

Unit 1 - Introduction, Testing Criteria, and Design Criteria

[1-1 Introduction](#)

[1-2 Testing Criteria Requirements](#)

[1-3 System Design Requirements](#)

What You Will Learn in This Lesson

In this lesson, you will learn about the alternate steep slope elevated sand mound bed design requirements and the advantage and disadvantage of the system.



This shows an alternate steep slope elevated sand mound bed at the final inspection stage. This system is 10 feet wide and 75 feet long.

Prior to taking this course, review the DEP Alternate Systems Guidance (guidance) Section 13. This course covers information from that section of the guidance.

The Alternate Steep Slope Elevated Sand Mound Bed

There are two major design differences between the conventional elevated sand mound bed on a site with a slope of 8 to 12 percent, and the alternate steep slope elevated sand mound with slopes from 12 to 15 percent.

Differences	Conventional Sand Mound	Steep Slope Sand Mound
Slope	8% to 12%	12% to 15%
Min. bed length-to-width ratio	4-to-1	6-to-1
Min. downslope berm ratio	3-to-1	4-to-1

The increased ratios are intended to protect the bed on a steeper slope. Keeping the bed long and narrow decreases the [horizontal linear loading rate](#), minimizing the likelihood of effluent seeping through the berm.

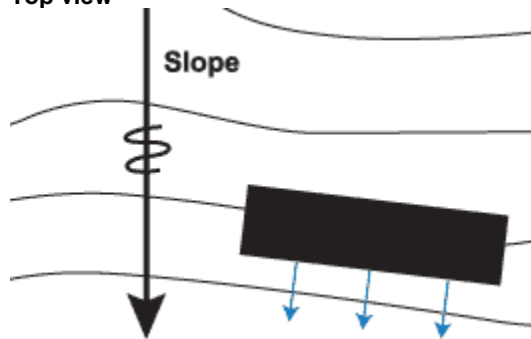
The wider berm on the downslope side of the bed provides an extra buffer zone, as the system is on a steep slope and effluent will tend to move laterally downslope. This also prevents effluent from seeping through the berm and increases stability to the mound.

1) Absorption Area Bed

Click on the image of each system type for more information about its design in relation to the horizontal linear loading rate and renovation.

LONG AND NARROW SYSTEM

Top view

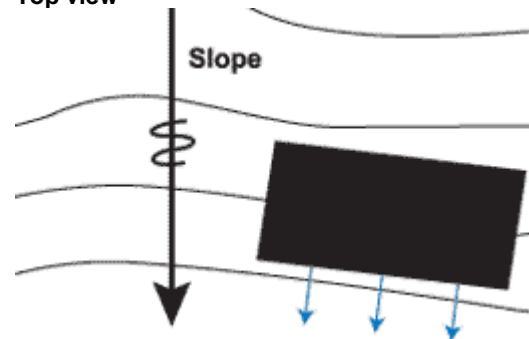


Side view



WIDE SYSTEM

Top view



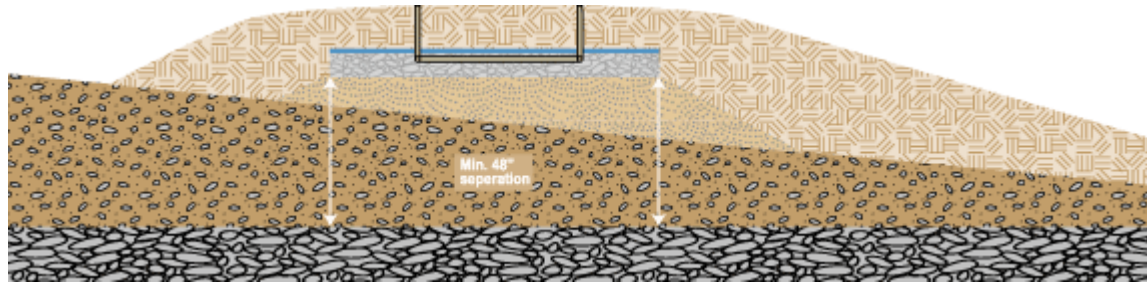
Side view



The Alternate Steep Slope Elevated Sand Mound Bed

Like a conventional mound system, the alternate steep slope elevated sand mound bed must maintain a 48-inch vertical separation between the bottom of the absorption area aggregate and the limiting zone.

Additionally, the system is pressure dosed and constructed with the same materials that are associated with a conventional mound system.



