Commonwealth of Pennsylvania
Department of Environmental Protection (DEP)
Bureau of Point and Non-Point Source Management
Harrisburg, PA

Issued to: Generic

Technology: Shallow Limiting Zone At-Grade Absorption Area

Classification Type: Alternate technology (A2014-0025-0003)

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In accordance with Title 25, Chapter 73, Section 73.72, DEP classifies the shallow limiting zone at-grade (shallow at-grade) for use as an alternate onlot sewage treatment system. This classification permits the use of the shallow at-grade as an absorption area capable of receiving sewage effluent at the advanced treatment level (not exceeding 10 mg/L $CBOD_5$ and not exceeding 10 mg/L TSS as monthly averages). With the use of an optional ultraviolet (uv) disinfection, the uv unit can also reduce fecal coliform concentrations to treatment levels which shall not exceed 200 cfu/100 ml on a monthly average basis. The inclusion of a uv disinfection unit is at the discretion of the homeowner.

I. Technology Description

The shallow at-grade is an absorption area that is constructed to receive effluent at the advanced treatment level where limiting zones are less than 20 inches. The shallow at-grade is designed and installed such that all or part of the absorption area is located at or above original ground elevation. The absorption area consists of an aggregate bed with a center feed single lateral pressurized piping distribution system. The dimensions of the shallow at-grade are determined using the soil scientist's evaluation of the soil morphology and the corresponding hydraulic linear loading rates itemized in Table 2. The minimum limiting zones are greater than or equal to 10 inches to the seasonal high water table or greater than or equal to 16 inches to rock. A final cover over the absorption area aggregate is required for suitable growth of vegetation.

II. Design Requirements

A. Location: The shallow at-grade absorption area may be installed for the treatment of domestic strength wastewater (as defined by Table 1 of Miscellaneous Data to be used in Conjunction with PA DEP listings) serving a new construction or as a repair.

B. Tank installations must consist of either a two-compartment rectangular tank, two rectangular tanks in series, and otherwise conform to meet the requirements of Section 73.31. Vertically aligned circular (round) tanks are not permitted. Aerobic treatment tanks must be in compliance with Section 73.32.

C. The components preceding the shallow at-grade must be able to achieve advanced treatment standards (not exceeding 10 mg/l $CBOD_5$ and not exceeding 10 mg/l TSS) prior to discharge to the absorption area. Applicable subsequent filters capable of achieving advanced treatment standards for discharge onto a shallow at-grade are itemized in Table 1.

Table 1

Subsequent Filter Treatment Units
Anua Puraflo Peat Filter
Norweco Singulair 960-HKBFR
Orenco AdvanTex
Premier Tech Aqua Ecoflo Coco/Peat Filter

Note: Refer to each individual listing to determine if other specifications are allowed.

D. Siting:
(1) The slope of the installation must not exceed 15 percent.
(2) The vertical isolation distance from the bottom of the absorption area must be at least either of the following:
a) At least 10 inches to the seasonal high water table whether perched or regional, determined by direct observation of the water table or indicated by soil redoximorphic depletions.
b) At least 16 inches to rock or a rock formation with open joints, fracture or solution channels, or masses of loose rock fragments, including gravel, with insufficient fine soil to fill the voids between the fragments.
(3) The absorption area must be placed on a contour that is uniform (i.e. straight) and/or convex. Placement of the absorption area on concave slope shapes must be avoided.
(4) An area downgradient from the absorption area must be protected as specified by the soil scientist during testing, construction, and during the use of the absorption area.
(5) A soil scientist who is a professional member of the Pennsylvania Association of Professional Soil Scientists (PAPSS) or who is a "Qualified Soil Scientist" as defined in Chapter 73 of the regulations must perform a soil morphological test.
(6) Preparation of a soils report which includes the following at a minimum:
a) Inclusion of project name, project location, date of investigation, soils series, slope, and site conditions.
b) A minimum of four soil profile test pits shall be evaluated to verify the morphology of the proposed absorption site. The profiles should adhere to the following:
i. Inclusion of results addressing: (1) color (Munsell notation), (2) textural classes, (3) rock fragment modifiers, (4) redoximorphic features (mottles), (5) grade and type of structure, (6) consistence, and (7) boundary.

