

An Educator's Guide to the Meaningful Watershed Educational Experience (MWEE)



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AN EDUCATOR’S GUIDE TO THE MEANINGFUL WATERSHED EDUCATIONAL EXPERIENCE (MWEE)

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noaa.gov/office-education/bwet/resources/mwee-guide.

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Front Cover Photo: Foothill Technology High School students measure pH of the Ventura River, California. *(Rocío Lozano-Knowlton)*

Back Cover Photo: Sunnyland Elementary student conducts a habitat assessment on Squalicum Creek, Washington. *(Nooksack Salmon Enhancement Association)*

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ABOUT THE EDUCATOR'S GUIDE TO THE MWEE

An Educator's Guide to the Meaningful Watershed Educational Experience (MWEE), commonly referred to as the MWEE Guide, is designed for users with varying levels of familiarity with the MWEE. It is an easy-to-use manual for constructing high-quality MWEEs for all students. In this guide you will find information about why the MWEE is a powerful educational framework, descriptions of the MWEE essential elements and supporting practices, and resources for planning a MWEE. The tools and information in this guide help ensure that MWEEs are done thoroughly and thoughtfully to increase student environmental literacy.

“The MWEE Guide and accompanying planning tools helped us demystify the process of implementing action projects with students as we guided K-12 teachers through the process during our professional development field course. It makes the project management side of MWEEs much simpler by providing tools for each step of the process.”

Juliana Lisuk

Associate Director, Inland Seas Education Association

ICON LEGEND

The below icons are used throughout the document to indicate additional resources.



ONLINE RESOURCE: This symbol indicates that there is a supplemental resource available online related to the MWEE Guide content.



TOOL OR WORKSHEET: This symbol indicates that there is a tool or worksheet available to help plan, implement, or evaluate a MWEE.

THE MWEE IS A POWERFUL EDUCATIONAL FRAMEWORK

The MWEE is a learner-centered framework that focuses on investigations into local environmental issues and leads to informed action. MWEEs are made up of multiple components that include learning both outdoors and in the classroom and are designed to increase environmental literacy by actively engaging students in building knowledge and meaning through hands-on experiences. In these experiences, the core ideas and practices of multiple disciplines are applied to make sense of the relationships between the natural world and society. MWEEs help connect students with their local environment and equip them to make decisions and take actions that contribute to stronger and more sustainable communities.

The MWEE is a unique project-based framework for environmental literacy based on educational best practices supported by evaluation and research. MWEEs feature authentic approaches to learning science, technology, engineering, and math (STEM) and align with state science and social studies standards, including Next Generation Science Standards and the College, Career, and Civic Life (C3) Framework for Social Studies State Standards. MWEEs also reflect research-based instructional

models, including place-based education, the North American Association for Environmental Education’s (NAAEE) Guidelines for Excellence, and Investigating and Evaluating Environmental Issues and Actions (IEEIA).

While MWEEs can affect a broad array of outcomes — from student health to career awareness — there are four outcomes that stand out as important and timely for the education and environmental fields.

NOT FOCUSED ON WATERSHEDS? THE MWEE IS STILL FOR YOU!

While MWEEs can directly support watershed education by exploring issues such as water quality or land-use impacts, they can also provide rich learning around climate change, air quality, food systems, and many other issues that are also an important part of community, environmental, and watershed health.

“So why is the word ‘watershed’ in the term MWEE?” Watersheds can be connected to virtually every environmental issue, and since every person on Earth lives in a watershed, they are universally relatable and relevant. The intersection of the natural and social systems that make up a watershed provide an opportunity for students to use systems thinking to understand how their actions impact humans, animals, and ecosystems; how natural systems and processes within a watershed affect humans; and how civic engagement factors into the equation. Understanding these relationships requires knowledge and skills from multiple disciplines, as well as skills like active learning, critical thinking, and effective decision making.

We hope you find value in using the MWEE framework with students to explore whatever environmental issues make sense for your classroom.

WHY MWEE?

1. MWEEs INCREASE STUDENT INTEREST AND ENGAGEMENT IN LEARNING:

During MWEEs, students lead their own research about local issues that affect their schools, neighborhoods, and communities. By conducting hands-on field investigations and meaningful action related to real-world issues, students are fully engaged as active learners. This approach can positively impact student interest in learning.

2. MWEEs SUPPORT STUDENT ACHIEVEMENT:

MWEEs provide the opportunity for students to engage in problem-solving situations that place learning in the context of their daily lives. When life-relevant, student-centered learning is integrated into the curriculum or used to connect and organize themes across the curriculum, students are better equipped to meet academic standards.

3. MWEEs ADVANCE 21ST-CENTURY SKILLS:

MWEEs ask students to think critically, solve problems, communicate effectively, and employ analytical skills and higher-order thinking. These skills are essential to prepare a workforce ready for the innovation and challenges of the 21st century.

Today's economy offers tremendous opportunities for careers related to the environment. MWEEs can help prepare students for these jobs.

- ### 4. MWEEs ADVANCE ENVIRONMENTAL STEWARDSHIP AND CIVIC RESPONSIBILITY:
- MWEEs ask students to design and implement action projects that make positive change in their environment. This process of understanding an issue and taking action to address it gives students a sense of agency to make change, building a foundation for a lifetime of environmental stewardship and civic responsibility.

STUDENTS BENEFIT FROM ENVIRONMENTAL EDUCATION

A Stanford analysis of over 100 studies, summarized in *eeWORKS: The Benefits of Environmental Education for K–12 Students*, demonstrates the many ways K-12 students benefit from environmental education.

KEY FINDINGS INCLUDE:

98% of studies that examined whether students gained knowledge from environmental education saw a positive impact

90% reported increased academic and other skills

83% reported enhanced environment related behaviors saw a positive impact



More findings, and details about this research, can be found at: naaee.org/our-work/programs/eeeworks

UNDERSTANDING THE MWEE

The MWEE consists of four essential elements and four supporting practices that build upon each other to create a comprehensive, student-centered learning experience. Throughout the MWEE, teachers provide structure, support, and encouragement as students use their curiosity and creativity to investigate and take action to address a local environmental issue.

MWEEs are appropriate for all grade levels with content and practices growing in complexity and sophistication across the grades — starting with teacher-guided investigations and progressing to student-led inquiry. Using the MWEE framework helps educators create an engaging program to achieve their learning objectives (i.e., the knowledge, skills, and attitudes that students should be able to exhibit following instruction). Learning objectives should address academic standards, but might also include other objectives, such as teamwork, social-emotional learning, and civic responsibility.

While MWEEs can be successfully designed and implemented by individual teachers, embedding MWEEs into the curriculum at the school district level broadens the reach of this important learning framework by setting the expectation that all teachers in a grade should implement the MWEE with their students. This helps to ensure that every student, regardless of their teacher or school, has the opportunity to engage in the experience. Embedding a MWEE into the curriculum is also a good way to be sure it directly supports learning objectives established by the school district and can lead to increased awareness and support at the

administration level. For more information about how to scale up a MWEE from the classroom to a systemic district-level effort, refer to the Sustaining a MWEE section.



Fourth grade students from Conewago Valley Intermediate School, Pennsylvania, investigate macroinvertebrates to learn about the insect life cycle and adaptations and assess the health of the stream. (Gettysburg College)

“The MWEE is a learner-centered, inquiry and action framework that provides educators a roadmap for teaching content in a more engaging way. This type of hands-on learning helps students to understand their impact and realize their personal power to make changes in their local community, which in turn has the potential to affect all habitats and species living downstream.”

Tamara E. Pepper

Environment & Ecology Content Advisor, Pennsylvania Department of Education

WHAT IS AN ENVIRONMENTAL ISSUE?

Throughout this guide, we refer to MWEEs focusing on a driving question that engages students in learning about, investigating, and taking action, to address an environmental issue. But what is an environmental issue? An environmental issue is an environmental problem, often with observable phenomena, to which community members bring a variety of perspectives. This creates a multidimensional context for student learning that explores both human and natural systems.

PHENOMENON:

A fact or situation that is observed to exist or happen, especially one whose cause or explanation is in question. Observable phenomena that illustrate environmental problems help support student inquiry within the MWEE framework.

Example: Students observe that the stream behind their school periodically turns brown with sediment. They wonder why.

PROBLEM:

An interaction between humans and the environment that threatens or puts something of value to humans at risk; it often includes cause-and-effect relationships.

Example: The failure of stormwater management controls in the community has allowed excessive runoff that has degraded habitat for fish and macroinvertebrates. Community members have noticed that the fishing is not as good as it used to be downstream from the school.

“MWEEs have become an invaluable part of our fourth grade curriculum over the last several years. They have opened up unique opportunities for our students to participate in authentic scientific studies and have been a catalyst for ongoing community connections.”

Brooke Campbell and Bryan Smyth

Third and fourth grade teachers, Bethlehem, New Hampshire

ENVIRONMENTAL ISSUE:

An environmental problem about which individuals and/or groups may have varying perspectives. The disagreement may be over how the problem is to be solved or it may be over whether or not the problem is, in fact, a problem. People disagree because of differing beliefs or values.

Example: To address a housing shortage, there is a new residential development planned upstream from the school. This will involve the removal of an existing forest. This development has the potential to affect the health of the stream. There is disagreement in the community about whether or not this project should be permitted.

MWEE ESSENTIAL ELEMENTS

The MWEE contains four essential elements that describe “what students do:” **Issue Definition**, **Outdoor Field Experiences**, **Synthesis and Conclusions**, and **Environmental Action Projects**. These elements, together with the supporting practices, create a learner-centered framework that emphasizes the role of the student in actively constructing meaning from the learning experiences. The essential elements are not meant to be linear. In fact, some elements, such as **Synthesis and Conclusions**, occur repeatedly throughout the MWEE.

Issue Definition

During **Issue Definition**, students learn about an environmental issue by planning and conducting background research and investigations. To provide structure for this work, students focus on a driving question that is defined by the teacher. This question is the “big picture” question that sparks curiosity and organizes student inquiry and investigations, which ultimately informs environmental actions. It should be open-ended, relevant to students’ lived experiences, and meet learning objectives. To support youth voice and deepen the learning, students are actively involved in co-developing supporting

questions with teachers to better understand the driving question and environmental issue.

