

Single-Family Individual Lot Design Options

Rhode Island Stormwater Design and Installation
Standards Manual
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Richard Claytor, Jr., P.E.
Horsley Witten Group, Inc.
508-833-6600

Which is the Better LID LOT?



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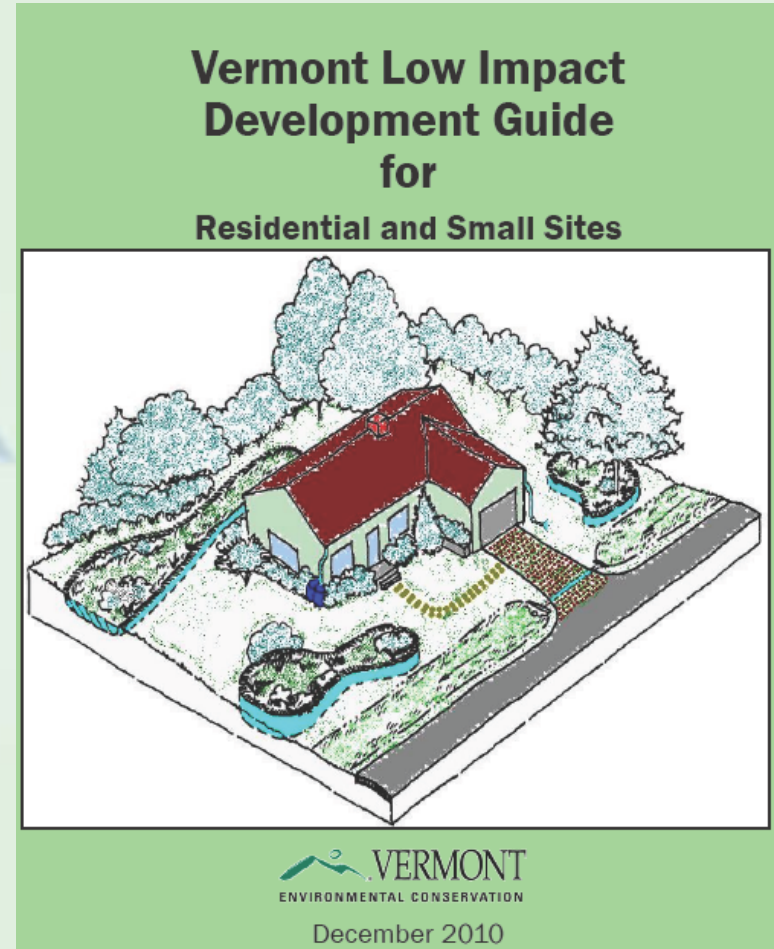
Barr Eng, Minn, MN

Roger Bannerman, Madison, WI



Guidance for Sources for Individual Lot Controls

- Chapter 5;
- Design Example #3 in Appendix D;
- The Vermont LID Guide;
- CRMC to issue additional clarification on this issue;
- Pending RI Community LID Site Planning; and Design Guidance.



