**Presentation Topics**

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

**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 Department of Public Health**

Keeping Connecticut Healthy

Connecticut Department of Public Health

Environmental Engineering Program

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Phone: (860) 509-7296
www.ct.gov/DPH/subsurfacesewage
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

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.
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

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>
<thead>
<tr>
<th>Seating Capacity</th>
<th>Single-family</th>
<th>Multi-family</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3 bedrooms</td>
<td>1,000 gallons</td>
<td>1,250 gallons</td>
</tr>
<tr>
<td>4 bedrooms</td>
<td>1,250 gallons</td>
<td>1,250 gallons</td>
</tr>
<tr>
<td>For each bedroom beyond 4</td>
<td>Add 125 gallons per bedroom</td>
<td>Add 250 gallons per bedroom</td>
</tr>
</tbody>
</table>

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

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.

* 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.
**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.).*

**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.*

**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.

**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.
* Elevated Entirely in Select Fill

- Elevated means 50% or more of the system above existing grade.
- System bedded in a minimum of 2” of select fill to be considered entirely in select septic fill.
- Select fill 5'
- Clean backfill material

* Not Entirely in Select Fill

- Not bedded in select fill
  - ELA calculated on perc rate in natural soil

*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

*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.
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.

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.

Henry Darcy
  * 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.
**Darcy's Experiments**

Discharge is proportional to area, head difference inversely proportional to length. Coefficient of proportionality is $K = \text{hydraulic conductivity}$.

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

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

**Site Hydraulics**

Modified Darcy's Law:

$$ Q = K_i A $$

$Q = \text{flow}$

$K = \text{permeability}$

$i = \text{hydraulic gradient}$

$A = \text{soil area}$

**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

**Hydraulic gradient**

Slope = rise/run

Groundwater slope

Rear Property Line

Well
**Calculating Slope**

\[
\frac{4}{32 \times 100} = 12.5\%
\]

**Area**

\[\text{Height} \times \text{Spread} = \text{Area}\]

**Spread and Slope**

System 100’ long

**Spread and Slope**

95°

98

96

94

92

80°
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

Spread flat GW lots

- Spread can be measured around the perimeter of leaching system
- MLSS = 50+50+10+10 = 120’ total

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.

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.
**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.

- **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).

- **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.

**Receiving Soil on Sloped Lots**

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

Building Served

Soil in Leaching System Area

Surrounding Soil

25 Feet (< 2000 GPD system)

50 feet (>= 2000 GPD system)
*Receiving Soil on Flat Water Table Lots*

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

*MLSS*

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

MLSS = 75’ + 75’ = 150’ of credit

*MLSS Formula*

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

MLSS = HF x PF x FF

*MLSS*

*Factor tables*
**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*

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**Percolation Factor**

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

**PERCOLATION FACTOR (PF)**

<table>
<thead>
<tr>
<th>Percolation Rate</th>
<th>Percolation Factor (PF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up To 0.5 Maurer/Inch</td>
<td>1.0</td>
</tr>
<tr>
<td>0.51 to 1.00 Maurer/Inch</td>
<td>1.2</td>
</tr>
<tr>
<td>1.01 to 2.00 Maurer/Inch</td>
<td>1.5</td>
</tr>
<tr>
<td>2.01 to 3.00 Maurer/Inch</td>
<td>2.0</td>
</tr>
<tr>
<td>3.01 to 4.00 Maurer/Inch</td>
<td>2.5</td>
</tr>
<tr>
<td>4.01 to 6.00 Maurer/Inch</td>
<td>3.0</td>
</tr>
</tbody>
</table>

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**MLSS Perc Factor**

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

*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).*
Hydraulic Factor

Hydraulic analysis

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

<table>
<thead>
<tr>
<th>Hydraulics Gradient (Vs. Vertical)</th>
<th>RS Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1 - 0.2</td>
<td>12</td>
</tr>
<tr>
<td>0.2 - 0.3</td>
<td>18</td>
</tr>
<tr>
<td>0.3 - 0.4</td>
<td>24</td>
</tr>
<tr>
<td>0.4 - 0.5</td>
<td>30</td>
</tr>
<tr>
<td>0.5 - 0.6</td>
<td>36</td>
</tr>
<tr>
<td>0.6 - 0.7</td>
<td>42</td>
</tr>
<tr>
<td>0.7 - 0.8</td>
<td>48</td>
</tr>
<tr>
<td>0.8 - 0.9</td>
<td>54</td>
</tr>
<tr>
<td>0.9 - 1.0</td>
<td>60</td>
</tr>
</tbody>
</table>

* 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

* Conceptual B100a CCA's and new lot creation

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

* Use of MLSS Formula

* New and B100a CCA Installations

* Systems to be installed
* Keep systems shallower 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.
* 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 then 12” into grade.

