STEWARDSHIP AND MEANINGFUL WATERSHED EDUCATIONAL EXPERIENCES

The "Stewardship and Community Engagement" Commitment of the *Chesapeake 2000* agreement clearly focuses on connecting individuals and groups to the Bay through their shared sense of responsibility and action. The goal of this Commitment, included below, not only defines the role of the jurisdictions to *promote* and *assist*, but formally engages schools as integral partners *to undertake initiatives* in helping to meet the Agreement. This goal commits to:

> *Promote individual stewardship and assist individuals, community-based organizations, businesses, local governments and schools to undertake initiatives to achieve the goals and commitments of this agreement*.

Similarly, two objectives developed as part of this goal describe more specific outcomes to be achieved by the jurisdictions in promoting stewardship and assisting schools. These are:

> *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.*
>
> *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*.

There is overwhelming consensus that knowledge and commitment build from firsthand experience, especially in the context of one's neighborhood and community. Carefully selected experiences driven by rigorous academic learning standards, engendering discovery and wonder, and nurturing a sense of community will further connect students with the watershed and help reinforce an ethic of responsible citizenship.

To this end, the Chesapeake Bay Program Education Workgroup seeks to define a common set of criteria to help the Bay watershed jurisdictions meet the intent of this Commitment of the *Chesapeake 2000 Agreement.* From these criteria, each jurisdiction will continue to craft and refine its own plan, tailored to its own population, geography, and fiscal and human resources.

Defining a Meaningful Bay or Stream Outdoor Experience

A *meaningful* Bay or stream outdoor experience should be defined by the following.

Experiences are investigative or project oriented

Experiences include activities where questions, problems, and issues are investigated by the collection and analysis of data, both mathematical and qualitative. Electronic technology, such as computers, probe ware, and GPS equipment, is a key component of these kinds of activities and should be integrated throughout the instructional process. The nature of these experiences is based on each jurisdiction's academic learning standards and should include the following kinds of activities.

- Investigative or experimental design activities where students or groups of students use equipment, take measurements, and make observations for the purpose of making interpretations and reaching conclusions.

- Project-oriented experiences, such as restoration, monitoring, and protection projects, that are problem solving in nature and involve many investigative skills.

- Social, economic, historical, and archaeological questions, problems, and issues that are directly related to Bay peoples and cultures. These experiences should involve fieldwork, data collection, and analysis and directly relate to the role of the Bay (or other bodies of water) to these peoples' lives. Experiences such as tours, gallery visits, simulations, demonstrations, or "nature walks" may be instructionally useful, but alone do not constitute a *meaningful* experience as defined here.

Experiences are richly structured and based on high-quality instructional design.

Experiences should consist of three general parts including a) a preparation phase; b) an outdoor action phase; and c) a reflection, analysis, and reporting phase. These "phases" do not necessarily need to occur in a linear fashion. These include the following:

- The *preparation phase* should focus on a question, problem, or issue and involve students in discussions about it. This should require background research and student or team assignments as well as management and safety preparation.

- The *action phase* should include one or more outdoor experiences sufficient to conduct the project, make the observations, or collect the data required. Students should be actively involved with the measurements, planning, or construction as safety guidelines permit.

- The *reflection phase* should refocus on the question, problem, or issue; analyze the conclusions reached; evaluate the results; and assess the activity and the student learning.

Experiences are an integral part of the instructional program

Experiences should not be considered ancillary, peripheral, or enrichment only, but clearly part of what is occurring concurrently in the classroom. The outdoor experiences should be part of the division curriculum and be aligned with the jurisdiction's learning standards. Experiences should make appropriate connections among subject areas and reflect an integrated approach to learning. Experiences should occur where and when they fit into the instructional sequence.

Experiences are part of a sustained activity

Though an outdoor experience itself may occur as one specific event, occurring in one day, the total duration leading up to and following the experience should involve a significant investment of instructional time. This may entail smaller amounts of outdoor time spread over an entire school year. Likewise, the actual outdoor experiences may not necessarily involve all students in a class at the same time. Rich learning experiences, especially those involving monitoring and restoration activities may require time increments spread over weeks or even months. A sustained activity will generally involve regularly scheduled school time and may involve extended day or weekend activity.

Experiences consider the watershed as a system

Experiences are not limited to water-based activities directly on the Bay, tidal rivers, streams, creeks, ponds, wetlands, or other bodies of water. As long as there is an intentional connection made to the water quality, the watershed, and the larger ecological system, outdoor experiences that meet the intent of the Commitment may include terrestrial activities in the local community (e.g., erosion control, buffer creation, groundwater protection, and pollution prevention).

