Massachusetts Department of Environmental Protection
Bureau of Resource Protection • Residuals Management Program
Residuals Land Application Approvals

BRP WP 44 Modifications to Residuals Management Landfills

Instructions and Supporting Materials

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Introduction

MassDEP *Permit Applications*, as well as *Instructions & Support Materials*, are available for download from the MassDEP Web site at mass.gov/dep in two file formats: Microsoft Word™ and Adobe Acrobat PDF™. Either format allows documents to be printed.

Instructions & Support Materials files in Microsoft Word™ format contain a series of documents that provide guidance on how to prepare a permit application. Although we recommend that you print out the entire package, you may choose to print specific documents by selecting the appropriate page numbers for printing.

Permit Applications in Microsoft Word™ format must be downloaded separately. Users with Microsoft Word™ 97 or later may complete these forms electronically.

Permitting packages in Adobe Acrobat PDF™ format combine *Permit Applications* and *Instructions & Support Materials* in a single document. Adobe Acrobat PDF™ files may only be viewed and printed without alteration. *Permit Applications* in this format may not be completed electronically.

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Permit Fact Sheet

1. What is the purpose of this permit?

The purpose of this permit is to insure the proper operation and maintenance of existing residual management landfills through review and approval of any proposed changes to existing Operation and Maintenance plans, monitoring plans, closure, or post closure plans. Legislative authority is stated in Massachusetts General Laws, Chapter 21, sections 27 and 43(2); Chapter 83, sections 6 and 7; and Chapter 14, sections 17; and 314 CMR 1.00 to 314 CMR 12.00.

2. Who must apply for this permit?

Any owner/operator of a residuals management landfill who proposes any of the modifications to an existing facility including but not limited those plans cited in item 1 above.

3. What other requirements should be considered when applying for this permit?

3a. What prerequisites should be considered when applying for this permit?

• Ownership of the property and any restrictive covenants on the land should be determined. The extent of any property use restrictions should be determined. To site a facility, authority must be obtained from all parties with ownership of, or rights to the property.

• Identification should be made of all local abutters and the approximate distance from the proposed facility to those receptors.

• Permits of this type may require MEPA review. Please carefully examine 301 CMR 11.00, the MEPA Regulations, to determine if your project exceeds the MEPA review thresholds, or for more information contact the MEPA Unit of the Executive Office of Environmental Affairs (100 Cambridge Street, Boston, MA 02202; 617-727-5830). MassDEP cannot complete technical review of the permit application until the MEPA process has been concluded. Copies of MEPA filings (with reference to any applicable Transmittal numbers) should be sent to the appropriate program offices in Boston and the MEPA Coordinator in the appropriate Regional Office.

3b. What concurrent applications are related to this permit?

• A site hearing may be required pursuant to M.G.L. Chapter 21, Section 21-43 or Chapter 83, Section 6 and 7 after submission of design plans and after completion of the MEPA process but prior to final Department approval of plans and specifications.

• Depending on site location and facility design a Wetland Order of Conditions (310 CMR 10.00), or Air Quality permit (310 CMR 7.00) may be required.

• Notification and submittal of process flow schematic is required to the wastewater operator certification board (257 CMR 2.00) for any new facilities and significant operational changes to existing facilities.

Note: These additional requirements are intended to serve as a guide to the applicant. It does not necessarily include all additional requirements.

4. What is the application fee?

The application fee is $2,180.

5. What is the Primary Permit Location? What is the Reserve Copy Location?

Primary Permit Location:
Department of Environmental Protection
One Winter Street
Boston, MA 02108

Reserve Copy Location:
MassDEP
_____* Regional Office
Water Pollution Control

* Find your region: http://www.mass.gov/eea/agencies/massdep/about/contacts/

6. Where can I get a copy of the timelines?

The timelines are available on the MassDEP Website:
http://www.mass.gov/eea/agencies/massdep/service/approvals/timely-action-fees-and-payments.html

7. What is the annual compliance fee?

Current annual compliance fees can be found on the MassDEP Website at
http://www.mass.gov/eea/agencies/massdep/service/approvals/timely-action-fees-and-payments.html.
If you fail to pay the annual compliance fee, your permit could be suspended or revoked.

8. How long is the permit in effect?

Maintenance and monitoring of the site is generally conducted for a post closure period equal to 30 years. Upon request MassDEP may reduce or extend the post-closure period as deemed necessary depending upon site specific conditions.

9. How can I avoid the most common mistakes made in applying for this permit?

a. Provide all necessary information that properly describes the modification requested and the basis for the request.

b. Provide all detailed engineering drawings and specifications for final approvals.

c. Make sure a Massachusetts Registered Professional Engineer stamps and signs all submittals for design approvals.

d. Submit the fee and one copy of the MassDEP Transmittal Form to: Department of Environmental Protection, P.O. Box 4062, Boston, MA 02201.

10. What are regulations and policies that apply to this permit? Where can I get copies?

These regulations and policies include, but are not limited to:

a. WPC Wastewater Residuals Guidance Document No. 89-2, "Closure/Post Closure Requirements For Residuals Landfills".
b. WPC Residuals Guidance Document No. 90-1, "Guidelines for Hydrogeologic Evaluations".
c. WPC Residuals Guidance Document No. 90-2, "Residuals Landfill Plan Submittal Checklist".
d. Water Pollution Control Regulations, 314 CMR 1.00 through 12.00.
e. Timely Action and Fee Provisions, 310 CMR 4.00.
f. Administrative Penalty Regulations, 310 CMR 5.00.

They may be purchased at:

State House Bookstore
Room 116
Boston, MA 02133
617-727-2834

State House West Bookstore
436 Dwight Street
Springfield, MA 01103
413-784-1376

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Application Completeness Checklist

☐ The MassDEP Transmittal Form has been completed:
http://www.mass.gov/eea/agencies/massdep/service/approvals/transmittal-form-for-payment.html

If municipality, "Fee Exempt" has been selected from among the Special Provisions under Section F of the Transmittal Form.

☐ Engineering Report is included.

☐ Plans and Specifications are included.

☐ Hydrogeological Report is included.

☐ Environmental Monitoring Plan is included.

☐ A Massachusetts Registered Professional Engineer has stamped and signed all submittals for design approvals.

To submit the application package:

☐ All appropriate application materials have been submitted.

☐ Send a copy of the application package along with one copy of the MassDEP Transmittal Form to:

Department of Environmental Protection
_____* Regional Office
Wastewater Permitting
* Find your region:
http://www.mass.gov/eea/agencies/massdep/about/contacts/

☐ Send fee of $2,180 for BRP WP 44 in the form of a check or money order, along with one copy of the MassDEP Transmittal Form to:

Department of Environmental Protection
P.O. Box 4062
Boston, MA 02211

DWPC Wastewater Residuals Guidance Document No. 89-2

Closure/Post Closure Requirements For Residuals Landfills

1. Landfill Closure Requirements.

(1) **Notification of closure.** ***The owner or operator of a landfill must submit for Department review and approval a closure/post closure plan at least six (6) months prior to proposed closure activities.***

(2) **Final Closure Plan Requirements.** ***The closure/post closure plan shall provide such schematic, descriptive, and data information as the Department deems necessary to describe and evaluate the procedures the applicant proposes to use to close the facility and maintain and care for the site during post closure in a manner that minimizes the impacts to public health, safety, and the environment. A closure/post closure plan shall include:***

a. a narrative description, with appropriate references to the site and design plans, of the activities and sequence of activities necessary to deactivate and/or close the facility including the site preparation and closure activities necessary to cap and secure the landfill; and activities necessary to maintain the landfill during post-closure.

b. a description of measures to be utilized to comply with the closure and post closure requirements set forth in this document;

c. a description of the proposed subsequent use of the site and/or facility and;

d. other provisions that the Department deems necessary on a site or facility specific basis to ensure proper closure of the facility.

e. proof that the proposed facility is located within the site assigned boundaries as described in the Departments hearings pursuant to M.G.L. c. 83, ss. 6 & 7; or c. 21, s. 43.

f. certification from the Secretary of Environmental Affairs that the applicant has complied with the MEPA process, if applicable; and

g. proof that the applicant has received required approval for work in a wetlands resource area, or its buffer zone in accordance with M.G.L. c. 131, s. 40 and the regulations promulgated thereunder and 310 CMR 10, if applicable.

h. a description and implementation schedule of the proposed closure activities and a description and schedule of proposed post closure maintenance, monitoring, and assessment activities necessary to protect the public health, safety and the environment.