Review

SEO John Smith is reviewing an alternate steep slope elevated sand mound bed design. He needs to make sure two major design differences from the conventional elevated sand mound bed are correct on the design.



What two major design differences between the alternate steep slope and conventional sand mound bed must John Smith verify?

- A) Bed length-to-width ratio
- B) Uphill berm ratio
- C) Downhill berm ratio
- D) Side berm ratio

Submit

Reset

Advantage of the Alternate Steep Slope Elevated Sand Mound Bed

The advantage of this system is that it provides an onlot sewage disposal option for sites with slopes between 12 and 15 percent, as long as all other testing requirements can be met.

Other System Options

Other possible options, not including experimental systems, for a site with a slope of 12 to 15 percent are:

- 1) Conventional individual residential spray irrigation system (IRSIS)
- 2) Conventional in-ground trenches
- 3) Conventional subsurface sand filter trenches
- 4) Alternate drip irrigation system

Note: Refer to the regulations and the alternate guidance for other requirements for the systems listed above.

Disadvantage of the Alternate Steep Slope Elevated Sand Mound Bed

A disadvantage of the system for some sites may be the size of the system. The design specification requires a minimum six-to-one bed length-to-width ratio and a four-to-one downslope berm ratio. Even if the site meets the testing criteria, it must also have enough space to physically place the system on the site.

CALCULATING THE SIZE OF THE BERM

If you would like to review reference materials for calculating the size of the berm, click on ["Calculating the Size of the Berm."](#) or go to the "job aids." This material may also be found in the "SEO Field Manual" under the "Disposal Area Options" section. Both references review the math needed to calculate the footprint of the berm.

Disadvantage of the Alternate Steep Slope Elevated Sand Mound

CALCULATING THE SIZE OF THE BERM

Example:

400 gpd

Perc rate of 20 minutes per inch

14% slope

400 gpd x 1.5 sq. ft. of aggregate per gpd (Section 73.16 Table A conversion of the regulations) =
Minimum 600 square feet of absorption area aggregate
The bed aggregate area would need to be 60 feet by 10 feet to meet the 6-to-1 ratio. However,
these are not the dimensions of the entire absorption area including the berm. The berm footprint
must also be added to the bed aggregate area.

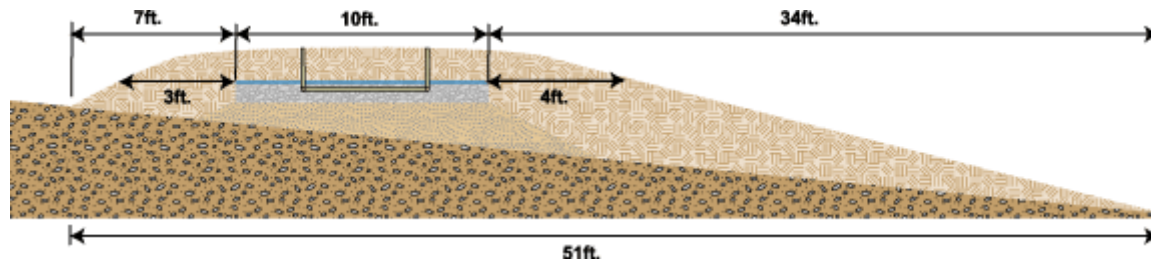
Consider and compare the following examples on the next page.

Disadvantage of the Steep Slope Elevated Sand Mound Bed

CALCULATING THE SIZE OF THE BERM

Example 1

12 in. min. sand depth = upslope footprint at 3:1=7ft.
+
10 ft.- wide absorption area
+
Downslope footprint at 4:1 = 34 ft.
=
Total system width 7 ft + 10 ft. + 34 ft. = 51 ft.



If you would like to review reference materials for calculating the size of the berm for this example, click on ["Calculating the Size of the Berm Example 1"](#) or go to the "job aids."

Disadvantage of the Steep Slope Elevated Sand Mound Bed

CALCULATING THE SIZE OF THE BERM

Example 2

28 in. min. sand depth = upslope footprint at 3:1 = 10 ft.

