COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

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HAZARDOUS WASTE MANAGEMENT POST-CLOSURE PERMIT For RUSSELL ROAD LANDFILL

Permittee: **Marine Corps Combat Development Command (MCCDC)**
Marine Corps Base Quantico
3049 Bordelon Street
Quantico, VA 22134

EPA I.D. No. VA1170024722

Pursuant to Chapter 14, Section 10.1-1426, Code of Virginia (1950), as amended and regulations promulgated thereunder by the Department of Environmental Quality, Division of Land Protection & Revitalization (DLPR) (former Waste Division), a Post-Closure Care Permit is issued to the Marine Corps Combat Development Command (MCCDC), Marine Corps Base Quantico, (hereinafter referred to as the Permittee), for the post-closure care of one closed hazardous waste management unit (HWMU), a closed and capped hazardous waste landfill, located in Prince William/Stafford County located in the MCB Quantico, Virginia at latitude 38°33' North and longitude 77°25' West.

The Permittee shall comply with all terms and conditions set forth in this Permit including all Permit Attachments. If the Permit Modules and the Permit Attachments conflict, the wording of the Permit Conditions within the Permit Modules shall prevail. The Permittee shall also comply with all applicable regulations contained in the Virginia Hazardous Waste Management Regulations (VHWMR) as codified in Title 9 of the Virginia Administrative Code, Agency 20, Chapter 60 (9 VAC 20-60) and the *Resource Conservation and Recovery Act* (RCRA) Regulations under in the Code of Federal Regulations (CFR) under 40 CFR Parts 124, 260, 261, 262, 264, 265, 268, and 270, as adopted by reference in the VHWMR. (For convenience, wherever the RCRA Regulations are adopted by reference and cited in this Permit and the Permit Attachments, the regulatory citations will be only those from 40 CFR.

The Commonwealth of Virginia has received authorization for these programs under Section 3006(b) of the RCRA, 42 U.S.C. § 6926(b), to administer and enforce the RCRA Regulations under the VHWMR in lieu of the federal hazardous waste management program. Applicable Regulations are those under the VHWMR under (9 VAC 20-60) and the RCRA which are in effect on the date of final administrative action on this Permit and as well as any self implementing statutory provisions and related Regulations which are automatically applicable to the Permittee's hazardous waste management activities, notwithstanding the conditions of this Permit.

This Permit is based on the administrative record and the assumption that the information submitted by the Permittee and contained in the administrative record is complete and accurate. The Permittee's failure in the application or during the Permit issuance process to fully disclose all relevant facts, or the Permittee's misrepresentation of any relevant facts at any time, shall be grounds for the modification or termination of this Permit pursuant to 40 CFR § 124.5, § 270.41, § 270.42, and § 270.43, and shall also be grounds for initiation of an enforcement action. The Permittee shall inform the Department of any deviations from permit conditions or changes from information provided in the application. In particular, the Permittee shall inform the Department of any proposed changes that might affect the ability of the Permittee to comply with applicable Regulations and/or conditions of the Permit, or which alter any of the conditions of the Permit in any way.

This Permit is effective as of September XX, 20011, and shall remain in effect until October XX, 2021, unless revoked and reissued in accordance with 40 CFR § 124.5 and § 270.41, or terminated in accordance with 40 CFR § 270.43, or administratively continued in accordance with 40 CFR § 270.51.

Date Signed	Leslie A. Romanchik Hazardous Waste Program Manager Office of Waste Permitting and Compliance

HAZARDOUS WASTE MANAGEMENT POST-CLOSURE PERMIT For RUSSELL ROAD LANDFILL

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LIST OF ATTACHMENTS

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DEFINITIONS

For the purposes of this Permit, the following definitions shall apply:

a. The term "**Permit**" shall mean the Permit issued by the Virginia Department of Environmental Quality, pursuant to Chapter 14, Article 4, Title 10.1, Code of Virginia (1950), as amended, and the Virginia Hazardous Waste Management Regulations (VHWMR) as codified in Title 9 of the *Virginia Administrative Code*, Agency 20, Chapter 60 (9 VAC 20-60).

b. The term "**Director**" shall mean the Director of the Virginia Department of Environmental Quality or his designated representative.

c. The term "**Department**" shall mean the Virginia Department of Environmental Quality (DEQ), (with the address as specified in Permit Condition I.I.2).

d. The terms "**facility**" or "**site**" shall mean all contiguous land, and structures, other appurtenances, and improvements on the land, used for treating, storing, or disposing of hazardous waste. For the purpose of implementing corrective action under 40 CFR § 264.101, "facility" means all contiguous property under the control of the owner or operator under a permit under Subtitle C of RCRA.

e. The term "**hazardous waste management unit**" is a contiguous area of land on or in which hazardous waste is placed, or the largest area in which there is significant likelihood of mixing hazardous waste constituents in the same area. Examples of hazardous waste management units include a surface impoundment, a waste pile, a land treatment area, a landfill cell, an incinerator, a tank and its associated piping and underlying containment system and a container storage area. A container alone does not constitute a unit; the unit includes containers and the land or pad upon which they are placed.

f. The term "**release**" shall mean any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment, including abandonment or discarding of barrels, containers, and other closed receptacles containing any hazardous substance, pollutant, or contaminant (40 CFR § 302.2 and CERCLA § 101(22)) .

g. The term **"Area of Concern"** shall mean an area at the facility or an off-site area, which is not at this time known to be a solid waste management unit, where hazardous waste and/or hazardous constituents are present or are suspected to be present as a result of a release from the facility.

h. The term **"Hazardous Constituent"** shall mean a constituent that caused the Administrator to list the hazardous waste in 40 CFR Part 261, Appendix VIII.

i. The term **"Permittee"** shall mean the facility to which the Permit is issued.

j. The term **"EPA"** shall mean United States Environmental Protection Agency.

k. The term **"Solid Waste Management Unit"** shall mean any discernable unit at the facility from which hazardous constituents might migrate, irrespective of whether the units were intended for the management of solid and/or hazardous wastes. Such units include any area at a facility which solid wastes have been routinely and systematically released. The term "unit" refers to containers, container storage areas, tanks, surface impoundments, waste piles, land treatment units, landfills, incinerators, underground injection wells, and other physical, chemical, and biological units or treatment units.

l. The term "**Regulated Unit**" shall mean a surface impoundment, waste pile, land treatment unit, or landfill that receives hazardous waste after July 26, 1982. (40 CFR § 264.90.)

m. The term **"Days"** shall mean calendar days except as otherwise provided herein.

n. All definitions contained in 40 CFR Sections 124.2, 260.10, 270.2, 264.141, 264.1031, 264.1051, 264.1081, and 9 VAC 20-60 are hereby incorporated, in their entirety, by reference into this Permit. Any of the definitions used above, (a) through (f), shall supersede any definition of the same term given in 40 CFR Sections 124.2, 260.10, 270.2, 264.141, 264.1031, 264.1051, 264.1081, and 9 VAC 20-60. Where terms are not defined in the regulations or the Permit, the meaning associated with such terms shall be defined by a standard dictionary reference or the generally accepted scientific or industrial meaning of the term.

o. Throughout the Permit, all references to 40 C.F.R. Parts 261-266, 268, 270, 273, 279, are as adopted by reference in the *Virginia Hazardous Waste Management Regulations (VHWMR),* 9 VAC 20-60.

MODULE I

STANDARD CONDITIONS

This Permit has been developed for the Marine Corps Combat Development Command (MCCDC), Marine Corps Base Quantico (MCB Quantico) (Facility) to ensure compliance with all appropriate maintenance, monitoring, and reporting requirements as defined by 9 VAC 20-60 *et seq.* for the closed Russell Road Landfill (RRL), a hazardous waste landfill or "Regulated Unit," which is located in Prince Williams/Stafford at latitude 38°33' North and longitude 77°25' West.

Hazardous waste management at the "Regulated unit" at the above Facility which is addressed by this Permit is limited to the following activities: maintenance, gas monitoring, leachate collection, groundwater monitoring, and groundwater corrective action (CA) of one (1) closed and capped hazardous waste landfill containing hazardous wastes as specified in this Permit.

Hazardous waste leachate with the hazardous waste number/code F039 is collected and managed by a leachate collection system (installed around the perimeter of the landfill) and a leachate collection sump, which were installed at closure to mitigate the lateral migration of leachate from the closed "Regulated Unit." F039 leachate is assigned to liquids that have percolated through land disposed wastes resulting from the disposal of more than one restricted waste which is classified as hazardous under 40 CFR Part 261, Subpart D. Leachate which is collected in the leachate collection system and sump is manifested and shipped off-site to a regulated treatment, storage, disposal (TSD) facility regulated under the RCRA Regulations.

I.A. EFFECT OF PERMIT

This Permit authorizes only the management of hazardous waste expressly described in this Permit and does not authorize any other management of hazardous waste. Compliance with this Permit generally constitutes compliance, for the purposes of enforcement, with Chapter 14, Section 10.1-1426, Code of Virginia (1950), as amended. Issuance of this Permit does not convey property rights of any sort or any exclusive privilege; nor does it authorize any injury to persons or property, an invasion or other private rights, or any infringement of State or local laws or regulations. Compliance with the terms of this Permit may not constitute a defense to any action brought under Chapter 14, Section 10.1-1455, Code of Virginia (1950), as amended, or any other law governing protection of the public or the environment.

I.B. PERMIT ACTIONS

This Permit may be modified, revoked and reissued, or terminated for cause as specified in 40 CFR §§ 124.5, 270.30(f), 270.41, 270.42, and 270.43. The filing of a request for permit modification, revocation and reissuance, or termination or the notification of planned changes or anticipated noncompliance on the part of

the Permittee does not stay the applicability or enforceability of any Permit condition (40 CFR § 270.30(f)).

I.C. SEVERABILITY

The provisions of this Permit are severable, and if any provision of this Permit or the application of any provision of this Permit to any circumstance is held invalid, the application of such provision to other circumstances and the remainder of this Permit shall not be affected thereby.

I.D. DEFINITIONS

For the purpose of this Permit, terms used herein shall have the same meaning as those in 40 CFR §§ 124.2, 260.10, 264.141, 270.2, 9VAC 20-60-12, 9VAC 20-60-14, and 9VAC 20-60-17, unless this Permit specifically states otherwise. Where terms are not otherwise defined, the meaning associated with such terms shall be as defined by a standard dictionary reference or the generally accepted scientific or industrial meaning of the term.

I.E. REPORTS, NOTIFICATIONS, AND SUBMISSIONS TO THE DIRECTOR

I.E.1. The Department will review the plans, reports, schedules and other documents (hereinafter collectively referred to as "submission") submitted which require Department approval. The Department will notify the Permittee in writing of DEQ's approval or disapproval of each submission.

I.E.2. In the event of DEQ disapproval in whole or in part of any submission, the Director shall specify the deficiencies in writing. Document review and approval shall be in accordance with **Permit Condition I.L.**

I.E.3. Two (2) complete copies of all reports, notifications or other submissions which are required by this Permit to be sent or given to the Director of the DEQ shall be sent certified mail or be hand-delivered to:

Department of Environmental Quality
Attn: Ms. Leslie Romanchik, Hazardous Waste Program Manager
Office of Waste Permitting and Compliance
Division of Land Protection and Revitalization
PO Box 1105
Richmond, VA 23218-0009
Phone: (804) 698-4129

Street address:
629 East Main Street
Richmond, Virginia 23219

Director
Virginia Department of Environmental Quality
Northern Virginia Regional Office
13901 Crown Court
Woodbridge, Virginia 22193
Phone: (703) 583-3900

I.F. SIGNATORY REQUIREMENTS

All reports or other information requested by the Director shall be signed and certified as specified by 40 CFR § 270.11.

I.G. DOCUMENTS TO BE MAINTAINED AT THE FACILITY SITE

I.G.1. The Permittee shall maintain at the Facility, until post-closure care is completed and certified by the owner/operator and an independent professional engineer registered in Virginia, the following documents (as amended, revised and/or modified):

a. The Permit including all attachments.

b. Personnel training documents and records required by 40 CFR § 264.16 and this Permit.

c. Operating record required by 40 CFR § 264.73, **Permit Condition II.F.1.and Permit Module III**.

d. Inspection schedules and logs required by 40 CFR § 264.15(d) and **Permit Attachment H, Inspection Requirements**.

e. Groundwater sampling and analysis plan required by 40 § CFR 264.92 and this Permit.

f. Groundwater monitoring results required by 40 CFR § 264.73(b)(6) and this Permit.

g. Corrective Action Work Plans, Reports, and other information and submissions regarding corrective action, as applicable under this Permit.

h. All other documents required by **Permit Conditions I.H.9., and I.H.13. through I.H.15**.

I.H. DUTIES AND REQUIREMENTS

I.H.1. Duty to Comply

The Permittee shall comply with all conditions of this Permit, except to the extent and for the duration such noncompliance is authorized by an emergency permit (see 40 CFR § 270.61). Any other permit noncompliance constitutes a violation of Title 10.1, Code of Virginia (1950), as amended, and Regulations promulgated thereunder and is grounds for enforcement action, permit termination, revocation and reissuance, modification, or denial of a permit renewal application (40 CFR § 270.30(a)).

I.H.2. Permit Expiration

This Permit and all conditions herein will remain in effect beyond the Permit's expiration date if the Permittee has submitted a timely, complete application in accordance with 40 CFR § 270.10(c) and through no fault of the Permittee, the Director has not issued a new permit with an effective date on or before the expiration date of the previous permit as set forth in 40 CFR § 270.51(d)).

I.H.3. Duty to Reapply

If the Permittee wishes to or is required to continue an activity regulated by this Permit after the expiration date of this Permit, the Permittee shall apply for and obtain a new permit as specified below.

a. The Permittee shall submit a new and complete application for a new permit at least 180 days before the permit expires, unless a later date has been approved by the Director.

b. Pursuant to 40 CFR § 270.10(h), the Director shall not grant permission for an application to be submitted later than the existing permit's expiration date.

I.H.4. Need to Halt or Reduce Activity Not a Defense

It shall not be a defense in an enforcement action to argue that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this Permit (40 CFR § 270.30(c)).

I.H.5. Duty to Mitigate

In the event of noncompliance with the Permit, the Permittee shall take all reasonable steps to minimize or correct any adverse impact on the environment resulting from noncompliance with this Permit, and shall carry out such measures as are reasonable to prevent significant adverse impacts (40 CFR § 270.30(d)).

I.H.6. Proper Operation and Maintenance

The Permittee shall at all times properly operate and maintain all facilities and systems of the treatment and controls (and related appurtenances) which are installed or used by the Permittee to achieve compliance with the conditions of this Permit. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls; including appropriate quality assurance/quality control procedures. This provision requires the operation of back-up or auxiliary facility or similar systems only when necessary to maintain compliance with the conditions of the permit (40 CFR 270.30(e)).

I.H.7. Duty to Provide Information

The Permittee shall furnish the Director within a reasonable time, any relevant information the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this Permit, or to determine compliance with this Permit. The Permittee shall also furnish the Director, upon request, copies of records required by this Permit (40 CFR § 270.30(h)).

I.H.8. Inspection and Entry

The Permittee shall allow the Director or an authorized representative, upon the presentation of credentials and other documents as may be required by law to:

a. Enter at reasonable times upon the Permittee's premise where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this Permit;

b. Have access to and copy, at reasonable times, any records kept under conditions of this Permit;

c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this Permit; and

d. Sample or monitor, at reasonable times, for the purpose of assuring permit compliance or as otherwise authorized by the VHWMR, any substance or parameters at any location (40 CFR § 270.30(i)).

I.H.9. Monitoring and Records

a. Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity. The method used to obtain a representative sample of the waste to be analyzed must be the appropriate method from Appendix I to Part 261 of 40 CFR or an equivalent method

approved by the EPA. Laboratory methods must be those specified in Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW-846 (3rd edition, Third Update, 1998, as updated).

b. The Permittee shall retain at the Facility or a designated repository, records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for any continuous monitoring instrumentation, copies of all reports and records required by this Permit, and records of all data used to complete the application for this Permit for the duration of the post-closure period. The Permittee shall maintain records from all groundwater monitoring wells and associated static water level surface elevations for the duration of the post-closure care period. These periods may be extended by the Director at any time and are automatically extended during the course of any unresolved enforcement actions.

c. Records of monitoring information shall specify:

i. The date, exact place, and time of sampling or measurements;

ii. The individual(s) who performed the sampling or measurements;

iii. The date(s) the analyses were performed;

iv. The individual(s) who performed the analyses;

v. The analytical techniques or methods used; and

vi. The results of such analyses (40 CFR § 270.30(j)).

I.H.10. Reporting Planned Changes

The Permittee shall give notice to the Director as soon as possible of any planned physical alterations or additions to the permitted Facility which will or has the potential to affect the Regulated Unit or the associated groundwater monitoring system. This notice shall include a detailed description of all incidents of noncompliance reasonably expected to result from the proposed changes (40 CFR § 270.30(l)(i)).

I.H.11. Anticipated Noncompliance.

The Permittee shall give advance notice to the Director of any planned changes in the permitted Facility or activity which may result in noncompliance with the permit requirements (40 CFR § 270.30(l)(2)).

I.H.12. Twenty-four Hour Reporting

The Permittee shall report to the Director any non-compliance which may endanger human health or the environment. Information shall be provided orally within 24-hours of the Permittee becoming aware of the circumstances. Information specified in **Permit Conditions I.H.12.a. and b.** shall be reported verbally within 24 hours:

a. Information concerning the release of any hazardous waste that may endanger public water supplies.

b. Any information of a release or discharge of hazardous waste, or of a fire or explosion at the Facility, which could threaten the environment or human health. The description of the occurrence and its cause shall include at a minimum:

   i. Name, address, and telephone number of owner/operator;

   ii. Facility name, address, and telephone number;

   iii. Date, time, and type of incident;

   iv. Name and quantity of material(s) involved;

   v. The extent of injuries, if any;

   vi. Assessment of actual or potential hazard to human health and the environment outside the Facility; and

   vii. Estimated quantity and disposition of recovered material from the incident (40 CFR § 270.30 (1)(6)).

c. A written submission shall also be provided to the Director within five (5) days of the Permittee becoming aware of the circumstances. The written submission shall contain at a minimum the following:

   i. Description of the noncompliance and cause;

   ii. The periods of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated duration of the noncompliance; and

   iii. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of noncompliance.

The Permittee need not comply with the 5-day written notice requirement only if the Director waives that requirement following verbal notification

(**Permit Condition I.H.12.**) and the Permittee submits a written report within fifteen (15) days of the time the Permittee becomes aware of the circumstances (40 CFR § 270.30(1)(6)(iii)).

I.H.13. Other Noncompliance

The Permittee shall report all other instances of noncompliance not otherwise required to be reported above, at the time monitoring reports are submitted. The reports shall contain at a minimum the information listed in **Permit Condition I.H.12.** (40 CFR § 270.30(1)(10)).

I.H.14. Transfer of Permits

This Permit may be transferred to a new owner or operator only if it is modified or revoked and reissued pursuant to 40 CFR § 270.40, 40 CFR § 124.5, 40 CFR § 270.42, 40 CFR § 270.43, and 40 CFR § 270.61. Before transferring ownership or operation of the Facility during the Post-closure Care Period, the Permittee shall notify the new owner or operator in writing of the requirements of 40 CFR Part 264, 40 CFR § 270.40, 40 CFR § 270.41, and the requirements of this Permit.

I.H.15. Other Information

Whenever the Permittee becomes aware that he failed to submit any relevant facts in the permit application, or submitted incorrect information in a permit application or in any report to the Director, the Permittee shall promptly submit such facts or information to the Director.

I.I. PERMIT DURATION

This permit shall be in effect for ten (10) years from the date of issuance; however, the post-closure period is 30 years from the date of closure certification, dated September 3, 1998. Therefore, the post-closure care period shall extend to September 3, 2028, and the facility is required to operate under a Post-closure Permit until that date.

I.J. EXTENSION OR REDUCTION OF POST-CLOSURE PERIOD

I.J.1. The Permittee may request a reduction in the 30-year post-closure period if the following conditions exist (40 § CFR 264.117(a)(2)(i)):

a. All land-disposal units have been closed.

b. A shortened period is sufficient to protect human health and the environment based upon: leachate or groundwater monitoring results, characteristics of the hazardous wastes, application of advanced technology, or alternate disposal, treatment, or reuse techniques indicate that the facility is secure.

I.J.2. The Director may extend the post-closure period applicable to the hazardous waste management unit or facility if the extended period is necessary to protect human health and the environment (e.g., leachate or groundwater monitoring results indicate a potential for migration of constituents at levels which may be harmful to human health and the environment) in accordance with 40 CFR § 264.117(a)(2)(ii).

I.K. COMPLIANCE PERIOD

The Compliance Period is the period of time that the facility is required to remain in compliance with the Groundwater Protection Standards (GPS) in the uppermost aquifer beneath the unit at the point of compliance (40 CFR § 264.92 and § 264.96). The compliance period is the number of years equal to the active life of the Regulated Unit including the post-closure period.

I.K.1. The 28-acre closed landfill was used as the primary disposal area for the base from 1971 until 1983. The 28-acre site contains the hazardous waste management area, a borrow area used during closure, a concrete decontamination area, five stormwater management areas, leachate sump area, passive methane vents and monitoring wells. The cap was completed and the landfill was certified closed in accordance with the approved closure plan and post-closure plan and approved by the Department on September 3, 1998. In accordance with the VHWMR, the compliance period during which the GPSs apply is 30 years. Therefore, the post-closure care period shall extend to September 3, 2028. (40 CFR § 264.310 and 40 CFR § 264.117)

I.K.2. If at the end of the specified compliance period, the facility is engaged in a corrective action program, the compliance period shall be extended until the Permittee can demonstrate that the GPS has not been exceeded at the point of compliance for a period of three (3) consecutive years (40 CFR § 264.96(c)).

I.L. REVIEW AND APPROVAL OF SUBMISSIONS

I.L.1. The DEQ will review the plans, reports, schedules and other documents (hereinafter collectively referred to as "submissions") submitted which require the Director's approval. The DEQ will notify the Permittee in writing of the DEQ's approval, conditional approval, or disapproval of each submission.

I.L.2. Each submission required by this Permit, upon approval by the Director, is incorporated into this Permit. Any noncompliance with a DEQ-approved submission shall be deemed as noncompliance with this Permit. A conditionally approved submission, including any terms of such conditional approval set forth in DEQ's decision, shall constitute the DEQ-approved submission and shall be incorporated into this Permit.

I.L.3. In the event of the DEQ's conditional approval of submission, the Director shall specify in writing any deficiencies in the submission and the terms upon which approval of the submission is conditioned. If the Permittee disputes any term upon which approval of the submission was conditioned, the Permittee may initiate Dispute Resolution pursuant to permit condition I.M.

I.L.4. In the event of the DEQ's disapproval of a submission, the Director or the DEQ shall specify the deficiencies in writing. Such disapproval shall not be subject to the Dispute Resolution provision set forth in permit condition I.M. The Permittee shall modify the submission to correct/address the specified deficiencies within a reasonable time period established by the Director or the DEQ taking into account the tasks to be performed, and submit the revised submission to the DEQ for approval.

I.L.5. If the revised submission is disapproved, the Director or the DEQ will notify the Permittee of the deficiencies in writing and specify a schedule for the Permittee to correct the deficiencies and resubmit the submission to DEQ. The Permittee shall correct the deficiencies as directed by DEQ, and forward the revised submission within the time period specified by DEQ. In the event the Permittee disagrees with the DEQ's disapproval of the revised submission, the Permittee shall notify the DEQ in writing and the disagreement shall be resolved in accordance with the Dispute Resolution provision in permit condition I.M. of this Permit.

I.M. DISPUTE RESOLUTION

I.M.1. Except as otherwise provided in this Permit, in the event the Permittee disagrees, in whole or in part, with Department disapproval of any submission required by this Permit, the Permittee shall notify the Department in writing of its objections, and the basis thereof, within fourteen (14) days of receipt of the Department's disapproval. Such notice shall set forth the specific matters in dispute, the position(s) the Permittee asserts which should be adopted as consistent with the requirements of the Permit, the basis for the Permittee's position, and supporting documentation considered necessary for the Department's determination.

I.M.2. The Department and the Permittee shall have an additional fourteen (14) days from the Department's receipt of the notification to meet or confer to resolve any disagreement/dispute. In the event agreement is reached, the Permittee shall submit the revised submission and implement the same in accordance with such agreement.

I.M.3. In the event the Permittee and the DEQ are not able to reach an agreement on the dispute items within the additional 14-day period, the Department will notify the Permittee in writing of its decision on the dispute and the Permittee shall comply with the terms and conditions of the Department's decision in the dispute. The Permittee does not waive its right to assert any and all available defenses in a proceeding to enforce this Permit.

I.M.4. In the event the Permittee disagrees with DEQ's disapproval of a submission or revised submission and the DEQ's written decision regarding dispute items, the Permittee may file an appeal with the Director within 30 days of the disapproval (as provided for in Rule 2A:2 of the Supreme Court of Virginia).

MODULE II

GENERAL FACILITY CONDITIONS

II.A. DESIGN AND OPERATION OF FACILITY

The Permittee shall maintain and operate its facility, the location of which is shown by the location map, topographic map, and facility map (**Permit Attachment A and B**), to minimize the possibility of fire, explosion, or any unplanned sudden or non-sudden release of hazardous waste constituents to the air, soil, or surface water which could threaten human health or the environment.

II.B. GENERAL WASTE ANALYSIS

A list of all wastes and waste constituents which were ever known to have been discharged to the closed landfill is provided in the List of Wastes, **Permit Attachment D**. This list is based upon information provided by the Facility.

II.C. SECURITY

The Permittee shall comply with the security provisions of 40 CFR § 264.14. The security provisions shall follow the requirements described in **Permit Attachments E and G.**

II.D. GENERAL INSPECTION REQUIREMENTS

The Permittee shall follow the inspection plan set out in **Permit Attachment H.** The Permittee shall remedy any deterioration or malfunction discovered by an inspection (40 CFR § 264.15). Inspection records shall be kept as required by 40 CFR § 264.15(d).

II.E. PERSONNEL TRAINING

The Permittee shall conduct required personnel training (40 CFR § 264.16). This training program shall follow **Permit Attachment I**, and the Permittee shall maintain training documents and records (40 CFR § 264.16).

II.F. RECORDKEEPING AND REPORTING

IIF.1 Operating Record

Pursuant to 40 CFR § 264.73, as adopted by reference in 9 VAC 20-60-264, the Permittee shall maintain a written operating record at the Facility. The record can be a compilation of various documents and shall include, but not be limited to, the information listed below.

a. The following records shall be maintained until post-closure is complete and certified:

i. Records of spills and releases required by existing environmental laws, including, but not limited to § 103 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA);

ii. Written reports and records of verbal notification to the Director to address releases, fires, and explosions;

iii. All reports of noncompliance pursuant to **Permit Condition I.H.11**;

iv. All submittals prepared pursuant to **Permit Condition I.H.12**;

v. Records of all monitoring information pursuant to **Permit Condition I.E. and I.H.9.**; and

vi. Training records of current Facility personnel.

b. The following records shall be maintained for a minimum of 3 years. This time period may be extended by the Department in the event of enforcement action or notification by the Department that an investigation is ongoing.

i. Generator Biennial Reports submitted in compliance with 40 CFR § 262.41, and § 264.75, as adopted by reference in 9 VAC 20-60-262 and 9 VAC 20-60-264;

ii. Groundwater Monitoring Annual Reports shall be submitted on or before March 1 of the calendar year (40 CFR § 264.90, as adopted by reference in 9 VAC 20-60-264);

iii. Training records of former Facility personnel; and

iv. Records of all inspections, pursuant to 40 CFR § 264.73(b)(5), 40 CFR § 264.15(d), as adopted by reference in 9 VAC 20-60-264, which shall include at a minimum:

a) The date and time of the inspection;

b) The name of the person performing the inspection;

c) A notation of the observations made; and

d) The date and nature of any repairs or remedial actions.

c. Current copies of the following documents as amended, revised, and modified shall be maintained at the Facility until post-closure and corrective actions are complete and certified:

i. Training Plan; and

ii. All closure, post-closure, interim measures, and final corrective action cost estimates; financial assurance documents prepared pursuant to this Permit; and the company names and addresses of Facility insurers.

II.F.2. Required Reports

The Permittee shall comply with all applicable reporting requirements as described in **Permit Conditions I.E., I.F. and I.H.**

MODULE III

POST-CLOSURE CARE

III.A. HIGHLIGHTS - BACKGROUND

The MCB Quantico Russell Road Landfill (landfill) was closed by capping in accordance with the approved closure plan, dated December 30, 1994. The Department concurred that the closure was conducted in accordance with the approved plan, as amended, on September 3, 1998; therefore, the closure date for the landfill is September 3, 1998.

Hazardous waste management at the landfill Facility addressed by this Permit is currently limited to the following activities: maintenance, gas monitoring, groundwater monitoring, and groundwater corrective action (CA) of one (1) closed and capped hazardous waste landfill containing hazardous wastes as specified in this Permit. Hazardous waste leachate with hazardous waste number/code F039 is collected and managed by leachate collection system (installed around the perimeter of the landfill) and a leachate collection sump, which were installed at closure to mitigate the lateral migration of leachate from the closed "Regulated Unit." F039 leachate is assigned to liquids that have percolate through land disposed wastes resulting from the disposal of more than one restricted waste which is classified as hazardous under 40 CFR Part 261, Subpart D. Leachate which is collected in the sump is manifested and shipped off-site to a regulated treatment, storage, disposal (TSD) facility regulated under the RCRA Regulations.

III.B. UNIT IDENTIFICATION

The hazardous waste landfill closure details and specifications are included in **Permit Attachment E, Post-Closure Plan**. The 28-acre landfill was the primary disposal facility for MCB Quantico from 1971 until 1983 and received a variety of hazardous and non-hazardous waste streams. The unit is known as the Russell Road Landfill.

III.B.1. Closed Hazardous Waste Management Area

The facility was closed as a hazardous waste landfill in accordance with all applicable cap design and construction requirements.

a. Final Cover

The slopes were graded between 3.3% and 10% and a RCRA cap was constructed over the disposal area. The final cover consists of: a 24-inch clay liner with maximum permeability of 1×10^{-7}; a 40-mil, very low density polyethylene flexible membrane cap in direct and uniform contact with the

clay liner or cap; a 10-ounce geotextile fabric filter; a 12-inch drainage layer; a second 10-ounce filter fabric layer; and an 18-inch erosion layer with an additional 6-inch topsoil layer to support vegetation. The landfill facility also has a passive leachate collection system and a landfill gas venting system.

b. List of Wastes

During operation the landfill functioned as the primary disposal facility for the base; therefore, it is not possible to determine the exact list of wastes and hazardous wastes. The Permittee has provided an estimate of the type, quantities, and origins of Hazardous Wastes in Table 1 of the Approved Closure plan, which is found in **Attachment D, Table 2-1.**

However, the Permittee's groundwater monitoring program is based upon the list of constituents on Appendix VIII to 40 CFR Part 261. Constituents that were not detected above established background concentrations in groundwater were not included in the groundwater monitoring program.

c. Liner System Description

There is no bottom liner installed in the landfill.

However, there was a high density polyethylene (HDPE) liner and leachate collection system installed to a depth of 20 feet below grade around the perimeter of the landfill to mitigate and minimize the lateral migration of leachate from the landfill. (See Permit Condition III.B.1.d.)

d. Leachate Collection and Detection System

The leachate collection system is fully described and illustrated in the approved Closure Plan and Post Closure Plan, which is contained in **Permit Attachment E.**

The leachate collection trench was designed to minimize the lateral migration of leachate from the landfill. (See Sheet RD-6, Record Drawing - Investigation and Monitoring of the Landfill Closure Plan.)

The leachate collection system was located approximately 2 feet outside the limits of waste, after relocation of waste from the clean closure areas. The maximum depth of the leachate collection trench was 20 feet. The trench had maximum side slopes of 1.5 feet horizontal to 1 foot vertical (1.5H:1V). At the bottom of the "V" trench, a 2-foot-wide rectangular section was excavated. The rectangular excavation ranged in depth from 2 feet to 4 feet. A single layer of smooth 60-mil HDPE lined the location of the trench and extended up the outer excavation slope to an anchor trench at the same elevation as the landfill cap anchor trench. The bottom section of the trench

was to accommodate the drainage media (stone) and pipe to collect and convey the leachate.

The anchor trench of the leachate collection liner was approximately 2 feet inside the final cap anchor trench. An additional 60,000 cubic yards of waste/debris were removed from the leachate collection trench during the excavation activities. In accordance with Section 5.3 of the "Closure In-Place and Post-Closure Care Plan," waste encountered during trench excavation was removed and placed within the limits of the landfill cap. Waste, such as large or sharp debris that would pose some risk to the integrity of the leachate collection trench liner, was relocated to the portion of the landfill that is inside the leachate collection trench. A typical cross-section of the leachate collection trench is shown in the on Details 1 and 3, Sheet RD-11, Record Drawing Miscellaneous Details, of the Landfill Closure Plan.

Approximately 5,700 linear feet of 4-inch-diameter, perforated, HDPE pipe was placed on top of the 3-inch-thick stone bedding layer in the leachate collection trench. The pipe was sloped from the north end (high) of the landfill and extended along both the east and west sides to a single sump located in the southwest comer as shown on Sheet RD-6, Record Drawing - Investigation and Monitoring of the Landfill Closure Plan. The slope of the pipe ranged from a minimum of 1 percent to a maximum of 3 percent. The pipe was butt fusion welded by OHM recovery technicians in accordance with the manufacturer's specifications.

In the southwest corner of the landfill, where the two leachate collection lines meet, a tee coupling was used to connect a 4-inch-diameter, double-walled, leachate trench HDPE pipe. The double-walled pipe was passed through and booted to the 60-mil leachate collection trench liner of the excavation and extended to the HDPE sump. The double-wall pipe terminates in the leachate collection sump. (See Details 6 and 7, Sheet RD-11, Record Drawing - Miscellaneous Details, of the Landfill Closure Plan.)

During installation of the leachate collection pipe network, OHM installed 13 cleanouts at approximately 400-foot intervals. (See Sheet RD-1, Record Drawing - Final Conditions Topographic Map, of the Landfill Closure Plan.) The cleanouts were installed by butt fusion welding a 45-degree "Y" to the main line, then welding 20-foot sections of solid 4-inch-diameter, I-IDPE SDR 17 pipe and cap to the "Y" connection.

The cleanouts were extended as necessary to ensure that when the topsoil layer was installed, the cleanouts would be exposed to minimum of 12 inches above the final cap grade as shown on Sheet RD-1 RD-1, Record Drawing - Final Conditions Topographic Map, of the Landfill Closure Plan.

Four steel bollards were installed around each cleanout to protect the cleanouts from damage during cap maintenance activities. The bollards were painted orange and the exposed section of the cleanout pipe was painted white for visibility. VDOT No. 8 stone was also placed in a 4-foot x 4-foot area around the cleanout pipes to keep grass from camouflaging the exposed sections.

III.C. POST-CLOSURE PROCEDURES AND USE OF PROPERTY

III.C.1. The Permittee shall conduct post-closure care for the hazardous waste management unit listed in **Permit Section III.B.**, for a period of thirty (30) years after final closure certification was accepted by DEQ. The Department concurred that the closure was conducted in accordance with the approved plan, as amended, on September 3, 1998; therefore, the closure date for the landfill is September 3, 1998. Therefore, the post-closure care period shall extend to September 3, 2028. (40 CFR § 264.310 and 40 CFR § 264.117)

The 30-year post-closure care period may be shortened upon petition and demonstration, approved by the Department that the facility is secure, or may be extended if the Department finds this necessary to protect human health and the environment in accordance with 40 CFR 264.117(a)(2).

III.C.2. The Permittee shall maintain and monitor the cap, the monitoring system, and all related structures in accordance with this Permit and the approved Post-closure Plan. The Permittee shall also monitor the groundwater and comply with all other applicable requirements of 40 CFR § 264.90 during the post-closure care period in accordance with 40 CFR § 264.117(a).

III.C.3. The Permittee shall not allow any use of the units designated in **Permit Section III.B**, which would disturb the integrity or the function of the facility's cap, cap drainage system, leachate collection system, runoff and sedimentation control structures and systems, groundwater, gas, and other monitoring systems during the post-closure care period, in accordance with 40 CFR § 264 117(c).

III.C.4. The Permittee shall implement the Post-closure Plan in accordance with **Permit Attachment E**. All post-closure care activities must be conducted in accordance with the provisions of the Post-closure Plan, 40 CFR § 264.117(d), and 40 CFR § 264.118(b).

III.C.5 Passive gas vents were installed at the locations shown on Sheet RD-6, Record Drawing - Investigation and Monitoring, in **Permit Attachment C**. In addition to the gas monitoring wells inside the landfill, four (4) gas monitoring wells/probes were installed at the southern end of the landfill cap by Badger Drilling. The four gas monitoring wells/probes provide a means to monitor the concentrations of methane and oxygen in soil gases just outside the landfill cap.

a. Inspection Schedule, Reporting, and Records

Post-closure care will be performed in accordance with 9 VAC 20-60-264 and 40 CFR Part 264. MCB Quantico or a designated contractor will perform the inspections. See **Permit Attachment E, Post-Closure Plan, Permit Attachment H, Inspection Requirements**, for details in the maintenance/inspection schedule, the reporting requirements, and records required.

b. Gas Remediation Plan

Permit Attachment S provides the Methane Gas Migration Assessment and Remediation Plan.

If, at any time during gas monitoring, if the concentration of methane gas reaches or exceeds 5 percent by volume in air (5 % is equivalent to the lower explosive limit (LEL)), the MCB Quantico will commission a study to be conducted by a professional engineer to determine the source (i.e., gas control system failure, climatic conditions, etc.), extent of migration, concentration, direction, and any necessary corrective action. Additional probes may have to be installed and additional characterization of the soil strata, within the area of concern, will be made. If a gas migration problem is demonstrated to exist or is imminent, the engineer will design the appropriate corrective action. The Department will be notified within 5 working days of learning that gas monitoring compliance levels have been exceeded. A gas remediation plan will be prepared and implemented within 60 days of exceeding regulatory methane levels, and submitted to the Department for approval. Because no structures are next to the landfill, there is no immediate danger to human health. Access to the area will be restricted while the extent of methane migration is determined.

III.D. INSPECTIONS

The Permittee shall inspect the components, structures, and equipment at the site in accordance with the Inspection Requirements of **Permit Attachment H, Inspection Requirements,** and 40 CFR § 264.117(a)(l)(ii).

III.E. SECURITY

The Permittee shall maintain security at the facility during the post-closure care period, in accordance with the Post-closure Plan, **Permit Attachment G, Security Provisions**, and 40 CFR § 264.117(b).

III.F. NOTICES AND CERTIFICATION

III.F.1. If the Permittee, or any subsequent owner or operator of the land upon which the closed landfill is located, wishes to remove hazardous wastes and hazardous waste

residues, or contaminated soils, or contaminated soils, then he shall request modification to this Post-closure Permit in accordance with the applicable requirements of 40 CFR Parts 124 and 270. The Permittee, or any subsequent owner or operator of the land, shall demonstrate that the removal of hazardous wastes will satisfy the criteria of 40 CFR § 264.117(c), as adopted by reference in 9 VAC 20- 60-264.

III.F.2. Post Closure Care Certification

No later than sixty (60) days after completion of the established post-closure care period, the Permittee shall submit for approval, by registered mail to the Department, a certification that the post-closure care for the hazardous waste disposal unit was performed in accordance with the specifications in the approved Post-closure Plan. The certification must be signed by the Permittee and an independent, licensed, registered, Virginia-certified, professional engineer. Documentation supporting this license and certification must be furnished to the Department at any time upon request, until the Department releases the Permittee from the financial assurance requirements for post-closure care found at 40 CFR § 264.145(i).

III.G. FINANCIAL ASSURANCE

Financial assurance is not required for federal facilities.

III.H. POST-CLOSURE PERMIT MODIFICATIONS

The Permittee must request a permit modification to authorize a change in the approved Post-Closure Plan. This request must be in accordance with applicable requirements of 40 CFR § 264.119(c) and § 270.42 and must include a copy of the proposed amended Post-Closure Plan, for approval by the Department. The Permittee shall request a permit modification whenever changes in operating plans or facility design affect the approved Post-Closure Plan, or other events occur that affect the approved Post-Closure Plan.

MODULE IV

DETECTION MONITORING PROGRAM

IV.A. HIGHLIGHTS - BACKGROUND

The MCB Quantico was required by the terms of the Federal Facility Compliance Agreement to demonstrate clean closure of the Russell Road Landfill (RRL), a hazardous waste landfill or "Regulated Unit," with respect to the saturated soils (groundwater) for all 40 CFR Part 264 Appendix IX constituents unless the Department concurred that certain constituents were not expected to be present.

The MCB Quantico chose to implement a groundwater monitoring program for the Russell Road Landfill (RRL) predicated upon the belief that groundwater clean closure was not likely. Data collected in previous investigations clearly indicated that groundwater was being impacted by the "Regulated Unit." As clean-closure of the unit was not possible (it was closed with waste-in-place), the detection monitoring system was designed to function as an assessment monitoring system to define the extent of contamination.

At the time of permit issuance, the concentrations of constituents of concern (COCs) at the points of compliance (POCs) wells exceeded the groundwater protection standards (GPSs). The MCB Quantico submitted a permit modification request to implement corrective action for the "Regulated Unit." Corrective action is being performed in accordance with **Module VI, Corrective Action Program – Groundwater Monitoring - Regulated Unit,** and the approved Corrective Action Plan (CAP) **(Permit Attachment T)** of this Permit.

MODULE V

GROUNDWATER COMPLIANCE MONITORING

V.A. HIGHLIGHTS - BACKGROUND

The MCB Quantico was required by the terms of the Federal Facility Compliance Agreement to demonstrate clean closure for the Russell Road Landfill (RRL) with respect to the saturated soils (groundwater) for all 40 CFR Part 264 Appendix IX constituents unless the Department concurred that certain constituents were not expected to be present.

The MCB Quantico chose to implement a groundwater monitoring program for the Russell Road Landfill (RRL) predicated upon the belief that groundwater clean closure was not likely. Data collected in previous investigations clearly indicated that groundwater was being impacted by the "Regulated Unit." As clean-closure of the unit was not possible (it was closed with waste-in-place), the detection monitoring and compliance groundwater monitoring systems were designed to function as an assessment monitoring system to define the extent of contamination in groundwater and monitor the status of groundwater conditions.

It was determined under the detection and compliance groundwater monitoring that groundwater protection standards (GPSs) (**Permit Attachment N**) at the points of compliance (POC) wells MW-9 and MW-15R were exceeded.

The primary constituents of concern (COC) at MW-9 are Tetrachloroethylene and Trichlorethylene and the primary COCs at MW-15R is cis-1,2 Dichloroethylene. (**See Permit Attachment T, Corrective Action Plan for Groundwater**).

In addition, exceedances of Tetrachloroethylene, Trichloroethylene, cis-1,2-Dichloroethylene, and Vinyl Chloride were identified in temporary monitoring wells near MW-15R during a field investigation conducted in the summer of 2003. To address these groundwater exceedances and to ensure that the contaminants do not continue to migrate, MCB Quantico implemented a Corrective Action Program for the Russell Road Landfill (RRL) in accordance with requirements of 40 CFR § 264.99 and § 264.100.

The **Permit Attachment T, Corrective Action Plan for Groundwater,** provides the general approach and specifics of the Corrective Action Program. The Corrective Action Plan (CAP) provides groundwater treatment and remediation in two areas of the landfill – one at the north end and the other at the south end of the landfill.

The CAP remediation treatment method incorporates the injection of an "electron donor" material into the contaminated groundwater in the North and South

Treatment Areas to feed naturally occurring aerobic and anaerobic microbes present in the aquifer. The electron donor material slowly releases lactic acid to the target groundwater treatment areas. During this microbial "feeding" process, oxygen in the groundwater is depleted and electrons are produced by anaerobically induced conditions, which, in turn, lead to the reductive dechlorination or the breakdown of chlorinated VOCs into comparatively harmless hydrocarbon and mineral species (ethane, ethene, and dilute hydrochloric acid (HCl)).

Groundwater monitoring shall be performed in accordance with conditions of **Permit Module VI, Corrective Action Program – Groundwater Monitoring – Regulated Unit**. Groundwater corrective action shall be performed in accordance with conditions and requirements of **Permit Module VI,** and **Permit Attachment T, Corrective Action Plan for Groundwater,** of this Permit.

MODULE VI

CORRECTIVE ACTION PROGRAM

GROUNDWATER MONITORING - REGULATED UNIT

VI.A. HIGHLIGHTS - BACKGROUND

The purpose of this Permit Module is to implement a Corrective Action Program for select volatile organic compounds (VOCs) and other constituents of concern (COCs) at the Russell Road Landfill (RRL), a "Regulated Unit," and to address ongoing exceedances of the Groundwater Protection Standards (GPSs).

Groundwater Protection Standards (GPSs) for groundwater at the point of compliance (POC) wells MW-9 and MW-15R have been exceeded at the time of permit issuance. The contaminants at MW-9 are Tetrachloroethylene and Trichloroethylene and the contaminant at MW-15R is cis-l,2-Dichloroethylene. (**See Permit Attachment T, Corrective Action Plan for Groundwater**).

In addition, exceedances of Tetrachloroethylene, Trichloroethylene, cis-l, 2-Dichloroethylene, and Vinyl Chloride were identified as COCs in temporary monitoring wells screened to the plume near MW-15R during a field investigation conducted in the summer of 2003.

To address the exceedances of GPSs and to ensure that the contaminants do not continue to migrate, MCB Quantico-RRL implemented a Corrective Action Program based on specifications in the CAP in **Permit Attachment T**.

The COCs in groundwater listed above were delineated at the north (MW-9) and south (MW-15R) ends of the landfill during the development of the CAP and to identify the nature and extent of the groundwater treatment areas. The results of the groundwater delineation investigation indicated two discrete areas limited to the vicinity surrounding monitoring wells MW-9 and MW-15R (North and South Treatment Areas, respectively).

The Corrective Action Program consists of two remediation systems for enhanced natural attenuation of volatile organic constituents (VOCs) in groundwater via electron donor injections (located at MW-9 and MW-15R) and groundwater monitoring for remedial effectiveness and compliance with GPSs. Groundwater corrective action and groundwater monitoring shall be performed in accordance

with conditions of this **Permit Module and Permit Attachment J, Sampling and Analysis Plan [SAP], Permit Attachment T, Corrective Action Plan for Groundwater.**

VI.B. ENHANCED NATURAL ATTENUATION SYSTEM OPERATION

The goal of this corrective action program or measure is to reduce chlorinated VOCs to levels below the GPSs for the respective COCs (contaminants), within a reasonable period of time, at the point of compliance and throughout the identified plumes at both the north and south ends of the landfill. (40 CFR § 264.100(b) and § 264.100(e))

An "electron donor" material that slowly releases lactic acid, has been injected into contaminated groundwater in the North and South Treatment Areas to feed naturally occurring aerobic and anaerobic microbes present in the aquifer. During this "feeding" process, oxygen in the groundwater will be depleted and electrons will be produced by anaerobically induced conditions, which, in turn, will lead to the reductive dechlorination or the breakdown of chlorinated VOCs into comparatively harmless hydrocarbon and mineral species (ethane, ethene, and dilute hydrochloric acid (HCl)). Injections of the "electron donor" material or substrate may be suspended in accordance with protocols and remedial measures and performance metrics as specified in the CAP and as approved by the Department. (See **Permit Attachment T, Corrective Action Plan for Groundwater.)**

VI.B.1 Remediation System and Design Conformance

The Permittee shall install monitoring wells and injection points as needed and shall operate the Enhanced Natural Attenuation Systems in accordance with the CAP (**Permit Attachment T**), conditions of this Permit Module, and as approved by the Department. Subsequent changes to the system design are to be addressed in accordance with **Permit Section VI.B.5.**

VI.B.2. Remedial Objectives

The principal remediation objective is to reduce chlorinated VOCs to levels below the GPSs, within a reasonable period of time. In order to accomplish this principal objective, the monitoring systems shall be able to, at a minimum, collect data designed to address the following:

a. Delineate the nature and extent of the chlorinated VOCs in groundwater, where previously unknown as necessary or applicable under current site conditions.

b. Assess the dosage of continued applications of the electron donor, which is needed to maintain favorable conditions for enhanced reductive dechlorination of the contaminants.

c. Establish the treatment frequency and response duration.

d. Identify the presence and concentrations of contaminants, parameters, and biodegradation indicators in groundwater which enable the Facility to evaluate and verify the performance of the groundwater treatment under the CAP in the North and South Treatment Areas, as needed.

VI.B.3. Remediation System Operations

Operation specifications for the Enhanced Natural Attenuation Systems, located at the north and south ends of the landfill, shall comply with the CAP **(Permit Attachment T)** and conditions of **Permit Conditions VI.B.3, VI.B.4 and VI.B.5.**

The following design parameters shall be maintained:

a. The Permittee shall operate the treatment systems for Enhanced Natural Attenuation of VOCs in groundwater at both the North and South ends of the landfill (contaminant plumes in the vicinities of MW-9 and MW-15R, respectively) generally as described in the CAP under **Permit Attachment T**, but subject to modifications as indicated in **Permit Condition VI.B.5.**

b. Points for the injection of the electron donor may include new injection points constructed specifically for this purpose and/or include existing monitoring wells (provided that such injection does not interfere with general groundwater monitoring duties required in **Permit Condition VI.C. and Permit Attachment T.**

c. "Performance wells" installed for the purpose of monitoring enhanced natural attenuation shall be constructed as specified in the CAP **(Permit Attachment T).**

VI.B.4. Remediation System Maintenance

The Enhanced Natural Attenuation Systems apply both an active and a passive remedial approach that relies on the enhancement of natural degradation processes. In general, other than the wells and scheduled injections at the specified injection points, there is no equipment in the remediation systems that require regular maintenance or upkeep other than as prescribed below. The specifications for the continued maintenance of the Enhanced Natural Attenuation Systems shall comply with the CAP **(Permit Attachment T)** and conditions of this Permit Module.

The following items shall be maintained on a regular basis, as specified:

a. Injection points which were not otherwise part of the point of compliance groundwater monitoring network may be installed with or without prior Department approval. Injection points and monitoring wells which are installed must be abandoned subject to prior Department approval. Installation or abandonment of remediation system injection points normally will not require a formal modification of the Permit under 40 CFR § 270.41 or § 270.42, unless an accompanying change in the Permit text or maps (figures) of the Permit is required.

b. Groundwater monitoring wells, as indicated in the CAP, are to be constructed for the purpose of plume delineation and are likely to require replacement by one or more accurately located wells at a future date. In compliance with 40 CFR § 264.97(a)(3), a performance well becomes a "permanent" well when the Department recognizes that the well is necessary for the "permanent" allowance of detection of hazardous waste constituents that have migrated from the landfill to the uppermost aquifer.

   Although construction of a well does not require prior Department approval, the abandonment of a well does require prior Department approval, but does not necessarily require modification of the Permit under 40 CFR § 270.41 or § 270.42.

c. To ensure that groundwater monitoring wells are appropriately restricted in their use to plume delineation, the Permittee shall notify the Department within one year of Permit issuance or well installation, whichever comes later. In this notification, the Permittee shall explain why an application for a permit modification under 40 CFR § 270.42 has not been submitted to the

Department to establish the well as a permanent compliance monitoring well, in accordance with **Permit Condition VI.C.1.b.**

d. The Permittee shall follow the procedures set forth in the CAP **(Permit Attachment T)** to determine the frequency and extent (dosage rates) of injection of electron donor material. Actual dosage rates of electron donor material, dosage rates of other chemical amendments, and the associated evaluations of the treatment systems of the North and South Treatment Areas shall be reported to the Department in the Semi-annual Groundwater Monitoring and Remedial Measures Reports required under **Permit Condition VI.K.**

e. In accordance with the CAP, the Permittee shall conduct semi-annual (every 6 months) groundwater monitoring and electron donor injection events. During this semi-annual period at each defined treatment area, the Permittee may inject the contaminated groundwater with the electron donor material one or more times, with the results reported in the Semi-annual Groundwater Monitoring and Remedial Measures Reports required under **Permit Section VI.K.**

   Groundwater samples collected during the semi-annual events shall be collected prior to performing the semi-annual electron donor injection activities.

f. If, during the following six months after an injection event, the VOCs concentrations at the point of compliance (POC) monitoring wells and throughout the performance monitoring wells in the plume(s) indicate that the GPSs for PCE, TCE, cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride are no longer exceeded, then the Permittee may choose to either: 1) proceed to inject an additional dose of the electron donor material or 2) omit the dose of the electron donor material scheduled for the semi-annual injection event period.

g. However, if the GPS for the specified VOCs continues to be exceeded at any of the points of compliance (POCs) wells or treatment areas performance monitoring wells, then the Permittee shall proceed to inject the dose of the electron donor materials for the consecutive semi-annual period and all decisions and outcomes shall be reported in accordance with **Permit Section VI.K.**

h. Groundwater elevations will be measured during each groundwater monitoring and electron donor injection event at each groundwater monitoring well, including the background well, point of compliance wells, compliance monitoring wells, and corrective action wells prior to the scheduled sampling (monitoring) and treatment event.

i. In addition to chemical analysis, groundwater quality will be monitored during each monitoring event and shall include, but not be limited to the following parameters: pH, temperature, specific conductance, dissolved oxygen, oxidation reduction potential, alkalinity, total organic carbon, total and dissolved iron, total and dissolved manganese, nitrate, sulfate, sulfide, chloride, lactic acid, pyruvic acid, acetic acid, propionic acid, butyric acid, dissolved carbon dioxide, dissolved methane, dissolved ethane, dissolved ethene, PCE, TCE, cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride.

The facility's lab shall analyze these samples in accordance with the sampling and the analytical methods listed in **Permit Attachment J, Sampling and Analysis Plan, Attachment K, Groundwater Sampling Constituent and Analytical Method List, and Attachment T, CAP for Groundwater**, as appropriate. Alternate SW-846 analytical methods may be approved by the Department in accordance with the procedure established in **Permit Condition VI.C.2.**

j. If at any point during the Corrective Action Program any of the permanent monitoring wells, established in or incorporated into the Enhanced Natural Attenuation Systems, can no longer yield groundwater samples representative of groundwater quality in their respective treatment areas, owing to low water levels during the remediation activities, then the Permittee must apply for a Permit modification to deepen the impacted permanent monitoring wells.

k Injection points and monitoring wells in the Enhanced Natural Attenuation Systems (both temporary and permanent in status) are subject to the inspection requirements for groundwater monitoring wells as set forth in **Permit Attachment H, Inspection Requirements.**

l. Piezometers or monitoring wells solely for the purpose of measuring water levels (and not for water quality sampling), that are part of the Enhanced Natural Attenuation Systems, may be installed with or without prior Department approval. Piezometers and monitoring wells which are installed must be abandoned subject to prior Department approval.

Such piezometers or water-level monitoring wells normally will not require a formal modification of the Permit under 40 CFR § 270.41 or § 270.42-unless an accompanying change in the text or maps of the Permit is required.

Piezometers and water-level monitoring wells remain subject to the inspection requirements for groundwater monitoring wells as set forth in **Permit Attachment H.**

VI.B.5. Changes in Remediation System Design

If changes are required, during remedial measures, to either correct deficiencies or enhance performance of the groundwater treatment system(s), the Permittee shall submit a written request to the Department to change the approved remediation system design.

a. The Department shall be notified by letter of any proposed changes to the Treatment Systems, at least thirty (30) days prior to the tentatively scheduled date of the proposed changes. The proposed changes are subject to Department approval prior to implementation.

   The notification to the Department shall include the following information:

   i. The proposed changes to be made.

   ii. The rationale and justifications for the proposed changes.

   iii. The methodology proposed to be used to evaluate the performance of Treatment Systems after the changes in the design.

   iv. The revised maps, drawings, and schematics, if appropriate, associated with the proposed changes to the Treatment Systems.

b. Design or Systems changes which are required for the continued operations of the Treatment Systems or which are required for the immediate protection of human health and the environment shall be implemented immediately.

   In such an emergency, the facility must act while assuming the risk of immediate action, subject to the subsequent administrative approval of the design or changes in the Treatment Systems.

   The Permittee is to contact DEQ as soon as possible upon taking emergency action, to mitigate any potential releases to the environment or potential non-compliance in accordance with the requirements of **Permit Condition I.H.12, Twenty-four Hour Reporting.**

   The Department will decide on a case by case basis whether such a design or Systems change requires a permit modification (see **Permit Condition VI.N.**).

VI.B.6. Evaluation of the Corrective Action Measures

At least semi-annually, the effectiveness of the Enhanced Natural Attenuation Systems under the Corrective Action Program shall be evaluated. (40 CFR § 264.100(g)) This evaluation shall be submitted to the Department as part of the Groundwater Monitoring and Remedial Measures Report (see **Permit Condition VI.K.**). The evaluation shall contain adequate information to demonstrate that the remedial measures are addressing the groundwater contamination at the landfill and progress is being made toward the remediation objectives.

The submitted CA Program evaluation shall include the following, if available:

a. Estimated amounts of contaminants (COCs) remediated during the previous six months and total (COCs) remediated in each of the North and South Treatment Systems Areas.

b. Sampling and Analysis results collected for the Enhanced Natural Attenuation remedy (see **Permit Conditions VI.B.3. and VI.B.4.**) that are all inclusive of characterizing groundwater quality, the nature and extent of COCs above GPSs, and which are needed to evaluate the effectiveness and progress of the remediation in each of the North and South Area Treatment Systems.

c. Proposed modifications to the Treatment Systems in each of the North and South Area Treatment Systems so to enhance performance or to correct identified deficiencies and/or malfunctions, as applicable.

d. Other recommendations regarding the Corrective Action Program, and/or Corrective Action Plan (CAP), as appropriate.

VI.B.7. Termination of Remedial Measures

The Permittee must continue corrective action measures and the Enhanced Natural Attenuation remedial measures at the MCB-Quantico-RRL during the compliance period for as long as necessary to ensure that the ground-water protection standards are not exceeded. If the Facility is conducting corrective action at the end of the compliance period, he must continue that corrective action for as long as necessary to achieve compliance with the groundwater protection standards (GPSs). (40 CFR § 264.100(f))

The following steps are to be taken by the Permittee in establishing that the GPSs is no longer exceeded and before the Permittee can discontinue Corrective Action remedial measure:

a. Statistical Evaluation of Data Supporting Completion of 40 CFR § 264.100.

The transition from the Compliance Monitoring Program (40 CFR § 264.99) to the Corrective Action Program (40 CPR § 264.100) was based upon a statistical comparison of groundwater data collected at the points of compliance to the GPSs.

The RCRA Regulations under 40 CFR § 264.100(e) specifically requires the removal or decontamination of hazardous constituents above the GPSs from throughout the groundwater plume. Therefore, the data from all monitoring wells associated with the release of hazardous constituents from the landfill must be at or below the GPSs, based upon the statistical procedures approved in the facility's Permit, to demonstrate that the objectives under 40 CFR § 264.100 have been met.

The Permit Conditions for completing the statistical evaluation are as follows:

i. A plan for the statistical analysis should be submitted for review if one has not already been approved by the Department at the time the evaluation is proposed. The plan should conform to the requirements for statistical analysis of data as set forth in this Permit and **Permit Attachment O, Statistical Procedures.**

ii. The size of the data set required to demonstrate that contaminant or COC concentrations throughout the plume no longer statistically exceed the GPSs must be adequate for the statistical method selected by the Permittee. The data must be collected in accordance with the Sampling and Analysis Plan (SAP) and quality assurance and quality control procedures (QAP) established in this Permit.

iii. The Permittee may cite to previously submitted statistical reports (e.g., quarterly or semi-annual) for the information required in i) and ii), above, provided that the references provided clearly document and address the information required in this **Permit Condition VI.B.7.**

iv. Once the Permittee has received a letter from the Department approving the statistical analysis submitted to support completion of the Corrective Action Program and Corrective Action Plan (CAP) under 40 CFR § 264.100, the Permittee must send a letter requesting written approval from the Department to discontinue the remedial measures under the Corrective Action Program and Corrective Action Plan (CAP). The Permittee's request letter must include adequate summary and detailed

information for the public record, to demonstrate that the termination of remedial measures is appropriate based upon the statistical analysis as approved by the Department.

Upon receipt of the Department's approval to terminate remedial measures under the Corrective Action Program and CAP , the Permittee shall continue to monitor groundwater at the points of compliance (POCs) during the remainder of the compliance period in accordance with this **Permit Condition VI.C.,** satisfying requirements of 40 CFR § 264.99 and 40 CFR Part 264, Subpart F.

v. Any future exceedances of GPSs that may result from rebound effects in the North and South Treatment Areas will result in the implementation of additional corrective measures in accordance with this **Permit Module VI** and 40 CFR § 264.99 and § 264.100.

Therefore, to avoid a premature discontinuation of remedial measures, the Permittee may wish to take additional steps to demonstrate the long-term effectiveness of the implemented Corrective Action remedy.

The Permittee should refer to the DEQ's Draft Guidance Memo No. 01-2003, Section V, Post-Remediation Effectiveness Evaluation issued by the DEQ's Division of Land Protection and Revitalization (DLPR) (former Waste Division) for additional guidance regarding identification of rebound effects before requesting discontinuation of the Enhanced Natural Attenuation remedial measures.

b. Termination of remediation measures of the existing Corrective Action Program and CAP is through the permit modification process in accordance with 40 CFR § 264.100, and 40 CFR § 270.42, and § 270.42 Appendix I.

c. The Department maintains the authority to terminate this Enhanced Natural Attenuation Program (remedial measures) in accordance with 40 CFR § 270.41 and 40 CFR § 270.42, subject to the Director's approval of a Permit Modification for an alternative Corrective Action Program and CAP.

In substitution for the current Corrective Action Program established in this Permit Module, an alternative remediation system under a revised CAP would be designed to achieve the equivalent objectives for remediation of chlorinated VOCs and/or other COCs in compliance with 40 CFR § 264.100.

VI.C. CORRECTIVE ACTION GROUNDWATER MONITORING PROGRAM

This Corrective Action Groundwater Monitoring Program is based upon the Groundwater Compliance Monitoring Program and was modified as necessary to meet the performance standards for a Compliance Monitoring Program and the Corrective Action Monitoring Program, respectively, under 40 CFR § 264.99 and 40 CFR § 264.100.

The performance standards set forth in the CAP (**Permit Attachment T**) and continued groundwater monitoring during the compliance period are designed to meet requirements and standards of 40 CFR § 264.99 and 40 CFR § 264.100.

VI.C.1. Monitoring Requirements

The Corrective Action Groundwater Monitoring Program requires monitoring at the background well, the point of compliance wells, and at compliance monitoring wells, semi-annually, in single samples. Other wells in the system shall be sampled at frequencies specified in the applicable Permit Modules, Permit Conditions, and Permit Attachments. Static groundwater elevations will be measured at all wells, specified in **Permit Condition VI.C.1.a through VI.C.1.c.**, during each sampling event.

a. The groundwater beneath the closed landfill shall be monitored with one background groundwater monitoring well and 11 point of compliance wells located as specified on the map presented in **Permit Attachment B.** Monitoring well MW-10 is the background well for the landfill. Monitoring wells MW-9, MW-11R, MW-12, MW-13, MW-14, MW-15R, MW-16, MW-17, MW-18, MW-19R, and MW-20 are the point of compliance (POC) wells.

b. In addition to the POC wells specified in **Permit Condition VI.C.1.a.**, compliance monitoring wells MW-21S, MW-21D, MW-22-S, MW-22-D, and MW-24 shall be used to determine whether continued migration of contaminants has occurred in the South Treatment Area of the Landfill.

c. If during the course of purging and sampling, the data from turbidity measurements and field parameters indicate that silt has accumulated in the well, the pumps shall be pulled and total depths and sediment thickness shall be measured. Corrective measures shall be taken prior the next sampling event to remove excess silt from the applicable wells.

VI.C.2. Sampling Requirements

The background well, point of compliance wells, and compliance monitoring wells will be sampled in accordance with the **Permit Attachment J, Sampling Analysis Plan (SAP)**, and the following schedule:

a. The background well and downgradient point of compliance wells specified in **Permit Condition VI.C.1.a.** shall be sampled at least semi-annually for the constituents listed in **Permit Attachment K**. A single sample for each constituent will be collected from each specified well and analyses shall be obtained using the EPA SW-846 Methods specified in **Permit Attachment K.** Alternate SW-846 methods may be approved by the Department, provided the request is in writing and submitted 30 days prior to the sampling event. Proposed alternate methods must achieve the same PQL (or lower) as the specified method.

b. The compliance monitoring wells specified in **Permit Condition VI.C.1.b.** shall be sampled at least semi-annually for all constituents listed in **Permit Attachment K.** Single samples for each constituent shall be collected and analyses shall be obtained using the EPA SW-846 Methods specified in **Permit Attachment K.**

c. Downgradient point of compliance wells (**Permit Condition VI.C.1.a.**) MW-9, MW-13, MW-14, MW-15R, MW-16, MW-17, and MW-19R will be sampled annually for all constituents in Appendix IX to 40 CFR Part 264, as listed in **Permit Attachment L** and analyses shall be obtained using the EPA SW-846 Methods specified in **Permit Attachment L**. Alternate SW-846 methods are subject to the approval process described under **Permit Condition VI.C.2.a.**

d. The Permittee will specify the statistical methods used in evaluating ground-water monitoring data for each hazardous constituent which, upon approval by the Department, will be specified in the Permit. The statistical test chosen shall be conducted separately for each hazardous constituent in each well. Where practical quantification limits (PQLs) are used in any statistical procedures to comply with 40 CFR § 264.97(i)(5), the PQL must be proposed by the Permittee, and approved by the Department. Use of any statistical methods must be protective of human health and the environment and must comply with the performance standards outlined in 40 CFR § 264.97(i).

e. In accordance with 40 CFR § 264.97(i)(5), the statistical method used in this Permit shall account for data below the limit of detection with one or more

statistical procedures that are protective of human health and the environment. Any practical quantification limit (PQL) used by the Permittee and approved by the Department under 40 CFR 264.97(h), that is used in the statistical method under this Permit, shall be the lowest concentration level that can be reliably achieved with specified limits of precision and accuracy during routine laboratory operating conditions that are available to the Permitted Facility.

VI.C.3. Continued Plume Assessment

If additional constituents on the groundwater monitoring list (**Attachment K**) are detected at levels above established GPS (**Attachment N**) in the compliance monitoring wells specified in **Permit Condition VI.C.1.b.**, the Permittee shall install additional groundwater monitoring wells to further define the vertical and horizontal extent of contamination in accordance with 40 CFR § 264.90, § 264.98, and § 264.99.

a. The Permittee shall notify the Department within seven (7) days of determining that an additional constituent was detected at levels exceeding established GPSs in any compliance monitoring well.

b. If the Permittee chooses to attempt a resampling demonstration as defined by **Permit Condition VI.I.**, the intent and a brief description of proposed resampling activities shall be included in the notification required above. Resampling shall be completed within thirty (30) days of the date that the data is available from the laboratory, or within (60) days from date of the original sampling, whichever occurs first. (See **Permit Sections VI.I.4.** and **VI.I.5.** below.) (See 40 CFR § 264.99(g), 264.99(i), § 264.98(f), and § 264.98(g).)

c. If the results of the resampling indicate that the exceedance was valid, or otherwise no resampling is conducted, the Permittee shall submit to the Department a plan to sample existing wells and/or install additional monitoring wells to define the vertical and horizontal extent of the constituent in the groundwater downgradient from the Regulated Unit. This plan shall be submitted within thirty (30) days of the notification required above.

d. Appropriate modifications to the Corrective Action Monitoring Program shall be proposed following the installation of any additional wells and/or as required to meet the performance standards of the program. (40 CFR § 264.99(j) and § 264.100(h).

VI.D. WELL LOCATION, INSTALLATION, AND CONSTRUCTION

VI.D.1. The Permittee shall maintain the monitoring wells located at the facility as specified below.

a. All monitoring wells listed in **Permit Sections VI.C.1. and VI.C.2.** shall be maintained at the locations shown on the map in **Permit Attachment B** and in accordance with the well and boring logs in **Permit Attachment P.**

b. All of the monitoring wells shall be inspected at least semi-annually to ensure proper operation. Any necessary repairs shall be made by the Permittee as soon as possible.

VI.D.2. All groundwater monitoring wells required by this Permit in the Corrective Action Program shall be maintained in accordance with the following.

a. The groundwater monitoring system must yield samples in well(s) that represent the quality of the background groundwater quality, unaffected by leakage from any regulated unit, and in downgradient wells must yield samples that represent the quality of groundwater passing the points of compliance.

b. The number and location of monitoring wells must be sufficient to identify and define all potential release pathways from the unit to the uppermost aquifer, based on site specific hydrogeologic characterization.

VI.D.3. The Department must approve the addition or removal of all monitoring wells that are part of the sampling network, prior to installation or abandonment, through a permit modification.

a. All wells removed from the monitoring program shall be abandoned in accordance with **Permit Attachment Q**. Well decommissioning methods and abandonment certification shall be submitted to the Department within thirty (30) days from the date the wells are removed from the monitoring program.

b. All monitoring wells added to the existing groundwater monitoring system described in **Permit Section VI.C.1.** must be constructed in accordance with the requirements of EPA's *RCRA Groundwater Monitoring Technical Enforcement Guidance Document* (TEGD) and approved by the Department.

VI.E. GROUNDWATER PROTECTION STANDARD

VI.E.1 The Permittee shall monitor the groundwater to ensure that regulated units are in compliance with the GPSs under 40 CFR § 264.92, or that the groundwater is being actively remediated to attain that standard. The GPSs are based in part upon concentrations from the facility's background monitoring, the EPA Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs), and the Alternate Concentration Limits (ACLs), which are Health-based standards calculated by DEQ. (See **Permit Attachment N.**)

The hazardous constituents, and their concentration limits (based upon background data, SWDA MCLs, or ACLs), are listed in **Permit Attachment N**, and are the basis of the GPSs.

VI.E.2. The compliance period, during which the GPSs apply, is equal to 30 years from the date of the Department's approval of the final closure of the landfill HWMU, which was September 3, 1998. Therefore, the period of compliance for the closed landfill HWMU is until September 3, 2028.

If the Permittee is conducting corrective action at the end of the specified compliance period, then the compliance period shall be extended automatically until the Permittee demonstrates that the GPSs have not been exceeded in any point of compliance well for three (3) consecutive years. (40 CFR § 264.100(f))

VI.F. SAMPLING AND ANALYSIS PROCEDURES

The Permittee shall use the following techniques and procedures when obtaining and analyzing samples from the groundwater monitoring wells described in **Permit Sections VI.C.1.** and **VI.C.2.**

VI.F.1. Samples shall be collected using the techniques contained in the SAP (**Permit Attachment J).**

VI.F.2. Samples shall be preserved, packed, and shipped or hand-delivered off-site for analysis in accordance with the procedures specified in the SAP (**Permit Attachment J).**

VI.F.3. Samples shall be analyzed in accordance with the methods specified in **Permit Attachments K and L.**

VI.F.4. Samples shall be tracked and controlled using the chain-of-custody procedures specified in the SAP (**Permit Attachment J**).

VI.F.5. The Permittee must determine the concentration of hazardous constituents and parameters listed in **Permit Attachment K** in the groundwater at the point of compliance wells at least semi-annually during the compliance period specified in **Permit Section VI.E.2.**

VI.F.6. The Permittee must analyze samples from downgradient point of compliance wells MW-9, MW-13, MW-14, MW-15R, MW-16, MW-17, and MW-19R, for all constituents contained in Appendix IX to 40 CFR Part 264 (**Permit Attachment L, Appendix IX to 40 CFR part 264**) at least annually during the compliance period.

VI.G. ELEVATION OF THE GROUNDWATER SURFACE

VI.G.1. The Permittee shall determine the groundwater surface elevation at each monitoring well specified in **Permit Sections VI.C.1. and VI.C.2.a.** to 0.01 foot each time groundwater is sampled in accordance with procedures contained in the SAP (**Permit Attachment J**).

VI.G.2. The Permittee shall report the surveyed elevation of any additional or replacement monitoring well(s) to 0.01 foot following Departmental approved installation, including well construction diagrams. The total depth of wells and the elevation of the following shall be recorded: top of the casing, ground surface and/or apron elevation, and the protective casing.

VI.H. STATISTICAL PROCEDURES

VI.H.1. The Permittee shall perform a simple empirical comparison of groundwater monitoring data to the GPSs and the established background concentrations in **Permit Attachment M** following each monitoring event. Results of this evaluation shall be provided in each semi-annual Groundwater Monitoring and Remedial Measures Report.

VI.H.2. The Permittee shall perform a statistical comparison of the groundwater monitoring data to the GPSs and established background concentrations, as applicable. When using statistical procedures to evaluate the monitoring results, the Permittee shall use the procedures in **Permit Attachment O, Statistical Procedures**. Results of this statistical evaluation shall be provided in the annual

Groundwater Monitoring and Remedial Measures Report, due no later than March 1st of each year (**Permit Condition VI.K.**). **(See Permit Condition VI.C.2.d. and VI.C.2.e.)**

VI.I. MONITORING PROGRAM AND DATA EVALUATION

The Permittee shall determine groundwater quality as follows:

VI.I.1. Sampling and Analysis

Groundwater samples taken in accordance with **Permit Condition VI.C.** shall be collected, preserved, and analyzed as required by **Permit Condition VI.F. and Permit Attachment J, SAP.**

VI.I.2. Analytical Constituents

The Permittee shall determine the concentration of hazardous constituents and/or parameters, as specified in **Permit Attachment K** at least semi-annually in accordance with 40 CFR § 264.99(f) and § 264.100(a). The Permittee shall determine the concentration of hazardous constituents and/or parameters, as specified in **Permit Attachment L** at least annually in accordance with 40 CFR § 264.99(g) and § 264.100(a).

VI.I.3. Groundwater Flow Direction and Rate

The Permittee shall determine the groundwater flow rate in the uppermost aquifer and the direction of flow at least semi-annually and reported in the semi-annual report.

VI.I.4. Additional Hazardous Constituents - Appendix IX to 40 CFR 264 Analyses

The Permittee shall analyze samples from point of compliance wells MW-9, MW-13, MW-14, MW-15R, MW-16, MW-17, and MW-19R for all constituents contained in **Permit Attachment L** annually to determine whether additional hazardous constituents are present in the uppermost aquifer-at levels exceeding the established GPS or available screening concentrations.

a. If the Permittee finds additional constituents present at levels exceeding an established GPS or available screening concentration (i.e. not listed in **Permit Attachment L**), the Permittee shall screen against a maximum concentration for groundwater protection. **Permit Attachment N** lists all established GPSs. For constituents without an established GPS, the screening

concentration shall be the higher of the facility's background concentrations, EPA MCLs, DEQ ACLs, or EPA Region III RBCs for tap water.

b. The Permittee shall notify the director within seven (7) days of any exceedances of the maximum concentration limit. The notification shall include the concentration of constituent exceeding the GPS and shall identify the monitoring well(s) at which the exceedance occurred. Constituents exceeding the GPSs or other available screening levels shall be added to **Permit Attachment K.**

c. The Permittee may resample within (60) days from date of the original sampling and repeat the analysis for the detected Appendix IX constituent. If the second analysis confirms the presence of constituents at levels exceeding an established GPS or an available screening concentration, the Permittee shall then report the constituents to the Director in writing within seven (7) days and must add it to **Permit Attachment K.**

VI.I.5. GPS for Newly Detected Additional Constituents

For each additional Appendix IX constituent added to **Permit Attachment K** in accordance with **Permit Condition VI.I.4.** and for which a GPS has not been established, the Director shall establish a GPS and amend **Permit Attachment N.** A background value determined through data from at least four (4) samples from the specified background monitoring well will be utilized as the GPS under 40 CFR§ 264.92 if no applicable MCL is listed in the EPA Safe Drinking Water Act or the concentration in the background well exceeds the listed MCL. The Director may establish an ACL in accordance with 40 CFR § 264.94(b) and **Permit Condition VI.I.4. a.**

VI.I.6. Comparison to Groundwater Protection Standards (GPSs)

For each hazardous constituent listed in **Permit Attachments K and L**, the Permittee shall determine whether there is statistically significant evidence of an increase over the GPS for that parameter (or hazardous constituent) each time the groundwater is monitored. In determining whether such an increase has occurred, the Permittee shall compare the groundwater quality at each monitoring well specified in **Permit Condition VI.C.1.** to the GPS for that constituent specified in **Permit Attachment N.** (40 CFR § 264.99.)

a. If a single independent sample was collected at the monitoring well, the Permittee shall conduct a simple empirical comparison of the GPS and the measured value.

b. If multiple independent samples were collected from each monitoring well, a statistical comparison to the GPS in accordance with **Permit Attachment O, Statistical Procedures,** shall be conducted. **(See Permit Condition VI.C.2.d. and VI.C.2.e.)**

VI.I.7. Data Evaluation

The Permittee shall complete the validation of the data within forty-five (45) days of the data being available from the laboratory performing the analyses.

VI.I.8. Analytical Data Presentation

The Permittee shall present the groundwater quality at each monitoring well in a form appropriate for the determination of statistically significant increases, in accordance with 40 CFR § 264.97(h). The Permittee's report shall include at least the following information: the constituents analyzed; the SW-846 test methods; method detection limits (MDLs); level of quantitation; estimated practical quantitation limits (PQLs); the internal laboratory quality assurance/quality control (QA/QC); matrix spike duplicates; percent recovery; duplicate analyses; dilution factors; any lab specific limit of detection and/or limit of quantitation; and, the results of screening analysis. **(See Permit Condition VI.C.2.d. and VI.C.2.e.)**

VI.I.9 Constituent Removal

If a monitoring constituent added to the semi-annual monitoring list in accordance with **Permit Conditions VI.I.4.b and VI.I.4.c.** has not been detected over a period of six consecutive sampling periods in three years, the facility may notify the Department and request to remove the constituent from the semi-annual groundwater monitoring list **(Permit Attachment K)**. The Department will consider approval of such a request, provided the detection limit for the reported data is below the applicable GPS for the constituent. The Director's approval would be subject to the criteria and standards in 40 CFR § 264.93(b). The preceding relief does not preclude the continued requirement of **Permit Condition VI.I.4.** to sample for Part 264, Appendix IX Groundwater Monitoring List, constituents listed in **Permit Attachment L** at least annually.

VI.J. OTHER SOURCE DEMONSTRATION

The Permittee may make a demonstration that a GPS as indicated in **Permit Attachment N** was exceeded due to sources other than the "Regulated Unit;"

errors in sampling, analysis, and evaluation; or natural variation in the groundwater. (40 CFR § 264.99(i)) The demonstration shall be conducted as follows:

a. The Permittee shall include in the notification to the Director in **Permit Condition VI.I.4.,** that the demonstration in accordance with 40 CFR § 264.99(i) will be attempted.

b. Resampling must be conducted within forty-five (45) days of receipt of original laboratory data, not to exceed sixty days (60) from date of original sample collection.

c. The Permittee must submit a report to the Director within 90 days of the notification that demonstrates a source other than the unit caused the GPS to be exceeded or that the apparent non-compliance was a result of an error in sampling, analysis, statistical evaluation, or natural variation in the groundwater.

d. The Permittee must also submit to the Director within 90 days of the notification in **Permit Condition VI.I.4.** an application for a permit modification to make any appropriate changes in the Corrective Action Groundwater Monitoring Program, as applicable, based on the finding of the above demonstration.

e. The Permittee must continue to monitor in accordance with the Corrective Action Monitoring Program established under 40 CFR § 264.99(i), and 40 CFR § 264.100.

VI.K. REPORTING AND RECORD KEEPING

The Permittee shall enter all monitoring, testing, and analytical data obtained pursuant to **Permit Module VI** into the operating record. The data packages must include all computations, calculated means, variances, t-statistic values, and t-test results or the calculations and results of statistical tests that the Department has determined to be equivalent as appropriate. Information concerning the maintenance and operation of the corrective measures shall also be entered into the Operating Record. Reports containing the information shall be submitted in accordance with **Permit Condition I.E.3.**

The permittee shall submit semi-annual reports no later than March 1st and September 1st of each calendar year. The report due no later than March 1st of each year shall serve as the annual report and shall contain the required information as listed in the following Permit Conditions for the previous calendar year.

VI.K.1. Groundwater Elevation/Potentiometric Contour Maps

a. Annually, the Permittee shall submit groundwater elevations and potentiometric contour maps depicting groundwater flow paths and supporting groundwater elevation data to verify that the monitoring well network continues to satisfy requirements of 40 CFR § 264.97(a), at a minimum.

b. If the evaluation determines that the existing monitoring well network no longer satisfies the requirements of 40 CFR§ 264.97(a), the Permittee shall immediately submit an application for a permit modification to make any appropriate changes to bring the monitoring system into compliance.

VI.K.2. Contents of Annual Report

The Groundwater Monitoring and Remedial Measures Report, submitted by March 1st of each year, shall include information, data, and applicable specifications on the effectiveness of the Corrective Action Program as required by **Permit Condition VI.B.,** and shall meet all the requirements of an Annual Groundwater Report. The annual Groundwater Monitoring and Remedial Measures Report shall include, at a minimum, the following information:

a. Groundwater sampling results collected during the previous calendar year.

b. Long-term time concentration plots of constituents of concern exceeding background and/or GPS for each well.

c. When appropriate, graphic representation of groundwater contamination plumes for constituents exceeding background.

d. Laboratory certificates from the previous year.

e. Potentiometric surface maps and static groundwater level elevation data during each sampling event during the previous calendar year.

f. Evaluation of groundwater flow directions and gradients.

g. Calculated or measured rate of migration of hazardous constituents in the groundwater.

h. Statistically calculated background values, updated, as applicable.

i. Statistical evaluations, as applicable, of the groundwater data collected during the previous calendar year, including all computations, calculated means,

variances, t-statistic values, and t-test results or the calculations and results of statistical tests.

j. Remediation systems operations and maintenance data including electron donor injection information and remedial effectiveness evaluation including applicable remedial effectiveness monitoring data as specified in the CAP (**Permit Attachment T**).

k. Copies of all notifications and reports submitted as required by this Permit.

l. Recommendations for any changes to the existing Corrective Action Program, CAP, and the groundwater monitoring programs.

VI.K.3. The Department shall be notified in writing when the remedial system is taken off-line or is being repaired, or when equipment is replaced, or upgraded and the anticipated or actual duration when the remedial system repair or off-line condition is greater than 30 days. When the remedial system is taken off-line and the period is less than 30 days, then such incident shall be noted in the Operating Record and included in the relevant subsequent semi-annual monitoring report. Note that such notification is required only for action or inaction other than the regular routine operation of the system set forth in this Permit Module VI, and/or as specified in **Permit Attachment T, Corrective Action Plan For Groundwater**.

VI.L. ASSURANCE OF COMPLIANCE

The Permittee shall demonstrate to the Department that groundwater monitoring and corrective action remedial measures necessary to achieve compliance with the GPSs of 40 CPR § 264.92, are performed in accordance with the requirements of this Permit, the **Permit Module VI, and Permit Attachment T, CAP**, during the period of compliance of this Permit.

VI.M. SPECIAL REQUIREMENT IF ADDITIONAL CORRECTIVE ACTION AT THE REGULATED UNIT IS REQUIRED

In accordance with the requirements of this permit and the VHWMR, if the Department or the Permittee has determined that additional corrective action at the point of compliance of the Waste Management Area is required, this **Permit Section (VI.M.)** applies. The Permittee is responsible for compliance with **Permit Section VI.M.** immediately upon notification by the Department that

additional corrective action is required at the point of compliance (40 CPR 264.99(h)(l).

VI.M.1. The Permittee must notify the Department in writing within seven (7) days from the date that the analytical data is available from the laboratory that a GPS **(Permit Attachment N)** has been exceeded for any constituent listed in **Permit Attachment K** at any monitoring well in which the GPS has not been exceeded previously, and where the Department has not been previously notified, in accordance with **Permit Condition VI.I.**

VI.M.2. Within 180 days from the date when the new GPS exceedance was first identified by the Permittee, the Permittee must submit a Plan for its proposed Corrective Action(s) to address the exceedance (40 CFR § 264.99(h)(2).

The Permittee is to choose the proposed Corrective Action(s) or remedial measures from all of the technologically feasible Corrective Action (remedial measures) alternatives, which were investigated, evaluated, and documented in the revised Corrective Action Plan. The Plan shall address and conform to requirements set forth at 40 CFR 264.99(h)(2) and shall constitute the Permittee's application for a permit modification to initiate the additional Corrective Action(s). (40 CFR § 264.99(j) and § 264.100(h))

VI.M.3. To demonstrate an alternative contamination source for the GPS exceedance, other than the "Regulated Unit," the Permittee should follow the procedures set forth at 40 CFR § 264.99(i) and in **Permit Condition VI.J.**

VI.N. REQUESTS FOR PERMIT MODIFICATION

VI.N.1. If the Permittee or the Department determines that groundwater corrective action is required to protect human health and the environment or if the Department determines that the corrective action ongoing at the facility is not adequate, the Permittee shall submit to the Department an application for a permit modification to establish or modify a Corrective Action Program meeting the requirements of 40 CFR 264.100 within 90 days of receipt of the Department's determination that corrective action is required.

VI.N.2. If the Permittee or the Department determines the Corrective Action Monitoring Program no longer satisfies the requirements of 40 CFR § 264.99 and § 264.100, then within 90 days, the Permittee must submit an application for a permit modification to make any appropriate changes and which meet the applicable requirements of 40 CFR § 264.99, and 40 CFR § 264.100.

MODULE VII

FACILITY SITE-WIDE CORRECTIVE ACTION

VII.A. CORRECTIVE ACTION FOR CONTINUING RELEASES; PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

VII.A.1. Section 3004(u) of RCRA, 42 U.S.C. § 6924(u), and regulations codified at 40 CFR §264.101, provide that all permits issued after November 8, 1984 must require corrective action as necessary to protect human health and the environment for all releases of hazardous waste or hazardous constituents from any solid waste management unit (SWMU), regardless of when waste was placed in the unit.

VII.A.2. Under Section 3004(v) of RCRA, 42 U.S.C. § 6924(v), and 40 CFR § §264.101(c), the Department may require that corrective action at a permitted facility be taken beyond the facility boundary where necessary to protect human health and the environment, unless the owner or operator of the facility concerned demonstrates to the satisfaction of the Department that, despite the owner or operator's best efforts, the owner or operator was unable to obtain the necessary permission to undertake such action.

VII.A.3. Section 3005(c)(3) of RCRA, 42 U.S.C. § 6925(c)(3), and the Virginia Hazardous Waste Management Regulations (VHWMR), 9 VAC 20-60, and as incorporated by reference under the RCRA Regulations under 40 CFR § 270.32(b)(2) provides that each permit shall contain such terms and conditions as the Department determines necessary to protect human health and the environment.

VII.A.3. If the Department determines, subsequent to the issuance of this Permit, that additional permit conditions are necessary to protect human health or the environment, this permit shall be modified in accordance with the applicable provisions of the VHWMR, under 40 CFR § 270.41 and/or 40 CFR § 270.42.

VII.A.4. On December 31, 1991, the United States Environmental Protection Agency (U.S. EPA) and the U.S. Department of Navy (DON), Marine Corps Combat Development Command, Quantico, Virginia, (MCB, Quantico) entered into a entered into a Federal Facility Compliance Agreement (FFCA), Administrative Agreement on Consent under RCRA §7003 (Docket No: RCRA-III-FF-RCRA-008). The FFCA directs the DON and the MCB, Quantico to achieve and maintain compliance with RCRA requirements, including effecting proper closure

of 20 units identified in the RCRA FFCA, paragraphs 2-20 and to conduct the on-going remedial investigation activities in accordance with the requirements of CERCLA (42 USC§9601-9675) under the authority of RCRA §7003 to fulfill the requirements of 40 CFR § 264.101.

The MCB, Quantico, was included on the final National Priority List (NPL) listing on June 30, 1994.

A Federal Facilities Agreement (FFA) was signed between the U.S. EPA and the DON on February 5, 1999. The FFA is intended to cover the investigation, development, selection, and implementation of Response Actions for all releases or threatened releases of hazardous substances, contaminants, hazardous wastes, hazardous constituents, or pollutants at or from MCB, Quantico. The FFA covers all phase of remediation for these releases, which bring together under one agreement, the requirements for remediation and the system to be used to determine and accomplish remediation, and the sites under the initial RCRA FFCA. CA will continue to be addressed at the MCB Quantico Facility under the FFA.

Effective June 1, 2011, 315 potential sites (solid waste management units (SWMUs) and/or areas of concern (AOCs)) are in review as part of this FFA investigation and remediation process and are sites to be included in the new FFA, which was under negotiation at the time of this Permit reissuance. As part of this FFA effort, the MCB, Quantico Site Management Plan (SMP) and Military Munitions Management Plan (MMMP) were prepared and are being used by the Navy, MCB, Quantico, the Department, and the U.S. EPA Region III as a planning tool for reviewing, summarizing, and prioritizing remedial response activities.

The above Final FFA (Agreement), dated February 1999, was submitted as part of the permit application for reissuance, and are incorporated by reference in this Permit to demonstrate compliance with the requirements of 40 CFR § 264.101, Corrective Action for Solid Waste Management Units.

The SMP and MMP are updated annually and include proposed activities, actual projected schedules, and target dates for completion of investigation and/or remediation activities. The 2009 updated copies of the SMP and MMP were submitted as part of the permit application for reissuance and are incorporated by reference in this Permit to demonstrate compliance with the requirements of 40 CFR § 264.101, Corrective Action for Solid Waste Management Units.

Electronic copies (CDs) of the 2009 SMP and MMP are included under **Permit Attachment R.**

VII.B. EMERGENCY RESPONSE; RELEASE REPORTING

VII.B.1. Emergencies

If, at any time during the term of this Permit, the Permittee discovers that a release of hazardous waste or hazardous constituents at or from the facility, under existing environmental laws, including, but not limited to § 103 of the Comprehensive Environmental Response, Compensation, and Liability Act, is presenting or may present an imminent and substantial endangerment to human health or the environment, the Permittee shall take the following actions:

a. Notify the Department, as soon as practicable and shall be provided orally within 24-hours of the Permittee becoming aware of the circumstances. The notice shall include a description of the source, nature, location, and amount of such release and the actions taken and/or to be taken (to the extent known) to address such release. Such notification shall be confirmed in writing within five (5) calendar days of the discovery of such release unless the Director waives the requirement for the submittal of the written report within five days. **(See Permit Condition I.H.12.)** (40 CFR § 270.30(1)(6)(iii)).

b. Unless otherwise directed by the Department, immediately take such action(s) as are necessary under existing environmental laws and as appropriate to address such release.

VII.B.2. Releases

If at any time during the term of this Permit, the Permittee discovers a release of hazardous waste or hazardous constituents at or from the facility which:

a. Is not being addressed by corrective measures at the time of such discovery; or

b. Is not being addressed pursuant to **Permit Condition VII.C.1.** and in accordance with the protocols and procedures specified in the Federal Facilities Agreement (FFA) as described **under Permit Condition VII.A.4.**

The Permittee shall notify the Department, in writing, of the nature, source, extent, location, and approximate amount of the release within five (5) calendar days of such release. **(See Permit Conditions I.H.12. and VII.B.1)**

VII.B.3. Reporting Releases

Nothing in this permit shall relieve the Permittee of any obligation it may have under any law, including, but not limited to, Section 103 of CERCLA, 42 USC § 9603, to report releases of hazardous waste, hazardous constituents, or hazardous substances at, to, or from, the facility.

VII.C. SOLID WASTE MANAGEMENT UNIT (SWMU) ASSESSMENT

VII.C.1. Existing SWMUs:

The information regarding SWMUs at the facility is based upon previous studies conducted with respect to the Permittee's listing on the National Priority List (NPL). **Attachment R** contains a summary of the previous investigations and a listing of SWMUs and Areas of Concern (AOCs) at the faculty.

VII.C.2. If, after the date of issuance of this Permit, the Permittee discovers any additional SWMU(s) at the facility, they shall provide the EPA and the Department with written notification of such discovery no later than 30 calendar days after the date discovered. The notification shall include, but not be limited to, the following information:

a. A description of the SWMU's type, function, dates of operation, location (including a map), design criteria, dimension, materials of construction, capacity, ancillary systems (e.g., piping), release controls, alterations made to the unit, engineering drawings, and all closure and post-closure information available, particularly whether wastes were left in place;

b. A description of the composition and quantities of solid wastes processed by the units with emphasis on hazardous wastes and hazardous constituents; and

c. A description of any release (or suspected release), as described in **Permit Condition VII.B.1.**, of hazardous waste or hazardous constituents originating from the unit. The notification shall include information on the date of release, type of hazardous waste or hazardous constituents released, quantity released, nature of the release, extent of release migration, and cause of release (e.g.: overflow, broken pipe, tank leak, etc,). Also, the notification

shall provide any available data which would quantify the nature and extent of environmental contamination, including the results of soil and/or groundwater sampling and analysis efforts, Likewise, the notice shall submit any existing monitoring information that indicates whether releases of hazardous waste or hazardous constituents have or have not occurred or are or are not occurring, The Permittee may refer to information regarding releases previously submitted to the Department under **Permit Condition VII.C.**

VII.C.3. Upon completion of closure or corrective action activities of any SWMU or AOC, the Permittee shall maintain in the Facility operating record a record of the closure and/or corrective action measures taken and the complete administrative record for the SMWUs and AOCs. Information shall include, but not be limited to, the documentation regarding the following: SWMU and/or AOC investigations and findings, remediation measures taken, and the nature and extent of the remaining constituents of concern (COCs) for each SWMU and AOC and the associated risks to human health and/ or the environment related with COCs, and whether engineering and/or institutional controls are needed to be protective of human health and/or the environment for each SWMU and AOC.

MODULE VIII

GAS MANAGEMENT PROGRAM

VIII.A. HIGHLIGHTS - BACKGROUND

Pursuant to 40 CFR § 270.31, the Permit shall specify the proper use, maintenance, and installation of monitoring equipment, when appropriate.

Results from gas monitoring probes, collected at Russell Road Landfill in 2000, indicated levels of methane gas was in exceedance of the lower explosive limit (LEL) (5 % methane in air by volume) at the landfill facility boundary. In response, the Permittee submitted and implemented a *Methane Gas Migration Assessment and Remediation Plan*, dated January 2001, which is provided in **Permit Attachment S**.

As part of the permit application for reissuance, in 2010 – 2011, the MCB Quantico submitted a *Methane Gas Migration Assessment and Remediation Plan Addendum (Plan Addendum)*, dated June 2011. Information provided in the Plan Addendum indicates that methane gas migration has been successfully mitigated or controlled and no methane gas exceedances of the LEL have been detected in more than 16 quarterly gas monitoring events from the gas monitoring wells (GMWs) and the leachate sump, the sole structure constructed in the landfill facility.

This **Permit Module VIII** establishes the requirements for the gas management program at the Russell Road Landfill Facility.

VIII.B. GENERAL REQUIREMENTS

VIII.B.1. To provide for the protection of public health and safety, and the environment, the operator shall ensure that methane generated at the facility is controlled during the periods of operation, closure, and post-closure care, in accordance with following requirements:

a. If structures are constructed on the landfill facility (other than gas control or recovery system components) the concentration of methane gas generated by the landfill shall not exceed 25% of the lower explosive limit (LEL) for methane in said structures. (i.e. not exceeding methane 1.25 % by volume in air (25° C, 760 mm Hg.)

b. The concentration of methane gas generated by the facility shall not exceed the LEL for methane at the landfill facility boundary. (i.e. not exceeding methane 5% by volume in air (25° C, 760 mm Hg)

VIII.B.2. The gas monitoring program, as enhanced in Section 6 of the Methane Gas Migration Assessment and Remediation Plan (**Permit Attachment S**), shall continue throughout the Post-closure Care period or until the Permittee receives written authorization to discontinue the gas monitoring program from the Department. Authorization to cease gas monitoring and control shall be based on a demonstration by the Permittee that there is no potential for gas migration beyond the landfill facility boundary or into facility structures.

VIII.B.3. Gas monitoring and control systems shall be modified, during the post-closure maintenance period, to reflect changing on-site and adjacent uses. Post-closure land use at the site shall not interfere with the function of gas monitoring and control systems.

VIII.B.4. The Permittee may request a reduction of monitoring or control activities based upon the results of monitoring data collected. The request for reduction of gas monitoring or control activities must be submitted in writing to the Department.

VIII.C. GAS MONITORING

At a minimum, gas monitoring must ensure the following:

VIII.C.1. The gas monitoring network must be maintained to ensure detection of the presence of methane gas migrating beyond the landfill facility boundary and into facility structures, if constructed.

VIII.C.2. The gas monitoring network shall be maintained to account for the following site specific site characteristics, and potential migration pathways or barriers, including, but not limited to the following:

a. Local soils and rock conditions. (e.g., sandy soils and fractured rock may allow decomposition gases to migrate rapidly.)

b. Hydrogeological and hydraulic conditions surrounding the facility. (e.g., the presence of streams, ponds, drainage structures, etc., can have a major impact on the propensity of decomposition gases to migrate.)

c. Locations of buildings and structures relative to the waste disposal area.

d. Adjacent land use, and habitable structures within 1000 feet of the landfill facility boundary. (i.e., if residences, schools, day care centers, etc., are adjacent to the landfill, monitoring locations may be require closer spacing.)

e. Man-made pathways, such as underground construction. (e.g., methane gas will seek the easiest pathway, such as the bedding material used in underground utilities such as underground power lines, sewers, water lines, etc.)

f. The nature and age of waste and its potential to generate methane gas. (e.g., the depth of the waste and former waste management practices can have a major impact on the potential for wastes to generate methane gas.

VIII.D. MONITORING FREQUENCY

VIII.D.1. The gas monitoring frequency has been reduced to annually based upon the findings of the *Methane Gas Migration Assessment and Remediation Plan Addendum (Plan Addendum)*, dated June 2011. .

VIII.D.2. More frequent monitoring may be required by the Department at locations where monitoring results indicate that methane gas migration is occurring. In addition, if structures are added to the landfill facility, more frequent monitoring may be required in structures where methane results indicate that methane could accumulate.

VIII.E. RECORDKEEPING

The Permittee shall keep records of gas monitoring results throughout the Post-closure Care period. Monitoring records shall include the following:

VIII.E.1. The concentrations of the methane as measured at each probe and (if structures are added to the facility) within each on-site structure. The units of measure must be clearly indicated because different monitoring devices measure concentrations in various units. (i.e., % LEL, % Methane, ppm, etc.)

VIII.E.2. The documentation of date, time, barometric pressure, atmospheric temperature, general weather conditions, and probe pressures. The verification of weather conditions during sampling events is very important because differing weather conditions can impact decomposition gas monitoring results in a large degree. (e.g., elevated concentrations during periods of low atmospheric pressure and depressed concentrations during periods of high atmospheric pressure are expected.)

VIII.E.3. The names of sampling personnel, apparatus utilized, and a brief description of the sampling methods used. Varying the types of sampling apparatus and the sampling methods used can result in monitoring which indicates false positives.

The recommended apparatus for monitoring for landfill decomposition gases is an infrared detector. In addition, sampling should be performed in a manner that three volumes of gas are extracted from each probe with the maximum and steady state methane concentration being recorded. Extraction or purging of gas in excess of three volumes of the individual sampling probe can result in migration of decomposition gases to the probe which would result in a false positive sampling result.

VIII.E.4. A numbering system to correlate monitoring results to a corresponding gas monitoring well or probe location. Gas monitoring wells or sample probes should be numbered, labeled, and mapped in a manner so that any personnel can locate any individual gas monitoring well or probe in the field.

VIII.F. GAS CONTROL SYSTEM

VIII.F.1. The gas control system, described in **Permit Attachment S**, shall be maintained so to address the following:

a. Prevent methane accumulation in any on-site structures if they are constructed on the landfill facility. The gas control system or measure may include, but may not be limited to, installation specific to these structures of methane monitors, building exhausts, air handlers, etc.

b. Reduce methane concentrations at monitored landfill property boundaries to below LEL levels specified in this Permit in the timeframes specified in the approved gas remediation plan.

c. Provide for the collection and treatment and/or disposal of decomposition gas condensate produced at the surface. Condensate generated from gas control systems may be recirculated into the landfill provided the facility is equipped with liner and leachate control systems. Condensate collected in condensate traps and drained by gravity into the waste mass is not considered to be recirculation.

VIII.F.2. Extensive systems to control emissions of non-methane organic compounds may be required under the Clean Air Act (40 CFR § 60.33c and 40 CFR Part 750) and Emission Standards for Municipal Solid Waste Landfills under 9 VAC 5-40-5800.

Gas control systems may also be subject to the Regulations for the Control and Abatement of Air Pollution under the Virginia Operating Permit Program under 9 VAC 5-80-40 or other State Air Pollution Control Regulations.

VIII.G. EMERGENCY CONTINGENCY MEASURES

VIII.G.1. If the gas control system, described in **Permit Attachment S**, fails to prevent methane concentrations from either exceeding one or both of the following: (1) 1.25% by volume in air (250 C, 760 mm Hg) in structures on the landfill facility (other than gas control or recovery system components), or (2) 5% by volume in air at the landfill facility boundary, then the Permittee must:

a. Take all immediate steps necessary to protect public health and safety. The Permittee's contingency plan shall specify emergency contacts and what measures will be taken to protect public health and safety. These measures include, but are not limited to, contacting the local fire marshal, securing the affected areas from public access, evacuating buildings, etc.

b. Notify the Department within 24 hours verbally and in writing within five days of learning that the levels specified in this Permit have been exceeded, and indicate what has been done or is planned to be done to resolve the problem. **(See Permit Condition I.H.12.)**

MODULE IX

SCHEDULE OF COMPLIANCE

IX.A. REGULATED UNIT - GROUNDWATER CORRECTIVE ACTION

IX.A.1. On September 10, 2004, the Department approved a Class 3 permit modification of the MCB Quantico Facility's Post-Closure Permit to incorporate the *Corrective Action Plan for Groundwater at the Russell Road Landfill (CAP)*, dated January 2004, and to make other applicable modifications to the Facility's Permit. The original CAP was prepared by Battelle of Columbus, OH.

Within 90 days of the effective date of this above noted Class 3 permit modification and Department's approval of the CAP, the Permittee was required to begin monitored injection of the electron donor material into contaminated groundwater at the North and South ends of the Russel Road Landfill, and monitoring of the groundwater treatment areas as specified in the original **Permit Module VI, Groundwater Corrective Action, and Permit Attachment T, Corrective Action Plan for Groundwater at the Russell Road Landfill.** (Injections of electron donor material into groundwater actually began in 2003.)

IX.A.2. Since the CAP was initially submitted to the Department, there have been three primary periods of corrective action or remediation activity to treat the groundwater at the Russell Road Landfill as follows:

a. The first corrective action period was implemented from October 2003, through May 2004.

b. The second corrective action period began in April 2005, and ended in March 2006. There were four injections of electron donor material into the groundwater within this period: April 25, 2005, July 29, 2005, October 24, 2005, and January 19, 2006.

c. The third corrective action period began in June 2007, and continued through 2010. In June 2007, additional injection points or injection wells were installed to treat groundwater within the South end Treatment Area. Quarterly injection of HRC® occurred within the North and South Treatment Areas in 2007 and 2008. In 2009 and 2010, HRC® was injected within the North and South Treatment Areas on a semi-annual basis.

IX.A.3. On June 1, 2011, the Permittee submitted an updated Corrective Action Plan (CAP) as part of the revised RCRA Permit Application for Permit renewal or reissuance. The updated CAP for Marine Corps Base Quantico is entitled *Draft Corrective Action Plan for Russell Road Landfill*, dated June 2011. **(See Permit Attachment T.)** This updated and revised CAP includes updated data, discusses remedial activities, and provides a discussion of evaluations and findings since the inception of

the CAP, and provides a projected treatment program and schedule for the near term period of the reissued Permit (2011). The updated short-term schedule in the above CAP is provided under Section 7.0, Schedule, and within Table 7-1, Schedule for Corrective Action Activities at RRL, Russell Road landfill, Quantico, VA.

Table 7-1 provides the implementation of recommended CA evaluation sampling in accordance with the CAP, Table 6-1, South End RRL Focused Investigation Analytical Parameters Summary, Russell Road Landfill, MCB Quantico, VA.

The field implementation of the CA evaluation sampling of the South End of the RRL was scheduled to occur in June 2011. The interpretation of the data from above sampling of the South End of the RRL is scheduled to occur from August 2011, through December 2011.

A CAP Addendum will be prepared and drafted in consultation with the Department and will be submitted by the Permittee to the Department for review and consideration for approval. The summary of the data, evaluations, and findings in the above South End RRL Focused Investigation will be incorporated into the Annual Remedial Measure Report submittal for 2011 to the Department.

Future Schedules associated with remedial measures of the RRL under the CAP will be in accordance with CAP submittals and approvals by the Department and such approvals will be considered to be incorporated by reference into this Permit. Such submittals, upon approval by the Department, will be added to the **Permit Attachment T, Corrective Action Plan for Groundwater at the Russell Road Landfill,** for CAP tracking purposes and will not require a permit modification, unless it is determined that such the revisions to the CAP are considered to significantly change the purpose and general remedial design specified in the current CAP, dated June 2011.

The need for a subsequent permit modification to incorporate changes to the approved CAP will be made on a case-by-case basis regarding each submittal to the Director and will be based upon the significance and the nature and extent of proposed revisions to the current CAP.

