

A Guide to Creating Meaningful Watershed Experiences



How to provide meaningful outdoor experiences for your students as mandated by the Chesapeake Bay Program Chesapeake 2000 Agreement



CHESAPEAKE BAY FOUNDATION
Save the Bay

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Introduction

The purpose of *A Guide to Creating Meaningful Watershed Experiences* is to provide information and resources that will enable educators to engage students in “meaningful” Bay or stream outdoor experiences¹. A “meaningful” Bay or stream outdoor experience consists of at least three parts: inquiry-based field investigations; classroom based-research and standards-based activities; and a student action designed and implemented to reduce pollution and improve water quality in the Chesapeake Bay and its watershed.

This guide is organized into three sections:

1. Definition of a *Meaningful Watershed Experience* and background on how this goal was developed.
2. How formal and informal educators can use the *Integrated Watershed Education (IWE)* model to plan and implement a *Meaningful Watershed Experience*.
3. A case study of a school successfully implementing the *Integrated Watershed Education* model to create *Meaningful Watershed Experiences* for its students.

¹ Chesapeake Bay Program Education Workgroup: STEWARDSHIP AND MEANINGFUL WATERSHED EDUCATIONAL EXPERIENCES. <http://www.chesapeakebay.net/pubs/subcommittee/cesc/c2k.pdf>

I. What Is a Meaningful Watershed Experience?

In June 2002, the governors of Pennsylvania, Maryland, and Virginia and the mayor of Washington, D.C., signed the *Chesapeake 2000 Agreement*. This voluntary document outlines goals and objectives to reduce nutrients, toxics, and sediments, while restoring underwater grasses, wetlands, oyster reefs, riparian buffers, and other keystone components of the Bay system. If met by 2010, these goals will remove the Chesapeake Bay from the EPA's Impaired Waters list. In the "Stewardship and Community Engagement" section of the Agreement, two objectives have a direct impact on our schools and the way we teach. They read as follows:

1. Beginning with the class of 2005, provide a meaningful Bay or stream outdoor experience for every school student in the watershed before graduation from high school.
2. Provide students and teachers alike with opportunities to directly participate in local restoration and protection projects, and to support stewardship efforts in schools and on school property.

What Are the Criteria for a Meaningful Watershed Experience?

The Chesapeake Bay Program Education Workgroup (*Stewardship and Meaningful Watershed Educational Experiences*, 2001) defined the following eight criteria for a Meaningful Watershed Educational Experience.

Essential Elements to a Meaningful Watershed Experience:

- Investigative or project-oriented
- Richly structured and based on high-quality instructional design
- Integral part of the instructional program
- Considers the watershed as a system
- Part of a sustained activity
- Involves external sharing and communication
- Enhanced by natural resource personnel
- For all students

CBF has further defined these criteria by specifying a local context for the investigations and emphasizing the need for learner-centered, collaborative instruction. As students are engaged in hands-on, meaningful investigations of the Chesapeake Bay watershed, they will be motivated to act to protect and restore it.



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Meaningful Watershed Experiences must connect standards-based classroom activities with hands-on investigations in the field and authentic assessments of learning that involve students in projects that reduce pollution and improve water quality in order to Save the Bay. The result is that students are taking positive action for the environment as a result of their investigations.

Components of a Meaningful Watershed Experience:

