


March 2016 Septic Training

Connecticut Department of Public Health
Keeping Connecticut Healthy

* Presentation Topics


- EEP updates
- Web page items
- Safety, Sizing and Siting
- MLSS



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* Technical Standards

- * Code Advisory Committee
 - * CT Department of Energy & Environmental Protection
 - * CT Home Builders & Remodelers Association
 - * CT Environmental Health Association
 - * CT Association of Directors of Health
 - * CT Engineering Associations
 - * CT On-site Wastewater Recycling Association
 - * CT Soil Scientists
 - * DPH



CONNECTICUT PUBLIC HEALTH CODE
On-site Sewage Disposal Regulations, and Technical Standards for Subsurface Sewage Disposal Systems

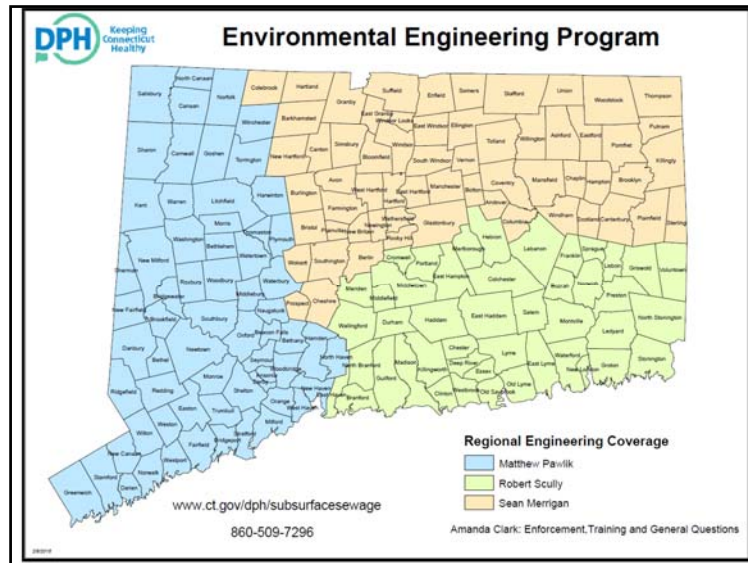
PHC Section 19-13-B100a (e.g., Building Conversions, Changes in Use, Building Additions)
Effective August 3, 1998

PHC Section 19-13-B103 (Design Flows 5,000 Gallons per Day or Less)
Effective August 16, 1982

Technical Standards for Subsurface Sewage Disposal Systems
Effective August 16, 1982
Former revisions: 1986, 1989, 1992, 1994, 1997, 2000, 2004, 2007, 2009, 2011
Revised January 1, 2015

PHC Section 19-13-B104 (Design Flows Greater than 5,000 Gallons per Day)
Effective August 16, 1982

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January 2015



DPH * Secondary Safety Lid

- * Septic tank, pump chamber, holding tanks and grease interceptor tank covers shall be kept on the tank when riser assemblies are utilized, and in no case shall a cover be left off a tank when the riser cover weighs less than 59 pounds unless a secondary safety lid or device is provided below the riser cover.
- * Retroactive requirement

DPH * Secondary Safety Lid

DPH * Sizing

- * Outbuilding means an ancillary structure served by a water supply and sewage system that is located on a lot with an associated primary residential building, which cannot be split off and sold separately from the primary building. Outbuildings: detached garages w/ ½ bath, pool house cabanas, guest bedroom/rec bldg., in-law apartments, etc.

DPH * **Sizing**

- * Reserve areas are not required for outbuildings w/ design flows of 150 GPD or less on single-family residential building lots.
- * 1-bedroom leaching system sizing for residential outbuildings on single-family residential building lots. Minimum ELA is 50% of the required 2-bedroom ELA. MLSS Flow Factor would be 0.5

DPH * **Sizing Multi-family**

- * Table 5: includes the minimum septic tank capacities for residential buildings.

B. Septic tank capacities

1. Residential Buildings

The minimum liquid capacities/volumes of septic tanks serving residential buildings shall be based on Table 5.

Table 5

	Single-family	Multi-family
1-3 bedrooms	1,000 gallons	1250 gallons
4 bedrooms	1250 gallons	1250 gallons
For each bedroom beyond 4	Add 125 gallons per bedroom	Add 250 gallons per bedroom

- * Table 6: Required ELA for multi-family residential building shall be based on a minimum of 4 bedrooms.

DPH * **Sizing: Leaching Systems**

- * Leaching trenches and galleries with perforated piping (SDR 35) on the top of the system's stone: ELA credit increased by 0.6 SF/LF for trenches and 12 inch galleries. All other galleries ELA credit increased by 0.8 SF/LF.

.6 increase in credit

6 inches

10 inches

Filter Fabric

6 inches

6 inches

Pipe cradled in stone to prevent fabric from obstructing perforations

DPH * **Sizing**

- * Proprietary pressure-dosed dispersal system added to Technical Standards.
- * A manufactured dosing and dispersal system that uniformly applies effluent into the receiving soil via small diameter holes in small diameter distribution piping.
- * Sized based on 3 foot trench equivalent.

DPH * Sizing


- * Perc Rite drip irrigation (dispersal) system
- * DPH Approval stipulates minimum linear footage to be 4 times the required linear footage of a 3-foot wide trench system.
- * Minimum tube spacing is 1.5 feet center to center (minor deviations allowed-around tree, etc.).

DPH * Sizing: Center to Center

- * Reduced center to center spacing for certain leaching systems possible, upon application to DPH
- * Approval for Geomatrix GeoMat spacing reduction pending.

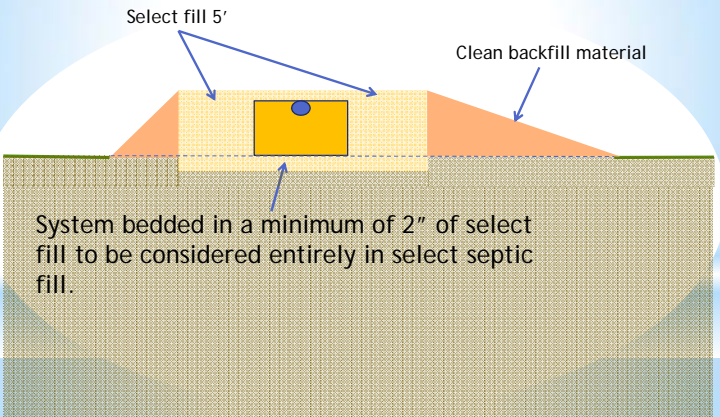
DPH * Sizing

- * Leaching system elevated entirely in select fill can be sized on anticipated perc rate of select fill. (change from 10.1-20 minimum)
- * Confirmation perc test required.



DPH * Elevated Entirely in Select Fill

*Elevated means 50% or more of the system above existing grade.



Select fill 5'

Clean backfill material

System bedded in a minimum of 2" of select fill to be considered entirely in select septic fill.

DPH * **Elevated Entirely in Select Fill**

*Elevated means 50% or more of the system above existing grade.

Select fill 5'

Clean backfill material

System bedded in a minimum of 2" of select fill to be considered entirely in select septic fill.

DPH * **Not Entirely in Select Fill**

Not bedded in select fill

- ELA calculated on perc rate in natural soil

DPH * **Siting: Vertical Control**

- * Non-Engineered repair plans shall include information about the placement of the leaching system relative to *restrictive layers*.
- * How deep into grade?

GW at 26"
Bottom no more than 8" into grade


18" to groundwater

DPH * **Siting: Table 1 Item S**

- * Grade cuts or soil disturbances down gradient of a leaching system.
- * Grade cuts within 50 feet not allowed if bleed-out may be a concern.
- * LHD may reduce distance if demonstrated that cut/soil disturbance does not diminish the receiving soil necessary for the proper operation of the leaching system.

DPH * **Siting: Costal Areas**

- * Sites with tidally impacted groundwater table
 - * Minimum separation distance for the bottom of the leaching system above maximum groundwater shall be 24 inches.
 - * Max. groundwater determination shall take into account water level rise associated with high tides.



* **Minimum Leaching System Spread (MLSS)**


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DPH * **Pre-MLSS**

- * 1982 Health Code requires sufficient naturally occurring soil to handle sewage flow and allows for hydraulic assessments.
- * Natural soil does not include fill
- * Design Manual for early 80's provides guidance on hydraulic assessments based on Darcy's law.

DPH * **Henry Darcy**



The Public Fountains of the City of Dijon

Henry Darcy, 1856
English Translation by Patricia Rebeck

- Henry Darcy, a French engineer, was commissioned by the city of Dijon to find a solution for cleaning the city's water supply contaminated by the waste of the mustard industry.
- Darcy conducted experiments with sand packed filters .
- The work of Darcy published in 1856 and provides the law of fluid flow through a porous media.

