6/5/20

Rain Garden Deficiencies

Since we have found deficiencies in the retention basin, I did additional research and looked at the requirements and construction of the rain gardens required for Mr. Bacon (34 Bristol Road)and myself (31Bristol Road). Through my research, I found many problems with the construction and design. I know at this point since the design was developed by the builder's engineer and approved by the board, it may be difficult to change. However, the construction/installation of the rain gardens is another matter. Mr. Bacon and I don't want to come off as complainers or nit-picking, but as we started to peel back the onion and understand what was required and what was built, we are finding these deficiencies. And since we are directly tied to the functionality of the rain gardens and their maintenance through an easement with the towns conservation board, we feel we need to bring it up to ensure we are protected in the future.

After reviewing the construction drawings, notes, and referenced Mass DEP Stormwater Management Handbook Section: Bioretention Areas/Rain Gardens, I discovered a number of deficiencies in the installation of the gardens. I wanted to review why the rain gardens were required in the subdivision design. A rain garden is a way to collect water that runs off of impermeable surfaces. It acts as a filter and a pathway to groundwater or an adjacent wetland. The size of the garden is based on the size of the impermeable surface. Specific plantings are installed into the garden to assist in moisture removal, nutrient uptake, and to make the grade esthetically pleasing.

Bioretention Areas & Rain Gardens

Description: Bioretention is a technique that uses soils, plants, and microbes to treat stormwater before it is infiltrated and/or discharged.
Bioretention cells (also called rain gardens in residential applications) are shallow depressions filled with sandy soil topped with a thick layer of mulch and planted with dense native vegetation. Stormwater runoff is directed into the cell via piped or sheet flow. The runoff percolates through the soil media that acts as a filter.
There are two types of bioretention cells: those that are designed solely as an organic filter filtering bioretention areas and those configured to recharge groundwater in addition to acting as a filter exfiltrating bioretention areas. A filtering bioretention area includes an impermeable liner and underdrain that intercepts the runoff before it reaches the water table so that it may be conveyed to a discharge outlet, other best management practices, or the municipal storm drain system. An exfiltrating bioretention area has an underdrain that is designed to enhance exfiltration of runoff into the groundwater.

Ability to meet specific standards

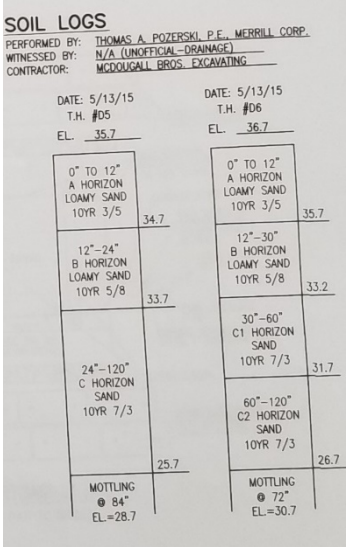
Standard	Description
2 - Peak Flow	N/A

The construction of the gardens as Bristol Estates called for the removal of material within the location of the garden to a specific depth specified on the drawings and soil logs.

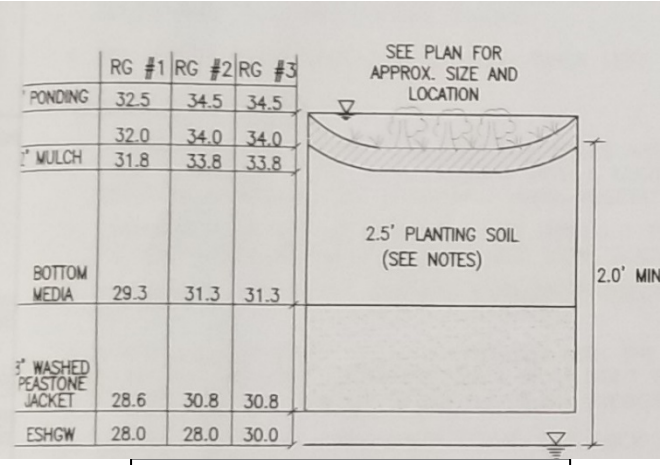
4. EXCAVATE ALL MATERIAL BELOW INFILTRATION BASIN TO LOAMY SAND LAYER (SEE SOIL LOGS) AND REPLACE WITH CLEAN COARSE FILL IN ACCORDANCE WITH 310 CMR 15.255. TREAT THE BOTTOM OF THE BASIN WITH 4" OF SANDY LOAM AND SEED.

Note from the Approved drawings

Once the specific depth was reached and the material has been removed, the garden construction could start. The drawings show that a washed stone a specific bottom media, then mulch was to be installed.



Soil profile referenced on drawings



Construction profile of Rain Garden

Once the media was installed, specific plantings were to be installed at the **bottom** of the drainage area of the garden.