In addition to the aforementioned requirements the final closure plan shall include a hydrogeological evaluation of the landfill site that shall be conducted as part of the environmental assessment. The Department may require that closure plans for an existing facility be updated to reflect actual conditions of the site prior to final closure.

(3) **Filing.** ***The applicant shall file two (2) copies of the plan to the Department. One (1) copy shall be filed with the Division of Water Pollution Control section in the appropriate Regional Office and one (1) copy shall be filed with the Division of Water Pollution Control's Boston Office.***

(4) **Site Preparation for Closure.** ***The owner or operator of a residuals landfill shall prepare the portion of the site to be closed by undertaking the following actions:***

a. perform all necessary corrective site activities to the satisfaction of the Department; and

b. dispose of all residual materials stockpiled at the site.

(5) **Closure Requirements.** *In addition to the closure requirements previously set forth the operator shall ensure that:*

a. the completed landfill is graded in a manner that facilitates surface drainage and is consistent with the surrounding topography;

b. the completed landfill is completely covered by final cover in accordance with section 2 of this document;

c. the closure of the landfill does not in any way interfere with the proper drainage of adjacent lands or concentrate run-off waters on adjacent areas;

d. the landfill has an explosive gas control system, as outlined in section 3(3) of this document; and

e. the landfill has an operative environmental monitoring system designed and implemented in accordance with section 4 of this document.

(6) **Closure Procedures for Residuals Landfills.** *Closure of landfills shall consist of two (2) phases; Closure Construction and Termination of Closure.*

a. Closure Construction. Closure construction consists of the construction of the final cover. During this phase the operator shall:

1. notify the Department in writing two weeks prior to the start of construction of the impermeable cap as detailed in section 2 of this document. Work on the drainage layer and vegetative support layer as outlined in section 2 shall not commence until the impermeable cap has been inspected and approved by the Department;

2. notify the Department in writing two weeks prior to the completion of construction of the final cover;

3. hire an independent professional engineer knowledgeable in matters of landfill design and closure who shall oversee all closure activities. The engineer shall:

(a) determine the final grades of the landfill and the extent of its conformance to the approved final closure plan;

(b) inspect and certify subbase construction prior to the installation of the impermeable cap;

(c) oversee the installation and certify construction of the impermeable cap in accordance with approved plans, manufacturer's specifications and an approved QA/QC plan; and

(d) certify that the landfill is closed and covered in accordance with the approved final closure plans; and

(e) submit a copy of the engineer's certification to the Department. Following the receipt of the engineers certification the Department shall inspect the landfill and

(1) issue a determination of Construction Completion; or

(2) issue a letter citing deficiencies and requiring corrective action.

b. Termination of closure marks the beginning of the post-closure period. A facility should be deemed closed on the date of the Department's written determination that the closure of the facility has been completed in accordance with the final closure plan approved by the Department.

(7) **Record Notice of Landfill Operation.**

a. Notification that a residuals landfill has been operated on the site shall be recorded in the registry of deeds or in the registry section of the land court for the district wherein the land lies. The notification should contain the following information:

1. identification of record owners of the property;

2. a description of the landfill site, by metes and bounds and by reference to an appropriate map or plan to be recorded therewith, signed by a qualified professional engineer or a land surveyor, depicting the boundaries of the filled area and the location of any and all leachate collection devices and gas or ground water monitoring wells associated with the site;

3. a detailed description of the type and extent of the final cap and cover on the landfill; and

4. a description of the nature and duration of post closure maintenance and monitoring systems.

5. notification that said premises shall not be used for any purpose other than as a landfill without the prior written approval of the Department of Environmental Protection (MassDEP). Continued operation of the site as a landfill requires prior written approval of the Department.

2. Landfill Capping and Final Cover Criteria.

(1) **General.** *All landfills and portions thereof shall be covered with final cover, as soon as possible, but no later than ninety (90) days after reaching final approved elevations. When greater than thirty (30) days of the ninety day period falls between November 1 and March 1, the ninety (90) day period shall begin the following March 2.*

Final cover shall be applied to a section of the landfill under each of the following circumstances:

a. whenever a new lift has not or will not be applied within a one year period;

b. whenever approved final elevations have been reached;

c. whenever the permit terminates or is revoked.

(2) **Performance Standard.** *The final cover should be designed, constructed, and maintained to:*

a. minimize infiltration of liquid into the landfill;

b. promote proper drainage;

c. minimize erosion of the landfill;

d. accommodate settling and subsidence of the landfill;

e. ensure isolation of the landfill wastes from the environment; and

f. facilitate the control of air pollutants.

(3) **Components.** ***The final cover should consist of:***

a. a subgrade layer;

b. an impermeable layer;

c. a drainage layer or system;

d. a layer capable of supporting vegetative cover; and

e. the vegetative cover.

(4) **Design Standards.** ***The final cover should:***

a. have a final top slope of not less than five (5%) percent and side slopes no greater than three (3) horizontal to one (1) vertical (3:1);

b. be constructed in accordance with a quality assurance/quality control plan approved by the Department under direction of the supervising field engineer;

c. be tested in accordance with the Department's approved testing procedures as detailed in Appendix A of this document; and

d. be repaired immediately upon the detection of any failure which may result in the imminent or future release of pollutants to the environment.

(5) **Subgrade Preparation and Certification.** ***Prior to the placement of the impermeable layer, the subgrade should be prepared according to approved plan. The subgrade should be designed and constructed to provide adequate support for the final cover and be free from materials that may damage or abrade the impermeable layer. The subgrade preparation shall be inspected by the supervising engineer and certified as to the conformance of the subgrade to the approved plan.***

(6) **Low Permeability Layer.** ***The low permeability layer of the final cover may be composed of natural, admixed, or amended soils, a flexible membrane, or any combination of the above, with Department prior approval. It shall be constructed in accordance with a construction plan approved by the Department and promote the positive drainage of the landfill final cover system and prevent erosion. It shall also minimize the movement or percolation of water into the landfill.***

a. Clay or other natural or amended soils used as the low permeability layer, shall:

1. have a minimum compacted thickness of 18 inches;

2. be constructed using materials and procedures that result in a maximum in-place hydraulic capacity of $1x10^{-7}$ cm/sec throughout the entire thickness of the layer;

3. be compacted to minimize void spaces and support the weight imposed by the post closure use without settling so as to cause or to contribute to the failure of the low permeability layer;

4. be free of materials that, because of their physical, chemical, or biological characteristics, may cause or contribute to an increase in the permeability of the layer or otherwise cause failure of the layer;

b. Flexible membrane liners shall:

1. have an underlying base that will support the weight of the final cover and not abrade or puncture the flexible membrane;

2. *be capable of being seamed to produce leak-tight, high strength seams that retain their integrity during final cover installation and the post-closure period;*