Experiences involve external sharing and communication

Experiences should warrant and include further sharing of the results beyond the classroom. Results of the outdoor experiences should be the focus of school-based reporting, community reporting, publishing, and contribution to a larger database of water quality and watershed information, or other authentic communication.

Experiences are enhanced by natural resources personnel

Utilizing the expertise of scientists and natural resources professionals can heighten the impact of outdoor experiences. This includes both their participation in the classroom and leadership on-site during outdoor activities. These personnel have technical knowledge and experience that can serve to complement the classroom teacher's strengths and augment the array of resources for the learning. Additionally, these professionals can serve as important role models for career choices and as natural resources stewards.

Experiences are for all students.

As it is crucial for all citizens to have an understanding of and connection with their own watershed, an outdoor experience is for all students regardless of where they live. Much of the land area in the jurisdictions is outside of the Bay watershed; however, it is intended that students residing in those areas have similar opportunities within their own local setting or beyond. It is also clear that these kinds of experiences must be extended to all students including students with disabilities, in alternative programs, and special populations. No child should be excluded from a *meaningful* watershed experience.

Meaningful Experiences across the K-12 Program

It is the intention that every student somewhere in the K-12 program will have a *meaningful* outdoor watershed experience before graduation from high school; however, it is the expectation that these kinds of activities will occur throughout formal schooling. Beginning with the primary grades, the jurisdictions' academic learning standards in the social and natural sciences call for inquiry, investigation, and active learning. These skills, concepts, and processes increase in complexity and abstraction, "spiraling" and building throughout the elementary, middle, and high school programs. Likewise, the experiences should reflect this progression. Outdoor experiences should occur at each level, elementary, middle, and high school. These experiences should be defined by the local curriculum, be aligned with the jurisdiction's learning standards, and mirror the developmental level of students. The following example "scope and sequence" describes experiences that should be appropriate for many students in the K-12 program.

> **K-5 experiences** should be predominantly local, school, or neighborhood-based, including activities reflecting students' background knowledge, shorter attention span, and physical capabilities. Experiences must clearly relate to academic learning standards across subject areas

and reinforce basic concepts such as maps and models, habitat principles, and the concept of the water cycle and watersheds. Care must be taken with the introduction or discussion of complex issues.

6-8 experiences should focus on team and class projects and investigations.
These experiences should reinforce research skills requiring the use and analysis of more authoritative print and electronic resources. Longer-term restoration, monitoring, or investigative projects should be conducted locally or on school grounds. Actual student experiences in or near water may be appropriate for many middle school students (following school safety guidelines carefully) Activities such as water quality testing can be used to reinforce many science, mathematics, and technology skills developed in middle school.

9-12 experiences should reflect students' more abstract reasoning and detailed planning ability. Locally based activities continue to be important, but student watershed experiences beyond the immediate community will have considerable impact in meeting academic and stewardship goals. First-hand experiences in or near water should be part of the implemented curriculum, especially as these experiences relate to the Earth and biological sciences, concepts developed in civics and government, and attitudes reinforcing responsible citizenship.

Conclusion

The preceding consensus criteria define a clear vision for bringing the Bay into every classroom and every child out into the watershed in a *meaningful* way. It will be the goal of every educator, teacher and administrator, to move toward incorporating those experiences that build academic success, reinforce responsible citizenship, and work toward the goals of the *Chesapeake 2000* agreement. With inspired leaders, committed parents, and supporting communities garnering the fiscal and human resources to help make this happen, young people will be significant contributors to healthy, bountiful, and enduring watersheds.

Choose an Issue

There are a variety of places close to schools 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 outdoor school yard/campus area, you may want to use one or more of the following places and issues for study:

- ✓ the school building and its impact on the surrounding land/area;
- ✓ 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;
- ✓ a creek or stream near/behind your school;
- ✓ planted/landscaped areas;
- ✓ 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, organizations, 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" Bay or stream outdoor experience that includes outdoor investigations, classroom work that is tied to standards, and restoration.

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. Each lesson plan that is developed should include the following:

- ✓ the supporting question
- ✓ a clear and measurable skill and content objective that is tied directly to your curriculum standards
- ✓ a pre assessment
- ✓ one or more investigations of the question
- ✓ a summative assessment

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 outdoor 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 web sites; 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. Contact and involve local watershed groups and organizations in the project. They are happy to assist with "meaningful" Bay or stream outdoor experiences and have connections to an array of resources and technical experts.

Evaluate

Completed restoration 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 affect 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.

