Working Together to Implement Green Infrastructure in a Historic New England Village

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Brian Kuchar, R.L.A., P.E.
Horsley Witten Group, Inc.
508-833-6600
Acknowledgements and Project Partners

- Environmental Protection Agency-Region 1
- Town of Glocester Rhode Island
  - Planning Department
  - Department of Public Works
  - Town Council
  - Fuss & O’Neil (Remediation Consultant)
- Rhode Island Department of Environmental Management
  - Water Resources
  - Waste Management
- Rhode Island Department of Transportation
  - Commonwealth Engineers
- Rhode Island Historical Preservation and Heritage Commission
  - Public Archeology Laboratory
PROJECT SCOPE

• Funded by a grant from the U.S. Environmental Protection Agency and the Rhode Island Department of Environmental Management

• Part of a village revitalization program
  – Stormwater Management Solutions
  – Wastewater Management Solutions
  – Public Outreach

• Timeline
  – February 2008 to October 2012
PROJECT BACKGROUND

• Location
  – Chepachet, RI
    • Village of Glocester, RI
  – Northwestern RI
  – Intersection of Route 44 and 102
  – Along the Chepachet River

• Background
  – Historic Mill Village
  – Long history of stormwater and wastewater problems
  – River impaired for bacteria
STORMWATER APPROACH

Three Phases:

1. Conceptual design and site selection
   a. Field assessment /data collection
   b. Site selection, watershed delineation and stormwater retrofit inventory
   c. Field investigation, site retrofit assessment and ranking
   d. Conceptual designs
   e. Selection of final site location(s) and design(s)

2. Completion of the final design(s)
   a. Permitting

3. Installation and construction oversight
Priority sites were chosen based on:

a. Site pollutant load potential
b. Site feasibility (e.g., space available, grade, drainage area, accessible)
c. Field investigation
d. Site visibility for public outreach
RETROFIT ASSESSMENT AND RANKING

Site Ranking based on:

a. Impervious cover/pollutant reduction
b. Cost
c. Permitting
  a. Wetlands
d. Public education
e. Public/private lot ownership
f. Maintenance
SITE ADVANTAGES

- Undeveloped land in the village
- Town Owned
- Downgradient
- Treatment capacity
- Solve existing drainage problem
- Incorporate into Future Park?
WET VEGETATED TREATMENT SYSTEM (WVTS)
SITE CHALLENGES

- Brownfield
- Historical/Archeological Ruins
- Wetlands
- Future Park?
- Cost
AREAS OF CONCERN (DASHED WHERE SUSPECTED)

CHEPACHET RIVER - AREA OF CONCERN

SEE FIGURE 2 FOR SOIL EXCEEDANCES IN THIS AREA
HISTORICAL
A FUTURE PARK TOO?
CHALLENGES PRESENT OPPORTUNITIES

- Rhode Island Department of Transportation
  - Route 44 Roadway and Streetscape Improvements
  - Existing direct discharge of runoff to Chepachet River
  - Stormwater treatment required
DESIGN PLANS
WVTS DESIGN PARAMETERS

KEY CONSIDERATIONS

FEASIBILITY
- Additional restrictions apply in cold-water fishery watershed based on distance from discharge point to streams (and any contiguous wetlands).

PRETREATMENT
- Sediment forebay at inlet, capturing 10% of the WQv.

TREATMENT
For a Shallow WVTS:
- Surface area must be minimum of 1.5% of drainage area.
- 35% of the total surface area in depths 6 inches or less, and 65% of the total surface area shallower than 18 inches.
- At least 10% of the WQv shall be provided in a sediment forebay or other pretreatment practice, and 25% of the WQv in deepwater zones. The remaining 65% of the WQv shall be provided in some combination of shallow permanent pool and ED. ED storage volume shall not exceed 50% of the WQv and shall drain over 24 hours.

STORMWATER MANAGEMENT

SUITABILITY
- Water Quality
- Channel Protection
- Overbank Flood Control

Accepts LUHPPPL Runoff: Yes
(3 feet of separation distance required to water table)

IMPLEMENTATION
CONSIDERATIONS

- M Capital Cost
- M Maintenance Burden:
  - Shallow WVTS
  - Gravel WVTS

Residential Subdivision Use: Yes
High-Density/Ultra-Urban: No

Drainage Area: Shallow WVTS-10 acres min. and Gravel WVTS-5 acres min., unless intercepting groundwater

Soils: Highly permeable soils/karst geology may require liner

Key: L=Low  M=Moderate  H=High

Taken from RI Stormwater Design and Installations Standards Manual
## WVTS Design

### Wet Vegetated Treatment System Calculations

<table>
<thead>
<tr>
<th>Drainage Areas and Water Quality Volume</th>
<th>Required</th>
<th>Provided</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Contributing Drainage Area (10 Ac. Min.)</td>
<td>439,520 sf</td>
<td>10.1 acres</td>
<td></td>
</tr>
<tr>
<td>Total Impervious Area (Tanyard/Oil Mill)</td>
<td>65,300 sf</td>
<td>1.5 acres</td>
<td></td>
</tr>
<tr>
<td>Total Impervious Area (RIDOT System Per Commonwealth)</td>
<td>190,800 sf</td>
<td>4.4 acres</td>
<td></td>
</tr>
<tr>
<td>Total Impervious Area</td>
<td>256,100 sf</td>
<td>5.9 acres</td>
<td></td>
</tr>
<tr>
<td>Runoff Depth for Water Quality Volume (WQv)</td>
<td>1.00 in</td>
<td>1.00 in</td>
<td></td>
</tr>
<tr>
<td>Treatment Volume Required (WQv)</td>
<td>0.49 ac-ft</td>
<td>21,342 cf</td>
<td></td>
</tr>
</tbody>
</table>