The Problem: Conventional Site Design

*Collect
Concentrate
Convey
Centralized-
Control*

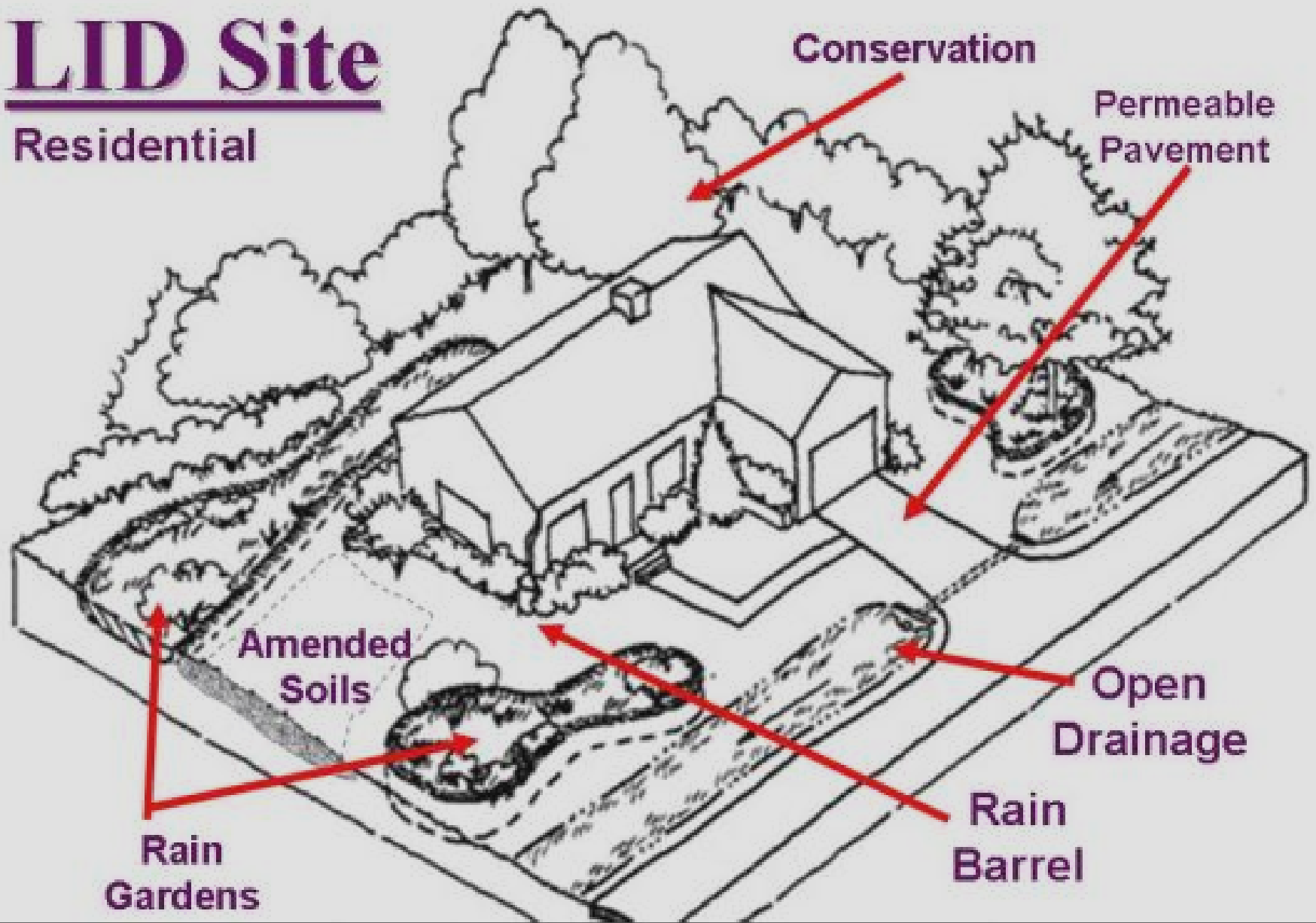


Good Drainage Paradigm

Courtesy Larry Coffman/LID Center

LID Site

Residential



Create a Hydrologically Functional Lot

Applicable Practices at the Single-Lot Scale

- Rooftop Runoff:
 - Drywells
 - Bioretention/Rain Gardens
 - Qualified Pervious Areas (QPAs)?
 - Rain Barrels/Cisterns
- Non-rooftop Runoff:
 - Bioretention (rain gardens)
 - Infiltration
 - Swales
 - QPAs?







Courtesy Larry Coffman/LID Center



Courtesy Larry Coffman/LID Center

Qualifying Pervious Area (QPA)

- Natural or landscaped vegetated areas;
- Fully stabilized;
- CNs based on “good hydrologic conditions”;
- Must be shown on site plans;
- Must have 4 inches of topsoil and located outside regulated wetlands and buffer zones; and
- Excessively fertilized lawn areas are not QPAs (low maintenance grasses adapted to NE region).



