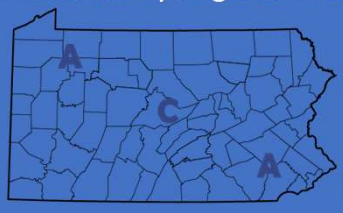
The Pennsylvania Association of SEWAGE ENFORCEMENT OFFICERS

PERCOLATION TEST

Presented By Roger Lehmann



Est. 1992

All County and Associates, Inc.

1

OBJECTIVES

The purpose of this session is to:

- Understand how to prepare a Percolation Test
- Understand how to perform a Percolation Test
- To calculate the minimum absorption area size

2

SITE EVALUATION STAGE

The percolation test determines:

1) the size of the absorption area required for the system,

2) the type of system that could be placed on the proposed site, and

3) the possible unsuitability of the site.

3

KEY TERMS

ABSORPTION AREA

PERCOLATION RATE

4

QUESTION

What are the two types of onlot sewage disposal systems that require percolation testing?

5

QUESTION

What are the minimum depths of suitable soil for each system?

In-ground – need a minimum of 60 inches of suitable soil (not including slope).

Elevated – need a minimum of 20 inches of suitable soil.

6

PERCOLATION TEST

SEOs must be able to correctly complete, calculate, and interpret the results from a percolation test to know if a permit can be issued according to the regulations. The test determines the proper size of a system, and it may determine the type of system for a site.

7

PERCOLATION TEST

What does a percolation test tell us?

- The test determines the rate at which sewage effluent can be expected to seep into the soil. The area required to properly dispose of the expected sewage flow (the absorption area) is based on this rate.
- The percolation rate determines the size of the system and may also further determine the type of system or the unsuitability of the site.

8

QUESTION

What are the factors that determine where to place the percolation holes?

9

PERCOLATION HOLES

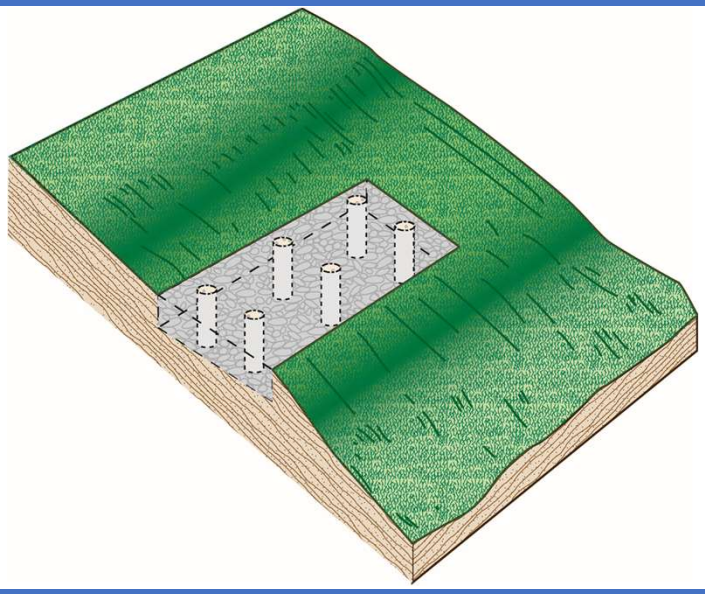
1) **Soil probe**–The soil probe must be dug within 10 feet of the absorption area.

2) **Daily flow requirements**–Daily flow contributes to the size of the system; the larger the daily flow, the larger the system.

3**) Slope**–The length of the absorption area must be placed parallel to the contours.

10

PERCOLATION HOLES



11

PERCOLATION HOLES

4) Size of absorption area – The regulations require a minimum of six test holes to be placed uniformly throughout the absorption area.

A sufficient number of holes must be tested to adequately cover the proposed absorption area, so at any given site, *you may need more than the minimum of six holes*.

12

NUMBER/LOCATION OF HOLES

Turn to Chapter 73.15(1) in the regulation book

§ 73.15. Percolation tests.

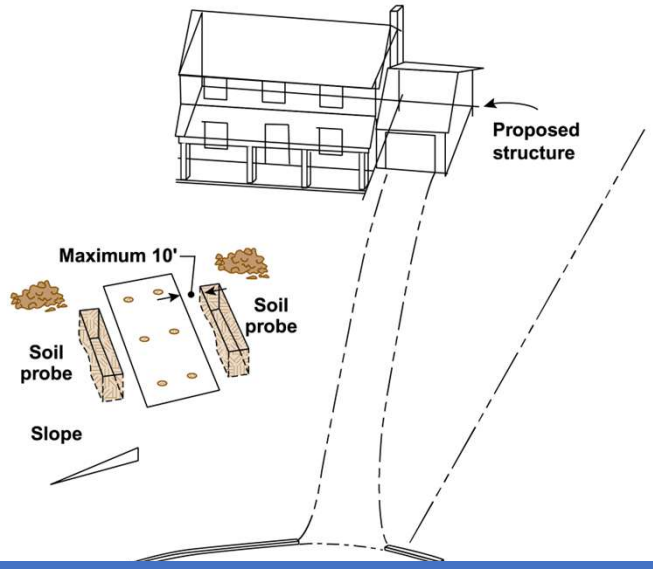
Percolation tests shall be conducted in accordance with the following procedure.

§ 73.15. Percolation tests

(1) *Number and location*. Six or more tests shall be made in separate test holes spaced uniformly over the proposed absorption area site.

13

NUMBER/LOCATION OF HOLES



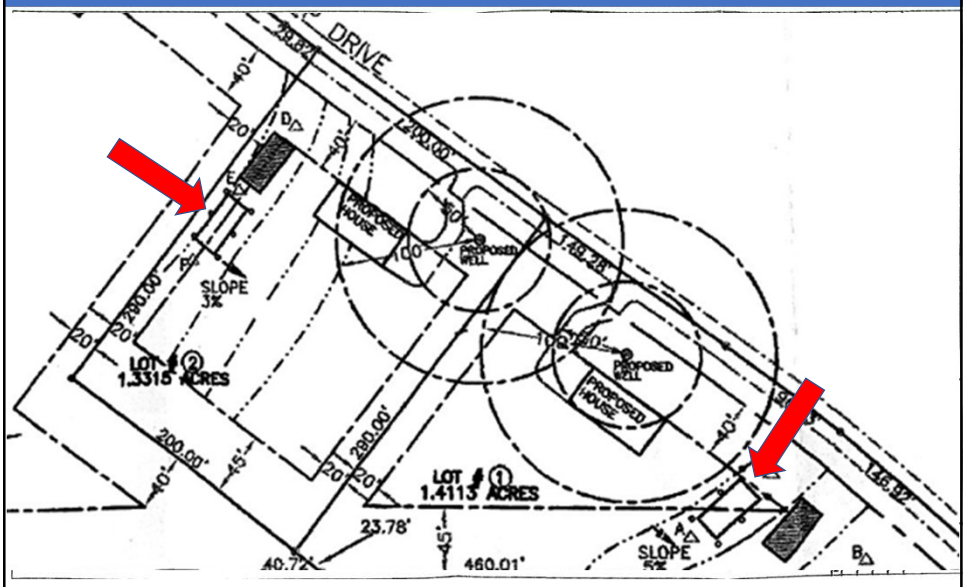
14

QUESTION

Can you locate the percolation holes on the following plot plan?

15

NUMBER/LOCATION OF HOLES



16

DIGGING THE HOLES

Turn to Chapter 73.15(4) in the regulation book

§ 73.15. Percolation tests.

