1) Title: From the Mountains to the Ocean Chesapeake Bay Academy Professional Development Institute at The State Arboretum of Virginia, University of Virginia

2) Academy Theme/Focus: Hydro-ecological Connections between the northern Shenandoah Valley and Chesapeake Bay

3) Course Summary: The "From the Mountains to the Ocean Chesapeake Bay Academy" will introduce middle and high school teachers to environmental science research and policy development that is relevant to understanding and teaching about the interconnection of the northern Shenandoah River watershed with the Chesapeake Bay estuary ecosystem. The Academy will draw on the expertise of University of Virginia Department of Environmental Science faculty, Blandy Experimental Farm education specialists, Virginia Commonwealth environmental agency educators, and Potomac Conservancy policy and land-use professionals to provide professional development training in current environmental science content knowledge and skills necessary for providing place-based, authentic and meaningful watershed experiences for the teachers' students. Teachers will gain knowledge in hydrology, biogeochemistry, geology, and aquatic and marine ecology and will be exposed to new technologies that can be used in the field and the classroom to investigate watershed science topics. Each day, participants will engage in investigative activities that model the processes of science outlined in the appendix of the VA Science Standards of Learning. Teachers also will examine the connections between their daily knowledge and skills gains with several content strands in the K-6 Science Standards including Matter, Life Processes, Living Systems, Inter-relationships in Earth Systems, and Resources as well as applicable standards in Physical Science, Life Science, Biology, Earth Science, and Chemistry. The interdisciplinary nature of watershed science will be emphasized.

4) Goals of the Course

The goals of the From the Mountains to the Ocean Bay Academy are to:

- expose teachers to science knowledge and research relevant to understanding how the watersheds within the northern Shenandoah region are inextricably linked to the Chesapeake Bay estuary hydrological system
- introduce teachers to student-friendly scientific field equipment for the study of aquatic ecosystems
- assist teachers in integrating their new science knowledge and skills into grade-level appropriate lesson plans designed to provide field- and classroom-based MWEE lessons with an emphasis on inquiry learning and a focus on regional hydrology and aquatic ecology that meet Virginia Science Standards of Learning, integrate with the science and math curriculum currently offered in teachers' respective schools, and that draw upon current scientific data and NOAA and VA agency educational resources

5) Grades of Target Audience: Middle school and high school science teachers

6) Desired Outcomes/Learner Objectives

Teachers Gain:

- Deeper knowledge of watershed science and comfort in teaching watershed science content
- Field research skills, specifically wetland ecological site survey and analysis; water chemistry testing and analysis; aquatic macro-invertebrate collecting, identification, and analysis
- Awareness of new technologies that can be used in the field and classroom for MWEE investigations

- Increased skill in developing and presenting student-centered, inquiry-based MWEE science lessons
- Expanded resource tool kit (including web, print, personnel, and grant resources)
- Commitment to providing outdoor based MWEE experiences for students
- Lesson plans developed by themselves and other Academy participants for use with their students that integrate their new watershed science knowledge, investigation, and analytical skills

7) Academy Type: Residential

8) Dates: August 9-13, 2010 (5 days)

9) Academy Sponsor: Foundation of the State Arboretum (FOSA) & Blandy Experimental Farm/The State Arboretum of Virginia (BEF), University of Virginia
- Mailing Address: 400 Blandy Farm Lane
  Boyce, VA 22620
- FEIN: 54-1268275 (FOSA)

10) Academy Coordinator: Candace Lutzow-Felling, Director of Education
Blandy Experimental Farm
University of Virginia
- Email: lutzow-felling@virginia.edu
- Phone: (540) 837-1758 ext. 230

11) Academy Locations
- Classroom Location (inside): Blandy Experimental Farm/The State Arboretum of Virginia
- Field Locations: Blandy Experimental Farm, Shenandoah Valley karst areas, and tributaries to the Potomac River including the Shenandoah River and one other such as, the Opequon River, Cedar Creek, or Abrams Creek
- Lodging: Blandy Experimental Farm/The State Arboretum of Virginia, dorm rooms