To explore the driving and supporting questions, students gather information by making observations, finding and reading credible sources, talking to experts, and carrying out field investigations. Students also consider environmental policies and community practices and reflect on personal, stakeholder, and societal values and perspectives to develop a comprehensive picture of the root causes of the environmental issue.



Hana High School students from the Learning Endeavors’ Champions of Coastal Resilience program observe the coastal area of Kōkī Beach on Maui as they conduct their ecological study. (Brianna Craig)

DRIVING AND SUPPORTING QUESTIONS

Criteria for Effective Driving Questions

- Supports learning objectives (i.e., knowledge, skills, and attitudes)
- Serves as a context for both increasing content knowledge and practicing inquiry and methodological skills
- Open-ended (i.e., arguable, with no single, final, or correct answer)
- Relevant and related to students' lived experiences
- Anchored in real-world environmental and social problems
- Affords the opportunity for continuity and coherence across the MWEE
- Provides the opportunity for students to develop and explore supporting questions as knowledge and understanding evolve
- Provides opportunities for environmental action
- Allows students to design and enact investigations that yield answers
- Calls for higher-order thinking, including analysis, inference, prediction, and evaluation
- Allows for the exploration of both natural and social systems

Supporting Questions

Supporting questions help students find information needed to develop potential answers to the driving question. Ideally, they are generated by students or co-developed by students and teachers. They should uncover the students' current knowledge about the issue, create interest, and begin to frame an investigation that addresses the driving question in a local context.

Supporting questions provide an opportunity to bring in a variety of subject disciplines, strengthening the life-relevant and authentic contexts for learning.

“In the study *Model my watershed: An investigation into the role of big data, technology, and models in promoting student interest in watershed action* published in the *Journal of Environmental Education*, researchers found, “...that MWEE aligned curricula help move students from isolated content learning to interest and knowledge to carry out civic and environmental action.”

Marcum-Dietrich et al. in *The Journal of Environmental Education*, 2021



For more research and references supporting MWEEs please see:
noaa.gov/office-education/bwet/resources/mwee-resources

Outdoor Field Experiences

Students participate in multiple **Outdoor Field Experiences** to explore the driving question and strengthen their connection to the natural world. Within appropriate safety guidelines, students are actively involved in planning and conducting the field investigations, including developing supporting questions to explore the driving question in the field. Field experiences allow students to interact with their local environment and contribute to learning in ways that traditional classroom or laboratory settings may not. During field experiences, students can use their senses, scientific equipment, and technology to make observations, collect data or measurements, and conduct experiments necessary to answer their supporting questions and inform environmental action. Students who have opportunities to learn in, thrive in, and appreciate the outdoors can become informed and engaged champions for our natural resources.

Outdoor Field Experiences can take place on school grounds or at locations close to schools, such as streams or local parks. They can also take place at off-site locations such as state or national parks, wildlife refuges, marine protected areas, or nature centers that are often staffed by experts and may provide access to field equipment and facilities. A range of partners, including environmental educators, natural resource professionals, or trained volunteers, can help facilitate field experiences; however, they should be co-developed and co-taught with teachers so that field experiences support learning objectives. Teachers and partners should ensure an accessible outdoor learning environment for all participants, including students with a range of physical, cognitive, emotional, and social abilities. They should also prepare students by providing information and discussing what students can expect to see, feel, or experience during their time outdoors to ensure students feel safe and comfortable during their field experiences.

Synthesis and Conclusions

During **Synthesis and Conclusions**, students reflect on each experience and investigation in relation to the issue, and share their claims and conclusions with each other. Teachers should plan for this to occur regularly throughout the MWEE. This learning and frequent reflection provide the foundation for the development of claims and environmental action that address the driving question and connect to the environmental issue. Throughout this process, students should demonstrate understanding of their investigations and conclusions with their peers or the school community. This could involve multiple disciplines and a variety of formats including discussion, journaling, presentations, graphing, performing skits or songs, or creating art.

Environmental Action Projects

As a result of their investigations, students identify solutions and develop **Environmental Action Projects** that directly address the issue within their school, neighborhood, or community. Students are actively engaged in and, to the extent possible, drive the decision-making, planning, and implementation of the action project. Teachers facilitate this process by forming groups, moderating, and answering questions. Students reflect on the value of the action and determine the extent to which it successfully addressed the issue.

This essential element allows students to understand that they personally have the power to bring about change by taking action to address environmental issues at the personal, community, or societal level. Taking action instills confidence in students and can contribute to students becoming environmental stewards in their communities.

TYPES OF ENVIRONMENTAL ACTION PROJECTS

RESTORATION OR PROTECTION:

Actions that assist in the recovery or preservation of a watershed or related ecosystem that has been degraded, damaged, or destroyed.

Examples include:

- Plant or restore vegetation/trees
- Restore a local habitat
- Remove invasive plants
- Clean up litter at local beaches, parks, or school grounds
- Develop a school garden, natural history area, community garden, or other sustainable green space
- Install rain gardens to help manage stormwater

EVERYDAY CHOICES:

Actions that reduce human impacts on watersheds and related ecosystems and offer ways to live more sustainably.

Examples include:

- Refuse/reduce/reuse/recycle
- Monitor and save water in the face of potential drought or reduction in water availability
- Compost food or yard waste
- Research and implement energy efficient strategies or energy alternatives at school and/or at home

“A takeaway that I had from participating in this experience is that I learned how impactful my choices can be towards the environments that I don’t see every day, which made me work even harder at being aware of the ecosystems around me and how my choices can impact them.”

Student

J. Frank Dobie High School, Houston, Texas

COMMUNITY ENGAGEMENT:

Actions that inform others about how to address community-level environmental issues.

Examples include:

- Give presentations to local organizations
- Organize community events
- Record or broadcast public service announcements
- Share information on social media
- Post flyers in community
- Share posters at community events/fairs/festivals
- Mentoring

CIVIC ENGAGEMENT:

Actions that identify and address issues of public concern. Students acting alone or together to protect societal values or make a change or difference in a student’s school, neighborhood, or community.

Examples include:

- Present to school principal or school board
- Attend, speak, or present at town meetings
- Write to local or state decision makers or elected officials

INCORPORATING YOUTH VOICE INTO THE MWEE

Encouraging youth voice during a MWEE is important for instilling confidence in students and supporting students as they become environmental stewards in their communities. Giving your students the opportunity to make decisions throughout the MWEE helps them believe in their own abilities, realize their voices matter in the community, and apply innovation and creativity to tackle real issues. Here are some ideas to help you work youth voice into each of the essential elements:

ISSUE DEFINITION

- Encourage students to generate or add to supporting questions, based on their previous knowledge, lived experience, and interest, that help them develop potential answers to the driving question and shape investigations.
- Support students reaching out to local experts who can share more about a local issue. Students can develop their own interview questions and facilitate the dialogue.

OUTDOOR FIELD EXPERIENCES

- Provide space for students to design their own inquiries and experiments to conduct during field experiences.
- Encourage students to identify the equipment and resources that they need to conduct field investigations and, when appropriate, design data collection protocols.

SYNTHESIS AND CONCLUSIONS

- Highlight student talents by encouraging a variety of formats for demonstrating their understanding of the issue.
- Give students the opportunity to share and debate their evidence and conclusions with their peers.

ENVIRONMENTAL ACTION PROJECTS

- Provide opportunities for students to present their findings to a meaningful audience, such as schools, school boards or school administrators, or local, state, or federal decision makers.
- Provide time and space for all students to be a part of designing and choosing an action project.
- Support students in identifying how they can use their skills and interests to plan and implement an action project.

OTHER CONSIDERATIONS

- Ask students questions instead of providing answers.
- Create a safe space where everyone is comfortable contributing, including using techniques to encourage introverted youth to share their perspectives.
- Set up a speaking and decision-making system. Democratic or consensus practices often work well.
- Welcome and proactively incorporate multiple perspectives.
- Be prepared to remind students to always connect back to the driving question when developing supporting questions and brainstorming solutions. For many students, the opportunity to direct their own learning may be new, so they might need a little practice.

MWEE SUPPORTING PRACTICES

The MWEE also includes four supporting practices that describe “what teachers do,” along with their partners, to ensure successful implementation with students. The supporting practices are ***Teacher Facilitation***, ***Learning Integration***, ***Sustained Experiences***, and ***Local Context***.

Teacher Facilitation

MWEEs require that teachers support student learning for the duration of the MWEE, both inside and outside the classroom. Teachers balance roles of facilitation, direct instruction, and coaching to create a student-centered learning experience where the essential elements of the MWEE come together to support goals for learning and create opportunities for students to take active roles in the learning process. Teachers provide space for student choice and voice by creating learning experiences that center on what students value. Even when activities or lessons occur at partner sites or are primarily led by partners at the school, teachers should be actively engaged. Teachers should connect these experiences to prior learning, foster critical thinking, and lead reflection after the experience so, regardless of the facilitator, the entire

MWEE experience feels cohesive to the students. To support this level of engagement, teachers should have access to professional development opportunities that support their content knowledge, understanding of the MWEE framework, and confidence and intention to implement MWEEs independently.

Learning Integration

The MWEE is an educational framework that helps teachers meet their learning objectives in an engaging way. MWEEs are not meant to be something “extra,” but rather a means of enhancing lessons for deeper student learning while meeting academic standards. To achieve this vision, MWEEs should be embedded into the school curriculum to support goals for learning and student achievement. They can



The Pacific Center for Environmental Studies, Hawaii, graduates and peer mentors (Jon Rosen, Jayten Galario, Sarah Weible) and Coordinator Manning Taite help students learn molecular genetics. (*Manning Taite*)

also provide authentic, engaging interdisciplinary learning that crosses traditional boundaries between disciplines. Finally, the MWEE essential elements can also be used by educators in out-of-school settings (for example, after school programs, clubs, or summer camps) to enrich activities and complement school-based programming.