3. *have a minimum thickness of 30 mils.;*

4. *have sufficient flexibility and strength for the proposed application, taking into consideration tensile strength, puncturability, stress cracking, and chemical compatibility;*

5. *be constructed to ensure that the seams connecting synthetic membrane panels are of equal or greater strength than the panels themselves and be oriented parallel to the slope and not across the slope (a QA/QC plan should be submitted as part of the closure plan).*

(7) **Drainage Layer or System.** *The drainage layer or system shall meet the following criteria:*

a. *be placed above the impermeable cap;*

b. *be of sufficient thickness and hydraulic conductivity or capacity to drain the immediate and up-gradient areas of the final cover;*

c. *be composed of either:*

1. *a soil material that has a minimum thickness of six inches and have a hydraulic conductivity equal to, or greater than 1 x 10^{-3} cm/sec; or*

2. *when allowed by the Department, synthetic drainage material (geonet) that shall:*

(a) *be of sufficient strength to prevent deformation and impairment of function by the weight of vehicles or the final cover;*

(b) *have sufficient flow capability;*

(c) *be properly oriented for proper function; and*

(d) *be bound on its upper surface with filter material where needed to prevent the infiltration of fine material and to maintain the integrity of the layer; and*

(e) *be maintained to prevent conditions that could compromise the integrity of the landfill or cause erosion.*

(8) **Filter Material.** *Filter material, where placed, shall be capable of preventing migration of fine soil particles into the drainage or venting layer.*

(9) **Vegetative Support/Protection Layer.** *The vegetative support/protection layer shall:*

a. *be of sufficient thickness and composition to support the selected vegetation and protect underlying layers from the adverse effects of desiccation, extremes in temperature, including frost effects and erosion.*

b. *there shall be at least 18 inches of soil material above the low permeability layer. This 18 inches may be composed of soil in the drainage layer and the vegetative support/protection layer. The vegetative layer alone must be at least must be a minimum of twelve (12) inches thick and be comprised of soil capable of supporting the selected vegetation.*

(10) **Vegetative Cover.** *The vegetative cover shall:*

a. *provide complete coverage of the landfill;*

b. have root systems that shall not compromise the drainage layer or the low permeability layer;

c. be composed of plants which shall be capable of self propagation;

d. minimize erosion of the underlying material;

e. promote evapotranspiration of water to the maximum practicable extent; and

f. provide for an effective and permanent cover compatible with the site.

(11) **Alternative Designs.** *Landfill final cover systems designed using components, materials, technologies or methodologies other than those provided for in this document may be approved by the Department provided that either the proponent demonstrates to the Department's satisfaction that the alternative final cover system design meets the standards established in this document and adequately protects the public health, safety, and the environment.*

3. Environmental Protection Systems.

(1) **Storm Water Control.** *Storm water control systems shall be designed to prevent erosion, discharge of pollutants, and protect the physical integrity of the landfill. Controls shall also be designed to prevent flow onto the active portion of the landfill during the peak discharge from a 24 hour, 25 year storm. Controls shall also be designed to control the run-off from the active portion of the landfill of at least the water volume resulting from the 24 hour, 25 year storm.*

(2) **Surface and Groundwater Protection.** *Landfills shall prevent direct discharge of contaminated run-off or leachate from the landfill to any surface water bodies or to the groundwater, except in accordance with a Massachusetts Surface Water Discharge Permit or Groundwater Discharge Permit issued by the Department pursuant to 314 CMR 5.00 or 7.00, respectively, and the National Pollution Discharge Elimination System permit issued jointly by the U.S. Environmental Protection Agency and the Department.*

(3) **Air Quality Protection System.** *Landfills shall control the concentration levels of explosive gas and malodorous gases and other air pollutants as necessary in order to maintain air quality and to prevent the occurrence of nuisance conditions or public health and safety problems. Air quality protection systems shall be designed to control the concentration of explosive gases to no greater than twenty-five percent (25%) of the Lower Explosive Limit (LEL) for individual components or total LEL detected in any on-site structure or at the property boundary at any time, excluding gas control or recovery system components or any leachate collection components.*

a. **Gas Vents.** *At a minimum, passive gas vents shall be provided at all facilities in all areas of the landfill over which final cover has been applied. Gas vents shall allow for the movement and adequate venting of landfill gases in order to prevent the buildup of explosive concentrations of gas and prevent lateral migration of gases beyond the boundaries of the landfill. Landfill gas vents must be designed:*

1. to maintain the integrity of the low permeability cap at the penetration of the cap;

2. to provide adequate venting of landfill gases;

3. with "T's", goosenecks or other equivalent cap at the top of the riser pipe to allow effective venting;

4. to allow for retrofitting for active gas recovery or treatment at a later time if required;

5. to operate without clogging; and

6. to remain secure from vandalism.

b.* Installation.** ***Gas vents shall be installed concurrently with the phased construction of a facility and in accordance with any permits or orders issued by the Department.

4. Environmental Monitoring Systems.

***(1)* Ground Water Monitoring Systems.**

a.* Performance Standard.** ***A ground water monitoring system shall:

1. ***be capable of yielding groundwater samples for analysis; and***

2. ***consist of a sufficient number of wells properly located and screened at appropriate depths to detect the release of contaminants from the landfill into the groundwater.***

b.* Design Standard.** ***A ground water monitoring system shall:

1. ***at a minimum be composed of one monitoring well or cluster of wells installed hydraulically upgradient from the limit of the filled or proposed fill area capable of yielding groundwater samples which are representative of background ground water quality;***

2. ***at a minimum be composed of three (3) monitoring wells, or clusters of wells, installed hydraulically downgradient from the limit of the filled areas or areas proposed to be filled capable of detecting contaminants that migrate from the landfill to the groundwater;***

3. ***be composed of wells drilled by a person licensed under Well Driller Regulations, 313 CMR 3.00;***

4. ***be composed of wells readily accessible to sampling equipment and located so that they do not interfere with routine facility operations; and***

5. ***be composed of wells designed with locking caps and secured to prevent tampering with or vandalism.***

6. ***be designed and constructed in accordance with MassDEP "Standard References for Monitoring Wells" (MassDEP Publication # WSC-310-91)***

***(2)* Surface Water Monitoring Systems.**

a.* Performance Standard.** ***Where required by the Department, permanent surface water sampling location markers shall be established upstream and downstream of the residuals landfill facility in sufficient numbers and locations to adequately represent surface waters flowing through or past the facility.

b.* Design Standard.** ***All surface water sampling stations shall be readily accessible to sampling equipment and located so that they do not interfere with routine facility operations.