DPH * **Darcy's Experiments**

* Discharge is Proportional to

- * Area
- * Head difference

Inversely proportional to

- * Length

* Coefficient of proportionality is

$K = \text{hydraulic conductivity}$

$Q \propto A \frac{h_1 - h_2}{L}$

$Q = -KA \frac{\Delta h}{L}$

DPH * **Site Hydraulics**

- * Modified Darcy's Law
- * $Q = KiA$
- * $Q = \text{Flow}$
- * $K = \text{Permeability}$
- * $i = \text{Hydraulic gradient}$
- * $A = \text{Soil Area}$

DPH * **What is Permeability?**

* Permeability is the measure of the soil's ability to permit water to flow through its pores or voids.

Loose soil

- easy to flow
- **high permeability**

Dense soil

- difficult to flow
- **low permeability**

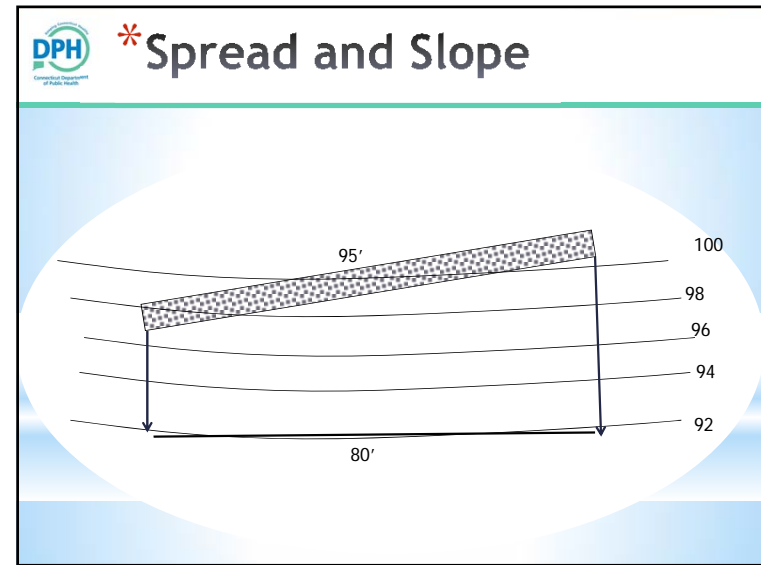
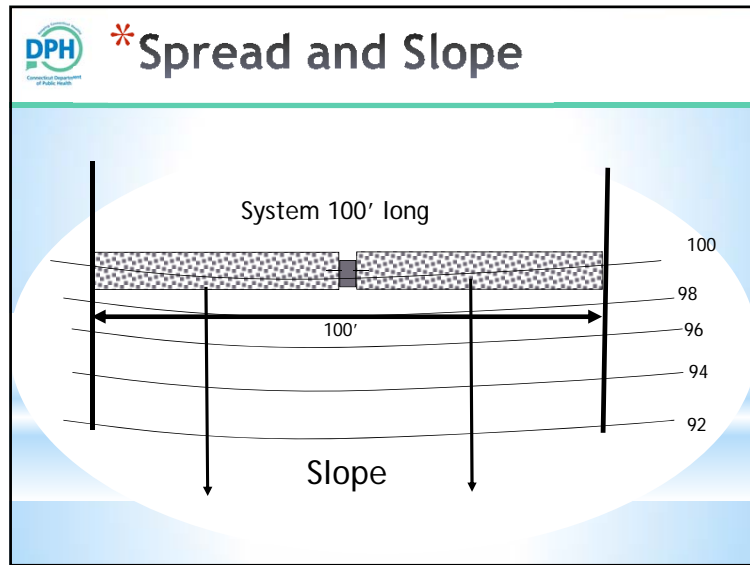
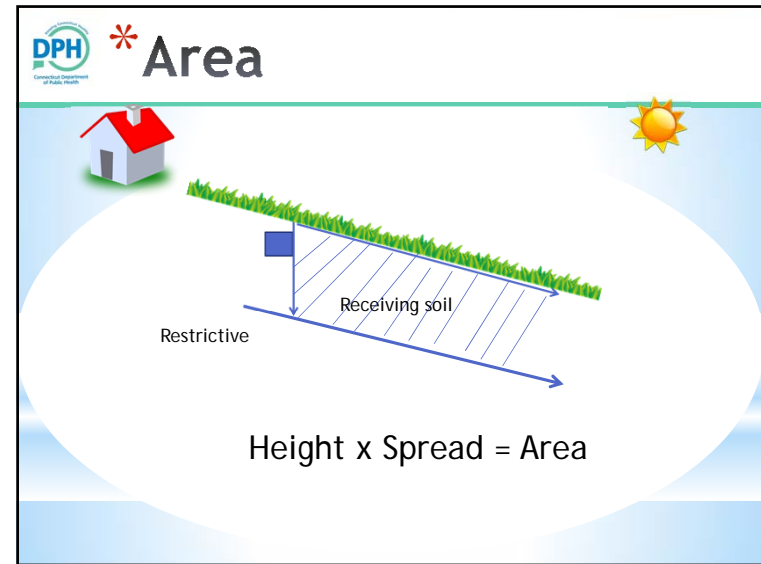
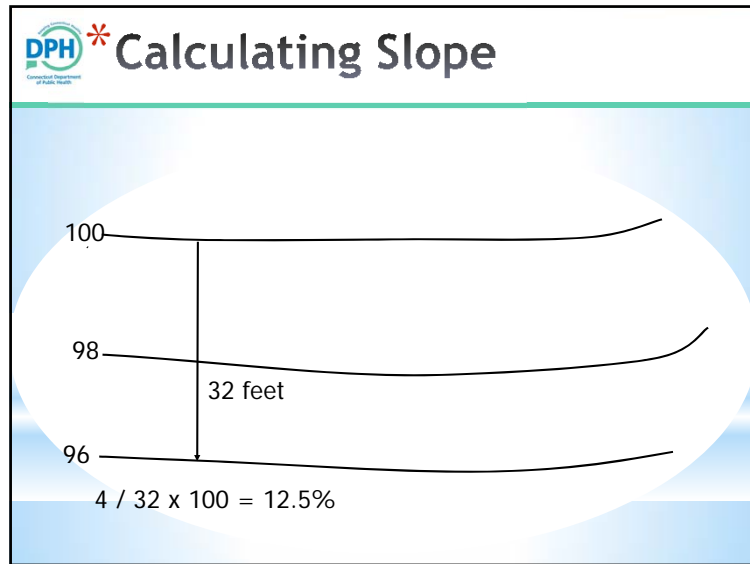
DPH * **Hydraulic gradient**

Groundwater slope

Slope = rise/run

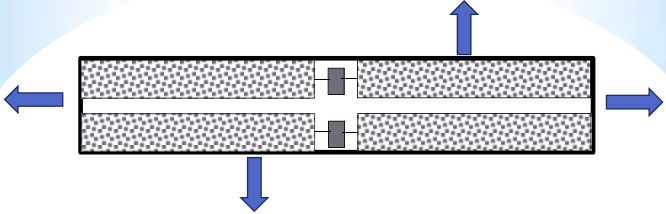
Well

Rear Property Line



DPH * **Spread Flat GW**

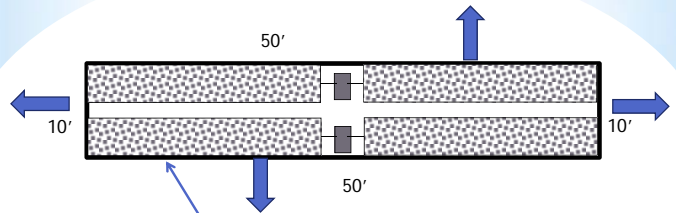
What is a flat GW table lot?



- Typically found in areas with sand and gravel type soils
- Shoreline areas
- Determination should be made based on actual GW elevations in the area

DPH * **Spread Flat GW**

Spread flat GW lots



Spread can be measured around the perimeter of leaching system

$MLSS = 50+50+10+10 = 120'$ total

DPH * **Minimum Leaching System Spread (MLSS)**

- * Simplified method to address site hydraulics based on Darcy's law introduced into the TS in 1994 based on natural soils only.
- * Not applicable for reserve areas.
- * Minimum spread based on design flow, perc rate, hydraulic gradient and available depth of receiving soil.
- * Hydraulic Analysis not needed if MLSS (or loading test) compliance is demonstrated.

DPH * **MLSS**

- * In 2011 modified to consider fill (select or existing) for repairs thru a Non-Compliant Repair (NCR) analysis.
- * In 2015 further modified:
 - PE plan requirement reduced to 25% or less.
 - Standardized determination of depth of receiving soil.