ATTACHMENT A

MARINE CORPS BASE QUANTICO, QUANTICO, VA

FIGURE A-1, FACILITY LOCATION MAP

FIGURE A-2, MCB QUANTICO BASE MAP

FIGURE A-3, RUSSELL ROAD LANDFILL LOCATION MAP

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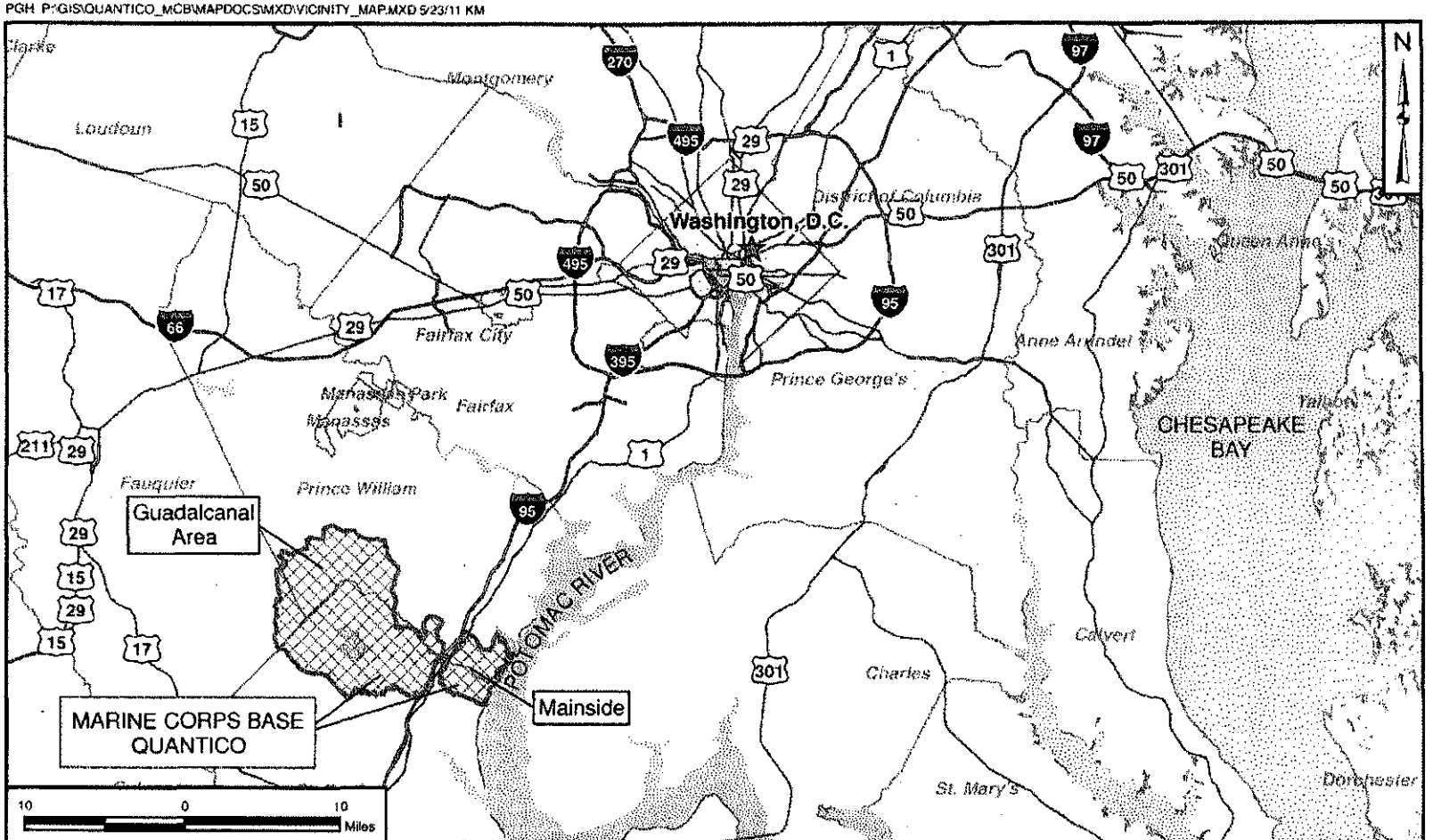

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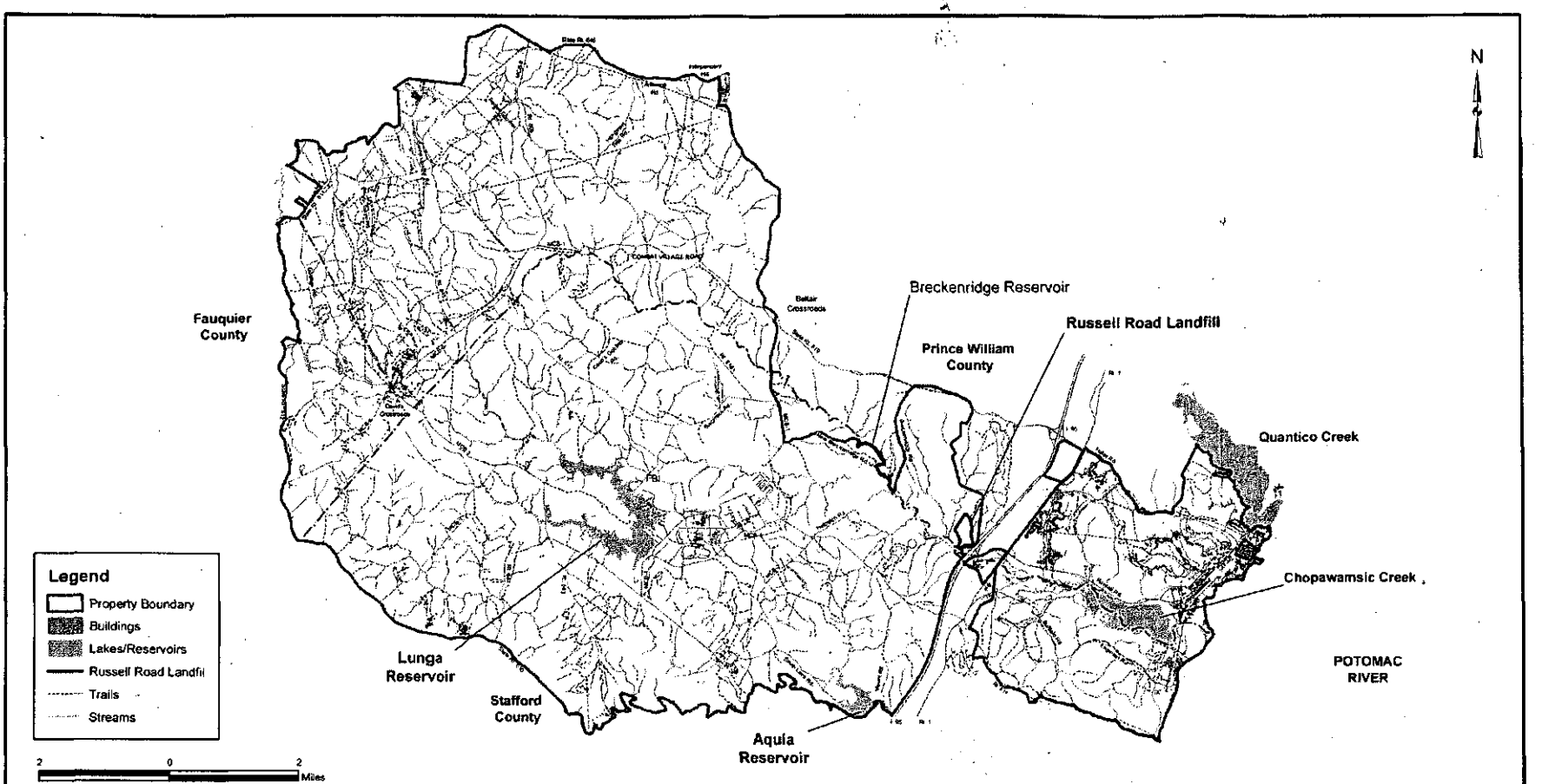
K. MOORE	05/02/08		CTO JU06
CHECKED BY	DATE		APPROVED BY / DATE
J. BUEL	05/23/11	SITE LOCATION MAP MCB QUANTICO, VIRGINIA	J. BUEL 05/23/11
REVISED BY	DATE		APPROVED BY / DATE
J. ENGLISH	03/07/11		
SCALE			FIGURE NO. / REV
AS NOTED			FIGURE A-1 / 0



NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY MP DATE 4/8/11
CHECKED BY DATE
COST/SCHEDULE-AREA
SCALE AS NOTED

BASE MAP
RUSSELL ROAD LANDFILL
MCB, QUANTICO, VIRGINIA

CONTRACT NUMBER N40080-D-08-0498
OWNER NUMBER TO 010
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. A-2
REV 0

Map Document: (K:\GProject\QuanticoData\mxd\Base Map_040811.mxd)
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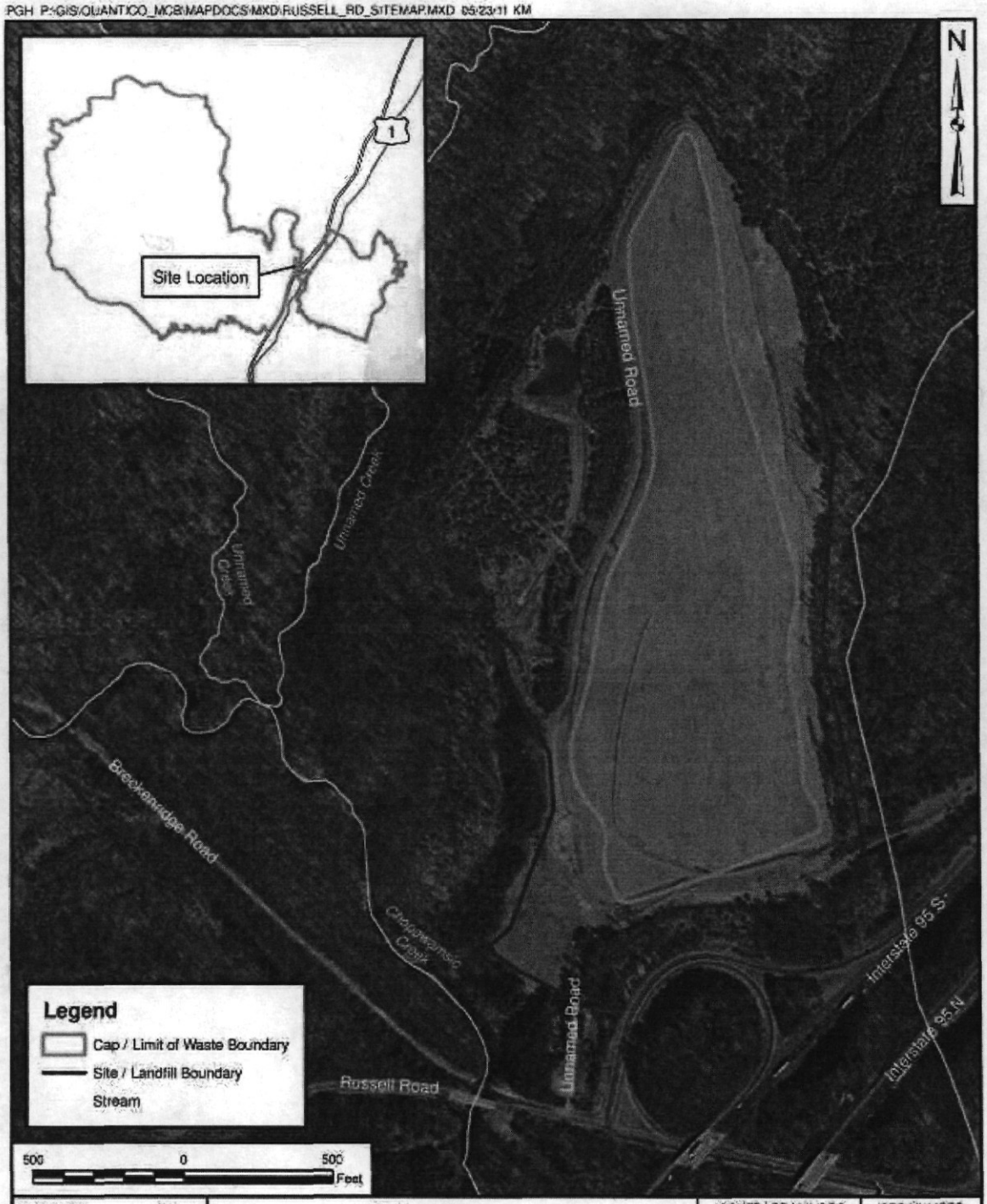

DRAWN BY J. ENGLISH — DATE 03/03/11	TETRA TECH	CONTRACT NUMBER —	CTO NUMBER JU06
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REVISED BY — DATE —		APPROVED BY — DATE —	
SCALE AS NOTED		FIGURE NO. FIGURE A-3	REV 0

ATTACHMENT B

RUSSELL ROAD LANDFILL

MARINE CORPS BASE QUANTICO, QUANTICO, VA

FIGURE B-1, SITE PLAN – CROSS SECTION TRANSECTS, RRL, MCBQ

FIGURE B-2, CROSS SECTION A-A', RRL, MCB QUANTICO

FIGURE B-3, CROSS SECTION B-B', RRL, MCB QUANTICO

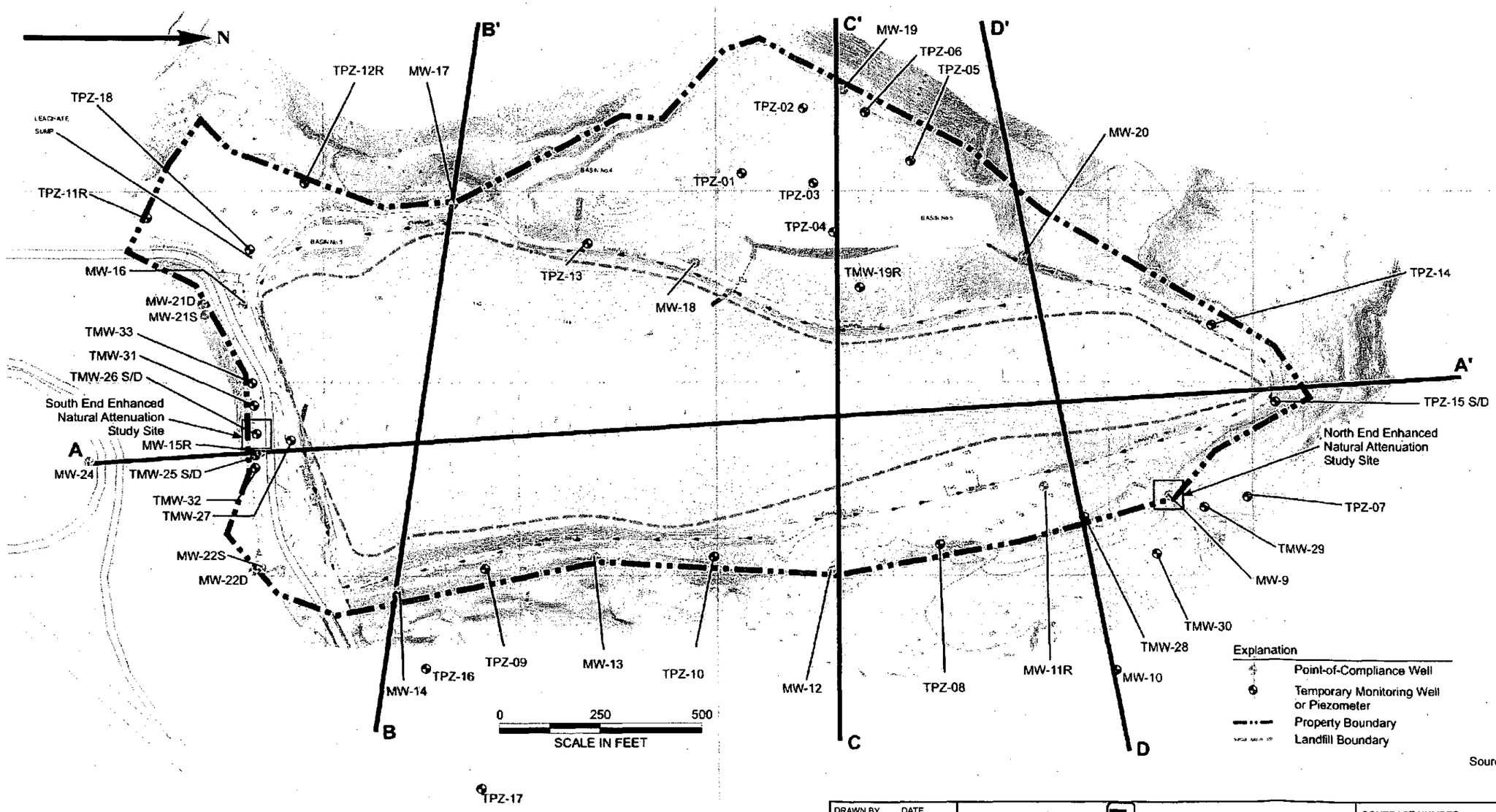
FIGURE B-4, CROSS SECTION C-C', RRL, MCB QUANTICO

FIGURE B-5, CROSS SECTION D-D', RRL, MCB QUANTICO

FIGURE B-6, STRATIGRAPHIC COLUMN, RRL, MCB QUANTICO

FIGURE B-7, POTENTIOMETRIC SURFACE MAP, RRL, MCB QUANTICO

FIGURE B-8, EXISTING PERIMETER LEACHATE COLLECTION SYSTEM AND CAP DETAIL, RRL, MCB QUANTICO



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CHECKED BY AS DATE 4/29/11	CROSS SECTION TRANSECTS COMPLETED AT RRL RUSSELL ROAD LANDFILL MARINE CORPS BASE, QUANTICO QUANTICO, VIRGINIA	APPROVED BY	DATE
COST/SCHEDULE-AREA		APPROVED BY	DATE
SCALE AS NOTED		FIGURE NO. B-1	REV 0

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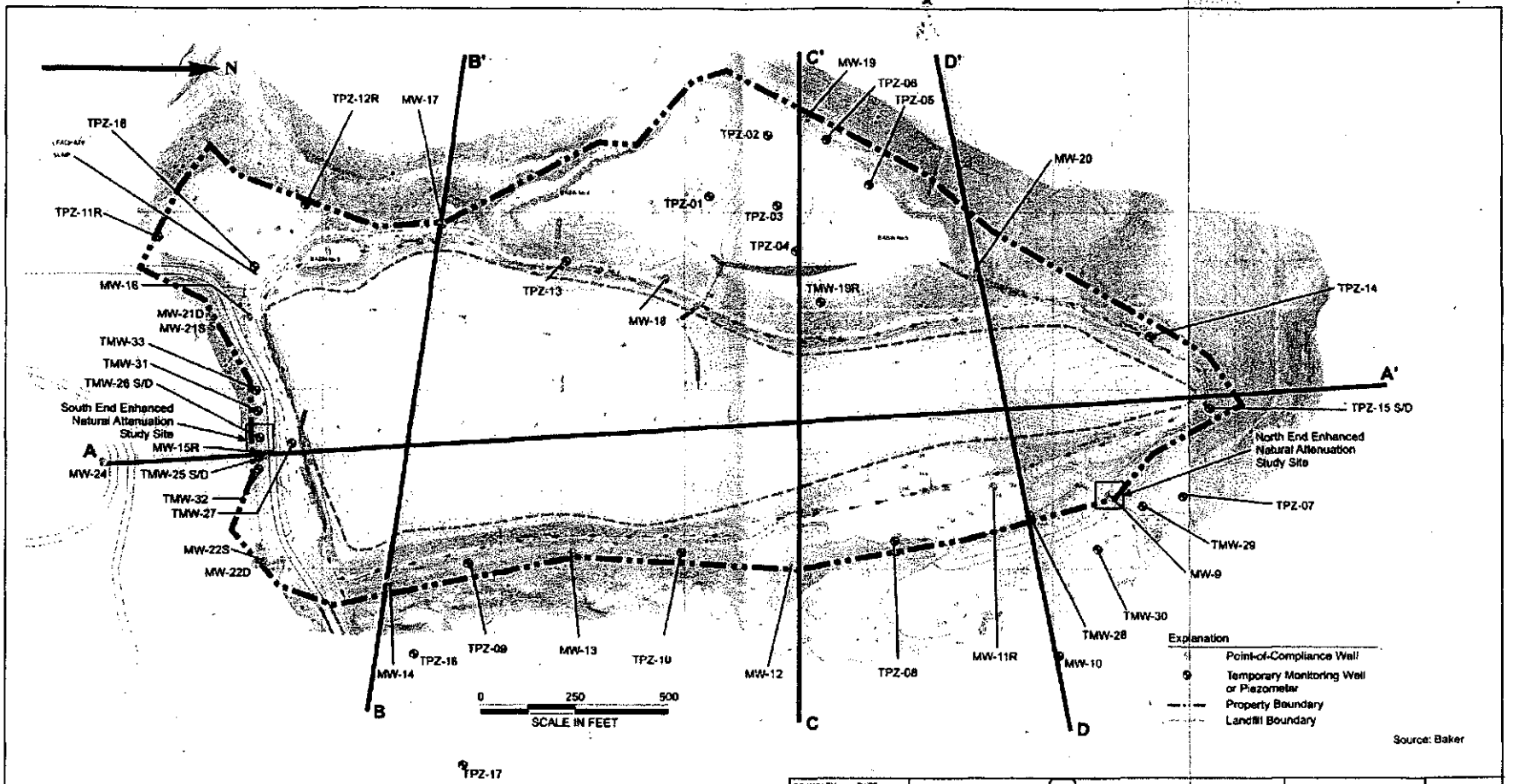

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CHECKED BY AS DATE 4/29/11	CROSS SECTION TRANSECTS COMPLETED AT RRL RUSSELL ROAD LANDFILL MARINE CORPS BASE, QUANTICO QUANTICO, VIRGINIA	APPROVED BY	DATE
COST/SCHEDULE-AREA		APPROVED BY	DATE
SCALE AS NOTED		FIGURE NO. B-1	REV 0

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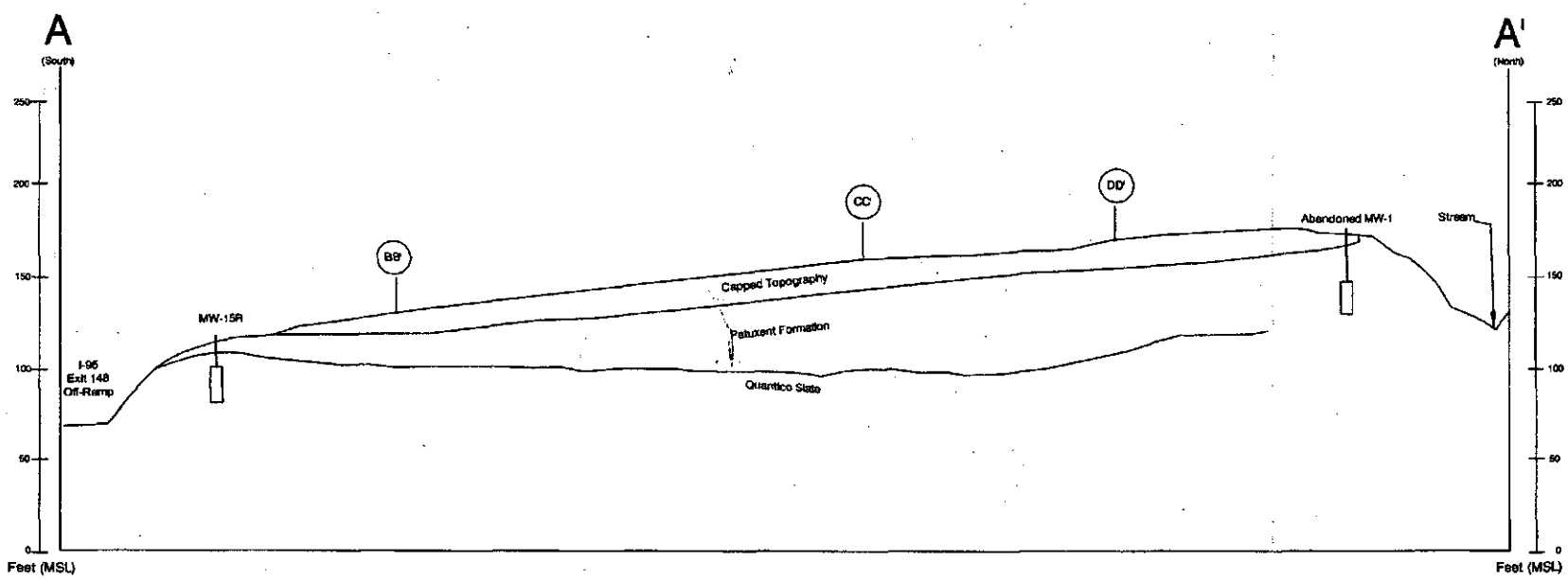
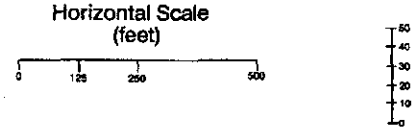


Horizontal Scale
(feet)



SOURCE: CORRECTIVE ACTION PROCESS WORKPLAN (12/00)

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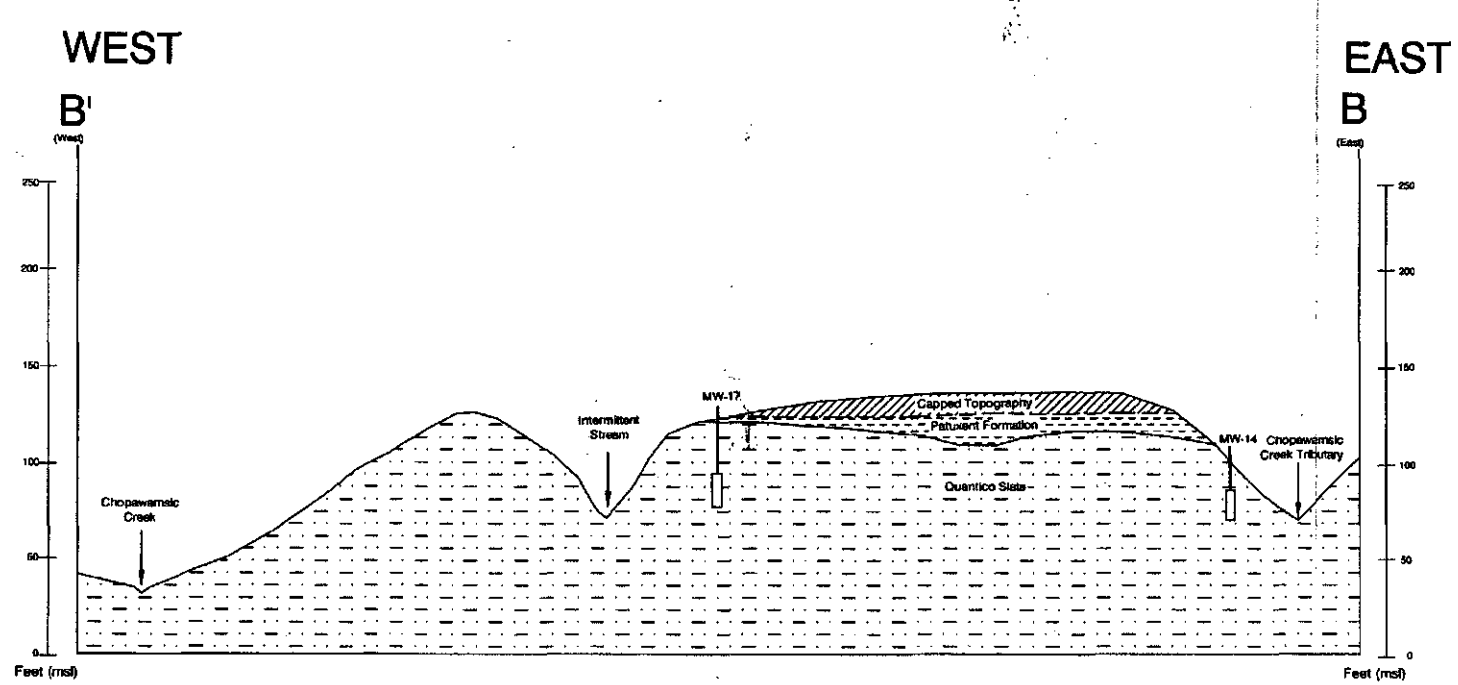
CHECKED BY BB DATE 12/04/00	CROSS SECTION A-A' NSWCDL ~~DAHLGREN~~, VIRGINIA MCB Quantico	APPROVED BY	DATE
COST/SCHED-AREA		APPROVED BY	DATE
SCALE NOT TO SCALE		DRAWING NO. Figure B-2	REV. 0



Horizontal Scale
(feet)

0 125 250 500
SCALE IN FEET

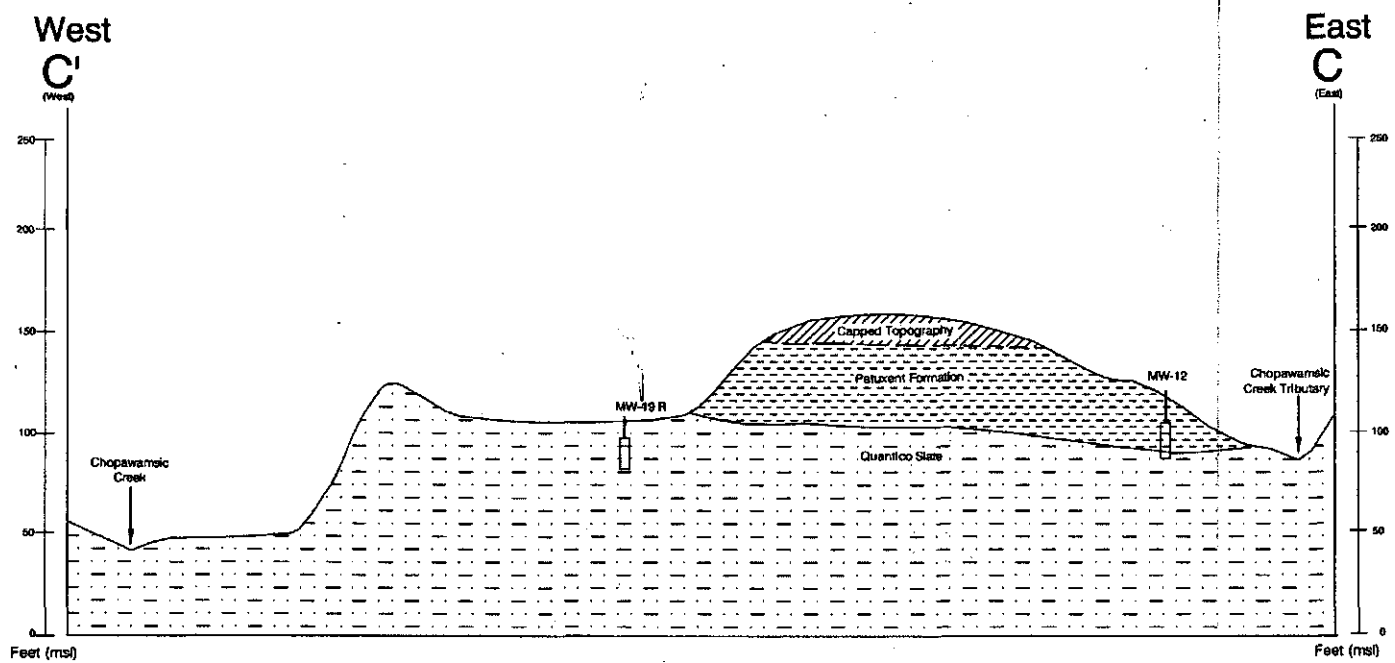
LEGEND

Lithology Boundary

Groundwater Monitoring Well

Mean Sea Level

DRAWN BY TB DATE 11/8/02	Tetra Tech NUS, Inc.	CONTRACT NO. N40080-08-D-0498	OWNER NO. TO 010
CHECKED BY MM DATE 11/8/02	CROSS SECTION B-B' RUSSELL ROAD LANDFILL MCB QUANTICO, VIRGINIA	APPROVED BY DATE	
COST/SCHED-AREA		APPROVED BY DATE	
SCALE AS SHOWN		DRAWING NO. Figure B-3	REV. 0



Horizontal Scale
(feet)

0 125 250 500

SCALE IN FEET

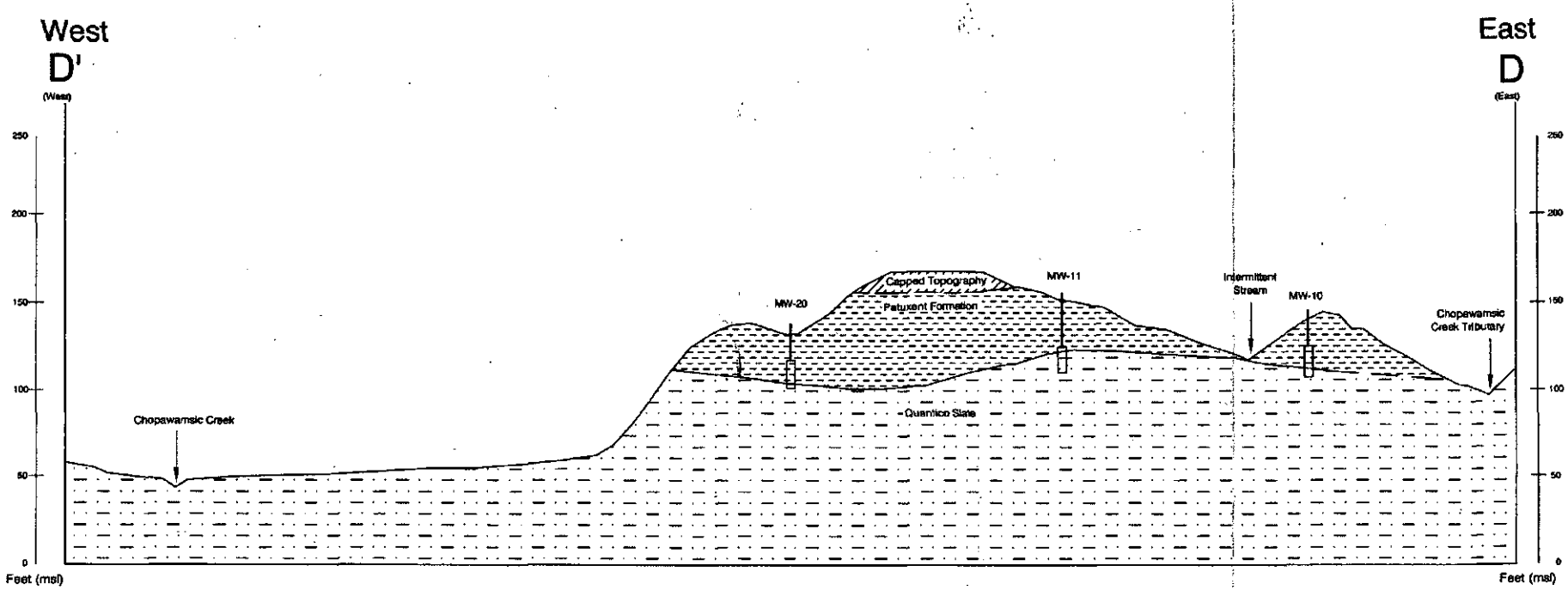
LEGEND

Lithology Boundary

Groundwater Monitoring Well

Mean Sea Level

DRAWN BY TB	DATE 11/8/02	Tetra Tech NUS, Inc.	CONTRACT NO. N40080-98-D-0498 / OWNER NO. TO 010
CHECKED BY MM	DATE 11/8/02	CROSS SECTION C-C' RUSSELL ROAD LANDFILL MCB QUANTICO, VIRGINIA	APPROVED BY / DATE
COST/SCHED-AREA			APPROVED BY / DATE
SCALE AS SHOWN			DRAWING NO. Figure B-4 / REV. 0



Horizontal Scale
(feet)

0 125 250 500

SCALE IN FEET

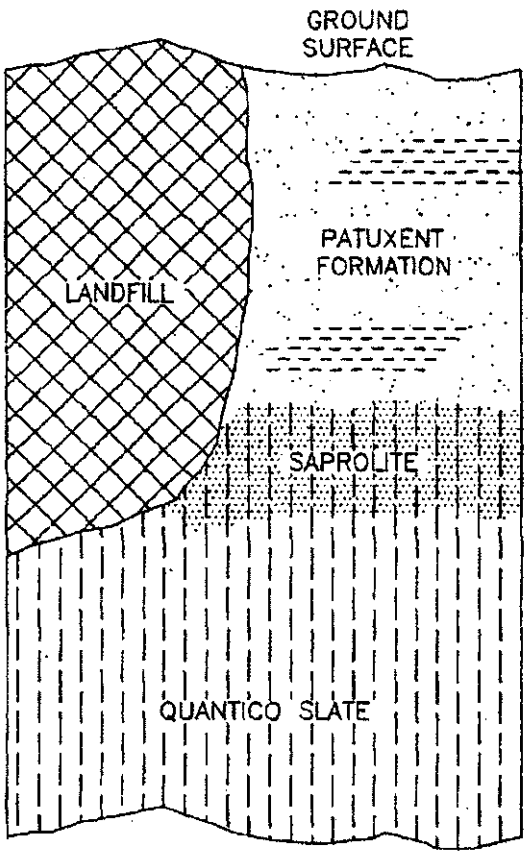
LEGEND

Lithology Boundary

Groundwater Monitoring Well

Mean Sea Level

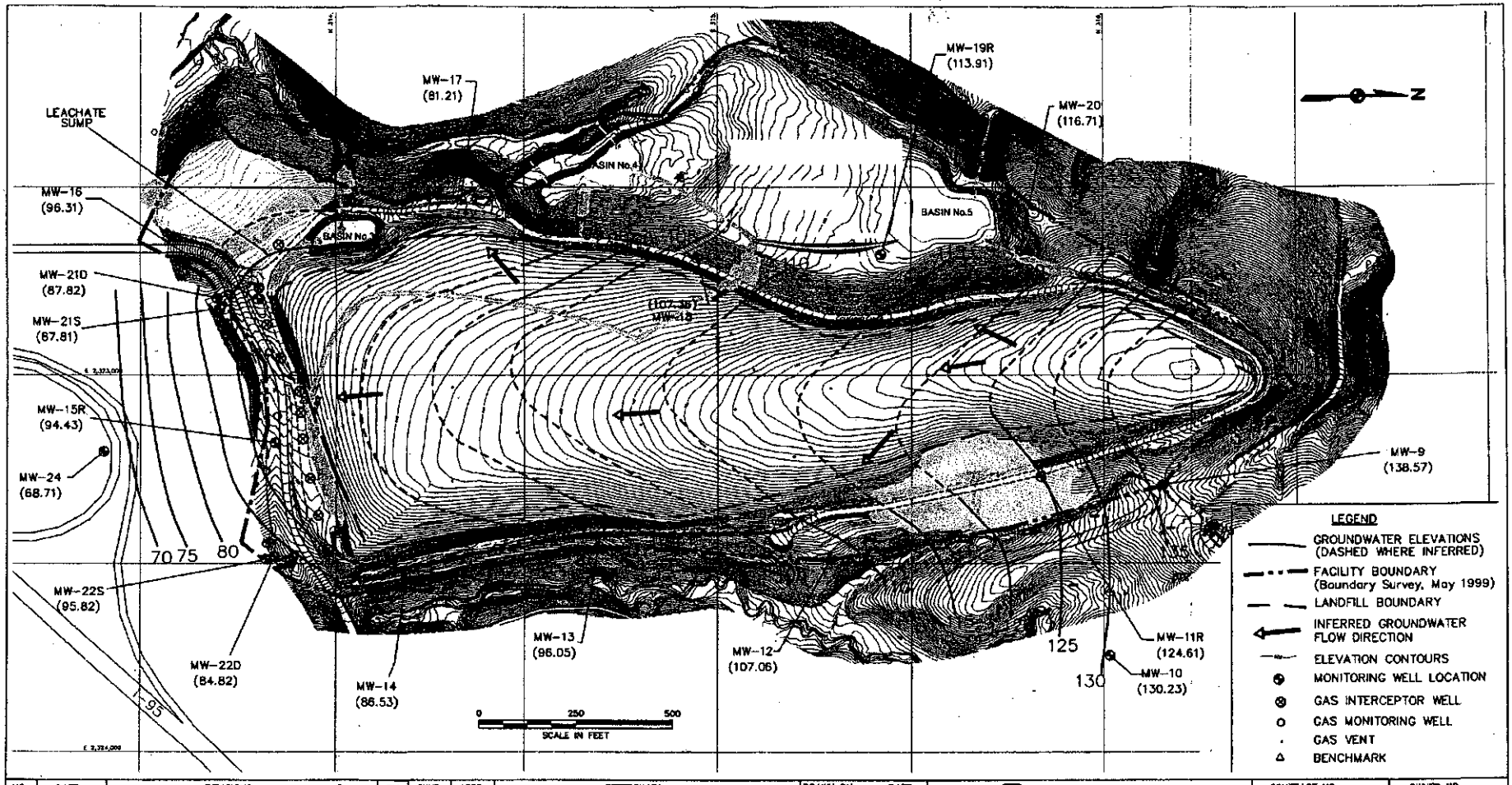
DRAWN BY TB DATE 11/8/02	Tetra Tech NUS, Inc.	CONTRACT NO. N40080-08-D-0498	OWNER NO. TO 010
CHECKED BY MM DATE 11/8/02	CROSS SECTION D-D' RUSSELL ROAD LANDFILL MCB QUANTICO, VIRGINIA	APPROVED BY	DATE
COST/SCHED-AREA		APPROVED BY	DATE
SCALE AS SHOWN		DRAWING NO. Figure B-5	REV. 0



RUSSELL ROAD LANDFILL
RCRA GROUNDWATER ASSESSMENT
MONITORING PLAN
MCCDC, QUANTICO, VIRGINIA

FIGURE B-6
STRATIGRAPHIC COLUMN

DWG DATE: 03/21/94 | DWG NAME: 05STRAT3



NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

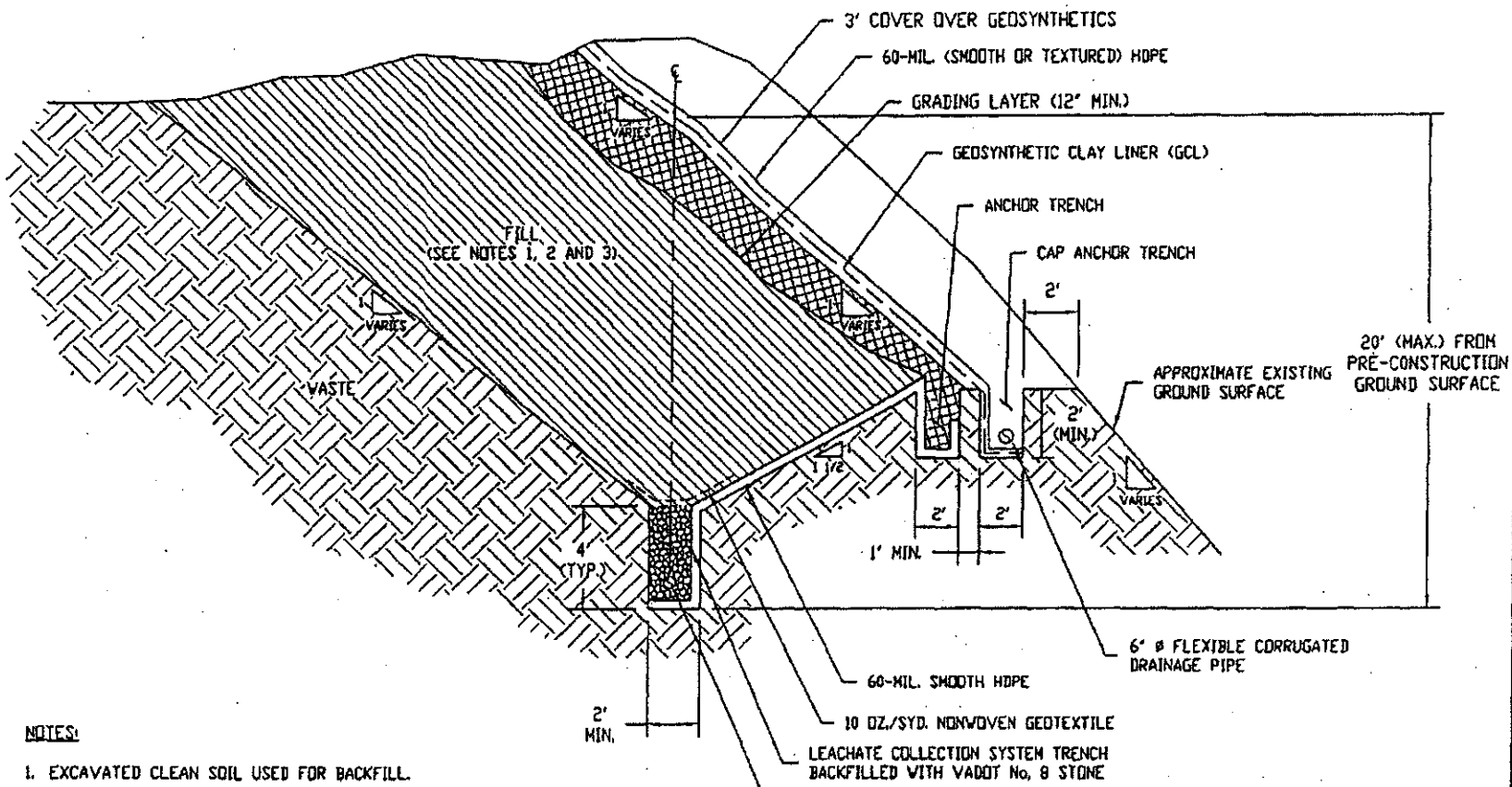
DRAWN BY MP DATE 2/1/11
CHECKED BY AS DATE 2/1/11
COST/SCHED-AREA
SCALE AS SHOWN

Tetra Tech NUS, Inc.

POTENTIOMETRIC SURFACE MAP
ROUND (DECEMBER 6, 2010)
RUSSELL ROAD LANDFILL
MCB QUANTICO, VIRGINIA

CONTRACT NO. N40080-08-D-0498
OWNER NO. XD010
APPROVED BY DATE
APPROVED BY DATE
FIGURE NO. B-7
REV. 0

FILENAME: K:\gproject\CADD\Quantico\Groundwater Contours_Dec2010.dwg



NOTES:

1. EXCAVATED CLEAN SOIL USED FOR BACKFILL.
2. EXCAVATED WASTE/DEBRIS WAS RELOCATED WITHIN THE LANDFILL.
3. ADDITIONAL BACKFILL CONSISTED OF COMMON ON-SITE BORROW MATERIAL.
4. EXCAVATION OF CAP ANCHOR TRENCH AND LEACHATE ANCHOR TRENCH VARIES.

TETRA TECH NUS, INC.

FIGURE 2-2

EXISTING PERIMETER LEACHATE COLLECTION SYSTEM DETAIL
RUSSELL ROAD LANDFILL
MCCDC, QUANTICO, VIRGINIA

T:\Environm\5684\Figure 2

ATTACHMENT C

RUSSELL ROAD LANDFILL

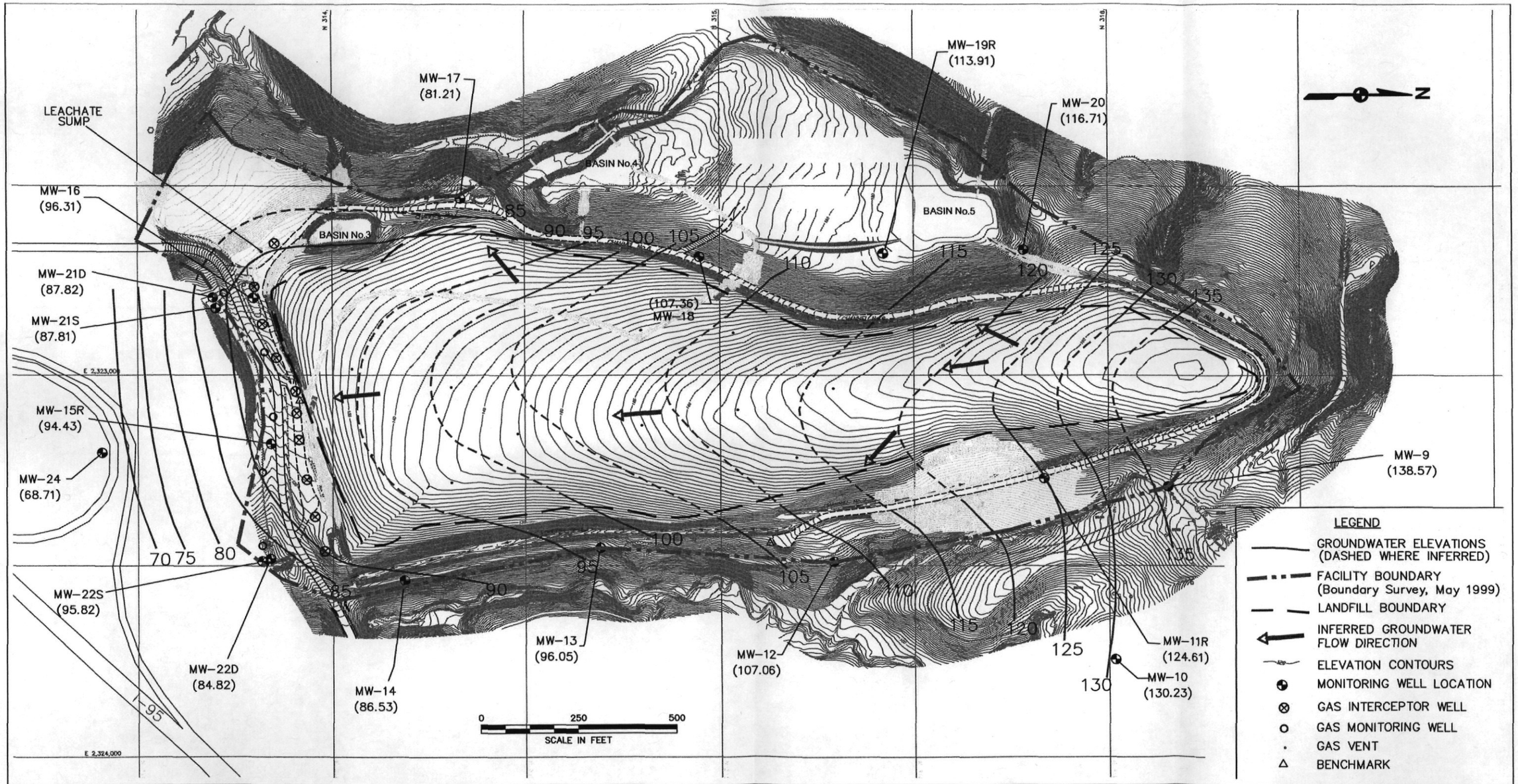
MARINE CORPS BASE QUANTICO, QUANTICO, VA

FIGURE C-1, SITE PLAN – MONITORING WELL LOCATIONS, RRL, MCBQ

FIGURE C-2, SITE PLAN – GAS MONITORING POINTS AND VENTS, RRL, MCBQ

FIGURE C-3, SITE PLAN – CORRECTIVE ACTION - TEMPORARY MONITORING WELL INSTALLATIONS AT THE SOUTH END OF THE RRL, MCBQ

FIGURE C-4, SITE PLAN – CORRECTIVE ACTION – TEMPORARY MONITORING WELL INSTALLATIONS AT THE NORTH END OF THE RRL, MCBQ



NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY MP DATE 2/1/11
CHECKED BY AS DATE 2/1/11
COST/SCHED-AREA
SCALE AS SHOWN

Tetra Tech NUS, Inc.

POTENTIOMETRIC SURFACE MAP
ROUND (DECEMBER 6, 2010)
RUSSELL ROAD LANDFILL
MCB QUANTICO, VIRGINIA

CONTRACT NO. N40080-08-D-0498
OWNER NO. X0010
APPROVED BY DATE
APPROVED BY DATE
FIGURE NO. B-7
REV. 0

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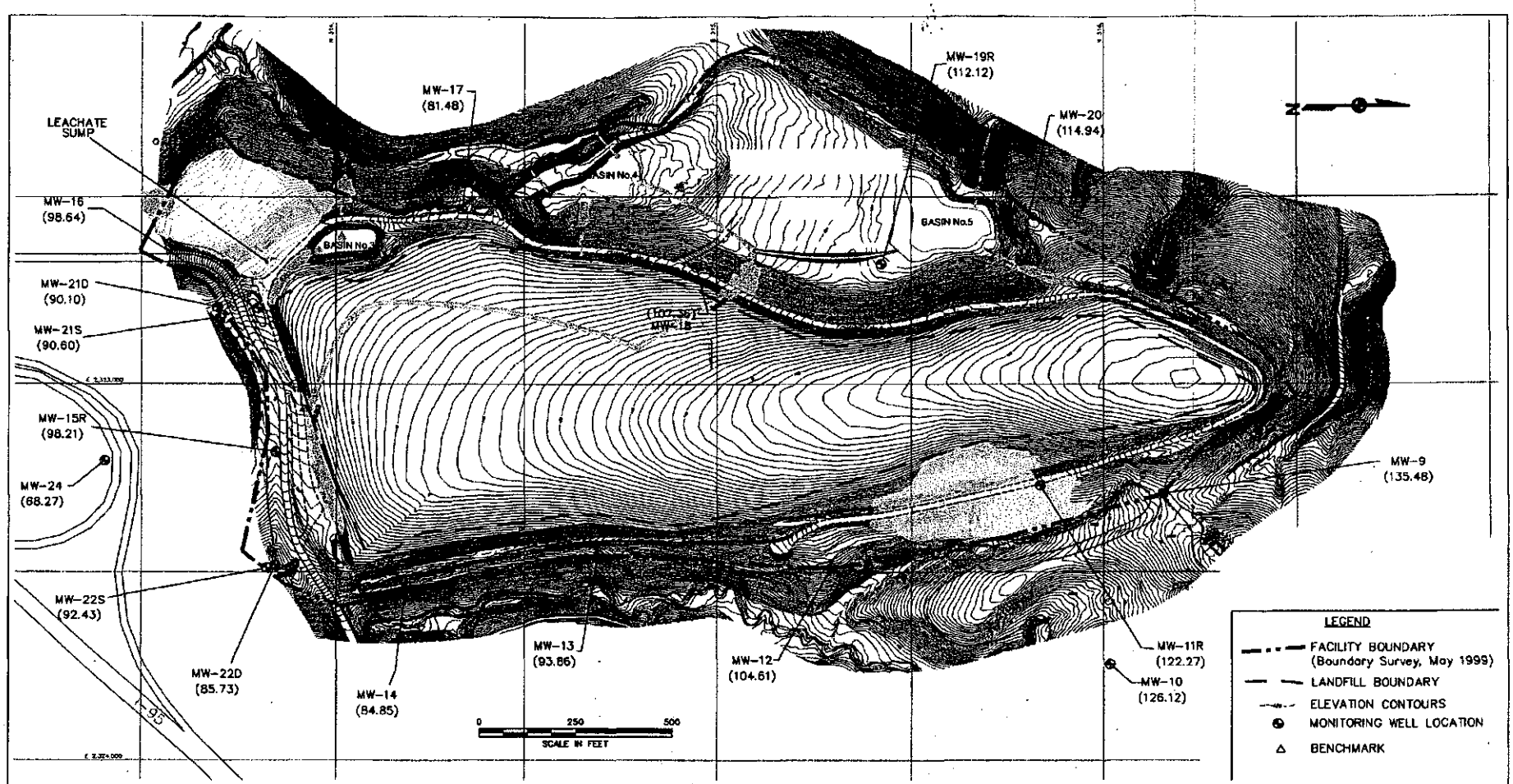

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY MP DATE 4/29/11
CHECKED BY AS DATE 4/29/11
COST/SCHED-AREA
SCALE AS SHOWN

Tetra Tech NUS, Inc.

MONITORING WELL LOCATIONS
RUSSELL ROAD LANDFILL
MCB QUANTICO, VIRGINIA

CONTRACT NO. N40080-08-D-0498
OWNER NO. X0010
APPROVED BY DATE
APPROVED BY DATE
FIGURE NO. C-1
REV. 0

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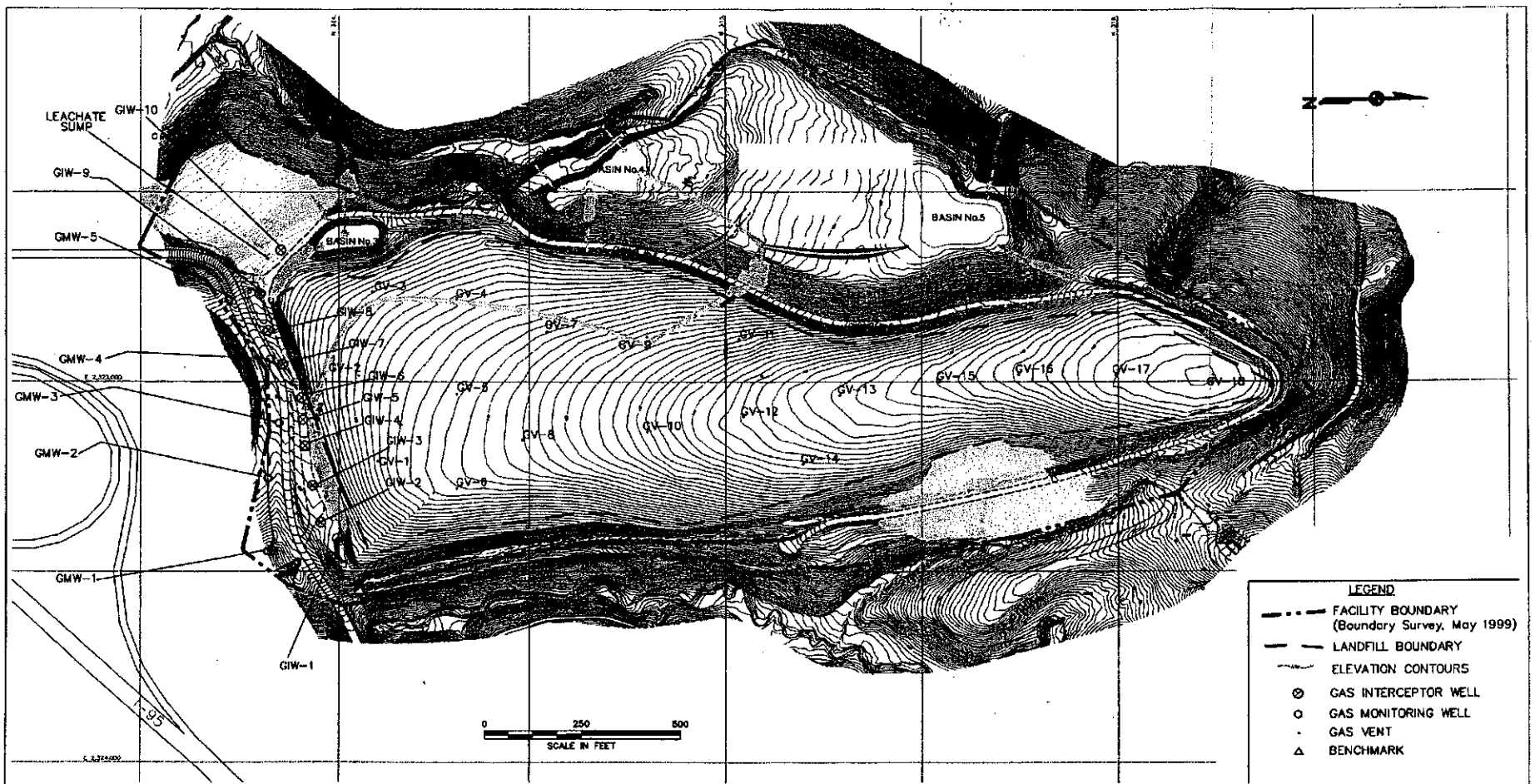


NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

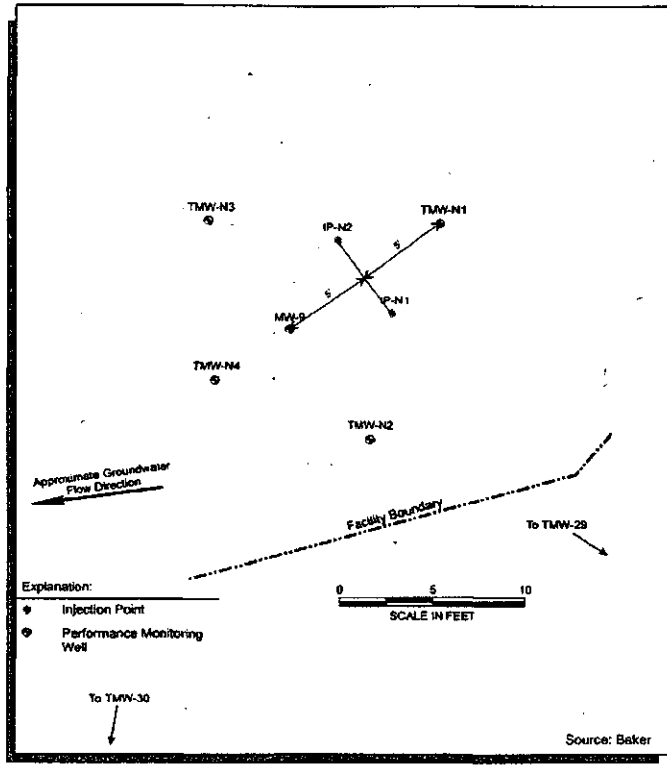
DRAWN BY MP DATE 4/5/11
CHECKED BY AS DATE 4/5/11
COST/SCHED-AREA
SCALE AS SHOWN

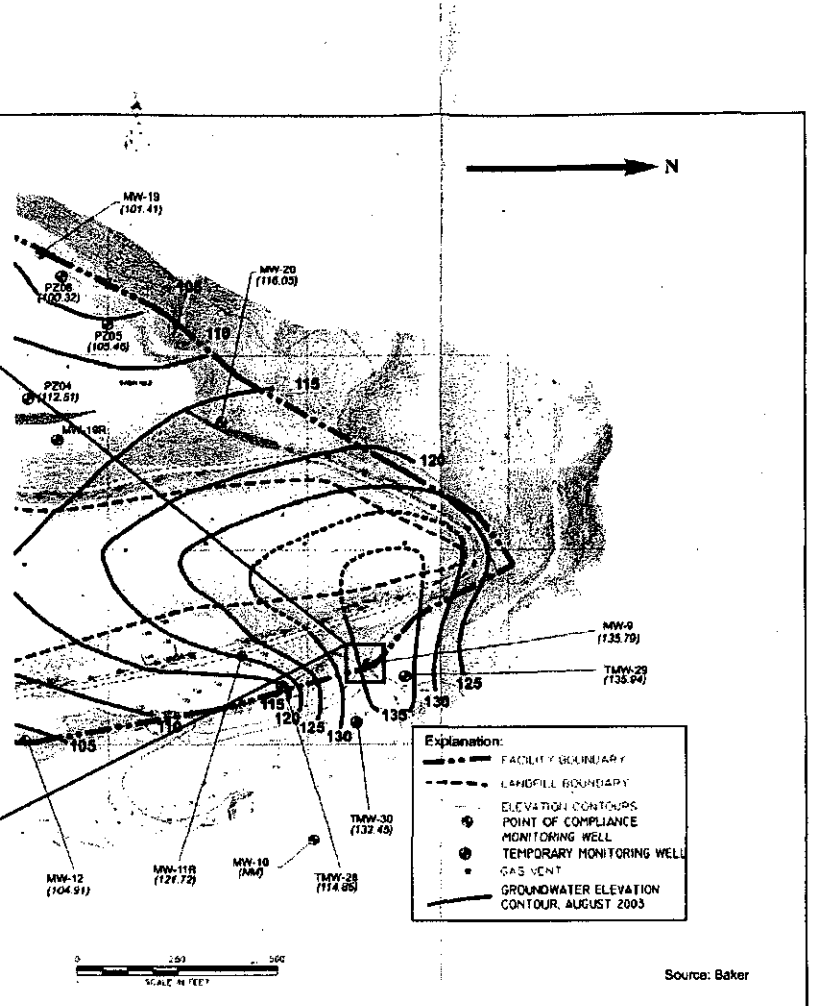
Tetra Tech NUS, Inc.

GAS MONITORING POINTS AND VENTS
RUSSELL ROAD LANDFILL
MCB QUANTICO, VIRGINIA

CONTRACT NO. N40080-08-D-0498
OWNER NO. X0010
APPROVED BY DATE
APPROVED BY DATE
FIGURE NO. C-2
REV. 0

FILENAME: K:\gproject\CADD\Quantico\Gas Monitoring Points_04 05 11.dwg





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CHECKED BY	DATE	DIAGRAM FOR ELECTRON DONOR INJECTION POINTS AND GROUNDWATER PERFORMANCE MONITORING WELLS AROUND MW-9 RUSSELL ROAD LANDFILL MARINE CORPS BASE, QUANTICO QUANTICO, VIRGINIA	APPROVED BY	DATE
AS	4/22/11			
COST/SCHEDULE-AREA			APPROVED BY	DATE
SCALE			FIGURE NO.	REV
NOT TO SCALE			4-1	0

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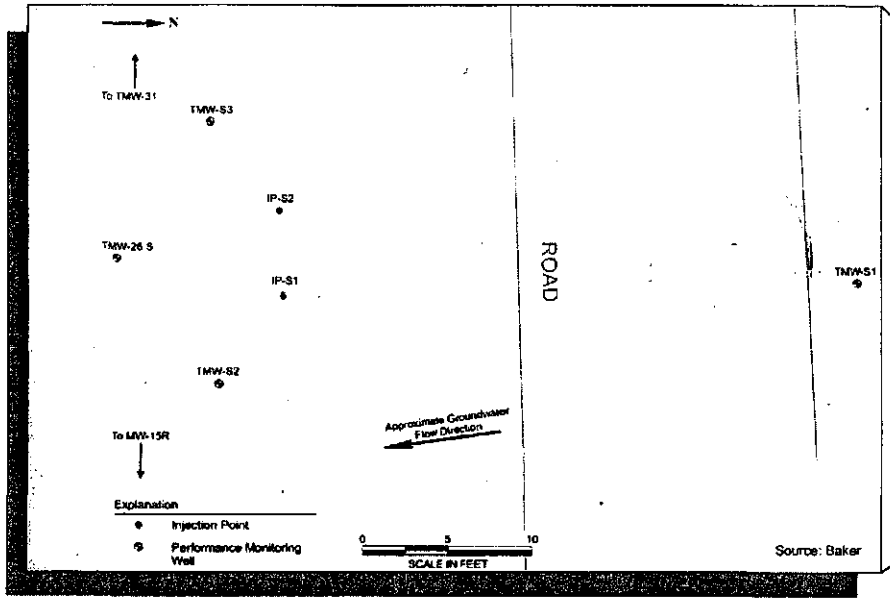

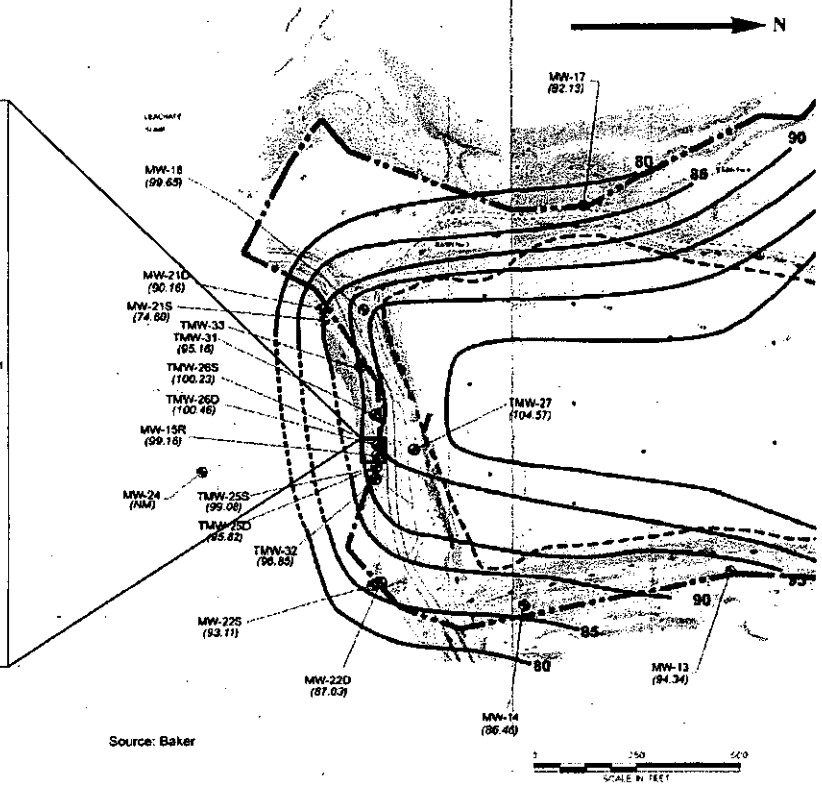

Source: Baker

DRAWN BY MP DATE 4/22/11	Tetra Tech	CONTRACT NUMBER N40080-08-D-0498	TASK ORDER TO 010
CHECKED BY AS DATE 4/22/11	TEMPORARY MONITORING WELL INSTALLATIONS AT THE SOUTH END OF RUSSELL ROAD LANDFILL RUSSELL ROAD LANDFILL MARINE CORPS BASE, QUANTICO QUANTICO, VIRGINIA	APPROVED BY	DATE
COST/SCHEDULE-AREA		APPROVED BY	DATE
SCALE NOT TO SCALE		FIGURE NO. 5-1	REV 0

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ATTACHMENT D

LIST OF WASTES, HAZARDOUS WASTES, AND LEACHATE (F039) INFORMATION

CLOSED RUSSELL ROAD LANDFILL

ATTACHMENT D

LIST OF WASTES, HAZARDOUS WASTES, AND LEACHATE (F039) INFORMATION

CLOSED RUSSELL ROAD LANDFILL

D.1. LIST OF WASTES AND HAZARDOUS WASTES

The Table 2-1, in **Appendix D-1**, contains an estimate of the solid and hazardous wastes which were placed or disposed within the Russell Road Landfill during the landfill's operational period from 1971 to 1983.

In addition to the wastes listed in Table 2-1, Information within the previous Post-Closure Permit documented that the following various wastes were disposed within the landfill at unknown quantities: ammunition crates, gas masks, cleared brush and debris, water heaters, tar, ceiling tiles, insulation, drywall frames, mattresses, coaxial cables, tires, steel lockers, scrap steel, old meat, and unserviceable steel helmets, boots, canteens, etc.

D.2. Chemical and Physical Analysis of the RRL Multi-Source Leachate (F039)

In accordance with 40 CFR § 270.14(b)(2), the facility is to provide a chemical and physical analyses of the hazardous waste and hazardous debris to be handled at the facility. At a minimum, these analyses shall contain all the information which must be known to treat, store, and/or dispose of the wastes properly in accordance with 40 CFR Part 264 and Part 268.

In accordance with 40 CFR § 268.7, Testing, Tracking, and Recordkeeping Requirements for Generators, Treaters, and Disposal Facilities, a generator of hazardous waste must determine if the waste has to be treated before it can be land disposed. This is done by determining if the hazardous waste meets the treatment standards in 40 CFR § 268.40, § 268.45, or § 268.49.

The RRL Facility is a "Regulated Unit," which is a landfill used for the disposal of an undetermined amount of hazardous wastes of various characteristic and listed hazardous wastes with various hazardous waste codes or numbers.

Under the RCRA Regulations, the Hazardous Waste Code/Number F039 is defined as follows: *Leachate (liquids that have percolated through land disposed wastes) resulting from the disposal of more than one restricted waste classified as hazardous under 40 CFR Part 261, Subpart D (Listed Hazardous Wastes). (Leachate resulting from the disposal of one or more of the following EPA Hazardous Wastes and no other Hazardous Wastes retains its EPA Hazardous Waste Number(s): F020, F021, F022, F026, F027, and/or F028.*

Therefore, in accordance with the RCRA, the leachate collected from the landfill's perimeter leachate collection system and sump is considered to be a hazardous waste multisource leachate (F039) and must be managed as hazardous waste until demonstrated

to be non- hazardous through a combination of testing and/or knowledge and based on the EPA's "Contained-in Policy."

Groundwater contaminated with multi-source leachate and which contains hazardous constituents present in the leachate is to be managed as a hazardous waste and demonstrated to be non-hazardous through a combination of testing and/or knowledge and based on the EPA's "Contained-in Policy.

D.3. F039 Leachate Waste Profiles and Analytical Data

Appendix D-2 provides waste characterization profiles and analytical data for leachate which has been managed and shipped off-site for subsequent management, treatment, and disposal in accordance with the RCRA Regulatory requirements. These records and other required records for leachate management, treatment, and disposal are on file at the MCB Quantico's Natural Resources and Environmental Affairs (NREA) Office.

D.4. LDR Notification and Certification Requirements

In accordance with 40 CFR 268.7, if the multi-source leachate (F039) will be managed at an off-site treatment, storage, or disposal facility, the owner/operator must submit to the facility either:

1. A notification and certification that the multi-source leachate meets the treatment standards in 40 CFR § 268.41 and § 268.43, including the information specified in 40 CFR § 268.7(a)(2), or;

2. A notification that the multi-source leachate does not meet the treatment standards, including the information specified in 40 CFR § 268.7(a)(1).

Please provide documentation regarding documentation regarding compliance with the above.

Appendix D-3 provides the owner certification in accordance with 40 CFR § 268.7(a)(3) which provides the "Certification Requirements for Generators of Waste That Meet Treatment Standards."

Appendix D-3 also provides the owner certification in February 2001, in accordance with 40 CFR § 268.7(a)(2) for the treatment and disposal of the landfill leachate, identified as EPA Hazardous Waste Code Number F039. The treatability group of the above leachate waste is identified as non-wastewater, F039 waste requiring treatment. The manifest number of the initial shipment of waste associated with the certification is NJA3188287. The waste analysis data, is attached to the certification in February 2001, and the certification statement signed by an authorized representative.

A copy of these certifications, and data, along with the originating manifests are maintained in the MCB Quantico's RRL files located at the MCB Quantico NREA office.

These certification records and other required records for leachate management, treatment, and disposal are on file at the MCB Quantico's Natural Resources and Environmental Affairs (NREA) Office.

APPENDIX D-1

TABLE 2-1, ESTIMATED TYPE, QUANTITY AND ORIGIN OF WASTES AND HAZARDOUS WASTES DISPOSED IN THE RUSSELL ROAD LANDFILL MCB QUANTICO, QUANTICO, VIRGINIA

Table 2-1
Estimated Type, Quantity, and Origin of Uncharacterized Wastes in Russell Road Landfill
Russell Road Landfill
Quantico, Virginia

Uncharacterized Waste	Estimated Quantity	Origin
Paint[a]	27,000 gallons	paint shop
Paint thinner and cleaner[b]	16,000 gallons	paint shop
Vehicle batteries[c]	2,800 batteries	motor transport maintenance
Sludge from Visconine[d]	7 gallons	air conditioning shop
Compressor oil[e]	30 gallons	air conditioning shop
Sludge from paint spray booth[f]	1,000 gallons	paint shop
Oil drums	unknown	unknown
Gas cylinders	unknown	unknown
Partially filled paint cans	unknown	unknown
Drywall sealer	unknown	unknown
Partially filled gasoline cans	unknown	unknown
Engine oils	unknown	unknown
Photographic and other unidentified chemicals	unknown	unknown
Cleanup materials from the 11/17/78 JP-4 spill and other oil spills	unknown	unknown
Movie film and magnetic tape	unknown	unknown

(a) (42,000 gal/year) (5% wasted) (13 years of operation) = 27,000 gallons
(b) (23,900 gal/year) (5% wasted) (13 years of operation) = 16,000 gallons
(c) (400 batteries/year) (7 years of battery disposal) = 2,800 batteries
(d) (50 gal/year used) (1% to sludge) (13 years of operation) = 7 gallons
(e) (25 gal/year used) (10% survived burning) (13 years of operation) = 30 gallons
(f) (836 gal/year used) (10% survived burning) (13 years of operation) = 1,000 gallons
Source: Ensafe/Allen and Hoshall, 1994a

(OHM, 1997) estimated the total maximum waste volume to be 24.4 million ft^3 or 0.9 million yd^3. The volume was estimated assuming a total acreage of the fill (28 acres) and a maximum waste depth of 20 ft.

APPENDIX D-2

F039 LEACHATE WASTE PROFILES AND ANALYTICAL DATA FOR THE RUSSELL ROAD LANDFILL MCB QUANTICO, QUANTICO, VIRGINIA

DuPont Environmental Treatment

Treatment Standards for F039 Multisource Leachate Wastes

Instructions: Mark the constituents present in the waste.*

*You are not required to include this attachment or to mark the constituents present in the waste because the DuPont Wastewater Treatment Plant (WWTP) is regulated under the Clean Water Act.

Constituents of Concern	Total Composition WW (mg/l)	Total Composition Non-WW (mg/kg)	Constituents of Concern	Total Composition WW (mg/l)	Total Composition Non-WW (mg/kg)
__ Acenaphthylene	0.059	3.4	__ Cyclohexanone	0.36	NA
__ Acenaphthene	0.059	3.4	__ 1,2-Dibromo-3-chloropropane	0.11	15
X Acetone	0.28	160	__ Ethylene dibromide (1,2-Dibromoethane)	0.028	15
__ Acetonitrile	5.6	NA	__ Dibromomethane	0.11	15
__ Acetophenone	0.010	9.7	__ 2,4-D (2,4-Dichlorophenoxyacetic acid)	0.72	10
__ 2-Acetylaminofluorene	0.059	140	__ o,p'-DDD	0.023	0.087
__ Acrolein	0.29	NA	__ p,p'-DDD	0.023	0.087
__ Acrylonitrile	0.24	84	__ o,p'-DDE	0.031	0.087
__ Aldrin	0.021	0.066	__ p,p'-DDE	0.031	0.087
__ 4-Aminobiphenyl	0.13	NA	__ o,p'-DDT	0.0039	0.087
__ Aniline	0.81	14	__ p,p'-DDT	0.0039	0.087
__ Anthracene	0.059	3.4	__ Dibenz(a,h) anthracene	0.055	8.2
__ Aramite	0.36	NA	__ Dibenzo(a,e) pyrene	0.061	NA
__ alpha-BHC	0.00014	0.066	__ m-Dichlorobenzene	0.036	6.0
__ beta-BHC	0.00014	0.066	__ o-Dichlorobenzene	0.088	6.0
__ delta-BHC	0.023	0.066	__ p-Dichlorobenzene	0.090	6.0
__ gamma-BHC	0.0017	0.066	__ Dichlorodifluoromethane	0.23	7.2
__ Benzene	0.14	10	X 1,1-Dichloroethane	0.059	6.0
__ Benz(a)anthracene	0.059	3.4	__ 1,2-Dichloroethane	0.21	6.0
__ Benzo(b)-fluoranthene	0.11	6.8	__ 1,1-Dichloroethylene	0.025	6.0
__ Benzo(k)-fluoranthene	0.11	6.8	__ trans-1,2-Dichloroethylene	0.054	30
__ Benzo(g,h,i)-perylene	0.0055	1.8	__ 2,4-Dichlorophenol	0.044	14
__ Benzo(a)pyrene	0.061	3.4	__ 2,6-Dichlorophenol	0.044	14
__ Bromodichloromethane	0.35	15	__ 1,2-Dichloropropane	0.85	18
__ Methyl bromide (Bromomethane)	0.11	15	__ cis-1,3-Dichloropropene	0.036	18
__ 4-Bromophenyl phenyl ether	0.055	15	__ trans-1,3-Dichloropropene	0.036	18
__ n-Butyl alcohol	5.6	2.6	__ Dieldrin	0.017	0.13
__ Butyl benzyl phthalate	0.017	28	__ Diethyl phthalate	0.20	28
__ 2-sec-Butyl-4,6-dinitrophenol	0.066	2.5	__ 2,4-Dimethyl phenol	0.036	14
__ Carbon disulfide	3.8	NA	__ Dimethyl phthalate	0.047	28
__ Carbon tetrachloride	0.057	6.0	__ Di-n-butyl phthalate	0.057	28
__ Chlordane (alpha & gamma isomers)	0.0033	0.26	__ 1,4-Dinitrobenzene	0.32	2.3
__ p-Chloroaniline	0.46	16	__ 4,6-Dinitro-o-cresol	0.28	160
__ Chlorobenzene	0.057	6.0	__ 2,4-Dinitrophenol	0.12	160
__ Chlorobenzilate	0.10	NA	__ 2,4-Dinitrotoluene	0.32	140
__ 2-Chloro-1,3-butadiene	0.057	NA	__ 2,6-Dinitrotoluene	0.55	28
__ Chlorodibromomethane	0.057	15	__ Di-n-octyl phthalate	0.017	28
__ Chloroethane	0.27	6.0	__ Di-n-propylnitrosoamine	0.40	14
__ bis(2-Chloroethoxy) methane	0.036	7.2	__ 1,4-Dioxane	12.0	170
__ bis(2-Chloroethyl) ether	0.033	6.0	__ Diphenylamine	0.92	NA
__ Chloroform	0.046	6.0	__ Diphenyl nitrosamine	0.92	NA
__ bis(2-Chloroisopropyl) ether	0.055	7.2	__ 1,2-Diphenylhydrazine	0.087	NA
__ p-Chloro-m-cresol	0.018	14	__ Disulfoton	0.017	6.2
__ Chloromethane (Methyl chloride)	0.19	30	__ Endosulfan I	0.023	0.066
__ 2-Chloronaphthalene	0.055	5.6	__ Endosulfan II	0.029	0.13
__ 2-Chlorophenol	0.044	5.7	__ Endosulfan sulfate	0.029	0.13
__ 3-Chloropropylene	0.036	30	__ Endrin	0.0028	0.13
__ Chrysene	0.059	3.4	__ Endrin aldehyde	0.025	0.13
__ o-Cresol	0.11	5.6	__ Ethyl acetate	0.34	33
__ m-Cresol	0.77	5.6	__ Ethyl cyanide (Propanenitrile)	0.24	360
__ p-Cresol	0.77	5.6	__ Ethyl benzene	0.057	10

Treatment Standards for F039 Multisource Leachate Wastes

Constituents of Concern	Total Composition WW (mg/l)	Total Composition Non-WW (mg/kg)
__ Ethyl ether	0.12	160
__ bis(2-Ethylhexyl) phthalate	0.28	28
__ Ethyl methacrylate	0.14	160
__ Ethylene oxide	0.12	NA
__ Famphur	0.017	15
__ Fluoranthene	0.068	3.4
__ Fluorene	0.059	3.4
__ Heptachlor	0.0012	0.066
__ Heptachlor epoxide	0.016	0.066
__ Hexachlorobenzene	0.055	10
__ Hexachlorobutadiene	0.055	5.6
__ Hexachlorocyclopentadiene	0.057	2.4
__ HxCDDs (Hexachlorodibenzo-p-dioxins)	0.000063	0.001
__ HxCDFs (Hexachlorodibenzofurans)	0.000063	0.001
__ Hexachloroethane	0.055	30
__ Indeno(1,2,3-c,d)pyrene	0.0055	3.4
__ Iodomethane	0.19	65
__ Isobutanol	5.6	170
__ Isodrin	0.021	0.066
__ Isosafrole	0.081	2.6
__ Kepone	0.0011	0.13
__ Methacrylonitrile	0.24	84
__ Methanol	5.6	NA
__ Methapyrilene	0.081	1.5
__ Methoxychlor	0.25	0.18
__ 3-Methylchlolanthrene	0.0055	15
__ 4,4-Methylene-bis(2-chloroaniline)	0.50	30
__ Methylene chloride	0.089	30
__ Methyl ethyl ketone	0.28	36
__ Methyl isobutyl ketone	0.14	33
__ Methyl methacrylate	0.14	160
__ Methyl methansulfonate	0.018	NA
__ Methyl parathion	0.014	4.6
__ Naphthalene	0.059	5.6
__ 2-Naphthylamine	0.52	NA
__ p-Nitroaniline	0.028	28
__ Nitrobenzene	0.068	14
__ 5-Nitro-o-toluidine	0.32	28
__ p-Nitrophenol	0.12	29
__ N-Nitrosodiethylamine	0.40	28
__ N-Nitrosodimethylamine	0.40	NA
__ N-Nitroso-di-n-butylamine	0.40	17
__ N-Nitrosomethylethylamine	0.40	2.3
__ N-Nitrosomorpholine	0.40	2.3
__ N-Nitrosopiperidine	0.013	35
__ N-Nitrosopyrrolidine	0.013	35
__ Parathion	0.014	4.6
__ Total PCBs (sum of all PCB isomers)	0.10	10
__ Pentachlorobenzene	0.055	10
__ PeCDDs (Pentachlorodibenzofurans)	0.000063	0.001
__ PeCDFs (Pentachlorodibenzo-p-dioxins)	0.000035	0.001
__ Pentachloronitrobenzene	0.055	4.8
__ Pentachlorophenol	0.089	7.4
__ Phenacetin	0.081	16
__ Phenanthrene	0.059	5.6
__ Phenol	0.039	6.2
__ Phorate	0.021	4.6
__ Phthalic anhydride	0.055	NA
__ Pronamide	0.093	1.5
__ Pyrene	0.067	8.2
__ Pyridine	0.014	16
__ Safrole	0.081	22
__ Silvex (2,4,5-TP)	0.72	7.9
__ 2,4,5-T	0.72	7.9
__ 1,2,4,5-Tetrachlorobenzene	0.055	14
__ TCDDs (Tetrachlorodibenzo-furans)	0.000063	0.001
__ TCDFs (Tetrachlorodibenzo-p-dioxins)	0.000063	0.001
__ 1,1,1,2-Tetrachloroethane	0.057	6.0
__ 1,1,2,2-Tetrachloroethane	0.057	6.0
__ Tetrachloroethylene	0.056	6.0
__ 2,3,4,6-Tetrachlorophenol	0.030	7.4
__ Toluene	0.080	10
__ Toxaphene	0.0095	2.6
__ Bromoform (Tribromomethane)	0.63	15
__ 1,2,4-Trichlorobenzene	0.055	19
__ 1,1,1-Trichloroethane	0.054	6.0
__ 1,1,2-Trichloroethane	0.054	6.0
__ Trichloroethylene	0.054	6.0
__ Trichloromonofluoromethane	0.020	30
__ 2,4,5-Trichlorophenol	0.18	7.4
__ 2,4,6-Trichlorophenol	0.035	7.4
__ 1,2,3-Trichloropropane	0.85	30
__ 1,1,2-Trichloro-1,2,2-trifluoroethane	0.057	30
__ tris(2,3-dibomopropyl) phosphate	0.11	NA
__ Vinyl chloride	0.27	6.0
__ Xylene(s) (sum of mixed isomers)	0.32	30

__ Antimony	1.9	2.1 mg/l [TCLP]
__ Arsenic	1.4	5.0 mg/l [TCLP]
__ Barium	1.2	7.6 mg/l [TCLP]
X Beryllium	0.82	NA
__ Cadmium	0.69	0.19 mg/l [TCLP]
__ Chromium (Total)	2.77	0.86 mg/l [TCLP]
__ Cyanides (Total)	1.2	590
__ Cyanides (Amendable)	0.86	NA
__ Fluoride	35	NA
__ Lead	0.69	0.37 mg/l [TCLP]
__ Mercury	0.15	0.025 mg/l [TCLP]
__ Nickel	3.98	5.0 mg/l [TCLP]
__ Selenium	0.82	0.16 mg/l [TCLP]
__ Silver	0.43	0.30 mg/l [TCLP]
__ Sulfide	14	NA
__ Thallium	1.4	NA
__ Vanadium	4.3	NA

DUPONT

Chambers Works Wastewater Treatment Facility
Land Disposal Restrictions
(cont.)

Corrected

4. In Table B, identify all additional characteristic, listed, newly identified, and newly listed U.S. EPA hazardous waste codes that apply to this waste. For each waste code, identify the subcategory, indicate whether the waste is a wastewater or nonwastewater, and indicate how the waste must be managed, based on the options below.

TABLE B

U.S. EPA HAZARDOUS WASTE CODE(S) Per 40 CFR 261	SUBCATEGORY		Waste-water	Non-waste-water	HOW MUST THE WASTE BE MANAGED?
	Description	None	(Check only one)		Enter the letter from options below*
D039	LANDFILL LEACHATE			X	B

(Use Attachment I if more room is needed to list all applicable waste codes)

5. If this waste is a spent solvent (F001-F005), you MUST include Attachment II, Treatment Standards for F001-F005 Spent Solvents.
6. If this waste is a multisource leachate (F039), you may include Attachment III, Treatment Standards for F039 Multisource Leachate Wastes.
7. If this waste is D001 ignitable (other than the high TOC ≥ 10% subcategory), D002, D003, or D012-D043, you may include Attachment IV, Universal Treatment Standards. You may also include Attachment IV for nonhazardous waste which was hazardous (for these waste codes) as generated but rendered nonhazardous by pretreatment.

*HOW MUST THE WASTE BE MANAGED? (Choose from the following options to complete Tables A and B.)

A. Restricted waste requires treatment [40 CFR 268.7(a)(2)].

B. Restricted waste meets applicable treatment standards at the original point of generation.

GENERATOR'S CERTIFICATION [40 CFR 268.7(a)(3)(i)]
I certify under penalty of law that I personally have examined and am familiar with the waste through analysis and testing or through knowledge of the waste to support this certification that the waste complies with the treatment standards specified in 40 CFR Part 268 Subpart D. I believe that the information I submitted is true, accurate, and complete. I am aware that there are significant penalties for submitting a false certification, including the possibility of a fine and imprisonment.

C. Waste is newly listed or newly identified.

D. Restricted waste is exempt from the Land Disposal Restrictions. Check the reason below and write in the date the waste is subject to prohibitions [40 CFR 268.7(a)(4)].

- ☐ The waste has been granted a Site-Specific Variance. _____
- ☐ The waste has been given a Case-by-Case Extension. _____
- ☐ The waste is subject to a National Capacity Variance. _____

E. Restricted waste has been pretreated on-site to remove the hazardous characteristic D001-D003 and/or D012-D043 and requires treatment of underlying hazardous constituents.

CHARACTERISTIC WASTE - UNDERLYING HAZARDOUS CONSTITUENTS [40 CFR 268.7(b)(5)(iv)]
I certify under penalty of law that the waste has been treated in accordance with the requirements of 40 CFR 268.40 to remove the hazardous characteristic. This decharacterized waste contains underlying hazardous constituents that require further treatment to meet universal treatment standards. I am aware that there are significant penalties for submitting a false certification, including the possibility of fine and imprisonment.

F. Restricted waste has been pretreated on-site to remove the hazardous characteristic D001-D003 and/or D012-D043 and to treat underlying hazardous constituents to levels in 40 CFR 268.48 Universal Treatment Standards.

CHARACTERISTIC WASTE - UNDERLYING HAZARDOUS CONSTITUENTS [40 CFR 268.7(b)(5)(v)]
I certify under penalty of law that the waste has been treated in accordance with the requirements of 40 CFR 268.40 to remove the hazardous characteristic, and that underlying hazardous constituents, as defined in § 268.2, have been treated on-site to meet the § 268.48 Universal Treatment Standards. I am aware that there are significant penalties for submitting a false certification, including the possibility of fine and imprisonment.

CERTIFICATION

I certify that, to the best of my knowledge, the information provided in this document is true, accurate, and complete.

Authorized Signature	Title	Date
[signature]	Env Eng Tech	1/29/02

DuPont

DuPont Environmental Treatment

Treatment Standards for F039 Multisource Leachate Wastes

Instructions: Mark the constituents present in the waste.*

*You are not required to include this attachment or to mark the constituents present in the waste because the DuPont Wastewater Treatment Plant (WWTP) is regulated under the Clean Water Act.

Constituents of Concern	Total Composition WW (mg/l)	Total Composition Non-WW (mg/kg)	Constituents of Concern	Total Composition WW (mg/l)	Total Composition Non-WW (mg/kg)
__ Acenaphthylene	0.059	3.4	__ Cyclohexanone	0.36	NA
__ Acenaphthene	0.059	3.4	__ 1,2-Dibromo-3-chloropropane	0.11	15
X Acetone	0.28	160	__ Ethylene dibromide (1,2-Dibromoethane)	0.028	15
__ Acetonitrile	5.6	NA	__ Dibromomethane	0.11	15
__ Acetophenone	0.010	9.7	__ 2,4-D (2,4-Dichlorophenoxyacetic acid)	0.72	10
__ 2-Acetylaminofluorene	0.059	140	__ o,p'-DDD	0.023	0.087
__ Acrolein	0.29	NA	__ p,p'-DDD	0.023	0.087
__ Acrylonitrile	0.24	84	__ o,p'-DDE	0.031	0.087
__ Aldrin	0.021	0.066	__ p,p'-DDE	0.031	0.087
__ 4-Aminobiphenyl	0.13	NA	__ o,p'-DDT	0.0039	0.087
__ Aniline	0.81	14	__ p,p'-DDT	0.0039	0.087
__ Anthracene	0.059	3.4	__ Dibenz(a,h) anthracene	0.055	8.2
__ Aramite	0.36	NA	__ Dibenzo(a,e) pyrene	0.061	NA
__ alpha-BHC	0.00014	0.066	__ m-Dichlorobenzene	0.036	6.0
__ beta-BHC	0.00014	0.066	__ o-Dichlorobenzene	0.088	6.0
__ delta-BHC	0.023	0.066	__ p-Dichlorobenzene	0.090	6.0
__ gamma-BHC	0.0017	0.066	__ Dichlorodifluoromethane	0.23	7.2
__ Benzene	0.14	10	X 1,1-Dichloroethane	0.059	6.0
__ Benz(a)anthracene	0.059	3.4	__ 1,2-Dichloroethane	0.21	6.0
__ Benzo(b)-fluoranthene	0.11	6.8	__ 1,1-Dichloroethylene	0.025	6.0
__ Benzo(k)-fluoranthene	0.11	6.8	__ trans-1,2-Dichloroethylene	0.054	30
__ Benzo(g,h,i)-perylene	0.0055	1.8	__ 2,4-Dichlorophenol	0.044	14
__ Benzo(a)pyrene	0.061	3.4	__ 2,6-Dichlorophenol	0.044	14
__ Bromodichloromethane	0.35	15	__ 1,2-Dichloropropane	0.85	18
__ Methyl bromide (Bromomethane)	0.11	15	__ cis-1,3-Dichloropropene	0.036	18
__ 4-Bromophenyl phenyl ether	0.055	15	__ trans-1,3-Dichloropropene	0.036	18
__ n-Butyl alcohol	5.6	2.6	__ Dieldrin	0.017	0.13
__ Butyl-benzyl-phthalate	0.017	28	__ Diethyl phthalate	0.20	28
__ 2-sec-Butyl-4,6-dinitrophenol	0.066	2.5	__ 2,4-Dimethyl phenol	0.036	14
__ Carbon disulfide	3.8	NA	__ Dimethyl phthalate	0.047	28
__ Carbon tetrachloride	0.057	6.0	__ Di-n-butyl phthalate	0.057	28
__ Chlordane (alpha & gamma isomers)	0.0033	0.26	__ 1,4-Dinitrobenzene	0.32	2.3
__ p-Chloroaniline	0.46	16	__ 4,6-Dinitro-o-cresol	0.28	160
__ Chlorobenzene	0.057	6.0	__ 2,4-Dinitrophenol	0.12	160
__ Chlorobenzilate	0.10	NA	__ 2,4-Dinitrotoluene	0.32	140
__ 2-Chloro-1,3-butadiene	0.057	NA	__ 2,6-Dinitrotoluene	0.55	28
__ Chlorodibromomethane	0.057	15	__ Di-n-octyl phthalate	0.017	28
__ Chloroethane	0.27	6.0	__ Di-n-propylnitrosoamine	0.40	14
__ bis(2-Chloroethoxy) methane	0.036	7.2	__ 1,4-Dioxane	12.0	170
__ bis(2-Chloroethyl) ether	0.033	6.0	__ Diphenylamine	0.92	NA
__ Chloroform	0.046	6.0	__ Diphenyl nitrosamine	0.92	NA
__ bis(2-Chloroisopropyl) ether	0.055	7.2	__ 1,2-Diphenylhydrazine	0.087	NA
__ p-Chloro-m-cresol	0.018	14	__ Disulfoton	0.017	6.2
__ Chloromethane (Methyl chloride)	0.19	30	__ Endosulfan I	0.023	0.066
__ 2-Chloronaphthalene	0.055	5.6	__ Endosulfan II	0.029	0.13
__ 2-Chlorophenol	0.044	5.7	__ Endosulfan sulfate	0.029	0.13
__ 3-Chloropropylene	0.036	30	__ Endrin	0.0028	0.13
__ Chrysene	0.059	3.4	__ Endrin aldehyde	0.025	0.13
__ o-Cresol	0.11	5.6	__ Ethyl acetate	0.34	33
__ m-Cresol	0.77	5.6	__ Ethyl cyanide (Propanenitrile)	0.24	360
__ p-Cresol	0.77	5.6	__ Ethyl benzene	0.057	10

Treatment Standards for F039 Multisource Leachate Wastes

Constituents of Concern	Total Composition WW (mg/l)	Total Composition Non-WW (mg/kg)
__ Ethyl ether	0.12	160
__ bis(2-Ethylhexyl) phthalate	0.28	28
__ Ethyl methacrylate	0.14	160
__ Ethylene oxide	0.12	NA
__ Famphur	0.017	15
__ Fluoranthene	0.068	3.4
__ Fluorene	0.059	3.4
__ Heptachlor	0.0012	0.066
__ Heptachlor epoxide	0.016	0.066
__ Hexachlorobenzene	0.055	10
__ Hexachlorobutadiene	0.055	5.6
__ Hexachlorocyclopentadiene	0.057	2.4
__ HxCDDs (Hexachlorodibenzo-p-dioxins)	0.000063	0.001
__ HxCDFs (Hexachlorodibenzofurans)	0.000063	0.001
__ Hexachloroethane	0.055	30
__ Indeno(1,2,3-c,d)pyrene	0.0055	3.4
__ Iodomethane	0.19	65
__ Isobutanol	5.6	170
__ Isodrin	0.021	0.066
__ Isosafrole	0.081	2.6
__ Kepone	0.0011	0.13
__ Methacrylonitrile	0.24	84
__ Methanol	5.6	NA
__ Methapyrilene	0.081	1.5
__ Methoxychlor	0.25	0.18
__ 3-Methylchlolanthrene	0.0055	15
__ 4,4-Methylene-bis(2-chloroaniline)	0.50	30
__ Methylene chloride	0.089	30
__ Methyl ethyl ketone	0.28	36
__ Methyl isobutyl ketone	0.14	33
__ Methyl methacrylate	0.14	160
__ Methyl methansulfonate	0.018	NA
__ Methyl parathion	0.014	4.6
__ Naphthalene	0.059	5.6
__ 2-Naphthylamine	0.52	NA
__ p-Nitroaniline	0.028	28
__ Nitrobenzene	0.068	14
__ 5-Nitro-o-toluidine	0.32	28
__ p-Nitrophenol	0.12	29
__ N-Nitrosodiethylamine	0.40	28
__ N-Nitrosodimethylamine	0.40	NA
__ N-Nitroso-di-n-butylamine	0.40	17
__ N-Nitrosomethylethylamine	0.40	2.3
__ N-Nitrosomorpholine	0.40	2.3
__ N-Nitrosopiperidine	0.013	35
__ N-Nitrosopyrrolidine	0.013	35
__ Parathion	0.014	4.6
__ Total PCBs (sum of all PCB isomers)	0.10	10
__ Pentachlorobenzene	0.055	10
__ PeCDDs (Pentachlorodibenzofurans)	0.000063	0.001
__ PeCDFs (Pentachlorodibenzo-p-dioxins)	0.000035	0.001
__ Pentachloronitrobenzene	0.055	4.8
__ Pentachlorophenol	0.089	7.4
__ Phenacetin	0.081	16
__ Phenanthrene	0.059	5.6
__ Phenol	0.039	6.2
__ Phorate	0.021	4.6
__ Phthalic anhydride	0.055	NA
__ Pronamide	0.093	1.5
__ Pyrene	0.067	8.2
__ Pyridine	0.014	16
__ Safrole	0.081	22
__ Silvex (2,4,5-TP)	0.72	7.9
__ 2,4,5-T	0.72	7.9
__ 1,2,4,5-Tetrachlorobenzene	0.055	14
__ TCDDs (Tetrachlorodibenzo-furans)	0.000063	0.001
__ TCDFs (Tetrachlorodibenzo-p-dioxins)	0.000063	0.001
__ 1,1,1,2-Tetrachloroethane	0.057	6.0
__ 1,1,2,2-Tetrachloroethane	0.057	6.0
__ Tetrachloroethylene	0.056	6.0
__ 2,3,4,6-Tetrachlorophenol	0.030	7.4
__ Toluene	0.080	10
__ Toxaphene	0.0095	2.6
__ Bromoform (Tribromomethane)	0.63	15
__ 1,2,4-Trichlorobenzene	0.055	19
__ 1,1,1-Trichloroethane	0.054	6.0
__ 1,1,2-Trichloroethane	0.054	6.0
__ Trichloroethylene	0.054	6.0
__ Trichloromonofluoromethane	0.020	30
__ 2,4,5-Trichlorophenol	0.18	7.4
__ 2,4,6-Trichlorophenol	0.035	7.4
__ 1,2,3-Trichloropropane	0.85	30
__ 1,1,2-Trichloro-1,2,2-trifluoroethane	0.057	30
__ tris(2,3-dibromopropyl) phosphate	0.11	NA
__ Vinyl chloride	0.27	6.0
__ Xylene(s) (sum of mixed isomers)	0.32	30

__ Antimony	1.9	2.1 mg/l [TCLP]
__ Arsenic	1.4	5.0 mg/l [TCLP]
__ Barium	1.2	7.6 mg/l [TCLP]
X Beryllium	0.82	NA
__ Cadmium	0.69	0.19 mg/l [TCLP]
__ Chromium (Total)	2.77	0.86 mg/l [TCLP]
__ Cyanides (Total)	1.2	590
__ Cyanides (Amendable)	0.86	NA
__ Fluoride	35	NA
__ Lead	0.69	0.37 mg/l [TCLP]
__ Mercury	0.15	0.025 mg/l [TCLP]
__ Nickel	3.98	5.0 mg/l [TCLP]
__ Selenium	0.82	0.16 mg/l [TCLP]
__ Silver	0.43	0.30 mg/l [TCLP]
__ Sulfide	14	NA
__ Thallium	1.4	NA
__ Vanadium	4.3	NA

DUPONT

Chambers Works Wastewater Treatment Facility
Land Disposal Restrictions
(cont.)

Corrected

4. In Table B, identify all additional characteristic, listed, newly identified, and newly listed U.S. EPA hazardous waste codes that apply to this waste. For each waste code, identify the subcategory, indicate whether the waste is a wastewater or nonwastewater, and indicate how the waste must be managed, based on the options below.

TABLE B

U.S. EPA HAZARDOUS WASTE CODE(S) Per 40 CFR 261	SUBCATEGORY		Wastewater	Non-wastewater	HOW MUST THE WASTE BE MANAGED?
			(Check only one)		Enter the letter from options below*
	Description	None			
D039	LANDFILL LEACHATE			X	B

(Use Attachment I if more room is needed to list all applicable waste codes)

5. If this waste is a spent solvent (F001-F005), you MUST include Attachment II, Treatment Standards for F001-F005 Spent Solvents.
6. If this waste is a multisource leachate (F039), you may include Attachment III, Treatment Standards for F039 Multisource Leachate Wastes.
7. If this waste is D001 ignitable (other than the high TOC ≥ 10% subcategory), D002, D003, or D012-D043, you may include Attachment IV, Universal Treatment Standards. You may also include Attachment IV for nonhazardous waste which was hazardous (for these waste codes) as generated but rendered nonhazardous by pretreatment.

***HOW MUST THE WASTE BE MANAGED?** (Choose from the following options to complete Tables A and B.)

A. Restricted waste requires treatment [40 CFR 268.7(a)(2)].

B. Restricted waste meets applicable treatment standards at the original point of generation.

GENERATOR'S CERTIFICATION [40 CFR 268.7(a)(3)(i)]
I certify under penalty of law that I personally have examined and am familiar with the waste through analysis and testing or through knowledge of the waste to support this certification that the waste complies with the treatment standards specified in 40 CFR Part 268 Subpart D. I believe that the information I submitted is true, accurate, and complete. I am aware that there are significant penalties for submitting a false certification, including the possibility of a fine and imprisonment.

C. Waste is newly listed or newly identified.

D. Restricted waste is exempt from the Land Disposal Restrictions. Check the reason below and write in the date the waste is subject to prohibitions [40 CFR 268.7(a)(4)].

- ☐ The waste has been granted a Site-Specific Variance. _____
- ☐ The waste has been given a Case-by-Case Extension. _____
- ☐ The waste is subject to a National Capacity Variance. _____

E. Restricted waste has been pretreated on-site to remove the hazardous characteristic D001-D003 and/or D012-D043 and requires treatment of underlying hazardous constituents.

CHARACTERISTIC WASTE - UNDERLYING HAZARDOUS CONSTITUENTS [40 CFR 268.7(b)(5)(iv)]
I certify under penalty of law that the waste has been treated in accordance with the requirements of 40 CFR 268.40 to remove the hazardous characteristic. This decharacterized waste contains underlying hazardous constituents that require further treatment to meet universal treatment standards. I am aware that there are significant penalties for submitting a false certification, including the possibility of fine and imprisonment.

F. Restricted waste has been pretreated on-site to remove the hazardous characteristic D001-D003 and/or D012-D043 and to treat underlying hazardous constituents to levels in 40 CFR 268.48 Universal Treatment Standards.

CHARACTERISTIC WASTE - UNDERLYING HAZARDOUS CONSTITUENTS [40 CFR 268.7(b)(5)(v)]
I certify under penalty of law that the waste has been treated in accordance with the requirements of 40 CFR 268.40 to remove the hazardous characteristic, and that underlying hazardous constituents, as defined in § 268.2, have been treated on-site to meet the § 268.48 Universal Treatment Standards. I am aware that there are significant penalties for submitting a false certification, including the possibility of fine and imprisonment.

CERTIFICATION

I certify that, to the best of my knowledge, the information provided in this document is true, accurate, and complete.

Authorized Signature	Tide	Date
[signature]	Env. Eng. Tech	4/12/02

DuPont Environmental Treatment

Treatment Standards for F039 Multisource Leachate Wastes

Instructions: Mark the constituents present in the waste.*

*You are not required to include this attachment or to mark the constituents present in the waste because the DuPont Wastewater Treatment Plant (WWTP) is regulated under the Clean Water Act.

Constituents of Concern	Total Composition WW (mg/l)	Total Composition Non-WW (mg/kg)	Constituents of Concern	Total Composition WW (mg/l)	Total Composition Non-WW (mg/kg)
__ Acenaphthylene	0.059	3.4	__ Cyclohexanone	0.36	NA
__ Acenaphthene	0.059	3.4	__ 1,2-Dibromo-3-chloropropane	0.11	15
X Acetone	0.28	160	__ Ethylene dibromide (1,2-Dibromoethane)	0.028	15
__ Acetonitrile	5.6	NA	__ Dibromomethane	0.11	15
__ Acetophenone	0.010	9.7	__ 2,4-D (2,4-Dichlorophenoxyacetic acid)	0.72	10
__ 2-Acetylaminofluorene	0.059	140	__ o,p'-DDD	0.023	0.087
__ Acrolein	0.29	NA	__ p,p'-DDD	0.023	0.087
__ Acrylonitrile	0.24	84	__ o,p'-DDE	0.031	0.087
__ Aldrin	0.021	0.066	__ p,p'-DDE	0.031	0.087
__ 4-Aminobiphenyl	0.13	NA	__ o,p'-DDT	0.0039	0.087
__ Aniline	0.81	14	__ p,p'-DDT	0.0039	0.087
__ Anthracene	0.059	3.4	__ Dibenz(a,h) anthracene	0.055	8.2
__ Aramite	0.36	NA	__ Dibenzo(a,e) pyrene	0.061	NA
__ alpha-BHC	0.00014	0.066	__ m-Dichlorobenzene	0.036	6.0
__ beta-BHC	0.00014	0.066	__ o-Dichlorobenzene	0.088	6.0
__ delta-BHC	0.023	0.066	__ p-Dichlorobenzene	0.090	6.0
__ gamma-BHC	0.0017	0.066	__ Dichlorodifluoromethane	0.23	7.2
__ Benzene	0.14	10	X 1,1-Dichloroethane	0.059	6.0
__ Benz(a)anthracene	0.059	3.4	__ 1,2-Dichloroethane	0.21	6.0
__ Benzo(b)-fluoranthene	0.11	6.8	__ 1,1-Dichloroethylene	0.025	6.0
__ Benzo(k)-fluoranthene	0.11	6.8	__ trans-1,2-Dichloroethylene	0.054	30
__ Benzo(g,h,i)-perylene	0.0055	1.8	__ 2,4-Dichlorophenol	0.044	14
__ Benzo(a)pyrene	0.061	3.4	__ 2,6-Dichlorophenol	0.044	14
__ Bromodichloromethane	0.35	15	__ 1,2-Dichloropropane	0.85	18
__ Methyl bromide (Bromomethane)	0.11	15	__ cis-1,3-Dichloropropene	0.036	18
__ 4-Bromophenyl phenyl ether	0.055	15	__ trans-1,3-Dichloropropene	0.036	18
__ n-Butyl alcohol	5.6	2.6	__ Dieldrin	0.017	0.13
__ Butyl benzyl phthalate	0.017	28	__ Diethyl phthalate	0.20	28
__ 2-sec-Butyl-4,6-dinitrophenol	0.066	2.5	__ 2,4-Dimethyl phenol	0.036	14
__ Carbon disulfide	3.8	NA	__ Dimethyl phthalate	0.047	28
__ Carbon tetrachloride	0.057	6.0	__ Di-n-butyl phthalate	0.057	28
__ Chlordane (alpha & gamma isomers)	0.0033	0.26	__ 1,4-Dinitrobenzene	0.32	2.3
__ p-Chloroaniline	0.46	16	__ 4,6-Dinitro-o-cresol	0.28	160
__ Chlorobenzene	0.057	6.0	__ 2,4-Dinitrophenol	0.12	160
__ Chlorobenzilate	0.10	NA	__ 2,4-Dinitrotoluene	0.32	140
__ 2-Chloro-1,3-butadiene	0.057	NA	__ 2,6-Dinitrotoluene	0.55	28
__ Chlorodibromomethane	0.057	15	__ Di-n-octyl phthalate	0.017	28
__ Chloroethane	0.27	6.0	__ Di-n-propylnitrosoamine	0.40	14
__ bis(2-Chloroethoxy) methane	0.036	7.2	__ 1,4-Dioxane	12.0	170
__ bis(2-Chloroethyl) ether	0.033	6.0	__ Diphenylamine	0.92	NA
__ Chloroform	0.046	6.0	__ Diphenyl nitrosamine	0.92	NA
__ bis(2-Chloroisopropyl) ether	0.055	7.2	__ 1,2-Diphenylhydrazine	0.087	NA
__ p-Chloro-m-cresol	0.018	14	__ Disulfoton	0.017	6.2
__ Chloromethane (Methyl chloride)	0.19	30	__ Endosulfan I	0.023	0.066
__ 2-Chloronaphthalene	0.055	5.6	__ Endosulfan II	0.029	0.13
__ 2-Chlorophenol	0.044	5.7	__ Endosulfan sulfate	0.029	0.13
__ 3-Chloropropylene	0.036	30	__ Endrin	0.0028	0.13
__ Chrysene	0.059	3.4	__ Endrin aldehyde	0.025	0.13
__ o-Cresol	0.11	5.6	__ Ethyl acetate	0.34	33
__ m-Cresol	0.77	5.6	__ Ethyl cyanide (Propanenitrile)	0.24	360
__ p-Cresol	0.77	5.6	__ Ethyl benzene	0.057	10

Treatment Standards for F039 Multisource Leachate Wastes

Constituents of Concern	Total Composition WW (mg/l)	Total Composition Non-WW (mg/kg)
__ Ethyl ether	0.12	160
__ bis(2-Ethylhexyl) phthalate	0.28	28
__ Ethyl methacrylate	0.14	160
__ Ethylene oxide	0.12	NA
__ Famphur	0.017	15
__ Fluoranthene	0.068	3.4
__ Fluorene	0.059	3.4
__ Heptachlor	0.0012	0.066
__ Heptachlor epoxide	0.016	0.066
__ Hexachlorobenzene	0.055	10
__ Hexachlorobutadiene	0.055	5.6
__ Hexachlorocyclopentadiene	0.057	2.4
__ HxCDDs (Hexachlorodibenzo-p-dioxins)	0.000063	0.001
__ HxCDFs (Hexachlorodibenzofurans)	0.000063	0.001
__ Hexachloroethane	0.055	30
__ Indeno(1,2,3-c,d)pyrene	0.0055	3.4
__ Iodomethane	0.19	65
__ Isobutanol	5.6	170
__ Isodrin	0.021	0.066
__ Isosafrole	0.081	2.6
__ Kepone	0.0011	0.13
__ Methacrylonitrile	0.24	84
__ Methanol	5.6	NA
__ Methapyrilene	0.081	1.5
__ Methoxychlor	0.25	0.18
__ 3-Methylchlolanthrene	0.0055	15
__ 4,4-Methylene-bis(2-chloroaniline)	0.50	30
__ Methylene chloride	0.089	30
__ Methyl ethyl ketone	0.28	36
__ Methyl isobutyl ketone	0.14	33
__ Methyl methacrylate	0.14	160
__ Methyl methansulfonate	0.018	NA
__ Methyl parathion	0.014	4.6
__ Naphthalene	0.059	5.6
__ 2-Naphthylamine	0.52	NA
__ p-Nitroaniline	0.028	28
__ Nitrobenzene	0.068	14
__ 5-Nitro-o-toluidine	0.32	28
__ p-Nitrophenol	0.12	29
__ N-Nitrosodiethylamine	0.40	28
__ N-Nitrosodimethylamine	0.40	NA
__ N-Nitroso-di-n-butylamine	0.40	17
__ N-Nitrosomethylethylamine	0.40	2.3
__ N-Nitrosomorpholine	0.40	2.3
__ N-Nitrosopiperidine	0.013	35
__ N-Nitrosopyrrolidine	0.013	35
__ Parathion	0.014	4.6
__ Total PCBs (sum of all PCB isomers)	0.10	10
__ Pentachlorobenzene	0.055	10
__ PeCDDs (Pentachlorodibenzofurans)	0.000063	0.001
__ PeCDFs (Pentachlorodibenzo-p-dioxins)	0.000035	0.001
__ Pentachloronitrobenzene	0.055	4.8
__ Pentachlorophenol	0.089	7.4
__ Phenacetin	0.081	16
__ Phenanthrene	0.059	5.6
__ Phenol	0.039	6.2
__ Phorate	0.021	4.6
__ Phthalic anhydride	0.055	NA
__ Pronamide	0.093	1.5
__ Pyrene	0.067	8.2
__ Pyridine	0.014	16
__ Safrole	0.081	22
__ Silvex (2,4,5-TP)	0.72	7.9
__ 2,4,5-T	0.72	7.9
__ 1,2,4,5-Tetrachlorobenzene	0.055	14
__ TCDDs (Tetrachlorodibenzo-furans)	0.000063	0.001
__ TCDFs (Tetrachlorodibenzo-p-dioxins)	0.000063	0.001
__ 1,1,1,2-Tetrachloroethane	0.057	6.0
__ 1,1,2,2-Tetrachloroethane	0.057	6.0
__ Tetrachloroethylene	0.056	6.0
__ 2,3,4,6-Tetrachlorophenol	0.030	7.4
__ Toluene	0.080	10
__ Toxaphene	0.0095	2.6
__ Bromoform (Tribromomethane)	0.63	15
__ 1,2,4-Trichlorobenzene	0.055	19
__ 1,1,1-Trichloroethane	0.054	6.0
__ 1,1,2-Trichloroethane	0.054	6.0
__ Trichloroethylene	0.054	6.0
__ Trichloromonofluoromethane	0.020	30
__ 2,4,5-Trichlorophenol	0.18	7.4
__ 2,4,6-Trichlorophenol	0.035	7.4
__ 1,2,3-Trichloropropane	0.85	30
__ 1,1,2-Trichloro-1,2,2-trifluoroethane	0.057	30
__ tris(2,3-dibromopropyl) phosphate	0.11	NA
__ Vinyl chloride	0.27	6.0
__ Xylene(s) (sum of mixed isomers)	0.32	30

__ Antimony	1.9	2.1 mg/l [TCLP]
__ Arsenic	1.4	5.0 mg/l [TCLP]
__ Barium	1.2	7.6 mg/l [TCLP]
X Beryllium	0.82	NA
__ Cadmium	0.69	0.19 mg/l [TCLP]
__ Chromium (Total)	2.77	0.86 mg/l [TCLP]
__ Cyanides (Total)	1.2	590
__ Cyanides (Amenable)	0.86	NA
__ Fluoride	35	NA
__ Lead	0.69	0.37 mg/l [TCLP]
__ Mercury	0.15	0.025 mg/l [TCLP]
__ Nickel	3.98	5.0 mg/l [TCLP]
__ Selenium	0.82	0.16 mg/l [TCLP]
__ Silver	0.43	0.30 mg/l [TCLP]
__ Sulfide	14	NA
__ Thallium	1.4	NA
__ Vanadium	4.3	NA

DUPONT

Chambers Works Wastewater Treatment Facility
Land Disposal Restrictions
(cont.)

4. In Table B, identify all additional characteristic, listed, newly identified, and newly listed U.S. EPA hazardous waste codes that apply to this waste. For each waste code, identify the subcategory, indicate whether the waste is a wastewater or nonwastewater, and indicate how the waste must be managed, based on the options below.

TABLE B

U.S. EPA HAZARDOUS WASTE CODE(S) Per 40 CFR 261	SUBCATEGORY		Waste-water	Non-waste-water	HOW MUST THE WASTE BE MANAGED?
			(Check only one)		Enter the letter from options below*
	Description	None			
D039	LANDFILL LEACHATE			X	B

(Use Attachment I if more room is needed to list all applicable waste codes)

5. If this waste is a spent solvent (F001-F005), you MUST include Attachment II, Treatment Standards for F001-F005 Spent Solvents.

6. If this waste is a multisource leachate (F039), you may include Attachment III, Treatment Standards for F039 Multisource Leachate Wastes.

7. If this waste is D001 ignitable (other than the high TOC ≥ 10% subcategory), D002, D003, or D012-D043, you may include Attachment IV, Universal Treatment Standards. You may also include Attachment IV for nonhazardous waste which was hazardous (for these waste codes) as generated but rendered nonhazardous by pretreatment.

*HOW MUST THE WASTE BE MANAGED? (Choose from the following options to complete Tables A and B.)

A. Restricted waste requires treatment [40 CFR 268.7(a)(2)].

B. Restricted waste meets applicable treatment standards at the original point of generation.

GENERATOR'S CERTIFICATION [40 CFR 268.7(a)(3)(i)]
I certify under penalty of law that I personally have examined and am familiar with the waste through analysis and testing or through knowledge of the waste to support this certification that the waste complies with the treatment standards specified in 40 CFR Part 268 Subpart D. I believe that the information I submitted is true, accurate, and complete. I am aware that there are significant penalties for submitting a false certification, including the possibility of a fine and imprisonment.

C. Waste is newly listed or newly identified.

D. Restricted waste is exempt from the Land Disposal Restrictions. Check the reason below and write in the date the waste is subject to prohibitions [40 CFR 268.7(a)(4)].

- ☐ The waste has been granted a Site-Specific Variance. _____
- ☐ The waste has been given a Case-by-Case Extension. _____
- ☐ The waste is subject to a National Capacity Variance. _____

E. Restricted waste has been pretreated on-site to remove the hazardous characteristic D001-D003 and/or D012-D043 and requires treatment of underlying hazardous constituents.

CHARACTERISTIC WASTE - UNDERLYING HAZARDOUS CONSTITUENTS [40 CFR 268.7(b)(5)(iv)]
I certify under penalty of law that the waste has been treated in accordance with the requirements of 40 CFR 268.40 to remove the hazardous characteristic. This decharacterized waste contains underlying hazardous constituents that require further treatment to meet universal treatment standards. I am aware that there are significant penalties for submitting a false certification, including the possibility of fine and imprisonment.

F. Restricted waste has been pretreated on-site to remove the hazardous characteristic D001-D003 and/or D012-D043 and to treat underlying hazardous constituents to levels in 40 CFR 268.48 Universal Treatment Standards.

CHARACTERISTIC WASTE - UNDERLYING HAZARDOUS CONSTITUENTS [40 CFR 268.7(b)(5)(v)]
I certify under penalty of law that the waste has been treated in accordance with the requirements of 40 CFR 268.40 to remove the hazardous characteristic, and that underlying hazardous constituents, as defined in § 268.2, have been treated on-site to meet the § 268.48 Universal Treatment Standards. I am aware that there are significant penalties for submitting a false certification, including the possibility of fine and imprisonment.

CERTIFICATION

I certify that, to the best of my knowledge, the information provided in this document is true, accurate, and complete.

Authorized Signature	Title	Date
[signature]	Env. Eng Tech	6/7/02

DuPont Environmental Treatment

Treatment Standards for F039 Multisource Leachate Wastes

Instructions: Mark the constituents present in the waste.*

*You are not required to include this attachment or to mark the constituents present in the waste because the DuPont Wastewater Treatment Plant (WWTP) is regulated under the Clean Water Act.

