil Gas Probe	SGP-#		

ATTACHMENT 3: PERSONNEL QUALIFICATIONS AND TASK DESCRIPTIONS

PERSONNEL AND QUALIFICATIONS	TASK DESCRIPTIONS
<p>Principal Engineer/Geologist/Hydrogeologist/Scientist Administrative and/or professional head of the organization or primary contract. Responsible for conceiving and executing business functions of the organization. Directs the professional staff. Normally has a financial interest in the company as partial owner, major investor or stockholder, or officer. Charges an extremely limited number of hours per site as the Principal. This position should never bill field or field supervision hours.</p>	<ul style="list-style-type: none"> - Expert testimony - Legal strategies - Depositions - Contract oversight (limited)
<p>Senior Engineer/Geologist/Hydrogeologist/Scientist Typically requires professional registration when applicable to task, 8 years of experience in technical or managerial roles, and regulatory compliance. Serves as senior technical leader, provides contract oversight for environmental remediation projects of medium to large scope and /or complexity and has developed substantial expertise in their field of practice. Generally, supervises Project Managers and oversees several projects. Duties typically include reviewing reports, developing strategies, and attending client and/or associated project meetings. Responsible for approving designs, reports, plans, and specifications before submittal to the Pre-Regulatory Landfill Unit. If significantly involved in a highly technical project, should have substantial technical expertise directly related to the project. Ensures compliance of field service operations with OSHA safety standards. Addresses public health concerns.</p>	<ul style="list-style-type: none"> - Expert testimony - Site strategy and planning - Contract oversight - Reviews technical reports - Reviews corrective action plans - Reviews engineering/remedial system design - Health and safety coordinator - Reviews site safety plans
<p>Project Engineer/Geologist/Hydrogeologist/Scientist Typically possesses at a minimum, a bachelor of science degree in engineering, geology, hydrogeology, or a directly related field. Serves as manager for entire project and has at least 5 years of experience in the environmental field. Duties typically include preparing proposals, reviewing reports, developing strategies, and attending client and/or associated project meetings. Under general supervision, prepares environmental design and plan specifications for site remedial activities. Leads and supervises teams of staff and technician level personnel, but would have a limited number of hours charged to each site, and only a small percentage of total field hours. Serves as site technical expert or supervisor for hydrogeological site characterizations and remediation activities and tests, and assembly of reports, plans, and specifications.</p>	<ul style="list-style-type: none"> - Project management - Site strategy and planning - Develop site health and safety plans - Engineering/remedial system design - Data review and analysis - Report review - Site meetings and reconnaissance - On-site supervision (periodic) - Work plan preparation/review - Site investigation planning/review - Field work planning/review - Site inspection (periodic)
<p>Staff Engineer/Geologist/Hydrogeologist/Scientist Requires at a minimum, a bachelor's degree in engineering, geology, hydrogeology, or related science and 1 to 5 years of experience in the environmental field. Works under supervision of the project manager to perform routine tasks related to environmental investigation and remediation projects. Is the primary person responsible for gathering field data and is competent at data analysis. Must be able to conduct investigation and remedial activities including directing drilling and monitoring well installation, sampling, conducting site and geologic mapping, documenting field activities, and compiling data. Must have knowledge of QA/QC procedures and protocol. This position will normally be highest in the number of hours billed for on-site work. However, technicians (see below) would conduct routine or on-going monitoring.</p>	<ul style="list-style-type: none"> - Report preparation - Field work preparation/planning - Supervises site investigation and remediation activities - Site reconnaissance and mapping - Engineering/remedial system design and installation - Limited data review and analysis - On-site health and safety supervisor
<p>Technician Typically requires a high school diploma, certified or licensed trades-person, or an associate's degree at a minimum. Responsible for general supervision of the installation, maintenance, and repair of on-site equipment. Conducting routine monitoring, collecting samples, and preparing equipment maintenance/operating logs.</p>	<ul style="list-style-type: none"> - Field work preparation - Operation and maintenance of equipment - Well developing and sampling - Soil sampling - Handling of investigation and remediation derived wastes - Remedial system installation, operation, and maintenance - Monitoring activities
<p>Draftsperson/CAD Typically requires a high school diploma. Requires 2 to 8 years of experience or 2 years of related college and more than 1 year of experience. Generally requires a Technical Drawing Certificate, and advanced drafting skills such as Computer Aided Drafting (CAD) & Design (CADD) operations.</p>	<ul style="list-style-type: none"> - Drafting - CAD/CADD work - Cartography - Plotting of GPS and standard survey data
<p>Word Processor/Clerical Operates computer for work processing, spreadsheets, and statistical typing, correspondence report generation, general office work, typing, and filing.</p>	<ul style="list-style-type: none"> - Spreadsheets - Report generation - Word processing - Typing - Filing - General secretarial - Document reproduction

ATTACHMENT 4: COST PROPOSAL AND INVOICE FORMAT SHEETS

The following formats must be used by both Contractors and Local Governments for developing cost proposals and invoice submittals.