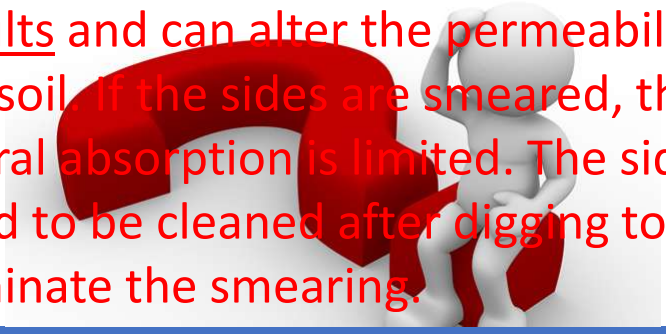
(4) *Preparation*. The bottom and sides of the hole shall be scarified with a knife blade or sharp-pointed instrument to completely remove any smeared soil surfaces and to provide a natural soil interface into which water may percolate. Loose material shall be removed from the hole. Two inches of coarse sand or fine gravel shall be placed in the bottom of the hole to protect the soil from scouring and clogging of the pores.

17

QUESTION

Does it matter how the holes are dug?

Yes. Smearing the sides can change your results and can alter the permeability of the soil. If the sides are smeared, the lateral absorption is limited. The sides need to be cleaned after digging to eliminate the smearing.



18

TOOLS

Posthole Digger This device is used to actually dig the holes.

Digging Iron This device is used to assist in digging a hole when there are rocks or the soil is compacted.

Power Auger This device is used if the holes are deep and difficult to dig, but watch for smearing. The core of a hole can be dug with the power auger and then expanded with the posthole digger.

Garden Claw This device is used to rough up the sides and bottom of the hole to remove smeared soil.

Tool Shed

Digging Iron

Garden Claw

Posthole Digger

Power Auger

19

SIZE OF HOLES

Chapter 73.15(3)
in the regulation book

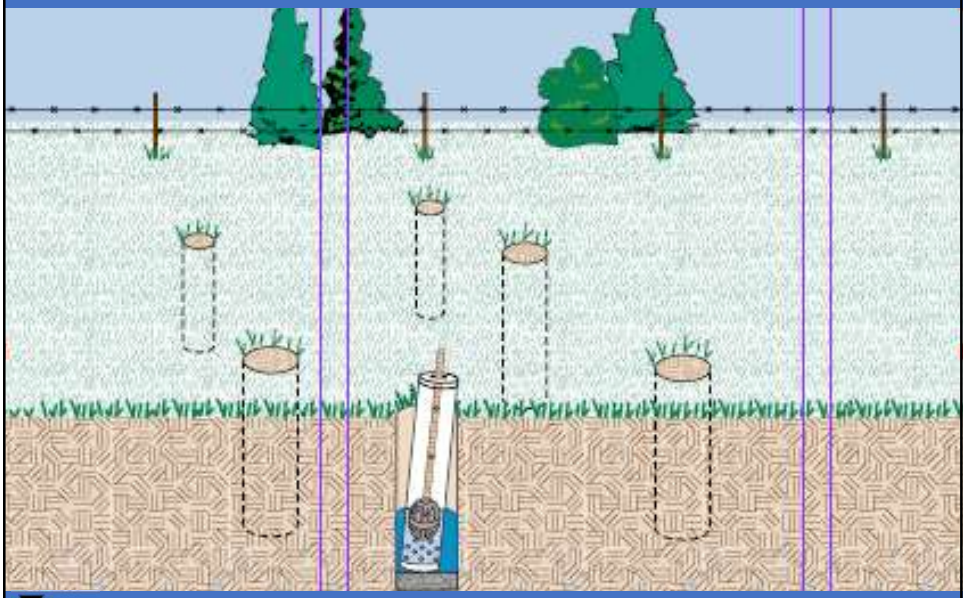
§ 73.15. Percolation tests.

(3) *Type of hole*. Holes having a uniform diameter of 6 to 10 inches […].

§ 73.15. Percolation tests

20

SIZE OF HOLES

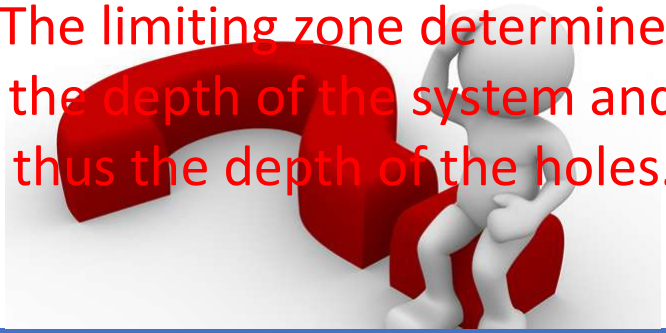


21

QUESTION

What is the factor that determines the depth of the holes?

The limiting zone determines the depth of the system and thus the depth of the holes.



22

QUESTION

What is the minimum depth of soil to the limiting zone required to perform a percolation test?

There must be at least 20 inches of suitable soil to perform a percolation test.

23

DEPTH OF HOLES

The type and depth of the limiting zone determine the depth of the percolation holes.

The regulations give us three situations that determine the depth of the percolation holes.

24

TYPE OF HOLES

Turn to Chapter 73.15(3) in the regulation book

§ 73.15. Percolation tests

(3) *Type of hole*. Holes having a uniform diameter of 6 to 10 inches shall be bored or dug as follows:

25

TYPE OF HOLES

Turn to Chapter 73.15(3) in the regulation book

(i) To the depth of the proposed absorption area, where the limiting zone is 60 inches or more from the mineral soil surface.

26

TYPE OF HOLES

Turn to Chapter 73.15(3) in the regulation book

(ii) To a depth of 20 inches if the limiting zone is identified as seasonal high water table, whether perched or regional; rock formation; other stratum; or other soil condition which is so slowly permeable that it effectively limits downward passage of effluent, occurring at less than 60 inches from the mineral soil surface.

27

TYPE OF HOLES

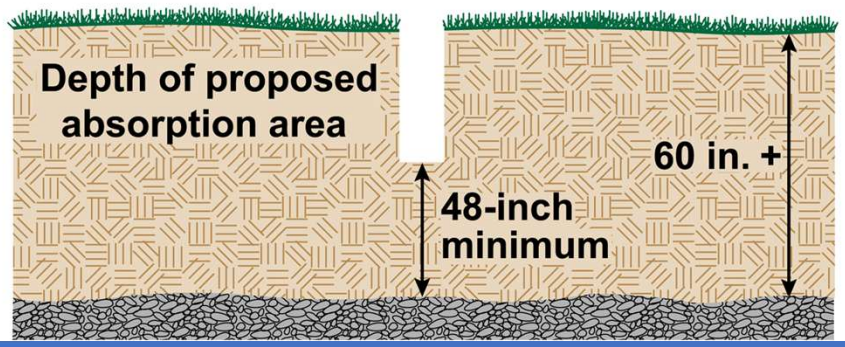
Turn to Chapter 73.15(3) in the regulation book

(iii) To a depth 8 inches above the limiting zone or 20 inches, whichever is less, if the limiting zone is identified as rock with open joints or with fractures or solution channels, or as masses of loose rock fragments including gravel with insufficient fine soil to fill the voids between the fragments, occurring at less than 60 inches from the mineral soil surface.

