Water Resources Education Program

Program Documents

The ***Water Resources Education Program*** is a pilot program that engages students in introductory, foundation-laying, watershed experiences that enhance the local curriculum, increase water resources literacy and foster stewardship ethic in a team structure.

Student Focus:

- Students participate in a long term, meaningful water resources experience that includes learning both outdoors and in the classroom with activities designed to increase watershed science literacy.

- Students learn to investigate environmental issues both locally and globally, identify actions to address these issues and learn the value of those actions.

- Students become aware of local issues and select a focus for deeper investigation.

- Students learn about their selected focus through the development of a stewardship action plan.

- Students practice life skills while implementing stewardship action plan.

Teacher Focus:

*Essential to the success of this program is an **interested middle school science teacher** instructing with aligned grade level science objectives.

This program includes five essential program elements:

1. *Interested, dedicated teacher* - Teachers are in the best position to help students make connections, draw on previous lessons, serve as environmental role models and support students overall environmental education experience. Teachers will have support from Watershed Council staff to integrate knowledge of environmental issues and watershed concepts into their current curriculum.

2. *Curriculum Integration*– Every effort will be made to integrate into classroom curriculum providing authentic, age appropriate, engaging multi-disciplinary content to address current standards. Content may vary from school to school, depending on their respective topic selection. Possible watershed protection-based activities include stormwater management, groundwater, invasive species, school drinking water quality, restoration, lake and beach monitoring, rain gardens, river clean-ups, and tree planting. Each classroom team will have an individualized experience based on interest within the group.

3. *Learn Local Spectrum/Place Based Education* – This program promotes learning from the local community and environment and is the primary resource for the student experience. Learning about local and regional issues creates a connection to community that will foster a stewardship ethic within the team. Creating an action plan with the team to address a selected issue will foster understanding on how actions impact the community as a whole.

4. *Team Service* – Participation include components that involve instructional time, development of experiences specific to each team, time for reflection and discussion, and includes all students in the classrooms. Watershed Council education staff will provide a framework of experiences including classroom sessions, support for team field trips, and resource support of a team stewardship project.

5. *Resource Persons* – Providing experiences connected with local resource persons based on team stewardship projects further serves to strengthen the "Learn Local Spectrum." Including applicable products and services as well as environmental resource persons can heighten the impact of environmental instruction both in the classroom and in the field. Additionally, environmental professionals can serve as important role models for career choices and encouraging stewardship.

Teacher/School Benefits

- **Place-Based Education** – The benefits to utilizing PBE with your classroom are numerous. The students and teachers reap the benefits of more engaging learning opportunities and the local community benefits from the outcomes of school- partner relationships and a next generation of stewards that are more invested in 'place.'
- **Team Support** – Watershed Council education staff is available to work with individual teachers and teams of students to provide guidance on project implementation, community partner engagement, PBE and project-related curriculum for implementation of a stewardship action plan.
- **Community Partner Relationships** – Community partners can serve as a wonderful resource to educators, providing teachers with greater background knowledge on specific content, engaging directly with students to share information, and involving classrooms in hands-on projects that produce visible outcomes. TOMWC's role is to provide resources and assistance to time-limited teachers to help nurture those valuable relationships with community partners.
- **Access To Resources** – TOMWC does the hard work of tracking down resources to make them easily available to teachers. Funding for classroom projects, community partners open to collaborating, curriculum and classroom activities, and professional development.
- **Informal professional development** – Watershed Council collaborates with partners, administrators, non-traditional educators and PBE resources to offer supportive sessions that cater to teachers' needs.

The *Tip of the Mitt Watershed Council* has received funding from the Great Lakes Fishery Trust to implement the ***Water Resources Education Program*** (WREP). WREP is a pilot program that engages students in introductory, foundation-laying, watershed experiences that enhance the local curriculum, increase water resources literacy and foster stewardship ethic in a team structure. As part of WREP, students will research and investigate a water resources issue and identify the need for action through learning about their surrounding community.

Students:

- *Participate* in a long term, meaningful water resources experience that includes learning both outdoors and in the classroom with activities designed to increase watershed science literacy.
- *Learn to investigate* environmental issues, identify actions to address these issues and learn the value of those actions.
- *Become aware* of local issues and select a focus for deeper investigation.
- *Learn* about their selected focus through the development of a stewardship action plan.
- *Practice life skills* while implementing stewardship action plan.

Essential program elements:

1. ***Interested, dedicated teacher*** - Teachers will have support from Watershed Council staff to integrate knowledge of environmental issues and watershed concepts into their current curriculum.

2. ***Curriculum Integration***– Every effort will be made to integrate into classroom curriculum providing authentic, age appropriate, engaging multi-disciplinary content to address current standards. Each classroom team will have an individualized experience based on interest within the group.

3. ***Learn Local Spectrum/Place Based Education*** – This program promotes learning from the local community and environment and is the primary resource for the student experience. Learning about local and regional issues creates a connection to community that will foster a stewardship ethic within the team.

4. ***Team Service*** – Watershed Council education staff will provide a framework of experiences including classroom sessions, support for site experiences, and resource support of a team stewardship project.

5. ***Resource Persons*** – Provides experience with local resource persons based on team stewardship projects to further strengthen the “Learn Local Spectrum.”

TIP OF THE MITT Watershed Council | Respected Advocacy. Innovative Education. Sound Science.

WREP – NGSS

Performance Expectations

ESS2-1
Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process

ESS2-2
Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales

ESS2-4
Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity

ESS3-1
Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes

ESS3-3
Apply scientific principles to design a method for monitoring and minimizing the impact on the environment

ESS3-4
Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems

LS2-4
Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations

LS2-5
Evaluate competing design solutions for maintaining biodiversity and ecosystem services

Science and Engineering Practices
Developing and Using Models
Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

- Develop a model to describe phenomena. (MS-LS2-3)

Analyzing and Interpreting Data
Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.

- Analyze and interpret data to provide evidence for phenomena. (MS-LS2-1)

Constructing Explanations and Designing Solutions
Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to

include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

- Construct an explanation that includes qualitative or quantitative relationships between variables that predict phenomena. (MS-LS2-2)

Engaging in Argument from Evidence
Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).

- Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS-LS2-4)
- Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-LS2-5)

Connections to Nature of Science
Science Knowledge Is Based on Empirical Evidence

- Science disciplines share common rules of obtaining and evaluating empirical evidence. (MS-LS2-4)

Disciplinary Core Ideas
Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes.

Crosscutting Concepts
Patterns

- Patterns can be used to identify cause-and-effect relationships. (MS-LS2-2)

Cause and Effect

- Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-LS2-1)

Energy and Matter

- The transfer of energy can be tracked as energy flows through a natural system. (MS-LS2-3)

Stability and Change

- Small changes in one part of a system might cause large changes in another part. (MS-LS2-4), (MS-LS2-5)

Connections to Engineering, Technology, and Applications of Science

Influence of Science, Engineering, and Technology on Society and the Natural World

- The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time. (MS-LS2-5)

Connections to Nature of Science

Science Addresses Questions about the Natural and Material World

- Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes. (MS-LS2-5)

Team Scheduling: Each team (class) will schedule training sessions in sequence, preferably October through January. Progress check(s) will be scheduled January through April. Each team needs to have some way to communicate their project results, completed by the end of April. W.R.E.P. Summit will be scheduled in May or June.

W.R.E.P. Team Training	Oct 2017	Nov	Dec	Jan 2018	Feb	Mar	April	May	June
Session One: Water Cycle and Watersheds		X	x						
Session Two: Groundwater and School grounds				x					
Session Three: Point & Non-point pollution				x	x				
Session Four: Invasive Species					x				
Session Five: Stewardship Action Project					X	x			
Stewardship Action Project - Progress Check (s)						x	x	x	
Stewardship Action Project - Communication (Poster, video, PPT, etc.)						x	x	x	
WREP Summit – Celebration and sharing of team results.								X	X

WREP Sessions Content and Activities

Session One: Water Cycle and Watersheds

Students learn the concept of a watershed and how the movement of water through the watershed is a part of the water cycle. Students will also learn about their local watershed and the geographical features that define their watershed. They will study their watershed map and locate their school neighborhood within their watershed.

Field Experience: Using the map as a reference, students will build a watershed model on school grounds for a visual and hands-on experience.

ESS2-1 - Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process

ESS2-4 - Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity

Teacher/Team Leader Activities: Location of homes on watershed map, Home Survey of Water Use

Session Two: Groundwater and School grounds

Students learn about the groundwater system, and the physical features of the system like aquifers, wells, etc. using a groundwater model. Students use this knowledge to discuss the impacts that human development can have on the system and the surrounding environment. Students will test school tap water – Chlorine, copper, hardness, nitrate, pH, phosphates, dissolved oxygen, temperature.

Field Experience: Students will use soil test kits and soil bores to test a variety of characteristics of the soil samples on school grounds. They will translate this knowledge to an assessment of the ground at their school property.

ESS3-1 - Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes

ESS3-4 - Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems

Teacher/Team Leader Activities: Student groundwater model lab, School Survey of Water Use

Session Three: Point & Non-point pollution

Students learn the difference between point source and non-point pollution and the impacts that humans can have on a watershed (fertilizer/pesticide pollution, chemicals, erosion, etc.) by using the watershed model.

Students then study a map of their local watershed and point out sites where human development may have an impact on the watershed. The map will be used as a reference when coming up with ideas for the stewardship project.

Field Experience: Students will tour their school to see how rainwater runoff is handled on the grounds. A map of the school grounds will be used to document data from the tour and this data will then be used to help develop a stewardship project.

LS2-3 – Develop a model to describe phenomena

Teacher/Team Leader Activities: Locate businesses, development, land use on watershed map, Design a Filter Lab, Community Survey of Water Use

Session Four: Invasive Species

Students learn what an invasive species is as well as the impacts that invasive species can have on the environment that they are exposed to. Students learn to identify local invasive species with specimens provided by TOMWC staff.

Field Experience: Invasive Species Food Chain Scenario, search for invasive species in the school community

LS2-4 - Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect population

Teacher/Team Leader Activities: Further Invasive Species research in watershed and locate this data on the map (MISIN, I-naturalist)

Session Five: Stewardship Action Project

Students discuss the differences between a healthy watershed and an unhealthy watershed. They then discuss the health of their own watershed and what measures can be taken to make it healthier.
Students brainstorm projects to improve the health of the school community/watershed.
Students develop a stewardship/action to enact change in their watershed. Example stewardship projects include: native planting, informational posters, invasive species removal, rain barrel installation.

ESS3-3 - Apply scientific principles to design a method for monitoring and minimizing the impact on the environment

LS2-5 - Evaluate competing design solutions for maintaining biodiversity and ecosystem services

Teacher/Team Leader Activities: Team Planning/Decision Making Guide, Stewardship Action Project Progress Check(s), Stewardship Action Project Communication (poster, video, PPT, etc.), RIPPLE Summit

WREP Session #1 Water Cycle and Watersheds

Lesson Overview (55 min)

5 min. TOMWC/WREP Introductions

10 min. WREP folders – Name (and #?) assemble folders.

15 min. Crumple Paper Watershed Model (2-4 students per group)

1. Review activity, model paper crumpling, "hands up" for precipitation.
2. Record response on handout.
3. Clean up – Stack used paper, drain yellow trays, wipe with towels.

15 min. Schoolyard Tour (partners – with coat)

1. Follow Eli, walk to nearest high point, and stop.
2. Read directions – give time limit (5 min.)
3. Circle team – Silent share maps (2 min.) Share observations (5 min.)

5 min. Lesson Wrap – Share Homework

What is a watershed?

Ask the students to define the term watershed
As they begin to form a definition of "watershed," ask them if they had ever been in a watershed or seen a watershed. After a rough definition has been worked out, tell the students that they will do a quick activity that will help them bring watersheds into focus.

"A watershed is a land area that drains to a specific body of water."

Show the Little Traverse Bay Watershed Map
Identify different places on the LT Bay Map (school, towns, places of interest, etc.)

Watersheds are constantly in the news. They are arguably THE defining environmental and political issue in the Great Lakes, and will be throughout the lifetime of your students. However, "watershed" can be difficult to describe in the classroom. The current working definition of a watershed is: an area of land from which all the rain flows to a specific river or lake (or underground aquifer for older students). The key point here is that a watershed is an area of land around a river or lake. It is not the river or lake itself. By definition, every piece of land on Earth is in a watershed (i.e., all rain goes somewhere).

Once the students have a working definition of a watershed ask them these questions:

- What causes water to move through the watershed?
  The water cycle.

- Where can drinking water come from?
  It can come from groundwater or watersheds.

- Where does *our* drinking water come from? How does it get here?
  Answers will vary depending on your location.

- What are some ways people can enjoy the features of a watershed?
  Swimming, boating, fishing, watching wildlife, and enjoying scenery are mentioned in Science Background. Students may suggest other activities.

- What might happen if the boundary between two countries runs through one watershed?
  Allow students to speculate.

What is a model?

Defining a watershed in a classroom is one thing, but intuitively appreciating the reality of a watershed is quite another. Watersheds are best studied in the field, walking through the watershed itself. However, watersheds are generally very large, on a scale larger than humans tend to think. Unlike other large geological features such as mountains, they are difficult to see unless you are above them. This activity should give classroom students a more approachable perspective of watersheds as students make simple watershed models.

You may want to model the activity by creating your own watershed model and demonstrating the procedure. Having a pre-made watershed available to show students what the final model looks like is often helpful.

WREP Session #1 Water Cycle and Watersheds

Crumpled Paper Watershed

Objectives: By the end of this activity, you should be able to . . . . .

- Define the word "watershed."
- Understand how to tell where the boundaries of a watershed are.
- Understand how runoff affects our water quality.

Background:

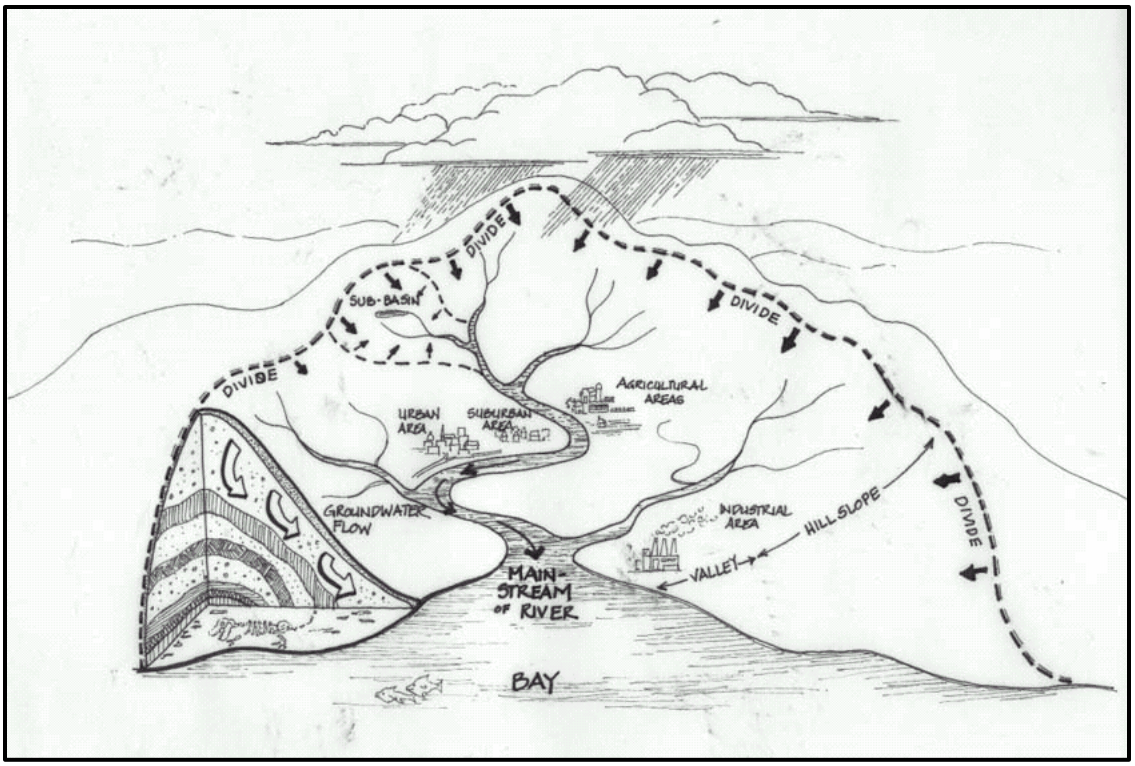
What is a watershed?