Sustained Experience

MWEEs rely on teachers to plan and implement a series of rich and connected learning opportunities where each essential element — from asking questions during *Issue Definition* through implementing *Environmental Action Projects* — builds upon and reinforces the others. To accomplish this, MWEEs are incorporated into a unit or multiple units, where learning happens both in and out of the classroom. This provides adequate time for students to not only reflect on the individual lessons and experiences, but also on how all of the elements cohesively come together. While an individual lesson may occur in one class period or field experience, that lesson or experience should be explicitly connected to the larger learning sequence of the MWEE.

Local Context

MWEEs have teachers use the local environment and community as a context for learning that is relevant to students' lives. Situating the MWEE within local contexts promotes learning that is rooted in the unique culture, history, environment, economy, literature, and art of a students' school, neighborhood, or community. To enrich MWEEs, local resources (e.g., partners, expertise, field sites) should be incorporated. Partnerships, such as those with local community-based organizations, create opportunities for students to engage with members of their community of different cultures, values, and expertise to support the educational experience.

Emphasizing the local context enables students and teachers to develop stronger connections to, and appreciation for, their local environments and communities. This also enables students and teachers to explore how their individual and collective decisions affect their immediate surroundings and in turn affect larger ecosystems and watersheds.

FACILITATOR'S GUIDES TO MWEE TRAINING

Facilitator's guides are companion texts to the MWEE Guide, designed to support effective MWEE professional learning experiences for teachers and educators. They are intended for practitioners who are deeply familiar with the MWEE and who will be training other educators on how to apply the tools and resources found in the MWEE Guide to their own classrooms and programs. Facilitator's guides provide easy-to-use training resources and consistency in MWEE professional development with modular activities that can be adapted to support your local context.



For more information about designing MWEE professional development, see the Facilitator's Guide to MWEE Training, available at:

noaa.gov/office-education/bwet/resources/mwee-resources

New facilitation resources will be added to the webpage as they are developed.

PLANNING A MWEE

GETTING STARTED

There are many ways to generate ideas for planning a MWEE ranging from an inspiring learning objective that lends itself to field-based learning to a compelling local environmental issue. During this phase, it may be worthwhile to consider existing field trips and district-, community-, or school-based initiatives for natural opportunities to build off. What outdoor assets do you have at or around your school?

Remember, MWEEs are not meant to be something “extra,” but rather a means of enhancing lessons for deeper student learning while meeting academic standards. You may want to start by exploring and gathering information on local environmental issues and/or reviewing your curriculum for lessons that address environmental issues. Also, consider existing teaching resources at your school and partnerships with other teachers. Working with teachers of the same and different subjects can foster collaboration, connect to multiple disciplines, and engage more students in the MWEE.

Successful MWEEs often involve the support of partners who play important roles in planning, delivering, and/or sustaining MWEE programs. Environmental education professionals from the school district or local nonprofit organizations have extensive experience and can often assist with MWEE planning and implementation, including brainstorming MWEE ideas, offering teacher professional learning, and assisting with **Outdoor Field Experiences** and/or **Environmental Action Projects**. School district content specialists

are typically experts when it comes to identifying where in the scope and sequence of a curriculum a MWEE could fit and be sustained. They may also be able to provide access to information, materials, and resources maintained by the school district. Community-based organizations can support the local context of the MWEE, often bringing cultural and social expertise. Additionally, community partners such as businesses, universities, and government agencies can often be called on to support MWEEs by offering time, expertise, and supplies. Remember that while these are wonderful resources, **Teacher Facilitation** for all elements of the MWEE is an important practice so the experience feels cohesive to students.

With so many things to consider, planning a MWEE might seem both exciting and overwhelming at the same time. To organize your ideas, start with the MWEE Think Cloud planning tool. This tool can help you with some initial brainstorming about program ideas, collaborators, and resources and can be used to facilitate planning conversations with partners and team members.

“The biggest takeaway of participating in the Mālama Learning Center’s project is observing my haumāna (students) grow their love for our land, resources, and watershed through closely collaborating with community partners to work and learn in the watershed.”

Shannon Bucasas

Hawaiian Studies Teacher, Wai’anae High School

MWEES PROVIDE A RICH PLATFORM FOR CROSS-CURRICULAR LEARNING

In many cases, the project-based nature of MWEES allows for cross-curricular explorations and learning. Consider possibilities for involving teachers from across disciplines and content areas in your MWEE. Below are some examples of questions that may prompt cross-curricular opportunities:

ENGINEERING:

How can engineering practices be used to make sense of natural phenomena or develop solutions to address the environmental issue?

ENGLISH LANGUAGE ARTS:

How can novels, short stories, picture books, nonfiction books, websites, and other sources be used to explore the issue and different perspectives? How can different styles of writing, including narrative, expository, process, and descriptive essays, be used to synthesize ideas in different ways?

MATH:

How can data tables, charts, and graphs be used to support or strengthen their claims? Can students use their quantitative skills to enhance outdoor investigations? What data can be collected and/or organized during your MWEE?

PERFORMING AND VISUAL ARTS:

How can art be used to document observations or explain findings? How can music and dance be used in learning about or communicating about MWEE investigations or used in action projects? Can students create, perform, or learn through music and dance connected to their investigations?

SCIENCE:

How can scientific principles and practices be used to design investigations? How can observed phenomena be explained using scientific evidence?

SOCIAL STUDIES:

How has the history of the land and people affected the issue or vice versa? How do people from different cultural backgrounds perceive the issue? How is the geography of the area connected to the issue? How are local or state policies impacting the issue?

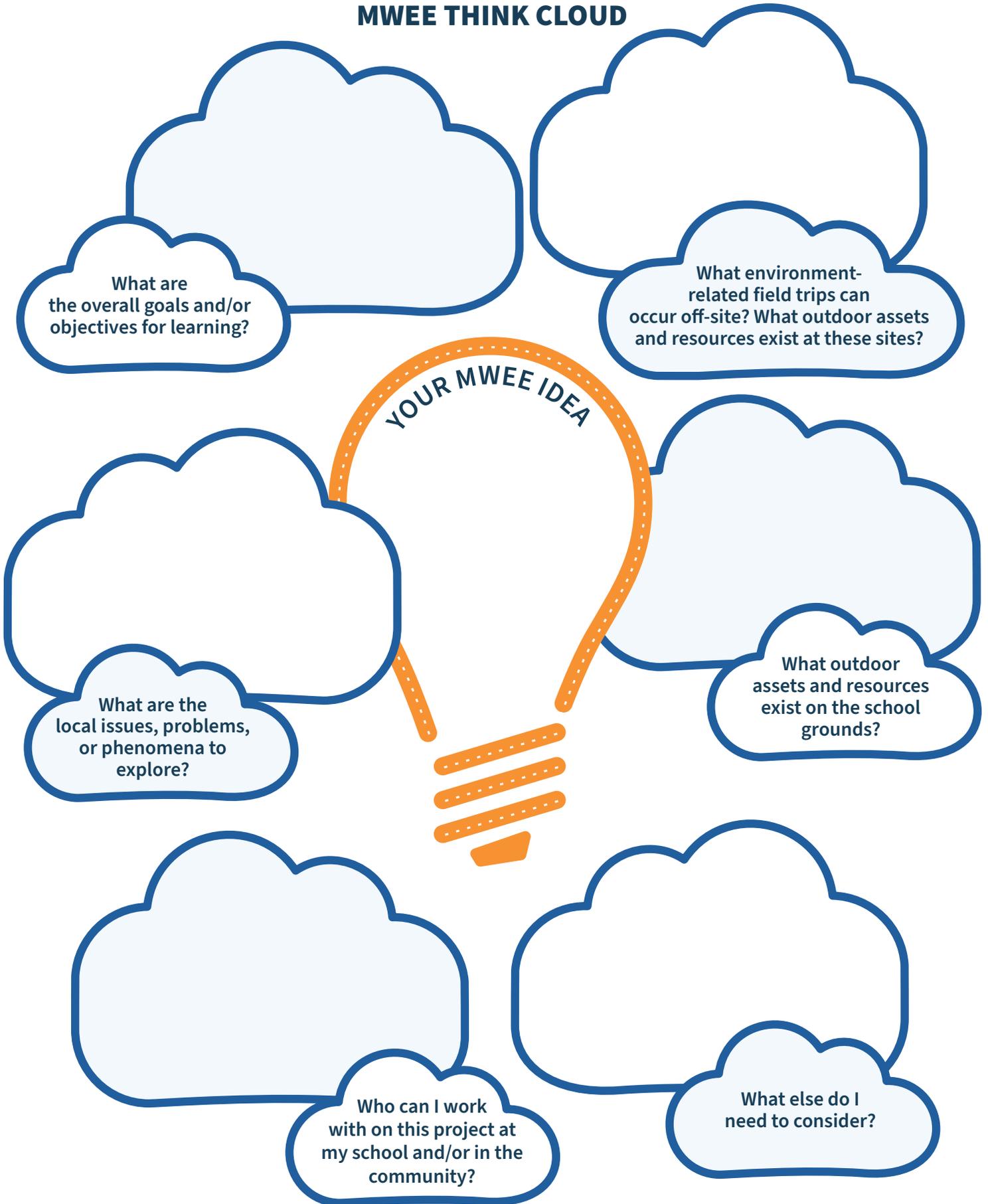
TECHNOLOGY:

How can our abilities to modify the natural world meet human needs and wants? Which tools and equipment would be needed to collect, record, analyze, and evaluate data? Could technology be used to design or build a solution to the issue investigated?

WORLD LANGUAGES:

How can the MWEE be used to expand vocabulary? Can students practice conversation skills to learn from community members about the issue or environmental action? Is there an opportunity to better engage community members by creating outreach materials in their preferred language?

MWEE THINK CLOUD



PLANNING TO GO OUTSIDE

Outdoor Field Experiences often require planning with multiple people. You may need to schedule with the field location, organize transportation, and prepare substitute teachers or support staff to help back in the classroom or on the field experience. Even if you stay on the school grounds, you still may need to get permission from the administration and schedule additional staffing to ensure all students are able to participate. With all this to consider, it is a good idea to start thinking about potential field experiences early.