28

TYPE OF HOLE

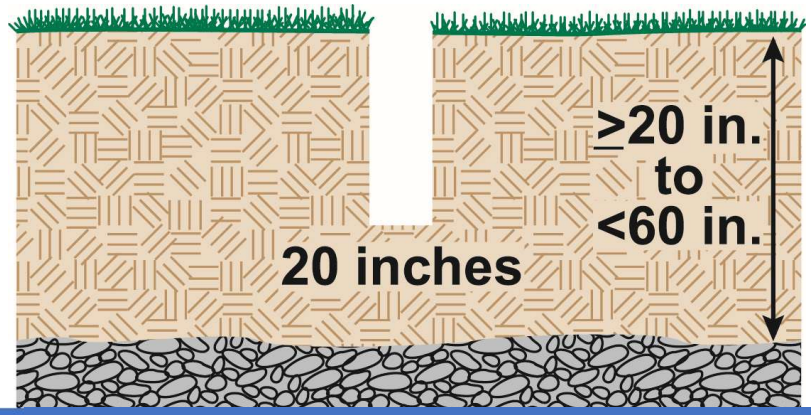
i) Limiting Zone at 60 Inches or More



29

TYPE OF HOLE

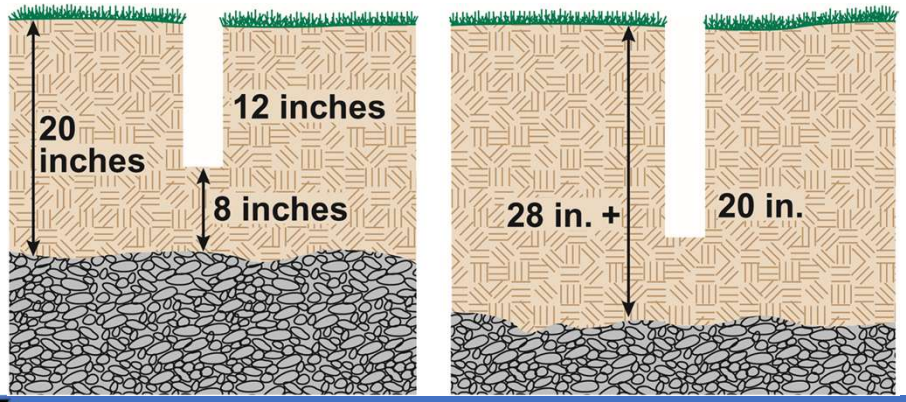
ii) Limiting Zone of Seasonal High Water Table, Rock Formation, or Slowly Permeable Soil Condition



30

TYPE OF HOLE

iii) Limiting Zone of Rock with Open Joints



31

EXERCISE

With each of the following scenarios, how deep would the percolation test holes need to be?

1) 72-inch limiting zone; the proposed depth of the absorption area is 24 inches for an in-ground system.

Answer: 24-inch percolation hole, the depth of the absorption area. (i)

32

EXERCISE

With each of the following scenarios, how deep would the percolation test holes need to be?

2) 45-inch limiting zone due to a seasonal high water table.

Answer: Any limiting zone of 20 to 60 inches due to a water table requires a 20-inch depth of perclation hole. (ii)

33

EXERCISE

With each of the following scenarios, how deep would the percolation test holes need to be?

3) 48-inch limiting zone due to rock with insufficient fines to fill the voids between the fragments.

Answer: 20-inch depth of percolation hole. With a limiting zone of 20 to 60 inches due to rock, the depth of the hole needs to be 8 inches above the limiting zone or 20 inches deep, whichever is less. (iii)

34

EXERCISE

With each of the following scenarios, how deep would the percolation test holes need to be?

4) 20-inch limiting zone due to rock with open joints.

Answer: 12-inch depth of hole. With a limiting zone of 20 to 60 inches due to rock, the depth of the hole needs to be 8 inches above the limiting zone or 20 inches deep, whichever is less. A 12-inch hole is the shallowest hole that can be tested. (iii)

35

PREPARING THE HOLES

Turn to Chapter 73.15(4) in the regulation book

§ 73.15. Percolation tests

(4) *Preparation.* The bottom and sides of the hole shall be scarified with a knife blade or sharp-pointed instrument to completely remove any smeared soil surfaces and to provide a natural soil interface into which water may percolate. Loose material shall be removed from the hole. Two inches of coarse sand or fine gravel shall be placed in the bottom of the hole to protect the soil from scouring and clogging of the pores.

36

PREPARING THE HOLES

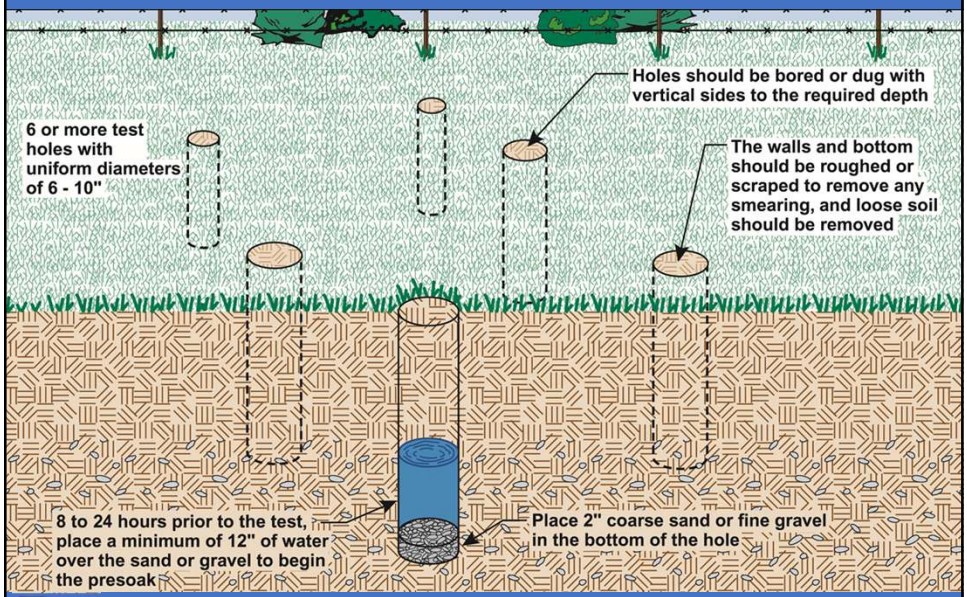
- To prepare the holes, you need to remove smeared edges and any loose material left in the hole. Do this with your hands or a garden claw.

- The soil pores and the space between peds may be blocked if smearing has occurred.

- By cleaning the sides of the hole, some of the pores and spaces may be opened. This procedure helps to provide accurate results.

37

PREPARING THE HOLES

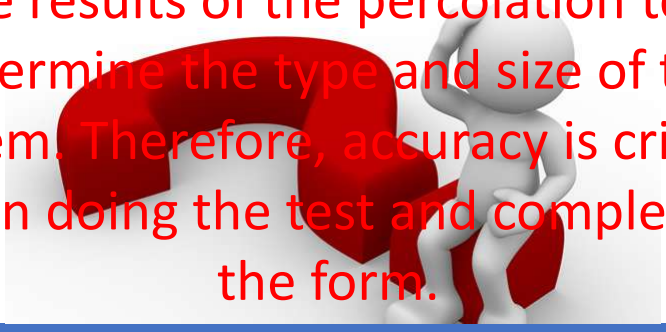


38

QUESTION

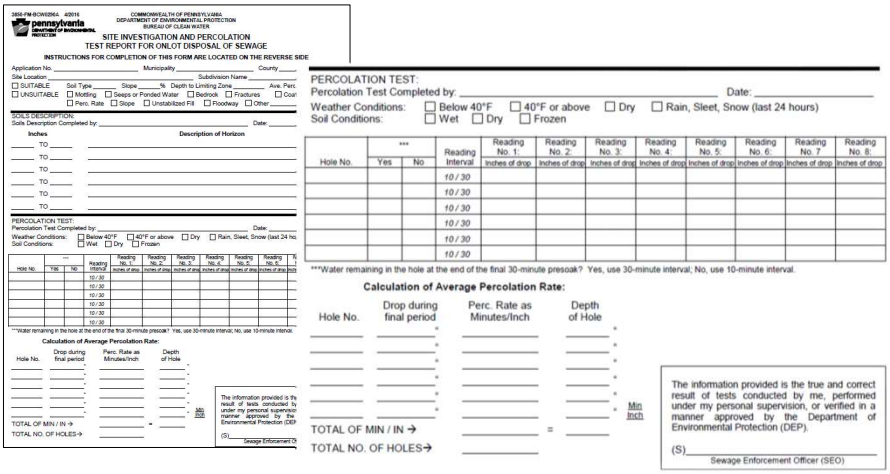
Why is accuracy of testing important?

The results of the percolation test determine the type and size of the system. Therefore, accuracy is critical when doing the test and completing the form.



