Rain Garden

A simple, yet effective method to control stormwater is through the use of rain gardens. The design of a rain garden involves, among other things, the hydrologic cycle, nonpoint pollutant treatment, resource conservation, habitat creation, nutrient cycles, soil chemistry, horticulture, landscape architecture, and ecology. Beyond its use for stormwater control, the rain garden provides attractive landscaping and a natural habitat for birds and butterflies, while encouraging environmental stewardship and community pride.

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Step 1 - Let's Begin

- Identify project participants (students and teachers)
  - Assign group leaders to communicate with maintenance staff
- Begin securing partnership involvement
- Get written agreement from school administration and maintenance staff
  - Clarify roles and responsibilities
  - Each school may allow a different amount of landscape changes
  - Ensure that there will be open communication throughout the project

Step 2 - Goals/Objectives and Budget

- Outline project goals and objectives
- Estimate amount you intend to spend [Budget]
- Establish link between current school curriculum and environmental enhancement project.

Cost

Planning - $25
Design - $100
Materials - $varies
Plants - $varies
Soil - $varies
Other - $varies
Construction - $950
Labor - $0 (volunteers)
TOTAL ESTIMATED COST: $1,075

Cost Spreadsheet

Residential rain gardens average about $3 to $4 per square foot, depending on soil conditions and the density and types of plants used. Commercial, industrial and institutional site costs can range between $10 to $40 per square foot, based on the need for control structures, curbing, storm drains and underdrains. In any bioretention cell design, the cost of plants varies substantially and can account for a significant portion of the facility's expenditures. While these cost estimates are slightly greater than those of typical landscaping treatment (due to the increased number of plantings, additional soil excavation, backfill material, use of underdrains etc.), those landscaping expenses that would be required regardless of the bioretention installation should be subtracted when determining the net cost.

Step 3 - Gather Information

- Obtain a schematic of the school including wetlands, power lines, fire lanes, future building plans, etc.
- Walk around and survey the school grounds to identify potential areas for project implementation
(i.e. areas where water ponds during/after storms, areas where there is a lot of erosion, landscaping doesn’t get enough water)

● Identify gutters/downspouts
● Request assistance from landscape architect, ecologist, and maintenance staff
● Investigate permit requirements
● Make list of problem areas
● Take pictures of problem areas
● Conduct informal survey of school community (including students, staff, parents, and maintenance staff) to determine their satisfaction with the current state of the school environment.

Step 4 - Location and Size of Rain Garden

Now that you have walked the campus, gathered all of the maps and materials you need, talked to the facilities manager, surveyed your fellow students and teachers, and listed the problem areas or potential areas for your rain garden, here are things to consider when locating and sizing your rain garden.

Make sure you do not plan your rain garden in a riparian buffer, too close to the foundation, and other factors listed below in the "Location" section. Also, be sure to design a manageable rain garden – make sure it is a size that can be maintained well by your class. Check out the maintenance requirements in Step 9.

● Two primary factors to consider when designing a rain garden are:

- Planning the location of your rain garden
- How to determine the size of your rain garden

**NOTE: Now is an excellent time to call your local Cooperative Extension Office to have them test the soil. They will do this free of charge. A good soil mix for a rain garden is 50% sand, 20% topsoil, and 30% compost. If the soil onsite contains less than 10% clay, then it can be used in place of imported topsoil in the mix. It is possible you may be able to use the existing soil, but if it is not in good condition, you may have to spend some money on new soil and/or amendments such as lime, gypsum and specific nutrients.

How to find an appropriate location for a rain garden

Take a walk around the school grounds during the next rainstorm. Make a note of where puddles are forming, which areas are not draining well, and where runoff is flowing.

Finding a good location for a rain garden involves balancing a number of different factors:

The rain garden should be located in a place where it will receive runoff. Check to make sure runoff flows to your site, or could flow with minor modifications, such as cutting a space out of a curb.

