

PROJECT-BASED LEARNING: DESIGN AND BUILD A RAIN GARDEN

Part 1: Rain Garden Proposal

Purpose and Overview:

This lesson assumes you have already determined that a rain garden might be a good project for your class and that you have generally located where you want to install the garden; for example, a location where a downspout spills water onto an impervious surface or lawn, or where stormwater runs off pavement. The lesson includes background content and context for students to understand how rain gardens address and fit into larger stormwater management issues and approaches. In the lesson, students develop a proposal and presentation to school stakeholders to install a rain garden on school grounds. The lesson lays the foundation for Parts 2-4: siting, designing, and installing a rain garden.

Time: Two to three 45-minute sessions

Objectives:

The student will...

- Define green infrastructure
- Understand how water behaves in natural and human-altered environments
- Identify examples of green infrastructure
- Understand what types of stormwater problems green infrastructure can solve
- Understand what a rain garden is and what problems rain gardens solve
- Define and identify examples of ecosystem services
- Know what watershed their community and school is in
- Explore and understand the physical and health benefits of nature
- Have familiarity with the area's native plants
- Understand why and how native plants work best in a rain garden
- Develop a formal proposal
- (Optional) Develop a presentation using presentation software

IS THIS THE RIGHT PROJECT?

For assistance in determining whether a rain garden project is right for your classroom and site, see the Nature Works Everywhere Sustainable Urban Design Toolkit [Introduction](#) and [Quick Guide to Projects](#).

For an overview of the selection and installation process, see Green Stormwater Infrastructure: [Rain Gardens](#).

Materials:

Nature Works Everywhere videos that support this lesson plan:

- *How Natural Areas Filter Water* (<https://vimeo.com/77811268>)
- *Sustainable Cities: Nature-based Solutions in Urban Design* (<https://vimeo.com/155849692>)
- *Design and Build a Rain Garden for Your School or Community* (<https://vimeo.com/234213950>)

For teachers:

- Access to computer, Internet, computer, speakers
- PowerPoint Presentations on **Stormwater** and **Green Infrastructure and Rain Garden Function** (<https://www.natureworkseverywhere.org/resources/design-and-build-rain-garden/>)

For each individual or group of students:

- Copies of the student handout (<https://www.natureworkseverywhere.org/resources/design-and-build-rain-garden/>) to accompany the video *Sustainable Cities: Nature-based Solutions in Urban Design*
- Notebook
- Access to computer with internet
- Access to presentation software

Suggested Flow:

Engage: Understanding Green Infrastructure

1. Show students photos of rain behaving in different ways as stormwater (included in the accompanying Stormwater PowerPoint presentation)—running off pavement, puddling up, overflowing banks of a creek, causing erosion, etc. Brainstorm as a class the effects of these scenarios.
2. Show students the video *How Natural Areas Filter Water* (<https://vimeo.com/77811268>). Ask students to reflect on their ideas about the photographs and make note of anything they saw or heard in the video that surprised them or that was new to them. Take a few minutes after the video to share these notes as a class.
3. Ask students what they think the term “green infrastructure” means. If your students are already familiar with this term, move on to developing a shared definition.
4. Together, develop a shared definition of green infrastructure. Ask students to consider green infrastructure in two ways, with and without humans in the mix. The shared definition should include both ideas: 1) The systems that exist in nature that “manage” natural processes (such as the way in which natural areas absorb and filter water) and 2) The human management of natural resources that works with and mimics natural processes or systems.
5. Explain to students that a key goal of this lesson is to develop a proposal to school administrators to install a rain garden, a type of green infrastructure, on school grounds. Later, they will do research that will directly inform their proposal.

Explore

1. Distribute the Part 1 handout and show students the video *Sustainable Cities: Nature-based Solutions in Urban Design* (<https://vimeo.com/155849692>).
2. Discuss as a class the various kinds of green infrastructure they saw in the video. Ask them to think about the shared definition of green infrastructure and to offer examples of how people in the video work with natural systems to solve a problem. Examples include directing water into gardens and other natural areas, engineering to mimic a natural stream bed, using sewage to create power, vertical gardens, rain gardens.
3. The rest of the “explore” lesson describes a student research project on rain gardens. If time for doing research is limited OR if students need extra support before conducting research, you can show them the **Green Infrastructure and Rain Garden Function** PowerPoint presentation found in the teacher materials section of the website page (<https://www.natureworkseverywhere.org/resources/design-and-build-rain-garden/>).
4. Have student groups each do research on one of the following to inform the proposal to install a rain garden. Make sure there is a group responsible for each bullet point.
 - Examples of green infrastructure and rain gardens, including photos;
 - What are *ecosystem services* and what services does a rain garden mimic (e.g., filtering water, mitigating flooding)?
 - School, local, and state regulations or guidelines regarding rain gardens. Students might find these online or might need to call government agencies, and/or seek expert advice. You may want to make the first contact with school grounds personnel and/or other district offices to lay the groundwork for students to follow up;
 - The watershed in which the school grounds sit (see [Wiki Watershed](#) resource, below);
 - How the school grounds fit into the watershed, including local bodies of water that may be affected by runoff or flooding;
 - An overall description of how a rain garden is constructed;
 - The short- and long-term requirements of rain gardens;
 - The physical and mental health benefits of nature;
 - The area’s native plants and why they work best in a rain garden.

