Promoting Green Streets
A Recipe for Integrating Water and Transportation Infrastructure Investment
What we will cover

• Green Street Overview
• Ingredients needed
• Explanation of steps
• Nashville context and experience
JUST ADD WATER
Hitch your wagon to municipal priorities

Source: Overlake Village Complete Streets Plan & Guidelines, Redmond, WA

Source: saferoutespartnership.org
1. Assess the impervious cover associated with the road system
2. Calculate stormwater runoff from the road system
3. Identify appropriate right-of-way green elements
4. Determine suitable locations
5. Quantify the volume reduction to conveyance system
6. Estimate Implementation Cost
7. Develop a master plan
8. Advocate for green streets

Source: AmericanRivers.org
Green Street Ingredients

- Runoff Coefficient
- Impervious Cover Calcs.
- GIS Layers
- Amount of Rainfall
- Local Government Support
- Community Input
- Local Champions
Green Street Recipe

1. STAKEHOLDER INPUT
2. SELECT A DRAINAGE AREA
3. ASSESS IMPERVIOUS AREA
4. TEST CRITERIA
5. TAILOR YOUR CRITERIA
6. DESIGN TEMPLATES
7. CALCULATE RUNOFF
8. DETERMINE UNIT COST
9. SELECT PILOT LOCATIONS
10. STAKEHOLDER INPUT

Options:
- DOES CRITERIA CREATE A LOGICAL HIERARCHY?
  - YES
    - DESIGN TEMPLATES
  - NO
    - IS CAPTURE POTENTIAL MEANINGFUL?
      - YES
        - DEVELOP A MASTERPLAN
      - NO
        - STAKEHOLDER INPUT

Flow:
- Yes to 4.
- No to 1.
- Yes to 6.
- No to 3.
- Yes to 10.
- No to 2.
- Yes to 5.
- No to 1.
Big Picture

Image courtesy of AMEC
“In 2008, which was closer to a typical rainfall year than 2009 and 2010, 37 overflows occurred which resulted in a discharge of 18.3 MG of combined wastewater.”

- Nashville LTCP (2011)
Step 1: Choosing a Drainage Area
Step 1: Choosing a Drainage Area
Step 2: Assess Impervious Area

Basin Size: 230 Acres

Paved road cover: 35 Acres

Building Coverage: 40 Acres

Parking Lots: 6.3 Acres

Miscellaneous: 0.06 Acres

43% percent of basin is roadway surface
Step 2: Assess Impervious Area

Paved road cover: 35 Acres

That means approximately 43 MILLION GALLONS of rainfall run off the road network alone.

What if we could capture 80, 90, or 95% percent of that volume before it reaches the conveyance system???
Step 3: Calculate Volumes From Roadway Impervious Cover

Catchment Area (ft²) \times \text{Avg Rainfall (ft)} \times \text{Runoff Coefficient} = \text{TOTAL RUNOFF (ft³)}

Boscobel’s roadway represent approximately 35 acres or 1,525,000 sq. ft. of impervious surface

Average rainfall in Nashville is 48 inches or 4ft.

The accepted runoff coefficient in Nashville for impervious surfaces is 0.95. This means that 95% of water falling on a paved surface moves off-site. The remaining 5% evaporates or clings to a material surface.

1,525,000 (ft²) \times 4.0 (ft) \times 0.95 = 5,795,000 (ft³) OF RUNOFF
Step 3: Calculate Volumes

Total Runoff Volume (ft³) × 7.48 gallons per cubic foot = TOTAL RAINWATER (GAL)

5,795,000 (ft³) × 7.48 gal/ft³ = 45,200,000 gallons
Step 4a: Potential Treatments

For Streets
1. Curb Bump-outs
2. Linear Bioretention

For Alleys
3. Permeable Pavement
So how do we assess suitability?
Step 4: Tailor Suitability Criteria to your area

Who comes to the table is up to you: Officials, engineers, designers, citizens
Step 4: Tailor Suitability to your area

- SLOPE
- ROW WIDTH
- SOIL COMPOSITION
- UTILITY CONFLICTS
- STORMWATER COMPLAINT DATA
- HOUSE FRONTAGE / ON STREET PARKING
- PROXIMITY TO NODES OF PEDESTRIAN ACTIVITY
Step 4: Tailor Suitability to your area

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<tr>
<th>Block #</th>
<th>Slope</th>
<th>ROW Width</th>
<th>≤ 1/3 mile of Park/School</th>
<th>Hydrologic Soil Group</th>
<th>Utility Conflict</th>
<th>Flooding Complaints</th>
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Our process produced a suitability matrix
Step 4: Tailor Suitability to your area

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Step 5: Apply to your test area

Forrester Ave.