The rain garden must be located far enough from the building to avoid damage to the foundation. If your school has a basement, the rain garden should be located at least 25’ from the building. If there is no basement, the rain garden should be at least 5’ from the building.

Find out where underground utilities are buried. Common utilities will include: water, sewer, electricity, natural gas, telephone, cable, and possibly a separate storm sewer (some older areas have combined sewers, where the stormwater drains directly into the sanitary sewer system). It is often difficult and time consuming to find out exactly where all of the utilities are buried on your site, so start early. Write letters to each of the utilities, requesting plans showing the locations of underground utilities on your property. Have your maintenance staff show you where the utilities enter the building, and try to avoid using this area for rain gardens. Before construction, you can call Miss Utility, who will come to your site and mark the locations of utilities with spray paint, so you can be certain of avoiding them. Stay at least five feet horizontally and one foot vertically from any utilities.

Check your soil. Since a lot of earth was moved during the construction of your school and school grounds, it is likely that your soils will be highly compacted, and will not drain well. In order to compensate for this, you should use a special soil mix within the rain garden. You should also install an underdrain at the bottom of the rain garden.

The underdrain should be a perforated PVC pipe that runs from the bottom of the rain garden out to some discharge point. This could be a grassy area, a wooded area, a stream, or even a parking lot.

Also consider what will happen to runoff during very large storms. The rain garden is designed for small storms. When there is a great deal of rain, the rain garden will fill and eventually overflow. Be aware of where water will go when it overflows the rain garden. Minimize the impact that this overflow will have by directing it toward grassy areas, wooded areas, or existing storm drains.

Avoid trees. Soils near trees tend to have the best drainage, and should not be disturbed.

Avoid areas where there will be heavy foot traffic. Heavy foot traffic will pack down the soil in the rain garden, which will degrade its ability to infiltrate runoff. Place the rain garden somewhere out of the way, where the soil will not be compacted, and the vegetation will not be trampled.

Be sensitive to how other people use of the site. For example, avoid building your rain garden on a favorite picnic spot.

How to determine the size of a rain garden

When full, the ponded area should have a maximum depth of six inches. The planting soil usually has a minimum depth of 2.5 feet, but this depth may be constrained by the maximum depth of the underdrain at your site. The underdrain must discharge down gradient from the rain garden. Depending on your site topography, the bottom of the rain garden may need to be shallower than three feet below the ground surface.

When rain gardens are designed for new sites, their sizes are matched to their drainage areas. When a site is being retrofit, the size of the rain garden is often limited by the availability of suitable space. Even in this case, it is important to estimate how effectively your proposed rain garden will capture, treat and infiltrate runoff from your site. This can be accomplished using the sizing tool.

Step 5 - Designing Your Rain Garden

Now that you have determined the location and size of your rain garden you can begin to design it:

- Copy and increase the size of the school plan so that every inch equal 10 feet (1" = 10')
- Draw a schematic drawing of the rain garden on a copy of the school plan
- Show where the water source comes into the rain garden (bioswale, rain barrel hose, or where water sheets off of sidewalk or parking lot)
- Determine the size of the rain garden (in square feet)

Step 6 - Selecting Plants for Your Rain Garden

Now that you have selected the location and determined the size of your rain garden take a few days to analyze the site you have selected. The success of your rain garden depends on this important information. Take notes and track what is happening at the site in the rain and on sunny days. Write down how much sun it gets – how many hours of afternoon sun? morning sun? Is there a reflection off of an adjacent building that provides more light or seems to make the heat more severe? Figure out if there are any unusual 'microclimates' at the site and then begin researching the plants that like these conditions.

Plant your rain garden with plants that thrive in that environment. Whether in the sun or shade, rain gardens can be planted with shrubs and flowers that are beautiful and low maintenance – as long as you select the plants that love those conditions. Native plants – or plants that grow naturally in this climate or region -- can thrive without a lot of care, extra water, or extra fertilizer.