A watershed is all of the land that drains runoff (from precipitation) into a body of water, such as a creek, river, lake, bay or ocean. The boundary of a watershed is the ridgeline of high land surrounding it, like the edge of a bowl. Another term for watershed is "drainage basin."

As rainwater and snowmelt run downhill, they carry whatever is on the land, such as oil dripping from cars, trash and debris on streets, or exposed soil from construction or farming to the nearest water body.

Our Local Watershed

Everyone lives, works and plays in a watershed. Precipitation that falls on land drains to a body of water, like a creek or river. Our local watershed may lead to a tiny creek, but that eventually drains into a river, lake or ocean



The Experiment:

1. Crumple up the piece of paper and then smooth it back out most of the way. It should still be a bit crumpled, showing small ridges (high points) and valleys (low points).
2. Imagine this paper is a section of land and find the ridgelines (tops of the fold-lines).
3. Use washable blue marker to color along the ridgelines of your "land".

Make Your Hypotheses:

You are going to "rain" on the land you created. Answer the following question to make your hypotheses BEFORE conducting the experiment.

1. What do you think will happen to your land when it "rains"?

_____

_____

2. What will happen to the blue ridge lines you colored?

_____

_____

3. Where will the "rainwater" travel?

_____

_____

Do The Experiment:

Follow the direction below to conduct the experiment.

1. When you are ready for precipitation, raise your hand and the teachers will bring the spray bottle to you.
2. Use a spray bottle of water to create a "rainstorm" over your land. You want a gentle mist.
3. Observe what happens after every misting.
4. As your "rainfall" accumulates, observe the pathways where the excess "rainfall" travels.

Record Observations:

In the space below, record your observations about what happened. Use words and pictures if you wish.

Analyze Your Data and Draw Conclusions:

1. Explain how your hypothesis were or were not accurate.

_____

_____

2. How did the “rainfall” travel over your land?

_____

_____

3. Where did the water collect? Explain why this happened.

_____

_____

4. Find an area on your land where water collected. This is a lake, and you get to name it!

   My lake is Lake_____

5. Look for the major stream running into your lake. Name this stream as well.

   My stream is called_____

6. This stream may have several tributaries (small streams which run into the larger stream).

   How many tributaries does your stream have? _____

7. With your finger, trace your stream all the way back up to where it starts at the top of the ridge. (This should be a path of blue ink.) When you reach the top, this is the edge of the watershed for your stream and lake.

8. Trace the entire edge of the watershed with your finger, by following the ridgeline. This will be something like tracing the edge of a bowl.

   All of the inside, downward-sloping area you have just outlined is the <u>watershed</u> for your stream and lake.

9. Draw a picture of your watershed below. Label your stream and lake.

10. How many other watersheds can you find on your "land"? _____

11. How would you define the word "watershed"?

_____

Session #1 Water Cycle and Watersheds

Schoolyard Tour – Mapping

Objective: Explore the school grounds, using the maps to identify how water (precipitation) moves and where it goes.

Follow The Leader:

- **Walk in pairs** with your team to the **nearest high point** on the school grounds.
- Look at the map of school.
- Locate where you are standing on the map by **drawing an "X".**
- **Draw a line** to show where you walked from the school.
- Look over the land and the way the ground slopes down from this high point. If it rained, where would water flow?
- **Draw arrows to show the direction** you think water might flow.
- **Walk around this area.** Look for the following things and check them off the list below.

At our site, water flows to:

__low points __gutters __storm drains __ditches

__streams/ponds __culverts ___other _____

On its way, water passes:

__bare soil __vegetation (trees/grass/shrubs) __wells __streets

__parking lots __school __houses __animals __litter

__other _____

Mark your maps with the things you have checked off with a **"circle".**

Share Your Findings:

- **Share** your map with the team by passing your map to the right. Look at each map **SILENTLY** for at least a count of 10, then pass it to the right. When you get your map, be prepared to talk about what you noticed.
- **Using the cloth provided, wipe your map clean for the next team!**

WREP journal reflection:
What have you learned about your school grounds "watershed" today?

WREP Session #1 Water Cycle and Watersheds

Home Water Use Survey

This survey will help you understand where the water that you use comes from, and how your personal choices impact the health of the watershed that you are in.

Work with your parents, family members, or the people in your household to answer the questions on the survey.

1. Where does the water in your home come from?

   ___Public water supply ___Well ___I don't know

   ___Other:_____

2. Have you ever had your water supply tested for nitrates, bacteria, pesticides or lead?

   If you are interested in having your water supply tested contact your county extension office or public health office for information on testing.

   ___Yes ___No ___We need more information

3. Where does the waste water from your home go?

   ___Sewer system ___Septic tank

   ___Holding tank ___I don't know

4. Do you use low-flow shower heads and take quick showers?

   ___Yes ___No

Some showers can use up to 2.5 gallons of water per minute!

5. Do you turn the water off when you brush your teeth, wash or rinse the dishes, etc.?

   ___Yes ___No

6. Do you use home products that don't contain hazardous ingredients?
   When possible, use baking soda, vinegar, citrus solvent, soap flakes and other products which won't pollute our water supply.

   ___Yes ___No

7. Do you take hazardous wastes such as used motor oil, leftover paint, varnish, etc. to an oil recycling center or hazardous waste disposal site? Is there an annual "clean sweep" day in your community designated for disposal of leftover hazardous products?

   ___Yes ___No ___We need more information

8. Where does the rainwater/snowmelt drain from your property?

   - ☐ It soaks into the ground
   - ☐ It flows into the storm drains over the land
   - ☐ It is piped into the storm drains
   - ☐ It is captured in rain barrels and used to water lawn/gardens

9. Do you pick up or remove pet waste from your property?

   ___Yes ___No _____ No pets

10. Do you use fertilizers and pesticides only when necessary?

    ___Yes ___No

11. Do you keep yard waste out of street gutters and ditches?

    ___Yes ___No

Rainwater can wash pet waste, fertilizers, pesticides, and other waste into nearby water bodies where it can cause pollution!

12. Do you have a compost pile as an alternative method of disposing of food waste? (garbage disposals require lots of water)

    - ☐ Yes
    - ☐ No
    - ☐ What is a compost pile?

13. List at least one question that you or your family has about water use or water resources

_____

_____

_____

_____

Parent Initials _____

Name_____Teacher_____

Checking for Understanding:

Circle the letter of the correct answer for each of the following questions to show you understand the information in this activity.

1. Choose the best description for the **watershed** of a stream:

    a. The water of a stream and all the tributaries that feed into it, including wetlands.
    b. All the land that slopes toward the stream and drains rain and melting snow into the stream.
    c. A large wet area of land that completely surrounds the stream.

2. You are hiking along a trail in a hilly country side. You know that you have reached the boundary of a watershed because:

    a. The ground changes from soggy soil to dry soil.
    b. You can see another stream.
    c. You are standing on a high spot and the land starts to slope downward again.

Name _____Teacher_____

Checking for Understanding:

Circle the letter of the correct answer for each of the following questions to show you understand the information in this activity.

1. Choose the best description for the **watershed** of a stream:

    a. The water of a stream and all the tributaries that feed into it, including wetlands.
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    b. You can see another stream.
    c. You are standing on a high spot and the land starts to slope downward again.

Session Two: Groundwater and School grounds

Students learn about the groundwater system, and the physical features of the system like aquifers, wells, etc. using a groundwater model. Students use this knowledge to discuss the impacts that human development can have on the system and the surrounding environment. Students will test school tap water – Chlorine, copper, hardness, nitrate, pH, phosphates, dissolved oxygen, temperature.

Field Experience: Students will use soil test kits and soil bores to test a variety of characteristics of the soil samples on school grounds. They will translate this knowledge to an assessment of the ground at their school property.

> ESS3-1 - Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes
> ESS3-4 - Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems

Teacher/Team Leader Activities: Team testing of site soil sample, School Survey of Water Use-teacher assigns members of team to get information – Eight different aspects (one set of questions per team)

1. Journal question:
2. Vocabulary – Add to glossary (Perhaps matching?)
3. Introduction to soil and effect on water quality (soil testing)
4. Porosity, permeability, soil type
5. Use maps – select eight (8) sample sites – locate on map- Tour sites. (Temperature, soil bore x2 for soil sample. (one bore = tests, one bore = intact

- Each team (class) will perform 7 tests on team sample.
- Nitrogen, Phosphorus, pH, Potash, porosity, permeability, determine soil type, soil horizon sketch, site characteristics (vegetation, litter, slope, elevation

WREP Session 2: School Water Use Survey

Teacher Instructions

The School Water Use survey questions are designed to help teams gain a deeper understanding of how water is used at school. After teams investigate the answers to their questions, a discussion during sessions that follow will identify problems or concerns and teams will begin to brainstorm solutions.

Each team will receive twenty (20) questions that their class/team is responsible for answering before the Session #3 meeting.

1. Select students to answer specific questions or answer the questions as a class.
2. The students may have to reach out to school staff to set up an interview in order to answer the questions.
3. Have students record their answers on the survey paper.
4. If team members think of another question, they can record it and try to find the answer.

WREP Session 2: School Water Use Survey

Teacher: Date:

1. When you wash your hands, do you turn off the water while you soap up? Does your school have “hands-free” faucets? (turn off automatically)

   Student name:
   Who are you asking?

   _____

   _____

2. Does the school dispose of hazardous wastes at a hazardous waste disposal facility?
   - Hazardous wastes include used engine oil, leftover pesticides, building repair and strong cleaning products, and some used art, shop and science materials.

   Student name:
   Who are you asking?

   _____

   _____

   _____

3. Do students and staff use non-hazardous cleaning products when possible, such as baking soda, vinegar, citrus cleaner, soap flakes and a little scrubbing power!

   Student name:
   Who are you asking:

   _____

   _____

   _____

4. Your question:_____

   _____

   _____

   _____

WREP Session 2: School Water Use Survey

Teacher: Date:

1. Does your school recycle? Record the details of the recycling plan. Can you make any improvements to the plan?

   Student name:
   Who are you asking:

   _____
   _____
   _____
   _____
   _____

2. Does your school compost? Record the details of the composting plan. Can you make any improvements to the plan?

   Student name:
   Who are you asking:

   _____
   _____
   _____
   _____
   _____

3. Your question: _____
   _____
   _____
   _____

WREP Session 2: School Water Use Survey

Teacher: Date:

1. Are school grounds planted with trees, shrubs, grasses and wildflowers that are adapted to your climate so that they do not need any extra water? (This is sometimes called "Xeriscaping," pronounced zeer-is-cape-ing.)

   Student name:
   Who are you asking:

   _____

   _____

   _____

   _____

2. Does your school have a water-efficient **watering plan** for the school grounds (one that doesn't waste water)?
   a) Does the staff person in charge of the school grounds use a rain gauge to determine whether the grass needs to be watered? If there is one inch or more of rain per week, the grass is probably getting enough water.
   b) Do the maintenance staff water early in the morning or in the evening so that water does not evaporate quickly?
   c) Do they use efficient watering devices such as soaker hoses and sprinklers which spray drops near the ground?

   Student name:
   Who are you asking?

   _____

   _____

   _____

   _____

   _____

3. Your question:_____

   _____

   _____

   _____

WREP Session 2: School Water Use Survey

Teacher: Date:

1. Does rainwater flow from the school parking lot into a grassy area or does it flow into a storm drain or stream?
   - Water flow into a grassy area may reduce the amount of watering that needs to be done in that area and keeps the parking lot contaminants from going directly into the water supply.

   Student name:
   Who are you asking?

   _____

   _____

   _____

2. Where do the storm drains at your school flow to? You may need to ask maintenance staff at your school to help you answer this question.

   Student name:
   Who are you asking?

   _____

   _____

   _____

3. Are grass clippings or needles/leaves swept off the sidewalks and parking lots for composting so that they don't wash into storm sewers?

   Student name:
   Who are you asking?

   _____

   _____

   _____

4. Your question:_____

   _____

   _____

   _____

WREP Session 2: School Water Use Survey

Teacher: Date:

1. Does runoff which might contain contaminants such as pesticides and fertilizers reach streams or ponds?
   - If you are interested in testing runoff for contaminants, contact the Tip of the Mitt Watershed Council for help.

   Student name:
   Who are you asking?

   _____

   _____

   _____

2. Does the maintenance staff use only the amount of fertilizers needed on the school grounds?
   - Do they test the soil before applying the fertilizers?
   - Do they use organic fertilizers such as compost or manure?

   Student name:
   Who are you asking?

   _____

   _____

   _____

3. Does the maintenance staff spread sand rather than salt on ice-covered sidewalks in the winter?
   - Commercial salt can harm plants, grass, trees, animals and nearby waterbodies. If they are required to use salt, do they use the minimum amount necessary?

   Student name:
   Who are you asking?

   _____

   _____

   _____

4. Your question: _____

   _____

WREP Session 2: School Water Use Survey

Teacher: Date:

1. Do the faucets in your bathrooms, showers or drinking fountains have leaks or dripping water?
   - Take a walk through you school and check all the faucets.
   - Take a meter reading at the end of the school day. (If your school gets water from a well, you may not have a water meter.) Check with the janitors to make sure that no one will be using the building that night and using water. First thing the next morning, before anyone else arrives at school, check the meter again. If the readings are different, you may have leaks somewhere.

   Student name:
   Who are you asking?

2. Does your school have low flow faucets and shower heads in the bathrooms and locker rooms?
   - Possible teacher led investigation: Use a gallon bucket and a stopwatch to time the amount of water used per minute. Turn on the shower or faucet to normal flow. Start the stopwatch when you begin to catch water in the bucket. When the bucket is full, stop the stopwatch. Empty the bucket and do it again until you reach one minute on the stopwatch. If the result is more than 2 gallons for the faucet or 2.5 gallons for the shower, your faucets and showers use too much water.

