FITCHBURG PUBLIC SCHOOLS

EDUCATOR RESOURCE GUIDE

FOR STORMWATER EDUCATION

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Education is not to reform students or amuse them or to make them expert technicians. It is to unsettle their minds, widen their horizons, inflame their intellects, teach them to think straight, if possible.
—Robert M. Hutchins

Preface

Welcome to the educator resource guide to stormwater and environmental education for Fitchburg Public Schools! This handbook serves to guide you in the creation of your own education plan to educate your students about the water cycle, human impact on the water cycle, stormwater, and green infrastructure. This guide will provide you with direct resources for curriculum development, classroom activities, and specialized resources for environmental education in Fitchburg.

Curriculum Development and Student Workbook

The student workbook was built to be directly compatible with the 2016 Massachusetts Science, Technology, and Engineering Standards (STE) for grade 5. Additionally, each workbook section contains activities that are directly compatible to the 8 science and engineering practices that are a part of the 2016 STE Frameworks. All activities are focused on being interdisciplinary: combining science, math, english, and the creative process. If you would like to only focus on specific frameworks or specific science and engineering practices, this section is for you.

The following table illustrates the specific frameworks and practices that are satisfied by each section of the student workbook. For example, Section 1.2 "The Water Cycle" is directly aligned with the 5 ESS2-2 Framework found within the 2016 Massachusetts STE Standards. Furthermore, each of the activities found at the end of the student workbook correspond to the Science and Engineering Practices identified in the table on the following page.

Curriculum Guide

Section	Subject	Content	Frame works	8 Science and Engineering Practices
1.1	The Water Cycle	Evaporation, Precipitation, absorption, and condensation cycle	ESS2-1	Practices 1, 2 and 3
1.2	The Water Cycle	Importance and availability of freshwater	ESS2-2	Practices 2, 5, and 6
2.1	Surface Runoff and Stormwater	Stormwater	ESS2-1	Practices 1, 2, and 5
2.2	Surface Runoff and Stormwater	Runoff and urban pollutants	ESS2-1 ESS3-1	Practices 3, 4, and 7
2.3	Surface Runoff and Stormwater	Human driven water pollution and its effects	ESS3-1	Practices 2, 3, and 7
3.1	Green Infrastructure	Reducing human impact on the environment	ESS3-1	Practices 1, 6, and 8
3.2	Green Infrastructure	Designing systems for mitigating human impact	ESS3-2	Practices 3, 6, and 8

8 Science and Engineering Practices

These science and engineering practices were developed by the Massachusetts Department of Education to engage students in scientific inquiry and engineering design. Students should learn and grow throughout these practices during their time in Fitchburg Public Schools. The practices are:

1. Asking questions (for science) and defining problems (for engineering).
2. Developing and using models.
3. Planning and carrying out investigations.
4. Analyzing and interpreting data.
5. Using mathematics and computational thinking.
6. Constructing explanations (for science) and designing solutions (for engineering).
7. Engaging in an argument from evidence.
8. Obtaining, evaluating, and communicating information

For a more detailed description of the 8 Science and Engineering Practices visit the 2016 STE Frameworks online and see page 107.

Community Resources for Students and Classrooms

A great way to get students interested in environmental education is by giving them ample opportunity to get fully immersed in hands-on, active, and engaging learning. While we provide you with supporting activities in the Supporting Activities chapter of this handbook, we have found that giving students extracurricular opportunities within the local area of Fitchburg may help increase interest and excitement about environmental education.

This section aims to help you, as an educator, take advantage of the programs and resources in the Fitchburg and Leominster area that may be great resources for guest speakers, field trips, or general classroom support. Students can either take advantage of these opportunities during their free time or they can be implemented directly into classroom activities. Please consider connecting with these great resources when designing your environmental education curriculum.

Coggshall Park, Fitchburg MA

Community Resources Continued

Nashua River Watershed Association (N.R.W.A.)

The N.R.W.A. is a local non-profit organization in Fitchburg that works to protect the natural ecosystem of the Nashua River and preserve clean water for human and wildlife communities. The N.R.W.A. was founded in 1969 on the belief that every individual has the power to make a difference. That belief led to the clean-up of one of the nation's most polluted rivers, The Nashua River. This cleanup effort has been an internationally recognized success story.

The N.R.W.A. provides many different programs and educational opportunities for the students of Fitchburg such as:

- Scientists-in-Residence
- The River Classroom
- Wild World of Water

Many of these programs are ELL accessible. For more information contact:

Stacey Billings Chilcoat
NRWA Education & River Classroom Director
Nashua River Watershed Association
592 Main Street, Groton, MA 01450
Phone: 978-448-0299
Email: StaceyC@nashuariverwatershed.org

Community Resources Continued

Montachusett Opportunity Council

The Montachusett Opportunity Council (M.O.C.) is a local organization that is extremely involved with community-based advocacy in Central Massachusetts. They are focused on advocating for change, coordinating community resources, and creating opportunities for those in poverty.