PERCOLATION TEST TOOLS

1) Percolation test form



SITE INVESTIGATION AND PERCOLATION
TEST REPORT FOR ONLOT DISPOSAL OF SEWAGE

PERCOLATION TEST:
Percolation Test Completed by: _____ Date: _____
Weather Conditions: ☐ Below 40°F ☐ 40°F or above ☐ Dry ☐ Rain, Sleet, Snow (last 24 hours)
Soil Conditions: ☐ Wet ☐ Dry ☐ Frozen

Hole No.	*** Yes	*** No	Reading Interval	Reading No. 1: Inches of drop	Reading No. 2: Inches of drop	Reading No. 3: Inches of drop	Reading No. 4: Inches of drop	Reading No. 5: Inches of drop	Reading No. 6: Inches of drop	Reading No. 7 Inches of drop	Reading No. 8: Inches of drop
			10 / 30								
			10 / 30								
			10 / 30								
			10 / 30								
			10 / 30								
			10 / 30								

***Water remaining in the hole at the end of the final 30-minute presoak? Yes, use 30-minute interval; No, use 10-minute interval.

Calculation of Average Percolation Rate:

Hole No.	Drop during final period		Perc. Rate as Minutes/Inch		Depth of Hole	
		*		*		*
		*		*		*
		*		*		*
		*		*		*
		*		*		*
TOTAL OF MIN / IN →				=		Min / Inch
TOTAL NO. OF HOLES→						

The information provided is the true and correct result of tests conducted by me, performed under my personal supervision, or verified in a manner approved by the Department of Environmental Protection (DEP).

(S)_____
Sewage Enforcement Officer (SEO)

PERCOLATION TEST TOOLS

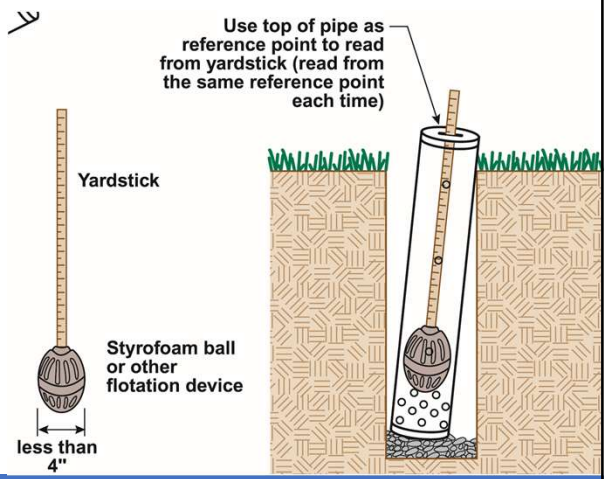
2) Water and buckets

3) Watering can

41

PERCOLATION TEST TOOLS

4) Percolation PVC pipe apparatus with a yardstick



42

REFERENCE POINT

(7) Measurement. After the final presoaking period, water in the hole shall again be adjusted to approximately 6 inches over the gravel and readjusted when necessary after each reading.

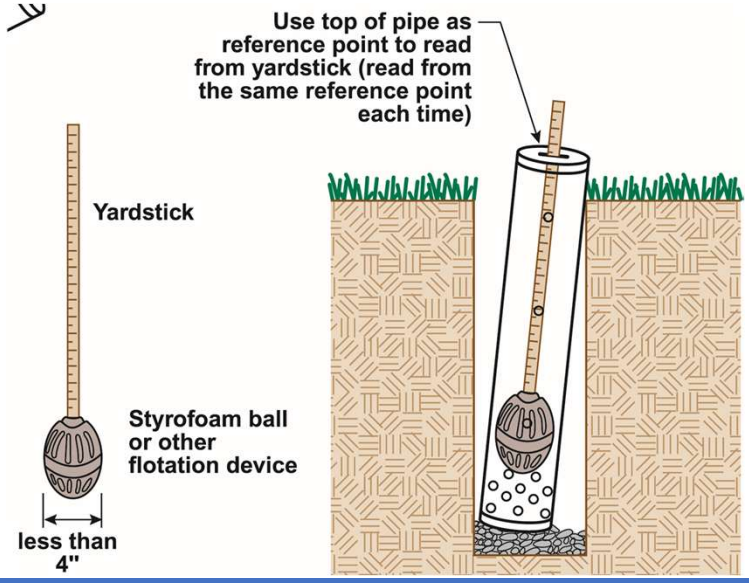
Turn to Chapter 73.15(7) in the regulation book

(i) Measurement to the water level in the individual percolation holes shall be made from a fixed reference point and shall continue at the interval determined from paragraph (6) for each individual percolation hole until a minimum of eight readings are completed or until a stabilized rate of drop is obtained whichever occurs first. A stabilized rate of drop means a difference of 1/4 inch or less of drop between the highest and lowest readings of four consecutive readings.

REFERENCE POINT

- You need to establish a reference point to use on all the holes.
- The reference point is the level you fill the water to after each reading on the yardstick.
- According to the regulations, you must fill each hole with approximately 6 inches of water.

REFERENCE POINT



45

INITIAL & FINAL PRESOAKS

(5) Procedure for presoaking. Holes shall be presoaked, according to the following procedure, to approximate normal wet weather or in-use conditions in the soil:

Turn to Chapter 73.15(5) in the regulation book

(i) Initial presoak. Holes shall be filled with water to a minimum depth of 12 inches over the gravel and allowed to stand undisturbed for 8 to 24 hours prior to the percolation test.

(ii) Final presoak. Immediately before the percolation test, water shall be placed in the hole to a minimum depth of 6 inches over the gravel and readjusted every 30 minutes for 1 hour.

46

INITIAL & FINAL PRESOAKS

Two presoaks must be performed before the percolation test:

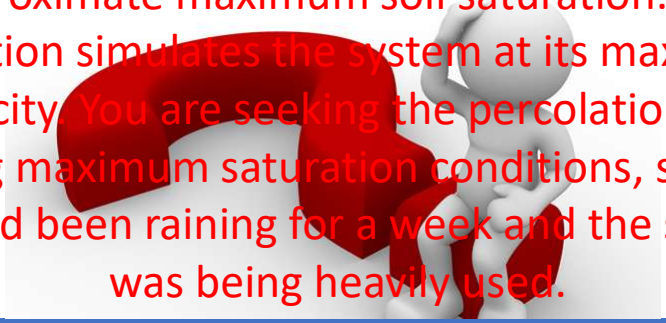
1) Initial presoak
2) Final presoak

47

QUESTION

Why must the holes be presoaked before the test?

The test needs to be done under conditions that approximate maximum soil saturation. This condition simulates the system at its maximum capacity. You are seeking the percolation rate during maximum saturation conditions, such as if it had been raining for a week and the system was being heavily used.



48

INITIAL & FINAL PRESOAKS

For the initial presoak, place 2 inches of clean coarse sand or fine aggregate in the bottom of each hole.

Fill the hole with water to a minimum depth of 12 inches over the sand or fine aggregate and let it sit for 8 to 24 hours.

49

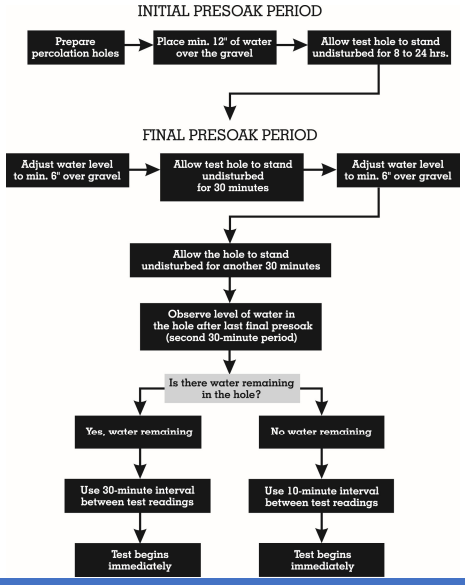
QUESTION

Why should the sand or aggregate be placed in the bottom of the hole?

This protects the soil from clogging or scouring the pores, which would give you inaccurate readings.