ii. Two soil profile evaluations on contour, bracketing the proposed absorption area.
iii. Two soil profile evaluations on contour with the downgradient distance determined by the soil scientist.
iv. The soil profiles must be conducted on-contour and the probes cannot be spaced more than 100 feet apart. In cases where the calculated aggregate area length exceeds 100 feet, additional test pit evaluations are required to verify the soil morphology of both the absorption area and the downgradient area.
v. Additional soil profiles may be required to verify the soil morphology of both the absorption area and the downgradient area in finer textured soils or higher flow rate projects that result on longer length absorption beds.

c) Determination of whether subsurface soil conditions are suitable for a shallow at-grade absorption area as evidenced by the depth to the seasonal high water table limiting zone and/or the depth to the rock limiting zone.
d) Determination of the soil drainage classification and the appropriate loading rate and horizontal linear load from the HLLR table based upon the soils which are the most restrictive. Overall site suitability will be limited by the most restrictive depth to the seasonal high water table, depth to rock formation and soil morphology from all of the soil test pits evaluated.
e) The soil must have a consistence of "very firm" or less to be suitable.
f) Distribution of the effluent in the absorption area will be determined by the soil profile evaluations and the vertical depth between the bottom of the aggregate and the top of the seasonal high water table or rock formation.
g) The loading rate (required to calculate aggregate area square footage) and hydraulic loading rate (required to calculate aggregate area length) shall be determined with the HLLR table by using the most restrictive results from the soil profile evaluations bracketing the absorption area. The shape and grade of structure, as well as textural classification of the mineral soil from the profile horizon above the seasonal high water table or restrictive horizon, is used to determine these rates.
h) The report should identify and offer recommendations to address site conditions (i.e. soil quality, slope, stoniness, vegetation, surface drainage, site preparation, etc.) that could affect the design and or field investigation.
i) Signature of the qualified soil scientist (a professional member of the Pennsylvania Association of Professional Soil Scientists (PAPSS) or is a qualified soil scientist as defined in Section 73.1) certifying the contents of the soils report which includes the items in Section II.C.

(7) On these sites, the treatment and disposal distribution configuration is based on the horizontal linear loading rate derived from the soil morphological analysis and the Hydraulic Linear Loading Rate (HLLR) described by Table 2. The absorption area must be sized in accordance with the Hydraulic Linear Loading Rate Table shown as Table 2. The length and width of the infiltration field are determined as follows:

$$Length\ of\ Infiltration\ Field = \frac{Peak\ Daily\ Sewage\ Flow\ Rate}{HLLR}$$

$$Width\ of\ Infiltration\ Field = \frac{HLLR}{ILR}$$

where: HLLR = Hydraulic Linear Loading Rate
ILR = Infiltration Loading Rate

E. Construction: The shallow at-grade absorption area requires the following:
(1) Lateral Specifications:
a) Design requirements for the laterals must conform to the pressure distribution design requirements provided by Section 73.44 except for the following deviations described in Section II.E(1).
b) Distribution of effluent to the individual laterals shall be by a central manifold extending into the absorption area from the delivery pipe. The shallow at-grade pressure distribution design shall consist of a single pair of opposing laterals placed on the same contour. The overall length of the laterals may exceed 51 feet.
c) The laterals should be placed 1 foot from the upslope edge of the aggregate. The distance of the lateral from the downslope edge of the aggregate is dependent upon the calculated width of the absorption area.
d) The laterals shall be required to be fitted with end caps.
e) The laterals shall include lateral end cleanouts. End cleanouts shall be extended to the soil surface and be constructed using two 45-degree bends.
f) The laterals must terminate 2 to 5 feet from the ends of the aggregate.
g) The distribution system must include a minimum of 3 feet of head at the terminal ends of the laterals.

