R.W. KERN CENTER

WATER AT THE R.W. KERN CENTER: FROM RAIN TO RECHARGE

Revised: 1/30/2020

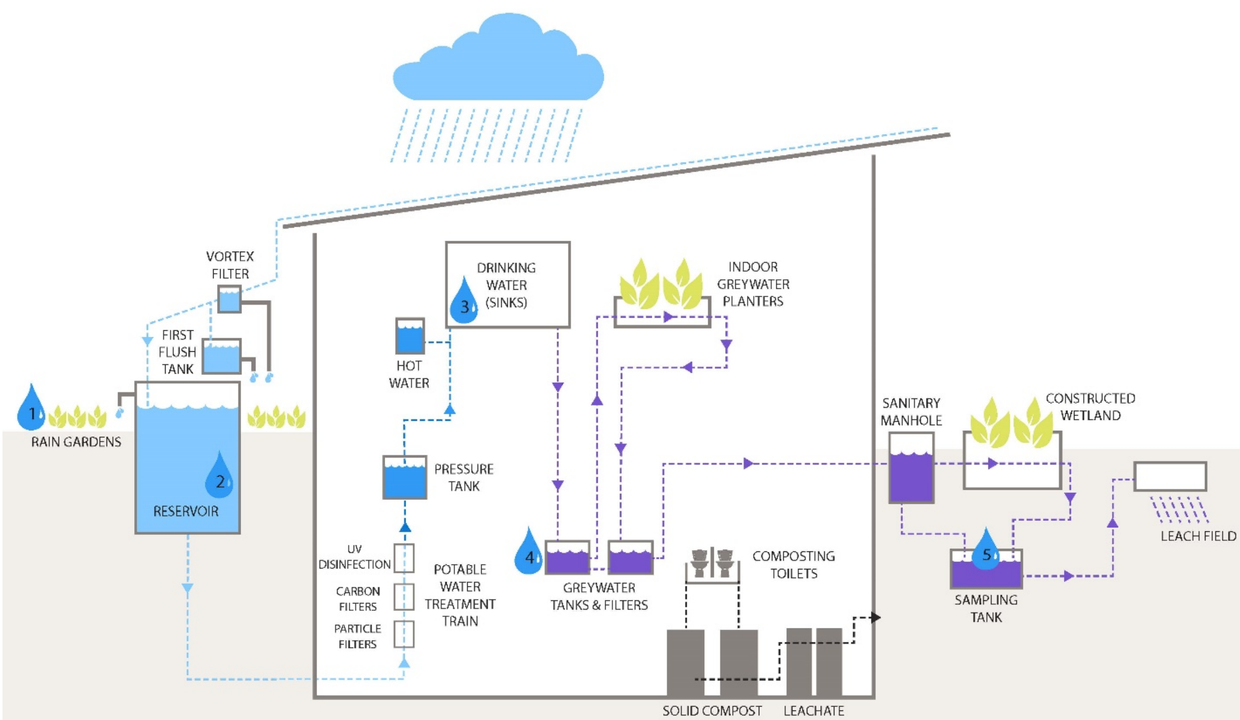
Overview

This one-hour workshop familiarizes participants of all ages with water flows through the R.W. Kern Center (RWKC) in an effort to increase awareness about *net-zero water* and the effects of the built environment on the natural environment. Participants will learn about the innovative water collection and treatment strategies used by the RWKC to meet its net-zero water goals. Participants will be encouraged to consider important questions such as: where does my water come from? Where does it go? How is it treated? How is it different at the RWKC? How can we reduce our water consumption? Participants who complete this workshop will be able to differentiate between stormwater, potable (drinking) water, greywater, and blackwater.

Background

The RWKC meets the rigorous standards of the Living Building Challenge (LBC), a building certification system that includes a *net-zero water* initiative. This means that the RWKC cannot use more water than it can source on site, and it must manage 100% of wastewater and stormwater on site.

To meet these net-zero water goals, the RWKC implements several innovative water collection and treatment strategies designed to minimize the impact of the building on the natural environment. When it rains in a natural environment, water flows into the ground as a part of the water cycle. But when we build roads and buildings, this cycle is interrupted. Water is rerouted to storm drains, canals, or even sewage treatment plants. The RWKC was designed to minimize that interruption, reducing the financial, energy-related, and carbon-related costs associated with transporting and treating water. When it rains, the RWKC collects that rainwater, treats it, uses it, treats it again, and returns it to the ground so it can reenter the water cycle.



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Massachusetts Science and Technology/Engineering Learning Standards

The Massachusetts Science and Technology/Engineering Learning Standards are set by the Massachusetts Department of Elementary and Secondary Education and adapted from the Next Generation Science Standards (NGSS). This workshop, though designed for learners of all ages, can be led to meet the following standards.

Pre-K: Earth and Space Sciences

ESS2. Earth's Systems

- PreK-ESS2-3(MA). Explore and describe different places water is found in the local environment.

ESS3. Earth and Human Activity

- PreK-ESS3-1(MA). Engage in discussion and raise questions using examples about local resources (including soil and water) humans use to meet their needs.
- PreK-ESS3-2(MA). Observe and discuss the impact of people's activities on the local environment.

Kindergarten: Earth and Space Sciences

ESS3. Earth and Human Activity

- K-ESS3-3. Communicate solutions to reduce the amount of natural resources an individual uses.

Grade 2: Earth and Space Sciences

ESS2. Earth's Systems

- 2-ESS2-3. Use examples obtained from informational sources to explain that water is found in the ocean, rivers and streams, lakes and ponds, and may be solid or liquid.

Grade 5: Earth and Space Sciences

ESS2. Earth's Systems

- 5-ESS2-1. Use a model to describe the cycling of water through a watershed through evaporation, precipitation, absorption, surface runoff, and condensation.