   Student name:
   Who are you asking?

3. Your question:

WREP Session 2: School Water Use Survey

Teacher: Date:

1. Is the flush valve on the toilets adjusted so that you use the least amount of water possible? You may need to ask the custodian for help on this one.

   Student name:
   Who are you asking?

2. Does your school cafeteria have an efficient dish washing system?
   a) Do the kitchen staff run the dishwashers only when they are full?
   b) When washing dishes by hand, do they turn the water off in between rinsing batches of dishes?

   Student name:
   Who are you asking?

3. Does your school celebrate Earth Day, National Wildlife Week, Arbor Day, National Drinking Water Week, Wetlands Month, National Beach Clean-up Day or other environmental holidays?

   Student name:
   Who are you asking?

4. Your question:

WREP Session 2: School Water Use Survey

Teacher: Date:

1. Does your school test the drinking water for lead, bacteria or other contaminants?
    a) Do they test at least once a year?
    b) Do they keep records of these tests?
    c) Are the levels of contaminants within safe ranges? Contact your local state department of public health to find out the maximum safe levels.

    Student name:
    Who are you asking?

2. What is the water bottle policy at your school? Are there reusable water bottle filling stations at your school?

    Student name:
    Who are you asking?

3. Your question:

Session #2 Groundwater and School Grounds

Team Soil Testing Kit INSTRUCTIONS

The Soil Testing Kit includes materials, equipment and instructions for completing **Soil Sample Datasheet** for your team. Read through all descriptions and instructions before conducting tests.

Soil Sample:

Each team will collect three soil samples from the designated site on the school grounds. **One sample will be carefully preserved in the shape of the "core" as it appears in the soil bore tool. The second and third samples should be dried for 48 hours BEFORE conducting tests.**

ALL tests have color coded, laminated instructions and results are recorded on soil sample datasheet or profile card.

Chemical Tests (Blue cards)

1. Prepare the soil sample for chemical testing (K, N, P) by mixing 100 mL of dried soil (with large gravel and vegetation removed) with 500 mL of distilled water in the container provided.
2. Allow soil solution to settle for at least 30 minutes. The liquid solution will be used to conduct Potash, Nitrogen and Phosphorus tests. The pH test uses dried soil sample.
3. Rinse and clean test containers in the sink, pouring solution down the drain.

Porosity and Permeability (Green cards)

1. Use prepared soil sample (dried and large gravel/vegetation removed) for both tests.
2. Follow directions on instruction sheets. When the test is complete, drain water and dry soil in container.
3. Rinse and clean containers used in test.

Soil Texture and Type (Yellow card)

1. Use a heaping spoonful of soil with a little water mixed in to provide texture.
2. Follow the "Yes" or "No" texture key.
3. Return soil to container and wash hands.

Soil Particle Size and Profile (Orange card)

1. Soil sieve should be EMPTY before sorting new sample.
2. The soil profile card is prepared with doubled sided tape.
3. Return the leftover soil to the container.

Soil Sample Datasheet

Sample # _____ Team_____Date_____

Chemical Characteristics (circle results)

Nitrogen: 0 (depleted) 1 (deficient) 2 (adequate) 3(sufficient) 4 (surplus)

Phosphorous: 0 (depleted) 1 (deficient) 2 (adequate) 3(sufficient) 4 (surplus)

Potash: 0 (depleted) 1 (deficient) 2 (adequate) 3(sufficient) 4 (surplus)

pH (describe): _____ (ex. 4.5 Very Acidic)

Physical Characteristics

Soil Texture/Type:_____(ex. Sandy loam)

Soil Particle Size Profile Card (check if complete) _____

Porosity and Permeability Table

Sediment	Total Volume (mL)	Volume left in cylinder (mL)	Pore Space Volume (total volume – volume left)	% porosity	Permeability (seconds for water to pass through)
Example	100 mL	65 mL	100 – 65 = 35 mL	35/100 x 100 = 35%	8 seconds

Site Characteristics

Slope: Bottom of slope Top of Slope Other _____

Vegetation:

__Trees __Grasses __Shrubs __Vegetables __Wildflowers

Other Characteristics (ex. near building or waterbody): _____

_____

_____Soil Sample

Site #_____ Date_____

Particle Size	Profile
2 mm to 75 mm	
0.05 mm to 2 mm	
0.002 mm to 0.05 mm	
Less than 0.002 mm	

_____Soil Sample

Site #_____ Date_____

Particle Size	Profile
2 mm to 75 mm	
0.05 mm to 2 mm	
0.002 mm to 0.05 mm	
Less than 0.002 mm	

_____Soil Sample

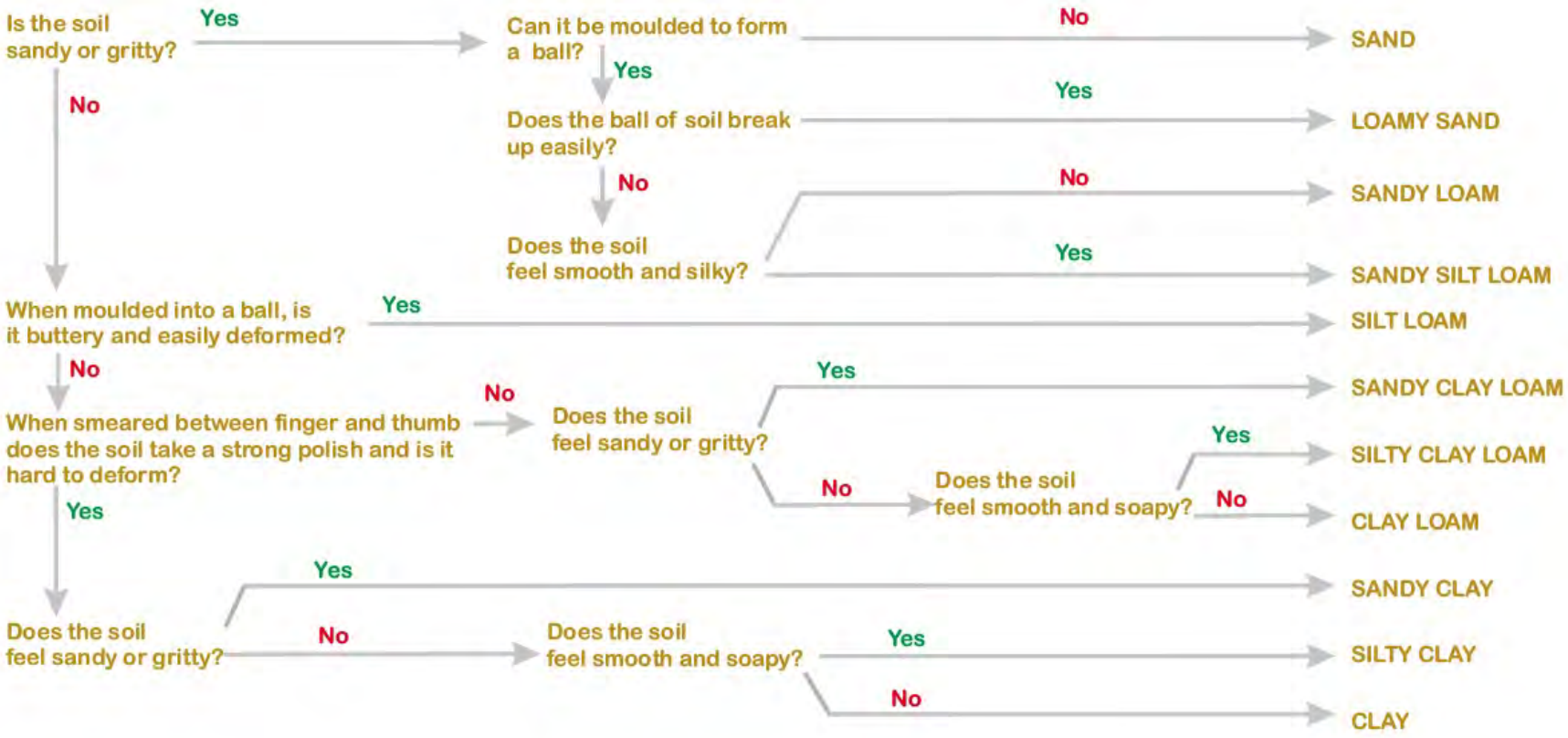
Site #_____ Date_____

Particle Size	Profile
2 mm to 75 mm	
0.05 mm to 2 mm	
0.002 mm to 0.05 mm	
Less than 0.002 mm	

WREP Session 2: Hand Texturing of Soil

What type of soil do you have?

Take a small clump of moistened soil and knead between fingers and thumb



What type of soil do you have?

_____

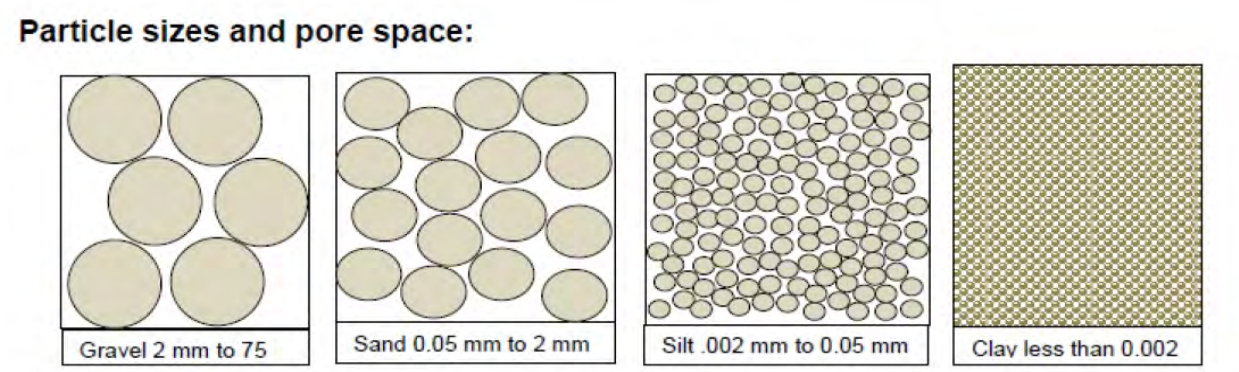
_____

_____

Porosity

Porosity is the amount of empty space in a rock or other earth substance; this empty space is known as pore space. **Porosity is how much water a substance can hold.** Porosity is usually stated as a percentage of the material's total volume.

Water flows between the spaces in the material. If the spaces are close together such as in clay based soils, the water will tend to cling to the material and not pass through it easily or quickly. If the spaces are large, such as in the gravel, the water passes through quickly.



There are two other terms that are used with water: percolation and infiltration.

- **Percolation** – the downward movement of water from the land surface into soil or porous rock.
- **Infiltration** – when the water enters the soil surface after failing from the atmosphere.

Materials:

1 clear cup marked at 100 mL, 100 graduated cylinder, spoon, water, team soil sample, small flat container.

Procedure:

1. Using the spoon, fill the clear cup with the team soil sample until it reaches the line.
2. Measure out 100 mL of water in the graduated cylinder.
3. Pour the 100 mL of water slowly into the team soil sample.
4. Stop when the water level just reaches the top of the sample.
5. **Record** the amount of water left in the graduated cylinder on the soil sample team data sheet.
6. **Calculate** the pore space by subtracting the amount left in the graduated cylinder from the original 100 mL. **Record in the table** on datasheet.
7. **Calculate** the % porosity and **record in the table** on datasheet.

$$\textbf{Porosity} = \frac{\textbf{pore space volume}}{\textbf{total volume}} \times 100$$

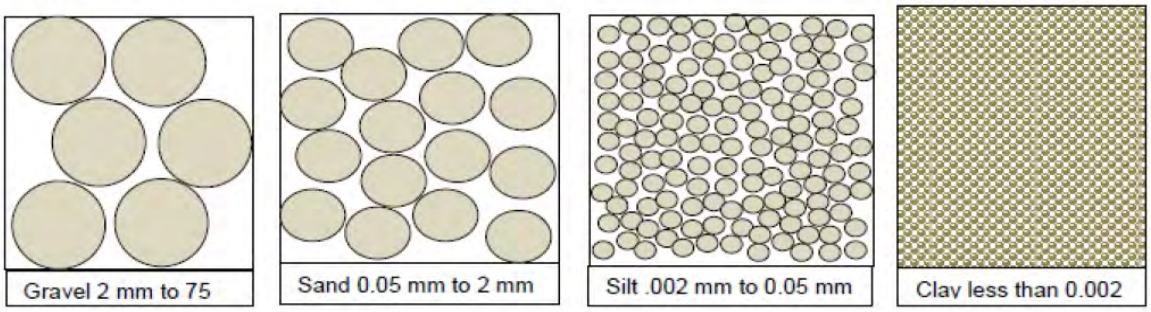
8. Empty water from graduated cylinder.
9. Dump soil sample into container and leave uncovered to dry out.

Permeability

Permeability is **how well water flows** through rock or other earth substance. Factors that affect permeability are how large the pores in the substance are and how well the particles fit together.

Water flows between the spaces in the material. If the spaces are close together such as in clay based soils, the water will tend to cling to the material and not pass through it easily or quickly. If the spaces are large, such as in the gravel, the water passes through quickly.

Particle sizes and pore space:



There are two other terms that are used with water: percolation and infiltration.

- **Percolation** – the downward movement of water from the land surface into soil or porous rock.
- **Infiltration** – when the water enters the soil surface after failing from the atmosphere.

Materials:

1 large cup with a hole in the bottom, 100 graduated cylinder, timer, water, team soil sample, large beaker, small flat container.

Procedure:

1. Using the spoon, fill the large cup with a hole in the bottom with the team soil sample until it reaches the line, 100 mL volume.
2. Measure out 100 mL of water in the graduated cylinder.
3. Pour the entire 100 mL of water quickly into the team soil sample.
4. Start recording time as soon as the water hits the soil.
5. Stop timing as soon as the first drop if water comes out of the hole in the bottom.
6. **Record** how many seconds it takes for the water to reach the bottom of the soil sample on the team data sheet.
7. Empty water from graduated cylinder.
8. Dump soil sample into container and leave uncovered to dry out.

Nitrogen (N)
Nitrogen is important to plant nutrition and is directly responsible for producing leaf growth and green leaves. A deficiency, or lack of nitrogen causes yellow leaves and stunted growth. Too much nitrogen causes overabundant foliage (leaves) with delayed flowering and poor fruit production. Excess nitrogen in water increases plant growth and decay, promotes bacterial decomposition and decreases the amount of oxygen available in the water. Fertilizer and agricultural runoff contribute to high levels of nitrogen in soil and surrounding water bodies.

Test Procedure:

1. Check that you have the **Nitrogen Test** container **(Purple)** and open the cap.
2. Using the SOIL SOLUTION from the soil sample, **fill both sides of container with a dropper using only liquid.**
3. Remove **one purple capsule** and hold it over the test chamber (left/smaller).
4. Gently **separate the two halves** and **pour the powder** into the **test chamber**.
5. Fit the cap on the container and shake thoroughly.
6. Allow color to develop for **10 minutes**. If flakes of color are present, shake again.
7. Hold up to the light. Compare the color of the solution in the **test chamber** to the **color chart**.