+

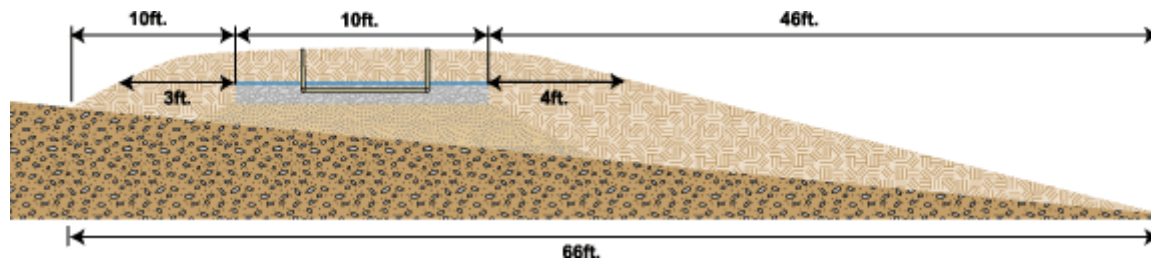
10 ft.- wide absorption area

+

Downslope footprint at 4:1 = 46 ft.

=

Total system width 10 ft + 10 ft. + 46 ft. = 66 ft.



If you would like to review reference materials for calculating the size of the berm for this example, click on "[Calculating the Size of the Berm Example 2](#)" or go to the "job aids."

Lesson Summary

In this lesson, you learned about the alternate steep slope elevated sand mound bed design requirements and the advantage and disadvantage of the system.

Design requirements

- Bed minimum length-to-width ratio of six-to-one.
- Downslope berm ratio of four-to-one.

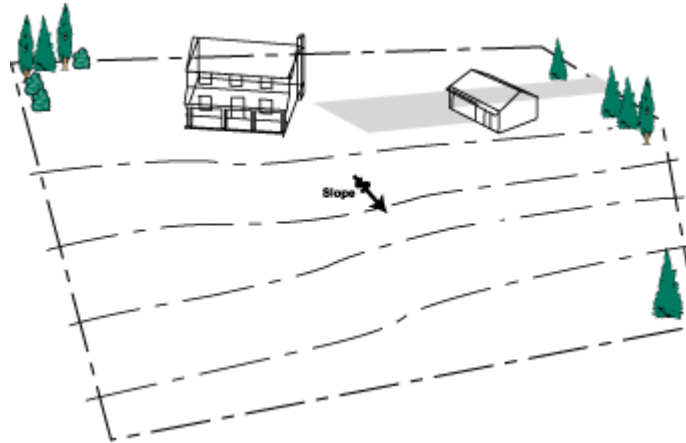
Advantage: Another sewage disposal option for sites with a slope of 12 to 15 percent.

Disadvantage: The berm footprint may be too large, with the four-to-one downslope ratio, for some sites.

What You Will Learn in This Lesson

In this lesson, you will learn about the criteria that must be met to use an alternate steep slope elevated sand mound bed. The following criteria will be covered in this lesson:

- 1) Slope
- 2) Sewage flows
- 3) Soil profile evaluation
- 4) Percolation test



1) Slope

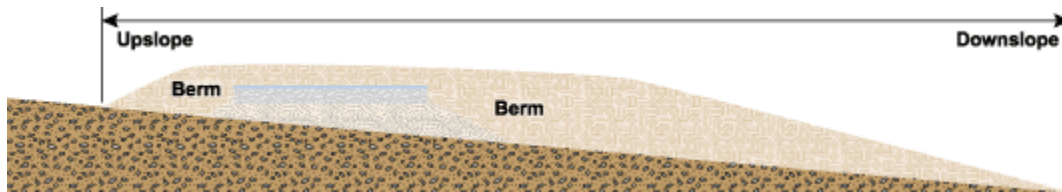


Section 13.A.2

The first criterion to check is the slope. If the site does not meet the slope requirements, another system must be considered.

The slope must be greater than or equal to 12 percent or less than or equal to 15 percent throughout the entire proposed absorption area location. If the slope is 12 percent or less, a conventional elevated sand mound bed may be considered. If the slope is more than 15 percent, another system must be evaluated for the site.

Note: The slope must be measured perpendicular to the contours and from the upslope to the downslope side of the projected berm. There is a graphic in the “job aids” that explains how to measure slope, or click on [“How to Measure Slope”](#) to view this graphic now. The “SEO Field Manual” is also another good reference for instructions on measuring slope.



2) Sewage flow



Section 13.B.1

The second criterion to check is the sewage flow. This system has a sewage flow limit of **600** gallons per day (gpd) and may only be used for single-family dwellings or facilities that have residential flow characteristics. To view a description of these characteristics click on ["Residential Flow Characteristics."](#) this document can also be found in the "job aids."