Constituents of Concern	Total Composition WW (mg/l)	Total Composition Non-WW (mg/kg)	Constituents of Concern	Total Composition WW (mg/l)	Total Composition Non-WW (mg/kg)
__ Acenaphthylene	0.059	3.4	__ Cyclohexanone	0.36	NA
__ Acenaphthene	0.059	3.4	__ 1,2-Dibromo-3-chloropropane	0.11	15
X Acetone	0.28	160	__ Ethylene dibromide (1,2-Dibromoethane)	0.028	15
__ Acetonitrile	5.6	NA	__ Dibromomethane	0.11	15
__ Acetophenone	0.010	9.7	__ 2,4-D (2,4-Dichlorophenoxyacetic acid)	0.72	10
__ 2-Acetylaminofluorene	0.059	140	__ o,p'-DDD	0.023	0.087
__ Acrolein	0.29	NA	__ p,p'-DDD	0.023	0.087
__ Acrylonitrile	0.24	84	__ o,p'-DDE	0.031	0.087
__ Aldrin	0.021	0.066	__ p,p'-DDE	0.031	0.087
__ 4-Aminobiphenyl	0.13	NA	__ o,p'-DDT	0.0039	0.087
__ Aniline	0.81	14	__ p,p'-DDT	0.0039	0.087
__ Anthracene	0.059	3.4	__ Dibenz(a,h) anthracene	0.055	8.2
__ Aramite	0.36	NA	__ Dibenzo(a,e) pyrene	0.061	NA
__ alpha-BHC	0.00014	0.066	__ m-Dichlorobenzene	0.036	6.0
__ beta-BHC	0.00014	0.066	__ o-Dichlorobenzene	0.088	6.0
__ delta-BHC	0.023	0.066	__ p-Dichlorobenzene	0.090	6.0
__ gamma-BHC	0.0017	0.066	__ Dichlorodifluoromethane	0.23	7.2
__ Benzene	0.14	10	X 1,1-Dichloroethane	0.059	6.0
__ Benz(a)anthracene	0.059	3.4	__ 1,2-Dichloroethane	0.21	6.0
__ Benzo(b)-fluoranthene	0.11	6.8	__ 1,1-Dichloroethylene	0.025	6.0
__ Benzo(k)-fluoranthene	0.11	6.8	__ trans-1,2-Dichloroethylene	0.054	30
__ Benzo(g,h,i)-perylene	0.0055	1.8	__ 2,4-Dichlorophenol	0.044	14
__ Benzo(a)pyrene	0.061	3.4	__ 2,6-Dichlorophenol	0.044	14
__ Bromodichloromethane	0.35	15	__ 1,2-Dichloropropane	0.85	18
__ Methyl bromide (Bromomethane)	0.11	15	__ cis-1,3-Dichloropropene	0.036	18
__ 4-Bromophenyl phenyl ether	0.055	15	__ trans-1,3-Dichloropropene	0.036	18
__ n-Butyl alcohol	5.6	2.6	__ Dieldrin	0.017	0.13
__ Butyl benzyl phthalate	0.017	28	__ Diethyl phthalate	0.20	28
__ 2-sec-Butyl-4,6-dinitrophenol	0.066	2.5	__ 2,4-Dimethyl phenol	0.036	14
__ Carbon disulfide	3.8	NA	__ Dimethyl phthalate	0.047	28
__ Carbon tetrachloride	0.057	6.0	__ Di-n-butyl phthalate	0.057	28
__ Chlordane (alpha & gamma isomers)	0.0033	0.26	__ 1,4-Dinitrobenzene	0.32	2.3
__ p-Chloroaniline	0.46	16	__ 4,6-Dinitro-o-cresol	0.28	160
__ Chlorobenzene	0.057	6.0	__ 2,4-Dinitrophenol	0.12	160
__ Chlorobenzilate	0.10	NA	__ 2,4-Dinitrotoluene	0.32	140
__ 2-Chloro-1,3-butadiene	0.057	NA	__ 2,6-Dinitrotoluene	0.55	28
__ Chlorodibromomethane	0.057	15	__ Di-n-octyl phthalate	0.017	28
__ Chloroethane	0.27	6.0	__ Di-n-propylnitrosoamine	0.40	14
__ bis(2-Chloroethoxy) methane	0.036	7.2	__ 1,4-Dioxane	12.0	170
__ bis(2-Chloroethyl) ether	0.033	6.0	__ Diphenylamine	0.92	NA
__ Chloroform	0.046	6.0	__ Diphenyl nitrosamine	0.92	NA
__ bis(2-Chloroisopropyl) ether	0.055	7.2	__ 1,2-Diphenylhydrazine	0.087	NA
__ p-Chloro-m-cresol	0.018	14	__ Disulfoton	0.017	6.2
__ Chloromethane (Methyl chloride)	0.19	30	__ Endosulfan I	0.023	0.066
__ 2-Chloronaphthalene	0.055	5.6	__ Endosulfan II	0.029	0.13
__ 2-Chlorophenol	0.044	5.7	__ Endosulfan sulfate	0.029	0.13
__ 3-Chloropropylene	0.036	30	__ Endrin	0.0028	0.13
__ Chrysene	0.059	3.4	__ Endrin aldehyde	0.025	0.13
__ o-Cresol	0.11	5.6	__ Ethyl acetate	0.34	33
__ m-Cresol	0.77	5.6	__ Ethyl cyanide (Propanenitrile)	0.24	360
__ p-Cresol	0.77	5.6	__ Ethyl benzene	0.057	10

Treatment Standards for F039 Multisource Leachate Wastes

Constituents of Concern	Total Composition WW (mg/l)	Total Composition Non-WW (mg/kg)
__ Ethyl ether	0.12	160
__ bis(2-Ethylhexyl) phthalate	0.28	28
__ Ethyl methacrylate	0.14	160
__ Ethylene oxide	0.12	NA
__ Famphur	0.017	15
__ Fluoranthene	0.068	3.4
__ Fluorene	0.059	3.4
__ Heptachlor	0.0012	0.066
__ Heptachlor epoxide	0.016	0.066
__ Hexachlorobenzene	0.055	10
__ Hexachlorobutadiene	0.055	5.6
__ Hexachlorocyclopentadiene	0.057	2.4
__ HxCDDs (Hexachlorodibenzo-p-dioxins)	0.000063	0.001
__ HxCDFs (Hexachlorodibenzofurans)	0.000063	0.001
__ Hexachloroethane	0.055	30
__ Indeno(1,2,3-c,d)pyrene	0.0055	3.4
__ Iodomethane	0.19	65
__ Isobutanol	5.6	170
__ Isodrin	0.021	0.066
__ Isosafrole	0.081	2.6
__ Kepone	0.0011	0.13
__ Methacrylonitrile	0.24	84
__ Methanol	5.6	NA
__ Methapyrilene	0.081	1.5
__ Methoxychlor	0.25	0.18
__ 3-Methylchlolanthrene	0.0055	15
__ 4,4-Methylene-bis(2-chloroaniline)	0.50	30
__ Methylene chloride	0.089	30
__ Methyl ethyl ketone	0.28	36
__ Methyl isobutyl ketone	0.14	33
__ Methyl methacrylate	0.14	160
__ Methyl methansulfonate	0.018	NA
__ Methyl parathion	0.014	4.6
__ Naphthalene	0.059	5.6
__ 2-Naphthylamine	0.52	NA
__ p-Nitroaniline	0.028	28
__ Nitrobenzene	0.068	14
__ 5-Nitro-o-toluidine	0.32	28
__ p-Nitrophenol	0.12	29
__ N-Nitrosodiethylamine	0.40	28
__ N-Nitrosodimethylamine	0.40	NA
__ N-Nitroso-di-n-butylamine	0.40	17
__ N-Nitrosomethylethylamine	0.40	2.3
__ N-Nitrosomorpholine	0.40	2.3
__ N-Nitrosopiperidine	0.013	35
__ N-Nitrosopyrrolidine	0.013	35
__ Parathion	0.014	4.6
__ Total PCBs (sum of all PCB isomers)	0.10	10
__ Pentachlorobenzene	0.055	10
__ PeCDDs (Pentachlorodibenzofurans)	0.000063	0.001
__ PeCDFs (Pentachlorodibenzo-p-dioxins)	0.000035	0.001
__ Pentachloronitrobenzene	0.055	4.8
__ Pentachlorophenol	0.089	7.4
__ Phenacetin	0.081	16
__ Phenanthrene	0.059	5.6
__ Phenol	0.039	6.2
__ Phorate	0.021	4.6
__ Phthalic anhydride	0.055	NA
__ Pronamide	0.093	1.5
__ Pyrene	0.067	8.2
__ Pyridine	0.014	16
__ Safrole	0.081	22
__ Silvex (2,4,5-TP)	0.72	7.9
__ 2,4,5-T	0.72	7.9
__ 1,2,4,5-Tetrachlorobenzene	0.055	14
__ TCDDs (Tetrachlorodibenzo-furans)	0.000063	0.001
__ TCDFs (Tetrachlorodibenzo-p-dioxins)	0.000063	0.001
__ 1,1,1,2-Tetrachloroethane	0.057	6.0
__ 1,1,2,2-Tetrachloroethane	0.057	6.0
__ Tetrachloroethylene	0.056	6.0
__ 2,3,4,6-Tetrachlorophenol	0.030	7.4
__ Toluene	0.080	10
__ Toxaphene	0.0095	2.6
__ Bromoform (Tribromomethane)	0.63	15
__ 1,2,4-Trichlorobenzene	0.055	19
__ 1,1,1-Trichloroethane	0.054	6.0
__ 1,1,2-Trichloroethane	0.054	6.0
__ Trichloroethylene	0.054	6.0
__ Trichloromonofluoromethane	0.020	30
__ 2,4,5-Trichlorophenol	0.18	7.4
__ 2,4,6-Trichlorophenol	0.035	7.4
__ 1,2,3-Trichloropropane	0.85	30
__ 1,1,2-Trichloro-1,2,2-trifluoroethane	0.057	30
__ tris(2,3-dibomopropyl) phosphate	0.11	NA
__ Vinyl chloride	0.27	6.0
__ Xylene(s) (sum of mixed isomers)	0.32	30

__ Antimony	1.9	2.1 mg/l [TCLP]
__ Arsenic	1.4	5.0 mg/l [TCLP]
__ Barium	1.2	7.6 mg/l [TCLP]
X Beryllium	0.82	NA
__ Cadmium	0.69	0.19 mg/l [TCLP]
__ Chromium (Total)	2.77	0.86 mg/l [TCLP]
__ Cyanides (Total)	1.2	590
__ Cyanides (Amendable)	0.86	NA
__ Fluoride	35	NA
__ Lead	0.69	0.37 mg/l [TCLP]
__ Mercury	0.15	0.025 mg/l [TCLP]
__ Nickel	3.98	5.0 mg/l [TCLP]
__ Selenium	0.82	0.16 mg/l [TCLP]
__ Silver	0.43	0.30 mg/l [TCLP]
__ Sulfide	14	NA
__ Thallium	1.4	NA
__ Vanadium	4.3	NA

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Chambers Works Wastewater Treatment Facility
Land Disposal Restrictions
(cont.)

4. In Table B, identify all additional characteristic, listed, newly identified, and newly listed U.S. EPA hazardous waste codes that apply to this waste. For each waste code, identify the subcategory, indicate whether the waste is a wastewater or nonwastewater, and indicate how the waste must be managed, based on the options below.

TABLE B

U.S. EPA HAZARDOUS WASTE CODE(S) Per 40 CFR 261	SUBCATEGORY		Waste-water	Non-waste-water	HOW MUST THE WASTE BE MANAGED?
			(Check only one)		Enter the letter from options below*
	Description	None			
D039	LANDFILL LEACHATE			X	B

(Use Attachment I if more room is needed to list all applicable waste codes)

5. If this waste is a spent solvent (F001-F005), you MUST include Attachment II, Treatment Standards for F001-F005 Spent Solvents.
6. If this waste is a multisource leachate (F039), you may include Attachment III, Treatment Standards for F039 Multisource Leachate Wastes.
7. If this waste is D001 ignitable (other than the high TOC ≥ 10% subcategory), D002, D003, or D012-D043, you may include Attachment IV, Universal Treatment Standards. You may also include Attachment IV for nonhazardous waste which was hazardous (for these waste codes) as generated but rendered nonhazardous by pretreatment.

*HOW MUST THE WASTE BE MANAGED? (Choose from the following options to complete Tables A and B.)

A. Restricted waste requires treatment [40 CFR 268.7(a)(2)].

B. Restricted waste meets applicable treatment standards at the original point of generation.

GENERATOR'S CERTIFICATION [40 CFR 268.7(a)(3)(i)]
I certify under penalty of law that I personally have examined and am familiar with the waste through analysis and testing or through knowledge of the waste to support this certification that the waste complies with the treatment standards specified in 40 CFR Part 268 Subpart D. I believe that the information I submitted is true, accurate, and complete. I am aware that there are significant penalties for submitting a false certification, including the possibility of a fine and imprisonment.

C. Waste is newly listed or newly identified.

D. Restricted waste is exempt from the Land Disposal Restrictions. Check the reason below and write in the date the waste is subject to prohibitions [40 CFR 268.7(a)(4)].

- ☐ The waste has been granted a Site-Specific Variance. _____
- ☐ The waste has been given a Case-by-Case Extension. _____
- ☐ The waste is subject to a National Capacity Variance. _____

E. Restricted waste has been pretreated on-site to remove the hazardous characteristic D001-D003 and/or D012-D043 and requires treatment of underlying hazardous constituents.

CHARACTERISTIC WASTE - UNDERLYING HAZARDOUS CONSTITUENTS [40 CFR 268.7(b)(5)(iv)]
I certify under penalty of law that the waste has been treated in accordance with the requirements of 40 CFR 268.40 to remove the hazardous characteristic. This decharacterized waste contains underlying hazardous constituents that require further treatment to meet universal treatment standards. I am aware that there are significant penalties for submitting a false certification, including the possibility of fine and imprisonment.

F. Restricted waste has been pretreated on-site to remove the hazardous characteristic D001-D003 and/or D012-D043 and to treat underlying hazardous constituents to levels in 40 CFR 268.48 Universal Treatment Standards.

CHARACTERISTIC WASTE - UNDERLYING HAZARDOUS CONSTITUENTS [40 CFR 268.7(b)(5)(v)]
I certify under penalty of law that the waste has been treated in accordance with the requirements of 40 CFR 268.40 to remove the hazardous characteristic, and that underlying hazardous constituents, as defined in § 268.2, have been treated on-site to meet the § 268.48 Universal Treatment Standards. I am aware that there are significant penalties for submitting a false certification, including the possibility of fine and imprisonment.

CERTIFICATION

I certify that, to the best of my knowledge, the information provided in this document is true, accurate, and complete.

Authorized Signature	Title	Date
[signature]	Env. Eng Tech	7/16/02

DuPont

DuPont Environmental Treatment

Treatment Standards for F039 Multisource Leachate Wastes

Instructions: Mark the constituents present in the waste.*

*You are not required to include this attachment or to mark the constituents present in the waste because the DuPont Wastewater Treatment Plant (WWTP) is regulated under the Clean Water Act..

Constituents of Concern	Total Composition WW (mg/l)	Total Composition Non-WW (mg/kg)	Constituents of Concern	Total Composition WW (mg/l)	Total Composition Non-WW (mg/kg)
__ Acenaphthylene	0.059	3.4	__ Cyclohexanone	0.36	NA
__ Acenaphthene	0.059	3.4	__ 1,2-Dibromo-3-chloropropane	0.11	15
X Acetone	0.28	160	__ Ethylene dibromide (1,2-Dibromoethane)	0.028	15
__ Acetonitrile	5.6	NA	__ Dibromomethane	0.11	15
__ Acetophenone	0.010	9.7	__ 2,4-D (2,4-Dichlorophenoxyacetic acid)	0.72	10
__ 2-Acetylaminofluorene	0.059	140	__ o,p'-DDD	0.023	0.087
__ Acrolein	0.29	NA	__ p,p'-DDD	0.023	0.087
__ Acrylonitrile	0.24	84	__ o,p'-DDE	0.031	0.087
__ Aldrin	0.021	0.066	__ p,p'-DDE	0.031	0.087
__ 4-Aminobiphenyl	0.13	NA	__ o,p'-DDT	0.0039	0.087
__ Aniline	0.81	14	__ p,p'-DDT	0.0039	0.087
__ Anthracene	0.059	3.4	__ Dibenz(a,h) anthracene	0.055	8.2
__ Aramite	0.36	NA	__ Dibenzo(a,e) pyrene	0.061	NA
__ alpha-BHC	0.00014	0.066	__ m-Dichlorobenzene	0.036	6.0
__ beta-BHC	0.00014	0.066	__ o-Dichlorobenzene	0.088	6.0
__ delta-BHC	0.023	0.066	__ p-Dichlorobenzene	0.090	6.0
__ gamma-BHC	0.0017	0.066	__ Dichlorodifluoromethane	0.23	7.2
__ Benzene	0.14	10	X 1,1-Dichloroethane	0.059	6.0
__ Benz(a)anthracene	0.059	3.4	__ 1,2-Dichloroethane	0.21	6.0
__ Benzo(b)-fluoranthene	0.11	6.8	__ 1,1-Dichloroethylene	0.025	6.0
__ Benzo(k)-fluoranthene	0.11	6.8	__ trans-1,2-Dichloroethylene	0.054	30
__ Benzo(g,h,i)-perylene	0.0055	1.8	__ 2,4-Dichlorophenol	0.044	14
__ Benzo(a)pyrene	0.061	3.4	__ 2,6-Dichlorophenol	0.044	14
__ Bromodichloromethane	0.35	15	__ 1,2-Dichloropropane	0.85	18
__ Methyl bromide (Bromomethane)	0.11	15	__ cis-1,3-Dichloropropene	0.036	18
__ 4-Bromophenyl phenyl ether	0.055	15	__ trans-1,3-Dichloropropene	0.036	18
__ n-Butyl alcohol	5.6	2.6	__ Dieldrin	0.017	0.13
__ Butyl benzyl phthalate	0.017	28	__ Diethyl phthalate	0.20	28
__ 2-sec-Butyl-4,6-dinitrophenol	0.066	2.5	__ 2,4-Dimethyl phenol	0.036	14
__ Carbon disulfide	3.8	NA	__ Dimethyl phthalate	0.047	28
__ Carbon tetrachloride	0.057	6.0	__ Di-n-butyl phthalate	0.057	28
__ Chlordane (alpha & gamma isomers)	0.0033	0.26	__ 1,4-Dinitrobenzene	0.32	2.3
__ p-Chloroaniline	0.46	16	__ 4,6-Dinitro-o-cresol	0.28	160
__ Chlorobenzene	0.057	6.0	__ 2,4-Dinitrophenol	0.12	160
__ Chlorobenzilate	0.10	NA	__ 2,4-Dinitrotoluene	0.32	140
__ 2-Chloro-1,3-butadiene	0.057	NA	__ 2,6-Dinitrotoluene	0.55	28
__ Chlorodibromomethane	0.057	15	__ Di-n-octyl phthalate	0.017	28
__ Chloroethane	0.27	6.0	__ Di-n-propylnitrosoamine	0.40	14
__ bis(2-Chloroethoxy) methane	0.036	7.2	__ 1,4-Dioxane	12.0	170
__ bis(2-Chloroethyl) ether	0.033	6.0	__ Diphenylamine	0.92	NA
__ Chloroform	0.046	6.0	__ Diphenyl nitrosamine	0.92	NA
__ bis(2-Chloroisopropyl) ether	0.055	7.2	__ 1,2-Diphenylhydrazine	0.087	NA
__ p-Chloro-m-cresol	0.018	14	__ Disulfoton	0.017	6.2
__ Chloromethane (Methyl chloride)	0.19	30	__ Endosulfan I	0.023	0.066
__ 2-Chloronaphthalene	0.055	5.6	__ Endosulfan II	0.029	0.13
__ 2-Chlorophenol	0.044	5.7	__ Endosulfan sulfate	0.029	0.13
__ 3-Chloropropylene	0.036	30	__ Endrin	0.0028	0.13
__ Chrysene	0.059	3.4	__ Endrin aldehyde	0.025	0.13
__ o-Cresol	0.11	5.6	__ Ethyl acetate	0.34	33
__ m-Cresol	0.77	5.6	__ Ethyl cyanide (Propanenitrile)	0.24	360
__ p-Cresol	0.77	5.6	__ Ethyl benzene	0.057	10

Treatment Standards for F039 Multisource Leachate Wastes

Constituents of Concern	Total Composition WW (mg/l)	Total Composition Non-WW (mg/kg)
__ Ethyl ether	0.12	160
__ bis(2-Ethylhexyl) phthalate	0.28	28
__ Ethyl methacrylate	0.14	160
__ Ethylene oxide	0.12	NA
__ Famphur	0.017	15
__ Fluoranthene	0.068	3.4
__ Fluorene	0.059	3.4
__ Heptachlor	0.0012	0.066
__ Heptachlor epoxide	0.016	0.066
__ Hexachlorobenzene	0.055	10
__ Hexachlorobutadiene	0.055	5.6
__ Hexachlorocyclopentadiene	0.057	2.4
__ HxCDDs (Hexachlorodibenzo-p-dioxins)	0.000063	0.001
__ HxCDFs (Hexachlorodibenzofurans)	0.000063	0.001
__ Hexachloroethane	0.055	30
__ Indeno(1,2,3-c,d)pyrene	0.0055	3.4
__ Iodomethane	0.19	65
__ Isobutanol	5.6	170
__ Isodrin	0.021	0.066
__ Isosafrole	0.081	2.6
__ Kepone	0.0011	0.13
__ Methacrylonitrile	0.24	84
__ Methanol	5.6	NA
__ Methapyrilene	0.081	1.5
__ Methoxychlor	0.25	0.18
__ 3-Methylchlolanthrene	0.0055	15
__ 4,4-Methylene-bis(2-chloroaniline)	0.50	30
__ Methylene chloride	0.089	30
__ Methyl ethyl ketone	0.28	36
__ Methyl isobutyl ketone	0.14	33
__ Methyl methacrylate	0.14	160
__ Methyl methansulfonate	0.018	NA
__ Methyl parathion	0.014	4.6
__ Naphthalene	0.059	5.6
__ 2-Naphthylamine	0.52	NA
__ p-Nitroaniline	0.028	28
__ Nitrobenzene	0.068	14
__ 5-Nitro-o-toluidine	0.32	28
__ p-Nitrophenol	0.12	29
__ N-Nitrosodiethylamine	0.40	28
__ N-Nitrosodimethylamine	0.40	NA
__ N-Nitroso-di-n-butylamine	0.40	17
__ N-Nitrosomethylethylamine	0.40	2.3

Constituents of Concern	Total Composition WW (mg/l)	Total Composition Non-WW (mg/kg)
__ N-Nitrosomorpholine	0.40	2.3
__ N-Nitrosopiperidine	0.013	35
__ N-Nitrosopyrrolidine	0.013	35
__ Parathion	0.014	4.6
__ Total PCBs (sum of all PCB isomers)	0.10	10
__ Pentachlorobenzene	0.055	10
__ PeCDDs (Pentachlorodibenzofurans)	0.000063	0.001
__ PeCDFs (Pentachlorodibenzo-p-dioxins)	0.000035	0.001
__ Pentachloronitrobenzene	0.055	4.8
__ Pentachlorophenol	0.089	7.4
__ Phenacetin	0.081	16
__ Phenanthrene	0.059	5.6
__ Phenol	0.039	6.2
__ Phorate	0.021	4.6
__ Phthalic anhydride	0.055	NA
__ Pronamide	0.093	1.5
__ Pyrene	0.067	8.2
__ Pyridine	0.014	16
__ Safrole	0.081	22
__ Silvex (2,4,5-TP)	0.72	7.9
__ 2,4,5-T	0.72	7.9
__ 1,2,4,5-Tetrachlorobenzene	0.055	14
__ TCDDs (Tetrachlorodibenzo-furans)	0.000063	0.001
__ TCDFs (Tetrachlorodibenzo-p-dioxins)	0.000063	0.001
__ 1,1,1,2-Tetrachloroethane	0.057	6.0
__ 1,1,2,2-Tetrachloroethane	0.057	6.0
__ Tetrachloroethylene	0.056	6.0
__ 2,3,4,6-Tetrachlorophenol	0.030	7.4
__ Toluene	0.080	10
__ Toxaphene	0.0095	2.6
__ Bromoform (Tribromomethane)	0.63	15
__ 1,2,4-Trichlorobenzene	0.055	19
__ 1,1,1-Trichloroethane	0.054	6.0
__ 1,1,2-Trichloroethane	0.054	6.0
__ Trichloroethylene	0.054	6.0
__ Trichloromonofluoromethane	0.020	30
__ 2,4,5-Trichlorophenol	0.18	7.4
__ 2,4,6-Trichlorophenol	0.035	7.4
__ 1,2,3-Trichloropropane	0.85	30
__ 1,1,2-Trichloro-1,2,2-trifluoroethane	0.057	30
__ tris(2,3-dibromopropyl) phosphate	0.11	NA
__ Vinyl chloride	0.27	6.0
__ Xylene(s) (sum of mixed isomers)	0.32	30

__ Antimony	1.9	2.1 mg/l [TCLP]
__ Arsenic	1.4	5.0 mg/l [TCLP]
__ Barium	1.2	7.6 mg/l [TCLP]
X Beryllium	0.82	NA
__ Cadmium	0.69	0.19 mg/l [TCLP]
__ Chromium (Total)	2.77	0.86 mg/l [TCLP]
__ Cyanides (Total)	1.2	590
__ Cyanides (Amendable)	0.86	NA
__ Fluoride	35	NA
__ Lead	0.69	0.37 mg/l [TCLP]
__ Mercury	0.15	0.025 mg/l [TCLP]
__ Nickel	3.98	5.0 mg/l [TCLP]
__ Selenium	0.82	0.16 mg/l [TCLP]
__ Silver	0.43	0.30 mg/l [TCLP]
__ Sulfide	14	NA
__ Thallium	1.4	NA
__ Vanadium	4.3	NA

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Chambers Works Wastewater Treatment Facility
Land Disposal Restrictions
(cont.)

4. In Table B, identify all additional characteristic, listed, newly identified, and newly listed U.S. EPA hazardous waste codes that apply to this waste. For each waste code, identify the subcategory, indicate whether the waste is a wastewater or nonwastewater, and indicate how the waste must be managed, based on the options below.

TABLE B

U.S. EPA HAZARDOUS WASTE CODE(S) Per 40 CFR 261	SUBCATEGORY		Wastewater	Non-wastewater	HOW MUST THE WASTE BE MANAGED?
			(Check only one)		Enter the letter from options below*
	Description	None			
F039	LANDFILL LEACHATE			X	

(Use Attachment I if more room is needed to list all applicable waste codes)

5. If this waste is a spent solvent (F001-F005), you MUST include Attachment II, Treatment Standards for F001-F005 Spent Solvents.

6. If this waste is a multisource leachate (F039), you may include Attachment III, Treatment Standards for F039 Multisource Leachate Wastes.

7. If this waste is D001 ignitable (other than the high TOC ≥ 10% subcategory), D002, D003, or D012-D043, you may include Attachment IV, Universal Treatment Standards. You may also include Attachment IV for nonhazardous waste which was hazardous (for these waste codes) as generated but rendered nonhazardous by pretreatment.

*HOW MUST THE WASTE BE MANAGED? (Choose from the following options to complete Tables A and B.)

A. Restricted waste requires treatment [40 CFR 268.7(a)(2)].

B. Restricted waste meets applicable treatment standards at the original point of generation.

GENERATOR'S CERTIFICATION [40 CFR 268.7(a)(3)(i)]
I certify under penalty of law that I personally have examined and am familiar with the waste through analysis and testing or through knowledge of the waste to support this certification that the waste complies with the treatment standards specified in 40 CFR Part 268 Subpart D. I believe that the information I submitted is true, accurate, and complete. I am aware that there are significant penalties for submitting a false certification, including the possibility of a fine and imprisonment.

C. Waste is newly listed or newly identified.

D. Restricted waste is exempt from the Land Disposal Restrictions. Check the reason below and write in the date the waste is subject to prohibitions [40 CFR 268.7(a)(4)].

- ☐ The waste has been granted a Site-Specific Variance. _____
- ☐ The waste has been given a Case-by-Case Extension. _____
- ☐ The waste is subject to a National Capacity Variance. _____

E. Restricted waste has been pretreated on-site to remove the hazardous characteristic D001-D003 and/or D012-D043 and requires treatment of underlying hazardous constituents.

CHARACTERISTIC WASTE - UNDERLYING HAZARDOUS CONSTITUENTS [40 CFR 268.7(b)(5)(iv)]
I certify under penalty of law that the waste has been treated in accordance with the requirements of 40 CFR 268.40 to remove the hazardous characteristic. This decharacterized waste contains underlying hazardous constituents that require further treatment to meet universal treatment standards. I am aware that there are significant penalties for submitting a false certification, including the possibility of fine and imprisonment.

F. Restricted waste has been pretreated on-site to remove the hazardous characteristic D001-D003 and/or D012-D043 and to treat underlying hazardous constituents to levels in 40 CFR 268.48 Universal Treatment Standards.

CHARACTERISTIC WASTE - UNDERLYING HAZARDOUS CONSTITUENTS [40 CFR 268.7(b)(5)(v)]
I certify under penalty of law that the waste has been treated in accordance with the requirements of 40 CFR 268.40 to remove the hazardous characteristic, and that underlying hazardous constituents, as defined in § 268.2, have been treated on-site to meet the § 268.48 Universal Treatment Standards. I am aware that there are significant penalties for submitting a false certification, including the possibility of fine and imprisonment.

CERTIFICATION

I certify that, to the best of my knowledge, the information provided in this document is true, accurate, and complete.

Annie Olsen	Env. Prot. Spec	9-10-02
Authorized Signature	Title	Date

DuPont

DuPont Environmental Treatment

Treatment Standards for F039 Multisource Leachate Wastes

Instructions: Mark the constituents present in the waste.*

*You are not required to include this attachment or to mark the constituents present in the waste because the DuPont Wastewater Treatment Plant (WWTP) is regulated under the Clean Water Act.

Constituents of Concern	Total Composition WW (mg/l)	Total Composition Non-WW (mg/kg)	Constituents of Concern	Total Composition WW (mg/l)	Total Composition Non-WW (mg/kg)
__ Acenaphthylene	0.059	3.4	__ Cyclohexanone	0.36	NA
__ Acenaphthene	0.059	3.4	__ 1,2-Dibromo-3-chloropropane	0.11	15
X Acetone	0.28	160	__ Ethylene dibromide (1,2-Dibromoethane)	0.028	15
__ Acetonitrile	5.6	NA	__ Dibromomethane	0.11	15
__ Acetophenone	0.010	9.7	__ 2,4-D (2,4-Dichlorophenoxyacetic acid)	0.72	10
__ 2-Acetylaminofluorene	0.059	140	__ o,p'-DDD	0.023	0.087
__ Acrolein	0.29	NA	__ p,p'-DDD	0.023	0.087
__ Acrylonitrile	0.24	84	__ o,p'-DDE	0.031	0.087
__ Aldrin	0.021	0.066	__ p,p'-DDE	0.031	0.087
__ 4-Aminobiphenyl	0.13	NA	__ o,p'-DDT	0.0039	0.087
__ Aniline	0.81	14	__ p,p'-DDT	0.0039	0.087
__ Anthracene	0.059	3.4	__ Dibenz(a,h) anthracene	0.055	8.2
__ Aramite	0.36	NA	__ Dibenzo(a,e) pyrene	0.061	NA
__ alpha-BHC	0.00014	0.066	__ m-Dichlorobenzene	0.036	6.0
__ beta-BHC	0.00014	0.066	__ o-Dichlorobenzene	0.088	6.0
__ delta-BHC	0.023	0.066	__ p-Dichlorobenzene	0.090	6.0
__ gamma-BHC	0.0017	0.066	__ Dichlorodifluoromethane	0.23	7.2
__ Benzene	0.14	10	X 1,1-Dichloroethane	0.059	6.0
__ Benz(a)anthracene	0.059	3.4	__ 1,2-Dichloroethane	0.21	6.0
__ Benzo(b)-fluoranthene	0.11	6.8	__ 1,1-Dichloroethylene	0.025	6.0
__ Benzo(k)-fluoranthene	0.11	6.8	__ trans-1,2-Dichloroethylene	0.054	30
__ Benzo(g,h,i)-perylene	0.0055	1.8	__ 2,4-Dichlorophenol	0.044	14
__ Benzo(a)pyrene	0.061	3.4	__ 2,6-Dichlorophenol	0.044	14
__ Bromodichloromethane	0.35	15	__ 1,2-Dichloropropane	0.85	18
__ Methyl bromide (Bromomethane)	0.11	15	__ cis-1,3-Dichloropropene	0.036	18
__ 4-Bromophenyl phenyl ether	0.055	15	__ trans-1,3-Dichloropropene	0.036	18
__ n-Butyl alcohol	5.6	2.6	__ Dieldrin	0.017	0.13
__ Butyl benzyl phthalate	0.017	28	__ Diethyl phthalate	0.20	28
__ 2-sec-Butyl-4,6-dinitrophenol	0.066	2.5	__ 2,4-Dimethyl phenol	0.036	14
__ Carbon disulfide	3.8	NA	__ Dimethyl phthalate	0.047	28
__ Carbon tetrachloride	0.057	6.0	__ Di-n-butyl phthalate	0.057	28
__ Chlordane (alpha & gamma isomers)	0.0033	0.26	__ 1,4-Dinitrobenzene	0.32	2.3
__ p-Chloroaniline	0.46	16	__ 4,6-Dinitro-o-cresol	0.28	160
__ Chlorobenzene	0.057	6.0	__ 2,4-Dinitrophenol	0.12	160
__ Chlorobenzilate	0.10	NA	__ 2,4-Dinitrotoluene	0.32	140
__ 2-Chloro-1,3-butadiene	0.057	NA	__ 2,6-Dinitrotoluene	0.55	28
__ Chlorodibromomethane	0.057	15	__ Di-n-octyl phthalate	0.017	28
__ Chloroethane	0.27	6.0	__ Di-n-propylnitrosoamine	0.40	14
__ bis(2-Chloroethoxy) methane	0.036	7.2	__ 1,4-Dioxane	12.0	170
__ bis(2-Chloroethyl) ether	0.033	6.0	__ Diphenylamine	0.92	NA
__ Chloroform	0.046	6.0	__ Diphenyl nitrosamine	0.92	NA
__ bis(2-Chloroisopropyl) ether	0.055	7.2	__ 1,2-Diphenylhydrazine	0.087	NA
__ p-Chloro-m-cresol	0.018	14	__ Disulfoton	0.017	6.2
__ Chloromethane (Methyl chloride)	0.19	30	__ Endosulfan I	0.023	0.066
__ 2-Chloronaphthalene	0.055	5.6	__ Endosulfan II	0.029	0.13
__ 2-Chlorophenol	0.044	5.7	__ Endosulfan sulfate	0.029	0.13
__ 3-Chloropropylene	0.036	30	__ Endrin	0.0028	0.13
__ Chrysene	0.059	3.4	__ Endrin aldehyde	0.025	0.13
__ o-Cresol	0.11	5.6	__ Ethyl acetate	0.34	33
__ m-Cresol	0.77	5.6	__ Ethyl cyanide (Propanenitrile)	0.24	360
__ p-Cresol	0.77	5.6	__ Ethyl benzene	0.057	10

Treatment Standards for F039 Multisource Leachate Wastes

Constituents of Concern	Total Composition WW (mg/l)	Total Composition Non-WW (mg/kg)
__ Ethyl ether	0.12	160
__ bis(2-Ethylhexyl) phthalate	0.28	28
__ Ethyl methacrylate	0.14	160
__ Ethylene oxide	0.12	NA
__ Famphur	0.017	15
__ Fluoranthene	0.068	3.4
__ Fluorene	0.059	3.4
__ Heptachlor	0.0012	0.066
__ Heptachlor epoxide	0.016	0.066
__ Hexachlorobenzene	0.055	10
__ Hexachlorobutadiene	0.055	5.6
__ Hexachlorocyclopentadiene	0.057	2.4
__ HxCDDs (Hexachlorodibenzo-p-dioxins)	0.000063	0.001
__ HxCDFs (Hexachlorodibenzofurans)	0.000063	0.001
__ Hexachloroethane	0.055	30
__ Indeno(1,2,3-c,d)pyrene	0.0055	3.4
__ Iodomethane	0.19	65
__ Isobutanol	5.6	170
__ Isodrin	0.021	0.066
__ Isosafrole	0.081	2.6
__ Kepone	0.0011	0.13
__ Methacrylonitrile	0.24	84
__ Methanol	5.6	NA
__ Methapyrilene	0.081	1.5
__ Methoxychlor	0.25	0.18
__ 3-Methylchlolanthrene	0.0055	15
__ 4,4-Methylene-bis(2-chloroaniline)	0.50	30
__ Methylene chloride	0.089	30
__ Methyl ethyl ketone	0.28	36
__ Methyl isobutyl ketone	0.14	33
__ Methyl methacrylate	0.14	160
__ Methyl methansulfonate	0.018	NA
__ Methyl parathion	0.014	4.6
__ Naphthalene	0.059	5.6
__ 2-Naphthylamine	0.52	NA
__ p-Nitroaniline	0.028	28
__ Nitrobenzene	0.068	14
__ 5-Nitro-o-toluidine	0.32	28
__ p-Nitrophenol	0.12	29
__ N-Nitrosodiethylamine	0.40	28
__ N-Nitrosodimethylamine	0.40	NA
__ N-Nitroso-di-n-butylamine	0.40	17
__ N-Nitrosomethylethylamine	0.40	2.3
__ N-Nitrosomorpholine	0.40	2.3
__ N-Nitrosopiperidine	0.013	35
__ N-Nitrosopyrrolidine	0.013	35
__ Parathion	0.014	4.6
__ Total PCBs (sum of all PCB isomers)	0.10	10
__ Pentachlorobenzene	0.055	10
__ PeCDDs (Pentachlorodibenzofurans)	0.000063	0.001
__ PeCDFs (Pentachlorodibenzo-p-dioxins)	0.000035	0.001
__ Pentachloronitrobenzene	0.055	4.8
__ Pentachlorophenol	0.089	7.4
__ Phenacetin	0.081	16
__ Phenanthrene	0.059	5.6
__ Phenol	0.039	6.2
__ Phorate	0.021	4.6
__ Phthalic anhydride	0.055	NA
__ Pronamide	0.093	1.5
__ Pyrene	0.067	8.2
__ Pyridine	0.014	16
__ Safrole	0.081	22
__ Silvex (2,4,5-TP)	0.72	7.9
__ 2,4,5-T	0.72	7.9
__ 1,2,4,5-Tetrachlorobenzene	0.055	14
__ TCDDs (Tetrachlorodibenzo-furans)	0.000063	0.001
__ TCDFs (Tetrachlorodibenzo-p-dioxins)	0.000063	0.001
__ 1,1,1,2-Tetrachloroethane	0.057	6.0
__ 1,1,2,2-Tetrachloroethane	0.057	6.0
__ Tetrachloroethylene	0.056	6.0
__ 2,3,4,6-Tetrachlorophenol	0.030	7.4
__ Toluene	0.080	10
__ Toxaphene	0.0095	2.6
__ Bromoform (Tribromomethane)	0.63	15
__ 1,2,4-Trichlorobenzene	0.055	19
__ 1,1,1-Trichloroethane	0.054	6.0
__ 1,1,2-Trichloroethane	0.054	6.0
__ Trichloroethylene	0.054	6.0
__ Trichloromonofluoromethane	0.020	30
__ 2,4,5-Trichlorophenol	0.18	7.4
__ 2,4,6-Trichlorophenol	0.035	7.4
__ 1,2,3-Trichloropropane	0.85	30
__ 1,1,2-Trichloro-1,2,2-trifluoroethane	0.057	30
__ tris(2,3-dibromopropyl) phosphate	0.11	NA
__ Vinyl chloride	0.27	6.0
__ Xylene(s) (sum of mixed isomers)	0.32	30

__ Antimony	1.9	2.1 mg/l [TCLP]
__ Arsenic	1.4	5.0 mg/l [TCLP]
__ Barium	1.2	7.6 mg/l [TCLP]
X Beryllium	0.82	NA
__ Cadmium	0.69	0.19 mg/l [TCLP]
__ Chromium (Total)	2.77	0.86 mg/l [TCLP]
__ Cyanides (Total)	1.2	590
__ Cyanides (Amendable)	0.86	NA
__ Fluoride	35	NA
__ Lead	0.69	0.37 mg/l [TCLP]
__ Mercury	0.15	0.025 mg/l [TCLP]
__ Nickel	3.98	5.0 mg/l [TCLP]
__ Selenium	0.82	0.16 mg/l [TCLP]
__ Silver	0.43	0.30 mg/l [TCLP]
__ Sulfide	14	NA
__ Thallium	1.4	NA
__ Vanadium	4.3	NA

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Chambers Works Wastewater Treatment Facility
Land Disposal Restrictions
(cont.)

4. In Table B, identify all additional characteristic, listed, newly identified, and newly listed U.S. EPA hazardous waste codes that apply to this waste. For each waste code, identify the subcategory, indicate whether the waste is a wastewater or nonwastewater, and indicate how the waste must be managed, based on the options below.

TABLE B

U.S. EPA HAZARDOUS WASTE CODE(S) Per 40 CFR 261	SUBCATEGORY		Waste-water	Non-waste-water	HOW MUST THE WASTE BE MANAGED?
			(Check only one)		Enter the letter from options below*
	Description	None			
F039	LANDFILL LEACHATE			X	A

(Use Attachment I if more room is needed to list all applicable waste codes)

5. If this waste is a spent solvent (F001-F005), you MUST include Attachment II, Treatment Standards for F001-F005 Spent Solvents.

6. If this waste is a multisource leachate (F039), you may include Attachment III, Treatment Standards for F039 Multisource Leachate Wastes.

7. If this waste is D001 ignitable (other than the high TOC ≥ 10% subcategory), D002, D003, or D012-D043, you may include Attachment IV, Universal Treatment Standards. You may also include Attachment IV for nonhazardous waste which was hazardous (for these waste codes) as generated but rendered nonhazardous by pretreatment.

*HOW MUST THE WASTE BE MANAGED? (Choose from the following options to complete Tables A and B.)

A. Restricted waste requires treatment [40 CFR 268.7(a)(2)].

B. Restricted waste meets applicable treatment standards at the original point of generation.

GENERATOR'S CERTIFICATION [40 CFR 268.7(a)(5)(i)]
I certify under penalty of law that I personally have examined and am familiar with the waste through analysis and testing or through knowledge of the waste to support this certification that the waste complies with the treatment standards specified in 40 CFR Part 268 Subpart D. I believe that the information I submitted is true, accurate, and complete. I am aware that there are significant penalties for submitting a false certification, including the possibility of a fine and imprisonment.

C. Waste is newly listed or newly identified.

D. Restricted waste is exempt from the Land Disposal Restrictions. Check the reason below and write in the date the waste is subject to prohibitions [40 CFR 268.7(a)(4)].

- ☐ The waste has been granted a Site-Specific Variance. _____
- ☐ The waste has been given a Case-by-Case Extension. _____
- ☐ The waste is subject to a National Capacity Variance. _____

E. Restricted waste has been pretreated on-site to remove the hazardous characteristic D001-D003 and/or D012-D043 and requires treatment of underlying hazardous constituents.

CHARACTERISTIC WASTE - UNDERLYING HAZARDOUS CONSTITUENTS [40 CFR 268.7(b)(5)(iv)]
I certify under penalty of law that the waste has been treated in accordance with the requirements of 40 CFR 268.40 to remove the hazardous characteristic. This decharacterized waste contains underlying hazardous constituents that require further treatment to meet universal treatment standards. I am aware that there are significant penalties for submitting a false certification, including the possibility of fine and imprisonment.

F. Restricted waste has been pretreated on-site to remove the hazardous characteristic D001-D003 and/or D012-D043 and to treat underlying hazardous constituents to levels in 40 CFR 268.48 Universal Treatment Standards.

CHARACTERISTIC WASTE - UNDERLYING HAZARDOUS CONSTITUENTS [40 CFR 268.7(b)(5)(v)]
I certify under penalty of law that the waste has been treated in accordance with the requirements of 40 CFR 268.40 to remove the hazardous characteristic, and that underlying hazardous constituents, as defined in § 268.2, have been treated on-site to meet the § 268.48 Universal Treatment Standards. I am aware that there are significant penalties for submitting a false certification, including the possibility of fine and imprisonment.

CERTIFICATION

I certify that, to the best of my knowledge, the information provided in this document is true, accurate, and complete.

DuPont Environmental Treatment

Treatment Standards for F039 Multisource Leachate Wastes

Instructions: Mark the constituents present in the waste.*

*You are not required to include this attachment or to mark the constituents present in the waste because the DuPont Wastewater Treatment Plant (WWTP) is regulated under the Clean Water Act.

Constituents of Concern	Total Composition WW (mg/l)	Total Composition Non-WW (mg/kg)	Constituents of Concern	Total Composition WW (mg/l)	Total Composition Non-WW (mg/kg)
__ Acenaphthylene	0.059	3.4	__ Cyclohexanone	0.36	NA
__ Acenaphthene	0.059	3.4	__ 1,2-Dibromo-3-chloropropane	0.11	15
X Acetone	0.28	160	__ Ethylene dibromide (1,2-Dibromoethane)	0.028	15
__ Acetonitrile	5.6	NA	__ Dibromomethane	0.11	15
__ Acetophenone	0.010	9.7	__ 2,4-D (2,4-Dichlorophenoxyacetic acid)	0.72	10
__ 2-Acetylaminofluorene	0.059	140	__ o,p'-DDD	0.023	0.087
__ Acrolein	0.29	NA	__ p,p'-DDD	0.023	0.087
__ Acrylonitrile	0.24	84	__ o,p'-DDE	0.031	0.087
__ Aldrin	0.021	0.066	__ p,p'-DDE	0.031	0.087
__ 4-Aminobiphenyl	0.13	NA	__ o,p'-DDT	0.0039	0.087
__ Aniline	0.81	14	__ p,p'-DDT	0.0039	0.087
__ Anthracene	0.059	3.4	__ Dibenz(a,h) anthracene	0.055	8.2
__ Aramite	0.36	NA	__ Dibenzo(a,e) pyrene	0.061	NA
__ alpha-BHC	0.00014	0.066	__ m-Dichlorobenzene	0.036	6.0
__ beta-BHC	0.00014	0.066	__ o-Dichlorobenzene	0.088	6.0
__ delta-BHC	0.023	0.066	__ p-Dichlorobenzene	0.090	6.0
__ gamma-BHC	0.0017	0.066	__ Dichlorodifluoromethane	0.23	7.2
__ Benzene	0.14	10	X 1,1-Dichloroethane	0.059	6.0
__ Benz(a)anthracene	0.059	3.4	__ 1,2-Dichloroethane	0.21	6.0
__ Benzo(b)-fluoranthene	0.11	6.8	X 1,1-Dichloroethylene	0.025	6.0
__ Benzo(k)-fluoranthene	0.11	6.8	__ trans-1,2-Dichloroethylene	0.054	30
__ Benzo(g,h,i)-perylene	0.0055	1.8	__ 2,4-Dichlorophenol	0.044	14
__ Benzo(a)pyrene	0.061	3.4	__ 2,6-Dichlorophenol	0.044	14
__ Bromodichloromethane	0.35	15	__ 1,2-Dichloropropane	0.85	18
__ Methyl bromide (Bromomethane)	0.11	15	__ cis-1,3-Dichloropropene	0.036	18
__ 4-Bromophenyl phenyl ether	0.055	15	__ trans-1,3-Dichloropropene	0.036	18
__ n-Butyl alcohol	5.6	2.6	__ Dieldrin	0.017	0.13
__ Butyl benzyl phthalate	0.017	28	__ Diethyl phthalate	0.20	28
__ 2-sec-Butyl-4,6-dinitrophenol	0.066	2.5	__ 2,4-Dimethyl phenol	0.036	14
__ Carbon disulfide	3.8	NA	__ Dimethyl phthalate	0.047	28
__ Carbon tetrachloride	0.057	6.0	__ Di-n-butyl phthalate	0.057	28
__ Chlordane (alpha & gamma isomers)	0.0033	0.26	__ 1,4-Dinitrobenzene	0.32	2.3
__ p-Chloroaniline	0.46	16	__ 4,6-Dinitro-o-cresol	0.28	160
__ Chlorobenzene	0.057	6.0	__ 2,4-Dinitrophenol	0.12	160
__ Chlorobenzilate	0.10	NA	__ 2,4-Dinitrotoluene	0.32	140
__ 2-Chloro-1,3-butadiene	0.057	NA	__ 2,6-Dinitrotoluene	0.55	28
__ Chlorodibromomethane	0.057	15	__ Di-n-octyl phthalate	0.017	28
__ Chloroethane	0.27	6.0	__ Di-n-propylnitrosoamine	0.40	14
__ bis(2-Chloroethoxy) methane	0.036	7.2	__ 1,4-Dioxane	12.0	170
__ bis(2-Chloroethyl) ether	0.033	6.0	__ Diphenylamine	0.92	NA
__ Chloroform	0.046	6.0	__ Diphenyl nitrosamine	0.92	NA
__ bis(2-Chloroisopropyl) ether	0.055	7.2	__ 1,2-Diphenylhydrazine	0.087	NA
__ p-Chloro-m-cresol	0.018	14	__ Disulfoton	0.017	6.2
__ Chloromethane (Methyl chloride)	0.19	30	__ Endosulfan I	0.023	0.066
__ 2-Chloronaphthalene	0.055	5.6	__ Endosulfan II	0.029	0.13
__ 2-Chlorophenol	0.044	5.7	__ Endosulfan sulfate	0.029	0.13
__ 3-Chloropropylene	0.036	30	__ Endrin	0.0028	0.13
__ Chrysene	0.059	3.4	__ Endrin aldehyde	0.025	0.13
__ o-Cresol	0.11	5.6	__ Ethyl acetate	0.34	33
__ m-Cresol	0.77	5.6	__ Ethyl cyanide (Propanenitrile)	0.24	360
__ p-Cresol	0.77	5.6	__ Ethyl benzene	0.057	10

Treatment Standards for F039 Multisource Leachate Wastes

Constituents of Concern	Total Composition WW (mg/l)	Total Composition Non-WW (mg/kg)
__ Ethyl ether	0.12	160
__ bis(2-Ethylhexyl) phthalate	0.28	28
__ Ethyl methacrylate	0.14	160
__ Ethylene oxide	0.12	NA
__ Famphur	0.017	15
__ Fluoranthene	0.068	3.4
__ Fluorene	0.059	3.4
__ Heptachlor	0.0012	0.066
__ Heptachlor epoxide	0.016	0.066
__ Hexachlorobenzene	0.055	10
__ Hexachlorobutadiene	0.055	5.6
__ Hexachlorocyclopentadiene	0.057	2.4
__ HxCDDs (Hexachlorodibenzo-p-dioxins)	0.000063	0.001
__ HxCDFs (Hexachlorodibenzofurans)	0.000063	0.001
__ Hexachloroethane	0.055	30
__ Indeno(1,2,3-c,d)pyrene	0.0055	3.4
__ Iodomethane	0.19	65
__ Isobutanol	5.6	170
__ Isodrin	0.021	0.066
__ Isosafrole	0.081	2.6
__ Kepone	0.0011	0.13
__ Methacrylonitrile	0.24	84
__ Methanol	5.6	NA
__ Methapyrilene	0.081	1.5
__ Methoxychlor	0.25	0.18
__ 3-Methylchlolanthrene	0.0055	15
__ 4,4-Methylene-bis(2-chloroaniline)	0.50	30
__ Methylene chloride	0.089	30
__ Methyl ethyl ketone	0.28	36
__ Methyl isobutyl ketone	0.14	33
__ Methyl methacrylate	0.14	160
__ Methyl methansulfonate	0.018	NA
__ Methyl parathion	0.014	4.6
__ Naphthalene	0.059	5.6
__ 2-Naphthylamine	0.52	NA
__ p-Nitroaniline	0.028	28
__ Nitrobenzene	0.068	14
__ 5-Nitro-o-toluidine	0.32	28
__ p-Nitrophenol	0.12	29
__ N-Nitrosodiethylamine	0.40	28
__ N-Nitrosodimethylamine	0.40	NA
__ N-Nitroso-di-n-butylamine	0.40	17
__ N-Nitrosomethylethylamine	0.40	2.3
__ N-Nitrosomorpholine	0.40	2.3
__ N-Nitrosopiperidine	0.013	35
__ N-Nitrosopyrrolidine	0.013	35
__ Parathion	0.014	4.6
__ Total PCBs (sum of all PCB isomers)	0.10	10
__ Pentachlorobenzene	0.055	10
__ PeCDDs (Pentachlorodibenzofurans)	0.000063	0.001
__ PeCDFs (Pentachlorodibenzo-p-dioxins)	0.000035	0.001
__ Pentachloronitrobenzene	0.055	4.8
__ Pentachlorophenol	0.089	7.4
__ Phenacetin	0.081	16
__ Phenanthrene	0.059	5.6
__ Phenol	0.039	6.2
__ Phorate	0.021	4.6
__ Phthalic anhydride	0.055	NA
__ Pronamide	0.093	1.5
__ Pyrene	0.067	8.2
__ Pyridine	0.014	16
__ Safrole	0.081	22
__ Silvex (2,4,5-TP)	0.72	7.9
__ 2,4,5-T	0.72	7.9
__ 1,2,4,5-Tetrachlorobenzene	0.055	14
__ TCDDs (Tetrachlorodibenzo-furans)	0.000063	0.001
__ TCDFs (Tetrachlorodibenzo-p-dioxins)	0.000063	0.001
__ 1,1,1,2-Tetrachloroethane	0.057	6.0
__ 1,1,2,2-Tetrachloroethane	0.057	6.0
__ Tetrachloroethylene	0.056	6.0
__ 2,3,4,6-Tetrachlorophenol	0.030	7.4
__ Toluene	0.080	10
__ Toxaphene	0.0095	2.6
__ Bromoform (Tribromomethane)	0.63	15
__ 1,2,4-Trichlorobenzene	0.055	19
__ 1,1,1-Trichloroethane	0.054	6.0
__ 1,1,2-Trichloroethane	0.054	6.0
__ Trichloroethylene	0.054	6.0
__ Trichloromonofluoromethane	0.020	30
__ 2,4,5-Trichlorophenol	0.18	7.4
__ 2,4,6-Trichlorophenol	0.035	7.4
__ 1,2,3-Trichloropropane	0.85	30
__ 1,1,2-Trichloro-1,2,2-trifluoroethane	0.057	30
__ tris(2,3-dibromopropyl) phosphate	0.11	NA
__ Vinyl chloride	0.27	6.0
__ Xylene(s) (sum of mixed isomers)	0.32	30

__ Antimony	1.9	2.1 mg/l [TCLP]
__ Arsenic	1.4	5.0 mg/l [TCLP]
__ Barium	1.2	7.6 mg/l [TCLP]
X Beryllium	0.82	NA
__ Cadmium	0.69	0.19 mg/l [TCLP]
__ Chromium (Total)	2.77	0.86 mg/l [TCLP]
__ Cyanides (Total)	1.2	590
__ Cyanides (Amendable)	0.86	NA
__ Fluoride	35	NA
__ Lead	0.69	0.37 mg/l [TCLP]
__ Mercury	0.15	0.025 mg/l [TCLP]
Nickel	3.98	5.0 mg/l [TCLP]
__ Selenium	0.82	0.16 mg/l [TCLP]
__ Silver	0.43	0.30 mg/l [TCLP]
__ Sulfide	14	NA
__ Thallium	1.4	NA
__ Vanadium	4.3	NA

APPENDIX D-3

LDR NOTIFICATION AND CERTIFICATION INORMATION FOR THE RUSSELL ROAD LANDFILL MCB QUANTICO, QUANTICO, VIRGINIA

Cycle Chem, Inc

550 Industrial Drive Lewisberry PA 17339 PHONE: 717-938-4700, FAX: 717-938-3301

Land Disposal Restriction Notification and Certification Form

Generator: MARINE CORPS BASE QUANTICO
EPAID: VA1170024722

Manifest Number: 20319
Document Number: 000741556JJK

The EPA hazardous wastes identified below must be treated to the applicable treatment standards set forth in 40 CFR 268.40.

EPA Waste Code Information

Manifest Line	Waste-water?	EPA Codes
Page 1 Line 1	No	F039

Underlying Hazardous Constituents

(None present unless identified below.)

Manifest Line	Constituents

I certify that all information submitted on this Land Disposal Restriction and Certification Form is accurate and complete, to the best of my knowledge and information.

Signature: BKThaker

Name: Bhasker Thaker

Title: Env. Prot. Spec

Date: 12/1/06

CycleChem

Recycling Treatment & Disposal of Hazardous Waste

March 6,2008

BHASKER THAKER
MARINE CORPS BASE QUANTICO
3250 CATLIN AVE (8046)
QUANTICO, VA 22134

Broker:Dave Roesler
Clean Venture Balt
2031 Inverness Avenue
Baltimore, MD 21230

Re: Certificate of Disposal
Marine Corps Base-Quantico
27007 Russell Road Landfill
Quantico, VA 22134

Dear Sir/Madam:

This letter is to certify that Cycle Chem, Inc. EPA ID No. PAD067098822 has accepted and processed the following shipments. This acceptance is in accordance with all State & Federal Regulations and with the requirements Set forth In Cycle Chem's Hazardous Waste Facility Permit.

Date In	Manifest In	Prod Code (Off Spec)	Date Out	Manifest Out	Disposal Facility	Disposal Method	Drum ID	Mgt Code
12/01/2006	000741556JJK-1	WR3-A ()	12/11/2006	000744272JJK	Dupont Company	Wastewater Treatment/Steam Stripping	120655199	H135

If there are any further questions about the disposal of your waste, please call (717) 938-4700.

Sincerely

Gary Hoadley
General Manager
Cycle Chem, Inc. Representative
EPA ID No. PAD067098822

New Jersey TSDF:
217 South First Street
Elizabeth, NJ 07206
908-355-5800
FAX: 908-355-0562

Corporate Office:
201 South First Street
Elizabeth, NJ 07206
908-355-5800
FAX: 908-355-3495

Pennsylvania TSDF:
550 Industrial Drive
Lewisberry, PA 17339
717-938-4700
Fax: 717-938-3301

Massachusetts TSDF:
General Chemical
138 Leland Street
Framingham, MA 01702
508-872-5000
FAX: 508-875-5271

www.cyclechem.com

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Notification and Certification Form

DuPont Environmental Treatment

OW/DW No. DW00952
Release No. 01
(please fill in)

Chambers Works Wastewater Treatment Facility
Land Disposal Restrictions

1. Generator's EPA ID No. VA1170024722 Hazardous Waste Manifest No. NJA3188287
Generator COMMANDING OFFICER NREA BRANCH B046
Generator's Address MARINE CORPS BASE
3250 CATLIN AVENUE
QUANTICO, VA 22134
Manifest Page No./Line Letter 11a
(for drummed aqueous waste only)

Note: The DuPont Chambers Works Wastewater Treatment Plant (WWTP) is regulated under the Clean Water Act.

2. Is waste analysis information attached? ☐ Yes ☒ Not available

3. In Table A, check (if applicable) the characteristic U.S. EPA hazardous waste codes that apply to this waste. For each waste code checked, identify whether the waste is a wastewater or nonwastewater, and indicate how the waste must be managed based on the options found on page 2.

TABLE A:

Check Waste Code	U.S. EPA Hazardous Waste Code	Subcategory	Waste-water*	Non-waste-water	How must the waste be managed?
			(Check only one)		(Enter the letter from page 2)
___	D001	Low TOC (<10% TOC)	___	___	___
___	D001	High TOC (≥ 10% TOC)	NA	___	___
___	D001	Oxidizer	___	___	___
___	D002	Acid (pH ≤ 2)	___	___	___
___	D002	Alkaline (pH ≥ 12.5)	___	___	___
___	D002	Other corrosives	___	___	___
___	D003	Reactive sulfides	___	___	___
___	D003	Reactive cyanides	___	___	___
___	D003	Water reactive	___	___	___
___	D003	Explosives (pretreated)	___	___	___
___	D003	Other reactives	___	___	___
___	D004	Arsenic	___	___	___
___	D005	Barium	___	___	___
___	D006	Cadmium	___	___	___
___	D007	Chromium	___	___	___
___	D008	Lead	___	___	___
___	D009	Mercury	___	NA	___
___	D009	Low Mercury <260 mg/kg Hg	NA	___	___
___	D010	Selenium	___	___	___
___	D011	Silver	___	___	___

*Wastewaters contain <1% TOC and <1% TSS.

Chambers Works Wastewater Treatment Facility
Land Disposal Restrictions
(cont.)

4. In Table B, identify all additional characteristic, listed, newly identified, and newly listed U.S. EPA hazardous waste codes that apply to this waste. For each waste code, identify the subcategory, indicate whether the waste is a wastewater or nonwastewater, and indicate how the waste must be managed, based on the options below.

TABLE B

U.S. EPA HAZARDOUS WASTE CODE(S) Per 40 CFR 261	SUBCATEGORY		Waste-water	Non-waste-water	HOW MUST THE WASTE BE MANAGED?
	Description	None	(Check only one)		Enter the letter from options below*
F039	LEACHATE WASTE			X	A

(Use Attachment I if more room is needed to list all applicable waste codes)

5. If this waste is a spent solvent (F001-F005), you MUST include Attachment II, Treatment Standards for F001-F005 Spent Solvents.
6. If this waste is a multisource leachate (F039), you may include Attachment III, Treatment Standards for F039 Multisource Leachate Wastes.
7. If this waste is D001 ignitable (other than the high TOC ≥ 10% subcategory), D002, D003, or D012-D043, you may include Attachment IV, Universal Treatment Standards. You may also include Attachment IV for nonhazardous waste which was hazardous (for these waste codes) as generated but rendered nonhazardous by pretreatment.

***HOW MUST THE WASTE BE MANAGED?** (Choose from the following options to complete Tables A and B.)

A. Restricted waste requires treatment [40 CFR 268.7(a)(2)].

B. Restricted waste meets applicable treatment standards at the original point of generation.

GENERATOR'S CERTIFICATION [40 CFR 268.7(a)(3)(i)]
I certify under penalty of law that I personally have examined and am familiar with the waste through analysis and testing or through knowledge of the waste to support this certification that the waste complies with the treatment standards specified in 40 CFR Part 268 Subpart D. I believe that the information I submitted is true, accurate, and complete. I am aware that there are significant penalties for submitting a false certification, including the possibility of a fine and imprisonment.

C. Waste is newly listed or newly identified.

D. Restricted waste is exempt from the Land Disposal Restrictions. Check the reason below and write in the date the waste is subject to prohibitions [40 CFR 268.7(a)(4)].

- ☐ The waste has been granted a Site-Specific Variance. _____
- ☐ The waste has been given a Case-by-Case Extension. _____
- ☐ The waste is subject to a National Capacity Variance. _____

E. Restricted waste has been pretreated on-site to remove the hazardous characteristic D001-D003 and/or D012-D043 and requires treatment of underlying hazardous constituents.

CHARACTERISTIC WASTE - UNDERLYING HAZARDOUS CONSTITUENTS [40 CFR 268.7(b)(5)(iv)]
I certify under penalty of law that the waste has been treated in accordance with the requirements of 40 CFR 268.40 to remove the hazardous characteristic. This decharacterized waste contains underlying hazardous constituents that require further treatment to meet universal treatment standards. I am aware that there are significant penalties for submitting a false certification, including the possibility of fine and imprisonment.

F. Restricted waste has been pretreated on-site to remove the hazardous characteristic D001-D003 and/or D012-D043 and to treat underlying hazardous constituents to levels in 40 CFR 268.48 Universal Treatment Standards.

CHARACTERISTIC WASTE - UNDERLYING HAZARDOUS CONSTITUENTS [40 CFR 268.7(b)(5)(v)]
I certify under penalty of law that the waste has been treated in accordance with the requirements of 40 CFR 268.40 to remove the hazardous characteristic, and that underlying hazardous constituents, as defined in § 268.2, have been treated on-site to meet the § 268.48 Universal Treatment Standards. I am aware that there are significant penalties for submitting a false certification, including the possibility of fine and imprisonment.

CERTIFICATION

I certify that, to the best of my knowledge, the information provided in this document is true, accurate, and complete.

R Gleason	ENV PRO SPEC	15 FEB 01
Authorized Signature	Title	Date

DUPONT

DuPont

DuPont Environmental Treatment

Treatment Standards for F039 Multisource Leachate Wastes

*Instructions: Mark the constituents present in the waste.**

*You are not required to include this attachment or to mark the constituents present in the waste because the DuPont Wastewater Treatment Plant (WWTP) is regulated under the Clean Water Act.

Constituents of Concern	Total Composition WW (mg/l)	Total Composition Non-WW (mg/kg)	Constituents of Concern	Total Composition WW (mg/l)	Total Composition Non-WW (mg/kg)
__ Acenaphthylene	0.059	3.4	__ Cyclohexanone	0.36	NA
__ Acenaphthene	0.059	3.4	__ 1,2-Dibromo-3-chloropropane	0.11	15
X Acetone	0.28	160	__ Ethylene dibromide (1,2-Dibromoethane)	0.028	15
__ Acetonitrile	5.6	NA	__ Dibromomethane	0.11	15
__ Acetophenone	0.010	9.7	__ 2,4-D (2,4-Dichlorophenoxyacetic acid)	0.72	10
__ 2-Acetylaminofluorene	0.059	140	__ o,p'-DDD	0.023	0.087
__ Acrolein	0.29	NA	__ p,p'-DDD	0.023	0.087
__ Acrylonitrile	0.24	84	__ o,p'-DDE	0.031	0.087
__ Aldrin	0.021	0.066	__ p,p'-DDE	0.031	0.087
__ 4-Aminobiphenyl	0.13	NA	__ o,p'-DDT	0.0039	0.087
__ Aniline	0.81	14	__ p,p'-DDT	0.0039	0.087
__ Anthracene	0.059	3.4	__ Dibenz(a,h) anthracene	0.055	8.2
__ Aramite	0.36	NA	__ Dibenzo(a,e) pyrene	0.061	NA
__ alpha-BHC	0.00014	0.066	__ m-Dichlorobenzene	0.036	6.0
__ beta-BHC	0.00014	0.066	__ o-Dichlorobenzene	0.088	6.0
__ delta-BHC	0.023	0.066	__ p-Dichlorobenzene	0.090	6.0
__ gamma-BHC	0.0017	0.066	__ Dichlorodifluoromethane	0.23	7.2
__ Benzene	0.14	10	X 1,1-Dichloroethane	0.059	6.0
__ Benz(a)anthracene	0.059	3.4	X 1,2-Dichloroethane	0.21	6.0
__ Benzo(b)-fluoranthene	0.11	6.8	__ 1,1-Dichloroethylene	0.025	6.0
__ Benzo(k)-fluoranthene	0.11	6.8	__ trans-1,2-Dichloroethylene	0.054	30
__ Benzo(g,h,i)-perylene	0.0055	1.8	__ 2,4-Dichlorophenol	0.044	14
__ Benzo(a)pyrene	0.061	3.4	__ 2,6-Dichlorophenol	0.044	14
__ Bromodichloromethane	0.35	15	__ 1,2-Dichloropropane	0.85	18
__ Methyl bromide (Bromomethane)	0.11	15	__ cis-1,3-Dichloropropene	0.036	18
__ 4-Bromophenyl phenyl ether	0.055	15	__ trans-1,3-Dichloropropene	0.036	18
__ n-Butyl alcohol	5.6	2.6	__ Dieldrin	0.017	0.13
__ Butyl benzyl phthalate	0.017	28	__ Diethyl phthalate	0.20	28
__ 2-sec-Butyl-4,6-dinitrophenol	0.066	2.5	__ 2,4-Dimethyl phenol	0.036	14
__ Carbon disulfide	3.8	NA	__ Dimethyl phthalate	0.047	28
__ Carbon tetrachloride	0.057	6.0	__ Di-n-butyl phthalate	0.057	28
__ Chlordane (alpha & gamma isomers)	0.0033	0.26	__ 1,4-Dinitrobenzene	0.32	2.3
__ p-Chloroaniline	0.46	16	__ 4,6-Dinitro-o-cresol	0.28	160
__ Chlorobenzene	0.057	6.0	__ 2,4-Dinitrophenol	0.12	160
__ Chlorobenzilate	0.10	NA	__ 2,4-Dinitrotoluene	0.32	140
__ 2-Chloro-1,3-butadiene	0.057	NA	__ 2,6-Dinitrotoluene	0.55	28
__ Chlorodibromomethane	0.057	15	__ Di-n-octyl phthalate	0.017	28
__ Chloroethane	0.27	6.0	__ Di-n-propylnitrosoamine	0.40	14
__ bis(2-Chloroethoxy) methane	0.036	7.2	__ 1,4-Dioxane	12.0	170
__ bis(2-Chloroethyl) ether	0.033	6.0	__ Diphenylamine	0.92	NA
__ Chloroform	0.046	6.0	__ Diphenyl nitrosamine	0.92	NA
__ bis(2-Chloroisopropyl) ether	0.055	7.2	__ 1,2-Diphenylhydrazine	0.087	NA
__ p-Chloro-m-cresol	0.018	14	__ Disulfoton	0.017	6.2
__ Chloromethane (Methyl chloride)	0.19	30	__ Endosulfan I	0.023	0.066
__ 2-Chloronaphthalene	0.055	5.6	__ Endosulfan II	0.029	0.13
__ 2-Chlorophenol	0.044	5.7	__ Endosulfan sulfate	0.029	0.13
__ 3-Chloropropylene	0.036	30	__ Endrin	0.0028	0.13
__ Chrysene	0.059	3.4	__ Endrin aldehyde	0.025	0.13
__ o-Cresol	0.11	5.6	__ Ethyl acetate	0.34	33
__ m-Cresol	0.77	5.6	__ Ethyl cyanide (Propanenitrile)	0.24	360
__ p-Cresol	0.77	5.6	__ Ethyl benzene	0.057	10

Treatment Standards for F039 Multisource Leachate Wastes

Constituents of Concern	Total Composition WW (mg/l)	Total Composition Non-WW (mg/kg)
Ethyl ether	0.12	160
bis(2-Ethylhexyl) phthalate	0.28	28
Ethyl methacrylate	0.14	160
Ethylene oxide	0.12	NA
Famphur	0.017	15
Fluoranthene	0.068	3.4
Fluorene	0.059	3.4
Heptachlor	0.0012	0.066
Heptachlor epoxide	0.016	0.065
Hexachlorobenzene	0.055	10
Hexachlorobutadiene	0.055	5.6
Hexachlorocyclopentadiene	0.057	2.4
HxCDDs (Hexachlorodibenzo-p-dioxins)	0.000063	0.001
HxCDFs (Hexachlorodibenzofurans)	0.000063	0.001
Hexachloroethane	0.055	30
Indeno(1,2,3-c,d)pyrene	0.0055	3.4
Iodomethane	0.19	65
Isobutanol	5.6	170
Isodrin	0.021	0.066
Isosafrole	0.081	2.6
Kepone	0.0011	0.13
Methacrylonitrile	0.24	84
Methanol	5.6	NA
Methapyrilene	0.081	1.5
Methoxychlor	0.25	0.18
3-Methylcholanthrene	0.0055	15
4,4-Methylene-bis(2-chloroaniline)	0.50	30
Methylene chloride	0.089	30
Methyl ethyl ketone	0.28	36
Methyl isobutyl ketone	0.14	33
Methyl methacrylate	0.14	160
Methyl methansulfonate	0.018	NA
Methyl parathion	0.014	4.6
Naphthalene	0.059	5.6
2-Naphthylamine	0.52	NA
p-Nitroaniline	0.028	28
Nitrobenzene	0.068	14
5-Nitro-o-toluidine	0.32	28
p-Nitrophenol	0.12	29
N-Nitrosodiethylamine	0.40	28
N-Nitrosodimethylamine	0.40	NA
N-Nitroso-di-n-butylamine	0.40	17
N-Nitrosomethylethylamine	0.40	2.3
N-Nitrosomorpholine	0.40	2.3
N-Nitrosopiperidine	0.013	35
N-Nitrosopyrrolidine	0.013	35
Parathion	0.014	4.6
Total PCBs (sum of all PCB isomers)	0.10	10
Pentachlorobenzene	0.055	10
PeCDDs (Pentachlorodibenzofurans)	0.000063	0.001
PeCDFs (Pentachlorodibenzo-p-dioxins)	0.000035	0.001
Pentachloronitrobenzene	0.055	4.8
Pentachlorophenol	0.089	7.4
Phenacetin	0.081	16
Phenanthrene	0.059	5.6
Phenol	0.039	6.2
Phorate	0.021	4.6
Phthalic anhydride	0.055	NA
Pronamide	0.093	1.5
Pyrene	0.067	8.2
Pyridine	0.014	16
Safrole	0.081	22
Silvex (2,4,5-TP)	0.72	7.9
2,4,5-T	0.72	7.9
1,2,4,5-Tetrachlorobenzene	0.055	14
TCDDs (Tetrachlorodibenzo-furans)	0.000063	0.001
TCDFs (Tetrachlorodibenzo-p-dioxins)	0.000063	0.001
1,1,1,2-Tetrachloroethane	0.057	6.0
1,1,2,2-Tetrachloroethane	0.057	6.0
Tetrachloroethylene	0.056	6.0
2,3,4,6-Tetrachlorophenol	0.030	7.4
Toluene	0.080	10
Toxaphene	0.0095	2.6
Bromoform (Tribromomethane)	0.63	15
1,2,4-Trichlorobenzene	0.055	19
1,1,1-Trichloroethane	0.054	6.0
1,1,2-Trichloroethane	0.054	6.0
Trichloroethylene	0.054	6.0
Trichloromonofluoromethane	0.020	30
2,4,5-Trichlorophenol	0.18	7.4
2,4,6-Trichlorophenol	0.035	7.4
1,2,3-Trichloropropane	0.85	30
1,1,2-Trichloro-1,2,2-trifluoroethane	0.057	30
tris(2,3-dibromopropyl) phosphate	0.11	NA
Vinyl chloride	0.27	6.0
Xylene(s) (sum of mixed isomers)	0.32	30

Antimony	1.9	2.1 mg/l [TCLP]
Arsenic	1.4	5.0 mg/l [TCLP]
Barium	1.2	7.6 mg/l [TCLP]
Beryllium	0.82	NA
Cadmium	0.69	0.19 mg/l [TCLP]
Chromium (Total)	2.77	0.86 mg/l [TCLP]
Cyanides (Total)	1.2	590
Cyanides (Amendable)	0.86	NA
Fluoride	35	NA
Lead	0.69	0.37 mg/l [TCLP]
Mercury	0.15	0.025 mg/l [TCLP]
Nickel	3.98	5.0 mg/l [TCLP]
Selenium	0.82	0.16 mg/l [TCLP]
Silver	0.43	0.30 mg/l [TCLP]
Sulfide	14	NA
Thallium	1.4	NA
Vanadium	4.3	NA

DU PONT

Cycle Chem, Inc.
217 South 1st St.
Elizabeth, NJ 07206
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Fax: (908) 355-0562

550 Industrial Dr.
Lewisberry, PA 17339
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Fax: (717) 938-3301

www.cyclechem.com

General Chemical Corporation
133-138 Leland St., Framingham, MA 01701
Phone: (508) 872-5000 Fax: (508) 875-5271

Material Profile Sheet
Gen.code/Gen #: Stream:(if applicable)
Process/Product Code:

A. GENERATOR INFORMATION

EPA ID # VA1170024722

GENERATOR NAME: MARINE CORPS BASE QUANTICO
MAILING ADDRESS: 3250 CATLIN AVENUE (B046)
QUANTICO VA 22134
GENERATOR CONTACT: BHASKER THAKER
GENERATOR PHONE #: 703-784-4030
GENERATOR FAX: 703-784-4953
SITE ADDRESS: 27007 RUSSELL ROAD (LANDFILL)
QUANTICO VA 22134

BILLING COMPANY: CVI/04 EWSI
BILLING ADDRESS:
BILLING CONTACT: LIBBY NOVAK
BILLING PHONE #: 703-502-0100 FAX: 703-502-1796

NAME OF WASTE: LANDFILL LEACHATE
PROCESS GENERATING WASTE: LANDFILL LEACHATE

B. PHYSICAL CHARACTERISTICS OF WASTE (AT 70° F)

Color / Odor / Physical Description: AMBER / NONE / LIQUID

Wastewater: (•) Wastewater ( ) Non-wastewater
Specific Gravity:
Physical State: [X] Single Phase [ ] Bi-Layered [ ] Multi-Layered [ ] Powder [ ] Solid [X] Liquid [ ] Semi-Solid [ ] Sludge [ ] Gas/Aerosol [ ] Lab Pack

Liquid/Solid/Sludge
% Liquid 100%
% Suspended Solids
% Sludge
% Solid
Combustible? ( ) Yes (•) No
Pumpable? (•) Yes ( ) No
Pourable? (•) Yes ( ) No

Flash Point: ( ) Flash Point <74 F ( ) Flash Point 74-100 F ( ) Flash Point 101-140 F ( ) Flash Point 141-200 F (•) Flash Point >200 F ( ) No Flash Point ( ) Exact Flash Point
( ) Open cup ( ) Closed cup

Potable/Solid? ( ) Yes (•) No
pH: ( ) <2.0 ( ) 2.01-5.0 (•) 5.01-9.0 ( ) 9.01-12.49 ( ) >12.5 ( ) Exact pH

C. CHEMICAL COMPOSITION

ATTACHMENTS: [ ] MSDS attached [ ] Supplemental Analysis [ ] Additional Information [ ] LDR Attachment

Chemical Composition	Percent	Minimum	Maximum
ACETONE		<0.1ppm	
CIS-1,2 DICHLOROETHENE		<0.1ppm	
BERYLLIUM		<0.1ppm	
1,1,-DICHLOROETHANE		<0.1ppm	
OTHER METALS/ORGANICS		K specs	
WATER		balance	
(SEE ATTACHED)			

D. REGULATORY INFORMATION

Is it USEPA Haz waste? (•) Yes ( ) No
USEPA Haz Codes: F039
EPA Sub Categories:
Is it STATE waste? ( ) Yes ( ) No
STATE Haz Codes:
DOT Hazardous Material? (•) Yes ( ) No
Proper Shipping Name: RQ HAZARDOUS WASTE LIQUID, NOS
Hazard Class: 9 UN/NA #: NA3082 P. G.: III
RQ: landfill leachate ERG#: 171

E. SHIPPING INFORMATION

Shipment Method:
[X] Bulk Liquid - Tanker [ ] Bulk Solid - Dump Tr. [ ] Bulk Solid - Rail Car [ ] Pallet(s) [ ] Tote(s) [ ] Cubic Yard Box(s) [X] Drum(Size): 55-Gallon [ ] Other (Size):
Anticipated Volume: LESS THAN 1,000/gallons Per load
Quantity: Price: / Unit:

F. SPECIAL HANDLING CONSIDERATIONS

[ ] Radioactive [ ] Biologic/Medical Waste [ ] Fuming [ ] Phenolics
[ ] PA RW SQG [ ] DRM/SIDRMO Waste [ ] CERCLA Waste [ ] Asbestos
[ ] No Land Filling [ ] Incinerate Only [ ] Recycle Only [ ] Other:

EWSI NEEDS PRICING FOR BULK AND DRUM QUANTITIES
CERTIFICATE OF DISPOSAL REQUIRED

Indicate if waste contains any of the following:

	Non-Reg.	or Less Than	or Actual
PCBs	[X]	[ ] 50 PPM	
Cyanides	[X]	[ ] 250 PPM	
Phenolics	[X]	[ ] 50 PPM	
Sulfides	[X]	[ ] 500 PPM	
VOCs	[X]	[ ] 500 PPM	
Chlorides	[X]	[ ] 1000 PPM	

G. TRANSPORTER ARRANGEMENTS

( ) CCI/GCC Provides Transportation (•) Other:
( ) Customer Delivers to CCI/GCC
( ) Customer Delivers to End Facility via CCI/GCC CVI - BALTIMORE

H. OTHER HAZARDOUS CHARACTERISTICS

[ ] RCRA REACTIVE [ ] WATER REACTIVE [ ] RADIOACTIVE [ ] SUBJECT TO SUBPART FF BENZENE REG
[ ] ETIOLOGICAL [ ] TSCA REG [ ] OXIDIZING MAT'L [ ] PYROPHORIC
[ ] EXPLOSIVE/SHOCK SENSITIVE [X] NONE OF THE ABOVE

1. Is this waste characteristically hazardous for metals or organics (EPA Waste Codes D004 through D043)? ( ) Yes (•) No
If YES, please list the constituents and concentrations in section C.

2. Does this waste contain underlying hazardous constituents as defined in 40 CFR 268 Part 2, Section 1 at concentrations exceeding the UTS treatment standards? (•) Yes ( ) No
If YES, please list the constituents and concentrations in section C.

GENERATOR CERTIFICATION: I hereby certify that all information submitted in this and all other attached documents is complete, contains true and accurate descriptions and is representative of the waste material, and that all relevant information regarding known or suspected hazards in the possession of the generator has been disclosed. If CCI/GCC discovers, after having taken the delivery of the waste, that any waste does not conform to the specifications or descriptions contained in this MPS then CCI/GCC shall provide notice to Generator and coordinate the return, if applicable, of the non conforming waste to the point of origin as set forth in the manifest or to such location designated in writing by the Generator. Generator agrees to reimburse CCI/GCC for all handling, packaging, disposal and transportation costs or charges, damage to equipment and costs associated with lost time incurred by CCI/GCC during the receipt, handling, temporary storage and return of such non conforming waste to the point of origin or to such other location designated by the Generator. I hereby authorize CCI/GCC to amend and correct any information on the MPS with the full understanding that if any amendment or correction is performed, I will be contacted as such to issue any approval.

Authorized Signature: B Thaker Title: Env. Prot. Specialist Date: 11/3/06

CCI/GCC APPROVAL	Sales Code	Tech Initials	Date	Management Initials	Date	Residual Waste / Fate Code

DuPont

DuPont Secure Environmental Treatment

D25298
T025298

FINAL Waste Characterization Profile Sheet

(A) GENERATOR INFORMATION			
Generator	Marine Corps Base Quantico	Submitter	Environmental Waste Specialists Inc.
USEPA I.D. No	VA1170024722	Mail Address	14100 Sullyfield Circle - Suite 400
Site Loc	3250 Catlin Avenue		Chantilly, VA 20151
	Quantico, VA 22134		
Contact Bhasker K Thaker	Ph. 703-784-4030	Contact Libby Novak	Ph. 703-502-0100
	Fax703-784-4953		Fax 703-502-1796

(C) GENERAL WASTE INFORMATION	(B) SPECIFIED TREATMENT		(F) EXPECTED VOLUME			
Name of Waste: landfill leachate	X	Water Treatment			Gal	Drum
Process Generating Waste:		Organic Recovery	Annual	30000	X	
Landfill Leacheate		Oil/Water	Per Load	5000	X	
		Other				
			(J) METHOD OF SHIPMENT			
			TANK TRUCK			

(D) WASTE STREAM COMPOSITION Major Components:	Concentration Range (wt % or ppm) Lower	Upper	Typical	(E) EPA INFORMATION RCRA HAZARDOUS WASTE CODES (and/or State Codes) Codes in () may or may not apply to waste.
ACETONE		<0.1PPM		F039
CIS-1,2 DICHLOROETHENE		<0.1PPM		
BERYLLIUM		<0.1PPM		
1,1-DICHLOROETHANE		<0.1PPM		
OTHER METALS/ORGANICS		SEC.K		
WATER		BALANCE		

(I) PHYSICAL PROPERTIES			
Water miscible: X	Multiple liquid phases:	Oxidizer:	Reaction products with acidic water:
pH Range	5.00 to 9.00	Total Suspended Solids (TSS) (%)	< 1.0
Flash Point (°F)	> 200	Color/Appearance	AMBER
Dissolved Organic Carbon (DOC) (%)	< 0.1	Temperature (as delivered) (°F)	AMB
Total Organic Carbon (TOC) (%)	< 0.1	Odor	N

GENERATOR CERTIFICATION STATEMENT:

I hereby certify that I am authorized to sign this form on behalf of the Wastewater Generator identified, and that I have personally examined and am familiar with the information submitted in this and all attached pages. Based on my inquiry of those individuals immediately responsible for obtaining the information, the submitted information is true, accurate, and complete and all known suspected hazards, including hazardous air pollutants (HAPs) have been disclosed. I further acknowledge my responsibility to immediately inform DuPont of any changes to this information. I acknowledge and recognize that failure to properly identify all components (including HAPs) in, or that may be in, my waste could result in delay, rejection, and/or the imposition of a penalty or surcharge by DuPont. I am aware that DuPont must report all permit exceedances to appropriate environmental agencies. These agencies may bring enforcement actions against companies and individuals who caused the exceedances, to include waste generators who do not provide accurate information to DuPont.

BK Thaker — Generator Signature

Env. Prot Specialist — Title

11/3/06 — Date

DuPont Secure Environmental Treatment

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FINAL Waste Characterization Profile Sheet

(*) Hazardous Air Pollutant (HAP) (N/A = not present)

(K) SPECIFICATIONS	TCLP (ppm)	Total Comp (ppm)		TCLP (ppm)	Total Comp (ppm)
Characteristic Metals			**TC Organics (cont.)**		
Arsenic	<1	<1	(*) Hexachlorobutadiene	N/A	N/A
Barium	<1	<1	(*) Hexachloroethane	N/A	N/A
Cadmium	<1	<1	(*) Methyl ethyl ketone (2-Butanone)	N/A	N/A
Chromium	<3	<3	(*) Nitrobenzene	N/A	N/A
Lead	<1	<1	(*) Pentachlorophenol	N/A	N/A
Mercury	<0.2	<0.2	Pyridine	N/A	N/A
Selenium	<1	<1	(*) Tetrachloroethylene	<0.1	<0.1
Silver	<1	<1	(*) Trichloroethylene	<0.1	<0.1
			(*) 2,4,5-Trichlorophenol	<0.1	<0.1
Other Metals			(*) 2,4,6-Trichlorophenol	N/A	N/A
			(*) Vinyl chloride	N/A	N/A
Antimony		<1			
Chrome +6		<1	**Non-TC Organics**		
Cobalt		N/A			
Copper		<1	(*) Acetaldehyde		N/A
Iron		<200	(*) Acetonitrile		N/A
Molybdenum		N/A	(*) Acetophenone		N/A
Nickel		<10	(*) Acrolein		N/A
Thallium		N/A	(*) Acrylonitrile		N/A
Tin		N/A	(*) Allyl chloride		N/A
Titanium		N/A	Anthracene		N/A
Vanadium		N/A	(*) Benzotrichloride		N/A
Zinc		<1	(*) Benzyl chloride		N/A
			(*) Biphenyl		N/A
Other Components			(*) Bis(2-chloroethyl)ether (Dichloroethyl ether)		N/A
			Bis (2-ethylhexyl) phthalate		N/A
Ammonia		N/A	(*) Bis(chloromethyl) ether		N/A
Cyanides			(*) Bromoform		N/A
- soluble		N/A	(*) 1,3-Butadiene		N/A
- total		N/A	Butyl benzyl phthalate		N/A
- amenable		N/A	(*) Carbon disulfide		N/A
Fluoride		N/A	(*) Carbonyl sulfide		N/A
Mercaptans		N/A	(*) Chloramben		N/A
PCB's		N/A	(*) Chloroethane (Ethyl chloride)		N/A
Sulfides			(*) Chloromethyl methyl ether		N/A
- soluble		N/A	2-Chlorophenol		N/A
- total		N/A	(*) Chloroprene (2-chloro-1,3-butadiene)		N/A
Total organic halogens		N/A	(*) Cumene		N/A
			Cyclohexadiene		N/A
TC Organics			(*) Diazomethane		N/A
			(*) Dibenzofuran		N/A
			(*) 1,2-Dibromo-3-chloropropane		N/A
(*) Benzene	<0.1	<0.1	1,2-Dichlorobenzene (ODCB)		N/A
(*) Carbon tetrachloride	N/A	N/A	(*) 1,1-Dichloroethane (Ethylidene dichloride)		N/A
Chlordane	N/A	N/A	2,4-Dichlorophenol		N/A
(*) Chlorobenzene	N/A	N/A	(*) Dichlorophenoxyacetic acid (2,4-D)		N/A
(*) Chloroform	N/A	N/A	(*) 1,2-Dichloropropane (Propylene dichloride)		N/A
Cresols	N/A	N/A	(*) 1,3-Dichloropropene		N/A
(*) 1,4-Dichlorobenzene	N/A	N/A	Dicyclopentadiene		N/A
(*) 1,2-Dichloroethane (Ethylene dichloride)	<0.02	<0.02	(*) Diethyl sulfate		N/A
(*) 1,1-Dichloroethylene (Vinylidene chloride)	N/A	N/A	Dimethyl hydrazine		N/A
(*) 2,4-Dinitrotoluene	N/A	N/A	(*) Dimethyl sulfate		N/A
Heptachlor	N/A	N/A	(*) N-N-Dimethylaniline		N/A
(*) Hexachlorobenzene	N/A	N/A	(*) Dimethylcarbamoyl chloride		N/A

DuPont Secure Environmental Treatment

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FINAL Waste Characterization Profile Sheet

(*) Hazardous Air Pollutant (HAP) (N/A = not present)

(K) SPECIFICATIONS (cont.)	Total Comp (ppm)		Total Comp (ppm)
Non-TC Organics (cont.)		Non-TC Organics (cont.)	
2,4-Dimethylphenol	N/A	(*) Methyl tert-butyl ether	0.0052
Di-n-butyl phthalate	N/A	Methylacetylene	N/A
4,6 Dinitro-o-cresol	N/A	(*) Methylene chloride (Dichloromethane)	0.0078
(*) 2,4-Dinitrophenol	N/A	Monomethyl aniline	N/A
2,6-Dinitrotoluene	N/A	Monomethyl hydrazine	N/A
Di-n-octal phthalate	N/A	(*) Naphthalene	N/A
(*) 1,4-Dioxane (1,4-Diethyleneoxide)	N/A	2-Nitrophenol	N/A
(*) Epichlorohydrin	N/A	4-Nitrophenol	N/A
(*) 1,2-Epoxybutane	N/A	(*) 2-Nitropropane	N/A
(*) Ethyl acrylate	N/A	1,1-Oxybis butane	N/A
(*) Ethyl benzene	N/A	(*) Pentachloronitrobenzene (Quintobenzene)	N/A
(*) Ethylene dibromide (Dibromoethane)	N/A	Phenanthrene	N/A
(*) Ethylene imine (Aziridine)	N/A	Phenol	N/A
(*) Ethylene oxide	N/A	(*) Phosgene	N/A
Formaldehyde	N/A	(*) Propionaldehyde	N/A
Fluorene	N/A	(*) Propylene oxide	N/A
Furfuryl alcohol	N/A	(*) 1,2-Propylenimine (2-Methyl aziridine)	N/A
(*) GE- Diethylene Glycol diethyl ether	N/A	Pyrene	N/A
(*) GE- Diethylene Glycol dimethyl ether	N/A	(*) Styrene	N/A
(*) GE- Ethylene Glycol dimethyl ether	N/A	(*) Styrene oxide	N/A
(*) GE- Ethylene Glycol monobutyl ether acetate	N/A	(*) 1,1,2,2-Tetrachloroethane	N/A
(*) GE- Ethylene Glycol monoethyl ether acetate	N/A	Tetramethyl lead	N/A
(*) GE- Ethylene Glycol monomethyl ether acetate	N/A	(*) Toluene	N/A
(*) Hexane	N/A	Toluene diisocyanate	N/A
Hydrazine	N/A	(*) o-Toluidine	N/A
(*) Isophorone	N/A	(*) 1,2,4-Trichlorobenzene	N/A
(*) Lindane	N/A	(*) 1,1,1-Trichloroethane (Methyl chloroform)	N/A
(*) Methanol	N/A	(*) 1,1,2-Trichloroethane (Vinyl trichloride)	N/A
(*) Methyl bromide (Bromomethane)	N/A	(*) Triethylamine	N/A
(*) Methyl chloride (Chloromethane)	N/A	(*) 2,2,4-Trimethylpentane	N/A
(*) Methyl iodide (Iodomethane)	N/A	(*) Vinyl acetate	N/A
(*) Methyl isobutyl ketone (Hexone)	N/A	(*) Vinyl bromide	N/A
(*) Methyl isocyanate	N/A	(*) Xylenes (Isomers and mixtures)	N/A
(*) Methyl methacrylate	N/A		

(L) ADDITIONAL SPECIFICATIONS

Cannot accept waste with requirements for Benzene NESHAP Controls or HON Group 1 Controls. An LDR form is required with each shipment that was hazardous "As Generated" but has been rendered Non-Hazardous by treatment. All waste must be flowable, and all truck and rail cars must be bottom-unloading.

PLEASE NOTE ALL LIMITS/CODES ABOVE

APPROVED FOR F039 HAZ WASTE ONLY

MINIMUM P.P.E.

Approved By

DuPont Environmental Treatment Signature _____ Date _____

ATTACHMENT E

POST-CLOSURE PLAN

CLOSED HAZARDOUS WASTE LANDFILL

RUSSELL ROAD LANDFILL - MARINE CORPS BASE QUANTICO, VA

ATTACHMENT E

POST-CLOSURE PLAN

CLOSED HAZARDOUS WASTE LANDFILL

RUSSELL ROAD LANDFILL - MARINE CORPS BASE QUANTICO, VA

E. INTRODUCTION - BACKGROUND

E.1. The 28-acre MCB Quantico Russell Road Landfill (RRL) was the primary land disposal facility for MCB Quantico from 1971 until 1983, and received a variety of hazardous and non-hazardous waste streams. The landfill was closed by capping in accordance with the approved closure plan, dated December 30, 1994. The Department received the certifications of closure, dated July 1997, and subsequently received the required Closure Report to document closure in accordance with the approved Closure Plan.

The Department concurred by correspondence, dated September 3, 1998, that the closure was conducted in accordance with the approved plan, as amended, under the Virginia Hazardous Waste Management Regulations (VHWMR) under 9 VAC 20-60, and as incorporated by reference, the Resource Conservation and Recovery Act (RCRA) Regulations. Therefore, the closure date for the landfill is September 3, 1998.

The post-closure care period for the landfill shall continue for 30 years after the Department's approval of the certification of closure, therefore, the post-closure care period shall continue until September 3, 2028.

Hazardous waste management at the landfill Facility addressed by this Permit currently includes, but is not limited to, the following activities: operation and maintenance (O&M) of the landfill cover/cap and cap drainage system, O&M of the runoff and erosion and sedimentation control structures and systems, O&M of the landfill leachate system, groundwater monitoring, landfill gas monitoring, and groundwater corrective action (CA). These above requirements are as specified in this Permit, and in accordance with the requirements of Permit Modules I through and IX, and in accordance with the requirements of the VHWMR and the RCRA Regulations under 40 CFR Part 264, Subpart F, Releases from Solid waste Management Units.

Hazardous waste leachate with hazardous waste number/code F039 is collected and managed by lateral leachate collection system (installed around the perimeter of the landfill) and a leachate collection sump, which were installed at closure to mitigate the lateral migration of leachate from the closed "Regulated Unit." Landfill leachate is assigned the hazardous waste number/code of F039 where liquids have percolated through land disposed wastes resulting from the disposal of more than one restricted waste which is classified as hazardous under 40 CFR Part 261, Subpart D. Leachate which is collected in the sump is manifested and shipped off-site to a regulated treatment, storage, disposal (TSD) facility regulated under the RCRA Regulations as F039 wastes.

E.2. CLOSURE STANDARDS

The facility was closed as a hazardous waste landfill with hazardous waste closed-in-place in accordance with all applicable RCRA cap design and construction requirements to meet the requirements of the VHWMR and the RCRA Regulations.

E.2.a. Final Cover

The slopes were graded between 3.3% and 10% and a RCRA cap was constructed over the disposal area. The final cover consists of: a 24-inch clay liner with maximum permeability of 1×10^{-7}; a 40-mil, very low density polyethylene flexible membrane cap in direct and uniform contact with the clay liner or cap; a 10-ounce geotextile fabric filter; a 12-inch drainage layer; a second 10-ounce filter fabric layer; and an 18-inch erosion layer with an additional 6-inch topsoil layer to support vegetation. The landfill facility also has a passive leachate collection system and a landfill gas venting system.

Figure 2-2, Existing Perimeter Leachate Collection System Detail, Tetra Tech NUS, Inc., provides a cross sectional view of the landfill cap and drainage layer design along with the perimeter leachate collection system. **(See Appendix E-6.)**

E.2.b. List of Wastes

During operation, the landfill functioned as the primary disposal facility for the base; therefore, it is not possible to determine the exact list of wastes and hazardous wastes. The Permittee has provided an estimate of the type, quantities, and origins of Hazardous Wastes in Table 1 of the Approved Closure plan, which is found in **Attachment D, Appendix D-1, Table 2-1**.

However, the Permittee's groundwater monitoring program is based upon the list of constituents on 40 CFR Part 261, Appendix VIII, and 40 CFR Part 264, Appendix IX. Constituents that were not detected above established background concentrations in groundwater were not included in the groundwater monitoring program.

E.2c. Liner System Description

There is no bottom liner installed in the landfill.

However, there was a high density polyethylene (HDPE) liner and leachate collection trench system installed to a depth of 20 feet below grade around the perimeter of the landfill to mitigate and minimize the lateral migration of leachate from the landfill. (See **Appendix E-6** Text and Figures herein this Post-Closure Plan, and **Permit Condition III.B.1.d.**)

Figure 2-2, Existing Perimeter Leachate Collection System Detail, Tetra Tech NUS, Inc., provides a cross sectional view of the landfill cap and drainage layer design along with the perimeter leachate collection system. **(See Appendix E-6.)**

E.2.d. Leachate Collection and Detection System

The leachate collection system is fully described and illustrated in the approved Closure Plan and Post Closure Plan. Excerpts from the MCB Quantico's RRL Closure Plans and Post-Closure Plans and related design plans and specifications are provided in **Appendix E-6.**

The leachate collection trench was designed to minimize the lateral migration of leachate from the landfill. (See Sheet RD-6, Record Drawing - Investigation and Monitoring of the Landfill Closure Plan.)

The leachate collection system was located approximately 2 feet outside the limits of waste, after relocation of waste from the clean closure areas. The maximum depth of the leachate collection trench was 20 feet. The trench had maximum side slopes of 1.5 feet horizontal to 1 foot vertical (1.5H:1V). At the bottom of the "V" trench, a 2-foot-wide rectangular section was excavated. The rectangular excavation ranged in depth from 2 feet to 4 feet. A single layer of smooth 60-mil HDPE lined the trench and extended up the outer excavation slope to an anchor trench at the same elevation as the landfill cap anchor trench. The bottom section of the trench was to accommodate the drainage media (stone) and pipe to collect and convey the leachate.

The anchor trench of the leachate collection liner was approximately 2 feet inside the final cap anchor trench. An additional 60,000 cubic yards of waste/debris were removed from the leachate collection trench during the excavation activities. In accordance with Section 5.3 of the "Closure In-Place and Post-Closure Care Plan," waste encountered during trench excavation was removed and placed within the limits of the landfill cap. Waste, such as large or sharp debris that would pose some risk to the integrity of the leachate collection trench liner, was relocated to the portion of the landfill that is inside the leachate collection trench.

A typical cross-section of the leachate collection trench is shown in the on Details 1 and 3, Sheet RD-11, Record Drawing Miscellaneous Details, of the Landfill Closure Plan.

Figure 2-2, Existing Perimeter Leachate Collection System Detail, Tetra Tech NUS, Inc., provides a cross sectional view of the landfill cap and drainage layer design along with the perimeter leachate collection system. **(See Appendix E-6.)**

Approximately 5,700 linear feet of 4-inch-diameter, perforated, HDPE pipe was placed on top of the 3-inch-thick stone bedding layer in the leachate collection trench. The pipe was sloped from the north end (high) of the landfill and extended along both the east and west sides to a single sump located in the southwest comer as shown on Sheet RD-6, Record Drawing - Investigation and Monitoring of the Landfill Closure Plan. The slope of the pipe ranged from a minimum of 1 percent to a maximum of 3 percent. The pipe was butt fusion welded by OHM recovery technicians in accordance with the manufacturer's specifications.

In the southwest corner of the landfill, where the two leachate collection lines meet, a tee coupling was used to connect a 4-inch-diameter, double-walled, leachate trench HDPE pipe. The double-walled pipe was passed through and booted to the 60-mil leachate collection trench liner of the excavation and extended to the HDPE sump. The double-wall pipe terminates in the leachate collection sump. (See Details 6 and 7, Sheet RD-11, Record Drawing -Miscellaneous Details, of the Landfill Closure Plan.)

During installation of the leachate collection pipe network, OHM installed 13 cleanouts at approximately 400-foot intervals. (See Sheet RD-1, Record Drawing - Final Conditions Topographic Map, of the Landfill Closure Plan.) The cleanouts were installed by butt fusion welding a 45-degree "Y" to the main line, then welding 20-foot sections of solid 4-inch-diameter, I-IDPE SDR 17 pipe, and cap to the "Y" connection.

The cleanouts were extended as necessary to ensure that when the topsoil layer was installed, the cleanouts would be exposed to minimum of 12 inches above the final cap grade as shown on Sheet RD-1, Record Drawing - Final Conditions Topographic Map, of the Landfill Closure Plan.

Four steel bollards were installed around each cleanout to protect the cleanouts from damage during cap maintenance activities. The bollards were painted orange and the exposed section of the cleanout pipe was painted white for visibility. VDOT No. 8 stone was also placed in a 4-foot x 4-foot area around the cleanout pipes to keep grass from camouflaging the exposed sections.

E.2.e. Gas Vent Monitoring System

Passive gas vents were installed at the locations shown on Sheet RD-6, Record Drawing - Investigation and Monitoring, in **Appendix E-6, Permit Attachment C, and Permit Attachment S**. In addition to the gas monitoring wells inside the landfill, four (4) gas monitoring wells/probes were installed at the southern end of the landfill cap by Badger Drilling. The four gas monitoring wells/probes provide a means to monitor the concentrations of methane and oxygen in soil gases just outside the landfill cap.

Permit Attachment S provides the Methane Gas Migration Assessment and Remediation Plan.

If, at any time during gas monitoring, if the concentration of methane gas reaches or exceeds 5 percent by volume in air (5 % is equivalent to the lower explosive limit (LEL)), the MCB Quantico will commission a study to be conducted by a professional engineer to determine the source (i.e., gas control system failure, climatic conditions, etc.), extent of migration, concentration, direction, and any necessary corrective action. Additional probes may have to be installed and additional characterization of the soil strata, within the area of concern, will be made.

If a gas migration problem is demonstrated to exist or is imminent, the engineer will design the appropriate corrective action. The Department will be notified within 5 working days of learning that gas monitoring compliance levels have been exceeded. A

gas remediation plan will be prepared and implemented within 60 days of exceeding regulatory methane levels, and submitted to the Department for approval. Because no structures are next to the landfill, there is no immediate danger to human health. Access to the area will be restricted while the extent of methane migration is determined.

E.2.f. Corrective Action Plan for Groundwater

Groundwater Protection Standards (GPSs) for groundwater at the point of compliance (POC) wells MW-9 and MW-15R had been exceeded at the time of permit issuance of the first Post-Closure Permit, dated October 29, 2000. (Monitoring well MW-9 is in the North end of the landfill and monitoring well MW-15R is in the South end of the landfill.) The primary contaminants detected above GPSs at MW-9 are Tetrachloroethylene and Trichloroethylene and the contaminant at MW-15R is cis-l,2-Dichloroethylene.

In addition, exceedances of Tetrachloroethylene, Trichloroethylene, cis-l, 2-Dichloroethylene, and Vinyl Chloride were identified as COCs in temporary monitoring wells screened to the plume near MW-15R during a field investigation conducted in the summer of 2003. The results of the groundwater delineation investigation indicated two discrete areas limited to the vicinity surrounding monitoring wells MW-9 and MW-15R (North and South Treatment Areas, respectively).

To address the exceedances of GPSs and to ensure that the contaminants do not continue to migrate, MCB Quantico-RRL implemented a Corrective Action Program based on specifications in the CAP in **Permit Attachment T**. The initial CAP was submitted to the Department in 2004, and incorporated into the Facility's Permit. A revised CAP was submitted to the Department in 2008.

An updated and revised CAP, dated June 2011, was submitted in the revised permit application for reissuance, received by the DEQ on June 1, 2011. The updated CAP, dated June 1, 2011, provides an update of the CA remediation findings and describes the nature and extent of contamination in the North and South Treatment Areas of the RRL.

The Corrective Action Program consists of two remediation systems for enhanced natural attenuation of volatile organic constituents (VOCs) in groundwater via electron donor injections (located at MW-9 and MW-15R) and groundwater monitoring for remedial effectiveness and compliance with GPSs. Groundwater corrective action and groundwater monitoring shall be performed in accordance with conditions of **Permit Module VI, Corrective Action Program – Groundwater Monitoring - Regulated Unit, Permit Attachment J, Sampling and Analysis Plan [SAP], and Permit Attachment T, Corrective Action Plan for Groundwater.**

E.3. POST-CLOSURE STANDARDS

Post-closure care will be performed in accordance with standards for Permitted Hazardous Waste Management Facilities under 40 CFR Part 264.

After final closure of the Russell Road Landfill (RRL), a copy of the approved Post-Closure Plan shall be furnished to the USEPA Region III, Regional Administrator, and the DEQ Director upon request, including a request by mail.

In accordance with 40 CFR § 264.310, after final closure of the RRL, the Facility must comply with all post-closure requirements contained in 40 CFR § 264.117 through § 264.120, including maintenance and monitoring throughout the post-closure care period specified in the Permit under § 264.117.

The MCB Quantico Facility shall:

1. Maintain the integrity and effectiveness of the final cover, including making repairs to the cap as necessary to correct the effects of settling, subsidence, erosion, or other events.

2. Continue to operate the leachate collection and removal system until leachate is no longer detected.

3. Maintain, monitor, the leachate detection system and comply with all applicable leak detection system requirements, and empty the leachate collection sumps at least every 90 days. The Facility will check the sumps secondary containment systems for leaks and repair and/or replace as necessary.

4. Maintain and monitor the groundwater monitoring system and comply with all other applicable requirements of 40 CFR Part 264, Subpart F.

5. Prevent run-on and run-off from eroding or otherwise damaging the final cover.

6. Protect and maintain surveyed benchmarks used in complying with 40 CFR § 264.309.

7. Manage the multi-source hazardous waste leachate as (F039) listed wastes in accordance with the VHWMR, and the RCRA Regulations.

8. Maintain adequate security to prohibit unauthorized access and disturbance of the landfill site.

9. Map the location and approximate dimensions of the landfill, including the depth of the landfill with respect to permanently surveyed benchmarks and drawings.

10. Estimate the nature and contents of the landfill and their locations, as feasible.

E.4. POST-CLOSURE CARE USE OF THE PROPERTY

In accordance with 40 CFR § 264.117, post-closure use of the property on or in which hazardous wastes remain after final closure must never be allowed to disturb the integrity of the final cover, liner(s), or any other components of the containment system or the

function of the facility's monitoring systems, unless the Director finds that the disturbance:

1. Is necessary to the proposed use of the property and will not increase the potential hazard to human health or the environment; or

2. Is necessary to reduce the threat to human health or the environment.

Therefore, written permission of the Department is required prior to implementation of post-closure use of the property, which is not in accordance with the approved Post-Closure Plan.

In accordance with 40 CFR § 264.117(a)(2), the Director may shorten or extend the post-closure care period for the landfill if doing so will protect human health and the environment.

The MCB Quantico Facility understands that any future activities carried out at the capped landfill will be furnished to the DEQ Director. At this time, there are no plans to use the capped landfill.

Signs posted along the landfill boundaries will warn that breaking of the ground surface is prohibited. This notice is designed to help ensure the integrity of the clay cap is maintained and not disturbed.

E.5. CERTIFICATIONS OF CLOSURE

Within 60 days of completion of closure, MCB Quantico was required to submit to Department, by registered mail, a certification that the landfill was closed in accordance with the specifications in the approved Closure Plan. The certifications were signed by the owner/ operator and by an independent professional engineer registered in the Commonwealth of Virginia. Documentation supporting the owner/operator's and independent registered professional engineer's certifications of closure were furnished to the Director and are included in **Appendix E-1**. **Appendix E-1** also includes the owner/operator's and P.E. Certifications for the submittal of the revised Part B, RCRA Permit Application submittal, received by the DEQ on June 1, 2011.

E.6. SURVEY PLAT

By the time that the certification of closure of the Russell Road landfill was submitted, the MCB Quantico Facility submitted a survey plat indicating the location and dimensions of the capped landfill area with respect to permanently surveyed benchmarks to the authority with jurisdiction over local land use, the USEPA Regional Administrator, and to the DEQ's Director.

In accordance with 40 CFR Part 264, Subpart G, Closure and Post-Closure, and § 264.116, a survey plat of the closed landfill was prepared and certified by a professional land surveyor. The survey plat was filed with the authority with jurisdiction

over local land use, and contained a note, prominently displayed, which states MCB Quantico's obligations to restrict disturbance of the capped landfill disposal area.

A Survey Plat with 2 benchmarks and the required post-closure notices and restrictions has been filed with the Washington Navy Yard and the Real Estate Office of the Marine Corps Base, Quantico, the EPA, and the DEQ. The DEQ received a copy of the Survey Plat and the specified post-closure notices and restrictions on July 13, 1999. A copy of the Survey is in Appendix E-2. (A pdf file/electronic copy of this Landfill Survey is maintained in the DEQ's Electronic Management System.)

E.7. SECURITY CONTROLS

Security shall be sufficient to comply with security requirements under 40 CFR § 264.14 and § 264.117(b). Adequate security shall be maintained to prohibit unauthorized access to the landfill site.

The RRL is bordered by a fence on three sides and a stream on the fourth side. Access points through the fence are through locked gates. Gates to the Facility are locked in order to prevent unauthorized access. Additional security measures will be implemented if there are signs of intrusion into the landfill area.

Warning signs are placed around the landfill gates, fencing, and perimeter warning against unauthorized entry to the RRL Facility. The warning signs state: "Warning-Disturbing Soil Surface Prohibited" locations at the capped disposal area to ensure the area is not disturbed. Additional warning signs state: "Danger - Keep Out Authorized Personnel Only" are posted at the south entrance gates to the landfill adjacent to the gravel access road. A fence with gates at the perimeter access roads is installed along the south perimeter of the capped landfill to control access from the adjacent road.

General access to RRL Facility is controlled by MCB Quantico's Base Security; secured access to the RRL Facility is through authorized personnel only.

Inspections of the RRL Facility are conducted a minimum of twice a year (semi-annually) to verify no unauthorized entry or activity is being conducted.

E.8. INSPECTIONS AND MAINTENANCE SCHEDULE

E.8.a. General Inspection Requirements

The MCB Quantico Facility is to comply with 40 CFR § 264.15, General Inspection Requirements, for the Russell Road Landfill (RRL) Facility.

In accordance with 40 CFR § 264.15, the Permittee is to follow a written inspection schedule for inspections and identification of malfunctions, deterioration, or operational errors in the final landfill cap, the leachate collection systems, and leachate collection sump, the gas vents, the gas and groundwater monitoring systems, and the runoff management systems for the landfill.

The MCB Quantico Facility is to implement the necessary operation and maintenance and/or remedial action when necessary for any malfunctions or deterioration of equipment or systems is identified.

The MCB Quantico Facility is to maintain signed and dated inspection logs at the Facility, and be made available to the DEQ upon request, which provides inspection observations, noted deficiencies, and corrective action taken.

Inspection requirements of the RRL are identified in this Post-Closure Plan and are also included in **Permit Attachment H, Inspection Requirements.** (An example of several inspection logs containing the minimum information are included in Appendices 1 through 3 of **Permit Attachment H.**)

The Permittee shall inspect, at the frequency specified below, for the following and in accordance with **Permit Attachment H, Inspection Requirements**:

1. The groundwater monitoring wells, piezometers, corrective action (CA) treatment injection wells, shall be inspected annually and during sampling events. Wells and piezometers shall be inspected for obstructions, bends, excess sediment accumulation, grout erosion, inadequate yield, etc.

2. The landfill benchmarks, landfill gas vents, and gas vent monitoring wells shall be inspected annually. **(Gas monitoring will be conducted annually and is to be conducted during the summer months.)**

3. The landfill cap, the vegetative cover, the cap drainage collection system (immediately above the landfill cap/liner, but below the vegetative cover), the surface runoff management control systems (such as the constructed drainage ways, surface runoff impoundments (sediment basins), and inlets and outlets to the sediment basins) shall be inspected quarterly, and after major rainfall events (defined as 2 inches/8 hr period).

4. The lateral leachate collection system and leachate collection sump shall be inspected monthly and after major rainfall events. If the auto dialer system is inoperable, the leachate collection sump will be inspected weekly.

5. Leachate collection sump, alarm system, and auto-dialer system integrity, operation and maintenance. Alarm and auto-dialer systems shall be tested at a minimum on a semi-annual basis.

6. Inspections of the RRL Facility are conducted a minimum of twice a year (semi-annually) to verify no unauthorized entry or activity is being conducted; however, the integrity of security measures are to be observed and assessed during other routine inspections of the RRL Facility. Additional security measures will be implemented if there are signs of intrusion into the landfill area.

7. A professional engineer, registered in the Commonwealth of Virginia, shall inspect the site annually to assess the condition of the landfill with regards to the

approved Closure Plan and Permit Post-Closure Plan requirements, and plans and specifications, and shall report any identified deficiencies in a written and certified Report. This Report with the engineer's certification shall be submitted to the Director in accordance with **Permit Condition I.E.3.**

If the engineer discovers a deficiency in the landfill cap, this deficiency will be noted and corrective action will be initiated within 14 days.

Table 14 in this Post-Closure Plan provides an example inspection log. Other example landfill inspection logs are provided in **Permit Attachment H**.

The following items will be inspected and maintained during the post closure care period:

1. Security controls - effectiveness and breaches.

2 Erosion and sedimentation controls - run-on and run-off controls operation and maintenance.

3. Vegetative cover condition and maintenance.

4. Final landfill cover and landfill cap system integrity and maintenance. (Landfill cover settlement, subsidence, and displacement.)

5. Lateral leachate collection system integrity, operation and maintenance.

6. Leachate collection sump, alarm system, and auto-dialer system integrity, operation and maintenance. Alarm and auto-dialer systems shall be tested at a minimum on a semi-annual basis.

7. Groundwater monitoring wells and system.

8. Gas vents and gas monitoring wells system.

9. Benchmarks.

E.9. Erosion and Sedimentation Controls - Run-On and Run-Off Controls

Excerpts of information from the MCB Quantico's Russell Road Landfill (RRL) Closure Plans and Post-Closure Plans and related design plans and specifications are provided in Appendix E-5, which describe the constructed engineered infrastructure and erosion and sedimentation control systems, which were designed to control runoff and to minimize sedimentation of surface waters.

An adequate stand of grass was established before termination of the construction contractor's contract of the Landfill. Permanent diversion ditches around the perimeter of

the landfill direct surface water flow into temporary slope drains to control runoff and prevent erosion.

After construction of the landfill was completed and vegetation established, the temporary slope drains were to be removed and permanent rip-rap lined channels under the temporary drains are to be maintained. The permanent rip-rap lined channels will direct surface runoff and subsurface runoff from the lateral drainage layer away from the landfill area and into the surface water drainage system surrounding the landfill.

Temporary erosion controls were maintained until the vegetation was well established.

Temporary sediment traps and rock check dams will be placed where needed to prevent erosion and control flow. The rip-rap lined channels, diversion ditches, and rock check dams will be maintained throughout the post-closure period.

Cover erosion of 0.33 tons/acre/year was predicted using the United States Department of Agriculture Universal Soil Loss Equation (Calculation 11, Appendix A of the approved Closure Plan). This rate of soil loss is less than the maximum allowance of 2 tons/acre/year. Therefore, the slope of the cap should not cause significant erosion.

The final cover of the RCRA cap will be inspected monthly and after major rainfall events (defined as 2 inches in an 8-hour period) throughout the post-closure care of 30 years. The inspector will look for evidence of settlement, subsidence, or displacement; drainage and ponding of surface water; damaged vegetation; presence of undesirable vegetation; and erosion.

Areas of minor erosion in the final cover will be backfilled or regraded as necessary and reseeded, in accordance with this Post-Closure Plan. Areas of significant erosion will be repaired by placing appropriate layers of the RCRA cap as necessary and re-seeding as described in this Post-Closure Plan. Repaired areas of the final cover will be monitored until vegetation is successfully re-established.

The integrity of run-on and runoff control measures such as the constructed drainage ways (drainage ditches), surface runoff impoundments (sedimentation basins), and inlets and outlets to the sediment basins, etc., shall be inspected quarterly and after major rainfall events.

The topography of the Russell Road landfill is such that run-on of precipitation is not a concern. The site has been graded to allow relatively uniform runoff from the capped area. Runoff from the cap will flow into existing ditches and streams surrounding the landfill, via constructed drainage ways or drainage ditches.

Any erosion problems identified during inspections are to be corrected promptly. Existing erosion controls are to be repaired or improved as necessary. Additional erosion control measures will be installed if the existing measures prove to be inadequate.

E.10. VEGETATIVE COVER CONDITION AND MAINTENANCE

The condition of the vegetation of the capped area and perimeter of the landfill area will be inspected quarterly and after major rainfall events (defined as 2 inches/8 hr. period).

If the inspection shows stressed or dead vegetation, an evaluation will be performed to determine the extent and cause of the problem. Appropriate remedial measures, such as topsoil replacement or pH adjustment, fertilization, etc., will be taken and the area will be reseeded in accordance with this Post-Closure Plan and the construction specifications of the Closure Plan.

The vegetation will be cut during the growing season or as necessary so that visual observation of potential problems on the cap can be seen, and that no large rooted vegetation (i.e., trees and other rooted woody species) develops which could puncture the very low density polyethylene (VLDPE) landfill liner/cap/cover.

E.11. FINAL LANDFILL COVER AND LANDFILL CAP SYSTEM

The final cover of the RCRA cap will be inspected monthly and after major rainfall events (defined as 2 inches in an 8-hour period) throughout the post-closure care of 30 years.