Phosphorus (P)
Growing plants need phosphorus. It is important to plant genetics and seed development. A lack of phosphorus causes stunted growth and inactive seeds. Phosphorus helps plants grow, increases number of seeds and fruit, and helps plants resist disease. In water bodies, high levels of this nutrient can lead to overgrowth of plants, increased bacterial activity and decreased dissolved oxygen levels. Phosphorus comes from several sources including human and animal waste, industrial pollution and agricultural runoff.

Test Procedure:

1. Check that you have the **Phosphorus Test** container **(Blue)** and open the cap.
2. Using the SOIL SOLUTION from the soil sample, **fill both sides of container with a dropper using only liquid.**
3. Remove **one blue capsule** and hold it over the test chamber (left/smaller).
4. Gently **separate the two halves** and **pour the powder** into the **test chamber**.
5. Fit the cap on the container and shake thoroughly.
6. Allow color to develop for **10 minutes**. If flakes of color are present, shake again.
7. Hold up to the light. Compare the color of the solution in the **test chamber** to the **color chart**.

Potash (K)

Potash or potassium, strengthens plants structure. It improves the color and flavor of plant fruit, helps with early growth and stem strength. Plants lacking in potash are usually stunted and have poorly developed root systems. Leaves may be spotted, curled and appear dried out at the edges. There is no level at which potassium becomes toxic to plants. But when plants get too much potassium, the absorption of other nutrients is inhibited, which leads to the symptoms caused by the deficiency of these nutrients. Potash is a mineral that dissolves easily in water.

Test Procedure:

1. Check that you have the **Potash Test** container **(Orange)** and open the cap.
2. Using the SOIL SOLUTION from the soil sample, **fill both sides of container with a dropper using only liquid.**
3. Remove **one orange capsule** and hold it over the test chamber (left/smaller).
4. Gently **separate the two halves** and **pour the powder** into the **test chamber**.
5. Fit the cap on the container and shake thoroughly.
6. Allow color to develop for **10 minutes**. If flakes of color are present, shake again.
7. Hold up to the light. Compare the color of the solution in the **test chamber** to the **color chart**.

pH

pH is the measure of the acidic or basic quality of water. The pH scale ranges from a value of 0 (very acidic) to 14 (very basic), with 7 being neutral. The pH of natural water is usually between 6.2 and 8.2. Plants need the correct pH (acidity/alkalinity) level because it controls how well plants use the available nutrients in the soil. Most aquatic organisms are adapted to a specific pH level and may die if the pH of the water changes even slightly. pH can be affected by industrial waste, agricultural runoff, or drainage from improperly run mining operations.

Test Procedure:

1. Check that you have the **pH Test** container **(Green)** and open the cap.
2. Fill test chamber (smaller/left side) to soil fill line with soil sample.
3. Remove **one green capsule** and hold it over the test chamber (left/smaller).
4. Gently **separate the two halves** and **pour the powder** into the **test chamber**.
5. Using the dropper, fill the test chamber with distilled water to water fill line.
6. Fit the cap on the container and shake thoroughly.
7. Allow color to develop for **1-2 minutes.**
8. Hold up to the light. Compare the color of the solution in the **test chamber** to the **color chart**.

Soil Particle Size and Profile

Soil sieves are a useful tool for separating coarse sand, fine sand, silt and clay particles from the soil sample. The size of the particles are used to classify soils and give them generic names such as sandy loam, clay loam, loamy sand and so on.

The soil particle profile is used to show the actual size of particles in a soil sample, comparing size and shape. The four sizes of particles are separated by the soil sieve.

Soil Sample

Site #_____ Date _____

Particle Size	Profile
2 mm to 75 mm	
0.05 mm to 2 mm	
0.002 mm to 0.05 mm	
Less than 0.002 mm	

Procedure

1. Check the soil sieve so that it is stacked to match the soil particle profile card above.
2. **Measure 100 mL** of dried soil.
3. Take the lid off and **pour 100 mL soil into the top** of the stacked soil sieve.
4. **Gently** shake soil sieve side to side for **1 minute.**
5. **Pour the soil** remaining in each sieve level **onto a piece of paper in a separate pile.**
6. Using the soil profile card with doubled sided tape, sprinkle a little soil from each sieve "pile" on the corresponding size square on the profile card.
7. Return the leftover soil to the soil sample container.

Session Three: Point & Non-point pollution

Students learn the difference between point source and non-point pollution and the impacts that humans can have on a watershed (fertilizer/pesticide pollution, chemicals, erosion, etc.) by using the watershed model.

Students then study a map of their local watershed and point out sites where human development may have an impact on the watershed. The map will be used as a reference when coming up with ideas for the stewardship project.

Field Experience: Students have previously toured their school yard to see how rainwater runoff is handled on the grounds. A map of the school grounds will be used to document data from the tour and this data will then be used to help develop a stewardship project.

LS2-3 – Develop a model to describe phenomena

Teacher/Team Leader Activities: Getting to the Source student activity

Team Homework: Community Water Use Survey – Whole team/class

WREP Session #3 Point & Non-point Source Pollution

Lesson Overview (55 min)

5 min. Quick Review of Watershed, Groundwater, WREP purpose

20 min. Watershed Model
- Review watershed map – Mark a few land uses
- Use model to engage students w/discussion

5 min. Identify a Source Activity – Teacher copies
- Using photos of PS/NPS Identify and Justify (If, Then, Because)
- Share results in a "lightning round" –Team choice

10 min. Soil Tour Datasheet – Teacher copies
- Students look at soil datasheets from all soil sites.
- Complete the soil tour datasheet

5 min. Lesson Wrap – If time, review session and preview Invasive Species

Collect School Use Water Survey

Student Homework – Getting to the source
Team Homework – Community Water Use Survey

EXAMPLES OF NONPOINT SOURCE POLLUTION (NPS)

SEDIMENT: Sediment is tiny soil and rock particles carried by rain and snowmelt into streams, lakes and estuaries. It can carry chemical pollutants with it into the water. Sediment also increases the turbidity {cloudiness} of water, which reduces the penetration of sunlight. This slows the photosynthesis process in plants, which alters the amount of oxygen in the water and the availability of food for other aquatic organisms. Finally, sediment can accumulate along channels and bottoms, contributing significantly to flooding. *Sedimentation can occur as the result of soil erosion, construction and other types of land disturbances in rural, urban and suburban areas.*

EXCESSIVE NUTRIENTS: All plants require nutrients to survive and reproduce. Two naturally occurring nutrients, nitrogen and phosphorus, are commonly present in fertilizers. When an overabundance of fertilizer is used, excess nutrients are picked up by stormwater runoff and washed into nearby waterways. This excess causes increased algae and aquatic plant growth, resulting in a competition with each other, and with fish, for oxygen. This excessive growth lowers the amount of dissolved oxygen in the water, interferes with recreational use of the water, impairs potability and alters fish diversity and abundance. *An oversupply of nitrogen in the water is usually the result of leaking septic systems or fertilizers and manure from farms or lawns that is carried into the waterway by stormwater runoff. An excessive amount of phosphates could indicate the presence of fertilizers, industrial waste, domestic sewage, car and laundry detergents, grass clippings and leaves.*

ANIMAL WASTE: Pathogens are disease-causing microorganisms present in human and animal waste, or fecal matter. Diseases that can result from exposure to fecal matter include dysentery, hepatitis, food poisoning and parasitic infections. When pathogens are found beyond safe levels in Michigan waters, beaches are closed and flows or sections of water are condemned for drinking and shellfish harvesting. Bacterial contamination is caused by the untreated waste of humans, pets, livestock and concentrated populations of wildlife. These materials are washed from the ground by stormwater runoff into local waterways. *Contamination also occurs at marinas, docks and other areas frequented by large populations of waterfowl or by boaters discharging raw sewage overboard. Finally, improperly operating septic systems are a source of bacterial contamination from untreated human waste.*

PESTICIDES: Pesticides, which include insecticides and herbicides, contain various substances that can negatively impact human health. These types of chemicals are used agriculturally and domestically. The use of "harder" pesticides, such as DOT, was banned because they can remain in the environment for years before decaying. The effects of currently-used pesticides on the aquatic environment depend on a number of factors, including the physical, chemical and biological properties of the pesticide, the amount, method and timing of the application, and the intensity of the first storm following application. *Improper application and usage leads to pesticide-laden runoff and groundwater, and possible "kills" of aquatic vegetation, insects and fish.*

TOXIC METALS: Metals such as copper, mercury, nickel, chromium, zinc and lead are considered to be toxic or poisonous because they can cause harmful health effects should concentrated amounts accumulate in the body. Their impact on human health can occur quickly or over a long period of time. Also, algae, shellfish and fish accumulate metals in their tissues, which can then be consumed by other animals and humans. *Metals originate from cars, industrial waste and misused pesticides and are transported by rain and highway runoff.*

ACIDIC DEPOSITION: Acid rain is the most common form of acidic deposition and is caused, in Michigan, primarily by car emissions. It is also associated with the burning of coal and wood and other industrial emissions. It is defined as the settling of the aerial acid particles (sulfur dioxide and nitrogen oxides) by means of precipitation. Acid rain not only removes certain nutrients from the soil and affects tree growth, but it also washes toxic metals from the soil into the waterways. *Acidic deposition can lead to reproductive failure or death among aquatic animals.*

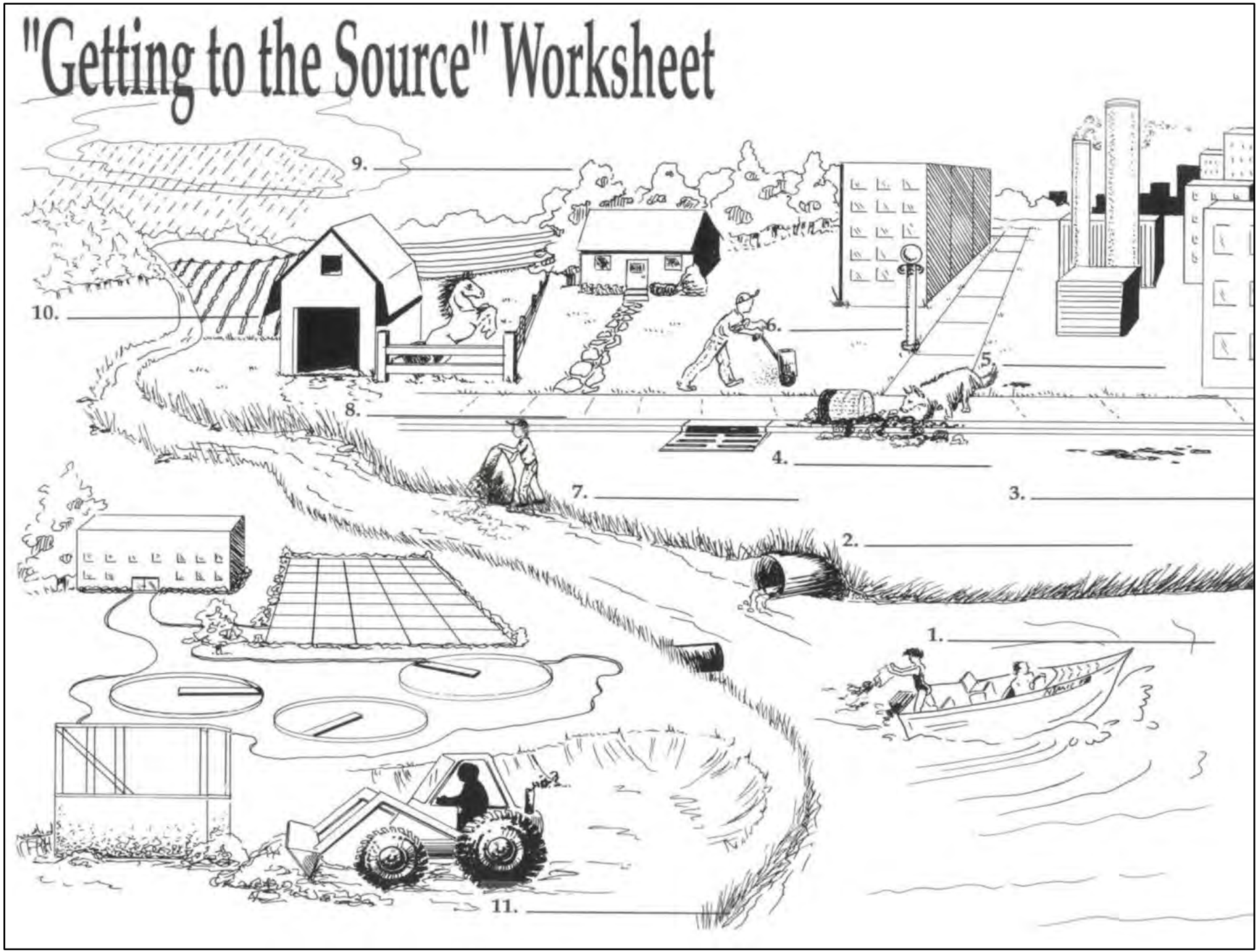
MOTOR OIL: Improper disposal of used motor oil is as environmentally "offensive" as offshore drilling and tanker spills. Motor oil contains toxic substances, including lead and chemical additives, which seriously contaminate ground water and inland and coastal waterways. It stunts or kills algae and other vegetation, smothers aquatic animals and contaminates shellfish beds and drinking water supplies. *The presence of oil in water is usually the result of used motor oil poured directly onto the ground or into storm drains and leakage from improperly maintained vehicles and equipment.*

HOUSEHOLD HAZARDOUS WASTE: Toxic or poisonous substances in the home include oven cleaners, gasoline, turpentine, nail polish remover, antifreeze and paints, to name just a few.
When they are improperly used or improperly disposed of onto the ground or down a storm drain, they enter nearby waterways or ground water without any type of treatment. *When dumped into a sink, toilet or household drain, they can harm the bacteria used to treat the water, either in the septic system or at the wastewater treatment facility.*

ROAD SALTS: Salt is used to de-ice highways every winter. Used in this way, however, it can contaminate ground water supplies and affect the lives of fish. It also retards the annual springtime mixing of surface and bottom waters in lakes and ponds by changing the salinity and density of the water, which decreases the amount of oxygen available for bottom dwelling animals. *Road salts are presently used on highways, parking lots and other paved areas and are sometimes stored improperly adjacent to waterways.*

LITTER: Roadside trash, overflowing garbage cans and dumpsters, littered parking lots and alleys, illegally dumped tires and "junk" as well as piles of leaves, sticks and grass clippings piled along curbs or dumped into ditches, are all forms of litter. With time, wind, rain and melting snow aid in "breaking down" or decomposing some of these materials and carrying the lighter ones into nearby ditches, storm drains, streams and rivers. *Not only does litter collect in piles and cause flooding, but during heavy rains it can travel far from its original location to eventually clutter the shorelines of rivers, bays and the ocean itself. Also, the contents of partially empty containers of hazardous materials, such as cleansing materials or paints, that become litter will eventually empty into a waterway and contribute to its contamination.*

"Getting to the Source" Worksheet



“Getting to the Source” Activity – Teacher Directions

This activity can be completed after Session #3 Watershed model and “Identify the Source” activity.

