Low Impact Development for your homes, businesses & streets
What’s the problem anyways?

Development Impacts the Water Cycle

[Diagram showing percentages of water cycle components: 30% Evapo-Transpiration, 55% Runoff, 10% Shallow Infiltration, 5% Deep Infiltration, 75-100% Impervious Surface]
In the past, our main pollution concern was Point Source Pollution.

Our current most pressing pollution concern is Non-Point Source Pollution.
Impervious Surfaces

These surfaces included cement, asphalt, roofing, gravel roads and compacted soils that prevent percolation of runoff into the ground.
Development Pressure
Pollutants in Vermont’s Water

**Nutrients:** Phosphorus, Nitrogen – lawns, golf courses

**Pathogens:** E. Coli – septic systems, wastewater treatment plants

**Sediment:** construction, stream bank erosion

**Toxic Contaminants:** Heavy metals, mercury, PCBs, chlorides, pesticides – landfills, combustion of coal, solid-waste incinerators

**Excess Algae:** reduces oxygen in water

**Acid Rain:** combustion of fossil fuels (coal, oil and gas)

www.vtwaterquality.org/wqd_mgtplan/swms_appB.htm
Impervious surfaces send too much water to local streams. This “flashiness” increases the destruction power of the peak flow, meaning more water flows over a shorter period of time.
NASA Satellite image taken on Sept. 2, 2011
What are the Water Issues in Your Town?

- Flooding
- Water quality
- Drinking water
- Stream alterations
- Wildlife habitat
- Sensitive wildlife
- Erosion Hazards
The Low Impact Development Shift

Regional & Centralized  
- drain, direct, dispatch
- Pipe, channel, sewer
- Expansive drainage
- Large control structures
- Intensive engineering
- Built capital Investment

Decentralized & Distributed  
- Slow, spread, soak
- Don’t generate or accelerate runoff
- Low energy design
- Integrated design
- Extensive planning & education → DIY
- Human and natural capital investment
LID Site
Residential

Conservation
Permeable Pavement
Open Drainage
Rain Barrel
Amended Soils
Rain Gardens

Create a Hydrologically Functional Lot
LID Goals

- Stormwater management should *not* be seen as *waste disposal* but as a RESOURCE MANAGEMENT

- Include small, cost-effective landscape features at the lot level that treat stormwater.
Conventional Stormwater Management Practices

- Stormwater Ponds
  - Detention (dry)
  - Retention (wet)
- Underground infiltration sands filters
- Storm drain and culvert infrastructure
LID Practices

- Bio-retention and rain gardens
- Disconnect downspout from storm system
- Vegetated Swales
- Water harvesting systems - rain barrels or cisterns
  - Milton HS has underground cisterns
- Green roofs
- Permeable pavement & concrete
- Subsurface gravel wetlands
Rain Barrels and Cisterns

- Water harvesting from roofs of building
- Reduces stress on treated public water supply during
- Can be used for gardening, car washing, equipment cleaning and other non-potable use
- Easy to install and maintain
- Variable sizes
- Can be installed under ground or disconnected in winter month
Green Roofs

- Types
  - Intensive
  - Extensive – Heritage Aviation Hanger

- Consisting of
  - Lightweight growing medium
  - Plants
  - Drainage system
  - Waterproofing layer

Courtesy of Low Impact Development Center
Permeable Pavement

- **Whole System**
  - Permeable surface course
  - Stone/sand sub-base
  - Drainage system

- **Surface course material**
  - Asphalt
  - Concrete
  - Grid-block pavers
  - Plastic grid pavers
Subsurface Gravel Wetland

- A modification of a constructed wetland
  - Stormwater travels laterally through subsurface drains

- Consisting of
  - Subsurface gravel layer and drain
  - Soil medium
  - Wetland plants
What is a Rain Garden?

Functional gardens designed to capture & infiltrate water running off roofs and roads.
Size of garden calculated based on amount of water entering garden

Soils, plants and microbes remove the pollutants as the water absorbs into the ground
Consider....

- What’s the purpose of a rain garden in a particular spot?
- Can you find a good place (or two, or more) for a rain garden?
- What water would you like to capture?
Size of Rain Garden

Depends on:

A. Size of impervious area (roof, lawn, driveway)
B. Soil type
C. Slope
A. SIZE OF IMPERVIOUS AREA

- Identify portion of roof that will drain into the rain garden
- Measure square foot by multiplying length by width. Hang onto this number, you will need it later.
B. SOIL TYPE

- Conduct soil ribbon test
  - Sand: no clumping
  - Silt: a ribbon <1.5”
  - Clay: a ribbon >1.5”

- Test the infiltration
  - Dig a hole and fill with water.
  - Does it drain in 24 hrs?
  - If so, suitable for rain garden
  - If not, infiltration poor and look for another location
C. CALCULATING SLOPE

- Slope determines depth of garden
- Rain gardens need to be level to evenly distribute water

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<th>Slope</th>
<th>Depth</th>
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<tr>
<td>4%</td>
<td>3-5 in</td>
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<tr>
<td>5-7%</td>
<td>6-7 in</td>
</tr>
<tr>
<td>8-12%</td>
<td>8 in+</td>
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Figure 3 The string should be tied to the base of the uphill stake, then tied to the downhill stake at the same level.
Rain Garden Sizing Exercise

- House roof drainage area - 815 sq ft
- Silty soil
- 3% slope

How big should the garden be?

Size Factor Chart

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<th>Slope</th>
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<tbody>
<tr>
<td>&lt; 4%</td>
<td>3-5 in</td>
</tr>
<tr>
<td>5-7%</td>
<td>6-7in</td>
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<td>8-12%</td>
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<table>
<thead>
<tr>
<th>Depth</th>
<th>3-5 in</th>
<th>6-7 in</th>
<th>8 in+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand</td>
<td>0.19</td>
<td>0.15</td>
<td>0.08</td>
</tr>
<tr>
<td>Silt</td>
<td>0.34</td>
<td>0.25</td>
<td>0.16</td>
</tr>
<tr>
<td>Clay</td>
<td>0.43</td>
<td>0.32</td>
<td>0.20</td>
</tr>
</tbody>
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\[
\text{Size Factor} \times \frac{815 \text{ (Drainage Area (sq. ft))}}{277 \text{ (Size of Garden)}} = 0.34 \times 815 = 277 \text{ sq. ft}
\]
Designing The Rain Garden

Need to consider: how water is directed to garden & where water could overflow to
Directing Water to Rain Garden

- Dig depressed grass trench or trench for extender pipe
- Redirect downspout
- Connect extender pipe to downspout
Shape of Rain Garden

Kidney

Linear

Circular
Building the Rain Garden

Start digging on the uphill side until you reach your desired depth.

A Level Bed is Key – Think Terraces

- Between 3% and 6% slope lawn
The Berm

- Water naturally wants to flow downhill
- The berm is built on three sides as a wall
- It will be highest at downhill side and gradually taper off as it goes uphill
- It should be well compacted soil, gently sloped on the sides, and seeded with grasses
Plant Choices

- **New England Aster**
- **swamp milkweed**
- **Red Osier Dogwood**

- **Taller plants**
  - Asters, spiked blazing star, swamp milkweed, joe pye weed, lilies, iris
- **Preferably native plants**
- **Adapted to flood plain or moist soils**
- **Add compost before planting**
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