COST PROPOSAL FORMAT SHEET

Cost Proposal

Site ID #: _____ Task Order #: _____ Work Phase Description: RI Delineation
 State Contract #: _____ Site Name: _____

Task Order # & Task Description (Work Plan and Field Services):

Subtask A - Subtask Description (Work Plan and Estimate):

Labor	Unit Rate (\$)	# Units	Total Cost
Personnel Level	\$0	0	\$0
Project	\$0	0	\$0
Staff	\$0	0	\$0
Word Processor/Clerical	\$0	0	<u>\$0</u>
		Subtotal Subtask A	\$0

Subtask B – Cover Soil Sampling:

Labor	Unit Rate (\$)	# Units	Total Cost
Personnel Level	\$0	0	\$0
Staff	\$0	0	\$0
Technician	\$0	0	\$0

Expendables and Reimbursable:

GPS Unit	\$0	0	\$0
PID	\$0	0	\$0
Subcontractor drilling	\$0	0	\$0
Per diem	\$0	0	\$0
Mileage	\$0	0	<u>\$0</u>
		Subtotal Subtask B	\$0

Cost Proposal Task Total \$0

INVOICE FORMAT SHEET

Invoice

Site ID #: Task Order #: Work Phase Description: RI Delineation
 State Contract #: Site Name:

Task Order # & Task Description (Work Plan and Field Services):

Subtask A - Subtask Description (Work Plan and Estimate):

Labor			
Personnel Level	Unit Rate (\$)	# Units	Total Cost
Project	\$0	0	\$0
Staff	\$0	0	\$0
Word Processor/Clerical	\$0	0	<u>\$0</u>
		Subtotal Subtask A	\$0

Subtask B – Cover Soil Sampling:

Labor			
Personnel Level	Unit Rate (\$)	# Units	Total Cost
Staff	\$0	0	\$0
Technician	\$0	0	\$0

Expendables and Reimbursable:

GPS Unit	\$0	0	\$0
PID	\$0	0	\$0
Subcontractor drilling	\$0	0	\$0
Per diem	\$0	0	\$0
Mileage	\$0	0	<u>\$0</u>
		Subtotal Subtask B	\$0

Invoice Task Total \$0

(Contractor PM Signature)

Name:

Invoice # (Company Invoice #):

Title:

Remit To: (Company Name)
(Company Address)

Company Name:

ATTACHMENT 5: PRLF INVOICING CHECK LIST FORM

PRLF INVOICING CHECK LIST

Contractor PM Initial:
Date Invoice Submitted to PRLF:

Task Order ID:

PRLF PM Initial:
Date to PRLF Peer:

Contractor PM

Local Gov't PM

PRLF PM

PRLF PEER

EXAMPLE ONLY

Contractor Invoice

- Is the approved cost proposal included at the end of the invoice package?
- Was a work plan variance submitted that affected costs? (If so, explain in notes below)
- Is the site name and ID # correct on the invoice and cost proposal?
- Is the invoice date representative of the latest invoice submittal date?
- Does the format of the invoice match the format of the cost proposal, including breakout of subtasks?
- Are all line items from the cost proposal included in the invoice?
- Is an explanation provided in the notes for **all** items that vary from the cost proposal to the invoice? Such as:
 - Invoiced line items not included in the cost proposal?
 - Equipment unit rates invoiced higher than proposed?
 - Large variances in proposed personnel hours and invoiced hours? (Reasonable variances are accepted)
- Are the unit costs correct per the contract fee schedule?
- Is tax for rented equipment and purchased supplies listed as a separate line item?
- Are shipping costs listed as a separate line item?
- Is an explanation provided in the notes if the invoice includes project or senior level hours for field work?
- Is the math correct?

Subcontractor Invoice(s)

- Are all subcontractor invoices provided, and in the order they appear on the contractor's invoice?
- Are all subcontractor bids provided with the cost proposal in the order they appear in the cost proposal?
- Do the subcontractor's total costs match the consultant's invoice line items?
- Is an explanation provided in the notes for sub line items not included in the cost proposal bid?
- Is an explanation provided in the notes for sub rates invoiced higher than in the cost proposal bid?
- If the sub invoice covers multiple tasks and/or cost adjustments, are the totals clearly broken out for each?
- If a sub's proposed line items/unit hours were reduced, are the consultant's associated line items reduced?
- Do all sub invoices and bids show a breakdown of costs in separate line items (no lump sum costs)?
- Is the math correct on the subcontractor invoices?

Additional Items for Remedy Invoices

- Is the cost spreadsheet from the consultant/subcontractor contract included?
- Are the line items relevant to this invoice highlighted on the contractor/subcontractor cost spreadsheet?
- Does the invoice contain validation of units for invoiced subcontractor items?
 - Such as: weight tickets, surveyor statements of volumes (SF, acres, etc.) field measurements collected by contractor, cut/fill reports, field observation reports documenting days, activities, etc.*
- If a sub hires a sub to complete a line item (i.e. surveyor, driller, etc) is there proof of services rendered?
 - Such as: surveyor report, driller well abandonment records, field observation reports, etc.*

To be Completed by PRLF Staff Only

- Is the invoice and approved cost proposal separately secured (if more than 1 page each)?
- Is the task order on the database?
- Does the total cost of the cost proposal match the database?

Notes: _____