What is a Rain Garden?

Nature's Water Filter: Rain gardens are shallow landscaped depressions that capture, clean and absorb stormwater runoff from roofs, parking lots and roads.



Image credit: TNC

5. Have student groups identify and record 3-5 key points from their research they think should be included in the proposal. They will revisit these key points in the next section when they write their part of the proposal.

Suggested resources:

- Sustainable Urban Design: Educator's Toolkit for Project-based Learning (Nature Works Everywhere) <https://www.natureworkseverywhere.org/resources/sustainable-urban-design-toolkit/>
- Wiki Watershed, Model My Watershed (Stroud Water Research Center) <https://wikiwatershed.org>
- Rain Gardens - General overview of a rain garden and its benefits (Habitat Network) <http://content.yardmap.org/learn/rain-gardens/>
- Rain Garden Handbook for Western Washington (WA State Department of Ecology) <https://fortress.wa.gov/ecy/publications/documents/1310027.pdf>
- City Habitats Newspapers in Education Flipbook on Polluted Runoff (The Nature Conservancy) <https://ad.seattletimes.com/FlippingBook/NIE/2016/CityHabitats/>
- Low Impact Development Manual for Schools (Sustainability Ambassadors) [http://www.sustainabilityambassadors.org/lid-manual-for-schools'](http://www.sustainabilityambassadors.org/lid-manual-for-schools/)
- Rain Gardens for Schools (12,000 Rain Gardens) <http://www.12000raingardens.org/build-a-rain-garden/schools/>

Explain: Proposal Research

1. Remind students they will be responsible for writing a proposal to school stakeholders. Let them know that they will also develop a presentation to accompany the proposal. Show students the video *Design and Build a Rain Garden for Your School or Community* (<https://vimeo.com/234213950>) as an overview to the issues and purpose of installing a rain garden. Have them keep a list of key points to include in their proposal.
2. Help students organize the proposal development process. Different groups can compile and write different sections of the proposal and some students can be responsible for graphic elements, such as diagrams and photos. Some examples of infographics are included at the end of this lesson plan, but students can create their own.

Components of the proposal and presentation:

- a brief overview of green infrastructure and stormwater management;
- an introduction to rain gardens, including information about native plants and the health benefits of nature;
- an explanation for the proposed site for the rain garden;
- a description of how school district and local or state regulations will be addressed;
- why a rain garden is a good solution to stormwater issues on school grounds;
- a brief overview of how a rain garden is built and the construction plan for your rain garden*;
- the short- and long-term maintenance plan for the garden, including how maintenance will be handled in summers and subsequent school years.

*Note that students will be exploring the construction of a rain garden in detail in Part 2. For the proposal, they need only include a general description.

4. Have students develop a proposal to the school administration and/or school board, using their research on green infrastructure and rain gardens, the health benefits of nature, understanding of regulations, and their own connection to nature. You may also want them to put together a presentation (e.g., Prezi, PowerPoint or other presentation software) to present images and possibly portions of the videos they have viewed.

Extend (Optional)

Options for extending the learning:

1. Students identify a location in the community that might benefit from a rain garden. They can work to organize a community effort to get the rain garden installed.
2. Students do a stormwater inventory in the community. As they travel through the town or city as usual, they identify and log examples of 1) areas where stormwater is or might be an issue and suggest potential green infrastructure solutions, and 2) places where stormwater problems have been addressed with green infrastructure and note what problems were solved.
3. Students select and write a research paper on one aspect of green infrastructure/stormwater management to further explore—e.g., ecosystem services, other stormwater management activities, engineering, health benefits of nature in cities, etc.

Evaluate

Students can self or peer evaluate based on the requirements of their respective sections of the proposal. To what extent did they do research and collaborate on their section? How comprehensive and well-organized was their section? How accurate is the information they included?

