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TITLE 5 ALTERNATIVE TO PERCOLATION TESTING GUIDANCE FOR SYSTEM UPGRADES

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Program Applicability: BRP/DWM/Watershed Permitting/Title 5 Program

Supersedes Policy #: BRP/DWM/PeP-P00-1, dated January 7, 2000

Regulation Reference: 310 CMR 15.104 / 310 CMR 15.405(1)(i)

Approved by:

Purpose: This document contains the Title 5 Program's guidance for reviewing applications for Local Upgrade Approvals which propose use of sieve analysis in substitution of the percolation testing requirements of Title 5 for the upgrade of on-site sewage treatment and disposal systems.

Applicability: This guidance applies to applications for Local Upgrade Approval for system upgrades where percolation testing in accordance with Title 5 cannot be performed. The alternative to percolation testing set forth in this guidance may be used, when percolation testing is not possible due to high groundwater and the applicant seeks to proceed with a system upgrade, rather than wait for groundwater to recede to perform percolation tests.

The alternative outlined in this guidance may be used only for the repair or upgrade of an existing system when no increase in design flow is proposed. This alternative is an option for Board of Health consideration under Local Upgrade Approvals at 310 CMR 15.405.

Title 5, 310 CMR 15.104, requires percolation testing as part of the site evaluation for a new system or a system upgrade. Since the standards for new construction are more stringent than those for system upgrades, the alternative described in this guidance does not apply to cases of new construction, or increases in existing design flow.

Title 5 requires percolation testing to be performed in the most restrictive soil layer of the naturally occurring pervious material beneath a proposed soil absorption system (SAS). The Department recognizes that at certain times, however, high groundwater conditions preclude performance of standard percolation tests. During such times, the applicant may choose to perform dewatered percolation testing. Provided that an immediate upgrade is not being required by the local approving authority or DEP, or the upgrade timelines in 310 CMR 15.305, if applicable, would not be violated, the applicant also may wait until groundwater has receded and standard percolation testing can be performed. Alternatively, in accordance with this guidance, the applicant may proceed with a sieve analysis if the local Approving Authority determines a percolation test cannot be performed.

Dewatered percolation testing involves lowering the groundwater table to a point where testing can be performed in accordance with Title 5. Since dewatered percolation testing frequently is difficult and, in many cases, infeasible, attempting dewatered percolation testing is not a prerequisite prior to applying for use of a sieve analysis under this guidance.

Impervious & extremely low permeability soils

In cases of impervious soils or soils with extremely low permeability, the alternatives set forth in this guidance are **not** appropriate as such soils simply cannot support an on-site system. Where the Soil Evaluator, the local approving authority, or DEP determines that the soils are impervious or of extremely low permeability, for example, due to the presence of ledge, greater than 40% clay, or highly compacted till, and there is no feasible alternative (e.g. a shared system), then a tight tank to eliminate a failed system, approved under 310 CMR 15.260, would be the only option.

Requirements for obtaining local upgrade approval for sieve analysis use and relief from the percolation testing provisions

When an applicant proposes to upgrade a system, percolation testing cannot be performed due to high groundwater and the soils are neither impervious nor of extremely low permeability, the Approving Authority may approve/allow a sieve analysis in substitute of the Title 5 percolation testing requirements. In addition to complying with the other requirements of Title 5, the sieve analysis and local upgrade approval application to the local approving authority must contain the following:

1. documentation of a demonstration that percolation testing cannot be performed;
2. the Soil Evaluator's determination, along with the written concurrence of the local approving authority, of whether the soils are uncompacted or compacted;
3. results of performance of a Particle Size Analysis by a soils laboratory;
4. the Soil Evaluator's determination of the soil type, which must be based on the Particle Size Analysis and the USDA Soil Textural Triangle in Title 5; and
5. the Soil Evaluator's determination of the soil class under 310 CMR 15.243, which must be based on the soil type; and
6. plans for a system upgrade designed in accordance with the criteria in this policy for the soil type, class and determination of soil compaction.

1) Demonstration that percolation testing cannot be performed

Percolation testing must be attempted in the presence of the local approving authority, or its authorized representative, and determined not to be possible due to high groundwater.

