STATE OF COLORADO

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Colorado Department of Public Health and Environment

August 2014

Clarification for Determining the Number of Chamber Units in OWTS Design under Regulation 43

Since the recent implementation of local regulations which comply with Regulation 43, the Water Quality Control Division has received several inquiries regarding the use of chamber units within an OWTS and how to calculate the number of chambers required.

Section 43.13(E)(1)(d) of Regulation 43 generally states: If the width of the chamber unit is within 90% of the width of the excavation, the area may be approved for the equivalent width of the excavation. Thus:

- If a chamber is 4' long x 33"-36" wide, the equivalent size is calculated at 12.0 Sq.Ft./Chamber in a 36-inch wide trench (i.e., 33/36 = 92%). Thus a chamber 33" – 36" wide, placed in a 36" wide trench is given credit for the entire 36" of trench width. Note that if a chamber is 5' long and 33" – 36" wide and placed in a 36" wide excavation, the equivalent size is 15.0 Sq.Ft./Chamber.
- The equivalent area is similar for a "Bed" installation. If the excavation is 12' wide (144") and four 33" wide chamber units are placed side-by-side across the width of the excavation, the site would receive credit for the entire 12' width of the excavation (i.e., 4 x 33" = 132" / 144" = 92%).

This sizing principle replaces the various calculations for each specific chamber model such as 11.55, 9.87, 10.00, etc. Do not use them.

System sizing example. 3-bedroom home, gravity trench, Soil Type 2, using 33" x 48" chambers in 36" wide trench excavation:

- 3 Bedroom Home: (3 rooms x 150 gal per room) = 450 gpd
- Table 10.1: The LTAR for a Soil Type 2 and TL1 = 0.6 gpd/Sq.Ft.
    - 450 / 0.6 = 750 Sq.Ft.
- Table 10.2: The Size Adjustment Factor for a "Gravity Trench" system = 1.0
    - 450 / 0.6 = 750 Sq.Ft. x **1.0** = 750 Sq.Ft.
- Table 10.3: The Size Adjustment Factor for "Chambers" = 0.7
    - 450 / 0.6 = 750 Sq.Ft. x 1.0 = 750 Sq.Ft. x **0.7** = 525 Sq.Ft. of Soil Treatment Area (STA)
- Number of Chambers Required: 525 Sq.Ft. / 12 Sq.Ft. per chamber = 43.75 (Use 44 chambers)

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October 2014

Clarification Regarding the Acceptable Location of a Pump or Dosing Siphon

The Water Quality Control Division (Division) has received inquiries regarding the acceptable location of a dosing siphon when used as an integral component of an OWTS. The following is provided as a clarification of the requirements of Regulation 43.

Section 43.9(H)(3)(a) of Regulation 43 states in part: "*A pump may be, or a siphon shall be, installed in a separate tank following the septic tank … The use of a three-compartment septic tank, sized to provide effective volume in the first two compartments with the pump in the third compartment, is acceptable*."

However, section 43.9(I)(2) of Regulation 43 states in part: "*If a pump or dosing siphon is used to remove septic tank effluent from the final compartment of the septic tank, an effluent screen must be provided prior to the pump or siphon inlet…*"

Note that section 43.9(H)(3)(a) states: "*a siphon shall be installed in a separate tank following the septic tank"* while section 43.9(I)(2) states: *"if a pump or dosing siphon is used to remove septic tank effluent from the final compartment of a septic tank…*" These two items seem to be in conflict.

A pump system typically incorporates floats to define the required dose volume, while a dosing siphon controls the dose by the size of the bell and the surface area of the tank. Thus, both systems have capabilities to control the dose volume and ultimately provide essentially the same function, intermittantly dosing an established volume of effluent to the soil treatment area (STA).

There are two main concerns when proposing to provide dosing from the final compartment of a septic tank: 1) the volume of the initial compartments of the tank must be adequate to provide the detention time required by regulation, which is based on the time needed to settle and float solids, and 2) the design of the tank and additional components must be proper to minimize the amount of suspended solids being discharged to the STA.

A point of clarification needs to be made as to what constitutes a septic tank. A definition is provided in Regulation 43. However, in a multiple compartment tank, the question could be posed as to where the "septic tank" ends and additional components begin. For example, say a three-compartment tank provides a liquid volume of 1000 gallons in the first compartment, 500 gallons in the second compartment and 500 gallons in the third compartment. If the required volume for septic tank detention is 1500 gallons and the crossover between the second and third compartments is accomplished through an effluent screen at the typical outlet elevation of a standard septic tank, would the third compartment (even though it is a monolithic tank) still be considered a part of the "septic tank"? Or, would the "septic tank" be considered to end at the outlet to the second compartment?