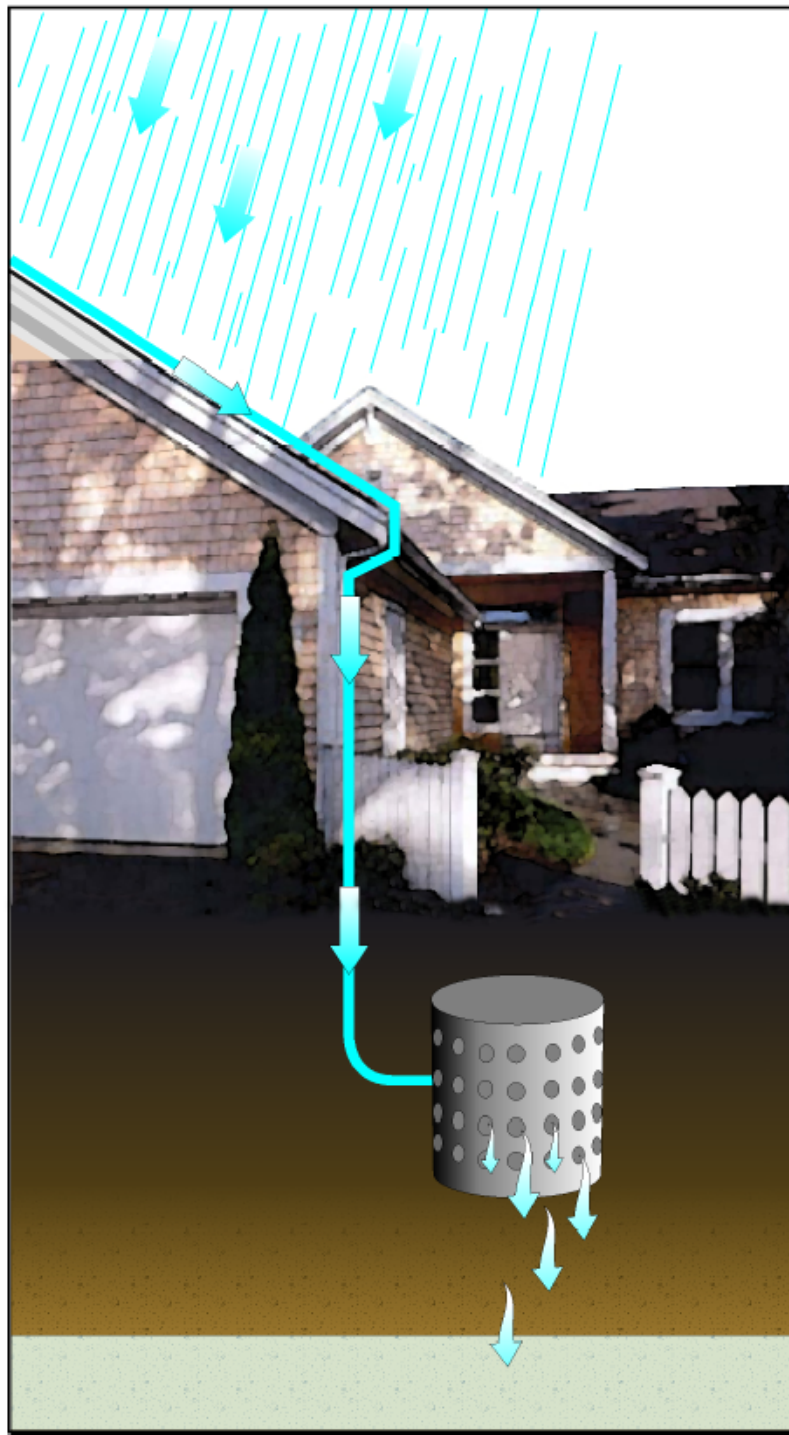


Which lot looks like it might qualify for a QPA?





Dry Well



Dry Wells

Design and Permitting Considerations

- Good soils ($> 0.5''$ /hr inf rate);
- No more than 2 feet of fill (this is an exception for residential land uses);
- 2 foot separation from bottom to seasonal high gw table (another exception);
- Exempt from gw mounding analysis (if $< 1,000$ sf);
- No pretreatment required.