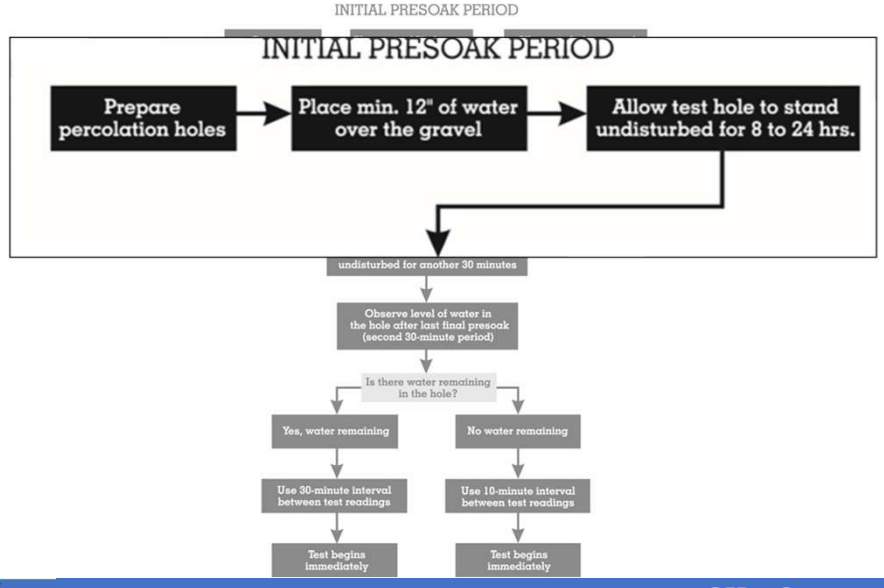
50

INITIAL & FINAL PRESOAKS



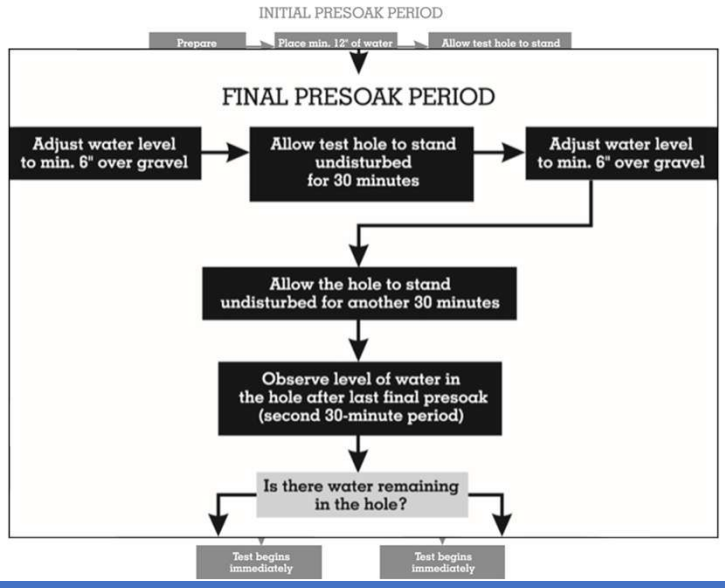
51

INITIAL & FINAL PRESOAKS



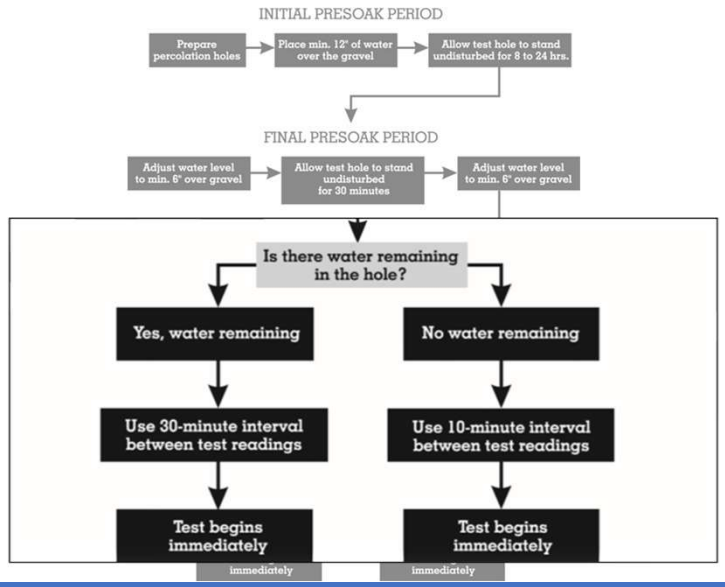
52

INITIAL & FINAL PRESOAKS



53

INITIAL & FINAL PRESOAKS



54

QUESTION

Why do a final presoak?

The second 30-minute final presoak reading determines if the measurement interval on that hole will be 10 or 30 minutes for the remainder of the test.

55

10- OR 30-MINUTE READINGS

- If the hole is dry at the end of the second 30-minute final presoak, put an "×" on the percolation form in the "no" column and do 10-minute readings. This means the hole could not hold 6 inches of water in 30 minutes.

Hole No.	*** Yes	No	Reading Interval	Reading No. 1: Inches of drop	Reading No. 2: Inches of drop	Reading No. 3: Inches of drop	Reading No. 4: Inches of drop	Reading No. 5: Inches of drop	Reading No. 6: Inches of drop	Reading No. 7 Inches of drop	Reading No. 8: Inches of drop
			10 / 30								
			10 / 30								
			10 / 30								
			10 / 30								
			10 / 30								
			10 / 30								

***Water remaining in the hole at the end of the final 30-minute presoak? Yes, use 30-minute interval; No, use 10-minute interval.

56

10- OR 30-MINUTE READINGS

- If there is water left in the hole after the final presoak, check "yes" and continue to do 30-minute readings. This means the hole can hold 6 inches of water in 30 minutes.

Hole No.	*** Yes	*** No	Reading Interval	Reading No. 1: Inches of drop	Reading No. 2: Inches of drop	Reading No. 3: Inches of drop	Reading No. 4: Inches of drop	Reading No. 5: Inches of drop	Reading No. 6: Inches of drop	Reading No. 7 Inches of drop	Reading No. 8: Inches of drop
			10 / 30								
			10 / 30								
			10 / 30								
			10 / 30								
			10 / 30								
			10 / 30								

***Water remaining in the hole at the end of the final 30-minute presoak? Yes, use 30-minute interval; No, use 10-minute interval.

57

10- OR 30-MINUTE READINGS

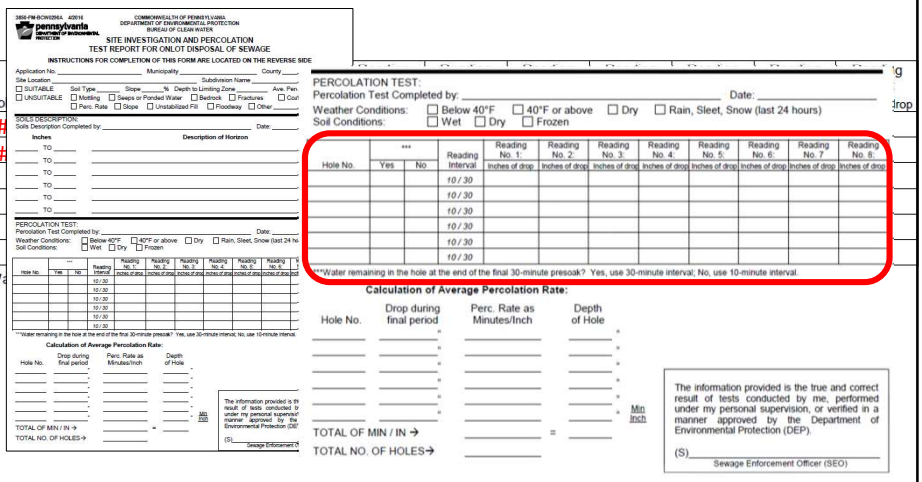
- Under the "reading interval" column, circle 10 or 30 showing that the hole requires a 10- or 30-minute reading.