***(3)* Gas Monitoring Systems.**

a.* Performance Standard.** ***Gas monitoring wells for the monitoring of explosive and other landfill gases shall be provided at all landfills to determine is gas is migrating beyond the boundaries of the landfill and shall:

1. ***be capable of yielding representative air samples for analysis; and***

2. *consist of a sufficient number of wells properly located to detect the presence and migration of landfill gases.*

5. Environmental Monitoring Requirements.

(1) **Surface and Ground Water Monitoring.**

a. *Sampling and analysis of surface and groundwater shall be conducted in accordance with methods approved by the Department.*

b. *The owner/operator shall conduct surface and groundwater monitoring at sampling points approved by the Department.*

c. *The owner/operator shall establish background surface water and groundwater quality at sampling points hydraulically upgradient of the landfill. Background water quality shall be determined by a minimum of four quarterly rounds of samples for each of the monitoring parameters listed in section 5(1)h below.*

d. *The owner/operator shall conduct surface and ground water monitoring on a schedule approved by the Department. At a minimum monitoring shall be performed semi-annually.*

e. *The Department may refuse to accept monitoring data where:*

1. *the sample was taken from a groundwater monitoring well for which the Department has not received and approved as-built construction plans, boring logs, and well locations;*

2. *the sample was taken from a groundwater monitoring well constructed in a manner not approved by the Department;*

3. *the analysis were performed by a laboratory other than a Massachusetts certified laboratory, unless the sample is accompanied by a complete QA/QC submittal; or*

4. *the sample was not handled in accordance with the sampling and preservation requirements specified by the testing method.*

(f) *All analytical results shall be submitted to the Department within 60 days after the scheduled sampling period or immediately upon receipt to the owner if earlier.*

(g) *Static ground water elevations shall be recorded prior to sampling whenever a monitoring well is to be sampled.*

(h) *At a minimum, surface and ground water samples shall be analyzed for the following parameters:*

(1) **general parameters:**

** pH (in situ);*
** temperature (in situ);*
** specific conductance (in situ);*
** alkalinity;*
** nitrogen series (TKN, ammonia-n, nitrate-n);*
** total dissolved solids;*
** chlorides;*
** iron;*
** manganese;*

** sulfate;*
** chemical oxygen demand (COD); and*
** dissolved oxygen*

(2) **inorganics:**

** arsenic;*
** barium;*
** cadmium;*
** chromium (total & cr^{+6})[1];*
** cyanide;*
** lead;*
** mercury;*
** selenium;*
** silver; and*
** zinc.*

(3) all of the organic compounds included in EPA test method 624, as amended, and methyl ethyl ketone, xylenes, methyl isobutyl ketone, and acetone. In addition, unknown peaks having intensities greater than 5 times the background intensity shall be identified; and

(4) any additional priority pollutants as set forth under 40 CFR part 141, as amended, or required by the Department.

(i) Upon a determination by the Department that the facility may represent a threat to surface water or ground water, the Department may require the owner to conduct more frequent surface water or ground water sampling or to analyze for additional parameters than previously noted.

(j) If the concentrations of any of the parameters listed in section 8 of this document exceed the state or federal drinking water standards, Maximum Contaminant Levels (MCLs) or any alternative standards established by the Department, at any sampling point, the owner/operator shall:

(1) notify the Department within fourteen (14) days of the finding;

(2) collect, analyze and submit to the Department another round of samples within 60 days of the prior date of sample collection and determine the concentration of all parameters identified above or as specified by the Department.

(k) Where the Department determines, based upon the ground and surface water analyses from a facility, that assessment and corrective actions shall be required, the operator shall undertake the assessment and corrective actions as determined by the Department.

(2) **Leachate Monitoring.** *The owner/operator shall submit to the Department for review and approval a plan to properly sample and analyze leachate as deemed necessary by the Department. When leachate is discharged in accordance with a discharge permit issued by the Department the owner/operator shall monitor in accordance with the permit requirements. The owner/operator shall monitor the quantity and quality of leachate generated. The owner/operator shall submit the results of all leachate monitoring data to the Department with the inspection reports.*

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[1] *The Department may waive the requirement to analyze for hexavalent chromium provided that total chromium does not exceed 0.05 mg/l.*

(3) **Gas Monitoring.** ***Gas monitoring shall be conducted as deemed necessary by the Department and on a frequency approved by the Department.***

6. Landfill Post Closure Requirements.

(1) **Post Closure Period.** ***For the purposes of this section the post-closure period shall extend for a minimum of a thirty (30) year period. The Department may, upon request, reduce the post-closure period to less than 30 years if it finds that a shorter period will be sufficient to protect public health, safety, and the environment. The Department's review will include, but not be limited to, a consideration of the quantity and quality of leachate generated by the landfill, groundwater monitoring results, characteristics of the waste disposed, stability of the waste, design of the facility, and the location of the site. The Department also reserves the right to extend the post-closure period at any time prior to the time the post-closure period is due to expire where the Department finds an extension is necessary in order to ensure protection of public health, safety, or the environment or to mitigate adverse impacts.***

(2) **Post-Closure Requirements.** ***During the post-closure period the owner/operator shall perform the following activities on any closed portion of the facility:***

a. take corrective actions to remediate and/or mitigate conditions that would compromise the integrity and purpose of the final cover;

b. maintain the integrity of the liner system and the final cover system;

c. collect leachate from and monitor and maintain the leachate collection system(s);

d. monitor and maintain the environmental monitoring systems for surface water, groundwater, and air quality;

e. maintain access roads;

f. maintain landfill gas control systems; and

g. protect and maintain surveyed benchmarks.

(3) **Reporting Requirements.** ***The owner/operator, successors, or assigns shall submit a report every two years except as otherwise required by the Department during the post-closure period describing any activity at the site and summarizing the results of the environmental monitoring programs.***

(4) **Termination of the Post-closure Period.** ***The post-closure period shall end on the date of the Department's written determination that the post-closure care, maintenance, and monitoring of the site are no longer required. Said determination in no way limits or absolves the owner of the liability for the site in the future.***

7. Post-closure Use of Residuals Landfills.

(1) **Applicability.** ***No site on which a residuals landfill was operated shall be used for any other purpose without the prior written approval of the Department.***

(2) **Submission of Post-Closure Use Plans.** ***Any person proposing to use a residuals landfill for any purpose following closure of a facility shall submit plans for the post closure use to the Department for review and approval.***

(3) **Criteria for Approval of a Post-Closure Use.** ***Any post-closure use of a residuals landfill shall be accomplished such that:***

a. the final contours of the landfill are not altered, unless the Department determines:

1. *the disturbance is necessary for the proposed use and that it will not result in an adverse impact on public health, safety, or the environment; or*

2. *the disturbance is necessary to reduce threats to public health, safety, or the environment;*

b. *the integrity of the final cover, the components of any containment system and the function of the facility's monitoring systems are not impaired;*

c. *drainage facilities, ponds, swales, ditches, or other erosion/sedimentation controls are maintained.*

(4) **Post-Closure Construction.** *Construction during the post-closure phase shall be accomplished in accordance with the following:*

a. *buildings shall be above grade structures. Any penetration of the landfill final cover shall be designed and constructed to ensure that the integrity of the final cover system is maintained. Construction of basements which penetrate the drainage layer or low permeability layer is prohibited;*

b. *buildings shall be constructed to prevent accumulation of gas within the structure. Buildings shall include gas monitoring and warning systems and may be required to include an active gas venting system; and*

c. *all utility connections shall be designed and constructed with flexible connections.*

Appendix A

Landfill Caps and Liners and Sub-Grade
Testing Methods, Testing Frequency, and Specifications

Soils used for landfill caps and liners should have the following properties.

****minimum of 50% of the soil by weight, should pass the No. 200 sieve***
****minimum of 25% of the soil by weight should consist of <2µm clay size particles***
****plasticity index should be 15% or greater, but less than 30-40%***
****density should be, at a minimum, 95% standard, or 90% Modified Proctor Density***
****maximum clod size should not exceed ½ of the lift thickness***
****maximum rock size should not exceed ¾ to 1 inch***
****coarse fragments < 10% (or passing the No. 4 sieve)***

Low Permeability Cover Material Testing (for each Borrow Source)

For each source of low permeability cover material, the following testing shall be performed. Depending upon the conditions at the borrow pit, more frequent testing may be required.

Type of Test	*Frequency**	*Testing Method(s)*
Soil		
Grain Size Analysis (Hydrometer)	***1 test/2000 cy***	***ASTM D 422***
Moisture Content	***1 test/2000 cy***	***ASTM D 2216***
Moisture-Density Curve	***1 test/5000 cy***	***ASTM D 1557***
Liquid and Plastic Limit (Atterberg Limits)	***1 test/5000 cy***	***ASTM D 423 and ASTM D 424***
Lab Permeability (Triaxial cell method with back pressure)	***1 test/10,000 cy***	***U.S. Army Corps of Engineers Manual, EM 1110-2-1906 Appendix VII Permeability Tests***

**** Tests should be conducted at the established testing frequency or any change in material.***

The lab permeability sample will be compacted to a dry density equal to 90 percent of that determined from the moisture density curve determined by ASTM D 1557.