(2) All coarse aggregate shall meet either specifications described by Section II.C.2 (Reference: Section 73.51(a) or Pennsylvania Department of Transportation, Publication 408, Section 703.2(a) and (b))

a) The coarse aggregate shall not contain more than 15% by weight total deleterious material. Deleterious material is any material that will adversely affect the structural soundness or storage capacity of the coarse aggregate including material finer than No. 200 sieve, clay lumps, and friable particles.

b) The coarse aggregate shall not contain more than 5% by weight clay lumps and friable particles. Testing shall be performed using the most recent revision of ASTM C142.

c) The coarse aggregate shall not contain more than 5% by weight material finer than No. 200 sieve. Testing shall be performed using the most recent revision of ASTM C117 or PTM No. 100.

d) All coarse aggregate testing shall be conducted within 1 year prior to the delivery date.

e) A minimum of a total of 10 inches of coarse aggregate meeting the requirements of either Section 73.51(a) or the coarse aggregates meeting AASHTO No 3, 467, 5, or 57 described in the alternate aggregates must be used. The minimum amount of coarse aggregate must conform to the following:

i. A minimum of 6 inches of aggregate beneath the lateral.
ii. A minimum of 2 inches over the lateral.
iii. A minimum of 2 inches of aggregate on either side of lateral.

The aggregate shall be placed beneath the laterals so that they are level. A 2:1 aggregate slope shall be maintained on all sides of the aggregate. At least one observation port is required.

(3) Berm Specifications:

a) The shallow at-grade shall be surrounded by a berm consisting of mineral soil containing less than 20% coarse fragments with no coarse fragments greater than 4 inches in diameter, more stable and less permeable than the fine aggregate, and lightly compacted during construction to contain and protect the absorption area interior. The width of this berm shall be a minimum of 3 feet at the top of the aggregate. (Section 73.55(b)(7)).

b) Upon completion, the outside slope of the berm on slopes of 8% or less may be no greater than 2:1, on slopes of 8% to 12% the outside slope of the berm shall be no greater than 3:1. On sites with slopes ranging 12% to 15%, the outside slope of the berm may be no greater than 25% (4:1) downslope and no greater than 3:1 upslope, with the downslope berm no greater than 4:1.

c) The cover over the aggregate shall be a minimum of 8 inches of soil suitable for the growth of vegetation and shall be seeded to assure the stability of the berm.

(4) The area around the absorption area and treatment tanks shall be graded for diversion of surface waters.

(5) Designing the location of multiple absorption areas so that one absorption area is placed hydraulically upgradient or downgradient from the other may cause the lower

absorption area to fail because of excessive hydraulic loading from the upper absorption area. Unless the applicant shows the potential for such an impact is nonexistent through the experimental system process, this type of absorption area placement is prohibited.

F. Installation:
   (1) An onsite preconstruction conference attended by the sewage enforcement officer, designer, installer, and the property owner prior to construction is recommended.
   (2) Construction of this system must comply with Chapter 73, Section 73.51(b) and 73.51(c).
   (3) The surface shall be chisel plowed across the slope, including the area under the berm, as described in Section 73.55(b)(2).
   (4) Immediately after plowing, aggregate shall be placed over the exposed plowed surface. The aggregate shall be placed from the upslope side of the bed using only lightweight equipment. Under no circumstance may equipment travel on the plowed soil surface until the aggregate is in place.
   (5) The top of the coarse aggregate shall be covered with geotextile material or similar barrier material to prevent backfill material from settling into the aggregate.

III. Minimum Maintenance Standards

A. Inspection of the area around the soil absorption area every 6 months by the homeowner to ensure that there is no ponding of effluent or downgradient seepage.
B. The manufacturer's representative must meet with the property owner within one (1) month of system start-up and/or occupancy of the dwelling and with the local agency's SEO upon request, to explain the operation and maintenance of the system, provide written instructions to the property owner, and to identify the locations of all parts of the system.
C. The service provider shall inspect at least the following items at an interval frequency recommended by the manufacturer's requirements:
   (1) Inspect septic tanks, dosing tanks, and lift pump tanks for structural integrity of the tank, inlet and outlet baffles, solids retainer, pumps, siphons, and electrical connections;
   (2) Inspect aerobic tanks for structural integrity of the tank, inlets, and outlet baffles, buoyed solids retainer, pumps, siphons, and electrical connections.
   (3) Ensure that the pumping system is operational.
D. The service provider shall inspect and pump excess solids in accordance with the manufacturer's requirements.