The inspector will look for evidence of settlement, subsidence, or displacement; drainage and ponding of surface water; damaged vegetation; presence of undesirable vegetation; and erosion.

Areas of minor erosion in the final cover will be backfilled or regraded as necessary and reseeded, fertilized, etc. in accordance with this Post-Closure Plan. Areas of significant erosion will be repaired by placing appropriate layers of the RCRA cap as necessary and re-seeding as described in this Post-Closure Plan. Repaired areas of the final cover will be monitored until vegetation is successfully re-established.

Plans and specifications of the approved Closure Plan and Post-Closure Plan, provide the detail of the landfill cap and cover system and the drainage system installed to remove rainwater and to prevent rainwater from infiltrating into the landfill proper. Such rainwater is collected and discharged to the surface drainage system. (See **Appendix E-5, Drainage Layer Design.**)

Damage to the landfill cap or any puncture of the VLDPE landfill cap/cover and drainage layer system will need to be repaired in accordance with the approved Closure Plan and Post-Closure Plan.

E.12. LATERAL LEACHATE COLLECTION SYSTEM

The perimeter of the landfill and the lateral leachate collection system (trench and leachate collection sump system) will be inspected monthly and after major rainfall events (defined as 2 inches/8 hr. period).

The collection sumps will be inspected monthly and emptied at a minimum of every 90 days.

If evidence of blockage is detected in the lateral leachate collection system or sump (e.g., leachate is visible at the ground surface, blocked and/or damaged collection lines will be cleaned by "snaking" to eliminate the blockage. If the line is in need of repair, it will be repaired to comply with the approved Closure Plan and Post-Closure Plan Plans and Specifications.

If there is evidence of leachate leaking from the primary containment sump into the secondary containment area sump, the leachate collection sump system will be replaced or repaired as necessary so to comply with the approved Closure Plan and Post-Closure Plan, and Plans and Specifications.

The collection sump system (a 2,020 gallon, double walled tank) will be inspected monthly when autodialer is working and emptied every 90 days. In the case of autodialer failure, the collection sump system will be inspected weekly during regular business hours and after major rainfall events.

The leachate collection sump is equipped with a high level alarms and an auto-dialer system to notify the MCB Quantico Public Works Office when the capacity of the sump is being approached.

The leachate collection sumps high level alarms and auto-dialer systems integrity, operational functionality shall be tested on a semi-annual basis.

Any malfunctioning leachate collection, sump alarm and auto-dialer systems shall be reported to the Director and repaired in a timely manner so to comply with the approved Closure Plan and Post-Closure Plan plans and specifications.

The multi-source leachate F039 waste generated will be managed as a hazardous waste and in full accordance with the VHWMR.

Appendix E-3 provides detailed information on the leachate collection system, sump, and alarm system.

Appendix E-6 provides excerpts of information from the MCB Quantico's Russell Road Landfill (RRL) Closure Plans and Post-Closure Plans and related design plans and specifications which describe the landfill's perimeter liner and leachate collection system designed to control the lateral migration of leachate from the landfill and to collect the leachate for subsequent storage, treatment, and disposal to a RCRA permitted treatment, storage, disposal (TSD) facility.

E.13. GROUNDWATER MONITORING WELLS AND SYSTEM

Groundwater monitoring will be conducted in accordance with the groundwater monitoring required under **Permit Module VI, Corrective Action Program,**

Groundwater Monitoring – Regulated Unit, Permit Attachment J, Sampling and Analysis Plan, and Permit Attachment T, Corrective Action Plan.

At least annually, the Permittee shall inspect and maintain all monitoring wells and piezometers to sustain their original intended purpose. Monitoring well locking caps shall be locked at all times except when the monitoring wells are being sampled or maintained

The groundwater monitoring wells and piezometers and CA treatment injection wells will be inspected annually and during sampling events for damage to wells, caps, and locks. The inner cap and well will also be examined for damage. The monitoring wells and piezometers, and injection wells shall be inspected for obstructions, bends, excess sediment accumulation, grout erosion, inadequate yield, etc.

Protective concrete aprons shall be inspected for subsidence and breakage.

During the post-closure care period, locks will be lubricated or replaced as required, well caps will be replaced as necessary, and concrete pads and guard posts will be repaired or replaced as necessary.

During the post-closure care period, the monitoring wells and piezometers will be maintained in accordance with the approved Closure Plan and Post-Closure Plan, the design Plans and Specifications, and best engineering practices, as needed.

Damage to wells, piezometers, and corrective action (CA) injection wells will be repaired and replaced as necessary, so the wells, piezometers, and injection wells perform as designed. If damage is severe, the entire well, piezometer, or injection well may need to be replaced so to perform as designed, and/or so to prevent short circuiting of surface water to groundwater.

For monitoring well diagrams, see **Permit Attachment P**. Injection wells are included under **Permit Attachment T.** Information regarding gas monitoring wells is in **Permit Attachment S.**

E.14. GAS VENT/MONITORING SYSTEM

Landfill gas monitoring will be monitored from the gas vent monitoring wells and system, and the leachate collection sump, etc., in accordance with the gas monitoring requirements under **Permit Module III, Post-Closure Care, Corrective Action Program, Groundwater Monitoring – Regulated Unit, and Permit Attachment S, Methane Gas Migration Assessment and Remediation Plan.**

The gas venting/monitoring system will be inspected annually for damage to the vents and the probes/wells.

Gas monitoring will be conducted annually and is to be conducted during the summer months.

During post-closure care, the vents and probes will be maintained in accordance with the design plans and specifications of the Permit Attachment S, and best engineering practices, as needed. Damage to vents and probes/wells will be repaired and replaced as necessary. If damage is severe, the entire vent or probe may be replaced.

Information regarding gas monitoring wells is in **Permit Attachment S.**

E.15. BENCHMARKS

Benchmarks were installed in accordance with the landfill survey requirements of 40 CFR § 264.116. The benchmarks are critical to act as points of reference for locating the monitoring wells and determining the elevations of the groundwater potentiometric surface. Benchmarks were installed by a certified land surveyor. Their location and elevations are tied into the property boundaries and USGS Datum's and the benchmarks are recorded in the survey plat filed with the Washington Navy Yard and the Real Estate Office of the Marine Corps Base, Quantico. **(See Appendix E-2., Survey Plat.)**

The location and elevation of the benchmarks shall be determined annually and any changes noted in the log book. The benchmarks shall be inspected annually for any disturbance and maintained as necessary to sustain their intended use. Any changes,

required maintenance, or corrective measures to the benchmarks that are necessary shall be reported to the Department in the semi-annual groundwater monitoring reports.

E.16. POST-CLOSURE NOTICES

In accordance with 40 CFR Part 264, Subpart G, § 264.119, Post-Closure Notices, no later than 60 days after certification of closure of each hazardous waste disposal unit, the owner or operator must submit to the local zoning authority, or the authority with jurisdiction over local land use, to the Regional Administrator, and the Department, a record of the type, location, and quantity of hazardous wastes disposed of within each cell or other disposal unit of the facility.

For hazardous wastes disposed of before January 12, 1981, the owner or operator must identify the type, location, and quantity of the hazardous wastes to the best of his knowledge and in accordance with any records he has kept.

Within 60 days of certification of closure of the first hazardous waste disposal unit and within 60 days of certification of closure of the last hazardous waste disposal unit, the owner or operator must:

1. Record, in accordance with State law, a notation on the deed to the facility property--or on some other instrument which is normally examined during title search--that will in perpetuity notify any potential purchaser of the property that:

   (i) The land has been used to manage hazardous wastes; and

   (ii) Its use is restricted under 40 CFR part 264, Subpart G Regulations; and

   (iii) The survey plat and record of the type, location, and quantity of hazardous wastes disposed of within each cell or other hazardous waste disposal unit of the facility required by 40 CFR § 264.116 and § 264.119(a) have been filed with the local zoning authority or the authority with jurisdiction over local land use and with the Regional Administrator and Director; and

2. Submit a certification, signed by the owner or operator, that he has recorded the notation specified in paragraph (b)(1) of this section, including a copy of the document in which the notation has been placed, to the Regional Administrator and Director.

If the owner or operator or any subsequent owner or operator of the land upon which a hazardous waste disposal unit is located wishes to remove hazardous wastes and hazardous waste residues, the liner, if any, or contaminated soils, he must request a modification to the post-closure permit in accordance with the applicable requirements in 40 CFR Parts 124 and 270. The owner or operator must demonstrate that the removal of hazardous wastes will satisfy the criteria of 40 CFR § 264.117(c). By removing hazardous waste, the owner or operator may become a generator of hazardous waste and must manage it in accordance with all applicable requirements of

this chapter. If he is granted a permit modification or otherwise granted approval to conduct such removal activities, the owner or operator may request that the Director approve either:

1. The removal of the notation on the deed to the facility property or other instrument normally examined during title search; or

2. The addition of a notation to the deed or instrument indicating the removal of the hazardous waste.

The local government authority, Stafford County, has no jurisdiction over the zoning of the Marine Corps Base Quantico and Russell Road Landfill and there is no Deed (or similar instrument) encompassing the Russell Road Landfill.

Therefore, a survey plat with benchmarks and the required post-closure notices and restrictions has been filed with the Washington Navy Yard and the Real Estate Office of the Marine Corps Base, Quantico, the EPA, and the DEQ. The DEQ received a copy of the Survey Plat and the specified post-closure notices and restrictions on July 13, 1999. **(See Appendix E-2, Survey Plat.)** The above and filing and recording of the survey plat and post-closure notices and restrictions with the above entities complies with the requirements of § 264.119, Post-Closure Notices.

The RRL is also entered into the MCB Quantico GIS database. The Facility site is tagged on the MCB Quantico GIS with a note about the restrictions and instructions to contact the Environmental Office at the MCB Quantico Facility prior to performing any land disturbance activities.

Any land disturbance requires an excavation permit issued by Facilities and Logistics Services (FLSS) who checks the area on the MCB Quantico GIS for any restrictions prior to issuing any dig permit. If site restrictions are identified, the Environmental Office at MCB Quantico is included in the review process prior to approving a dig permit. The approval process for an excavation permit includes review by any applicable utility services and review of Permit requirements.

E.17. PERSONNEL AND TRAINING

The MCB Quantico will use experienced personnel for site inspections, monitoring, and operation and maintenance programs associated with the RRL.

Appropriate training shall be completed by all persons at MCB - Quantico - RRL and/or their consultants who are or who may be involved in the task associated with a hazardous waste post-closure care activity. The Permittee shall ensure that those individuals responsible for groundwater monitoring, gas monitoring, and other landfill components and systems monitoring, inspections, and repair are appropriately trained.

Any major problems arising such as problems with the landfill cap, and drainage system, the leachate collection system, leachate seeps, groundwater monitoring wells, and/or gas

migration problems will be immediately referred to a professional engineer registered in the Commonwealth of Virginia.

(See Permit Attachment I, Personnel, and Training.)

E.18. RECORDKEEPING AND REPORTING

Recordkeeping and reporting shall comply with the recordkeeping and reporting requirements specified in this Permit, including but not limited to the requirements specified in, **Permit Module I, Standard Conditions, Permit Module II, General Facility Conditions, Permit Module III, Post-Closure Care, Permit Module VI, Corrective Action Program, Ground-water Monitoring – Regulated Unit, Module VIII, Gas Management Program, and in the Permit Attachments, and Module IX, Schedule of Compliance.**

The MCB Quantico Facility is to comply with 40 CFR § 264.15, General Inspection Requirements, for the Russell Road Landfill (RRL) Facility.

In accordance with 40 CFR § 264.15, the Permittee is to follow a written inspection schedule for inspections and identification of malfunctions, deterioration, or operational errors in the final landfill cap, the leachate collection systems and leachate collection sump, the gas vents, the gas and groundwater monitoring systems, and the runoff management systems for the landfill. (See **Permit Attachment H, Inspection Requirements.**)

The MCB Quantico Facility is to implement the necessary operation and maintenance and/or remedial action when necessary for any malfunctions or deterioration of equipment or systems are identified. All repairs and infrastructure maintenance of the RRL shall be recorded and maintained at the facility and included in semi-annual reports.

The MCB Quantico Facility is to maintain a signed and dated inspection logs and operation and maintenance and repair logs at the Facility, which provides inspection observations, noted deficiencies, and corrective action or taken of the RRL infrastructure, components, and systems.

The logged reports of each inspection and operation and maintenance and repair logs at the Facility shall be maintained at the facility during the entire post-closure care period.

The inspection results, groundwater sampling and analysis results, and gas sampling and analysis results, and corrective action (CA) investigations and findings, and CA remediation and findings shall be reported to the Department and records of these events be made available at the facility for inspection and review by the Department of Environmental Quality representatives during periodic site inspections of the facility.

E.19. FACILITY CONTACT

The post-closure care Facility contact and primary representative for the MCB Quantico Russell Road Landfill is provided below:

On-site Facility Contact:

Major Adam Gutshall
Head, Natural Resources and Environmental Affairs Branch
NREA Branch (B046)
Installation & Environment Division
3049 Bordelon St.
Quantico, VA 22134-5001
Phone: (703) 432-0535
E-mail: adam.gutshall@usmc.mil

E.20. CERTIFICATION OF COMPLETION OF POST-CLOSURE

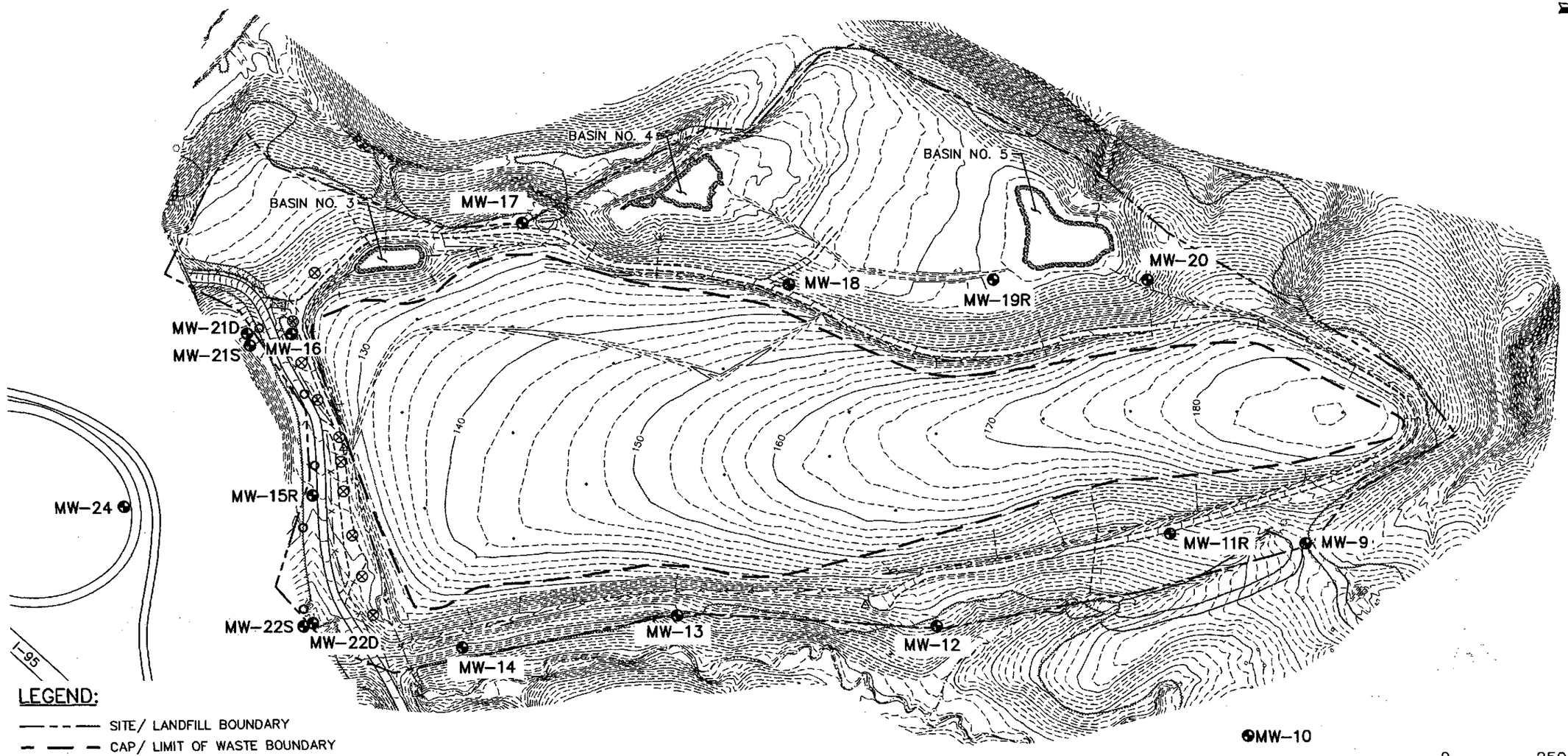
In accordance with 40 CFR § 264.117(a)(2), the Director may shorten or extend this post-closure period for the RRL, a "regulated unit," if doing so will protect human health and the environment.

In accordance with 40 CFR § 264.120, Certification of Completion of Post-Closure, no later than 60 days after completion of the established post-closure care period for the MCB Quantico Russell Road Landfill, the hazardous waste disposal unit, the owner or operator must submit to the Director, by registered mail, a certification that the post-closure care period for the hazardous waste disposal unit was performed in accordance with the specifications in the approved post-closure plan.

The certifications must be signed by the owner or operator and by a qualified Professional Engineer registered in the Commonwealth of Virginia.

Documentation supporting the Professional Engineer's certification must be furnished to the Director upon request until he releases the owner or operator from the requirements for post-closure care under the VHWMR, and the RCRA Regulations.

As the RRL is a Federal Facility, no financial assurance is required for the Permitted RRL Facility.



LEGEND:

- SITE/ LANDFILL BOUNDARY
- CAP/ LIMIT OF WASTE BOUNDARY
- 10' TOPOGRAPHIC CONTOUR
- 2' TOPOGRAPHIC CONTOUR
- 10' CORRUGAGATED HDPE PIPE ANCHOR TRENCH
- MONITORING WELL
- GAS MONITORING WELL
- GAS INTERCEPTOR WELL
- BENCHMARK
- GAS VENT

0 250 500

SCALE: 1" = 250'

REFERENCE:
HORIZONTAL DATUM: VIRGINIA STATE PLANE COORDINATE SYSTEM, NAD 83, NORTH ZONE
VERTICAL DATUM: NGS MEAN SEA LEVEL

TETRA TECH
WWW.TETRATECH.COM
661 ANDERSEN DRIVE - FOSTER PLAZA 7
PITTSBURGH, PA 15220
T: (412) 921-7090 | F: (412) 921-4040

RUSSELL ROAD LANDFILL
MCB, QUANTICO, VIRGINIA

SITE LAYOUT AND MONITORING LOCATIONS

SCALE: 1" = 250'

DATE:	3/15/11
PROJECT NO.:	112G02160
DESIGNED BY:	JB
DRAWN BY:	ZM
CHECKED BY:	KL
SHEET: 1 OF 2	

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FIGURE 10-1

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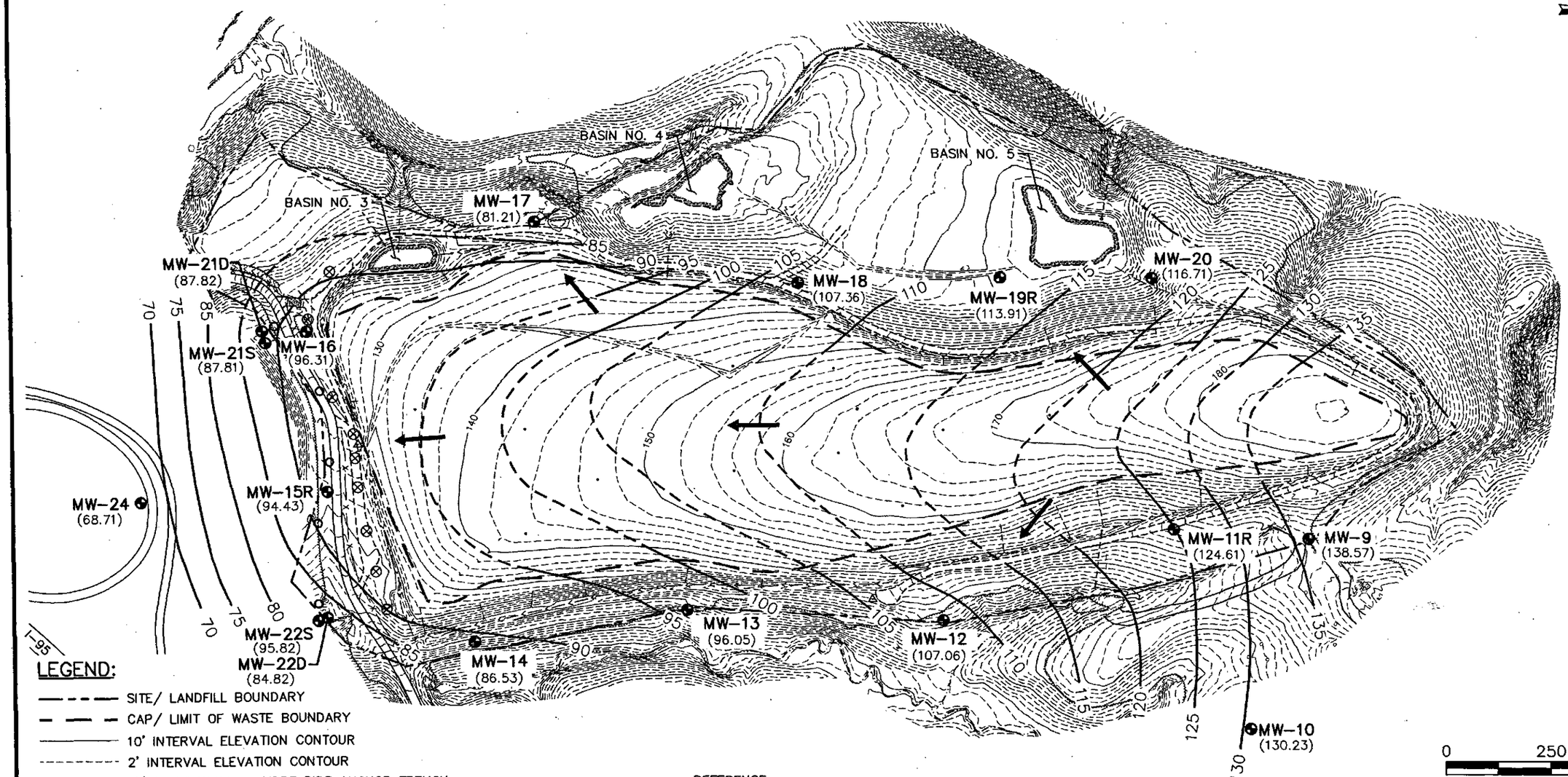

LEGEND:

- SITE/ LANDFILL BOUNDARY
- CAP/ LIMIT OF WASTE BOUNDARY
- 10' INTERVAL ELEVATION CONTOUR
- 2' INTERVAL ELEVATION CONTOUR
- 10' CORRUGAGATED HDPE PIPE ANCHOR TRENCH
- MONITORING WELL LOCATION
- GAS MONITORING WELL
- GAS INTERCEPTOR WELL
- BENCHMARK
- GAS VENT
- GROUNDWATER POTENTIOMETRIC CONTOUR (DASHED WHERE INFERRED)
- INFERRED GROUNDWATER FLOW DIRECTION
- (68.71) GROUNDWATER ELEVATION

REFERENCE:
HORIZONTAL DATUM: VIRGINIA STATE PLANE COORDINATE SYSTEM, NAD 83, NORTH ZONE
VERTICAL DATUM: NGS MEAN SEA LEVEL

TETRA TECH
WWW.TETRATECH.COM
661 ANDERSEN DRIVE - FOSTER PLAZA 7
PITTSBURGH, PA 15220
T: (412) 921-7090 | F: (412) 921-4040

RUSSELL ROAD LANDFILL
MCB, QUANTICO, VIRGINIA

POTENTIOMETRIC SURFACE MAP (DECEMBER 6, 2010)

SCALE: 1" = 250'

DATE:	3/15/11
PROJECT NO.:	112G02160
DESIGNED BY:	JB
DRAWN BY:	ZM
CHECKED BY:	KL
SHEET: 2 OF 2	

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FIGURE 10-2

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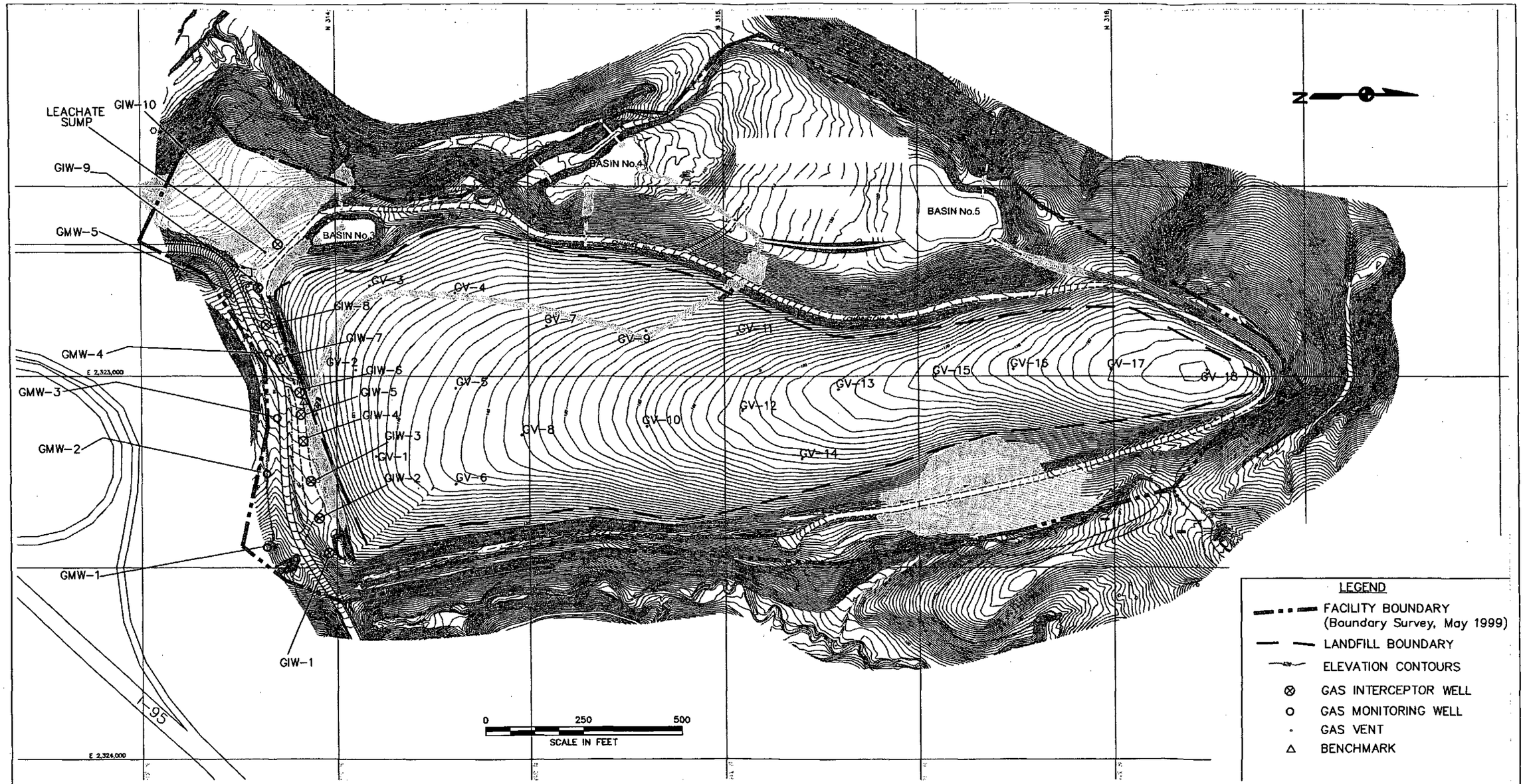


NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY MP DATE 4/5/11
CHECKED BY AS DATE 4/5/11
COST/SCHED-AREA
SCALE AS SHOWN

Tetra Tech NUS, Inc.

GAS MONITORING POINTS AND VENTS
RUSSELL ROAD LANDFILL
MCB QUANTICO, VIRGINIA

CONTRACT NO. N40080-08-D-0498
OWNER NO. X0010
APPROVED BY DATE
APPROVED BY DATE
FIGURE NO. C-2
REV. 0

FILENAME: K:\gproject\CADD\Quantico\Gas Monitoring Points_04 05 11.dwg

APPENDIX E-1

CERTIFICATIONS OF LANDFILL CLOSURE, 1997 & CERTIFICATIONS OF REVISED RCRA PERMIT APPLICATIONS, RECEIVED JUNE 1, 2011 RUSSEL ROAD LANDFILL, MCB QUANTICO

4.4 COMPLETION CERTIFICATE

CERTIFICATION OF CLOSURE

RUSSELL ROAD LANDFILL
MCB QUANTICO, VIRGINIA

LANTDIV NO N62470-93-D-3032
DELIVERY ORDER NO. 045

On behalf of OHM, I certify that, to the best of my knowledge and belief, the remediation of the Russell Road Landfill in Quantico, Virginia, as is described in the July 11, 1997 Contractor Close-out Report prepared by OHM Remediation Services Corp.(OHM) has been completed in accordance with all applicable federal, state and local rules and regulations.

includes 7 surrounding areas

Joseph W. Colella — 7-11-97
J. Colella, P.E., Project Engineer — Date

7/11/97
K.Davis, P.E. Project Manager — Date

7/11/97
S. Lambiotte, Site QC Manager — Date

COMMONWEALTH OF VIRGINIA
JOSEPH W. COLELLA
No. 010845
PROFESSIONAL ENGINEER
Joseph W. Colella

OWNER/OPERATOR CLOSURE CERTIFICATION

UNITED STATES MARINE CORPS
MARINE CORPS BASE, QUANTICO
RUSSELL ROAD LANDFILL
EPA ID# VA1170024722
QUANTICO, VIRGINIA

I hereby certify that, based on my inquiry of the person or persons who manage this facility, or those persons directly responsible for gathering information, to the best of my knowledge and belief, the information submitted is true, accurate, and complete and the Russell Road Landfill has been closed in accordance with the Virginia Department of Environmental Quality approved closure plan.

MARK A. COSTA
Name

Signature

Director, Facilities Division
Title

28 JUL 1997
Date

4.4 COMPLETION CERTIFICATE

CERTIFICATE OF CLOSURE

RUSSELL ROAD LANDFILL
MCB QUANTICO, VIRGINIA

LANTDIV NO. N62470-93-D-3032
DELIVERY ORDER NO. 045

I certify that, to the best of my knowledge and belief, the work performed in the execution of this project has been completed, inspected, tested, and is in compliance with the contract.

S. Lambiotte, Site QC Manager

Date 7/7/97

PROFESSIONAL ENGINEER CERTIFICATION

I, Steven P. Giannino, an Independent Certified Professional Engineer in the Commonwealth of Virginia, certify based on my knowledge of the conditions of the property described in the Hazardous Waste Management Post-Closure Care Permit and my inquiry of those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including possibility of fine and imprisonment for knowing violations.

Steven P. Giannino

(Signature)

May 27, 2011

(Date)

04020 11470

(P. E. Number)

Seal

OWNER/OPERATOR CERTIFICATION

United States Marine Corps
Marine Corps Base Quantico
Russell Road Landfill

I hereby certify that, based on my inquiry of the person or persons who manage this facility, or those persons directly responsible for gathering information, to the best of my knowledge and belief, the proposed modifications to the Hazardous Waste Management Post-Closure Care Permit for the Russell Road Landfill are true, accurate, and complete.

D. J. CHOIKE

Name

Colonel, U.S. Marine Corps, Commander

Title

(Signature)

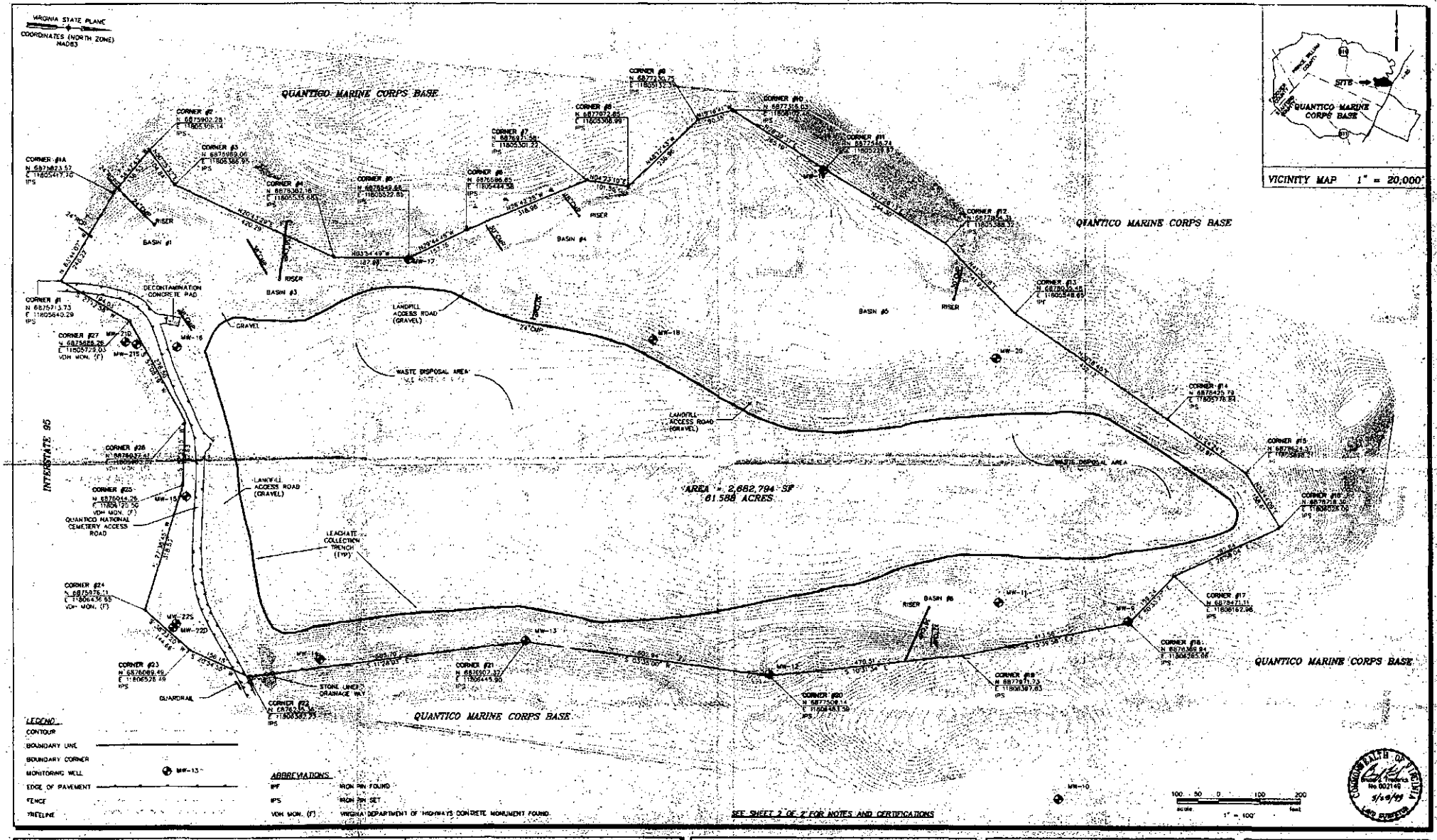
6/27/11

(Date)

APPENDIX E-2

SURVEY PLATT – RUSSELL ROAD LANDFILL, MCB QUANTICO

PATTON HARRIS, RUST & ASSOCIATES, MAY 25, 1997



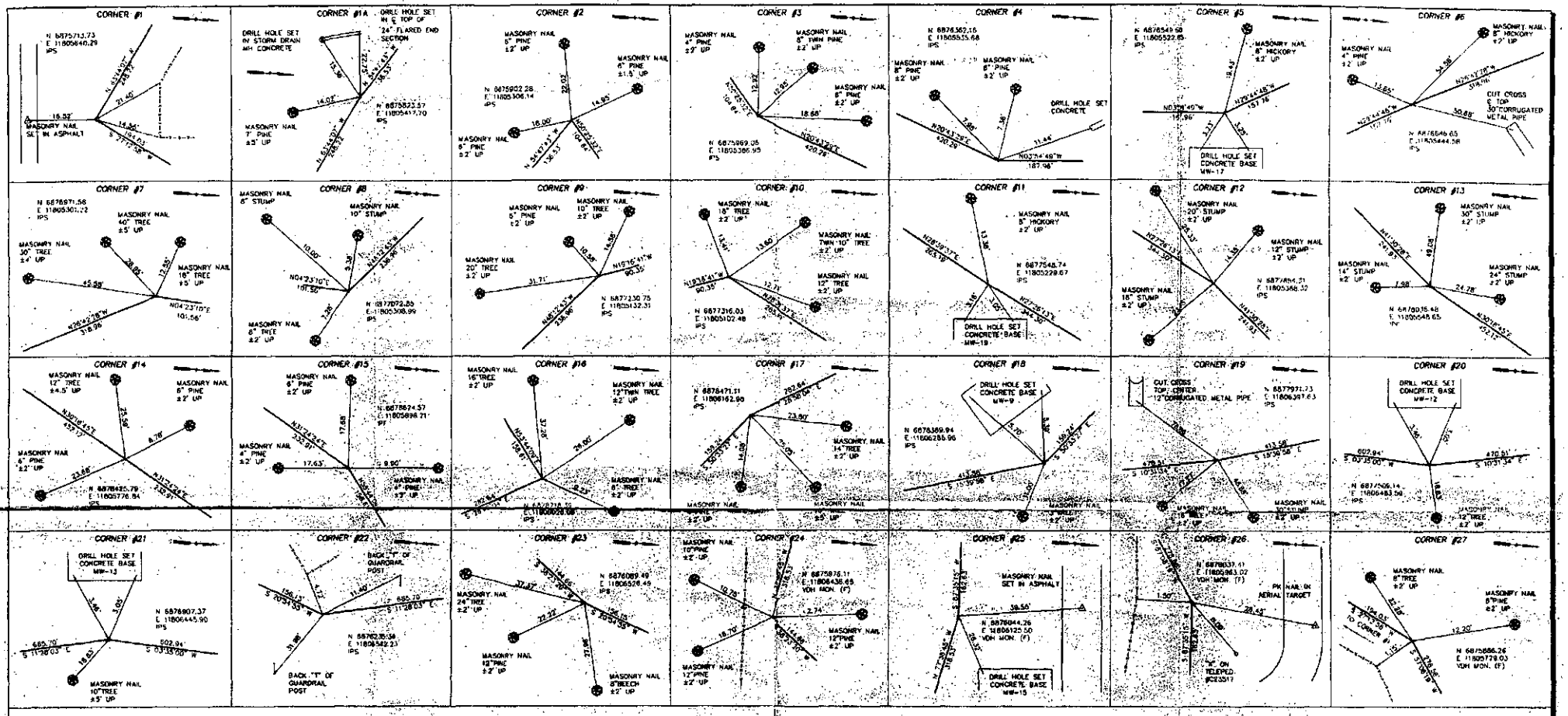
NOTES

1. COORDINATES SHOWN ARE BASED UPON THE VIRGINIA STATE PLANE COORDINATE SYSTEM, (NAD83) NORTH ZONE
2. ALL REFERENCE RIS TO TREES ARE MASONRY NAILS SET
3. ALL PINS SET ON BOUNDARY CORNERS ARE IDENTIFIED BY AN ORANGE PLASTIC WITNESS POST
4. THE LAND HAS BEEN USED TO DISPOSE OF HAZARDOUS WASTES. THE LANDFILL CONTAINS THE TYPES AND QUANTITIES OF HAZARDOUS WASTES AS SPECIFIED IN TABLE 1 OF THE APPROVED CLOSURE PLAN, AND THE HAZARDOUS CONSTITUENTS SPECIFIED IN TABLE 2-1 OF THE APPROVED CLOSURE PLAN.
5. ITS USE IS RESTRICTED UNDER VHWMR 9VAC 20-60-264 (SUBPART G) "CLOSURE AND POST-CLOSURE"
6. THE OWNER OR OPERATOR OF THIS PROPERTY IS OBLIGATED TO RESTRICT DISTURBANCE OF THE HAZARDOUS WASTE LANDFILL IN ACCORDANCE WITH THE VIRGINIA HAZARDOUS WASTE REGULATIONS, 9VAC 20-60-264.118 AND 9VAC 20-60-264.119(b)
7. VERTICAL DATUM BASED ON NGS MEAN SEA LEVEL
8. THE BOUNDARY SHOWN HEREON IS BASED ON A CURRENT FIELD SURVEY

TITLE: PLAT SHOWING PERIMETER BOUNDARY OF RUSSELL ROAD LANDFILL QUANTICO MARINE CORPS BASE QUANTICO, VIRGINIA PRINCE WILLIAM, FAUQUIER AND STAFFORD COUNTIES

PHR&A
Patton Harris Rust & Associates, pc.
Offices: Bridgewater, Va. Leesburg, Va. Virginia Beach, Va. Culpeper, Va. Winchester, Va.

SURVEY	KW/BC	DATE	5/25/99
FILE NAME	LFILL-2.DWG	DRAWN	JLS
CHKD.	BJF	F.B 66 PGS. 1-34	
SHEET 1 OF 2		PROJECT NO.	8724-1-82



ABBREVIATIONS

IPF	IRON PIN FOUND
IPS	IRON PIN SET
VDH MON. (F)	VIRGINIA DEPARTMENT OF HIGHWAYS CONTRETE MONUMENT FOUND

NOTES

1. COORDINATES SHOWN ARE BASED UPON THE VIRGINIA STATE PLANE COORDINATE SYSTEM, (NAD83) NORTH ZONE
2. ALL REFERENCE TIES TO TREES ARE MASONRY NAILS SET
3. ALL PINS SET ON BOUNDARY CORNERS ARE IDENTIFIED BY AN ORANGE PLASTIC WITNESS POST
4. THE LAND HAS BEEN USED TO DISPOSE OF HAZARDOUS WASTES. THE LANDFILL CONTAINS THE TYPES AND QUANTITIES OF HAZARDOUS WASTES AS SPECIFIED IN TABLE 1 OF THE APPROVED CLOSURE PLAN, AND THE HAZARDOUS CONSTITUENTS SPECIFIED IN TABLE 2-1 OF THE APPROVED CLOSURE PLAN.
5. ITS USE IS RESTRICTED UNDER VHWMR 9VAC 20-60-264 (SUBPART G) "CLOSURE AND POST-CLOSURE".
6. THE OWNER OR OPERATOR OF THIS PROPERTY IS OBLIGATED TO RESTRICT DISTURBANCE OF THE HAZARDOUS WASTE LANDFILL IN ACCORDANCE WITH THE VIRGINIA HAZARDOUS WASTE REGULATIONS, 9VAC 20-60-264.116 AND 9VAC 20-60-264.119(b).
7. VERTICAL DATUM BASED ON MGS MEAN SEA LEVEL.
8. THE BOUNDARY SHOWN HEREON IS BASED ON A CURRENT FIELD SURVEY.

TITLE:

PLAT SHOWING PERIMETER
BOUNDARY OF RUSSELL ROAD LANDFILL
QUANTICO MARINE CORPS BASE
QUANTICO, VIRGINIA
PRINCE WILLIAM, FAUQUIER AND STAFFORD COUNTIES

PHR&A

Patton Harris Rust & Associates, pc.

Offices:
Bridgewater, Va.
Leesburg, Va.
Virginia Beach, Va.
Chantilly, Va.
Winchester, Va.

SURVEY KW/BC	DATE 5/25/99
FILE NAME LFILL-2.DWG	DRAWN JLS
CHKD BJF	SCALE F.B. 86 PGS. 1-34
SHEET 2 OF 2	PROJECT NO. 8724-1-62

COMMONWEALTH OF VIRGINIA
Bruce J. Frederick
No. 002149
5/25/99
LAND SURVEYOR

APPENDIX E-3

LIST OF CONTACTS FOR EMERGENCIES & LEACHATE COLLECTION SUMP ALARM SYSTEM & AUTO DIALER SYSTEM LEACHATE COLLECTION SUMP DESIGN INFORMATION RUSSEL ROAD LANDFILL, MCB QUANTICO

Table 1, Emergency Contact Information, RRL, MCB Quantico

Table 2, Auto-Dialer Notification Contacts, RRL, MCB Quantico

Table 3, Leachate Collection Sump Alarm Information, RRL, MCB Quantico

Figure 4, Leachate Sump Detail, RRL, MCB Quantico

Figure 5, Lightning Mast Detail for Control Box of Leachate Collection Sump Alarm System, RRL, MCB Quantico

Table 1, System Components, Leachate Collection Sump & Alarm System RRL, MCB Quantico

Example Inspection Checklist, Leachate Collection Sump, & Alarm System RRL, MCB Quantico

Summary Design Information - Leachate Collection Sump & Alarm System Information, RRL, MCB Quantico

Summary of Inspections and O & M - Leachate Collection Sump & Alarm System Information, Russell Road Landfill, MCB Quantico

TABLE 1

EMERGENCY CONTACT INFORMATION
RUSSELL ROAD LANDFILL
MCB QUANTICO, VIRGINIA

Contact	Telephone Number
Mr. Bruce Frizzell Head, Natural Resources and Environmental Affairs Branch	703-784-4030
Military Police	703-784-2251
Fire	703-784-2222

TABLE 2

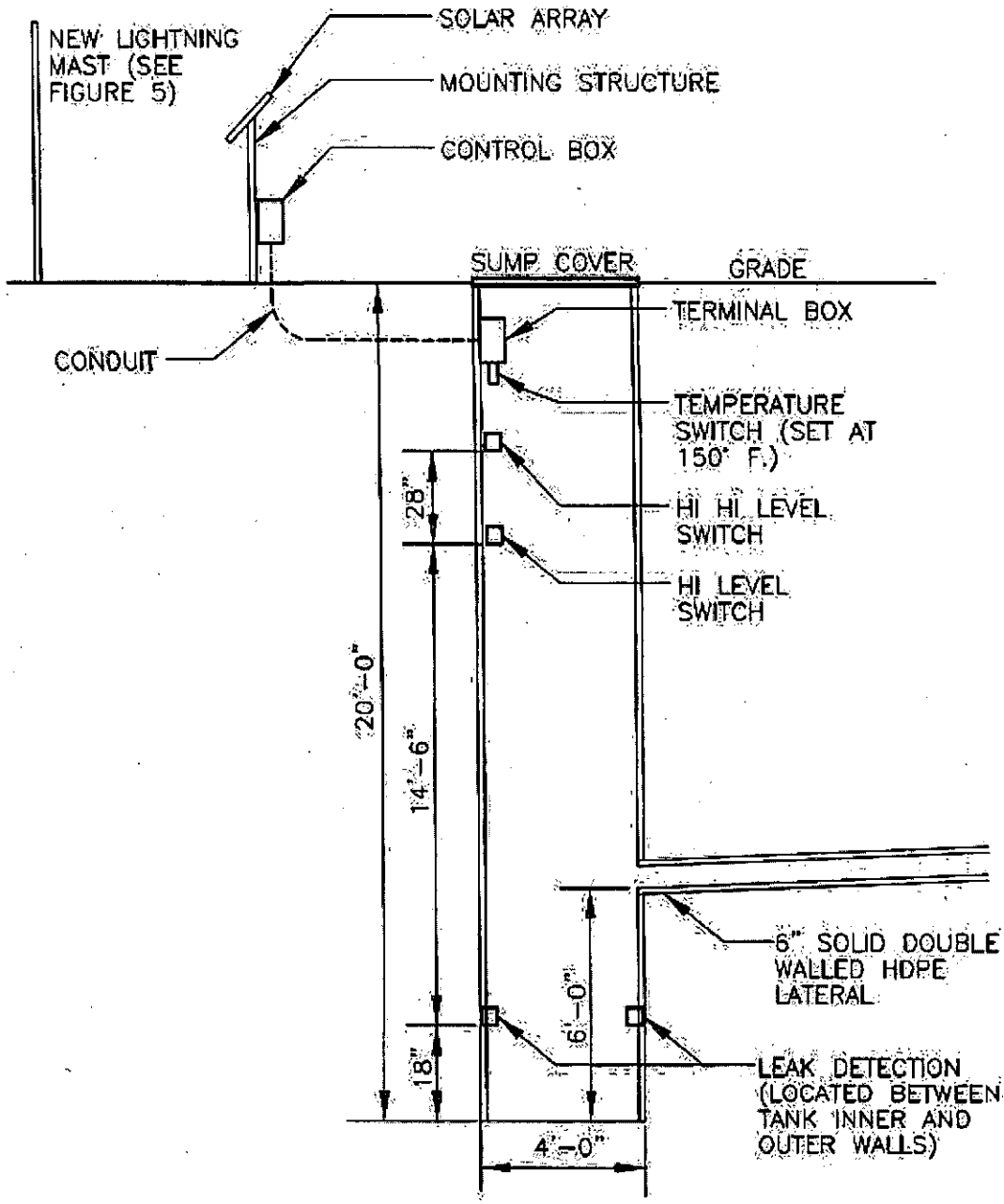
AUTODIALER NOTIFICATIONS
RUSSELL ROAD LEACHATE SUMP
MCB QUANTICO, VIRGINIA

Contact No.	Contact	Telephone No.
1	Tanks Program Manager - Camilo Cobile	703-432-0523
2	Hazardous Waste Program Manager - Dwaine O'Barr	703-432-0530
3	Installation Remediation Program Manager - Marla Raney	703-432-0521
4	Fire Department	703-784-2222

TABLE 3

LEACHATE COLLECTION SUMP ALARM INFORMATION
RUSSELL ROAD LEACHATE SUMP
MCB QUANTICO, VIRGINIA

Alarm Message	Situation	Action to be Taken
This is the Russell Road Leachate Collection System High Level Zone No. 1	Liquid in the leachate collection sump has reached a depth of 15 feet, 10 inches. The capacity of the sump is being approached.	The leachate collection sump must be emptied as soon as possible. Leachate will be managed as a hazardous waste and in full accordance with VHWMR as per Section 8.0 (Post-Closure Activities) of the Closure Plan. Notify NREAB. Inspect control panel for water damage. Repair immediately if necessary.
This is the Russell Road Leachate Collection System High Level Zone No. 2	Liquid in the leachate collection sump has reached a depth of 14 feet, 10 inches.	The leachate collection sump should be emptied. The leachate will be managed as a hazardous waste and in full accordance with VHWMR as per section 8.0 (Post-Closure Activities) of the closure Plan. Notify NREAB.
This is the Russell Road Leachate Collection System Leachate Sump Temperature Zone No. 3	The internal temperature of the leachate collection sump has reached 150 degrees Fahrenheit.	Notify base fire department and NREAB. Inspect the leachate collection sump immediately.
This is the Russell Road Leachate Collection System Secondary Containment Zone No. 4	Liquid in the annular space of the leachate collection sump has reached a depth of 18 inches. The primary containment system has been compromised and the leachate has entered the secondary containment system.	Refer to Table 2 (Manufacturers' contact Information) and Attachment A (Manufacturers' Data) of the Operations and Maintenance Manual, Russell Road Landfill Closure, OHM, 1997. Repair or replace the sump as necessary. All repairs must comply with the manufacturer's specifications. Notify NREAB.



DRAWN BY MF DATE 9/15/10	NAVFAC	LEACHATE SUMP DETAIL RUSSELL ROAD LANDFILL LEACHATE COLLECTION SUMP MCB QUANTICO QUANTICO, VIRGINIA	CONTRACT NO. 3020
CHECKED BY DW DATE 10/7/10			OWNER NO.
REVISED BY DATE			APPROVED BY DATE
SCALE NONE			DRAWING NO. FIGURE 4 REV. 0

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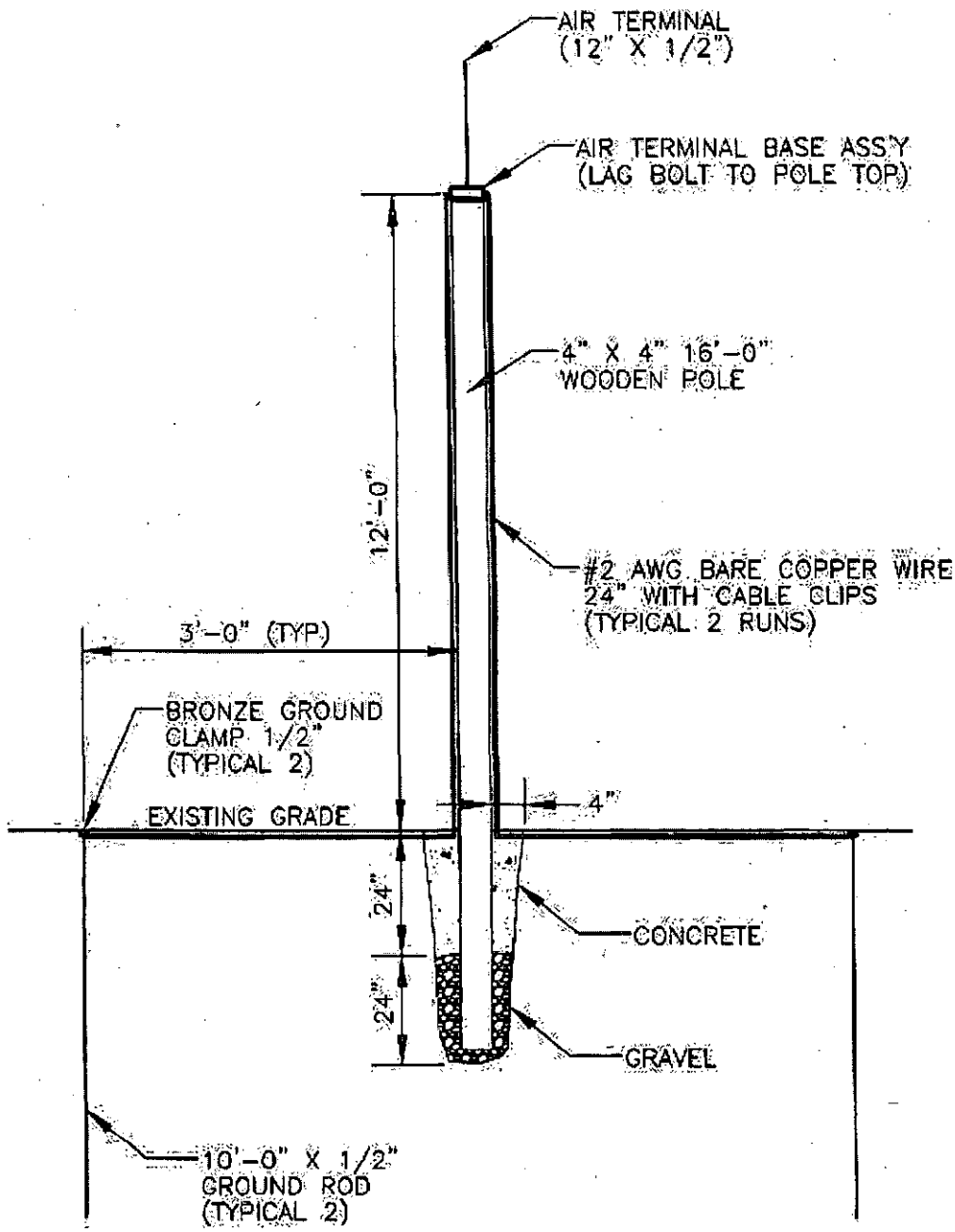

DRAWN BY MF DATE 9/15/10	NAVFAC	LIGHTNING MAST DETAIL RUSSELL ROAD LANDFILL LEACHATE COLLECTION SUMP MCB QUANTICO QUANTICO, VIRGINIA	CONTRACT NO. 3020
CHECKED BY DW DATE 11/24/10			OWNER NO.
REVISED BY DATE			APPROVED BY DW DATE 11/24/10
SCALE NONE			DRAWING NO. FIGURE 5 REV. 0

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TABLE 1

SYSTEM COMPONENTS
RUSSELL ROAD LEACHATE SUMP
MCB QUANTICO, VIRGINIA
PAGE 1 OF 1

Component	Components Description
Power	Solar array to power a 12 volt auto dialer and sensors. The solar array provides 89 watts per day.
Water Level Sensors	Two mechanical tilt, float-type switches located in the leachate sump to alert base personnel when the sump is required to be emptied.
Temperature Sensor	One adjustable temperature sensor located in the leachate sump to detect the presence of dangerous exothermic reactions or fire.
Leak Detection Sensors	Two single station, vertical float type sensors located within the annular space between the double wall containment system of the leachate sump.
Auto dialer	9-volt auto dialer which can call four telephone numbers and report one of four alarms plus a fifth alarm for a temperature reading in the control panel. The auto dialer will include an integral battery backup which consists of 6 C-cell batteries which will power the auto dialer for a minimum of 24 hours if the solar panel and the storage battery for solar panel cannot supply power to the autodialer. The storage battery for the solar panel is sized to provide power to the autodialer for 5-10 days without any input from the solar panel.
Lightning Protection	A 13-foot lighting mast (12-inch air terminal mounted on a 12-foot pressure-treated wooden pole) with two 10-foot grounding rods.
Voltage Converter	9-18 volt DC input, 9 volt DC 0.6 ampere output solid state converter.
Surge Protector	An in-line surge protector is included on the telephone line to protect the auto dialer from voltage spikes coming into the control panel through the telephone line. In addition a fuse is included between the solar panel and the rest of the components in the control panel to protect from voltage spikes coming from the solar panel.
Cooling Fan/Thermostat	A 12-volt cooling fan and thermostat is included to cool the control panel when the temperature reaches 110 Degrees Fahrenheit. The Fan is rated at 31 CFM and 0.17 amps.

WEEKLY INSPECTION CHECKLIST

RUSSELL ROAD LANDFILL LEACHATE COLLECTION SUMP

MCB Quantico, Virginia

In accordance with 40 CFR Part 265 Subpart J, the contents collected in the Russell Road Leachate Collection Sump is listed as hazardous waste, F039 – Leachate.

1.	Are the descriptions on the tank's waste label clearly legible and correct? The label should clearly state the accumulation start date and include the words "HAZARDOUS WASTE", and "F039 –LEACHATE"	☑ YES	☐ NO
2.	Is the tank in good condition? There should be no signs of uplifting, settling, sinking, cracking, or other damage.	☑ YES	☐ NO
3.	Are the spill prevention devices in proper working order? There should be no visible signs of damage.	☐ YES	☑ NO SEE COMMENT
4.	Is leachate in the sump within 12 inches of the "Low Level Alarm" probe or are there any indications that there is inadequate freeboard for additional storage in the tank?	☐ YES	☑ NO
5.	Has the leak detection monitoring system provided a daily fax to the NREA Branch office on each of the last seven days?	☐ YES	☑ NO
6.	Does the solar panel appear to be in proper working order? The panel should be correctly oriented toward the sun and free of cracks, punctures, or gouges.	☑ YES	☐ NO
7.	Are there signs of leachate spillage or releases in the immediate area surrounding the tank?	☐ YES	☑ NO

REMARKS: LEAK DETECTION DEVICES DYSFUNCTIONAL. CIM 5000 COMMO. INTERFACE IRREPLACEABLE – MANUFACTURER DEFUNCT. ADVISED SALLY TO HAVE IR/NAVFAC FIND REPLACEMENT FOR THE LEAK DETECTION SYSTEM. MEANWHILE, WE ARE REVER TO "DAILY INSPECTIONS BEGINNING 16 JUNE 08. DONNA HERIC & RICHARD GLEASON ARE BACKUP FOR INSPECTIO

INSPECTOR: Camilo Cobile DATE: 13 Jun 08

SIGNATURE: [signature]

APPENDIX E-3

Summary Design Information - Leachate Collection Sump & Alarm System Information, Russell Road Landfill, MCB Quantico

Overview Summary

The leachate collection sump is a 4 foot diameter x 21 foot tall, double walled HDPE manhole with interstitial monitoring. The collection sump contains sensors/alarms for high and low water level, leakage in the annular space between inner and outer walls), and temperature monitoring. The sensors transmit signals to an auto dialer to alert base personnel via a telephone pair. The leachate is periodically emptied by base personnel and the leachate disposed of. The current system was powered by a solar array.

The leachate sump alarm system and auto dialer was upgraded in December 2010 to address system deficiencies related to apparent lightning damage to the solar panel and control box. A new solar array and control panel was installed with a lightning arrestor. All of the system sensors and wiring was replaced. The current system contains two water level sensors, two leak detection sensors, and a temperature sensor. Each Sensor in the sump has a set point. If the conditions in the leachate sump reaches the one of the set points, the sensors will send an alarm to the auto dialer which in turn the calls base personnel and reports the alarm.

The system is powered by a new solar array consisting of high efficiency photovoltaic module using silicon nitride multi-crystalline silicon cells. The solar panel is 26.5 inches by 59.4 inches and provides 115 watts with a nominal voltage of 12 volts. A 12 volt battery in a NEMA 3R/4 enclosure is used to store the power from the solar panel(s). The battery is designed to maintain power for 5 to 10 days without receiving a charge from the solar panels. A voltage regulator is used to control the power for the system.

Figures and schematics for the leachate sump and new alarm system are included in **Appendix E-3.**

A revised Operations and Maintenance Manual for the Russell Road Leachate Sump Alarm System, dated March 2011, is on file at the MCB Quantico NREA office.

Alarm System Auto Dialer System – Summary

The leachate collection sump high level and temperature sensors allow for continuous monitoring to maintain safe conditions and proper function of the sump. The sensors consist of dry contact devices in the normally off position. When a sensor is tripped, the contact closes completing the circuit to the auto dialer.

The auto dialer will then notify up to 4 personnel of the abnormal condition(s) of the leachate sump. The auto dialer is powered from the storage battery that is charged from the solar panels. The auto dialer also contains a battery back-up in the event the solar charging system fails. The battery back-up for the auto dialer is integral to the auto dialer. The auto dialer is connected to a standard telephone line. An inline surge protector is included on the phone line in the control panel and the power coming from the solar panel will include an in-line fuse. Both the fuse and

the surge protector will protect the electrical components in the control panel from electrical spike either coming from the solar panel or from the phone line.

Tables 1, 2, and 3 have been updated and are provided in **Appendix E-3**. The MCB Quantico Fire Department is the fourth contact on the auto-dialer system; the MCB Fire Department provides 24-hour response to the auto dialer notifications for the RRL leachate tank.

APPENDIX E-3

Summary of Inspections and O & M - Leachate Collection Sump & Alarm System Information, Russell Road Landfill, MCB Quantico

The leachate tank system has been inspected on a weekly basis during the permit period from October 2001 through 2010.

In addition, the leachate tank system has been inspected on a daily basis from May 31, 2008 to May 1, 2011. Daily inspections were initiated May 31, 2008 in response to the disabling of the alarm system during an electrical storm that occurred on that date. Subsequent to that date, the operation of the damaged auto dialer system was periodically restored by MCB Quantico personnel. However, full functionality could not be maintained; therefore, daily inspections continued until the new, upgraded system was brought fully online in May 2011.

Daily, weekly, and monthly leachate sump inspection logs are maintained and compiled by year in binders at the NREA office at MCB Quantico.

During the current Permit period, the leachate collection sump and system is to be inspected 1/month and after major rainfall events (defined as 2 inches/8 hr. period). If the alarm and autodialer system should become inoperable, then the leachate collection sump will be inspected weekly.

The facility maintains records of the auto dialer system alarm events since installation of the leachate collection system.

APPENDIX E-4

SUMMARY INFORMATION – LEACHATE GENERATION & MANAGEMENT LEACHATE COLLECTION SYSTEM & SUMP RUSSEL ROAD LANDFILL, MCB QUANTICO

Appendix E-4 contains summary historical information associated with the ongoing management, and operation and maintenance of the leachate collection system and tank system at the RRL, MCB Quantico for the period from 2001 through 2010. This summary table provides the historical dates and volumes of removal of leachate from the leachate collection sump and subsequent management, treatment, and disposal of the leachate for these leachate removal events.

EXHIBIT 12-3

RUSSELL ROAD LANDFILL
VA1170024722
LEACHATE (2001 – 2010)

CALENDAR YEAR	DATE OF PICK UP	QUANTITY	MANIFEST #	DISPOSAL FACILITY	ANALYSIS DATA
2001					
	2/15/01	55 gallons	NJA3188287	E. I. Dupont	
	4/13/01	55 gallons	NJA3246478	E. I. Dupont	
	5/29/01	25 gallons	NJA3246488	E. I. Dupont	
	7/19/01	225 gallons	NJA3246510	E. I. Dupont	
	10/12/01	40 gallons	NJA4019413	E. I. Dupont	
	11/21/01	55 gallons	NJA4019425	E. I. Dupont	Acetone, 1,1-Dichloroethane, Beryllium
		455 GALLONS TOTAL			
2002					
	1/29/02	55 gallons	NJA4019430	E. I. Dupont	Acetone, 1,1-Dichloroethane, Beryllium
	4/12/02	55 gallons	NJA4019450	E. I. Dupont	Acetone, 1,1-Dichloroethane, Beryllium
	6/7/02	55 gallons	NJA4019460	E. I. Dupont	Acetone, 1,1-Dichloroethane, Beryllium
	7/16/02	55 gallons	NJA4019475	E. I. Dupont	Acetone, 1,1-Dichloroethane, Beryllium
	9/10/02	55 gallons	NJA4077082	E. I. Dupont	Acetone, 1,1-Dichloroethane, Beryllium
	12/5/02	55 gallons	NJA4141682	E. I. Dupont	
		330 GALLONS TOTAL			
2003					
	2/4/03	40 gallons	NJA4141705	E. I. Dupont	
	4/3/03	55 gallons	NJA4141734	E. I. Dupont	Acetone, 1,1-Dichloroethane, 1,1 Dichloroethylene, Beryllium

CALENDAR YEAR	DATE OF PICK UP	QUANTITY	MANIFEST #	DISPOSAL FACILITY	
(2003)	5/30/03	550 gallons	NJA5121075	E. I. Dupont	
	7/22/03	1100 gallons	NJA5055652	E. I. Dupont	
	9/11/03	1375 gallons	NJA5055700	E. I. Dupont	
	11/7/03	890 gallons	NJA5057252	E. I. Dupont	
		4010 GALLONS TOTAL			
2004		UNABLE TO LOCATE			UNABLE TO LOCATE DATA
2005					
	1/28/05	850 gallons	NJA5234592	E. I. Dupont	
	4/4/05	420 gallons	NJA5234638	E. I. Dupont	
	6/8/05	1050 gallons	NJA5234675	E. I. Dupont	
	8/24/05	1075 gallons	NJA5262187	E. I. Dupont	
	10/31/05	387 gallons	NJA5262246	E. I. Dupont	
		3782 GALLONS TOTAL			
2006					
	1/19/06	55 gallons	NJA5286725	E. I. Dupont	
	3/9/06	165 gallons	NJA5285172	E. I. Dupont	
	5/30/06	110 gallons	NJA5285141	E. I. Dupont	
	7/31/06	165 gallons	NJA5285086	E. I. Dupont	
	9/20/06	110 gallons	000066379	E. I. Dupont	
	12/01/06	831 gallons	000741556	CYCLE CHEM	11/3/06: Acetone, 1,1-Dichloroethane, 1,1-Dichloroethane, Beryllium
		1436 GALLONS TOTAL			

CALENDAR YEAR	DATE OF PICK UP	QUANTITY	MANIFEST #	DISPOSAL FACILITY	
2007					
	2/1/07	1211 gallons	000741558	CYCLE CHEM	
	3/29/07	748 gallons	000741559	CYCLE CHEM	
	6/1/07	1105 gallons	000741557	CYCLE CHEM	
	7/23/07	294 gallons	000743554	CYCLE CHEM	
	9/28/07	325 gallons	000743553	CYCLE CHEM	
	11/30/07	200 gallons	000844195	CYCLE CHEM	
		3883 GALLONS TOTAL			
2008					
	1/28/08	108 gallons	000844192	CYCLE CHEM	
	3/17/08	222 gallons	000844193	CYCLE CHEM	
	7/7/08	478 gallons	000844194	CYCLE CHEM	
	9/2/08	516 gallons	004470188	CYCLE CHEM	
	10/30/08	67 gallons	004728088	CYCLE CHEM	
		1391 GALLONS TOTAL			
2009					
	1/5/09	226 gallons	004728089	CYCLE CHEM	
	3/10/09	366 gallons	004728090	CYCLE CHEM	
	5/5/09	1105 gallons	004728091	CYCLE CHEM	
	7/1/09	1211 gallons	004728260	CYCLE CHEM	
	9/2/09	325 gallons	004728335	CYCLE CHEM	
	11/6/09	67 gallons	004728383	CYCLE CHEM	
	12/31/09	1275 gallons	004728409	CYCLE CHEM	
		4575 GALLONS TOTAL			

CALENDAR YEAR	DATE OF PICK UP	QUANTITY	MANIFEST #	DISPOSAL FACILITY	
2010					
	1/14/10	1053 gallons	004728413	CYCLE CHEM	
	3/10/10	901 gallons	004728454	CYCLE CHEM	3/6/10: Lead, Barium
	5/4/10	1319 gallons	004728496	CYCLE CHEM	
	6/29/10	1429 gallons	000838064	CYCLE CHEM	
	8/31/10	445 gallons	003044896	CYCLE CHEM	
	11/16/10	368 gallons	004728178	CYCLE CHEM	
		5515 GALLONS TOTAL			
	2001	455 gallons			
	2002	330 gallons			
	2003	4010 gallons			
	2004	unable to locate data			
	2005	3782 gallons			
	2006	1436 gallons			
	2007	3883 gallons			
	2008	1391 gallons			
	2009	4575 gallons			
	2010	5515 gallons			
		25,377 TOTAL			

DISPOSAL FACILITIES

Cycle Chem Inc.
550 Industrial Drive
Lewisberry, PA 17339

Nature of Treatment: Wastewater Treatment/Steam Stripping

EPA ID# PAD067098822

E. I. Dupont de Nemours Co., Inc.
Chamberts Works, Route 130
Deepwater, NJ 08023

Nature of Treatment: Wastewater Treatment

EPA ID# NJD002385730

APPENDIX E-5

LANDFILL CAP DRAINAGE LAYER DESIGN – RUNOFF CONTROL SYSTEM – EROSION CONTROL STRUCTURES

RUSSEL ROAD LANDFILL, MCB QUANTICO

APPENDIX E-5

LANDFILL CAP DRAINAGE LAYER DESIGN – RUNOFF CONTROL SYSTEM – EROSION AND SEDIMENTATION CONTROL STRUCTURES

RUSSEL ROAD LANDFILL, MCB QUANTICO

INTRODUCTION

Excerpts of information from the MCB Quantico's Russell Road Landfill (RRL) Closure Plans and Post-Closure Plans and related design plans and specifications are provided below which describe the constructed engineered infrastructure and erosion and sedimentation control systems, which were designed to control runoff and to minimize sedimentation of surface waters.

Design information is provided below on the landfill's drainage features and engineered system components as follows:

1. Drainage Layer Design.
2. Runoff Control.
3. Sediment Basin.
4. Discharge Structures.
5. Emergency Spillway.
6. Sediment Traps.
7. Stormwater Collection Channels.

In addition to the below text, excerpted design plans and specifications record drawings are provided below as follows from the *Final Closeout Report for the Russell Road Landfill*, OHM, 1997:

1. Record Drawing RD-1, Final Conditions Topographic Map, RRL, OHM Remediation Services Corp., 1997
2. Record Drawing RD-3, Final Drainage, RRL, OHM, 1997
3. Record Drawing RD-4, Top of Drainage Layer, RRL, OHM, 1997.
4. Record Drawing RD-6, Investigation and Monitoring, RRL, OHM, 1997.
5. Record Drawing RD-10, Drop Inlet Plan, Sections, and Detail, RRL, OHM, 1997.

On RD-3, the stormwater conveyance system is labeled as channel sections in the perimeter ditch (channel sections C1 to C9) and surface impoundments are labeled as Basin #1 and #3 to #6.

Figure 2-2, Existing Perimeter Leachate Collection System Detail, Tetra Tech NUS, Inc., provides a cross sectional view of the landfill cap and drainage layer design along with the perimeter leachate collection system.

The Hydrologic Evaluation of Landfill Performance (HELP) Modeling calculations used to model storm events and related drainage feature capacity during the design is also included in this **Appendix E-5**.

This below excerpt is taken from Section 5.0, "Leachate and Subsurface Water Collection", subsection 5.2 "Drainage Layer Design" in the Closure In-Place and Post Closure Care Plan, OHM, 1997.

5.2 DRAINAGE LAYER DESIGN

To ensure the integrity of the flexible membrane liner (FML), the guidance document recommends maintaining less than 12 inches of head on the geomembrane. This condition will be accomplished with the construction of the lateral drainage layer, consisting of VDOT No.8 stone (angular with no calcium carbonate) with a minimum permeability of 1x10" cm/set. The minimum permeability value is based on the previously mentioned guidance documents. The HELP model analyses were used to calculate the maximum head on the FML and the amount of runoff from the cap for the longest lengths of the 2.5 percent slope. The results of the HELP model calculations are presented and indicate that the maximum head on the liner will be 2 inches. This value is well below the recommended allowable head of 12 inches. The HELP model calculations indicate the daily peak runoff from the cap will be 9,180 cubic feet per acre and the daily peak drainage from the lateral drainage layer will be 258 cubic feet per acre.

Rainwater flowing from the cap drainage layer is collected in the cap anchor trench where it is conveyed through perforated pipe to a number of cap drainage lateral pipes. Rainwater is discharged from these lateral pipes to perimeter ditches which convey the rainwater to sedimentation basins.

This below excerpt is taken from Section 5.5 "Runoff Control" in the Closure In-Place and Post Closure Care Plan, OHM, 1997.

5.5 RUNOFF CONTROL

Runoff from the capped landfill will be controlled by several measures. Runoff from the landfill will be controlled through permanent drainage channels constructed along the perimeter of the cap of the landfill. Check dams will be used to control the flow of surface water from the landfill area to the sediment basins that will be constructed to collect runoff during construction of the RCRA cap. The entire disturbed area will be seeded upon completion of the cap. The control measures, channels, and check dams will be relocated and re-installed as necessary to accommodate the landfill cap construction.

An Erosion and Sediment Control Plan has been prepared for the site in accordance with the Virginia Erosion and Sediment Control Handbook (VESCH), Third Edition, 1992. This E&S Control Plan has been submitted under separate cover. Also, all runoff controls have been designed in accordance with the VESCH. OHM Project 17OllPCCP Russell Road Landfill - Quantico, Virginia.

This below excerpt is provided from Section 1.5 in the Russell Road Landfill Operations and Maintenance Manual, 1997 (OHM, July 11, 1997):

1.5 EROSION CONTROLS

A series of channels, approximately 5,500 linear feet, along the perimeter of the landfill cap convey stormwater runoff from the cap to the sediment basins and sediment traps. The channels are lined with grass, erosion control matting, or riprap, depending on their design velocity. On the west side of the landfill, a drop inlet was installed to convey stormwater through a culvert under the road. The drop inlet discharges onto a concrete and riprap apron and then into Sediment Basin No. 4. (See Sheet RD-3 (Appendix A) for location of erosion controls and Sheet RD- 10, Drop Inlet, Plan, Sections, and Detail, for erosion control details.)

Each of the five sediment basins has a riser discharge pipe service spillway to accommodate the discharge from a 25-year storm. In addition, Basin Nos. 3, 4, 5, and 6 have emergency spillways, in the event the riser pipes become clogged.

The following excerpts are taken from SECTION 2.1 "INSTALLATION OF EROSION CONTROL STRUCTURES", Section 2.1.2, "Permanent Features", in the Final Closeout Report, 1997 (OHM, July 11, 1997).

2.1.2.1 Sediment Basins

Five sediment basins were designed and constructed to contain a minimum of 120 percent of the runoff from a 25-year storm at the landfill. Basin No. 1 was constructed in the southwest area of the site by excavating soil from the side slope of the landfill and using the excavated soil to construct the confining berms. The berms were constructed by first excavating a keyway/bench into the existing slope. Then 8- to 12-inch loose lifts of soil were placed and compacted to a minimum of 90 percent of maximum dry density, based on American Society for Testing and Materials (ASTM) Method D698. The placement and compaction of lifts continued until the design elevations of the berms were reached.

Basin No 1 receives stormwater runoff from the southern end of the capped landfill, as well as from Channels 7 and 8. The principal spillway (riser pipe) of Basin No. 1 was relocated to discharge to an existing catch basin. (See Sheet RD- 1, Appendix A.) Excess capacity in the basin permitted OHM to install an emergency spillway from Basin No. 3 to Basin No. 1. This provides the added capacity required in Basin No. 3.

Basin No. 3 was constructed on the southwest side of the site by excavating clean soil from an area northeast of Basin No. 1 as per the construction drawings. Some of the soil was used to increase the elevation of the western berm for a road bed. Basin No. 3 accepts limited flows from the southwest side of the capped landfill. Its primary purpose was to accommodate construction runoff. It remains in place as a convenience, and it disperses the flow from the cap to the existing stream tributaries. The primary spillway from Basin No. 3 was located so that direct discharge to the tributary was possible. (See Sheet RD-I, Appendix A.)

Basin No. 4 was constructed on the west side of the site to accommodate the surface runoff accumulated from Channel No. 6. In addition to the runoff from Channel No. 6, Basin No. 4

accepts approximately 65 percent of the surface runoff from the restored borrow pit. The emergency overflow culvert for Basin No. 4 is located just west of the existing riser pipe inside the basin. The emergency overflow culvert consists of a 30-inch corrugated metal pipe (CMP) that has a riprap-lined swale located at the outfall of the pipe. An additional riprap-lined emergency spillway was constructed just north of the principal spillway in Basin No. 4. This weir structure was added as additional protection in case both the principal spillway and the emergency culvert becomes plugged by storm debris.

Basin No. 5 on the west side was constructed to accommodate the surface runoff from the borrow pit and to accept the discharge from Channel 5. The berm in Basin No. 5 has a higher elevation than any point inside the borrow pit and the berm for Basin No. 4. As such, constructing an emergency spillway is not necessary. All excess flow from Basin No. 5 will overflow into Basin No. 4 before discharging from the RRL site.

Basin No. 6 was constructed to accept surface runoff from the northern end of the capped landfill, and from Channels 2 and 3. The emergency overflow for Basin No. 6 is a 12-inch-diameter CMP located in the east berm of the basin as shown on Sheet RD-3. (See Appendix A.)

2.1.2.1.1 Discharge Structures

During placement of the berm soils, corrugated metal pipe (CMP) discharge structures with anti-seep collars were installed to the lines and grades shown in the approved Erosion and Sediment Control Plan. Each basin located around the site contains one principal spillway discharge structure for a total of five structures. The principal spillway discharge structures consist of a 120-inch x 120-inch x 1 g-inch concrete base, to reduce the potential for riser settlement and to provide a firm base for the 60-inch-diameter riser pipe. All riser pipes were fitted with a minimum 24-inch discharge pipe in accordance with the approved Erosion and Sediment Control Plan. Soil that was used for backfill around the piping and anti-seep collars was placed in 12-inch lifts and compacted by hand using plate compactors to 95 percent of maximum dry density (based on ASTM D698). The outfall of the discharge structures have non-woven geotextile fabric and riprap aprons to prevent erosion and scouring of the soils. The discharge structures were designed to accommodate at least the discharge from a 25-year storm. Each of the 60-inch-diameter CMP outfall structures was fitted with an anti-vortex/trash rack.

2.1.2.1.2 Emergency Spillway

Each sediment basin, except for Basin No. 5, has an emergency spillway. Emergency spillways are either the riprap-lined open channels as shown on Sheet RD-3 (see Appendix A) or CMPs. The CMP emergency spillway was used for Basin Nos. 3 and 6 because the outer berm of each basin was used as part of the access road. Basin No. 3 contains a 36-inch-diameter CMP that is installed from Basin No. 3 to outlet at a riprap revetment in Basin No. 1, which has excess storage capacity. A single 12-inch-diameter CMP was installed in the berm of Basin No. 6. The pipe was sized to accommodate the quantity of runoff that exits the basin through the principal spillway. The pipe was installed to ensure that the basin could not overflow. A 30-inch-diameter CMP emergency overflow pipe and a riprap-lined "V" ditch emergency spillway were installed in Basin No. 4. This emergency overflow pipe discharges into a riprap revetment leading to an unnamed tributary.

2.1.2.2 Sediment Trap

Sediment traps differ from sediment basins in the following way. A sediment basin in a barrier or dam with a controlled stormwater release structure, i.e., a perforated riser and principal spillway, whereas a sediment trap is an earthen embankment with a stone outlet. A sediment basin has wet and dry storage areas where the sediments are allowed to settle. Whereas, in a sediment trap, the runoff flows through the stone outlet and the sediment is separated from the water.

There were two sediment traps constructed at the landfill.

The first sediment trap was installed along the southeastern edge of the landfill. This sediment trap was used to contain any sediment that ran off the east slope of the landfill during construction. It was cleaned out on several occasions due to sediment buildup, which was affecting the function of the trap. A sediment trap was selected for the east side of the site due to the confined area available for construction. The design of the sediment trap was included in the approved Erosion and Sediment Control Plan and the location of the sediment trap is shown on Sheet RD-3. (See Appendix A.) The landfill cap slope contributing to the trap is the steepest on the site at approximately 2H: lV, but the drainage area was minimized to stay within the capacity requirements. Protection of the eastern landfill slope was accomplished by establishing permanent and temporary erosion control measures. Temporary measures, such as the installation of additional silt fence, hay bales, and erosion fabric, protected the slope from the heavy runoff that had been observed during the winter of 1996. As an added measure of protection, a more substantial tackifier, HydroblanketTM had been installed on the steeper portion of this slope. As a steady stand of grass was established, the temporary measures were removed.

The second sediment trap was installed at the south end of the cap in Channel 9. This sediment trap was constructed to accommodate excess surface runoff and erosion sediment from the southern end of the capped landfill. A small earthen berm was constructed on the cap to redirect some of the sheet flow away from Channel 1 and toward the sediment trap located within Channel 9. This berm was constructed from topsoil and was compacted by several passes of a bulldozer.

2.1.2.3 Stormwater Collection Channels

Approximately 5,500 linear feet of stormwater collection channels were constructed around the perimeter of the Russell Road Landfill.

The stormwater channels were used to convey the stormwater runoff to one of the newly constructed sediment control structures. The stormwater channels are "V'" shaped, having a minimum depth of 2 feet. Each channel is lined with erosion control matting or riprap, depending on the channel's design velocity. See Sheet RD-3 (Appendix A) for channel locations and design elements.

A 32-inch- x 4%inch- x 72-inch-deep (inner dimensions) drop inlet was installed in Channel 6 along the west side of the landfill. This drop inlet was not part of the original design, however, it

was installed when it became necessary to convey stormwater from approximately 40 percent of the landfill to Sediment Basin No. 4 to meet the erosion control/sedimentation criteria for the site.

The final landfill cap configuration required surface drainage from a large portion of the landfill to flow to the west. Topographic constraints would not allow this stormwater to flow directly into Basin No. 1 as originally designed. Therefore, OHM designed and installed, with Navy approval, the drop inlet (shown on Sheet RD-9, Appendix A) to accommodate the 10-year storm.

The above drop inlet structure has three inlets located on the north and south side as well as the east side. The north and south inlets are for the drainage of surface runoff in Channel 6. The east side inlet is for a 10-inch lateral from the liner anchor trench. The outlet of the drop inlet structure is a 30-inch-diameter CMP that discharges the surface runoff into a "V" channel lined with filter fabric and riprap. To accommodate the velocity of runoff from the 30-inch CMP, lean concrete was installed around the riprap for the first 25 feet of the channel.

APPENDIX B
HELP MODEL

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****

USSELL ROAD HAZARDOUS WASTE LANDFILL, QUANTICO, VA
MODEL RUN OVER 2000 FEET AT 2.5%
7/17/95

****
****

BARE GROUND

LAYER 1

VERTICAL PERCOLATION LAYER

THICKNESS	=	6.00 INCHES
POROSITY	=	0.5010 VOL/VOL
FIELD CAPACITY	=	0.2838 VOL/VOL
WILTING POINT	=	0.1353 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2837 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY	=	0.000189999992 CM/SEC 1E-4

LAYER 2

VERTICAL PERCOLATION LAYER

THICKNESS	=	18.00 INCHES
POROSITY	=	0.4057 VOL/VOL
FIELD CAPACITY	=	0.3089 VOL/VOL
WILTING POINT	=	0.2099 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3089 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY	=	0.000002100000 CM/SEC 2E-6

LAYER 3

LATERAL DRAINAGE LAYER

THICKNESS	=	12.00 INCHES
POROSITY	=	0.4170 VOL/VOL
FIELD CAPACITY	=	0.0454 VOL/VOL
WILTING POINT	=	0.0200 VOL/VOL

35.10	37.40	45.70	56.40	64.50	71.60
75.70	74.80	68.40	57.10	47.00	38.30

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 74 THROUGH 78

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	4.05	1.54	4.58	3.17	4.99	4.36
	2.67	4.27	4.30	4.16	2.90	3.65
STD. DEVIATIONS	2.39	0.98	2.67	2.03	2.10	1.81
	1.44	1.98	2.53	4.56	1.51	0.54
RUNOFF						
TOTALS	1.143	0.104	0.940	0.825	0.765	0.557
	0.260	0.570	1.330	1.547	0.419	0.550
STD. DEVIATIONS	1.853	0.143	1.554	1.088	0.703	0.647
	0.285	0.462	1.135	2.506	0.488	0.305
EVAPOTRANSPIRATION						
TOTALS	1.391	1.810	2.751	2.623	3.427	4.188
	2.403	3.301	2.446	1.930	1.500	1.409
STD. DEVIATIONS	0.236	0.499	0.212	0.864	1.259	1.231
	1.356	1.531	0.505	1.414	0.395	0.248
LATERAL DRAINAGE FROM LAYER 3						
TOTALS	0.9316	1.1468	0.6081	0.4304	0.2781	0.2188
	0.1929	0.1785	0.2471	0.3624	0.5795	0.8427
STD. DEVIATIONS	0.6636	0.5249	0.3797	0.5263	0.1699	0.1582
	0.1209	0.0906	0.2305	0.2472	0.5805	0.7173
PERCOLATION FROM LAYER 4						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

****

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FINAL WATER STORAGE AT END OF YEAR 78

LAYER	(INCHES)	(VOL/VOL)
1	1.62	0.2696
2	7.29	0.4050
3	1.14	0.0952
4	0.43	0.4300
SNOW WATER	0.00	

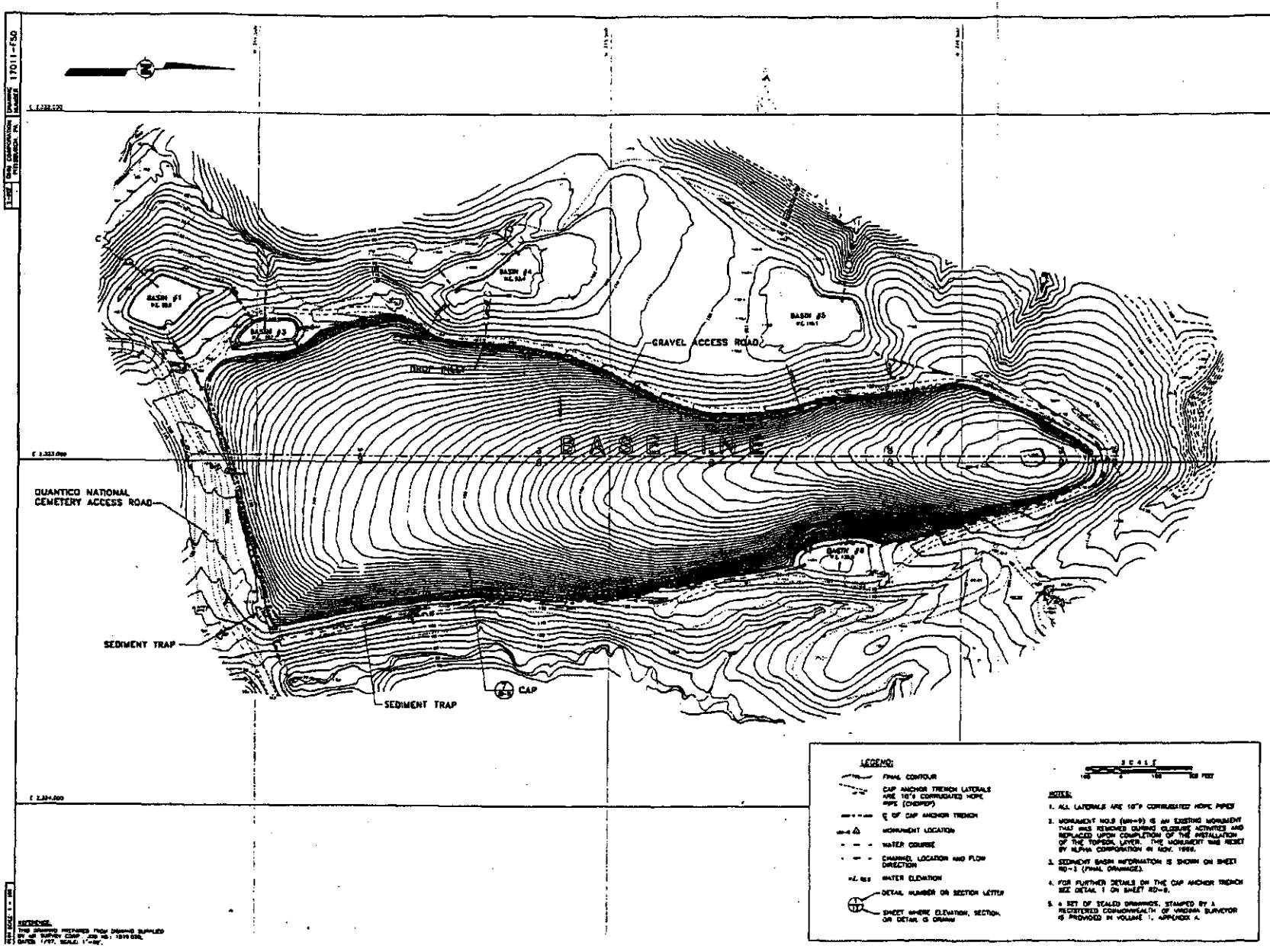
****
****

APPENDIX E-5

DRAWINGS

LANDFILL CAP DRAINAGE LAYER DESIGN – RUNOFF CONTROL SYSTEM – EROSION CONTROL STRUCTURES

RUSSEL ROAD LANDFILL, MCB QUANTICO



LEGEND:

- FINAL CONTOUR
- CAP ANCHOR TRENCH LATERALS KWE 18"ø CORRUGATED HDPE PIPE (CHOPED)
- ℄ OF CAP ANCHOR TRENCH
- MONUMENT LOCATION
- WATER COURSE
- CHANNEL LOCATION AND FLOW DIRECTION
- WATER ELEVATION
- DETAIL NUMBER OR SECTION LETTER
- SHEET WHERE ELEVATION, SECTION, OR DETAIL IS DRAWN

SCALE: 100 0 100 200 FEET

NOTES:

1. ALL LATERALS ARE 18"ø CORRUGATED HDPE PIPES
2. MONUMENT NO.8 (BM-8) IS AN EXISTING MONUMENT THAT WAS REMOVED DURING CLOSURE ACTIVITIES AND REPLACED UPON COMPLETION OF THE INSTALLATION OF THE TOPSOIL LAYER. THE MONUMENT WAS RESET BY ALPHA CORPORATION IN NOV. 1999.
3. SEDIMENT BASIN INFORMATION IS SHOWN ON SHEET RD-3 (FINAL DRAINAGE).
4. FOR FURTHER DETAILS ON THE CAP ANCHOR TRENCH SEE DETAIL 1 ON SHEET RD-6.
5. A SET OF SEALED DRAWINGS, STAMPED BY A REGISTERED COMMONWEALTH OF VIRGINIA SURVEYOR IS PROVIDED IN VOLUME 1, APPENDIX A.

REFERENCE:
THIS DRAWING PREPARED FROM DRAWING SUPPLIED BY WE AP SURVEY CORP. JOB NO.: 1919 008, DATED 1/97, SCALE: 1"=50'.

DRAWING NUMBER 17011-F50

GRA CORPORATION PITTSBURGH, PA.

REVISIONS

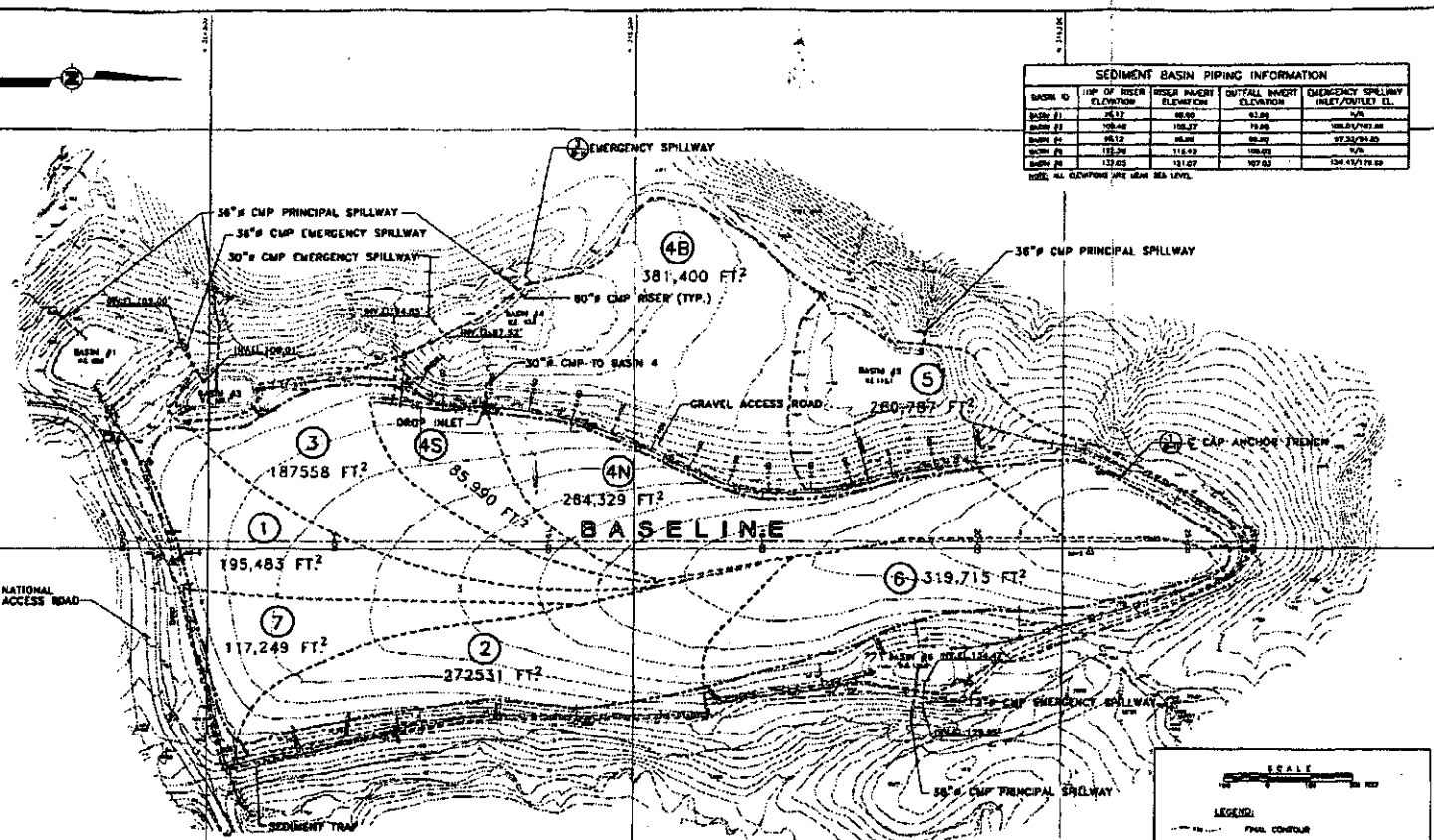
GRA Remediation Services Corp.

EFA - CHESAPEAKE
RUSSELL ROAD LANDFILL CLOSURE
MARINE BASE - QUANTICO, VIRGINIA

RECORD DRAWING - FINAL CONDITIONS TOPOGRAPHIC MAP

3066671

SHEET NO.
RD-1



SEDIMENT BASIN PIPING INFORMATION

BASIN ID	TOP OF RISER ELEVATION	RISER INVERT ELEVATION	OUTFALL INVERT ELEVATION	EMERGENCY SPILLWAY INLET/OUTLET EL.
BASIN #1	96.12	88.00	83.00	N/A
BASIN #3	109.40	100.27	79.00	100.01/101.00
BASIN #4	96.12	88.00	88.00	97.33/94.00
BASIN #5	133.20	116.03	109.03	N/A
BASIN #6	132.05	121.07	107.03	134.41/129.00

NOTE: ALL ELEVATIONS ARE MSL SEA LEVEL

TABLE 1 – STORMWATER DIVERSION CHANNEL WORKSHEET

Channel ID	Channel Segment	Hyd. Condition	Low Elevation	Length (LF)	Slope Percent	Bottom Width (ft)	Estimated Channel Depth (ft)	Side Slope (H:V)	Q Type	Q Value	Min. Radius of Curvature (ft)	Manning's Coefficient (n)	Velocity (fps)	Flow Area (ft²)	Wetted Perimeter (ft)	Hydraulic Radius (ft)	Freeboard (ft)	Channel Stability (fps)	Channel Stability (ft)	Channel Stability (cfs)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

LEGEND:

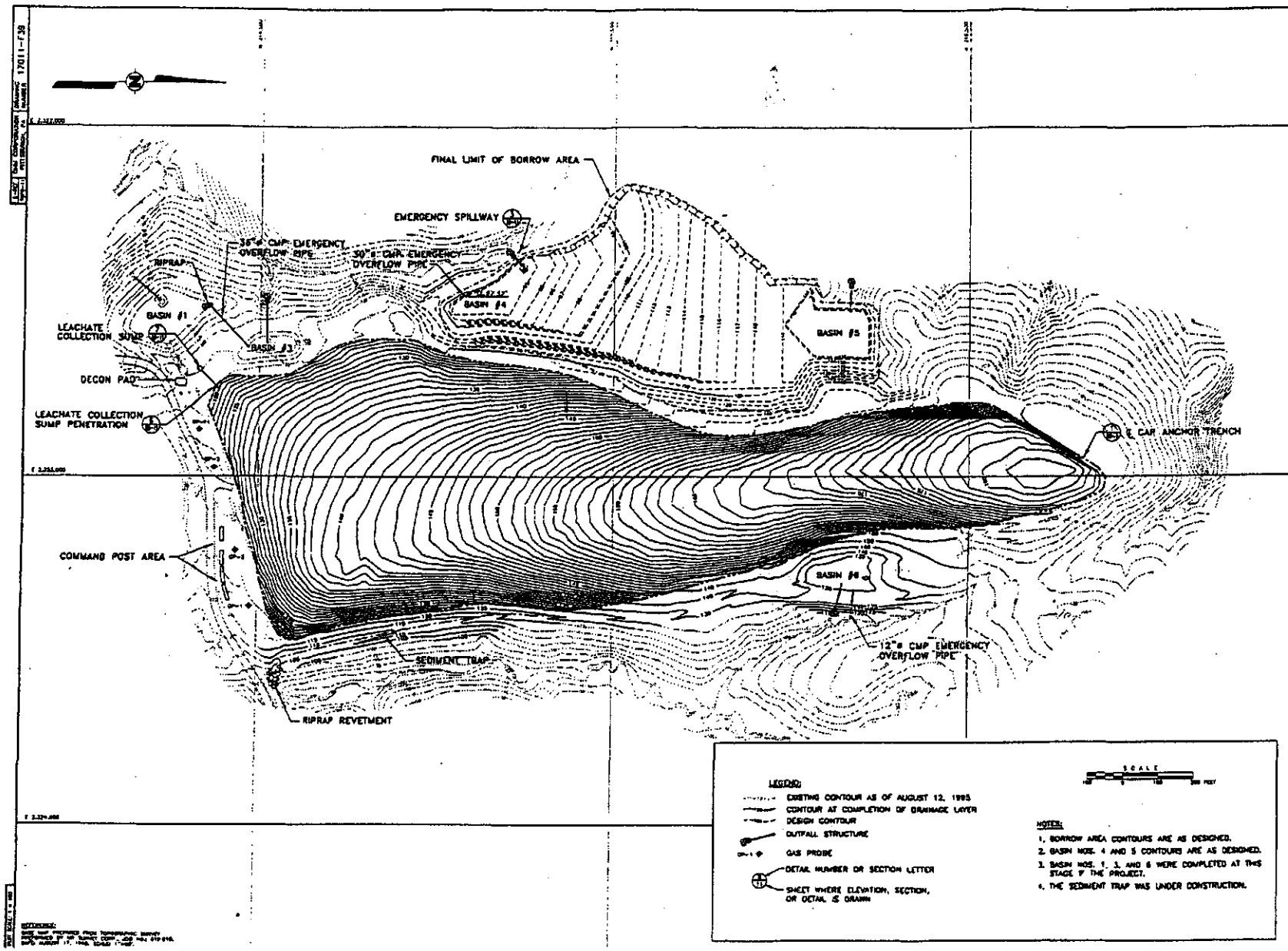
- FINAL CONTOUR
- WATERSHED DELINEATION
- CAP ANCHOR TRENCH LATERALS ARE 10"ø CORRUGATED HDPE PIPE (CHDPEP)
- MONUMENT LOCATION
- WATER COURSE
- CHANNEL NUMBER, SEGMENT IDENTIFICATION AND FLOW DIRECTION
- WATER ELEVATION
- DETAIL NUMBER OR SECTION LETTER
- SHEET WHERE ELEVATION, SECTION, OR DETAIL IS DRAWN
- DRAINAGE AREA

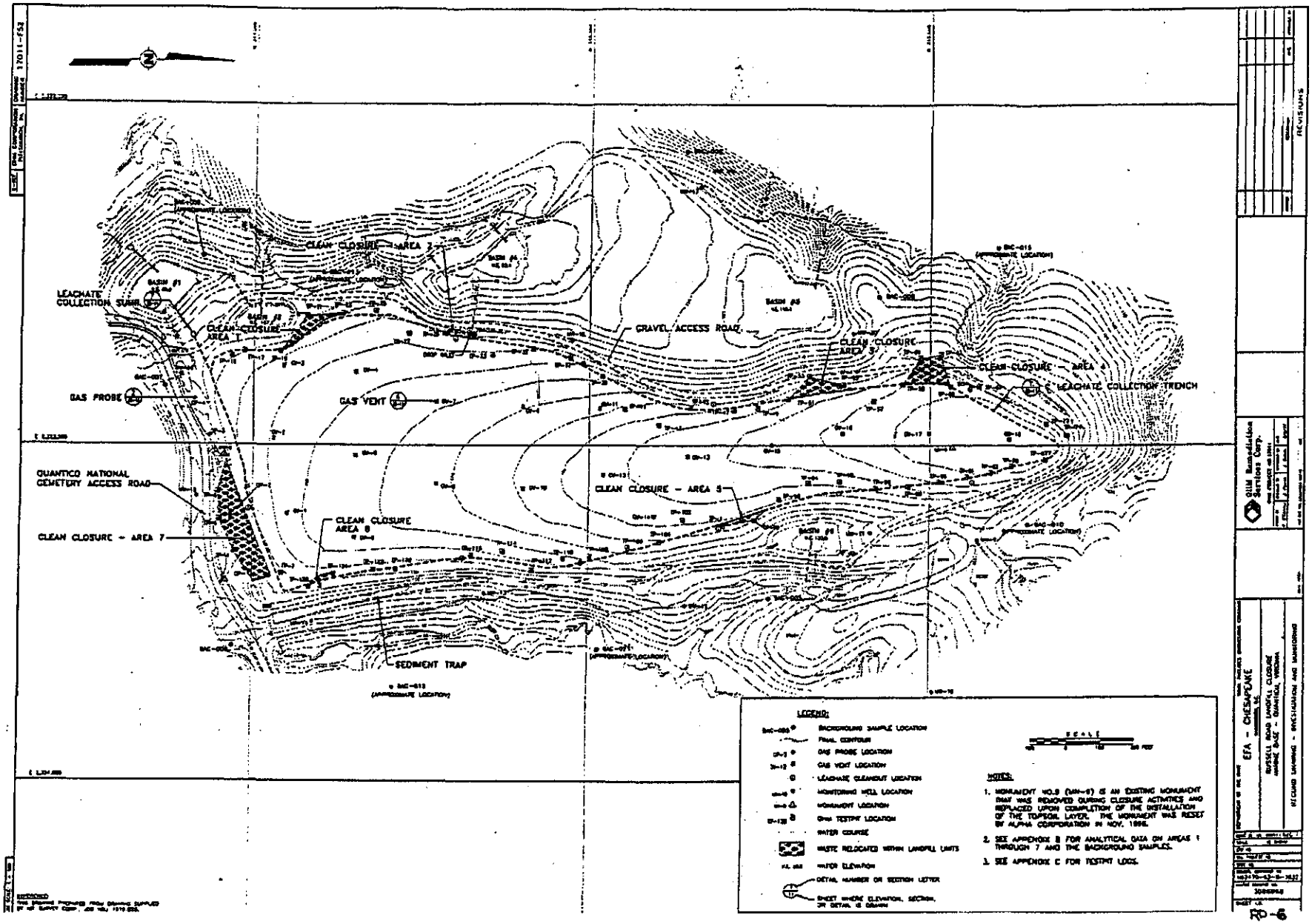
NOTES:

1. ALL LATERALS ARE 10"ø CORRUGATED HDPE PIPES
2. MONUMENT NO.3 (MH-8) IS AN EXISTING MONUMENT THAT WAS REMOVED DURING CLOSURE ACTIVITIES AND REPLACED UPON COMPLETION OF THE INSTALLATION OF THE TOPSOIL LAYER. THE MONUMENT WAS RESET BY ALPHA CORPORATION IN NOV. 1999.

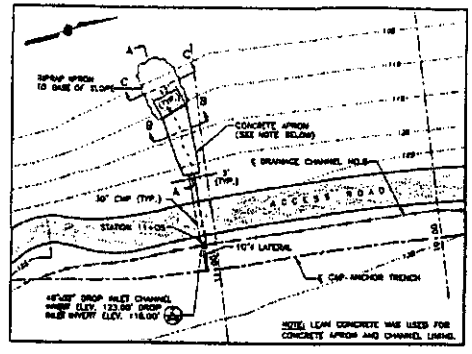
EFA – CHESAPEAKE
BASIN 1, BASIN 3, BASIN 4, BASIN 5, BASIN 6
QUANTICO, CORPORAL, MARINE BASE, QUANTICO, VIRGINIA
RECORD DRAWING – FINAL DRAWING

RD-3

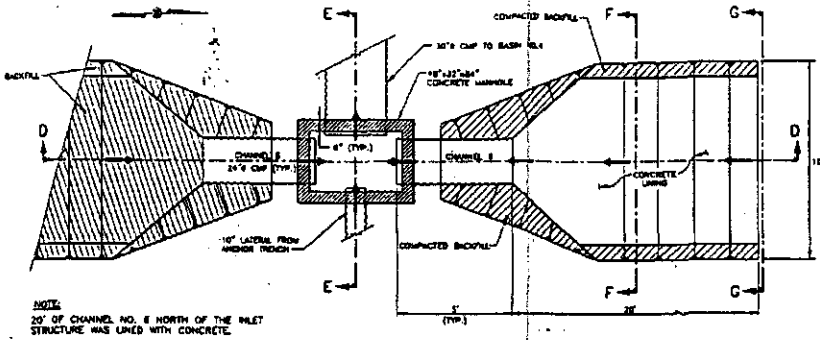

FINAL LIMIT OF BORROW AREA
EMERGENCY SPILLWAY
35"ø CMP EMERGENCY OVERFLOW PIPE
30"ø CMP EMERGENCY OVERFLOW PIPE
RIPRAP
BASIN #1
BASIN #3
BASIN #4
BASIN #5
BASIN #6
LEACHATE COLLECTION SUMP
DECON PAD
LEACHATE COLLECTION SUMP PENETRATION
COMMAND POST AREA
SEDIMENT TRAP
RIPRAP REVETMENT
12"ø CMP EMERGENCY OVERFLOW PIPE
E. CAP ANCHOR TRENCH
LEGEND:
EXISTING CONTOUR AS OF AUGUST 12, 1995
CONTOUR AT COMPLETION OF DRAINAGE LAYER
DESIGN CONTOUR
OUTFALL STRUCTURE
GAS PROBE
DETAIL NUMBER OR SECTION LETTER
SHEET WHERE ELEVATION, SECTION, OR DETAIL IS DRAWN
SCALE
NOTES:
1. BORROW AREA CONTOURS ARE AS DESIGNED.
2. BASIN NOS. 4 AND 5 CONTOURS ARE AS DESIGNED.
3. BASIN NOS. 1, 3, AND 6 WERE COMPLETED AT THIS STAGE IF THE PROJECT.
4. THE SEDIMENT TRAP WAS UNDER CONSTRUCTION.
REVISIONS
OHM Remediation Services Corp.
EFA - CHESAPEAKE
RUSSELL ROAD LANDFILL CLOSURE
MARINE BASE - QUANTICO, VIRGINIA
RECORD DRAWING - TOP OF DRAINAGE LAYER
RD-4



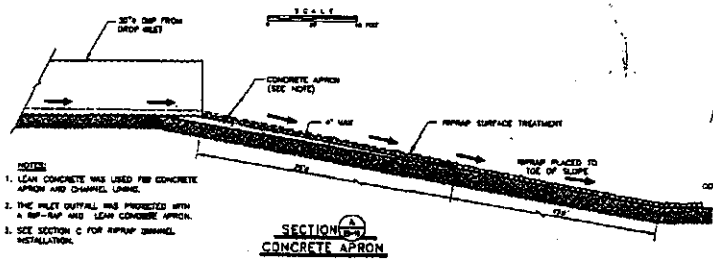
CLEAN CLOSURE - AREA 2
LEACHATE COLLECTION SUMP
CLEAN CLOSURE AREA 1
GRAVEL ACCESS ROAD
CLEAN CLOSURE AREA 3
CLEAN CLOSURE - AREA 4
LEACHATE COLLECTION TRENCH
GAS PROBE
GAS VENT
QUANTICO NATIONAL CEMETERY ACCESS ROAD
CLEAN CLOSURE - AREA 5
CLEAN CLOSURE AREA 6
CLEAN CLOSURE - AREA 7
SEDIMENT TRAP
LEGEND:
BACKGROUND SAMPLE LOCATION
FINAL CONTOUR
GAS PROBE LOCATION
GAS VENT LOCATION
LEACHATE CLEANOUT LOCATION
MONITORING WELL LOCATION
MONUMENT LOCATION
GWA TESTPIT LOCATION
WATER COURSE
WASTE RELOCATED WITHIN LANDFILL LIMITS
WATER ELEVATION
DETAIL NUMBER OR SECTION LETTER
SHEET WHERE ELEVATION, SECTION, OR DETAIL IS DRAWN
SCALE
NOTES:
1. MONUMENT NO.9 (MN-9) IS AN EXISTING MONUMENT THAT WAS REMOVED DURING CLOSURE ACTIVITIES AND REPLACED UPON COMPLETION OF THE INSTALLATION OF THE TOPSOIL LAYER. THE MONUMENT WAS RESET BY ALPHA CORPORATION IN NOV. 1996.
2. SEE APPENDIX B FOR ANALYTICAL DATA ON AREAS 1 THROUGH 7 AND THE BACKGROUND SAMPLES.
3. SEE APPENDIX C FOR TESTPIT LOGS.
REVISIONS
QUM Remediation Services Corp.
EFA - CHESAPEAKE
RUSSELL ROAD LANDFILL CLOSURE
MARINE BASE - QUANTICO, VIRGINIA
RECORD DRAWING - INVESTIGATION AND MONITORING
RD-6



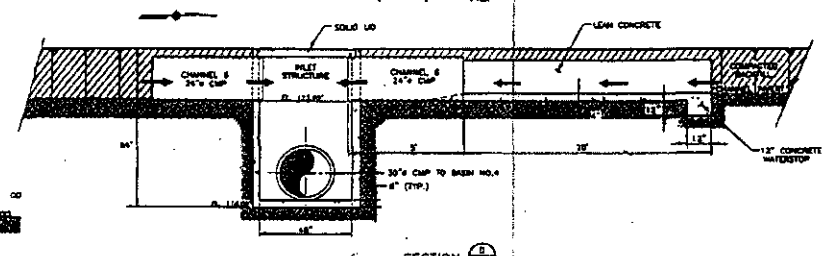
PLAN (1/B-9)
DROP INLET BASIN NO. 4



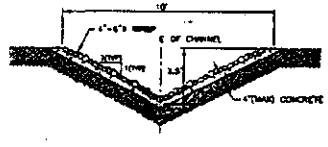
DETAIL (2/B-9)
DROP INLET



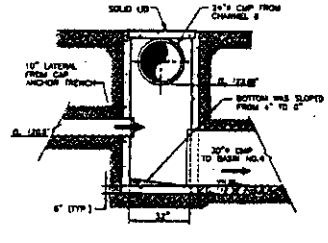
SECTION (A/B-9)
CONCRETE APRON



SECTION (D/B-9)



SECTION (B/B-9)



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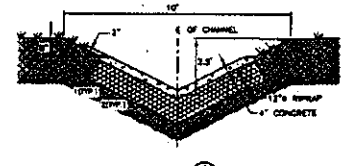
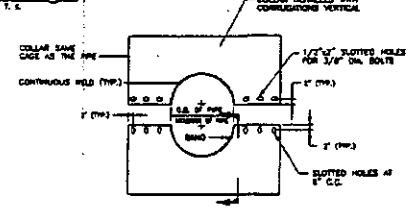
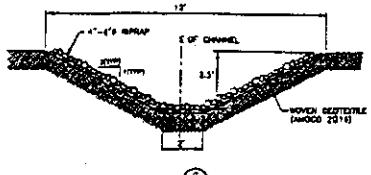
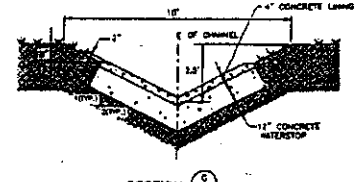


SECTION (F/B-9)





SECTION (C/B-9)



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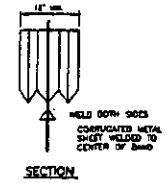


SECTION

DETAIL (3/B-9)
CORRUGATED METAL ANTI-SEEP COLLAR
TYPICAL SEDIMENT BASIN DISCHARGE PIPE ONLY

REVISIONS

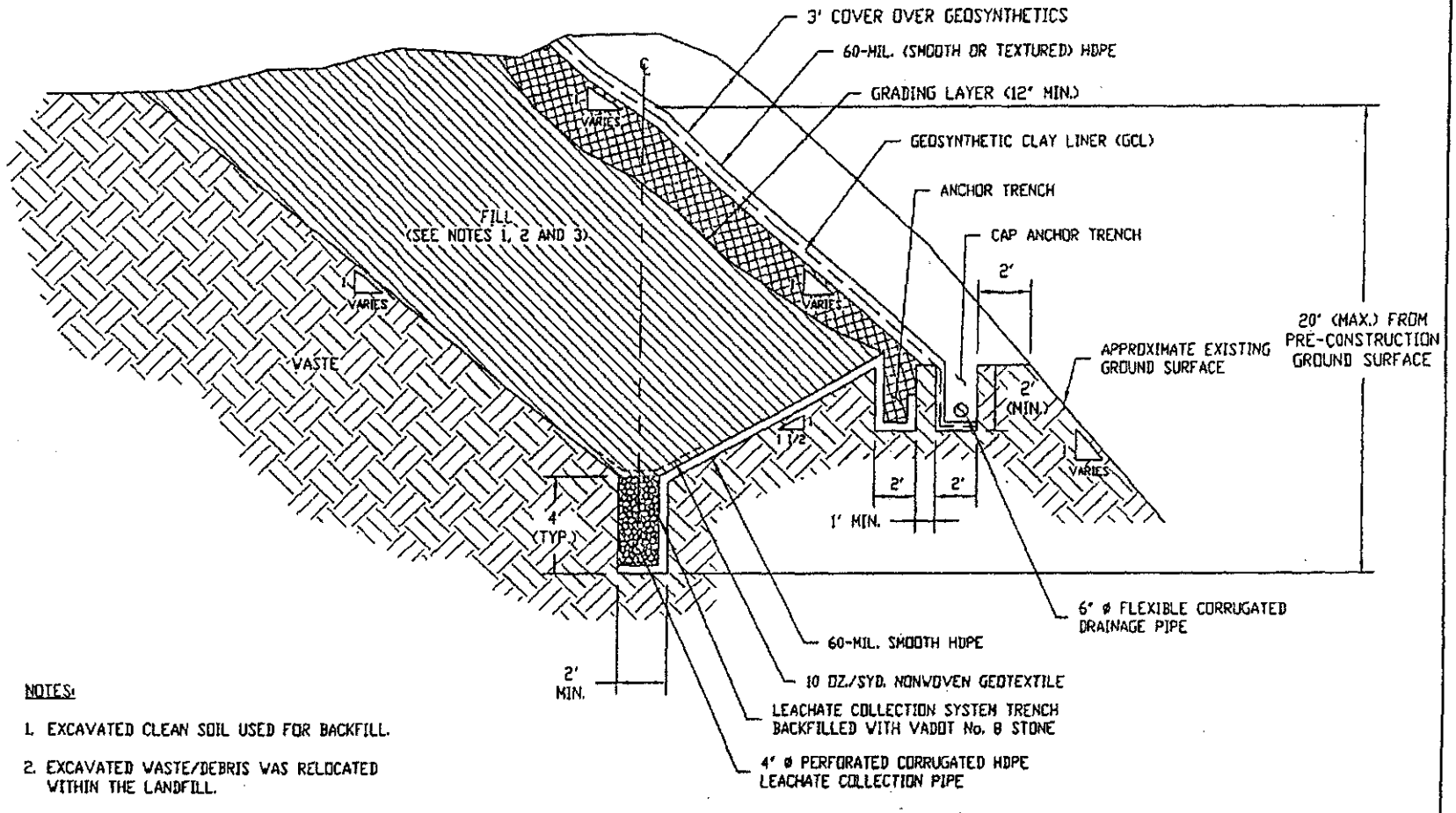
OHM Remediation Services Corp.