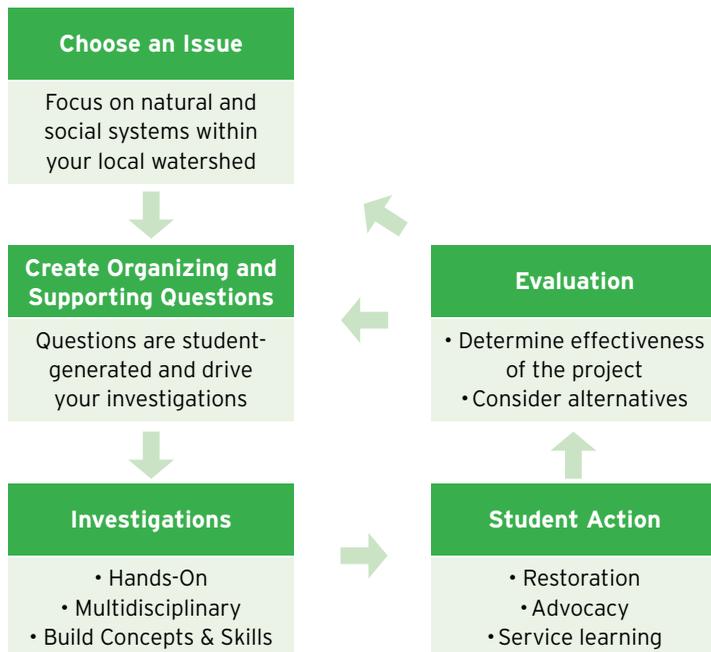


II. Integrated Watershed Education Model

Issues and questions that focus on the environment in and around a school provide an engaging context for learning and will allow students to engage in *Meaningful Watershed Experiences*. These experiences should integrate hands-on outdoor investigations, classroom work, and restoration projects. CBF has created the *Integrated Watershed Education (IWE)* model to assist teachers in involving students in outdoor investigations of the local watershed. IWE is a strategy that educators can employ to create *Meaningful Watershed Experiences* for students. IWE uses the local school and community setting and local issues to address learning goals and Chesapeake Bay environmental issues. Its methods have been positively correlated to student achievement and engagement in learning by the SEER group² and provide a focus on issues investigation as they relate to behavior change as described by Drs. Hungerford and Volk in their 1990 paper, "Changing Learner Behavior Through Environmental Education"³.

Although this guide is written with the classroom teacher in mind, the methods described here can be used in almost any teaching setting to make a program more learner-centered, inquiry-based, interdisciplinary, action-oriented, and locally relevant. These elements, when used to create *Meaningful Watershed Experiences*, will lead to more productive outdoor experiences, student-directed investigations, and action projects that reduce pollution and improve water quality. MWE will assist in increasing student and teacher enthusiasm in course content and assist students in demonstrating mastery of required state content standards.

Integrated Watershed Education Model



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Choose an Issue

There are a variety of places in the community that can provide an engaging setting for outdoor learning. Exploring these areas can be incorporated into a multi-day issue investigation or can be used for a single day lesson that addresses one or more basic skills. When exploring the outdoors, you may want to use one or more of the following places and issues for study:

- The Chesapeake Bay or creek or stream near/behind your school;
- The school building and its impact on the surrounding land/area;
- A National Wildlife Refuge, state park, or local county park;
- Use of the playground/ball field area and its environmental impact;
- The health and diversity of undeveloped areas, fields, and woodlands;
- Parking lot use and chemical contaminants found there;
- Local populations of wildlife including insects, birds, mammals, reptiles, etc.;
- Activity at feeders or nest boxes;
- Planted/landscaped areas; and
- A plot of land or "no-mow" area that has been allowed to develop naturally.

Issues typically involve an interaction between *natural and social systems*. Components of natural systems include wildlife, plants and physical environment (soils, atmosphere, climate, etc.). Examples of natural systems include forests, streams, wetlands, water cycle, and meadows. Social systems are created and used by people to meet their wants and needs. Examples of social systems include transportation systems, school buildings, organi-

² Lieberman, Gerald A., Ph.D. and Linda L. Hoody, M.A. *Closing the Achievement Gap: Using the Environment as an Integrating Context for Learning*. State Education and Environment Roundtable. 16486 Bernardo Center Drive, Suite 328, San Diego, CA 92128. Copyright 1998 & 2002.

³ *Journal of Environmental Education*. V21 n3, 1990, 8-21.

zations, and public utilities. Systems may conflict or compliment each other. For example, a stream running through the school grounds (natural system) is affected by the local climate (natural system). It is also affected by development in the community (social system). Students can investigate the interactions between these systems in order to identify issues. These issues become the focus for a *Meaningful Watershed Experience* that includes outdoor investigations, classroom work that is tied to content standards, and student action.

Create Organizing and Supporting Questions

A typical inquiry-based investigation should start with an **organizing question** that will focus the learning. Organizing questions should include the systems that provide the focus for instruction. The systems have been underlined in the following examples of organizing questions:

- In what ways does our schoolyard affect the health of the Chesapeake Bay?
- How has development in our community affected the health of our local river?
- In what ways does the local river affect the local economy?

Organizing questions should be posed to students at the beginning, during, and after investigations have been completed. This will allow students to communicate ways that their understandings change as they learn more through experience and exploration. At the completion of the project, student responses to the organizing question should demonstrate an understanding of the major concepts emphasized throughout the various investigations.

Next, teachers will need to facilitate a process that allows students to generate smaller **supporting questions** that connect to the organizing question. These questions allow students to explore individual systems and to fully understand their inputs, outputs, and integrated parts. Individual lessons should focus on a single supporting question and should provide opportunities to gather information in a variety of ways that reflect multiple learning styles and intelligences. It may take several lessons to fully explore some supporting questions.