Hole No.	*** Yes	*** No	Reading Interval	Reading No. 1: Inches of drop	Reading No. 2: Inches of drop	Reading No. 3: Inches of drop	Reading No. 4: Inches of drop	Reading No. 5: Inches of drop	Reading No. 6: Inches of drop	Reading No. 7 Inches of drop	Reading No. 8: Inches of drop
			10 / 30								
			10 / 30								
			10 / 30								
			10 / 30								
			10 / 30								
			10 / 30								

***Water remaining in the hole at the end of the final 30-minute presoak? Yes, use 30-minute interval; No, use 10-minute interval.

58

PERC TEST FORM



PERCOLATION TEST:
Percolation Test Completed by: _____ Date: _____
Weather Conditions: ☐ Below 40°F ☐ 40°F or above ☐ Dry ☐ Rain, Sleet, Snow (last 24 hours)
Soil Conditions: ☐ Wet ☐ Dry ☐ Frozen

Hole No.	*** Yes	*** No	Reading Interval	Reading No. 1: Inches of drop	Reading No. 2: Inches of drop	Reading No. 3: Inches of drop	Reading No. 4: Inches of drop	Reading No. 5: Inches of drop	Reading No. 6: Inches of drop	Reading No. 7 Inches of drop	Reading No. 8: Inches of drop
			10 / 30								
			10 / 30								
			10 / 30								
			10 / 30								
			10 / 30								
			10 / 30								

***Water remaining in the hole at the end of the final 30-minute presoak? Yes, use 30-minute interval; No, use 10-minute interval.

Calculation of Average Percolation Rate:

Hole No.	Drop during final period		Perc. Rate as Minutes/Inch		Depth of Hole	
		*		*		*
		*		*		*
		*		*		*
		*		*		*
		*		*		*
		*		*		*
TOTAL OF MIN / IN →				=		Min / Inch
TOTAL NO. OF HOLES→						

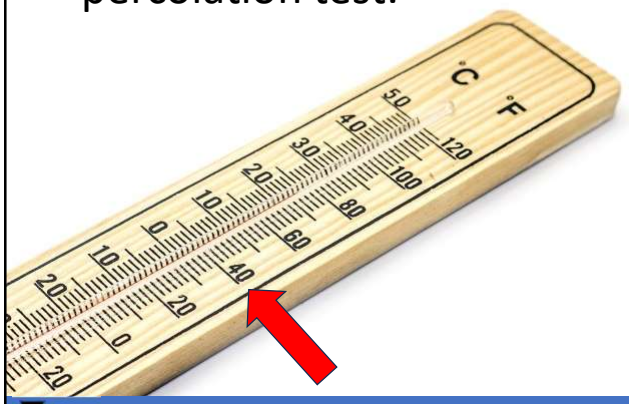
The information provided is the true and correct result of tests conducted by me, performed under my personal supervision, or verified in a manner approved by the Department of Environmental Protection (DEP).

(S)_____
Sewage Enforcement Officer (SEO)

59

WEATHER

It is DEP policy for air temperature to be above 40 degrees when performing a percolation test.



60

QUESTION

Should a percolation test be done while it is raining?

No. It is not recommended to do a test during the rain. The physical rain that runs into the holes can alter the results.

61

WEATHER

Record weather information on test form…

PERCOLATION TEST:
Percolation Test Completed by: Date:
Weather Conditions: ☐ Below 40°F ☐ 40°F or above ☐ Dry ☐ Rain, Sleet, Snow (last 24 hours)
Soil Conditions: ☐ Wet ☐ Dry ☐ Frozen

Hole No.	*** Yes	*** No	Reading Interval	Reading No. 1: Inches of drop	Reading No. 2: Inches of drop	Reading No. 3: Inches of drop	Reading No. 4: Inches of drop	Reading No. 5: Inches of drop	Reading No. 6: Inches of drop	Reading No. 7 Inches of drop	Reading No. 8: Inches of drop
			10 / 30								

62

STABILIZE READINGS

(i) Measurement to the water level in the individual percolation holes shall be made from a fixed reference point and shall continue at the interval determined from paragraph (6) for each individual percolation hole until a minimum of eight readings are completed or until a stabilized rate of drop is obtained whichever occurs first. A stabilized rate of drop means a difference of 1/4 inch or less of drop between the highest and lowest readings of four consecutive readings.

Turn to Chapter 73.15(7)(i) in the regulation book

63

STABILIZE READINGS

A stabilized reading means that the difference between the highest and lowest reading is not more than 1/4 of an inch in any four consecutive readings after the final presoak.

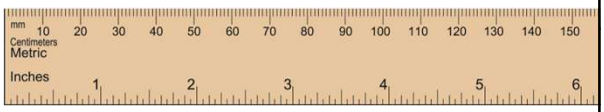
If the hole does not stabilize in any four consecutive readings, then the eighth reading becomes the stabilized reading.

64

SAMPLE PROBLEM

Determine if holes #1 and #2 are stabilized in the four given readings.

Hole No.	Yes/No ***		Reading Interval	Reading No. 1: inches of drop	Reading No. 2: inches of drop	Reading No. 3 inches of drop	Reading No. 4 inches of drop	R N i o
#1	x		10/30	1	1/2	1/4	1/4	
#2		x	10/30	1-1/2	1-5/8	1-3/4	1-1/2	



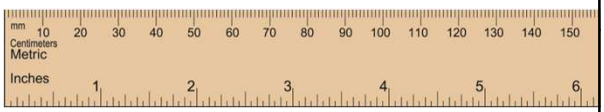
65

SAMPLE PROBLEM

Hole #1 – Are these readings stabilized?

Hole No.	Yes/No ***		Reading Interval	Reading No. 1: inches of drop	Reading No. 2: inches of drop	Reading No. 3 inches of drop	Reading No. 4 inches of drop	R N i o
#1	x		10/30	1	1/2	1/4	1/4	

No, these readings are not stabilized. There is a greater than ¼-inch difference between the greatest drop (1 in.) and the least drop (1/4 in.). You need to continue testing until the hole is stabilized.



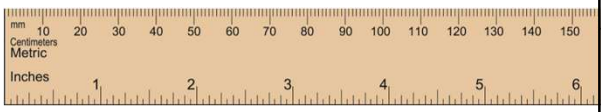
66

SAMPLE PROBLEM

Hole #2 – Are these readings stabilized?

Hole No.	Yes/No ***		Reading Interval	Reading No. 1: inches of drop	Reading No. 2: inches of drop	Reading No. 3 inches of drop	Reading No. 4 inches of drop	R N i o
#2		x	10 30	1-1/2	1-5/8	1-3/4	1-1/2	

Yes, these readings are stabilized. There is no more than a ¼-inch difference between the greatest drop (1¾ in.) and the least drop (1½ in.).



67

EXERCISE

Hole No.	Yes/No ***		Reading Interval	Reading No. 1: inches of drop	Reading No. 2: inches of drop	Reading No. 3 inches of drop	Reading No. 4 inches of drop	Reading No. 5 inches of drop	Reading No. 6 inches of drop	Reading No. 7 inches of drop	Reading No. 8 inches of drop
#1	x		10 30	1-3/4	1-1/2	1-5/8	1-7/8				
#2		x	10 30	2-3/8	2-1/4	2-1/2	2-1/2				
#3	x		10 30	5-1/2	5-7/8	5-5/8	5-1/2				

Hole #1—Are these readings stabilized?

No. 1-1/2 least; 1-7/8 greatest – difference is 3/8

Hole #2—Are these readings stabilized?

