Section 5 of six curriculum sections

Developed by Kris Stepenuck, University of Wisconsin-Extension and Wisconsin Dept. of Natural Resources; and Katie Murphy, Middle School Science Teacher

For more information about volunteer stream monitoring opportunities in Wisconsin, and for printable pdf's of this curriculum visit: watermonitoring.uwex.edu/wav

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**WATER ACTION VOLUNTEERS’ EDUCATION MATERIALS**

- Water Action Volunteers’ Stream Monitoring DVD Set: In addition to the video trainings and presentations mentioned throughout this curriculum, other content may be useful as background for teachers or older students. These are available upon request from the WAV Coordinator.

- Water Action Volunteers’ Stream Monitoring Fact Sheets:
  
  [http://watermonitoring.uwex.edu/wav/monitoring/methods.html](http://watermonitoring.uwex.edu/wav/monitoring/methods.html)

- Water Action Volunteers’ More Information About “What’s Monitored”:
  
  [http://watermonitoring.uwex.edu/wav/monitoring/monitored.html](http://watermonitoring.uwex.edu/wav/monitoring/monitored.html)

- Wonderful, Wacky, Water Critters (classroom sets available upon request from the WAV Coordinator):
  
  [http://watermonitoring.uwex.edu/pdf/level1/WWWC.pdf](http://watermonitoring.uwex.edu/pdf/level1/WWWC.pdf)

- Key to Life in the River (classroom sets available upon request from the WAV Coordinator):
  
  [http://watermonitoring.uwex.edu/pdf/level1/riverkey.pdf](http://watermonitoring.uwex.edu/pdf/level1/riverkey.pdf)

- Aquatic Macroinvertebrate Wisconsin Wildcards: Not currently available for download. Classroom sets available upon request from the WAV Coordinator.

**RELATED WISCONSIN CURRICULA**

For links to the following resources visit: [watermonitoring.uwex.edu/wav](http://watermonitoring.uwex.edu/wav)

- Climate Change: A Wisconsin Activity Guide – Grades 7-12

- Educating Young People About Water Curricula Database

- Give Water a Hand Action Guide: A Youth Program for Environmental Education

- Hook, Line & Thinker: An Angler’s Perspective on Life Sciences and Related Social Issues – Grades 7–12

- Wisconsin Project WET

- Wisconsin Project WILD Aquatic
OTHER EDUCATIONAL RESOURCES

For links to the following resources visit: watermonitoring.uwex.edu/wav

- Build a Bug Activity, Utah 4H
- Citizens Monitoring Bacteria Manual – a three-year multi-state project in the upper Midwest initially funded by USDA to develop \textit{E. coli} bacteria monitoring methods for use by volunteers
- Holding onto the GREEN Zone: A Youth Program for the Study and Stewardship of Community Riparian Areas
- National Project WET
- National Project WILD Aquatic
- Stream Side Science: Lesson Plans and Water Related Activities for Utah 9th Grade Earth Systems Science
- University of Arizona GLOBE. This site includes a very helpful description of the Hach dissolved oxygen kit chemistry
- Natural Resources Conservation Service’s \textit{How to read a topographic map and delineate a watershed}
- Online source for obtaining U.S. Geological Survey topographical maps
- U.S. Geological Survey \textit{Topographic Map Symbols} brochure
- 3M\textsuperscript{TM} (for Petrifilm\textsuperscript{TM}, \textit{E. coli}/coliform count plates, and spreaders for \textit{E. coli} monitoring)
- Micrology Labs (for 1 mL droppers and 30 mL bottles for \textit{E. coli} monitoring)
These standards will be addressed when students complete the student workbook and the stream monitoring stations. As this curriculum was developed during the shift to Common Core State Standards, an addendum has been developed to aid teachers in understanding how these new standards align with each activity. (Visit: [http://watermonitoring.uwex.edu/wav](http://watermonitoring.uwex.edu/wav) for printable pdfs of this curriculum and addendum.) Additional information about these standards may be available through the Wisconsin Department of Public Instruction at:

[http://dpi.wi.gov/standards/stds.html](http://dpi.wi.gov/standards/stds.html)

**I. Agricultural Education**

- A.6-8.3 Recognize the importance of community service
- A.9-12.3 Participate actively in community service
- B.8.3 Access and apply information in the evaluation of natural resource use
  - access and apply information in the study of water pollution causes and remediation (surface water, groundwater)
- E.8.2 Describe and give examples of how land use impacts the environment
  - explain how urbanization has impacted native ecosystems
  - explain how agricultural use of land has impacted native ecosystems
  - explain how urbanization has impacted agricultural land