12) Services & Experiences provided by the FOSA/BEF will include:
1. Watershed science topical lectures presented by practicing research scientists, and state agency and non-profit watershed professionals/practitioners
2. Exposure to potential field trip locations for teachers' classes
3. Modeling of field trip teaching techniques, including safety preparedness
4. Using inquiry in MWEE investigations
5. Watershed site survey techniques
6. Incorporating new field technologies into students' MWEE experiences, including the SMART2 colorimeter (for water chemistry) and field macro/microscopes (for biotic observations)
7. Using Fieldscope, an on-line tool for watershed analysis
8. Incorporating on-line water quality data and weather data into MWEE analysis
9. Using hydro-geological models to explore stormwater run-off and groundwater recharge
10. Using a karst model to explore karst and groundwater hydrology
11. MWEE lesson and lesson extension ideas and sources

13) Curricula sources that will be used for instruction:

- NOAA Education (www.education.noaa.gov/)
- NOAA Ocean Service Education (http://oceanservice.noaa.gov/education)
- NOAA Ocean Data Education Project (NODE; www.dataintheclassroom)
- Blandy Experimental Farm/The State Arboretum of Virginia, UVa
- Project Wet: *Healthy Water, Healthy People* (Testing Kit Manual and Water Quality Educator's Guide), *Discover a Watershed: Watershed Manager* and *WOW! The Wonders of Wetlands*
- Project Underground: *Natural Resource Education Guide*
- Project Learning Tree: *Environmental Education Activity Guide*
- Project Wild: *K-12 Curriculum Activity Guide* ("Habitats, Ecosystems, and Niches" section)
- VA Department of Education ("Lessons from the Bay")
- EPA Office of Wetlands, Oceans, and Watersheds web (www.epa.gov/owow)
- USGS web (www.usgs.gov)
- NSTA journals (*Science Scope* and *Science Teacher*)
- Chesapeake Bay Program, Resource Library (www.chesapeakebay.net/bayresourcelibrary.aspx?menuitem=13998)
- Guest speakers (watershed scientists, Virginia Commonwealth and Non-profit environmental agency professionals)
- AAAS Project 2061

14) Resources to be distributed to Academy participants: This is a partial list of materials that will be distributed to Academy participants; more materials will be included as Academy planning progresses. Efforts will be made to provide these materials in CD format to reduce resource use.

Watershed Science Materials

- Readings from the Ecological Society of America, EPA Watershed Academy, The National Academies of Science, NOAA, and handouts from visiting speakers
- Water Quality Indicators (VA Cooperative Extension)
- Chesapeake Bay Forests Matter Poster (USDA Forest Service)
- Virginia's Water Resources (VA DEQ)

Education Materials

- Ocean Literacy: The Essential Principles of Ocean Sciences
- Earth Science Literacy Principles: The Big Ideas and Supporting Concepts of Earth Science
- Climate Literacy: The Essential Principles of Climate Literacy
- Essential Principles and Fundamental Concepts for Atmospheric Science Literacy
- Virginia Meaningful Watershed Educational Experiences Resources CD (VRUEC & VA DGIF)
- A Guide to Creating Meaningful Watershed Experiences (Chesapeake Bay Foundation)

Lesson Examples

- Selected Lessons from Project Wet, Project Underground and Project Learning Tree
- VA Department of Education, "Lessons from the Bay" (http://www.doe.virginia.gov/VDOE/watershed/lessonplans/)
- Lessons prepared specifically for the Academy by Blandy education staff
- Potomac Conservancy "Growing Native" Curriculum
- EPA Watershed Patch Project
- Virginia's Water Resources: A Tool for Teachers (lesson packet)
- Chesapeake Bay: Watershed Activity Guide (USFWS)