DPH * **MLSS Definitions**

- **Hydraulic gradient** means the percent slope of the naturally occurring grade, or when demonstrated slope of restrictive layer.
 - If groundwater table that has been confirmed to be flat (essentially 0%), then radial flow applies.
 - Slope based on naturally occurring soil shall be evaluated in leaching system area and to at least 25 feet down-gradient.
- **Leaching system spread** means the leaching system length of effluent application to the receiving soil.

DPH * **MLSS Definitions**

- **Restrictive layer** means the first layer beneath the receiving soil that impedes downward movement of effluent.
 - ledge rock
 - maximum groundwater (redoximorphic features/mottling or groundwater monitoring)
 - groundwater monitoring: average of at least 5 consecutive weekly readings taken during the most restrictive 30-day period of the wet season (Feb. 1 - May 31)
 - impervious soil (percolation rate slower than 60 minutes per inch).

DPH * **MLSS Definitions**

- **Receiving soil** is the soil in the leaching system area and surrounding soil
 - flat groundwater table includes the soil within 25 feet around the perimeter of the leaching system.
 - Lots with a slope
 - Includes the soil 50 feet down-gradient of a large system (2,000 GPD or greater)
 - Includes the soil at least 25 feet down-gradient of a small system.
- **Receiving soil depth (RS Depth)** means the average depth of receiving soil (soil in a leaching system area and surrounding soil) measured down to the restrictive layer.

DPH * **Receiving Soil on Sloped Lots**

RS Depth = average depth of receiving soil in system area and surrounding soils

DPH * **Receiving Soil on Flat Water Table Lots**

Surrounding Soil

Building Served

Soil in Leaching System Area

25 Feet

25 Feet

25 Feet

RS Depth = average depth of receiving soil in system area and surrounding soils

DPH * **MLSS**

* Leaching systems located 50' apart or greater on a sloped lot.

75'

50'

75'

MLSS = 75' + 75' = 150' of credit

DPH * **MLSS Formula**

- * Hydraulic Factor (HF)
- * Percolation Factor (PF)
- * Flow Factor (FF)

* $MLSS = HF \times PF \times FF$

DPH * **MLSS**

* **Factor tables**

HYDRAULIC FACTORS (HF)						
Hydraulic Gradient (% Slope)						
	1.0	1.5	2.0	2.5	3.0	3.5
0.1 - 0.15	12	14	16	18	20	22
0.15 - 0.20	14	16	18	20	22	24
0.2 - 0.25	16	18	20	22	24	26
0.25 - 0.30	18	20	22	24	26	28
0.3 - 0.35	20	22	24	26	28	30
0.35 - 0.40	22	24	26	28	30	32
0.4 - 0.45	24	26	28	30	32	34
0.45 - 0.50	26	28	30	32	34	36
0.50 - 0.55	28	30	32	34	36	38
0.55 - 0.60	30	32	34	36	38	40
0.60 - 0.65	32	34	36	38	40	42
0.65 - 0.70	34	36	38	40	42	44
0.70 - 0.75	36	38	40	42	44	46
0.75 - 0.80	38	40	42	44	46	48
0.80 - 0.85	40	42	44	46	48	50
0.85 - 0.90	42	44	46	48	50	52
0.90 - 0.95	44	46	48	50	52	54
0.95 - 1.00	46	48	50	52	54	56

FLOW FACTORS (FF)	
Flow Factor = Design Flow / 700	
Design Flow (GPD) / 700	Flow Factor
100	0.14
200	0.29
300	0.42
400	0.57
500	0.71
600	0.86
700	1.00
800	1.14
900	1.29
1000	1.43
1100	1.57
1200	1.71
1300	1.86
1400	2.00
1500	2.14
1600	2.29
1700	2.43
1800	2.57
1900	2.71
2000	2.86
2100	3.00
2200	3.14
2300	3.29
2400	3.43
2500	3.57
2600	3.71
2700	3.86
2800	4.00
2900	4.14
3000	4.29
3100	4.43
3200	4.57
3300	4.71
3400	4.86
3500	5.00
3600	5.14
3700	5.29
3800	5.43
3900	5.57
4000	5.71
4100	5.86
4200	6.00
4300	6.14
4400	6.29
4500	6.43
4600	6.57
4700	6.71
4800	6.86
4900	7.00
5000	7.14
5100	7.29
5200	7.43
5300	7.57
5400	7.71
5500	7.86
5600	8.00
5700	8.14
5800	8.29
5900	8.43
6000	8.57
6100	8.71
6200	8.86
6300	9.00
6400	9.14
6500	9.29
6600	9.43
6700	9.57
6800	9.71
6900	9.86
7000	10.00

PERCOLATION FACTORS (PF)	
Percolation Rate	Percolation Factor (PF)
15.0 in 15 Minutes	1.0
11.1 in 15 Minutes	1.2
10.0 in 30 Minutes	1.5
10.0 in 45 Minutes	1.8
10.0 in 60 Minutes	2.0
10.0 in 75 Minutes	2.2
10.0 in 90 Minutes	2.4
10.0 in 105 Minutes	2.6
10.0 in 120 Minutes	2.8
10.0 in 135 Minutes	3.0
10.0 in 150 Minutes	3.2

DPH * **Flow Factor**

* **FF = Flow Factor**-Based on the number of bedrooms in residential buildings, and design flow for non residential.

- * 1 Bedroom = .5 (including outbuildings)
- * 2 bedrooms = 1.0
- * 3 bedrooms = 1.5
- * 4 bedrooms = 2.0

DPH **Flow Factor**

FLOW FACTORS (FF)

Flow Factor = Design Flow/300

Residential: Design Flow for each bedroom is 150 gallons per day (GPD) except for bedrooms beyond 4 in single-family residential buildings, which have a 75 GPD per bedroom design flow.

Single-family lots:	FF
1 Bedroom = 150/300	0.5
2 Bedroom = 300/300	1.0
3 Bedroom = 450/300	1.5
4 Bedroom = 600/300	2.0
5 Bedroom = 675/300	2.25

Increase FF by 0.25 for each additional bedroom

Multi-family buildings:
Minimum FF is 2.0 (4 bedrooms) and each additional bedroom increases FF by 0.5.

Non-Residential: Design Flow (GPD) / 300

DPH * **MLSS Perc Factor**

* **PF = Percolation Factor**-Based on the percolation rate of the receiving soil

PERCOLATION FACTOR (PF)

Percolation Rate	Percolation Factor (PF)
Up To 5.0 Minutes/Inch	1.0
5.1 To 10.0 Minutes/Inch	1.2
10.1 To 20.0 Minutes/Inch	1.5
20.1 To 30.0 Minutes/Inch	2.0
30.1 To 45.0 Minutes/Inch	3.0
45.1 To 60.0 Minutes/Inch	5.0

Large impact on MLSS requirement.

DPH **Percolation Factor**

- * The percolation rate of the naturally occurring soil is always used for the PF for new systems, B100a code-complying areas (CCA's), and new lot layouts.
- * The percolation rate of the receiving soil is used for non-compliant repairs (NCR MLSS).

DPH **Hydraulic Factor** Hydraulic analysis

HYDRAULIC FACTORS (HF)
Hydraulic Gradient (% Slope)

	<-1.0	1.0-2.0	2.1-3.0	3.1-4.0	4.1-6.0	6.1-8.0	8.1-10.0	10.1-15.0	>15.0
0.1 - 17.9	See Comments in Section VIII A								
18.0 - 22.0	72	62	54	48	42	34	30	28	26
22.1 - 26.0	66	56	48	42	34	30	28	26	24
26.1 - 30.0	56	49	42	34	30	28	26	24	20
30.1 - 36.0	48	42	34	30	28	26	24	20	18
36.1 - 42.0	42	36	30	28	26	24	20	18	16
42.1 - 48.0	36	32	28	26	24	20	18	16	14
48.1 - 60.0	30	28	24	22	20	18	16	14	10
>60.0	MLSS Need Not be Considered								

Receiving Soil Depth (Inches)

RS Depth: means the average depth of soil (soil in a leaching system area and surrounding soil) measured down to the restrictive layer.