**II. English**

- A.8.1 Use effective reading strategies to achieve their purposes in reading
  - use knowledge of sentence and word structure, word origins, visual images and context clues to understand unfamiliar words and clarify passages of text
  - use knowledge of the visual features of texts, such as headings and bold face print, and structures of texts, such as chronology and cause-and-effect, as aids to comprehension
  - establish purposeful reading and writing habits by using texts to find information, gain understanding of diverse viewpoints, make decisions and enjoy the experience of reading
  - select, summarize, paraphrase, analyze and evaluate, orally and in writing, passages of texts chosen for specific purposes
A.8.4 Read to acquire information: Interpret and use technical resources such as charts, tables, timelines and manuals; Compare, contrast and evaluate the relative accuracy and usefulness of information from different sources; identify and explain information, main ideas and organization found in a variety of informational passages; distinguish between the facts found in documents, narratives, charts, maps, tables and other sources and the generalizations and interpretations that are drawn from them.

III. Environmental Education

- A.8.4 Use critical-thinking strategies to interpret and analyze gathered information
- A.8.5 Use the results of their investigations to develop answers, draw conclusions and revise their personal understanding
- A.8.6 Communicate the results of investigations by using a variety of media and logically defend their answers
- A.12.4 State and interpret their results accurately and consider other explanations for their results
- A.12.5 Communicate the results of their investigations to groups concerned with the issue
- B.8.5 Give examples of human impact on various ecosystems
- B.8.8 Explain interactions among organisms or populations of organisms
- B.8.10 Explain and cite examples of how humans shape the environment
- B.8.15 Analyze how people impact their environment through resource use
- B.8.17 Explain how human resource use can impact the environment; e.g., erosion, burning fossil fuels
- B.8.18 Identify major air, water or land pollutants and their sources
- B.8.19 Distinguish between point and nonpoint source pollution
- B.8.21 Identify and analyze individual, local, regional, national and global effects of pollution on plant, animal and human health
- B.12.2 Describe the value of ecosystems from a natural and human perspective; e.g., food, shelter, flood control, water purification
- B.12.3 Evaluate the stability and sustainability of ecosystems in response to changes in environmental conditions
- B.12.11 Assess how changes in the availability and use of natural resources (especially water and energy sources) will affect society and human activities; such as, transportation, agricultural systems, manufacturing
B.12.17 Explain the concept of exported/imported pollution; e.g., smokestacks, watersheds and weather systems

B.12.18 Analyze cause and effect relationships of pollutants and other environmental changes on human health

C.8.2 Use environmental monitoring techniques such as observations, chemical analysis and computer mapping software to collect data about environmental problems

C.8.3 Use questioning and analysis skills to determine beliefs, attitudes and values held by people involved in an environmental issue

C.12.1 Compare the effects of natural and human-caused activities that either contribute to or challenge an ecologically and economically sustainable environment

D.8.1 Identify options for addressing an environmental issue and evaluate the consequences of each option

D.8.5 Explain how personal actions can impact an environmental issue; e.g., doing volunteer work in conservation

D.12.5 Develop a plan to maintain or improve some part of the local or regional environment, and enlist support for the implementation of that plan

E.12.3 Take action in regard to environmental issues in the home, school or communities

IV. Information and Technology Literacy

A.8.1 Use common media and technology terminology and equipment

- identify and define computer and networking terms (e.g., modem, file server, client station, LAN, Internet/Intranet, data storage device)

- demonstrate the correct operation of a computer system on a network

- demonstrate touch keyboarding skills at acceptable speed and accuracy levels (suggested range 20-25 wpm)

- organize and backup files on a computer disk, drive, server or other storage device

- recognize and solve routine computer hardware and software problems

- use basic content-specific tools (e.g., environmental probes, measurement sensors) to provide evidence/support in a class project

- scan, crop, and save a graphic using a scanner, digital camera or other digitizing equipment

- use simple graphing calculator functions to solve a problem

- capture, edit, and combine video segments using a multimedia computer with editing software or a video editing system
A.12.1 Use common media and technology terminology and equipment