15) Potential Academy Presenters and Academy Topics/SOLs

Name	**Agency/Institution**	**Topic *(SOL taught)***
Candace Lutzow-Felling	Blandy Experimental Farm/The State Arboretum of Virginia, UVA	Watershed science & Wetland site analysis *(6.1, LS.1, ES.1, BIO.1 & 6.7, LS.7, LS.10, BIO.9)*
Emily Ford	Blandy Experimental Farm/The State Arboretum of Virginia, UVA	Water chemistry & analysis *(6.7, LS.12, ES.9, BIO.9)*
Lisa Green	Blandy Experimental Farm/The State Arboretum of Virginia, UVA	Aquatic macroinvertebrates: collection, identification and analysis as indicators of water quality *(6.7, LS.10, ES.9, BIO.9)*
Robin Coutts	Blandy Experimental Farm/The State Arboretum of Virginia, UVA	Developing MWEE lessons using scientific inquiry
Carol Zokaites	VA DCR or UVA Dept. Environmental Science Faculty	Hydrology of karst and groundwater systems *(6.7, LS.10, ES.9)*
Paula Klonowski (if possible)	VA Department of Education, Science Coordinator	Importance of outdoor and inquiry-based MWEE & potential funding sources
TBD	NOAA Chesapeake Bay Office	Monitoring Chesapeake Bay estuarine water quality; resources & activities *(6.7, LS.10, LS.12, ES.9, LS.12)*
Todd Scanlon	UVA Dept. Environmental Science, Shenandoah Watershed Study	Hydrological cycle/Shenandoah watershed hydrology *(6.7, LS.7, LS.10, LS.12, ES.9, BIO.9)*
Paolo D`Ordorico	UVA Dept. Environmental Science, hydrologist	Forest hydrology & Riverine buffers *(6.7, LS.7, LS.12, ES.7, BIO.9)*
Arthur Schwartzchild	UVA Dept. Environmental Science, Chesapeake Bay LTER	Hydro-ecological connectivity between the Shenandoah Valley and Chesapeake Bay *(6.7, LS.7, LS.10, LS.12, ES.9, ES.11, BIO.9)*
Patrick Felling	Potomac Conservancy, environmental risk assessment & land-use policy specialist	Land use & its impacts on the Chesapeake Bay watershed *(6.5, 6.7, 6.9, LS.12, ES.7, ES.11, BIO.9)*

16) Teacher Preparation:

Prior to attending the Academy teachers will prepare for the course by

a) compiling a portfolio of the MWEE lessons they currently use (if any) and examples of student work from those lessons
b) reading the on-line EPA document, "Introduction to Watershed Ecology", 31 pp. (http://www.epa.gov/watertrain) and recording any questions they have regarding the content

17) Evaluation

A. Academy Structure & Instruction

A mixed evaluation method, including qualitative and quantitative assessment tools will provide formative and summative feedback in which to assess the structure and instruction of the "From the Mountains to the Ocean Bay Academy". A daily survey will be given to participants requesting feedback on the topics and skills presented and the effectiveness of the instructional methods used. Suggestions for improvement will be requested (A sample survey is attached with this proposal.). Open-ended questions regarding the Academy format, topics presented, and instruction also will be asked of participants each day. The goal of these evaluations will be to assess and guide instruction plans for the next day and to inform plans for future Bay Academies.

B. Teacher Demonstration of MWEE Understanding:

Formative assessment of teachers' development of MWEE understanding will be integrated into each day's activities; these daily assessments will also provide information to guide Academy instructors in making adjustments to improve learning. Various pre- and post-Academy evaluation instruments will be used for the summative assessment of teachers' MWEE understanding. Assessment instruments will include, but not be limited to, concept maps, short daily surveys or questionnaires, field skills development, lesson plans & demonstrations.

18) Tentative Daily Schedule for the Academy

Each day of the Academy will be structured to incorporate preparation (learning new science content and MWEE investigation skills), action (MWEE investigations outdoors and/or using on-line resources), and reflection (data analysis & synthesis, personal & group learning assessment, and application of new knowledge & skills to develop MWEE lesson ideas for teachers' individual classrooms).