DPH * **Use of MLSS Formula**

* Created 3 categories for the use of MLSS:

- 1) New SSDS, code-complying areas and conceptual SSDS for new lots
- 2) Leaching system repairs and B100a potential repair area
- 3) Non-compliant MLSS repairs

DPH * **Conceptual B100a CCA's and new lot creation**

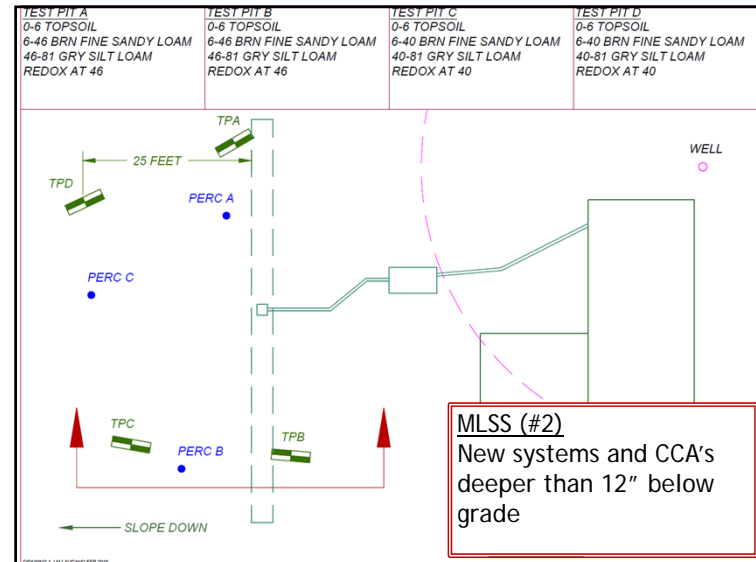
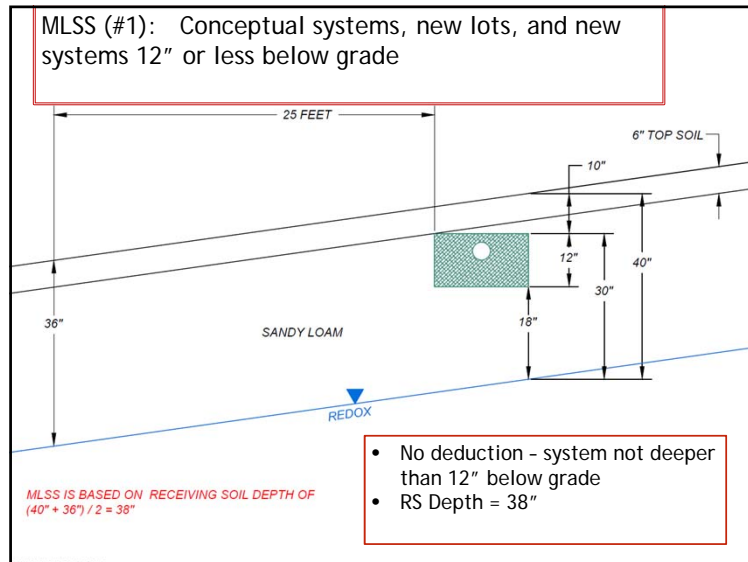
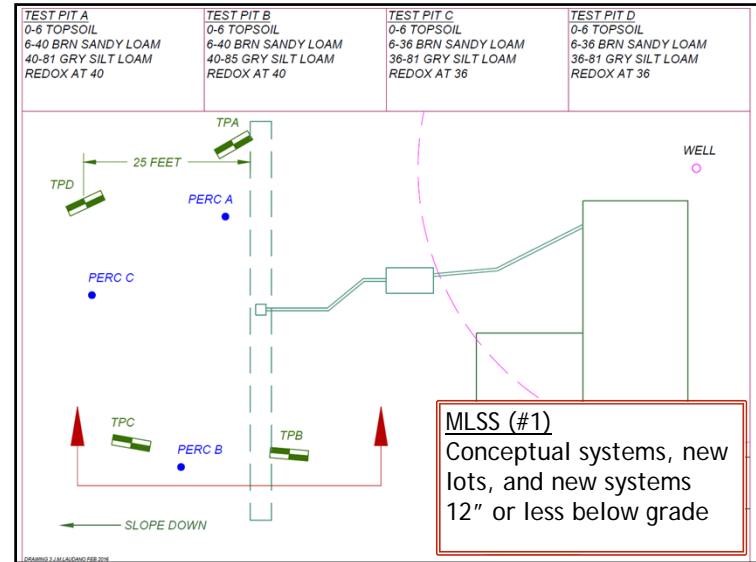
- * RS Depth based on naturally occurring soil only.
- * No consideration given for septic fill.

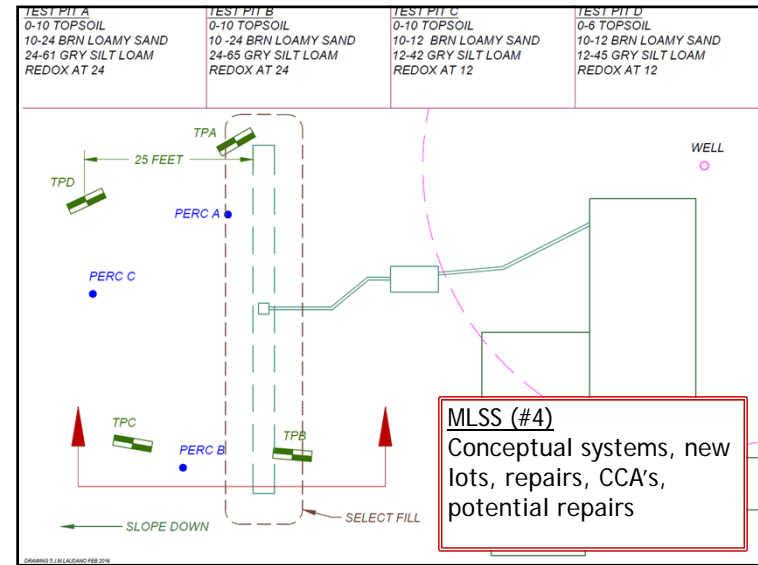
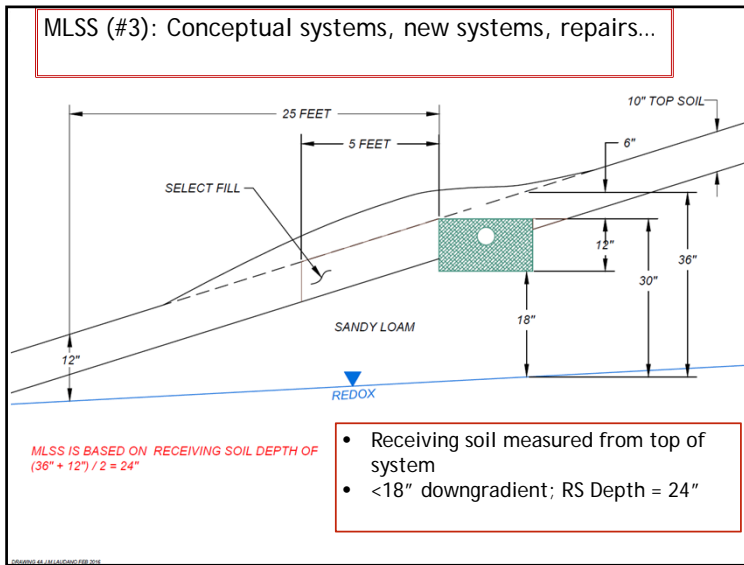
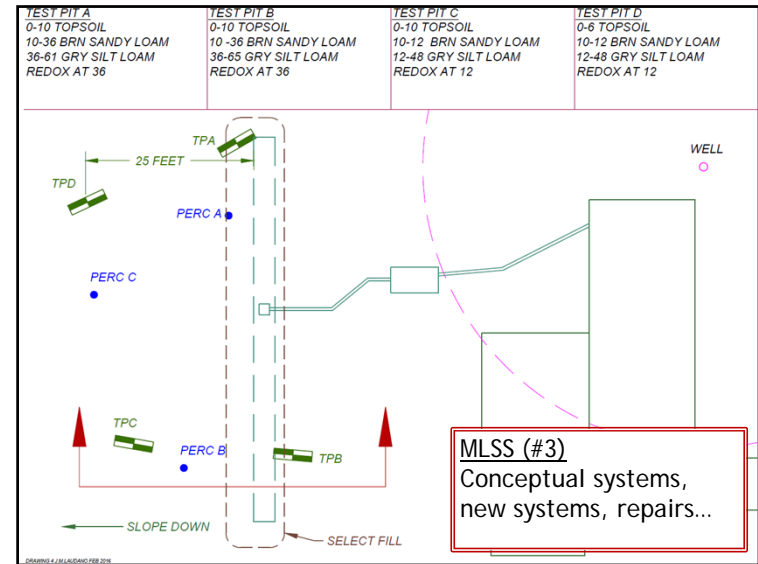
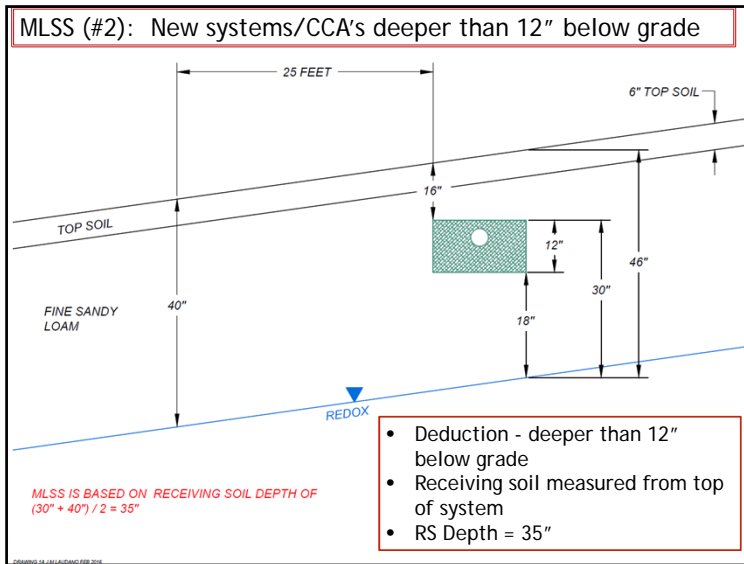
DPH * **New and B100a CCA Installations**