EFA - CHESAPEAKE
BUSSELL ROAD LANDFILL CLOSURE
MARINE BASE - QUANTICO, VIRGINIA
RECORD DRAWING - DROP INLET, PLAN, SECTIONS, AND DETAIL

N62470-92-D-3032
3068874

RD-10

DRAWING NUMBER 17011-F37



NOTES:

1. EXCAVATED CLEAN SOIL USED FOR BACKFILL.
2. EXCAVATED WASTE/DEBRIS WAS RELOCATED WITHIN THE LANDFILL.
3. ADDITIONAL BACKFILL CONSISTED OF COMMON ON-SITE BORROW MATERIAL.
4. EXCAVATION OF CAP ANCHOR TRENCH AND LEACHATE ANCHOR TRENCH VARIES.

TETRA TECH NUS, INC.

FIGURE 2-2

EXISTING PERIMETER LEACHATE COLLECTION SYSTEM DETAIL
RUSSELL ROAD LANDFILL
MCCDC, QUANTICO, VIRGINIA

T:\Environ\5684\Figure 2

APPENDIX E-6

LANDFILL PERIMETER LINER AND LEACHATE COLLECTION TRENCH SYSTEM DESIGN

RUSSEL ROAD LANDFILL, MCB QUANTICO

APPENDIX E-6

LANDFILL PERIMETER LINER AND LEACHATE COLLECTION TRENCH SYSTEM DESIGN RUSSEL ROAD LANDFILL, MCB QUANTICO

Excerpts of information from the MCB Quantico's Russell Road Landfill (RRL) Closure Plans and Post-Closure Plans and related design plans and specifications are provided below which describe the landfill's perimeter liner and leachate collection system designed to control the lateral migration of leachate from the landfill and to collect the leachate for subsequent storage, treatment, and disposal to a RCRA permitted treatment, storage, disposal (TSD) facility.

Design information is provided below on the landfill's perimeter liner and leachate collection system components as follows:

1. Leachate Collection Trench.
2. Stone.
3. Pipe.
4. Backfill.
5. Leachate Collection Sump.
6. Solar Panels.
7. Auto-Dialer and Monitoring System.
8. Placement of Geosynthetics.
9. Leachate Collection System Liner.
10. Geosynthetic Clay Liner.
11. Cap Anchor Trench.
12. HDPE Liner.
13. Geotextile Protection Layer.
14. Geotextile Separation Layer.
15. Drainage Layer
16. Placement of Frost Protection Layer.
17. Inspection and Testing.
18. Leachate Collection System.
19. Subgrade.
20. Passive Gas Venting and Monitoring System.
21. Geosynthetics.
22. Aggregate/Soil Materials.
23. Site Restoration.

In addition to the below text, excerpted design plans and specifications record drawings are provided below as follows from the *Final Closeout Report for the Russell Road Landfill*, OHM, 1997:

1. Record Drawing RD-1, Final Conditions Topographic Map, RRL, OHM Remediation Services Corp., 1997.

2. Record Drawing RD-2, Top of Frost Protection Layer, RRL, OHM, 1997.
3. Record Drawing RD-4, Top of Drainage Layer, RRL, OHM, 1997.
4. Record Drawing RD-6, Investigation and Monitoring, RRL, OHM, 1997.
5. Record Drawing RD-7, Geomembrane Panel Layout, RRL, OHM, 1997.
6. Record Drawing RD-9, Leachate Collection Trench Profile, RRL, OHM, 1997.
7. Record Drawing RD-11, Miscellaneous Details, RRL, OHM, 1997.

Figure 2-2, Existing Perimeter Leachate Collection System Detail, Tetra Tech NUS, Inc., provides a cross sectional view of the landfill cap and drainage layer design along with the perimeter leachate collection system.

This below excerpt taken from Section 2.0, "Description of Remedial Activities", subsection 2.4 "Leachate Collection Trench" from the Final Closeout Report for the Russell Road Landfill, OHM, 1997.

2.4 LEACHATE COLLECTION TRENCH

The leachate collection trench, as shown on **Sheet RD-6** was designed to minimize the lateral migration of leachate from the landfill. It was located approximately 2 feet outside the limits of waste, after relocation of waste from the clean closure areas. The trench was excavated using two excavation crews starting at different locations. The first crew began excavation with a hydraulic excavator, starting at Clean Closure Area 6, as shown on **Sheet RD-6.** Area 6 is located on the southeast comer of the landfill. The second crew started on the southwest side of the landfill at Clean Closure Area 2. Both crews advanced in a northerly direction and tied the trench together at the northern end of the cap. The last area of leachate trench to be excavated was across the southern end of the landfill from east to west. All excavation work was done in Level B personal protective equipment (PPE) due to potential exposure to unknown contaminants. Air monitoring was performed in accordance with the Health and Safety Plan (HASP). Results of the air monitoring are included in Appendix D. All of the material excavated from the leachate collection trench was placed within the limits of the cap.

The maximum depth of the leachate collection trench was 20 feet. The trench had maximum side slopes of 1.5 feet horizontal to 1 foot vertical (1.5H:1V). At the bottom of the "V" trench, a 2-foot-wide rectangular section was excavated. The rectangular excavation ranged in depth from 2 feet to 4 feet. A single layer of smooth 60-mil HDPE lined the location of the trench and extended up the outer excavation slope to an anchor trench at the same elevation as the cap anchor trench. The bottom section of the trench was to accommodate the drainage media (stone) and pipe to collect and convey the leachate.

The anchor trench of the leachate collection liner was approximately 2 feet inside the final cap anchor trench. An additional 60,000 cubic yards of waste/debris were removed from the leachate collection trench during the excavation activities. In accordance with Section 5.3 of the "Closure In-Place and Post-Closure Care Plan," waste encountered during trench excavation was removed and placed within the limits of the cap. Waste, such as large or sharp debris that would pose some risk to the integrity of the trench liner, was relocated to the portion of the landfill that is

inside the leachate collection trench. A typical cross-section of the leachate collection trench is shown on Detail 3, **Sheet RD-11.** Table 1 describes the various subsurface conditions encountered during trench construction.

2.4.1 Stone

The specified bedding layer for the leachate collection trench was Virginia Department of Transportation (VDOT) No. 8 stone. An excavator was used to place the stone in the bottom of the leachate collection trench. Finished grade was achieved by hand raking the stone prior to the installation of the 4-inchdiameter perforated HDPE pipe. The 4-inch-diameter HDPE pipe was lowered in sections on top of the bedding material, and then welded together with a butt fusion heating plate. Once a 20-foot section of pipe was installed and connected, the remainder of the trench was filled with the VDOT No. 8 stone and a sheet of lo-ounce per-square-yard (oz/sq yd) non-woven geotextile was placed over the top of the stone. OHM's on-site surveying team monitored the grades of the leachate collection line with a laser level to ensure the pipe was placed to the proper lines and grades. **(See Sheet RD-9 for trench profile.)**

2.4.2 Pipe

Approximately 5,700 linear feet of 4-inch-diameter, perforated, high density polyethylene (HDPE) pipe was placed on top of the 3-inch-thick stone bedding layer in the trench. The pipe was sloped from the north end (high) of the landfill and extended along both the east and west sides to a single sump located in the southwest comer as shown on **Sheet RD-1**. The slope of the pipe ranged from a minimum of 1 percent to a maximum of 3 percent. The pipe was butt fusion welded by OHM recovery technicians in accordance with the manufacturer's specifications.

In the southwest corner, where the two lines meet, a tee coupling was used to connect a 4-inch-diameter, double-walled, leachate trench HDPE pipe **(Detail 6, Sheet RD-11)**. The double-walled pipe was passed through and booted to the 60-mil leachate collection trench liner of the excavation and extended to the HDPE sump. The double-wall pipe terminates in the leachate collection sump **(Detail 7, Sheet RD-11)**.

During installation of the leachate collection pipe network, OHM installed 13 cleanouts at approximately 400-foot intervals **(see Sheet RD-1)**. The cleanouts were installed by butt fusion welding a 45-degree "Y" to the main line, then welding 20-foot sections of solid 4-inch-diameter, I-IDPE SDR 17 pipe, and cap to the "Y" connection. The cleanouts were extended as necessary to ensure that when the topsoil layer was installed, the cleanouts would be exposed to minimum of 12 inches above the final cap grade as shown on **Sheet RD-7)**. Four steel bollards were installed around each cleanout to protect the cleanouts from damage during cap maintenance activities. The bollards were painted orange and the exposed section of the cleanout pipe was painted white for visibility. VDOT No. 8 stone was also placed in a 4-foot x 4-foot area around the cleanout pipes to keep grass from camouflaging the exposed sections.

2.4.3 Backfill

Select fill from the on-site borrow area was used to backfill the leachate trench excavation after the stone and geotextile were installed. The soil was placed in 1 inch loose lifts and compacted

with a smooth drum roller to achieve a 90 percent of the maximum dry density based on ASTM D698. Density tests were performed every 200 feet along the centerline of the leachate collection trench on the final 12 inches of the grading layer. The compaction results and locations are included in Appendix C.

2.4.4 Leachate Collection Sump

The leachate collection sump is located in the southwest corner of the landfill as shown on **Sheet RD- 11)**. The sump consists of a 48-inch-diameter by 21-foot-tall, double-walled HDPE manhole with a polyethylene lid, 2-inch-diameter vent pipe, and a 1-inch-thick stock HDPE top and bottom plate. The manhole contains five sensors which measure temperature and liquid level and are connected to an autodialer. Two sensors, which detect the presence of liquid, are installed in the annular space between the two walls to advise if the first wall of the sump has been compromised. Three sensors, which monitor high and low water level and temperature, are installed within the main tank. The 6-inch-diameter double-walled HDPE pipe enters the tank 6 feet above the bottom of the tank. This pipe is connected to the leachate collection piping network.

The sump was installed by first excavating a 24-foot-deep pit. A 36-inch-thick bedding layer of AASHTO No. 57 stone was placed and compacted at the base of the excavation. Next, a hydraulic excavator hoisted and lowered the manhole into place. Upon verification of the tank position, a cast-in-place concrete anchor was installed around the base of the tank. When the concrete had cured, OHM backfilled the excavation to within 2 feet of existing ground surface, using VDOT No. 8 stone. Common fill was then placed and compacted in the remainder of the excavation.

2.4.5 Solar Panels

Two 47-inch x 15-inch 22-watt solar electric panels are used to supply the required 80-watt-per-day-at-12-volts power to power the autodialer and sensors. A 12-volt, gas-adsorbed electrolyte, <2 percent hydrogen gas, microfibrous silica glass mat (lead calcium design) battery in a Nema 3R/4X battery box is used to store power from the solar panels. The battery is designed to maintain power for 7 to 10 days without receiving a charge from the solar panels. A voltage regulator is used to control the power for the system.

2.4.6 Autodialer and Monitoring System

The autodialer and sump alarm were installed after the HDPE sump had been set and backfilled in place. The sensors and autodialer system allow for continuous monitoring of the sump. When the various sensors are engaged, the remote system output tells the user the status of the tank, including water level and internal temperature. The autodialer and sensors are powered via solar power and the autodialer is connected to a standard phone line (land line).

2.8 PLACEMENT OF GEOSYNTHETICS

The geosynthetics placed during cap construction and leachate collection system installation consisted of 8-oz/sq yd and 16-oz/sq yd non-woven geotextile, Bentomat™ /Claymax™ GCL,

and 60-mil smooth and textured HDPE liner. The installation of these geosynthetic components are discussed in detail below.

2.8.1 Leachate Collection System Liner

The leachate collection system liner (LCSL) consists of a single layer of smooth 60-mil HDPE liner placed along the outside slope and bottom side of the leachate collection trench as previously discussed in Section 2.4. The liner was welded parallel to the slope. All destructive and non-destructive testing results are included in Appendix D. Leachate collection system liner installation was performed in Level B PPE based on the results of air monitoring data, which is included in Appendix E. A hydraulic excavator with a spreader bar and a four-wheeled all-terrain vehicle was used to deploy the liner, while 10 technicians pulled, placed, and welded the LCSL.

2.8.2 Geosynthetic Clay Liner

The geosythetic clay liner (GCL) was placed over the cap subgrade to provide a base for the flexible geomembrane liner and reduce liquid infiltration should the geomembrane fail. All GCL used on site had a maximum permeability less than 1×10^{-7} centimeters per second (cm/sec). Bentomat™ and Claymax™ GCLs were used for the cap construction. Claymax™ was used on slopes less than 14H:1V and Bentomat™ was used on all steeper slopes. Bentomat™ was chosen for steeper slope application due to material testing, which showed, a higher internal friction angle and friction coefficient between the Bentomat™ and both the common fill and the textured HDPE liner material. The interface between the Claymax™ and Bentomat™ panels had a 6- to 9-inch overlap and loose powdered bentonite was applied to the seam. A hydraulic excavator with a spreader bar was utilized to deploy the GCL. The material was placed and aligned by six to eight recovery technicians.

2.8.3 Cap Anchor Trench

The cap anchor trench was installed around the perimeter of the landfill to anchor the liner system. The length of the cap anchor trench is approximately 5,875 linear feet. The trench was constructed by excavating a minimum 2-foot-wide x 2-foot-deep trench. **(See Detail 1 Sheet RD-11.)** The trench is located as shown on **Sheet RD-2.** The excavation activities for the anchor trench began during the GCL installation. The trench was excavated only as necessary each day, to ensure sufficient trench was available for GCL and liner installation activities. Once the GCL was in place for a section of the landfill, the HDPE liner and 16-oz/syd geotextile were installed. A 6-inch-diameter flexible corrugated drainage pipe with a geotextile sock was installed inside the cap anchor trench to allow surface water that seeped through the soil portion of the cap **(see Detail 1, Sheet RD- 11**to be collected and discharged away from the anchor trench. As the pipe installation progressed around the landfill, laterals that would drain the collected water to the landfill exterior were installed every 250 linear feet. These lateral drains would minimize the potential that the anchor trench would overflow or collected large amounts of water and cause a potential failure of the outside trench wall. After completion of the anchor trench construction, drainage pipe installation, and liner placement activities, the trench was backfilled to grade using VDOT No. 8 stone.

The laterals consisted of a 10-inch-diameter flexible corrugated drain pipe which was attached to the anchor trench pipe using a 6-inch to 10-inch corrugated HDPE reducer. The reducers were extrusion welded to the HDPE liner. The locations of all laterals are shown on **Sheet RD-1**. The laterals were extended to either stormwater channels or to the closest sediment structure. The termination of the lateral was based on the invert elevation of the anchor trench versus the invert elevation of the stormwater channel. In some cases where no perimeter stormwater channel existed, the lateral was extended to the base of one of the sediment structures. This generally occurs along the east side of the landfill where the stormwater channels are significantly lower in elevation than the cap anchor trench.

2.8.4 HDPE Liner

Both smooth and textured 60-mil HDPE geomembrane liner were installed to cap the landfill. **Sheet RD-7** shows the location of each type of liner material and each panel. Smooth HDPE liner was placed on slopes no steeper than 14H:1V, while textured liner was used on slopes from 7H:1V to 14H:1V. **Sheet RD-7** also shows the location of each destructive test.

The HDPE liner was placed directly over the GCL layer. A hydraulic excavator with spreader bar and a four-wheeled all-terrain vehicle were used to deploy the liner, while six recovery technicians positioned the HDPE liner. All HDPE welding was performed by Serrot Corporation. Serrot Corporation QC technicians performed all on-site liner testing. The HDPE was welded using double-fusion welding (double hot wedged) techniques with the repairs and boots being extrusion welded. All seams were cleaned according to manufacturers' recommendations and, where practical, were aligned parallel to the slope. Seams were overlapped a minimum of 4 inches. Grinding of seams was accomplished in accordance with the manufacturer's instructions and no damage was caused to the geomembrane liner. Air pressure testing was performed on all double-fusion welds and a vacuum box was used to test the remaining extrusion welded seams. All repairs were performed in accordance with applicable quality assurance/quality control (QA/QC) procedures and the project specifications. Appendix D contains the results of all destructive testing and HDPE repair logs. Appendix F contains the subcontractor's daily reports and non-destructive test logs. Additional details on the QC program are included in Section 4.0. Serrot Corporation's installation manual is included in Appendix D.

2.8.5 Geotextile Protection Layer

A single layer of 16-oz/sq yd non-woven geotextile was placed directly over the geomembrane. This material was used as a protective layer to prevent the 60-mil HDPE from being damaged during drainage layer installation. The geotextile was placed parallel to the geomembrane seams. The geotextiles were secured on slopes with sand bags to keep tension on the geotextile panel. Each sheet of geotextile overlapped the previous sheet by a minimum of 12 inches and was heat seamed together. Six to eight recovery technicians with assistance provided by two Serrot Corporation personnel installed the geotextile. All geosynthetics were stored in protective wrapping, off the ground, with an additional cover to prevent ultraviolet light exposure and impact from precipitation and other deleterious conditions. The site QC manager collected several samples and examined and approved all results from the laboratory for the conformance requirement, prior to the installation of the geotextile. Appendix D contains all of the geotextile conformance test data and Appendix F contains the subcontractor's daily reports.

2.8.6 Geotextile Separation Layer

An 8-oz/sq yd non-woven geotextile was used to separate the stone drainage and the frost protection layer. This material was placed directly over the stone drainage material. The intent of the geotextile layer was to ensure that the soil particles of the overlying common fill did not enter into the more porous underlying drainage stone. The 8-oz/sq yd geotextile panels were oriented parallel to the geomembrane panel and each sheet overlapped the previous sheet by a minimum of 12 inches. Conformance tests on the geotextile were performed at a rate of 1 per every 100,000 square feet of geotextile. All test results were reviewed and approved by the site QC manager prior to installation. Appendix D contains all the geotextile conformance test data and Appendix G contains the subcontractor's daily reports.

2.9 DRAINAGE LAYER

The drainage layer consists of a minimum of 12 inches of VDOT No. 8 stone. The drainage layer was placed in conjunction with the 16-oz/sq yd geotextile to minimize the exposure of the geotextile to ultraviolet radiation. The drainage layer was installed immediately following geotextile installation. The stone was placed using "surge wall techniques." OHM started at the northern end of the landfill and progressed south and west. The "surge wall" method consists of pushing the material in a single 3-foot lift with a bulldozer and then cutting down the lift to the required 12-inch thickness, using low ground pressure (LGP) bulldozers. The 12-inch thickness was the minimum acceptable thickness that would prevent damage to the HDPE liner material. As stone was delivered to the northern end, it was pushed down from the north and was graded to the south to form the required lines and grades.

Haul roads were constructed across the liner using the stone to allow the stone to be placed close to the working face. The road base was kept to a 3-foot minimum thickness, and these were maintained until approximately 95 percent of the area was covered. The top 24 inches of the road was then removed and the excess material was used to complete placement activities. Spotters were used during spreading operations to direct traffic and traffic cones with finish grade markings were placed on top of the geotextile so that equipment operators could closely grade the material. **Sheet RD-4** shows the drainage layer grading plan. OHM's on-site surveying staff closely monitored the thickness of the drainage stone to ensure that the thickness met project specifications and that the placement equipment did not get too close to the geotextile protection layer. The compaction of the drainage layer was incidental with the placement, spreading, and grading. The thickness was verified by taking the difference between the 16-oz/sq yd geotextile protection layer elevation at each grid node and the corresponding elevation at the top of the drainage layer.

2.10 PLACEMENT OF FROST PROTECTION LAYER

Placement of the frost protection layer began after approximately 4 acres of the geotextile separation layer had been placed. Soil from both the on-site borrow area and an off-site source were used for construction of this layer. Construction of the frost protection layer began at the northern end of the landfill and proceeded along the east side to the southeast comer of the landfill. Materials were then advanced to the center, and finally to the southwest comer of the

landfill. Off-road trucks hauled material from the on-site borrow pit area, while triaxle dumps, and tractor/trailers imported fill from off site. LGP dozers were utilized to grade the frost protection layer.

This below excerpt taken from Section 4.0, "Quality Control Report", subsection 4.3 "Inspection and Testing" from the Final Closeout Report for the Russell Road Landfill, OHM, 1997.

4.3 INSPECTION AND TESTING

The Inspection and Test Plan contained in the QC Plan describes the test methods and frequency as required by the contract specification. The Testing Plan and Log was used to document all civil and geotechnical testing performed by off-site laboratories. The Testing Plan and Log is included in Appendix G. Geosynthetic conformance testing was documented separately and is included in Appendix D.

4.3.1 Leachate Collection System

The leachate collection system consisted of approximately 5,700 linear feet of perforated 4-inch HDPE pipe. Leachate flowing into the leachate collection trench is gravity fed to a leachate collection sump at the southern end of the site. Pipe elevation and slope is critical to the operation of the system. As the trench was advanced along the perimeter of the site, its elevation was maintained by laser level. Verification of the pipe bedding slope was achieved by surveying the leachate pipe at 50-foot intervals along the entire length of the pipe and, at a minimum, at each change in design slope. Material certifications and manufacturers catalog data for the 60-mil HDPE leachate trench liner and the 4-inch-diameter HDPE pipe and fittings was approved by the site QC manager and submitted to the Navy prior to installation. The 4-inch pipe was joined by the butt fusion process, or HDPE mechanical couplings where configuration prohibited the use of the butt fusion machine. The welds received a visual inspection prior to the backfill of VDOT 8 stone.

The 60-mil HDPE liner was installed in the leachate trench by Serrot Corporation, the manufacturer of the product. Serrot's welding technicians performed the pre-production tests prior to each day's liner installation. Specimen tensile strength was verified using an on-site tensiometer. Conformance testing of production welds was performed at a frequency of 1 per 500 linear feet of seam weld by an independent laboratory. All seam welds were air tested or spark tested in accordance with the contract specification and witnessed by the site QC manager. All non-destructive testing was performed and recorded by the liner installer who was responsible for preparing the record panel layout drawing. Leachate cleanout lengths vary due to the cap contour. Actual lengths were documented by the site QC manager and maintained on red-line record drawings. A trench profile is provided in Appendix A.

The leachate alarm system was installed as shown in the record drawings in Appendix A. The system was tested on December 10, 1996, and satisfied the requirements of the MCB Quantico Natural Resources Environmental Affairs Branch (NREAB). The system was tested manually by tilting each alarm and allowing the system to dial the appropriate number.

4.3.2 Subgrade

The on-site borrow pit was developed to provide earthen materials for the construction of the cap and E&S controls. Geotechnical analysis of the borrow pit soils is included in Appendix C.

A 12-inch-minimum-thickness grading layer was placed over the waste grade using material from the on-site borrow pit. The thickness of this layer was controlled by use of grade stakes and ongoing survey by the site engineer. Additional verification of the 12-inch minimum thickness was accomplished by taking core samples at randomly selected locations. Final elevation of this layer was confirmed by an independent professional surveyor registered in the Commonwealth of Virginia, and documented on a record drawing contained in Appendix A of this document.

Compaction of the grading layer was verified visually. Compaction was said to be achieved when the sheepsfoot roller walked-out of the lift being compacted. Compaction data was collected at a rate of 1 per 5 acres for record keeping purposes. These results are reported in Appendix C.

4.3.3 Passive Gas Venting and Monitoring System

Eighteen 4-inch-diameter HDPE gas vent riser pipes were installed throughout the cap. The vent pipes were prefabricated for ease of installation. Pipe welds were butt fused and received visual inspection. Gas vent depth was verified by measuring the depth of the bottom of the excavation.

Four gas probes were installed south of the cap between the anchor trench and Cemetery Road. Locations for the vent pipes and gas probes were surveyed and logged on the record drawings contained in Appendix A of this document.

4.3.4 Geosynthetics

The geosynthetics installation included a geosythetic clay liner GCL), 60-mil HDPE geomembrane, and geotextile layers. All geosynthetics material was receipt inspected by the site QC manager to ensure each roll number was traceable to a material certification. Geosynthetics samples were sent to an independent laboratory for conformance testing at the required frequencies. The liner installer visually inspected the subgrade prior to placement of the GCL and documented its findings in the Surface Acceptance Form included in Appendix D of this document.

The GCL consisted of Bentomat™ placed on the slopes and Claymax™ placed in flatter areas. Only Bentomat™ seams received bentonite pellets. The GCL seams were visually inspected to ensure proper seam overlap.

Seam welding technicians for the geomembrane performed pre-production tests prior to welding cap liner. Samples were tensile tested on site by the Serrot QC specialist and monitored by the site QC manager. All seam welds received non-destructive testing by either vacuum testing or air test. Samples of the seam welds were obtained for every 500 linear feet of seam weld for destructive testing at an independent testing laboratory. Results were evaluated by the site QC

manager for compliance to the contract specifications. Panel roll numbers, seam weld identification, and repair welding locations were identified on panel layout drawings maintained by the Serrot QC specialist. Documentation including destructive testing, nondestructive testing, seam weld location, repair weld location, geomembrane roll number, and material certifications are contained in Appendix D.

The geotextiles consisted of a 16-ounce layer placed over the geomembrane and an 8-ounce layer placed over the stone drainage layer. The seams were welded using a heat gun. These seams received a visual inspection and repairs were performed as identified.

4.3.5 Aggregate/Soil Materials

Three aggregate/soil layers were installed above the geosynthetics: a 12-inch stone layer, an 18-inch frost protection layer, and a 6-inch topsoil layer. This section describes the QC procedures used to verify compliance with the specifications.

The drainage layer consisted of a 12-inch-minimum-thickness layer of VDOT No. 8 stone. Permeability tests were performed prior to placement. Grain size (ASTM-D422) was performed by the supplier (Vulcan) at a frequency of 1 per 5,000 tons of placed stone. Grade control consisted of placing marked cones to assist operators during grading and survey by the site engineer. The layer thickness was confirmed by an independent professional surveyor registered in the Commonwealth of Virginia and documented on record drawings contained in Appendix A of this document.

An 18-inch-thick frost protection layer consisted of material from the on-site borrow pit and an off-site borrow source. Samples were obtained for analytical testing for contaminants from the off-site source and the results submitted to the Navy for approval (results are provided in Appendix B). This layer was placed in two lifts: a 12-inch lift and a final 6-inch lift compacted to 90 percent of standard proctor maximum dry density. Geotechnical tests were performed by PSI and Golder Construction at the frequency specified in the contract specifications.

Compaction test were performed on the final lift by OHM at a minimum of 1 acre in accordance with the contract specifications. Results of these tests are included in Appendix C of this document. The layer thickness was confirmed by an independent professional surveyor registered in the Commonwealth of Virginia and documented on record drawings contained in Appendix A of this document.

A 6-inch-thick vegetative support layer was placed using topsoil from the on-site borrow pit and an off-site source. A composition analysis was performed on the topsoil obtained from the off-site source and was submitted to the Navy for approval. An analytical test was also performed for contaminants and submitted to the Navy. Both analyses are included in Appendix B. Grade control for this layer was performed by grade stakes and survey by the site engineer. The layer thickness was confirmed by an independent professional surveyor registered in the Commonwealth of Virginia and documented on record drawings contained in Appendix A of this document.

4.3.6 Site Restoration

Seed mixtures were inspected by the site QC manager to ensure QC compliance with the specification. Certification of the seed mixture was reviewed and submitted the Navy for approval. Hydroseeding activities were monitored and areas requiring additional coverage were identified for rework. A Hydroblanket™ was placed on steeper sloped areas of the landfill cap to prevent erosion. Warning signs were installed in the locations shown on Sheet RD- 1 (Appendix A). The warning signs were installed to notify the public against disturbing soils in the area of the cap. The access road was installed in accordance with the contract drawings.

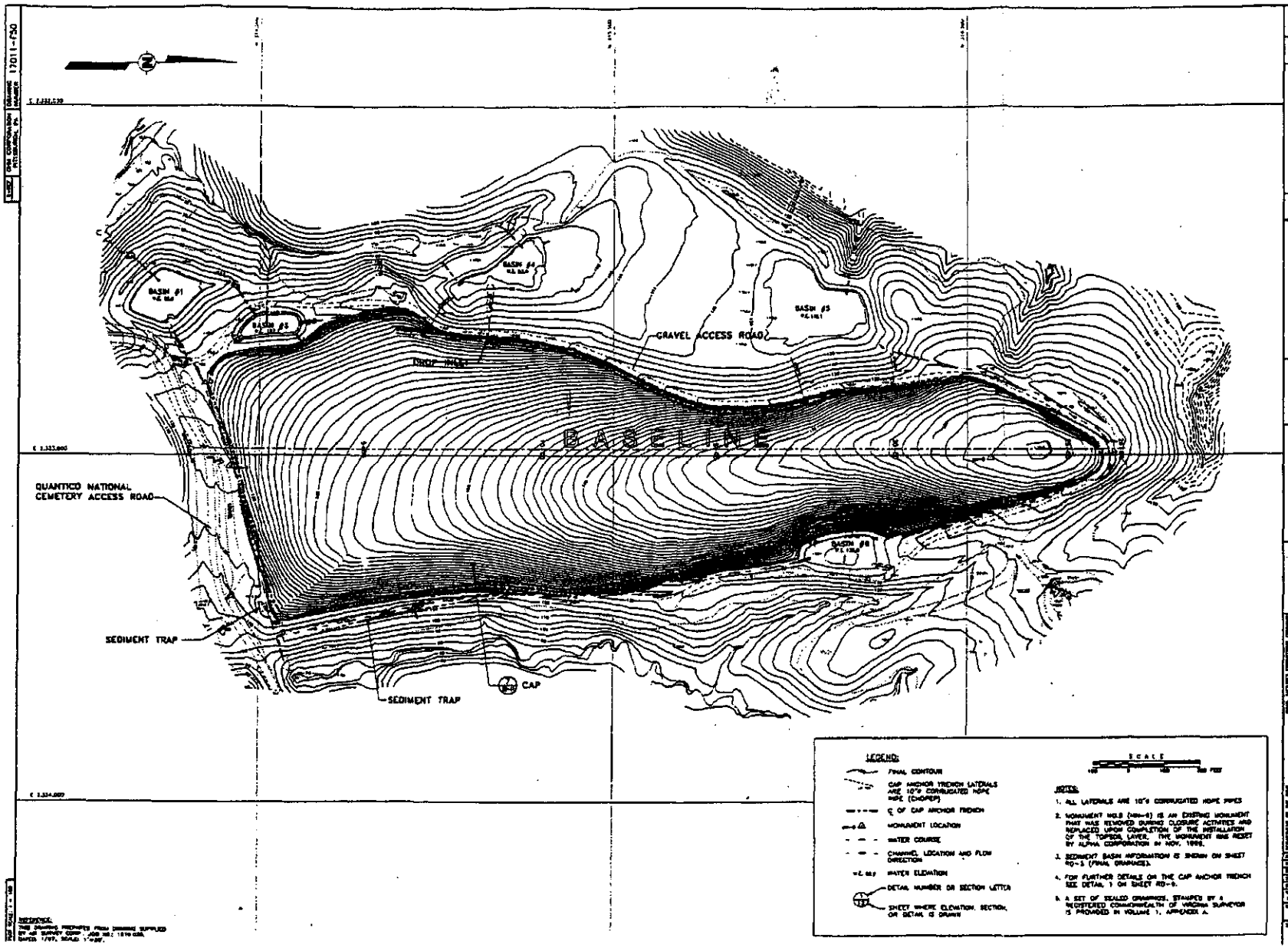
Substantial completion of the project coincided with the 1996/1997 winter. Inspections of the site will continue through the spring and, when necessary, crews will be mobilized to address erosion and other problems that may occur. All necessary repairs were made to the vegetative layer of the cap in May/June 1997 and final acceptance of the work occurred in June 1997.

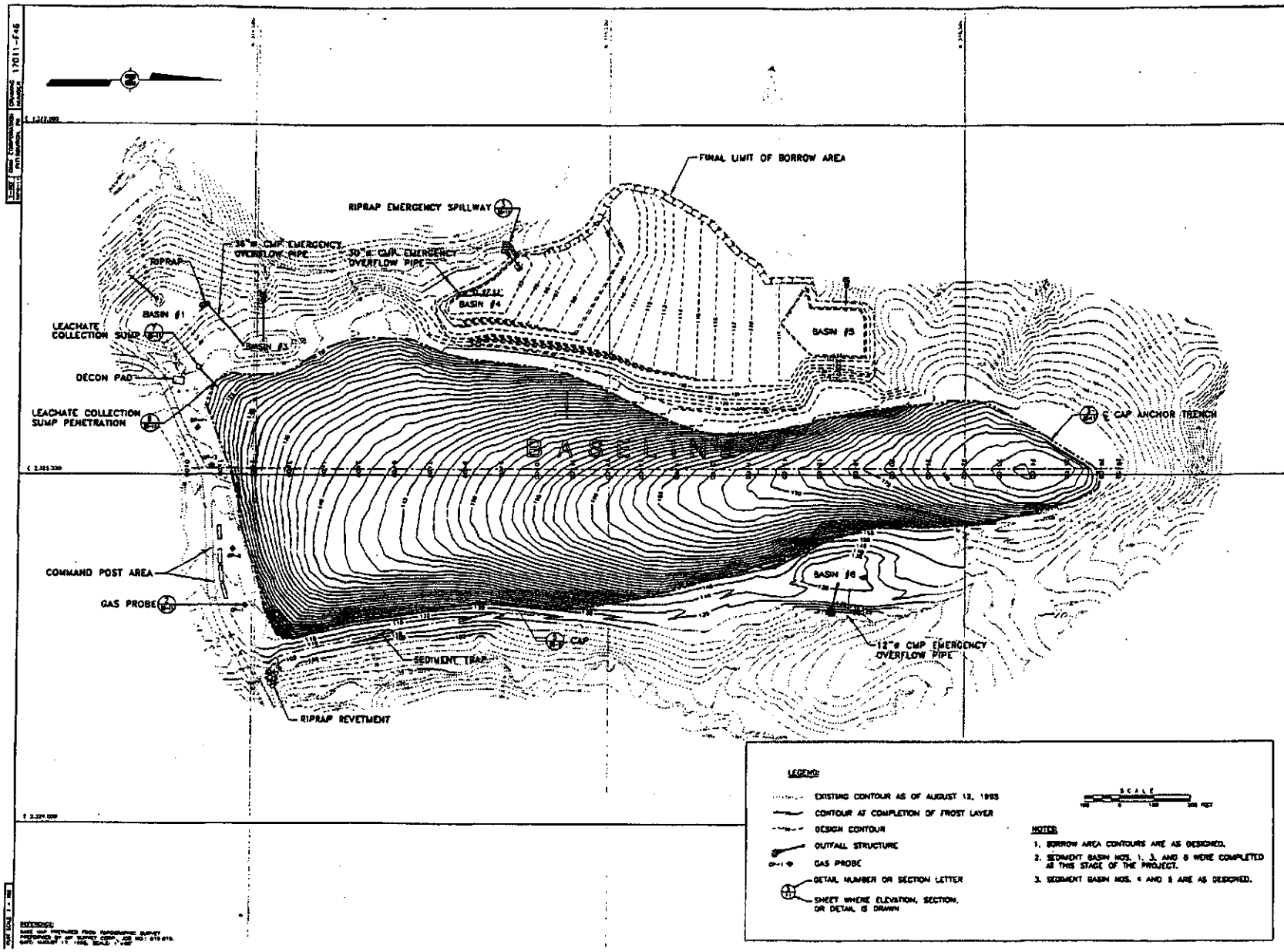
APPENDIX E-6

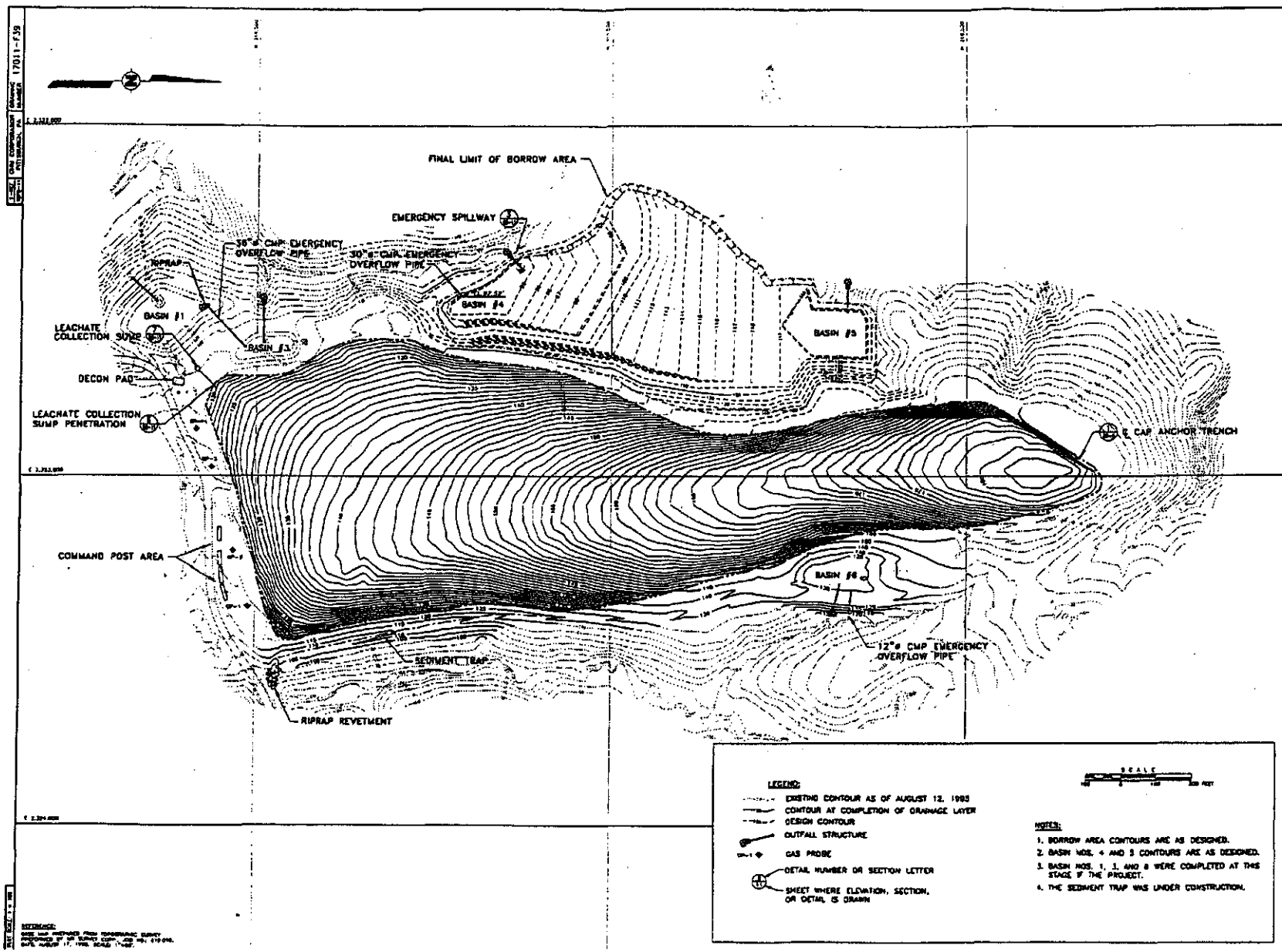
DRAWINGS

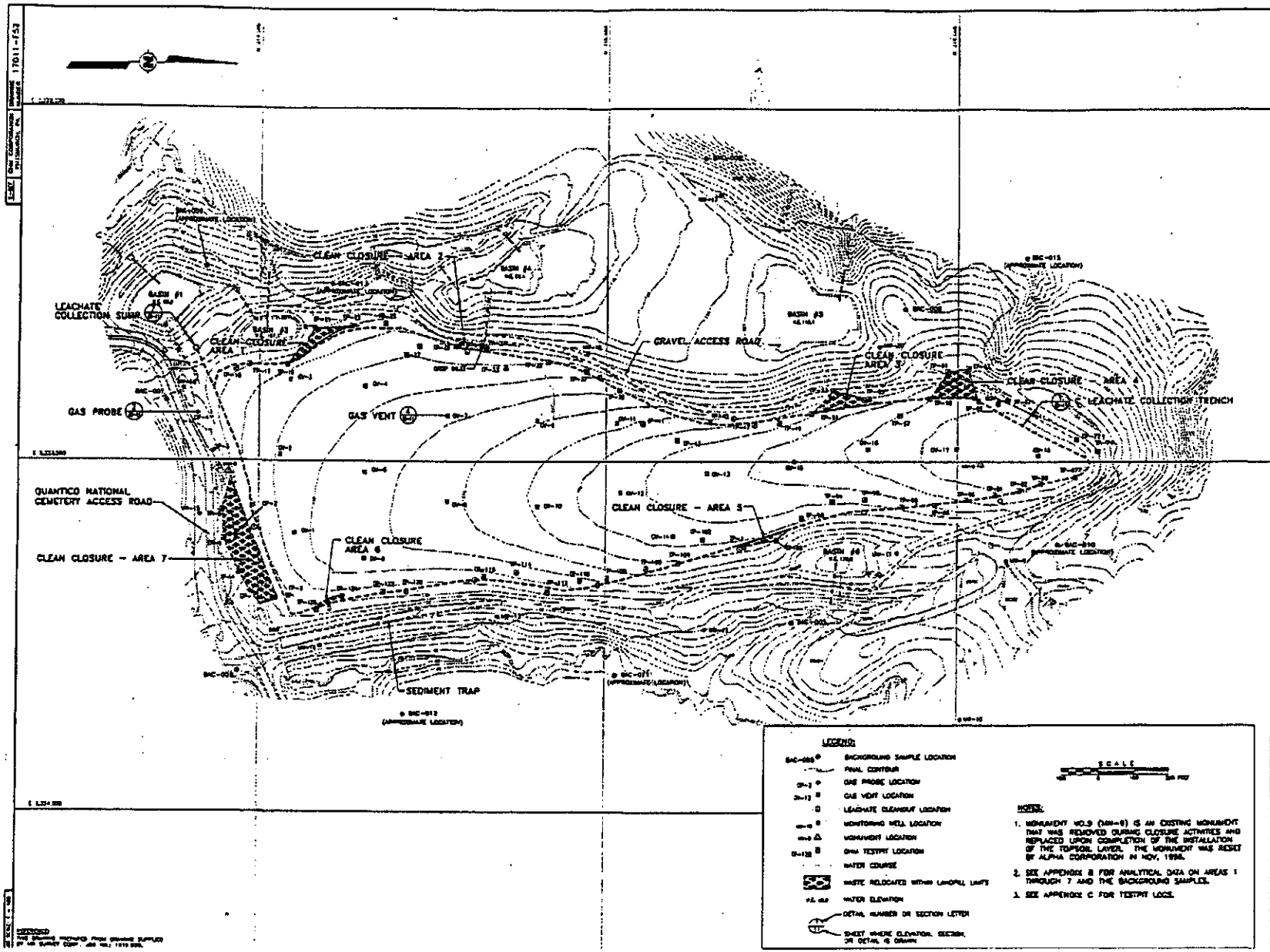
LANDFILL PERIMETER LINER AND LEACHATE COLLECTION TRENCH SYSTEM DESIGN

RUSSEL ROAD LANDFILL, MCB QUANTICO

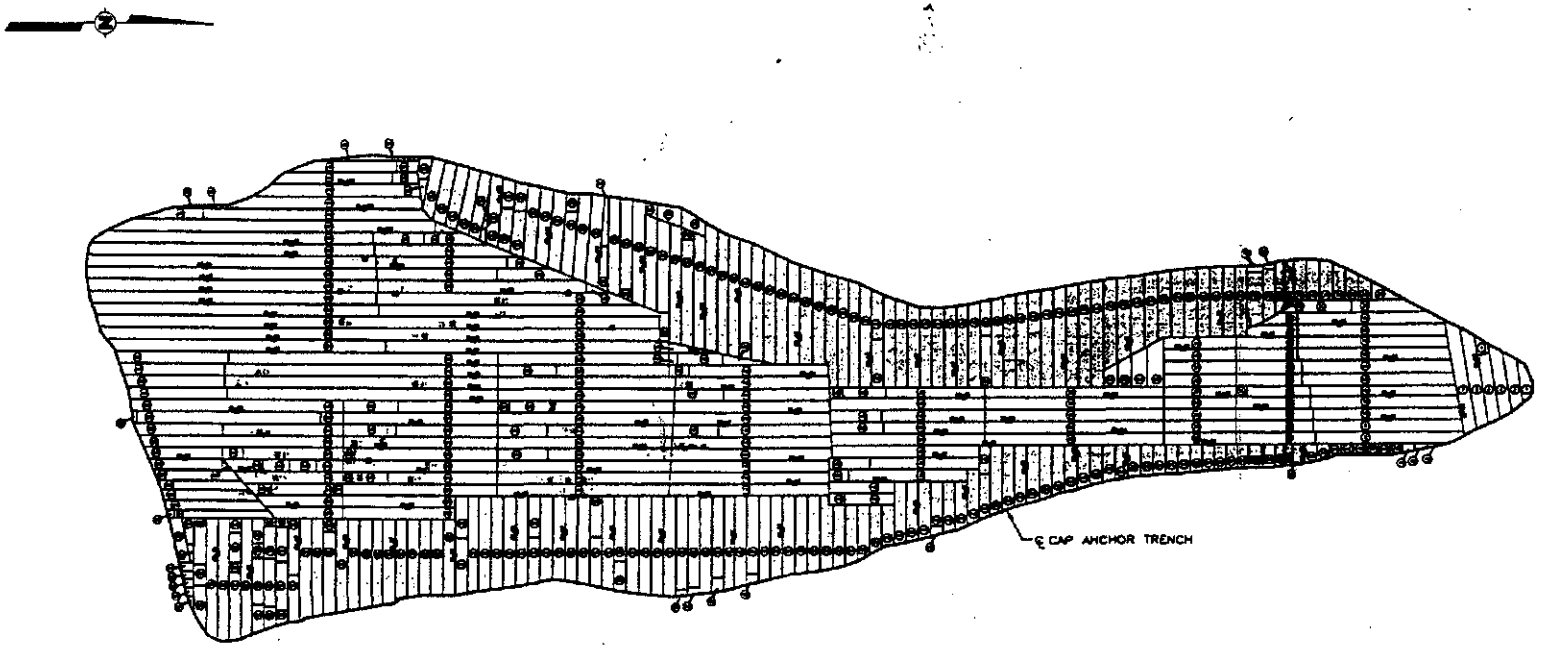

BASIN #1
BASIN #2
BASIN #3
BASIN #4
BASIN #5
BASIN #6
GRAVEL ACCESS ROAD
DROP INLET
BASELINE
QUANTICO NATIONAL CEMETERY ACCESS ROAD
SEDIMENT TRAP
SEDIMENT TRAP
CAP
LEGEND:
FINAL CONTOUR
CAP ANCHOR TRENCH LATERALS ARE 10"ø CORRUGATED HDPE PIPE (CHOPEP)
℄ OF CAP ANCHOR TRENCH
MONUMENT LOCATION
WATER COURSE
CHANNEL LOCATION AND FLOW DIRECTION
WATER ELEVATION
DETAIL NUMBER OR SECTION LETTER
SHEET WHERE ELEVATION, SECTION, OR DETAIL IS DRAWN
SCALE
NOTES:
1. ALL LATERALS ARE 10"ø CORRUGATED HDPE PIPES
2. MONUMENT NO.5 (MN-5) IS AN EXISTING MONUMENT THAT WAS REMOVED DURING CLOSURE ACTIVITIES AND REPLACED UPON COMPLETION OF THE INSTALLATION OF THE TOPSOIL LAYER. THE MONUMENT WAS RESET BY ALPHA CORPORATION IN NOV. 1998.
3. SEDIMENT BASIN INFORMATION IS SHOWN ON SHEET RD-5 (FINAL DRAINAGE).
4. FOR FURTHER DETAILS ON THE CAP ANCHOR TRENCH SEE DETAIL 1 ON SHEET RD-9.
5. A SET OF SEALED DRAWINGS, STAMPED BY A REGISTERED COMMONWEALTH OF VIRGINIA SURVEYOR IS PROVIDED IN VOLUME 1, APPENDIX A.
REFERENCE:
THIS DRAWING PREPARED FROM DRAWING SUPPLIED BY AM SURVEY CORP. AND NO.2 1616-GIS, DATED 7/97, SCALE 1"=50'.
EFA - CHESAPEAKE
RUSSELL ROAD LANDFILL CLOSURE
MARINE BASE - QUANTICO, VIRGINIA
RECORD DRAWING - FINAL CONDITIONS TOPOGRAPHIC MAP
3066871
RD-1
REVISIONS
OSM Remediation Services Corp.
CRA CORPORATION PITTSBURGH, PA.
DRAWING NUMBER 17011-750


FINAL LIMIT OF BORROW AREA
RIPRAP EMERGENCY SPILLWAY
36"ø CMP EMERGENCY OVERFLOW PIPE
30"ø CMP EMERGENCY OVERFLOW PIPE
RIPRAP
BASIN #1
BASIN #2
BASIN #3
BASIN #4
BASIN #5
BASIN #6
LEACHATE COLLECTION SUMP
DECON PAD
LEACHATE COLLECTION SUMP PENETRATION
COMMAND POST AREA
GAS PROBE
SEDIMENT TRAP
CAP
RIPRAP REVETMENT
12"ø CMP EMERGENCY OVERFLOW PIPE
℄ CAP ANCHOR TRENCH
BASELINE
LEGEND
EXISTING CONTOUR AS OF AUGUST 12, 1993
CONTOUR AT COMPLETION OF FROST LAYER
DESIGN CONTOUR
OUTFALL STRUCTURE
GAS PROBE
DETAIL NUMBER OR SECTION LETTER
SHEET WHERE ELEVATION, SECTION, OR DETAIL IS DRAWN
SCALE
NOTES:
1. BORROW AREA CONTOURS ARE AS DESIGNED.
2. SEDIMENT BASIN NOS. 1, 3, AND 6 WERE COMPLETED AS THIS STAGE OF THE PROJECT.
3. SEDIMENT BASIN NOS. 4 AND 5 ARE AS DESIGNED.
REVISIONS
OHM Remediation Services Corp.
EFA - CHESAPEAKE
BUSKILL ROAD LANDFILL CLOSURE
MARINE BASE - QUANTICO, VIRGINIA
RECORD DRAWING - TOP OF FROST PROTECTION LAYER
RD-2


FINAL LIMIT OF BORROW AREA
EMERGENCY SPILLWAY
36"ø CMP EMERGENCY OVERFLOW PIPE
30"ø CMP EMERGENCY OVERFLOW PIPE
RIPRAP
BASIN #1
BASIN #3
BASIN #4
BASIN #5
BASIN #6
LEACHATE COLLECTION SUMP
DECON PAD
LEACHATE COLLECTION SUMP PENETRATION
℄ CAP ANCHOR TRENCH
COMMAND POST AREA
SEDIMENT TRAP
RIPRAP REVETMENT
12"ø CMP EMERGENCY OVERFLOW PIPE
LEGEND:
EXISTING CONTOUR AS OF AUGUST 12, 1993
CONTOUR AT COMPLETION OF DRAINAGE LAYER
DESIGN CONTOUR
OUTFALL STRUCTURE
GAS PROBE
DETAIL NUMBER OR SECTION LETTER
SHEET WHERE ELEVATION, SECTION, OR DETAIL IS DRAWN
SCALE
NOTES:
1. BORROW AREA CONTOURS ARE AS DESIGNED.
2. BASIN NOS. 4 AND 5 CONTOURS ARE AS DESIGNED.
3. BASIN NOS. 1, 3, AND 6 WERE COMPLETED AT THIS STAGE IF THE PROJECT.
4. THE SEDIMENT TRAP WAS UNDER CONSTRUCTION.
CFA - CHESAPEAKE
RUTLEDGE ROAD LANDFILL CLOSURE
MARINE BASE - QUANTICO, VIRGINIA
RECORD DRAWING - TOP OF DRAINAGE LAYER
REVISIONS
RD-4



CLEAN CLOSURE - AREA 2
LEACHATE COLLECTION SUMP
CLEAN CLOSURE AREA 1
GRAVEL ACCESS ROAD
CLEAN CLOSURE AREA 3
CLEAN CLOSURE - AREA 4
LEACHATE COLLECTION TRENCH
GAS PROBE
GAS VENT
QUANTICO NATIONAL CEMETERY ACCESS ROAD
CLEAN CLOSURE - AREA 5
CLEAN CLOSURE AREA 6
CLEAN CLOSURE - AREA 7
SEDIMENT TRAP
LEGEND:
BACKGROUND SAMPLE LOCATION
FINAL CONTOUR
GAS PROBE LOCATION
GAS VENT LOCATION
LEACHATE CLEANOUT LOCATION
MONITORING WELL LOCATION
MONUMENT LOCATION
GHM TESTPIT LOCATION
WATER COURSE
WASTE RELOCATED WITHIN LANDFILL LIMITS
WATER ELEVATION
DETAIL NUMBER OR SECTION LETTER
SHEET WHERE ELEVATION, SECTION, OR DETAIL IS DRAWN
SCALE
NOTES:
1. MONUMENT NO.9 (MN-9) IS AN EXISTING MONUMENT THAT WAS REMOVED DURING CLOSURE ACTIVITIES AND REPLACED UPON COMPLETION OF THE INSTALLATION OF THE TOPSOIL LAYER. THE MONUMENT WAS RESET BY ALPHA CORPORATION IN NOV. 1996.
2. SEE APPENDIX B FOR ANALYTICAL DATA ON AREAS 1 THROUGH 7 AND THE BACKGROUND SAMPLES.
3. SEE APPENDIX C FOR TESTPIT LOGS.
REVISIONS
GHM Remediation Services Corp.
EFA - CHESAPEAKE
RUSSELL ROAD LANDFILL CLOSURE
MARINE BASE - QUANTICO, VIRGINIA
RECORD DRAWING - INVESTIGATION AND MONITORING
RD-6



PANEL NUMBER	ROLL NO.	PANEL NUMBER	ROLL NO.	PANEL NUMBER	ROLL NO.	PANEL NUMBER	ROLL NO.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

APPROXIMATE SCALE

LEGEND:

- 60 MIL HDPE PANEL AND PANEL NUMBER
- 60 MIL TEXTURED HDPE PANEL AND PANEL NUMBER.
- DESTRUCTIVE TEST SAMPLE LOCATION
- BUBBLE LOCATION
- BUBBLE LOCATION, CUT 8/18/98

NOTES:

1. PANELS CONSIST OF 60 MIL. HDPE TYP. 22 FT. WIDE.
2. PANELS NUMBERS SHOWN ON PLAN, SUPPLIER ROLL NUMBERS SHOWN ON TABLE.

REVISIONS

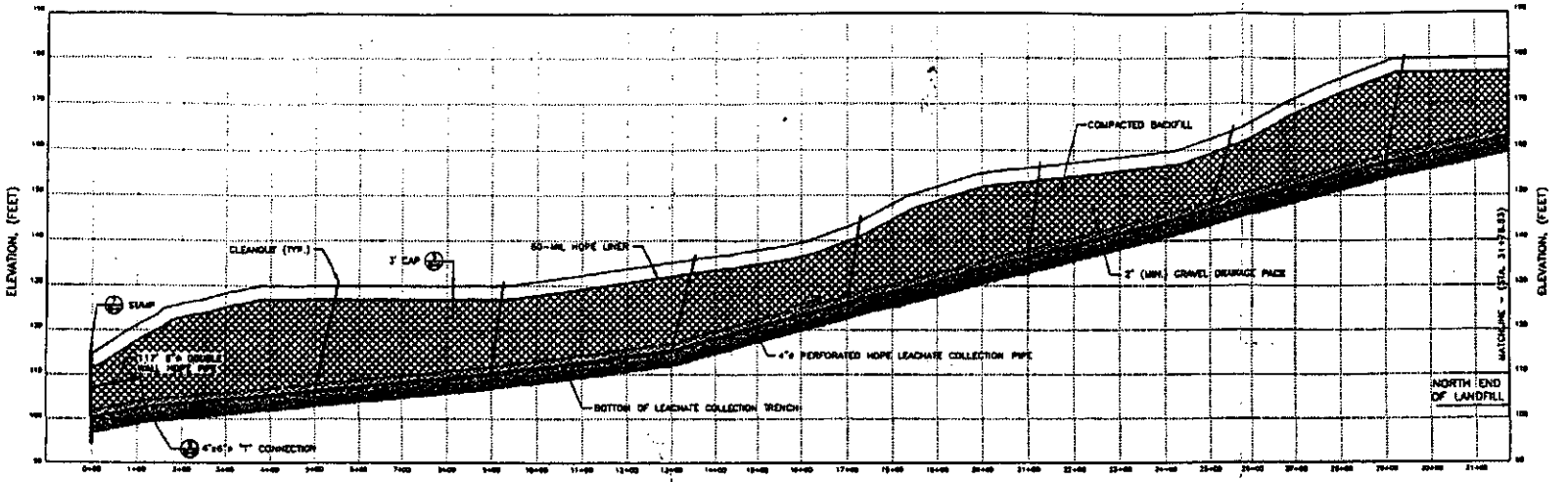
OHM Remediation Services Corp.

EFA - CHESAPEAKE

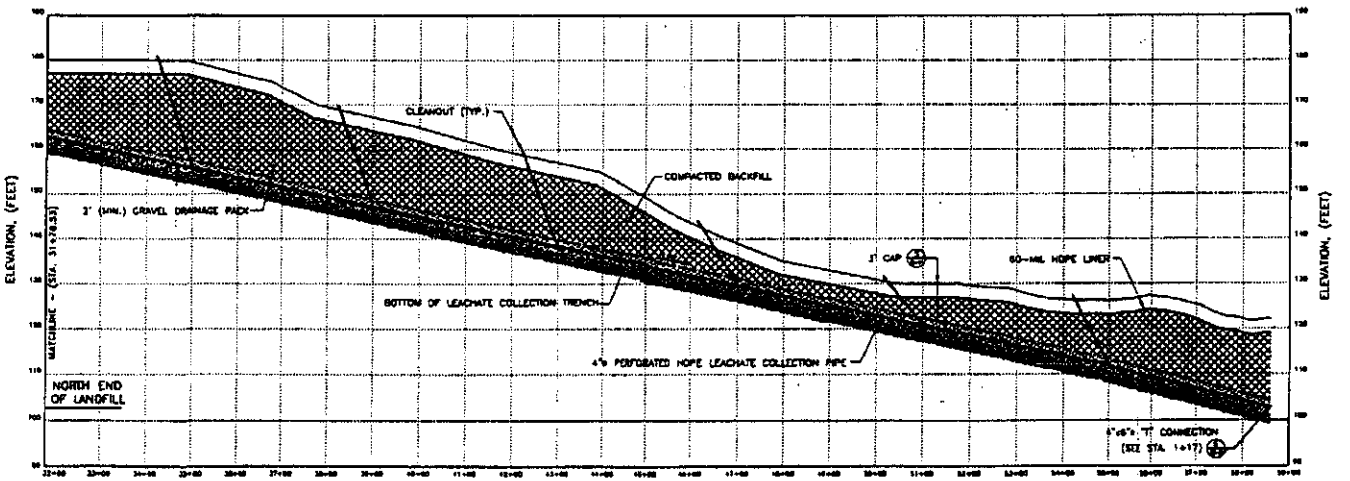
RUSSELL ROAD LANDFILL CLOSURE
MARINE BASE - QUANTICO, VIRGINIA

RECORD DRAWING - GEOMEMBRANE PANEL LAYOUT

RD-7



PROFILE ALONG WEST SIDE OF LEACHATE COLLECTION TRENCH
(LOOKING WEST)



PROFILE ALONG WEST SIDE OF LEACHATE COLLECTION TRENCH
(LOOKING EAST)

NOTES:

1. FOR LOCATION OF LEACHATE COLLECTION SYSTEM, SEE SHEET RD-5.
2. THE 2 FOOT (MIN.) GRAVEL DRAINAGE PACK WAS CONSTRUCTED AS SHOWN ON DETAIL 1 ON SHEET RD-11.
3. GEOSYNTHETIC TESTING DATA IS INCLUDED IN VOLUME 4 APPENDIX B, SECTION 7.0.
4. Gs CERTIFICATES FOR THE GEOSYNTHETICS AND PIPING ARE INCLUDED IN VOLUME 4, APPENDIX D, SECTION 7.0.
5. COMPACTION TEST DATA IS INCLUDED IN VOLUME 4, APPENDIX C, SECTION 5.0.
6. THE LEACHATE COLLECTION SYSTEM TRENCH WAS BACKFILLED WITH VOOT MOLD STONE. THE REMAINDER OF THE EXCAVATION, NECESSARY TO CONSTRUCT THE TRENCH, WAS BACKFILLED WITH COMMON ON SITE BORROW SOIL.
7. THE LEACHATE COLLECTION SYSTEM PIPING NETWORK IS CONTINUOUS AROUND THE PERIPHERY OF THE LANDFILL.
8. THE LEACHATE COLLECTION SYSTEM PIPING NETWORK FLOWS INTO A SINGLE COLLECTION SUMP LOCATED NEAR SEDIMENT BASIN NO.1, AS SHOWN ON SHEET RD-7.
9. CLEANOUTS ARE INSTALLED AT APPROXIMATELY 400 FOOT INTERVALS ALONG THE LENGTH OF THE COLLECTION SYSTEM PIPING NETWORK.
10. THE SLOPE OF THE LEACHATE COLLECTION PIPING NETWORK WAS MAINTAINED BETWEEN A MINIMUM OF 1% AND A MAXIMUM OF 3% IN ACCORDANCE WITH THE APPROVED CLOSURE PLAN BY OHM, DATED, 1992.

VERTICAL SCALE
HORIZONTAL SCALE

REVISIONS

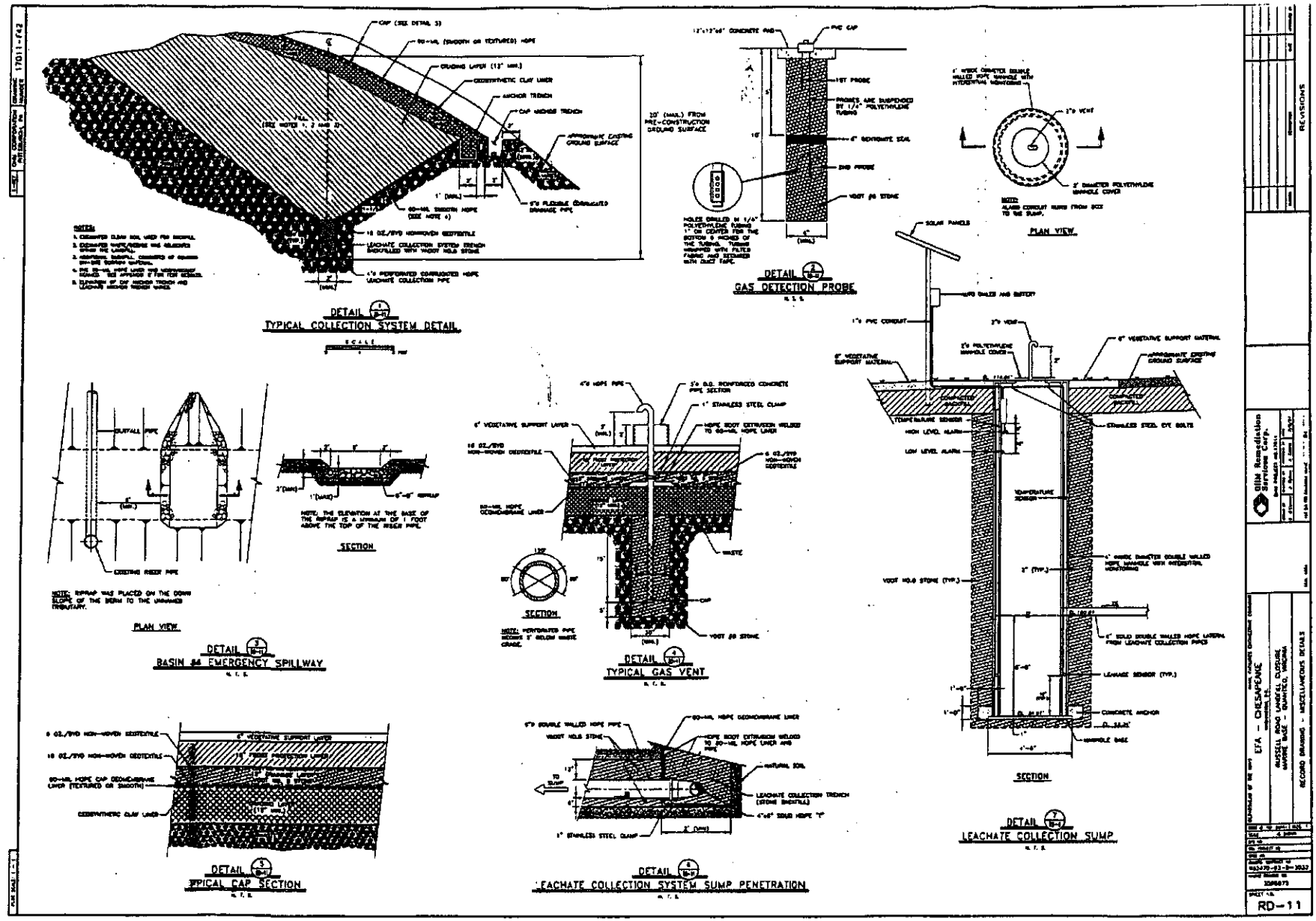
OHM Remediation Services Corp.

EFA - CHESAPEAKE
RUSSELL ROAD LANDFILL CLOSURE
MARINE BASE - QUANTICO, VIRGINIA

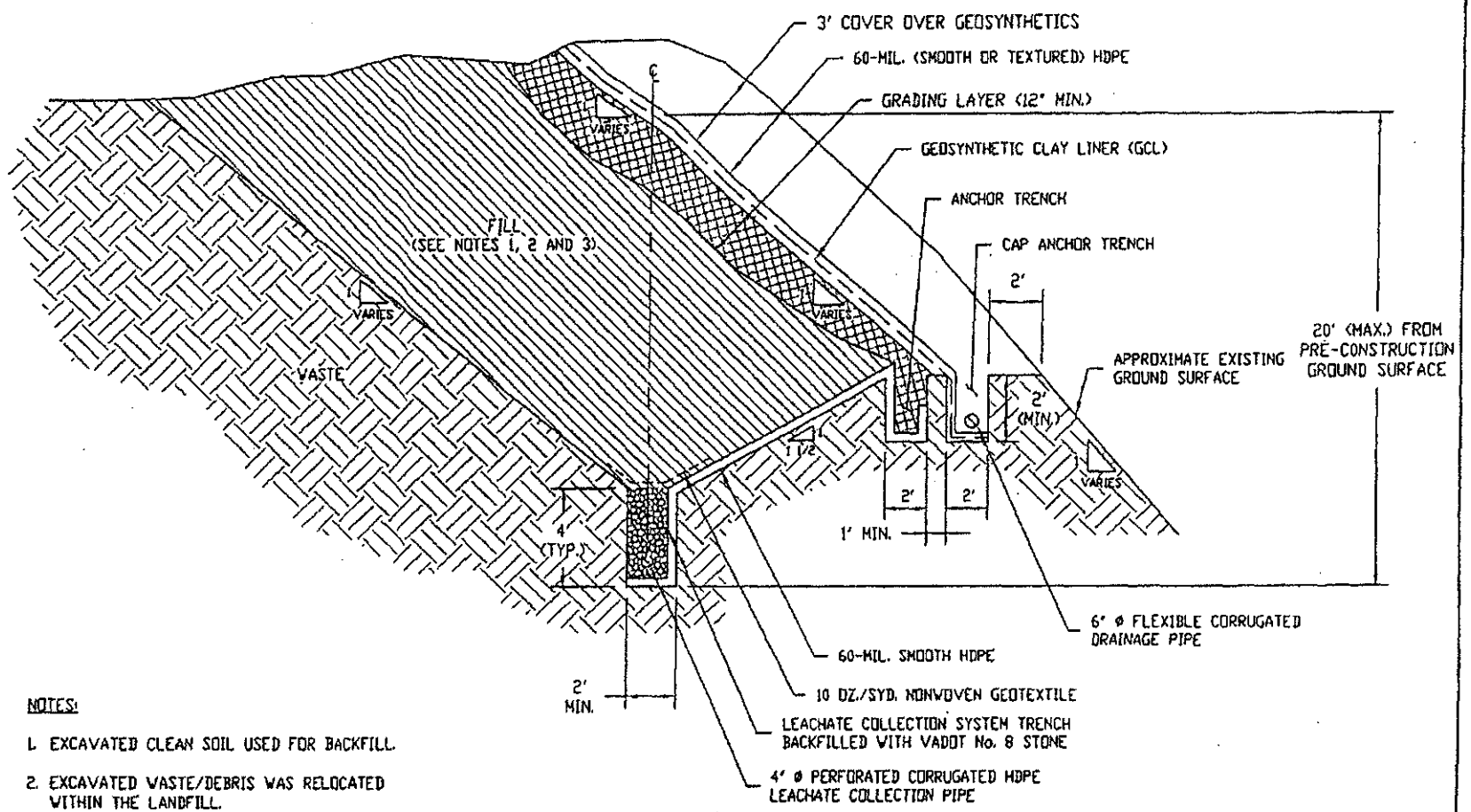
RECORD DRAWING - LEACHATE COLLECTION TRENCH PROFILE

SHEET NO.
RD-9

17011-F49



DETAIL 1
TYPICAL COLLECTION SYSTEM DETAIL
DETAIL 2
GAS DETECTION PROBE
PLAN VIEW
DETAIL 3
BASIN 84 EMERGENCY SPILLWAY
SECTION
DETAIL 4
TYPICAL GAS VENT
SECTION
DETAIL 5
TYPICAL CAP SECTION
DETAIL 6
LEACHATE COLLECTION SYSTEM SUMP PENETRATION
DETAIL 7
LEACHATE COLLECTION SUMP
SECTION
REVISIONS
Gilin Remediation Services Corp.
EFA - CHESAPEAKE
RECORD DRAWING - MISCELLANEOUS DETAILS
RD-11



NOTES:

1. EXCAVATED CLEAN SOIL USED FOR BACKFILL.
2. EXCAVATED WASTE/DEBRIS WAS RELOCATED WITHIN THE LANDFILL.
3. ADDITIONAL BACKFILL CONSISTED OF COMMON ON-SITE BORROW MATERIAL.
4. EXCAVATION OF CAP ANCHOR TRENCH AND LEACHATE ANCHOR TRENCH VARIES.

TETRA TECH NUS, INC.

FIGURE 2-2

EXISTING PERIMETER LEACHATE COLLECTION SYSTEM DETAIL
RUSSELL ROAD LANDFILL
MCCDC, QUANTICO, VIRGINIA

T:\Environm\5684\Figure 2

ATTACHMENT F

FACILITY CONTACT REPRESENTATIVE

POST-CLOSURE PLAN – RUSSELL ROAD LANDFILL

MCB QUANTICO, QUANTICO, VIRGINIA

ATTACHMENT F
FACILITY CONTACT REPRESENTATIVE
POST-CLOSURE PLAN – RUSSELL ROAD LANDFILL
MCB QUANTICO, QUANTICO, VIRGINIA

F.1. FACILITY CONTACT

The post-closure care Facility contact and primary representative for the MCB Quantico Russell Road Landfill is provided below:

On-site Facility Contact:

Major Adam Gutshall
Head, Natural Resources and Environmental Affairs Branch
NREA Branch (B046)
Installation & Environment Division
3049 Bordelon St.
Quantico, VA 22134-5001
Phone: (703) 432-0535
E-mail: adam.gutshall@usmc.mil

ATTACHMENT G

SECURITY PROVISIONS

ATTACHMENT G

SECURITY PROVISIONS

G.1. The Permittee shall maintain security at the MCB Quantico Russell Road Landfill (RRL) Facility during the post-closure care period, in accordance with the Post-closure Plan, Permit Attachment E, and as specified herein Permit Attachment G. Security shall be sufficient to comply with security requirements under 40 CFR § 264.14 and § 264.117(b).

G.2. The RRL is bordered by a fence on three sides and a stream on the fourth side. Access points through the fence are through locked gates. Gates to the Facility are locked in order to prevent unauthorized access.

Warning signs are placed around the landfill gates, fencing, and perimeter warning against unauthorized entry to the RRL Facility.

G.3. General access to RRL Facility is controlled by MCB Quantico's Base Security; secured access to the RRL Facility is through authorized personnel only.

G.4. Inspections of RRL are conducted a minimum of twice a year (semi-annually) to verify no unauthorized entry or activity is being conducted.

G.5. The RRL Facility Permit, **Permit Attachment E, Post-Closure Plan,** requires the MCB Quantico Facility to complete a survey plat indicating the location and dimensions of the capped landfill and include permanently surveyed benchmarks, and to submit the survey to the local authority with jurisdiction over local land use, the EPA, and the DEQ.

The submission to the local land use authority requires that the land use record for the Facility site documents that the land has been used to manage and dispose of hazardous wastes, and that the use of the Facility site is restricted under 40 CFR Part 264, Subpart G, Closure and Post-Closure, and includes the noted survey plat identified above.

A Survey Plat with benchmarks and the required post-closure notices and restrictions has been filed with the Washington Navy Yard and the Real Estate Office of the Marine Corps Base, Quantico, the EPA, and the DEQ. The DEQ received a copy of the Survey Plat and the specified post-closure notices and restrictions on July 13, 1999. (See **Permit Attachment E.**)

G.6. The RRL is entered into the MCB Quantico GIS database. The Facility site is tagged on the MCB Quantico GIS with a note about the restrictions and instructions to contact the Environmental Office at the MCB Quantico Facility prior to performing any land disturbance activities.

Any construction or land disturbing activity requires a National Environmental Policy Act (NEPA) form, which is reviewed by the MCB Quantico NREA Branch, NEPA Section for environmental impact. This review includes verification, using the MCB Quantico GIS and the Base RPM to ensure that no remediation site land use or Permit related controls are violated.

Any land disturbance requires an excavation permit issued by Facilities and Logistics Services (FLSS) who checks the area on the MCB Quantico GIS for any restrictions prior to issuing any dig permit. If site restrictions are identified, the Environmental Office at MCB Quantico is included in the review process prior to approving a dig permit. The approval process for an excavation permit includes review by any applicable utility services and review of Permit requirements.

ATTACHMENT H

INSPECTION REQUIREMENTS

ATTACHMENT H

INSPECTION REQUIREMENTS

H.1. HIGHLIGHTS

The MCB Quantico Facility is to comply with 40 CFR § 264.15, General Inspection Requirements, for the Russell Road Landfill (RRL) Facility.

In accordance with 40 CFR § 264.15, the Permittee is to follow a written inspection schedule for inspections and identification of malfunctions, deterioration, or operational errors in the final landfill cap, the leachate collection systems and leachate collection sump, the gas vents, the gas and groundwater monitoring systems, and the runoff management systems for the landfill.

The MCB Quantico Facility is to implement the necessary operation and maintenance and/or remedial action when necessary for any malfunctions or deterioration of equipment or systems is identified.

The MCB Quantico Facility is to maintain a signed and dated inspection logs at the Facility, available to the DEQ upon request, which provides inspection observations, noted deficiencies, and corrective action taken. (An example of several inspection logs containing the minimum information are included in Appendices 1 through 3 of this Attachment.)

H.2. Inspections

The Permittee shall inspect, at the frequency specified below, for the following and in accordance with **Permit Attachment E, Post-Closure Plan:**

1. The groundwater monitoring wells, piezometers, corrective action (CA) treatment injection wells, shall be inspected annually and during sampling events. Wells and piezometers shall be inspected for obstructions, bends, excess sediment accumulation, grout erosion, inadequate yield, etc.

2. The landfill benchmarks, landfill gas vents, and gas vent monitoring wells shall be inspected annually. **(Gas monitoring will be conducted annually and is to be conducted during the summer months.)**

3. The landfill cap, the vegetative cover, the cap drainage collection system (immediately above the landfill cap/liner, but below the vegetative cover), the surface runoff management control systems (such as the constructed drainage ways, surface runoff impoundments (sediment basins), and inlets and outlets to the sediment basins) shall be inspected quarterly, and after major rainfall events (defined as 2 inches/8 hr period).

4. The lateral leachate collection system and leachate collection sump shall be inspected monthly and after major rainfall events. If the auto dialer system is inoperable, the leachate collection sump will be inspected weekly.

5. Leachate collection sump, alarm system, and auto-dialer system integrity, operation and maintenance. Alarm and auto-dialer systems shall be tested at a minimum on a semi-annual basis.

6. Inspections of the RRL Facility are conducted a minimum of twice a year (semi-annually) to verify no unauthorized entry or activity is being conducted; however, the integrity of security measures are to be observed and assessed during other routine inspections of the RRL Facility. Additonal security measures will be implemented if there are signs of intrusion into the landfill area.

7. A professional engineer, registered in the Commonwealth of Virginia, shall inspect the site annually to assess the condition of the landfill with regards to the approved Closure Plan and Permit Post-Closure Plan requirements, and plans and specifications, and shall report any identified deficiencies in a written and certified Report. This Report with the engineer's certification shall be submitted to the Director in accordance with **Permit Condition I.E.3.**

If the engineer discovers a deficiency in the landfill cap, this deficiency will be noted and corrective action will be initiated within 14 days.

LIST OF APPENDICES

Appendix H-1 - Example Landfill Inspection Log

Appendix H-2 - Example Monitoring Well Inspection Log

Appendix H-3 - Example Benchmark Survey Log

Appendix H-1 - Example Landfill Inspection Log

Appendix H-1 - Example Landfill Inspection Log
Inspection Observations and Comments

1. **Inspectors Full Name:**_____

   Inspectors Signature:_____

2. **Date/Time of Inspection:**_____

3. **Weather Conditions During Inspection:**_____

4. **Security Controls - Gate, Gate Locks, Security Fence, Warning Signs – Condition and Status:** _____

5. **Landfill Final Cover - Vegetative Cover – Landfill Cap – Cap Subsurface Drainage System – Erosion and Sedimentation Control Measures – Condition and Status:**

   5.1 **Condition of Vegetative Cover/Landfill Cap:**_____

   5.2 **Vegetation Stress Observed:**_____

   5.3 **Deep Rooted Vegetation (Trees) or Undesirable Vegetation Observed:**

   5.4 **Any Settlement, Subsidence, Cracks, Erosion, or Displacement of Cover/Cap Observed and in Need of Repair, Soil Amendment, and Regrading:**

   5.5. **Any Signs of Water/Wind Erosion of the Cap:** _____

   5.6. **Any Signs of Rodent Activity or Burrowing Animals Observed:**

   5.7. **Any Evidence of Malfunctioning of Cap - Subsurface Drainage System:**

   5.8 **Erosion and Sedimentation Control Structures – Sedimentation Basins – Condition of Run-on and Run-off Control Structures – Drainage Systems Any signs of Erosion or Sedimentation or Conditions which require maintenance and/or repair:** _____

6. **Perimeter Leachate Collection System and Sump – For Management of F039 Leachate and Lateral Migration of Leachate - Condition and Status**

   6.1 **Describe, and Identify Location if Evidence of Visible Leachate around the Perimeter of Landfill:**_____

_____

_____

6.2 **Leachate Collection Sump – Condition and Status – Estimate Volume (gallons) and sump height of Leachate Accumulated Since Last Leachate Removal:** _____

_____

_____

6.3 **Date of Last Leachate Removal:**_____

6.4. **Days of Leachate Accumulation in Sump:**_____

6.3 **Inspection and Testing of Leachate Collection Sump High Level Alarms and Auto-Dialer Systems:**_Yes or No

Systems Tests Results:_____

_____

7. **Gas Vent and Gas Monitoring System - Condition and Status**

7.1 **Gas Vents – Condition and Status of All Vents:** _____

_____

7.2 **Gas Monitoring Wells – Condition and Status of All Gas Wells:**_____

_____

8. **Summary - Inspections Observations – Comments:**

_____

_____

_____

9. **Repairs – Remediation Comments:** **Date:** _____

_____

_____

_____

Appendix H-2 - Example Monitoring Well Inspection Log

Appendix H-2 - Example Monitoring Well Inspection Log

(Note; A Separate Inspection Sheet is Required for Each Groundwater Monitoring Well and Piezometer.)

1. **Inspectors Full Name:**_____

   Inspectors Signature: _____

2. **Date/Time of Inspection:**_____

3. **Weather Conditions During Inspection:**_____

4. **Monitoring Well ID No.** _____ **Exterior Well ID No. Legible: Yes or No**

5. **Well Inspection – Conditions and Observations:**

   5.1 **Locking Protective Casing:**_____

   5.2 **Concrete Well Apron or Pad:** _____

   5.3 **Lock – Is Well Locked?: Yes or No**

   Condition of Lock: _____

   5.4 **Erosion around Well Casing or Apron of Well: Yes or No**

   5.5 **Condition of Well Casing - Note any obstructions, bends, excess sediment accumulation, grout erosion, inadequate yield, etc.:**

6. **Summary – Well Inspections Observations – Comments:**

7. **Repairs – Remediation Comments:** **Date:** _____

Appendix H-3 - Example Benchmark Survey Log

Appendix H-3 - Example Benchmark Survey Log

Benchmarks will be inspected yearly for obvious damage and to determine if they are still present. A Certified land surveyor, registered in the Commonwealth of Virginia, will verify the elevations and locations of the benchmarks annually.

1. **Inspectors – Surveyors - Full Name:**_____

   Inspectors – Surveyors Signature: _____

   Surveyor Company Name, Address, Phone No. and e-mail:

   _____
   _____
   _____
   _____
   _____

2. **Date/Time of Inspection:**_____

3. **Inspection Observations:** _____

4. **Determine and Confirm The Location of All Benchmarks and Note Changes:**

   _____
   _____
   _____
   _____

5. **Attach Results of Benchmark(s) Survey.**

6. **Benchmark Repair – Remediation Comments:** **Repair Date:**_____

   _____
   _____
   _____
   _____
   _____

ATTACHMENT I

PERSONNEL AND TRAINING

ATTACHMENT I

PERSONNEL AND TRAINING

I.1. Appropriate training shall be completed by all persons at MCB - Quantico - RRL and/or their consultants who are or who may be involved in the task associated with a hazardous waste post-closure care activity. The Permittee shall ensure that those individuals responsible for groundwater monitoring, gas monitoring, and other landfill components and systems monitoring, inspections, and repair are appropriately trained. New employees who have as part of their job responsibility tasks which are associated or may be associated with the post-closure care activity shall not work unsupervised until the training requirements in accordance with this Permit are completed. Such new employees shall complete required training within six months of their employment date.

I.2. All training of personnel shall be documented at the time of each completed session and such documentation shall be maintained in the facility files in the Facility's operating record for at least three years from the date on which the training was completed. Such documentation shall include the name of each trainee and trainer, date of instruction, and a summary or outline of the training session.

I.3. All training under this Permit shall be reviewed at least annually and updated as necessary. All personnel who are subject to the training requirements under this Permit shall be required to review their training at least annually.

I.4. In general, all personnel who are actively associated or may be associated with the proper inspection and operation and maintenance of the monitoring wells and the facility landfill are required to read the following:

1. Permit Attachment E, Post-Closure Plan.
2. Permit Attachment G, Security Provisions.
3. Permit Attachment H, Inspection Requirements.
4. Permit Attachment J, Sampling and Analysis Plan.

The personnel shall be trained to properly perform their assigned duties so to conform to the requirements of this Permit including, but not limited to: conducting inspections of the landfill and landfill components and systems, obtaining samples from groundwater monitoring wells and gas monitoring wells, and maintaining documentation in accordance with the requirement of this Permit.

I.5. The personnel noted above shall be required under this Permit to be fully trained so to understand the techniques of proper maintenance and operation and maintain appropriate documentation required under this Permit. Supervisory staff shall be trained to review and to provide appropriate guidance and/or liaison with the Permittee's management and subordinate staff and contracted employees, as applicable. The Permittee shall provide sufficient opportunity for personnel to acquire a full understanding of maintenance and operation techniques by providing sufficient instruction and/or sponsoring sufficient instruction by professionals who are qualified to provide such instruction.

I.6. All personnel who are or may be exposed to the hazards associated with the post-closure care activity shall receive the appropriate training and shall utilize the appropriate personnel training as specified by the Occupational Safety and Health Act (OSHA) requirements in 29 CFR § 1910.120.

I.7. The personnel involved in the actual post-closure care activity, specifically the groundwater monitoring wells, within the scope of this permit will be trained in the proper management procedures for handling, storage, treatment, and disposal, of spent monitoring well sample effluent (i.e., purge water, decontamination fluids, etc.) to comply with the Virginia Hazardous Waste Management Regulations (VHWMR), and the Department's Investigation of Derived Waste (IDW) Policy specified in **Permit Attachment J, Sampling and Analysis Plan**, and as required by **Permit Module VI.** These procedures will ensure continued safe operation and maintenance and compliance with applicable State and federal environmental regulations.

I.8. The MCB Quantico Facility contact will be responsible for the overall training program, scheduling, and documentation of such training and shall serve as the post-closure care Training Director. The Facility contact shall ensure that all sub-contractors are trained in accordance with the applicable OSHA Regulations under 29 CFR § 1910.120.

All personnel required to receive training under this Permit shall at minimum be instructed in the following areas:

1. Specific management practices regarding post-closure care activities of the Landfill, Operation and Maintenance, Sampling, Corrective Action, and Waste Management.
2. Security and safety.
3. General and area specific inspections and record keeping requirments.
4. Permit modifications and/or updates to the Permit which affects post-closure care activities of the Landfill, Operation and Maintenance, Sampling, Corrective Action, and Waste Management.
5. Job functions and procedural descriptions of each employee's respective role in post-closure care of the Landfill.

I.9. Appendix I-1 of this Attachment provides a summary of the job descriptions of positions and specific training requirements for personnel who have or may be given tasks associated with post-closure care activity of the Landfill.

APPENDIX I-1

JOB DESCRIPTION SUMMARY

I.A. Facility Coordinator

Oversees all aspects of administration, regulatory requirements, recordkeeping, operation and maintenance, security, inspections, sampling, corrective action, waste management, treatment, and disposal, and compliance associated with the Hazardous Waste Management Facility Permit in accordance with the conditions and requirements of the Permit Modules and Permit Attachments.

Maintains a current up-to-date copy of the Hazardous Waste Management Facility Permit.

Maintains current and up-to-date records associated with the administration, regulatory requirement aspects, recordkeeping, operation and maintenance, security, inspections, sampling, corrective action, waste management, treatment, and disposal, and compliance associated with the Hazardous Waste Management Facility Permit in accordance with the conditions and requirements of the Permit Modules and Permit Attachments, herein.

Maintains current inspection checklists and/or logs and assures that all inspections and operations and maintenance, and other permit schedules are in accordance with **Permit Attachment H, Inspection Requirements,** and other conditions and requirements of this Permit.

I.B. Monitoring Well Samplers

Follows sampling, equipment handling and decontamination procedures, and waste management procedures and protocols as described in **Permit Attachment J, Sampling and Analysis Plan.**

Collects samples and decontaminates sampling equipment. Stabilizes samples and provides for transportation to appropriate laboratory facility for analysis.

Manages, stores, and provides for transportation for treatment, storage, and disposal of purge or decontamination water in accordance with the requirements of this Permit and the Virginia Hazardous Waste Management Regulations (VHWMRs), and as incorporated by reference, the RCRA Regulations, and other applicable regulations.

Records of purge water and decontamination waste handling, treatment, and disposal shall be maintained by the contracted sampler and contracted Facility and by the MCB Quantico Facility.

Checks wells for structural integrity and proper operation and completes monitoring wells inspection logs as required in this Permit. Maintains accurate and detailed records of inspection logs of observations of monitoring wells and records of any remediation of wells, if required, in accordance with requirements of **Permit Attachment H.**

Annual training will include but is not limited to: OSHA 8-hour Refresher Training, OSHA and Employee's Workplace Rights, Hazard Communication, Health Awareness and Evaluation, Health Effects of Chemicals: Characteristics of Hazardous Chemicals - Toxic Properties of Hazardous Chemicals, Medical Surveillance Requirements, Fire Protection and Safety, Air Monitoring and Equipment, Decontamination Procedures, Site Control, and Sampling Technique and Procedures.

ATTACHMENT J

SAMPLING AND ANALYSIS PLAN (SAP)

FOR GROUNDWATER CORRECTIVE ACTION AND COMPLIANCE MONITORING PROGRAM

ATTACHMENT J

SAMPLING AND ANALYSIS PLAN (SAP) FOR GROUNDWATER CORRECTIVE ACTION AND COMPLIANCE MONITORING PROGRAM

J.1. INTRODUCTION

The Sampling and Analysis Plan (SAP) submitted as part of the revised permit application for reissuance of the MCB Quantico Facility's Permit. The revised permit application was received by the DEQ on June 1, 2011. The SAP herein Attachment J is entitled *Draft Groundwater Corrective Action Monitoring and Sampling and Analysis Plan for Russell Road Landfill, Marine Corps Base, Quantico, Virginia*, and is dated May 2011. This above SAP has been prepared for the Naval Facilities Engineering Command (NAVFAC) Washington, D.C., and has been prepared by Tetra Tech NUS, Inc.

This submitted SAP has been revised so it is current and consistent with the facility's Permit and updated permit monitoring (sampling and analysis) requirements under **Permit Module VI, Corrective action Program – Groundwater Monitoring – Regulated Unit**, and under **Permit Attachment T, Corrective Action Plan (CAP) For Groundwater at Russell Road Landfill**. The SAP is to reflect the ongoing and proposed CA and compliance sampling and analysis, remediation and monitoring measures for the Russell Road Landfill (RRL).

J.2. SAMPLING AND ANALYSIS PLAN - SUMMARY

The SAP provides the sampling and analysis and related protocols and procedures which are necessary to comply with the requirements of the Facility's Permit and the Virginia Hazardous Waste Management Regulations (VHWMR), under 9 VAC 20-60, and as incorporated by reference, the Resource Conservation and Recovery Act (RCRA) Regulations.

The SAP includes, but is not limited to, the following items:

1. The most current SW-846 Analytical Test Methods utilized by the Permittee.

2. The current sampling procedures and protocols and test methods which are identified as necessary to comply with the requirements of the Permit and to evaluate the effectiveness of the ongoing remediation under the CAP.

3 Information on dedicated sampling pumps.

4. The current sampling equipment and other equipment decontamination procedures.

5. Information regarding the management, storage, treatment and disposal of investigation derived waste (IDW) and decontamination wastes.

6. An updated Quality Assurance Project Plan (QAPP) so to reflect the current Facility's QAPP procedures, and the QAPP information and procedures from the facility's contracted laboratory, which is based upon EPA's QAPP Guidance.

   The updated QAPP follows guidelines found in the EPA's following guidance documents: 1) *EPA Requirements for Quality Assurance Project Plans (EPA QA/R-5*, 2001) and 2) *EPA Requirements for Quality Assurance Project Plans (EPA QA/G-5)*, 1998, 3) The Uniform Federal Policy for Quality Assurance Project Plans (UFP – QAPPs), January 2007, which includes UFP Sampling and Analysis Plans (UFP-SAPs).

   The Uniform Federal Policy Sampling and Analysis Plan (UFP-SAP) format was used to revise the SAP. The establishment of project-specific data quality objectives (DQOs) is integral to this format.

7. A Summary Target Analyte List (TAL) or COCs Table based upon the list of COCs in **Permit Attachment N, Groundwater Protection Standards**. Within this Summary TAL Table the Facility provides the COCs, the applicable EPA test methods, the facility laboratory's practical quantitation limits (PQLs), and method detection limits (MDLs) for each COC for the groundwater medium, based upon the facility's laboratory. Either the PQLs or the MDLs are sufficiently low to meet the groundwater protection standards (GPSs) specified in Permit Attachment N.

   The MCB Quantico Facility has incorporated DQO language into the SAP as appropriate. The MCB Quantico Facility acknowledges that there is limited flexibility in the Compliance Monitoring program and more flexibility in the Corrective Action Program and that any changes to the monitoring and analysis associated with these Programs will be done with the concurrence and approval of the DEQ.

   A summary of any analytical methods proposed in the SAP that differed from those listed in the DEQ's revised Permit Attachments K and/or L, dated December 2010, including an explanation of the reason for the proposed alternate Test Method, is provided in Exhibit 2-1. Permit Attachments K and L have been revised to reflect the updated Test Methods in Exhibit 2-1, if appropriate.

8. The SAP indicates that limited data validation (instead of full data validation) will be completed and data packages similar to that required under the EPA's Contract Laboratory Program (CLP) will be requested from the laboratory conducting the analyses in case full data validation is necessary at some point in the future. The CLP-like data packages will allow subsequent full data validation of data packages, if needed.

NAVFAC Washington is required to conduct data validation using a third party. Original contracted laboratories do not validate their own data because it could be considered a conflict of interest; however, the laboratory would be contacted by the third party conducting the data validation if they had any specific questions/concerns related to interpretation of the analyses. The process of objective data review by a third party is defined by EPA QAAP guidelines. Consequently, validation of the data will be conducted by a third party which is independent of the laboratory.

SAMPLING AND ANALYSIS PLAN (SAP)
FOR GROUNDWATER CORRECTIVE ACTION AND COMPLIANCE MONITORING PROGRAM

Draft Groundwater Corrective Action Monitoring and Sampling and Analysis Plan for Russell Road Landfill, **Marine Corps Base, Quantico, Virginia, dated May 2011.**

Draft
Groundwater Corrective Action Monitoring Sampling and Analysis Plan
for
Russell Road Landfill
Marine Corps Base (MCB)
Quantico, Virginia

Naval Facilities Engineering Command
Washington
Contract Number N62470-08-D-1001
Contract Task Order JU06

May 2011

SAP WORKSHEET NO. 1 – TITLE AND APPROVAL PAGE
(UFP-QAPP Manual Section 2.1)

DRAFT
GROUNDWATER CORRECTIVE ACTION MONITORING SAMPLING AND ANALYSIS PLAN
For
RUSSELL ROAD LANDFILL
MCB QUANTICO, VIRGINIA

June 2011

Prepared for:
Naval Facilities Engineering Command Washington
1314 Harwood Street, SE
Washington Navy Yard, D.C. 20374-5018

Prepared by:
Tetra Tech NUS, Inc.
234 Mall Boulevard, Suite 260
King of Prussia, Pennsylvania 19406

Prepared under:
Contract No. N62470-08-D-1001
Contract Task Order JU06

Review Signatures:

T.E. Johnston 5-25-11
Tom Johnston/Quality Assurance Manager — Date
Tetra Tech NUS, Inc.

Jennifer Buel for 5/25/11
Karen Lyons/Project Manager — Date
Tetra Tech NUS, Inc.

Approval Signatures:

Fred Evans/Remedial Project Manager — Date
NAVFAC Washington

Maria Raney/Remediation Program Manager — Date
MCB Quantico NREA

Richard Criqui/Senior Environmental Engineer — Date
VDEQ

see signature page on 04/11 version (next page)
Government Chemist — Date
NAVFAC QA Review

SAP WORKSHEET NO. 1 – TITLE AND APPROVAL PAGE
(UFP-QAPP Manual Section 2.1)

DRAFT
GROUNDWATER CORRECTIVE ACTION MONITORING SAMPLING AND ANALYSIS PLAN
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1314 Harwood Street, SE
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Review Signatures:

T.E. Johnston — 4-1-2011
Tom Johnston/Quality Assurance Manager — Date
Tetra Tech NUS, Inc.

Jennifer Buel for — 4/1/11
Karen Lyons/Project Manager — Date
Tetra Tech NUS, Inc.

Approval Signatures:

Fred Evans/Remedial Project Manager — Date
NAVFAC Washington

Maria Raney/Remedial Project Manager — Date
MCB Quantico NREA

Richard Criqui/Senior Environmental Engineer — Date
VDEQ

Jonathan Tucker — Digitally signed by TUCKER.JONATHAN.P.1239524180 Date: 2011.04.21 09:24:13 -04'00'

Government Chemist — Date
NAVFAC QA Review

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EXECUTIVE SUMMARY

Tetra Tech NUS, Inc. (Tetra Tech) has prepared this Corrective Action (CA) Groundwater Monitoring Sampling and Analysis Plan (SAP) on behalf of Naval Facilities Engineering Command (NAVFAC) Washington under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract No. N62470-08-D-1001, Contract Task Order (CTO) JU06. This SAP has been prepared for the Russell Road Landfill (RRL) at Marine Corps Base (MCB) Quantico, Virginia (Figures ES-1 and ES-2) and documents the existing conceptual site model (CSM), defines the data quality objectives (DQOs) for the CA Groundwater Monitoring Program, and describes the process of obtaining and evaluating the data needed for the project. Although this SAP has been prepared by Tetra Tech, the contractors to the Navy (hereafter referred to as the CA Monitoring Contractor), who will implement this SAP and conduct the CA groundwater monitoring activities, has not been identified.

The RRL is a 28-acre landfill that was the primary sanitary waste disposal facility in operation at MCB Quantico from 1971 to 1983. Trench and fill operations began at the southern end of the landfill and continued north across the landfill. Trenches were filled with waste material that were compacted and covered daily with a layer of clean soil. Hazardous and inert wastes were disposed of in the landfill.

Several investigations were conducted at the RRL beginning in 1993. Closure of the RRL under the Resource Conservation and Recovery Act (RCRA) was completed in 1997 with the construction of a cap to contain the waste in place, along with the installation of a passive leachate system and gas migration system.

Post-closure activities are currently being conducted at the RRL in accordance with a Hazardous Waste Management Post-Closure Permit (hereafter referred to as the RCRA Permit). The RCRA Permit (United States Environmental Protection Agency [USEPA] Identification [ID] #VA1170024722) was issued by the Commonwealth of Virginia Department of Environmental Quality (VDEQ) on October 29, 2000 and is effective for a ten year period before it must be renewed (VDEQ, 2000). The permit was recently modified in September 2010; however the VDEQ issued a notice of deficiency (NOD) on the permit reissuance. MCB Quantico has been issued a permit extension by VDEQ to address the NOD, and a revised permit is scheduled to be submitted to the VDEQ on June 1, 2011.

As part of post-closure activities, groundwater monitoring is being conducted. Since site closure, groundwater monitoring has been conducted for sixty quarters. There have been six CA periods at the RRL from 2003 to 2010. CAs involved the injection of hydrogen-release compound (HRC®) to address chlorinated ethane compounds detected in groundwater in excess of established groundwater protection standards (GPSs). These injections occurred in the vicinity of MW-9 (northern CA area) and MW-15R

(southern CA area). An updated CAP (Tetra Tech, 2011) was prepared in 2011 as part of the RCRA Permit update. The updated CAP, included as Attachment T of the RCRA Permit, evaluated the current effectiveness of the CA. The CAP recommended that HRC® injections be suspended in the northern CA area and that a focused investigation be performed in the southern CA area to determine if enhanced reductive dechlorination was still effective. The focused investigation, which is scheduled to occur in June 2011, will involve the collection of certain pre-design information that will be used to develop a modified remedial design that will be submitted as an addendum to the CAP. Some adjustments to this CA groundwater monitoring SAP may be necessary depending on the requirements of the CAP addendum. The format in which the adjustments are documented will be decided by NAVFAC Washington after completion of the revised CAP. Adjustments to the SAP will be made under the oversight of VDEQ.

The monitoring of 17 existing groundwater monitoring wells located upgradient, around the perimeter, and downgradient of the RRL are included in the SAP, as required by the RCRA Permit. Groundwater from these wells will be analyzed on a semi-annual basis. For one sampling event per calendar year, all wells will be analyzed for analytes listed in Attachment K of the RCRA Permit. This list is considered a reduced target analyte list comprised of chemicals previously detected at potentially unacceptable concentrations. For the other yearly sampling event, select wells will be analyzed for the Attachment K list and the remaining group of wells will be analyzed for analytes listed in Attachment L of the RCRA Permit, which includes Appendix IX parameters. The analytes that will be measured in each well are defined by the RCRA Permit. Monitored natural attenuation (MNA) parameters identified in this SAP will be analyzed at select well locations and at sampling frequencies to be determined in the revised CAP. MNA parameter interpretation will be implemented through implementation of the CAP.

To be compliant with the RCRA Permit, groundwater must be monitored to verify that contaminants are not migrating beyond the site boundary (compliance boundary), to ensure that groundwater concentrations are not in exceedance of GPSs, and to understand the geochemical and physical properties of the groundwater under changing conditions. Because of the CA that have been implemented at the RRL, groundwater monitoring requirements will be conducted in accordance with Module VI, Groundwater Corrective Action, of the RCRA Permit through the remainder of the compliance monitoring period.

Currently, the compliance period (and corresponding CA period) for monitoring extends to the year 2025, which is 27 years from the date of the final closure of the landfill (September 3, 1998). However, NAVFAC Washington and MCB Quantico, with ultimate approval from VDEQ, expects to optimize the monitoring program to make the most cost-effective use of resources while also being protective of human health and the environment and adhering to regulatory requirements.

Changes in personnel or organization-specific nuances to be implemented through the CAP are likely to require changes to this SAP regarding, for example, specific personnel such as the Project Manager, Quality Assurance Manager, distribution list, organizational chart, and personnel roles/responsibilities and contact information. To the extent possible, placeholders (e.g., "TBD") have been incorporated throughout this SAP as reminders that these items will, or may, change.

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ACRONYMS

°C	Degree Celsius
%	Percent
%D	Percent Difference or Percent Drift
%R	Percent Recovery
ACL	Alternate Concentration Limit
ASTM	American Society for Testing and Materials
ASV	Anodic Stripping Voltammetry
BFB	Bromofluorobenzene
CA	Corrective Action
CAP	Corrective Action Plan
CCB	Continuing Calibration Blank
CCC	Calibration Check Compound
CCV	Continuing Calibration Verification
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-Term Environmental Action Navy
CMW	Compliance Monitoring Well
COC	Chemical of concern
CSM	Conceptual site model
CTO	Contract Task Order
CVAA	Cold Vapor Atomic Absorption
DBCP	1,2-Dibromo-3-chloropropane
DL	Detection Limit
DM	Data Manager
DO	Dissolved oxygen
DoD	Department of Defense
DQI	Data Quality Indicator
DQO	Data Quality Objective
DVM	Data Validation Manager
ECD	Electron Capture Detector
EDB	Ethylene dibromide
EDD	Electronic Data Deliverable
EDL	Estimated Detection Limit
ELAP	Environmental Laboratory Accreditation Program
FID	Flame ionization detector
FOL	Field Operations Leader

ft^3	Cubic foot
FTMR	Field Task Modification Request
GC	Gas Chromatograph
GPS	Groundwater protection standard
H_2SO_4	Sulfuric acid
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HCl	Hydrochloric acid
HDPE	High-density polyethylene
HRGC	High-Resolution Gas Chromatography
HRC	Hydrogen release compound
IATA	International Air Transportation Association
IC	Ion Chromatography
ICAL	Initial Calibration
ICB	Initial Calibration Blank
ICP/MS	Inductively Coupled Plasma/Mass Spectrometer
ICS	Interference Check Standard
ICSA	Interference Check Standard A
ICSB	Interference Check Standard B
ICV	Initial Calibration Verification
ID	Identification
IDW	Investigation-derived waste
IR	Installation Restoration
IS	Internal Standard
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
LOD	Limit of Detection
LOQ	Limit of Quantitation
LRMS	Low-Resolution Mass Spectrometer
MCB	Marine Corps Base
MCL	Maximum Contaminant Level
MDL	Method Detection Limit
mg/L	Milligram per liter
MNA	Monitored natural attenuation
MPC	Measurement Performance Criteria
MS	Matrix Spike or Mass Spectrometer
MSD	Matrix Spike Duplicate

NAD	North American Datum
NaOH	Sodium Hydroxide
NAVFAC	Naval Facilities Engineering Command
NEDD	NIRIS Electronic Data Deliverable
NIRIS	Naval Installation Restoration Information Solution
NOD	Notice of Deficiency
NREA	Natural Resources and Environmental Affairs
NTU	Nephelometric turbidity unit
ORP	Oxidation-reduction potential
OSHA	Occupational Safety and Health Administration
PAL	Project Action Level
PCB	Polychlorinated biphenyl
PDF	Portable Document Format
PHSO	Project Health and Safety Officer
PM	Project Manager
POC	Point of Compliance
PPE	Personal protective equipment
PQLG	Project Quantitation Limit Goal
PSL	Project Screening Level
PT	Proficiency Testing
QA	Quality Assurance
QAM	Quality Assurance Manager
QAPP	Quality Assurance Project Plan
QC	Quality Control
QSM	Quality Systems Manual
RB	Rinsate Blank
RCRA	Resource Conservation and Recovery Act
RDM	Regional Database Manger
RF	Response Factor
RPD	Relative Percent Difference
RPM	Remedial Project Manager
RRL	Russell Road Landfill
RRT	Relative Retention Time
RSD	Relative standard deviation
RSL	Regional Screening Level
RT	Retention Time
RTC	Response to Comments

SAP	Sampling and Analysis Plan
SDG	Sample Delivery Group
SDWA	Safe Drinking Water Act
SOP	Standard Operating Procedure
SPCC	System Performance Check Compound
SQL	Structured Query Language
SSO	Site Safety Officer
SVOC	Semivolatile organic compound
TEF	Toxicity equivalency factor
Tetra Tech	Tetra Tech NUS, Inc.
TOC	Total organic carbon
UFP-QAPP	Uniform Federal Policy for Quality Assurance Project Plan
µg/L	Microgram per liter
USEPA	United States Environmental Protection Agency
VDEQ	Virginia Department of Environmental Quality
VELAP	Virginia Environmental Laboratory Accreditation Program
VOC	Volatile organic compound
yd^3	Cubic yard

SAP WORKSHEET NO. 2 -- SAP IDENTIFYING INFORMATION

(UFP-QAPP Manual Section 2.2.4)

Site Name/Number:	Russell Road Landfill (RRL), Marine Corps Base (MCB) Quantico, Virginia
Operable Units:	Not Applicable (NA)
Contractor Name:	To Be Determined (TBD)
Contract Number:	TBD
Contract Title:	Comprehensive Long-Term Environmental Action Navy (CLEAN)
Work Assignment Number:	TBD

1. This Sampling and Analysis Plan (SAP) was prepared in accordance with the requirements of the *Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP)* (USEPA, 2005a) and *United States Environmental Protection Agency (USEPA) Guidance for Quality Assurance Project Plans*, QA/G-5, Quality Assurance Manuals (QAMs) (USEPA, 2002).

2. Identify regulatory program: Resource Conservation and Recovery Act (RCRA).

3. This SAP is a project-specific SAP.

4. List dates of scoping sessions that were held:

Scoping Session	Date
Discussion of Notice of Deficiency (NOD) on Post-Closure Care Permit Modification/Renewal Application	January 24, 2011

5. List dates and titles of any SAP documents written for previous site work that are relevant to the current investigation.

Title	Date
Hazardous Waste Management Permit, MCB Quantico USEPA ID#: VA117024722; Attachment J, Groundwater Compliance Monitoring Program SAP	September 2004

6. List organizational partners (stakeholders) and connection with lead organization:

Virginia Department of Environmental Quality (VDEQ) – Regulatory Oversight

MCB Quantico Natural Resources and Environmental Affairs (NREA) – Property Stakeholder

7. Lead organization:

Naval Facilities Engineering Command (NAVFAC) Washington

8. If any required SAP elements or required information are not applicable to the project or are provided elsewhere, then note the omitted SAP elements and provide an explanation for their exclusion below:

There are no exclusions.

SAP WORKSHEET NO. 3 -- DISTRIBUTION LIST

(UFP-QAPP Manual Section 2.3.1)

Name of SAP Recipients	Title/Role	Organization	Telephone Number	E-Mail Address or Mailing Address	Document Control Number
Fred Evans	NAVFAC Washington Remedial Project Manager (RPM)/Project Management	NAVFAC Washington	202-685-3303	frederick.j.evans@navy.mil	NA
Maria Raney	MCB Quantico NREA RPM/Project Management	MCB Quantico NREA	703-432-0521	maria.raney@usmc.mil	NA
Richard Criqui	VDEQ Senior Environmental Engineer/Regulatory Oversight	VDEQ	804-698-4013	richard.criqui@deq.virginia.gov	NA
Glenn Wagner(final SAP only)	Tetra Tech Records Manager	Tetra Tech	412-920-8603	glenn.wagner@tetratech.com	NA
Karen Lyons	Tetra Tech Activity Coordinator/Project Manager (PM)	Tetra Tech	412-921-7160	karen.lyons@tetratech.com	NA
Amy Stattel	Tetra Tech Project Lead	Tetra Tech	301-528-3018	amy.stattel@tetratech.com	NA
Tom Johnston	Tetra Tech Quality Assurance Manager (QAM)	Tetra Tech	412-921-8615	tom.johnston@tetratech.com	NA
Corrective Action (CA) Monitoring Contractor (TBD[1])	Project Manager	TBD[1]	TBD[1]	TBD[1]	NA
Laboratory Subcontractor (TBD[1])	Laboratory PM	TBD[1]	TBD[1]	TBD[1]	NA

1. An CA Monitoring Contractor has not been selected by the Navy yet, and the Laboratory Subcontractor will be selected by the CA Monitoring Contractor. Copies of this SAP designated for the CA Monitoring Contractor and Laboratory Subcontractor will be sent to the Navy RPM, who will be responsible for forwarding the SAP to the selected CA Monitoring Contractor once the selection process is complete.

SAP WORKSHEET NO. 4 -- PROJECT PERSONNEL SIGN-OFF SHEET

(UFP-QAPP Manual Section 2.3.2)

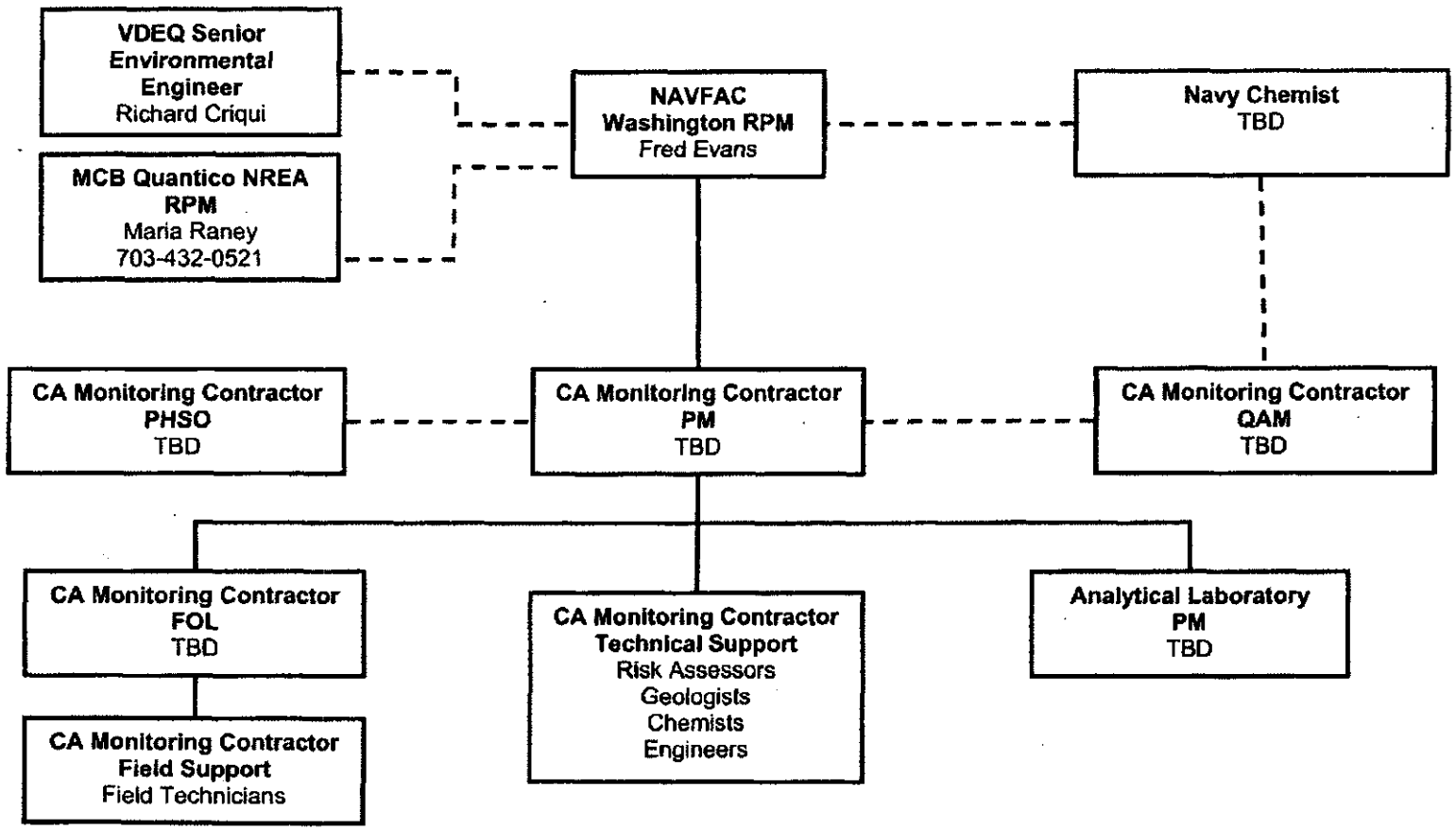
Name [1]	Organization/Title/Role	Telephone Number	Signature/E-Mail Receipt	SAP Section Reviewed	Date SAP Read
Fred Evans	NAVFAC Washington/Navy RPM	202-685-3303		All	
TBD	CA Monitoring Contractor/PM	TBD		All	
TBD	CA Monitoring Contractor/ Field Operations Leader (FOL)	TBD		All	
TBD	CA Monitoring Contractor/ Site Safety Officer (SSO)	TBD		All	
TBD	CA Monitoring Contractor/ Project Health and Safety Officer (PHSO)	TBD		Health and Safety Plan (HASP)	
TBD	CA Monitoring Contractor/ Project Chemist	TBD		All	
TBD	CA Monitoring Contractor/ QAM	TBD		All	
TBD	CA Monitoring Contractor/ Data Validation Manager (DVM)	TBD		Worksheet Nos. 12, 14, 15, 19, 20, 23-28, 30, and 34-36	
TBD	Laboratory/PM	TBD		Worksheet Nos. 12, 14, 15, 19, 20, 23-28, 30, and 34-36	

1 - Persons listed on this worksheet will be responsible for distributing the SAP to the appropriate people within their organization.