Yes. 2-1/4 least; 2-1/2 greatest – difference is 1/4

68

EXERCISE

Hole No.	Yes/No ***		Reading Interval	Reading No. 1: inches of drop	Reading No. 2: inches of drop	Reading No. 3 inches of drop	Reading No. 4 inches of drop	Reading No. 5 inches of drop	Reading No. 6 inches of drop	Reading No. 7 inches of drop	Reading No. 8 inches of drop
#1	x		10/30	1-3/4	1-1/2	1-5/8	1-7/8				
#2		x	10/30	2-3/8	2-1/4	2-1/2	2-1/2				
#3	x		10/30	5-1/2	5-7/8	5-5/8	5-1/2				

Hole #3—Are these readings stabilized?

No. 5-1/2 least; 5-7/8 greatest – difference is 3/8

69

CALCULATION

CALCULATION OF AVERAGE PERCOLATION RATE

70

FRACTION TO DECIMALS

To calculate the average percolation rate, you must first convert all fractions to a decimal for each final established reading. To change fractions to a decimal, divide the fraction.

71

FRACTION TO DECIMALS

Examples:

1/8 = 1 ÷ 8 = 0.125
2-5/8 = 5 ÷ 8 = .625 + 2 = 2.625

This decimal number is placed under the "Drop during final period" column for each hole on the percolation test form.

72

FRACTION TO DECIMALS

PERCOLATION TEST:
Percolation Test Completed by: _____ Date: _____
Weather Conditions: ☐ Below 40°F ☐ 40°F or above ☐ Dry ☐ Rain, Sleet, Snow (last 24 hours)
Soil Conditions: ☐ Wet ☐ Dry ☐ Frozen

Hole No.	*** Yes	No	Reading Interval	Reading No. 1: Inches of drop	Reading No. 2: Inches of drop	Reading No. 3: Inches of drop	Reading No. 4: Inches of drop	Reading No. 5: Inches of drop	Reading No. 6: Inches of drop	Reading No. 7 Inches of drop	Reading No. 8: Inches of drop
			10 / 30								
			10 / 30								
			10 / 30								
			10 / 30								
			10 /								

***Water remaining in the hole at t… the final 30-minute presoak? Yes, use 30-minute interval; No, use 10-minute interval.

Calculation of Average Percolation Rate:

Hole No.	Drop during final period	Perc. Rate as Minutes/Inch	Depth of Hole
_____	_____ "	_____	_____ "
_____	_____ "	_____	_____ "
_____	_____ "	_____	_____ "
_____	_____ "	_____	_____ "
_____	_____ "	_____	_____ "
_____	_____ "	_____	_____ " Min / Inch
TOTAL OF MIN / IN →		_____ =	_____

The information provided is the true and correct result of tests conducted by me, performed under my personal supervision, or verified in a manner approved by DEP.

(S)_____
Sewage Enforcement Officer

PASEO Roger Lehmann 78

73

FRACTION TO DECIMALS

Hole No.	Yes/No ***		Reading Interval	Reading No. 1: inches of drop	Reading No. 2: inches of drop	Reading No. 3 inches of drop	Reading No. 4 inches of drop	Reading No. 5 inches of drop	Reading No. 6 inches of drop	Reading No. 7 inches of drop	Reading No. 8 inches of drop
#1	x		10/30	1-3/4	1-1/2	1-5/8	1-7/8	*1-3/4*	*1-7/8*		
#2		x	10/30	2-3/8	2-1/4	2-1/2	2-1/2				
#3	x		10/30	5-1/2	5-7/8	5-5/8	5-1/2	*5-5/8*	*5-1/4*	*5-1/2*	*5-5/8*

Calculation of Average Percolation Rate:

Hole No.	Drop during final period	Perc. Rate as Minutes/Inch	Depth of Hole
#1	1.875 "		"
#2	2.5 "		"
#3	5.625 "		"
	"		"
	"		"

PASEO Roger Lehmann 79

74

MINUTES PER INCH

Once you convert the stabilized reading to a decimal, you must calculate the percolation rate by dividing the time interval for the readings for that hole (10 or 30) by the inches of drop during the final stabilized period (expressed in decimals).

75

MINUTES PER INCH

Examples:

30 minutes ÷ 0.125 inches = 240 minutes/inch
10 minutes ÷ 3.25 inches = 3.1 minutes/inch

The 240 minutes/inch and 3.1 minutes/inch would be recorded under the “percolation rate as minutes/inch” column on the percolation test form.

76

MINUTES PER INCH

Hole No.	Yes/No ***		Reading Interval	Reading No. 1: inches of drop	Reading No. 2: inches of drop	Reading No. 3 inches of drop	Reading No. 4 inches of drop	Reading No. 5 inches of drop	Reading No. 6 inches of drop	Reading No. 7 inches of drop	Reading No. 8 inches of drop
#1	x		10/30	1-3/4	1-1/2	1-5/8	1-7/8	*1-3/4*	*1-7/8*		
#2		x	10/30	2-3/8	2-1/4	2-1/2	2-1/2				
#3	x		10/30	5-1/2	5-7/8	5-5/8	5-1/2	*5-5/8*	*5-1/4*	*5-1/2*	*5-5/8*

Calculation of Average Percolation Rate:

Hole No.	Drop during final period	Perc. Rate as Minutes/Inch	Depth of Hole
#1	1.875 "	16	"
#2	2.5 "	4	"
#3	5.625 "	5.3	"
	"		"
	"		"

77

MINUTES PER INCH

CONVERSION TABLE FOR DROP OF WATER LEVEL IN STANDARD PERCOLATION TEST HOLES

Drop in 1/8" Increments	Equivalent in Inches	30-Minute Interval Between Readings	10-Minute Interval Between Readings
less than 1/8	0.000	240	*
1/8	0.125	240	*
1/4	0.25	120	*
3/8	0.375	80	26.7
1/2	0.5	60	20
5/8	0.625	48	16
3/4	0.75	40	13.3
7/8	0.875	34.3	11.4
1	1.0	30	10
1 1/8	1.125	26.7	8.9
1 1/4	1.25	24	8.0
1 3/8	1.375	21.8	7.3
1 1/2	1.5	20	6.7
1 5/8	1.625	18.5	6.2
1 3/4	1.75	17.1	5.7
1 7/8	1.875	16	5.3
2	2.0	15	5

78

EXERCISE

Hole No.	Yes/No ***		Reading Interval	Reading No. 1: inches of drop	Reading No. 2: inches of drop	Reading No. 3 inches of drop	Reading No. 4 inches of drop	Reading No. 5 inches of drop	Reading No. 6 inches of drop	Reading No. 7 inches of drop	Reading No. 8 inches of drop
#1	x		10/30	1-3/4	1-1/2	1-5/8	1-7/8	1-3/4	1-7/8	1-3/4	1-7/8
#2		x	10/30	2-3/8	2-1/4	2-1/2	2-1/2	2-1/4	2-1/4	2-1/2	2-1/2
#3	x		10/30	5-1/2	5-7/8	5-5/8	5-1/2	5-5/8	5-1/4	5-1/2	5-5/8
#4	x		10/30	1/4	1/8	1/4	7/8	1/4	1/4	1/4	1/4
#5	x		10/30	1-3/4	1-3/4	1-5/8	1-1/4	1	1-1/4	1-5/8	1-5/8
#6	x		10/30	1/4	1/4	1/2	1/2	1/4	3/8	1	1/4

Hole No.	Drop during final period	=	Perc. rate as minutes/inch	Depth of hole
1	1.875	=	16	20"
2	***2.5***	=	***4***	20"
3	***5.625***	=	***5.3***	20"
4	***.25***	=	***120***	20"
5	***1.625***	=	***18.5***	20"
6	***.5***	=	***60***	20"

79

PERCOLATION TEST

There are a few scenarios you may encounter while taking a percolation test.

80

PERC HOLE TOO SLOW

(iii) When the rate of drop in a percolation test is too slow to obtain a measurable rate, the rate of 240 minutes per inch shall be assigned to that hole for use in calculating the arithmetic average percolation rate. The absorption area may be placed over holes with no measurable rate when the average percolation rate for the proposed absorption area is within the limits established in §73.16 (relating to absorption and spray field area requirements), Table A.

