SUSTAINABLE TECHNOLOGIES

## SECTION 5: SUPPORT PRACTICES

# Filtrexx® SiltSoxx™ Design Tool Guide

### PURPOSE & DESCRIPTION

An MS Excel based interactive design capacity prediction model was created by engineers at The Ohio State University so designers working with runoff/sediment control devices can easily determine the following design considerations based on real site and rainfall conditions: slope spacing between sediment/runoff control devices, maximum allowable slope length or watershed area draining to a sediment/runoff control device, time until sediment/runoff control device will overflow, runoff rate required to overflow sediment/runoff control device, and effective height of the sediment/runoff control device after field installation and under field conditions. The design tool allows the user to choose the appropriate design height/diameter control device and to compare the performance of each effective height/diameter for silt fence and Filtrexx SiltSoxx Sediment Sontrol. Site and rainfall input parameters that the user can manipulate include: total rainfall (in)/duration (hrs), rainfall intensity (in/hr)/duration (hr), area of watershed (ac) or slope width (ft) and length (ft), percent slope, potential runoff reduction (%) for soil/vegetation/erosion control/management practices, effective length of filter used to drain watershed area, diameter of Filtrexx® Soxx™, and height of silt fence. The output tells the user whether the silt fence and/or Soxx will fail based on the input parameters and how long (hrs) it will take for each control device to overflow.

T · H · E OHIO STATE UNIVERSITY OARDC

Designed by OSU-OARDC for Filtrexx International

**Figure 3.1** Filtrexx SiltSoxx Design Tool view

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Step 1: Choose units, ft or m | | ft | | | | | |
| Step 2. Choose input: Tr or I | | Tr | | | | | |
| total rainfall | inches | 1.5 | | storm duration | hours | 24 | |
| Step 3. Choose input: A or W | | W | | | | | |
| width of area | ft | 400.00 | | length of slope | ft | 250 | 43560 |
| Step 4. Input slope | % | 10 | | | | | 452.588 |
| Step 5. Input reduction runoff percent | % | 10 | | | | | |
| | | siltsoxx (8,12,18) | silt fence(24,30) | | | | |
| Step 6. Input effective length of filter | ft | 400 | 400 | | | | |
| Step 7. Input diameter/height of filter | inches | 12 | 36 | | | | |
| Step 8. Find time to overflow filter and total flow/ft the filter can handle | | | | | | | |
| Step 9. On figure find for given flow expected time to overflow filter. | | | | | | | |

**Part A. Evaluation of $q_i$**

| I | A | s | Q | $L_{ss}$ | $q_i$ |
|---|---|---|---|---|---|
| inches/hr | acres | percent | gpm | ft | gpm/ft |
| 0.063 | 2.2957 | 10 | 58.15 | 400 | 0.145 |

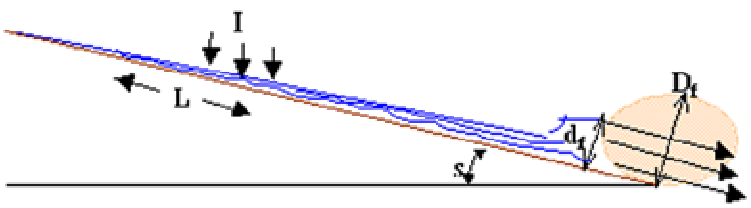
**Part B. Predicted time and total flow to top filter.**

| | $q_o$ | D | Effective D | time overflow | total flow | Filter Okay |
|---|---|---|---|---|---|---|
| | gpm/ft | inches | inches | hr | gal/f | time > tr |
| SiltSoxx™ (Coarse Material) | 0.145 | 12 | 9.6 | 99.1 | 865 | OKAY |
| Silt Fence | 0.145 | 36 | 30.6 | 97.5 | 851 | OKAY |

**Table 3.1** Results summary of elapsed time to overflow at three flow rates* for silt fence and Soxx

| Sediment Control Device | 1gpm/linear ft | 5 gpm/linear ft | 7.5 gpm/linear ft |
|---|---|---|---|
| 36 in silt fence | 6.5 hrs | 2 hrs | 45 min |
| 30 in silt fence | 5 hrs | 5 hrs | 30 min |
| 24 in silt fence | 3.5 hrs | 1 hr | 20 min |
| 18 in Filtrexx Soxx | 11.5 hrs | 4 hrs | 1 hr |
| 12 in Filtrexx Soxx | 7.5 hrs | 2.5 hrs | 30 hr |
| 8 in Filtrexx Soxx | 5 hrs | 1.5 hrs | 10 min |
| *Sheet flow runoff with 10,000 mg L-1 of suspended solids consisting only of silt and clay. | | | |

**Figure 3.2** Diagram representation of control structure in operation and listing of variables used to calculate water runoff rates from a slope.




The design tool is based on research results, the ponding formula and calculations described in Table 3.1 for silt fence and Soxx, and the equation for site and rainfall/runoff characteristics described in Figure 3.2. A copy of the research and/or design tool completed by The Ohio State University can be obtained from Filtrexx International.

**Formulas**

Formula to determine ponding depth behind sediment/runoff control device:

df = A(qf)t + B(qf)

Where:
df = pond depth (in)
qf = sediment-laden flow rate (gal/linear ft/min)
t = time (min)
A(qf) = rate of increase in depth as a function of runoff flow rate (sediment-laden) and suspended solids concentration of runoff (in/min)
B(qf) = initial pond depth behind filter before sediment clogging occurs (in)

Based on results from the research at Ohio State University and this formula the following calculations were developed to estimate time to overflow a silt fence and a Silt Soxx.

Silt Fence:
t = df - (1.1932qf + 1.2993)/0.0132 qf + 0.029

Filtrexx Soxx:
t = df - (0.8282exp0.2564qf)/0.014exp 0.3132qf

The equations for runoff are:
Q =[I W L cos(s) 7.48 /(60 *12 )] = 0.01039 I W L cos(s)
Q = 0.01039 I W L cos(s)
qf = Q/W

Where:
Qf = flow rate to filter, gpm
I = rainfall intensity, in/hr
W = width, i.e. length of filter, feet
L = length of slope, feet
s = angle of slope, degrees
df = depth of water at the filter measured to slope, inches
qf = flow rate to filter, gpm/f

**Runoff Reduction Coefficient**

The runoff reduction coefficient was incorporated into the equation for predicting runoff using the following relationship:

qf = (100 - RC)/100 * Q/W

where:

qf = flow rate to Filtrexx® Sediment control (gpm/ft)
Q = flow rate to Filtrexx® Sediment control (gpm)
W = width, i.e. length of sediment control filter (ft)
RC = runoff reduction coefficient (percent)

RC accounts for loss of water volume (mass) due to the effects of absorption by ground cover and/or infiltration as it moves down the watershed to the sediment control structure. Past research has shown values ranging from 0 for concrete to as much as 60% for some compost blankets and mulches.

## ADDITIONAL INFORMATION

For other references on this topic, including additional research reports and trade magazine and press coverage, visit the Filtrexx website at www.filtrexx.com

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