2) Determination of compacted vs. uncompacted soils

Without the benefit of percolation testing, more reliance is placed on the determination of soil compaction. Since compacted soils can be extremely firm in place, but friable when removed for a sample, the Soil Evaluator must make an in-situ determination of the soil structure and consistence. The Soil Evaluator, **with the written concurrence of the local approving authority**, must determine whether the soils in the area of the proposed SAS are compacted or uncompacted. The Soil Evaluator must use the techniques described in Appendix 1.

For uncompacted soils, the Soil Evaluator can use the results of the particle size analysis to determine the soil type and class, and, subsequently, the effluent loading rate. In compacted soils, such as dense, compact till, the compacted nature of the material results in a significant decrease in the amount of pore space necessary for groundwater flow and particle size analysis results alone are inadequate for determining an effluent loading rate.

3) Particle Size Analysis

In the presence of the local approving authority or its authorized representative, the Soil Evaluator must obtain a soil sample from the most restrictive layer of the four feet of naturally occurring pervious material for the particle size analysis. Although for purposes of obtaining an effluent loading rate, the particle size analysis is considerably more useful in the case of uncompacted soils, the analysis still is useful to characterize compacted soils, particularly where the soils have a high percentage of clay.

The particle size analysis, performed by a qualified soils laboratory, must be used to determine the percentages of sand, silt and clay in the soil sample. The analysis must be performed for both compacted and uncompacted soils. The particle size analysis must be performed in accordance with Appendix 2.

4) Determination of soil type

Once the relative percentages of sand, silt and clay have been determined through particle size analysis, the Soil Evaluator must use the USDA Soil Textural Triangle in 310 CMR 15.243(2) to determine the soil type.

5) Determination of soil class

Based on the soil type, the Soil Evaluator must classify the soil into one of the four soil textural classes described in 310 CMR 15.243 (1).

6) Design Criteria – uncompacted vs. compacted soils

a) For **uncompacted Class I and uncompacted Class II soils**, the results of the particle size analysis, the soil type and the soil classification must be used to determine the effluent loading rate based on the effluent loading rate table, below. The system upgrade must be designed with that effluent loading rate and the requirements of Title 5.

b) For **compacted soils and all Class III and all Class IV soils** the design criteria, set forth below, must be used to design the system upgrade. Where the soils are compacted or Class III or Class IV soils, extremely low permeability could limit the soils' ability to adequately accept a subsurface discharge. These systems, therefore, must have a conservative design, intended both to allow an on-site discharge and prevent breakout. In addition to meeting Title 5 requirements, the design criteria for a system upgrade in compacted soils and in Class III and Class IV soils are as follows:

1. in accordance with the Effluent Loading Rate table, below, the effluent loading rate is limited to 0.15 gallons per day (gpd) per square foot (sf);
2. pressure distribution is required;
3. a four foot vertical separation to high groundwater elevation, or a five separation in soils greater than 85% sand. Where the required separation to the high groundwater elevation will not be met, an Innovative/Alternative (I/A) treatment technology approved by DEP for Remedial Use is required and the local approving authority and DEP may approve a reduction down to a minimum of a two foot separation to high groundwater elevation, or a three foot separation in soils that are greater than 85% sand;
4. where feasible, four feet of naturally occurring pervious material. Where there are not four feet of naturally occurring pervious material, the applicant must satisfy the requirements of 310 CMR 15.415 for the siting of a system upgrade with less than four feet of naturally occurring pervious material and an I/A treatment technology approved by DEP for Remedial Use is required. In such cases, the local approving authority and DEP may approve a reduction to a minimum of two feet of naturally occurring pervious material;
5. where feasible, a fully sized SAS. Where a fully sized SAS is not feasible, then an I/A treatment technology approved by DEP for Remedial Use is required and the local approving authority and DEP may approve a reduction of up to 50% in the required SAS size;
6. a modified septic tank is required where there will be a reduction in the required four or five foot separation to high groundwater elevation, or a reduction in the required four feet of naturally occurring pervious material, or a reduction in the required SAS size. The modified septic tank shall have a valve located in the septic tank discharge pipe so that in the event of breakout or other hydraulic failure, the discharge pipe valve could be closed and sealed and the discharge pipe beyond the valve removed, converting the septic tank to a tight tank. If converted to a tight tank, the volume of the septic tank, together with that of the pump chamber, may be used to meet the requirements for tight tank size in 310 CMR 15.260(2)(a);
7. a condition that prohibits any increase in design flow and requires a notice, recorded with the deed, that both prohibits any increase in design flow and references the Approving Authority's approval letter of the Local Upgrade Approval.