Rain Barrels and Cisterns



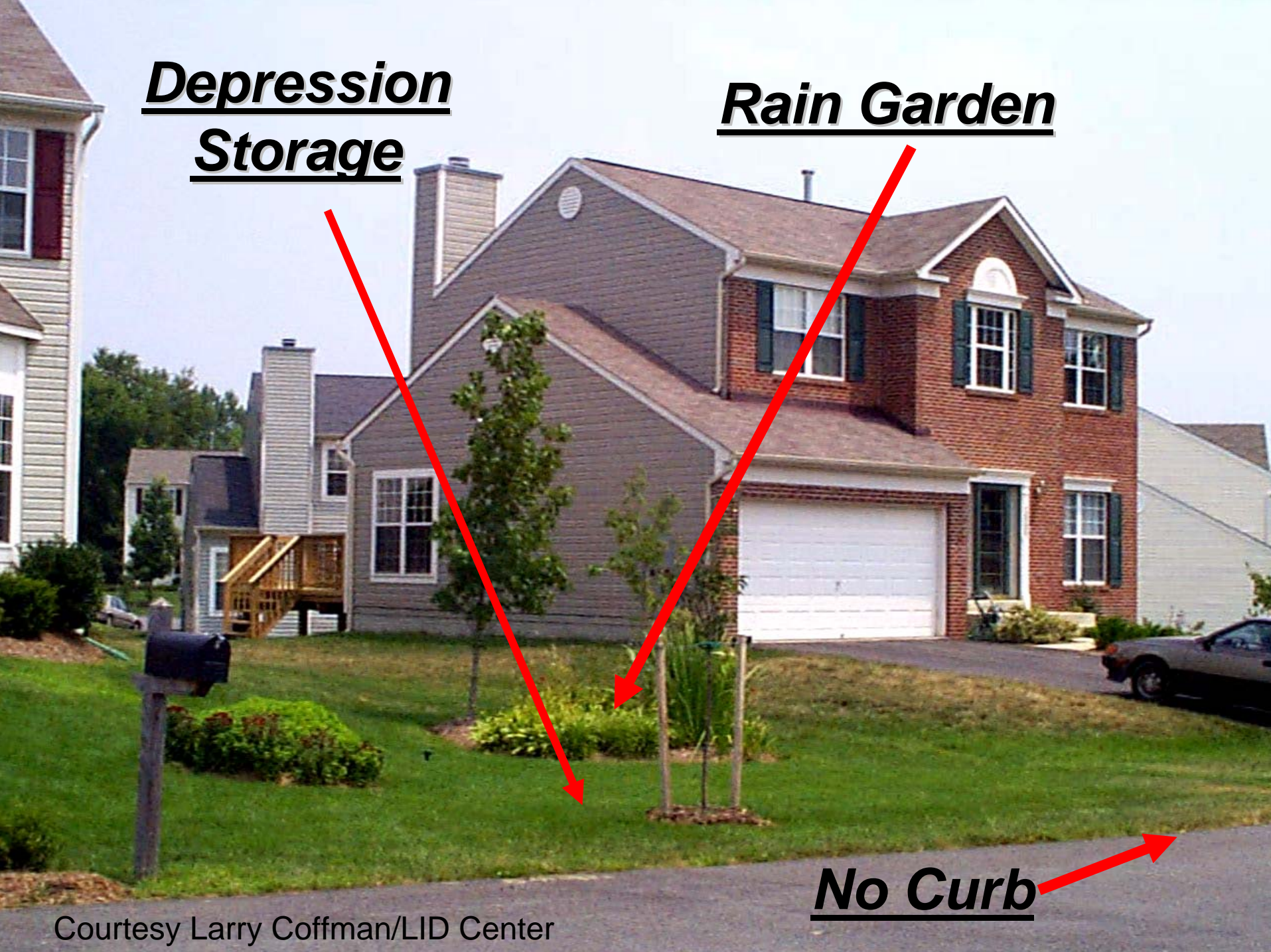
Rain Garden



Courtesy Larry Coffman/LID Center

Depression
Storage

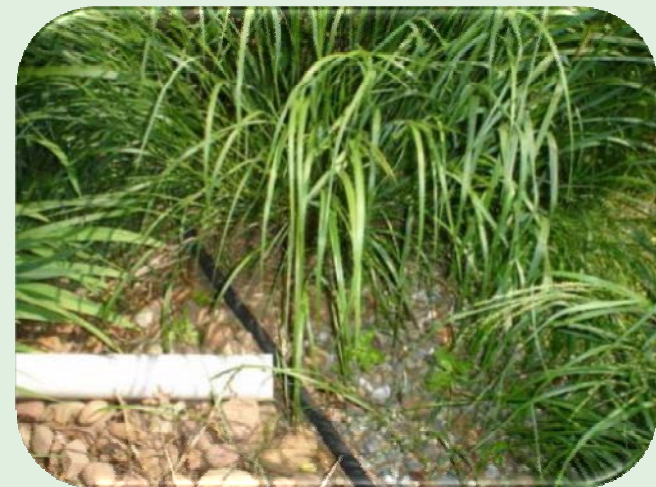
Rain Garden



No Curb

What is a Rain Garden?

- Shallow landscaped depression that treats stormwater runoff;
- Designed to merge important goals: aesthetics, groundwater recharge, and water quality;
- Can be blended into the landscape and made to look natural; and
- Water is directed into them by sheet flow, pipes, swales, or curb openings.



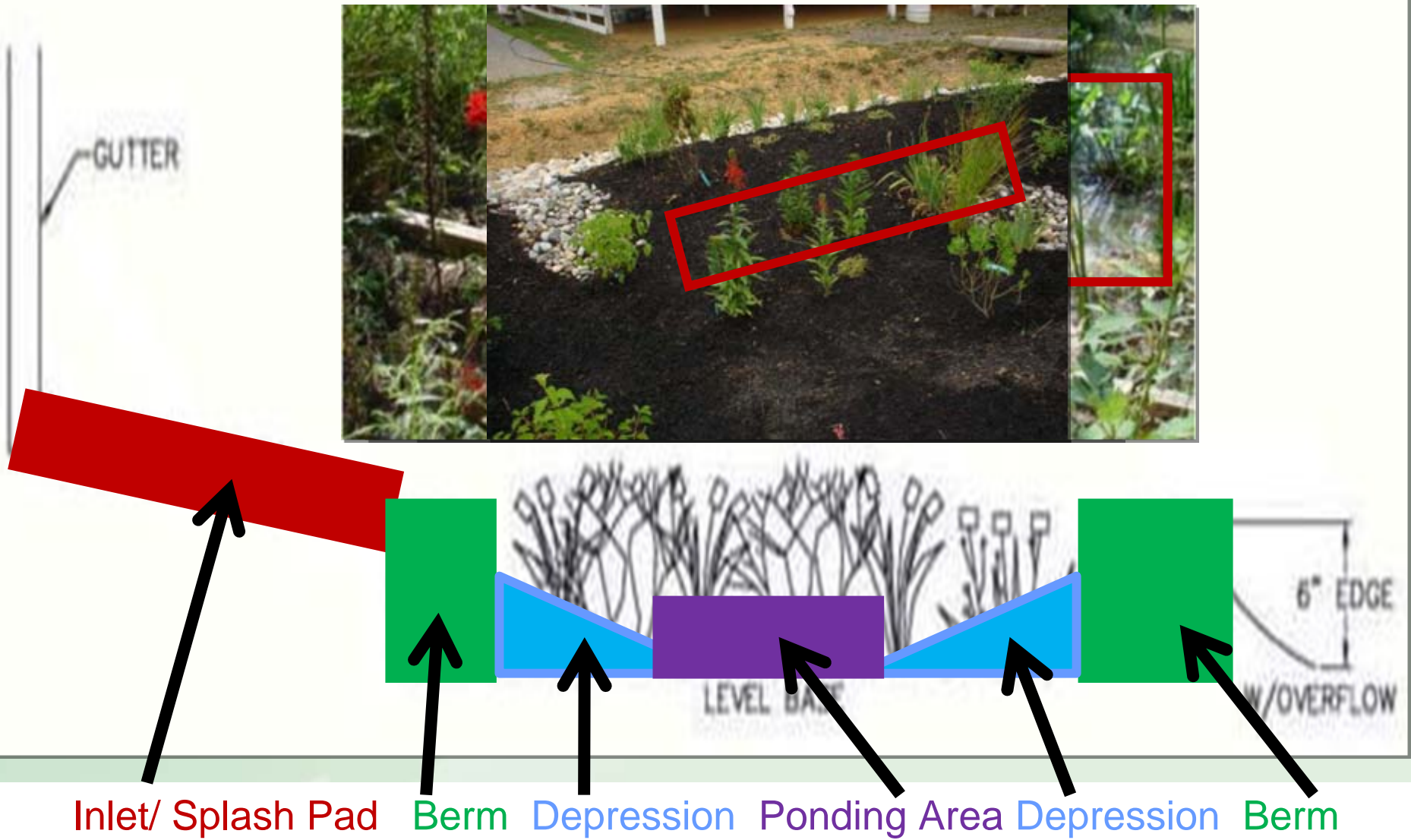
Bioretention or a Rain Garden?