Granular Drainage Material Testing

Minimum testing requirements for granular drainage and cover material placed over the low permeability cover material or liner are as follows:

Type of Test	*Frequency*	*Testing Method(s)*
Grain Size Analysis (to the No. 200 Sieve)	***1 test/1500 cy***	***ASTM D 422***
Permeability	***1 test/3000 cy***	***ASTM D 2434***
Bearing Ratio		***ASTM D 1883***

Low Permeability Cover Material (In-Place) Testing

Clay soils used as low permeability cover material should be compacted at a moisture content of no more than 1 percent drier or 3 percent wetter than the optimum moisture content determined by ASTM D 1557. Minimum testing requirements for the impervious cover material for EACH LIFT are as follows:

Type of Test	*Frequency*	*Testing Method(s)*
Soil (each lift unless otherwise noted)		
In-place Density and Moisture Content	***5 tests/acre***	***ASTM D 1556 or ASTM D 2922 and ASTM D 3017***
Moisture-density Curve (as per clay borrow requirements)	***1 test/5000 cy and all changes in material***	***ASTM D 1557***
Liquid and Plastic Limits (Atterberg Limits)	***1 test/acre***	***ASTM D 423 and ASTM D 424***
Grain Size Analysis (Hydrometer- to the 2 micron particle size)	***1 test/acre***	***ASTM D 422***
Undisturbed permeability (triaxial cell method with back pressure)	***1 test/acre***	***U.S. Army Corps of Engineers Manual, EM 1110-2-1906 Appendix VII Permeability Tests***

When nuclear methods are used to test in-place density and moisture content, as a minimum, one sand cone test will be taken for each 20 tests taken using nuclear methods. As a minimum at least one sand cone test must be taken when the in-place density tests using nuclear methods is less than 20.

Sand and Gravel Fill Material Requirements

Sand and gravel fill may be used where drainage is critical, such as with underdrain systems and working mats, and as a base course below pavements, walkways, and slabs on grade. Sand and gravel fill shall consist of hard, durable sand and gravel, and shall conform to the following gradation requirements.

Sieve Size	*Percent Finer by Weight*
(a)	***100***
½ - inch	***50-85***
No. 4	***40-75***
No. 10	***--***
No. 40	***10-35***
No. 100	***(b)***

Notes: (a) Maximum grain size shall be 1/3 of the loose lift thickness unless otherwise indicated.

(b) The amount passing the No. 100 sieve should be between 40 percent and 70 percent of the amount passing the No. 40 sieve.

Compaction Requirements

The degree of compaction is expressed as a percentage of the maximum dry density at optimum moisture content as determined by ASTM Test D 1557, Method C. The compaction requirements are as follows:

Area	*ASTM Density Degree of Compaction*
Trench Backfill	***92 %***
Landfill Cap and Cover	***Minimum 90 % standard proctor or 95 % modified proctor or as required to meet permeability specifications***
General Fill	***90 %***

Riprap Stone Material Requirements

Riprap stone for slope protection and drainage swales shall be hard, durable, angular shaped stones, containing no more than 2 percent crusher dust, and shall be the following gradation requirements.

Slope Protection Riprap

Square Mesh Sieves (inches)	*Percent Passing by Weight*
2½	***100***
2	***95 to 100***
1½	***35 to 70***
1¼	***0 to 25***
1	***1 to 10***
¾	***0***

Drainage Swale Riprap[(a)]

Weight of Stone Over (lbs.)	*Percent of Total by Weight*
40	***50***
20	***70***
5	***90***

(a) The drainage swale riprap gradation requirements given above are dependent upon the slope of the swale and the peak-run-off expected in the swale.

Residuals Guidance Document No. 90 - 1
Guidelines for Hydrogeologic Evaluations

The project proponent should submit a hydrogeological survey report, prepared by a qualified hydrogeologist, for Department approval. The purpose of the study is to determine the following:

(1) Define the geology beneath the site area,

(2) Identify groundwater flow paths and rates,

(3) Determine design characteristics of the landfill liner based upon maximum observed or expected groundwater conditions, and

(4) Determine the location of all proposed groundwater protection and monitoring systems.

The report shall include a determination of groundwater flow and velocities prior to and subsequent to landfill construction, groundwater elevations, and potential effect of leachate migration on the surrounding area including public and private water supplies, streams, ponds, wetlands, and coastal waters. The report shall also recommend a ground water monitoring network including upgradient and downgradient monitoring wells, their location and number, method of construction and sampling, and screen depth and intervals.

The hydrogeologic report shall include, as a minimum the following items:

* a determination of the nature of the soils and subsurface geology, thickness and porosity of the unsaturated zone, aquifer saturated thickness, and hydraulic conductivity and porosity of the aquifer and confining layers;

* recommendation of the appropriate location and construction of monitoring wells based on a thorough understanding of the site's subsurface stratigraphy, depth to ground water, groundwater fluctuations, ground water flow direction and mounding potential due to proposed storm water detention basins;

* an evaluation of the potential impacts on current and potential downgradient receptors based on full characterization of subsurface conditions, location of public and private wells, location of hydraulically connected surface waters, hydraulic conductivity, saturated thickness and porosity, and ground water velocities and flow directions;

* a determination of ambient water quality including ground water sample collection from monitoring wells and samples from adjacent surface water bodies;

* a determination of required liner elevations to maintain a vertical separation of four (4) feet between the bottom of the secondary liner and maximum observed or anticipated ground water elevations; and

* a summary of all soil boring and geotechnical evaluations and a plan indicating the location of all subsurface testing.

A general outline for the scope of work to be conducted for hydrogeologic evaluations is as follows:

I. Background Information.

A. Site Description.

1. Owner of the site,

2. Location of the site,
3. Acreage of the site and of the proposed landfill footprint,
4. Description of the surrounding environment and potential environmental resources affected,
5. Identification of abutting property owners and land uses.

B. Reason for the Investigation.

II. Project Schedule.

A. Order or procession of Investigations.

1. Timetable for investigations.
2. Timetable for deliverables.

III. Technical Approach.

Phase 1 - Preliminary Assessment.

A. Historical Review / Literature Search.

1. Provide historical research on the site.
2. Provide a base map and locus map of appropriate scale.
3. Review, evaluation, and summary of existing data from the site.

a. Previous subsurface investigations.

(1) soil and water quality data,
(2) soils information from deep observation hole tests, soil borings, or monitoring wells,
(3) observed water levels,
(4) water table fluctuation information,
(5) seasonal and tidal influences on water table fluctuations,
(6) provide relevant U.S.G.S. data,

4. Provide available quality data for all materials proposed to be disposed in the residuals landfill.

B. Regional Survey.

1. Determine the location and use of existing and potential public groundwater supply wells within 1 mile of the proposed facility.

a. Wells - historical and anticipated pumping rates, pumped volumes, and pumping durations for existing and proposed public supply wells.

b. Zone of contribution (Zone II) information generated for public supply wells or interim wellhead protection area (½ mile radius).

c. well construction, depth, and related soils information.

d. provide information on areas within a 1 mile radius under investigation for water supply purposes.

e. provide all historical water quality data.

2. Determine the location and use of surface water supply areas within a 1 mile radius of the facility.

   a. contributing watershed areas.
   b. supply existing volumes and pumping system information.
   c. anticipated future use.
   d. surface water areas under investigation as a potential drinking water supply source.
   e. historical water quality data.