When reviewing options for your **Outdoor Field Experiences**, consider what natural features, equipment, facilities, and/or programs would be needed for the location to be accessible for all your students to investigate the driving and supporting questions. Also consider how you, as the educator, would facilitate learning. If you involve partner educators or support staff, think through how they would facilitate learning. Consider your learning objectives for the field experience. These could be skills focused (e.g., connected to quantitative analysis) or content focused (e.g., fostering a systems perspective). Then consider how one site might help you with those objectives more than another site.

Consider both off-site locations and the school grounds for outdoor learning. There are likely opportunities for **Outdoor Field Experiences** to occur on or near the school grounds — for example, at local parks, museums, or nearby fields or streams. Often off-site field experiences include fees for transportation and programs and may require securing permits and permissions. Including at least one outdoor field experience on school grounds can help ensure the MWEE persists if there are restrictions on leaving school property, scheduling conflicts, or limited transportation or programmatic funding. When planning a MWEE, it is important to consider sustainability from the beginning.

Your school may have a planned field trip that is already budgeted for that can be woven into the MWEE.

Outdoor Field Experiences are an important part of the MWEE. The Incorporating Outdoor Field Experiences planning tool can be used to evaluate potential sites for your **Outdoor Field Experiences**, including exploring how these sites can support the **Issue Definition** and **Environmental Action Projects** essential elements. For sustainability purposes, it is helpful to have at least one of these experiences occur on the school grounds.



Students at Nelson School in Michigan plant native plants to provide a rain garden at their school as part of their Great Lakes B-WET project. (Jessica Vander Ark)

“The MWEE framework is a great tool for helping educators to package really powerful, meaningful, and locally relevant learning experiences for their learners. After all, not all classrooms have four walls! #LearnOutside”

Tarrea Potter

7-12 Science Teacher, Huntingdon Area School District



INCORPORATING OUTDOOR FIELD EXPERIENCES

How will field experiences be used to make observations, collect data, or otherwise help answer the driving/supporting questions?

How can field experiences be used to explore solutions as part of Environmental Action Projects?

	Possible Site #1: School Grounds	Possible Site #2:	Possible Site #3:
Site location and description			
What do the field experiences contribute to your MWEE (learning objectives, science and engineering practices, etc.)?			
What will the teacher do to facilitate learning?			

	Possible Site #1: School Grounds	Possible Site #2:	Possible Site #3:
What natural features, facilities, and/or programs are available at the site?			
Are there costs associated with this site (transportation, program fees, etc.)?			
What permissions and/or permits need to be secured?			
Does the site provide adequate access for students of all abilities? This may include technology mediation, boardwalks, guide ropes, braille signs, etc.			
What resources would you need to make it happen?			

PUTTING IT ALL TOGETHER

Once you have moved past the initial brainstorming phase, the Environmental Literacy Model (ELM) is a more comprehensive planning tool that can help you think through the details of your MWEE. The ELM is designed to help situate the MWEE within the scope and sequence of the curriculum and to ensure that **Environmental Action Projects** are in direct response to the learning that took place during the earlier phases of the MWEE. ELMs may also be helpful with communicating to school leadership, the local community, and colleagues.

The ELM features three primary components — Curriculum Anchor, Issue Investigation, and Informed Action. These components provide space for you to describe where the essential elements and supporting practices are embedded in the MWEE. As you develop your ELM, you should also plan your methods for incorporating youth voice and integrating your required curriculum content and lessons. Your ELM will evolve over time, changing as new challenges or opportunities arise and/or as each group of students develops or co-develops their own supporting questions, investigations, and action projects.

When you first complete your ELM, it may feel incomplete — it should! You don't yet know the supporting questions or action project your students will develop or co-develop. After completing your

MWEE, you can return to your ELM and add in your students' questions, investigations, and the action project they completed so you can use the ELM to share your MWEE with others.

The Curriculum Anchor ELM component identifies connections of the MWEE to academic standards and establishes life-relevant, local contexts for learning. By defining the learning objectives and the driving question within the local context, the Curriculum Anchor component of the ELM demonstrates the MWEE supporting practices of **Learning Integration** and **Local Context**, and the identification of a driving question for the **Issue Definition** essential element. Usually the Curriculum Anchor is completed by the teacher with no student involvement so the teacher can place the ELM within their curriculum.



The Bay Backpack website provides educators with the tools to support MWEEs for students. Explore Bay Backpack for teaching resources and lesson plans, examples of completed ELMs, action project ideas, and more at: www.baybackpack.com





Elementary students make underwater observations to learn about their watershed at the Science and Discovery Center of Northwest Florida. (Linda MacBeth)

The Issue Investigation ELM component provides the opportunities for students to construct knowledge and understanding through multiple investigations or lessons around a life-relevant issue. Some of these investigations should take place outdoors, while others may take place in the classroom. By working together throughout the investigation to construct, communicate, and refine explanations about the driving question, the Issue Investigation component of the ELM demonstrates how students engage in the **Issue Definition**, **Outdoor Field Experiences**, and **Synthesis and Conclusions** essential elements of a MWEE. Issue Investigation may include supporting questions developed by the teacher that cover required curriculum content and lessons; however, be sure to leave space for questions and investigations developed or co-developed by your students. Use this student-directed space to plan out how you will guide students through each step of Issue Investigation. After completing the MWEE, you can fill in what your students worked on.

The Informed Action ELM component empowers students to adapt and apply the knowledge they have constructed through Issue Investigation. As students develop a claim, identify solutions, design plans, and take informed action, they engage in the essential elements of **Synthesis and Conclusions** and **Environmental Action Projects**. Remember, students should be actively involved in developing the action project. When using the ELM to plan your MWEE, use this component to plan how you will guide your students through the process of identifying solutions, ensure all students are engaged in planning and taking informed action, and lead them in evaluating that action.

By directly supporting the full suite of activities outlined in the ELM, you also fulfill the MWEE supporting practices of **Teacher Facilitation** and **Sustained Learning Experience**.



ENVIRONMENTAL LITERACY MODEL (ELM)

Title: _____ Author: _____

School/district: _____ Audience (grade/course): _____

CURRICULUM ANCHOR

DEFINING THE LEARNING OBJECTIVES AND CURRICULUM CONNECTION

What are the curriculum indicators, performance expectations, and/or student learning objectives?
Are there opportunities to meet academic standards in multiple disciplines or content areas?

DESCRIBING THE LOCAL CONTEXT

What is the local and life-relevant environmental issue, problem, or phenomenon that will serve as the context for learning?

IDENTIFYING THE DRIVING QUESTION

What is the open-ended, life-relevant question that meets academic standards/learning objectives?
Reminder: It should guide inquiry for the investigations and provide opportunities for environmental action.

ISSUE INVESTIGATION

ASKING QUESTIONS AND DEFINING ISSUES

What are supporting questions that students may investigate to further explore the driving question? List the supporting questions that cover your required curriculum content and lessons, but leave at least one Issue Investigation open for those developed or co-developed by your students. Use the space to describe how you will guide them through this student-directed process. After completing your MWEE, add in the student-directed investigations.

Issue Investigation 1 Who is involved in developing this investigation? <i>teacher and/or students?</i>	Issue Investigation 2 Who is involved in developing this investigation? <i>teacher and/or students?</i>	Issue Investigation 3 Who is involved in developing this investigation? <i>teacher and/or students?</i>

PLANNING AND CONDUCTING INVESTIGATIONS

How could students plan and conduct indoor and outdoor investigations to actively address the supporting questions? What kinds of data could be collected to draw conclusions and make actionable claims?

Issue Investigation 1 Is this investigation occurring <i>indoors and/or outdoors?</i>	Issue Investigation 2 Is this investigation occurring <i>indoors and/or outdoors?</i>	Issue Investigation 3 Is this investigation occurring <i>indoors and/or outdoors?</i>

ISSUE INVESTIGATION (CON'T)

ANALYZING AND INTERPRETING DATA

How could students analyze data (graphs, models, etc.) to reveal patterns and relationships? What could the process of synthesizing evidence look like?

Issue Investigation 1	Issue Investigation 2	Issue Investigation 3

CONSTRUCTING AND COMMUNICATING A CLAIM

How could you guide your students through the process of developing claims based on their evidence? How may they communicate these evidence-based claims to internal and/or external audiences?

Issue Investigation 1	Issue Investigation 2	Issue Investigation 3

INFORMED ACTION

IDENTIFYING SOLUTIONS

How could you encourage your students to identify and explore a variety of solutions that could directly address the issue? How could students make decisions about which solution(s) to implement?

DESIGNING A PLAN AND TAKING INFORMED ACTION

What resources or frameworks will students use to create their plan of environmental action? During what time period will they execute their action project?

EVALUATING ACTION

In what ways could students reflect on the action project and determine the extent to which it successfully addresses the issue?

IMPLEMENTING MWEES WITH STUDENTS

Once you have a plan in place, it is time to implement it with your students. Because MWEs provide an opportunity for students to shape their learning, the actual execution of the plan that you created using the planning tools may or may not be exact. Though the learning objectives and curriculum connections, the driving question, and some of your investigations may stay the same, other aspects will change based on your students' interest, questions, and ideas. The ELM is meant to be a resource that you can continually come back to and refine just like you would a lesson or unit plan.



The Student Worksheets Toolbox is included in the appendix of the online version of the MWE Guide and as individual worksheets on the MWE Guide webpage:
noaa.gov/office-education/bwet/resources/mwee-guide



Teachers conduct water quality testing on a dock at Virginia Commonwealth University's Rice Rivers Center. (Terry Brown)

STUDENT WORKSHEETS

In addition to the planning tools for educators included in this guide, see the Student Worksheets Toolbox for resources you can use to help guide student-directed learning. These resources are designed to be used by or with students and can be printed out and used as worksheets, or you could enlarge them and create a collaborative working space in your classroom.

ASKING QUESTIONS AND PLANNING INVESTIGATIONS WORKSHEET

This worksheet will help students connect the dots between the driving question, the supporting questions (*what do we want to know?*), and the investigations (*how can we investigate it?*). Engaging students in developing questions is one way of incorporating student voice from the outset of the MWE. This worksheet can be used to explore opportunities both in the classroom and in the field.

CLAIM, EVIDENCE, REASONING WORKSHEET

This worksheet helps students make a claim about the issue, problem, or phenomenon they explored during *Issue Investigation*. This claim will be used to inform *Environmental Action Projects*.