Materials:

- **Whiteboard**
- Student copy of **“Getting to the Source” diagram.**
- Group copy of **“Examples of NPS” (this is an informational handout that describes different types of NPS in detail)**

Estimated time: 45 minutes (depending on discussion)

1. Write the terms below on the board. Clarify terms if necessary.

Pesticides	**Animal Waste**	**Litter**	**Stormwater Runoff**
Trash and Raw Sewage	**Fertilizers**	**Dumped Oil**	**Grass Clippings/Sticks**
Pet Waste	**Acidic Deposition**	**Sediment/Erosion**	

2. Give each student (or group of students) one copy of the "Getting to the Source" diagram and a pencil.
3. Have them work individually or in small groups to **write the terms on the proper blank lines on the diagram that is on the worksheet.**
4. **Before** discussing correct answers, **distribute copies of the "Examples of NPS" information sheets and give them time to review the information.** Encourage them to check and discuss their answers.

5. The correct diagram answers are as follows:

1) Trash and Raw Sewage	5) Pet Waste	9) Acidic Deposition
2) Stormwater Runoff	6) Fertilizers	10) Pesticides
3) Dumped Oil	7) Grass Clippings/Sticks	11) Sediments/Erosion
4) Litter	8) Animal Waste	

6. Discuss the definition of “nonpoint source pollution” and ask the following questions:

- How does NPS move through the water cycle? (It moves with the water flow; the flow of water and pollution is greater after it rains or after snow melts.)

- Where can these types of pollution collect? (It can collect in water bodies as well as in the ocean.)

7. Discuss the following questions with the students:

- What factors aid in determining the types of NPS sources in a given area? (Land use. Considerations include population, industry and business, geography, when the area was established and how quickly it was developed, etc.).

- How could an increase in population in any of these areas affect NPS examples and amounts? (Additional types of development and land use would occur.)

- What natural factors determine the rate that NPS pollutants mix with water and travel, or stay in one water body? (These factors include topography, water velocity, weather, soil and rock types, etc.).

- Why do you think people knowingly or unknowingly contribute to NPS problems?

- If you were the mayor of a town that had problems with NPS in nearby waterways, what would you do to address this problem?

Name:_____

Identify the Source!

1. **Classify** the pollution events as a class by checking point source (**PS**) or nonpoint source pollution (**NPS**).
2. **Circle the event** your team has to identify.
3. Answer the questions about your pollution event on the bottom of the paper.

Pollution Event	**PS**	**NPS**	**Correct?**
Runoff from a parking lot.			
Oil dumped in a pond.			
Animal owners neglecting to clean up a pet's waste.			
Automobiles leaking brake fluid.			
Using fertilizer on a lawn everyday.			
Spraying a garden with pesticide to eliminate bugs.			
Pouring antifreeze down the storm drain.			
Boats in a lake.			
Construction site runoff.			
Microplastics from a waste water management plant.			

Do you think your pollution event point source or non-point source pollution?

_____

Can you point to a specific/single source for the pollution in your event? Circle: YES NO

Example: pollution from a leaky septic tank has one source, the bad septic tank.

Why did you classify your pollution event as point source (PS) or non-point source (NPS)?

_____

_____

_____

Runoff from a parking lot.

Oil dumped in a pond.

Animal Owners Neglecting to clean up a pet's waste.

Automobiles leaking brake fluid.

Using fertilizer on a lawn every day.

Spraying a garden with pesticides to eliminate bugs.

Pouring antifreeze down the storm drain.

Boats on
a lake.

Construction site runoff.

Microplastics from a wastewater management plant.

WREP Session 3: Community Water Use Survey

Teacher Instructions

The Community Water Use survey questions are designed to be answered as whole team (class) through discussion so all members have input. If more space is needed to record answers, attach additional paper.

The Community Water Use Survey should be completed by Session #4 Invasive Species. All surveys will be compiled and posted for the team(s) and school community to view. These surveys provide a foundation for beginning the process of choosing and planning a stewardship project for each team.

WREP Session 3: Community Water Use Survey

Teacher: Date:

1. Are there signs posted in automotive, hardware, grocery and other stores telling people where they can recycle used oil? If so, where?

   _____

   _____

2. List at least *one store* in your community that sells:

   - Low-flow shower heads _____
   - Recycled paper products_____
   - Water testing kits _____
   - Rain gauges _____

3. Do the playground surfaces in your parks allow water to soak in, or does the water run-off into the street and storm sewers?

   _____

   _____

4. Do you have a city water department? Where is it located?

   _____

5. Do you have a recycling center in your community? Where is it located?

   _____

   _____

6. Is soil from area construction sites kept from washing down storm sewers?

   _____

WREP Session 3: Community Water Use Survey

Teacher: Date:

7. Do you have places to go fishing where the fish are safe to eat? Where?

_____

_____

8. Are there lakes, rivers or other waterbodies which are safe for swimming?

   List waterbodies with the following impacts:

   - Have beaches been closed because of a health risk? If so, which?

     _____

   - Is there garbage or litter floating in the water or washed up on a specific beach?

     _____

   - Do plants grow thick in a waterbody, making swimming uncomfortable or unpleasant?

     _____

9. Does your community educate citizens about nonpoint source pollution and dumping into storm drains? How is this information communicated?

   _____

   _____

10. What are some businesses in your community that use more than the average water?

    _____

    _____

Soil Data Tour – Comparing Schoolyard Sites

As you visit each soil sample, look carefully at the datasheet and record data below.

Data	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8
Nitrogen								
Phosphorus								
Potash								
pH								
Soil Type								
Porosity %								
Permeability (Seconds)								

Answer questions:

1. Which soil samples were similar? (site #) _____
2. Which soil samples were different? (site #) _____
3. Choose two different sites and explain below what YOU think makes the soil different.

Session Four: Invasive Species

Students learn what an invasive species is as well as the impacts that invasive species can have on the environment that they are exposed to. Students learn to identify local invasive species with specimens provided by TOMWC staff.

Standards

LS2-4 - Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect population.

Materials:

- Invasive Species kits
- Invasive Species Tags
- Climbing rope for Lake Perimeter

Lesson Overview

1. **Oral review of past sessions.**
   WREP Journal entry – What do you think an invasive species is?

2. **Introduce Invasive Species Video and questionnaire – 10 min**
   https://www.youtube.com/watch?v=spTWwqVP_2s – invasive species video (TED ED)
   Discussion Questions (4:46 min.)
   - Even though governments monitor the transport of plants and animals, what other strategies could be adopted to stop the unwanted introductions of non-native species?
   - What are some of the problems that the rabbit and the Burmese python cause? (They compete for space and food with native species)
   - What are limiting factors? (Environmental conditions that restrict the size or range of a species)
   - Explain the role that limiting factors play in keeping population sizes in check.
   - List some examples of limiting factors (soil nutrients, food availability, predators)

3. **ID invasive species with TOMWC specimens – 15 min (Classroom)**
   - One Minute Update handout

4. **MISIN introduction – 5 min**
   - https://www.misin.msu.edu/browse/
   - Look up Emmet County invasive species with the class and discuss

Teacher/Team Leader Activities

- Further Invasive Species research in watershed and locate this data on the map (MISIN, Inaturalist)

Follow-up activity

- MISIN Homework

Rainbow Smelt

What are they?

- Rainbow Smelt are a non-native, invasive species that have expanded their range in North American freshwater lakes over the last 100 years.

Where did they come from?

- Although stocked several times in the Great Lakes, it is generally accepted that the Great Lakes population of rainbow smelt resulted from their being stocked into Crystal Lake, Michigan, in 1912.
- Rainbow smelt spread throughout all the Great Lakes and into many inland waters in Ontario, Minnesota, Wisconsin and other states and provinces.

Life Cycle Information

- Rainbow smelt thrive in clear, cool, deep lakes. Although they spend most of their time in deep water offshore, they spawn in early spring along shorelines, rivers and streams. They often school in open water in summer.
- Adult size of up to 12 inches. Colorful in water, but fades quickly out of water. Has an adipose fin. Has large teeth on jaws and tongue, and a large mouth.
- Rainbow Smelt fry grow rapidly; in the Great Lakes most are mature by the end of two growing seasons, and nearly all will mature by the end of the third season. As with many other fish species, females grow faster and larger and live longer than males. Rainbow Smelt grow to an average size of 3 to 6inches in length in the Great Lakes.

What are its impacts?

- Rainbow smelt prey upon many native game fish, including lake trout, cisco, whitefish and walleye. They contributed to the extinction of the blue pike.
- Rainbow smelt feed upon the young of native fish and compete for resources with other fish species.

How to prevent the spread?

- Learn to identify Rainbow Smelt.
- Inspect and remove aquatic plants and animals from boat, motor and trailer.
- Drain lake or river water from live well and bilge before leaving access.
- Never dump live fish or crayfish from one body of water into another.

Rainbow Smelt

Eurasian Ruffe

What are they?

- Ruffe are bottom dwelling fish that inhabit fresh and brackish (mixture of freshwater and saltwater).

Where did they come from?

- The ruffe is a small but aggressive fish species native to Northern Europe and Asia.
- It was introduced into Lake Superior in the mid-1980s via the ballast water of ocean-going vessels.
- Since their introduction into the Great Lakes, Eurasian Ruffe have also been detected in Alpena, Michigan in Alpena, Michigan in Lake Huron.

Life Cycle Information

- In Europe, the ruffe generally matures in two or three years, but it may mature in one year in warmer waters.
- It spawns between mid-April and July, depending on location, water temperature, and preferred habitat. A female ruffe lives an average of seven years, but may live up to 11 years.
- Males live up to seven years but have an average lifespan of three to five years.
- In Europe, the ruffe is found in fresh and brackish (salinity less than 3-5 ppm) waters and in all types of lakes from deep, cold, and clear to shallow, warm and full of nutrients. In rivers, the ruffe prefers slower-moving water; in lakes, it prefers turbid areas and soft bottoms, usually without vegetation.
- Unlike other perch species, the ruffe is more tolerant of murky, nutrient-rich (eutrophic), conditions. Like walleye, the ruffe spends its days in deeper water and moves to the shallows to feed at night.

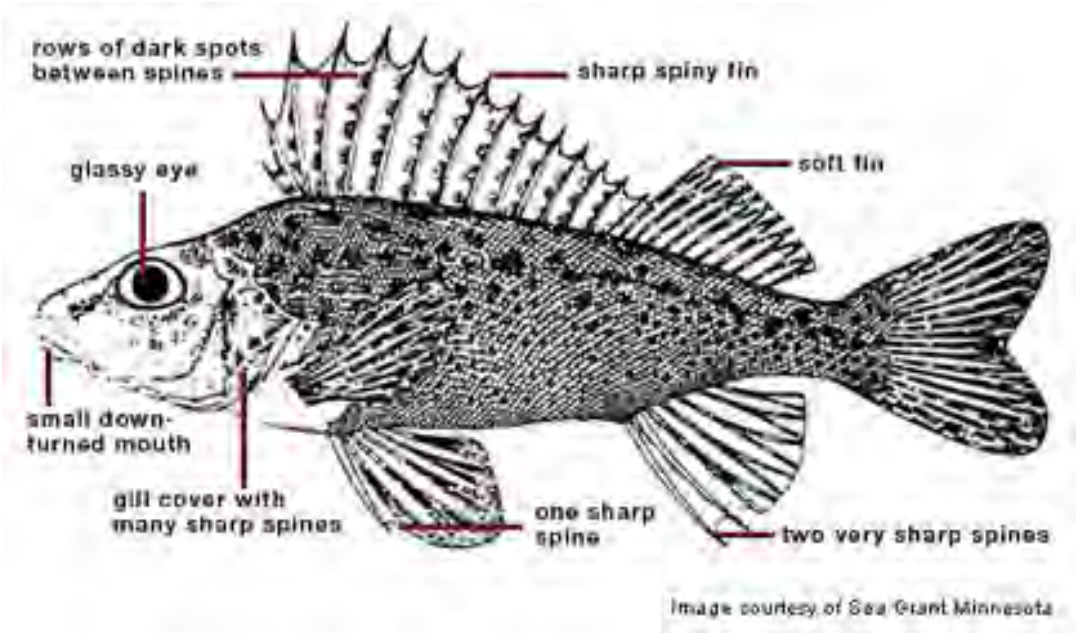
What are its impacts?

- Ruffe pose a threat to native fish because they mature quickly, have a high reproductive capacity, and easily adapt to new environments.
- Ruffe are more tolerant of poor water conditions and have several well developed sensory organs that allow them to detect vibrations given off by both predators and prey that give them an advantage over native fishes.
- Explosive growth of the ruffe population means less food and space in the ecosystem for other fish with similar diets and feeding habits. Because of this, walleye, perch, and a number of small forage fish species are seriously threatened by continued expansion of the ruffe's range.

How to prevent the spread?

- Learn to identify Eurasian Ruffe.
- Inspect and remove aquatic plants and animals from boat, motor and trailer.
- Drain lake or river water from livewell and bilge before leaving access.
- Never dump live fish or crayfish from one body of water into another.

Eurasian Ruffe



Asian Carp

What are they?

- Asian carp are a type of fish native to Asia that have been introduced in the United States.
- They include the flowing species:
    - Bighead carp, black carp, grass carp, silver carp, and large-scale silver carp.

Where did they come from?

- Originally, Asian carp were introduced to the United States as a management tool for aqua culture farms and sewage treatment facilities. They were imported into the southeastern U.S. in the 1970s to remove algae and suspended matter out of catfish farm ponds and wastewater treatment ponds. The carp made their way north to the Illinois River after escaping from fish farms during massive flooding along the Mississippi River.

Life Cycle Information

- Bighead and silver carp are filter feeders, straining tiny plants (phytoplankton) and animals (zooplankton) out of the water. By eating plankton, the carp compete with native filter feeding fish.
- Bighead and silver carp migrate up streams or rivers to breed; eggs and larvae drift downstream to develop. These fish are fast growing and can weigh up to 100 pounds. They are also highly prolific, producing up to one million eggs.

What are its impacts?

- They are well-suited to the climate of the Great Lakes region, which is similar to that of their native range in Asia. If introduced to the Great Lakes these fish are expected to flourish in the near shore areas and large river tributaries.
- Researchers predict bighead and silver carp, due to their large size and high reproductive rates, pose a significant threat to disrupt the food chain that supports the native fish of the Great Lakes, such as walleye, yellow perch and lake whitefish.
- Silver carp pose a direct threat to human health due to their propensity to leap high out of the water when disturbed by vibrations like those commonly caused by recreational watercraft. Boaters can and have been injured when hit by leaping fish weighing up to 40 pounds. This has the potential to threaten Michigan's recreational economy because fear of injury could diminish the desire to recreate in areas inhabited by these fish.
- It is illegal under federal law to transport live specimens of black, bighead, silver and large-scale silver carp across state lines. Furthermore all five species are illegal to transport, possess live or stock under state law in Michigan.

How to prevent the spread?