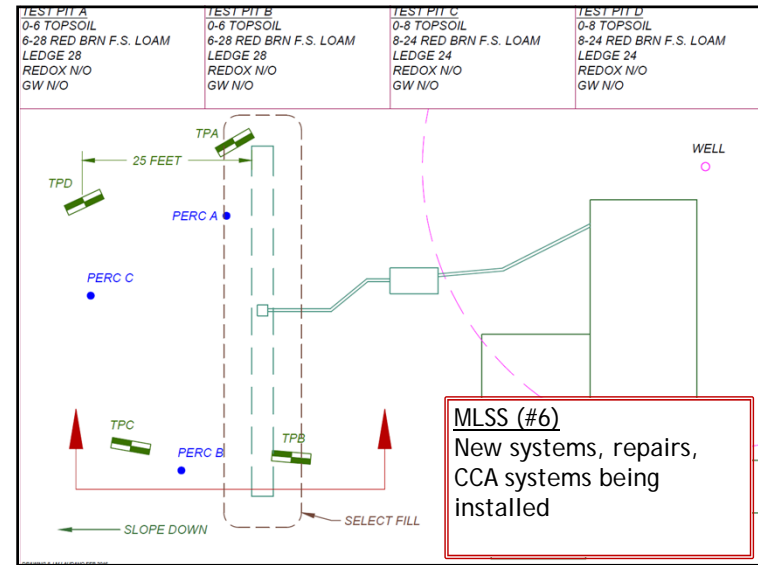
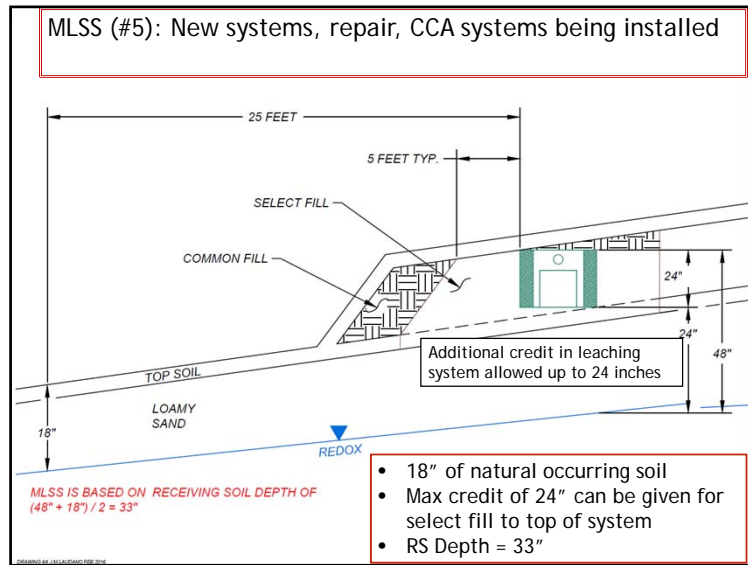
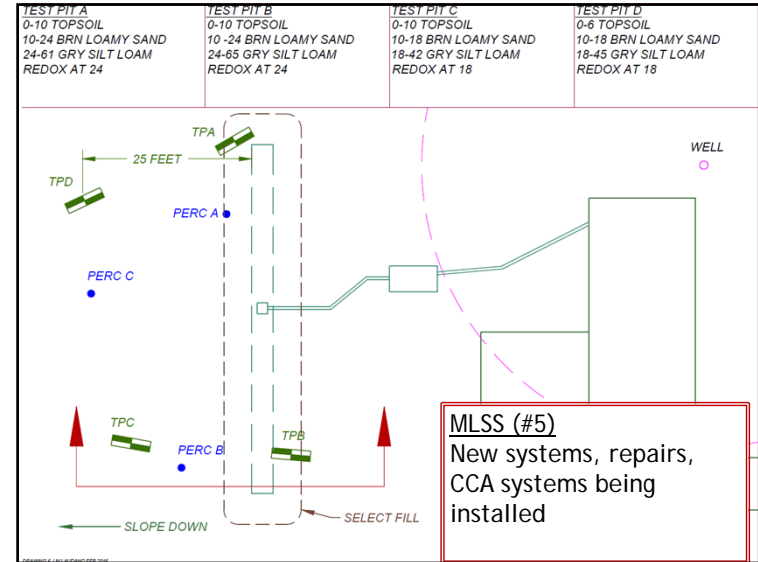
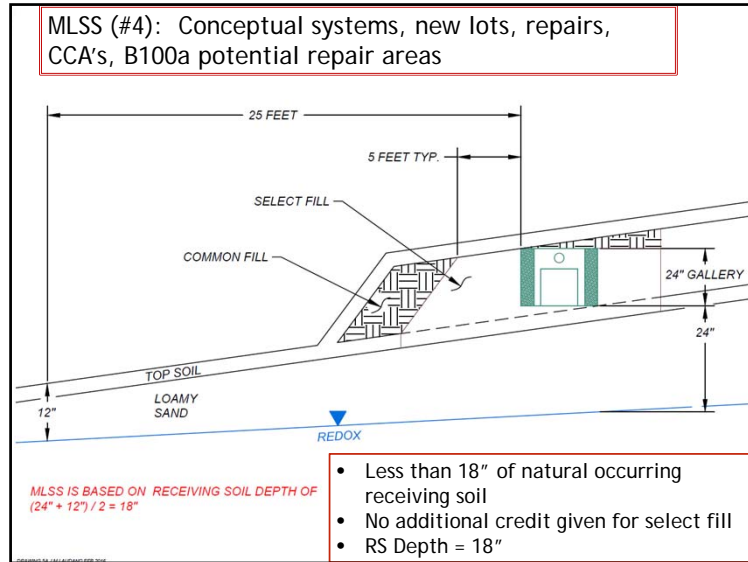
- * Systems to be installed
- * Keep systems shallow less than 12" into grade to avoid penalty to RS Depth
- * Count up to 24" of select fill in the leaching system area.
 - Must have 18" of naturally occurring receiving soil (25' downgradient) on the property.