### Treatment Volume Provided (WQv)

| Sediment Forebay (10% of WQv) | 2,134 cf | 4,963 cf |
| Permanent Pool (40%-90% of WQv) | 0.05 ac-ft | 0.11 ac-ft |
| Extended Detention (0%-50% of WQv) | 16,917 cf | 0.39 ac-ft |
| Total Treatment Volume Provided (WQv) | 0.00 ac-ft | 21,880 cf |

### WVTS Area and Volume Characteristics

| Min. Surface Area of WVTS (1.5% of Drainage area) | 6,593 sf | 10,070 sf |
| Deepwater Zone Volume (25% of WQv) | 5,335 cf | 12,822 cf |
| High Marsh Area - 0"-6" Depth (35% of total surface area) | 3,525 sf | 3,565 sf |
| Total Marsh Area - 0"-18" Depth (65% of Total Surface Area) | 6,546 sf | 6,548 sf |
CONSTRUCTION
## CONSTRUCTION COSTS

<table>
<thead>
<tr>
<th>Cost</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated Conceptual Planning</td>
<td>$459,000</td>
</tr>
<tr>
<td>Estimated 50% Design</td>
<td>$516,000</td>
</tr>
<tr>
<td>Estimated Construction (2011)</td>
<td>$456,000</td>
</tr>
<tr>
<td>Actual (2012)</td>
<td>$468,281</td>
</tr>
<tr>
<td>Town Contribution (in kind services)</td>
<td>$216,281</td>
</tr>
<tr>
<td>EPA Grant</td>
<td>$252,000</td>
</tr>
<tr>
<td>RIDOT Contribution (Archeological Service)</td>
<td>$300,000</td>
</tr>
</tbody>
</table>
## COST BREAKDOWN

<table>
<thead>
<tr>
<th>Description</th>
<th>Estimated Cost</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site Clearing</td>
<td>$ 49,900</td>
<td>11%</td>
</tr>
<tr>
<td>Earthwork</td>
<td>$ 104,600</td>
<td>23%</td>
</tr>
<tr>
<td>Pavement removal</td>
<td>$ 38,300</td>
<td>8%</td>
</tr>
<tr>
<td>Drainage Collection System</td>
<td>$ 94,500</td>
<td>21%</td>
</tr>
<tr>
<td>Repaving</td>
<td>$ 39,500</td>
<td>9%</td>
</tr>
<tr>
<td>Wetland Construction</td>
<td>$ 69,400</td>
<td>15%</td>
</tr>
<tr>
<td>Plantings</td>
<td>$ 59,800</td>
<td>13%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$ 456,300</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>
### CHEPACHET VILLAGE TROUBLE-SHOOTING AND CORRECTIVE ACTIONS

#### CLOSED PIPE DRAINAGE SYSTEM

<table>
<thead>
<tr>
<th>Problem Observed</th>
<th>Corrective Measure(s)</th>
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<tr>
<td>Excessive sedimentation</td>
<td>• Inspect contributing drainage area for sediment sources.</td>
</tr>
<tr>
<td></td>
<td>• Reduce sand usage during winter activities.</td>
</tr>
<tr>
<td></td>
<td>• Increase street-sweeping regiment.</td>
</tr>
<tr>
<td></td>
<td>• Increase catchbasin cleaning regiment.</td>
</tr>
<tr>
<td>Runoff bypasses catchbasins</td>
<td>• Remove leaf litter and debris jams from catchbasin/inlet grate.*</td>
</tr>
<tr>
<td></td>
<td>• Lower catchbasin frame &amp; grate.</td>
</tr>
<tr>
<td>Low or excessive flow at WVTS</td>
<td>• Contact Engineer; consider weir wall adjustments at the Putnam Pike diversion manhole.</td>
</tr>
<tr>
<td>Root intrusion</td>
<td>• Remove by mechanical devices including rodding machines, bucket machines, winches with root cutters or ‘porcupines’, pressure washers.</td>
</tr>
</tbody>
</table>

#### INLET AND SEDIMENT FOREBAY

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</tr>
<tr>
<td></td>
<td>• Drain sediment forebay and remove sediment. Riprap replacement may be required.</td>
</tr>
<tr>
<td>Riprap displacement or settling</td>
<td>• Remove riprap and compact subbase material. Add additional subbase material as necessary and replenish riprap to match the proposed finish grade(s). Compact riprap using the bucket of an excavator.</td>
</tr>
<tr>
<td></td>
<td>• Check for excessive flows from diversion structure. Weir wall may need to be adjusted.</td>
</tr>
</tbody>
</table>
LESSONS LEARNED

• Every Challenge Presents an Opportunity
• Coordination, Coordination, Coordination
• Dewatering Critical
• Stabilization can be a challenge
• Partnerships can be beneficial
• Consider those who will be maintaining.
• Perseverance
Thank You

- Contact Information
  - Horsley Witten Group
  - Phone number: 508-833-6600
  - Email
    - Brian Kuchar - bkuchar@horsleywitten.com