MLSS (#1): Conceptual systems, new lots, and new systems 12” or less below grade

- No deduction - system not deeper than 12” below grade
- RS Depth = 38”

MLSS (#2): New systems and CCA’s deeper than 12” below grade
MLSS (#2): New systems/CCA’s deeper than 12” below grade

- Deduction - deeper than 12” below grade
- Receiving soil measured from top of system
- RS Depth = 35”

MLSS (#3): Conceptual systems, new systems, repairs...

- Receiving soil measured from top of system
- <18” downgradient; RS Depth = 24”

MLSS (#3): Conceptual systems, new systems, repairs...

MLSS (#4): Conceptual systems, new lots, repairs, CCA’s, potential repairs
MLSS (#4): Conceptual systems, new lots, repairs, CCA’s, B100a potential repair areas

- Less than 18” of natural occurring receiving soil
- No additional credit given for select fill
- RS Depth = 18”

MLSS (#5): New systems, repair, CCA systems being installed

- 18” of natural occurring soil
- Max credit of 24” can be given for select fill to top of system
- RS Depth = 33”
MLSS (#6)

- MLSS for new, repairs, CCA’s being installed
- Maximum of 24” additional credit can be given for select fill
- RS Depth = 38”

MLSS (#7)

- MLSS for new, repairs, CCA’s being installed
- Maximum of 24” additional credit can be given for select fill to top of system
- RS Depth = 38”

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
**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

**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%)

**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
*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**

For NCR MLSS: Flat lots

Average depth within the system area and 25’ around the perimeter.

- **Select Fill**: 15”
- **Restrictive Layer**: 10”

Minimum 6” at 25’ around the perimeter

**NCR MLSS: All other lots**

Average depth of the receiving soil in the system area and within 25’ downgradient

- **Select Fill**: 14”
- **Restrictive Layer**: 10”

Minimum 12” at 25’ around the perimeter

**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.
* Select Fill as Receiving Soil

Select fill material

Perc tests required after select fill placement

* 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.

* NCR Maximizing Spread

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.

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.
* NCR MLSS

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

* Cannot reduce potential repair area!

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**NCR Maximizing Spread (B100a)**

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!

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**NCR MLSS (#1)**

Site with limited subsoil and moderate perc rate

\[
\frac{48 + 12}{2} = 30''
\]

- Increased soil available in leaching system area only.
- NCR MLSS designed on perc in natural soil.
NCR MLSS (#2)
Site with existing non-native material to be considered in design

• ELA based on perc in fill
• NCR MLSS designed on perc in non-native material (if faster than 30 m/i).

NCR MLSS (#3)
Site with existing non-native material to be considered for design

• Existing fill unsuitable; design entirely in select fill
• ELA and NCR MLSS designed on perc in select fill material
NCR MLSS (#4)
Site with limited subsoil available and poor perc rate

NCR MLSS (#4)
- Select fill material may be used for entire system design
- Keep system 18” above redox
- ELA and NCR MLSS sized on perc in fill

NCR MLSS (#5)
Site with limited subsoil and moderate perc rate

NCR MLSS (#5)
- NCR MLSS perc factor may be averaged on ratio of select fill and natural soil
- ELA sized on select fill perc
NCR MLSS (#6)
Site with limited subsoil and slow perc rate

20'

NCR MLSS (#6)
cont’d

It may be beneficial to size NCR MLSS on perc rate and depth of select fill only.

NCR MLSS (assuming 3 BR, slope 8%)
1. Natural soil only. \(HF \times PF = 34 \times 1.5 \times 3 = 153\)’
2. Natural and select fill. \(HF \times PF = 24 \times 1.5 \times 2.1 = 76\)’
3. Select fill only. \(HF \times PF = 34 \times 1.5 \times 1.2 = 62\)’ ←Shortest spread!!
Do the best you can and use professional judgment. Should 25' always be required?