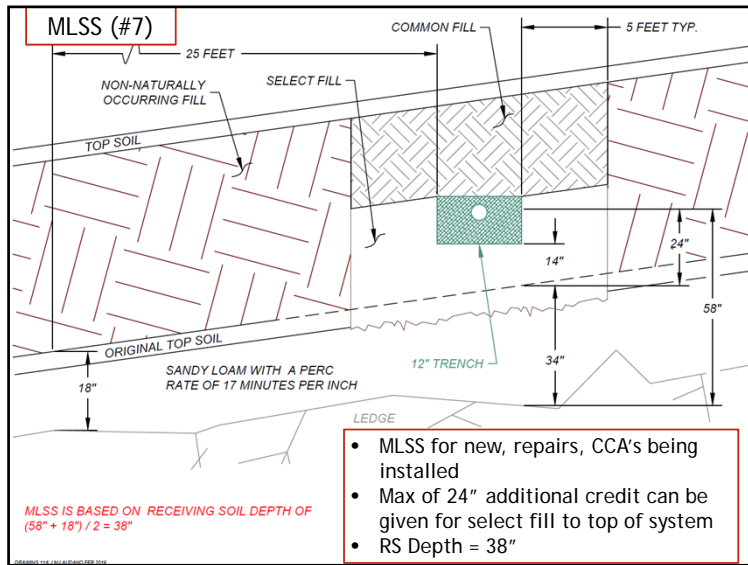
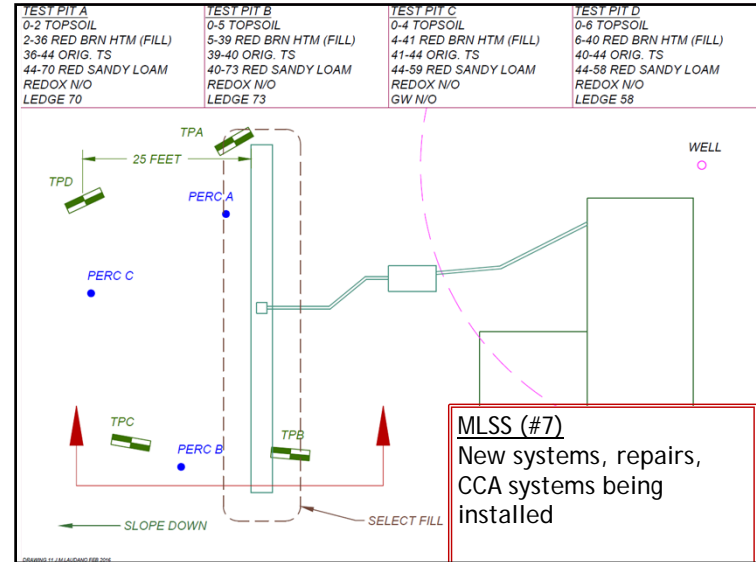
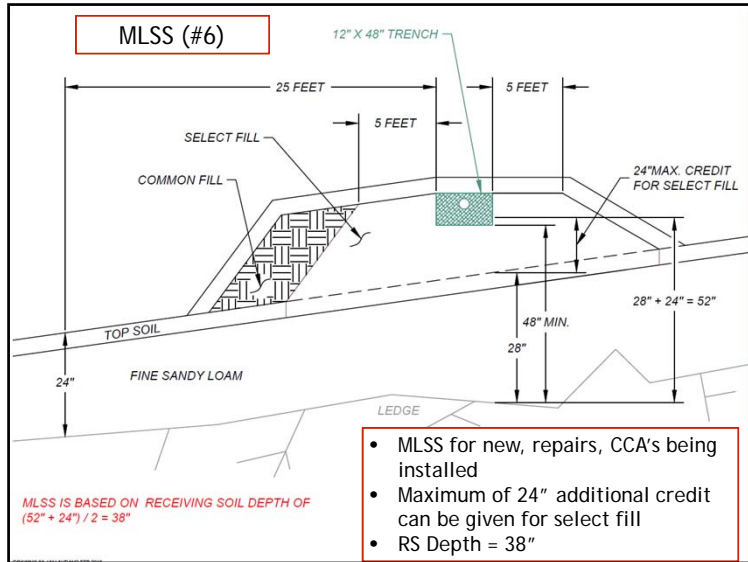
DPH * Leaching system repairs and B100a potential repair area's

- * System to be installed
- * Count up to 24" of select fill in the leaching system area.
 - Must have 18" of naturally occurring receiving soil (25' downgradient) on the property.
- * Keep systems shallow if possible, no penalty if greater than 12" into grade.









DPH * Use of MLSS Formula

* Created 3 categories for the use of MLSS:

- 1) New SSDS, code-complying areas and conceptual SSDS for new lots
- 2) Leaching system repairs and B100a potential repair area
- 3) Non-compliant (NCR) MLSS repairs

DPH * **NCR MLSS**

- *Repairs and Potential Repair Areas that cannot provide the MLSS require an exception from the local DOH.
- *An assessment called a NCR MLSS is necessary

DPH * **NCR MLSS**

- *NCR MLSS assessment required when <18" of naturally occurring RS depth or MLSS cannot be achieved.
- *PE plan required if less than 25% compliance with required NCR MLSS. (previously 50%)

DPH * **NCR MLSS**

- *Permit to Discharge shall note that system is non-compliant relative to MLSS, and that an exception has been granted.
- *Permitted flow shall be based on most limited percentage of ELA or NCR MLSS provided

DPH * **NCR MLSS**

PERMIT TO DISCHARGE

Approval is hereby given to John L. Smith, in accordance with Public Health Code Section 19-13-B103e (b) to discharge to a subsurface sewage disposal system located at 123 East Main Street in the town of Hartford (Street Address) CT that will receive domestic sewage from a:

Residential building containing 3 bedrooms. Single family (Y/N): Y
 Restaurant containing seats.
 Commercial/Office building providing square feet.
 Other structure as described:

Design Flow = 450 gallons per day. **Permitted Flow** = 315 gallons per day.
 The design flow shall equal the permitted flow, except for non-compliant repairs (See Section IV D).

In order to provide a sufficient factor of safety it is recommended that the average daily discharge not exceed 2/3 of the permitted flow or 210 gallons per day.

Operation and Maintenance: Septic tank shall be inspected regularly and pumped as needed but not less frequently than every five years. The septic tank has an effluent filter (Y/N): Y. Effluent filters require periodic cleaning. Failure to clean filters can result in sewage backup into the building or effluent breakout. Restaurants serviced by external grease interceptor tank(s) require quarterly inspections and cleaning as necessary. Tank pump-outs tracked by local health department (Y/N): Y. If yes, stipulate pump-out requirements: Every 5 years.

Special Requirements and Restrictions: 1 System malfunction or failure shall be addressed

Exceptions (Repairs Only): Leaching system is non-compliant relative to MLSS requirements. 70% of the NCR MLSS has been provided. Refer to approved plan dated 3/7/14 on file for additional information.

DPH * **NCR MLSS**

- *Receiving soil in the leaching system area shall be measured from the top of the leaching system to the restrictive layer.
- *Existing receiving soil fill must perc faster than 30 min/inch.

NCR MLSS: Flat lots
Average depth within the system area and 25' around the perimeter.

RS depth $\frac{37+15}{2} = 26$

RS = 37"

12"

10" Select Fill

Original Grade

Minimum 6" at 25' around the perimeter

15"

25' Restrictive 0 0 25'

NCR MLSS: All other lots
Average depth of the receiving soil in the system area and within 25' downgradient

12"

8"

Select fill

Original Grade

34"

Restrictive Layer

14"

Minimum 12" @ 25'

RS Depth = $\frac{34 + 14}{2} = 24$ "

DPH * **NCR MLSS**

- *Percolation rate of select fill can be used for NCR MLSS calculations when receiving soil is entirely select fill.
- *Select fill used as receiving soil must be perc tested to confirm basis of design.

DPH * **Select Fill as Receiving Soil**

Select fill material

25'

Perc tests required after select fill placement

DPH * **NCR MLSS**

*The leaching system spread must be the maximum percent possible of the NCR MLSS based on RS depth of 18-22 inches, or based on the depth of the existing receiving soil if greater.

DPH * **NCR Maximizing Spread**

HOUSE

55'

If NCR MLSS based on 18" = 55 feet, then each row must be at least 55 feet in length if it can be installed on the property.

DPH * **NCR Maximizing Spread**

HOUSE

35'

If NCR MLSS based on 18" = 55 feet, but only 35 feet can be installed on the property, then each row must be at least 35 feet in length.
Additional fill can be used to reduce NCR MLSS to no less than 35 feet.

DPH * NCR MLSS

* B100a NCR MLSS used for building additions, pools and accessory structures.

* Cannot reduce potential repair area!

DPH * NCR Maximizing Spread (B100a)

HOUSE

Proposed Shed

55'

Not allowed

If NCR MLSS based on 18" = 55 feet, then each row must be at least 55 feet in length if it can be installed on the property. Additional fill cannot be used to reduce the NCR MLSS and to allow for shed!

TEST PIT A 0-10 TOPSOIL 10-24 BRN LOAMY SAND 24-61 GRY SILT LOAM REDOX AT 24	TEST PIT B 0-10 TOPSOIL 10-24 BRN LOAMY SAND 24-65 GRY SILT LOAM REDOX AT 24	TEST PIT C 0-10 TOPSOIL 10-12 BRN LOAMY SAND 12-42 GRY SILT LOAM REDOX AT 12	TEST PIT D 0-6 TOPSOIL 10-12 BRN LOAMY SAND 12-45 GRY SILT LOAM REDOX AT 12
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WELL

25 FEET

TPA

TPD

PERC A

PERC C

TPC

PERC B

TPB

SLOPE DOWN

SELECT FILL

NCR MLSS (#1)
Site with limited subsoil and moderate perc rate

25 FEET

5 FEET TYP.

SELECT FILL

COMMON FILL

24" GALLERY

24"

TOP SOIL

LOAMY SAND

12"