- identify and define basic on-line and telecommunications terminology or concepts (e.g., bandwidth, satellite dish, distance learning, desktop conferencing, listserv, downlink, teleconference, virtual reality)
- demonstrate proper keyboarding mechanics and touch type accurately (suggested range 30-35 wpm)
- use a camcorder, VCR, multimedia computer or editing equipment to produce a short video program
- identify common graphic, video and sound file formats (e.g., JPEG, GIF, MPEG, QUICKTIME, WAV)
- use desktop or video conferencing equipment and systems

B.8.1 Define the need for information

- identify the information problem or question to be resolved
- relate what is already known to the information need
- formulate general and specific research questions using a variety of questioning skills
- revise and narrow the information questions to focus on the information need

B.8.2 Develop information seeking strategies

- identify relevant sources of information including print, non-print, electronic, human and community resources
- evaluate possible sources of information based on criteria of timeliness, genre, point of view, bias and authority
- select multiple sources that reflect differing or supporting points of view
- identify and select keywords and phrases for each source, recognizing that different sources use different terminology for similar concepts
- organize ideas, concepts and phrases using webbing, outlines, trees or other visual or graphic tools
- focus search strategies on matching information needs with available resources

B.8.3 Locate and access information sources

- identify the classification system used in the school library media center, public library and other local libraries
- locate materials using the classification systems of the school library media center and the public library
- use an on-line catalog and other databases of print and electronic resources
recognize differences in searching bibliographic records, abstracts or full text databases

search for information by subject, author, title and keyword

use Boolean operators with human or programmed guidance to narrow or broaden searches

use biographical dictionaries, thesauri, and other common reference tools in both print and electronic formats

use a search engine to locate appropriate Internet or Intranet resources

B.8.4 Evaluate and select information from a variety of print, non-print and electronic formats

examine selected resources for pertinent information using previewing techniques to scan for major concepts and keywords

differentiate between primary and secondary sources

distinguish between fact and opinion; recognize point of view or bias

determine if information is timely, valid, accurate, comprehensive and relevant

analyze and evaluate information presented in charts, graphs and tables

locate indicators of authority for all sources of information

select resources in formats appropriate to content and information need and compatible with their own learning style

B.8.5 Record and organize information

use note taking strategies including summarizing and paraphrasing

record concise notes in a prescribed manner, including bibliographic information

cite the source of specific quotations or visuals using footnotes, endnotes or internal citation formats

organize and compare information using graphic organizers, storyboarding and other relational techniques

organize information in a systematic manner appropriate to question, audience and intended format of presentation

record sources of information in a standardized bibliographic format

B.8.6 Interpret and use information to solve the problem or answer the question

compare and integrate new information with prior knowledge
- analyze information for relevance to the question
- analyze findings to determine need for additional information
- gather and synthesize additional information as needed
- draw conclusions to address the problem or question

**B.8.7 Communicate the results of research and inquiry in an appropriate format**
- determine the audience and purpose for the product or presentation
- identify possible communication or production formats
- select a presentation format appropriate to the topic, audience, purpose, content and technology available
- develop an original product or presentation which addresses the information problem or question

**D.8.1 Participate productively in workgroups or other collaborative learning environments**
- collaborate with others to identify information needs and seek solutions
- demonstrate acceptance to new ideas and strategies from workgroup members
- determine workgroup goals and equitable distribution of individual or subgroup responsibilities and tasks
- plan for the efficient use and allocation of time
- complete workgroup projects on time
- evaluate completed projects to determine how the workgroup could have functioned more efficiently and productively

**D.12.1 Participate productively in workgroups or other collaborative learning environments**
- collaborate with others to design and develop information products and solutions
- incorporate effective group processes and shared decision-making in project development
- specify and detail workgroup goals and individual and subgroup responsibilities
- finalize workgroup strategies, resources, budget and timeline
- allocate time for a project based on an inventory of the responsibilities of workgroup members
- complete specific projects within a timeline and budget
- critique completed projects and workgroup processes for future improvement
V. Mathematics: Measurement

D.8.3 Determine measurement directly using standard units (metric and U.S. Customary) with these suggested degrees of accuracy

- lengths to the nearest mm or 1/16 of an inch
- weight (mass) to the nearest 0.1 g or 0.5 ounce
- liquid capacity to the nearest ml
- angles to the nearest degree
- temperature to the nearest °C or °F
- elapsed time to the nearest second

D.8.4 Determine measurements indirectly using

- estimation
- conversion of units within a system (e.g., quarts to cups, millimeters to centimeters)
- ratio and proportion (e.g., similarity, scale drawings)
- geometric formulas to derive lengths, areas, volumes of common figures (e.g., perimeter, circumference, surface area)
- the Pythagorean relationship
- geometric relationships and properties for angle size (e.g., parallel lines and transversals; sum of angles of a triangle; vertical angles)