MOVING FROM CLAIMS TO INFORMED ACTION WORKSHEET

This worksheet helps students brainstorm different *Environmental Action Project* options for addressing the driving question explored in the MWE. Remember that environmental action comes in many shapes and forms, including restoration or protection, everyday choices, community engagement, and civic engagement.

CHOOSING AN ACTION PROJECT WORKSHEET

This worksheet is one method you can use to guide students in selecting a single action project. It should be completed by a group or classroom. Start by adding five student-created action project

ideas to the grid. These ideas should be directly related to the driving question and supported by evidence. Next, as a group, decide on criteria for choosing an action project. This is the time where you, as the educator, should talk about the absolute criteria. For example: the action project must be completed in three class periods, cost less than \$50, and involve every student. Make sure to leave at least one or more criteria for students to create. Criteria may be specific or general.

After you and your students select the criteria, write them on the grid and then rate each strategy against each criterion. Tally the results using the grid. After each strategy is ranked against the criteria, one strategy may stand out as the clear winner. If one does not emerge, students may need to establish additional criteria to apply to each possible action idea. This worksheet was adapted from a resource from EarthForce.

ENVIRONMENTAL ACTION PLANNING WORKSHEETS

This set of worksheets can be used to plan the *Environmental Action Project*. The worksheets cover basic steps in planning and implementing an action project and can be used by students independently, in small groups, or as a class. There are five total worksheets in this planning set. Use the worksheets that make sense for your students' action project and/or assign different pages to small groups or individuals to complete. These worksheets were adapted from a resource by ShoreRivers in Easton, Maryland.

SUSTAINING A MWEE

MWEEs take effort to establish, so it is important to both celebrate your success and create a plan to ensure it continues into the future. Below are a few examples of ways to think about sustaining MWEEs.

CELEBRATING SUCCESS

Now that you have a MWEE in place, celebrate your success! This can help increase your school's understanding of and excitement for the MWEE, and to build toward or reinforce a school culture that embraces environmental education. Principals, other teachers, Parent Teacher Associations (PTAs), building services staff, parents, and other students are all important partners. Getting them involved and excited can go a long way toward ensuring that a MWEE has the support to continue into the future and potentially expand to other grades and involve other disciplines. It is also important to recognize community partners who lend support in the form of resources, money, or time teaching and supporting students. Schools often have a variety of built-in mechanisms for helping with this — from the school or PTA newsletter, website, or social media accounts to the morning announcements, bulletin boards, or events.

Students can deliver powerful testimonials about their MWEE during press events or at school board meetings. The community surrounding a school is generally interested in learning more about school initiatives, especially because many of the community members have family who are attending, will attend, or have attended the school. Reaching out to the community through the media, public service announcements, meetings of local government officials, or community outreach events can increase

awareness and support of a MWEE. Teachers, school administrators, or partners may also want to reach out to local television stations, newspapers, and online media services to invite them to witness a MWEE in action.

BUILDING AWARENESS IN YOUR SCHOOL DISTRICT

As demonstrated through the Curriculum Anchor emphasis in the ELM planning tool, it's important to spend time thinking about how the MWEE fits into the scope and sequence of the curriculum. These clearly defined curricular connections enable teachers and school leaders to see how the MWEE supports existing goals for learning rather than being something “extra.” There is a great opportunity for teachers and their principals to share information and accolades about their MWEE with curriculum coordinators and content supervisors to identify ways to scale classroom-based MWEEs to more classrooms and schools, ideally becoming embedded systemically into the curriculum. It is often helpful for MWEEs to be piloted in one school or classroom to demonstrate a proof of concept before scaling it up across an entire district to reach all students.

Embedding MWEEs into the curriculum can create the space, permission, and sometimes even funding for these experiences to occur. Depending on the size and resources of the school district, people



Tips and tools for highlighting your MWEE or program, such as a press release template, can be found at: noaa.gov/office-education/bwet/resources/comms-toolkit

in positions like curriculum coordinator, content supervisor, or principal are important to collaborate with because they typically know when curriculum is due for updates or if there are opportunities for supporting professional development. Other partners that may be involved could include the superintendent, board of education members, and additional central office staff such as health and facilities managers.

PROMOTING TEACHER PROFESSIONAL DEVELOPMENT

Regular professional development provides an opportunity for teachers at all levels to continually build their knowledge, practice, and skills around MWEE implementation. Professional development may focus on content, pedagogy, emerging technology and tools, curricular resources, and more. A traditional MWEE professional development may include a blend of asynchronous and synchronous work, use planning tools included in this guide, and model activities and investigations including outdoor

learning and action. More specialized professional development may focus on a specific topic, like climate change or conducting a biodiversity study, that can enhance a teacher's knowledge-base or skill-set and be applied to a MWEE. These kinds of professional development are often offered by local environmental education organizations, natural resource agencies, and other community partners. In addition to formal professional development, it can be helpful for teachers to engage in regular individual and team-based reflection on how the MWEE is working and to revisit challenging areas as needed.

Partners, such as nonformal educators, are often well-poised to support professional development and have an opportunity to work with school district administrators to coordinate what long-term support can look like. A long-term plan for professional development is crucial for ensuring that new teachers and staff are familiar with both the MWEE framework generally and what it looks like practically in the classroom.

“Professional development plays a key role in deepening and enriching teachers’ understanding of local environmental issues and how they can be used as context for learning many different subject areas. When teachers actually engage in the essential elements of a MWEE in workshops, they better understand how to facilitate them with their students.”

Paul Robertson

Staff Scientist, Project and Communication Manager, Cascade Head Biosphere Collaborative



For more information about designing MWEE professional development, see the **Facilitator’s Guide to MWEE Training**, available at the MWEE resources webpage: noaa.gov/office-education/bwet/resources/mwee-resources

SECURING FUNDING

The most sustainable MWEs are often embedded in school curriculum and supported with school district resources. Outreach to school board members or central office personnel can help to build the awareness about and support for MWEs, and partner organizations are often eager to help with this outreach. Many school districts support the installation of schoolyard projects, support system-wide field experiences for students, or otherwise provide ongoing, reliable funding for components of the MWE. And if a school happens to be planning construction, teachers can sometimes work with facilities staff to incorporate green elements, including outdoor classrooms and other schoolyard projects that can be used by students for authentic research (e.g., a stormwater retention pond can be a great wildlife habitat if planned appropriately).



Kuehn-Haven Middle School Flint River GREEN Bridges students plant native riparian plants along the Flint River at Barber Park in Montrose, Michigan. (Kelly Sanborn)

The school and local community can also be a great source for funding. School PTAs are often supportive of hands-on field experiences and can sometimes help defray costs if they have budgets for special projects. They may also be able to help fund supplies or equipment. Even if a PTA does not have the funding to support the MWEE, parents can have excellent ideas about how to reach out to the broader community.

Neighborhood organizations, local nonprofits, and local businesses will often donate supplies, equipment, or time, and may offer easy-to-manage small grants with very little paperwork.

In addition to community, school, and school district funding, there are many opportunities to secure funding from external sources, including grants from federal and state governments, businesses and corporations, and private foundations. Some school districts have grants coordinators to assist in these efforts while other smaller districts may explore how local partners can support both grant writing and project management.

The National Oceanic and Atmospheric Administration (NOAA) Bay Watershed Education and Training (B-WET) program is a federal competitive grants program that promotes MWEEs. B-WET funding supports hands-on MWEEs for students and related professional development for teachers, administrators, and other educators who

serve formal K-12 audiences, as well as projects that create systemic change in school districts in support of environmental education. B-WET is implemented regionally in seven geographic areas of the country: California, Chesapeake Bay, Great Lakes, Gulf of Mexico, Hawaii, New England, and Pacific Northwest. To learn more, visit: noaa.gov/office-education/bwet.

While grants are wonderful to help kick-start a project, they are not meant to provide long-term support. In fact, many grantmakers ask for a sustainability plan as a part of their application process. The information from the previous section on Building Awareness can guide the development of a communications plan that generates excitement and momentum that can lead to longer-term support for the MWEE.

Additional funding is not required for all MWEEs. MWEEs built around local sites (e.g., school grounds or nearby parks and streams) and/or existing resources (e.g., planned field trips or events, or materials and equipment in classrooms) may not require additional funds to ensure their sustainability. For MWEEs that incorporate off-campus trips, specialized supplies, or other resources not currently available, additional funding may be required. For these MWEEs, as described in the Planning a MWEE section, it's important to consider sustainability from the beginning so that the programs are not contingent on inconsistent sources of funding.

“MWEEs are at the heart of our efforts to strengthen and build ... coordinated regional environmental literacy and stewardship programs throughout Santa Cruz County. MWEEs that are systemic ensure that every student has the opportunities to participate in these transformational experiences.”

Amity Sandage

Environmental Literacy Coordinator, Santa Cruz County Office of Education, Educational Services

EVALUATING A MWEE

Educators are continually assessing student learning, either formally through tests and quizzes or informally through on-the-fly judgements about what students are learning. Similarly, evaluators assess project or program effectiveness using a variety of approaches. Evaluating a MWEE can improve its long-term success and inform the design and implementation of future programs and experiences. Evaluation is the systematic collection of information regarding program or project objectives, using a variety of sources and methods, to inform decisions about program or project improvement. In this way, evaluation is both a process and a product for measuring change.



Aquatic Care Team students conduct a dissolved oxygen analysis at the Navarre Beach Boat Ramp, Florida.
(Anne Laurenzi)

To evaluate your MWEE, you need to create an evaluation plan. The plan will provide a roadmap for evaluating your MWEE by describing how you will monitor your progress toward meeting your program’s objectives and to what degree your program meets all the components of the MWEE. The plan will ultimately help you make decisions about, make improvements to, and communicate the results of your MWEE.

You may wish to work with your partners, or perhaps an external evaluator, to create this plan. If you want professional help evaluating your MWEE, consider working with someone who specializes in evaluation of science or environmental education to lighten your load and ensure you are providing high-quality MWEEs for your students. Look for someone in your area who knows the local geographic and social context.