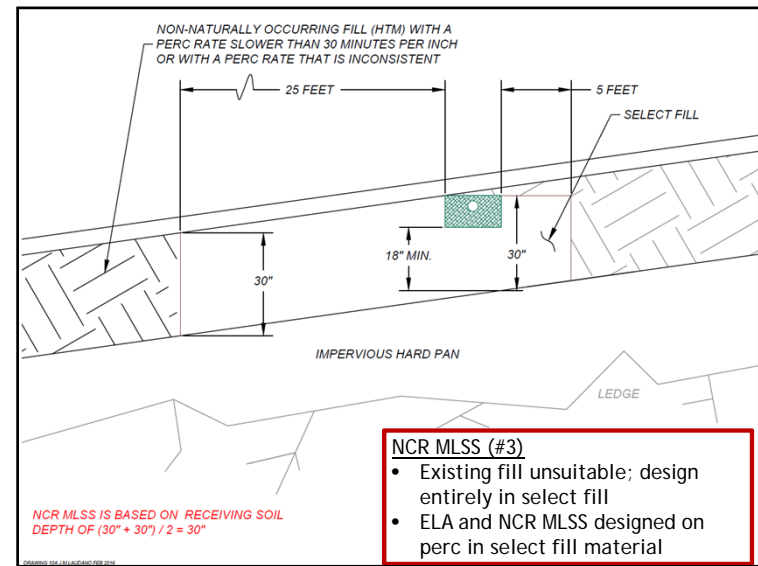
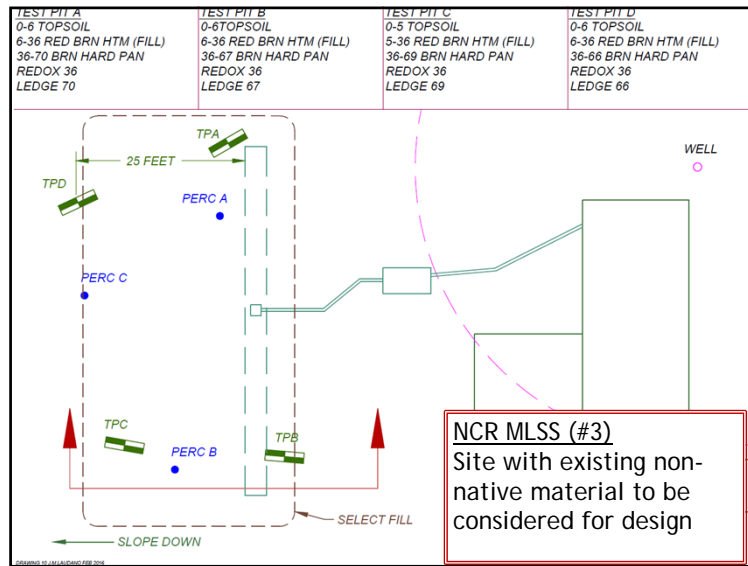
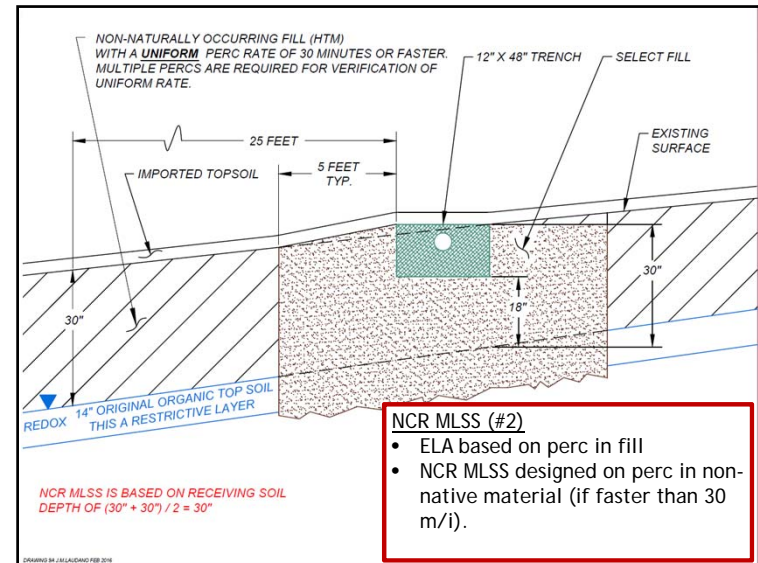
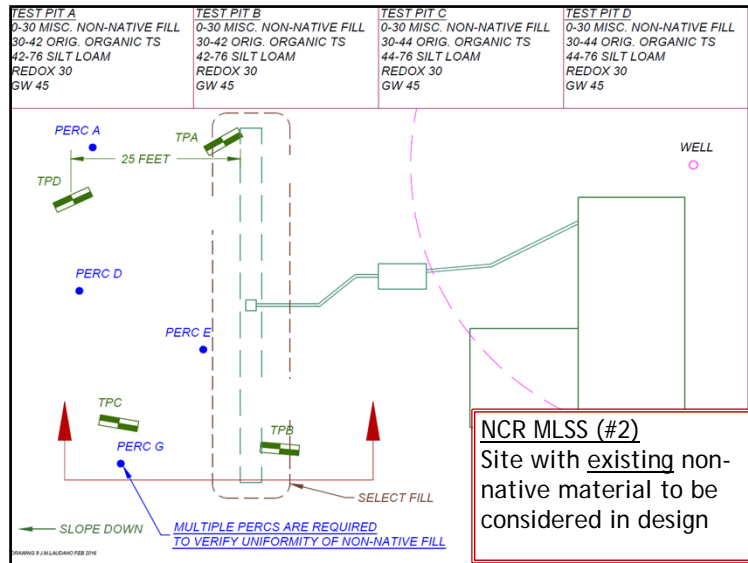
REDOX

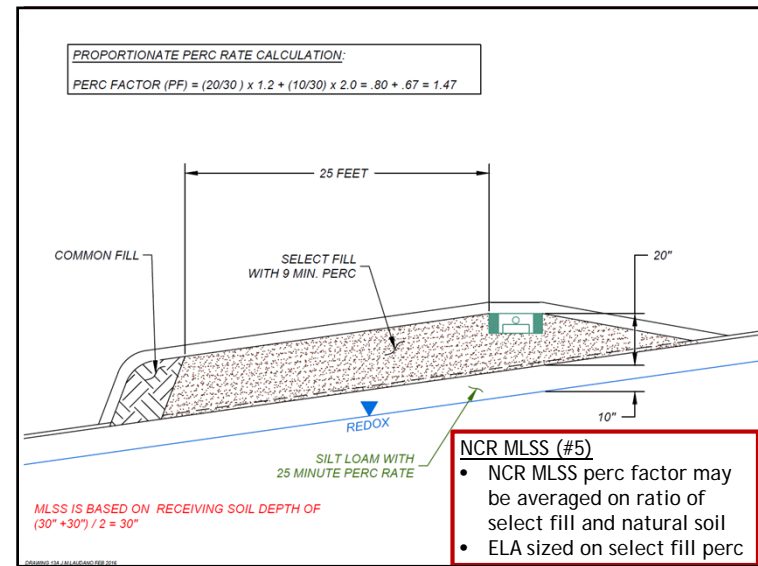
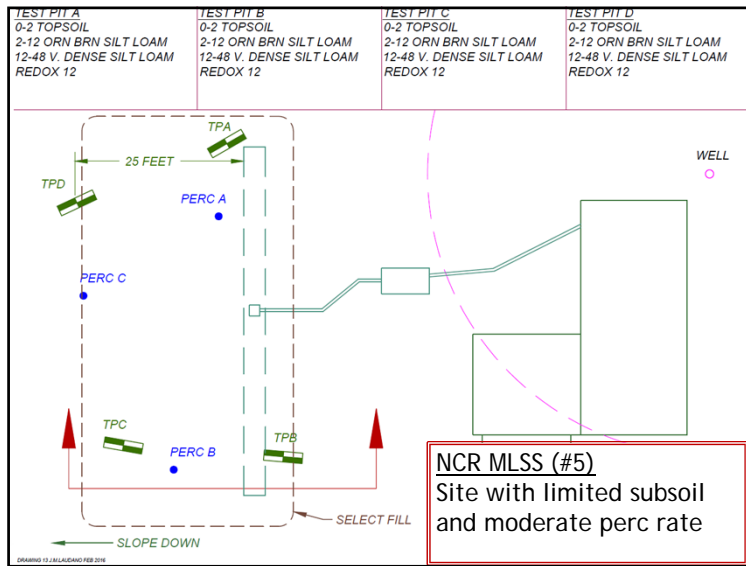
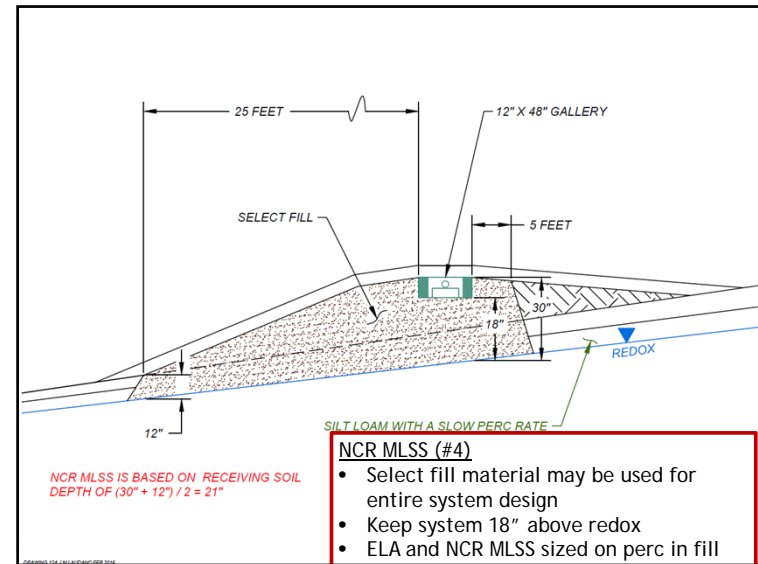
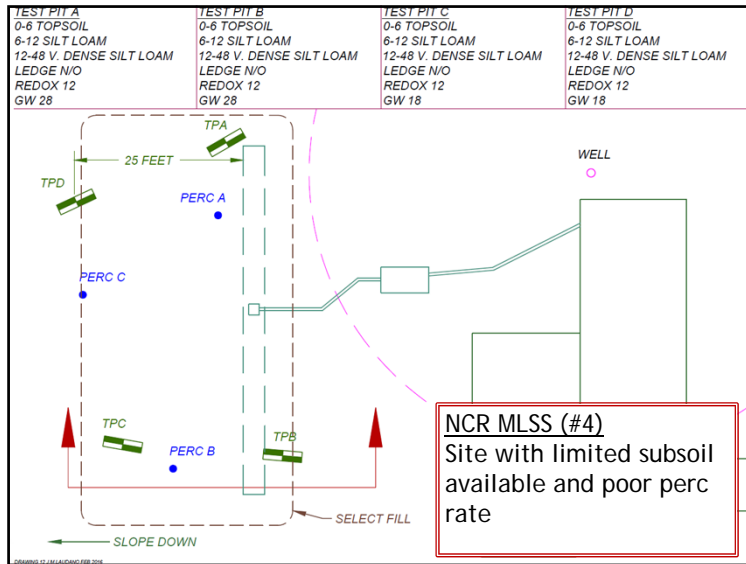
NCR MLSS (#1)

