Case Study No. 3: Waterfront Drive, East Providence

Background:

- Over a mile of new road proposed to improve traffic circulation, sited in former railroad corridor
- Immediately adjacent to Seekonk River in HSG B Soils
- Portions of road will be underwater during 100-yr storm
- Proposed roadway width varies between 32 and 40 feet: 2 12-foot travel lanes with varying shoulder widths
- Curb-and-gutter drainage to extended detention ponds and a proprietary device (Vortech)
- Designed to meet requirements of 1993 Manual
- Total drainage area to project is 44 acres, 29% impervious
Former Railroad

Warren Ave

Dexter Road

Horsley Witten Group, Inc.
Would this project meet new requirements?

• First question - Is any portion of this project redevelopment?

• Our assumption: Yes. Existing railroad bed consists of a compacted dense-grade material.

• However, the site has <40% impervious cover (assumed), so entire project would need to meet all standards anyhow.
Would this project meet new requirements?

- Standard 1?
- Utilizing existing disturbed area, minimum widths based on LOS. Other options?
- Standards 2 and 3?
- No - extended detention and proprietary devices do not provide recharge nor adequate water quality treatment.
Would this project meet new requirements?

- Standards 4 and 5?
- Discharge to tidal waters - not needed.
- Standard 7?
- SWPPP needed.
- Standard 8?
- N/A - Not a LUHPPL.
- Standards 9, 10, 11?
- Must confirm no illicit discharges, provide adequate ESC, and O&M Plan.
Focus Drainage Area

- 2.37 acres, 59.1% Impervious
- Catchbasins collect road runoff, discharge to proposed extended detention basin with sediment forebay
- Soils are HSG B
- Discharges to Seekonk River

<table>
<thead>
<tr>
<th>Proposed Detention Pond #1</th>
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</thead>
<tbody>
<tr>
<td><strong>Top of Pond:</strong></td>
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<tr>
<td><strong>Bottom of Pond:</strong></td>
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<tr>
<td><strong>WQCV and Sediment Storage elevation required:</strong></td>
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<tr>
<td><strong>WQCV and Sediment Storage elevation provided:</strong></td>
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</tbody>
</table>
Proposed Area
BMP Selection

• Which BMP could be used to meet Standards 2 and 3 for the focus drainage area?
  • WVTS?
  • Permeable Pavers?
  • Infiltration?
  • Open Channels?
  • Filtration?

No “right” answer, but some wrong ones
Required Volume Calculations

• Compute required $R_{e_v}$ based on B Soils and Sect. 3.3.2

\[
R_{e_v} = \frac{[(1’’)(F)(l)]}{12} = \frac{[(0.35’’)(1.4 \text{ ac})]}{(1\text{ ft/12in})} = 0.041 \text{ ac-ft} = 1,800 \text{ cf}
\]

• Compute $WQ_{e_v}$ based on Sect. 3.3.3

\[
WQ_{e_v} = \frac{[(1’’)(l)]}{12} = \frac{[(1’’)(1.4 \text{ ac})]}{(1\text{ ft/12in})} = 0.117 \text{ ac-ft} = 5,100 \text{ cf}
\]
Filter Sizing Equation

\[ A_f = \frac{(WQ_v) (d_f)}{[(k) (h_f + d_f) (t_f)]]} \]

- \( A_f \) = surface area of filter bed (ft\(^2\))
- \( d_f \) = filter bed depth (ft)
- \( k \) = coef of permeability of filter media (ft/day)
- \( h_f \) = average height of water above filter bed (ft)
- \( t_f \) = design filter bed drain time (days) (2 days is recommended)
Bioretention Sizing Equation

Use sizing equation and values provided in Section 5.5.4:

\[ A_f = \frac{(WQ_v) \cdot (d_f)}{[(k) \cdot (h_f + d_f) \cdot (t_f)]} \]

- \( A_f \) = surface area of filter bed (ft\(^2\))
- \( d_f \) = filter bed depth (ft) (2-4 ft, depending on site constraints)
- \( k \) = coef of permeability of filter media (1 ft/day)
- \( h_f \) = ave ht of water above filter bed (ft) (half ponding depth)
- \( t_f \) = design filter bed drain time (days) (2 days recom.)

\[ A_f = \frac{(5,100 \text{ ft}^3) \cdot (4')}{[(1'/\text{day}) \cdot (0.25' + 4') \cdot (2 \text{ days})]} \]

(With \( d_f = 4' \), \( k = 1.0'\)/day, \( h_f = 0.25' \), \( t_f = 2 \text{ days} \))

\[ A_f = 2,400 \text{ sq ft} \]
Pretreatment?

• 25% of Water Quality Volume - Sediment Forebay
• Sizing Calculation in Section 6.4.1

\[ A_s = 5,750 \times Q \]

Where:
- \( A_s \) = Minimum sedimentation surface area (sf)
- \( Q \) = discharge from drainage area = \( \% WQ_v / 86,400 \) sec

\[ A_s = 5,750 \times (0.25 \times 5,100 \text{ cf/86,400 sec}) = 85 \text{ sf} \]
Benefits:

• Meets Recharge and WQ\textsubscript{v} rqmnts
• Less clearing
• Less earthwork
• Lower safety risk