- Bioretention involves:
 - Amended soils;
 - Complex sizing calculations (e.g. modeling);
 - Detailed engineering specifications;
 - Sophisticated conveyance devices (flow splitters, underdrains, overflow inlets, etc).
- Rain Garden:
 - Generally doesn't involve the above- usually a shallow depression in native soils, or modestly amended soils (but might contain some of the above features)



Beware of what something is called: One person's
Bioretention is another person's Rain Garden

The Parts of a Rain Garden

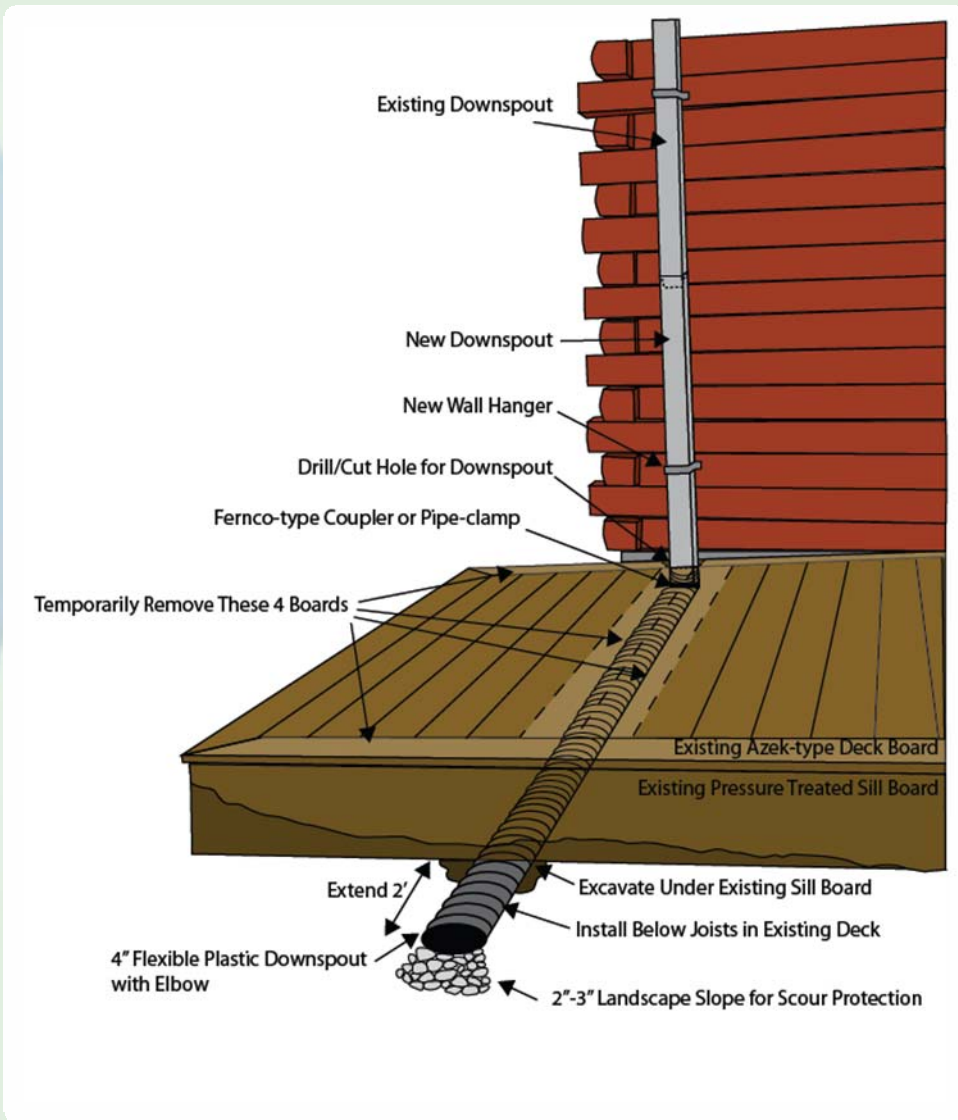


Where do Rain Gardens go?