Any site that has a sewage flow that exceeds 600 gpd **cannot** use this alternate technology.

3) Suitable Soil Depth

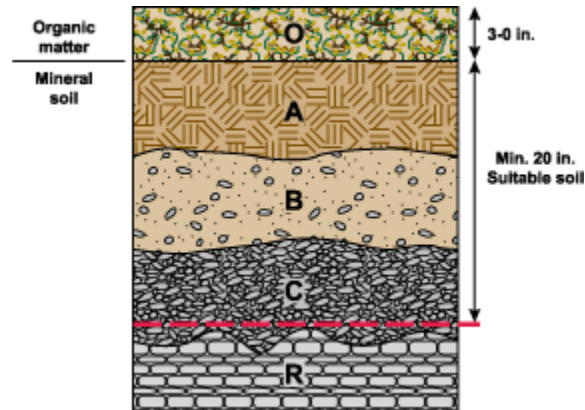


Section 13.A.1

The third criterion to evaluate is the suitable soil depth. The soil probe must be conducted according to Section 73.14 of the regulations. To use the alternate steep slope elevated sand mound bed, there must be at least **20 inches** of suitable soil. This requirement is the same as for a conventional elevated sand mound bed.



Section 73.14



4) Percolation Test



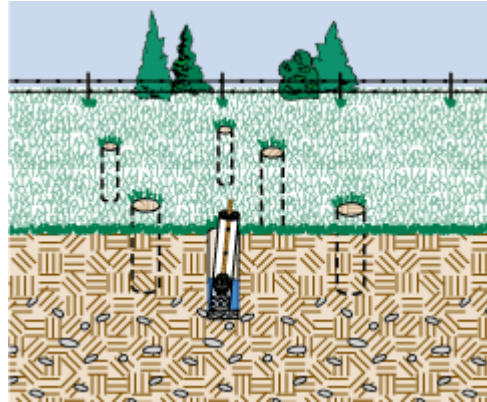
Section 13.A.4



Section 73.15(3)(ii) or (iii)

The fourth criterion to evaluate is the percolation test result. If a site has the minimum required 20-inch suitable soil depth and a slope of 12 to 15 percent, a percolation test may be conducted at the proposed absorption area.

The percolation test result must range from 3 to 30 minutes per inch. If the result is lower than 3 or higher than 30 minutes per inch, the site cannot use an alternate steep slope elevated sand mound bed. The percolation test hole depth must be conducted in accordance with Section 73.15(3)(ii) or (iii) of the regulations. The test hole depth follows the same criteria as a conventional elevated sand mound bed.



Review

An SEO was reviewing the testing criteria for this site with the following characteristics:

- Slope – 14%
- Sewage flow – 400 gpd
- Suitable soil depth – 22 inches
- Percolation test rate – 15 min./inch



Would the characteristics of this site meet the required criteria for an alternate steep slope elevated sand mound bed?

- A) Yes
- B) No

Review

An SEO was reviewing the testing criteria for a site with the following characteristics:

- Slope – 16%
- Sewage flow – 400 gpd
- Suitable soil depth – 26 inches
- Percolation test rate – 25 min./inch



Would the characteristics of this site meet the required criteria for an alternate steep slope elevated sand mound bed?

- A) Yes
- B) No

Review

An SEO was reviewing the testing criteria for a site with the following characteristics:

- Slope – 16%
- Sewage flow – 400 gpd
- Suitable soil depth – 26 inches
- Percolation test rate – 25 min./inch



Which one of the characteristics prevents this site from meeting the required criteria for an alternate steep slope elevated sand mound bed?

- A) Slope – 16%
- B) Sewage flow – 400 gpd
- C) Suitable soil depth – 26 inches
- D) Percolation test rate – 25 min./inch

Review

An SEO was reviewing the testing criteria for a site with the following characteristics:

- Slope – 15%
- Sewage flow – 500 gpd
- Suitable soil depth – 31 inches
- Percolation test rate – 33 min./inch



Would the characteristics of this site meet the required criteria for an alternate steep slope elevated sand mound bed?

- A) Yes
- B) No

Review

An SEO was reviewing the testing criteria for a site with the following characteristics:

- Slope – 15%
- Sewage flow – 500 gpd
- Suitable soil depth – 31 inches
- Percolation test rate – 33 min./inch



Which one of the characteristics prevents this site from meeting the required criteria for an alternate steep slope elevated sand mound bed?