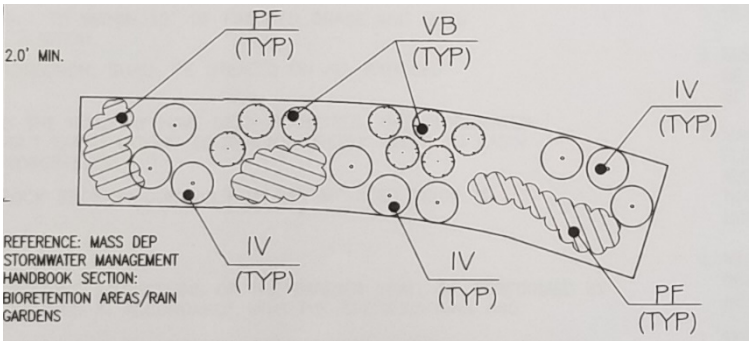
RAIN GARDEN PLANTING SCHEDULE

SYMBOL	BOTANICAL NAME	COMMON NAME	QUANTITY	SIZE	COMMENTS
VB	VIBURNUM SIEBOLDI	SIEBOLD VIBURNUM	TBD	4/5' B&B	
IV	ILEX VERTICILLATA	WINTERBERRY HOLLY	TBD	#3	MALE & FEMALE
PF	POTENTILLA FRUTICOSA	SHRUBBY CINQUEFOIL	TBD	#2	VARY COLOR

NOTE: QUANTITY OF PLANTINGS TO BE DETERMINED AT THE TIME OF INDIVIDUAL LOT DEVELOPMENT

List of approved plantings, no alternates listed only

The drawing below shows a potential layout that could be used for the planting of the garden. The final layout would be installed by that landscaper, and the numbers would be based on the size of the garden. Note that the paintings are to be at the bottom of the garden. Also note that the reference for all the designs and installation is based on the Mass DEP Stormwater Management Handbook Section: Bioretention Areas/Rain Gardens



Proposed typical layout on approved site drawings.

The specifics of the design for a rain garden are based on the size or volume of the rain garden is based on the amount or size of the area you want to drain to it. The design manual suggests it should be between 5-7% of the area draining to it. Unfortunately, the design of the rain gardens did not reflect the final site plans or the final slopes or elevations of the site. Basically, the gardens were way too big, and the site elevations were steeper than they should have been.

I want to provide you with some examples of constructed rain gardens that were based on the manual then I will review the current conditions of the rain gardens at lots 31 (Timmis) and 34 (Bacon).

This is what has been installed at 31 and 34 Bristol Road.

Grain Garden at 34 Bristol Road

Rain Garden at 31 Bristol Road

Review of construction

31 Bristol Road

The drain along the driveway does not collect water and drain it into the rain garden. Due to the elevations of the house construction, the size of the driveway and the slope of the driveway, all the water drains to the street. The construction does not match the design on the drawings or referenced in the MDOT manual.

- There is no stone sub-base or filter media, or mulch. Could not determine if the removal of the sub-base occurred. (see photo below)
- The construction does not match the grade elevations on drawings creating a deep bowl. Maintenance is very difficult.

- The soil used to construct the basin/berms is from onsite material and has no organic content, and it is difficult to grow grass. It is also extremely high in fines (silts and clays), allowing for easy erosion and creating an impervious surface when dry.
- The plantings are not correct in species and are scattered not just in the bottom but around the sides.

Pictures of the material in the garden, no mulch, no filter material or stone at the bottom

Example of the steep slopes, lack of grass growth and elevation.

Driveway sloped to road, collection pipe is to the left of driveway

34 Bristol Road

The drain along the driveway does not collect water and drain it into the rain garden. Due to the elevations of the house construction, the size of the driveway and the slope of the driveway, the majority of the water drains to the street. The construction does not match the design on the drawings or referenced in the MDOT manual.

- There is no stone sub-base or filter media, or mulch. Could not determine if the removal of the sub-base occurred. (see photo below)
- The construction does not match the grade elevations on drawings creating a deep bowl. Maintenance is very difficult.
- The soil used to construct the basin/berms is from onsite material and has no organic content, and it is difficult to grow grass. It is also extremely high in fines (silts and clays), allowing for easy erosion and creating an impervious surface when dry.
- The plantings are not correct in species and are scattered not just in the bottom but around the sides.
- The steep front slope washed out multiple times during construction
- Plants root plugs exposed, improperly installed on the slope and throughout
- When construction was "completed," the water did not drain and stagnated for many days. The "fix" was pumping out the water, and a small hole dug and filled pea stone and covered with dirt along with a thin layer of mulch.
- Drainpipe water flow from the driveway barely even trickles out any rainwater. Most of what fills the area come from direct rainfall and what drains from the lawn.
- The drain pipe elevation is too high, so insufficient dirt cover to grow grass.
- The size of the rain garden is too big for the relative size of the driveway.

Driveway note slope towards road, the drainage pipe is at the far end of the pavement

Exposed roots, and bad soil that wont grow grass.

Soil from the bottom of garden, slight covering of mulch, no stone or filter material

Steep slope and poor soil

Drainage Pipe

Potential resolution

Thank you for allowing us to present our situation for the current conditions of the rain gardens. We would like to present 3 options to the board for consideration.

First: Allow for the redesign and reconstruct the rain gardens to match better the current conditions of the site eliminating the steep slopes and deep bowl design. This would require the regrading of the areas and start from scratch at a lower location of the yard.

Second: Allow for the reconstruct the gardens in there current locations to meet the required design but adjust the grades to reduce the slopes. Install actual topsoil to allow the regrowth of grass

Third: Allow for the elimination of the rain gardens altogether. Based on the final grades of the houses and driveways, they are obsolete. They are basically big holes with bushes and providing no value. No rain is being collected and going to the garden. This would allow the regrading of both lots to allow the use of the yard, maintain the yard. Quality topsoil would need to be installed to allow for grass to grow.

Thank you for allowing us to present our situation. If you have any questions or would like any additional information, please feel free to contact me.

Andrew Timmis
31 Bristol Road