- It depends on the surface you are collecting the runoff from

- Rooftop
- Driveway
- Road

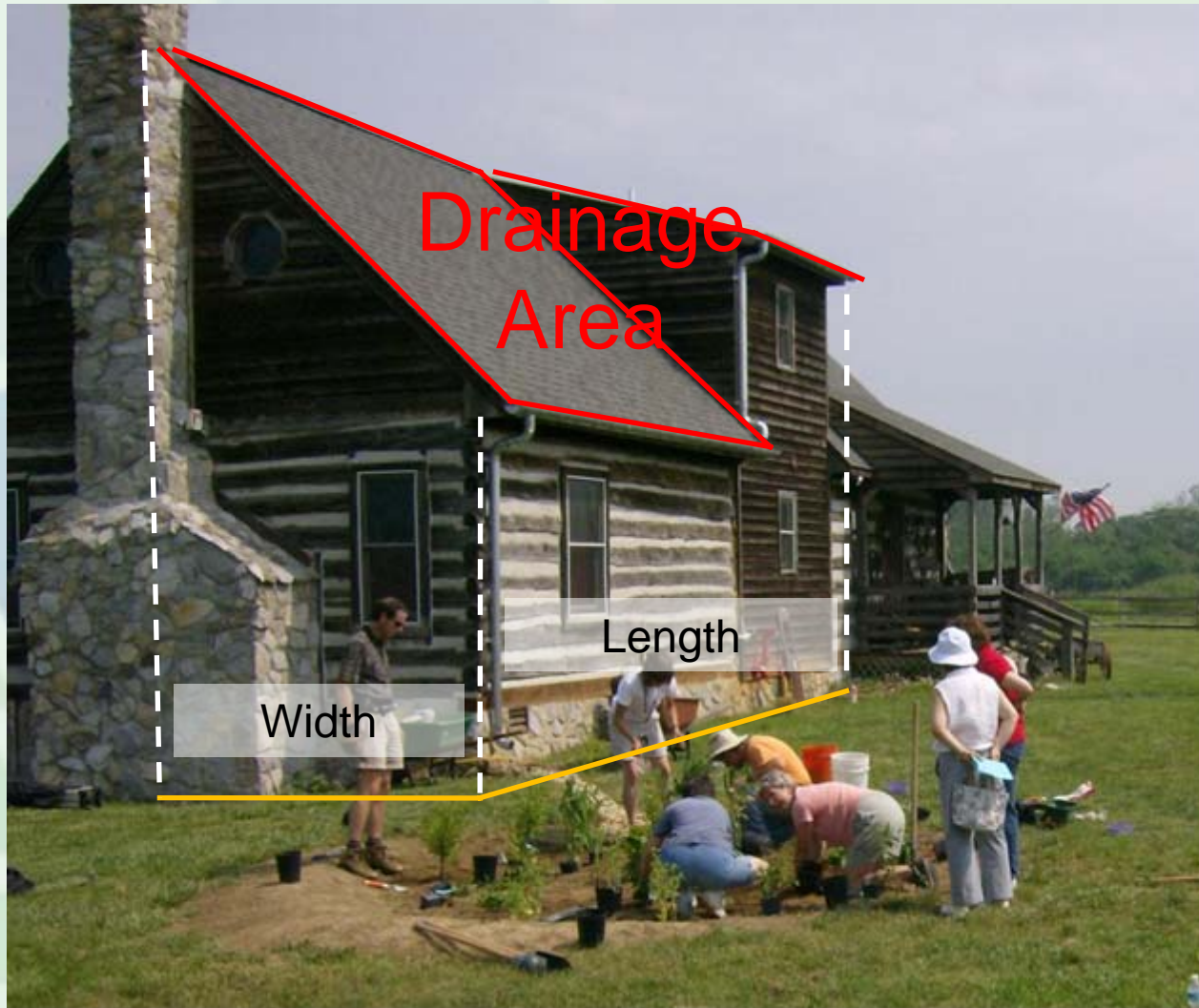






Rain Garden Sizing

Surface Area = Length x Width



Hockman Farm, Winchester, Virginia

Size of the Rain Garden

- The size of the rain garden is a function of volume of runoff to be treated and recharged.
- A rain garden is sized to handle the Water Quality Volume: First inch of runoff from impervious surfaces.
 - $WQ_v = (1")(I)/12$ where:
 - WQ_v = water quality volume (ac-ft)
 - I = impervious cover (ac)
- A typical residential rain garden ranges from 100 to 300 square feet.

Rain Garden Sizing Table for the Water Quality Volume

How do you determine the size of the rain garden?

$$\frac{\text{Drainage Area (sq ft)}}{\text{Depth (ft)}} \times \text{Water Quality Design Storm (ft)} = \text{Approx size of Rain Garden (sq ft)}$$

Drainage Area: the impervious surface that you're collecting the stormwater runoff from

Water Quality Volume: 1.0 inches of rain
(1.0 inch = 0.08 feet)