The overall intent is to have adequate septic tank volume and a hydraulically separate chamber for the dosing of effluent. Therefore, if the design of the tank complies with the following items, then the placement of a pump, or a siphon, in the third compartment of a monolithic tank would be acceptable:

- The required septic tank storage volume must be provided in the first two compartments.
- The wall between the second and third compartment must be watertight; other than the outlet to the third compartment (see below). Fluctuation in water levels when dosing must only be allowed in the third compartment. The water level of the first and second compartments should remain basically constant.
    - Note that section 43.9(B)(3) of Regulation 43 provides for field testing to ensure that the tank is structurally sound and watertight. This section may be used by a local public health agency to require testing that ensures that the third compartment itself is watertight.
- The transfer of the effluent from the second to the third compartment must be through an outlet designed and located as per the requirements of section 43.9(B)(4) of Regulation 43.

Note that section 43.9(H)(3)(b) makes a limited exception and allows a "pump" to be placed within the second compartment of a septic tank, as long as the conditions of section 43.9(H)(3)(b) are met. However, there is no condition in which a dosing sipon is allowed within the second compartment of a septic tank.

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April 30, 2014

Clarification Regarding Section 43.10(H) of Regulation 43

During our review of local OWTS regulations, there have been several inquiries as to the intent and Water Quality Control Division's interpretation of section 43.10(H) of Regulation 43. This section states:

> *"Soil replacement must be permitted to bring the soil within the requirements of suitable soil. Added soil must meet the specifications of sand filter media, as specified in section 43.11.C.2.a.(1). All added soil must be completely settled prior to installation of components as specified and approved by the design engineer. The loading rate for sand filters must be used. Pressure distribution must be used".*

To understand this section, it needs to be broken down into its individual parts. The first sentence states: *"Soil replacement must be permitted to bring the soil within the requirements of suitable soil."* The reference to "soil replacement" means that soil has been removed. That removal and replacement of the soil "must be permitted." However, when replacing with the same soil, it must meet the definition of "suitable soil."

The definition of "suitable soil" states:

> *"Suitable soil" means a soil which will effectively treat and filter effluent by removal of organisms and suspended solids before the effluent reaches any highly permeable earth such as joints in bedrock, gravels, or very coarse soils and which meets percolation test or soil test pit excavation requirements for determining long-term acceptance rate and has a vertical thickness of at least four feet below the bottom of the soil treatment area unless the treatment goal is met by other performance criteria". [emphasis added]*

From the requirements of suitable soil stated above, soils that are removed from within a soil treatment area, then disturbed and acted upon such as screening, can be replaced into the excavation as long as the manipulated existing soils will: a) effectively treat and filter the effluent, b) meet percolation test or soil test pit excavation requirements (i.e., soil types 1 through 3 in Table 10-1), and c) have a vertical thickness of at least four feet.

If during this process it is found that additional material needs to be imported to provide for the proper elevation of the OWTS, then the other requirements noted in section 43.10(H) apply. Specifically, all additional material must meet the specifications of sand filter media as specified in section 43.11(C)(2)(a)(1) of Regulation 43 and the design must use pressure distribution.

Therefore, soil can be removed and re-installed from within a proposed soil treatment area as long as the above noted requirements for suitable soil are met. Further, any added soil must meet sand filter media specifications as stated in Regulation 43. If removing and replacing the same soil is proposed, the Division's expectation is that the following procedures will be followed to ensure that the replaced soil complies with the definition of "suitable soil" and generally accepted OWTS design practice.

1. The replaced soil may not fall under the criteria of "Soil Type 0" noted in Table 10-1 of Regulation 43 as being Soil Type 1 with more than 35% rock (>2mm) or being "Soil Types 2 - 5" with more than 50% rock (>2mm).
2. Replaced soil must be of uniform composition throughout the soil treatment area and settled into place without intentional compaction.
3. After placement of the soil into the excavation, percolation testing must then be conducted per the requirements of Regulation 43 to ensure that the replaced soil meets the specification of a Soil Type 1 through 3. It is recommended that wetting of the soil approaching 2% optimal moisture content should be conducted to assist in ensuring that the media is settled and stable prior to performing any percolation tests. In most cases, machine tamping is not recommended.
4. If additional sand is necessary to obtain the required elevation of the infiltrative surface, the sand must be added after percolation testing has been conducted (see item 3 above).
5. Certification of items 1 through 4 above from the design engineer must be included in the submittal package for final system approval.

Note that because the system is required to be "pressure dosed," the minimum vertical separation requirement is reduced to three (3) feet as defined in Table 7-2 (Item 4) of Regulation 43.

Further, please note that local regulations may be more stringent than Regulation 43. Therefore, a local board of health may adopt a requirement that all unsuitable soil that is removed from an excavation must be exchanged with material meeting the sand media specification.

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October 2014

Clarification for Use of Tables 10-1, 10-2 and 10-3 of Regulation 43
When Designing an Unlined (Open Bottom) Sand Filter System

The Water Quality Control Division (Division) has received inquiries regarding the use of size adjustment factors in Tables 10-1, 10-2 and 10-3 when an unlined sand filter (Section 43.11(C)(2)(c)) is proposed. The following examples are used to provide a clarification of the requirements of Regulation 43.