Forrester and Lockeland

Lockland Springs Elementary
Step 5: Apply to your test area

SLOPE ASSESSMENT
The slope on this block averages 3.8% from the high point at the right of the image to the low point at the left.

RIGHT OF WAY ASSESSMENT
ROW width is approximately 60'-0". Nashville's Metro Public Works department defines this road as a *Medium Density Local Road* with a minimum standard with of 50'-0".
Step 5: Apply to your test area

- This block has a slope of less than 2%.
- The figure above shows a block with a slope of over 9%.

- This block has a 50 foot Right of Way, letting us reduced drive lanes to create room for stormwater features.
- This block has a 46 foot Right of Way, the minimum width for installing green features and maintaining standard drive lanes.
Step 5: Apply to your test area

LOT FRONTAGE ASSESSMENT
In this neighborhood many of the street frontages are narrow and deep, with the short side (typically 50'-0" wide) fronting the street. This means most homeowners do not have driveways and therefore park a vehicle on these street with quick access to their front door. The north-south street have longer frontages and would not displace as much parking.
Suitable and Potential Blocks
Step 6: Develop Templates

Curb Bumpout

Vegetated Swale

Tree Trench

Pervious Pavement
Step 6: Develop Templates

WATER QUALITY SWALES

Components:
- Best on slopes of less than 2%
- Level spreaders needed every 50 feet
- Filter Bed of engineered soils
- Underdrain for impermeable soils.

Advantages:
- Less expensive than curb and gutter
- Reduces Runoff Velocity
- Promotes Infiltration
- Conveyance and stormwater treatment

Limitations:
- Cannot be used on steep slopes
- Higher land requirement
- Higher maintenance than curb / gutter
## Step 7: Price Templates

### Vegetated Swale (100 ft long x 6 ft wide, typ.)

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<th>Traditional Infrastructure Improvements</th>
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<td><strong>Utilities</strong></td>
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<td>New single sump inlet with casting</td>
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<td>Water line 6” CI</td>
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<td><strong>Sub-total</strong></td>
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<tr>
<td><strong>Contingency (30%)</strong></td>
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### Green Infrastructure Improvements

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<td><strong>Misc</strong></td>
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<td>Engineered Soil</td>
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<td>6’ perforated underdrains</td>
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<tr>
<td>Mulch</td>
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<tr>
<td>2’ deep linear gravel diaphragm</td>
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<td><strong>Sub-total</strong></td>
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<tr>
<td><strong>Contingency (30%)</strong></td>
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<td><strong>GI total</strong></td>
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</table>

**TOTAL**                              |   | **$23,283.00** |

**PRICE PER SQUARE FOOT**              | s.f. | 600 | **$38.81**
Step 8: Select Appropriate Pilot Locations
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Step 8: Select Appropriate Pilot Locations
Step 9: Assess Capture Potential

Rainfall depth (in) × Runoff Coefficient × Contributing Drainage Area (SF) / 12 inches = TOTAL RUNOFF

The design team used a 1.2” storm volume for this equation (90th percentile storm)

Again, the design team used a 0.95 runoff coefficient.

The total contributing drainage area for ideal and potential roadway segments is 1.2 million SF

\[1.2 \times 0.95 \times 1,200,000 / 12 = 114,000\text{ cubic feet of runoff}\]
Step 9: Assess Capture Potential

Total Runoff Volume (ft³) × 7.48 gallons per cubic foot = TOTAL RAINWATER (GAL)

114,000 (ft³) × 7.48 gal/ft³ = 852,700 gallons
Step 10: Develop a Master Plan

- 850k gal per storm
- 32M gal per year Potential
Thank you!

Gayle Killam
River Network

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