For example:

Organizing Question:

In what ways does our schoolyard affect the health of the Chesapeake Bay?

Sample Supporting Questions:

- What activities take place on the schoolyard?
- What lives on the schoolyard?
- What kinds of soils do we have on our schoolyard?
- How healthy is the stream that runs through our schoolyard?
- How does water get from our schoolyard to the Bay?
- What kinds of chemicals enter and leave our schoolyard?

Investigations

A sequence of investigations will lead students through an exploration of the natural and social systems that are related to the issue being studied. Lesson plans should focus on individual supporting questions enabling students to acquire and demonstrate skills and concepts. The sequence of investigations will enhance and develop student understanding of the organizing question.



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Each lesson plan that is developed should include the following:

- The organizing and supporting question;
- A clear and measurable skill and content objective that is tied directly to your curriculum standards;
- A pre-assessment such as a pre-test or question to assess what your students currently know;
- One or more investigations of the question; and
- A summative assessment to evaluate student understanding at the conclusion of a lesson or unit.

Lesson plans may focus on a single discipline or be interdisciplinary. Use the following information to incorporate a variety of disciplines into "meaningful" Bay or stream field experiences.

- **Math** – What opportunities are there to collect, organize, and analyze data?
- **Science** – In what ways can students engage in hands-on explorations to collect information and data?
- **Social Studies/Geography** – What is the history of the land and people who live there? How is the geography of the area connected to environmental issues? How are people involved in the issue or question?
- **Reading** – What opportunities are there for students to interact with various texts: sets of directions; non-fiction books, brochures and websites; and literature?
- **Writing** – What opportunities are there for students to synthesize ideas in writing and to write for a real audience: journal entries; poetry; brief constructed responses; extended constructed responses; and persuasive or informative letters?
- **Art** – What opportunities are there for students to sketch observations, to create labeled drawings, or to enhance written work?

Student Action

If students are investigating a local issue, the investigation should culminate in a service-learning project that addresses or resolves the issue and improves the health of one or more natural systems. Student action may involve advocacy, restoration, or both. For example, if it is determined that the local stream is unhealthy, students might plan and carry out a stream buffer planting. Students should share the results of their investigations and action project with the local community, and contact and involve local watershed groups and organizations in the project. These groups are happy to assist with *Meaningful Watershed Experiences* and have connections to an array of resources and technical experts.

Organizing a Student Generated Schoolyard Action Project

Use this plan to help students generate project ideas and proposals. This plan allows students to evaluate the schoolyard for potential project ideas, generate proposals, and present them to a discerning audience. Here's the general plan:

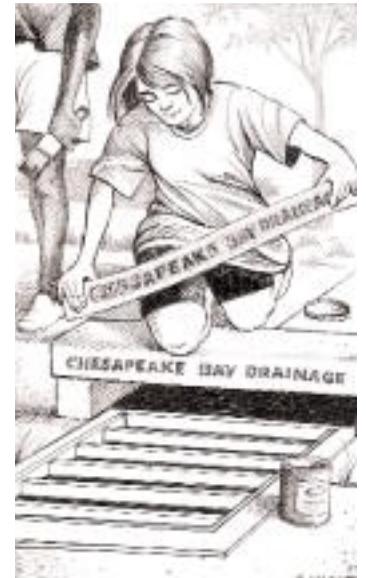
1. Facilitate a schoolyard investigation to allow students to find potential action project sites.
2. Have teams of students brainstorm action projects to correct problems on the schoolyard. Have plenty of copies of resources available for students such as U.S. Fish & Wildlife's *Schoolyard Habitat Project Guide* and *Chesapeake Bay Community Action Guide: A Step-by-step Guide to Improving the Environment in Your Neighborhood* produced by Metropolitan Washington Council of Governments Department of Environmental Programs. In addition, the following websites might be helpful:

Bayscaping Information:	http://www.acb-online.org/bayscapes.htm
Gardening Projects:	http://www.kidsgardening.com/
Floating Habitats:	http://members.aol.com/Tjacmc/index.html
Miscellaneous Project Ideas:	http://www-ed.fnal.gov/help/index.html
Habitat Projects:	http://nwf.org/nationalwildlifeweek/stewards.html
Native Plant Info:	http://www.mdflora.org/
General Bay Info:	http://www.cbf.org
Habitat Projects:	http://www.cee-ane.org/topics/schlyds.html
Information and Resources:	http://www.mdsg.umd.edu/Extension/valuation/chesapeake.htm
Bird Projects:	http://www.chesapeakeaudubon.org/
Native Plant Restoration Projects:	http://www.wetland.org/
General Environmental Info:	http://www.webdirectory.com/
Ocean Science Info:	http://www.vims.edu/bridge/
Chesapeake Bay Info:	http://www.chesapeakebay.net
US Fish and Wildlife:	http://www.fws.gov/
Chesapeake Bay Trust:	http://www.chesapeakebaytrust.org/

3. Based on the schoolyard investigation, research, and class discussions, student teams should collaboratively complete all parts of the proposal.