Turn to Chapter 73.15(7)(iii) in the regulation book

81

PERC HOLE TOO SLOW

If the percolation rate is too slow (less than 1/8 in.), zero, or not measurable, a value of 240 minutes per inch should be assigned to that hole for use in calculating the average percolation rate.

82

PERC HOLE TOO FAST

(iv) When a percolation test hole is dry at the end of a 10 minute testing interval, that hole may not be used in the calculation of the arithmetic average percolation rate. If 1/3 or more of the percolation test holes are dry at the end of a 10 minute testing interval, the proposed absorption area may not be designed or installed over these holes unless the local agency determines that an anomaly caused the fast percolation rate and a retest of the area is within the acceptable percolation rate limits. If no anomaly is discovered, the local agency may accept the percolation test results from the remaining holes if the results are supplemented with the results of additional percolation testing conducted outside of the area in which the dry percolation holes were found.

Turn to Chapter 73.15(7)(iv) in the regulation book

83

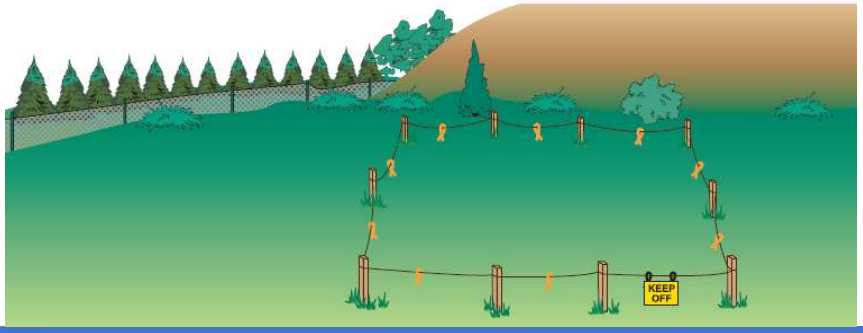
PER HOLE TOO FAST

This section gives the local agency some power to decide how to handle fast holes (a third or more of the holes are dry at the end of a 10-minute reading interval at the end of the test).

84

STAKING OUT THE SITE

When you have completed the testing and have the location of the site, stake the site to prevent it from being destroyed during construction of the building.



85

AVERAGE PERC RATE

To determine the average percolation rate (expressed in minutes/inch) for all six holes, add up the minutes/inch for each hole and divide by the number of holes tested. This gives you the average percolation rate.

86

AVERAGE PERC RATE

Hole No.	Drop during final period	=	Perc. rate as minutes/inch	Depth of hole
1	1.875	=	16	20"
2	2.5	=	4	20"
3	5.625	=	5.3	20"
4	.25	=	120	20"
5	1.625	=	18.5	20"
6	.5	=	60	20"
			Sum = 223.8	

CALCULATION AVERAGE:

TOTAL OF MIN / IN → 223.8 = 37.3 min/in

TOTAL NO. OF HOLES → 6

(PERC RATE AVERAGE = 223.8 ÷ 6 = 37.3 min/in)

87

QUESTION

What does the average percolation rate (37.3 minutes/inch) tell us?

It takes 37.3 minutes for one inch of water to percolate through the soil.

88

SQ FT OF AGGREGATE

The average percolation rate we just calculated is used to determine the amount of square feet of aggregate needed for the absorption area.

89

SQ FT OF AGGREGATE

§73.16, TABLE A

Minimum Aggregate Absorption Area Requirements for Treatment Tank Effluent:

	Square Feet of Aggregate Area Per Gallon Per Day	
Average Percolation Rate Expressed as Minute Per Inch	*All Systems Except Elevated Sand Mounds and Subsurface Sand Filters*	*Subsurface Sand Filters and Elevated Sand Mounds*
Less than 3.0[D]	Unsuitable	Unsuitable
3 - 5[C]	Unsuitable	1.50[AB]
6 - 15[C]	1.19[B]	1.50[AB]
16 - 30[C]	(Avg. Perc Rate - 15) x (0.040) + 1.19[B]	1.50[AB]
31 - 45[C]	(Avg. Perc Rate - 30) x (0.030) + 1.79[B]	(Avg. Perc Rate - 30) x (0.026) + 1.50[AB]
46 - 60[C]	(Avg. Perc Rate - 45) x (0.028) + 2.24[B]	(Avg. Perc Rate - 45) x (0.022) + 1.89[A]
61 - 90[C]	(Avg. Perc Rate - 60) x (0.023) + 2.66[A]	(Avg. Perc Rate - 60) x (0.020) + 2.22[A]
91 - 120[ACD]	Unsuitable	(Avg. Perc Rate - 90) x (0.017) + 2.82[A]
121 - 150[CD]	Unsuitable	((Avg. Perc Rate - 120) x (0.015) + 3.33) (1.05)[A]
151 - 180[CD]	Unsuitable	((Avg. Perc Rate - 150) x (0.014) + 3.78) (1.10)[A]
Greater than 181[CD]	Unsuitable	Unsuitable

90

SAMPLE PROBLEM

SQUARE FEET OF AGGREGATE

Using the formula for an elevated sand mound and a 400 gpd design flow, calculate the needed square feet of aggregate using Table A in Section 73.16 in the regulations.

91

SAMPLE PROBLEM

Formula from regulations:

[(Avg. perc. rate – 30) × (0.026)] + 1.50 = square feet of aggregate per gallon per day

Formula with data from exercise 9-3 included:

[(37.3 - 30) × 0.026]+ 1.50 = 1.69 sq. ft./gal

92

SAMPLE PROBLEM

Multiply the answer by the gpd for the system:

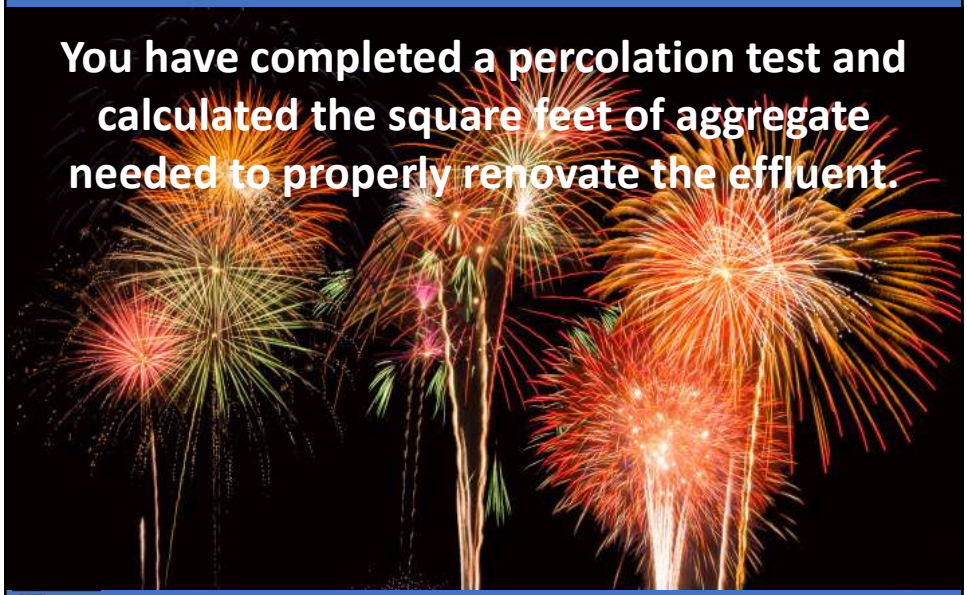
1.69 sq. ft./gal × 400 gpd = 676 sq. ft.

Min. sq ft of aggregate required for system = 676 sq. ft.

93

CONGRATULATIONS!

You have completed a percolation test and calculated the square feet of aggregate needed to properly renovate the effluent.



94

KEY POINTS

- The soil probe determines the general location of your percolation holes.
- The presoaks are to help create a saturated situation.
- You stop conducting the percolation test on a hole when the readings are stabilized or the eighth reading, whichever comes first.
- The percolation rate and the daily flow requirement are needed to determine the size of the system.