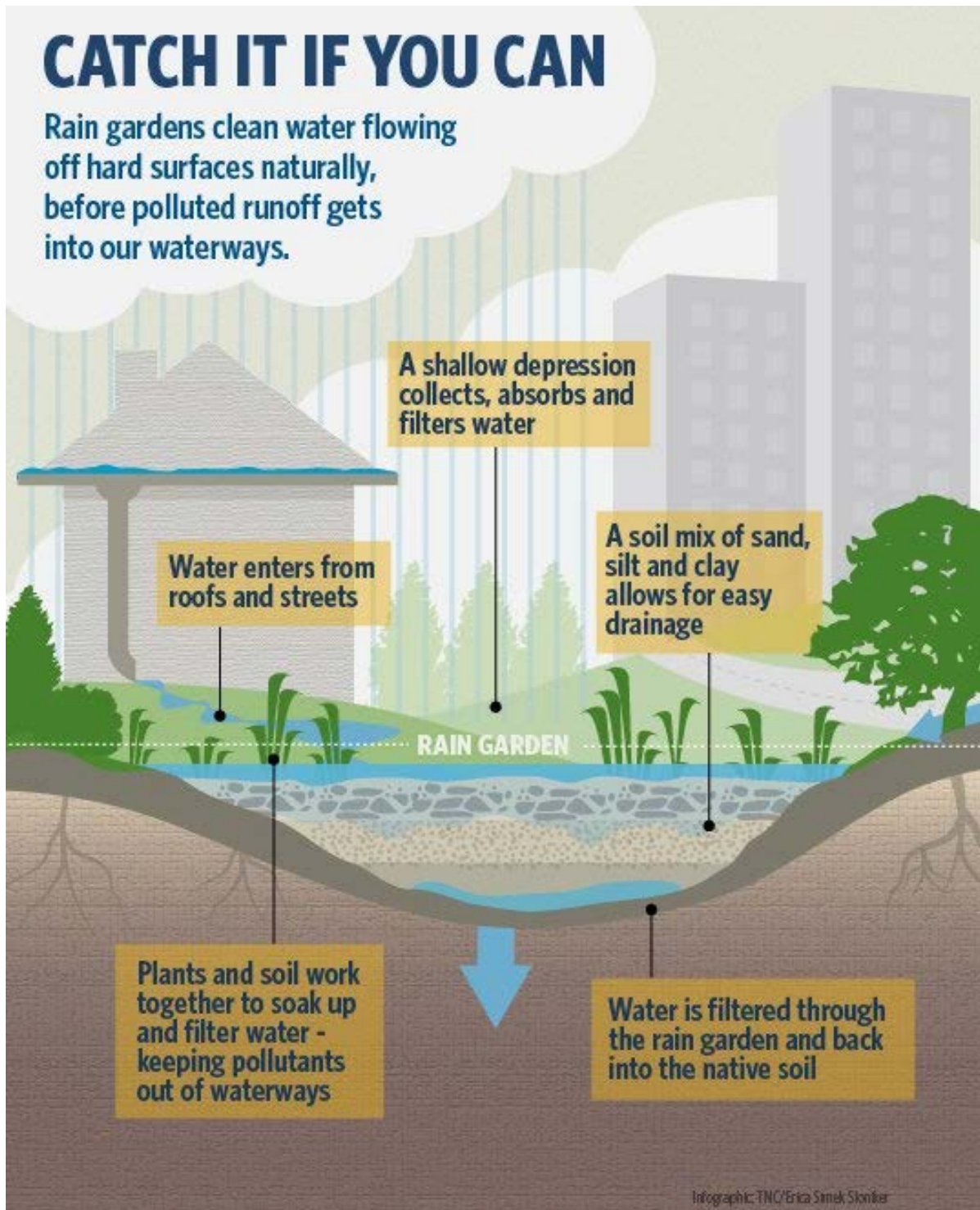
Sections include

- a brief overview of green infrastructure and stormwater management;
- an introduction to rain gardens, including information about native plants and the health benefits of nature;
- an explanation for the proposed site for the rain garden*;
- a description of how local or state regulations will be addressed;
- why a rain garden is a good solution to stormwater issues on school grounds;
- a brief overview of how a rain garden is built and the construction plan for your rain garden*;
- the short- and long-term maintenance plan for the garden, including how maintenance will be handled in summers and subsequent school years.

Additional Resources and Further Reading

- Accessing Urban Environmental Education Opportunities via Green Infrastructure (The Nature of Cities) <https://www.thenatureofcities.com/2016/07/03/accessing-urban-environmental-education-opportunities-via-green-infrastructure/>
- 5 Ways That Rain Gardens Help Seattle and Puget Sound (The Nature Conservancy) <https://www.nature.org/ourinitiatives/urgentissues/nature-in-cities/5-ways-that-rain-gardens-help-seattle-and-puget-sound.xml?redirect=https-301>
- What is Green Stormwater Infrastructure? Infographic (The Nature Conservancy-Washington State) <http://www.washingtonnature.org/cities/stormwater/green-infrastructure-infographic>
- Seeing Green Infrastructure (Esri) <https://nation.maps.arcgis.com/apps/Cascade/index.html?appid=9497dbc933bc46efac5236722cebde6>
- Map Local Green Infrastructure (Esri) <https://green-infrastructure.esri.com/AssetFinder/index.html>
- Cities Can Save Money Investing in Natural Infrastructure (World Resources Institute) <http://www.wri.org/blog/2015/10/cities-can-save-money-investing-natural-infrastructure-water>
- American Public Health Association <https://www.apha.org/policies-and-advocacy/public-health-policy-statements/policy-database/2014/07/08/09/18/improving-health-and-wellness-through-access-to-nature>

Example Infographics:



REDESIGNING CITIES TO FUNCTION LIKE FORESTS

We are re-envisioning cities to function more like a forest. By enhancing nature in cities, more rainfall will be absorbed into the ground and more of the water flowing into our waterways will be clean.