This is an opportunity to learn more about the types of plants that love the sun, love the shade, love to have their 'feet wet' for a day or two, or don't mind being dry for days on end. It is like a puzzle. See if you can pick out plants that are different heights, have different leaf color, and bloom different colors throughout the spring, summer, and fall seasons. Remember that even in the winter, plants without leaves can provide berries for birds

and have an unusual structure that can be accentuated in the snow.

Designing with Plants:
● Use a circle template (or ruler) to place plants in your rain garden
● Select several 4-6’ shrubs, a lot of perennials (flowers that come back every year), and depending on the size of the rain garden a medium-sized tree or two [15-20’ at full growth])
Refer to the sample drawing to help you.

Consider these things when selecting plants:
● Choose native plants when possible
● Avoid planting non-native invasive plants
● Choose fragrant or edible plants when possible
● Avoid toxic/poisonous plants
● Avoid plants that produce excessive pollen

Sample plant list to use as a guide:
Prince George's County, MD Plant List

Additional plant information:
Useful Links

Step 7 - Design Review and Obtaining Permission

Once you have a schematic design of your rain garden, schedule a meeting with your principal and facilities/maintenance manager. This is an information gathering meeting and be prepared to make revisions based on the discussion at the meeting.

Be prepared to discuss the construction and maintenance issues with the principal and maintenance staff.
[Read the following steps (Step 8 – Construction and Step 9 – Maintenance) to understand the materials, material delivery, and site and soil preparation procedures.]

During the meeting:
● Review the draft design
● Discuss the construction of the rain garden

- Find out about school regulations about delivery and storage of materials and equipment that will be used for construction of the rain garden.
- Discuss the maintenance issues (roles and responsibilities)

Step 8 - Construction

Construction techniques are extremely critical in ensuring the success of a rain garden. Various construction guidelines and inspection points are given below, as well as a general construction schedule adapted from the Prince George's County Bioretention Manual. Local or regional rain garden/bioretention cell guides may also have useful information.

Sequence of Construction

1/2 day - Install sediment control devices. (These are for larger projects. Check with your local building permit office. It's a good idea to surround the down gradient part of the site with straw bales or silt fence. It's readily available and inexpensive.)

1 day - Grade site to elevations shown on plan. If applicable, construct curb openings and/or remove and replace existing concrete. Curb openings should be blocked or other measures taken to prohibit drainage from entering construction area. (Equipment such as a backhoe may be rented for this. Make sure any Miss Utility is notified before any digging. Safety fence should be used around any construction area or excavation.)

1/2 day - Stabilize grading within Limit of Disturbance except for the bioretention area, which will be planted. (Surrounding the cell with a biolog, straw bales, or compost berm to keep sediment out of the bioretention cell.)

1/2 day - Excavate bioretention area to proposed invert depth and scarify the existing soil surfaces, taking care not to compact the in-situ materials. (A contractor may be hired to dig the hole. Make sure that there are no open areas or pits open at the end of the day and no excavation over local jurisdiction or OSHA limits. Generally bioretention cells are less than 3 feet deep.)

1/2 day - Install underdrain system and observation wells, if specified. (Use perforated 4” HDPE pipe and surround the pipe with about 2” of gravel)

1/4 day - Backfill bioretention area with planting soil. (Fill the cell with 8” lifts of soil. Saturate each lift and let it drain and then place the next lift. Be careful not to compact the soil with equipment and saturate it.)

1/4 day - Plant vegetation.

1/4 day - Mulch and install erosion protection at entrance points. Remove sediment control practices or entrance blocks with inspector authorization if this project requires a permit. (It is recommended to leave perimeter biodegradable controls to reduce sediment loads to cell)

Total Estimated Construction Time: 5.5 Days

Step 9 - Maintenance

A routine maintenance schedule can be followed. An example is presented here, as adapted from the Prince George's County Bioretention Manual. Experience has shown that the economic incentive of maintaining property values ensures that most homeowners will maintain their LID landscape.