ESS3. Earth and Human Activity

- 5-ESS3-1. Obtain and combine information about ways communities reduce human impact on the Earth's resources and environment by changing an agricultural, industrial, or community practice or process.

Grade 7: Earth and Space Sciences

ESS3. Earth and Human Activity

- 7.MS-ESS3-4. Construct an argument supported by evidence that human activities and technologies can mitigate the impact of increases in human population and per capita consumption of natural resources on the environment.

High School: Earth and Space Science

ESS3. Earth and Human Activity

- HS-ESS3-1. Construct an explanation based on evidence for how the availability of key natural resources and changes due to variations in climate have influenced human activity.

Activity Summary

Participants will match water samples from the RWKC to their specific location in the building, placing sample bottles on a large laminated diagram of the building's water system. Learners will work in groups of 4-6 to discuss the samples and decide where to place each sample.

Learning Objectives

By the end of the workshop, participants should understand:

- Difference between stormwater, potable water, greywater, and blackwater
- Impact of the built environment on ecological water flow
- Concept of *net-zero water*
- How the RWKC meets its net-zero water goals
- Strategies they can use to reduce water use

Key Terms

- Potable (Drinking) Water: water that is fit for human consumption
- Greywater: Water discharged from sinks, showers, laundry, drinking fountains, etc., but not including water discharged from toilets/urinals
- Blackwater: Discharged water containing solid and liquid human waste from toilets/urinals
- Stormwater: Precipitation (rain, snow, etc.) that falls on a site

Materials (per group of 4-6)

- 5 numbered, clear bottles with reliable caps (here is one example; they can be bigger)
  - Stormwater, rainwater, potable water, raw greywater, treated greywater
- Laminated poster of the RWKC water cycle
- White board or blank laminated poster
- Dry erase markers

Preparation

- Collect bottles of water from each sample site (one bottle per site for each group): rain garden, cistern, bathroom tap, primary greywater filter, outdoor sampling tank

Step-by-Step Instructions

1. Introductions: names, pronouns, roles
2. Overview: Tell participants we will look at different water samples from the building to learn about how water flows through the RWKC, and how buildings can work with natural water flows.
3. Group Brainstorm #1: Describe the water cycle. What happens to rain when it reaches the ground? Where does it go from there? How might buildings change this process? Facilitator should write or draw out responses on the whiteboard.
4. Group Brainstorm #2: Where does your water come from (in your home, school)? Where does it go? Write or draw out responses on the whiteboard.
   a. Define: *potable water, greywater, blackwater, stormwater*
5. Background: Introduce the RWKC and net-zero water philosophy
   a. The RWKC is a Living Building, meaning it is designed to "live within its means" from a resource perspective. This also means it is a *net-zero water* building.
   b. Net-zero water (as defined by LBC) has three components:
      i. All the building's water needs must be supplied from an on-site source.
      ii. All water used in the building must be treated and returned to the natural water loop (i.e. re-infiltrated into the ground).
      iii. All stormwater must also be re-infiltrated on site; no sewer discharge is allowed.

6. Water matching activity (10-15 minutes)
    a. Groups of 4-6 people
    b. Each group receives a set of five (5) bottles and a laminated RWKC water diagram.
    c. Participants must match the five (5) bottles of water to the sample sites labeled on the diagram.
7. Discussion (30 minutes)
    a. Discuss water flows at the RWKC as shown on diagram (step-by-step from when it rains to greywater discharge) and answer questions about the systems.
    b. Some questions to pose: are there any words or concepts you are unfamiliar with in the descriptions of each water sample or system? Do you understand the difference between all the types of water we collected?
    c. Pause explanation at each sample site and see if groups matched the bottles correctly.
        i. Stormwater
            1. Collected from RWKC raingarden, which treats and slowly infiltrates runoff produced on-site
            2. Discuss stormwater management (ecological water flow)
                a. What would happen on this site if the RWKC wasn't here?
        ii. Rainwater
            1. Collected from one of the RWKC's two concrete storage reservoirs; each cistern stores 5,500 gallons of rainwater
            2. Just two inches of rain can provide up to 90 days' worth of water for the RWKC!
            3. Our building was designed with rainwater collection in mind – our roof was sized and slanted to direct water to storage (and for maximum energy production!)
        iii. Potable (drinking) water
            1. Collected from a bathroom tap; potable water from the Town of Amherst
            2. If our rainwater harvesting system were functioning properly, the water coming out of the tap would be treated rainwater collected from the RWKC's roof.
        iv. Raw greywater
            1. Collected from the primary greywater tank, where water discharged from the cafe, bathrooms, and anywhere else in the building is collected
            2. Discuss composting toilets — they reduce water use & prevent the need for on-site blackwater treatment
                a. Part of meeting net-zero water goals is figuring out how to reduce amount of water used in building – do we really need to use clean water to move around our poop?
        v. Treated greywater
            1. Collected from outdoor sampling tank; this water was treated by the RWKC's greywater treatment system, which includes a series of physical filters and constructed wetlands
8. Wrap-up (5 minutes)
    a. Group Brainstorm #3: How might you conserve water in your own home/school?
        i. Discuss ways people can reduce water use in their homes: cistern displacement devices, greywater/rainwater used in toilest or for other appropriate uses (rain barrel to water plants), flushing less frequently, shorter showers, full laundry & dishwasher loads
    b. Review learning objectives
    c. Answer any lingering questions.

Notes

- For a more advanced version, sample bottles can be labeled with water quality indicators like pH, total suspended solids (TSS), or total nitrogen (TN).
- This activity can be modified for other buildings and locations; all that's needed is a clear diagram of the water system and the ability to take samples from multiple locations.

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