Depth: depends on the soil texture

CLAY = 3 in = 0.25 ft



SANDY = 8 in = 0.67 ft



Permeable pavers are an alternative



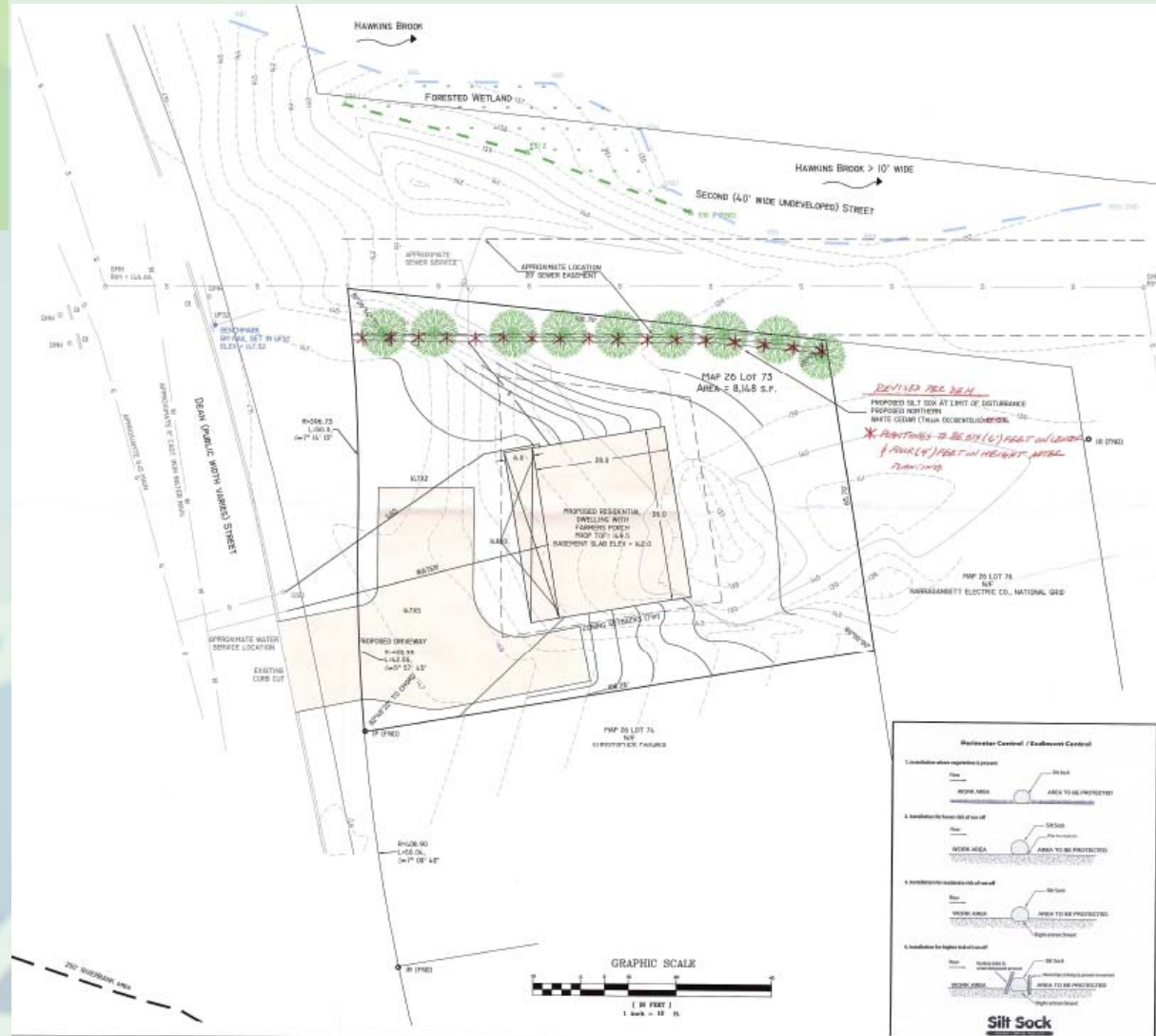


Non-rooftop Runoff Design and Permitting Considerations

- Good soils (> 0.5" /hr inf. rate);
- Default inf. setback distances- 10 ft to structure, 15 ft to OWTS, 25 ft to steep slopes (includes provision to reduce setbacks);
- Same separation to seasonal high gw;
- Inf. facility, swale, and bioretention sizing per Chapter 5.
- QPAs applicable for small drainage areas (CRMC exception - more info from Jim Boyd to follow).