3. Determine the location of private wells within ½ mile of the facility.

   a. bedrock and overburden wells.
   b. well depth and screened intervals.
   c. potential areas of development near the facility which could utilize private wells for a source of water supply.

4. Provide background geologic data for the area from the following sources:

   a. U.S.G.S. topographic map, locus map, and site plan.
   b. U.S.G.S. surficial geologic map.
   c. U.S.G.S. bedrock map.
   d. U.S.G.S. hydrologic atlas.

5. Develop a conceptual groundwater transport model.

6. Preliminary mapping - Provide an up-to-date base map. The scale of the map must be between 1" = 40' and 1" = 100'. The following features must be shown:

   a. Site topography,
   b. Property boundaries, including landfill boundary and proposed waste deposition areas.
   c. Location of all existing monitoring wells, test pits, borings, surface water, and soil sampling locations,
   d. On or within 1 mile of the site, identify:

      (1) Public water supplies (surface and groundwater),
      (2) Existing Zone II delineations,
      (3) Interim Wellhead Protection Areas - (a ½ mile radius around public wells),
      (4) Watersheds and their drainage patterns,
      (5) Aquifer protection zones,
      (6) other areas of environmental concern.

   e. On or within ½ mile of the site, identify:

      (1) Private water supplies,
      (2) Surface water bodies, wetlands, 100 year floodplains,
      (3) Areas of critical environmental concern,
      (4) Existing buildings and/or man-made structures, monitoring devices, utilities, etc.

   f. Submit a copy of the U.S.G.S. surficial geology map locating the site.

g. Submit a copy of the U.S.G.S. bedrock geology map locating the site.

7. Develop a preliminary report which summarizes the previous information including but not limited to a description of the regional and site specific surficial geology, bedrock geology, hydrogeology, potentially affected receptors, and potential environmental resources affected. In addition, the preliminary report must provide recommendations for additional subsurface work to be accomplished and the reasons the work is necessary.

Phase 2 - Comprehensive Assessment

1. Provide a brief summary of prior data on the site, and any analyses of that data used to develop the scope of work for phase 2 activities.

2. Phase 2 activities should include the following:

A. Preliminary field work

(1) Revisions to site plan based upon field observations,
(2) Revisions to preliminary mapping of wetlands, surface water bodies, existing monitoring devices, man-made features, etc.
(3) Geologic mapping,
(4) Sampling of existing monitoring devices (if applicable),
(5) Identification and installation of necessary soil borings, test pits, piezometers, and / or monitoring wells,
(6) Identification and conductance of necessary geophysical surveys,
(7) Obtaining static water measurements.

B. Preliminary compilation, interpretation, and presentation of data.

(1) Determine ground and surface water quality,
(2) Construct water table and potentiometric surface contour maps,
(3) Construct vertical equipotential sections,
(4) Construct vertical and horizontal flow nets,
(5) Determine possible ground and surface water flow paths,
(6) Perform a water balance to determine potential volumes of leachate and surface runoff,
(7) Determine overburden thickness and saturated thickness,
(8) Determine if a bedrock investigation is necessary,
(9) Compile all soil boring, piezometer, and monitoring well data,
(10) Construct geologic cross-sections,
(11) Refine conceptual model,
(12) Prepare a draft report that includes an amended scope of work and a QA / QC plan for additional phase 3 work (if necessary).

Drilling Program Guidance

1. Submit a plan for a drilling program which includes:

(1) The rational for the choice of location, depth, and number of boreholes, monitoring wells, piezometers installed and environmental samples collected,
(2) Locus map indicating the proposed locations listed above,
(3) Drilling method(s) and field procedures,
(4) Copy of a standard boring log to be utilized,

(5) Soil sampling procedures to be utilized,
(6) Soil classification system,
(7) Bore hole abandonment procedures,
(8) Drilling QA / QC plan which includes:

a. Well logs, both drillers and consultants,
b. As built monitoring well, piezometer designs,
c. Equipment decontaminant procedures,

Subsurface Work Required

1. Determine a sufficient number of monitoring wells, screened intervals and multilevel wells clusters (bedrock, deep, and water table) to:

(1) determine groundwater flow direction,
(2) determine vertical and horizontal hydraulic groundwater gradients,
(3) determine the over burden / bedrock hydraulic relationships,
(4) determine the groundwater quality in bedrock, at depth in the aquifer, and at the water table interface,
(5) determine the permeabilities of the above through the use of in-situ down hole permeability testing and sieve analysis of lithologic units encountered,
(6) generation of potential contaminant contour maps (if necessary),
(7) estimate groundwater flow rates based on hydraulic gradients and permeabilities as encountered,
(8) determine competency of bedrock through coring and RQD's. Bedrock wells should be screened from 10-20 feet into rock, rock type should also be determined,
(9) estimate flow path of a potential plume based on the hydrogeologic data gathered during the investigation,
(10) wells must be constructed according to MassDEP monitoring well guidelines,
(11) fracture trace analysis or similar technique should be utilized for determining rock fracture and joint patterns,
(12) Determine the hydraulic conductivity (reference the method used to do so and include all data generated.

2. Soil Borings and Soil Sampling

(1) Soil samples must be collected from the deepest well (bedrock) at each well cluster,
(2) Soil samples should be collected with a split spoon sampler utilizing ASTM guidelines for sample retrieval and determination of compactedness,
(3) Soil samples must be collected at five (5) foot intervals, changes in stratigraphy, and at the water table, unless continuous sampling is warranted,
(4) Split spoon samplers must be de-contaminated with methanol, scrubbed, and rinsed with clean water after each use,

(5) All drilling tools and associated machinery should be steam cleaned prior to starting the installation of each new individual well,
(6) Soil samples undergoing laboratory analysis for organic compounds must be collected in appropriate jars and vials; a field organic vapor detector (HNU, photo vac, OVA, AID, etc.) should be used to screen the head space in soil jars,

(7) Samples of wash water used during drilling operations should be analyzed for the same constituents as the groundwater samples.

Phase 3 - Additional Field Work/ Refinement of Data

Phase 3 activities should include the following:

1. Additional field work.

   a. refine phase 2 site characterization with additional field work,
   b. perform bedrock investigation if necessary and required.

2. Refine all preliminary data compilations, interpretations, and presentations.

3. Refine conceptual model.

4. Design an environmental monitoring system.

   a. Determine depth and location of all well screens.
   b. Confirm location and depths with the Department.
   c. Install monitoring wells after approved by the Department.

5. Design sampling and analysis program.

6. Initiate at least one round of sampling.

7. Prepare final report.

Design of the Sampling and Analysis Plan

1. Prepare a sampling and analysis plan to establish background groundwater, surface water, and soil quality. If prior analysis has not been conducted of the products to be disposed in the landfill, then the plan should include methods for obtaining such data.

   a. Groundwater Samples.

   (1) First round sampling should include analysis for those parameters identified in DWPC Guidance Document No. 89-2, Closure/Post Closure Requirements for Residuals Landfills. For metals the initial analysis should be conducted for total metals. If the results indicate the presence of metals above Maximum Contaminant drinking Water Levels (MCL), re-sampling should be conducted for dissolved metals.

   (2) Quarterly samples should be collected from each monitoring well and analyzed by EPA approved methods. Analysis must be conducted by a laboratory certified by the State.

   (3) Samples should be collected at extreme ground water elevations for each season. This sampling program should be continued for at least one year at which time it may be amended based on the results obtained.

   (4) Samples should not be taken within 48 hours after a precipitation event.

   (5) The location of all sampling points must be shown on the base map.