SAP WORKSHEET NO. 5 -- PROJECT ORGANIZATIONAL CHART

(UFP-QAPP Manual Section 2.4.1)

Lines of Authority ———— ..... Lines of Communication



SAP WORKSHEET NO. 6 -- COMMUNICATION PATHWAYS

(UFP-QAPP Manual Section 2.4.2)

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or E-mail	Procedure
SAP amendments	CA Monitoring Contractor FOL CA Monitoring Contractor PM Navy RPM	TBD TBD Fred Evans	TBD TBD 202-685-3303	The CA Monitoring Contractor FOL will verbally inform the CA Monitoring Contractor PM within 24 hours of realizing a need for an amendment. The CA Monitoring Contractor PM will document the proposed changes via a Field Task Modification Request (FTMR) form within 5 days and send the Navy RPM a concurrence letter within 7 days of identifying the need for change. SAP amendments will be submitted by the CA Monitoring Contractor PM to the Navy RPM for review and approval. The CA Monitoring Contractor PM will send scope changes to NAVFAC Washington, MCB Quantico and VDEQ via e-mail within 1 business day.
Changes in schedule	CA Monitoring Contractor PM Navy RPM	TBD Fred Evans	TBD 202-685-3303	CA Monitoring Contractor PM will verbally inform the Navy RPM on the day that a schedule change is known and document via a schedule impact letter within 1 business day from when impact is realized.
Issues in the field that lead to changes in the scope of work	CA Monitoring Contractor FOL CA Monitoring Contractor PM Navy RPM	TBD TBD Fred Evans	TBD TBD 202-685-3303	CA Monitoring Contractor FOL will verbally inform CA Monitoring Contractor PM within 1 business day of the day that the issue is discovered; CA Monitoring Contractor PM will inform the Navy RPM (verbally or via email) by close of the next working day, and Navy RPM will issue scope change if warranted. The scope change will be implemented before further work is executed. CA Monitoring Contractor PM will document the changes on an FTMR form within 2 days of identifying the need for change and will obtain required approvals within 5 days of initiating the form.

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or E-mail	Procedure
Recommendations to stop work and initiate work upon CA	CA Monitoring Contractor FOL CA Monitoring Contractor PM CA Monitoring Contractor QAM Navy RPM	TBD TBD TBD Fred Evans	TBD TBD TBD 202-685-3303	The Responsible Party for a stop-work command will inform (verbally or via e-mail) on-site personnel, subcontractors, the Navy RPM, and the identified Project Team members within 1 business day.
Field data quality issues	CA Monitoring Contractor FOL CA Monitoring Contractor PM	TBD TBD	TBD TBD	The CA Monitoring Contractor FOL will inform the CA Monitoring Contractor PM (verbally or via e-mail) on the same day that a field data quality issue is identified.
Analytical data quality issues	Laboratory PM CA Monitoring Contractor PM CA Monitoring Project Chemist Navy RPM	TBD TBD TBD Fred Evans	TBD TBD TBD 202-685-3303	The Laboratory PM will notify (verbally or via email) CA Monitoring Contractor Project Chemist within 1 business day of when an issue related to laboratory data is discovered. The CA Monitoring Contractor Project Chemist will notify (verbally or via e-mail) the data validation staff and the CA Monitoring Contractor PM, within 1 business day. The CA Monitoring Contractor Project Chemist notifies CA Monitoring Contractor PM verbally or via e-mail within 48 hours of validation completion that a non-routine and significant laboratory quality deficiency has been detected that could affect this project and/or other projects. The CA Monitoring Contractor PM verbally advises the Navy RPM within 24 hours of notification from the CA Monitoring Contractor Project Chemist. The Navy RPM takes corrective action that is appropriate for the identified deficiency. Examples of significant laboratory deficiencies include data reported that has a corresponding failed tune or initial calibration verification. Corrective actions may include a consult with the Navy Chemist.

SAP WORKSHEET NO. 7 -- PERSONNEL RESPONSIBILITIES AND QUALIFICATIONS TABLE

(UFP-QAPP Manual Section 2.4.3)

Name	Title/Role	Organizational Affiliation	Responsibilities
Fred Evans	RPM	NAVFAC Washington	Oversees project implementation, including scoping, data review, and evaluation.
Richard Criqui	Senior Environmental Engineer	VDEQ	Regulatory oversight; participates in scoping, data review, evaluation, and approves the SAP.
TBD	PM	CA Monitoring Contractor	Oversees project, including financials, schedule, and technical day-to-day management of the project.
TBD	FOL/SSO (or equivalent)	CA Monitoring Contractor	As FOL, supervises, coordinates, and performs field sampling activities. As SSO, will be responsible for on-site project specific health and safety training and monitoring site conditions related to personnel safety. Details of the SSO's responsibilities are presented in the site-specific HASP.
TBD	QAM	CA Monitoring Contractor	Ensures quality aspects of the program are implemented, documented, and maintained.
TBD	Project Chemist	CA Monitoring Contractor	Ensures that a qualified laboratory is selected to perform analyses in accordance with this SAP. Verifies that the selected analytical laboratory is qualified to conduct analyses as specified in this SAP and ensures that the analytical laboratory has current Department of Defense (DOD) Environmental Laboratory Accreditation Program (ELAP) accreditation to perform these analyses. Participates in project scoping, prepares laboratory scopes of work, and coordinates laboratory related functions with laboratory. Oversees data quality reviews and quality assurance of data validation deliverables. If a Project Chemist is unavailable, then the Navy Chemist will verify the suitability of the laboratory to implement this SAP.
TBD	DVM	CA Monitoring Contractor	Manages data validation activities, including: • Ensure data quality assurance of data validation deliverables. • Provide technical advice on data usability. • Coordinate and maintain data validation review schedule.
TBD	PHSO	CA Monitoring Contractor	Oversees Health and Safety Program.
TBD	Laboratory PM	Laboratory	Coordinates analyses with laboratory chemists, ensures that scope of work is followed, provides QA of data packages, and communicates with CA Monitoring Contractor project staff.

In some cases, one person may be designated responsibilities for more than one project role. For example, the FOL may also be responsible for SSO duties. This approach will be used when it is conducive with only as credentials, experience, and availability.

SAP WORKSHEET NO. 8 -- SPECIAL PERSONNEL TRAINING REQUIREMENTS

(UFP-QAPP Manual Section 2.4.4)

Each site worker will be required to have completed appropriate Hazardous Waste Operations and Emergency Response (HAZWOPER) training specified in Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) 1910.120 (e). Project-specific safety requirements will be addressed in greater detail in the site-specific HASP, which will be completed by the selected CA Monitoring Contractor.

SAP WORKSHEET NO. 9 -- PROJECT SCOPING SESSION PARTICIPANTS SHEET

(UFP-QAPP Manual Section 2.5.1)

Project Name: RRL Monitoring **Projected Date(s) of Sampling:** Semi-annually **Project Manager:** TBD	**Site Name:** RRL **Site Location:** MCB Quantico, Virginia

Date of Session: January 24, 2011
Scoping Session Purpose: Discussion of NOD on Post-Closure Care Permit Modification/Renewal Application

Name	Title	Affiliation	Phone No.	E-Mail Address	Project Role
Fred Evans	RPM	NAVFAC Washington	202-685-3303	frederick.j.evans@navy.mil	Navy RPM
Sally Meckle	Base Representative	MCB Quantico NREA	703-432-1335	sally.meckle@usmc.mil	Project support
Donna Heric	Base Point of Contact	MCB Quantico NREA	703-784-4030	donna.heric@usmc.mil	Project support/ coordination
Richard Criqui	Senior Environmental Engineer	VDEQ	804-698-4013	richard.criqui@deq.virginia.gov	Regulatory Oversight
Hasan Keceli	Statistician	VDEQ	804-698-4000	hasan.keceli@deq.virginia.gov	Regulatory Oversight
Brett Fisher	Geologist	VDEQ	804-698-4000	brett.fisher@deq.virginia.gov	Regulatory Oversight
Leslie Romanchik	Hazardous Waste Manager	VDEQ	804-698-4129	leslie.romanchik@deq.virginia.gov	Regulatory Oversight
Amy Stattel	Engineer	Tetra Tech	301-528-3018	amy.stattel@tetratech.com	Project lead
Irv Leichter	Permitting Specialist	Tetra Tech	301-983-8719	irving.leichter@tetratech.com	Project support

Comments/Decisions:

Attendees discussed the December 21, 2010, NOD letter issued by VDEQ on the RRL RCRA Permit reissuance. Key points of discussion associated with this SAP were how to revise the CA module of the RCRA Permit and update the existing SAP. The schedule for the RCRA Permit was discussed. A draft permit (which includes the SAP) will be submitted to VDEQ for review on June 1, 2011. The final permit must be submitted to VDEQ on July 1, 2011. Public notices of permit availability for public review should be published during the second week of July, and the permit needs to be issued by September 30, 2011.

In regards to the SAP, VDEQ reiterated the request outlined in the NOD letter that the SAP should reflect current SW-846 methods and sampling procedures used for the groundwater monitoring program. Information on dedicated sampling pumps and current decontamination procedures should be added to the SAP. Updated information regarding investigation-derived waste (IDW) disposal procedures should be included. VDEQ also requested an example laboratory Quality Assurance Project Plan (QAPP) be included as an attachment to the SAP.

VDEQ indicated that monitoring activities conducted under the revised permit should be performed in accordance with the requirements of CA Monitoring (Module VI of the RCRA Permit) because groundwater concentrations at the point of compliance (POC) wells have been exceeded and CA is being conducted. VDEQ will revise permit Modules V and VI to reflect acceptable post-closure monitoring of point of compliance (POC) wells and compliance monitoring wells (CMW).

Action Items:

Revise existing SAP (Attachment J of the RCRA Permit); SAP will be in the UFP-SAP format. This action item has been completed by the Navy in conjunction with the development of this SAP.

VDEQ to provide revised permit sections to the Navy and MCB Quantico; revised permit sections will outline the specific wells to be included under the CA monitoring program. VDEQ provided this information to the Navy and is the basis for the well selections in this SAP.

Consensus Decisions:

Because of the well defined data trends observed over the monitoring period, NAVFAC Washington, MCB Quantico and VDEQ agreed to reduce sampling frequency for the CA Monitoring Program from quarterly to semi-annual.

SAP WORKSHEET NO. 10 -- CONCEPTUAL SITE MODEL

(UFP-QAPP Manual Section 2.5.2)

10.1 SITE DESCRIPTION

The RRL is a 28-acre former sanitary disposal facility located approximately 300 yards north of the intersection of Interstate Route 95 and Russell Road on the Guadalcanal Area of MCB Quantico, Virginia (Figure ES-2). The RRL occupies a ridgeline in a slightly hilly area with steep slopes on all sides. The RRL boundaries are roughly delineated by the tree line of the surrounding woods. A locked chain-link fence is present along the southern edge of the RRL, prohibiting unauthorized vehicular access.

The RRL surface has been capped in accordance with RCRA closure standards (see cap boundary Figure ES-2). The landfill cap consists of a geosynthetic clay liner and a high-density polyethylene (HDPE) flexible membrane liner that is in direct contact with the clay liner. Two unnamed streams flank the RRL to the east, west, and northwest (Figure ES-2). Along the western side of RRL, streams converge to form Chopawamsic Creek. The unnamed stream to the east of the RRL discharges to Chopawamsic Creek approximately 1,900 feet south of RRL.

10.2 SITE HISTORY

The RRL was the primary sanitary disposal facility for MCB Quantico and was in operation from 1971 to 1983. Trench and fill operations began at the southern end of the landfill and continued north across the landfill. Trenches were filled with waste material that was compacted and covered daily with a layer of clean soil.

Wastes disposed of at the site included the following:

- Hazardous wastes: oil drums (some with fluids), gas cylinders, partially filled paint cans, drywall sealer, partially filled gasoline cans, auto batteries, engine oils, photographic and other unidentified chemicals, clean-up materials from a November 19, 1978, JP-4 fuel spill and other spills, movie film, and magnetic tape. The following types and quantities of waste are known to have been disposed of at the site:

  - From the paint shop, 27,000 gallons of paint, 16,000 gallons of paint thinner and cleaner, and 1,000 gallons of sludge from paint booths.

- From the air conditioning shop, 7 gallons of sludge from viscosine and 30 gallons of compressor oil.

- From motor transport and maintenance facility, 2,800 lead acid vehicle batteries.

- Inert wastes: Ammunition crates on wooden pallets, gas masks, cleared brush, water heaters, tar, unserviceable steel helmets, liners, cartridge belts, canteens, pouches, boots, ceiling tiles, insulation (yellow fiberglass), drywall bed frames, mattresses, coaxial cables, tires, old meat, steel lockers, toilets, and scrap steel.

Information on the quantity of solid wastes deposited in the landfill is not available. However, calculations included in the Final Closeout Report for the RRL (OHM, 1997) estimated the total maximum waste volume to be 24.4 million cubic feet (ft^3) or 0.9 million cubic yards (yd^3). The volume was estimated assuming 28 acres of fill and a maximum waste depth of 20 feet.

10.3 SITE CLOSURE AND POST-CLOSURE GROUNDWATER MONITORING ACTIVITIES

Several investigations have been conducted at the RRL beginning in 1983. Closure of the RRL under RCRA was completed in 1997 with the construction of a RCRA cap to contain the waste in place, along with the installation of a passive leachate collection system and gas migration systems. The cap consists of a 60-mil HDPE liner and geosynthetic clay liner. Post-closure activities are currently being conducted according to the Hazardous Waste Management Post-Closure Permit (hereafter referred to as the RCRA Permit), first issued by VDEQ on October 29, 2000 and subject to renewal every ten years thereafter. The post-closure activities include landfill gas monitoring, landfill inspections, and groundwater monitoring.

The groundwater monitoring network for RRL post-closure activities consists of 17 monitoring wells (Figure 10-1). One well (MW-10) is located crossgradient of the landfill and serves as the background well for the site (Figure 10-2). Eleven wells (MW-9, MW-11R, MW-12, MW-13, MW-14, MW-15R, MW-16, MW-17, MW-18, MW-19R, and MW-20) are located around the perimeter of the landfill and are used to evaluate groundwater at the RRL as POC wells. Five wells (MW-21S, MW-21D, MW-22S, MW-22D, and MW-24) are located at the southern end of the landfill to serve as compliance monitoring wells (CMWs) to evaluate potential releases downgradient of the RRL. The POC and CMWs monitor both the shallow and deeper portions of the surficial aquifer (approximately 8 to 48 feet below ground surface).

At the time this SAP was prepared, groundwater monitoring has been conducted for sixty quarters since site closure; the sixtieth quarterly event was conducted in December 2010. There have been six CA periods at the site from 2003 to 2010. As part of CA, hydrogen-release compound (HRC®) has been

injected into the groundwater to promote anaerobic reductive dechlorination of chlorinated ethanes detected in excess of groundwater protection standards (GPSs) in the CMWs. The most recent injection was performed in September 2010. The injections occurred in the vicinity of MW-9 (northern CA area) and MW-15R (southern CA area) and were performed in accordance with conditions outlined in the CA Plan (CAP) (Rhea and Baker, 2003, updated 2008).

An updated CAP (Tetra Tech, 2011) was prepared in 2011 as part of the RCRA Permit update. The updated CAP, included as Attachment T of the RCRA Permit, evaluated the current effectiveness of the CA. The CAP recommended that HRC® injections be suspended in the northern CA area to determine the potential for rebound in chemical concentrations. If rebound occurs, then an appropriate CA will be determined at that time. In the southern CA area, it was recommended that HRC® injections be suspended so that a focused investigation could be performed to determine if enhanced reductive dechlorination was still effective in this area (i.e., complete degradation of cis-1,2-DCE) or whether an alternative CA approach was warranted. The focused investigation will involve the collection of groundwater samples and analysis of molecular biological tools (e.g., Dehalococcoides, and VD reductase genes), dissolved gases, VOCs, filtered and unfiltered metals, geochemistry parameters and volatile organic acids (e.g., lactate, acetate, propionate, and butyrate). The investigation will also evaluate whether reducing conditions caused arsenic demobilization in the southern CA area. Once the results of the pre-design investigation are known, a modified remedial approach will be developed for the southern CA area and an addendum to the CAP will be generated. The CAP addendum is scheduled to be submitted to VDEQ in September.

The RRL is currently being monitored under the CA Monitoring Program, as described in Module VI of the RCRA Permit, through the remainder of the compliance monitoring period. The compliance period is equal to 27 years from the date of the final closure of the landfill (September 3, 1998). A permit reissuance for the RRL is scheduled for September 2011.

10.4 CONCEPTUAL SITE MODEL

10.4.1 Geology

Based on previous investigations, the stratigraphy beneath the RRL includes fill material, the Patuxent Formation, and Quantico Slate. The subsurface geology identified on Figure 10-3 were based on cross sections available in the CAP (Rhea and Baker, 2008).

Waste disposal activities consisted primarily of trench and fill operations. Due to the waste disposal technique, the natural stratigraphy beneath the capped portion of the RRL has been assumed to be highly disturbed. The fill material is most likely a mixture of Patuxent soil, refuse, fill cover, and weathered

Quantico Slate (Rhea and Baker, 2008). In addition, several of the disposal trenches penetrated the Patuxent Formation and were excavated into the Quantico Slate. The exact total thickness of each geologic unit is unknown; however, borings advanced during previous investigations suggest a maximum fill material thickness of 15 to 20 feet.

10.4.2 Hydrogeology

Groundwater at the RRL generally ranges from approximately 8 to 48 feet below ground surface. However, artesian conditions have been observed at MW-24, which is located within the U.S. Interstate 95 access ramp south of the site and at a significantly lower elevation. Groundwater elevations observed in December 2010 for the RRL groundwater monitoring network are summarized in Table 10-1.

Groundwater flow at the RRL is largely influenced by surface topography and the two adjacent unnamed streams which act as the zones of discharge for shallow gorundwater. Overall, flow is generally radially outward from the landfill with a general southern direction within the landfill boundaries. To the south, flow is intercepted by the road cut for the U.S. Interstate 95 access ramps. Figure 10-2 presents the groundwater potentiometric surface map generated using groundwater data collected in December 2010.

10.4.3 Hydrology

There are no surface water bodies present on or crossing the capped portion of the RRL. Surface water runoff generated within the RRL capped area is diverted to sediment retention ponds (identified as basins on Figure 10-2) located along the edges of the landfill. Water within these retention ponds is either discharged to the adjacent streams or allowed to infiltrate into the underlying substrate. Two unnamed permanent streams flank the RRL to the east, west, and northwest. Along the western side of RRL, streams converge to form Chopawamsic Creek. The unnamed stream to the east of the RRL discharges to Chopawamsic Creek approximately 1,900 feet south of RRL. Chopawamsic Creek is not used for, nor does it discharge into any water body used as, a drinking water source.

A subsurface leachate collection system was constructed as part of the landfill closure process. This system is designed to capture lateral leachate seepage, but because the system was designed before RCRA became law in 1976, there is no leachate collection system below the landfill. Leachate collected within a drainage trench with a perforated pipe (Figure 10-1), approximately 20 feet below pre-construction grades, is drained by gravity to a leachate collection sump located near the southwestern corner of the site. Based on data supplied by MCB Quantico in 2008, less than 50 gallons of leachate are removed every 90 days, with the quantity varying based on rainfall amounts.

10.4.4 Nature and Extent of Contamination

It has been determined during groundwater compliance monitoring that GPSs at POC wells MW-9 and MW-15R have been exceeded. The contaminants in excess of the GPS at MW-9 are tetrachloroethene and trichloroethene, and the contaminant in excess of the GPS at MW-15R is cis-1,2-dichloroethene. In addition, GPS exceedances of tetrachloroethene, trichloroethene, cis-1,2-dichloroethene, and vinyl chloride were identified in temporary monitoring wells near MW-15R during a field investigation conducted in the summer of 2003. The CA Monitoring Program was implemented to address the exceedances of these chemicals of concern (COCs) and to ensure that the chemicals do not continue to migrate.

During the sixtieth groundwater sampling event conducted in December 2010, two volatile organic compounds (VOCs) and three total metals were detected at concentrations greater than GPSs. At well MW-15R, concentrations of 1,1-dichloroethane [4.9 microgram per liter (µg/L)] and cis-1,2-dichloroethene (240 µg/L) exceeded their GPSs of 1.88 and 70 µg/L, respectively. Total arsenic concentrations at MW15R (574 µg/L) and MW-21S (15.3 µg/L) exceeded the 10 µg/L GPS, and the total cadmium concentration at MW-16 (7.5 µg/L) exceeded the 5 µg/L GPS. Cobalt concentrations in excess of the GPS (4.7 µg/L) ranged from 5.7 µg/L to 71 µg/L at eight of POC wells (MW-9, MW-13, MW-14, MW-15R, MW-16, MW-17, MW-18, and MW-20) and all five CMW (MW-21S, MW-21D, MW-22S, MW-22D, and MW-24). It should be noted that due to the pending renewal of the permit, during the sixtieth quarter a revised GPS for cobalt was utilized in evaluation of compliance monitoring data (revised from 313 µg/L to 4.7 µg/L), and the frequency of cobalt exceedances increased from the previous monitoring period. Historical data indicate that cobalt has been detected at comparable concentrations in previous sampling events; however the historical concentrations did not exceed the old GPS (with the exception of concentrations in MW-15R). Data trend plots for the data are presented in the associated LTM Reports.

The relatively high levels of arsenic in excess of the GPS, particularly at MW-15R, are considered to be attributable to the HRC® treatment. A potential drawback to the anaerobic decomposition of chlorinated hydrocarbons with HRC® is the increased mobility of arsenic. Arsenic is often found at elevated concentrations in groundwater because it is more soluble and adsorbs more weakly to soil under reducing conditions. To reduce the mobility of arsenic, the frequency of HRC® injections has been decreased since 2009.

10.4.5 Land Use and Potential Receptors

A conceptual site model (CSM) that illustrates a plan view of the source area, stratigraphy, hydrogeology, contamination migration pathways, and potential receptors is provided as Figure 10-3. The RRL has been closed and there are no plans for future use. CA measures are currently being developed for the

RRL. The objective of the CA measures will be to prevent contaminated groundwater from migrating beyond the POC wells and CMWs.

Currently the landfill is not used by the base and access to the landfill is restricted by fencing. Future land use is expected to remain the same as the current land use. Potential receptors for the RRL include trespassers and workers/contractors involved with post-closure activities. Due to the security fencing around the landfill, trespassers are unlikely. The surface of the landfill has been capped and, therefore direct contact to impacted soils and waste left in place is not currently a potential exposure pathway for these receptors. Potential future exposures to this material for a trespasser or worker/contractor may occur if the integrity of the landfill cap is breached. In this case, precipitation could infiltrate the landfill and mobilize contaminants in groundwater or eroding soil could escape the landfill and potential direct contact to contaminants in soil or groundwater could occur via ingestion, inhalation or dermal contact with contaminated media.

Shallow groundwater at the base is not currently used or expected to be used in the future for potable purposes. However, based on current site conditions (i.e., represented by the sixtieth round of data) groundwater at the southern end of the landfill facility (MW-15R) is in excess of GPSs despite the corrective action measures that have been implemented, and contaminated groundwater may be exiting the landfill and ultimately discharging to surface water. Therefore, a hypothetical off-site receptor (downgradient of groundwater flow) has been identified for the RRL. Potential exposure to contaminated groundwater could occur if the off-site groundwater were used for potable purposes or if VOC concentrations in the off-site groundwater were high enough to warrant vapor intrusion concerns. Potential exposure pathways for surface water have also been identified for the offsite receptor and may include incidential injestion and dermal contact.

SAP WORKSHEET NO. 11 -- PROJECT QUALITY OBJECTIVES/SYSTEMATIC PLANNING PROCESS STATEMENTS

(UFP-QAPP Manual Section 2.6.1)

11.1 PROBLEM STATEMENT

The RRL served as the primary sanitary waste disposal facility for MCB Quantico from 1971 to June 1983. To contain the waste within the landfill boundary and to close the landfill, it was capped in accordance with RCRA closure standards in September 1996. MCB Quantico must monitor groundwater until at least the year 2025 (as required by the RCRA permit) to ensure that contaminant concentrations from the landfill decrease to less than GPS values prior to 2025 or within a reasonable time frame thereafter so NAVFAC Washington, MCB Quantico and VDEQ can implement additional corrective actions, if necessary, according to the protocols outlined within the RCRA Permit.

In parallel to this CA groundwater monitoring, the effectiveness of the CA is being reevaluated. A revised CA may involve injection of treatment chemicals into the groundwater in an effort to accelerate the degradation of chlorinated organic compounds. It is necessary to collect data regarding geochemical conditions in the surficial aquifer as part of this CA groundwater monitoring investigation but the data use for geochemical parameters will be determined once the modified CA approach has been developed. Some adjustments to this CA groundwater rmonitoring SAP may be necessary depending on the requirements of the final CAP. The format in which the adjustments are documented will be decided by NAVFAC Washington and MCB Quantico with ultimate approval from VDEQ.

11.2 IDENTIFY THE INPUTS NECESSARY TO RESOLVE THE PROBLEM

To achieve the monitoring goals identified in Section 11.1, the following information is needed:

1. Groundwater Well Stabilization Parameters – Specific conductance, pH, temperature, dissolved oxygen (DO), oxidation-reduction potential (ORP), and turbidity for use in determining when groundwater is representative of aquifer conditions and appropriate for sampling.

2. Groundwater Level Measurements – Synoptic groundwater levels measured to a precision of 0.01 foot within a 12-hour period in all wells being monitored to ensure that the measurements are representative of the same conditions. Groundwater level measurements should be timed to prevent rainfall events from influencing groundwater levels.

3. Groundwater Flow Rates – These must be calculated annually or more frequently using the measured water levels and hydraulic conditions presented in previous Annual Groundwater Monitoring reports.

4. Chemical Groundwater Data – Groundwater from select wells must be monitored according to the schedule outlined in the RCRA Permit Module VI and analyzed for the list of analytes presented in Attachments K (chemicals whose concentrations have previously exceeded GPSs) and L (RCRA Appendix IX analytes) of the RCRA permit. The sampling schedule is presented in Worksheet No. 17 and the analytes are presented in Worksheet No. 15. Simple comparison of measured contaminant concentrations in site wells to GPSs and background concentrations will be made.

5. Monitored Natural Attenuation (MNA) Parameters – Alkalinity, anions (chloride, nitrate, nitrite, and sulfate), dissolved gasses (ethane, ethene, methane, and carbon dioxide), total and dissolved iron and manganese, sulfide, metabolic acids (lactic acid, pyruvic acid, acetic acid, propionic acid, and butyric acid), and total organic carbon (TOC) must be measured to determine the effectiveness of the enhanced natural attenuation.

6. Land Survey – A land survey must be conducted by a professional land surveyor to obtain horizontal locations, ground surface elevations, and top-of-riser elevations for any new or replacement monitoring wells and to established benchmarks on an annual basis. Horizontal locations will be documented in Virginia State Plane, North American Datum of 1983 (NAD 83), North zone. The National Geodetic Survey Mean Sea Level will be used to record elevation data.

7. Background Groundwater Concentrations – A comparison of the groundwater monitoring data to the background concentrations must be performed annually, as prescribed in Attachment O of the RCRA permit and presented in the Annual Groundwater Monitoring Report. Background concentrations are the 95 percent upper tolerance limit (UTL) with 95 percent coverage of the data distribution if the data are normally distributed; otherwise the maximum detected value will be used as a substitute for the background concentration UTL. Methodology for computing the UTLs is presented in the RCRA Permit Section O. The UTLs must be updated annually.

8. Project Action Levels (PALs) – The PALs for this project are the GPSs, which are the greatest of the following concentrations: RRL background concentrations, USEPAs Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs), VDEQ Alternate Concentration Limits (ACLs), and USEPA Regional Screening Levels (RSLs) for tap water. The GPSs are presented in Worksheet No.15. By using the greatest of the background values and applicable criteria for decision making in

the decision flow charts, the requirement to conduct background comparisons annually (Item 7, above) is automatically addressed.

To conduct comparisons of site data to PALs for groundwater, the selected laboratory should be able to achieve limits of quantitation (LOQs) that are low enough to measure the analytes at concentrations less than the applicable PALs, which are identified in Worksheet No. 15. In some cases, this may not be achievable. These exceptions should be evaluated as described in Worksheet No. 37 and uncertainties documented in the Annual Monitoring Report.

11.3 STUDY AREA BOUNDARIES

Contaminated groundwater at the site is present in the shallow hydrogeologic unit. Within this hydrogeologic unit, the primary population of interest is groundwater (approximately 8 to 48 feet below ground surface) that is impacted by any contaminants that may leach and migrate from the landfill. Groundwater unaffected by the landfill must also be investigated to provide an appropriate data set for use in conducting comparisons of unimpacted groundwater and downgradient groundwater concentrations. The current monitoring well network consisting of POC wells, CMWs, and a sidegradient well (used as the point of comparison to POC well and CMW data), is presented on Figure 10-1.

Target analytes shown on Worksheet No. 15 include two groups (Attachment L list and Attachment K List). Groundwater monitoring must occur on a semi-annual basis per calendar year for the two analyte lists as presented in Worksheet No. 17. This monitoring must be conducted when groundwater represents normal groundwater conditions (i.e., it is unaffected by transient changes in groundwater quality caused, for example, by subsurface chemical injections). Currently, the compliance period for monitoring extends to the year 2025, which is 27 years from the date of final closure of the landfill (September 3, 1998). Monitoring beyond 2025 is required if contaminants concentration continue to exceed GPSs at that time.

11.4 ANALYTIC APPROACH

NAVFAC Washington and MCB Quantico with ultimate approval from VDEQ expect to optimize the monitoring strategy to make the most cost-effective use of resources while also being protective of human health and the environment and adhering to regulatory requirements. Optimization involves changing the monitoring well network, analyte lists, monitoring frequencies, and similar variables to obtain the greatest amount of information for the least consumption of resources.

Decision rules associated with CA optimization and use of MNA data identified in Section 11.2 are currently being developed and will be presented in a CAP addendum once the modified CA approach has

been developed. Decision rules for complying with the CA groundwater monitoring requirements of the RCRA Permit are illustrated in flow charts presented in Figures 11-1 and 11-2.

Figure 11-1 presents the decision rules for the select POC wells where the Attachment L list is required to be analyzed annually by the RCRA Permit (See Worksheet No. 17). The select POC wells for which these decision rules apply include MW-9, MW-13, MW-14, MW-15R, MW-16, MW-17 and MW-19R. Figure 11-2 presents the decision rules for all wells where the Attachment K List is required to be analyzed semi-annually by the RCRA Permit (See Worksheet No. 17). At any time in the process, NAVFAC Washington and MCB Quantico may make a demonstration to the VDEQ that a GPS exceedance is due to errors in sampling, analysis, and evaluation; natural variation in the groundwater; or a source other than the landfill. Allowance for this demonstration was omitted purposefully on Figures 11-1 or 11-2. If this demonstration is to be made, then the procedures and timeframes identified in Module VI, Section VI.J. of the RCRA Permit must be followed to make adjustments to the monitoring program in response to the observed conditions.

11.5 PERFORMANCE AND ACCEPTANCE CRITERIA

Individual measured concentrations in each monitoring well will be compared to GPSs for decision making. Data quality will be evaluated as part of the verification/validation and data usability processes described in Worksheet Nos. 34 through 37. Failure to meet validation targets or limitations on data use identified during data usability assessment will be described in the Annual Groundwater Monitoring Report.

Failure to collect a small number of data points is expected to have little negative impact on the project. However, NAVFAC Washington and MCB Quantico with VDEQ approval will evaluate all data gaps, including gaps related to analytical sensitivity to ensure that attainment of project objectives is not compromised for any round of data collection. This includes situations in which LOQs or levels of detection (LODs) are insufficiently low to measure target analyte concentrations near the GPS levels.

Data collected during groundwater monitoring activities will be compiled and used to evaluate and document whether the monitoring objectives are being met. A summary of the data compilation methods (i.e., reporting requirements) for each type of data measurement is provided in Section 14.15.

11.6 DEVELOP THE PLAN FOR COLLECTING THE DATA

Details of the groundwater sampling design, rationale, and locations are provided in Worksheet Nos. 17 and 18. These details include which groundwater monitoring wells are to be sampled, the analyses to be conducted on each sample, and the reasons for sampling and analysis of samples from each well.

SAP WORKSHEET NO. 12 -- MEASUREMENT PERFORMANCE CRITERIA TABLE – FIELD QC SAMPLES

(UFP-QAPP Manual Section 2.6.2)

QC Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria (MPCs)	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
Trip Blank	VOCs	One per cooler of VOC samples shipped to laboratory.	Accuracy/Bias/ Contamination	No analytes ≥ ½ LOQ, except common lab contaminants, which must be < LOQ.	S & A
Rinsate Blank	All analytical groups	One per 20 field samples per matrix per sampling equipment, or one per sampling event, whichever is greater.	Accuracy/Bias/ Contamination	No analytes ≥ ½ LOQ, except common lab contaminants, which must be < LOQ.	S & A
Field Duplicate	All analytical groups	One per 10 field samples per matrix.	Precision	Values > 5X LOQ: Relative Percent Difference (RPD) ≤30% [1](aqueous).	S & A
Cooler Temperature Indicator Blank	All analytical groups	One per cooler.	Representativeness	Temperature must be less than or equal to 6 degrees Celsius (≤6 °C).	S

1 – If one or both duplicate values for non-metals are less than five times the LOQ, the absolute difference should be less than two times the LOQ.

SAP WORKSHEET NO. 13 -- SECONDARY DATA CRITERIA AND LIMITATIONS TABLE

(UFP-QAPP Manual Section 2.7)

Secondary Data	Data Source (originating organization, report title and date)	Data Generator(s) (originating organization, data types, data generation/collection dates)	How Data Will Be Used	Limitations on Data Use
Groundwater Monitoring Results for Post-Closure Rounds 1 to 60	Various reports, including quarterly monitoring reports and annual monitoring reports.	Originating Organization: Various contractors Data Types: Groundwater Data Collection Dates: 1997 to 2010	Groundwater data for MW-10 will be used to calculate updated background concentrations for RRL.	Data from earlier rounds have higher DLs than recent rounds due to technology advancements.

SAP WORKSHEET NO. 14 -- SUMMARY OF PROJECT TASKS

(UFP-QAPP Manual Section 2.8.1)

This section describes the project tasks that will be conducted during field activities as part of the CA Program at the RRL at MCB Quantico. The project tasks will include the following:

- Field tasks
- Analytical tasks
- Data management
- Assessment and oversight
- Data review
- Project reports

The procedures described herein will be followed while performing the following field tasks:

- Mobilization and demobilization
- Site-specific health and safety training
- Monitoring equipment calibration
- Groundwater sampling
- Water level measurements
- IDW management
- Field decontamination procedures
- Sample handling and custody
- Field documentation

Note: Field documentation forms are included in Appendix A. All data recording and management procedures are described in Worksheet No. 29. The laboratory chosen to conduct analyses for this project must be DoD ELAP accredited to perform the analyses. Prior to initiating field work, the Project Chemist (or Navy Chemist) will verify proper accreditation of the laboratory and will ensure that the laboratory is able to meet the specifications of this SAP.

14.1 MOBILIZATION/DEMOBILIZATION

Field team members will review this SAP and the associated project-specific HASP, which will be prepared by the CA Monitoring Contractor completing the sampling. Mobilization includes attendance at a site-specific health and safety kick-off meeting during the initiation of on-site activities. This meeting will also include field team orientation to familiarize personnel with the scope of field activities.

The FOL will coordinate the mobilization activities, which will include responsibilities such as initiating and conducting equipment inventories to ensure that equipment is available, purchasing equipment as required, staging equipment for efficient loading and transport from the contractor's office to the site, and demobilizing the equipment after field activities are completed.

Demobilization will include transporting personnel, field equipment, and supplies from the site, performing general site cleanup, and organizing and finalizing field paperwork.

14.2 SITE-SPECIFIC HEALTH AND SAFETY TRAINING

Site-specific health and safety training of all field staff will be provided as part of site mobilization. Daily tailgate sessions will be held each morning to review specific aspects of the HASP and to review safe work permits. Additional health and safety requirements are addressed in Worksheet No. 8.

14.3 MONITORING EQUIPMENT CALIBRATION

These procedures are described in Worksheet No. 22.

14.4 GROUNDWATER SAMPLING

A total of 17 monitoring wells will be sampled as part of the CA Monitoring Program at the RRL. If HRC® injection activities are scheduled, groundwater samples for the semi-annual event will be collected prior to performing injection activities (as per Module VI, Section VIB.4.e of the RCRA Permit). Groundwater purging and sampling will be accomplished using low-flow sampling techniques in accordance with USEPA Region 3 Low-Flow Purging and Sampling of Groundwater Monitoring Wells (USEPA, 2008) [Standard Operating Procedure (SOP)-01, contained in Appendix B] and the American Society for Testing and Materials (ASTM) Standard D6771-02 titled Low-Flow Purging and Sampling for Wells and Devices Used for Groundwater Quality Investigations (SOP-02). Low-flow purging and sampling will be implemented because this method provides the least disturbance to the surrounding geologic formation (i.e., less turbidity in sample matrix and hence less sedimentation) and allows for the collection of a sample that is more representative of the dissolved groundwater matrix.

Wells will be purged prior to sampling using dedicated pumps and tubing. The dedicated pumps used at the RRL are QED™ Environmental Systems bladder pumps with Teflon® bladders and dedicated Teflon®-lined polyethylene tubing.

Prior to initiation of purging, the static water level and total depth of each monitoring well will be measured to the nearest 0.01 foot from the marked location on the top of the well riser pipe using an electronic water level indicator. All measurements for each well will be recorded on the groundwater sampling log sheet for that monitoring well. An example groundwater sample log sheet is contained in Appendix A.

Initially, the pumping rate will be set at approximately 0.3 liter per minute. The pumping rate will be reduced if turbidity is greater than 10 nephelometric turbidity units (NTUs) after the other field parameters have stabilized, as described below.

Water levels will be monitored every 5 to 10 minutes as purging occurs. The pumping rate will be adjusted to prevent drawdown from exceeding 0.3 foot during purging. If groundwater is drawn down below the pump intake, purging will cease and the well will be allowed to recover before purging continues. Slow recovering wells will be identified and purged at the beginning of the workday. If possible, samples will be collected from these wells within the same 8-hour work day.

During purging, water quality parameters (pH, turbidity, specific conductance, temperature, ORP, and DO) will be measured and recorded every 5 to 10 minutes using a multi-parameter analyzer in a flow-through cell (Horiba U-52 or similar equipment). Purge data will be recorded on a groundwater sample logsheet.

Well purging will continue until the parameters have stabilized and the minimum purge volume (stabilized well volume plus the extraction tubing volume) has been removed. Stabilization of parameters is defined as follows:

- Temperature +/- 0.5°C
- pH +/- 0.1 Standard Units
- Turbidity < 10 NTUs
- Specific conductance +/- 3 percent
- DO +/- 10 percent
- ORP +/- 10 milliVolts

If the parameters have not stabilized within three hours or after three well volumes have been purged, this information will be recorded and sampling will begin. Sampling data will be recorded on groundwater sample logsheets.

Following purging, samples will be collected in laboratory-supplied pre-preserved bottles. The samples will be labeled and handled as described in Section 14.8. The samples will be analyzed for the parameters identified in Worksheet No. 15 and MNA parameters identified in Worksheet No. 11.

Purge water will be containerized and disposed of as described in Section 14.6.

14.5 WATER LEVEL MEASUREMENTS

One synoptic round of water level measurements will be conducted at the site as part of each groundwater sampling event to provide information regarding groundwater flow patterns and gradients. Water level measurements will be completed within the shortest time possible on the same day, and no sooner than 24 hours after a significant precipitation event to minimize the precipitation effects on the data sets. Groundwater level measurements will be obtained from monitoring wells prior to purging and sampling and will be recorded to the nearest 0.01 foot. The measurement instrument will be decontaminated prior to conducting the event and between each monitoring well. The probe will be lowered slowly until the instrument alarm and light response indicate that the water surface has been encountered. The measurement will be taken from the surveyed point on the well's protective enclosure and will be checked by slowly raising and lowering the tape and watching the instrument response. The measurement will be recorded on a sample logsheet or in the field logbook.

14.6 INVESTIGATION-DERIVED WASTE MANAGEMENT

The groundwater monitoring program may generate three types of potentially contaminated residues: personal protective equipment (PPE), purge water, and sampling equipment decontamination fluids. Based on the activities and types of contaminants present, none of the residues are expected to represent a significant risk to human health or the environment if properly managed. Planned management of each residue is described in this section. Waste disposal operations will be coordinated through the appropriate MCB Quantico personnel.

PPE – PPE includes surgical gloves, Tyvek, etc. PPE will be double bagged and placed in MCB Quantico trash receptacles (dumpsters).

Purge Water – During low-flow purging and sampling activities, purge water will be collected from monitoring wells into 5-gallon covered buckets. Purge water historically has been characterized as a non-hazardous aqueous waste. The purge water will be transferred via buckets to the RRL collection sump. Liquid levels in the sump are monitored via an internal alarm system connected remotely to NREA office phones. When the liquid level in the sump reaches the "low-level" alarm, NREA is notified and a contractor is scheduled to empty the sump within two days. The CA Monitoring Contractor will coordinate

with the base prior to scheduling the sampling event to ensure that the leachate levels in the sump are not approaching alarm levels and that the sump has been emptied by designated base personnel prior to groundwater sampling activities. Sump contents, including any IDW (purge water) are transported off site for disposal at a certified facility.

Sampling Equipment Decontamination Fluids – Equipment decontamination fluids will be containerized and handled in the same manner as purge water.

14.7 FIELD DECONTAMINATION PROCEDURE

All non-disposable field equipment will be decontaminated before each use to avoid cross-contamination between samples and to ensure the health and safety of the field crew. Any tap water necessary for decontamination activities will be drawn from the potable municipal water supply at MCB Quantico. Field decontamination procedures include rinsing field analytical equipment (e.g., multi-parameter analyzer) and water level measuring equipment with analyte-free water.

14.8 SAMPLE HANDLING AND CUSTODY

This section presents sample handling and custody procedures. These procedures will ensure proper handling, custody, and documentation of the samples from field collection through laboratory analysis.

14.8.1 Sample Containers, Preservation, and Holding Times

Requirements for sample containers, preservation, and holding times are listed in Worksheet No. 19. New precleaned sample containers will be used for water sample collection. Once collected, each containerized sample will be labeled and placed into a sample cooler. The sample cooler will serve as the shipping container and will be packed with wet ice to cool samples to the appropriate temperature for preservation.

14.8.2 Sample Numbering

Sample nomenclature for CA Monitoring Program will be selected based on nomenclature used during historical sampling activities. The sample identification number for each sample includes the well designation and round number (i.e., a sample from MW-9 collected during the sixtieth quarterly round on December 9, 2010, was designated as RRL-MW009-00-60). Duplicate samples will be submitted to the laboratory as blind duplicates. The QA/QC type codes used for this field event will include TB for trip blanks and FB for field blanks. Field QC samples will be labeled sequentially followed by the round number (i.e., the first trip blank collected during the sixty-first quarterly round would be designated TB-01-61, and the second field blank collected that day would be designated FB-02-61). Samples to be

used for matrix spikes (MSs) and matrix spike duplicates (MSDs) will be labeled with "MS/MSD" on the container label and noted on the chain-of-custody form, as required in the Laboratory QA Plan; however, "MS/MSD" will not be part of the unique sample identifier to maintain consistency with the project database.

14.8.3 Sample Labeling

Each sample collected will have a sample label affixed to the outside of the container in an obvious location. All information will be recorded on the label with water-resistant ink. The exact sample label information will include the sample identification number, date and time of sample, sampler's name or initials, preservation used, analytical methods, and site name.

14.8.4 Sample Custody

All samples collected will be logged onto a chain-of-custody form in the field prior to shipment or pickup by the laboratory. An example chain-of-custody form is contained in Appendix A. The chain-of-custody form will be signed by the individual responsible for custody of the sample containers, and the original will accompany the samples to the laboratory. One copy of the chain-of-custody form will be kept by CA Monitoring Contractor PM and included in the project files.

14.8.5 Sample Packing and Shipment

Immediately after sample collection, sample labels will be affixed to each sample container. Groundwater samples will be placed in a sample ice chest or cooler lined with a heavy duty trash bag. Sample containers will be placed in Ziplock-type freezer bags or equivalent and placed in the cooler. The samples will be packed with shock-absorbent materials, such as bubble wrap, to prevent movement or breakage of the sample jars during transport. The cooler will be filled with loose ice to allow for distribution throughout the cooler to meet the appropriate temperature requirements. A temperature blank will accompany each cooler. Sample cooler drain spouts (if present) will be taped from the inside and outside of the cooler to prevent any leakage.

The chain-of-custody form will be placed in a resealable bag and taped to the lid inside of the cooler. The cooler will be banded with packaging tape, and custody seals will be placed along the ice chest lid to prevent or indicate tampering. The cooler containing the environmental samples will either be picked up by laboratory courier, or arrangements will be made to have the cooler delivered to the laboratory by an overnight delivery service such as FedEx. International Air Transportation Association (IATA) regulations will be adhered to when shipping samples by air courier services. If an overnight delivery service is used,

the package must be scheduled for priority overnight service to ensure that the temperature preservative requirement is not exceeded. Saturday deliveries will be coordinated with the laboratory.

14.9 FIELD QUALITY CONTROL

During each sampling event, QA/QC samples will be collected to aid in the data validation process (see Worksheet No. 20 for a summary of field QA/QC sampling identifications). The types of QA/QC samples and collection frequencies are described in Worksheet No. 12.

14.10 FIELD DOCUMENTATION

Entries on sampling activity log sheets, sample identification tags, and chain-of-custody forms will be made using water-resistant ink. None of these accountable serialized documents are to be destroyed or thrown away, even if they are illegible or contain inaccuracies that require replacement documents. If an error is made on an accountable document assigned to an individual, the individual will make corrections by crossing a single line through the error, entering the correct information, and initialing the change. The erroneous information will not be obliterated. All subsequent corrections must be initialed and dated.

At a minimum, the following information will be recorded in the site logbook:

- Name of the person to whom the logbook is assigned.
- Project name.
- Project start date.
- Names and responsibilities of on-site project personnel, including subcontractor personnel.
- Arrival/departure of site visitors.
- Arrival/departure of equipment.
- Sampling activities and sample log sheet references.
- Activities performed each day.
- Sample pick-up information, chain-of-custody numbers, air bill numbers, carrier, time, and date.
- Health and safety issues.
- Descriptions of photographs including date, time, photographer, roll and picture number, location, and compass direction of photograph.

All logbook entries will be written in ink, and no erasures will be made. If an incorrect entry is made, striking a single line through the incorrect information will make the correction, and the person making the correction will initial and date the change.

14.11 ANALYTICAL TASKS

Chemical analysis will be performed by the Subcontracted Laboratory selected by the CA Monitoring Contractor. Analyses will be performed in accordance with the analytical methods identified in Worksheet No. 30, and the laboratory will meet the LOQs specified in Worksheet No. 15. The laboratory will perform the chemical analyses in accordance with laboratory-specific SOPs that will be provided by the contracted laboratory (Worksheet No. 19 and No. 23) and will be based on the methods listed in Worksheet No. 19 and No. 30. Copies of the laboratory SOPs will be provided by the CA Monitoring Contractor to NAVFAC Washington and MCB Quantico with ultimate approval from VDEQ.

The laboratory performing these analyses must be DOD ELAP accredited for all analytical methods and analytes. Additionally beginning in 2012, the State of Virginia will require Virginia Environmental Laboratory Accreditation Program (VELAP) accreditation which will also be required for all analytical methods and analytes.

The analytical data packages provided by the subcontracted laboratory will be in a contract laboratory program-like format and will be fully validatable and contain raw data, summary forms for all sample and laboratory method blank data, and summary forms containing all method specific quality control (results, recoveries, relative percent differences, relative standard deviations, and/or percent differences etc.).

14.12 DATA MANAGEMENT

Project documentation and records include:

- Sample collection and field measurement records as described in Worksheet No. 27 and No. 29.
- Laboratory data package deliverables as described in the analytical specifications.
- Data assessment documents and records as listed in Worksheet No. 29.

Data recording formats are described in Worksheet No. 27.

Data Handling and Management - After each round of sampling is completed, the field sampling log-sheets will be organized by date and medium and filed in the project files. The field logbooks for this project will be used only for this site and will also be categorized and maintained in the project files after completion of the field program. Project personnel completing concurrent field sampling activities may maintain multiple field logbooks. When possible, logbooks will be segregated by sampling activity. The field logbooks will be titled based on date and activity. The data handling procedures to be followed by the subcontracted laboratory will meet the requirements of the analytical technical specification. The

electronic data results will be automatically downloaded into the CA Monitoring Contractor's database in accordance with the CA Monitoring Contractor's standard procedures.

Data Tracking and Control - The CA Monitoring Contractor PM (or designee) is responsible for the overall tracking and control of data generated for the project, which includes the following:

- **Data Tracking**. Data are tracked from their generation to archiving in the CA Monitoring Contractor project-specific files. The CA Monitoring Contractor Project Chemist (or designee) is responsible for tracking the samples collected and shipped to the Subcontracted Laboratory. Upon receipt of the data packages from the analytical laboratory, the CA Monitoring Contractor Data Validator will review the data packages as described in Worksheet No. 34 and No. 35 to verify that the data packages are complete and that results for all samples have been present. The CA Monitoring Contractor Data Validator will also oversee the limited data validation effort as described in Worksheet No. 36.

- **Data Storage, Archiving, and Retrieval**. The data packages received from the Subcontracted Laboratory will be tracked by the CA Monitoring Contractor in accordance with their data storage, archiving, and retrieval system. The field records including field logbooks, sample log sheets, chain-of-custody records, and field calibration logs will be submitted by the CA Monitoring Contractor FOL to be entered into the project files prior to archiving in secure project files. The project files are audited for accuracy and completeness. All generated project data will be submitted to the Navy via Naval Installation Restoration Information Solution (NIRIS). The contractor will submit all analytical data collected in the specified NIRIS Electronic Data Deliverable (NEDD) format. The contractor will coordinate with and submit all spatial data to the NAVFAC Mid-Atlantic NIRIS Regional Database Manager (RDM). All spatial data will be provided with meta data, using the appropriate coordinate system [e.g., State Plane Coordinate System North American Datum, (NAD) 83 (feet)] for that installation. The contractor will submit all Administrative Record files, site files, and post-decision files in accordance with the specifications defined in the NAVFAC Environmental Restoration Program Recordkeeping Manual. Once documents have been prepared, the contractor will submit them to the NAVFAC Mid-Atlantic records manager for inclusion into NIRIS. In addition, the retention requirements of storing data for the duration of the compliance period as identified Module I, Section 1.H.9, must be met.

- **Data Security**. The CA Monitoring Contractor's project files are restricted to designated personnel only. Records can only be borrowed temporarily from the project file using a sign-out system. The CA Monitoring Contractor DM maintains the electronic data files. Access to the data files is restricted to qualified personnel only. File and data backup procedures are routinely performed.

14.13 ASSESSMENT AND OVERSIGHT

Refer to Worksheet No. 32 for assessment findings and CAs and to Worksheet No. 33 for QA management reports.

14.14 DATA REVIEW

Data verification is described in Worksheet No. 34, data validation is described in Worksheet No. 35 and No. 36, and usability assessment is described in Worksheet No. 37.

14.15 CORRECTIVE ACTION GROUNDWATER MONITORING REPORTS

Semi-Annual Groundwater Monitoring Reports will be prepared after each sampling round. In accordance with the RCRA Permit, semi-annual reports will be submitted no later than March 1 and September 1 of each calendar year. The report that is due no later than March 1 of each year will serve as the annual report.

The reports will include appropriate sections concerning site background, investigation activities, physical characteristics, nature and extent of contamination, and conclusions and recommendations (annual report only). Each CA Groundwater Monitoring Report will be issued in draft to NAVFAC and MCB Quantico for initial review. NAVFAC and MCB Quantico comments will be addressed, and the draft final report will be issued for VDEQ review. At a minimum, the reports will contain the following information:

- Analytical results
- Static groundwater elevation tables
- Potentiometric surface maps
- Contaminant distribution maps
- Statistical evaluation (included in annual report only)
- Remediation systems operation and maintenance review (included in annual report only)
- Conclusions and Recommendations

The detailed reporting requirements for each report are listed in Module VI, Section VI.K of the RCRA Permit.

SAP WORKSHEET NO. 15 -- REFERENCE LIMITS AND EVALUATION TABLE

(UFP-QAPP Manual Section 2.8.1)

15.1 Target Analyte List - Attachment K List

Matrix: Groundwater
Analytical: VOCs (Attachment K List)

Analyte	CAS Number	PAL (µg/L)	PAL Reference[1]	Project Quantitation Limit Goal[2] (µg/L)	Laboratory (TBD)		
					LOQ (µg/L)	Limit of Detection (LOD) (µg/L)	DL (µg/L)
1,1-Dichloroethane	75-34-3	2.6	Background	0.87	TBD	TBD	TBD
1,1-Dichloroethene	75-35-4	340	RSL	110	TBD	TBD	TBD
Acetone	67-64-1	22,000	RSL	7,300	TBD	TBD	TBD
Benzene	71-43-2	5	MCL	1.7	TBD	TBD	TBD
Chloromethane	74-87-3	190	RSL	63	TBD	TBD	TBD
cis-1,2-Dichloroethene	156-59-2	73	RSL	24	TBD	TBD	TBD
Methylene chloride	75-09-2	5	MCL	1.7	TBD	TBD	TBD
Naphthalene	91-20-3	0.14	ACL	0.047	TBD	TBD	TBD
Tetrachloroethene	127-18-4	5	MCL	1.7	TBD	TBD	TBD
Toluene	108-88-3	2,300	RSL	770	TBD	TBD	TBD
trans-1,2-Dichloroethene	156-60-5	110	RSL	37	TBD	TBD	TBD
Trichloroethene	79-01-6	5	MCL	1.7	TBD	TBD	TBD
Vinyl chloride	75-01-4	2	MCL	0.67	TBD	TBD	TBD

1 PAL references: The PALs were selected using the hierarchy to select GPSs as defined in Module VI, Section VI.I.4 of the RCRA Permit. Based on this hierarchy, the PAL selected is the higher of the site background concentration, MCL, ACL, or RSL. If there is no value available from the PAL sources, the laboratory LOQ will serve as the PAL. Any published changes to the PAL sources will be immediately adopted. Refer to Appendix C for backup documentation.

Background – Site-specific established background concentration as identified in Attachment O of the RCRA Permit; MCL – USEPA Drinking Water Standards and Health Advisories, MCLs (USEPA, 2011); ACL – VDEQ risk-based ACLs (VDEQ, 2011); RSL – Regions 3, 6, and 9 Regional Screening Level Tapwater (USEPA, 2010).

2 Project Quantitation Limit Goal (PQLG) is equal to 1/3 of the PAL.

Matrix: Groundwater
Analytical: Semivolatile Organic Compounds (SVOCs) (Attachment K List)

Analyte	CAS Number	PAL (µg/L)	PAL Reference[1]	Project Quantitation Limit Goal[2] (µg/L)	Laboratory (TBD)		
					LOQ (µg/L)	LOD (µg/L)	DL (µg/L)
4-Methylphenol	106-44-5	180	RSL	60	TBD	TBD	TBD
bis(2-Ethylhexyl) phthalate	117-81-7	17	Background	5.7	TBD	TBD	TBD

1 PAL references: The PALs were selected using the hierarchy to select GPSs as defined in Module VI, Section VI.I.4 of the RCRA Permit. Based on this hierarchy, the PAL selected is the higher of the site background concentration, MCL, ACL, or RSL. If there is no value available from the PAL sources, the laboratory LOQ will serve as the PAL. Any published changes to the PAL sources will be immediately adopted. Refer to Appendix C for backup documentation.

Background – Site-specific established background concentration as identified in Attachment O of the RCRA Permit; MCL – USEPA Drinking Water Standards and Health Advisories, MCLs (USEPA, 2011); ACL – VDEQ risk-based ACLs (VDEQ, 2011); RSL – Regions 3, 6, and 9 Regional Screening Level Tapwater (USEPA, 2010).

2 PQLG is equal to 1/3 of the PAL.

Matrix: Groundwater
Analytical: Inorganics (Attachment K List)

Analyte	CAS Number	PAL (µg/L)	PAL Reference[1]	Project Quantitation Limit Goal[2] (µg/L)	Laboratory (TBD)		
					LOQ (µg/L)	LOD (µg/L)	DL (µg/L)
Arsenic	7440-38-2	10	MCL	3.3	TBD	TBD	TBD
Barium	7440-39-3	7,300	RSL	2,400	TBD	TBD	TBD
Beryllium	7440-41-7	73	RSL	24	TBD	TBD	TBD
Cadmium	7440-43-9	18	RSL	6.0	TBD	TBD	TBD
Chromium (total)	7440-47-3	100	MCL	33	TBD	TBD	TBD
Cobalt	7440-48-4	11	Background	3.7	TBD	TBD	TBD
Lead	7439-92-1	15	MCL	5.0	TBD	TBD	TBD

Analyte	CAS Number	PAL (µg/L)	PAL Reference[1]	Project Quantitation Limit Goal[2] (µg/L)	Laboratory (TBD)		
					LOQ (µg/L)	LOD (µg/L)	DL (µg/L)
Mercury	7439-97-6	2	MCL	0.67	TBD	TBD	TBD
Nickel	7440-02-0	730	RSL	240	TBD	TBD	TBD
Vanadium	7440-62-2	180	RSL	60	TBD	TBD	TBD

1 PAL references: The PALs were selected using the hierarchy to select GPSs as defined in Module VI, Section VI.I.4 of the RCRA Permit. Based on this hierarchy, the PAL selected is the higher of the site background concentration, MCL, ACL, or RSL. If there is no value available from the PAL sources, the laboratory LOQ will serve as the PAL. Any published changes to the PAL sources will be immediately adopted. Refer to Appendix C for backup documentation.

Background – Site-specific established background concentration as identified in Attachment O of the RCRA Permit; MCL – USEPA Drinking Water Standards and Health Advisories, MCLs (USEPA, 2011); ACL – VDEQ risk-based ACLs (VDEQ, 2011); RSL – Regions 3, 6, and 9 Regional Screening Level Tapwater (USEPA, 2010).

2 PQLG is equal to 1/3 of the PAL.

15.2 Appendix IX List - Attachment L List

Matrix: Groundwater
Analytical: VOCs (Attachment L List)

Analyte	CAS Number	PAL (µg/L)	PAL Reference[1]	Project Quantitation Limit Goal[2] (µg/L)	Laboratory (TBD)		
					LOQ (µg/L)	LOD (µg/L)	DL (µg/L)
1,1,1,2-Tetrachloroethane	630-20-6	0.52	ACL	0.17	TBD	TBD	TBD
1,1,1-Trichloroethane	71-55-6	9,100	RSL	3,000	TBD	TBD	TBD
1,1,2,2-Tetrachloroethane	79-34-5	0.067	ACL	0.022	TBD	TBD	TBD
1,1,2-Trichloroethane	79-00-5	5	MCL	1.7	TBD	TBD	TBD
1,1-Dichloroethane	75-34-3	2.6	Background	0.87	TBD	TBD	TBD
1,1-Dichloroethene	75-35-4	340	RSL	110	TBD	TBD	TBD
1,2,3-Trichloropropane	96-18-4	0.00072	ACL	0.00024	TBD	TBD	TBD
1,2,4-Trichlorobenzene	120-82-1	70	MCL	23	TBD	TBD	TBD
1,2-Dibromo-3-chloropropane (DBCP) (Method 8011)*	96-12-8	0.2	MCL	0.067	TBD	TBD	TBD
1,2-Dibromoethane (EDB) (Method 8011)*	106-93-4	0.05	MCL	0.017	TBD	TBD	TBD
1,2-Dichlorobenzene	95-50-1	600	MCL	200	TBD	TBD	TBD
1,2-Dichloroethane	107-06-2	5	MCL	1.7	TBD	TBD	TBD
1,2-Dichloropropane	78-87-5	5	MCL	1.7	TBD	TBD	TBD
1,3-Dichlorobenzene	541-73-1	TBD	LOQ	TBD	TBD	TBD	TBD
1,4-Dichlorobenzene	106-46-7	75	MCL	25	TBD	TBD	TBD
1,4-Dioxane	123-91-1	7.4	Background	2.5	TBD	TBD	TBD
2-Butanone (Methyl ethyl ketone)	78-93-3	7,100	RSL	2,400	TBD	TBD	TBD
2-Hexanone	591-78-6	47	RSL	16	TBD	TBD	TBD
4-Methyl-2-pentanone	108-10-1	2,000	RSL	670	TBD	TBD	TBD
Acetone	67-64-1	22,000	RSL	7,300	TBD	TBD	TBD
Acetonitrile	75-05-8	130	RSL	43	TBD	TBD	TBD
Acrolein	107-02-8	0.042	RSL	0.014	TBD	TBD	TBD
Acrylonitrile	107-13-1	0.05	ACL	0.017	TBD	TBD	TBD

Analyte	CAS Number	PAL (µg/L)	PAL Reference[1]	Project Quantitation Limit Goal[2] (µg/L)	Laboratory (TBD)		
					LOQ (µg/L)	LOD (µg/L)	DL (µg/L)
Allyl chloride	107-05-1	0.65	ACL	0.22	TBD	TBD	TBD
Benzene	71-43-2	5	MCL	1.7	TBD	TBD	TBD
Bromodichloromethane	75-27-4	80	MCL	27	TBD	TBD	TBD
Bromoform	75-2	80	MCL	27	TBD	TBD	TBD
Bromomethane	74-83-9	8.7	RSL	2.9	TBD	TBD	TBD
Carbon disulfide	75-15-0	1,000	RSL	330	TBD	TBD	TBD
Carbon tetrachloride	56-23-5	5	MCL	1.7	TBD	TBD	TBD
Chlorobenzene	108-90-7	100	MCL	33	TBD	TBD	TBD
Chloroethane	75-00-3	21,000	RSL	7,000	TBD	TBD	TBD
Chloroform	67-66-3	80	MCL	27	TBD	TBD	TBD
Chloromethane	74-87-3	190	RSL	63	TBD	TBD	TBD
Chloroprene	126-99-8	0.016	ACL	0.0053	TBD	TBD	TBD
cis-1,3-Dichloropropene	10061-01-5	0.43	RSL	0.14	TBD	TBD	TBD
Dibromochloromethane	124-48-1	80	MCL	27	TBD	TBD	TBD
Dibromomethane	74-95-3	8.2	RSL	2.7	TBD	TBD	TBD
Dichlorodifluoromethane	75-71-8	390	RSL	130	TBD	TBD	TBD
Ethyl methacrylate	97-63-2	3,300	RSL	1,100	TBD	TBD	TBD
Ethylbenzene	100-41-4	700	MCL	230	TBD	TBD	TBD
Iodomethane	74-88-4	TBD	LOQ	TBD	TBD	TBD	TBD
Isobutyl alcohol	78-83-1	11,000	RSL	3,700	TBD	TBD	TBD
Methacrylonitrile	126-98-7	1	RSL	0.33	TBD	TBD	TBD
Methyl methacrylate	80-62-6	1,400	RSL	470	TBD	TBD	TBD
Methylene chloride	75-09-2	5	MCL	1.7	TBD	TBD	TBD
Naphthalene	91-20-3	0.14	ACL	0.047	TBD	TBD	TBD
Pentachloroethane	76-01-7	0.75	ACL	0.25	TBD	TBD	TBD
Propionitrile	107-12-0	TBD	LOQ	TBD	TBD	TBD	TBD
Styrene	100-42-5	1,600	RSL	530	TBD	TBD	TBD
Tetrachloroethene	127-18-4	5	MCL	1.7	TBD	TBD	TBD

Analyte	CAS Number	PAL (µg/L)	PAL Reference[1]	Project Quantitation Limit Goal[2] (µg/L)	Laboratory (TBD)		
					LOQ (µg/L)	LOD (µg/L)	DL (µg/L)
Toluene	108-88-3	2,300	RSL	770	TBD	TBD	TBD
trans-1,2-dichloroethene	156-60-5	110	RSL	37	TBD	TBD	TBD
trans-1,3-dichloropropene	10061-02-6	0.433	ACL	0.14	TBD	TBD	TBD
trans-1,4-Dichloro-2-butene	110-57-6	0.0012	RSL	0.00040	TBD	TBD	TBD
Trichloroethene	79-01-6	5	MCL	1.7	TBD	TBD	TBD
Trichlorofluoromethane	75-69-4	1,300	RSL	430	TBD	TBD	TBD
Vinyl acetate	108-05-4	410	RSL	140	TBD	TBD	TBD
Vinyl chloride	75-01-4	2	MCL	0.67	TBD	TBD	TBD
Xylenes, total	534-52-1	195	ACL	65	TBD	TBD	TBD

* DBCP and EDB to be analyzed following SW-846 Method 8011 to obtain lower detection limits.

1 PAL references: The PALs were selected using the hierarchy to select GPSs as defined in Module VI, Section VI.I.4 of the RCRA Permit. Based on this hierarchy, the PAL selected is the higher of the site background concentration, MCL, ACL, or RSL. If there is no value available from the PAL sources, the laboratory LOQ will serve as the PAL. Any published changes to the PAL sources will be immediately adopted. Refer to Appendix C for backup documentation.

Background – Site-specific established background concentration as identified in Attachment O of the RCRA Permit; MCL – USEPA Drinking Water Standards and Health Advisories, MCLs (USEPA, 2011); ACL – VDEQ risk-based ACLs (VDEQ, 2011); RSL – Regions 3, 6, and 9 Regional Screening Level Tapwater (USEPA, 2010).

2 PQLG is equal to 1/3 of the PAL.

Matrix: Groundwater
Analytical: Semivolatile Organic Compounds (SVOCs) (Annual Appendix IX)

Analyte	CAS Number	PAL (µg/L)	PAL Reference[1]	Project Quantitation Limit Goal[2] (µg/L)	Laboratory (TBD)		
					LOQ (µg/L)	LOD (µg/L)	DL (µg/L)
1,2,4,5-Tetrachlorobenzene	95-94-3	11	RSL	3.7	TBD	TBD	TBD
1,3-Dinitrobenzene	99-65-0	3.7	RSL	1.2	TBD	TBD	TBD
1,3,5-Trinitrobenzene	99-35-4	1,100	RSL	370	TBD	TBD	TBD
1,4-Naphthoquinone	130-15-4	TBD	LOQ	TBD	TBD	TBD	TBD
1,4-Phenylenediamine	106-50-3	6,900	RSL	2,300	TBD	TBD	TBD
1-Naphthylamine	134-32-7	TBD	LOQ	TBD	TBD	TBD	TBD
2,2'-Oxybis(1-chloropropane)	108-60-1	0.32	RSL	0.11	TBD	TBD	TBD
2,3,4,6-Tetrachlorophenol	58-90-2	1,100	RSL	370	TBD	TBD	TBD
2,4,5-Trichlorophenol	95-95-4	3,700	RSL	1,200	TBD	TBD	TBD
2,4,6-Trichlorophenol	88-06-2	6.1	ACL	2.0	TBD	TBD	TBD
2,4-Dichlorophenol	120-83-2	110	RSL	37	TBD	TBD	TBD
2,4-Dimethylphenol	105-67-9	730	RSL	240	TBD	TBD	TBD
2,4-Dinitrophenol	51-28-5	73	RSL	24	TBD	TBD	TBD
2,4-Dinitrotoluene	121-14-2	31.2	ACL	10	TBD	TBD	TBD
2,6-Dichlorophenol	87-65-0	TBD	LOQ	TBD	TBD	TBD	TBD
2,6-Dinitrotoluene	606-20-2	37	RSL	12	TBD	TBD	TBD
2-Acetylaminofluorene	53-96-3	0.018	RSL	0.0060	TBD	TBD	TBD
2-Chloronaphthalene	91-58-7	2,900	RSL	970	TBD	TBD	TBD
2-Chlorophenol	95-57-8	180	RSL	60	TBD	TBD	TBD
2-Methyl-4,6-dinitrophenol	534-52-1	2.9	RSL	0.97	TBD	TBD	TBD
2-Methylnaphthalene	91-57-6	150	RSL	50	TBD	TBD	TBD
2-Methylphenol	95-48-7	1,800	RSL	600	TBD	TBD	TBD
2-Naphthylamine	91-59-8	0.04	ACL	0.013	TBD	TBD	TBD
2-Nitroaniline	88-74-4	370	RSL	120	TBD	TBD	TBD
2-Nitrophenol	88-75-5	TBD	LOQ	TBD	TBD	TBD	TBD
2-Picoline	109-06-8	TBD	LOQ	TBD	TBD	TBD	TBD
3-Methylphenol	108-39-4	1,800	RSL	600	TBD	TBD	TBD
3,3'-Dichlorobenzidine	91-94-1	0.15	ACL	0.050	TBD	TBD	TBD
3,3'-Dimethylbenzidine	119-93-7	0.0061	RSL	0.0020	TBD	TBD	TBD
3-Methylcholanthrene	56-49-5	0.0031	ACL	0.0010	TBD	TBD	TBD
3-Nitroaniline	99-09-2	TBD	LOQ	TBD	TBD	TBD	TBD
4-Aminobiphenyl	92-67-1	0.0032	ACL	0.0011	TBD	TBD	TBD
4-Bromophenyl phenyl ether	101-55-3	TBD	LOQ	TBD	TBD	TBD	TBD
4-Chloro-3-methylphenol	59-50-7	3,700	RSL	1,200	TBD	TBD	TBD
4-Chloroaniline	106-47-8	0.34	ACL	0.11	TBD	TBD	TBD

Analyte	CAS Number	PAL (µg/L)	PAL Reference[1]	Project Quantitation Limit Goal[2] (µg/L)	Laboratory (TBD)		
					LOQ (µg/L)	LOD (µg/L)	DL (µg/L)
4-Chloropheyl phenyl ether	7005-72-3	TBD	LOQ	TBD	TBD	TBD	TBD
4-Methylphenol	106-44-5	180	RSL	60	TBD	TBD	TBD
4-Nitroaniline	100-01-6	3.4	ACL		TBD	TBD	TBD
4-Nitrophenol	100-02-7	TBD	LOQ	TBD	TBD	TBD	TBD
4-Nitroquinoline-1-oxide	56-57-5	TBD	LOQ	TBD	TBD	TBD	TBD
5-Nitro-o-toluidine	99-55-8	2.0	ACL	0.67	TBD	TBD	TBD
7,12-Dimethylbenz(a)anthracene	57-97-6	0.00027	ACL	0.000090	TBD	TBD	TBD
a,a-Dimethylphenethylamine	122-09-8	TBD	LOQ	TBD	TBD	TBD	TBD
Acenaphthene	83-32-9	2,200	RSL	730	TBD	TBD	TBD
Acenaphthylene	208-96-8	2,200	RSL	730	TBD	TBD	TBD
Acetophenone	98-86-2	3,700	RSL	1,200	TBD	TBD	TBD
Aniline	62-53-3	12	RSL	4.0	TBD	TBD	TBD
Anthracene	120-12-7	11,000	RSL	3,700	TBD	TBD	TBD
Aramite	140-57-8	2.7	RSL	0.90	TBD	TBD	TBD
Benzo(a)anthracene	56-55-3	0.029	ACL	0.0097	TBD	TBD	TBD
Benzo(a)pyrene	50-32-8	0.2	MCL	0.067	TBD	TBD	TBD
Benzo(b)fluoranthene	205-99-2	0.029	ACL	0.0097	TBD	TBD	TBD
Benzo(g,h,i)perylene	191-24-2	1,100	RSL	370	TBD	TBD	TBD
Benzo(k)fluoranthene	207-08-9	0.29	ACL	0.097	TBD	TBD	TBD
Benzyl alcohol	100-51-6	3700	RSL	1,200	TBD	TBD	TBD
bis(2-Chloroethoxy)methane	111-91-1	110	RSL	37	TBD	TBD	TBD
bis(2-Chloroethyl)ether	111-44-4	0.012	ACL	0.0040	TBD	TBD	TBD
bis(2-Chloroisopropyl)ether	39638-32-9	TBD	LOQ	TBD	TBD	TBD	TBD
bis(2-Ethylhexyl)phthalate	117-81-7	17	Background	5.7	TBD	TBD	TBD
Butyl benzyl phthalate	85-68-7	35.4	ACL	12	TBD	TBD	TBD
Chlorobenzilate	510-15-6	0.61	ACL	0.20	TBD	TBD	TBD
Chrysene	218-01-9	2.95	ACL	0.98	TBD	TBD	TBD
Diallate	2303-16-4	1.10	ACL	0.37	TBD	TBD	TBD
Dibenzo(a,h)anthracene	53-70-3	0.0029	ACL	0.00097	TBD	TBD	TBD
Dibenzofuran	132-64-9	37	RSL	12	TBD	TBD	TBD
Diethyl phthalate	84-66-2	29,000	RSL	9,700	TBD	TBD	TBD
Dimethoate	60-51-5	7.3	RSL	2.4	TBD	TBD	TBD
Dimethyl phthalate	131-11-3	TBD	LOQ	TBD	TBD	TBD	TBD
Di-n-butyl phthalate	84-74-2	3,700	RSL	1,200	TBD	TBD	TBD
Di-n-octyl phthalate	117-84-0	312	ACL	100	TBD	TBD	TBD
Diphenylamine	122-39-4	910	RSL	300	TBD	TBD	TBD
Disulfoton	298-04-4	1.5	RSL	0.50	TBD	TBD	TBD
Ethyl methanesulfonate	62-50-0	TBD	LOQ	TBD	TBD	TBD	TBD

Analyte	CAS Number	PAL (µg/L)	PAL Reference[1]	Project Quantitation Limit Goal[2] (µg/L)	Laboratory (TBD)		
					LOQ (µg/L)	LOD (µg/L)	DL (µg/L)
Ethyl parathion	56-38-2	220	RSL	73	TBD	TBD	TBD
Famphur	52-85-7	TBD	LOQ	TBD	TBD	TBD	TBD
Fluoranthene	206-44-0	1,500	RSL	500	TBD	TBD	TBD
Fluorene	86-73-7	1,500	RSL	500	TBD	TBD	TBD
Hexachlorobenzene	118-74-1	1	MCL	0.33	TBD	TBD	TBD
Hexachlorobutadiene	87-68-3	0.86	ACL	0.29	TBD	TBD	TBD
Hexachlorocyclopentadiene	77-47-4	220	RSL	73	TBD	TBD	TBD
Hexachloroethane	67-72-1	4.80	RSL	1.6	TBD	TBD	TBD
Hexachlorophene	70-30-4	11	RSL	3.7	TBD	TBD	TBD
Hexachloropropene	1888-71-7	TBD	LOQ	TBD	TBD	TBD	TBD
Indeno(1,2,3-cd)pyrene	193-39-5	0.029	ACL	0.0097	TBD	TBD	TBD
Isodrin	465-73-6	TBD	LOQ	TBD	TBD	TBD	TBD
Isophorone	78-59-1	71	ACL	23.7	TBD	TBD	TBD
Isosafrole	120-58-1	TBD	LOQ	TBD	TBD	TBD	TBD
Kepone	143-50-0	0.007	ACL	0.0023	TBD	TBD	TBD
Methapyrilene	91-80-5	TBD	LOQ	TBD	TBD	TBD	TBD
Methyl methanesulfonate	66-27-3	0.68	ACL	0.23	TBD	TBD	TBD
Methyl parathion	298-00-0	9.1	RSL	3.0	TBD	TBD	TBD
Nitrobenzene	98-95-3	0.12	ACL	0.040	TBD	TBD	TBD
N-Nitrosodiethylamine	55-18-5	0.00014	ACL	0.000047	TBD	TBD	TBD
N-Nitrosodimethylamine	62-75-9	0.00042	ACL	0.00014	TBD	TBD	TBD
N-Nitroso-di-n-butylamine	924-16-3	0.0024	ACL	0.00082	TBD	TBD	TBD
N-Nitroso-di-n-propylamine	621-64-7	0.0096	ACL	0.0032	TBD	TBD	TBD
N-Nitrosodiphenylamine	86-30-6	14	ACL	4.7	TBD	TBD	TBD
N-Nitrosomethylethylamine	10595-95-6	0.0031	ACL	0.0010	TBD	TBD	TBD
N-Nitrosomorpholine	59-89-2	0.010	ACL	0.0033	TBD	TBD	TBD
N-Nitrosopiperidine	100-75-4	0.0072	ACL	0.0024	TBD	TBD	TBD
N-Nitrosopyrrolidine	930-55-2	0.032	ACL	0.010	TBD	TBD	TBD
o,o,o-Triethylphosphorothioate	126-68-1	TBD	LOQ	TBD	TBD	TBD	TBD
o-Toluidine	95-53-4	0.37	ACL	0.12	TBD	TBD	TBD
p-Dimethylaminoazobenzene	60-11-7	0.015	RSL	0.0050	TBD	TBD	TBD
Pentachlorobenzene	608-93-5	29	RSL	9.7	TBD	TBD	TBD
Pentachloronitrobenzene	82-68-8	0.26	ACL	0.087	TBD	TBD	TBD
Pentachlorophenol	87-86-5	1	MCL	0.33	TBD	TBD	TBD
Phenacetin	62-44-2	31	RSL	10	TBD	TBD	TBD
Phenanthrene	85-01-8	1,100	RSL	370	TBD	TBD	TBD
Phenol	108-95-2	11,000	RSL	3,700	TBD	TBD	TBD
Phorate	298-02-2	7.3	RSL	2.4	TBD	TBD	TBD

Analyte	CAS Number	PAL (µg/L)	PAL Reference[1]	Project Quantitation Limit Goal[2] (µg/L)	Laboratory (TBD)		
					LOQ (µg/L)	LOD (µg/L)	DL (µg/L)
Pronamide	23950-58-5	2,700	RSL	900	TBD	TBD	TBD
Pyrene	129-00-0	1,100	RSL	370	TBD	TBD	TBD
Pyridine	110-86-1	37	RSL	12	TBD	TBD	TBD
Safrole	94-59-7	0.31	ACL	0.10	TBD	TBD	TBD
Tetraethyl dithiopyrophosphate (Sulfotep)	3689-24-5	18	RSL	6.0	TBD	TBD	TBD
Thionazin	297-97-2	TBD	LOQ	TBD	TBD	TBD	TBD

1 PAL references: The PALs were selected using the hierarchy to select GPSs as defined in Module VI, Section VI.I.4 of the RCRA Permit. Based on this hierarchy, the PAL selected is the higher of the site background concentration, MCL, ACL, or RSL. If there is no value available from the PAL sources, the laboratory LOQ will serve as the PAL. Any published changes to the PAL sources will be immediately adopted. Refer to Appendix C for backup documentation.

Background – Site-specific established background concentration as identified in Attachment O of the RCRA Permit; MCL – USEPA Drinking Water Standards and Health Advisories, MCLs (USEPA, 2011); ACL – VDEQ risk-based ACLs (VDEQ, 2011); RSL – Regions 3, 6, and 9 Regional Screening Level Tapwater (USEPA, 2010).

2 PQLG is equal to 1/3 of the PAL.

Matrix: Groundwater
Analytical: Pesticides (Attachment L List)

Analyte	CAS Number	PAL (µg/L)	PAL Reference[1]	Project Quantitation Limit Goal[2] (µg/L)	Laboratory (TBD)		
					LOQ (µg/L)	LOD (µg/L)	DL (µg/L)
Aldrin	309-00-2	0.004	ACL	0.0013	TBD	TBD	TBD
alpha-BHC	319-84-6	2	Background	0.67	TBD	TBD	TBD
beta-BHC	319-85-7	0.037	ACL	0.012	TBD	TBD	TBD
Chlordane	12789-03-6	2	MCL	0.67	TBD	TBD	TBD
4,4'-DDD	72-54-8	0.28	ACL	0.093	TBD	TBD	TBD
4,4'-DDE	72-55-9	0.2	ACL	0.067	TBD	TBD	TBD
4,4'-DDT	50-29-3	0.2	ACL	0.067	TBD	TBD	TBD
delta-BHC	319-86-8	0.011	RSL	0.0037	TBD	TBD	TBD
Dieldrin	60-57-1	0.004	ACL	0.0013	TBD	TBD	TBD
Endosulfan I	959-98-8	220	RSL	73	TBD	TBD	TBD
Endosulfan II	33213-65-9	220	RSL	73	TBD	TBD	TBD
Endosulfan sulfate	1031-07-8	220	RSL	73	TBD	TBD	TBD
Endrin	72-20-8	11	RSL	3.7	TBD	TBD	TBD
Endrin aldehyde	421-93-4	11	RSL	3.7	TBD	TBD	TBD
gamma-BHC (Lindane)	58-89-9	0.2	MCL	0.067	TBD	TBD	TBD
Heptachlor	76-44-8	0.4	MCL	0.13	TBD	TBD	TBD
Heptachlor epoxide	1024-57-3	0.2	MCL	0.067	TBD	TBD	TBD
Methoxychlor	72-43-5	180	RSL	60	TBD	TBD	TBD
Toxaphene	8001-35-2	3	MCL	1.0	TBD	TBD	TBD

1 PAL references: The PALs were selected using the hierarchy to select GPSs as defined in Module VI, Section VI.I.4 of the RCRA Permit. Based on this hierarchy, the PAL selected is the higher of the site background concentration, MCL, ACL, or RSL. If there is no value available from the PAL sources, the laboratory LOQ will serve as the PAL. Any published changes to the PAL sources will be immediately adopted. Refer to Appendix C for backup documentation.

Background – Site-specific established background concentration as identified in Attachment O of the RCRA Permit; MCL – USEPA Drinking Water Standards and Health Advisories, MCLs (USEPA, 2011); ACL – VDEQ risk-based ACLs (VDEQ, 2011); RSL – Regions 3, 6, and 9 Regional Screening Level Tapwater (USEPA, 2010).

2 PQLG is equal to 1/3 of the PAL.

Matrix: Groundwater
Analytical: Polychlorinated Biphenyls (PCBs) (Attachment L List)

Analyte	CAS Number	PAL (µg/L)	PAL Reference[1]	Project Quantitation Limit Goal[2] (µg/L)	Laboratory (TBD)		
					LOQ (µg/L)	LOD (µg/L)	DL (µg/L)
Aroclor-1016	12674-11-2	0.96	ACL-based	0.32	TBD	TBD	TBD
Aroclor-1221	11104-28-2	0.96	ACL-based	0.32	TBD	TBD	TBD
Aroclor-1232	11141-16-5	0.96	ACL-based	0.32	TBD	TBD	TBD
Aroclor-1242	53469-21-9	0.96	ACL-based	0.32	TBD	TBD	TBD
Aroclor-1248	12672-29-6	0.96	ACL-based	0.32	TBD	TBD	TBD
Aroclor-1254	11097-69-1	0.96	ACL-based	0.32	TBD	TBD	TBD
Aroclor-1260	11096-82-5	0.96	ACL-based	0.32	TBD	TBD	TBD
Total Aroclors (PCBs)	1336-36-3	0.96	ACL	0.32	TBD	TBD	TBD

1 PAL references: The PALs were selected using the hierarchy to select GPSs as defined in Module VI, Section VI.I.4 of the RCRA Permit. Based on this hierarchy, the PAL selected is the higher of the site background concentration, MCL, ACL, or RSL. If there is no value available from the PAL sources, the laboratory LOQ will serve as the PAL. Any published changes to the PAL sources will be immediately adopted. Refer to Appendix C for backup documentation.

Background – Site-specific established background concentration as identified in Attachment O of the RCRA Permit; MCL – USEPA Drinking Water Standards and Health Advisories, MCLs (USEPA, 2011); ACL – VDEQ risk-based ACLs (VDEQ, 2011); ACL-based – ACL value for Total Aroclors applied to individual aroclors,; RSL – Regions 3, 6, and 9 Regional Screening Level Tapwater (USEPA, 2010).

2 PQLG is equal to 1/3 of the PAL.

Matrix: Groundwater
Analytical: Herbicides (Attachment L List)

Analyte	CAS Number	PAL (µg/L)	PAL Reference[1]	Project Quantitation Limit Goal[2] (µg/L)	Laboratory (TBD)		
					LOQ (µg/L)	LOD (µg/L)	DL (µg/L)
2,4-D	94-75-7	370	RSL	120	TBD	TBD	TBD
2,4,5-T	93-76-5	370	RSL	120	TBD	TBD	TBD
2,4,5-TP (Silvex)	93-72-1	290	RSL	97	TBD	TBD	TBD
Dinoseb	88-85-7	37	RSL	12	TBD	TBD	TBD

1 PAL references: The PALs were selected using the hierarchy to select GPSs as defined in Module VI, Section VI.I.4 of the RCRA Permit. Based on this hierarchy, the PAL selected is the higher of the site background concentration, MCL, ACL, or RSL. If there is no value available from the PAL sources, the laboratory LOQ will serve as the PAL. Any published changes to the PAL sources will be immediately adopted. Refer to Appendix C for backup documentation.

Background – Site-specific established background concentration as identified in Attachment O of the RCRA Permit; MCL – USEPA Drinking Water Standards and Health Advisories, MCLs (USEPA, 2011); ACL – VDEQ risk-based ACLs (VDEQ, 2011); RSL – Regions 3, 6, and 9 Regional Screening Level Tapwater (USEPA, 2010).

2 PQLG is equal to 1/3 of the PAL.

Matrix: Groundwater
Analytical Group: Dioxins/Furans (Attachment L List)

Analyte	CAS Number	PAL (µg/L)	PAL Reference[1]	PQLG[2] (ug/L)	Laboratory (TBD)		
					LOQ (µg/L)	LOD (µg/L)	EDL[3] (µg/L)
1,2,3,4,6,7,8,9-OCDD	3268-87-9	0.1	MCL-based	0.033	TBD	TBD	TBD
1,2,3,4,6,7,8,9-OCDF	39001-02-0	0.1	MCL-based	0.033	TBD	TBD	TBD
1,2,3,4,6,7,8-HpCDD	35822-46-9	0.003	MCL-based	0.0010	TBD	TBD	TBD
1,2,3,4,6,7,8-HpCDF	67562-39-4	0.003	MCL-based	0.0010	TBD	TBD	TBD
1,2,3,4,7,8,9-HpCDF	55673-89-7	0.003	MCL-based	0.0010	TBD	TBD	TBD
1,2,3,4,7,8-HxCDD	39227-28-6	0.0003	MCL-based	0.00010	TBD	TBD	TBD
1,2,3,4,7,8-HxCDF	70648-26-9	0.0003	MCL-based	0.00010	TBD	TBD	TBD
1,2,3,6,7,8-HxCDD	57653-85-7	0.0003	MCL-based	0.00010	TBD	TBD	TBD
1,2,3,6,7,8-HxCDF	57117-44-9	0.0003	MCL-based	0.00010	TBD	TBD	TBD
1,2,3,7,8,9-HxCDD	19408-74-3	0.0003	MCL-based	0.00010	TBD	TBD	TBD
1,2,3,7,8,9-HxCDF	72918-21-9	0.0003	MCL-based	0.00010	TBD	TBD	TBD
1,2,3,7,8-PeCDD	40321-76-4	0.00003	MCL-based	0.00001	TBD	TBD	TBD
1,2,3,7,8-PeCDF	57117-41-6	0.001	MCL-based	0.00033	TBD	TBD	TBD
2,3,4,6,7,8-HxCDF	60851-34-5	0.0003	MCL-based	0.00010	TBD	TBD	TBD
2,3,4,8-PeCDF	57117-31-4	0.0001	MCL-based	0.00003	TBD	TBD	TBD
2,3,7,8-TCDD	1746-01-6	0.00003	MCL	0.00001	TBD	TBD	TBD
2,3,7,8-TCDF	51207-31-9	0.0003	MCL-based	0.00010	TBD	TBD	TBD
Total HpCDD	37871-00-4	NC	None	—[4]	—[4]	—[4]	—[4]
Total HpCDF	38998-75-3	NC	None	—[4]	—[4]	—[4]	—[4]
Total HxCDD	34465-46-8	NC	None	—[4]	—[4]	—[4]	—[4]
Total HxCDF	55684-94-1	NC	None	—[4]	—[4]	—[4]	—[4]
Total PeCDD	36088-22-9	NC	None	—[4]	—[4]	—[4]	—[4]

Analyte	CAS Number	PAL (µg/L)	PAL Reference(1)	PQLG(2) (ug/L)	Laboratory (TBD)		
					LOQ (µg/L)	LOD (µg/L)	EDL(3) (µg/L)
Total PeCDF	30402-15-4	NC	None	--- (4)	--- (4)	--- (4)	--- (4)
Total TCDD	41903-57-5	NC	None	--- (4)	--- (4)	--- (4)	--- (4)
Total TCDF	55722-27-5	NC	None	--- (4)	--- (4)	--- (4)	--- (4)

1 PAL references: The PALs were selected using the hierarchy to select GPSs as defined in Module VI, Section VI.I.4 of the RCRA Permit. Based on this hierarchy, the PAL selected is the higher of the site background concentration, MCL, ACL, or RSL. If there is no value available from the PAL sources, the laboratory LOQ will serve as the PAL. Any published changes to the PAL sources will be immediately adopted. Refer to Appendix C for backup documentation.

Background – Site-specific established background concentration as identified in Attachment O of the RCRA Permit; MCL – USEPA Drinking Water Standards and Health Advisories, MCLs (USEPA, 2011); MCL-based – value calculated using toxicity equivalency factors based on MCL for 2,3,7,8-TCDD, ACL – VDEQ risk-based ACLs (VDEQ, 2011); RSL – Regions 3, 6, and 9 Regional Screening Level Tapwater (USEPA, 2010).

2 PQLG is equal to 1/3 of the PAL.

3 EDL = Estimated Detection Limit. Detection limits for dioxins and furans are reported as the average EDL in accordance with the method.

Congeners that do not have individual PALs are included to obtain total OCDD/OCDF values and to calculate TEFs.

4 Values are calculated based on individual parameter result.

Matrix: Groundwater
Analytical: Metals and Miscellaneous Parameters (Attachment L List)

Analyte	CAS Number	PAL (µg/L)	PAL Reference[1]	Project Quantitation Limit Goal[2] (µg/L)	Laboratory (TBD)		
					LOQ (µg/L)	LOD (µg/L)	DL (µg/L)
Metals							
Antimony	7440-36-0	15	RSL	5.0	TBD	TBD	TBD
Arsenic	7440-38-2	10	MCL	3.3	TBD	TBD	TBD
Barium	7440-39-3	7,300	RSL	2,400	TBD	TBD	TBD
Beryllium	7440-41-7	73	RSL	24	TBD	TBD	TBD
Cadmium	7440-43-9	18	RSL	6.0	TBD	TBD	TBD
Chromium (total)	7440-47-3	100	MCL	33	TBD	TBD	TBD
Cobalt	7440-48-4	11	Background	3.7	TBD	TBD	TBD
Copper	7440-50-8	1,500	RSL	500	TBD	TBD	TBD
Lead	7439-92-1	15	MCL	5.0	TBD	TBD	TBD
Mercury (Method 7470A or 7472)	7439-97-6	2	MCL	0.67	TBD	TBD	TBD
Nickel	7440-02-0	730	RSL	240	TBD	TBD	TBD
Selenium	7782-49-2	180	RSL	60	TBD	TBD	TBD
Silver	7440-22-4	180	RSL	60	TBD	TBD	TBD
Thallium	7440-28-0	2	MCL	0.67	TBD	TBD	TBD
Tin	7440-31-5	22,000	RSL	7,300	TBD	TBD	TBD
Vanadium	7440-62-2	180	RSL	60	TBD	TBD	TBD
Zinc	7440-66-6	11,000	RSL	3,700	TBD	TBD	TBD
Miscellaneous Parameters							
Cyanide (Total and Amenable) (9012B)	57-12-5	730	RSL	240	TBD	TBD	TBD
Phenols (Total) (Method 9066 or 9067)	NA	TBD	LOQ	TBD	TBD	TBD	TBD
Sulfide (Extractable) (Method 9031)	18496-25-8	TBD	LOQ	TBD	TBD	TBD	TBD

Metals analysis will be performed following SW-846 Method 6020A (and SW-846 Method 7470A or 7472 for mercury). Total and amenable cyanide analysis will be performed following SW-846 Method 9012B, total phenols analysis will be performed following SW-846 Method 9066 or 9067, and extractable sulfide analysis will be performed following SW-846 Method 9031.

1 PAL references: The PALs were selected using the hierarchy to select GPS as defined in Section VI.I.4 of the RCRA Permit. Based on this hierarchy, the PAL selected is the higher of the facility's background concentration, MCL, ACL, or RSL. If there is no value available from the PAL sources, then the laboratory LOQ shall serve as the PAL, unless a surrogate value is approved by VDEQ. Any published changes to the PAL sources shall be immediately adopted. Refer to Appendix C for backup documentation.

2 PQLG is equal to 1/3 of the PAL.

Background – Site-specific established background concentration as identified in Attachment O of the RCRA Permit; MCL – USEPA Drinking Water Standards and Health Advisories, MCLs (USEPA, 2011); ACL – VDEQ risk-based ACL (VDEQ, January 2011); RSL – Regions 3, 6, and 9 Regional Screening Level, Tapwater (USEPA, November 2010).

SAP WORKSHEET NO. 16 -- PROJECT SCHEDULE/TIMELINE TABLE

(UFP-QAPP Manual Section 2.8.2)

Activity	Organization	Dates (MM/DD/YY)		Deliverable	Deliverable Due Date
		Anticipated Date of Initiation	Anticipated Date of Completion		
Prepare Internal Draft SAP	Tetra Tech	2/25/11	3/31/11	N/A	N/A
Submit Internal Draft SAP to Navy Chemist for Review	Tetra Tech	4/01/11	4/01/11	Internal Draft SAP	4/01/11
Navy Chemist Review/Receipt of Comments	Navy	4/04/11	4/15/11	Review Comments	4/15/11
Prepare/Submit Response to Comments (RTC)/Attain Comment Resolution	Navy and Tetra Tech	4/18/11	4/26/11	RTC	04/21/11
Prepare Draft SAP	Tetra Tech	4/27/11	5/03/11	N/A	N/A
Submit Draft SAP to NAVFAC Washington and MCB Quantico	Tetra Tech	5/04/11	5/04/11	Draft SAP	5/04/11
Navy and MCB Quantico Review/Receipt of Comments	Navy and MCB Quantico	5/05/11	5/18/11	Review Comments	5/18/11
Prepare/Submit RTC/Attain Comment Resolution	Tetra Tech, Navy, and MCB Quantico	5/19/11	5/25/11	RTC	5/23/11
Prepare Draft Final SAP	Tetra Tech	5/26/11	5/31/11	N/A	N/A
Submit Draft Final SAP to VDEQ	Tetra Tech	6/01/11	6/01/11	Draft Final SAP	6/1/11
Regulatory Review/Receipt of Comments	VDEQ	6/2/11	6/15/11	Review Comments	6/15/11
Prepare/Submit RTC/Attain Comment Resolution	VDEQ and Tetra Tech	6/16/11	6/23/11	RTC	6/20/11
Prepare Final SAP	Tetra Tech	6/24/11	6/30/11	N/A	N/A
Submit Final SAP	Tetra Tech	07/1/11	07/1/11	Final SAP	N/A
Mobilization and Semi-Annual Groundwater CA Monitoring(1)	TBD	TBD	TBD	N/A	N/A

Activity	Organization	Dates (MM/DD/YY)		Deliverable	Deliverable Due Date
		Anticipated Date of Initiation	Anticipated Date of Completion		
Submit Semi-Annual Report to VDEQ[1]	TBD	September 1st of each calendar year	September 1st of each calendar year	Semi-Annual Report	September 1st of each calendar year
Submit Annual Report to VDEQ[1]	TBD	March 1 of each calendar year	March 1 of each calendar year	Annual Report	March 1 of each calendar year

1 Semi-annual monitoring requirements are defined by Section C of Module VI (Groundwater Corrective Action) of the RCRA Permit.

2 Report submittal dates for annual and semi-annual reports are defined in Section K of Module VI (Groundwater Corrective Action) of the RCRA Permit. This section states that the permittee will submit semi-annual reports no later than March 1 and September 1 of each calendar year. The report due no later than March 1 of each year will serve as the annual report and will contain the required information for the previous calendar year.

SAP WORKSHEET NO. 17 -- SAMPLING DESIGN AND RATIONALE

(UFP-QAPP Manual Section 3.1.1)

Groundwater is the medium of concern at the RRL. The chemicals in Worksheet No. 15 are a comprehensive list of analytes defined in the RCRA Permit for the CA Groundwater Monitoring Program. In addition, MNA parameters (summarized in Worksheet No. 11) identified in the permit will also be evaluated as part of the CA Groundwater Monitoring Program. Low to moderate concentrations of target analytes are anticipated based on historical data. The sections below provide an overview of sampling strategies and rationales.

17.1 GROUNDWATER SAMPLING DESIGN, LOCATIONS, AND RATIONALE

In accordance with the existing RCRA Permit, background and site groundwater data must be collected from 17 existing well locations on a semi-annual basis for the analytes identified in the permit. Figure 10-1 illustrates the sample locations. Table 17-1 summarizes the wells and chemical analyses to be performed at each well for each semi-annual sampling event under the CA Groundwater Monitoring Program. The sampling design takes advantage of current monitoring wells that are grouped according to functions required by the RCRA Permit, namely POC wells, CMW and background (sidegradient) well. These well locations and screened intervals were selected based on groundwater flow patterns to intercept contamination migrating in groundwater from under the landfill and thus constitute a biased sampling design.

One well (MW-10) is located sidegradient of the landfill and serves as the background well for the site. The background well is used to help determine the GPSs for CMWs and POC wells as defined in the RCRA Permit. Groundwater from MW-10 will be analyzed on a semi-annual basis for the analytes listed in Attachment K to the RCRA Permit (presented as such in Worksheet No. 15).

Eleven wells defined as POC wells by the RCRA Permit (MW-9, MW-11R, MW-12, MW-13, MW-14, MW-15R, MW-16, MW-17, MW-18, MW-19R, and MW-20) are monitored to evaluate groundwater around the perimeter of the landfill. Groundwater from four POC wells (MW-11R, MW-12, MW-18, and MW-20) will be analyzed on a semi-annual basis for the analytes listed in Attachment K of the permit (presented as such in Worksheet No. 15). Groundwater from seven downgradient POC wells (MW-9, MW-13, MW-14, MW-15R, MW-16, MW-17, and MW-19R) will also be analyzed on a semi-annual basis. However, groundwater from these seven wells will be analyzed for the analytes listed in Attachment K to the RCRA Permit (presented as such in Worksheet No. 15) during one of the semi-annual events and analyzed for the analytes listed in Attachment L of the RCRA Permit (presented as such in Worksheet No. 15), during the other semi-annual event. As described in the RCRA Permit, the

Appendix IX analytes are being monitored to ensure that there is not an undetected new release from the RRL.

Five wells (MW-21S, MW-21D, MW-22S, MW-22D, and MW-24) located on the southern end of the landfill are defined as CMWs by the RCRA Permit. These wells are used to monitor whether contaminants are migrating from the RRL. Groundwater from these four wells will be analyzed on a semi-annual basis for the analytes listed in Attachment K to the RCRA Permit (presented as target analytes in Worksheet No. 15).

MNA parameters (summarized in Worksheet No. 11) will be measured at select well locations and at sampling frequencies to be determined in the CAP. The MNA parameters will be monitored to help determine whether the HRC® injections are effectively reducing groundwater COC concentrations and to provide additional data to identify the most effective remedy for further degradation of chlorinated contaminants.

All data collected will undergo limited data validation, as described in Worksheet No. 36.

SAP WORKSHEET NO. 18 – SAMPLING LOCATIONS AND METHODS/SOP REQUIREMENTS TABLE

(UFP-QAPP Manual Section 3.1.1)

Sampling Location/ID Number	Matrix	Depth (units)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference
MW-10, MW11R, MW-12, MW-18, MW-20, MW-21S, MW-21D, MW-22S, MW-22D, MW-24	Groundwater	NA	Attachment K List (twice per year) (1)(2)	10 (plus 1 field duplicate)	See Worksheet No. 14
MW-9, MW-13, MW-14, MW15R, MW-16, MW-17, MW-19R	Groundwater	NA	Attachment K List (1) (once per year) (4) Attachment L List (3) (once per year) (4)	7 (plus 1 field duplicate)	See Worksheet No. 14

1 Analytes listed in Attachment K of RCRA Permit. The Attachment K list is summarized in Worksheet No. 15 and includes a target list of VOCs, SVOCs, and metals.

2 These wells are to be sampled for the Attachment K list of chemicals during both semi-annual monitoring events conducted each calendar year.

3 Analytes listed in Attachment L of RCRA Permit. The Attachment L list is summarized in Worksheet No. 15 and includes Appendix IX chemicals for VOCs, SVOCs, pesticides, PCBs, herbicides, dioxins, inorganics, sulfide, cyanide, and total phenolics.

4 These wells are to be sampled for the Attachment K list of chemicals during one monitoring event of the calendar year and the Attachment L list of chemicals during the other monitoring event of the calendar year.

SAP WORKSHEET NO. 19 -- ANALYTICAL SOP REQUIREMENTS TABLE

(UFP-QAPP Manual Section 3.1.1)

Matrix	Analytical Group[1]	Analytical and Preparation Method/SOP Reference	Containers (number, size, and type)	Sample Volume (units)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation / analysis)
Attachment K List Analyses						
Groundwater and Aqueous Field QC Samples	VOCs	SW-846 8260B	Three 40-milliliter (mL) clear glass vials	25 mL	Hydrochloric acid (HCl) to pH < 2; Cool to ≤6 °C	14 days to analysis
	SVOCs	SW-846 3510C/8270D	Two 1-liter (L) amber glass bottles	1,000 mL	Cool to ≤6 °C	7 days for preparation; 40 days to analysis
	Metals (Total and Dissolved)	SW-846 3050B/6020A	One 1-L HDPE bottle (1 for total, 1 for dissolved if necessary)	50 mL/ 30 mL mercury	Nitric acid (HNO_3) to pH < 2; Cool to ≤6 °C	180 days to analysis
	Mercury (Total and Dissolved)	SW-846 7470A or 7472				28 days to analysis
Attachment L List Analyses						
Groundwater and Aqueous Field QC Samples	VOCs	SW-846 8260B	Three 40-mL clear glass vials	25 mL	HCl to pH < 2; Cool to ≤6 °C	14 days to analysis
	EDB and DBCP	SW-846 8011	Three 40-mL clear glass vials	25 mL	Cool to ≤6 °C	14 days to analysis
	SVOCs	SW-846 3510C/8270D	Two 1-L amber glass bottles	1,000 mL	Cool to ≤6 °C	7 days for preparation; 40 days to analysis
	Pesticides	SW-846 3550B/8081B	Two 1-L glass amber bottles	1,000 mL	Cool to ≤6 °C	7 days for preparation; 40 days to analysis
	PCBs	SW-846 3550B/8082A	Two 1-L glass amber bottles	1,000 mL	Cool to ≤6 °C	7 days for preparation; 40 days to analysis
	Herbicides	SW-846 8151A	Two 1-L glass amber bottles	1,000 mL	Cool to ≤ 6 °C	7 days until extraction, 40 days to analysis
	Dioxins/Furans	SW-846 3520C/8280B	Two 1-L amber glass bottles	1,000 mL	Cool to ≤6 °C	30 days to extraction; 45 days to analysis

Matrix	Analytical Group[1]	Analytical and Preparation Method/SOP Reference	Containers (number, size, and type)	Sample Volume (units)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation / analysis)
	Metals (Total and Dissolved)	SW-846 3050B/6020A	One 1-L HDPE bottle (1 for total, 1 for dissolved if necessary)	50 mL/ 30 mL mercury	HNO_3 to pH < 2; Cool to ≤6 °C	180 days to analysis
	Mercury (Total and Dissolved)	SW-846 7470A or 7472				28 days to analysis
	Cyanide (Total and Amenable)	SW-846 9012B	One 250-mL HDPE bottle	50 mL	Sodium hydroxide (NaOH) to pH > 12; Cool to ≤6 °C	14 days to analysis
	Sulfide (Extractable)	SW-846 9031	One 500-mL plastic bottle	200 mL	1 mL 2 Normal zinc acetate with NaOH to a pH >9; Cool to < 6 °C	7 days to analysis
	Phenols (Total)	SW-846 9066 or 9067	Two 1-L glass bottles	1,000 mL	Sulfuric acid (H_2SO_4) to pH <2; Cool to < 6 °C	28 days to analysis
Enhanced Natural Attenuation Monitoring Analyses						
Groundwater and Aqueous Field Samples	Dissolved Gases (Light Organics - Methane, Ethane, and Ethene)	USEPA RSK-175 Modified	Three 40-mL glass vials	15 mL	HCl to pH <2; Cool to < 6 °C; no headspace	14 days to analysis
	Dissolved Gases (Permanent Gases - Carbon Dioxide)	USEPA RSK-175 Modified	One 20-mL glass vial with stopper septa	20 mL	HCl to pH <2; Cool to < 6 °C; no headspace	14 days to analysis
	Metabolic Acids (Volatile Fatty Acids)	Proprietary Method	Two 40-mL amber glass vials	80 mL	4 drops of benzalkonium chloride solution added; Cool to < 6°C	14 days to analysis
	Select Metals (Total and Dissolved)	SW-846 3050B/6020A	Two 1-L HDPE bottles (1 for total, 1 for dissolved)	50 mL	HNO_3 to pH < 2; Cool to ≤6 °C	180 days to analysis
	Select VOCs	SW-846 8260B	Three 40-mL clear glass vials	25 mL	HCl to pH < 2; Cool to ≤6 °C	14 days to analysis
	Anions (nitrate, nitrite, chloride, and sulfate)	SW-846 9056A	One 500-mL plastic bottle	5 mL for each analyte	Cool to < 6 °C	Nitrate and nitrite - 48 hours Chloride and sulfate - 28 days

Matrix	Analytical Group[1]	Analytical and Preparation Method/SOP Reference	Containers (number, size, and type)	Sample Volume (units)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation / analysis)
	TOC	SW-846 9060A	One 500-mL plastic bottle	250 mL	H_2SO_4 to pH <2; Cool to < 6 °C	28 days to analysis
	Dissolved Sulfide	SM4500S^{2-} F	One 500-mL plastic bottle	200 mL	1 mL 2 normal zinc acetate with NaOH to a pH >9; Cool to < 6 °C	7 days to analysis
	Alkalinity	SM 2320B	One 500-mL plastic bottle	25 mL	Cool to < 6 °C	14 days to analysis

1 See Worksheet No. 15 for the list of analytes in each analytical group.

SAP WORKSHEET NO. 20 -- FIELD QC SAMPLE SUMMARY TABLE

(UFP-QAPP Manual Section 3.1.1)

Matrix	Monitoring Event	Analytical Group	No. of Sampling Locations	No. of Field Duplicates	No. of MS/MSD(1)	No. of Source Blanks(2)	No. of Trip Blanks	No. of Proficiency Testing (PT) Samples	Total No. of Samples to Lab
Groundwater	Semi-Annual	Attachment K VOCs (3)	17	2	1/1	1	4	0	25
		Attachment K SVOCs (3)	17	2	1/1	1	NA	0	21
		Attachment K Metals (3)	17	2	1/1	1	NA	0	21
Groundwater	Annual	Attachment K VOCs(4)	10	1	0	0	See VOCs(6)	0	12
		Attachment K SVOCs(4)	10	1	0	0	NA	0	12
		Attachment K Metals (4)	10	1	0	0	NA	0	12
		Attachment L VOCs(5)	7	1	1/1	1	4	0	13
		Attachment L SVOCs(5)	7	1	1/1	1	NA	0	9
		Attachment L PCB/Pesticides(5)	7	1	1/1	1	NA	0	9
		Attachment L Herbicides(5)	7	1	1/1	1	NA	0	9
		Attachment L Phenolics(5)	7	1	1/1	1	NA	0	9
		Attachment L Dioxins(5)	7	1	1/1	1	NA	0	9
		Attachment L Metals(5)	7	1	1/1	1	NA	0	9
		Cyanide(5)	7	1	1/1	1	NA	0	9
		Sulfide(5)	7	1	1/1	1	NA	0	9

1 Although the MS/MSD is not typically considered a field QC sample, it is included here because location determination is often established in the field. The MS/MSD is not included in the total number of Samples sent to the Laboratory.
2 One source water blank will be collected from the source water used for decontaminating sampling equipment.
3 As per Attachment K list summarized in Worksheet No. 15 for all wells.
4 As per Attachment K list summarized in Worksheet No. 15 for select wells (see Worksheet No. 18 for well locations).
5 As per Attachment L list summarized in Worksheet No. 15 for select wells (see Worksheet No. 18 for well locations).
6 Trip blank count for select VOCs is included under VOCs.

SAP WORKSHEET NO. 21 -- PROJECT SAMPLING SOP REFERENCES TABLE

(UFP-QAPP Manual Section 3.1.2)

Reference Number	Title, Revision Date and/or Number	Originating Organization of Sampling SOP[1]	Equipment Type	Modified for Project Work? (Y/N)	Comments
SOP-01	Low-Flow Purging and Sampling of Groundwater Monitoring Wells, Bulletin No. QAD023, 10/97, updated 07/08	Region 3 USEPA	Groundwater Sampling Procedures	N	A copy of the SOP is included in Appendix B.
SOP-02	Low-Flow Purging and Sampling for Wells and Devices Used for Groundwater Quality Investigations, currently being revised	ASTM Standard D6771-02	Groundwater Sampling Procedures	N	Standard is currently being revised, and a copy of this SOP is not available at this time. Once available, It should be obtained and reviewed by the CA Monitoring Contractor.

SAP WORKSHEET NO. 22 -- FIELD EQUIPMENT CALIBRATION, MAINTENANCE, TESTING, AND INSPECTION TABLE

(UFP-QAPP Manual Section 3.1.2.4)

Field Equipment (1)	Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference	Comments
Water Quality Meter	Check manufacturer prepared standards (2)	Daily	Manufacturer's Guidance	Replace	CA Monitoring Contractor FOL or designee	Manufacturer's Guidance	None
Water Level Indicator	Field checks as per manufacturer	Daily	0.01-foot accuracy	Operator Correction or Replacement	CA Monitoring Contractor FOL or designee	Manufacturer's Guidance	None

1 This Worksheet will need to be updated to identify the specific field equipment that will be used by the field sampling crew for the groundwater sampling activities. The worksheet should be updated prior to the sampling event by the CA Monitoring Contractor.
2 Activities may include calibration, verification, testing, maintenance, and/or inspection.