In recent years, M.O.C. has completed a variety of stormwater projects within the Fitchburg Leominster Area, including the following:

- The Clearwater Revival Project
    - The purpose of the project was to educate property owners and residents on how to protect water quality as well as reduce stormwater runoff.
- Constructed a rain garden at Montachusett Regional Valley Technical High School as an example of Green Infrastructure
- Created a homeowner focused pamphlet about stormwater education

Jenna, the Director of Environmental Programs, is a graduate of Fitchburg Public Schools and is eager to help students become more aware of Stormwater Pollution. For more information please contact:

Jenna David
Director of Environmental Programs
Montachusett Opportunity Council, Inc
601 River Street, Fitchburg, MA 01420
Phone: 978-345-7040 x5427
Email: jdavid@mocinc.org

Community Resources Continued

Mass Audubon at Wachusett Meadow

Mass Audubon at Wachusett Meadow is an ecological sanctuary located on a former farmstead with historic buildings, barns, and a wetland area. The location of the sanctuary within Princeton Massachusetts makes it particularly special for a field-trip opportunity. The sanctuary offers a variety of activities that focus on empowering students to become explorers of their environment.

These programs include:

- Biomimicry Program
- Evolutionary Adaptations Program
- Climate Change Program
- Carbon Sequestration
- Pond/Forest/Habitat Explorations

For more information please contact:

Kristin Steinmetz
Education Coordinator
Mass Audubon Wachusett Meadow
113 Goodnow Road, Princeton, MA 01541
Phone: 978-464-2712
Email: ksteinmetz@massaudubon.org

Community Resources Continued

Mass Audubon at Broad Meadow Brook

Mass Audubon at Broad Meadow Brook is the largest urban wildlife sanctuary in New England with 430 acres of land. The sanctuary's main draw is their public trails as well as the butterfly, bird, plant, and wildlife species. The location of the sanctuary in Worcester lends the program to extracurricular curricular activities that students could participate in during their free time.

The sanctuary offers a "Real Math Real Science" program in which students perform a stormwater related activities. As part of this program, students will:

- Utilize an Enviroscape Model to understand watershed pollution.
- Utilize a watershed model of local geography to analyze water routes in the Blackstone River Watershed.
- Analyze flooding of Shrewsbury Street.
- Receive a tour of the rain gardens and permeable pavers on the property of the sanctuary.

For more information regarding Broad Meadow Brook and their educational programs, please contact:

Lisa Carlin
Assistant Sanctuary and Camp Director
Mass Audubuon Broad Meadow Brook
414 Massasoit Road, Worcester, MA 01604
Phone: 508-753-6087 x 5013
Email: lcarlin@massaudubon@org

Educational Resources for Educators

We found that it would be beneficial for educators if they were provided a contact list of local environmental experts and educational specialists to help guide their individualized curriculum development. This was designed to support educators directly for their professional development, and include professionals that can help with educational program implementation. This resource is to help create a network of educational specialists, environmental professionals, and leaders in environmental education that educators could use to help guide curriculum refinement.

Jessica Stodulski STEM Support Specialist, Fitchburg Public Schools 978-343-2149 stodulskij@fitchburg.k12.ma.us	**Bonnie Baer-Simahk** ELL Director, Office of English Language Acquisition 376 South Street Fitchburg, MA 01420 978-345-3200 baer-simahkb@fitchburg.k12.ma.us
Kristen Gallo M.Ed Special Education Teacher Mckay Arts Academy gallok@fitchburg.k12.ma.us	**Fred Civian** Stormwater Coordinator for the MassDEP 617-292-5821 frederick.civian@state.ma.us

Supporting Tools for Educators

This section provides additional educational resources that you are encouraged to use when developing stormwater lessons for grade 5 classes. Since it can be challenging to develop lessons and materials from scratch, this section includes a collection of supplementary materials to assist with lesson development.

"Better Lesson" Website:
https://betterlesson.com/

"Better Lessons" is a free open-source website where educators upload and share their curriculums. With an account, teachers have unlimited access to a database of lessons, activities, and educators that assist in curriculum development. All lessons are Common Core aligned, and can be filtered by grade, subject, or standard.

"Mystery Science" Website:
https://mysteryscience.com/r1

"Mystery Science" is a website that provides science lessons for Grades K-8. Each lesson poses a scientific question to the class, and gives the students a hands-on activity which will lead to them to an answer. These lessons are prepared for immediate implementation in the classroom environment.

