SDHM 3.1
User Workshop
Afternoon Session

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In this afternoon session we will cover some of the more advanced features in SDHM 3.1 and set up an example with biofiltration.
SDHM Advanced Topics

1. infiltration
2. lateral flow basins
3. porous pavement
4. biofiltration
5. example project with biofiltration
Infiltration

Runoff is infiltrated to groundwater through the bottom of the project mitigation facility.
Infiltration Facility Example

Predevelopment land use:
- Project: 10 ac B, NatVeg, Flat

Developed mitigated land use:
- Project: 3 ac B, UrbNoIrr, Flat
  7 ac Imp, Flat
Partial Infiltration

If less than 100% of the runoff is infiltrated to groundwater through the bottom of the project mitigation facility then the remaining surface discharge must meet the flow duration standard.
SDHM 3.1 Infiltration Facilities

These elements include the option to infiltrate:

1. Trapezoidal Pond
2. Irregular-Shaped Pond
3. Storage Vault
4. Storage Tank
5. Open Channel
6. Gravel Trench Bed
7. SSD Table
8. Biofiltration
9. Porous Pavement
Automated Infiltration Facility Sizing

![Image of automated infiltration facility sizing software interface]

- **Facility Name:** Vault 1
- **Downstream Connection:**
  - Outlet 1
  - Outlet 2
  - Outlet 3
- **Facility Dimensions:**
  - Length (ft): 200
  - Width (ft): 200
  - Effective Depth (ft): 7
- **Infiltration:**
  - Measured Infiltration Rate (in/hr): 8
  - Reduction Factor (infiltrator): 1
  - Use Wetted Surface Area (sidewalk): No
- **Volume Calculations:**
  - Total Volume Infiltrated (ac-ft): 295.557
  - Total Volume Through Filter (ac-ft): 3.87
  - Total Volume Through Facility (ac-ft): 271.687
- **Infiltrated:**
  - 36.87

**Size Infiltration Vault**

**Target %:** 100
SDHM 3.1 LID Modeling Options

• Lateral flow basins/impervious runoff dispersion.
• Porous pavement.
• Green roof.
• Biofiltration/bioretention.
How LID Works

- Uses long-term on-site infiltration and evapotranspiration to reduce stormwater runoff.

- What happens between storm events is more important than what happens during storm events.
Dispersion of impervious roof runoff on adjacent pervious lawn allowing some water to infiltrate before becoming stormwater runoff. Use lateral flow basins.
Lateral Flow Basins

Lateral flow basins allow the flow from an impervious basin to flow across a pervious basin. Total runoff is reduced.
Lateral Flow Basin Example

Predevelopment land use:
• Project: 10 ac C, Dirt, Flat

Developed mitigated land use:
• Project: 5 ac C, UrbNoIrr, Flat (Lateral Flow Soil Basin)
  5 ac Imp, Flat (Lateral Flow Impervious Area)

Parking lot runoff sheet flows onto the adjacent lawn area.
Porous Pavement Element
Porous Pavement Element

- Surface Runoff
  - Evaporation from pavement
  - Infiltration through pavement
  - Infiltration to gravel subgrade
  - Underdrain Flow
  - Infiltration to native soil

- Rain on pavement
Porous Pavement Element

Includes the effect of slope on storage:

*Effective Volume Factor for >2%: 0 to 1 (fraction ratio of the average max water height behind a check dam compared to the max gravel layer depth; for 6” average max water height and 9” gravel depth Effective Volume Factor = 0.67)*
Porous Pavement Element

Major issues:

• Pavements with bottom slopes greater than 2% should include Effective Volume Factor (average useable gravel depth/maximum gravel depth).

• Porous pavement must include infiltration into native soil and/or an underdrain to remove water from gravel subgrade.
Porous Pavement Example

Predevelopment land use:
- Project: 1 ac C, Dirt, Flat

Developed mitigated land use:
- Project: 1 ac Parking (included in Porous Pavement element dimensions 435’ x 100’)
  - 3% slope
  - Pavement depth 6 inches
  - Gravel depth 9 inches
  - Average max water depth in gravel layer 6 inches
  - $EVF = \frac{6}{9} = 0.67$
  - Underdrain dia = 6 inches
Biofiltration Element

Biofiltration/bioretention/rain garden/planter boxes

Water filters through an engineered soil mix before runoff.
Riser outlet option
Biofiltration Element

Vertical orifice and overflow outlet option
Biofiltration Element

- Native Soil
- Amended Soil (1-3 layers)
- Native Soil
- Vertical orifice and overflow outlet option
- Underdrain (optional)
Biofiltration Element

Major issues:

• The engineered soil layers must meet permit requirements.

• Typical:
  • Top layer: Mulch 3 inches (0.25 ft)
  • Second layer: ESM 18 inches (1.50 ft)
  • Bottom layer: Gravel minimum 12 inches (1.00 ft)

• Infiltration to the native soil should be encouraged even if there is an underdrain.
Hydromod low threshold is 0.1Q2 (10% of the 2-year peak flow)
Step 1. Select project location.