Maintenance Schedule

Soil
● Visually inspect and repair erosion monthly. Use small stones to stabilize erosion along drainage paths.
● Check the pH once or twice a year. Apply an alkaline product, such as limestone, if needed.

Mulch
● Re-mulch any void areas by hand as needed.
● Every 6 months, in the spring and fall, add a fresh mulch layer.
● Once every 2 to 3 years, in the spring, remove old mulch layer before applying new one.

Plants

● Immediately after the completion of cell construction, water plant material for 14 consecutive days unless there is sufficient natural rainfall.
● When trees have taken root, or at least by 6 months, remove stakes and wires.
● Once a month (more frequently in the summer), visually inspect vegetation for disease or pest problems.
● If treatment is warranted, use the least toxic approach.
● Twice a year, from March 15th to April 30th and October 1st to November 30th, remove and replace all dead and diseased vegetation considered beyond treatment.
● During times of extended drought, look for physical features of stress (unrevived wilting, yellow, spotted or brown leaves, loss of leaves, etc.). Water in the early morning as needed.
● Weed regularly, if needed.
● Prune excess growth annually or more often, if desired. Trimmed materials may be recycled back in with replenished mulch or land filled if there is a concern of heavy metals accumulation.

General
● After rainstorms, inspect the cell and make sure that drainage paths are clear and that ponding water dissipates over 4-6 hours. (Water may pond for longer times during the winter and early spring.)

**NOTE: Keep in mind, the rain garden is not a pond. It should not provide a breeding ground for mosquitoes. Mosquitoes need at least 4 days of standing water to develop as larva.

Step 10 - Advertise

● Spread the word!!!
● Develop a website
● Provide an outline of goals and objectives
● Post pictures
● Advertise URL through school newspaper, public television
● Update often

Step 11 - Create Timeline

● Order supplies
● Arrange for material delivery

● Advertise work days on web and in school newspaper
- Ask for volunteers
● Create timeline for project completion

Step 12 - Preliminary Plans for Construction Day

Some final preparations need to be made to make your construction day a success.

Be sure to:

1. Notify your school administrators and maintenance staff that the construction will begin
2. Call key volunteers (Ask them to arrive early and be Team Leaders)
3. Ask volunteers to bring gloves, shovels, and water bottles (make sure their tools are labeled with their names)
4. Create a Task List
5. Delegate responsibility so that you can be free to coordinate on construction day
6. Print out and copy the Construction Sequence page
7. Get an Emergency Kit and set up an Emergency Plan
8. Make sure building door(s) are open so that volunteers can use bathroom facilities
9. Make sure you have access to water hose
10. Provide refreshments and snacks (if possible) – at least provide water
11. Contact local newspaper, or designate a student volunteer or parent to take photos and write about the event
12. Bring camera

Step 13 - Construction Day

Now that all of your materials have been ordered and volunteers have been scheduled it is time to construct your rain garden.

Prior to construction:

1. Arrive early
2. Take "Before" photo
3. Organize the construction site:
   ● Position plants and materials
   ● Label tools

- Place tools that are not being used in a central location
- Put Emergency Kit on hand in the central location

4. Greet and organize volunteers
   - Have volunteers sign in
   - Delegate responsibilities
   - Announce the schedule and breaks
   - Provide info on emergency plan, bathroom locations, and refreshments
   - Distribute the Construction Sequence information
   - Take photo of all volunteers

During Construction:
1. Take photos of all the construction phases, emphasizing the volunteers
2. Interview the volunteers

Post-Construction:
1. Water the rain garden
2. Take "After" photo
3. Step back and appreciate

Remember to:
- Continuously monitor safety
- Have fun!

Step 14 - Write Summary Report

- Write final report
  - Use input from all students involved
- Post names of volunteers on web and in school newspaper
- Take follow-up survey of school community
- Review budget
- Plan long-term maintenance
- Determine future learning outcomes

Step 15 - Keep It Going

- Where do we go from here?!!!

The End!!