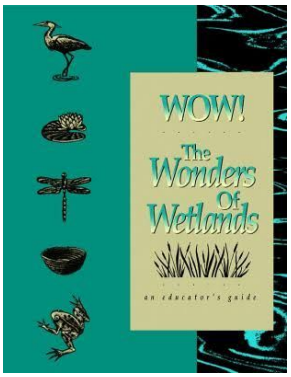
Project Wet:

https://www.projectwet.org/

Project Wet is an educational organization that offers water education materials for a variety of grade levels. The organization also offers informative training workshops for educators that are highly recommended by local outreach organizations. The *Project Wet: Curriculum and Activity Guide 2.0* is an extensive teaching resource detailing a wide-spectrum of K-12 water lessons that would assist lesson development.

Wonders of Wetlands Book:

While not directly about stormwater, *Wonders of Wetlands* is an educator guide focused on wetlands. Over 50 hands-on activities as well as lesson plans are included in this publication, and could be used in parallel with a *Project Wet* publication to teach about stormwater impacts within wetlands.



University of Nebraska-Lincoln ~ Stormwater Activities for Kids

https://water.unl.edu/article/stormwater-management/stormwater-education-kids

The University of Nebraska-Lincoln developed a website with activities targeted for students in Grades 4-6. Additionally, this page provides useful websites that educators and students can visit to learn more about stormwater.

University of Rhode Island ~ Stormwater Solutions

https://web.uri.edu/riss/stormwater-managers/educational-materials/

The University of Rhode Island developed a website containing a variety of materials about stormwater. The developed factsheets, cartoons, stickers, and worksheets for Grades 4-6.

Outdoor Activities for Students

This index is a list of hands-on outdoor activities that you may utilize to extend stormwater learning **beyond the classroom** and into the outside environment. Not only does hands-on outdoor learning help satisfy the certain STE Frameworks, but it caters to non-native English speakers and stimulates the interest of all students.

> "Hands-on learning has no language; it is universal"

Quote from Kristin Steinmetz

<u>Outdoor Activities</u>

- Build a Rain Garden with your classroom.
    - Get students involved in the design process by proposing to them how you could use the natural landscape to create a beautiful Rain Garden.
    - The Rain Garden may also help with other ecological learning components, such as Butterfly Migration and natural plant exploration.
    - Enlist help from the Fitchburg DPW, they can provide useful insight into how to fully implement one.

- Build a rain collection barrel
    - These may be built out of simple components such as a the ones listed on this website: *https://www.bhg.com/gardening/yard/tools/make-a-rain-barrel-save-water/*

Outdoor Activities Continued

- Local Pollutant Testing
    - Purchase a commercially available water test kit and have students perform various tests with either locally collected or tap water samples. Here is the kit we suggest. It is available in English and Spanish, and is also the kit Runoff Randy uses in the video and in the student workbook.
        - *Lab Aids Qualitative Introduction to Water Pollution Test Bilingual.*
        - We recommend this one because it is very simple. Students only need to be able to measure out water, and add droplets of test reagents. It is fun because they turn a wide array of colors from purple, to deep blue, to yellow.
        - *https://store.lab-aids.com/kits-and-modules/details/qualitative-introduction-to-water-pollution-BILINGUAL-ENG-SP/*
- Pollutant Narrative
    - A fun and creative way to get students outside. Ask students to go outside to their local watershed and describe the life of one polluted drop of water.
    - To make it more interactive, have students follow a stream to where an outflow is, and have them integrate it into their story.

- Outside Design Activity
    - Have the students develop their own type of Green Infrastructure that is most relevant to their school or community.
    - Designs can include bio-swales, rain barrels, and other Best Management Practices that are applicable to their school grounds.
    - Gradually implement this Green Infrastructure on the school grounds as a long or short term group project.
- Adopt a Storm Drain
    - Have students design a stencil to use on local or campus storm drains that say “Dump No Waste - Drains to River”. Have students periodically remove debris, such as leaves, trash and sticks, from the storm drain that may prevent water flow.
    - Mention to them that it is important to not dump waste down these drains as they flow directly to larger bodies of water.
- Adopt your watershed
    - A great way to get your classroom involved with your local watershed more, consider *adopting* a specific lake, river, or waterbody.
    - By adopting your watershed, you can have students continuously monitor a body of water, and help work to clean up problems surrounding that body of water.
    - Use the EPA’s Watershed Website for more information about how to adopt your local watershed. https://www.epa.gov/nutrientpollution/what-you-can-do-your-classroom

Educational Messages for Students:

In order to instill environmental stewardship in your students, provide them with a list of the following activities and messages they can do to protect the environment and prevent stormwater pollution from lowering the water quality in Fitchburg and the Nashua River.

- Pick up after your pets
- Wash your cars at a car wash, not in your driveway
- Do not dump waste down storm drains
- Plant native plants where there are none
- Start a compost pile for leaves and yard waste
- Clean oil spills in your driveway
- Avoid littering, and if possible remove litter from storm drains
- Sweep grass and yard trimmings onto the lawn so they do not clog nearby storm drains
- Use environmentally friendly fertilizers