DAY	SCIENCE THEME/*SOL*	TOPIC	SKILLS	INVESTIGATION
1	**Hydrosphere: Water cycle & watersheds** ***SOL's:*** *6.1, LS.1, ES.1, BIO.1 & 6.7, LS.7, LS.10, BIO.9*	1. Introductions & Course overview 2. Personal & Group MWEE teaching assessment 3. Watershed Science: interdisciplinary connections	Practice w/ new field technologies	Field investigation: problem, question, hypothesis, & methods design
2	**Hydrosphere/Biosphere interface** ***SOL's:*** *6.7, LS.7, LS.12, ES.7, BIO.9* **Hydrosphere: Water chemistry & aquatic ecology** ***SOL's:*** *6.7, LS.10, LS.12, ES.9, BIO.9*	1. Forest hydrology & the importance of riverine buffers 2. Aquatic ecosystem chemistry 3. Indicator species	1. Water chemistry: understanding the parameters 2. Using aquatic macroinverts as indicator species 3. How to conduct a site analysis	Shenandoah River Site 1: Site analysis, water chemistry, macroinvertebrate survey
3	**Hydrosphere: Regional watershed & Hydrosphere/Atmosphere interface** ***SOL's:*** *6.7, LS.7, LS.10, LS.12, ES.9, BIO.9*	Shenandoah River Watershed Hydrology Importance of outdoor-based watershed investigations for students	1. Data analysis 2. Hypothesis evaluation 3. Creating a safe, outdoor-based watershed field trip for your students	Shenandoah River Site 2: Site analysis, water chemistry, macroinvertebrate survey
4	**Biosphere: Terrestrial/Estuarine ecology** ***SOL's:*** *6.7, LS.7, LS.10, LS.12, ES.9, ES.11, BIO.9*	Hydro-ecological connectivity between the Shenandoah River watershed and the Chesapeake Bay	1. Using Fieldscope 2. Using on-line water quality & weather data	Watershed boundaries, water flow, & water quality analysis investigations
5	**Lithosphere: Karst topography & groundwater systems** ***SOL's:*** *6.7, LS.10, ES.9* **Stewardship: Land-use policy** ***SOL's****: 6.5, 6.7, 6.9, LS.12, ES.7, ES.11, BIO.9*	**1**. Karst topography & groundwater hydrology **2**.Land use impacts on C.B. watershed **3**.Group presentations of lessons developed **4**.Personal & group MWEE learning assessment	1. Using a karst hydrology model 2. Using hydro-geology models to investigate run-off & recharge	Shenandoah Valley karst and spring sites

19) Budget Summary (details in Appendix)

BAY ACADEMY	**REQUESTED**	**BLANDY MATCH**	**TOTAL REQUESTED**
a) Personnel	5150	7990	**5150**
b) Fringe	1416	5913	**1416**
c) Travel	2280	0	**2280**
d) Equipment	0	0	**0**
e) Supplies	4257	0	**4257**
f) Contractual	3400	0	**3400**
g) Construction	0	0	**0**
h) Other/Food & Beverages	4125	0	**4125**
i) Total Direct costs		$13,903	**20,628**
j) Total Indirect costs	0	0	**0**
k) TOTALS		**$13,903**	**$20,628**

From the Mountains to the Ocean:
Hydro-ecological Connections between the Northern Shenandoah Valley and Chesapeake Bay
Workshop Activities Evaluation Example

Please provide us feedback on the value of each of today's activities to develop either your watershed science knowledge or skills. Thank you!

ACTIVITY	**None**	**Little**	**Mod**	**Much**	**Very Much**
Draw a watershed	1	2	3	4	5
Comments/Suggestions					
Watershed Science Components	1	2	3	4	5
Comments/Suggestions					
Watershed Science Concept Map	1	2	3	4	5
Comments/Suggestions					
Shenandoah River Site Description	1	2	3	4	5
Comments/Suggestions					
Shenandoah River Macroinvertebrate Survey	1	2	3	4	5
Comments/Suggestions					
Water Chemistry Inquiry Activity	1	2	3	4	5
Comments/Suggestions					

Shenandoah River Water Chemistry Testing	1	2	3	4	5
Comments/Suggestions					
Shenandoah River Field Study Analysis & Summary	1	2	3	4	5
Comments/Suggestions					
Using Fieldscope to map watersheds, investigate flow patterns & explore watershed land use	1	2	3	4	5
Comments/Suggestions					
There was sufficient time given to each activity	1	2	3	4	5
Comments/Suggestions					
Any other comments/suggestions you would like to share are welcome!					