Resources like the North American Association for Environmental Education eeVAL website (evaluation.naaee.org) can help you get started.

Other resources to help you evaluate your MWEE are available at the MWEE resources webpage: noaa.gov/office-education/bwet/resources/mwee-resources

NOAA B-WET MWEE STUDENT OUTCOMES

The NOAA B-WET program has designed the Developing Student Outcomes for Environmental Literacy in K-12 Education document to identify some key program outcomes for students. This document attempts to bridge differences in language and practice between environmental education and formal K-12 education and includes four primary dimensions that make up environmental literacy:

- **Environmental knowledge:** The core ideas relevant to environmental literacy. These outcomes focus on understanding the complex, dynamic nature of life-sustaining systems and human impacts on them.
- **Environmentally responsible behavior:** The competencies, abilities, and actions relevant to making informed decisions and taking action to mitigate the negative effects of human activities on Earth's systems.
- **Attitudes and dispositions:** The qualities, habits, views, beliefs, judgements, and ways of thinking that are connected to individuals' abilities to make sense of environmental issues and to take action to preserve and protect Earth's systems.
- **Environmental literacy skills and disciplinary practices:** A broad set of knowledge, skills, competencies, traits, and practices related to environmental literacy that are important for success in postsecondary education, careers, and society.

These are not the only outcomes you could establish for your MWEE. You might be interested in changes in students' identities as science learners, or career paths, or comfort level with certain content or practices.

“Many of the specific MWEE instructional practices students reported experiencing or that their teachers reported that students experienced were statistically significantly related to students' [post-MWEE] intention to act, personal responsibility, knowledge of issues, individual locus of control, knowledge of actions, and knowledge of ecology.”

Zint et al. in *Studies in Educational Evaluation*, 2014.



For more research and references supporting MWEEs please see:
noaa.gov/office-education/bwet/resources/mwee-resources

MWEE AUDIT TOOL

As you plan a new program or update and strengthen an existing program, consider using the MWEE Audit Tool. The Audit Tool, in conjunction with the ELM, helps educators check their MWEE design to make sure it meets the definition of a MWEE and integrates all of the essential elements and supporting practices.

The Audit Tool can also be used as a reflection tool both during and after implementation. When used in this way, educators can identify where the implemented MWEE could be improved for next time, and determine the strengths of the MWEE. Evaluators might even use the Audit Tool as a starting place for designing outcome measures across several MWEE designs or many implementations of the same design. In this way, you can be sure you are creating objectives and outcome measures that align with the MWEE framework. The MWEE Audit Tool references several helpful tools and worksheets that are available in the MWEE Guide and Student Worksheets Toolbox.



Chariho Regional High School students plant seedlings to protect Quonochontaug Pond Marsh in Charlestown, Rhode Island from sea-level rise. (*Save the Bay*)



**MEANINGFUL WATERSHED
EDUCATIONAL EXPERIENCE
(MWEE)**
AUDIT TOOL

MWEE ESSENTIAL ELEMENTS

ISSUE DEFINITION

Evaluate the extent to which the MWEE supports student learning about a locally relevant environmental issue, problem, or phenomenon. Driving and supporting questions anchor learning about the issue, which is explored through background research, investigations, and reflection on values and perspectives. The student learning and investigations should have the potential to result in student-centered environmental action.

The driving question has the following characteristics (check all that apply). Aspire to create a driving question that includes all of these characteristics:

Supports learning objectives (i.e., knowledge, skills, and attitudes)

Serves as a context for both increasing content knowledge and practicing inquiry and methodological skills

Open-ended (i.e., arguable, with no single, final, or correct answer)

Relevant and related to students' lived experience

Anchored in real-world environmental and social problems

Affords the opportunity for continuity and coherence across the MWEE

Provides the opportunity for students to develop and explore supporting questions as knowledge and understanding evolve

Allows students to design and enact investigations that yield answers

Provides opportunities for environmental action

Calls for higher-order thinking, including analysis, inference, prediction, and evaluation

Allows for the exploration of both natural and social systems

	 MISSING MWEE COMPONENTS	 NEEDS IMPROVEMENT	 GREAT JOB!
The inquiry and investigations of the defined issue will logically culminate in environmental action.	<i>It is unclear if there is a solution students could implement to effect change related to the issue.</i>	<i>There is only one obvious solution students could implement to effect change related to the issue.</i>	<i>There are multiple solutions (including some that address root causes) that students could implement to effect change related to the issue.</i>
Students conduct background research sufficient to explore the driving question.	<i>Teachers find and provide all of the background information to students and/or background information may not be sufficient for students to fully understand the issue.</i>	<i>Teachers find and provide most of the background information for students to conduct the background research. The background research is sufficient to explore the driving question.</i>	<i>Students are actively engaged in finding and critiquing the information needed for conducting background research to explore the driving question. Teachers facilitate students exploring gaps in their understanding.</i>
Students are actively involved in developing or co-developing supporting questions based on their background research.	<i>All supporting questions are developed by the teacher.</i>	<i>Supporting questions are developed by the teacher with some opportunity for student input and/or co-development.</i>	<i>Students develop or co-develop their own supporting questions.</i>

	 MISSING MWEE COMPONENTS	 NEEDS IMPROVEMENT	 GREAT JOB!
<p>Students explore the driving question and supporting questions during classroom investigations.</p>	<p><i>Intent and activities of the classroom investigations are not related to exploring the driving and/or supporting questions.</i></p>	<p><i>Intent and activities of the classroom investigations are somewhat, generally, or in large part related to exploring the driving and/or supporting questions.</i></p>	<p><i>Classroom investigations are designed to purposefully explore the driving and supporting questions. Teachers look for opportunities to include students in planning investigations.</i></p>
<p>Students explore personal, stakeholder, and societal values, perspectives, and root causes related to the driving question.</p>	<p><i>There are no activities to explore values, perspectives, or root causes incorporated into the MWEE.</i></p>	<p><i>There are activities to explore values, perspectives, and/or root causes but not all are explored during the MWEE.</i></p>	<p><i>There are meaningful activities to explore values, perspectives, and root causes during the MWEE.</i></p>

How will you incorporate missing MWEE components?

How will you improve Issue Definition?

What are the best aspects of Issue Definition? How can they be strengthened or expanded?

For help, check out the [Asking Questions and Planning Investigations](#) student worksheet and the Issue Investigation section of the [Environmental Literacy Model \(ELM\)](#) planning tool.

OUTDOOR FIELD EXPERIENCES

Evaluate the extent to which students participate in multiple Outdoor Field Experiences sufficient to explore the driving question. Students are actively involved in planning and conducting the field investigations, as appropriate.

	 MISSING MWEE COMPONENTS	 NEEDS IMPROVEMENT	 GREAT JOB!
Students participate in Outdoor Field Experiences.	<i>Students do not go outdoors.</i>	<i>Students have one field experience during the course of their MWEE.</i>	<i>Students have multiple field experiences during the course of their MWEE.</i>
Outdoor Field Experiences are accessible to all students, including students with a range of physical, cognitive, emotional, and social abilities.	<i>Accommodations have not been considered, or no accommodations made to make outdoor learning spaces accessible to students with a range of physical, cognitive, emotional, and social abilities.</i>	<i>Accommodations have been considered and some accommodations made to make outdoor learning spaces more accessible to students with a range of physical, cognitive, emotional, and social abilities.</i>	<i>Accommodations have been considered and all reasonable accommodations have been implemented to make outdoor learning spaces accessible to students with a range of physical, cognitive, emotional, and social abilities.</i>
Students explore the driving question and/or supporting questions during field investigations.	<i>Intent and activities of the field investigations are not related to exploring the driving and/or supporting questions.</i>	<i>Intent and activities of the field investigations are somewhat, generally, or in large part related to exploring the driving and/or supporting questions.</i>	<i>Field investigations are designed to purposefully explore the driving and/or supporting questions.</i>
Students are actively involved in planning and conducting field investigations.	<i>Students are not involved in planning and conducting field investigations.</i>	<i>Teachers and/or partners plan field investigations with little input from students.</i>	<i>Students are actively involved in the planning including creating/ co-creating supporting questions that inform field experiences.</i>

How will you incorporate missing MWEE components?

How will you improve the Outdoor Field Experiences?

What are the best aspects of the Outdoor Field Experiences? How can they be strengthened or expanded?

For help, check out the [Incorporating Outdoor Field Experiences](#) planning tool.

SYNTHESIS AND CONCLUSIONS

Evaluate the extent to which students identify, synthesize, and apply evidence from their investigations to make claims, draw conclusions, and communicate about the issue, problem, or phenomenon. Synthesis and Conclusions should happen regularly throughout the MWEE for students to reflect on their experiences and investigations in relation to the issue.

	 MISSING MWEE COMPONENTS	 NEEDS IMPROVEMENT	 GREAT JOB!
Students have dedicated time to reflect on each experience and investigation in relation to the issue, including opportunities to reflect with their peers.	<i>Students have no time to reflect on each experience and investigation in relation to the issue.</i>	<i>Students have one or two opportunities to reflect on the experiences and investigations in relation to the issue and/or they do the reflection in isolation with no opportunities to reflect with their peers.</i>	<i>Students have structured and intentional ways to regularly revisit their experiences and investigations in relation to the issue with one or more opportunities to reflect with their peers.</i>
Students reflect on both environmental and social systems related to the issue.	<i>Students do not reflect on environmental and social systems.</i>	<i>Students reflect on either environmental or social systems but not both.</i>	<i>Students reflect on both environmental and social systems.</i>
Students communicate their understanding, conclusions, and/or claims as a result of the investigations to inform or engage in scholarly argument.	<i>Students do not communicate their understanding of the issue.</i>	<i>Students present basic results of their investigations that are not sufficient to demonstrate understanding of the issue.</i>	<i>Students construct coherent explanations of their investigations using evidence and demonstrate their understanding of the issue.</i>
Students make a claim about the issue that warrants environmental action.	<i>Students do not make a claim based on the collected evidence.</i>	<i>Students make a claim that warrants environmental action but the claim is not supported by collected evidence.</i>	<i>Students make an evidence-based claim that prepares them to take related environmental action.</i>

How will you incorporate missing MWEE components?