Rainfall: Poway
Step 2. Set up Predevelopment land use scenario.

Predevelopment land use:

- Project: 1.33 ac D, Dirt, Flat
Step 3. Set up Mitigated (developed) land use scenario.

Developed mitigated land use:

- Project:

<table>
<thead>
<tr>
<th>DMA</th>
<th>Description</th>
<th>Total (ac)</th>
<th>Impervious</th>
<th>Imp (ac)</th>
<th>Perv (ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>building, courtyard, parking</td>
<td>1.08</td>
<td>73%</td>
<td>0.79</td>
<td>0.29</td>
</tr>
<tr>
<td>1b*</td>
<td>graded slope (steep)</td>
<td>0.05</td>
<td>0%</td>
<td>0.00</td>
<td>0.05</td>
</tr>
<tr>
<td>1c</td>
<td>biofiltration basin bottom</td>
<td>0.06</td>
<td>0%</td>
<td>0.00</td>
<td>0.06</td>
</tr>
<tr>
<td>1c**</td>
<td>biofiltration basin sides</td>
<td>0.14</td>
<td>0%</td>
<td>0.00</td>
<td>0.14</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>1.33</td>
<td></td>
<td>0.79</td>
<td>0.54</td>
</tr>
</tbody>
</table>

* Slopes not draining directly to biofiltration basin.
** Slopes draining directly to biofiltration basin.

- Biofiltration area: do not include in Landuse Basin element area draining to the biofiltration area.
Step 3. Set up Mitigated (developed) land use scenario.

**Developed mitigated land use:**
- **Project:**

<table>
<thead>
<tr>
<th>Description</th>
<th>Area (ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>D, UrbNoIrr, Flat</td>
<td>0.29</td>
</tr>
<tr>
<td>D, UrbNoIrr, Steep</td>
<td>0.05</td>
</tr>
<tr>
<td>Biofiltration Total Area</td>
<td>0.20</td>
</tr>
<tr>
<td>Impervious, Flat</td>
<td>0.79</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1.33</strong></td>
</tr>
</tbody>
</table>

- Biofiltration area: do not include in Landuse Basin element area draining to the biofiltration area.
Step 3. Set up Mitigated (developed) land use scenario.

Mitigated scenario land use (DMA 1):
Step 4. Calculate lower and upper thresholds based on Predeveloped runoff.

SDHM Q2 = 0.3034 cfs; Q10 = 0.6313 cfs
Step 5. Calculate lower and upper thresholds based on USGS regional eqs.

\[ Q_2 = 3.60(A^{0.672})(P^{0.753}) \]

\[ Q_{10} = 6.56(A^{0.783})(P^{1.07}) \]

Where \( A \) = drainage area (sq. miles)

\[ P = \text{mean annual precipitation (inches)} \]

\( A = 1.33 \text{ acres (0.002078125 square miles)} \)

\( P \) for Poway = 12.2 inches.

USGS \( Q_2 = 0.373 \text{ cfs}; Q_{10} = 0.757 \text{ cfs} \)
Step 6. Compare sets of threshold values.

SDHM-computed Predeveloped Q2 = 0.303 cfs
SDHM-computed Predeveloped Q10 = 0.631 cfs

USGS Q2 = 0.373 cfs
USGS Q10 = 0.757 cfs

Select set with largest Q2 value (in this example that is the USGS set).
Step 7. Change thresholds.

Lower threshold = 10% Q2 = 0.0373 cfs
Upper threshold = Q10 = 0.757 cfs
Step 8. Size Mitigated HMP facility.

Mitigated scenario biofiltration basin:
Step 8. Size Mitigated HMP facility.

Mitigated scenario biofiltration basin:

- bottom length 174 ft
- bottom width 15 ft
- freeboard 1 ft
- bottom slope 0.000 ft/ft
- above ground side slopes 7H:1V
- exclude area under sideslopes
  - below ground side slopes: vertical
- soil layer 1: mulch, 0.25 ft
- soil layer 2: ESM, 1.5 ft
- soil layer 3: gravel, 2.0 ft
- underdrain dia 0.50 ft
- underdrain orifice dia 0.625 in
- underdrain offset 0 in
- riser height 1 ft
- riser dia 12 in

- bottom surface area 0.06 ac
- top surface area 0.20 ac
Step 8. Size Mitigated HMP facility.

Mitigated scenario biofiltration basin:

- above ground side slopes 7H:1V
- below ground side slopes vertical
- soil layer 1: mulch, 0.25 ft
- soil layer 2: ESM, 1.5 ft
- soil layer 3: gravel, 2.0 ft
- riser height 1 ft
- riser dia 12 in
- freeboard 1 ft
Step 9. Review analysis.

Mitigated scenario biofiltration basin (iterative solution):

1. Analysis
2. Durations
3. POC 1

Hydromod duration criteria: Passed

Create Project Report:

SDHM 3.1
PROJECT REPORT
Step 11. Save project.

File, Save As:
Step 12. Exit SDHM.

File, Exit:

FINISHED!!!
Questions?

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