- A) Slope – 15%
- B) Sewage flow – 500 gpd
- C) Suitable soil depth – 31 inches
- D) Percolation test rate – 33 min./inch

Review

An SEO was reviewing the testing criteria for a site with the following characteristics:

- Slope – 12%
- Sewage flow – 700 gpd
- Suitable soil depth – 32 inches
- Percolation test rate – 29 min./inch



Would the characteristics of this site meet the required criteria for an alternate steep slope elevated sand mound bed?

- A) Yes
- B) No

Review

An SEO was reviewing the testing criteria for a site with the following characteristics:

- Slope – 12%
- Sewage flow – 700 gpd
- Suitable soil depth – 32 inches
- Percolation test rate – 29 min./inch



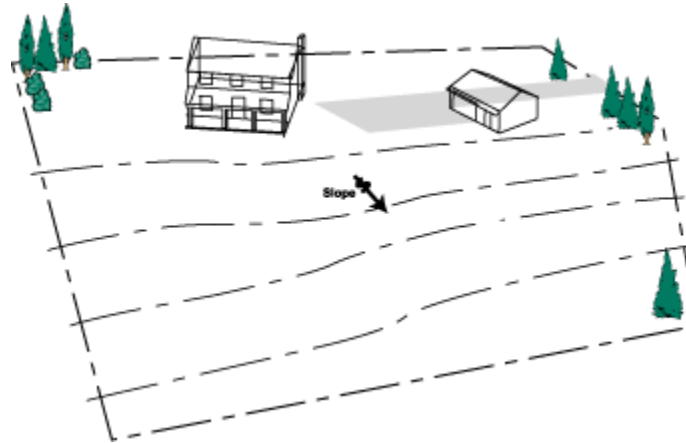
Which one of the characteristics prevents this site from meeting the required criteria for an alternate steep slope elevated sand mound bed?

- A) Slope – 12%
- B) Sewage flow – 700 gpd
- C) Suitable soil depth – 32 inches
- D) Percolation test rate – 29 min./inch

Lesson Summary

In this lesson, you learned about the criteria that must be met to use an alternate steep slope elevated sand mound bed.

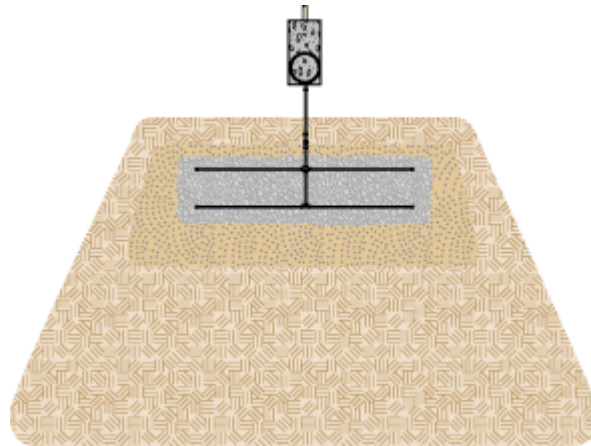
- 1) **Slope:** 12% to 15%
- 2) **Sewage flow:** Maximum 600 gallons per day with residential flow characteristics
- 3) **Suitable soil depth:** Minimum of 20 inches of suitable soil
- 4) **Percolation test:** On or between 3 and 30 minutes per inch



What You Will Learn in This Lesson

In this lesson, you will learn about the design requirements that must be met to use an alternate steep slope elevated sand mound bed. The items listed below will be covered in this lesson.

- 1) 48-inch vertical separation
- 2) Minimum absorption area aggregate
- 3) Primary treatment tank(s)
- 4) Sand
- 5) Bed dimensions
- 6) Downslope berm
- 7) Pressure distribution
- 8) Lateral cleanouts
- 9) Chisel plow