4. Student teams share proposals with another team. Teams provide feedback to each other and revise proposals.

5. Teams present proposals to their class. Classmates evaluate each proposal using the scoring tool.



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6. The top five proposals are shared with a final evaluation team of teachers, student reps, administration, and grounds maintenance staff.
7. The team selects projects based on feasibility and curriculum needs.
8. Teachers use proposals to submit grant requests and to plan instruction.
9. Action projects are carried out and evaluated by students.

Additional Action Projects and Resources

Additional projects offered to students, teachers, and community watershed organizations are listed below. Details can be accessed on the Chesapeake Bay Foundation's Education website at www.cbf.org/education.

Bay Grasses in Classes

This project is a partnership with the MD Department of Natural Resources and the Virginia Institute of Marine Science (VIMS). It involves students and teachers from Maryland, Virginia, Pennsylvania, and Washington, D.C., in the restoration of underwater grasses (Submerged Aquatic Vegetation) to the Bay. Students participating in this project grow the underwater grass, wild celery (*Vallisneria americana*), from seed in their classrooms using a simple aquaculture system. Teachers attend a training workshop and receive all the necessary equipment, wild celery seed, and supporting curriculum materials. Students grow the grasses for about two months while monitoring water quality and measuring growth daily. In the spring students transplant their grasses, thus restoring wild celery beds to their local waterways. The "Bay Grasses in Classes" project meets Maryland's Seven Best Practices for Service-Learning and Virginia's Standards of Learning. You may visit the Maryland Student Service Alliance website at www.mssa.sailorsite.net.

Student Oyster Corps

This project is for schools that have access to the more saline waters of the Bay and involves students, teachers, and volunteers in the direct restoration of oysters to oyster reefs near their communities. Teachers and students are trained in proper oyster care and how to build an oyster raising "cage". They receive supporting curriculum activities investigating oyster history as well as their ecological functions and values. The project culminates with an opportunity for students to plant their oysters on a sanctuary reef during a day-long, on-the-water field trip.

Build Your Own Rain Barrel

Did you know that one inch of rain in a 24 hour period will produce nearly 700 gallons of rainwater runoff from an average size home? Use our new rain barrel protocol to create your own rain catcher so you have a steady supply of water to care for your vegetable or flower garden. Complete with a sample material list and budget, our rain barrel protocol will help you build a rain barrel for your school, local park, or home.

Build Your Own Rain Garden

Using native plants suited to your school or home environment can slow runoff and improve your local water quality with this hands-on learning tool. A rain garden can be as big or small as you wish but this handy protocol will provide a sample material list and budget along with step-by-step instructions to plan and build your rain garden. Stop nutrient runoff from buildings today!

Storm Drain Stenciling

Storm drains were designed to be the fastest and most efficient way of getting rainwater off streets and parking lots. Unfortunately, the water that flows into your storm drain carries trash and sediment from the street, nutrients in the form of fertilizers, toxics in the form of pesticides, household cleaners, gasoline, and motor oil. All of the water in the storm drains ends up in your local stream, river, and eventually, the Bay. Stenciling storm drains in your community may discourage people from putting harmful things and trash in the drains.

Evaluate

Completed student action projects serve as an interesting context for learning. Projects will need to be monitored for months or even years in order to determine if they actually resolved the issue and had the desired effect on the natural system. Students should generate new questions that relate to the completed project and carry out necessary investigations. As issues are resolved, new investigations should be carried out. If issues are not resolved, new projects may be suggested and carried out to achieve the desired result.

Summary

Integrated Watershed Education is a strategy employed to meet the criteria of a *Meaningful Watershed Experience*. Included as Addendum 1 to this guide is the *Planning Projects through Systems Thinking and Authentic Investigations* template. This template will guide you in defining and identifying systems, developing organizing and supporting questions, creating an instructional plan, and ideas for organizing a student generated action project. Students and teachers can use this template as a planning resource when using the IWE model.