How will you improve Synthesis and Conclusions?

What are the best aspects of Synthesis and Conclusions? How can they be strengthened or expanded?

For help, check out the [Claims, Evidence, Reasoning](#) student worksheet.

ENVIRONMENTAL ACTION PROJECTS

Evaluate the extent to which students identify and implement an Environmental Action Project as a solution that directly addresses the defined issue or problem within their school, neighborhood, or community. Students reflect on the action and determine the extent to which the action successfully addressed the issue.

	 MISSING MWEE COMPONENTS	 NEEDS IMPROVEMENT	 GREAT JOB!
Students explore multiple solutions based on their claim and determine an action project.	<i>Students do not explore solutions and no action project is selected.</i>	<i>Students only explore one solution or they explore multiple solutions, but the action project has been preselected by the teacher.</i>	<i>Students explore multiple solutions and identify an action project to implement.</i>
The selected Environmental Action Project directly addresses the defined issue the students are studying.	<i>The action project is not connected to the issue.</i>	<i>The action project is indirectly aligned with the issue; students are unable to make a clear connection to their claim.</i>	<i>The action project is directly aligned with the issue and students can demonstrate this alignment with their evidence-based claim.</i>
Students are actively engaged in planning and implementing the selected action project.	<i>Students are not actively engaged in the implementation of an action project.</i>	<i>Students are engaged in the implementation of an action project, but have little or no opportunity to participate in the planning process.</i>	<i>Students are engaged in both planning and implementing the action.</i>
Students reflect on the action and determine the extent to which the action successfully addressed the issue.	<i>Students do not reflect on the action.</i>	<i>Students reflect on the action but make no conclusions about the effectiveness of the action on the issue.</i>	<i>Students reflect on the action and make conclusions about the effectiveness of the action on the issue.</i>

How will you incorporate missing MWEE components?

How will you improve Environmental Action Projects?

What are the best aspects of Environmental Action Projects? How can they be strengthened or expanded?

For help, check out the [Moving from Claims to Informed Action](#), [Choosing an Action Project](#), and [Environmental Action Planning](#) student worksheets and the Informed Action section of the [Environmental Literacy Model \(ELM\)](#) planning tool.

MWEE SUPPORTING PRACTICES

TEACHER FACILITATION

Evaluate the extent to which classroom teachers support student learning for the duration of the MWEE within all of the essential elements. Teachers balance roles of facilitation, direct instruction, and coaching to create an experience where the essential elements of the MWEE come together to support goals for learning and create opportunities for students to take active roles in the learning process.

	 MISSING MWEE COMPONENTS	 NEEDS IMPROVEMENT	 GREAT JOB!
Classroom teachers are involved in implementing each of the MWEE essential elements in the following ways (check one box per row):	<i>Classroom teachers are not involved in the implementation of this MWEE essential element.</i>	<i>Classroom teachers participate in the implementation of this MWEE essential element, but the majority of the facilitation and teaching is conducted by a partner.</i>	<i>Classroom teachers implement or co-implement this MWEE essential element. Partners may support or deliver specific activities or lessons, but classroom teachers are actively involved.</i>
Issue Definition			
Outdoor Field Experiences			
Synthesis and Conclusions			
Environmental Action Projects			

How will you incorporate missing MWEE components?

How will you improve Teacher Facilitation?

What are the best aspects of Teacher Facilitation? How can they be strengthened or expanded?

For help, check out the [Environmental Literacy Model \(ELM\)](#) planning tool and look for opportunities for classroom teachers to increase their level of engagement and facilitation.

LEARNING INTEGRATION

Evaluate the extent to which the MWEE is meaningfully embedded into the school curriculum to support goals for learning and student achievement. Keep in mind that the MWEE is not meant to be something extra, but rather a means of enriching lessons for deeper student learning while meeting academic standards.

	 MISSING MWEE COMPONENTS	 NEEDS IMPROVEMENT	 GREAT JOB!
The learning objectives (knowledge, skills, and attitudes) are clearly defined.	<i>Learning objectives are not present.</i>	<i>Learning objectives are present but there is no or little evidence that MWEE activities will affect the learning objectives.</i>	<i>Learning objectives are present and there is strong evidence that the MWEE clearly and explicitly supports the learning objectives.</i>
The MWEE clearly and explicitly supports academic standards and/or curriculum.	<i>Specific standards and/or curriculum are not identified.</i>	<i>Standards and/or curriculum are identified but there is no or little evidence of how the MWEE supports them.</i>	<i>There is evidence that the MWEE clearly and explicitly supports standards and/or curriculum.</i>
The MWEE connects learning across multiple disciplines or content areas.	<i>There is no attempt to connect the MWEE to multiple disciplines or content areas.</i>	<i>The MWEE connects to multiple disciplines or content areas, but only supports academic standards for one discipline or content area.</i>	<i>The MWEE supports academic standards in multiple disciplines or content areas. Teachers in other disciplines are included as appropriate.</i>

How will you incorporate missing MWEE components?

How will you improve Learning Integration?

What are the best aspects of Learning Integration? How can they be strengthened or expanded?

For help, check out the Curriculum Anchor section of the [Environmental Literacy Model \(ELM\)](#) planning tool.

SUSTAINED EXPERIENCE

Evaluate the extent to which the MWEE provides rich learning opportunities, where each essential element builds upon and reinforces the others and each lesson or experience is explicitly connected to the larger learning sequence of the MWEE.

	 MISSING MWEE COMPONENTS	 NEEDS IMPROVEMENT	 GREAT JOB!
The MWEE includes a variety of rich and connected learning opportunities.	<i>The MWEE does not contain multiple learning opportunities, or it includes multiple learning opportunities but there is no meaningful connection among these learning opportunities.</i>	<i>The MWEE includes multiple learning opportunities, but there are limited connections between these learning opportunities.</i>	<i>There is a clear arc of inquiry in the MWEE where all of the essential elements cohesively come together into multiple, connected learning opportunities.</i>
MWEE activities are sustained over time.	<i>MWEE activities occur over three or fewer class periods during one or two school days.</i>	<i>MWEE activities occur over four or five class periods during a week or two.</i>	<i>MWEE activities occur over a unit or multiple units and include a substantial amount of learning time.</i>

How will you incorporate missing MWEE components?

.....

How will you improve Sustained Experience?

What are the best aspects of Sustained Experience? How can they be strengthened or expanded?

For help, check out the Curriculum Anchor section of the [Environmental Literacy Model \(ELM\)](#) planning tool.

LOCAL CONTEXT

Evaluate the extent to which the MWEE uses the local environment and community as a context for learning that is relevant to students’ lives. The MWEE is situated within local contexts (e.g., students’ school, neighborhood, or community). Local resources (e.g., partners, expertise, field sites) should be incorporated. Emphasizing local contexts enables students and teachers to develop stronger connections to, and appreciation for, their local environments and communities.

	 MISSING MWEE COMPONENTS	 NEEDS IMPROVEMENT	 GREAT JOB!
The MWEE is centered on a local issue, problem, or phenomenon that is directly connected to the lives of the students.	<i>There is no local relevance.</i>	<i>A local issue is explored, but does not directly connect to the students’ lives.</i>	<i>A local issue is explored and directly connects to the students’ lives.</i>
The MWEE provides opportunities to explore the impacts of locally relevant (e.g., school, neighborhood, or community) environmental and social issues.	<i>Students are not exploring their local school, neighborhood, or community.</i>	<i>Students are exploring their local school, neighborhood, or community, but this is not directly, or is only peripherally, related to investigating the issue.</i>	<i>Students are exploring their local school, neighborhood, or community and it is directly related to investigating the issue.</i>
The MWEE incorporates local resources (e.g., partners, expertise, field sites).	<i>No local resources are incorporated into the MWEE.</i>	<i>Local resources are minimally incorporated into the MWEE.</i>	<i>Multiple local resources are incorporated throughout the MWEE to provide continuous and intentional connections to the community.</i>

How will you incorporate missing MWEE components?

How will you improve Local Context?

What are the best aspects of Local Context? How can they be strengthened or expanded?

For help, check out the Incorporating [Outdoor Field Experiences](#) planning tool and the [Environmental Literacy Model \(ELM\)](#) planning tool and look for opportunities to incorporate local resources.

REFERENCES

Resources that support the work outlined in this guide can be found on this webpage:

noaa.gov/office-education/bwet/resources/mwee-resources

ACKNOWLEDGMENTS

The authors would like to thank everyone who gave their time, attention, and expertise to reviewing and commenting on various iterations of the MWE Guide. This guide builds off of *An Educator’s Guide to the Meaningful Watershed Educational Experience (MWE)* published by the Chesapeake Bay Program in 2017 and revised in 2019. The Chesapeake Bay Program guide was developed to encourage teacher-supported MWEs in elementary, middle, and high school in support of the Environmental Literacy Goal of the 2014 Chesapeake Bay Watershed Agreement. Contributors to this guide included representatives from the NOAA Chesapeake Bay Office, the Chesapeake Bay Foundation, the Chesapeake Bay Trust, the Chesapeake Research Consortium, and the many organizations and individuals who participate in the Chesapeake Bay Program Education Workgroup:

chesapeakebay.net/who/group/education_workgroup.



The Environmental Literacy Model (ELM) was developed by the Chesapeake Bay Foundation through the Maryland Environmental Literacy Partnership and has been updated in partnership with the Chesapeake Bay Program for use with MWEs.



Students from West Seneca Christian School, New York collect water quality data in Buffalo Creek during the annual “Day in the Life of the Niagara River/Lake Erie Watershed” as a part of the Reinstein Woods B-WET project. (Orlando Buria)



**AN EDUCATOR'S
GUIDE TO THE MWEE**

**STUDENT
WORKSHEETS
TOOLBOX**



APPENDIX

STUDENT WORKSHEETS TOOLBOX

Asking Questions and Planning Investigations Worksheet

This worksheet will help students connect the dots between the driving question, the supporting questions (*what do we want to know?*), and the investigations (*how can we investigate it?*). Engaging students in developing questions is one way of incorporating student voice from the outset of the MWEE. This worksheet can be used to explore opportunities both in the classroom and in the field. If your field experience location is already set or you have limitations on where it could occur, it may be helpful to describe these locations (habitats, resources, tools available, etc.) to your students to help them think about questions they could explore while outside the classroom.