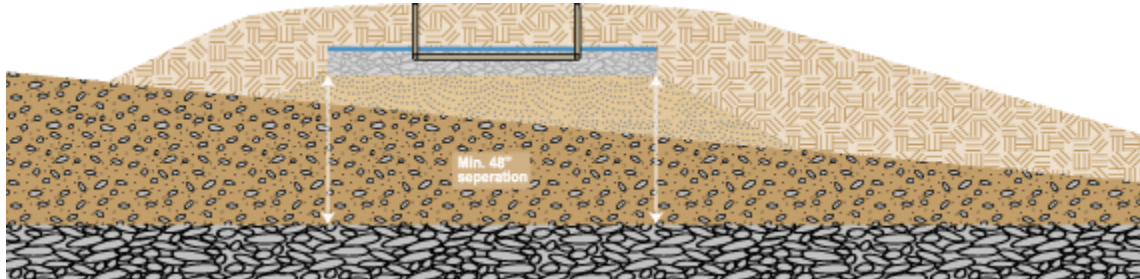


1) 48-Inch Vertical Separation



Section 13.A.3

Like any other conventional system (with the exception of IRSIS), the alternate steep slope elevated sand mound bed must maintain the minimum 48-inch separation between the bottom of the absorption area aggregate and the limiting zone. The diagram below shows the separation.



Review



If the suitable soil depth was 26 inches, what minimum depth of sand would be needed to maintain the minimum 48-inch separation?

- A) 20
- B) 22
- C) 30
- D) 48

2) Minimum Absorption Area Aggregate



Section 13.A.4



Section 73.16(c)

The minimum aggregate absorption area must be calculated using Table A from Section 73.16(c) of the regulations. Use the column labeled "Subsurface Sand Filters and Elevated Sand Mounds."

The minimum square feet of aggregate for an alternate steep slope elevated sand mound bed is calculated the same as for a conventional elevated sand mound bed. However, **no size reductions are permitted** when using system components that usually provide a size reduction. The minimum square feet of aggregate needed may be calculated using the daily flow and Table A, regardless of the system components being used.

3) Primary Treatment Tank(s)



Section 13.B.2



Sections 73.31 and 73.32

According to the guidance, primary treatment may be provided by either an aerobic tank or septic tank(s).

AEROBIC TANK



Section 73.32

If an [aerobic tank](#) is used for primary treatment, it must meet all the regulations regarding aerobic tanks.

Note: When an aerobic treatment tank is proposed for a conventional system, the regulations sometimes allow a reduction in the absorption area size. However, the guidance further specifies that **no** absorption area size reduction is permitted with this alternate system.

3) Primary Treatment Tank(s)

SEPTIC TANK(S)



Section 13.B.2



Section 73.31

If a septic tank(s) is used for primary treatment, it must meet all the regulations regarding septic treatment tank(s).

The guidance further requires that the septic treatment tank(s) either be a **multiple-compartment rectangular tank** or **two rectangular tanks in a series**.

Round tanks cannot be used with this alternate system.



4) Sand



Section 13.B.3



Section 73.55
(c)

The sand used in the alternate steep slope elevated sand mound bed must meet the requirements of Section 73.55(c) of the regulations. These are the same requirements for sand used in a conventional elevated sand mound bed.

4) Sand

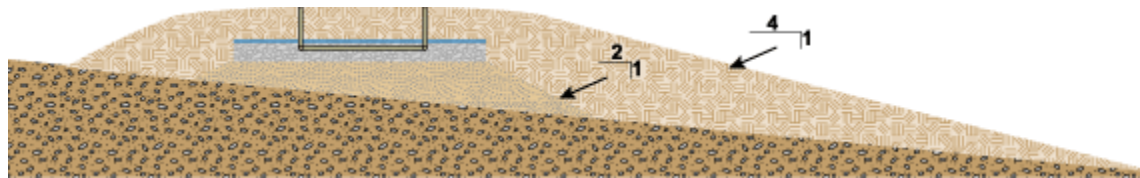
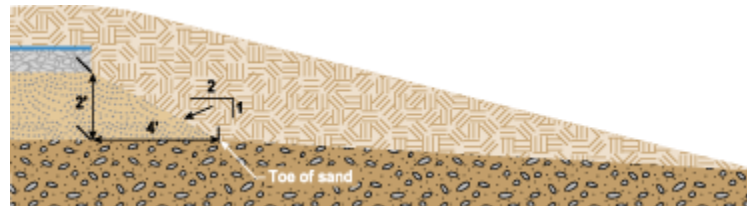


Section 13.B.3



Section 73.55(b)(5)

The guidance and the regulations specify that the sand not directly beneath the aggregate must be extended to a two-to-one ratio. This means that for every measurement the sand is deep, the sand must extend two times that measurement horizontally. The illustrations below show the two-to-one ratio.