- Electric barriers in the Chicago area. The electrical barrier system on the Chicago Sanitary and Ship Canal is not a fail-safe system, whereas a permanent barrier or biological separation of the Great Lakes and Mississippi River Basins would prevent bighead and silver carp from entering Lake Michigan via the ship canal pathway. Although an electrical barrier acts to repel the fish, it doesn't kill them.
- Do not dump live bait into Michigan waterbodies. Some live minnow vendors may accidentally stock juvenile Asian carp

Asian Carp

Sea Lamprey

What are they?

- Sea Lamprey are primitive, jawless fish native to the Atlantic Ocean.

Where did they come from?

- Traveled up the Welland Canal from the Atlantic Ocean.
- In 1921, lampreys appeared in Lake Erie for the first time, arriving via the Welland Canal, which was constructed for ships to avoid Niagara Falls on their way up the St. Lawrence Seaway. Shortly thereafter, sea lamprey quickly populated all of the upper Great Lakes.

Life Cycle Information

- The sea lamprey is an aggressive parasite with a toothed, funnel-like sucking mouth and rasping toungue which is used to bore into the flesh of other fishes to feed on their blood and body fluids.
- Mature adults migrate into streams to lay their eggs, after which they expire.

What are its impacts?

- A single lamprey will destroy up to 40 pounds of fish during its adult lifetime. Sea Lamprey are so destructive that, under some conditions, only one out of seven fish attacked will survive.

How to prevent the spread?

- Currently the Great Lakes Fishery Commission, in cooperation with Fisheries and Oceans Canada and U.S. Fish and Wildlife Service spend millions of dollars annually to control the sea lamprey population in the Great Lakes. Ongoing control efforts have been very sucessful, as a 90% reduction of sea lamprey populations in most areas has been achieved.
- Lampricide, chemicals that kill lamprey.
- Barriers to prevent lampreys from spawning in streams.
- Sterile male releasing technique.
- Trapping.

Sea Lamprey

Petromyzon marinus

Round Gobies

What are they?

- Round Gobies are a small aggressive fish native to Eastern European lakes.

Where did they come from?

- Round gobies originated in the Black and Caspian Seas.
- They were introduced into the Great Lakes by ballast water discharges from ships and were first discovered in 1990 along the St. Claire River (a Canadian river north of Detroit).
- Since then, gobies have been found all over the Great Lakes.

Life Cycle Information

- Round gobies have a single, scallop-shaped pelvic fin. This fin is used as a suction cup in flowing waters to anchor the fish to the substrate.
- Round gobies are aggressive, pugnacious fish. They feed voraciously and may eat the eggs and fry of native fish such as sculpins, darters, and logperch. They will aggressively defend spawning sites in rocky habitats
- They are robust and are able to survive under degraded water quality conditions. This ability and their propensity to swim into holes and other crevices probably allowed round gobies to enter and survive in the ballast water of ships.
- Round gobies in the Great Lakes are known to feed on insects and zebra mussels.

What are its impacts?

- they are capable of rapid population growth after they reach new areas.
- They have shown the ability to out-compete native fish for food and habitat because of their **aggressiveness**, a**bility to survive in poor water quality conditions**, **ability to feed in complete darkness**, and **long spawning period (April through September)**.

How to prevent the spread?

- Learn to identify round goby.
- Inspect and remove aquatic plants and animals from boat, motor, and trailer.
- Drain lake or river water from livewell and bilge before leaving access.
- Dispose of unwanted live bait in the trash.
- Never dump live fish from one body of water into another.

Round Gobies

Neogobius melanostomus

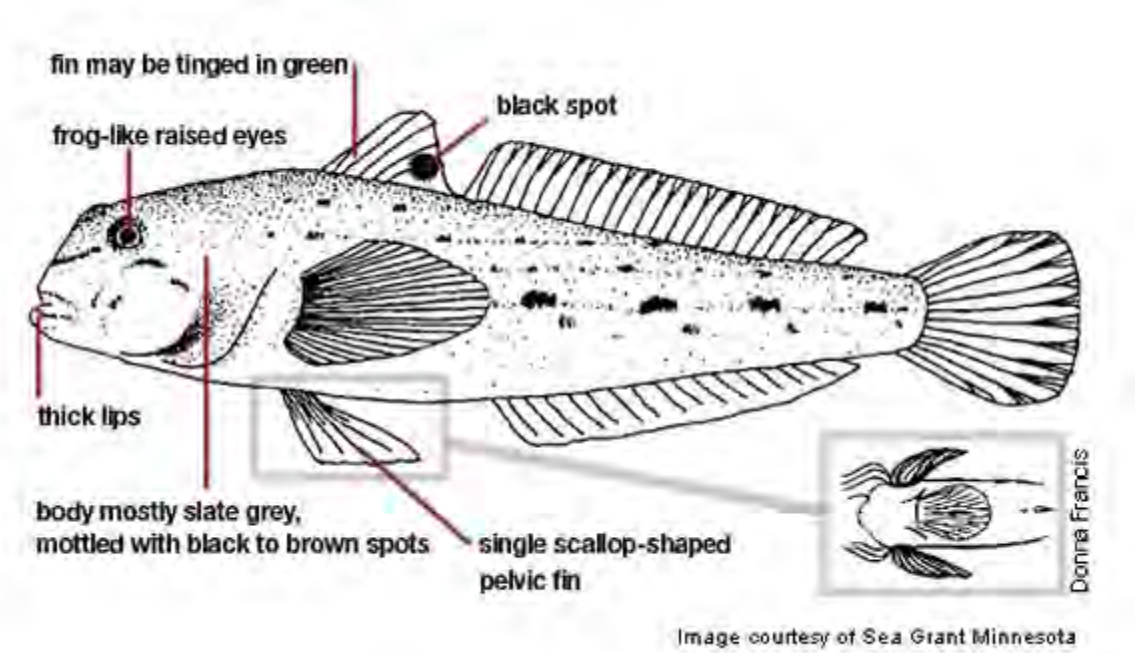


Image courtesy of Sea Grant Minnesota

Zebra and Quagga Mussels

What are they?

- Zebra and Quagga Mussels are small bivalve shellfish from Eastern Europe.

Where did they come from?

- It is thought that the invasive mussels were introduced to the Great Lakes via shipping from the Black Sea in Europe.
- Larval mussels are drawn into ballast tanks on commercial cargo ships. Ballast water is carried with the ship to its destination in the Great Lakes, where it is discharged. The larval mussels thrive in their new environment which is lush with food and habitat and relatively free of predators.

Life Cycle Information

- Each zebra mussel is capable of filtering a liter of water per day; thus, removing almost every microscopic aquatic plant and animal (phytoplankton and zooplankton).
- these freshwater bivalves colonize anywhere they can attach their tiny byssal threads. Many lake residents have indicated that thick colonies have attached to their docks, boat hulls, and water intake pipes.
- They are highly prolific reproducers; female zebra mussels can produce 1 million eggs per year

What are its impacts?

- The prolific filter feeding of mussels causes disruption of the ecosystem, which impacts organisms throughout the food chain, from tiny crustaceans to large trout.
- The effect of their feeding habits is easily discernable in water transparency data collected by volunteers, which shows that water has become clearer in lakes infested with the mussels. Increased water clarity has lead to yet another impact from zebra mussels; sunlight penetrates to greater depths and results in increased growth of rooted aquatic vegetation and bottom-dwelling algae.
- Zebra mussels have high levels of body fat, thus allowing them to accumulate ten times more PCBs and other toxic contaminants than the native mussels. Once these contaminants are stored in their bodies, they are then transferred up the food chain to their predators. Predators include some species of ducks, freshwater drum, carp, and lake sturgeon.
- Many lake residents have indicated that thick colonies have attached to their docks, boat hulls, and water intake pipes.

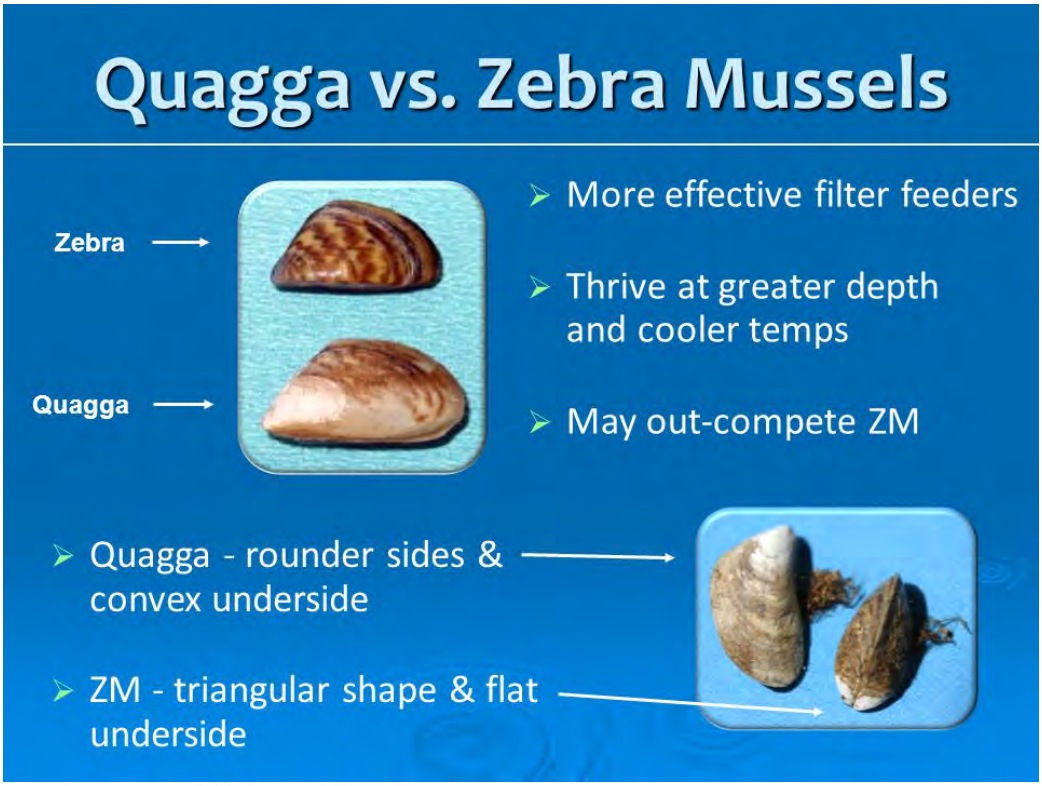
How to prevent the spread?

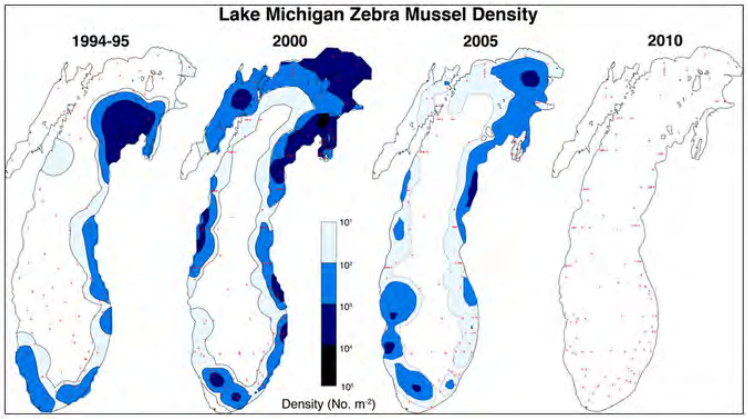
- Learn to identify zebra mussels.
- Inspect and remove aquatic plants and animals from boat, motor and trailer.
- Drain your livewells, bilge water, and transom wells before leaving the water access area.
- Rinse boat and equipment with high-pressure hot water (104° F),
  especially if moored for more than a day, or dry everything for at least 5 days.

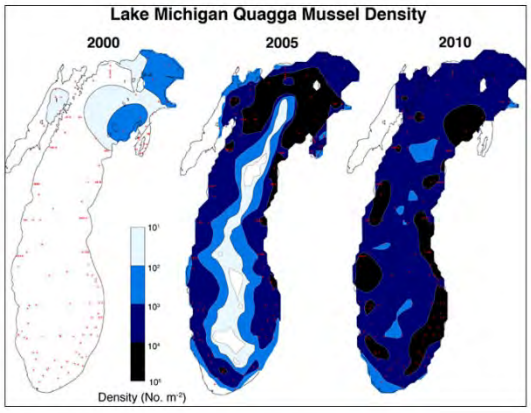
Quagga Mussels

- The quagga mussel, is also impacting the health of our lakes. The two look similar with black stripes on tan bodies, but the quagga mussel has a rounded or oval-shaped shell.
- Quagga mussels can live in deeper and colder waters than zebra mussels.
- Quagga mussels feed year round unlike zebra mussels.

Zebra and Quagga Mussels







Rusty Crayfish

What are they?

- Rusty Crayfish are invasive crustaceans spreading to lakes.

Where did they come from?

- Native to the Ohio River Basin and the States of Ohio and Kentucky.
- They are probably spread by non-resident anglers who bring them along to use as fishing bait.

Life Cycle Information

- Rusty Crayfish inhabit lakes, ponds, and streams. Unlike other crayfish they generally do not dig burrows and require permanent lakes or streams that provide suitable water quality year round.
- Crayfish are considered opportunistic feeders. Rusty crayfish feed on a variety of aquatic plants, benthic invertebrates (like aquatic worms, snails, leeches, clams, aquatic insects, and crustaceans such as side-swimmers and waterfleas), detritus (decaying plants and animals, including associated bacteria and fungi), fish eggs, and small fish. Juveniles especially feed on benthic invertebrates like mayflies, stoneflies, midges, and side-swimmers.

What are its impacts?