(6) Water quality parameters anticipated for analysis should be included in the scope of work. The parameters should be based on current drinking water standards and guidelines as well as those parameters found to be present in the material proposed to be landfilled. TCLP analysis must also be conducted on the waste material proposed to be landfilled.

(7) Wells must be properly developed and purged prior to sample acquisition.

(8) Monitoring well sampling must be conducted according to accepted sanitary groundwater sampling protocol. Acceptable sampling techniques vary for differing parameters. For example, VOA samples must not be aerated during pumping, collection, and bottling.

(9) Chain of custody protocols must be complied with.

2. Prepare a field QA / QC sampling plan to include:

(1) Sample collection method,
(2) Containers used,
(3) Sample preservation techniques,
(4) Equipment decontamination procedures,
(5) Trip blanks,
(6) Field blanks,
(7) Equipment blanks,
(8) Duplicates,
(9) Chain of custody procedures,
(10) Field log book.

3. Prepare a lab QA / QC plan (or obtain from the lab) to include:

(1) Lab blanks,
(2) Duplicates,
(3) Sample preservation techniques,
(4) Spiked samples,
(5) Chain of custody procedures.

* Laboratory data sheets must be submitted as part of the assessment report for all samples analyzed. These data sheets must include: date(s) of sample collection, arrival at the lab, analysis, and extraction, (if applicable). The data sheets must also include minimum detection limits, analytical methods employed, signature of the person who performed the analysis and reason for deviation from approved procedures, if necessary.

* Data sheets for all blanks and duplicates conducted must also be submitted.

Final Report Submittal

Upon completion of the above tasks, prepare a final report summarizing the results of the hydrogeological evaluation. The report should include the following information:

1. **Discussion and inclusion of all items listed in the previous phases as approved by the Department.**

2. Data compilations, interpretations, and presentations.

   a. Evaluation of ground and surface quality on-site,
   b. Evaluation of site hydrogeology with respect to local geology,
   c. Presentation of data on potential human and environmental receptors which may be effected by potential contamination from the site.
   d. Compilation of piezometric data on a site map contoured to indicate equipotential and flow lines for both horizontal and vertical flow for seasonal high and seasonal low groundwater elevations,
   e. Identification of possible surface water paths before and after design of the landfill,
   f. Calculation of water balance to determine potential volumes of leachate and surface water runoff,
   g. Compilation of all soil boring, piezometer, and monitoring well data,
   h. Construction of geologic cross-sections,
   i. Monitoring well construction details,
   j. Survey data with respect to mean sea level (MSL),
   k. Interpretation of trends observed in piezometric and analytical data,
   l. Recommendations for additional assessment work as may be necessary,
   m. Recommendations for minimum liner elevations based on observed or potential groundwater fluctuations,
   n. Recommendations for surface and/or groundwater control structures to control erosion and protect the landfill integrity and surrounding environment.

3. Maps, Plans, and Figures.

   a. Locus map,
   b. Site plan; scale between 1" = 40' and 1" = 100'
   c. Bedrock topography map,
   d. Surficial geologic map,
   e. Potentiometric surface contour maps;

      (1) Seasonal high with date of observation,
      (2) Seasonal low with date of observation,
      (3) Design elevation(s) (i.e. maximum anticipated)

   f. Vertical equipotential sections,
   g. Geological cross-sections (minimum of two at right angles),
   h. Contaminant concentration maps for key chemical parameters of concern.

4. Summaries, Tables, and Forms.

   a. Geologic logs of all boring and test pits,
   b. Summary and table of all analytical and field screening data,
   c. As built monitoring well design schematics for all wells,
   d. Summary of all geophysical results,
   e. Table of ground water level measurements,
   f. Table of hydraulic conductivity test results.

5. Recommendations.

6. Proposed monitoring plans.

I. Landfill Plan Submittal Checklist

A. Plan Approval Application.

The purpose of this section of the guidance document is to establish plan approval application submittal requirements. A checklist of the types of information and the format required for a complete residuals landfill plan approval application submittal has been included to provide guidance to applicants. Applicants should ensure that a submittal contains all the necessary maps, data, descriptions and other information in order to avoid delays in the review process. The Department will not proceed with the review of an incomplete application.

B. Site Plan.

The purpose of a site plan is to describe the general site surrounding a proposed residuals landfill facility. The following information should be included on suitably scaled maps of 1:200 or 1:400:

☐ 1. locus map of the site on a copy of a USGS topographical map (8½ x 11 inches);
☐ 2. the boundaries and acreage of the site and the boundaries of the waste disposal area on the site;
☐ 3. the location and identification of adjoining residential, commercial and industrial property;
☐ 4. the location of all public drinking water supply wells and surface water bodies within one mile of the boundaries of the landfill, including the limits of Zone II areas;
☐ 5. the location of all private drinking water wells within one-half mile of the boundaries of the landfill;
☐ 6. the location and elevations of all existing monitoring devices and surface water monitoring locations. This would include groundwater monitoring wells, piezometers, lysimeters, or other monitoring devices.
☐ 7. the location of all soil borings, excavations and test pits;
☐ 8. the location of all on-site borrow sources;
☐ 9. the locations of all existing and proposed utilities (including power lines), structures, (including fences and gates), and roads;
☐ 10. land use map of zoning for a one-half mile radius around the landfill.

C. Design Plan.

1. The purpose of the design plan is to describe the hydrogeological characteristics of the site, the design of the landfill, including groundwater protection systems, liner installation procedures and to provide a construction quality assurance/quality control plan. The following information should be included as a part of the design plan:

   ☐ (a) An updated and complete hydrogeological evaluation of the landfill site. The components of a complete hydrogeological evaluation are outlined in **Residuals Guidance Document No. 90-1, Guidelines for Hydrogeologic Evaluations.**

2. Additional design details on a scale of 1:40 which delineate, in cross-sectional view each of the following:

   ☐ (a) The initial elevations of the proposed landfill showing all grades of the liner and the subgrade;
   ☐ (b) The final elevations of any excavations showing all grades of the excavation and all grades of the subgrade;
   ☐ (c) The final elevations of the landfill after closure;
   ☐ (d) The leachate collection system showing all grades of the collection pipes, drainage layer(s), and manhole/ clean-out risers and sumps;

☐ (e) All berms, dikes, ditches, swales or other protection devices needed to divert or collect surface water run-on or run-off;
☐ (f) The system to be utilized for venting and monitoring the gases generated within the landfill and, if applicable, from beneath the liner;
☐ (g) The final elevations and grades of the final cover including the subgrade for the low permeability cap, the drainage layer and vegetative layer;
☐ (h) All grades of the leachate treatment and disposal systems including the leachate removal pipes, and treatment or pretreatment systems;
☐ (i) All proposed landscaping and screening techniques to be utilized to minimize the visual impact of the landfill.

3. Additional drawings or detailed diagrams on a scale of 1:40 showing the construction specifications of:

☐ (a) the subgrade;
☐ (b) the liner and/or any cut-off wall;
☐ (c) the drainage layer;
☐ (d) the collection pipes;
☐ (e) the inlet/outlet structures;
☐ (f) manholes, sumps, pumps, and pump stations;
☐ (g) the leachate collection and treatment systems;
☐ (h) the leachate disposal systems, if applicable;
☐ (i) gas vents, manifolds, and pump stations;
☐ (j) monitoring wells/devices;
☐ (k) surface drainage and erosion controls; and
☐ (l) the landfill cap and final cover.