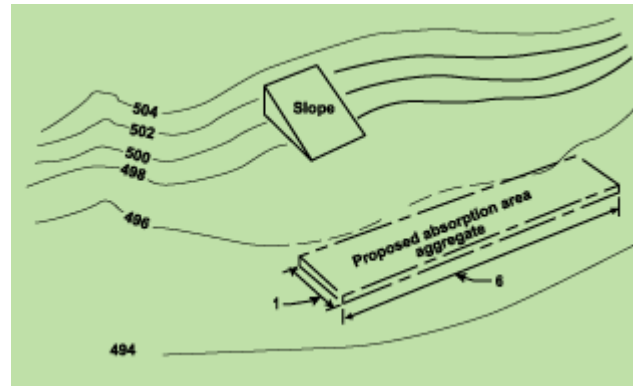


5) Bed Dimensions



Section 13.B.4

The guidance requires the absorption area aggregate to be at least six times as long as it is wide. This will give the bed a minimum **six-to-one** length-to-width ratio. In addition, the guidance also specifies the maximum aggregate width of the bed is **ten feet**.



5) Bed Dimensions

With a long narrow absorption area bed, the effluent is distributed along the slope, so there is less effluent per square foot moving downslope. This creates a lower [horizontal linear loading rate](#) as compared to a wider absorption area bed.

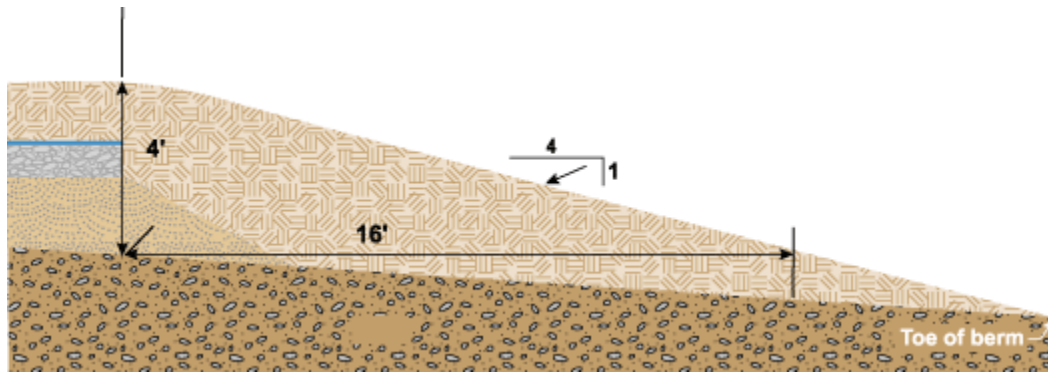
The lower horizontal linear loading rate is an important feature of the alternate steep slope elevated sand mound bed system. Since the slope is steeper than a conventional elevated sand mound bed system, and gravity will have a stronger influence on the movement of effluent.

6) Downslope Berm



Section 13.B.5

The downslope berm must have a four-to-one ratio. This extra berm material is required to help provide more stability to the mound, since it is on a steeper slope than a conventional mound installation. It also helps prevent effluent from seeping through the downslope berm.



7) Pressure Distribution



Section 13.B.6



Sections 73.43–73.46

The alternate steep slope elevated sand mound bed must be pressure dosed like the conventional elevated sand mound bed system. Refer to Sections 73.43 through 73.46 of the regulations for specific information on pressure distribution.

8) Lateral Cleanouts

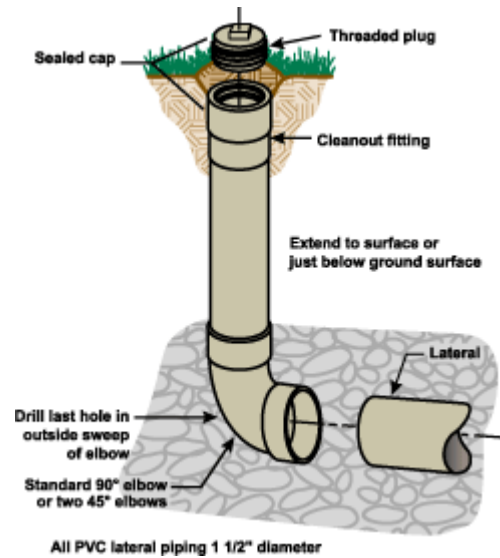


Section 13.B.7

Lateral-end cleanouts are required with the alternate steep slope elevated sand mound bed. In case of a system malfunction, the lateral-end cleanouts may be used to help determine if the cause of the malfunction is in the absorption area. The cleanouts also provide an inspection port into the absorption area bed and could be used to flush the lateral pipes.