D.12.2 Select and use tools with appropriate degree of precision to determine measurements directly within specified degrees of accuracy and error (tolerance)

D.12.3 Determine measurements indirectly, using

- estimation
- proportional reasoning, including those involving squaring and cubing (e.g., reasoning that areas of circles are proportional to the squares of their radii)
- techniques of algebra, geometry and right triangle trigonometry
- formulas in applications (e.g., for compound interest, distance formula)
- geometric formulas to derive lengths, areas, or volumes of shapes and objects (e.g., cones, parallelograms, cylinders, pyramids)
• geometric relationships and properties of circles and polygons (e.g., size of central angles, area of a sector of a circle)
• conversion constants to relate measures in one system to another (e.g., meters to feet, dollars to Deutschmarks

VI. Mathematics: Statistics and Probability

► E.8.1 Work with data in the context of real-world situations by
• formulating questions that lead to data collection and analysis
• designing and conducting a statistical investigation
• using technology to generate displays, summary statistics and presentations
► E.8.2 Organize and display data from statistical investigations using
• appropriate tables, graphs and/or charts (e.g., circle, bar or line for multiple sets of data)
• appropriate plots (e.g., line, stem-and-leaf, box, scatter)
► E.8.4 Use the results of data analysis to
• make predictions
• develop convincing arguments
• draw conclusions
► E.12.1 Work with data in the context of real-world situations by
• formulating hypotheses that lead to collection and analysis of one- and two-variable data
• designing a data collection plan that considers random sampling, control groups, the role of assumptions, etc.
• conducting an investigation based on that plan using technology to generate displays, summary statistics and presentations

VII. Science A, Science Connections

► A.8.1 Develop their understanding of the science themes by using the themes to frame questions about science-related issues and problems
► A.8.6. Use models and explanations to predict actions and events in the natural world
A.12.2 Show how conflicting assumptions about science themes lead to
different opinions and decisions about evolution, health, population,
longevity, education and use of resources, and show how these opinions and
decisions have diverse effects on an individual, a community and a country,
both now and in the future

VIII: Science B, Nature of Science

B.8.6 Explain the ways in which scientific knowledge is useful and also
limited when applied to social issues

IX: Science C, Science Inquiry

C.8.1 Identify questions they can investigate using resources and equipment
they have available
C.8.2 Identify data and locate sources of information including their own
records to answer the questions being investigated
C.8.3 Design and safely conduct investigations that provide reliable
quantitative or qualitative data, as appropriate, to answer their questions
C.8.4 Use inferences to help decide possible results of their investigations, use
observations to check their inferences
C.8.5 Use accepted scientific knowledge, models and theories to explain their
results and to raise further questions about their investigations
C.8.6 State what they have learned from investigations, relating their
inferences to scientific knowledge and to data they have collected
C.8.7 Explain their data and conclusions in ways that allow an audience to
understand the questions they selected for investigation and the answers they
have developed
C.8.8 Use computer software and other technologies to organize, process and
present their data
C.8.9 Evaluate, explain and defend the validity of questions, hypotheses and
conclusions to their investigations
C.8.10 Discuss the importance of their results and implications of their work
with peers, teachers and other adults
C.8.11 Raise further questions which still need to be answered
C.12.1 When studying science content, ask questions suggested by current
social issues, scientific literature and observations of phenomena; build
hypotheses that might answer some of these questions; design possible
investigations; and describe results that might emerge from such
investigations
C.12.2 Identify issues from an area of science study, write questions that could be investigated, review previous research on these questions, and design and conduct responsible and safe investigations to help answer the questions.

C.12.3 Evaluate the data collected during an investigation, critique the data-collection procedures and results, and suggest ways to make any needed improvements.

C.12.4 During investigations, choose the best data-collection procedures and materials available, use them competently, and calculate the degree of precision of the resulting data.

C.12.5 Use the explanations and models found in the earth and space, life and environmental, and physical sciences to develop likely explanations for the results of their investigations.

C.12.6 Present the results of investigations to groups concerned with the issues, explaining the meaning and implications of the results, and answering questions in terms the audience can understand.

X. Science F, Life and Environmental Science

F.8.2 Show how organisms have adapted structures to match their functions, providing means of encouraging individual and group survival within specific environments.