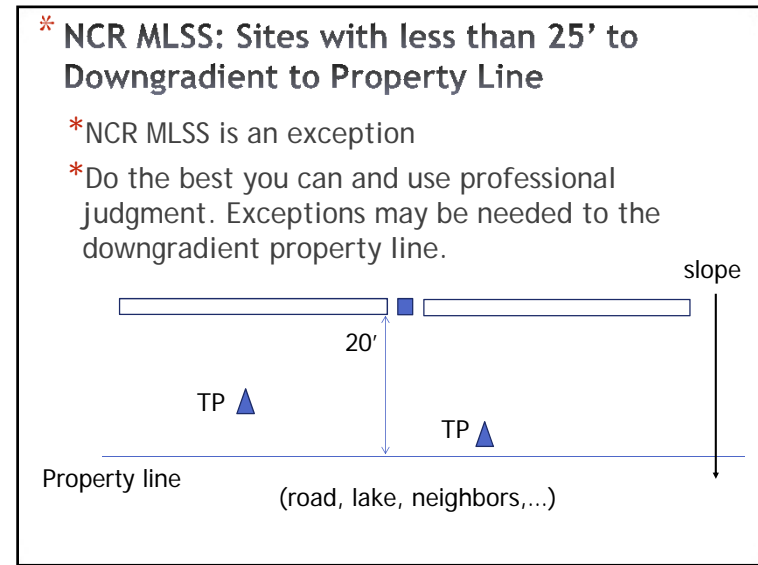
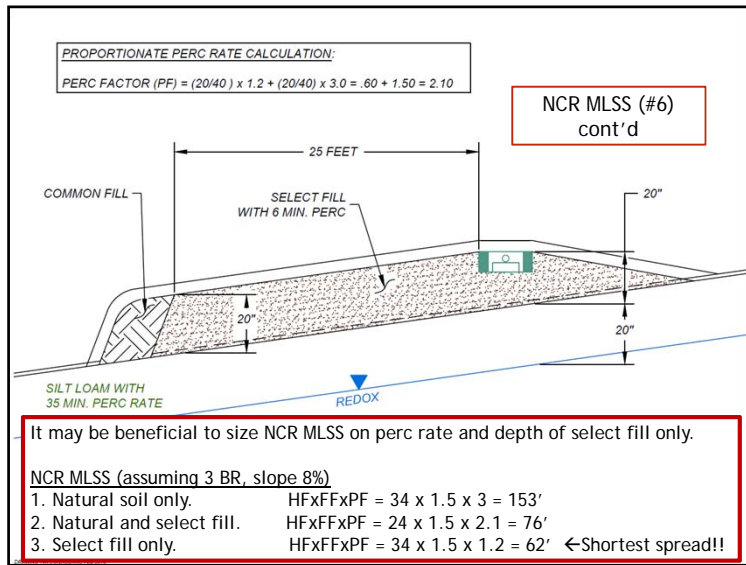
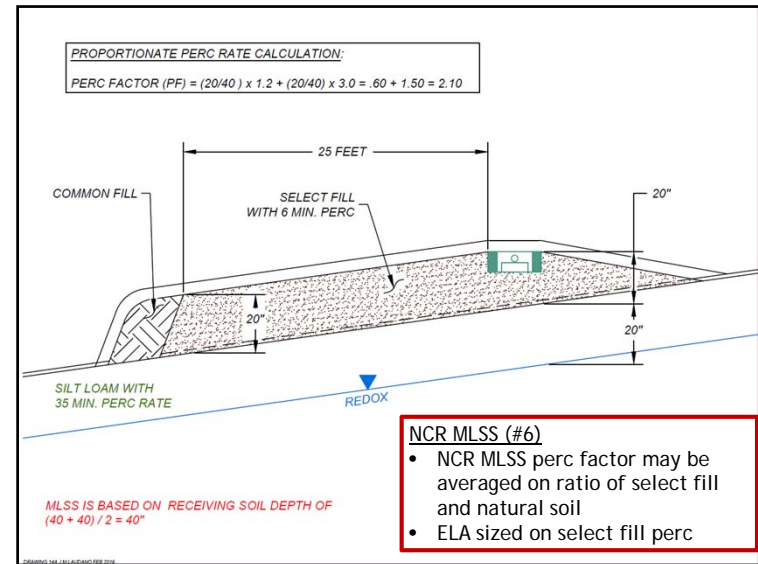
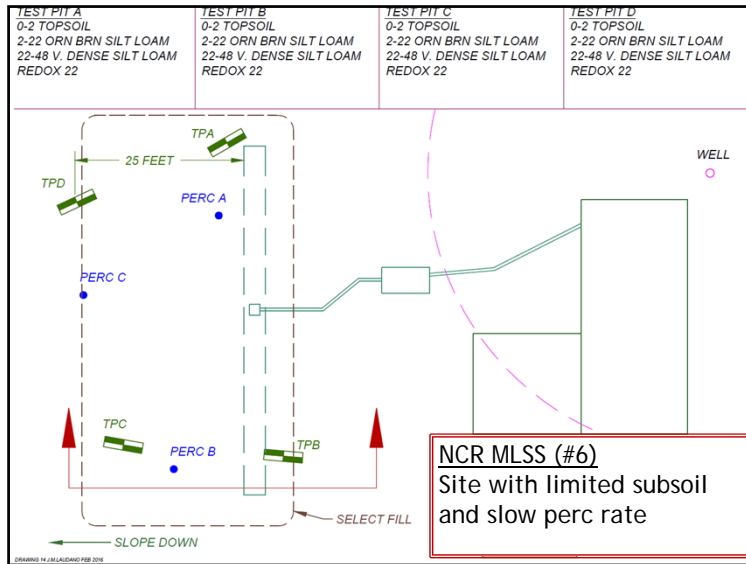
- Increased soil available in leaching system area only.
- NCR MLSS designed on perc in natural soil.

MLSS IS BASED ON RECEIVING SOIL DEPTH OF

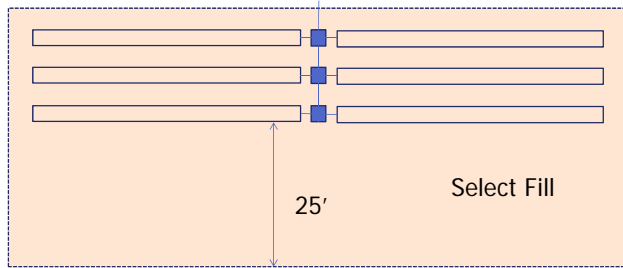
$$\frac{(48 + 12)}{2} = 30"$$







*NCR MLSS
Using Multiple Rows



Do the best you can and use professional judgment. Should 25' always be required?