This diagram shows a typical lateral-end cleanout.

Note: It is recommended to cut the cleanout flush with the finished grade, as the plastic pipe may become brittle and break after prolonged exposure to sunlight.



9) Chisel Plow



Section 13.B.8



Section 73.55(b)(2)

The guidance and the regulations require the surface under the sand and the berm to be chisel plowed across the slope (along contours). Refer to the regulations for more specifics on chisel plowing.

Review

An SEO was reviewing the design criteria for a site with the following characteristics:

<ul style="list-style-type: none">• Vertical separation – 47 inches from aggregate bottom to limiting zone• Primary treatment tank(s) – Multi-compartment rectangular septic tank• Sand – Meets material requirements and the slope of the sand not directly beneath the aggregate area must be approximately 50 percent	<ul style="list-style-type: none">• Bed dimensions – 6:1 ratio• Downslope berm – 4:1 ratio• Distribution – Pressure dosed• Lateral cleanouts – Present• Chisel plow – Across slope (along contours) under the bed and berm
--	--



Would the characteristics of this proposal meet the required criteria for an alternate steep slope elevated sand mound bed?

- A) Yes
- B) No

Review



Which of the design characteristic(s) would prevent the issuing of a permit for an alternate steep slope sand mound?

- A) Vertical separation – 47 inches from aggregate bottom to limiting zone
- B) Primary treatment tank(s) – Multi-compartment rectangular septic tank
- C) Sand – Meets material requirements and the slope of the sand not directly beneath the aggregate area must be approximately 50 percent
- D) Bed dimensions – 6:1 ratio
- E) Downslope berm – 4:1 ratio
- F) Pressure distribution – Pressure dosed
- G) Lateral cleanouts – Present
- H) Chisel plow – Across slope (along contours) under the bed and berm

Review

An SEO was reviewing the design criteria for a site with the following characteristics:

<ul style="list-style-type: none">• Vertical separation – 51 inches from aggregate bottom to limiting zone• Primary treatment tank(s) – Round septic tank• Sand – Meets material requirements and the slope of the sand not directly beneath the aggregate area must be approximately 50 percent	<ul style="list-style-type: none">• Bed dimensions – 6:1 ratio• Downslope berm – 4:1 ratio• Distribution – Pressure dosed• Lateral cleanouts – Present• Chisel plow – Across slope (along contours) under the bed and berm
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Would the characteristics of this proposal meet the required criteria for an alternate steep slope elevated sand mound bed?

A) Yes

B) No

Review



Which of the design characteristic(s) would prevent the issuing of a permit for an alternate steep slope sand mound?

- A) Vertical separation – 51 inches from aggregate bottom to limiting zone
- B) Primary treatment tank(s) – Round septic tank
- C) Sand – Meets material requirements and the slope of the sand not directly beneath the aggregate area must be approximately 50 percent
- D) Bed dimensions – 6:1 ratio
- E) Downslope berm – 4:1 ratio
- F) Pressure distribution – Pressure dosed
- G) Lateral cleanouts – Present
- H) Chisel plow – Across slope (along contours) under the bed and berm

When the Guidance is Silent

Refer to the regulations for anything that is not covered in the guidance. When the guidance is silent, you must follow the regulations for a conventional elevated sand mound bed on an >8 to ≤ 12 percent slope.

Example: The guidance does not discuss the upslope berm requirements, so you must refer to the regulations for this information. The regulations specify the berm requirements for a conventional sand mound bed on a slope of >8 to ≤ 12 percent is a three-to-one ratio (33.3%).

Lesson Summary

In this lesson, you learned about the design requirements that must be met to use an alternate steep slope elevated sand mound bed. They include the following:

- | | |
|--|--------------------|
| 1) <input type="text"/> vertical separation from aggregate bottom to limiting zone -
Must be maintained | 2-to-1 |
| 2) Minimum absorption area aggregate - Same as a conventional
sand mound | Round |
| 3) Septic tanks - <input type="text"/> tanks must be used | 6-to-1 |
| 4) Sand - Must meet the regulatory requirements | 48-Inch |
| 5) Bed dimensions - <input type="text"/> minimum length-to-width ratio | Rectangular |
| 6) Downslope berm - <input type="text"/> minimum ratio | |
| 7) Pressure distribution - Required | 4-to-1 |
| 8) Lateral cleanouts - Required | |
| 9) Chisel plow - Under the bed and berm area | 24-Inch |