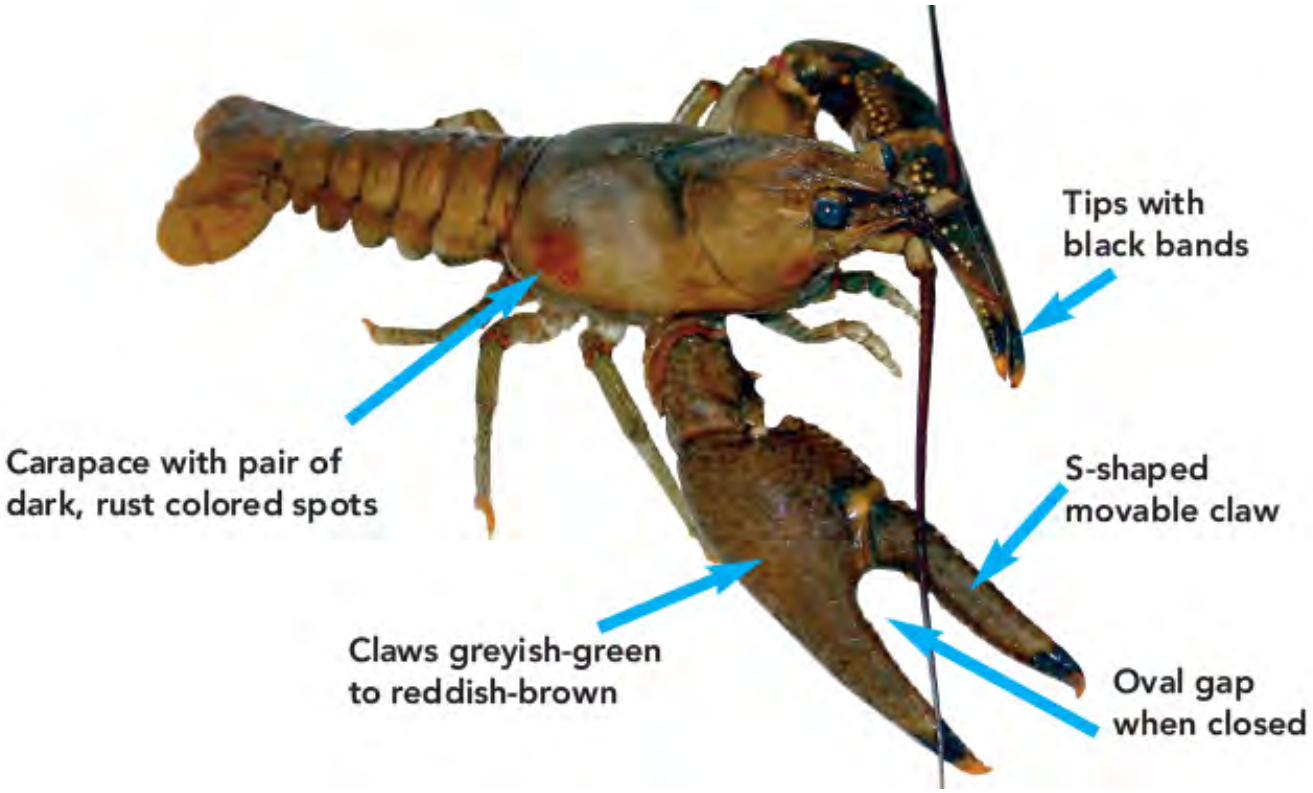
- Rusty Crayfish are an aggressive species, and often displace native or existing crayfish.
- The destruction of aquatic plant beds is perhaps the most serious impact. Rusty crayfish have been shown to reduce aquatic plant abundance and species diversity. Although other crayfish eat aquatic plants, rusty crayfish eat even more because they have a higher metabolic rate and appetite.
- Rusty crayfish can harm fish populations by eating fish eggs, reducing invertebrate prey, and through loss of habitat (aquatic plants).

How to prevent the spread?

- Learn to identify rusty crayfish.
- Inspect and remove aquatic plants and animals from boat, motor, and trailer.
- Drain lake or river water from livewell and bilge before leaving access.
- Dispose of unwanted live bait and study specimens in the trash.
- Never dump live fish or crayfish from one body of water into another.

Rusty Crayfish

Orconectes rusticus



New Zealand Mud Snail

What is it?

- New Zealand Mud Snails are tiny snails, usually less than 5mm (.2 in), that have been located in several Michigan streams.

Where did they come from?

- The New Zealand mudsnail, native to New Zealand, was first introduced to the US through contaminated ship ballast water and/or the transport of live fish or eggs for the commercial aquaculture industry.
- Once introduced to a region, snails may be spread locally on the fur or feathers of terrestrial wildlife and pets, or consumed and dispersed in the excrement of local fish species.
- Long distance dispersal of New Zealand mudsnail has been attributed to ballast water discharge, the movement of commercial aquaculture products (i.e., fish, eggs, and ornamental plants), and the transport of contaminated recreational gear.

What are its impacts?

- New Zealand mudsnails compete with other native species for food, disrupting the food chain and threaten the health and stability of aquatic ecosystems.
- Due to rapid self-reproduction, the species can quickly achieve densities of more than 500,000 snails per square meter.
- They are a non-native species that have no natural predators, parasites, or diseases to control their population size in North America.

How to prevent the spread?

- They are hardy, adaptable animals that can inadvertently be transported by boats, fishing gear, and waders. Be sure to thoroughly clean and dry equipment before transporting it to a new water body.

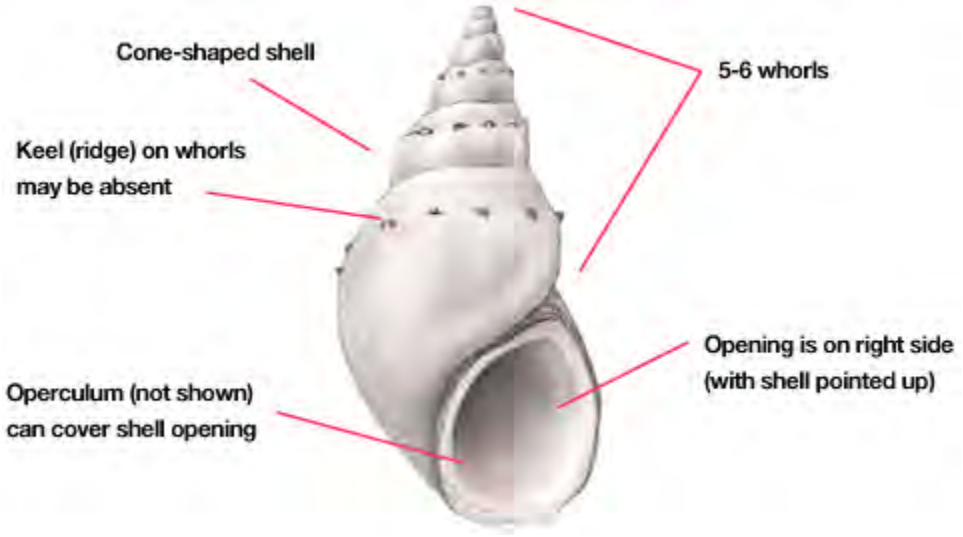
Think you have seen New Zealand mudsnails?

If you find what you think are New Zealand mudsnails:

- Take photos to document your sighting
- Note the location (adjacent street crossing, water body name, GPS coordinates, etc.)
- Report observations to the Midwest Invasive Species Information Network.

New Zealand Mudsnail

Potamopyrgus antipodarum



Team names:_____

Invasive Species - One Minute Update

Background: What is an invasive species?

An invasive species is a non-native species that **harms people**, **the economy**, **and/or the environment.** Invasive Species that are introduced to a healthy ecosystem can change the entire structure of an area.

Goal: To prepare a one minute update on the invasive species your group is studying and present the information in one minute or less.

Activity:

1. Using the information on the Invasive Species card, **answer the questions about your invasive species.**

2. Questions for your **One Minute Update**

    - What is your invasive species?

    - Where did it come from and how did it get here?

    - Why is it considered invasive? What does it do to harm the economy, environment or human health?

    - What can we do to prevent the spread or stop them?

WREP: MISIN Website Exploration

The MISIN (Midwest Invasive Species Information Network) website provides a valuable resource in reporting and reviewing invasive species in your local community. This exploration will help you and your students discover the types and amounts of invasive species that have been reported in your area.

How to access the website:

1. Open the MISIN website at: www.misin.msu.edu
2. Select **Explore** and **Browse Data** from the drop down menu.
3. Select **Search By Geography.**
4. Select State and County that you are in. The map will load the selected county, with colored icons showing reported invasive species. (Red=high density of reported invasive species, Yellow=moderate density, blue=low density)
5. Zoom in on the area that you are interested in by double clicking.
6. Click on the red pins to view the information for individual reported invasive species.

WREP Team Homework

Local Invasive Species Identification:

Identify 5 invasive species in your area, and answer the questions about each species. At least 2 of the species you identify should be non-plant species (mammal, insect, fish, etc.)

Invasive Species 1
Common Name:_____
How many times was it reported in the area? _____

Invasive Species 2
Common Name:_____
How many times was it reported in the area? _____

Invasive Species 3
Common Name:_____
How many times was it reported in the area? _____

Invasive Species 4
Common Name:_____
How many times was it reported in the area? _____

Invasive Species 5
Common Name:_____
How many times was it reported in the area? _____

Session Five: Stewardship Action Project

Students discuss the differences between a healthy watershed and an unhealthy watershed. They then discuss the health of their own watershed and what measures can be taken to make it healthier. Students brainstorm projects to improve the health of the school community/watershed. Students develop a stewardship/action to enact change in their watershed. Example stewardship projects include: native planting, informational posters, invasive species removal, rain barrel installation.

> ESS3-3 - Apply scientific principles to design a method for monitoring and minimizing the impact on the environment
> LS2-5 - Evaluate competing design solutions for maintaining biodiversity and ecosystem services

Teacher/Team Leader Activities: Team Planning/Decision Making Guide, Stewardship Action Project Communication (poster, video, PPT, etc.), WREP Summit

Overview

1. Review goal of WREP
    - Awareness and Experiences
    - Research and Questions
    - Planning and Action

2. Share one man planting a forest https://youtu.be/KvZcplZB-Oo

3. Discuss stewardship – what taking action means – planning an action – working as a team

4. Share kid videos – Discuss and identify key aspects of stewardship actions

    https://www.youtube.com/watch?v=V93mV3aH1Gw (rain garden to reduce run-off/stormwater
    https://www.youtube.com/watch?v=g_O0-ADjxOA (Squeaky Green products)
    https://www.youtube.com/watch?v=LsViaIPomDg (Bat boxes to reduce pesticide use)
    https://www.youngvoicesfortheplanet.com/youth-climate-videos/save-tomorrow/ (solar panels and forest protection)
    https://www.youngvoicesfortheplanet.com/youth-climate-videos/the-last-straw/ (preventing plastic straws)
    https://www.youngvoicesfortheplanet.com/youth-climate-videos/anya-siberia/ (water quality monitoring)

5. What do these projects have in common?
    - Research an issue/problem
    - Purpose-How does it help the watershed
    - Plan-How do we make it happen?
    - Action-Everyone contributes skills, ideas and effort

- Share-Communicate to others what happened
- Reflect-Is this it? Can we do more?

6. Brainstorm actions to help the school community and watershed

7. Share list of selected project ideas

Stewardship Action Project Timeline and Considerations

Session #5 Stewardship Action Project

- Teams will get the basics of how to brainstorm, select and plan a project.
- Choosing a project should reflect YOUR level of engagement with the team.
- Team project reflects what your team has learned through the home, school and community water surveys.
- Project action should address a specific issue or need at school/community.

Questions to consider:

1. Are you comfortable brainstorming with your team to choose a project *or* would you prefer offer a few choices for selection? (Project selection by 3/1/2018)

2. How much class time in March and April can you devote to the project?

3. Are you comfortable asking for parent/community help with the project?

4. Watershed Council staff will develop a list of resource people to support your team and the project. How comfortable do you feel contacting resource people, if needed?

5. Modest funds are available for project materials, but if your project requires additional funding, do you have sources or ideas for funding/donations?

6. Each team project will require a "presentation" at the WREP Summit on May 30th, 9:00-12:00 am at Petoskey Middle School auditorium. Will your team be able to participate in the summit?

WREP Stewardship Action Project – Planning Calendar

March	Monday	Tuesday	Wednesday	Thursday	Friday
				1 **Project IDEA**	2
	5	6	**7**	8	9
	12	13	**14**	15	16
	19	**20**	**21**	22 **CHECK IN**	23
Spring Break	26	**27**	**28**	29	30
April	**Monday**	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
	2	**3**	4	5	6
	9	10	**11**	12 **CHECK IN**	13
	16	17	**18**	19	20
	23	**24**	**25**	26	27
	30				

May	Monday	Tuesday	Wednesday	Thursday	Friday
		1	2	3 **PROJECT DONE**	4
	7	8	**9**	10	11
	14	15	**16**	17 **PRESENTATION**	18
	21	**22**	**23**	24	25
	28	**29**	**30** **WREP SUMMIT**	31	

WREP Stewardship Action Project - _____

1. **What is the purpose? How does the project help the watershed?**

2. **Do you need permission to do the project?**

3. **What do we need (materials) to complete the project?**

4. **What skills are required to complete the project?**

5. **How will we share the project success?**

6. **How do we include EVERYONE on the team in the project?**

WREP Project Possibilities

- **Landscape** part of the school yard with native trees, shrubs, flowers and grasses to **reduce water runoff and erosion.**

- **Review current recycling** practices at the school. **Measure effectiveness**, make suggestions for improvement and implement/publicize changes.

- **Sponsor a "Waste Awareness Week"** that **brings attention to food waste, paper waste**, etc. in the middle school for one week and publish findings.

- **Create a "Garbage Gang"** that is responsible for weekly school grounds clean-up of trash. **Each gang classifies the garbage, publish data and suggest improvements**.

- **Existing garden/landscape improvement** – Improve existing gardens or landscaping on school grounds by adding native species and providing signage for species.

- **Beach/River clean-up** – team sponsored school/community event.

- **Storm drain identification** that marks and brings attention to storm drains, possible visit to city water department.

- **Composting/vermicomposting** the vegetable waste from the school lunch room. Goal of reducing total waste for certain time period to show effectiveness.

- **Develop presentation/skit/book** on water conservation for younger children.

- **Rain garden** on school grounds to slow down runoff and increase absorption in low lying areas along pavement.

- **Compare alternative cleaning products** and show results. Demonstrate environmentally friendly cleaners to school community.

- **Scoop the Poop** awareness campaign in town. Work with the Chamber of Commerce to put signage up, public awareness.

- **Water Bottles not bottled water** – survey school community on use of water bottles vs. bottled water. Create posters and informational commercial on reducing waste.

- **School Yard Habitat** improvement through bird houses, cleaning trash, identifying trails to route traffic.

- **Growing milkweeds for Monarchs** – start seeds indoors for planting in spring.

- **Grocery bag "Awareness"** – partner with Meijer, Olsen's, D & W to print water conservation messages on bags for store.

- **Sew, Sell and Save campaign** – Cloth grocery bags are sewn, screen printed by team and sold to earn funds for future projects.

- **Sponsor/fundraise to place rain barrels** at key roof runoff sites around the building.

- **Make "Flower Bombs"** to give/sell with water conservation/protection message included – distribute throughout school and community.

- **GREEN School certification –** Submissions are due on March 1st each school year. Find information at www.michigangreenschools.us/

SAMPLE PROJECT

Project Example:	Establish a "Garbage Gang" with your team.
Purpose:	Beautification, reducing litter in school yard habitat, bring awareness through data collection (classification of garbage) and communication of findings, create an opportunity for students to care for the school community.
Questions/Ideas:	Create a "uniform" for students to wear when they pick up garbage.
	Decide how the garbage will be quantified and classified.
	How does the garbage get to the middle school?
	How many weeks in the spring will the Gangs collect garbage?
	How will the team share data with the rest of the school?
	What resources do you need to do the project?
	Are there other groups (high school students) that should be made aware of your efforts?
Resources:	Emmet County Recycling, School Waste Removal provider, Walmart
Timeline:	March – plan who does what, schedule event, gather materials, schedule speakers, etc.
	April – Conduct once a week collection and classification
	May – Create posters, plan presentation for Summit, schedule presentation of findings to school staff, students, HS, school board, etc.

Water Resources Education Programs
Participant Survey

Student Number _____ Date _____

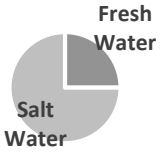
School _____Teacher_____

1. Which of these statements best describes a watershed?

A. Any area that is always wet or that floods regularly.
B. The land area that drains water into a river or other body of water.
C. The land along the bank of a river or stream.
D. The area where a river flows into the ocean and the waters mix.

