PERFORMANCE OF DRAINAGE DITCH IN INFILTRATING STORMWATER RUNOFF

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Overview

• Infiltration measurements on swales
• Results of statistical analysis of the data
• Application of infiltration measurement
  ü 1 inch 24hr storm for dry soil
  ü 1 inch 24hr storm for wet soil
  ü 2.6 inch 24hr storm wet soil
• Conclusion
Infiltration measurements on swales

<table>
<thead>
<tr>
<th>Swale location</th>
<th>Soil type</th>
</tr>
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<tbody>
<tr>
<td>Hwy 77</td>
<td>Loamy sand</td>
</tr>
<tr>
<td>Hwy 47</td>
<td>Loamy sand/ Sandy loam</td>
</tr>
<tr>
<td>Hwy 51</td>
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</tr>
<tr>
<td>Hwy 212</td>
<td>Silt loam/ Loam</td>
</tr>
<tr>
<td>Hwy 13</td>
<td>Loam/ Sandy clay loam/ Silt</td>
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Method of Infiltration Measurement

Modified Philip Dunne Infiltrometer
Spatial variation of Infiltration at Hwy 212
## Results for other hwys

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<tr>
<th>Location</th>
<th># of measurement</th>
<th>Geometric mean $K_{\text{sat}}$ (cm/hr)</th>
<th>Co-efficient of variance</th>
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<th>Typical $K_{\text{sat}}$ for this soil type(cm/hr)</th>
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- Geometric mean is within 1~3cm/hr.
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- High coefficient of variance.
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- No correlation between geometric mean and $K_{sat}$ for that type of soil for these swales
Application of infiltration measurement

- Green Ampt model was used.
- Area: 10% of the impervious area.
- A horizontal x-section of the swale was chosen.
- Comparison between 1 inch 24hr storm and 2.6 inch 24hr storm.
- Wet and dry soil.
Estimating infiltration capacity

Average water holding properties of soil based on texture
How to translate soil suction from dry to wet condition

\[ \psi = \frac{1}{K_{sat}} \int_0^h K(h) \, dh \]

\[ K(h) = K_{sat} S e^{1/2} [1 - (1 - (1 - S e^{1/m})^m]^2 \]

\[ S e = [1 + (\alpha h)^n]^{-m} \]

\[ m = 1 - \frac{1}{n} \]

\[ \psi = \text{Soil suction, } \alpha \text{ and } n = \text{VG parameter, } \]

\[ K_{sat} = \text{Saturated hydraulic conductivity, } \]

\[ K(h) = \text{Unsaturated hydraulic conductivity} \]
Estimating infiltration capacity

- 0.15 cm/hr
- 123 cm/hr
- 20 cm/hr
- 0.02 cm/hr
- 6.7 cm/hr
- 6.6 cm/hr
- 1.9 cm/hr
- 0.76 cm/hr
Estimating total infiltration (1 inch 24hr storm - dry condition)

- 11.3 cm runoff
- 16.64 cm runoff
- 12 cm runoff
- 15.94 cm runoff
Estimating infiltration capacity
(1 inch 24 hr storm- wet condition)

- 3.8 cm runoff
- 24.2 cm runoff
- 16.3 cm runoff
- 0.6 cm runoff
- 11 cm runoff
Estimating infiltration capacity
(2.6 inch 24hr storm - wet condition)

3.6 cm runoff
69 cm runoff
19.3 cm runoff
43 cm runoff
10.3 cm runoff
Conclusions

• Establishment of infiltration testing protocol is on-going process which needs verification.
• Testing and refining the protocol is needed.
• Calculation of infiltration capacity of a swale in dry and wet soil condition for various storm return periods will be included in the protocol and verified.
Conclusions

• Most of the stormwater runoff infiltrates through the side slope of the swale.
• Sediments accumulate at the center of the swale.
• No surrogate for measuring infiltration rate.
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  - Anne Haws and Bradley Weiss