SAP WORKSHEET NO. 23 -- ANALYTICAL SOP REFERENCES TABLE

(UFP-QAPP Manual Section 3.2.1)

Lab SOP Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
Appendix K List Analytes						
TBD	TBD (subject SOP to address VOCs by SW-846 Method 8260B)/TBD/TBD	Definitive	Groundwater and aqueous field QC samples – VOCs	Gas Chromatograph (GC)/ Mass Spectrometer (MS)	TBD	TBD
TBD	TBD (subject SOP to address SVOCs by SW-846 Method 8270D)/TBD/TBD	Definitive	Groundwater and aqueous field QC samples – SVOCs	GC/MS	TBD	TBD
TBD	TBD (subject SOP to address Metals by SW-846 Method 6020A)/TBD/TBD	Definitive	Groundwater and aqueous field QC samples – Metals	Inductively Coupled Plasma (ICP)/MS	TBD	TBD
Appendix L List Analytes						
TBD	TBD (subject SOP to address VOCs by SW-846 Method 8260B)/TBD/TBD	Definitive	Groundwater and aqueous field QC samples – VOCs	GC/MS	TBD	TBD
TBD	TBD (subject SOP to address EDB and DBCP by SW-846 Method 8011)/TBD/TBD	Definitive	Groundwater and aqueous field QC samples – EDB and DBCP	GC/Electron Capture Detector (ECD)	TBD	TBD
TBD	TBD (subject SOP to address SVOCs by SW-846 Method 8270D)/TBD/TBD	Definitive	Groundwater and aqueous field QC samples – SVOCs	GC/MS	TBD	TBD
TBD	TBD (subject SOP to address Pesticides by SW-846 Method 8081B)/TBD/TBD	Definitive	Groundwater and aqueous field QC samples – Pesticides	GC/ECD	TBD	TBD
TBD	TBD (subject SOP to address PCBs by SW-846 Method 8082A)/TBD/TBD	Definitive	Groundwater and aqueous field QC samples – PCBs	GC/ECD	TBD	TBD
TBD	TBD (subject SOP to address Herbicides by SW-846 Method 8151A)/TBD/TBD	Definitive	Groundwater and aqueous field QC samples – Herbicides	GC/ECD	TBD	TBD

Lab SOP Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
TBD	TBD (subject SOP to address Dioxins/Furans by SW-846 Method 8280B)/TBD/TBD	Definitive	Groundwater and aqueous field QC samples – Dioxins/Furans	High-Resolution GC/ Low-Resolution MS (HRGC/LRMS)	TBD	TBD
TBD	TBD (subject SOP to address Metals by SW-846 Method 6020A)/TBD/TBD	Definitive	Groundwater and aqueous field QC samples – Metals	ICP/MS	TBD	TBD
TBD	TBD (subject SOP to address Mercury by SW-846 Method 7470A or 7472)/TBD/TBD	Definitive	Groundwater and aqueous field QC samples – Mercury	Cold Vapor Atomic Absorption (CVAA) Spectrophotometer or Flow Injection Mercury Analyzer or Anodic Stripping Voltammetry (ASV)	TBD	TBD
TBD	TBD (subject SOP to address Total and Amenable Cyanide by SW-846 Method 9012B)/TBD/TBD	Definitive	Groundwater and aqueous field QC samples – Total and Amenable Cyanide	Automated Ion Analyzer or Spectrophotometer	TBD	TBD
TBD	TBD (subject SOP to address Extractable Sulfides by SW-846 Method 9031)/TBD/TBD	Definitive	Groundwater and aqueous field QC samples – Extractable Sulfides	Buret	TBD	TBD
TBD	TBD (subject SOP to address Total Phenols by SW-846 Method 9066 or 9067)/TBD/TBD	Definitive	Groundwater and aqueous field QC samples – Total Phenols	Colorimeter or Spectrophotometer	TBD	TBD
Enhanced MNA Parameters						
TBD	TBD (subject SOP to address Dissolved Gases by USEPA Method RSK-175 Modified)/TBD/TBD	Screening	Groundwater and aqueous field QC samples – Dissolved Gases	GC/Flame Ionization Detector (FID)	TBD	TBD
TBD	TBD (subject SOP to address Metabolic Acids [Volatile Fatty Acids] by Proprietary Method)/TBD/TBD	Screening	Groundwater and aqueous field QC samples – Metabolic Acids	Ion Chromatography (IC)	TBD	TBD

Lab SOP Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
TBD	TBD (subject SOP to address Anions by SW-846 Method 9056A)/TBD/TBD	Screening	Groundwater and aqueous field QC samples – Anions	IC	TBD	TBD
TBD	TBD (subject SOP to address TOC by SW-846 Method 9060A)/TBD/TBD	Screening	Groundwater and aqueous field QC samples – TOC	TOC Analyzer	TBD	TBD
TBD	TBD (subject SOP to address Dissolved Sulfide by Standard Method (SM) 4500SF)/TBD/TBD	Screening	Groundwater and aqueous field QC samples – Dissolved Sulfide	Buret	TBD	TBD
TBD	TBD (subject SOP to address Alkalinity by SM 2320B)/TBD/TBD	Screening	Groundwater and aqueous field QC samples – Alkalinity	Buret/pH Meter	TBD	TBD

SAP WORKSHEET NO. 24 -- ANALYTICAL INSTRUMENT CALIBRATION TABLE

(UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference[1]
GC/MS VOCs	Tune Verification – Bromofluoro-benzene (BFB)	Prior to Initial Calibration (ICAL) and at the beginning of each 12-hour analytical sequence.	Must meet the ion abundance criteria required by the method. No samples may be accepted without a valid tune.	TBD	TBD	TBD
	ICAL – A minimum of a five-point calibration curve is prepared for all target analytes	Perform after major instrument maintenance and when Continuing Calibration Verification (CCV) is out of criteria, prior to sample analysis.	The average response factor (RF) for System Performance Check Compound (SPCCs) must be ≥ 0.30 for chlorobenzene and 1,1,2,2-tetrachloroethane, ≥ 0.1 for chloromethane, bromoform, and 1,1-dichloroethane. The relative standard deviation (RSD) for RFs for calibration check compounds (CCCs) must be ≤ 30%; and RSD for each analyte must be ≤ 15%, or the linear regression correlation coefficient (r) must be ≥ 0.995; or the coefficient of determination (r^2) must be ≥ 0.99 (at least six standards).	TBD	TBD	
	Initial Calibration Verification (ICV) – Second source	Once after each ICAL, prior to beginning a sample run.	The percent recovery (%R) of all target analytes must be within 80-120% of true value.	TBD	TBD	
	Retention Time (RT) Window Position Establishment	Once per ICAL for each target analyte and surrogate.	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used.	TBD	TBD	
	Evaluation of Relative Retention Times (RRTs)	With each sample.	RRT of each target analyte must be within ± 0.06 RRT units.	TBD	TBD	
	CCV	Perform one per 12-hour analysis period after tune and before sample analysis.	The mean RF for SPCCs must be ≥ 0.30 for chlorobenzene and 1,1,2,2-tetrachloroethane, ≥ 0.1 for chloromethane, bromoform, and 1,1-dichloroethane. The percent difference or percent drift (%D) for all target compounds and surrogates must be ≤ 20%.	TBD	TBD	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference[1]
GC/ECD EDB and DBCP	ICAL – A minimum five-point calibration is required.	Calibrate the instrument when it is received and after a major change or if the daily calibration fails.	The %RSD must be ≤20%, or r must be ≥ 0.995, or r^2 must be ≥ 0.99 (minimum of six points required for second order).	TBD	TBD	TBD
	ICV	Once after each ICAL.	The %R of all target analytes must be within 80-120% of true value.	TBD	TBD	
	CCV	Analyze standard at the beginning and end of sequence and every 10 field samples.	The %D of all target analytes must be ≤ 20 %.	TBD	TBD	
GC/MS SVOCs	Tuning	Prior to ICAL and at the beginning of each 12-hour analytical sequence.	Must meet the ion abundance criteria required by the method. No samples may be accepted without a valid tune.	TBD	TBD	TBD
	Breakdown Check (DDT only)	At the beginning of each 12-hour analytical sequence.	The degradation must be ≤ 20 % for DDT to verify inertness of the injection port.	TBD	TBD	
	ICAL – A minimum of a 5-point calibration curve is analyzed	After major maintenance; upon second consecutive failure of CCV standard.	SPCC RFs must be above criteria in SOP; % RSD must be ≤ 30 % for the CCCs; and Option 1: %RSD must be ≤15% for each target analyte. If not met, Option 2: r must be > 0.99. If not met, Option 3: r^2 must be > 0.99 (at least six standards).	TBD	TBD	
	ICV – Second source	Once after each ICAL, prior to beginning a sample run.	The % R of all target analytes must be within 80-120% of the true value. SPCC RFs must be above criteria in SOP.	TBD	TBD	
	RT Window Position Establishment	Once per ICAL for each target analyte and surrogate.	Position will be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used.	TBD	TBD	
	Evaluation of RRTs	With each sample.	RRT of each target analyte must be within ± 0.06 RRT units.	TBD	TBD	
	CCV	Daily before analysis and every 12 hours after the analysis of the tuning standard.	SPCC RFs must be above criteria in SOP; All target analytes and surrogates must be ≤ 20% D.	TBD	TBD	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference[1]
GC/ECD Pesticides/PCBs	Breakdown Check (pesticides only)	At the beginning of each 12-hour period, *prior to analysis of* samples.	The degradation must be ≤ 15% of the total for both DDT and endrin to verify the inertness of the *injection* port.	TBD	TBD	TBD
	ICAL – A minimum of a 5-point calibration curve is analyzed	After major instrument maintenance; upon failure of second consecutive CCV.	%RSD must be ≤ 20 % for all target analytes. If not met (Option 2): r must be ≥ 0.995.	TBD	TBD	
	ICV – Second source	Once after each ICAL, prior to beginning a sample run.	The % R of all target analytes must be within 80-120% of true value.	TBD	TBD	
	CCV	After each 10 field samples and at the end of the analytical sequence.	The %D of all target analytes must be ≤20%.	TBD	TBD	
GC/ECD Herbicides	ICAL - A minimum of a five-point calibration is prepared for all target analytes	Upon instrument receipt, major instrument change, or when the CCV does not meet criteria.	r^2 must be ≥ 0.99 for six-point calibration.	TBD	TBD	TBD
	ICV – Second Source	Once after each ICAL prior to sample analysis.	The % R of all target analytes must be within 80-120% of true value.	TBD	TBD	
	CCV	Analyze standard at the beginning and end of sequence and after every 10 samples.	The % R of all target analytes must be within 80-120% of true value.	TBD	TBD	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference[1]
HRGC/LRMS Dioxins/ Furans	Tune/Mass Resolution Check	At the beginning and the end of each 12-hour period of analysis.	Static resolving power must be ≥ 10,000 (10% valley) for identified masses per method and lock-mass ion between lowest and highest masses for each descriptor and level of reference must be ≤ 10% full-scale deflection, per method.	TBD	TBD	TBD
	GC Column Performance Check Solution	Prior to ICAL or CCV.	Peak separation between 2,3,7,8-TCDD and other TCDD isomers must result in a valley of ≤ 25% per method; and identification of all first and last eluters of the eight homologue RT windows and documentation by labeling (F/L) on the chromatogram; and absolute RTs for switching from one homologous series to the next ≥ 10 seconds for all components of the mixture.	TBD	TBD	
	ICAL – a minimum of a five-point calibration is prepared for all target analytes	Prior to sample analysis, as needed by the failure of CCV, and when a new lot is used as a standard source.	Ion abundance ratios must be within limits specified in SOP; and signal-to-noise ratio (S/N) must be ≥10 for all target analyte ions; and RSD must be ≤ 20% for RFs for all 17 unlabelled standards and 9 labeled ISs.	TBD	TBD	
	CCV	At the beginning of each 12-hour period, and at the end of each analytical sequence.	Ion abundance ratios must be in accordance with SOP; and RF (unlabelled standards) must be ≤ 20% of average RF from ICAL; and RF (labeled standards) must be ≤ 30%D of average RF from ICAL.	TBD	TBD	
ICP-MS Metals	Tuning	Prior to ICAL.	Mass calibration must be ≤ 0.1 atomic mass units (amu) from the true value. Resolution must be <0.9 amu peak width at 10% peak height. For stability, RSD must be ≤ 5% for at least four replicate analyses.	TBD	TBD	TBD
	ICAL – A minimum of a one-point calibration curve is analyzed	Daily ICAL prior to sample analysis.	When calibration is performed using multi-level standards, r must be ≥ 0.995.	TBD	TBD	
	ICV – Second source	Once after each ICAL, prior to beginning a sample run.	The %R of all target analytes must be within 90-110% of the true value.	TBD	TBD	
	Initial Calibration Blank (ICB)	Before beginning a sample sequence.	No analytes detected > LOD.	TBD	TBD	
	CCV	After each 10 field samples and at the end of the analytical sequence.	The %R of all target analytes must be within 90-110% of the true value.	TBD	TBD	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference[1]
ICP-MS Metals (cont.)	Continuing Calibration Blank (CCB)	After the initial CCV, after every 10 samples, and at the end of the sequence.	No analyte detected > LOD.	TBD	TBD	TBD
	Low-Level Check Standard	Daily after ICAL and before samples.	The %R of all target analytes must be within 80-120 % of the true value.	TBD	TBD	
	Interference Check Standards (ICSs) – ICSA and ICSB	At the beginning of an analytical run.	The absolute value of ICS A recoveries must be <LOD and ICS B %Rs must be within 80-120% of the true value.	TBD	TBD	
CVAA or Mercury Analyzer or ASV Mercury	ICAL – A minimum of a five-point calibration curve is analyzed	Daily ICAL prior to sample analysis.	r must be ≥0.995.	TBD	TBD	TBD
	ICV - Second source	Once after each ICAL, prior to beginning a sample run.	The %R of mercury must be within 90-110% of the true value.	TBD	TBD	
	ICB	Before beginning a sample sequence.	No mercury detected > LOD.	TBD	TBD	
	CCV	After each 10 field samples and at the end of the analytical sequence.	The %R of mercury must be within 90-110% of the true value.	TBD	TBD	
	CCB	After the initial CCV, after every 10 samples, and at the end of the sequence.	No mercury detected > LOD.	TBD	TBD	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference[1]
Automated Ion Analyzer or Spectrophoto-meter Total and Amenable Cyanide	ICAL – A minimum of a six-point calibration curve is analyzed	Daily prior to sample analysis.	r must be ≥0.995. All calibration standards must be distilled if samples are expected to contain sulfides.	TBD	TBD	TBD
	ICV – Second source	At the start of every sequence prepared fresh daily (undistilled), prior to sample analysis.	The %R of analyte must be within 85-115% of the true value.	TBD	TBD	
	ICV (distilled, high and low)	Once per ICAL.	The %R must be within 85-115% of true value.	TBD	TBD	
	ICB	After the ICV (undistilled).	The target analyte must be < LOQ.	TBD	TBD	
	Low-Level Check Standard	At the beginning and end of the analytical sequence.	The %R of analyte must be within 80-120% of the true value.	TBD	TBD	
	CCV	After each 10 field samples (undistilled) and at the end of the analytical sequence.	The %R of analyte must be within 85-115% of the true value.	TBD	TBD	
Buret Extractable Sulfides	Standardization	Daily prior to sample analysis.	Standardized using 0.25 Normal sodium thiosulfate solution.	TBD	TBD	TBD
	ICV – Second Source	After ICAL and prior to sample analysis.	The %R must be within 80-120% of true value.	TBD	TBD	
	CCV	At beginning and end of each run sequence and after every 20 samples.	The %R must be within 80-120% of true value.	TBD	TBD	
Colorimeter or Spectrophoto-meter Total Phenols	ICAL – A minimum 3 point calibration is required.	Calibrate the instrument every hour of continuous service.	The %RSD must be ≤20%, or r must be ≥ 0.995, or r^2 must be ≥ 0.99 (minimum of 6 points required for second order).	TBD	TBD	TBD

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference[1]
GC/FID Dissolved Gases (Methane, Ethane, Ethene)	ICAL – a minimum of a five-point calibration is prepared for all target analytes	Upon instrument receipt, major instrument change, or when the CCV does not meet criteria.	The RSD for RFs for each target analyte must be ≤ 20%, or r must be ≥ 0.995.	TBD	TBD	TBD
	ICV – Second Source	Once after each ICAL prior to sample analysis.	The %R of all analytes must be within 80-120% of true value.	TBD	TBD	
	ICB	Before beginning a sample sequence.	All target analytes must be ≤ ½ LOQ.	TBD	TBD	
	CCV	Analyze standard at the beginning and end of sequence and after every 10 samples.	The %R of all target analytes must be within 80-120% of true value.	TBD	TBD	
	CCB	After the initial CCV, after every 20 samples, and at the end of the sequence.	All target analytes must be ≤ ½ LOQ.	TBD	TBD	
GC/FID Dissolved Gases (Carbon Dioxide)	ICAL – a minimum of a five-point calibration is prepared for all target analytes	Upon instrument receipt, major instrument change, or when the CCV does not meet criteria.	The RSD for RFs for each target analyte must be ≤ 20%, or r must be ≥ 0.995.	TBD	TBD	TBD
	ICV – Second Source	Once after each ICAL prior to sample analysis.	The %R of all target analytes must be within 80-120% of true value.	TBD	TBD	
	CCV	Analyze standard at the beginning and end of sequence and after every 10 samples.	The %R of all target analytes must be within 80-120% of true value.	TBD	TBD	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference[1]
IC Metabolic Acids	ICAL – a minimum of a seven-point calibration is prepared	Upon instrument receipt, major instrument change, or when the CCV does not meet criteria.	r^2 must be ≥ 0.99.	TBD	TBD	TBD
	ICV – Second Source	Once after each ICAL prior to sample analysis.	The %R of the target analytes must be within 85-115% of true value.	TBD	TBD	
	CCV	Analyze standard at the beginning and end of sequence and after every 20 samples.	The %R of the target analytes must be within 85-115% of true value.	TBD	TBD	
	CCB	After the initial CCV, after every 20 samples, and at the end of the sequence.	All target analytes must be ≤ LOQ.	TBD	TBD	
IC Anions	ICAL – A minimum of a three-point calibration is prepared and establish linear calibration range for all target analytes	Upon instrument receipt, major instrument change, or when the CCV does not meet criteria.	r must be ≥ 0.995.	TBD	TBD	TBD
	ICV – Second Source	Once after each ICAL prior to sample analysis.	The %R must be within 90-110% of true value and RTs must be within appropriate windows.	TBD	TBD	
	CCV	Analyze standard at the beginning and end of sequence and after every 10 samples.	The %R must be within 90-110% of true value and all target analytes must be within established RT windows.	TBD	TBD	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference[1]
TOC Analyzer TOC	ICAL – a minimum of a 5-point calibration is prepared	Upon instrument receipt, major instrument change, or when the CCV does not meet criteria.	The RSD for RFs for the target analyte must be ≤ 20%, or r must be ≥ 0.995.	TBD	TBD	TBD
	ICV – Second Source	Once after each ICAL prior to sample analysis.	The %R must be within 90-110% of true value.	TBD	TBD	
	CCV	Analyze standard at the beginning and end of sequence and after every 10 samples.	The %R must be within 90-110% of true value.	TBD	TBD	
Buret Dissolved Sulfide	Standardization	Daily prior to sample analysis.	Standardized using 0.25 Normal sodium thiosulfate solution.	TBD	TBD	TBD
	ICV – Second Source	After ICAL and prior to sample analysis.	The %R must be within 80-120% of true value.	TBD	TBD	
	CCV	At beginning and end of each run sequence and after every 10 samples.	The %R must be within 80-120% of true value.	TBD	TBD	
Buret / pH Meter Alkalinity	Standardization	Daily prior to sample analysis.	Standardize using pH 7 and pH 4, adjust as needed, and reread. Must be within SOP limits (i.e., ± 0.05 Standard Units) to proceed.	TBD	TBD	TBD
	Buffer check	Check every 3 hours.	Must be within SOP limits (i.e., ± 0.20 Standard Units).	TBD	TBD	

1 Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet No. 23).

SAP WORKSHEET NO. 25 -- ANALYTICAL INSTRUMENT AND EQUIPMENT MAINTENANCE, TESTING, AND INSPECTION TABLE

(UFP-QAPP Manual Section 3.2.3)

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
GC/MS	TBD	VOCs	TBD	Prior to ICAL and/or as necessary.	Acceptable ICAL and CCV.	Correct the problem and repeat ICAL or CCV.	TBD	TBD
GC/ECD	TBD	EDB and DBCP	TBD	Prior to ICAL and/or as necessary.	Acceptable ICAL and CCV.	Correct the problem and repeat ICAL or CCV.	TBD	TBD
GC/MS	TBD	SVOCs	TBD	Prior to ICAL and/or as necessary.	Acceptable ICAL and CCV.	Correct the problem and repeat ICAL or CCV.	TBD	TBD
GC/MS	TBD	Low-Level PAHs	TBD	Prior to ICAL and/or as necessary.	Acceptable ICAL and CCV.	Correct the problem and repeat ICAL or CCV.	TBD	TBD
GC/ECD	TBD	Pesticides	TBD	Prior to ICAL and/or as necessary.	Acceptable ICAL and CCV.	Correct the problem and repeat ICAL or CCV.	TBD	TBD
GC/ECD	TBD	PCBs	TBD	Prior to ICAL and/or as necessary.	Acceptable ICAL and CCV.	Correct the problem and repeat ICAL or CCV.	TBD	TBD
GC/ECD	TBD	Herbicides	TBD	Prior to ICAL and/or as necessary.	Acceptable ICAL and CCV.	Correct the problem and repeat ICAL or CCV.	TBD	TBD

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
HRGC/LRMS	TBD	Dioxins/ Furans	TBD	Prior to ICAL and/or as necessary.	Acceptable ICAL and CCV.	Correct the problem and repeat ICAL or CCV.	TBD	TBD
	TBD	Metals	TBD	Prior to ICAL and/or as necessary.	Acceptable ICAL and CCV.	Correct the problem and repeat ICAL or CCV.	TBD	TBD
CVAA or Mercury Analyzer or ASV	TBD	Mercury	TBD	Prior to ICAL and/or as necessary.	Acceptable ICAL and CCV.	Correct the problem and repeat ICAL or CCV.	TBD	TBD
Analyzer or Spectrophoto-meter	TBD	Total and Amenable Cyanide	TBD	Prior to ICAL and/or as necessary.	Acceptable ICAL and CCV.	Correct the problem and repeat ICAL or CCV.	TBD	TBD
Buret	TBD	Extractable Sulfides	TBD	Prior to ICAL and/or as necessary.	Acceptable ICAL and CCV.	Correct the problem and repeat ICAL or CCV.	TBD	TBD
Colorimeter or Spectrophoto-meter	TBD	Total Phenols	TBD	Prior to ICAL and/or as necessary.	Acceptable ICAL and CCV.	Correct the problem and repeat ICAL or CCV.	TBD	TBD
GC/FID	TBD	Dissolved Gases (Methane, Ethane, Ethene)	TBD	Prior to ICAL and/or as necessary.	Acceptable ICAL and CCV.	Correct the problem and repeat ICAL or CCV.	TBD	TBD
GC/FID	TBD	Dissolved Gases (Carbon Dioxide)	TBD	Prior to ICAL and/or as necessary.	Acceptable ICAL and CCV.	Correct the problem and repeat ICAL or CCV.	TBD	TBD
IC	TBD	Metabolic Acids	TBD	Prior to ICAL and/or as necessary.	Acceptable ICAL and CCV.	Correct the problem and repeat ICAL or CCV.	TBD	TBD

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
IC	TBD	Anions	TBD	Prior to ICAL and/or as necessary.	Acceptable ICAL and CCV.	Correct the problem and repeat ICAL or CCV.	TBD	TBD
TOC Analyzer	TBD	TOC	TBD	Prior to ICAL and/or as necessary.	Acceptable ICAL and CCV.	Correct the problem and repeat ICAL or CCV.	TBD	TBD
Buret	TBD	Dissolved Sulfide	TBD	Prior to ICAL and/or as necessary.	Acceptable ICAL and CCV.	Correct the problem and repeat ICAL or CCV.	TBD	TBD
Buret/pH Meter	TBD	Alkalinity	TBD	Prior to ICAL and/or as necessary.	Acceptable ICAL and CCV.	Correct the problem and repeat ICAL or CCV.	TBD	TBD

1 Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet No. 23).

SAP WORKSHEET NO. 26 -- SAMPLE HANDLING SYSTEM

(UFP-QAPP Manual Appendix A)

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): FOL or designee/CA Monitoring Contractor
Sample Packaging (Personnel/Organization): FOL or designee/CA Monitoring Contractor
Coordination of Shipment (Personnel/Organization): FOL or designee/CA Monitoring Contractor
Type of Shipment/Carrier: Overnight courier service (e.g., FedEx)
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Sample Custodians/TBD
Sample Custody and Storage (Personnel/Organization): Sample Custodians/TBD
Sample Preparation (Personnel/Organization): Preparation Laboratory Staff/TBD
Sample Determinative Analysis (Personnel/Organization): GC, GC/MS, Metals, and Wet Chemistry Laboratory sections/TBD
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): A minimum of 45 days from sample receipt
Sample Extract/Digestate Storage (No. of days from extraction/digestion): A minimum of 90 days from submittal of final report
Biological Sample Storage (No. of days from sample collection): NA
SAMPLE DISPOSAL
Personnel/Organization: Sample Custodians/TBD

SAP WORKSHEET NO. 27 – SAMPLE CUSTODY REQUIREMENTS TABLE

(UFP-QAPP Manual Section 3.3.3)

Field Sample Custody Procedures

Following sample collection into the appropriate bottleware, all samples will be immediately placed on ice in a cooler. The glass sample containers will be enclosed in bubble wrap to protect the bottleware during shipment. The cooler will be secured using strapping tape along with a signed custody seal. Sample coolers will be delivered to a local courier location for priority overnight delivery to the Subcontracted Laboratory for analysis. Samples will be preserved as appropriate based on the analytical method. The laboratory will provide pre-preserved sample containers for sample collection. Samples will be maintained at less than or equal to 6 °C until delivery to the laboratory. Proper custody procedures will be followed throughout all phases of sample collection and handling.

Chain-of-custody protocols will be used throughout sample handling to establish the integrity of sample containers. These protocols will be used to demonstrate that the samples were handled and transferred in a manner that would eliminate possible tampering.

Chain-of-Custody Procedures

After collection, each sample will be maintained in the sampler's custody until formally transferred to another party (e.g., FedEx). For all samples collected, chain-of-custody forms will document the date and time of sample collection, the sampler's name, and the names of all others who subsequently held custody of the sample. Specifications for chemical analyses will also be documented on the chain-of-custody form.

Laboratory Sample Custody Procedures

Chain-of-custody requirements are also documented with instructions contained in each shipment from the laboratory, which will be provided by the Subcontracted Laboratory at the time of laboratory selection.

SAP WORKSHEET NO. 28 – LABORATORY QC SAMPLES TABLE

(UFP-QAPP Manual Section 3.4)

Matrix	Groundwater and Aqueous Field QC Samples
Analytical Group	VOCs
Analytical Method/ SOP Reference	SW-846 8260B/TBD

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	(MPCs
Method Blank	One per batch of 20 samples or less per matrix.	All target analytes must be ≤ ½ LOQ, except common lab contaminants, which must be < LOQ.	TBD	TBD	Bias/Contamination	Same as QC Acceptance Limits.
Surrogates	All field and QC samples. The number of surrogates is laboratory specific (TBD).	Percent recovery (%R) must be within laboratory statistically-derived or Department of Defense (DoD) Quality Systems Manual (QSM) acceptance limits (Version 4.1 or current).	TBD	TBD	Accuracy/Bias	Same as QC Acceptance Limits.
Laboratory Control Sample (LCS) [Laboratory Control Sample Duplicate (LCSD) not required]	One per batch of 20 samples or less per matrix.	%Rs must be within laboratory statistically derived or DoD QSM acceptance limits (Version 4.1 or current). RPD must be ≤ 30% (for LCS/LCSD, if analyzed).	TBD	TBD	Accuracy/Bias Precision also, if LCSD is analyzed	Same as QC Acceptance Limits.
Internal Standards (IS)	Every field sample, standard, and QC sample. The number of ISs is laboratory specific (TBD).	RTs for each IS must be within ± 30 seconds and the responses must be within -50% to +100% of ICAL mid-point standard.	TBD	TBD	Accuracy/Bias	Same as QC Acceptance Limits.
MS/MSD	One per batch of 20 samples or less per matrix.	%R should be within laboratory statistically derived or DoD QSM acceptance limits (Version 4.1 or current). RPD between MS and MSD should be ≤ 30%.	TBD	TBD	Accuracy/Bias Precision	Same as QC Acceptance Limits.
Results between the DL and LOQ	NA.	Apply "J" qualifier to results detected between DL and LOQ.	None	TBD	Accuracy	Same as QC Acceptance Limits.

Matrix	Groundwater and Aqueous Field QC Samples
Analytical Group	EDB and DBCP
Analytical Method/ SOP Reference	SW-846 8011/TBD

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria (MPCs)
Method Blank	One per batch of 20 samples or less per matrix.	All target analytes must be ≤ ½ LOQ.	TBD	TBD	Bias/Contamination	Same as QC Acceptance Limits.
LCS (LCSD Not Required)	One per batch of 20 samples or less per matrix.	%Rs must be within laboratory statistically derived or DoD QSM acceptance limits (Version 4.1 or current). RPD must be ≤ 30% (for LCS/LCSD, if analyzed).	TBD	TBD	Accuracy/Bias Precision also, if LCSD is analyzed	Same as QC Acceptance Limits.
MS/MSD	One per batch of 20 samples or less per matrix.	%Rs should be within laboratory statistically derived or DoD QSM acceptance limits (Version 4.1 or current). RPD between MS and MSD should be ≤ 30%.	TBD	TBD	Accuracy/Bias Precision	Same as QC Acceptance Limits.
Second Column Confirmation	All positive results must be confirmed.	Results between primary and second column must be RPD ≤ 40%. Report the higher of the two concentrations, unless there is interference.	TBD	TBD	Accuracy/Bias Precision	Same as QC Acceptance Limits.
Results between the DL and LOQ	NA.	Apply "J" qualifier to results detected between DL and LOQ.	None	TBD	Accuracy	Same as QC Acceptance Limits.

Matrix	Groundwater and Aqueous *Field QC Samples*
Analytical Group	SVOCs
Analytical Method/ SOP Reference	SW-846 8270D/TBD

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria (MPCs)
Method Blank	One per batch of 20 samples or less per matrix.	All target analytes must be ≤ ½ LOQ, except common lab contaminants, which must be < LOQ.	TBD	TBD	Bias/Contamination	Same as QC Acceptance Limits.
Surrogates	All field and QC samples. The number of surrogates are laboratory specific (TBD).	%Rs must be within laboratory statistically derived or DoD QSM acceptance limits (Version 4.1 or current).	TBD	TBD	Accuracy/Bias	Same as QC Acceptance Limits.
LCS (LCSD Not Required)	One per batch of 20 samples or less per matrix.	%Rs must be within laboratory statistically derived or DoD QSM acceptance limits (Version 4.1 or current). RPD must be ≤ 30% (for LCS/LCSD, if analyzed).	TBD	TBD	Accuracy/Bias Precision also, if LCSD is analyzed	Same as QC Acceptance Limits.
MS/MSD	One per batch of 20 samples or less per matrix.	%Rs should be within laboratory statistically derived or DoD QSM acceptance limits (Version 4.1 or current). RPD between MS and MSD should be ≤ 30%.	TBD	TBD	Accuracy/Bias Precision	Same as QC Acceptance Limits.
Results between the DL and LOQ	NA.	Apply "J" qualifier to results detected between DL and LOQ.	None	TBD	Accuracy	Same as QC Acceptance Limits.

Matrix	Groundwater and Aqueous Field QC Samples
Analytical Group	Pesticides
Analytical Method/ SOP Reference	SW-846 8081B/TBD

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria (MPCs)
Method Blank	One per batch of 20 samples or less per matrix.	All target analytes must be ≤ ½ LOQ.	TBD	TBD	Bias/Contamination	Same as QC Acceptance Limits.
Surrogates	All field and QC samples. The number of surrogates are laboratory specific (TBD).	%Rs must be within laboratory statistically derived or DoD QSM acceptance limits (Version 4.1 or current).	TBD	TBD	Accuracy/Bias	Same as QC Acceptance Limits.
LCS (LCSD Not Required)	One per batch of 20 samples or less per matrix.	%Rs must be within laboratory statistically derived or DoD QSM acceptance limits (Version 4.1 or current). RPD must be ≤ 30% (for LCS/LCSD, if analyzed).	TBD	TBD	Accuracy/Bias Precision also, if LCSD is analyzed	Same as QC Acceptance Limits.
MS/MSD	One per batch of 20 samples or less per matrix.	%Rs should be within laboratory statistically derived or DoD QSM acceptance limits (Version 4.1 or current). RPD between MS and MSD should be ≤ 30%.	TBD	TBD	Accuracy/Bias Precision	Same as QC Acceptance Limits.
Second Column Confirmation	All positive results must be confirmed.	Results between primary and second column - RPD must be ≤ 40%.	TBD	TBD	Accuracy/Bias Precision	Same as QC Acceptance Limits.
Results between the DL and LOQ	NA.	Apply "J" qualifier to results detected between DL and LOQ.	None	TBD	Accuracy	Same as QC Acceptance Limits.

Matrix	Groundwater and Aqueous Field QC Samples
Analytical Group	PCBs
Analytical Method/ SOP Reference	SW-846 8082A/ TBD

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria (MPCs)
Method Blank	One per batch of 20 samples or less per matrix.	All target analytes must be ≤ ½ LOQ.	TBD	TBD	Bias Contamination	Same as QC Acceptance Limits.
Surrogates	All field and QC samples. The number of surrogates are laboratory specific (TBD).	%Rs must be within laboratory statistically derived or DoD QSM acceptance limits (Version 4.1 or current).	TBD	TBD	Accuracy/Bias	Same as QC Acceptance Limits.
LCS (LCSD Not Required)	One per batch of 20 samples or less per matrix.	%Rs must be within laboratory statistically derived or DoD QSM acceptance limits (Version 4.1 or current). RPD must be ≤ 30% (for LCS/LCSD, if analyzed).	TBD	TBD	Accuracy/Bias Precision also, if LCSD is analyzed	Same as QC Acceptance Limits.
MS/MSD	One per batch of 20 samples or less per matrix.	%Rs should be within laboratory statistically derived or DoD QSM acceptance limits (Version 4.1 or current). RPD between MS and MSD should be ≤ 30%.	TBD	TBD	Accuracy/Bias Precision	Same as QC Acceptance Limits.
Second Column Confirmation	All positive results must be confirmed.	Results between primary and second column - RPD must be ≤ 40%.	TBD	TBD	Accuracy/Bias Precision	Same as QC Acceptance Limits.
Results between the DL and LOQ	NA.	Apply "J" qualifier to results detected between DL and LOQ.	None	TBD	Accuracy	Same as QC Acceptance Limits.

Matrix	Groundwater and Aqueous Field QC Samples
Analytical Group	Herbicides
Analytical Method/ SOP Reference	SW-846 8151A/TBD

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria (MPCs)
Method Blank	One per batch of 20 samples or less per matrix.	All target analytes must be ≤ ½ LOQ.	TBD	TBD	Bias Contamination	Same as QC Acceptance Limits.
Surrogates	All field and QC samples. The number of surrogates are laboratory specific (TBD).	%Rs must be within laboratory statistically derived or DoD QSM acceptance limits (Version 4.1 or current).	TBD	TBD	Accuracy/Bias	Same as QC Acceptance Limits.
LCS (LCSD Not Required)	One per batch of 20 samples or less per matrix.	%Rs must be within laboratory statistically derived or DoD QSM acceptance limits (Version 4.1 or current). RPD must be ≤ 30% (for LCS/LCSD, if analyzed).	TBD	TBD	Accuracy/Bias Precision also, if LCSD is analyzed	Same as QC Acceptance Limits.
IS	Every field sample, standard, and QC sample. The number of ISs are laboratory specific (TBD).	RTs for each IS must be within ± 30 seconds and the responses must be within -50% to +100% of ICAL mid-point standard.	TBD	TBD	Accuracy/Bias	Same as QC Acceptance Limits.
MS/MSD	One per batch of 20 samples or less per matrix.	%Rs should be within laboratory statistically derived or DoD QSM acceptance limits (Version 4.1 or current). RPD between MS and MSD should be ≤ 30%.	TBD	TBD	Accuracy/Bias Precision	Same as QC Acceptance Limits.
Second Column Confirmation	All positive results must be confirmed.	Results between primary and second column - RPD must be ≤ 40%.	TBD	TBD	Accuracy/Bias Precision	Same as QC Acceptance Limits.
Results between the DL and LOQ	NA.	Apply "J" qualifier to results detected between DL and LOQ.	None	TBD	Accuracy	Same as QC Acceptance Limits.

Matrix	Groundwater and Aqueous Field QC Samples
Analytical Group	Dioxins/Furans
Analytical Method/ SOP Reference	SW-846 8280B/TBD

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria (MPCs)
Method Blank	One per batch of 20 samples or less per matrix.	All target analytes must be ≤ LOQ (OCDD is considered a common laboratory contaminant and treated accordingly).	TBD	TBD	Bias Contamination	Same as QC Acceptance Limits.
IS	Every field sample, standard, and QC sample.	The %R for each IS must be within 40-135%, per the method. The %R must be within 40-135%, per DoD QSM.	TBD	TBD	Accuracy/Bias	Same as QC Acceptance Limits.
LCS (LCSD Not Required)	One per batch of 20 samples or less per matrix.	%Rs must be within laboratory statistically derived or DoD QSM acceptance limits (Version 4.1 or current). RPD must be ≤ 20% (for LCS/LCSD, if analyzed).	TBD	TBD	Accuracy/Bias Precision also, if LCSD is analyzed	Same as QC Acceptance Limits.
MS/MSD	One per batch of 20 samples or less per matrix.	%Rs should be within laboratory statistically derived or DoD QSM acceptance limits (Version 4.1 or current). RPD between MS and MSD should be ≤ 20%.	TBD	TBD	Accuracy/Bias Precision	Same as QC Acceptance Limits.
Duplicate Sample (if no MSD or LCSD)	One per batch of 20 or fewer samples per matrix.	RPD between the original sample and duplicate must be ≤25%.	TBD	TBD	Precision	Same as QC Acceptance Limits.
Results between the EDL and LOQ	NA.	Apply "J" qualifier to results detected between EDL and LOQ.	None	TBD	Accuracy	Same as QC Acceptance Limits.

Matrix	Groundwater and Aqueous Field QC Samples
Analytical Group	Metals
Analytical Method/ SOP Reference	SW-846 6020A/ TBD

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria (MPCs)
Method Blank	One per batch of 20 samples or less per matrix.	All target analytes must be ≤ ½ LOQ, except common lab contaminants, which must be < LOQ.	TBD	TBD	Bias Contamination	Same as QC Acceptance Limits.
IS	Every sample.	IS intensity must be within 30-120% of intensity of the IS in the ICAL.	TBD	TBD	Precision	Same as QC Acceptance Limits.
LCS (LCSD Not Required)	One per batch of 20 samples or less per matrix.	%Rs must be within laboratory statistically derived or DoD QSM acceptance limits (Version 4.1 or current). RPD must be ≤ 20% (for LCS/LCSD, if analyzed).	TBD	TBD	Accuracy/Bias Precision also, if LCSD is analyzed	Same as QC Acceptance Limits.
MS/MSD	One per batch of 20 samples or less per matrix.	%Rs should be within laboratory statistically derived or DoD QSM acceptance limits (Version 4.1 or current). RPD between MS and MSD should be ≤ 20%, if MSD is analyzed.	TBD	TBD	Accuracy/Bias Precision	Same as QC Acceptance Limits.
Duplicate Sample	One per batch of 20 or fewer samples per matrix (if MSD is not included).	RPD between duplicate samples should be ≤20%, if both results are >5x LOQ.	TBD	TBD	Precision	Same as QC Acceptance Limits.
ICP Serial Dilution	One per batch of 20 or fewer samples per matrix on failure of MS/MSD.	The 5-fold dilution result must agree within ± 10%D of the original sample result.	TBD	TBD	Accuracy / Bias Precision	Same as QC Acceptance Limits.
Post-Digestion Spike	When serial dilution test fails or when all analyte concentrations are <50 x LOD.	The %R must be within 75-125% of expected value to verify the absence of an interference. Spike addition should produce a concentration of 10-100x LOQ.	TBD	TBD	Accuracy / Bias	Same as QC Acceptance Limits.
Results between the DL and LOQ	NA.	Apply "J" qualifier to results detected between DL and LOQ.	None	TBD	Accuracy	Same as QC Acceptance Limits.

Matrix	Groundwater and Aqueous Field QC Samples
Analytical Group	Mercury
Analytical Method/ SOP Reference	SW-846 7470A or 7472/ TBD

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria (MPCs)
Method Blank	One per batch of 20 samples or less per matrix.	Target analyte must be ≤ ½ LOQ.	TBD	TBD	Bias Contamination	Same as QC Acceptance Limits.
LCS (LCSD Not Required)	One per batch of 20 samples or less per matrix.	%Rs must be within laboratory statistically derived or DoD QSM acceptance limits (Version 4.1 or current). RPD must be ≤ 20% (for LCS/LCSD, if analyzed).	TBD	TBD	Accuracy/Bias Precision also, if LCSD is analyzed	Same as QC Acceptance Limits.
MS/MSD	One per batch of 20 samples or less per matrix.	%Rs should be within laboratory statistically derived or DoD QSM acceptance limits (Version 4.1 or current). RPD between MS and MSD should be ≤ 20%.	TBD	TBD	Accuracy/Bias Precision	Same as QC Acceptance Limits.
Duplicate Sample	One per batch of 20 or fewer samples per matrix (if MSD is not included).	RPD between duplicate samples should be ≤20%, if both results are >5x LOQ.	TBD	TBD	Precision	Same as QC Acceptance Limits.
Results between the DL and LOQ	NA.	Apply "J" qualifier to results detected between DL and LOQ.	None	TBD	Accuracy	Same as QC Acceptance Limits.

Matrix	Groundwater and Aqueous Field QC Samples
Analytical Group	Total and Amenable Cyanide
Analytical Method/ SOP Reference	SW-846 9012B/TBD

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria (MPCs)
Method Blank	One per batch of 20 samples or less per matrix.	Target analyte must be ≤ ½ LOQ.	TBD	TBD	Bias Contamination	Same as QC Acceptance Limits.
LCS (LCSD Not Required)	One per batch of 20 samples or less per matrix.	%Rs must be within laboratory statistically derived or DoD QSM acceptance limits (Version 4.1 or current). RPD must be ≤ 20% (for LCS/LCSD, if analyzed).	TBD	TBD	Accuracy/Bias Precision also, if LCSD is analyzed	Same as QC Acceptance Limits.
MS/MSD	One per batch of 20 samples or less per matrix.	%Rs should be within 80-120%, if sample < 4x spike added. RPD between MS and MSD should be ≤ 20%.	TBD	TBD	Accuracy/Bias Precision	Same as QC Acceptance Limits.
Duplicate Sample	One per batch of 20 or fewer samples per matrix.	RPD between duplicate samples should be ≤20%, if both results are >5x LOQ; or within ± the LOQ, if the concentration is < 5x LOQ.	TBD	TBD	Precision	Same as QC Acceptance Limits.
Results between the DL and LOQ	NA.	Apply "J" qualifier to results detected between DL and LOQ.	None	TBD	Accuracy	Same as QC Acceptance Limits.

Matrix	Groundwater and Aqueous Field QC Samples
Analytical Group	Extractable Sulfides
Analytical Method/ SOP Reference	SW-846 9031/TBD

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria (MPCs)
Method Blank	One per batch of 20 samples or less per matrix.	Target analyte must be ≤ ½ LOQ.	TBD	TBD	Bias Contamination	Same as QC Acceptance Limits.
LCS	One per batch of 20 samples or less per matrix.	%Rs must be within laboratory statistically derived acceptance limits.	TBD	TBD	Accuracy/Bias	Same as QC Acceptance Limits.
MS/MSD	One per batch of 20 samples or less per matrix.	%Rs should be within laboratory statistically derived acceptance limits. RPD between MS and MSD should be ≤ 30%.	TBD	TBD	Accuracy/Bias Precision	Same as QC Acceptance Limits.
Results between the DL and LOQ	NA.	Apply "J" qualifier to results detected between DL and LOQ.	None	TBD	Accuracy	Same as QC Acceptance Limits.

Matrix	Groundwater and Aqueous Field QC Samples
Analytical Group	Total Phenols
Analytical Method/ SOP Reference	SW-846 9066 or 9067/ TBD

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria (MPCs)
Method Blank	One per batch of 20 samples or less per matrix.	All target analytes must be ≤ ½ LOQ.	TBD	TBD	Bias Contamination	Same as QC Acceptance Limits.
LCS	One per batch of 20 samples or less per matrix.	%Rs must be within laboratory statistically derived acceptance limits.	TBD	TBD	Accuracy/Bias	Same as QC Acceptance Limits.
MS/MSD	One per batch of 20 samples or less per matrix.	%Rs should be within laboratory statistically derived acceptance limits. RPD between MS and MSD should be ≤ 30%.	TBD	TBD	Accuracy/Bias Precision	Same as QC Acceptance Limits.
Results between the DL and LOQ	NA.	Apply "J" qualifier to results detected between DL and LOQ.	None	TBD	Accuracy	Same as QC Acceptance Limits.

Matrix	Groundwater and Aqueous Field QC Samples
Analytical Group	Dissolved Gases
Analytical Method/ SOP Reference	USEPA RSK-175 Modified/ TBD

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria (MPCs)
Method Blank	One per batch of 20 samples or less per matrix.	All target analytes must be <½ LOQ.	TBD	TBD	Bias Contamination	Same as QC Acceptance Limits.
LCS (LCSD Not Required)	One per batch of 20 samples or less per matrix.	%Rs must be within laboratory statistically derived acceptance limits. RPD must be ≤ 20% (for LCS/LCSD, if analyzed).	TBD	TBD	Accuracy/Bias Precision also, if LCSD is analyzed	Same as QC Acceptance Limits.
MS/MSD	One per batch of 20 samples or less per matrix.	%Rs should be within laboratory statistically derived acceptance limits. RPD between MS and MSD should be ≤ 20%.	TBD	TBD	Accuracy/Bias Precision	Same as QC Acceptance Limits.
Results between the DL and LOQ	NA.	Apply "J" qualifier to results detected between DL and LOQ.	None	TBD	Accuracy	Same as QC Acceptance Limits.

Matrix	Groundwater and Aqueous Field QC Samples
Analytical Group	Metabolic Acids
Analytical Method/ SOP Reference	Proprietary Method/TBD

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria (MPCs)
Method Blank	One per batch of 20 samples or less per matrix.	All target analytes must be <½ LOQ.	TBD	TBD	Bias Contamination	Same as QC Acceptance Limits.
LCS (LCSD Not Required)	One per batch of 20 samples or less per matrix.	%Rs must be within laboratory statistically derived acceptance limits. RPD must be ≤ 30% (for LCS/LCSD, if analyzed).	TBD	TBD	Accuracy/Bias Precision also, if LCSD is analyzed	Same as QC Acceptance Limits.
MS/MSD	One per batch of 20 samples or less per matrix.	%Rs should be within laboratory statistically derived acceptance limits. RPD between MS and MSD should be ≤ 30%.	TBD	TBD	Accuracy/Bias Precision	Same as QC Acceptance Limits.
Results between the DL and LOQ	NA.	Apply "J" qualifier to results detected between DL and LOQ.	None	TBD	Accuracy	Same as QC Acceptance Limits.

Matrix	Groundwater and Aqueous Field QC Samples
Analytical Group	Anions
Analytical Method/ SOP Reference	SW-846 9056A/TBD

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria (MPCs)
Method Blank	One per batch of 20 samples or less per matrix.	All target analytes must be <½ LOQ.	TBD	TBD	Bias Contamination	Same as QC Acceptance Limits.
LCS (LCSD Not Required)	One per batch of 20 samples or less per matrix.	%Rs must be within laboratory statistically derived acceptance limits (not to exceed 80-120 %R). RPD must be ≤ 15% (for LCS/LCSD, if analyzed).	TBD	TBD	Accuracy/Bias Precision also, if LCSD is analyzed	Same as QC Acceptance Limits.
MS/MSD	One per batch of 20 samples or less per matrix.	%Rs must be within laboratory statistically derived acceptance limits (not to exceed 80-120 %R). RPD between MS and MSD should be ≤ 15%.	TBD	TBD	Accuracy/Bias Precision	Same as QC Acceptance Limits.
Sample Duplicate (Replicate)	One per every 10 samples.	RPD must be ≤ 10%.	TBD	TBD	Precision	Same as QC Acceptance Limits.
Results between the DL and LOQ	NA.	Apply "J" qualifier to results detected between DL and LOQ.	None	TBD	Accuracy	Same as QC Acceptance Limits.

Matrix	Groundwater and Aqueous Field QC Samples
Analytical Group	TOC
Analytical Method/ SOP Reference	SW-846 9060A/TBD

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria (MPCs)
Method Blank	One per batch of 20 samples or less per matrix.	Target analyte must be <½ LOQ.	TBD	TBD	Bias Contamination	Same as QC Acceptance Limits.
LCS (LCSD Not Required)	One per batch of 20 samples or less per matrix.	%Rs must be within laboratory statistically derived acceptance limits. RPD must be ≤ 20% (for LCS/LCSD, if analyzed).	TBD	TBD	Accuracy/Bias Precision also, if LCSD is analyzed	Same as QC Acceptance Limits.
MS/MSD	One per batch of 20 samples or less per matrix.	%Rs should be within laboratory statistically derived acceptance limits. RPD between MS and MSD should be ≤ 20%.	TBD	TBD	Accuracy/Bias Precision	Same as QC Acceptance Limits.
Results between the DL and LOQ	NA.	Apply "J" qualifier to results detected between DL and LOQ.	None	TBD	Accuracy	Same as QC Acceptance Limits.

Matrix	Groundwater and Aqueous Field QC Samples
Analytical Group	Dissolved Sulfide
Analytical Method/ SOP Reference	SM 4500S^{2-} F/TBD

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria (MPCs)
Method Blank	One per batch of 20 samples or less per matrix.	Target analyte must be < LOQ.	TBD	TBD	Bias Contamination	Same as QC Acceptance Limits.
LCS	One per batch of 20 samples or less per matrix.	Method specified - %R must be within 80-120%R.	TBD	TBD	Accuracy/Bias	Same as QC Acceptance Limits.
Duplicate Sample	One per batch of 20 samples or less per matrix.	RPD should be ≤ 20%.	TBD	TBD	Precision	Same as QC Acceptance Limits.
Results between the DL and LOQ	NA.	Apply "J" qualifier to results detected between DL and LOQ.	None	TBD	Accuracy	Same as QC Acceptance Limits.

Matrix	Groundwater and Aqueous Field QC Samples
Analytical Group	Alkalinity
Analytical Method/ SOP Reference	SM 2320B/TBD

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria (MPCs)
Method Blank	One per batch of 20 samples or less per matrix.	Target analyte must be ≤ ½ LOQ.	TBD	TBD	Bias Contamination	Same as QC Acceptance Limits.
LCS	One per batch of 20 samples or less per matrix.	%R must be within 80-120%R.	TBD	TBD	Accuracy/Bias	Same as QC Acceptance Limits.
Duplicate Sample	One per batch of 20 samples or less per matrix.	RPD should be ≤ 20%.	TBD	TBD	Precision	Same as QC Acceptance Limits.
Results between the DL and LOQ	NA.	Apply "J" qualifier to results detected between DL and LOQ.	None	TBD	Accuracy	Same as QC Acceptance Limits.

SAP WORKSHEET NO. 29 -- PROJECT DOCUMENTS AND RECORDS TABLE

(UFP-QAPP Manual Section 3.5.1)

Document	Where Maintained
Field Documents Field Logbook (and sampling notes) Field Sample Forms (e.g., boring logs, sample log sheets, drilling logs, etc.) Chain-of-Custody Records Sample Shipment Air Bills Equipment Calibration Logs Photographs FTMR Forms This SAP Field Sampling SOPs HASP	Field documents will be maintained in the CA Monitoring Contractor project file; results will be discussed in the project report. This SAP will be maintained in the CA Monitoring Contractor project file and will also be uploaded into NIRIS.
Laboratory Documents Sample Receipt, Custody, and Tracking Records Equipment Calibration Logs Analysis Run Logs Corrective Action Forms Reported Results for Standards, QC Checks, and QC Samples Raw Data Data Completeness Checklists	Laboratory documents will be included in the hardcopy and Portable Document Format (PDF) deliverables from the laboratory. Laboratory data deliverables will be maintained in the CA Monitoring Contractor project file (hardcopies) and electronic database (electronic data).
Assessment Findings All versions of the SAP All letter and e-mail correspondence with regulatory agencies, including approvals and comments Field Sampling Audit Checklist (if conducted) Analytical Audit Checklist (if conducted) Data Validation Memoranda (includes tabulated data summary forms)	All assessment documents will be maintained in the CA Monitoring Contractor project file.
Reports Annual MCB Quantico - CA Monitoring Reports Semi-Annual MCB Quantico - CA Monitoring Reports	All versions of the CA Monitoring Reports and all support documents (e.g., Data Validation Reports) will be stored in hardcopy format in the CA Monitoring Contractor project file and electronically and submitted to the Navy via NIRIS for the Administrative Record.

SAP WORKSHEET NO. 30 -- ANALYTICAL SERVICES TABLE

(UFP-QAPP Manual Section 3.5.2.3)

Matrix	Analytical Group	Sample Locations/ ID Numbers	Analytical Method	Data Package Turnaround Time	Laboratory/ Organization (name and address, contact person and telephone number)	Backup Laboratory/ Organization (name and address, contact person and telephone number)
Groundwater and Aqueous Field QC Samples	VOCs	See Worksheet No. 18	SW-846 8260B	21 calendar days	TBD	NA
	EDB and DBCP		SW-846 8011			
	SVOCs		SW-846 8270D			
	Pesticides		SW-846 8081B			
	PCBs		SW-846 8082A			
	Herbicides		SW-846 8151A			
	Dioxins/Furans		SW-846 8280B			
	Metals		SW-846 6020A			
	Mercury		SW-846 7470A or 7472			
	Total and Amenable Cyanide		SW-846 9012B			
	Extractable Sulfides		SW-846 9031			
	Total Phenols		SW-846 9066 or 9067			
	Dissolved Gases		USEPA RSK-175 Modified			
	Metabolic Acids		Proprietary Method			
	Anions		SW-846 9056A			
	TOC		SW-846 9060A			
	Dissolved Sulfide		SM 4500S^{2-} F			
	Alkalinity		SM 2320B			

SAP WORKSHEET NO. 31 -- PLANNED PROJECT ASSESSMENTS TABLE

(UFP-QAPP Manual Section 4.1.1)

Assessment Type	**Frequency**	**Internal or External**	**Organization Performing Assessment**	**Person(s) Responsible for Performing Assessment** (title and organizational affiliation)	**Person(s) Responsible for Responding to Assessment Findings** (title and organizational affiliation)	**Person(s) Responsible for Identifying and Implementing Corrective Actions** (title and organizational affiliation)	**Person(s) Responsible for Monitoring Effectiveness of Corrective Action** (title and organizational affiliation)
Laboratory Systems Audit[1, 2]	Every 2 years	External	DoD Environmental Laboratory Approval Program (ELAP) Accrediting Body	DoD ELAP Auditor	Laboratory QAM, TBD	Laboratory QAM or Laboratory Manager, TBD	Laboratory QAM or Laboratory Manager, TBD

1 A laboratory will be selected that has successfully completed the laboratory evaluation process required as part of the DoD ELAP and as described in the DoD QSM. A copy of the DoD ELAP certification letter will be submitted by the Navy or the Navy's CA Monitoring Contractor along with laboratory SOPs and field sampling SOPs after a laboratory is selected. The laboratory must also be VELAP accredited.

2 At the request of VDEQ, an Example Laboratory Quality Assurance Plan has been included as Appendix D.

SAP WORKSHEET NO. 32 -- ASSESSMENT FINDINGS AND CORRECTIVE ACTION RESPONSES

(UFP-QAPP Manual Section 4.1.2)

Assessment Type [1]	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (name, title, organization)	Time Frame of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (name, title, organization)	Time Frame for Response
Laboratory Systems Audit	Written audit report	TBD, Laboratory QA Manager, TBD	Specified by DoD ELAP Accrediting Body	Letter	DoD ELAP Accrediting Body	Specified by DoD ELAP Accrediting Body

1 Audits are scheduled at the program level and may or may not include this project.

SAP WORKSHEET NO. 33 -- QA MANAGEMENT REPORTS TABLE

(UFP QAPP Manual Section 4.2)

Type of Report	**Frequency** (daily, weekly monthly, quarterly, annually, etc.)	**Projected Delivery Date(s)**	**Person(s) Responsible for Report Preparation** (title and organizational affiliation)	**Report Recipient(s)** (title and organizational affiliation)
Data Validation Report	Per Sample Delivery Group (SDG)	After validation is complete	DVM or designee, CA Monitoring Contractor	PM, CA Monitoring Contractor; project file
Project Monthly Progress Report	Monthly for duration of the project	Monthly	PM, CA Monitoring Contractor	Navy RPM, Navy; PM, CA Monitoring Contractor; QAM, CA Monitoring Contractor; Program Manager, CA Monitoring Contractor; project file
Laboratory QA Report	When significant plan deviations result from unanticipated circumstances	Immediately upon detection of problem (on the same day)	Laboratory PM, TBD	PM, CA Monitoring Contractor; project file

SAP WORKSHEET NO. 34 -- VERIFICATION (STEP I) PROCESS TABLE

(UFP-QAPP Manual Section 5.2.1)

Verification Input	Description	Internal/ External	Responsible for Verification (name, organization)
Chain-of-Custody Forms	The CA Monitoring Contractor FOL or designee will review and sign each chain-of-custody form to verify that all samples listed are included in the shipment to the laboratory and that the sample information is accurate. The chain-of-custody forms will be signed by the sampler, and a copy will be retained for the project file, CA Monitoring Contractor PM, and CA Monitoring Contractor Data Validator.	Internal	FOL and field crew, CA Monitoring Contractor
	The Laboratory Sample Custodian will review the sample shipment for completeness and integrity and will sign accepting the shipment. The CA Monitoring Contractor Data Validator will check that the chain-of-custody form was signed and dated by the CA Monitoring Contractor FOL or designee relinquishing the samples and also by the Laboratory Sample Custodian receiving the samples for analyses.	Internal/ External	1 - Laboratory Sample Custodian, TBD 2 – Project Chemist or Data Validator, CA Monitoring Contractor
SAP/Field Logs/ Analytical Data Packages	Ensure that all sampling SOPs were followed. Verify that deviations have been documented and that MPCs have been achieved. Particular attention should be given to verifying that samples were correctly identified, that sampling location coordinates are accurate, and that documentation establishes an unbroken trail of documented chain of custody from sample collection to report generation. Verify that the correct sampling and analytical methods/SOPs were applied. Verify that the sampling plan was implemented and carried out as written and that any deviations are documented.	Internal	PM, FOL, or designee, CA Monitoring Contractor
SAP/Analytical SOPs/Analytical Data Packages	Ensure that all laboratory SOPs were followed. Verify that the correct analytical methods/SOPs were applied.	Internal	Laboratory QAM, TBD
SAP/Laboratory SOPs/Raw Data/ Applicable Control Limits Tables	Establish that all method QC samples were analyzed and in control as listed in the analytical SOPs. If method QA is not in control, the Laboratory QAM will contact the CA Monitoring Contractor PM for guidance prior to report preparation.	Internal	Laboratory QAM, TBD
SAP Sample Tables/Chain-of-Custody Forms	Verify that all proposed samples listed in the SAP tables have been collected.	Internal	FOL and field crew, CA Monitoring Contractor

Verification Input	Description	Internal/ External	Responsible for Verification (name, organization)
Sample Log Sheets	Verify that information recorded on the log sheets is accurate and complete and that the log sheets are maintained at the project office.	Internal	PM, FOL, or designee, CA Monitoring Contractor
SAP/Chain-of-Custody Forms	Verify that field QC samples listed in Worksheet No. 20 were collected as required.	Internal	FOL or designee, CA Monitoring Contractor
Analytical Data Packages	All analytical data packages will be verified internally for completeness by the laboratory performing the work. The Laboratory QAM will sign the case narrative for each data package.	Internal	Laboratory QAM, TBD
	Verify that the data package contains all the elements required by the Functional Guidelines and laboratory scope of work. Missing information will be requested from the laboratory, and validation will be suspended until missing data are received.	External	Project Chemist or Data Validator, CA Monitoring Contractor
Electronic Data Deliverables (EDDs)/ Analytical Data Packages	The electronic data will be compared to the chain-of-custody form and hard-copy data package to verify accuracy and completeness. Laboratory analytical results will be verified and compared to the electronic analytical results for accuracy. Sample results will be evaluated for laboratory contamination and will be qualified for false positives using the laboratory method/preparation blank summaries. Positive results reported between the detection limit (DL) and LOQ will be qualified as estimated. Extraneous laboratory qualifiers will be removed during the validation process.	External	Project Chemist or Data Validator, CA Monitoring Contractor

SAP WORKSHEET NO. 35 -- VALIDATION (STEPS IIA AND IIB) PROCESS TABLE

(UFP-QAPP Manual Section 5.2.2) (Figure 37 UFP-QAPP Manual) (Table 9 UFP-QAPP Manual)

Step IIa/IIb	Validation Input	Description	Responsible for Validation (name, organization)
IIa	SAP/Sample Log Sheets	Ensure that sample locations are correct and in accordance with the SAP proposed locations. Document any discrepancies in the final report.	PM, FOL, or designee, CA Monitoring Contractor
IIa	Chain-of-Custody Forms	Ensure that the custody and integrity of the samples were maintained from collection to analysis and that the custody records are complete and any deviations are recorded. Review that the samples were shipped and store at the required temperature and that the sample pH for chemically preserved samples met the requirements listed in Worksheet No. 19. Ensure that the analyses were performed within the holding times listed in Worksheet No. 19.	Project Chemist or Data Validator, CA Monitoring Contractor
IIa/IIb	SAP/Laboratory Data Packages/ EDDs	Ensure that the laboratory QC samples listed in Worksheet No. 28 were analyzed and that the MPCs listed in Worksheet No. 12 were met for all field samples and QC analyses. Check that specified field QC samples were collected and analyzed and that the analytical QC criteria set up for this project were met.	Project Chemist or Data Validator, CA Monitoring Contractor
		Check the field sampling precision by calculating the RPD for field duplicate samples. Check the laboratory precision by reviewing the RPD or %D values from laboratory duplicate analyses, MS/MSDs, and LCS/LCSDs, if available. Ensure compliance with the methods and project MPCs accuracy goals listed in Worksheet No. 12.	
		Check that the laboratory recorded the temperature at sample receipt and the pH of the chemically preserved samples to ensure sample integrity from sample collection to analysis.	
		Review the chain-of-custody forms generated in the field to ensure that the required analytical samples have been collected, appropriate sample identifications have been used, and correct analytical methods have been applied. The CA Monitoring Contractor Data Validator will verify that elements of the data package required for validation are present, and if not, the laboratory will be contacted and the missing information will be requested. Validation will be performed as per Worksheet No. 36. Check that all data have been transferred correctly and completely to the final database.	

Step IIa/IIb	Validation Input	Description	Responsible for Validation (name, organization)
IIb	SAP/Laboratory Data Packages/ EDDs	Ensure that the project LOQs listed in Worksheet No. 15 were achieved.	Project Chemist or Data Validator, CA Monitoring Contractor
		Discuss the impact on reported DLs due to matrix interferences or sample dilutions, performed because of the high concentration of one or more other contaminants, on the other target compounds reported as non-detected. Document this usability issue and inform the CA Monitoring Contractor PM. Review and add PSLs to the laboratory EDDs. Flag samples and notify the CA Monitoring Contractor PM of samples that exceed PALs listed in Worksheet No. 15.	
		Ensure that all QC samples specified in the SAP were collected and analyzed and that the associated results were within prescribed SAP acceptance limits. Ensure that QC samples and standards prescribed in analytical SOPs were analyzed and within the prescribed control limits. If any significant QC deviations occur, the Laboratory QAM will have contacted the CA Monitoring Contractor PM.	
		Summarize deviations from methods, procedures, or contracts in the Data Validation Report. Determine the impact of any deviation from sampling or analytical methods and SOPs requirements and matrix interferences effect on the analytical results. Qualify data results based on method or QC deviation and explain all data qualifications. Print a copy of the project database qualified data depicting data qualifiers and data qualifier codes that summarize the reasons for data qualifications. Determine if the data met the MPCs and determine the impact of any deviations on the technical usability of the data.	

SAP WORKSHEET NO. 36 -- ANALYTICAL DATA VALIDATION (STEPS IIA AND IIB) SUMMARY TABLE

(UFP-QAPP Manual Section 5.2.2.1)

Step IIa/ IIb	Matrix	Analytical Group	Validation Criteria	Data Validator (title and organizational affiliation)
IIa and IIb	Groundwater	VOCs (including EDB and DBCP), SVOCs, Pesticides, PCBs, and Herbicides	Limited data validation* will be performed using criteria for SW-846 Methods 8260B, 8011, 8270D, 8081B, 8082A, and 8151A listed in Worksheets Nos. 12, 15, 24, 25, and 28 and the current DoD QSM, unless anomalies or issues are evident with the data set. If formal data validation is deemed necessary, a full (Level IV) data validation will be performed using criteria for SW-846 Methods 8260B, 8011, 8270D, 8081B, 8082A, and 8151A listed in Worksheets Nos. 12, 15, 24, 25, and 28 and the current DoD QSM. The logic outlined in the Region III Modifications to the National Functional Guidelines for Organic Data Review (USEPA, 1994) should be used to apply qualifiers to data.	Data Validator, CA Monitoring Contractor
IIa and IIb	Groundwater	Metals (including Mercury), Total and Amenable Cyanide, Extractable Sulfides, and Total Phenols	Limited data validation* will be performed using criteria for SW-846 Methods 6020A, 7470A or 7472, 9012B, 9031, and 9066 or 9067 listed in Worksheets Nos. 12, 15, 24, 25, and 28 and the current DoD QSM, unless anomalies or issues are evident with the data set. If formal data validation is deemed necessary, a full (Level IV) data validation will be performed using criteria for SW-846 Methods 6020A, 7470A or 7472, 9012B, 9031, and 9066 or 9067 listed in Worksheets Nos. 12, 15, 24, 25, and 28 and the current DoD QSM. The logic outlined in the Region III Modifications to the Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses (USEPA, 1993) should be used to apply qualifiers to data.	Data Validator, CA Monitoring Contractor

Step IIa/ IIb	Matrix	Analytical Group	Validation Criteria	Data Validator (title and organizational affiliation)
IIa and IIb	Groundwater	Dioxins/Furans	Limited data validation* will be performed using criteria for SW-846 Methods 8280B listed in Worksheets Nos. 12, 15, 24, 25, and 28 and the current DoD QSM, unless anomalies or issues are evident with the data set. If formal data validation is deemed necessary, a full (Level IV) data validation will be performed using criteria for SW-846 Method 8280B listed in Worksheets Nos. 12, 15, 24, 25, and 28 and the current DoD QSM. The logic outlined in the Region III Draft Dioxin/Furan Data Validation Guidance (USEPA, 1999) and USEPA National Functional Guidelines for Dioxins/Furans (2005b) should be used to apply qualifiers to data.	Data Validator, CA Monitoring Contractor
IIa and IIb	Groundwater	Dissolved Gases, Metabolic Acids, Anions, TOC, Dissolved Sulfide, and Alkalinity	Data validation will not be performed on analytical groups that are only needed to support MNA evaluation.	Data Validator, Contractor

* Limited data validation. Limits the data review to specific review parameters (data completeness/data verification, holding times, calibrations, blank contamination, and DLs) to determine gross deficiencies only. The limited data validation is best expressed as a review to preclude the possibility of false negatives and to eliminate false positives. Raw data are not evaluated, and sample result verification is not conducted. A formal report, similar to a full data validation report, is prepared, but the scope is more limited than a full validation report. The data packages provided by the laboratory will be expansive enough to allow future complete formal data validation, if necessary.

** Note that data validation must be completed within 45 days of the data being available from the laboratory performing the analysis, as required by the RCRA Permit.

SAP WORKSHEET NO. 37 -- USABILITY ASSESSMENT

(UFP-QAPP Manual Section 5.2.3)

Data Usability Assessment

The usability of the data directly affects whether project objectives can be achieved. The following characteristics will be evaluated at a minimum. The results of these evaluations will be included in the CA Groundwater Monitoring Report. The characteristics will be evaluated for multiple concentration levels if the evaluator determines that this is necessary. To the extent required by the type of data being reviewed, the assessors will consult with other technically competent individuals to render sound technical assessments of these DQI characteristics.

Completeness

The CA Monitoring Contractor FOL acting on behalf of NAVFAC Washington and MCB Quantico will prepare a table listing planned samples/analyses and collected samples/analyses. If deviations from the scheduled samples or analyses are identified, the CA Monitoring Contractor PM and Project Risk Assessor will determine whether the deviations compromise the ability to meet project objectives. If they do, the CA Monitoring Contractor PM will consult with the Navy RPM and other Project Team members, as necessary (determined by the Navy RPM), to develop appropriate CAs.

Precision

The CA Monitoring Contractor Project Chemist acting on behalf of the NAVFAC Washington and MCB Quantico will determine whether precision goals for field duplicates and laboratory duplicates were met. This will be accomplished by comparing duplicate results to precision goals identified in Worksheet Nos. 12 and 28. This will also include a comparison of field and laboratory precision with the expectation that laboratory duplicate results will be no less precise than field duplicate results. If the goals are not met or if data have been flagged as estimated (J qualifier), limitations on the use of the data will be described in the CA Groundwater Monitoring Report.

Accuracy

The CA Monitoring Contractor Project Chemist acting on behalf of NAVFAC Washington and MCB Quantico will determine whether the accuracy/bias goals were met for project data. This will be accomplished by comparing %Rs of LCS, LCSD, MS, MSD, and surrogate compounds to accuracy goals identified in Worksheet No. 28. This assessment will include an evaluation of field and laboratory contamination; instrument calibration variability; and analyte recoveries for surrogates, MSs, and LCSs.. If the goals are not met, limitations on the use of the data will be described in the CA Groundwater Monitoring Report. Bias of the qualified results and a description of the impact of identified non-compliances on a specific data package or on the overall project data will be described in the CA Groundwater Monitoring Report.

Representativeness

An CA Monitoring Contractor Project Scientist identified by the CA Monitoring Contractor PM and acting on behalf of NAVFAC Washington and MCB Quantico will determine whether the data are adequately representative of intended populations, both spatially and temporally. This will be accomplished by verifying that samples were collected and processed for analysis in accordance with the SAP, by reviewing spatial and temporal data variations, and by comparing these characteristics to expectations. The usability report will describe the representativeness of the data for each analytical fraction. This will not require quantitative comparisons unless the Project Scientist indicates that a quantitative analysis is required.

Comparability

The CA Monitoring Contractor Project Chemist acting on behalf of NAVFAC Washington and MCB Quantico will determine whether the data generated under this project are sufficiently comparable to historical site data generated by different methods and for samples collected using different procedures and under different site conditions. This will be accomplished by comparing overall precision and bias among data sets for each analytical fraction. This will not require quantitative comparisons unless professional judgment of the Project Chemist indicates that such quantitative analysis is required.

Sensitivity

The CA Monitoring Contractor Project Chemist acting on behalf of NAVFAC Washington and MCB Quantico will determine whether the project sensitivity goals listed in Worksheet No. 15 are achieved. The overall sensitivity and quantitation limits from multiple data sets for each analysis will be compared. If sensitivity goals are not achieved, the limitations on the data will be described. The Project Chemist will enlist the help of the CA Monitoring Contractor Risk Assessor to evaluate deviations from planned sensitivity goals.

Project Assumptions and Data Outliers

The CA Monitoring Contractor PM and designated team members will evaluate whether project assumptions are valid. This will typically be a qualitative evaluation but may be supported by quantitative evaluations. The type of evaluation depends on the assumption being tested. Quantitative assumptions include those related to data distributions (e.g., normal or log-normal) and estimates of data variability. Statistical tests for outliers will be conducted using standard statistical techniques appropriate for this task. Potential outliers will be removed if a review of the associated data indicates that the results have an assignable cause the renders them inconsistent with the remainder of the data. During this evaluation, the CA Monitoring Contractor will consider whether outliers could be indications of unanticipated site conditions. Consideration will be given to whether outliers represent an unanticipated site condition.

Describe the evaluative procedures used to assess overall measurement error associated with the project:

After completion of the data validation (when appropriate), the data and data quality will be reviewed to determine whether sufficient data of acceptable quality are available for decision making. In addition to the evaluations described above, a series of inspections and statistical analyses will be performed to estimate these characteristics. The statistical evaluations will include simple summary statistics for target analytes, such as maximum concentration, minimum concentration, number of samples with non-detected results, number of samples with detected results, and the proportion of samples with detected and non-detected results. The CA Monitoring Contractor PM will assess whether the data collectively support the attainment of project objectives. They will consider whether any missing or rejected data have compromised the ability to make decisions or to make the decisions with the desired level of confidence. The data will be evaluated to determine whether missing or rejected data can be compensated for by other data. Although rejected data will generally not be used, there may be reason to use them in a weight-of-evidence argument, especially when they supplement data that have not been rejected. If rejected data are used, their use will be supported by technically defensible rationales and documented in the CA Groundwater Monitoring Report.

For statistical comparisons and mathematical manipulations, non-detected values will be represented by a concentration equal to one-half the sample-specific reporting limit. Duplicate results (original and duplicate) will not be averaged for the purpose of representing the range of concentrations. However, the average of concentrations in original and duplicate samples will be used to represent the concentration at a particular sampled location.

Identify the personnel responsible for performing the usability assessment: The CA Monitoring Contractor PM, Project Chemist, FOL, and Project Scientist will be responsible for conducting the listed data usability assessments. Data usability assessment results will be reviewed with the Navy RPM MCB Quantico, and VDEQ. If deficiencies affecting the attainment of project objectives are identified, the review will take place either in a face-to-face meeting or a teleconference depending on the extent of identified deficiencies. If no significant deficiencies are identified, the data usability assessment will simply be documented in the CA Groundwater Monitoring Report and reviewed during the normal document review cycle.
Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies: The data will be presented in tabular format, including data qualifications such as estimation (J, UJ) or rejection (R). Written documentation will support the non-compliance estimated or rejected data results. The CA Groundwater Monitoring Report will identify and describe the data usability limitations and suggest resampling or other CAs, if necessary.

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TABLES

TABLE 10-1

GROUNDWATER ELEVATIONS - DECEMBER 2010
RUSSELL ROAD LANDFILL
MCB QUANTICO, VIRGINIA

Monitoring Well	Top of Casing Elevations (feet above msl)	Depth to Groundwater (ft) 12/6/2010	Groundwater Elevation (feet above msl) 12/6/2010
MW-09	155.20	16.63	138.57
MW-10	147.25	17.02	130.23
MW-11R	143.89	19.28	124.61
MW-12	128.10	21.04	107.06
MW-13	113.61	17.56	96.05
MW-14	102.92	16.39	86.53
MW-15R	122.60	28.17	94.43
MW-16	123.35	27.04	96.31
MW-17	129.38	48.17	81.21
MW-18	130.72	21.94	108.78
MW-19	125.13	11.22	113.91
MW-20	135.98	19.27	116.71
MW-21D	118.44	30.62	87.82
MW21S	119.27	31.46	87.81
MW22D	102.45	17.63	84.82
MW22S	103.71	7.89	95.82
MW-24	69.57	-	-

Note: Monitoring well MW-24 not sampled due to artesion conditions.

TABLE 17-1

CORRECTIVE ACTION GROUNDWATER MONITORING WELLS, SAMPLING FREQUENCY AND ANALYTE LIST
RUSSELL ROAD LANDFILL
MCB QUANTICO, VIRGINIA

Well ID	Type of Well	Sampling Frequency	Analyte List
MW-10	Background Well	Semi-annual	Attachment K List
MW-09	POC Well	Semi-annual	Attachment K list for one sampling event per calendar year; Attachment L List for one sampling event per calendar year
MW-11R	POC Well	Semi-annual	Attachment K List
MW-12	POC Well	Semi-annual	Attachment K List
MW-13	POC Well	Semi-annual	Attachment K list for one sampling event per calendar year; Attachment L List for one sampling event per calendar year
MW-14	POC Well	Semi-annual	Attachment K list for one sampling event per calendar year; Attachment L List for one sampling event per calendar year
MW-15R	POC Well	Semi-annual	Attachment K list for one sampling event per calendar year; Attachment L List for one sampling event per calendar year
MW-16	POC Well	Semi-annual	Attachment K list for one sampling event per calendar year; Attachment L List for one sampling event per calendar year
MW-17	POC Well	Semi-annual	Attachment K list for one sampling event per calendar year; Attachment L List for one sampling event per calendar year
MW-18	POC Well	Semi-annual	Attachment K List
MW-19R	POC Well	Semi-annual	Attachment K list for one sampling event per calendar year; Attachment L List for one sampling event per calendar year
MW-20	POC Well	Semi-annual	Attachment K List
MW-21D	CMW Well	Semi-annual	Attachment K List
MW-21S	CMW Well	Semi-annual	Attachment K List
MW-22D	CMW Well	Semi-annual	Attachment K List
MW-22S	CMW Well	Semi-annual	Attachment K List
MW-24	CMW Well	Semi-annual	Attachment K List

Abbreviations:
CMW Compliance Monitoring Well
POC Point of Compliance

FIGURES

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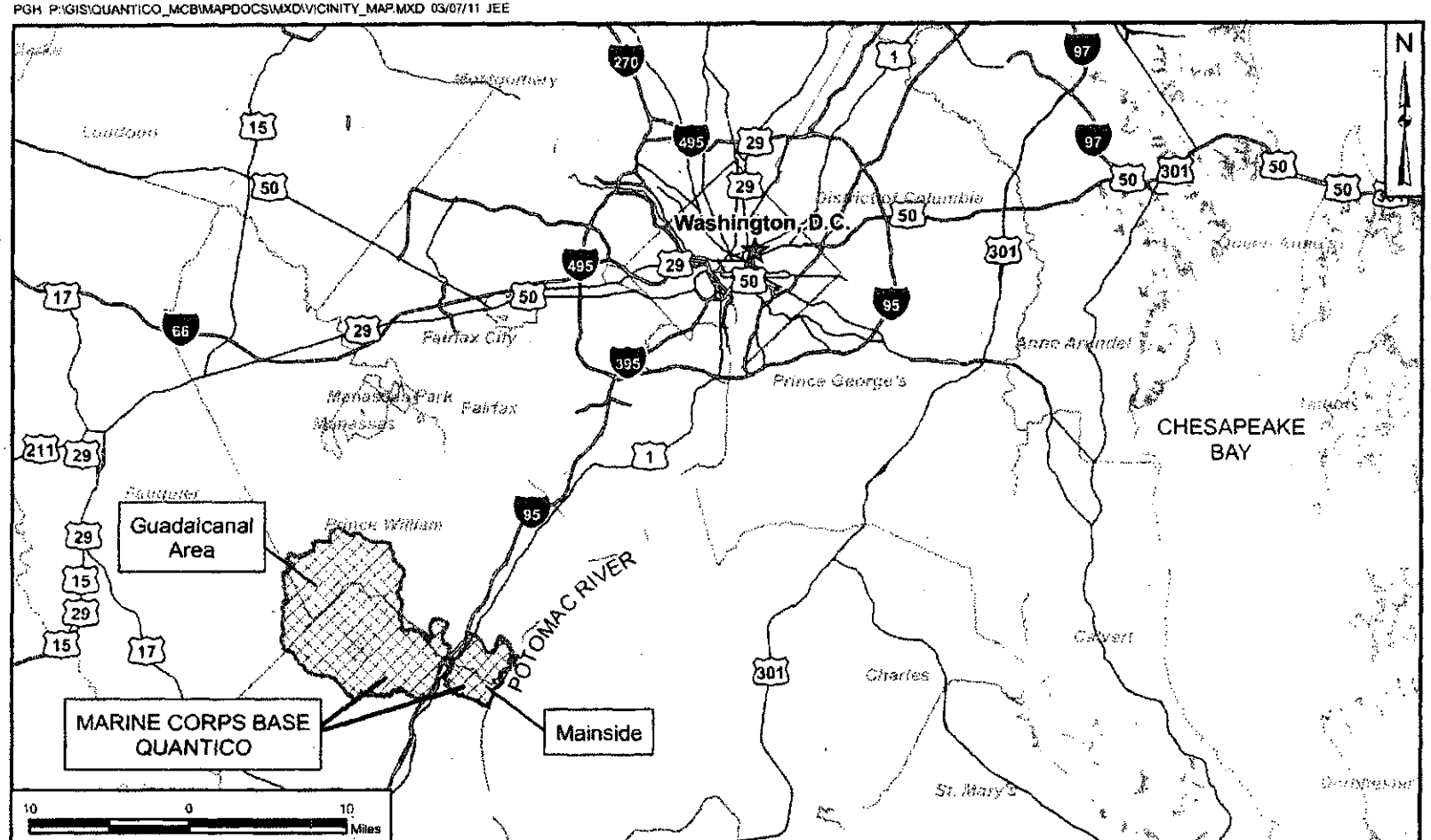

DRAWN BY S. STROZ	DATE 12/08/10	TETRA TECH	CONTRACT NUMBER — / CTO NUMBER 68
CHECKED BY J. BUEL	DATE 03/07/11	VICINITY MAP MCB QUANTICO, VIRGINIA	APPROVED BY K. LYONS / DATE 03/07/11
REVISED BY J. ENGLISH	DATE 03/07/11		APPROVED BY — / DATE —
SCALE AS NOTED			FIGURE NO. FIGURE ES-1 / REV 0

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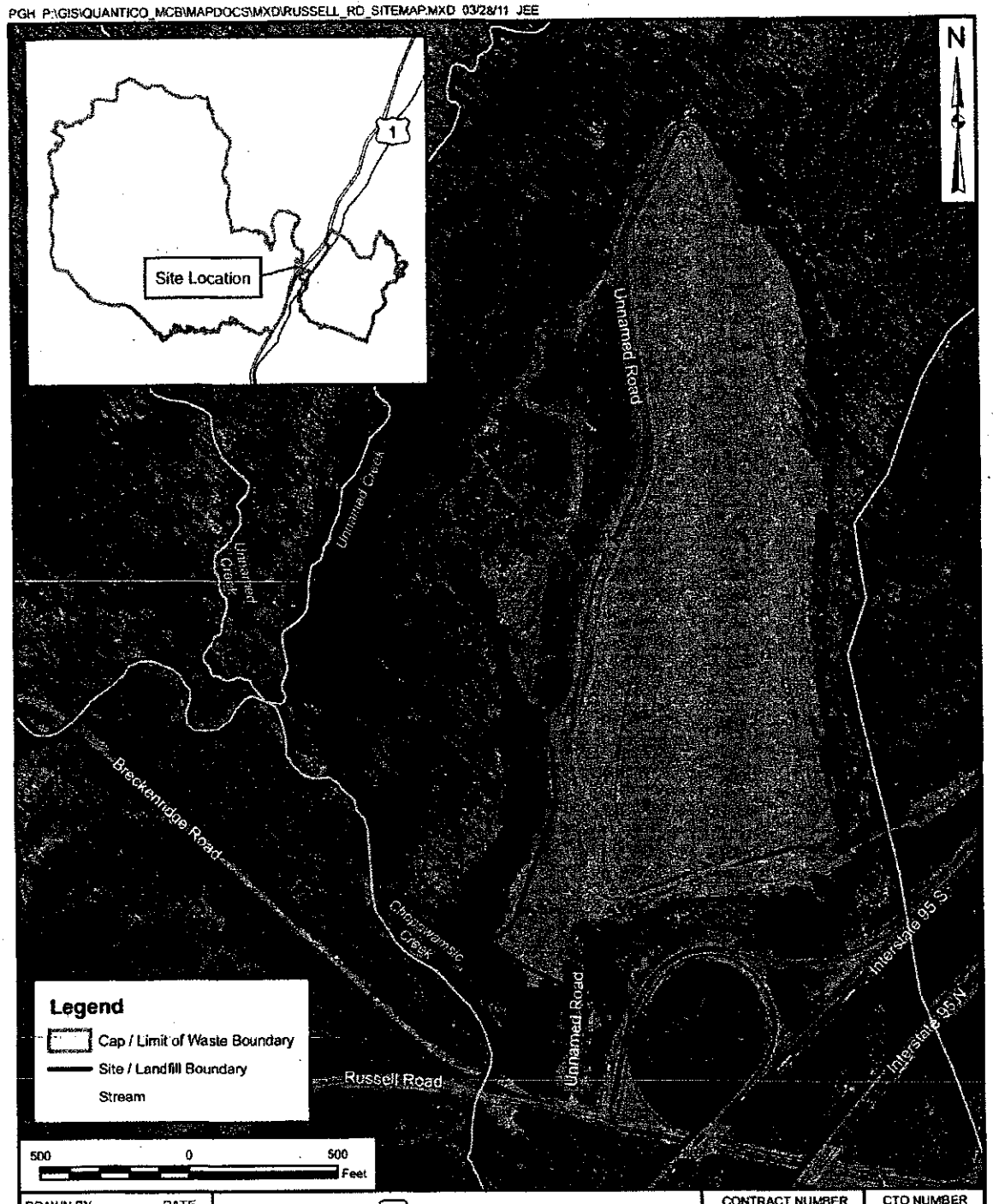
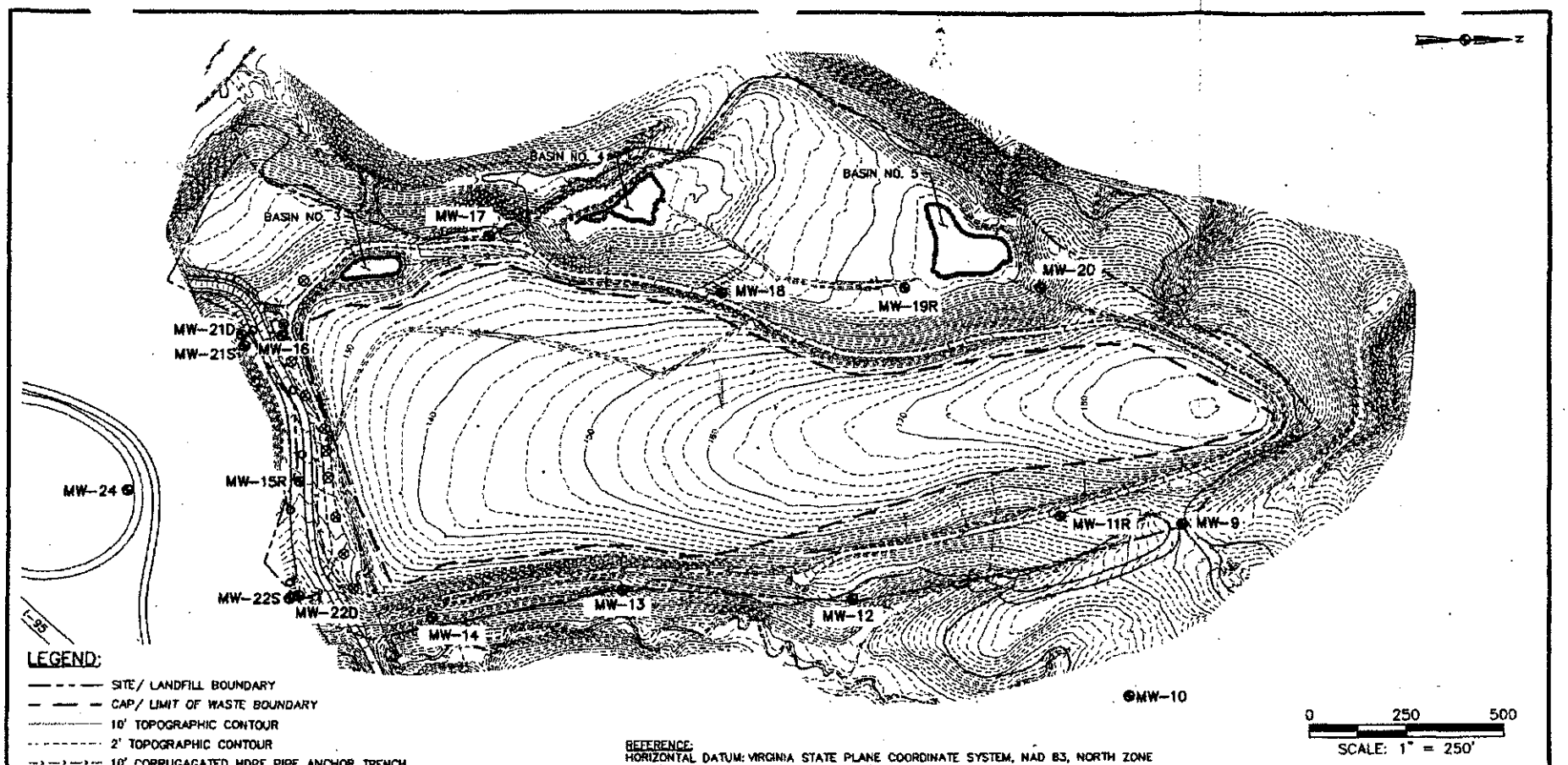


DRAWN BY	DATE	TETRA TECH	CONTRACT NUMBER	CTO NUMBER
J. ENGLISH	03/03/11			JU06
CHECKED BY	DATE	SITE LOCATION RUSSELL ROAD LANDFILL MCB QUANTICO, VIRGINIA	APPROVED BY	DATE
M. MENGEL	03/28/11		K. LYONS	03/28/11
REVISED BY	DATE		APPROVED BY	DATE
SCALE			FIGURE NO.	REV
AS NOTED			FIGURE ES-2	0



LEGEND:

- SITE/ LANDFILL BOUNDARY
- CAP/ LIMIT OF WASTE BOUNDARY
- 10' TOPOGRAPHIC CONTOUR
- 2' TOPOGRAPHIC CONTOUR
- 10' CORRUGAGATED HDPE PIPE ANCHOR TRENCH
- MONITORING WELL
- GAS MONITORING WELL
- GAS INTERCEPTOR WELL
- BENCHMARK
- GAS VENT

REFERENCE:
HORIZONTAL DATUM: VIRGINIA STATE PLANE COORDINATE SYSTEM, NAD 83, NORTH ZONE
VERTICAL DATUM: NGS MEAN SEA LEVEL

TETRA TECH
WWW.TETRATECH.COM
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PITTSBURGH, PA 15220
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RUSSELL ROAD LANDFILL
MCB, QUANTICO, VIRGINIA

SITE LAYOUT AND MONITORING LOCATIONS
SCALE: 1" = 250'

DATE:	3/15/11
PROJECT NO.:	112G02160
DESIGNED BY:	JB
DRAWN BY:	ZM
CHECKED BY:	KL
SHEET:	1 OF 2

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FIGURE 10-1

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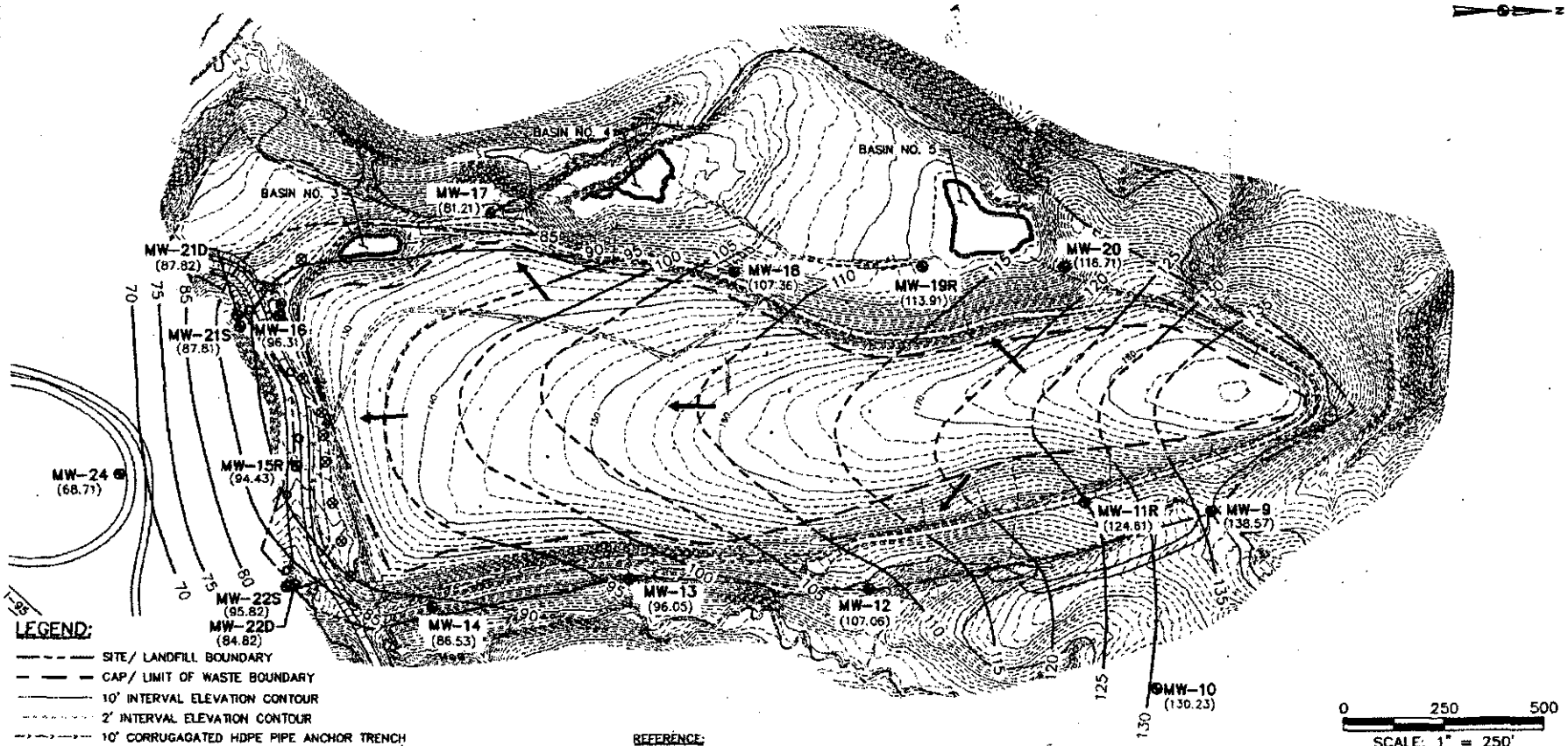

LEGEND:

- SITE/ LANDFILL BOUNDARY
- CAP/ LIMIT OF WASTE BOUNDARY
- 10' INTERVAL ELEVATION CONTOUR
- 2' INTERVAL ELEVATION CONTOUR
- 10' CORRUGAGATED HDPE PIPE ANCHOR TRENCH
- MONITORING WELL LOCATION
- GAS MONITORING WELL
- GAS INTERCEPTOR WELL
- BENCHMARK
- GAS VENT
- GROUNDWATER POTENTIOMETRIC CONTOUR (DASHED WHERE INFERRED)
- INFERRED GROUNDWATER FLOW DIRECTION
- (68.71) GROUNDWATER ELEVATION

REFERENCE:
HORIZONTAL DATUM: VIRGINIA STATE PLANE COORDINATE SYSTEM, NAD 83, NORTH ZONE
VERTICAL DATUM: NGS MEAN SEA LEVEL

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RUSSELL ROAD LANDFILL
MCB, QUANTICO, VIRGINIA

POTENTIOMETRIC SURFACE MAP
(DECEMBER 6, 2010)
SCALE: 1" = 250'

DATE:	3/15/11
PROJECT NO.:	112G02160
DESIGNED BY:	JB
DRAWN BY:	ZM
CHECKED BY:	KL
SHEET:	2 OF 2

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FIGURE 10-2

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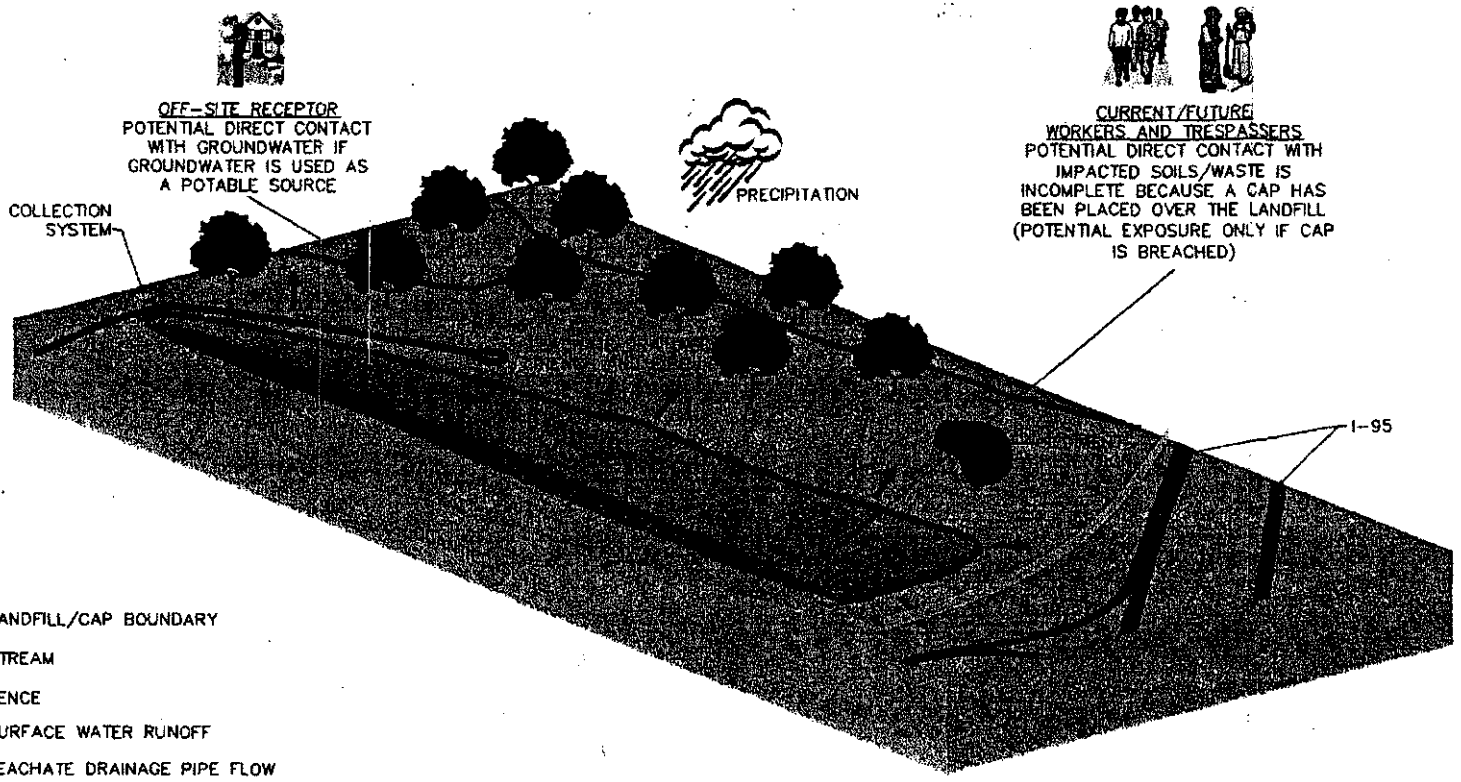

LEGEND

- - - - LANDFILL/CAP BOUNDARY

STREAM

FENCE

SURFACE WATER RUNOFF

LEACHATE DRAINAGE PIPE FLOW

NOTES:
1. GROUNDWATER FLOW IS RADIAL.
2. LEACHATE WITHIN DRAINAGE PIPE IS DRAINED BY GRAVITY TO LEACHATE COLLECTION SUMP.
3. SURFACE WATER TO GROUNDWATER INFILTRATION IS LIMITED DUE TO THE LANDFILL CAP. ANY SHALLOW GROUNDWATER BELOW CAP IS CAPTURED BY THE LEACHATE DRAINAGE TRENCH AND PIPE.
4. SURFACE WATER RUNOFF WITHIN THE LANDFILL IS DIVERTED TO SEDIMENT RETENTION PONDS LOCATED ALONG THE EDGES OF LANDFILL.

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RUSSELL ROAD LANDFILL
MCB, QUANTICO, VIRGINIA

CONCEPTUAL SITE MODEL
SCALE: NOT TO SCALE

DATE:	3/15/11
PROJECT NO.:	112G02160
DESIGNED BY:	
DRAWN BY:	CK
CHECKED BY:	
SHEET:	1 OF 2

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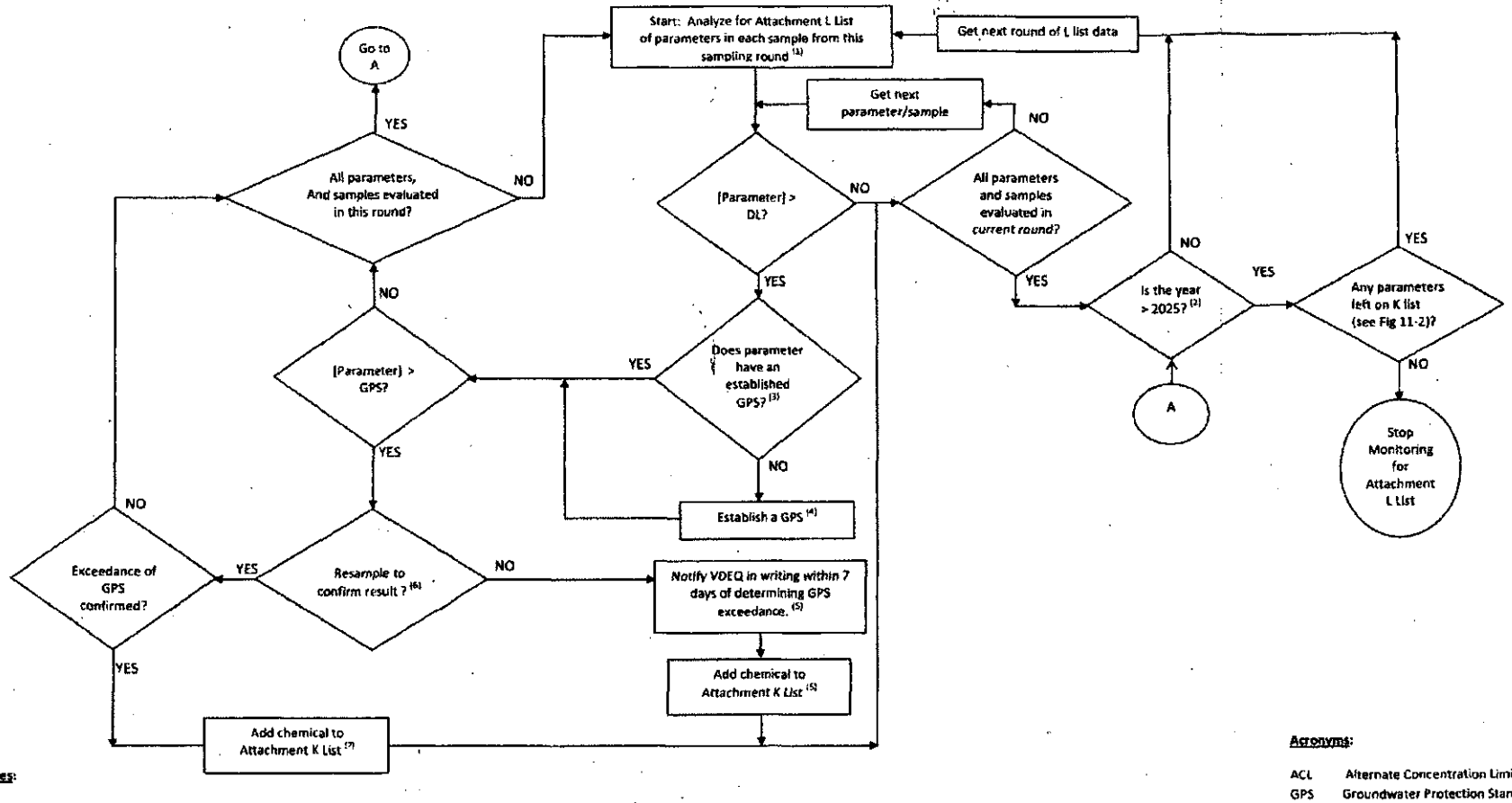
FIGURE 10-3

R:\2160 – Russell Road\CSM\2160CSM002.dwg PLT CARLY.KRAMER 3/15/2011 1:59:56 PM

GURE 11-1

ANNUAL GROUNDWATER MO' 'ING DECISION RULES FOR SELECT POC WELLS
(APPLIES TO ALL PARAMETERS IN EACI 'LE COLLECTED DURING A GIVEN SAMPLING ROUND)
RUSSELL ROAD LANDFILL, MCB QUANTICO, VIRGINIA



Footnotes:

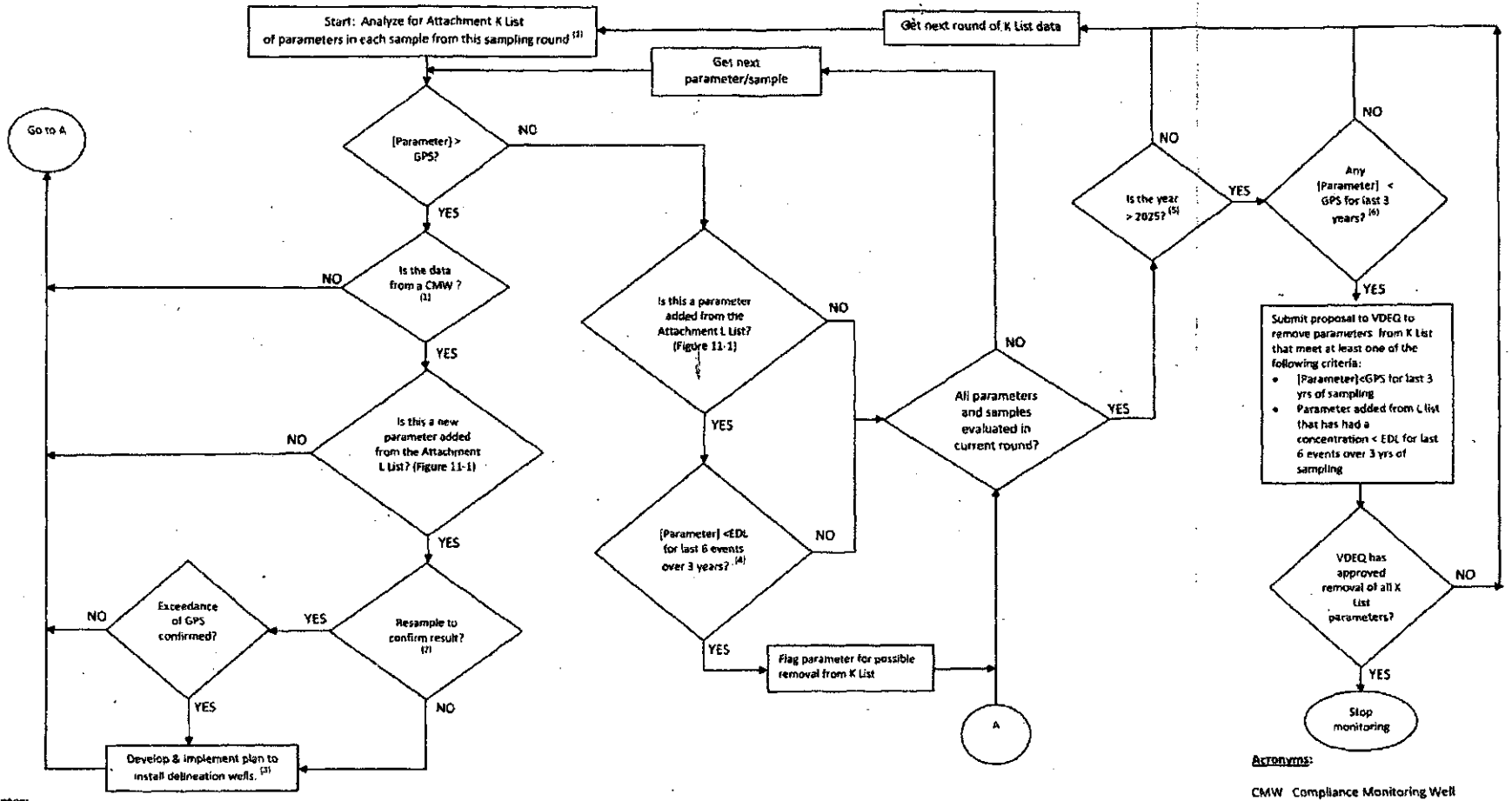
1 – Wells to be sampled annually for Attachment L List are defined in Section VI.C.2.c. of the RCRA Permit and include MW-9, MW-13, MW-14, MW-15R, MW-16, MW-17 and MW-19R.
2 – Compliance period is defined in Section VI.E.2 of the RCRA Permit and is equal to 27 years from the date of final closure of the landfill (September, 3, 1998).
3 – Established GPSs are listed in Attachment N of the RCRA Permit.
4 – Procedures to establish a GPS are listed in Section VI.I.4 of the RCRA Permit. GPS shall be the highest of the chemical-specific facility background concentration, MCLs, ACLs or RSLs.
5 – Notification as required by Section VI.I.4.b of the RCRA Permit.
6 – As defined in Section VI.I.4.c, the permittee has the option to resample and repeat analysis for the detected Attachment L constituent before determining whether to add analyte to the Attachment K List. The tendency will be to resample to confirm groundwater concentrations.
7 – As required by Section VI.I.4.c. of the RCRA Permit.
8 – In accordance with Section VI.J. of the RCRA Permit, the permittee has the option to demonstrate that a GPS exceedance was due to other sources other than the landfill. This determination will be made if information is

Acronyms:

ACL	Alternate Concentration Limit
GPS	Groundwater Protection Standard
DL	Detection Limit
MCB	Marine Corps Base
MCL	Maximum Contaminant Level
POC	Point of Compliance
RSL	Regional Screening Level
VDEQ	Virginia Department of Environmental Quality

FIGURE 11-2

SEMI-ANNUAL GROUNDWATER MC NING DECISION RULES FOR CMW AND POC WELLS
(APPLIES TO ALL PARAMETERS IN EACI LE COLLECTED DURING A GIVEN SAMPLING ROUND)
RUSSELL ROAD LANDFILL, MCB QUANTICO, VIRGINIA



Footnotes:

1 – CMW wells are defined in Section VI.C.1. of the RCRA Permit and include MW-21S, MW-21D, MW-22S, MW-22D, and MW-24.

2 – As defined in Section VI.C.3.b, the permittee has the option to resample and repeat the analysis for the detected Attachment K analyte prior to further vertical and horizontal delineation. The tendency will be resample to confirm groundwater concentrations.

3 – As required by Section VI.C.3.c of the RCRA Permit.

4 – As defined in Section VI.I.9. of the RCRA Permit. Note that permit specifies that the EDL must be below the applicable GPS for that constituent for VDEQ approval.

5 – Compliance period is defined in Section VI.E.2 of the RCRA Permit and is equal to 27 years from the date of final closure of the landfill (September 3, 1998).

6 – In accordance with Section VI.E.2., if corrective action is being conducted in 2025, then the compliance period automatically extends until the GPS is not exceeded in any POC well for 3 consecutive years.

Acronyms:

CMW Compliance Monitoring Well
EDL Estimated Detection Limit
GPS Groundwater Protection Standard
MCB Marine Corps Base
ND Not Detected
POC Point of Compliance
RCRA Resource Conservation and Recovery Act
VDEQ Virginia Department of Environmental Quality

APPENDIX A

EXAMPLE FIELD DOCUMENTATION FORMS

GROUNDWATER SAMPLE LOG SHEET

Tetra Tech NUS, Inc.

Event:
Project Site Name:
Project No.:

Sample ID:	Sampled By:
QA/QC Duplicate ID:	Sample Date:
MS/MSD Collected: YES NO	Sample Time:

WELL INFORMATION

Well ID :	Purge Date:
Well Diameter (in):	Static Water Level (ft-BTOR):
Top of Screen (ft-BTOR):	PID Monitor Reading:
Bottom of Screen (ft-BTOR):	Purge Method:
Total Well Depth (ft-BTOR):	Sample Method:

EQUIPMENT INFORMATION

Water Quality Instrument:	Pump Controller:
Turbidity Meter:	

PURGE DATA

Time (Hrs)	H^2O Level (ft-BTOR)	Flow mL / min.	Color	pH (S.U.)	S.C. (mS/cm)	DO (mg/L)	Turbidity (NTU)	Temp. (C°)	ORP (mV)	Salinity (% or ppt)	Other

FINAL PURGE / SAMPLE DATA

Start Purge	End Purge	Total (min.)	Total Vol. (gal. / L.)	pH (S.U.)	S.C. (mS/cm)	DO (mg/L)	Turbidity (NTU)	Temp. (C°)	ORP (mV)	Salinity (% or ppt)	Other

ANALYSIS, PRESERVATION AND BOTTLE REQUIRMENTS

Analysis	Method	Preservative	Number	Vol.	Bottle Type	Collected

OBSERVATIONS / NOTES:

Coordinates:	N	E	Signature(s):

Tetra Tech NUS, Inc.

CHAIN OF CUSTODY

NO. 001

Project No:	Facility:	Project Manger:	Phone:	Laboratory Name and Contact:
Samplers:		Field Ops. Leader:	Phone:	Address:
		Fed Ex Airbill Number:		City, State, Zip:
		Container Type: Plastic (P) or Glass (G)		
		Preservative Used:		

Date Year: 2010	Time	Sample ID	Location ID	Top Depth (FT)	Bottom Depth (FT)	Matrix (GW, SO, SW, QC)	Grab, Composite (G, C)	Total No. of Containers	ANALYSIS								Comments

1. Relinquished By:	Date:	Time:	1. Received By:	Date:	Time:
2. Relinquished By:	Date:	Time:	2. Received By:	Date:	Time:
Comments:					

INSTRUMENT CALIBRATION LOGSHEET

Tetra Tech NUS, Inc.

PROJECT NAME : _____

SITE NAME: _____

PROJECT NO.: _____

INSTRUMENT NAME/MODEL: _____

MANUFACTURER: _____

SERIAL NUMBER: _____

Date of Calibration (mn/dy/yr)	Person Performing Calibration (Initial)		pH (S.U.)	S.C (mS/cm)	Turbidity (1) (NTUs)	Turbidity (10) (NTUs)	D.O. (mg/L)	Temp. °C	Salinity (%)	ORP (mV)	Calibration Standard Lot # / Expiration Date	Remarks
		Pre									Lot #	
		Post									Exp. Date:	
		Pre									Lot #	
		Post									Exp. Date:	
		Pre									Lot #	
		Post									Exp. Date:	
		Pre									Lot #	
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		Pre									Lot #	
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		Pre									Lot #	
		Post									Exp. Date:	

GROUNDWATER LEVEL MEASUREMENT SHEET

Tetra Tech NUS, Inc.

Project Site Name: ______________________

Project No.: ______________________

Weather Conditions: ______________________ Personnel: ______________________

Tidally Influenced: Yes No Measuring Device: ______________________

Well or Peizometer No.	Date	Time	Elevation of Reference Point (feet)*	Total Well Depth (feet)*	Water Level (feet)*	Thickness of Free Product (feet)*	Groundwater Elevation (feet)*	Comments

* All measurements to the nearest 0.01 foot

APPENDIX B

USEPA REGION 3 GROUNDWATER SAMPLING BULLETIN

Mid-Atlantic Corrective Action

Low-Flow Purging and Sampling of Groundwater Monitoring Wells

Bulletin No. QAD023 October 15, 1997

RECOMMENDED PROCEDURE FOR LOW-FLOW PURGING AND SAMPLING OF GROUNDWATER MONITORING WELLS

1.0 OBJECTIVE AND APPLICATION

This directive provides a procedure for collection of ground-water samples in small-diameter wells with short-screened intervals using low-flow purging and sampling. While these procedures pertain to the Superfund program in Region 3, they were based on recommendations presented in the EPA Ground Water Issue paper entitled "Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures". The low-flow purging and sampling method is not appropriate for use in all hydrogeologic regimes, and particular groundwater monitoring well designs may make the method unsuitable (e.g. open hole and long screen monitoring wells in bedrock and stratified sand and clay where the water bearing zones have not been characterized). Therefore, please confer with a Region 3 hydrogeologist or geologist before using these procedures at a site.

2.0 BACKGROUND

Past scientific research (Barcelona et al., 1983; Nielson and Yeates, 1985) and EPA guidance have discussed sampling devices in terms of their compatibility with contaminants being sampled, and well construction, depth, and diameter. Although some sampling devices have been used in order to provide more representative groundwater samples in certain situations, most of these incorporate high-volume withdrawal techniques (i.e., in excess of the "natural" recharge rate of groundwater flow through the well screen) for both purging and sampling.