The local approving authority may approve an I/A system with one reduction criterion (# 3, #4 **or** #5, as described above), but **not** more than one. A system upgrade requiring more than one reduction would require local approving authority and then DEP approval under BRPWP64c - approval of an alternative system for remedial use. Such applications to DEP should be submitted to the appropriate DEP regional office.

A system designed for compacted soils or Class III or Class IV soils, without the benefit of percolation testing, is a high risk option; it does not guarantee that sewage breakout or backup will not occur. Accordingly, any local upgrade approval letter issued under this guidance for such a system must provide that should the system fail, the system owner shall immediately notify the Board of Health and the Department, in writing, and then proceed with an appropriate upgrade. Additionally, approval letters for systems designed under this guidance an I/A treatment technology and a reduction in the required separation to high groundwater, the depth of naturally occurring pervious material or the SAS size, should contain a condition requiring the system owner to: a) by 45 days of a system failure, submit for approval a tight tank application in accordance with 310 CMR 15.260; b) by 14 days of issuance of the Department’s tight tank approval, apply for a Disposal System Construction Permit from the local approving authority; and c) by 14 days of issuance of the permit, complete conversion of the system to or installation of the tight tank. Following any system failure, the Department and the local approving authority may require such interim measures as they deem appropriate.

Effluent Loading Rates for systems designed and approved under this guidance

Soil Type	Uncompacted Class I and Class II Soils ¹	All compacted soils and all Class III and all Class IV Soils ²
Class I	> 85% sand 0.74 gpd/sf 70 – 85% sand 0.66 gpd/sf	0.15 gpd/sf
Class II	0.33 gpd/sf	

- 1 The system must be designed based on the applicable effluent loading rate in this table and the requirements of Title 5.
- 2 The system must be designed based on a 0.15 gpd/sf loading rate, the design criteria on page 4 of this guidance, and the requirements of Title 5.

APPENDIX 1

On-site investigation techniques to determine if soils are compacted (compact till):

- Note the ease or difficulty of excavation by the backhoe (does the excavator experience difficulty digging, does the bucket chatter across the surface of the material making shallow cuts with each pass – these soils may be compacted).
- Pick at the side of a test hole with a knife or hand tool to feel for the ease or difficulty of penetration (difficulty would suggest compacted material).
- Note the presence of angular shaped rock fragments (suggests compacted till).
- Note the speed at which groundwater weeps into the pit (groundwater weeping slowly into the pit would suggest dense, compacted material).
- Note the consistency of undisturbed soil clod (squeeze the clod of soil between your thumb and index finger; initially compact till will resist crushing and then with increased pressure will rupture suddenly). The consistency of soil in compacted material will be firm, whereas in uncompacted material, the consistency will be loose or friable.
- Note the soil saturation (compacted soils will appear moist, not saturated, due to the lack of pore space).

Adapted from the DEP approved Title 5 Soil Evaluator Course Materials

APPENDIX 2

The standard method for Particle Size Analysis is the method of Gee and Bauder (1986) in **Methods of Soil Analysis, Part 1. Physical and Mineralogical Methods, 2nd Edition**, published by the American Society of Agronomy-Soil Science Society of America. This method, or another method acceptable to the Department, must be used by the soils laboratory. The soils laboratory must:

- determine the relative percentages of sand, silt and clay from the soil sample that passes through a #10 sieve, (which removes aggregate from the sample),
- use a #270 sieve to separate the sand fraction from the remaining combined silt and clay fraction,
- establish the relative percentages of silt and clay in the sample by either pipet or hydrometer method.