F.8.8 Show through investigations how organisms both depend on and contribute to the balance or imbalance of populations and/or ecosystems, which in turn contribute to the total system of life on the planet.

F.8.9 Explain how some of the changes on the earth are contributing to changes in the balance of life and affecting the survival or population growth of certain species.

F.8.10 Project how current trends in human resource use and population growth will influence the natural environment, and show how current policies affect those trends.

F.12.5 Understand the theory of evolution, natural selection, and biological classification.

F.12.7 Investigate how organisms both cooperate and compete in ecosystems.

F.12.8 Using the science themes, infer changes in ecosystems prompted by the introduction of new species, environmental conditions, chemicals, and air, water or earth pollution.
XI. Science H, Science in Personal and Social Perspectives

- H.8.2 Present a scientific solution to a problem involving the earth and space, life and environmental, or physical sciences and participate in a consensus-building discussion to arrive at a group decision

- H.8.3 Understand the consequences of decisions affecting personal health and safety

- H.12.1 Using the science themes and knowledge of the earth and space, life and environmental, and physical sciences, analyze the costs, risks, benefits and consequences of a proposal concerning resource management in the community and determine the potential impact of the proposal on life in the community and the region

- H.12.2 Evaluate proposed policy recommendations (local, state, and/or national) in science and technology for validity, evidence, reasoning and implications, both short and long-term

- H.12.3 Show how policy decisions in science depend on social values, ethics, beliefs and time-frames as well as considerations of science and technology

- H.12.4 Advocate a solution or combination of solutions to a problem in science or technology

- H.12.5 Investigate how current plans or proposals concerning resource management, scientific knowledge, or technological development will have an impact on the environment, ecology and quality of life in a community or region

- H.12.6 Evaluate data and sources of information when using scientific information to make decisions

- H.12.7 When making decisions, construct a plan that includes the use of current scientific knowledge and scientific reasoning

XII. Social Studies

- A.8.1 Use a variety of geographic representations, such as political, physical and topographic maps; a globe; aerial photographs and satellite images, to gather and compare information about a place

- A.12.2 Analyze information generated from a computer about a place, including statistical sources, aerial and satellite images and three-dimensional models
WISCONSIN’S MAJOR WATERSHEDS AND WATERSHED EDUCATION RESOURCES CENTER LOCATIONS

Use the map to get an idea of where Watershed Education Resource Centers (lending libraries for monitoring equipment) are located, then look on the following pages to find the contact information for the WERC based on the number in the star.

Each of the major watersheds above contains many intermediate watersheds, and many of those contain smaller local watersheds.

For contact information for each WERC location, visit:

http://watermonitoring.uwex.edu/wav/monitoring/coordinator/werc-locations.html

1 Superior
2 Baldwin
3 Park Falls
4 Marinette
5 Sturgeon Bay
6 Two Rivers
7 Manitowoc
8 Menasha
9 Shiocton
10 Stevens Point
11 Fall Creek
12 LaCrosse
13 Sheboygan
14 Newberg
15 Milwaukee
16 Milwaukee
17 Waukesha
18 Jefferson
19 Janesville
20 Beloit
21 Madison
22 Mazomanie
23 Platteville
When planning for your field trip, you will need to recruit between two and six volunteers to act as station leaders. These individuals might be fellow teachers, other school staff (e.g., guidance counselors, administrators), parents, advanced placement biology or chemistry students, or students from your school’s ecology club. Other human resources to consider when making preparations for your field trip include:

- **Volunteer Stream Monitors**
  - The Water Action Volunteers (WAV) Stream Monitoring Program has volunteers who monitor the exact same parameters as your students will monitor on their field trips. These WAV volunteers may be available and willing to act as station leaders for your field trips. Contact the WAV coordinator (see http://watermonitoring.uwex.edu/wav) to obtain a list of contacts in your area.

- **Local college students**
  - For instance, at UW-Madison, the Biocore Outreach Ambassadors Program is an award winning intercollegiate honors program. The program is designed to have students work side by side with classroom teachers to improve science education in rural Wisconsin. Contact the Program Advisors (see http://watermonitoring.uwex.edu/wav) to make arrangements for Biocore Outreach Ambassadors to assist with your field trip.

  - In the Stevens Point area, the student chapter of the American Water Resources Association has assisted as station leaders for school stream monitoring field trips over the years. Contact the student chapter (see http://watermonitoring.uwex.edu/wav) to make arrangements for these students to assist with your field trip.