Research conducted by Puls et al. (1992), Puls and Powell (1992), and Powell and Puls (1993) has shown that high-volume purging and sampling cause significant turbidity and suspended particulate artifacts that can result in biased-high metals results. Additionally, purging can cause pressure changes and bailing can cause aeration that can strip VOCs from the sample (Pennino, 1988). The use of low-flow pumping devices (preferably dedicated) for purging and sampling minimizes both the disturbance of water in well casing and the potential for mobilization of colloidal material (Barcelona et al., 1994). Low-flow purging with maintenance of water level in the well and stabilization of indicator parameters (especially turbidity) allows collection of groundwater samples that are more representative of conditions without filtering (U.S. EPA, 1993; Backhus et al., 1993). In many cases, use of a low-flow pump to purge and sample monitoring wells decreases sampling time, reduces the need to handle large volumes of purge water and lowers the cost associated with its disposal, and allows collection of samples for inorganic analyses without filtering. This procedure is designed to be used in conjunction with groundwater sampling and analyses for the most common types of groundwater contaminants (volatile and semi-volatile organic compounds, pesticides, PCBs and inorganic compounds).

3.0 EQUIPMENT

Adjustable rate, positive displacement pumps (e.g. low flow-rate submersible centrifugal or bladder pumps constructed of stainless steel or Teflon). Low flow-rate electrical submersible pumps are recommended because (1) they are not subject to cyclical flow/arrest and consequent potential for mobilizing fine-grained material, and (2) they may be less prone to operator error, thereby reducing potential error resulting from application by different personnel. The pump should be easily adjustable and capable of operating reliably at lower flow rates. Peristaltic pumps may be used only for inorganic sample collection. Bailers are inappropriate for use in this procedure.

Tubing: Tubing used in purging and sampling each well must be dedicated to the individual well. Once properly located, moving the pump in the well should be avoided. Consequently, the same tubing should be used for purging and sampling. Teflon or Teflon-lined polyethylene tubing must be used to collect samples for organic analysis. For samples collected for inorganic analysis, Teflon or Teflon lined polyethylene, PVC, Tygon or polyethylene tubing may be used. The tubing wall thickness should be maximized (3/8 to ½ inch) and the tubing length should be minimized (i.e. do not have excess tubing outside of the well).
Polyethylene sheeting and sampling gloves.
Water level measuring device, 0.01 feet accuracy, (electronic preferred for tracking water level drawdown during all pumping operations).
Flow measurement supplies (e.g. graduated cylinder and stop watch).
Interface probe, if needed.
Power source (e.g. generator, located downwind; nitrogen tank, etc). The generator should not be oversized for the pump.
In-line flow-through cell containing purge criteria parameter monitoring instruments for pH, turbidity, specific conductance, temperature, Eh and dissolved oxygen (DO). The in-line device should be bypassed or disconnected during sample collection.
Photoionization detector (PID), or equivalent.
Nylon stay-ties.
Decontamination supplies.
Logbook(s).
Sample Bottles. It is recommended that preservatives are added to sample bottles prior to field activities to reduce potential error or introduction of contaminants.
Sample preservation supplies (as required by the analytical method; see previous bullet).
Sample tags or labels, chain of custody.
Well construction data, location map, field data from last sampling event.
Approved Field Sampling Plan/QA Project Plan.

4.0 PRELIMINARY SITE ACTIVITIES

1) Check the condition of the monitoring well for damage and evidence of tampering, and record pertinent observations.

2) In order to maintain a clean work area, lay out a sheet of polyethylene to place sampling and monitoring equipment.

3) Remove well cap and measure VOCs at the rim of the well with a PID or FID instrument and record the reading in the field logbook.

4) If the well casing does not have a reference point (usually a V-cut or indelible mark in the well casing) make one.

5) Measure and record the depth to water (to 0.01 feet) in all wells to be sampled before any purging begins. Care should be taken to minimize disturbance to the water column and to any particulate attached to the sides or at the bottom of the well. Consequently, in order to avoid disturbing any accumulated sediment and to prevent mixing of stagnant water with water in the screened interval, the total depth of a well should be measured well in advance (one to two weeks) of purging and sampling or after sampling is completed. Obtain depth to bottom of well

information from the well construction log and calculate standing water volume as: depth of water column times cross-sectional area of the well.

6) For wells where an Light Non-aqueous Phase Liquid (LNAPL) has been detected, a stilling tube should be inserted into the well prior to purging. Refer to Section 7.2.4 of EPA (1992) for the procedure to follow. If the wells are constructed so that DNAPLs could accumulate, their detection and /or sampling should occur, at a minimum, a week before groundwater purging and sampling. Measurement and sampling of potential DNAPL should be conducted as a separate event to minimize disturbance of any sediments which have accumulated in the bottom of the well. A double check valve, bottom loading bailer is recommended for sampling. Light non-aqueous phase liquid (LNAPL) measurement may be conducted (with an interface probe), with care to avoid disturbance of the water column within the well.

5.0 PURGING AND SAMPLING PROCEDURES

The following describes the procedure for the low-flow purging and sampling method. Equipment calibration, logbook documentation, sample bottle filling and preservation, and shipping will be conducted in accordance with the site-specific Quality Assurance Project Plan (QAPjP). Personal protective equipment will be donned in accordance with the requirements of the site-specific Health and Safety Plan. Wells should be sampled in the order of least contaminated to most contaminated.

1) Attach and secure the polyethylene tubing to the low-flow pump. As the pump is slowly lowered into the well, secure the safety drop cable, tubing, and electrical lines to each other using nylon stay-ties.

2) Pump, safety cable, tubing and electrical lines should be lowered slowly into the well to a depth corresponding to the center of the saturated screen section of the well, or at a location determined to either be a preferential flow path or zone where contamination is present. The pump intake should be kept above the bottom of the well to prevent mobilization of any sediment or DNAPL present in the bottom of the well. It is recommended that the pump be placed in the well 12 to (preferably) 48 hours prior to purging/sampling to minimize the effects of turbidity and mixing in the well from introducing the pump.

3) Measure the water level again with the pump in the well before starting the pump. Start pumping water from the well at a rate of 100 to 400 milliliters per minute (mL/min). Avoid surging. Observe air bubbles displaced from discharge tube to assess progress of steady pumping until water arrives at the surface. The pumping rate should cause little or no water level drawdown in the well (less than 0.2 ft) and the water level should stabilize. Water level measurements should be made continuously. Precautions should be taken to avoid pump suction loss or air entrainment. Pumping rates should, if needed, be reduced to the minimum capabilities of the pump to avoid pumping the well dry and ensure stabilization of indicator parameters. If the recharge rate of the well is very low, purging should be interrupted so as not to cause the drawdown within the well to advance below the pump intake but the operator should attempt to maintain a steady flow rate with the pump to the extent practicable. In these low-yielding wells, where 100 mL/min exceeds the entrance rate of groundwater into the well, it is important to avoid dewatering the well screen interval. In these cases, the pump should remain in place and the water level should be allowed to recover repeatedly until there is sufficient volume in the well to permit collection of samples. An alternative means of sample collection may be necessary under these conditions.

4) While purging the well, monitoring of in-line water quality indicator parameters should include turbidity, specific conductance, pH, dissolved oxygen (DO) and redox potential (Eh) which must be collected every three to five minutes until all of the parameters have stabilized. Stabilization is achieved when three successive readings are within ± 0.1 for pH, $\pm 3\%$ for

conductivity, ±10mv for redox potential (Eh), and ±10% for turbidity and DO. A minimum subset of these parameters that can be used to determine stabilization during purging in this procedure are pH, specific conductivity and turbidity or DO. Turbidity and DO are typically the last parameters to stabilize. If the parameters have stabilized, but the turbidity is not in the range of 5-10 NTU, then follow step 6.

5) Once stabilization has been documented, VOC and gas sensitive (e.g. Fe^{+2}, CH_4, H_2S/HS) parameter samples should be immediately collected first and directly into pre-preserved sample containers. All sample containers should be filled by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence.

Samples requiring pH adjustment should have their pH checked to assure that the proper pH has been obtained. For VOC samples, this will require that a test sample be collected to determine the amount of preservative required to be added to the sample containers prior to sampling.

6) If the turbidity measurements do not approach the range of that of natural groundwater (10 NTU), both filtered and unfiltered samples should be collected for metals analysis. Filtered metal samples are to be collected with an in-line filter. A high capacity, in-line 0.45 micron particulate filter must be pre-rinsed according to the manufacturer's recommendations, or with approximately 1 liter of groundwater following purging and prior to sampling. After the sample is filtered it must be preserved immediately.

7) As each sample is collected, the sample should be labeled as defined in the QAPjP. All samples should be placed into a cooler with proper temperature control as outlined in the QAPjP.

After collection of the samples, the tubing from the pump should be properly discarded or dedicated to the well for re-sampling (by hanging the tubing inside the well).

8) Measure and record well total depth.

9) Secure the well (close and lock it up).

6.0 REFERENCES

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Return to RCRA Corrective Action Online Resources

APPENDIX C

PAL DOCUMENTATION

TABLE C-1
PROJECT ACTION LIMIT SELECTION FOR APPENDIX IX PARAMETERS (ATTACHMENT L OF PERMIT)
RUSSELL ROAD LANDFILL
MCB QUANTICO, VIRGINIA

Analyte	CAS Number	Established Background Concentration [1]	Federal MCL for Drinking Water	Virginia ACL [2]	ORNL RSL for Tapwater [3]	PAL [4]	PAL Reference	PQL Goal	Laboratory-specific		
		(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)		(µg/L)	LOD (ug/L)	LOQ (ug/L)	DL (ug/L)
VOCs											
1,1,1,2-TETRACHLOROETHANE	630-20-6	--	--	0.52	0.52	0.52	ACL	0.17	TBD	TBD	TBD
1,1,1-TRICHLOROETHANE	71-55-6	--	200	7821	9100	9100	RSL	3033	TBD	TBD	TBD
1,1,2,2-TETRACHLOROETHANE	79-34-5	--	--	0.067	0.067	0.067	ACL	0.022	TBD	TBD	TBD
1,1,2-TRICHLOROETHANE	79-00-5	--	5	0.24	0.24	5	MCL	1.7	TBD	TBD	TBD
1,1-DICHLOROETHANE	75-34-3	2.6	--	2.42	2.4	2.6	Background	0.87	TBD	TBD	TBD
1,1-DICHLOROETHENE	75-35-4	--	7	272	340	340	RSL	113	TBD	TBD	TBD
1,2,3-TRICHLOROPROPANE	96-18-4	--	--	0.00072	0.00072	0.00072	ACL	0.00024	TBD	TBD	TBD
1,2,4-TRICHLOROBENZENE	120-82-1	--	70	2.32	2.3	70	MCL	23	TBD	TBD	TBD
1,2-DIBROMO-3-CHLOROPROPANE	96-12-8	--	0.2	0.00032	0.00032	0.2	MCL	0.067	TBD	TBD	TBD
1,2-DIBROMOETHANE	106-93-4	--	0.05	0.00654	0.0065	0.05	MCL	0.017	TBD	TBD	TBD
1,2-DICHLOROBENZENE	95-50-1	--	600	322	370	600	MCL	200	TBD	TBD	TBD
1,2-DICHLOROETHANE	107-06-2	--	5	0.15	0.15	5	MCL	1.7	TBD	TBD	TBD
1,2-DICHLOROPROPANE	78-87-5	--	5	0.39	0.39	5	MCL	1.7	TBD	TBD	TBD
1,3-DICHLOROBENZENE	541-73-1	--	--	--	--	-- [5]	-- [5]	TBD [5]	TBD	TBD	TBD
1,4-DICHLOROBENZENE	106-46-7	2	75	0.43	0.43	75	MCL	25	TBD	TBD	TBD
1,4-DIOXANE	123-91-1	7.4	--	0.67	0.67	7.4	Background	2.5	TBD	TBD	TBD
2-BUTANONE	78-93-3	3.4	--	4940	7100	7100	RSL	2367	TBD	TBD	TBD
2-HEXANONE	591-78-6	--	--	34.8	47	47	RSL	15.7	TBD	TBD	TBD
4-METHYL-2-PENTANONE	108-10-1		--	1043	2000	2000	RSL	667	TBD	TBD	TBD
ACETONE	67-64-1	2.5	--	11561	22000	22000	RSL	7333	TBD	TBD	TBD
ACETONITRILE	75-05-8	--	--	125	130	130	RSL	43.3	TBD	TBD	TBD
ACROLEIN	107-02-8	--	--	0.04	0.042	0.042	RSL	0.014	TBD	TBD	TBD
ACRYLONITRILE	107-13-1	--	--	0.05	0.045	0.05	ACL	0.017	TBD	TBD	TBD
ALLYL CHLORIDE	107-05-1	--	--	0.65	0.65	0.65	ACL	0.22	TBD	TBD	TBD
BENZENE	71-43-2	0.79	5	0.41	0.41	5	MCL	1.7	TBD	TBD	TBD
BROMODICHLOROMETHANE	75-27-4	--	80	0.12	0.12	80	MCL	26.7	TBD	TBD	TBD
BROMOFORM	75-25-2	--	80	8.5	8.5	80	MCL	26.7	TBD	TBD	TBD
BROMOMETHANE	74-83-9	--	--	7.1	8.7	8.7	RSL	2.9	TBD	TBD	TBD
CARBON DISULFIDE	75-15-0	0.5	--	755	1000	1000	RSL	333	TBD	TBD	TBD
CARBON TETRACHLORIDE	56-23-5	--	5	0.44	0.44	5	MCL	1.7	TBD	TBD	TBD
CHLOROBENZENE	108-90-7	8.8	100	78.2	91	100	MCL	33.3	TBD	TBD	TBD
CHLOROETHANE	75-00-3	7.2	--	20800	21000	21000	RSL	7000	TBD	TBD	TBD
CHLOROFORM	67-66-3	0.14	80	0.19	0.19	80	MCL	26.7	TBD	TBD	TBD
CHLOROMETHANE	74-87-3		--	187	190	190	RSL	63.3	TBD	TBD	TBD
CHLOROPRENE	126-99-8	--	--	0.016	0.016	0.016	ACL	0.005	TBD	TBD	TBD
CIS-1,3-DICHLOROPROPENE	10061-01-5	--	--	--	0.43	0.43	RSL	0.14	TBD	TBD	TBD
DIBROMOCHLOROMETHANE	124-48-1	--	80	0.15	0.15	80	MCL	26.7	TBD	TBD	TBD
DIBROMOMETHANE	74-95-3	--	--	7.9	8.2	8.2	RSL	2.7	TBD	TBD	TBD
DICHLORODIFLUOROMETHANE	75-71-8	0.5	--	368	390	390	RSL	130	TBD	TBD	TBD
ETHYL METHACRYLATE	97-63-2	--	--	1404	3300	3300	RSL	1100	TBD	TBD	TBD
ETHYLBENZENE	100-41-4	--	700	1.5	1.5	700	MCL	233	TBD	TBD	TBD
IODOMETHANE (methyl iodide)	74-88-4	--	--	--	--	-- [5]	-- [5]	TBD [5]	TBD	TBD	TBD
ISOBUTYL ALCOHOL	78-83-1	--	--	4680	11000	11000	RSL	3667	TBD	TBD	TBD
METHACRYLONITRILE	126-98-7	--	--	0.76	1	1	RSL	0.33	TBD	TBD	TBD
METHYL METHACRYLATE	80-62-6	--	--	1369	1400	1400	RSL	467	TBD	TBD	TBD
METHYLENE CHLORIDE	75-09-2	0.5	5	4.8	4.8	5	MCL	1.7	TBD	TBD	TBD
NAPHTHALENE	91-20-3	--	--	0.14	0.14	0.14	ACL	0.05	TBD	TBD	TBD
PENTACHLOROETHANE	76-01-7	--	--	0.75	0.75	0.75	ACL	0.25	TBD	TBD	TBD
PROPIONITRILE	107-12-0	--	--	--	--	-- [5]	-- [5]	TBD [5]	TBD	TBD	TBD
STYRENE	100-42-5	--	100	1251	1600	1600	RSL	533	TBD	TBD	TBD
TETRACHLOROETHENE	127-18-4	0.51	5	0.11	0.11	5	MCL	1.7	TBD	TBD	TBD
TOLUENE	108-88-3	1.8	1000	1117	2300	2300	RSL	767	TBD	TBD	TBD
TRANS-1,2-DICHLOROETHENE	156-60-5	0.5	100	89.4	110	110	RSL	36.7	TBD	TBD	TBD
TRANS-1,3-DICHLOROPROPENE	10061-02-6	--	--	--	0.433	0.433	ACL	0.14	TBD	TBD	TBD
TRANS-1,4-DICHLORO-2-BUTENE	110-57-6	--	--	--	0.0012	0.0012	RSL	0.00040	TBD	TBD	TBD
TRICHLOROETHENE	79-01-6	0.5	5	2.0	2	5	MCL	1.7	TBD	TBD	TBD
TRICHLOROFLUOROMETHANE	75-69-4	--	--	1114	1300	1300	RSL	433	TBD	TBD	TBD

TABLE C-1

PROJECT ACTION LIMIT SELECTION FOR APPENDIX IX PARAMETERS (ATTACHMENT L OF PERMIT)

RUSSELL ROAD LANDFILL

MCB QUANTICO, VIRGINIA

Analyte	CAS Number	Established Background Concentration [1]	Federal MCL for Drinking Water	Virginia ACL [2]	ORNL RSL for Tapwater [3]	PAL [4]	PAL Reference	PQL Goal	Laboratory-specific		
		(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)		(µg/L)	LOD (ug/L)	LOQ (ug/L)	DL (ug/L)
VINYL ACETATE	108-05-4	--	--	406	410	410	RSL	137	TBD	TBD	TBD
VINYL CHLORIDE	75-01-4	--	2	0.02	0.016	2	MCL	0.7	TBD	TBD	TBD
TOTAL XYLENES	534-52-1	--	--	196	2.9	195.53534	ACL	65.2	TBD	TBD	TBD
SVOCs											
1,2,4,5-TETRACHLOROBENZENE	95-94-3	--	--	4.7	11	11	RSL	3.7	TBD	TBD	TBD
1,3 DINITROBENZENE	99-65-0	--	--	1.6	3.7	3.7	RSL	1.2	TBD	TBD	TBD
1,3,5-TRINITROBENZENE	99-35-4	--	--	468	1100	1100	RSL	366.7	TBD	TBD	TBD
1,4-NAPHTHOQUINONE	130-15-4	--	--	--	--	-- [5]	-- [5]	TBD [5]	TBD	TBD	TBD
1,4-PHENYLENEDIAMINE	106-50-3	--	--	2964	6900	6900	RSL	2300	TBD	TBD	TBD
1-NAPHTHYLAMINE	134-32-7	--	--	--	--	-- [5]	-- [5]	TBD [5]	TBD	TBD	TBD
2,3,4,6-TETRACHLOROPHENOL	58-90-2	--	--	468	1100	1100	RSL	367	TBD	TBD	TBD
2,4,5-TRICHLOROPHENOL	95-95-4	--	--	1560	3700	3700	RSL	1233	TBD	TBD	TBD
2,4,6-TRICHLOROPHENOL	88-06-2	--	--	6.1	6.1	6.1	ACL	2.0	TBD	TBD	TBD
2,4-DICHLOROPHENOL	120-83-2	--	--	46.8	110	110	RSL	36.7	TBD	TBD	TBD
2,4-DIMETHYLPHENOL	105-67-9	--	--	312	730	730	RSL	243	TBD	TBD	TBD
2,4-DINITROPHENOL	51-28-5	--	--	31.2	73	73	RSL	24.3	TBD	TBD	TBD
2,4-DINITROTOLUENE	121-14-2	--	--	31.2	0.22	31.2	ACL	10.4	TBD	TBD	TBD
2,6-DICHLOROPHENOL	87-65-0	--	--	--	--	-- [5]	-- [5]	TBD [5]	TBD	TBD	TBD
2,6-DINITROTOLUENE	606-20-2	--	--	15.6	37	37	RSL	12.3	TBD	TBD	TBD
2-ACETYLAMINOFLUORENE	53-96-3	--	--	0.02	0.018	0.018	RSL	0.01	TBD	TBD	TBD
2-CHLORONAPHTHALENE	91-58-7	--	--	1248	2900	2900	RSL	967	TBD	TBD	TBD
2-CHLOROPHENOL	95-57-8	--	--	78	180	180	RSL	60	TBD	TBD	TBD
2-METHYL-4,6-DINITROPHENOL	534-52-1	--	--	1.2	2.9	2.9	RSL	1.0	TBD	TBD	TBD
2-METHYLNAPHTHALENE	91-57-6	--	--	62.4	150	150	RSL	50.0	TBD	TBD	TBD
2-METHYLPHENOL	95-48-7	--	--	780	1800	1800	RSL	600	TBD	TBD	TBD
2-NAPHTHYLAMINE	91-59-8	--	--	0.04	0.037	0.04	ACL	0.012	TBD	TBD	TBD
2-NITROANILINE	88-74-4	--	--	156	370	370	RSL	123	TBD	TBD	TBD
2-NITROPHENOL	88-75-5	--	--	--	--	-- [5]	-- [5]	TBD [5]	TBD	TBD	TBD
2-PICOLINE	109-06-8	--	--	--	--	-- [5]	-- [5]	TBD [5]	TBD	TBD	TBD
3-METHYLPHENOL	108-39-4	--		780	1800	1800	RSL	600	TBD	TBD	TBD
3,3'-DICHLOROBENZIDINE	91-94-1	--	--	0.15	0.15	0.15	ACL	0.05	TBD	TBD	TBD
3,3'-DIMETHYLBENZIDINE	119-93-7	--	--		0.0061	0.0061	RSL	0.0020	TBD	TBD	TBD
3-METHYLCHOLANTHRENE	56-49-5	--	--	0.0031	0.0031	0.0031	ACL	0.0010	TBD	TBD	TBD
3-NITROANILINE	99-09-2	--	--	--	--	-- [5]	-- [5]	TBD [5]	TBD	TBD	TBD
4-AMINOBIPHENYL	92-67-1	--	--	0.0032	0.0032	0.0032	ACL	0.0011	TBD	TBD	TBD
4-BROMOPHENYL PHENYL ETHER	101-55-3	--	--	--	--	-- [5]	-- [5]	TBD [5]	TBD	TBD	TBD
4-CHLORO-3-METHYLPHENOL	59-50-7	--	--	1560	3700	3700	RSL	1233	TBD	TBD	TBD
4-CHLOROANILINE	106-47-8	--	--	0.34	0.34	0.34	ACL	0.11	TBD	TBD.	TBD
4-CHLOROPHENYL PHENYL ETHER	7005-72-3	--	--	--	--	-- [5]	-- [5]	TBD [5]	TBD	TBD	TBD
4-METHYLPHENOL	106-44-5	7.4	--	78	180	180	RSL	60	TBD	TBD	TBD
4-NITROANILINE	100-01-6	--	--	3.4	3.4	3.4	ACL		TBD	TBD	TBD
4-NITROPHENOL	100-02-7	--	--	--	--	-- [5]	-- [5]	TBD [5]	TBD	TBD	TBD
4-NITROQUINOLINE-1-OXIDE	56-57-5	--	--	--	--	-- [5]	-- [5]	TBD [5]	TBD	TBD	TBD
5-NITRO-O-TOLUIDINE	99-55-8	--	--	2.0	2	2.0	ACL	0.68	TBD	TBD	TBD
7,12-DIMETHYLBENZ(A)ANTHRACENE	57-97-6	--	--	0.00027	0.00027	0.00027	ACL	0.00009	TBD	TBD	TBD
A,A-DIMETHYLPHENETHYLAMINE	122-09-8	--	--	--	--	-- [5]	-- [5]	TBD [5]	TBD	TBD	TBD
ACENAPHTHENE	83-32-9	--	--	936	2200	2200	RSL	733	TBD	TBD	TBD
ACENAPHTHYLENE	208-96-8	--	--	--	2200	2200	RSL	733	TBD	TBD	TBD
ACETOPHENONE	98-86-2	--	--	1560	3700	3700	RSL	1233	TBD	TBD	TBD
ANILINE	62-53-3	--	--	11.8	12	12	RSL	4.0	TBD	TBD	TBD
ANTHRACENE	120-12-7	--	--	4680	11000	11000	RSL	3667	TBD	TBD	TBD
ARAMITE	140-57-8	--	--	--	2.7	2.7	RSL	1	TBD	TBD	TBD
BENZO(A)ANTHRACENE	56-55-3	--	--	0.029	0.029	0.029	ACL	0.010	TBD	TBD	TBD
BENZO(A)PYRENE	50-32-8	--	0.2	0.0029	0.0029	0.2	MCL	0.067	TBD	TBD	TBD
BENZO(B)FLUORANTHENE	205-99-2	--	--	0.029	0.029	0.029	ACL	0.010	TBD	TBD	TBD

TABLE C-1
PROJECT ACTION LIMIT SELECTION FOR APPENDIX IX PARAMETERS (ATTACHMENT L OF PERMIT)
RUSSELL ROAD LANDFILL
MCB QUANTICO, VIRGINIA

Analyte	CAS Number	Established Background Concentration [1]	Federal MCL for Drinking Water	Virginia ACL [2]	ORNL RSL for Tapwater [3]	PAL [4]	PAL Reference	PQL Goal	Laboratory-specific		
		(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)		(µg/L)	LOD (ug/L)	LOQ (ug/L)	DL (ug/L)
BENZO(G,H,I)PERYLENE	191-24-2	--	--	--	1100	1100	RSL	367	TBD	TBD	TBD
BENZO(K)FLUORANTHENE	207-08-9	--	--	0.29	0.29	0.29	ACL	0.10	TBD	TBD	TBD
BENZYL ALCOHOL	100-51-6	--	--	1560	3700	3700	RSL	1233	TBD	TBD	TBD
BIS(2-CHLOROETHOXY)METHANE	111-91-1	--	--	46.8	110	110	RSL	37	TBD	TBD	TBD
BIS(2-CHLOROETHYL)ETHER	111-44-4	--	--	0.012	0.012	0.012	ACL	0.004	TBD	TBD	TBD
BIS(2-CHLOROISOPROPYL)ETHER	39638-32-9	--	--	--	--	-- [5]	-- [5]	TBD [5]	TBD	TBD	TBD
BIS(2-ETHYLHEXYL)PHTHALATE	117-81-7	17	6	4.80	4.8	17	Background	5.7	TBD	TBD	TBD
BUTYL BENZYL PHTHALATE	85-68-7	--	--	35.4	35	35.4	ACL	11.8	TBD	TBD	TBD
CHLOROBENZILATE	510-15-6	--	--	0.61	0.61	0.61	ACL	0.204	TBD	TBD	TBD
CHRYSENE	218-01-9	--	--	2.95	2.9	2.95	ACL	0.982	TBD	TBD	TBD
DIALLATE	2303-16-4	--	--	1.10	1.1	1.10	ACL	0.367	TBD	TBD	TBD
DIBENZO(A,H)ANTHRACENE	53-70-3	--	--	0.0029	0.0029	0.0029	ACL	0.001	TBD	TBD	TBD
DIBENZOFURAN	132-64-9	--	--	15.6	37	37	RSL	12.3	TBD	TBD	TBD
DIETHYL PHTHALATE	84-66-2	2	--	12480	29000	29000	RSL	9667	TBD	TBD	TBD
DIMETHOATE	60-51-5	--	--	3.12	7.3	7.3	RSL	2.4	TBD	TBD	TBD
DIMETHYL PHTHALATE	131-11-3	--	--	--	--	-- [5]	-- [5]	TBD [5]	TBD	TBD	TBD
DI-N-BUTYL PHTHALATE	84-74-2	1.3	--	1560	3700	3700	RSL	1233	TBD	TBD	TBD
DI-N-OCTYL PHTHALATE	117-84-0	--	--	312	--	312	ACL	104	TBD	TBD	TBD
DIPHENYLAMINE	122-39-4	--	--	390	910	910	RSL	303	TBD	TBD	TBD
DISULFOTON	298-04-4	--	--	0.624	1.5	1.5	RSL	0.50	TBD	TBD	TBD
ETHYL METHANESULFONATE	62-50-0	--	--	--	--	-- [5]	-- [5]	TBD [5]	TBD	TBD	TBD
ETHYL PARATHION	56-38-2	--	--	--	--	-- [5]	-- [5]	TBD [5]	TBD	TBD	TBD
FAMPHUR	52-85-7	--	--	--	--	-- [5]	-- [5]	TBD [5]	TBD	TBD	TBD
FLUORANTHENE	206-44-0	--	--	624	1500	1500	RSL	500	TBD	TBD	TBD
FLUORENE	86-73-7	--	--	624	1500	1500	RSL	500	TBD	TBD	TBD
HEXACHLOROBENZENE	118-74-1	--	1	0.042	0.042	1	MCL	0.33	TBD	TBD	TBD
HEXACHLOROBUTADIENE	87-68-3	--	--	0.86	0.86	0.86	ACL	0.29	TBD	TBD	TBD
HEXACHLOROCYCLOPENTADIENE	77-47-4	--	50	93.6	220	220	RSL	73	TBD	TBD	TBD
HEXACHLOROETHANE	67-72-1	--	--	4.80	4.8	4.80	RSL	1.6	TBD	TBD	TBD
HEXACHLOROPHENE	70-30-4	--	--	4.68	11	11	RSL	3.7	TBD	TBD	TBD
HEXACHLOROPROPENE	1888-71-7	--	--	--	--	-- [5]	-- [5]	TBD [5]	TBD	TBD	TBD
INDENO(1,2,3-CD)PYRENE	193-39-5	--	--	0.029	0.029	0.029	ACL	0.01	TBD	TBD	TBD
ISODRIN	465-73-6	--	--	--	--	-- [5]	-- [5]	TBD [5]	TBD	TBD	TBD
ISOPHORONE	78-59-1	--	--	71	71	71	ACL	23.7	TBD	TBD	TBD
ISOSAFROLE	120-58-1	--	--	--	--	-- [5]	-- [5]	TBD [5]	TBD	TBD	TBD
KEPONE	143-50-0	--	--	0.007	--	0.007	ACL	0.0023	TBD	TBD	TBD
METHAPYRILENE	91-80-5	--	--	--	--	-- [5]	-- [5]	TBD [5]	TBD	TBD	TBD
METHYL METHANESULFONATE	66-27-3	--	--	0.68	0.68	0.68	ACL	0.23	TBD	TBD	TBD
METHYL PARATHION	298-00-0	--	--	3.9	9.1	9.1	RSL	3.03	TBD	TBD	TBD
NITROBENZENE	98-95-3	--	--	0.12	0.12	0.12	ACL	0.04	TBD	TBD	TBD
N-NITROSODIETHYLAMINE	55-18-5	--	--	0.00014	0.00014	0.00014	ACL	0.000048	TBD	TBD	TBD
N-NITROSODIMETHYLAMINE	62-75-9	--	--	0.00042	0.00042	0.00042	ACL	0.00014	TBD	TBD	TBD
N-NITROSO-DI-N-BUTYLAMINE	924-16-3	--	--	0.0024	0.0024	0.0024	ACL	0.00082	TBD	TBD	TBD
N-NITROSO-DI-N-PROPYLAMINE	621-64-7	--	--	0.0096	0.0096	0.0096	ACL	0.0032	TBD	TBD	TBD
N-NITROSODIPHENYLAMINE	86-30-6	--	--	14	14	14	ACL	4.67	TBD	TBD	TBD
N-NITROSOMETHYLETHYLAMINE	10595-95-6	--	--	0.0031	0.0031	0.0031	ACL	0.0010	TBD	TBD	TBD
N-NITROSOMORPHOLINE	59-89-2	--	--	0.010	0.01	0.010	ACL	0.0033	TBD	TBD	TBD
N-NITROSOPIPERIDINE	100-75-4	--	--	0.0072	0.0072	0.0072	ACL	0.0024	TBD	TBD	TBD
N-NITROSOPYRROLIDINE	930-55-2	--	--	0.032	0.032	0.032	ACL	0.01	TBD	TBD	TBD
O,O,O-TRIETHYLPHOSPHOROTHIOATE	126-68-1	--	--	--	--	-- [5]	-- [5]	TBD [5]	TBD	TBD	TBD
O-TOLUIDINE	95-53-4	--	--	0.37	--	0.37	ACL	0.12	TBD	TBD	TBD
P-DIMETHYLAMINOAZOBENZENE	60-11-7	--	--		0.015	0.015	RSL	0.01	TBD	TBD	TBD
PENTACHLOROBENZENE	608-93-5	--	--	12.5	29	29	RSL	9.67	TBD	TBD	TBD
PENTACHLORONITROBENZENE	82-68-8	--	--	0.26	0.26	0.26	ACL	0.09	TBD	TBD	TBD
PENTACHLOROPHENOL	87-86-5	--	1	0.17	0.17	1	MCL	0.33	TBD	TBD	TBD
PHENACETIN	62-44-2	--	--	30.6	31	31	RSL	10.3	TBD	TBD	TBD
PHENANTHRENE	85-01-8	--	--	--	1100	1100	RSL	367	TBD	TBD	TBD

TABLE C-1

PROJECT ACTION LIMIT SELECTION FOR APPENDIX IX PARAMETERS (ATTACHMENT L OF PERMIT)

RUSSELL ROAD LANDFILL

MCB QUANTICO, VIRGINIA

Analyte	CAS Number	Established Background Concentration [1]	Federal MCL for Drinking Water	Virginia ACL [2]	ORNL RSL for Tapwater [3]	PAL [4]	PAL Reference	PQL Goal	Laboratory-specific		
		(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)		(µg/L)	LDD (ug/L)	LOQ (ug/L)	DL (ug/L)
PHENOL	108-95-2	2	--	4680	11000	11000	RSL	3667	TBD	TBD	TBD
PHORATE	298-02-2		--	3.12	7.3	7.3	RSL	2.43	TBD	TBD	TBD
PRONAMIDE	23950-58-5	--	--	--	2700	2700	RSL	900	TBD	TBD	TBD
PYRENE	129-00-0	--	--	468	1100	1100	RSL	367	TBD	TBD	TBD
PYRIDINE	110-86-1	--	--	15.6	37	37	RSL	12.33	TBD	TBD	TBD
SAFROLE	94-59-7	--	--	0.31	0.31	0.31	ACL	0.10	TBD	TBD	TBD
SULFOTEPP	3689-24-5	--	--	7.8	18	18	RSL	6.0	TBD	TBD	TBD
THIONAZIN	297-97-2	--	--	--	--	-- [5]	-- [5]	TBD [5]	TBD	TBD	TBD
PEST											
ALDRIN	309-00-2	--	--	0.0040	0.004	0.004	ACL	0.0013	TBD	TBD	TBD
ALPHA-BHC	319-84-6	2	--	0.0107	0.011	2	Background	0.67	TBD	TBD	TBD
BETA-BHC	319-85-7	--	--	0.037	0.037	0.037	ACL	0.01	TBD	TBD	TBD
CHLORDANE	57-74-9		2	0.19	0.19	2	MCL	0.667	TBD	TBD	TBD
4,4'-DDD	72-54-8	--	--	0.28	0.28	0.28	ACL	0.09	TBD	TBD	TBD
4,4'-DDE	72-55-9	--	--	0.20	0.2	0.2	ACL	0.07	TBD	TBD	TBD
4,4'-DDT	50-29-3	--	--	0.20	0.2	0.2	ACL	0.07	TBD	TBD	TBD
DELTA-BHC	319-86-8	--	--	--	0.011	0.011	RSL	0.0037	TBD	TBD	TBD
DIELDRIN	60-57-1	--	--	0.004	0.0042	0.004	ACL	0.0014	TBD	TBD	TBD
ENDOSULFAN I	959-98-8	--	--	--	220	220	RSL	73.3	TBD	TBD	TBD
ENDOSULFAN II	33213-65-9	--	--	--	220	220	RSL	73.3	TBD	TBD	TBD
ENDOSULFAN SULFATE	1031-07-8	--	--	--	220	220	RSL	73.3	TBD	TBD	TBD
ENDRIN	72-20-8	--	2	4.68	11	11	RSL	3.7	TBD	TBD	TBD
ENDRIN ALDEHYDE	7421-93-4	--	--	--	11	11	RSL	3.7	TBD	TBD	TBD
GAMMA-BHC (LINDANE)	58-89-9	--	0.2	0.061	0.061	0.2	MCL	0.07	TBD	TBD	TBD
HEPTACHLOR	76-44-8	--	0.4	0.015	0.015	0.4	MCL	0.13	TBD	TBD	TBD
HEPTACHLOR EPOXIDE	1024-57-3	--	0.2	0.007	0.0074	0.2	MCL	0.07	TBD	TBD	TBD
METHOXYCHLOR	72-43-5	--	40	78	180	180	RSL	60	TBD	TBD	TBD
TOXAPHENE	8001-35-2	--	3	0.061	0.061	3	MCL	1.0	TBD	TBD	TBD
PCBs											
AROCLOR-1016	12674-11-2	--	0.5	0.96	0.96	0.96	ACL-based [6]	0.3	TBD	TBD	TBD
AROCLOR-1221	11104-28-2	--	0.5	0.96	0.0068	0.96	ACL-based [6]	0.3	TBD	TBD	TBD
AROCLOR-1232	11141-16-5	--	0.5	0.96	0.0068	0.96	ACL-based [6]	0.3	TBD	TBD	TBD
AROCLOR-1242	53469-21-9	--	0.5	0.96	0.034	0.96	ACL-based [6]	0.3	TBD	TBD	TBD
AROCLOR-1248	12672-29-6	--	0.5	0.96	0.034	0.96	ACL-based [6]	0.3	TBD	TBD	TBD
AROCLOR-1254	11097-69-1	--	0.5	0.96	0.034	0.96	ACL-based [6]	0.3	TBD	TBD	TBD
AROCLOR-1260	11096-82-5	--	0.5	0.96	0.034	0.96	ACL-based [6]	0.3	TBD	TBD	TBD
TOTAL PCBs	NA	--	0.5	0.96	0.17	0.96	ACL	0.3	NA	NA	NA
HERB											
2,4-D	94-75-7	--	70	156	370	370	RSL	123	TBD	TBD	TBD
2,4,5-T	93-76-5	--	--	156	370	370	RSL	123	TBD	TBD	TBD
2,4,5-TP (SILVEX)	93-72-1	--	50	125	290	290	RSL	96.7	TBD	TBD	TBD
DINOSEB	88-85-7	--	7	15.6	37	37	RSL	12.3	TBD	TBD	TBD
METALS (TOTAL)											
ANTIMONY	7440-36-0	5	6	6.24	15	15	RSL	5.0	TBD	TBD	TBD
ARSENIC	7440-38-2	0.48	10	0.045	0.045	10	MCL	3.3	TBD	TBD	TBD
BARIUM	7440-39-3	1220	2000	3120	7300	7300	RSL	2433	TBD	TBD	TBD
BERYLLIUM	7440-41-7	1	4	31.2	73	73	RSL	24.3	TBD	TBD	TBD
CADMIUM	7440-43-9	0.84	5	7.8	18	18	RSL	6.0	TBD	TBD	TBD
CHROMIUM	7440-47-3	4.7	100	--	--	100	MCL	33.3	TBD	TBD	TBD
COBALT	7440-48-4	11	--	4.68	11	11	Background	3.7	TBD	TBD	TBD
COPPER	7440-50-8	59.5	1300	624	1500	1500	RSL	500	TBD	TBD	TBD
LEAD	7439-92-1	2.7	15	--	--	15	MCL	5.0	TBD	TBD	TBD
MERCURY	7439-97-6	0.17	2	0.50	0.57	2	MCL	0.7	TBD	TBD	TBD
NICKEL	7440-02-0	18.3	--	312	730	730	RSL	243.3	TBD	TBD	TBD
SELENIUM	7782-49-2	3.7	50	50	180	180	RSL	60.0	TBD	TBD	TBD

TABLE C-1
PROJECT ACTION LIMIT SELECTION FOR APPENDIX IX PARAMETERS (ATTACHMENT L OF PERMIT)
RUSSELL ROAD LANDFILL
MCB QUANTICO, VIRGINIA

Analyte	CAS Number	Established Background Concentration [1]	Federal MCL for Drinking Water	Virginia ACL [2]	ORNL RSL for Tapwater [3]	PAL [4]	PAL Reference	PQL Goal	Laboratory-specific		
		(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)		(µg/L)	LOD (ug/L)	LOQ (ug/L)	DL (ug/L)
SILVER	7440-22-4	0.05	--	78	180	180	RSL	60.0	TBD	TBD	TBD
THALLIUM	7440-28-0		2	--	--	2	MCL	0.7	TBD	TBD	TBD
TIN	7440-31-5	24.5	--	9360	22000	22000	RSL	7333	TBD	TBD	TBD
VANADIUM	7440-62-2	3	--	1,092	180	180	RSL	60.0	TBD	TBD	TBD
ZINC	7440-66-6	674	--	4680	11000	11000	RSL	3667	TBD	TBD	TBD
WET CHEM											
TOTAL PHENOLICS	TTNU5348	--	--		--				TBD	TBD	TBD
SULFIDE	18496-25-8	--	--	--	--	-- [5]	-- [5]	TBD [5]	TBD	TBD	TBD
CYANIDE	57-12-5	--	200	312	730	730	RSL	243	TBD	TBD	TBD
DIOXIN											
1,2,3,4,6,7,8,9-OCDD	3268-87-9	--	0.1	0.00173	0.00173	0.1	MCL-based [7]	0.03	TBD	TBD	TBD
1,2,3,4,6,7,8,9-OCDF	39001-02-0	--	0.1	0.00173	0.00173	0.1	MCL-based [7]	0.03	TBD	TBD	TBD
1,2,3,4,6,7,8-HpCDD	35822-46-9	--	0.003	0.000052	0.000052	0.003	MCL-based [7]	0.0010	TBD	TBD	TBD
1,2,3,4,6,7,8-HpCDF	67562-39-4	--	0.003	0.000052	0.000052	0.003	MCL-based [7]	0.0010	TBD	TBD	TBD
1,2,3,4,7,8,9-HpCDF	55673-89-7	--	0.003	0.000052	0.000052	0.003	MCL-based [7]	0.0010	TBD	TBD	TBD
1,2,3,4,7,8-HxCDD	39227-28-6	--	0.0003	0.0000052	0.0000052	0.0003	MCL-based [7]	0.00010	TBD	TBD	TBD
1,2,3,4,7,8-HxCDF	70648-26-9	--	0.0003	0.0000052	0.0000052	0.0003	MCL-based [7]	0.00010	TBD	TBD	TBD
1,2,3,6,7,8-HxCDD	57653-85-7	--	0.0003	0.0000052	0.0000052	0.0003	MCL-based [7]	0.00010	TBD	TBD	TBD
1,2,3,6,7,8-HxCDF	57117-44-9	--	0.0003	0.0000052	0.0000052	0.0003	MCL-based [7]	0.00010	TBD	TBD	TBD
1,2,3,7,8,9-HxCDD	19408-74-3	--	0.0003	0.0000052	0.0000052	0.0003	MCL-based [7]	0.00010	TBD	TBD	TBD
1,2,3,7,8,9-HxCDF	72918-21-9	--	0.0003	0.0000052	0.0000052	0.0003	MCL-based [7]	0.00010	TBD	TBD	TBD
1,2,3,7,8-PeCDD	40321-76-4	--	0.00003	0.00000052	0.00000052	0.00003	MCL-based [7]	0.00001	TBD	TBD	TBD
1,2,3,7,8-PeCDF	57117-41-6	--	0.001	1.73E-05	1.73E-05	0.001	MCL-based [7]	0.00033	TBD	TBD	TBD
2,3,4,6,7,8-HxCDF	60851-34-5	--	0.0003	0.0000052	0.0000052	0.0003	MCL-based [7]	0.00010	TBD	TBD	TBD
2,3,4,7,8-PeCDF	57117-31-4	--	0.0001	1.73E-06	1.73E-06	0.0001	MCL-based [7]	0.00003	TBD	TBD	TBD
2,3,7,8-TCDD	1746-01-6	--	0.00003	5.70E-07	5.70E-07	0.00003	MCL	0.00001	TBD	TBD	TBD
2,3,7,8-TCDF	51207-31-9	--	0.0003	0.0000052	0.0000052	0.0003	MCL-based [7]	0.00010	TBD	TBD	TBD
Total HpCDD	37871-00-4	--	NA	NA	NA	NA	NA	NC	NA	NA	NA
Total HpCDF	38998-75-3	--	NA	NA	NA	NA	NA	NC	NA	NA	NA
Total HxCDD	34465-46-8	--	NA	NA	NA	NA	NA	NC	NA	NA	NA
Total HxCDF	55684-94-1	--	NA	NA	NA	NA	NA	NC	NA	NA	NA
Total PeCDD	36088-22-9	--	NA	NA	NA	NA	NA	NC	NA	NA	NA
Total PeCDF	30402-15-4	--	NA	NA	NA	NA	NA	NC	NA	NA	NA
Total TCDD	41903-57-5	--	NA	NA	NA	NA	NA	NC	NA	NA	NA
Total TCDF	55722-27-5	--	NA	NA	NA	NA	NA	NC	NA	NA	NA

Abbreviations:

ACL	Alternate Concentration Limit
DL	Detection Limit
GPS	Groundwater Protection
LOD	Limit of Detection
LOQ	Limit of Quantitation
MCL	Maximum Contaminant Level
MDL	Method Detection Limit
NA	Not Applicable
ORNL	Oak Ridge National
PAL	Project Action Limit
PQL	Project Quantitation Limit
QL	Quantitation Limit
RSL	Regional Screening Level
TBD	To be determined
TEF	Toxicity equivalency factor
ug/L	Microgram per liter
USEPA	United States Environmental Protection Agency
VDEQ	Virginia Department of Environmental Quality

Footnotes:

1 Background values established in accordance with procedures outlined in Attachment O of the RCRA Permit
2 Virginia ACLs for groundwater, January 31, 2011
3 RSL Summary Table, ORNL. November 2010.
4 PAL representative of the higher value of the background concentration, EPA MCLs, VDEQ ACLs, or USEPA ORNLs for tapwater. PAL selection is based on procedure to establish a GPS in accordance with Module VI, VI.I.4a of the RCRA Permit
5 Screening criteria for the chemical is not available from the sources outlined in the RCRA Permit (see footnote 4). Therefore the PAL will be set to the laboratory's PQL unless the VDEQ provides the recommendation for a surrogate value
6 PAL is representative of the ACL for Total PCBs.
7 PAL is representative of a calculated TEF based on the MCL for 2,3,7,8-TCDD

TABLE C-2

PROJECT ACTION LIMIT SELECTION FOR TARGET PARAMETER LIST (ATTACHMENT K OF PERMIT)

RUSSELL ROAD LANDFILL

MCB QUANTICO, VIRGINIA

Analyte	CAS Number	Established Background Concentration [1]	Federal MCL for Drinking Water	Virginia ACL [2]	ORNL RSL for Tapwater [3]	PAL [4]	PAL Reference	PQL Goal	Laboratory-specific		
		(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)		(µg/L)	LOD (ug/L)	LOQ (ug/L)	DL (ug/L)
VOCs											
1,1-DICHLOROETHANE	75-34-3	2.6	--	2.42	2.4	2.6	Background	0.87	TBD	TBD	TBD
1,1-DICHLOROETHENE	75-35-4	--	7	272	340	340	RSL	113	TBD	TBD	TBD
ACETONE	67-64-1	2.5	--	11561	22000	22000	RSL	7333	TBD	TBD	TBD
BENZENE	71-43-2	0.79	5	0.41	0.41	5	MCL	1.7	TBD	TBD	TBD
CHLOROMETHANE	74-87-3	--	--	187	190	190	RSL	63.3	TBD	TBD	TBD
CIS-1,2-DICHLOROETHENE	156-59-2	1.7	70	31.2	73	73	RSL	24.3	TBD	TBD	TBD
METHYLENE CHLORIDE	75-09-2	0.5	5	4.8	4.8	5	MCL	1.7	TBD	TBD	TBD
TETRACHLOROETHENE	127-18-4	0.51	5	0.11	0.11	5	MCL	1.7	TBD	TBD	TBD
TOLUENE	108-88-3	1.8	1000	1117	2300	2300	RSL	767	TBD	TBD	TBD
TRANS-1,2-DICHLOROETHENE	156-60-5	0.5	100	89.4	110	110	RSL	36.7	TBD	TBD	TBD
TRICHLOROETHENE	79-01-6	0.5	5	2.0	2	5	MCL	1.7	TBD	TBD	TBD
VINYL CHLORIDE	75-01-4	--	2	0.02	0.016	2	MCL	0.7	TBD	TBD	TBD
SVOCs											
4-METHYLPHENOL	106-44-5	7.4	--	78	180	180	RSL	60	TBD	TBD	TBD
BIS(2-ETHYLHEXYL)PHTHALATE	117-81-7	17	6	4.80	4.8	17	Background	5.7	TBD	TBD	TBD
NAPHTHALENE	91-20-3	--	--	0.14	0.14	0.14	ACL	0.05	TBD	TBD	TBD
METALS (TOTAL)											
ARSENIC	7440-38-2	0.48	10	0.045	0.045	10	MCL	3.3	TBD	TBD	TBD
BARIUM	7440-39-3	1220	2000	3120	7300	7300	RSL	2433	TBD	TBD	TBD
BERYLLIUM	7440-41-7	1	4	31.2	73	73	RSL	24.3	TBD	TBD	TBD
CADMIUM	7440-43-9	0.84	5	7.8	18	18	RSL	6.0	TBD	TBD	TBD
CHROMIUM	7440-47-3	4.7	100	--	--	100	MCL	33.3	TBD	TBD	TBD
COBALT	7440-48-4	11	--	4.68	11	11	Background	3.7	TBD	TBD	TBD
LEAD	7439-92-1	2.7	15	--	--	15	MCL	5.0	TBD	TBD	TBD
MERCURY	7439-97-6	0.17	2	0.50	0.57	2	MCL	0.7	TBD	TBD	TBD
NICKEL	7440-02-0	18.3	--	312	730	730	RSL	243.3	TBD	TBD	TBD
VANADIUM	7440-62-2	3	--	1.092	180	180	RSL	60.0	TBD	TBD	TBD

Abbreviations:

ACL	Alternate Concentration Limit
DL	Detection Limit
GPS	Groundwater Protection Standard
LOD	Limit of Detection
LOQ	Limit of Quantitation
MCL	Maximum Contaminant Level
MDL	Method Detection Limit
NA	Not Applicable
ORNL	Oak Ridge National Laboratory
PAL	Project Action Limit
PQL	Project Quantitation Limit
QL	Quantitation Limit
RSL	Regional Screening Level
TBD	To be determined
ug/L	Microgram per liter
USEPA	United States Environmental Protection Agency
VDEQ	Virginia Department of Environmental Quality

Footnotes:

1 Background values established in accordance with procedures outlined in Attachment O of the permit.

2 Virginia ACL for groundwater, January 31, 2011.

3 RSL Summary Table, ORNL. November 2010.

4 PAL representative of the higher value of the background concentration, USEPA MCLs, VDEQ ACLs or EPA ORNLs for tapwater. PAL selection is based on procedure to establish an GPS in accordance with Module VI, VI.I.4a of the permit

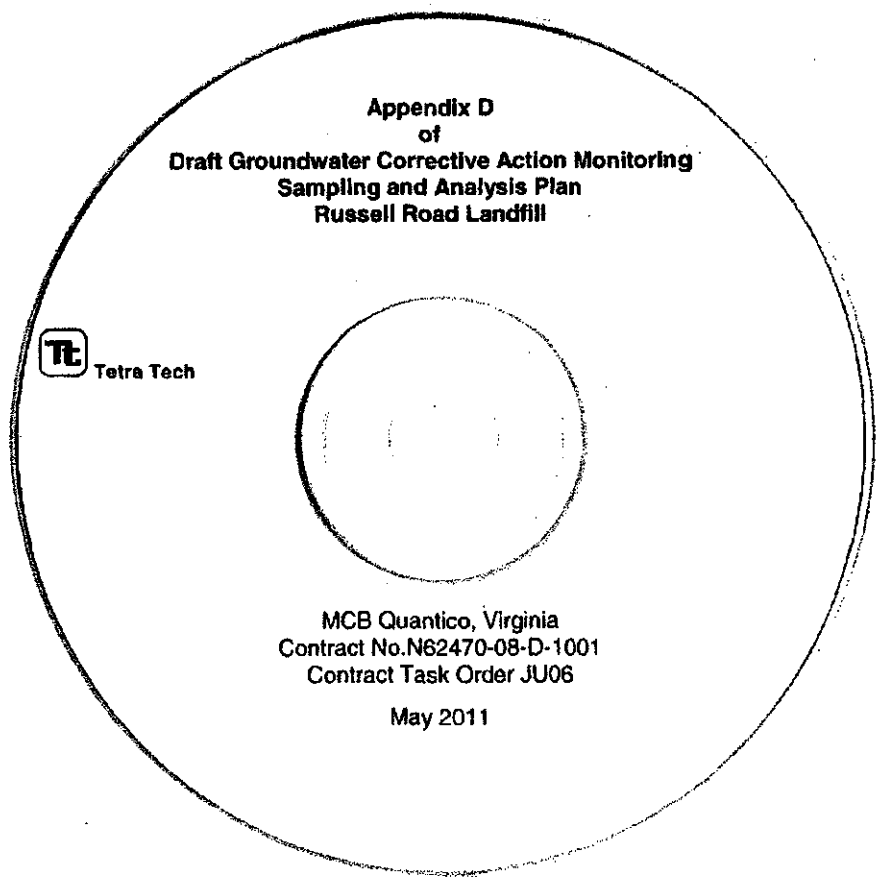
APPENDIX D

EXAMPLE LABORATORY QUALITY ASSURANCE MANUAL

This placeholder page is for document(s) that cannot be scanned.

The document indicated below is located in the paper file cabinet.

____ Map(s) - Oversized
____ Colored Spreadsheet(s)
____ Blueprint(s)
____ Diagram(s)
____ Pictures (s)
_X_ CD(s)



Insert disk appendix D

J-2

GROUNDWATER LOG EXAMPLE

GROUNDWATER LOG EXAMPLE

SAMPLING EVENT _____

LOCATION _____

WELL NO. _____ Date_____.

WEATHER _____.

TEMPERATURE_____.

MEASUREMENT TEAM_____.

TIME WELL CASING UNLOCKED _____.

DEPTH TO WATER FROM TOP OF (INNER/OUTER) CASING_____FT

DEPT OF WELL FROM TOP (INNER/OUTER) CASING _____ FT

STATIC WASTER LEVEL _____ FT

MEASUREMENT TECHNIQUE: [ ]WATER LEVEL INDICATOR

[ ]OTHER/EXPLAIN _____.

FORMULAS FOR DETERMINING PURGE VOLUME

Water Level above Sand Pack:

$$3 \times [(\pi r_b^2 h_s - \pi r_c^2 h_s) \times 0.3 + (\pi r_c^2 h_w)]$$

Water Level below Sand Pack:

$$3 \times [\pi r_b^2 h_w - \pi r_c^2 h_w) \times 0.3 + (\pi r_c^2 h_w)]$$

where:

r_b = radius of boring = _____.

r_c = radius of casing = _____.

h_s = height of sand = _____.

h_w = height of water = _____.

IMMISCIBLE LAYERS: [ ]YES [ ]NO

DETECTION METHOD : [ ]VISUAL [ ]OTHER_____.

COLLECTION METHOD: [ ]BEAKER [ ]OTHER

SAMPLE IDENTIFICATION_____.

PURGE TEAM _____.

PURGE PROCEDURE/EQUIPMENT: [ ]TEFLON BAILER [ ]WELL PUMP

URGE TIME_____ PURGE VOLUME_____.

PURGE APPEARANCE_____.

COMMENTS_____.

SAMPLING EVENT_____

WELL NO._____ DATE _____

SAMPLING TEAM_____

SAMPLING PROCEDURE/EQUIPMENT: [ ]TEFLON BAILER [ ]WELLPUMP

SAMPLING TIME

pH METER CALIBRATED WITH BUFFERS: [ ]4 [ ]7 [ ]10

pH METER CALIBRATED BY_____

CONDUCTIVITY METER CALIBRATED WITH STANDARD SOLUTION OF

_____UMHOS/CM BY_____

pH(S.U.) _____, _____, _____, _____.

TEMPERATURE(□C) _____, _____, _____, _____.

CONDUCTIVITY (UMHOS/CM) _____, _____, _____, _____.

SAMPLE COLLECTION TIME:CONTAINER*/PRESERVATIVE

(1)_____VOC(G/NONE)	(2)_____TOX(A/HNO_3)
(3)_____TOC(a/H_2SO_4)	(4)_____COD(A/H_2SO_4)
(5)_____O&G/TPH(A/HCL)	(6)_____PHEN(A/H_2SO_4)
(7)_____N(/)	(8)_____PHOS(A/H_2SO_2)
(9)_____SO(/)	(10)_____TMET(P/HNO_3)
(11)_____DMET(P/NONE)	(12)_____pH,COND(P/NONE)
(13)_____CHLORIDE(P/NONE)	(14)_____SMLL TST(P/NONE)
(15)_____ (/)	(16)_____(/)

FINAL pH(S.U.) _____ FINAL TEMPERATURE(□C) _____.

FINAL CONDUCTIVITY(UMHOS/CM) _____

LOCKED WELL AT _____

COMMENTS_____

_____

G=GLASS, A=AMBER GLASS BOTTLE, P=PLASTIC(POLYETHYLENE)

J-3

GROUNDWATER MONITORING WELL CONSTRUCTION DIAGRAM

Battelle
. . . Putting Technology To Work

MCB QUANTICO - T.O. 50
BORING LOG - TMW-30

Permit Number: 3-120 Project Number: G486050-31 Boring Location: TMW-30 Date Logged: 08/05/03 Geologist: R. Janosy Total Depth: 31' Reviewed by:	Drilling Contractor: Chesapeake Geosystems Driller: Brian Van Doren Drilling Equipment: Mobile B57 ATV Drilling Method: HSA Boring Diameter: 4" auger, 8" borehole Sampler Type: NA Hammer Type: NA	Northing (NAD 83): Easting (NAD 83): Surface Elevation (NAVD 88): Borehole Abandoned: _Yes X No Backfill Method: Monitoring Device Installed: X Yes _No Type: 2" PVC Monitoring Well

Depth (feet bgs)	Lithology	USCS Symbol	Sample Description	Grading % Gravel	% Sand	% Fines	Blow Counts	Sample Interval	Sample ID	Organic Vapor	Comments
0		SC	Clayey SAND, yellow brown, sand is medium fine grain, loose, slightly plastic, dry		70	30					
5		CL	CLAY, yellow brown, soft-firm, plastic-very plastic, damp								
10		CL	Same, but firm and dry at 12', changes to a mottled yellow gray at 15'								
15		CL	Same, soft to fine and damp, changes to a gray color at 17', damp-moist, very plastic (metallic color)								
20 ▽		CL	Sandy CLAY, light gray, very soft, plastic, saturated		20	80					
25		CL	Silty CLAY, light gray, very soft, plastic, saturated changes to a CLAY, metallic gray, soft, plastic, wet-moist								
30			TD=31 ft @ 1600								
35											

2 1/2 Drums Generated

TMW-30.CDR

Battelle
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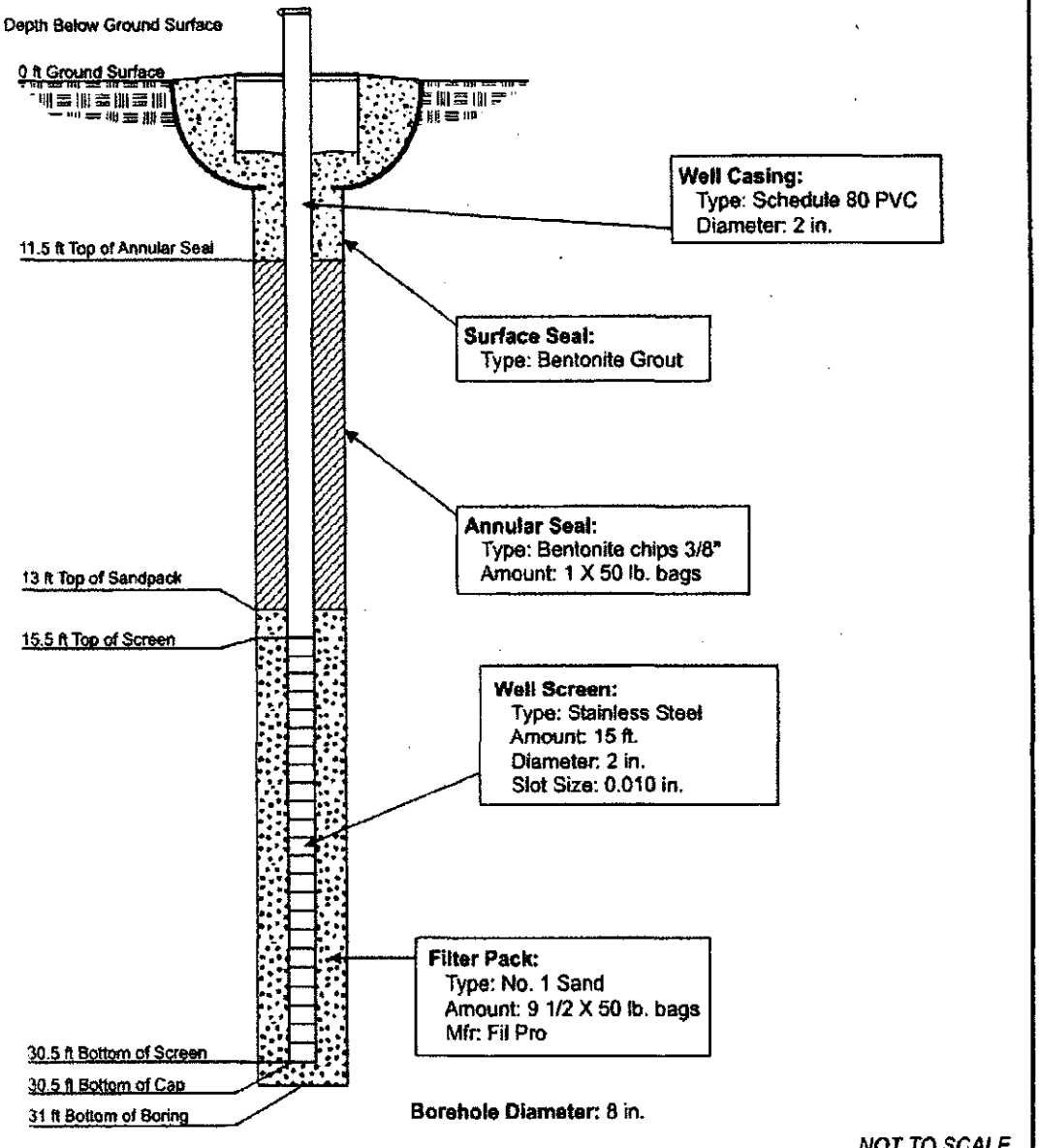
MCB QUANTICO - T.O. 50
MONITORING WELL COMPLETION DIAGRAM
TMW-30

Project #: G486050-31	Site: MCB Quantico - T.O. 50	Well #: TMW-30	Northing (NAD 83):
Drilling Contractor: Chesapeake Geosystems	Rig Type and Drilling Method: HSA	Date: 08/05/03	Easting (NAD 83):
Reviewed by: M. Gaberell	Driller: Brian Van Doren	Geologist: R. Janosy	Surface Elevation (NAVD 88):



NOT TO SCALE

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EPA MICROPURGING GUIDANCE

United States Environmental Protection Agency | Office of Research and Development | Office of Solid Waste and Emergency Response | EPA/540/S-95/504 April 1996

EPA Ground Water Issue

LOW-FLOW (MINIMAL DRAWDOWN) GROUND-WATER SAMPLING PROCEDURES

by Robert W. Puls[1] and Michael J. Barcelona[2]

Background

The Regional Superfund Ground Water Forum is a group of ground-water scientists, representing EPA's Regional Superfund Offices, organized to exchange information related to ground-water remediation at Superfund sites. One of the major concerns of the Forum is the sampling of ground water to support site assessment and remedial performance monitoring objectives. This paper is intended to provide background information on the development of low-flow sampling procedures and its application under a variety of hydrogeologic settings. It is hoped that the paper will support the production of standard operating procedures for use by EPA Regional personnel and other environmental professionals engaged in ground-water sampling.

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I. Introduction

The methods and objectives of ground-water sampling to assess water quality have evolved over time. Initially the emphasis was on the assessment of water quality of aquifers as sources of drinking water. Large water-bearing units were identified and sampled in keeping with that objective. These were highly productive aquifers that supplied drinking water via private wells or through public water supply systems. Gradually, with the increasing awareness of subsurface pollution of these water resources, the understanding of complex hydrogeochemical processes which govern the fate and transport of contaminants in the subsurface increased. This increase in understanding was also due to advances in a number of scientific disciplines and improvements in tools used for site characterization and ground-water sampling. Ground-water quality investigations where pollution was detected initially borrowed ideas, methods, and materials for site characterization from the water supply field and water analysis from public health practices. This included the materials and manner in which monitoring wells were installed and the way in which water was brought to the surface, treated, preserved and analyzed. The prevailing conceptual ideas included convenient generalizations of ground-water resources in terms of large and relatively homogeneous hydrologic *units*. With time it became apparent that conventional water supply generalizations of *homogeneity* did not adequately represent field data regarding pollution of these subsurface resources. The important role of *heterogeneity* became increasingly clear not only in geologic terms, but also in terms of complex physical,

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chemical and biological subsurface processes. With greater appreciation of the role of heterogeneity, it became evident that subsurface pollution was ubiquitous and encompassed the unsaturated zone to the deep subsurface and included unconsolidated sediments, fractured rock, and *aquitards* or low-yielding or impermeable formations. Small-scale processes and heterogeneities were shown to be important in identifying contaminant distributions and in controlling water and contaminant flow paths.

It is beyond the scope of this paper to summarize all the advances in the field of ground-water quality investigations and remediation, but two particular issues have bearing on ground-water sampling today: aquifer heterogeneity and colloidal transport. Aquifer heterogeneities affect contaminant flow paths and include variations in geology, geochemistry, hydrology and microbiology. As methods and the tools available for subsurface investigations have become increasingly sophisticated and understanding of the subsurface environment has advanced, there is an awareness that in most cases a primary concern for site investigations is characterization of contaminant flow paths rather than entire aquifers. In fact, in many cases, plume thickness can be less than well screen lengths (e.g., 3-6 m) typically installed at hazardous waste sites to detect and monitor plume movement over time. Small-scale differences have increasingly been shown to be important and there is a general trend toward smaller diameter wells and shorter screens.

The hydrogeochemical significance of colloidal-size particles in subsurface systems has been realized during the past several years (Gschwend and Reynolds, 1987; McCarthy and Zachara, 1989; Puls, 1990; Ryan and Gschwend, 1990). This realization resulted from both field and laboratory studies that showed faster contaminant migration over greater distances and at higher concentrations than flow and transport model predictions would suggest (Buddemeier and Hunt, 1988; Enfield and Bengtsson, 1988; Penrose et al., 1990). Such models typically account for interaction between the mobile aqueous and immobile solid phases, but do not allow for a mobile, reactive solid phase. It is recognition of this third *phase* as a possible means of contaminant transport that has brought increasing attention to the manner in which samples are collected and processed for analysis (Puls et al., 1990; McCarthy and Degueldre, 1993; Backhus et al., 1993; U. S. EPA, 1995). If such a phase is present in sufficient mass, possesses high sorption reactivity, large surface area, and remains stable in suspension, it can serve as an important mechanism to facilitate contaminant transport in many types of subsurface systems.

Colloids are particles that are sufficiently small so that the surface free energy of the particle dominates the bulk free energy. Typically, in ground water, this includes particles with diameters between 1 and 1000 nm. The most commonly observed mobile particles include: secondary clay minerals; hydrous iron, aluminum, and manganese oxides; dissolved and particulate organic materials, and viruses and bacteria. These reactive particles have been shown to be mobile under a variety of conditions in both field studies and laboratory column experiments, and as such need to be included in monitoring programs where identification of the *total* mobile contaminant loading (dissolved + naturally suspended particles) at a site is an objective. To that end, sampling methodologies must be used which do not artificially bias *naturally* suspended particle concentrations.

Currently the most common ground-water purging and sampling methodology is to purge a well using bailers or high speed pumps to remove 3 to 5 casing volumes followed by sample collection. This method can cause adverse impacts on sample quality through collection of samples with high levels of turbidity. This results in the inclusion of otherwise immobile artifactual particles which produce an overestimation of certain analytes of interest (e.g., metals or hydrophobic organic compounds). Numerous documented problems associated with filtration (Danielsson, 1982; Laxen and Chandler, 1982; Horowitz et al., 1992) make this an undesirable method of rectifying the turbidity problem, and include the removal of potentially mobile (contaminant-associated) particles during filtration, thus artificially biasing contaminant concentrations low. Sampling-induced turbidity problems can often be mitigated by using low-flow purging and sampling techniques.

Current subsurface conceptual models have undergone considerable refinement due to the recent development and increased use of field screening tools. So-called hydraulic *push* technologies (e.g., cone penetrometer, Geoprobe®, QED HydroPunch®) enable relatively fast screening site characterization which can then be used to design and install a monitoring well network. Indeed, alternatives to conventional monitoring wells are now being considered for some hydrogeologic settings. The ultimate design of any monitoring system should however be based upon adequate site characterization and be consistent with established monitoring objectives.

If the sampling program objectives include accurate assessment of the magnitude and extent of subsurface contamination over time and/or accurate assessment of subsequent remedial performance, then some information regarding plume delineation in three-dimensional space is necessary prior to monitoring well network design and installation. This can be accomplished with a variety of different tools and equipment ranging from hand-operated augers to screening tools mentioned above and large drilling rigs. Detailed information on ground-water flow velocity, direction, and horizontal and vertical variability are essential baseline data requirements. Detailed soil and geologic data are required prior to and during the installation of sampling points. This includes historical as well as detailed soil and geologic logs which accumulate during the site investigation. The use of borehole geophysical techniques is also recommended. With this information (together with other site characterization data) and a clear understanding of sampling

objectives, then appropriate location, screen length, well diameter, slot size, etc. for the monitoring well network can be decided. This is especially critical for new in situ remedial approaches or natural attenuation assessments at hazardous waste sites.

In general, the overall goal of any ground-water sampling program is to collect water samples with no alteration in water chemistry; analytical data thus obtained may be used for a variety of specific monitoring programs depending on the regulatory requirements. The sampling methodology described in this paper assumes that the monitoring goal is to sample monitoring wells for the presence of contaminants and it is applicable whether mobile colloids are a concern or not and whether the analytes of concern are metals (and metalloids) or organic compounds.

II. Monitoring Objectives and Design Considerations

The following issues are important to consider prior to the design and implementation of any ground-water monitoring program, including those which anticipate using low-flow purging and sampling procedures.

A. Data Quality Objectives (DQOs)

Monitoring objectives include four main types: detection, assessment, corrective-action evaluation and resource evaluation, along with *hybrid* variations such as site-assessments for property transfers and water availability investigations. Monitoring objectives may change as contamination or water quality problems are discovered. However, there are a number of common components of monitoring programs which should be recognized as important regardless of initial objectives. These components include:

1) Development of a conceptual model that incorporates elements of the regional geology to the local geologic framework. The conceptual model development also includes initial site characterization efforts to identify hydrostratigraphic units and likely flow-paths using a minimum number of borings and well completions;

2) Cost-effective and well documented collection of high quality data utilizing simple, accurate, and reproducible techniques; and

3) Refinement of the conceptual model based on supplementary data collection and analysis.

These fundamental components serve many types of monitoring programs and provide a basis for future efforts that evolve in complexity and level of spatial detail as purposes and objectives expand. High quality, reproducible data collection is a common goal regardless of program objectives.

High quality data collection implies data of sufficient accuracy, precision, and completeness (i.e., ratio of valid analytical results to the minimum sample number called for by the program design) to meet the program objectives. Accuracy depends on the correct choice of monitoring tools and procedures to minimize sample and subsurface disturbance from collection to analysis. Precision depends on the repeatability of sampling and analytical protocols. It can be assured or improved by replication of sample analyses including blanks, field/lab standards and reference standards.

B. Sample Representativeness

An important goal of any monitoring program is collection of data that is truly representative of conditions at the site. The term *representativeness* applies to chemical and hydrogeologic data collected via wells, borings, piezometers, geophysical and soil gas measurements, lysimeters, and temporary sampling points. It involves a recognition of the statistical variability of individual subsurface physical properties, and contaminant or major ion concentration levels, while explaining extreme values. Subsurface temporal and spatial variability are facts. Good professional practice seeks to maximize representativeness by using proven accurate and reproducible techniques to define limits on the distribution of measurements collected at a site. However, measures of representativeness are dynamic and are controlled by evolving site characterization and monitoring objectives. An evolutionary site characterization model, as shown in Figure 1, provides a systematic approach to the goal of consistent data collection.

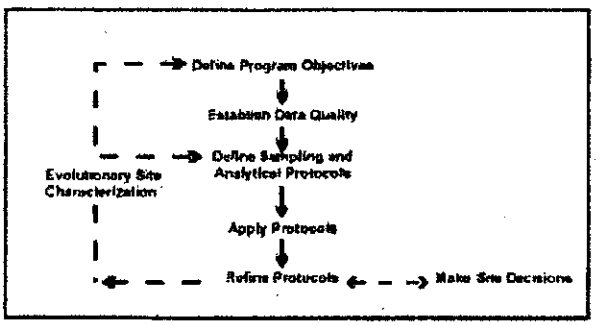

Figure 1. Evolutionary Site Characterization Model

The model emphasizes a recognition of the causes of the variability (e.g., use of inappropriate technology such as using bailers to purge wells; imprecise or operator-dependent methods) and the need to control avoidable errors.

1) Questions of Scale

A sampling plan designed to collect representative samples must take into account the potential scale of changes in site conditions through space and time as well as the chemical associations and behavior of the parameters that are targeted for investigation. In subsurface systems, physical (i.e., aquifer) and chemical properties over time or space are not statistically independent. In fact, samples taken in close proximity (i.e., within distances of a few meters) or within short time periods (i.e., more frequently than monthly) are highly auto-correlated. This means that designs employing high-sampling frequency (e.g., monthly) or dense spatial monitoring designs run the risk of redundant data collection and misleading inferences regarding trends in values that aren't statistically valid. In practice, contaminant detection and assessment monitoring programs rarely suffer these *over-sampling* concerns. In corrective-action evaluation programs, it is also possible that too little data may be collected over space or time. In these cases, false interpretation of the spatial extent of contamination or underestimation of temporal concentration variability may result.

2) Target Parameters

Parameter selection in monitoring program design is most often dictated by the regulatory status of the site. However, background water quality constituents, purging indicator parameters, and contaminants, all represent targets for data collection programs. The tools and procedures used in these programs should be equally rigorous and applicable to all categories of data, since all may be needed to determine or support regulatory action.

C. Sampling Point Design and Construction

Detailed site characterization is central to all decision-making purposes and the basis for this characterization resides in identification of the geologic framework and major hydro-stratigraphic units. Fundamental data for sample point location include: subsurface lithology, head-differences and background geochemical conditions. Each sampling point has a proper use or uses which should be documented at a level which is appropriate for the program's data quality objectives. Individual sampling points may not always be able to fulfill multiple monitoring objectives (e.g., detection, assessment, corrective action).

1) Compatibility with Monitoring Program and Data Quality Objectives

Specifics of sampling point location and design will be dictated by the complexity of subsurface lithology and variability in contaminant and/or geochemical conditions. It should be noted that, regardless of the ground-water sampling approach, few sampling points (e.g., wells, drive-points, screened augers) have zones of influence in excess of a few feet. Therefore, the spatial frequency of sampling points should be carefully selected and designed.

2) Flexibility of Sampling Point Design

In most cases *well-point* diameters in excess of 1 7/8 inches will permit the use of most types of submersible pumping devices for low-flow (minimal drawdown) sampling. It is suggested that *short* (e.g., less than 1.6 m) screens be incorporated into the monitoring design where possible so that comparable results from one device to another might be expected. *Short*, of course, is relative to the degree of vertical water quality variability expected at a site.

3) Equilibration of Sampling Point

Time should be allowed for equilibration of the well or sampling point with the formation after installation. Placement of well or sampling points in the subsurface produces some disturbance of ambient conditions. Drilling techniques (e.g., auger, rotary, etc.) are generally considered to cause more disturbance than *direct-push* technologies. In either case, there may be a period (i.e., days to months) during which water quality near the point may be distinctly different from that in the formation. Proper development of the sampling point and adjacent formation to remove fines created during emplacement will shorten this water quality *recovery* period.

III. Definition of Low-Flow Purging and Sampling

It is generally accepted that water in the well casing is non-representative of the formation water and needs to be purged prior to collection of ground-water samples. However, the water in the screened interval may indeed be representative of the formation, depending upon well construction and site hydrogeology. Wells are purged to some extent for the following reasons: the presence of the air interface at the top of the water column resulting in an oxygen concentration gradient with depth, loss of volatiles up the water column, leaching from or sorption to the casing or filter pack, chemical changes due to clay seals or backfill, and surface infiltration.

Low-flow purging, whether using portable or dedicated systems, should be done using pump-intake located in the middle or slightly above the middle of the screened interval. Placement of the pump too close to the bottom of the well will cause increased entrainment of solids which have collected in the well over time. These particles are present as a result of well development, prior purging and sampling events, and natural colloidal transport and deposition. Therefore, placement of the pump in the middle or toward the top of the screened interval is suggested. Placement of the pump at the top of the water column for sampling is only recommended in unconfined aquifers, screened across the water table, where this is the desired sampling point. Low-

flow purging has the advantage of minimizing mixing between the overlying stagnant casing water and water within the screened interval.

A. Low-Flow Purging and Sampling

Low-flow refers to the velocity with which water enters the pump intake and that is imparted to the formation pore water in the immediate vicinity of the well screen. It does not necessarily refer to the flow rate of water discharged at the surface which can be affected by flow regulators or restrictions. Water level drawdown provides the best indication of the stress imparted by a given flow-rate for a given hydrological situation. The objective is to pump in a manner that minimizes stress (drawdown) to the system to the extent practical taking into account established site sampling objectives. Typically, flow rates on the order of 0.1 - 0.5 L/min are used, however this is dependent on site-specific hydrogeology. Some extremely coarse-textured formations have been successfully sampled in this manner at flow rates to 1 L/min. The effectiveness of using low-flow purging is intimately linked with proper screen location, screen length, and well construction and development techniques. The reestablishment of natural flow paths in both the vertical and horizontal directions is important for correct interpretation of the data. For high resolution sampling needs, screens less than 1 m should be used. Most of the need for purging has been found to be due to passing the sampling device through the overlying casing water which causes mixing of these stagnant waters and the dynamic waters within the screened interval. Additionally, there is disturbance to suspended sediment collected in the bottom of the casing and the displacement of water out into the formation immediately adjacent to the well screen. These disturbances and impacts can be avoided using dedicated sampling equipment, which precludes the need to insert the sampling device prior to purging and sampling.

Isolation of the screened interval water from the overlying stagnant casing water may be accomplished using low-flow minimal drawdown techniques. If the pump intake is located within the screened interval, most of the water pumped will be drawn in directly from the formation with little mixing of casing water or disturbance to the sampling zone. However, if the wells are not constructed and developed properly, zones other than those intended may be sampled. At some sites where geologic heterogeneities are sufficiently different within the screened interval, higher conductivity zones may be preferentially sampled. This is another reason to use shorter screened intervals, especially where high spatial resolution is a sampling objective.

B. Water Quality Indicator Parameters

It is recommended that water quality indicator parameters be used to determine purging needs prior to sample collection in each well. Stabilization of parameters such as pH, specific conductance, dissolved oxygen, oxidation-reduction potential, temperature and turbidity should be used to determine when formation water is accessed during purging. In general, the order of stabilization is pH, temperature, and specific conductance, followed by oxidation-reduction potential, dissolved oxygen and turbidity. Temperature and pH, while commonly used as purging indicators, are actually quite insensitive in distinguishing between formation water and stagnant casing water; nevertheless, these are important parameters for data interpretation purposes and should also be measured. Performance criteria for determination of stabilization should be based on water-level drawdown, pumping rate and equipment specifications for measuring indicator parameters. Instruments are available which utilize in-line flow cells to continuously measure the above parameters.

It is important to establish specific well stabilization criteria and then consistently follow the same methods thereafter, particularly with respect to drawdown, flow rate and sampling device. Generally, the time or purge volume required for parameter stabilization is independent of well depth or well volumes. Dependent variables are well diameter, sampling device, hydrogeochemistry, pump flow rate, and whether the devices are used in a portable or dedicated manner. If the sampling device is already in place (i.e., dedicated sampling systems), then the time and purge volume needed for stabilization is much shorter. Other advantages of dedicated equipment include less purge water for waste disposal, much less decontamination of equipment, less time spent in preparation of sampling as well as time in the field, and more consistency in the sampling approach which probably will translate into less variability in sampling results. The use of dedicated equipment is strongly recommended at wells which will undergo routine sampling over time.

If parameter stabilization criteria are too stringent, then minor oscillations in indicator parameters may cause purging operations to become unnecessarily protracted. It should also be noted that turbidity is a very conservative parameter in terms of stabilization. Turbidity is always the last parameter to stabilize. Excessive purge times are invariably related to the establishment of too stringent turbidity stabilization criteria. It should be noted that natural turbidity levels in ground water may exceed 10 nephelometric turbidity units (NTU).

C. Advantages and Disadvantages of Low-Flow (Minimum Drawdown) Purging

In general, the advantages of low-flow purging include:

- samples which are representative of the *mobile* load of contaminants present (dissolved and colloid-associated);
- minimal disturbance of the sampling point thereby minimizing sampling artifacts;
- less operator variability, greater operator control;

- reduced stress on the formation (minimal drawdown);
- less mixing of stagnant casing water with formation water;
- reduced need for filtration and, therefore, less time required for sampling;
- smaller purging volume which decreases waste disposal costs and sampling time;
- better sample consistency; reduced artificial sample variability.

Some disadvantages of low-flow purging are:

- higher initial capital costs,
- greater set-up time in the field,
- need to transport additional equipment to and from the site,
- increased training needs,
- resistance to change on the part of sampling practitioners,
- concern that new data will indicate a *change in conditions* and trigger an *action*.

IV. Low-Flow (Minimal Drawdown) Sampling Protocols

The following ground-water sampling procedure has evolved over many years of experience in ground-water sampling for organic and inorganic compound determinations and as such summarizes the authors' (and others) experiences to date (Barcelona et al., 1984, 1994; Barcelona and Helfrich, 1986; Puls and Barcelona, 1989; Puls et. al. 1990, 1992; Puls and Powell, 1992; Puls and Paul, 1995). High-quality chemical data collection is essential in ground-water monitoring and site characterization. The primary limitations to the collection of *representative* ground-water samples include: mixing of the stagnant casing and *fresh* screen waters during insertion of the sampling device or ground-water level measurement device; disturbance and resuspension of settled solids at the bottom of the well when using high pumping rates or raising and lowering a pump or bailer; introduction of atmospheric gases or degassing from the water during sample handling and transfer, or inappropriate use of vacuum sampling device, etc.

A. Sampling Recommendations

Water samples should not be taken immediately following well development. Sufficient time should be allowed for the ground-water flow regime in the vicinity of the monitoring well to stabilize and to approach chemical equilibrium with the well construction materials. This lag time will depend on site conditions and methods of installation but often exceeds one week.

Well purging is nearly always necessary to obtain samples of water flowing through the geologic formations in the screened interval. Rather than using a general but arbitrary guideline of purging three casing volumes prior to sampling, it is recommended that an in-line water quality measurement device (e.g., flow-through cell) be used to establish the stabilization time for several parameters (e.g. , pH, specific conductance, redox, dissolved oxygen, turbidity) on a well-specific basis. Data on pumping rate, drawdown, and volume required for parameter stabilization can be used as a guide for conducting subsequent sampling activities.

The following are recommendations to be considered before, during and after sampling:

- use low-flow rates (<0.5 L/min), during both purging and sampling to maintain minimal drawdown in the well;
- maximize tubing wall thickness, minimize tubing length;
- place the sampling device intake at the desired sampling point;
- minimize disturbances of the stagnant water column above the screened interval during water level measurement and sampling device insertion;
- make proper adjustments to stabilize the flow rate as soon as possible;
- monitor water quality indicators during purging;
- collect unfiltered samples to estimate contaminant loading and transport potential in the subsurface system.

B. Equipment Calibration

Prior to sampling, all sampling device and monitoring equipment should be calibrated according to manufacturer's recommendations and the site Quality Assurance Project Plan (QAPP) and Field Sampling Plan (FSP). Calibration of pH should be performed with at least two buffers which bracket the expected range. Dissolved oxygen calibration must be corrected for local barometric pressure readings and elevation.

C. Water Level Measurement and Monitoring

It is recommended that a device be used which will least disturb the water surface in the casing. Well depth should be obtained from the well logs. Measuring to the bottom of the well casing will only cause resuspension of settled solids from the formation and require longer purging times for turbidity equilibration. Measure well depth after sampling is completed. The water level measurement should be taken from a permanent reference point which is surveyed relative to ground elevation.

D. Pump Type

The use of low-flow (e.g., 0.1-0.5 L/min) pumps is suggested for purging and sampling all types of analytes. All pumps have some limitation and these should be investigated with respect to application at a particular site. Bailers are inappropriate devices for low-flow sampling.

1) General Considerations

There are no unusual requirements for ground-water sampling devices when using low-flow, minimal drawdown techniques. The major concern is that the device give consistent results and minimal disturbance of the sample across a range of *low* flow rates (i.e., < 0.5 L/min). Clearly, pumping rates that cause minimal to no drawdown in one well could easily cause *significant* drawdown in another well finished in a less transmissive formation. In this sense, the pump should not cause undue pressure or temperature changes or physical disturbance on the water sample over a reasonable sampling range. Consistency in operation is critical to meet accuracy and precision goals.

2) Advantages and Disadvantages of Sampling Devices

A variety of sampling devices are available for low-flow (minimal drawdown) purging and sampling and include *peristaltic pumps, bladder pumps, electrical submersible* pumps, and gas-driven pumps. Devices which lend themselves to both dedication and consistent operation at definable low-flow rates are preferred. It is desirable that the pump be easily adjustable and operate reliably at these lower flow rates. The peristaltic pump is limited to shallow applications and can cause degassing resulting in alteration of pH, alkalinity, and some volatiles loss. Gas-driven pumps should be of a type that does not allow the gas to be in direct contact with the sampled fluid.

Clearly, bailers and other *grab* type samplers are ill-suited for low-flow sampling since they will cause repeated disturbance and mixing of *stagnant* water in the casing and the *dynamic* water in the screened interval. Similarly, the use of inertial lift foot-valve type samplers may cause too much disturbance at the point of sampling. Use of these devices also tends to introduce uncontrolled and unacceptable operator variability.

Summaries of advantages and disadvantages of various sampling devices are listed in Herzog et al. (1991), U. S. EPA (1992), Parker (1994) and Thurnblad (1994).

E. Pump Installation

Dedicated sampling devices (left in the well) capable of pumping and sampling are preferred over <u>any</u> other type of device. Any portable sampling device should be slowly and carefully lowered to the middle of the screened interval or slightly above the middle (e.g., 1-1.5 m below the top of a 3 m screen). This is to minimize excessive mixing of the stagnant water in the casing above the screen with the screened interval zone water, and to minimize resuspension of solids which will have collected at the bottom of the well. These two disturbance effects have been shown to directly affect the time required for purging. There also appears to be a direct correlation between size of portable sampling devices relative to the well bore and resulting purge volumes and times. The key is to minimize disturbance of water and solids in the well casing.

F. Filtration

Decisions to filter samples should be dictated by sampling objectives rather than as a *fix* for poor sampling practices, and field-filtering of certain constituents should not be the default. Consideration should be given as to what the application of field-filtration is trying to accomplish. For assessment of truly dissolved (as opposed to operationally *dissolved* [i.e., samples filtered with 0.45 µm filters]) concentrations of major ions and trace metals, 0.1 µm filters are recommended although 0.45 µm filters are normally used for most regulatory programs. Alkalinity samples must also be filtered if significant particulate calcium carbonate is suspected, since this material is likely to impact alkalinity titration results (although filtration itself may alter the CO_2 composition of the sample and, therefore, affect the results).

Although filtration may be appropriate, filtration of a sample may cause a number of unintended changes to occur *(e.g. oxidation, aeration) possibly leading to filtration-induced* artifacts during sample analysis and uncertainty in the results. Some of these unintended changes may be unavoidable but the factors leading to them must be recognized. Deleterious effects can be minimized by consistent application of certain filtration guidelines. Guidelines should address selection of filter type, media, pore size, etc. in order to identify and minimize potential sources of uncertainty when filtering samples.

In-line filtration is recommended because it provides better consistency through less sample handling, and minimizes sample exposure to the atmosphere. In-line filters are available in both disposable (barrel filters) and non-disposable (in-line filter holder, flat membrane filters) formats and various filter pore sizes (0.1-5.0 µm). Disposable filter cartridges have the advantage of greater sediment handling capacity when compared to traditional membrane filters. Filters must be pre-rinsed following manufacturer's recommendations. If there are no recommendations for rinsing, pass through a minimum of 1 L of ground water following purging and prior to sampling. Once filtration has begun, a filter cake may develop as particles larger than the pore size accumulate on the filter membrane. The result is that the effective pore diameter of the membrane is reduced and particles smaller than the stated pore size are excluded from the filtrate. Possible corrective measures include prefiltering (with larger pore size filters), minimizing particle loads to begin with, and reducing sample volume.

G. Monitoring of Water Level and Water Quality Indicator Parameters

Check water level periodically to monitor drawdown in the well as a guide to flow rate adjustment. The goal is minimal drawdown (<0.1 m) during purging. This goal may be difficult to achieve under some circumstances due to geologic heterogeneities within the screened interval, and may require adjustment based on site-specific conditions and personal experience. In-line water quality indicator parameters should be continuously monitored during purging. The water quality

indicator parameters monitored can include pH, redox potential, conductivity, dissolved oxygen (DO) and turbidity. The last three parameters are often most sensitive. Pumping rate, drawdown, and the time or volume required to obtain stabilization of parameter readings can be used as a future guide to purge the well. Measurements should be taken every three to five minutes if the above suggested rates are used. Stabilization is achieved after all parameters have stabilized for three successive readings. In lieu of measuring all five parameters, a minimum subset would include pH, conductivity, and turbidity or DO. Three successive readings should be within ± 0.1 for pH, ± 3% for conductivity, ± 10 mv for redox potential, and ± 10% for turbidity and DO. Stabilized purge indicator parameter trends are generally obvious and follow either an exponential or asymptotic change to stable values during purging. Dissolved oxygen and turbidity usually require the longest time for stabilization. The above stabilization guidelines are provided for rough estimates based on experience.

H. Sampling, Sample Containers, Preservation and Decontamination

Upon parameter stabilization, sampling can be initiated. If an in-line device is used to monitor water quality parameters, it should be disconnected or bypassed during sample collection. Sampling flow rate may remain at established purge rate or may be adjusted slightly to minimize aeration, bubble formation, turbulent filling of sample bottles, or loss of volatiles due to extended residence time in tubing. Typically, flow rates less than 0.5 L/min are appropriate. The same device should be used for sampling as was used for purging. Sampling should occur in a progression from least to most contaminated well, if this is known. Generally, volatile (e.g., solvents and fuel constituents) and gas sensitive (e.g., Fe^{2+}, CH_4, H_2S/HS^-, alkalinity) parameters should be sampled first. The sequence in which samples for most inorganic parameters are collected is immaterial unless filtered (dissolved) samples are desired. Filtering should be done last and in-line filters should be used as discussed above. During both well purging and sampling, proper protective clothing and equipment must be used based upon the type and level of contaminants present.

The appropriate sample container will be prepared in advance of actual sample collection for the analytes of interest and include sample preservative where necessary. Water samples should be collected directly into this container from the pump tubing.

Immediately after a sample bottle has been filled, it must be preserved as specified in the site (QAPP). Sample preservation requirements are based on the analyses being performed (use site QAPP, FSP, RCRA guidance document [U. S. EPA, 1992] or EPA SW-846 [U. S. EPA, 1982]). It may be advisable to add preservatives to sample bottles in a controlled setting prior to entering the field in order to reduce the chances of improperly preserving sample bottles or introducing field contaminants into a sample bottle while adding the preservatives.

The preservatives should be transferred from the chemical bottle to the sample container using a disposable polyethylene pipet and the disposable pipet should be used only once and then discarded.

After a sample container has been filled with ground water, a Teflon™ (or tin)-lined cap is screwed on tightly to prevent the container from leaking. A sample label is filled out as specified in the FSP. The samples should be stored inverted at 4°C.

Specific decontamination protocols for sampling devices are dependent to some extent on the type of device used and the type of contaminants encountered. Refer to the site QAPP and FSP for specific requirements.

I. Blanks

The following blanks should be collected:

(1) field blank: one field blank should be collected from each source water (distilled/deionized water) used for sampling equipment decontamination or for assisting well development procedures.

(2) equipment blank: one equipment blank should be taken prior to the commencement of field work, from each set of sampling equipment to be used for that day. Refer to site QAPP or FSP for specific requirements.

(3) trip blank: a trip blank is required to accompany each volatile sample shipment. These blanks are prepared in the laboratory by filling a 40-mL volatile organic analysis (VOA) bottle with distilled/deionized water.

V. Low-Permeability Formations and Fractured Rock

The overall sampling program goals or sampling objectives will drive how the sampling points are located, installed, and choice of sampling device. Likewise, site-specific hydrogeologic factors will affect these decisions. Sites with very low permeability formations or fractures causing discrete flow channels may require a unique monitoring approach. Unlike water supply wells, wells installed for ground-water quality assessment and restoration programs are often installed in low water-yielding settings (e.g., clays, silts). Alternative types of sampling points and sampling methods are often needed in these types of environments, because low-permeability settings may require extremely low-flow purging (<0.1 L/min) and may be technology-limited. Where devices are not readily available to pump at such low flow rates, the primary consideration is to avoid dewatering of

the well screen. This may require repeated recovery of the water during purging while leaving the pump in place within the well screen.

Use of low-flow techniques may be impractical in these settings, depending upon the water recharge rates. The sampler and the end-user of data collected from such wells need to understand the limitations of the data collected; i.e., a strong potential for underestimation of actual contaminant concentrations for volatile organics, potential false negatives for filtered metals and potential false positives for unfiltered metals. It is suggested that comparisons be made between samples recovered using low-flow purging techniques and samples recovered using passive sampling techniques (i.e., two sets of samples). Passive sample collection would essentially entail acquisition of the sample with no or very little purging using a dedicated sampling system installed within the screened interval or a passive sample collection device.

A. Low-Permeability Formations (<0.1 L/min recharge)

1. Low-Flow Purging and Sampling with Pumps

   a. "portable or non-dedicated mode" - Lower the pump (one capable of pumping at <0.1 L/min) to mid-screen or slightly above and set in place for minimum of 48 hours (to lessen purge volume requirements). After 48 hours, use procedures listed in Part IV above regarding monitoring water quality parameters for stabilization, etc., but do not dewater the screen. If excessive drawdown and slow recovery is a problem, then alternate approaches such as those listed below may be better.

   b. "dedicated mode" - Set the pump as above at least a week prior to sampling; that is, operate in a dedicated pump mode. With this approach significant reductions in purge volume should be realized. Water quality parameters should stabilize quite rapidly due to less disturbance of the sampling zone.

2. Passive Sample Collection

Passive sampling collection requires insertion of the device into the screened interval for a sufficient time period to allow flow and sample equilibration before extraction for analysis. Conceptually, the extraction of water from low yielding formations seems more akin to the collection of water from the unsaturated zone and passive sampling techniques may be more appropriate in terms of obtaining "representative" samples. Satisfying usual sample volume requirements is typically a problem with this approach and some latitude will be needed on the part of regulatory entities to achieve sampling objectives.

B. Fractured Rock

In fractured rock formations, a low-flow to zero purging approach using pumps in conjunction with packers to isolate the sampling zone in the borehole is suggested. Passive multi-layer sampling devices may also provide the most "representative" samples. It is imperative in these settings to identify flow paths or water-producing fractures prior to sampling using tools such as borehole flowmeters and/or other geophysical tools.

After identification of water-bearing fractures, install packer(s) and pump assembly for sample collection using low-flow sampling in "dedicated mode" or use a passive sampling device which can isolate the identified water-bearing fractures.

VI. Documentation

The usual practices for documenting the sampling event should be used for low-flow purging and sampling techniques. This should include, at a minimum: information on the conduct of purging operations (flow-rate, drawdown, water-quality parameter values, volumes extra ed and times for measurements), field instrument calibration data, water sampling forms and chain of custody forms. See Figures 2 and 3 and "Ground Water Sampling Workshop – A Workshop Summary" (U. S. EPA, 1995) for example forms and other documentation suggestions and information. This information coupled with laboratory analytical data and validation data are needed to judge the "useability" of the sampling data.

VII. Notice

The U.S. Environmental Protection Agency through its Office of Research and Development funded and managed the research described herein as part of its in-house research program and under Contract No. 68-C4-0031 to Dynamac Corporation. It has been subjected to the Agency's peer and administrative review and has been approved for publication as an EPA document. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

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Figure 2. Ground Water Sampling Log

Project _____ Site _____ Well No. _____ Date _____

Well Depth _____ Screen Length _____ Well Diameter _____ Casing Type _____

Sampling Device _____ Tubing type _____ Water Level _____

Measuring Point _____ Other Infor _____

Sampling Personnel _____

Time	pH	Temp	Cond.	Dis.O_2	Turb.	[ ]Conc			Notes

Type of Samples Collected

Information: 2 in = 617 ml/ft, 4 in = 2470 ml/ft: $Vol_{cyl} = \pi r^2 h$, $Vol_{sphere} = 4/3\pi r^3$

Figure 3. **Ground Water Sampling Log** (with automatic data logging for most water quality parameters)

Project _____ **Site** _____ **Well No.** _____ **Date** _____
Well Depth _____ **Screen Length** _____ **Well Diameter** _____ **Casing Type** _____
Sampling Device _____ **Tubing type** _____ **Water Level** _____
Measuring Point _____ **Other Infor** _____

Sampling Personnel _____

Time	Pump Rate	Turbidity	Alkalinity	[ ] Conc	Notes

Type of Samples Collected

Information: 2 in = 617 ml/ft, 4 in = 2470 ml/ft: $Vol_{cyl} = \pi r^2 h$, $Vol_{sphere} = 4/3\pi r^3$

Low-Flow Purging and Sampling of Groundwater Monitoring Wells

Bulletin No. QAD023 October 15, 1997

RECOMMENDED PROCEDURE FOR LOW-FLOW PURGING AND SAMPLING OF GROUNDWATER MONITORING WELLS

1.0 OBJECTIVE AND APPLICATION

This directive provides a procedure for collection of ground-water samples in small-diameter wells with short-screened intervals using low-flow purging and sampling. While these procedures pertain to the Superfund program in Region 3, they were based on recommendations presented in the EPA Ground Water Issue paper entitled "Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures". The low-flow purging and sampling method is not appropriate for use in all hydrogeologic regimes, and particular groundwater monitoring well designs may make the method unsuitable (e.g. open hole and long screen monitoring wells in bedrock and stratified sand and clay where the water bearing zones have not been characterized). Therefore, please confer with a Region 3 hydrogeologist or geologist before using these procedures at a site.

2.0 BACKGROUND

Past scientific research (Barcelona et al., 1983; Nielson and Yeates, 1985) and EPA guidance have discussed sampling devices in terms of their compatibility with contaminants being sampled, and well construction, depth, and diameter. Although some sampling devices have been used in order to provide more representative groundwater samples in certain situations, most of these incorporate high-volume withdrawal techniques (i.e., in excess of the "natural" recharge rate of groundwater flow through the well screen) for both purging and sampling.

Research conducted by Puls et al. (1992), Puls and Powell (1992), and Powell and Puls (1993) has shown that high-volume purging and sampling cause significant turbidity and suspended particulate artifacts that can result in biased-high metals results. Additionally, purging can cause pressure changes and bailing can cause aeration that can strip VOCs from the sample (Pennino, 1988). The use of low-flow pumping devices (preferably dedicated) for purging and sampling minimizes both the disturbance of water in well casing and the potential for mobilization of colloidal material (Barcelona et al., 1994). Low-flow purging with maintenance of water level in the well and stabilization of indicator parameters (especially turbidity) allows collection of groundwater samples that are more representative of conditions without filtering (U.S. EPA, 1993; Backhus et al., 1993). In many cases, use of a low-flow pump to purge and sample monitoring wells decreases sampling time, reduces the need to handle large volumes of purge water and lowers the cost associated with its disposal, and allows collection of samples for inorganic analyses without filtering. This procedure is designed to be used in conjunction with groundwater sampling and analyses for the most common types of groundwater contaminants (volatile and semi-volatile organic compounds, pesticides, PCBs and inorganic compounds).

3.0 EQUIPMENT

Adjustable rate, positive displacement pumps (e.g. low flow-rate submersible centrifugal or bladder pumps constructed of stainless steel or Teflon). Low flow-rate electrical submersible pumps are recommended because (1) they are not subject to cyclical flow/arrest and

consequent potential for mobilizing fine-grained material, and (2) they may be less prone to operator error, thereby reducing potential error resulting from application by different personnel. The pump should be easily adjustable and capable of operating reliably at lower flow rates. Peristaltic pumps may be used only for inorganic sample collection. Bailers are inappropriate for use in this procedure.

Tubing: Tubing used in purging and sampling each well must be dedicated to the individual well. Once properly located, moving the pump in the well should be avoided. Consequently, the same tubing should be used for purging and sampling. Teflon or Teflon-lined polyethylene tubing must be used to collect samples for organic analysis. For samples collected for inorganic analysis, Teflon or Teflon lined polyethylene, PVC, Tygon or polyethylene tubing may be used. The tubing wall thickness should be maximized (3/8 to ½ inch) and the tubing length should be minimized (i.e. do not have excess tubing outside of the well).
Polyethylene sheeting and sampling gloves.
Water level measuring device, 0.01 feet accuracy, (electronic preferred for tracking water level drawdown during all pumping operations).
Flow measurement supplies (e.g. graduated cylinder and stop watch).
Interface probe, if needed.
Power source (e.g. generator, located downwind; nitrogen tank, etc). The generator should not be oversized for the pump.
In-line flow-through cell containing purge criteria parameter monitoring instruments for pH, turbidity, specific conductance, temperature, Eh and dissolved oxygen (DO). The in-line device should be bypassed or disconnected during sample collection.
Photoionization detector (PID), or equivalent.
Nylon stay-ties.
Decontamination supplies.
Logbook(s).
Sample Bottles. It is recommended that preservatives are added to sample bottles prior to field activities to reduce potential error or introduction of contaminants.
Sample preservation supplies (as required by the analytical method; see previous bullet).
Sample tags or labels, chain of custody.
Well construction data, location map, field data from last sampling event.
Approved Field Sampling Plan/QA Project Plan.

4.0 PRELIMINARY SITE ACTIVITIES

1) Check the condition of the monitoring well for damage and evidence of tampering, and record pertinent observations.

2) In order to maintain a clean work area, lay out a sheet of polyethylene to place sampling and monitoring equipment.

3) Remove well cap and measure VOCs at the rim of the well with a PID or FID instrument and record the reading in the field logbook.

4) If the well casing does not have a reference point (usually a V-cut or indelible mark in the well casing) make one.

5) Measure and record the depth to water (to 0.01 feet) in all wells to be sampled before any purging begins. Care should be taken to minimize disturbance to the water column and to any particulate attached to the sides or at the bottom of the well. Consequently, in order to avoid disturbing any accumulated sediment and to prevent mixing of stagnant water with water in the screened interval, the total depth of a well should be measured well in advance (one to two weeks) of purging and sampling or after sampling is completed. Obtain depth to bottom of well

information from the well construction log and calculate standing water volume as: depth of water column times cross-sectional area of the well.

6) For wells where an Light Non-aqueous Phase Liquid (LNAPL) has been detected, a stilling tube should be inserted into the well prior to purging. Refer to Section 7.2.4 of EPA (1992) for the procedure to follow. If the wells are constructed so that DNAPLs could accumulate, their detection and /or sampling should occur, at a minimum, a week before groundwater purging and sampling. Measurement and sampling of potential DNAPL should be conducted as a separate event to minimize disturbance of any sediments which have accumulated in the bottom of the well. A double check valve, bottom loading bailer is recommended for sampling. Light non-aqueous phase liquid (LNAPL) measurement may be conducted (with an interface probe), with care to avoid disturbance of the water column within the well.

5.0 PURGING AND SAMPLING PROCEDURES

The following describes the procedure for the low-flow purging and sampling method. Equipment calibration, logbook documentation, sample bottle filling and preservation, and shipping will be conducted in accordance with the site-specific Quality Assurance Project Plan (QAPjP). Personal protective equipment will be donned in accordance with the requirements of the site-specific Health and Safety Plan. Wells should be sampled in the order of least contaminated to most contaminated.

1) Attach and secure the polyethylene tubing to the low-flow pump. As the pump is slowly lowered into the well, secure the safety drop cable, tubing, and electrical lines to each other using nylon stay-ties.

2) Pump, safety cable, tubing and electrical lines should be lowered slowly into the well to a depth corresponding to the center of the saturated screen section of the well, or at a location determined to either be a preferential flow path or zone where contamination is present. The pump intake should be kept above the bottom of the well to prevent mobilization of any sediment or DNAPL present in the bottom of the well. It is recommended that the pump be placed in the well 12 to (preferably) 48 hours prior to purging/sampling to minimize the effects of turbidity and mixing in the well from introducing the pump.

3) Measure the water level again with the pump in the well before starting the pump. Start pumping water from the well at a rate of 100 to 400 milliliters per minute (mL/min). Avoid surging. Observe air bubbles displaced from discharge tube to assess progress of steady pumping until water arrives at the surface. The pumping rate should cause little or no water level drawdown in the well (less than 0.2 ft) and the water level should stabilize. Water level measurements should be made continuously. Precautions should be taken to avoid pump suction loss or air entrainment. Pumping rates should, if needed, be reduced to the minimum capabilities of the pump to avoid pumping the well dry and ensure stabilization of indicator parameters. If the recharge rate of the well is very low, purging should be interrupted so as not to cause the drawdown within the well to advance below the pump intake but the operator should attempt to maintain a steady flow rate with the pump to the extent practicable. In these low-yielding wells, where 100 mL/min exceeds the entrance rate of groundwater into the well, it is important to avoid dewatering the well screen interval. In these cases, the pump should remain in place and the water level should be allowed to recover repeatedly until there is sufficient volume in the well to permit collection of samples. An alternative means of sample collection may be necessary under these conditions.

4) While purging the well, monitoring of in-line water quality indicator parameters should include turbidity, specific conductance, pH, dissolved oxygen (DO) and redox potential (Eh) which must be collected every three to five minutes until all of the parameters have stabilized. Stabilization is achieved when three successive readings are within ± 0.1 for pH, $\pm 3\%$ for conductivity, ± 10mv for redox potential (Eh), and $\pm 10\%$ for turbidity and DO. A minimum subset of these parameters that can be used to determine stabilization during purging in this procedure are pH, specific conductivity and turbidity or DO. Turbidity and DO are typically the last parameters to stabilize. If the parameters have stabilized, but the turbidity is not in the range of 5-10 NTU, then follow step 6.

5) Once stabilization has been documented, VOC and gas sensitive (e.g. Fe^{+2}, CH_4, H_2S/HS) parameter samples should be immediately collected first and directly into pre-preserved sample containers. All sample containers should be filled by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence.

Samples requiring pH adjustment should have their pH checked to assure that the proper pH has been obtained. For VOC samples, this will require that a test sample be collected to determine the amount of preservative required to be added to the sample containers prior to sampling.

6) If the turbidity measurements do not approach the range of that of natural groundwater (10 NTU), both filtered and unfiltered samples should be collected for metals analysis. Filtered metal samples are to be collected with an in-line filter. A high capacity, in-line 0.45 micron particulate filter must be pre-rinsed according to the manufacturer's recommendations, or with approximately 1 liter of groundwater following purging and prior to sampling. After the sample is filtered it must be preserved immediately.

7) As each sample is collected, the sample should be labeled as defined in the QAPjP. All samples should be placed into a cooler with proper temperature control as outlined in the QAPjP.

After collection of the samples, the tubing from the pump should be properly discarded or dedicated to the well for re-sampling (by hanging the tubing inside the well).

8) Measure and record well total depth.

9) Secure the well (close and lock it up).

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J-5

EXAMPLE PURGE VOLUME CALCULATIONS

CALCULATIONS OF PURGE VOLUME

Determine purge volume as follows:

Water Level above sand pack:

$3 \times [(\pi r_b^2 h_s - \pi r_c^2 h_s) \times 0.3 + (\pi r_c^2 h_w)]$

Water Level below sand pack:

$3 \times [(\pi r_b^2 h_w - \pi r_c^2 h_w) \times 0.3 + (\pi r_c^2 h_w)]$

where:

r_b = radius of boring
r_c = radius of casing
h_s = height of sand
h_w = height of water

This calculation must be based upon 30% filter pack volume. Once the volume to be purged is known, purging can begin. The purge water will be collected, containerized and disposed of in accordance with local, state and federal regulations and laws.

J-6

DEPARTMENT POLICY ON INVESTIGATIVE DERIVED WASTE (IDW)

Department of Environmental Quality
Waste Operations
Policy for the Handling of
Investigation Derived Waste (IDW)

The Department of Environmental Quality (DEQ), Waste Operations has received a request for guidance from the regulated community concerning the Commonwealth of Virginia's requirements regarding the management and disposal of investigation derived waste (IDW). Because Virginia administers an authorized state RCRA program, the Virginia Solid Waste Management Regulations (VSWMR) and the Virginia Hazardous Waste Management Regulations (VHWMR) will serve as the governing requirements in lieu of Federal RCRA regulations contained in the Code of Federal Regulations (40 CFR 260 - 270) except for the Land Disposal Restrictions of 40 CFR 268. For reference, please see the Virginia Waste Management Act, Code of Virginia §10.1-1400 et seq.; the Virginia Hazardous Waste Management Regulations (VHWMR) (VR 672-10-1); the Virginia Solid Waste Management Regulations (VSWMR) (VR 672-20-10); Federal: the Resource Conservation and Recovery Act (RCRA), 42 USC 6901; and the U. S. Department of Transportation Rules for the Transportation of Hazardous Materials, 49 CFR Part 107, 171.1 - 172.558.

With regard to IDW, it is the site manager's responsibility to determine whether the wastes generated during an investigation meet the definition of a solid or hazardous waste. The site manager will be either the on-scene coordinator (i.e., either the federal official predesignated by the Environmental Protection Agency (EPA) or the U.S. Coast Guard to coordinate and direct federal responses under subpart D or the official designated by the lead agency to coordinate and direct removal actions under subpart E of the National Contingency Plan (NCP)), or the remedial project manager (i.e., the official designated by the lead agency to coordinate, monitor, or direct remedial or other response actions under subpart E of the NCP).

If there is a possibility that either the ground water or the soil at the location where a monitoring well is installed is contaminated, the site manager must determine whether or not the well cuttings, purge water, and/or other IDW are contaminated (i.e., whether they are solid or hazardous wastes). In these cases, the site manager may use knowledge of the contaminated media to declare that the IDW is solid or hazardous waste. If analysis shows that no contamination is present in the soil or the ground water at the location where the monitoring well is installed, neither the well cuttings, nor the purge water would be regulated as a solid waste. An example of a situation where the site manager might use knowledge to determine proper disposition (i.e., testing would not be required) would involve materials generated at locations where wells are installed for the purpose of ascertaining naturally occurring levels of

inorganic constituents and there is no basis to expect contamination, i.e., there is no past history of hazardous waste management activities or releases in these areas. If this is the case, the soils, cuttings, purge water, etc. would not be regulated as solid wastes. Test results or knowledge of the waste should be used to screen the well cuttings, purge water and other IDW to demonstrate that concentrations of contaminants are below or equal to background levels.

Purge water, well cuttings from monitoring wells, and other IDW, if tested, must be done so in accordance with EPA SW-846, Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, 3rd edition, 1986, as updated. If contaminant levels are found to be above background levels, the IDW would be considered a solid waste. Should test results further indicate that the IDW contains a listed hazardous waste, or if the IDW exhibits a characteristic of hazardous waste, the IDW is a hazardous waste and must be managed and disposed in accordance with the VHWMR. Alternatively, contaminated IDW that contains a listed hazardous waste must be managed as a hazardous waste until it no longer "contains" the hazardous waste, i.e., until the constituent levels are below site specific risk based levels. This is consistent with EPA's Contained In Policy. The DEQ should be contacted directly to determine the site specific risk based levels that would apply to IDW that contains listed hazardous waste.

If the IDW is not a hazardous waste, but contains levels of contaminants above background levels, the IDW must be managed in accordance with the VSWMR. Solid waste generated from cleanup or investigation activities is considered a special waste under Part VIII of the VSWMR. Prior to acceptance of a special waste for disposal at a solid waste management facility, the operator must obtain prior authorization from the Department. Purge water, on the other hand, must be disposed at a publicly owned treatment works (POTW) or other wastewater treatment system operating in accordance with its Virginia Pollutant Discharge Elimination System (VPDES) permit, provided that all other pertinent criteria are satisfied.

The on-site treatment, storage, or disposal of IDW must be authorized by a permit from the DEQ. A generator of hazardous IDW may accumulate such wastes in tanks or containers in accordance with VHWMR §6.4.E. Treatment of hazardous waste in tanks or containers within the 90 day accumulation period may only occur upon prior written approval from the appropriate DEQ Regional Office.

ADDENDUM

Department of Environmental Quality
Waste Operations
Policy for the Handling of
Investigation Derived Waste (IDW)

This Addendum is being provided to clarify the distinction between the disposal requirements for Investigation Derived Waste (IDW) that is generated from an undefined area, and the requirements for soil and sediment IDW when soil and sediment is generated from an area of known contamination subject to further response measures with oversight from DEQ and/or EPA.

"DEQ Policy for the Handling of Investigation Derived Waste" dated July 5, 1995, specifies that IDW contaminated above background levels is considered a solid waste and must be managed in accordance with the Virginia Solid Waste Management Regulations. If the IDW contains a listed hazardous waste or exhibits a characteristic of hazardous waste, it must be managed as hazardous waste in accordance with the Virginia Hazardous Waste Management Regulations. Under this policy, returning contaminated IDW to the location from which it is generated is prohibited.

However, this policy was not intended to address the requirements associated with soil and sediment IDW generated from an area of known contamination when this area is subject to future response activities with oversight from DEQ or EPA. In such a case, the management and disposal of the IDW should be in accordance with the pertinent EPA guidance governing the applicability of RCRA land disposal restrictions. ("Management of IDW During SI's", EPA/540/G-91/009).

Under the EPA guidance, replacement of soil and sediment IDW into the area of contamination from which it is generated is permissible provided that the waste is not treated prior to placement. Therefore, the above-referenced DEQ IDW policy now recognizes that if soil and sediment IDW is generated from an area of known contamination, and this area is subject to further response measures with oversight from DEQ and/or EPA, the IDW may be placed back into the area from which it is taken provided there is no treatment of this waste prior to placement.

Signed Hassan Vakili Date 7/24/96

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