2. Which graph represents the amount of fresh water in the world?

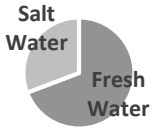
A.



B.

C.

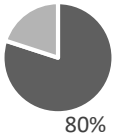
D.



3. What percentage of all freshwater on the Earth is contained in the Great Lakes? (freshwater shown in dark grey)

A.

B.



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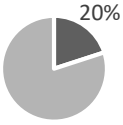
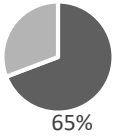


D.



4. What is the name of the Great Lake your local river flows into?

A. Lake Huron
B. Lake Erie
C. Lake Michigan
D. Lake Superior

5. What is an aquifer?

A. an underground storage and flow of water
B. an irrigation ditch filled with water
C. an artificial channel for conveying water
D. a river system

6. Storm drains around your school connect directly to?

A. Ocean
B. River
C. Sewer
D. Lake

7. What is the major source of energy that powers the water cycle?

A. Wind
B. Gravity
C. Sun
D. Rain

8. What is an invasive species?

A. a non-native species
B. a living species that is on the verge of extinction
C. a non-native species causing environmental or economic harm
D. a species that signifies a healthy environment

9. What are pesticides?

A. Small animals the live in the water
B. Insects that eat people's gardens
C. A type of mineral
D. Chemicals that people use to kill "pests"

10. Which the following is an example of point source pollution?

A. Storm water runoff
B. Waste flowing out of a factory outlet pipe
C. Animal owners not cleaning up pet waste
D. Fertilizer running off of shorelines into a lake

11. Which of the following types of pollution has the largest impact on streams, rivers, and lakes?

A. Dumping of garbage by cities
B. Trash washed into the lake from beaches
C. Waste from factories
D. Surface water running off yards, city streets, paved lots, and farm fields

12. How can pollution in a local lake or river harm humans? (circle all that apply)

A. Through drinking water from the sink
B. Through the sewer system
C. Through the food chain, by eating fish caught in a local waterbody
D. Through the storm drain system

13. An *invasive pond lily species* is introduced to a Michigan lake containing a large variety of native plants and animals. What will most likely happen to the lake over a period of time?

A. The pond lily species will not have an effect on the lake. It will grow side by side with other species in the lake.
B. The pond lily species will spread throughout the lake, becoming the dominant species in the area, while many of the native plants and animals will decrease or disappear altogether.
C. The native species will kill off the invasive pond lily species so that it will no longer be present in the lake.
D. The animals in the lake will eat the new pond lily species and keep it from growing in the area.

14. What are some ways in which a healthy local watershed contributes to the health and well-being of local communities? *List three*. If you can't list three, list as many as you can.

1. _____

2. _____

3. _____

How true or false are these statements to you?

15. Please select one answer for each row.

	Very true	Mostly true	Not sure	Mostly false	Very false
(a) To save energy, I turn off lights, televisions, and other electronic devices at home when they are not in use.	○	○	○	○	○
(b) I do not let a water faucet run when it is not necessary. For example, I turn off the faucet while I brush my teeth.	○	○	○	○	○
(c) I have talked with my friends about ways to help the environment.	○	○	○	○	○
(d) I have asked my parents to recycle some of the things we use.	○	○	○	○	○
(e) I leave the refrigerator open while I decide what to get out.	○	○	○	○	○
(f) When I need to carry drinking water with me, I use a refillable bottle that I fill with water from the tap.	○	○	○	○	○
(g) If I see litter, I pick it up.	○	○	○	○	○

What could you do?

If you found out about an environmental situation in your school or community that you wanted to do something about, for example, running buses are creating too much exhaust in the school parking lot, or a local beach has been closed for swimming due to water quality problems, how well do you think you would be able to do each of the following?

16. Please select the one answer that best matches your answer.

	I definitely can't	I probably can't	Maybe	I probably can	I definitely can
(a) Gather data and information to describe the nature and extent of the problem.	○	○	○	○	○
(b) Get other people to care about the problem.	○	○	○	○	○
(c) Express your views in front of a group of people.	○	○	○	○	○
(d) Identify individuals or groups who could help you with the problem.	○	○	○	○	○
(e) Write an opinion letter to a local newspaper.	○	○	○	○	○
(f) Call someone on the phone that you had never met before to get their help with the problem.	○	○	○	○	○

Water Resources Education Programs
Participant Post Survey

*************Use the Answer Sheet to record your responses to the questions. Thank You!!!!!!**

1. Which of these statements best describes a watershed?

A. Any area that is always wet or that floods regularly.
B. The land area that drains water into a river or other body of water.
C. The land along the bank of a river or stream.
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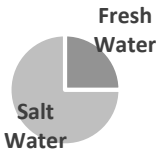
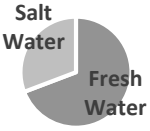


B.

C.

D.



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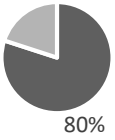

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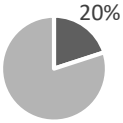
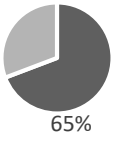


D.



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C. The native species will kill off the invasive pond lily species so that it will no longer be present in the lake.
D. The animals in the lake will eat the new pond lily species and keep it from growing in the area.

Water Resources Education Programs
Participant Survey Answer Sheet

Student Number _____ Date _____

School _____Teacher_____

Please write your responses next to the question number below.

1. _____	5. _____	9. _____	13. _____
2. _____	6. _____	10._____	
3. _____	7. _____	11. _____	
4. _____	8. _____	12._____	

14. What are some ways in which a healthy local watershed contributes to the health and well-being of local communities? *List three*. If you can't list three, list as many as you can.

15. Did your work through the Water Resources Education Program (WREP) this year help you develop any of the following skills? *Please check all that apply.*

- ☐ Working with others in a team or group
- ☐ Developing a plan to accomplish a long term goal
- ☐ Communicating through public speaking or presentations
- ☐ Communicating in writing
- ☐ Gathering trustworthy information from published sources
- ☐ Using tools, instruments, or technology for measuring or analysis
- ☐ Identifying and speaking with experts from the community who can help you accomplish a task or solve a problem

16. Do you have any ideas to make the WREP program better or enjoyable for students like you?

17. How true or false are these statements to you after participating in WREP?

Please select one answer for each row.	Very true	Mostly true	Not sure	Mostly false	Very false
(a) To save energy, I turn off lights, televisions, and other electronic devices at home when they are not in use.	○	○	○	○	○
(b) I do not let a water faucet run when it is not necessary. For example, I turn off the faucet while I brush my teeth.	○	○	○	○	○
(c) I have talked with my friends about ways to help the environment.	○	○	○	○	○
(d) I have asked my parents to recycle some of the things we use.	○	○	○	○	○
(e) I leave the refrigerator open while I decide what to get out.	○	○	○	○	○
(f) When I need to carry drinking water with me, I use a refillable bottle that I fill with water from the tap.	○	○	○	○	○
(g) If I see litter, I pick it up.	○	○	○	○	○

18. After participating in WREP, if an environmental situation happened at your school, how well do you think you would be able to do each of the following?

Please select the one answer that best matches your answer.	I definitely can't	I probably can't	Maybe	I probably can	I definitely can
(a) Gather data and information to describe the nature and extent of the problem.	○	○	○	○	○
(b) Get other people to care about the problem.	○	○	○	○	○
(c) Express your views in front of a group of people.	○	○	○	○	○
(d) Identify individuals or groups who could help you with the problem.	○	○	○	○	○
(e) Write an opinion letter to a local newspaper.	○	○	○	○	○
(f) Call someone on the phone that you had never met before to get their help with the problem.	○	○	○	○	○

WREP Student Reflection Survey - Thank you for participating in WREP!

Please let us know what you liked about the program this year.

1. **Circle the sessions you liked the most.**

Water Cycle and Watersheds

Groundwater & School grounds

Point & Non-point pollution

Invasive Species

Stewardship Action Project

Other experience not listed

2. **What did you like about these sessions?**

3. **Which activity helped you LEARN the most from during your participation? Explain WHY.**

4. **Please write about "the most important thing" YOU learned about your WATERSHED this year.**

Teacher Directions for Student Pre-Program Survey

Dear Teacher,

Thank you for helping us with our program evaluation by administering this survey to your team of students. Please read over the directions and carefully follow each direction when administering the survey to your team.

Directions

Before the Survey:

Please assign your students an identification number. **Each student will need his/her own unique "Student ID #" and will need to use the same number for the pre- and post-program surveys.**

When Administering the Survey:

1) Say: "Our class will be doing a science program with the Tip of the Mitt Watershed Council. We will be learning about water resources in our local environment and what we can do to make it a cleaner and healthier place for everyone."

2) **Say:** "Before the program starts, each of you will fill out some information on a survey." (Show them the survey.) "This survey is like a test, but you won't be graded on your answers. The Watershed Council is asking us to fill this out because they want to find out what students learn through their programs."

3) **Say:** "I will pass out the survey, and we will complete part of it together. Do not start on the questions yet."

4) **Pass out** the survey and with your students complete the following sections on the top of each page: student ID #, date, teacher's name, and school.

5) **Say:** "I will read each question out loud, and give you time to complete your answer. I will repeat the question if you need me to."

6) **Say:** "You might not know how to answer some of these questions. It is okay if you don't know the answer to a question. Just do your best. If you don't know an answer, make your best guess."

7) **Read** each question out loud, and then give students time to write their answer. Repeat the question if they need it read out loud again. **Do not influence students' answers at any point during the survey.**

8) When students are finished, make sure students have their names and other information filled out on each page, collect all of the surveys, and put them in the envelope provided. Give the envelope to Watershed Council Education staff during the next session.

Thank you again for helping us to improve our programs!

Teacher Directions for Student Post-Program Survey

Dear Teacher,
Thank you for helping us with our program evaluation by administering this survey to your team of students. Please read over the directions and carefully follow each direction when administering the survey to your class.

Directions

Before the Survey:
Your students will need to use the same unique identification numbers they used on their pre-program surveys. Please have these ID #'s ready so students can enter them onto their post-program surveys.

When Administering the Survey:

1) Say: "The Watershed Council wants to find out what you have learned through their program." (Show them the survey.) "This survey is the same one you completed before the program started. The survey is like a test, but you won't be graded on your answers. The Watershed Council is asking us to fill this out because they want to find out what you've learned."

2) **Say:** "I will pass out the survey, and we will complete part of it together. Do not start on the questions yet."

3) **Pass out** the survey and with your students complete the following sections on the top of each page: student ID #, date, teacher's name, and school.

4) **Say:** "I will read each question out loud, and give you time to complete your answer. I will repeat the question if you need me to."

5) **Say:** "You might not know how to answer some of these questions. It is okay if you don't know the answer to a question. Just do your best. If you don't know an answer, make your best guess."

6) **Read** each question out loud, and then give students time to write their answer. Repeat the question if they need it read out loud again. Try not to influence students' answers at any point during the survey.

7) When students are finished, make sure students have their names and other information filled out on each page, collect all of the surveys, and put them in the envelope provided. Give the envelope to your Watershed Education staff during the next session.

Thank you again for helping us to improve our programs!

Water Resources Education Program
Teacher Pre-Survey

Teacher _____ School_____

Date _____ Grade_____

Please respond to the questions below. Add comments or clarifications if needed.

1. To what extent do you feel comfortable using the local watershed environment as a learning resource?
_____ To no extent
_____ To a slight extent
_____ To a moderate extent
_____ To a considerable extent
_____ To a great extent

2. Last school year, to what extent did you use LOCAL natural resources in your teaching?
_____ In a very limited way, if at all
_____ In a significant but contained unit
_____ As a major part of my curriculum
_____ As the core organizing structure of my teaching

3. To what extent do you feel comfortable teaching environmental science concepts?
_____ To no extent
_____ To a slight extent
_____ To a moderate extent
_____ To a considerable extent
_____ To a great extent

4. To what extent do you feel comfortable leading an outdoor and/or school yard experience with your class?
_____ To no extent
_____ To a slight extent
_____ To a moderate extent
_____ To a considerable extent
_____ To a great extent

5. To what extent do you feel comfortable facilitating a stewardship action project with your class?

_____ To no extent
_____ To a slight extent
_____ To a moderate extent
_____ To a considerable extent
_____ To a great extent

6. What do you understand the term "stewardship action project" to mean or include? *Please write your response in some detail.*

Teacher Overall Evaluation Form and Post-Program Survey
Water Resources Education Program

School: Date:

Teacher's Name:

Stewardship Action Project:

Stewardship Action Project Evaluation - Please describe the overall experience of the team action project for you and your students.

1. Do you feel that the team action project was successful? Why or why not?

2. Please include any suggestions you might have to improve the action project component of the Water Resources Education Program.

Field Experience Evaluation:

1. Please describe the overall experience of using the school grounds and local community for field trips for you and your students.

2. Describe one or two highlights from your school grounds field trip experience.

3. Please suggest any improvements to the field experience component of the Water Resources Education Program.

Overall Program Evaluation

1. How has the Water Resources Education Program helped you as a classroom teacher?

2. Please share the impact that the WREP has had on your students.

Have you seen a **significant or meaningful change** emerge through the work of the Water Resources Education Program in your classroom, school or community?

Please focus on things you have witnessed or experienced directly, understanding that change is significant if it feels important to you, and may focus on one person, a whole community or anything in between. Please tell you story of change in as much detail as you can.

Post-Program Survey

1. To what extent do you feel comfortable using the local watershed environment as a learning resource?
_____To no extent
_____To a slight extent
_____To a moderate extent
_____To a considerable extent
_____To a great extent

2. To what extent do you feel comfortable teaching environmental science concepts?
_____To no extent
_____To a slight extent
_____To a moderate extent
_____To a considerable extent
_____To a great extent

3. To what extent do you feel comfortable leading an outdoor environmental field trip with your class?

_____To no extent
_____To a slight extent
_____To a moderate extent
_____To a considerable extent
_____To a great extent

4. To what extent do you feel comfortable facilitating an environmental action project with your class?
_____To no extent
_____To a slight extent
_____To a moderate extent
_____To a considerable extent
_____To a great extent

5. To what extent do you feel prepared to teach the Watershed Action Program to your class next year?
_____To no extent
_____To a slight extent
_____To a moderate extent
_____To a considerable extent
_____To a great extent

6. To what extent do you feel the following resources we provide **enable you to teach the program the following school year?**

Curriculum Resources	In-Class Modeling	Equipment & Materials
_____To no extent	____To no extent	___To no extent
____To a slight extent	____To a slight extent	___To a slight extent
____To a moderate extent	____To a moderate extent	___To a moderate extent
____To a considerable extent	____To a considerable extent	___To a considerable extent
____To a great extent	____To a great extent	___To a great extent

**Please add any additional comments or suggestions that would help to improve the Water Resources Education Program. If you produced any curriculum documents or additional activities you would like to share for grant reporting purposes, we would be most appreciative! We will make sure you receive credit for all work submitted.