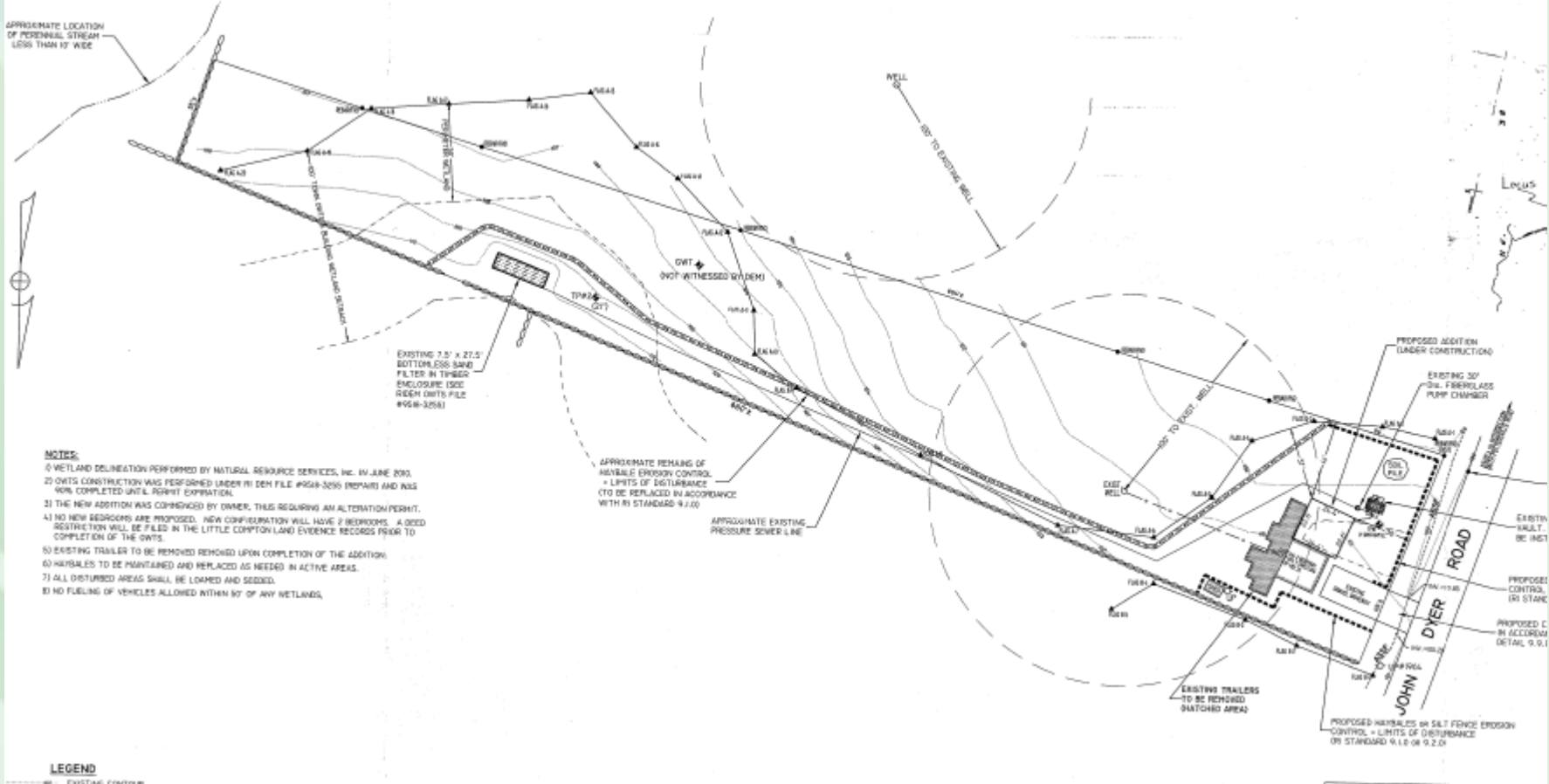
Single Lot - Steep Slopes

- QPA probably not feasible (slope);
- Dry wells for rooftop;
- Bioretention/rain garden for driveway;
- Permeable pavement for driveway.



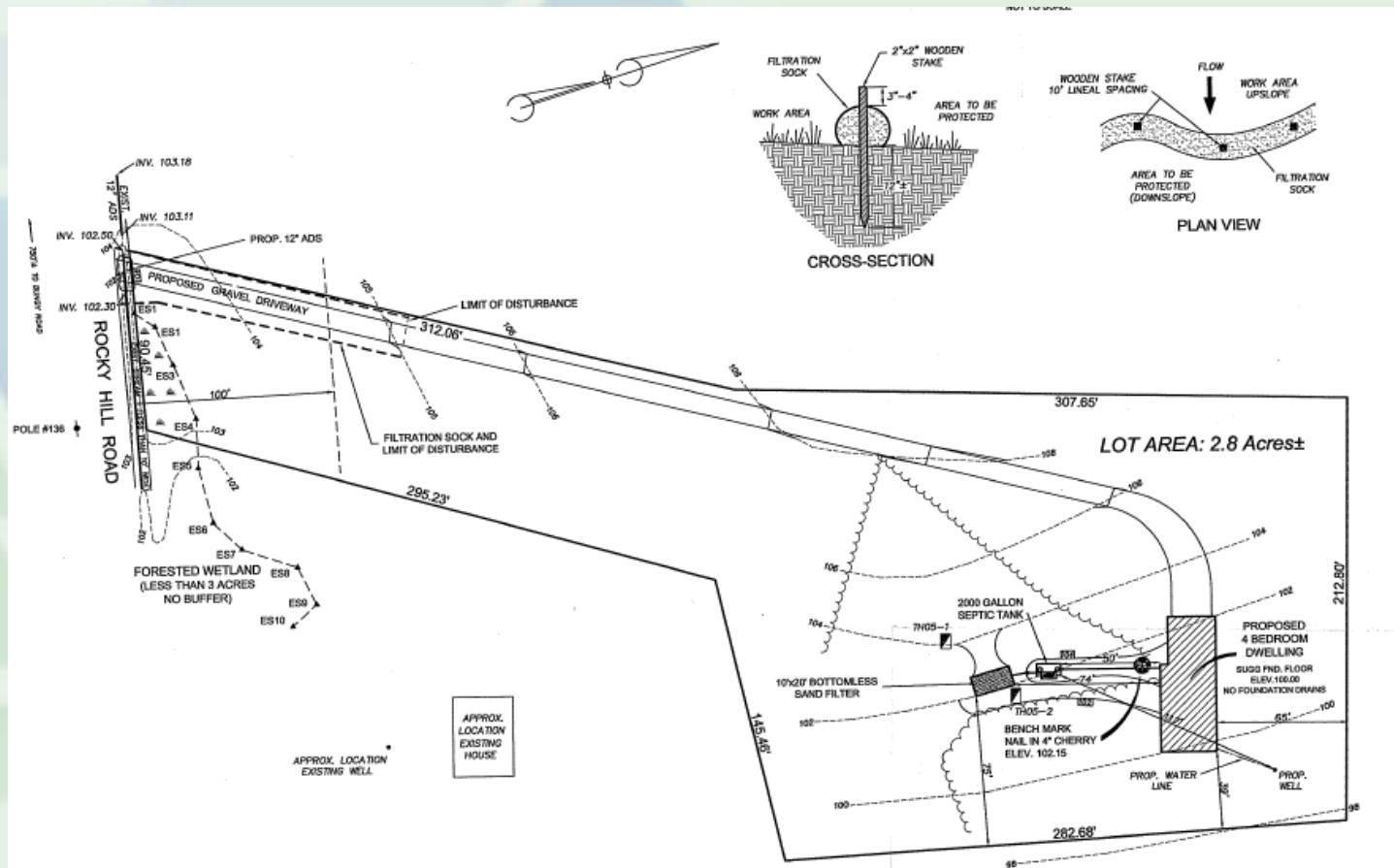
Narrow-Deep Lot - Addition

- Dry well for rooftop;
- QPA for driveway (cross slope);
- Limit clearing and grading for OWTS - aggressive ESC
- Permeable pavement



Long Driveway

- QPAs for long driveway;
- Bio/RG for rooftop
- Maybe QPA for rooftop
- Minimize clearing and grading



Fairly Steep - Small Disturbance

- Dry wells for rooftop;
- Bio/RG for rooftop;
- Bio/swale for driveway;
- Swale for Snagwood Rd;
- Re-grade driveway to create LP away from road.