Chesapeake CLASSROOMS

Planning Tools to Support "Meaningful" Bay or Stream Outdoor Experiences

Getting Started: Create a Map

Draw a map of you school, grounds and a 1-mile radius of the community
Make sure you include, buildings, parking lots, roads, power lines, landforms, neighborhoods, playgrounds, ball fields, meadows, empty fields, trees, or landscaped areas

Defining Natural and Social Systems

Issues are made of interconnected systems. **Systems:**

1. Change over time
2. Have interconnected parts
3. Are interesting to study
4. Have inputs and outputs

Directions: Look at your map, then in the boxes below, **list** as many different types of systems in or connected to your schoolyard as you can. Once your list for each box is complete, draw a line between these natural and manmade systems that seem closely related or interdependent.

Natural Systems in your Schoolyard/Community (ex: forest, stream, meadow)	**Social Systems (man-made) in your Schoolyard/community (ex: roads, landscaping, services)**

Developing an Organizing Question

Organizing questions serve as a framework for creating an instructional unit that will engage students in meaningful explorations of their community and local environment.

Characteristics of Organizing Questions

- provoke and sustain student interest;
- are broad enough to deal with both natural and social systems;
- provide a framework for creating interdisciplinary activities and investigations;
- require students to propose and evaluate a variety of solutions rather than leading to one "right" answer;
- are stated in simple language that is easily understood by students;
- are relevant and related to everyday life;
- encompass the essential content to be covered;
- provoke inquiry and focus student work;
- require students to revisit the problem frequently as knowledge and understanding evolves;
- will have no one "obvious" answer;
- recur naturally throughout the completion of an interdisciplinary investigation.

Examples:

a. In what ways can we improve the health of natural systems on our schoolyard?

b. How does air quality affect Chesapeake Bay fisheries?

c. In what ways does our schoolyard affect the health of local tributaries?

d. In what ways does development in our community affect the Bay?

Developing an Organizing Question Using Natural and Social Systems

Directions: **Choose** at least three (3) of the systems you listed from each box on the preceding page. **List** each system in the corresponding box below and then **write** several organizing questions that connect the two systems in the center box below.

List several natural systems on your schoolyard
Example: Wetland

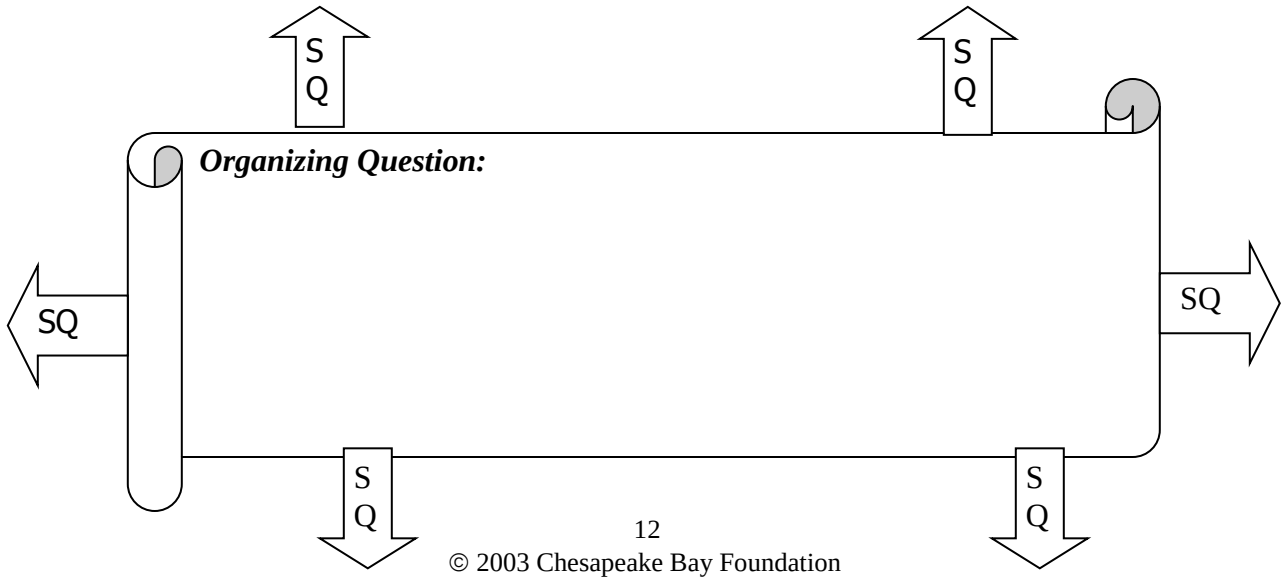
List several social systems on your schoolyard.
Example: your school's transportation and parking system

Organizing questions that connect the two systems…
Example: In what way is the parking system at our school affecting our wetland?

Developing Supporting Questions

Organizing questions need to be broken down into smaller, more tangible questions. Think of **supporting questions** as all the smaller questions that must be answered in the process of addressing the organizing question. These are the questions that will be answered each day with the planned activity and will assist students in learning more about the interrelated systems.