IV. Permitting Requirements

A. A sewage enforcement officer who has successfully completed an appropriate Department sponsored training course that included this specific technology or has received review delegation in writing from the Department may independently review the design and issue the permit for components under this listing. All other proposals under this listing must be submitted to the Department for review and comment.

B. The permit must include a written certification from the supplier to the sewage enforcement officer and permittee which includes the name of the supplier of the aggregate, testing results, testing date, amount of material purchased, and the delivery date which confirms that the aggregate meets the requirements of either the regulations or the alternate aggregates listing.
C. The sewage enforcement officer shall include on both the *Application for An Onlot Sewage Disposal* permit (Part III, Section 1) and the permit, the classification number itemized in the Classification Type of this listing.

V. Planning Requirements
Not Applicable

Table 2
Hydraulic Linear Loading Rate Table

Soil Characteristics			Infiltration Loading Rate, gal/ft²/d	Hydraulic Liner Loading Rate, gal/ft/d					
				Slope					
				0-4%		5-9%		>10%	
Texture	Structure			Infiltration Distance, Inch		Infiltration Distance, Inch		Infiltration Distance, Inch	
	Shape	Grade		10-12	12-20	10-12	12-20	10-12	12-20
COS, S, LCOS, LS	--	0SG	1.6	4.0	5.0	5.0	6.0	6.0	7.0
FS, VFS, LFS, LVFS	--	0SG	1.0	3.5	4.5	4.0	5.0	5.0	6.0
CSL, SL	--	0M	0.6	3.0	3.5	3.6	4.1	5.0	6.0
	PL	1	0.5	3.0	3.5	3.6	4.1	4.0	5.0
		2, 3							
	PR/BK /GR	1	0.7	3.5	4.5	4.0	5.0	5.0	6.0
		2, 3	1.0	3.5	4.5	4.0	5.0	5.0	6.0
FSL, VFSL	--	0M	0.5	2.0	2.3	2.4	2.7	2.7	3.2
	PL	1, 2, 3							
	PR/BK /GR	1	0.6	3.0	3.5	3.3	3.8	3.6	4.1
		2, 3	0.8	3.3	3.8	3.6	4.1	3.9	4.4
L	--	0M	0.5	2.0	2.3	2.4	2.7	2.7	3.2
	PL	1, 2, 3							
	PR/BK /GR	1	0.6	3.0	3.5	3.3	3.8	3.6	4.1
		2, 3	0.8	3.3	3.8	3.6	4.1	3.9	4.4
SIL	--	0M	0.2	2.0	2.5	2.2	2.7	2.4	2.9
	PL	1, 2, 3							
	PR/BK /GR	1	0.6	2.4	2.7	2.7	3.0	3.0	3.5
		2, 3	0.8	2.7	3.0	3.0	3.5	3.3	3.8
SCL, CL, SICL	--	0M							
	PL	1, 2, 3							
	PR/BK /GR	1	0.3	2.0	2.5	2.2	2.7	2.4	2.9
		2, 3	0.6	2.4	2.9	2.7	3.0	3.0	3.5
SC, C, SIC	--	0M							
	PL	1, 2, 3							
	PR/BK /GR	1							
		2, 3	0.3	2.0	2.5	2.2	2.7	2.4	2.9

Adapted from Tyler, 2000.
Width of Infiltration Field = Hydraulic Linear Loading Rate divided by Infiltration Hydraulic Loading Rate
Length of Infiltration Field = Peak Daily Sewage Flow Rate divided by Hydraulic Linear Loading Rate