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III. Integrated Watershed Education Case Study

Included in this section is an example of a unit plan written and implemented by teachers at Forest Oak Middle School in Gaithersburg, Maryland. As you follow the template, you will see an organizing question was identified as well as subsequent supporting questions, indoor and outdoor investigations,

assessment of skills and knowledge, and state content standards were addressed. The investigations carried out by Forest Oak Middle School students led to the creation of a Tree Guide and student letters recommending improvements that would benefit the health of the forest.

Organizing Question: How healthy is the forest at Forest Oak Middle School?

Supporting Question	Investigation	Assessment	State Standards
What does a healthy forest look like?	Read non-fiction text articles from various sources	Reading Stance Questions	Reading
What are the parts of a forest?	Read non-fiction text articles from various sources	Complete a labeled diagram showing the forest layers	Reading Science
What role do trees play in the ecosystem? Why are trees important to the overall health of the schoolyard ecosystem?	Read non-fiction text articles from various sources	Reading Stance Questions	Reading and Science
How can we estimate and determine the height of trees?	Students will use three methods – similar triangles, proportional heights, and scaled drawings	<ul style="list-style-type: none"> • Written explanation showing how to use each method • Experimental results • Completed calculations • Completed data charts 	Math
How can we measure the circumference and diameter of trees?	Students will use appropriate measuring tools to determine circumference and algebra to determine diameter ($d = c/\pi$)	<ul style="list-style-type: none"> • Written explanation showing how to use this method • Experimental results • Completed calculations • Completed data charts 	Math
How can we estimate the age of trees?	Read non-fiction text Perform calculations using data collected	<ul style="list-style-type: none"> • Stance questions • Completed calculations and estimates 	Reading and Math
How many healthy trees are on our schoolyard?	Students will set up 50m ² plots and use random sampling to count trees in selected areas of the forest and estimate population for the entire area	<ul style="list-style-type: none"> • Maps of plots • Completed calculations and estimates • Completed data charts 	Math and Science
How many dead or dying trees (snags) are on the schoolyard?	Above		
What's the ratio of mature/immature trees on the schoolyard?	Students will estimate numbers of mature and immature trees using random sampling techniques as described above	<ul style="list-style-type: none"> • Completed data charts • Completed calculations and estimates 	Math



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Supporting Question	Investigation	Assessment	State Standards
What tree species are present on the schoolyard?	Students will use field guides and survey the forest	Students will create a species list or field guide to the schoolyard that includes: <ul style="list-style-type: none"> • Leaf Sample • Common name • Scientific name • Value to wildlife • Tree data (average height, number present) 	Science LA
Which trees are most beneficial to wildlife for food and nesting?	Read non-fiction text articles from various sources	Reading Stance Questions	Reading
How many beneficial trees are present?	Students will estimate numbers of beneficial habitat trees using random sampling techniques as described above	<ul style="list-style-type: none"> • Completed data charts • Completed calculations and estimates 	Math
Is our forest healthy?	Using information from text and data collected, students will evaluate the health of the forest	Brief Constructed Response: Based on information you have read about healthy forests and data collected, do you think that the forest at Forest Oak is healthy?	LA Science Math
How can we improve the health of the forest?	Using information from text and data collected, students will make recommendations for improving the health of the forest	Extended Constructive Response: In the investigation your class carried out throughout the year, you have studied the health of the forest at your school. Write a letter to your Grade 8 Language Arts teacher that summarizes and justifies improvements that you would like to make to improve the health of the forest on your schoolyard.	LA Science Math



Major Products

- Tree Guide to Forest Oak Middle School
- Letter to Grade 8 Language Arts teachers with recommendations for forest improvements/enhancements setting the stage for fall 2003 tree restoration projects

Other Possible Interdisciplinary Connections

- Trees and Literature – “Forest Images” from *One Bird Two Habitats* guide
- Trees as natural resources – “Forest Products Inventory” from *One Bird Two Habitats* guide and PLT Guide
- Tree structure/function – Science
- Native vs. Exotic trees – Science/Reading

Resources

Project Learning Tree Guide

- <http://www.dnr.state.wi.us/org/caer/ce/pltwild/plt.htm>

Chesapeake Bay Foundation Community Forest Buffer Guide

- Published in 2001, this guide is a valuable tool in learning how to plant forest buffers in the Chesapeake Bay Watershed.
- For more information contact the Chesapeake Bay Foundation: www.cbf.org

Web Resources:

- <http://www2.champaign.isa-arbor.com/tree-ord/ordprt3d.htm>
- http://wiscinfo.doit.wisc.edu/arboretum/woodland/tree_height.htm
- <http://www2.champaign.isa-arbor.com/tree-ord/measuringdbh.htm>



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