4. A description of the general installation methods and procedures to be utilized for construction of the facility including materials required, equipment to be used, and scheduling of construction events and phases. To ensure that the construction requirements are properly implemented the description should include a discussion of installation of the following;

☐ (a) the subgrade;
☐ (b) the liner and/or any cut-off wall, including:

(1) the type of equipment to be used for compaction of soil liners;
(2) the weight of the compacting equipment;
(3) the number of passes required to achieve the desired density of each lift;

☐ (c) the drainage layer;
☐ (d) the collection pipes;
☐ (e) the inlet/outlet structures;
☐ (f) manholes, sumps, pumps, and pump stations;
☐ (g) the leachate treatment system;
☐ (h) the leachate disposal systems, if applicable;
☐ (i) gas vents, manifolds, and pump stations;
☐ (j) monitoring wells/devices;
☐ (k) surface drainage and erosion controls; and
☐ (l) the landfill cap and final cover.

5. A quality control/quality assurance (QA/QC) plan shall be included as a part of the design plan. The QA/QC plan should outline the observations and tests to be used to ensure that construction of the landfill meets or exceeds all design criteria, plans and specifications. The QA/QC plan shall include the following:

☐ (a) identity of the person or persons responsible for overseeing the QA/QC program;
☐ (b) discussion of how construction QC inspections will be performed;

☐ (c) location, availability, applicability, and calibration of test facilities and equipment, both field and lab;
☐ (d) procedures for observing and testing the borrow source, soil liner and membrane liner;
☐ (e) procedures for reviewing inspection test results and laboratory and field sampling testing results;
☐ (f) actions to be taken to replace or repair the liner or cap should deficiencies in the liner or cap construction be identified, including who is to be notified and in what manner;
☐ (g) procedures for seaming synthetic liners;
☐ (h) reporting procedures for all inspections and testing data.

D. Operation and Maintenance Plan.

The purpose of the Operation and Maintenance (O&M) Plan is to describe the methods, techniques and equipment that will be necessary to properly operate the landfill in compliance with the regulations. The O&M plan consists, in part, of a narrative of the method and schedule of landfilling activities, and the proposed engineering techniques and major types of equipment to be used in landfilling activities.

1. The narrative should include a description of the method and schedule for operation, use, and maintenance of the following components of the residuals landfill;

☐ (a) dams, embankments, ditches and other impoundments;
☐ (b) borrow pits, soil storage and handling areas, and structures;
☐ (c) scales and weigh station, if required;
☐ (d) water and air pollution control facilities;
☐ (e) erosion control facilities;
☐ (f) equipment storage and maintenance buildings, and other buildings;
☐ (g) access roads;
☐ (h) facility security;
☐ (i) groundwater, surface water and gas monitoring systems.

2. The narrative shall include procedures to be used by the operator to address:

☐ (a) waste handling and covering, which shall include:

(1) Unloading, spreading, compacting and covering operations;
(2) The frequencies of placement of immediate, daily, intermediate, and final cover;

(3) Cover materials to be utilized, including the estimated volumes required (show immediate, daily, intermediate, and final cover calculations) and their sources and availability.

☐ (b) stormwater, soil erosion, and sedimentation control;
☐ (c) leachate collection, transportation and treatment;
☐ (d) cleanout and maintenance of the leachate collection, transportation, treatment and disposal systems;
☐ (e) gas monitoring and control of the migration of explosive gases;
☐ (f) control of vectors;
☐ (g) the structures and procedures to be used in controlling and collecting blowing ash, dust, or other residuals disposed in the landfill;
☐ (h) dust control measures to be taken and when they would be implemented;
☐ (i) bird hazard control measures.

3. A facility safety plan shall be included which explains the emergency procedures to be followed, hazard prevention procedures, emergency equipment to be available, and from where such aid and equipment will come from in the event of a fire, explosion, or release of materials to the air, water, or soil of the Commonwealth that could threaten public health, safety, or the environment. The facility

safety plan for a landfill should address how the operator will prevent the following emergency situations from occurring and how to handle them should they occur:

☐ (a) fire prevention and control;
☐ (b) accident prevention and safety;
☐ (c) explosions;
☐ (d) odor control measures.

4. An inspection and maintenance plan shall be developed which shall include, at a minimum, a written schedule for regular inspections of:

☐ (a) landfill operations;
☐ (b) environmental monitoring systems;
☐ (c) environmental control systems including operational and structural equipment such as scales, dikes, berms, pumps, leachate collection systems and on-site treatment and disposal systems; and
☐ (d) all slopes, required evaluations and an evaluation of remaining capacity.

5. A staffing plan shall be included which indicates the number of personnel required to operate the facility, taking into consideration:

☐ (a) the type of facility;
☐ (b) the size of the facility;
☐ (c) the safety requirements of the facility;
☐ (d) the past history and present operation of the facility (if applicable);
☐ (e) the scope of the proposed operation;
☐ (f) the number of operational days per week;
☐ (g) the number of operational hours per day;
☐ (h) the number of shifts per day, if applicable;
☐ (i) the required number of personnel per day or shift;
☐ (j) emergency personnel coverage of operations;
☐ (k) activities which would require specially trained personnel.

E. Closure and Post-Closure Plan.

The purpose of the closure and post-closure plan is to indicate how the landfill, or phases of the landfill, will be closed, when each phase will close, and the schedule for post-closure maintenance and monitoring activities. The plan should also indicate any post-closure uses planned for the facility.

1. Information concerning closure activities should include:

☐ (a) a schedule for completion and closure of each phase of the landfill where landfill development is to proceed by a phased development, or for completion and closure of the entire landfill;
☐ (b) the closure elevation of each phase of the landfill;
☐ (c) an estimate of the final closure date for the entire facility;
☐ (d) a description of how the cap on adjoining phases will be tied together.

2. Information concerning post-closure activities should include:

☐ (a) identity of the persons responsible for carrying out post-closure monitoring and maintenance activities;
☐ (b) a description of the methods to be used to maintain the landfill and the final cover, including:

1. erosion control and repair of the final cover system;
2. maintenance and cleanout of the leachate collection system;
3. collection and disposal of leachate;

4. maintenance of groundwater, surface water and gas monitoring systems.

☐ (c) a description of the proposed leachate, groundwater, surface water, and gas monitoring activities to be conducted following closure, including:

1. locations of sampling points for groundwater, surface water, and air quality monitoring (if required);
2. frequency of sampling activities;
3. parameters to be analyzed and the schedule for analysis;
4. schedule for submission of results of the sampling and analysis program.

3. Information concerning the post-closure use of the landfill should include:

☐ (a) the relationship of the post-closure land use to existing land use and zoning surrounding the site;
☐ (b) how the proposed land use is to be achieved.

4. A closure cost estimate which should indicate projected closure costs at the projected closure date of the landfill. The closure cost estimate should include costs for:

☐ (a) grading the landfill;
☐ (b) materials used in the final cover;
☐ (c) placement of each component of the final cover;
☐ (d) drainage structures, retention basins and other run-on, run-off controls;
☐ (e) QA/QC activities for placement of the final cover;
☐ (f) placement and development of additional groundwater or gas monitoring wells.

5. A post-closure cost estimate which should indicate projected post-closure landfill maintenance and monitoring costs for the entire post-closure period. The post-closure cost estimate should include the costs for the following activities:

☐ (a) leachate, groundwater, surface water, and air quality monitoring activities (if required);
☐ (b) final cover maintenance, including seeding and repair of the final cover system due to erosion;
☐ (c) maintenance and repair of all drainage structures, run-on and run-off controls, and retention basins;
☐ (d) leachate collection and disposal.

F. Other Plan Submittal Requirements.

☐ (a) Professional Engineer registration stamp.
☐ (b) north arrow on all maps;
☐ (c) benchmarks clearly marked on all maps;
☐ (d) datum plane upon which all topographical measurements are based.