Example 1: A 3-bedroom home is proposed in a soil type "0". The existing material is removed and 3 feet of C-33 sand is placed in the excavation. Pressure distribution is used to distribute TL1 effluent into rock media through perforated distribution laterals. The following calculations show how the Soil Treatment Area (STA) must be sized:

Flows: **450 gpd** = Three-bedroom home at 150 gal./bedroom

Table 10-1:
- Soil Type "0"
- TL1 = *Minimum 3' deep unlined sand filter required*[2]
- *Footnote 2: Design shall conform to section 43.11(C)(2)(c), Unlined Sand Filters*

Application Rate: **1.0 gpd/ft^2** based on the following:

Section 43.11(C)(2)(c)(3) states: "*An unlined sand filter is to be sized based on section 11.C.2.a.(4)(i) or the long-term acceptance rate of the receiving soil for TL3, whichever results in the larger area.*"

Section 43.11(C)(2)(a)(4)(i) states: "*When receiving wastewater that meets TL1 treatment level, a maximum sand filter application rate of 1.0 gpd/ft^2 must be used.*"

Since the receiving soil is Soil Type "0", the application rate (LTAR) would revert to 1.0 gpd/ft^2

STA Size: GPD/LTAR = 450/1.0 = **450 ft^2**

Table 10-2: *Method of Application, Size Adjustment Factor, for All Treatment Levels*. The adjustment factor for a pressure dosed bed is "1.0", thus 450 x 1.0 = **450 ft^2**.

Table 10-3: *Types of Distribution Media, Size Adjustment Factor, Only for TL1 Effluent.* Relative to this example, the adjustment factors found in this table may not be used due to the following reason:

- Footnote 2 in Table 10-1, *"Design shall conform to section 11.C.2.c, Unlined Sand Filter."* The requirements for unlined sand filters are found within section 43.11 of Regulation 43 titled, "*Design Criteria – Higher Level Treatment Systems*". As an unlined sand filter provides a treated effluent to the native soil, it is considered a HLT system. Therefore, the reductions provided in Table 10-3 may not be used. However, the "minimum 3 foot deep unlined sand filter" requirement in Table 10-1 for soil type "0" creates a unique situation. As this requirement is found under the "Treatment Level 1" category of Table 10-1, local public health agencies that do not have an inspection and oversight program may still allow unlined sand filters for soil type "0" designed under the requirements noted above. Note that the bottom of the 3 feet deep sand filter must be at least 2 feet above the high ground water or bedrock (43.11(C)(2)(c)(1)).

Example 2: If an unlined sand filter receives TL1 quality effluent and was installed above a Soil Type "2", the following section of Regulation 43 would apply:

> Section 43.11(C)(2)(c)(3) states: "*An unlined sand filter is to be sized based on section 11.C.2.a.(4)(i) or the long-term acceptance rate of the receiving soil for TL3, whichever results in the larger area*."
>
> The size of the soil treatment area would be calculated as follows: 450 / 1.0 (43.11(C)(2)(c)(3)) = 450 ft^2. x 1.0 (for a pressure distributed bed; Table 10-2) = 450 ft^2. As this design includes a higher level treatment component, Table 10-3 may not be used. Thus the size requirement for the STA would be 450 ft^2.
>
> Note that the required depth for the C-33 sand in this example is only 2 feet, but must be installed so the bottom of the sand filter is at least 2 feet above the high ground water or bedrock (43.11(C)(2)(c)(1)). Further, the local public health agency must have a program for inspection and oversight of higher level treatment systems in order to receive the reductions provided to this system.

Example 3: If an unlined sand filter receives TL2 quality effluent or better, and was installed above a Soil Type "2", the following section of Regulation 43 would apply:

> Section 43.11(C)(2)(a)(4)(ii) states: "*When receiving wastewater that meets TL2, TL2N, TL3, or TL3N treatment levels, the sand filter must be sized based on the long-term acceptance rate for Soil Type 1."*
>
> The size of the soil treatment area would be calculated as follows: 450 / 1.25 (43.11(C)(2)(a)(4)(ii), Table 10-1) = 360 ft^2. x 1.0 (for a pressure distributed bed; Table 10-2) = 360 ft^2. As this design includes a higher level treatment component, Table 10-3 may not be used. Thus the size requirement for the STA would be 360 ft^2.
>
> Note that the required depth for the C-33 sand in this example is also 2 feet, however the bottom of the sand filter may be at or above the high ground water or bedrock (43.11(C)(2)(c)(2)).Further, the local public health agency must have a program for inspection and oversight of higher level treatment systems in order to receive the reductions provided to this system.

As shown in Example 3 above, the STA size reductions with the use of Higher Level Treatment systems are provided for through increased application rates found in Table 10-1 under the appropriate treatment level column, and under the criteria found within section 43.11(C)(2). It should also be noted that section 43.11(C)(2)(a)(3)(i) states, "*Dispersal of effluent to the surface of the sand filter must be by a pressurized distribution system for equal distribution*." Therefore, all calculations shown in the examples above have used the "pressure dosed" adjustment factor from Table 10-2.

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