From the Mountains to the Ocean: Hydro-ecological Connections between the Northern Shenandoah Valley and Chesapeake Bay

Workshop Topics, Structure & Instruction Evaluation (Example)

Please rank the following 8 watershed science topics that you would be interested in learning about in future workshops (1 = 1st choice; 8 = last choice).

_____ Karst topography & groundwater hydrology

_____ Water policy & land use impacts on watershed ecology

_____ Upstream land use impacts on Chesapeake Bay water quality & estuarine ecology

_____ Climate change impacts on regional water resources

_____ Water pollution & purification

_____ Water cycle & forests

_____ Vernal pools: biodiversity & ecological importance

_____ Water as a finite resource: personal water use & stewardship

Any other topics that you are interested in learning more about?

_____
_____
_____
_____

Please provide us with any suggestions on how we can improve our Instructional methods.

Thank you!

Categories				**Requested**	**Match (Blandy & FOSA)**	***TOTAL***
a) Personnel	Salary @ 10% time					
Academy Coordinator, Candace Lutzow-Felling	5150			5150	0	5150
Lead School Program Presenter, Emily Ford	3400			0	3400	0
School Program Presenter, Lisa Green	2340			0	2340	0
Program Presenter, Robin Coutts	2250			0	2250	0
Personnel Subtotal					***7990***	***5150***
b) Fringe	Fringe @ 10% time					
Academy Coordinator, 27.5%	1416			1416	0	1416
Lead School Program Presenter, 38.9%	1323			0	1323	0
School Program Presenter, 26.5%	620			0	2340	0
Program Presenter, 26.5%	596			0	2250	0
Fringe Subtotal					***5913***	***1416***
c) Travel						
Mileage (@ 0.55/mile; for guest presenters)	300 mile RT (estimate)	# Guest Presenters				
	165	6				990
Van Rental	*Unit Price*	*Quantity*				
6 days/van	540	2				1080
Fuel fillup (@ 2.99/gal)	105	2				210
Travel Subtotal						***2280***
d) Equipment	0	0	0			0
Equipment Subtotal						***0***
e) Supplies						
CD's & covers	1.1	25				27.5

CD & label burning software	100	1				100
Books & maps	80	20				160
LaMotte SMART2 Colorimeter	700	4				2800
Colorimeter pH test reagent	55	1				55
Colorimeter ortho-phosphate test	35	1				35
Colorimeter nitrate test	42	1				42
Colorimtere D.O. test	38	1				38
Colorimeter ammonia	30	1				30
D.O. low tech test	30	1				30
Nitrate test strips	9	1				9
pH test strips	4	1				4
Phosphate low tech test	22	1				22
Disposable gloves	7.50/box	2				14
Kick net	33	2				66
Waders	70	4				280
Forceps	1.5	10				15
Kim-wipes	3.5	2				7
Karst model handle	30	1				30
Folding table	90	2				180
2" binders	10	25				250
Notebook dividers	2.50/set	25				62.5
Supplies Subtotal						***4257***
f) Contractual/ Honoraria	Honorarium	Number				
Guest Presenters	200	6				1200
	Participant/5 days	Number				
Lodging (includes rooms & all facilities)	110	20				2200
Contractual Subtotal						***3400***

g) Construction	0	0				0
h) Other						
Food & Beverages	5 days	Number				
Breakfast, Lunch & 2 dinners (for 25 people; participants & instructors	165/person	25 (part. & instructors)				4125
Other Subtotal						***4125***
i) Total Direct costs						20,628
j) Total Indirect costs	0	0				0
k) TOTALS					$13,903; match	**$20,628; requested**