Directions: Select an organizing question and **brainstorm** possible supporting questions. This process will help you to anticipate the supporting questions that your students may come up with when you introduce them to the organizing question of your *Meaningful Watershed Educational Experience.* You may want to use the question words *who, what, when, how, where,* and *why* to start your questions.



Practice Sheet for Supporting Questions

Investigation Planner

Organizing Question: _____

Example: What are the impacts of a decreased oyster population to the health of the Chesapeake Bay?

Daily Supporting Question *The question that will frame each lesson*	***Investigation*** *Describe how students will explore the question*	***Assessment*** *What will students produce that will demonstrate skills and knowledge?*	***State Standard*** *What are the specific state standards being assessed?*
Ex: How do oysters improve water quality? (Day 1)	• Read CBF Oyster pamphlet • Conduct oyster filtration experiment	• Student will respond to three questions related to the text. • Students summarize observations and will write a conclusion to the oyster experiment.	• Reading to be Informed • Science Skills and Processes ** Specific state standards should be included here
(Day 2)			
(Day 3)			
(Day 4)			

Chesapeake Classrooms
Project Summary

<table>
<tr><td>Title of Unit:</td><td>School/Team/Grade Level:</td></tr>
<tr><td>Projected Timeline:</td><td>Participating Teachers/Disciplines:</td></tr>
<tr><td colspan="2">Organizing Question:</td></tr>
<tr><td colspan="2">Focus of Investigation:

Describe the issue or question that is central to the project. Be sure to address the who, what, when, where, why, and how in a project summary that you will use to introduce or set the stage for the investigation to students.</td></tr>
<tr><td colspan="2">Community Resources (people, places, stakeholders, things):

List name and contact information for people or organizations who will assist in the completion of the project or who will serve as a discerning audience.</td></tr>
<tr><td>Fieldwork:

Describe the investigations that will take place outdoors or outside the school building.</td><td>Culminating project:

Describe work that students will complete and share at the end of the project.</td></tr>
<tr><td colspan="2">Authentic Forum for the Presentation of Student Work:

Describe how students will present findings to a discerning audience from the school and community.</td></tr>
</table>

Systems

WHY?

"The natural and designed world is complex; it is too large and complicated to investigate and comprehend all at once. Scientists and students learn to define small portions for the convenience of investigation. The units of investigation can be referred to as "systems" (excerpted from *Content Standard K-12. In National Science Education Standards*-pg 115-6. National Research Council, 1996).

"Systems dynamics gives students a more effective way of interpreting the complexities of the world around them" (Forrester, in *Schools that Learn* by Peter Senge, et. al, 2000, p.233)

"Systems thinking is the ability to understand (and sometimes to predict) interactions and relationships in complex, dynamic systems: the kinds of systems we are surrounded by and embedded in." (Kruschwitz, Lyneis, & Stuntz, in *Schools that Learn* by Peter Senge, et. al, 2000, p.238)

WHAT?

A **System** is a collection of parts that interact with each other to function as a whole.
Characteristics of a system:

- ✓ Has a specific function
- ✓ Has things that influence it
- ✓ Has things that the system influences
- ✓ Changes over time
- ✓ Encourages you to step back and see the whole picture rather that just focusing on its parts. You are able to see the forest and the trees and how they interrelate!

Two Types Of Systems:

Social systems—systems that are created by humans
Examples: housing development, school system, landscaping, development, utilities, transportation, local government.

Natural systems—systems found naturally in the environment
Examples: stream, forest, tree, pond, natural cycles, oyster bed

How The Two Systems Interact:

Social systems affect and are affected by natural systems and vice/versa. Examples:

- ✓ Our economic system is such that factories, in trying to maximize profits, sometimes discard waste that pollutes rivers and streams. This in turn affects our economic system because taxpayers must pay to clean up the river. A polluted river might affect the tourist industry because people no longer want to recreate on the waterway.
- ✓ Natural occurrences can affect social systems: The shortage of water near large desert cities creates the need for political and economic problem solving.
- ✓ On a smaller scale: Our school parking system requires a large parking lot for teachers' cars. The parking lot interacts with the water cycle when it rains. Rain water, flowing off the parking lot, erodes the hillside, and ultimately affects the stream ecosystem. So, in this way, the school parking system (social system) and the stream ecosystem (natural system) are interrelated.
- ✓ The orientation of houses and landscape plantings is done to maximize sunlight in the winter and provide shade in the summer.
- ✓ Lawn fertilizers used in communities can get into the groundwater. These nutrients promote excess plant growth in local tributaries and that can lead to algae blooms.

- ✓ Urban sprawl, energy production and agriculture needed to produce food and fiber required by human communities have impacts on natural systems. Each of these requires space and reduces the capacity of an area to support plant and animals that had occupied the former habitat.