Claim, Evidence, Reasoning Worksheet

This worksheet helps students make a claim about the issue, problem, or phenomenon they explored during Issue Investigation. This claim will be used to inform Environmental Action Projects.

Students should start the worksheet by restating the question they investigated — this could be the MWEE driving question or a supporting question.

The claim should be a one-sentence response to the question that shares what they can conclude, given their evidence, and describes the relationship between dependent and independent variables. The evidence is the scientific data gathered by students that supports the claim. Students should include enough evidence to support their claim and only include the relevant evidence, which could be qualitative, quantitative, or both. The reasoning connects the claim and the evidence. The reasoning should show how and why the included data counts as evidence and why it is needed to support the claim.

Moving from Claims to Informed Action Worksheet

This worksheet helps students brainstorm different Environmental Action Project options for addressing the driving question explored in the MWEE. Remember that environmental action comes in many shapes and forms, including restoration and protection, everyday choices, community engagement, and civic engagement.

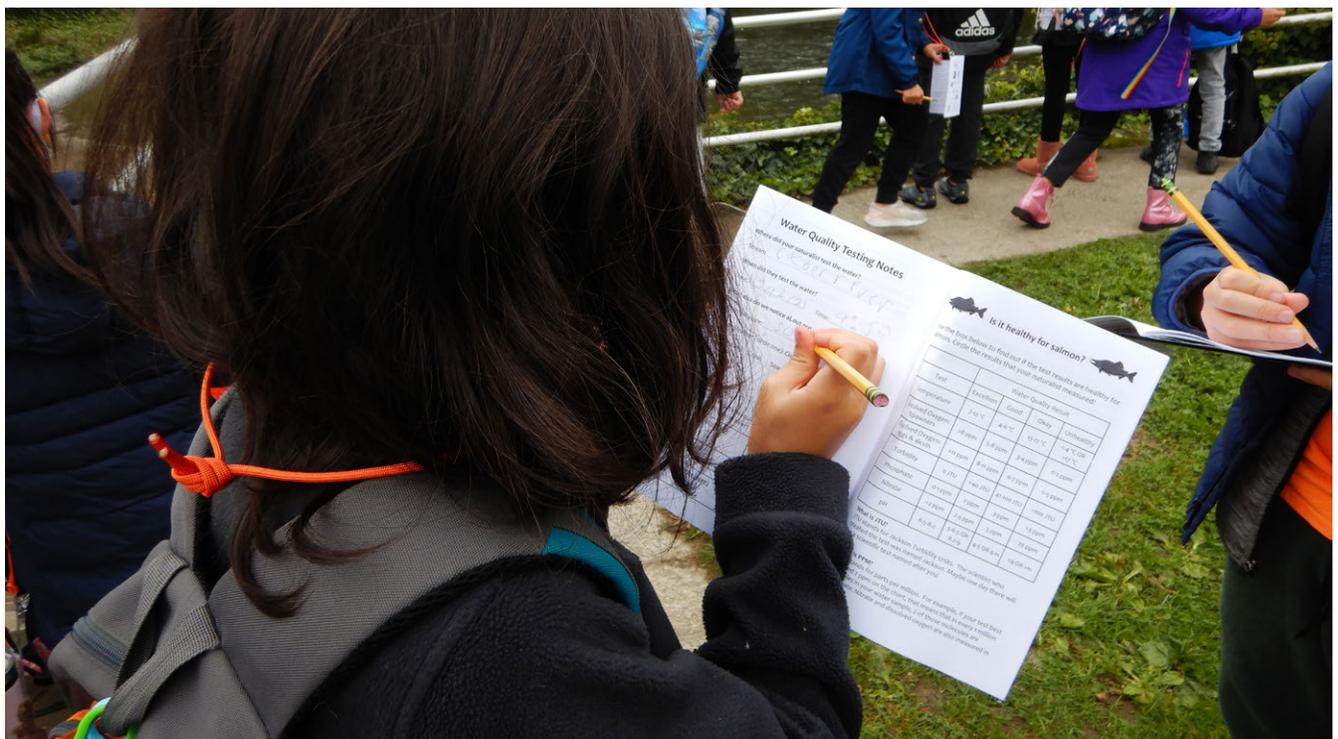
To learn how to move from action project brainstorming to selecting a project, check out the Explainer for Choosing an Action Project worksheet on page 63.

Choosing an Action Project Worksheet

This worksheet is one method you can use to guide students in selecting a single action project. It should be completed by a group or classroom. Participants use student-created action project ideas and criteria to score and select an action project to implement. This worksheet was adapted from a resource from EarthForce. More information about their tools and process can be found at: earthforceresources.org. For a more detailed explanation on how you can use this worksheet, check out the Explainer for Choosing an Action Project worksheet.

Environmental Action Planning Worksheets

This set of worksheets can be used to plan and implement an Environmental Action Project. There are five total worksheets that cover the following topics: contacts and requests for help, tasks, budget, and maintenance. Use the worksheets that make sense for your students' action project and/or assign different pages to small groups or individuals to complete. These worksheets were adapted from a resource from ShoreRivers in Easton, Maryland.



A fourth grader tests Cedar River's water quality in King County, Washington, to determine if it is healthy for salmon and captures notes in a field journal. (Kelly Steffen)



ASKING QUESTIONS AND PLANNING INVESTIGATIONS

Name: _____ Class: _____

Driving question:

.....

What do we want to know?	How can we investigate it?	Where can we investigate it?



CLAIM, EVIDENCE, REASONING

Name: _____ Class: _____

What question did you investigate?
.....

Claim: Make a statement that addresses the question above. Your claim must be supported by the evidence you list below.
.....

Evidence: What data (background research, observations, collected data) supports your claim? Only list the data that directly relates to your claim.
.....

Reasoning: How does your evidence allow you to make this claim? How are they connected?
.....



MOVING FROM CLAIMS TO INFORMED ACTION

Name: _____ Class: _____

Claim

Question	Solution #1	Solution #2	Solution #3
What action could be taken to address the environmental issue?			
How would this action help to address the issue?			
What resources would you need to make it happen?			

EXPLAINER FOR CHOOSING AN ACTION PROJECT WORKSHEET

You can support students in brainstorming action project ideas and then choosing a single project to carry out as a class or small group in many different ways. This explainer describes one way of how you might bridge the use of the Moving from Claims to Informed Action worksheet with the Choosing an Action Project worksheet. Adapt and create alternatives that meet your class needs.

1. Using the Moving from Claims to informed Action worksheet provides space for students to brainstorm possible solutions to their environmental issue. The prompts on the left-most column can be helpful in fleshing out concepts. This can be done individually or in pairs, and ideally students come up with at least three distinct ideas. Encourage your students to use divergent thinking to generate creative solutions.
2. Organize students into five small groups to discuss and debate their ideas. The focus is now on convergent thinking. Task them with developing a single idea they would want to carry out in order to take action on the issue. By the end, they should have a succinct one-sentence description of their action project idea.
3. Using the Choosing an Action Project worksheet, each of the five groups will briefly pitch their idea to the whole class. Add each idea into one of the boxes in the top column of the grid.
4. introduce the concept of criteria, or “standards on which decisions are based.” in order to make a decision about which project to move forward with, the class will use criteria to narrow down the options and arrive at a final selection. it can help for there to be teacher-created criteria as well as student-created criteria. Examples of teacher-created criteria may include restrictions around timing (e.g., the project must be completed in two class periods) or funding (e.g., the project must cost less than \$50). Encourage students to think about what they value most when they create criteria. Examples of student-created criteria may be around impact (e.g., will this make substantial change in our community) or interest (e.g., will this project be fun to work on). Add the criteria into the boxes in the left-most column of the grid.
5. Finally, engage the class in voting on the action project ideas listed at the top against the criteria that were written along the side. This can be done as a large class discussion or students can vote individually by placing dot stickers or check marks in the appropriate boxes. Tally the results. One strategy may stand out as the clear winner. if one does not emerge naturally, students may need to establish additional criteria or use a different kind of voting technique to come to consensus. Or perhaps, students can brainstorm a way to merge the ideas and execute aspects of both.



CHOOSING AN ACTION PROJECT

Group/Class: _____

ACTION PROJECT IDEAS	Idea #1	Idea #2	Idea #3	Idea #4	Idea #5
Criterion #1					
Criterion #2					
Criterion #3					



ENVIRONMENTAL ACTION PLANNING WORKSHEET

ASKING FOR HELP: LISTING CONTACTS

Name: _____ Class: _____

Who can help you make your action project a success? You may need to ask for permission to do something, find an expert to help with a specific task, or recruit volunteers from your community or school to help make your project a reality.

Use this first page to list all the people or groups you should contact about your action project. Then use the second page to draft your requests for help. You'll complete the second page for each person or group, so make sure to make enough blank copies before filling in the questions.

	Person/Group	Why do you need their help? (Are you asking for permission? To borrow equipment? For their time and expertise?) Be as specific as possible.
1		
2		
3		
4		
5		



ENVIRONMENTAL ACTION PLANNING WORKSHEET

ASKING FOR HELP: *DRAFTING A REQUEST*

Name: _____ Class: _____

Use this page to draft your request for help. Complete this page for each person or group you plan to contact so you can personalize their message and be specific about what you need from them.

Person or Group: _____

Tell them about your action project. What problem or issue will it address? Make this personal and connect their values to this action project—**why should they want to help?**

What else can you share to get them interested and motivated to help? Think about pictures, videos, news stories, etc., that would connect to their values.



ENVIRONMENTAL ACTION PLANNING WORKSHEET

ASKING FOR HELP: *DRAFTING A REQUEST, CONTINUED*

Why do you need their help? Start with the ideas you wrote on the Listing Contacts page and expand with more detail; be specific.

What are the logistics? Do you need help on a specific day or do you need them to complete something by a date? If they are helping on site, tell them the exact times you would need help and how they should dress. If they are loaning you equipment or signing a permission slip, tell them when and how to deliver these items.

What is the best way for this person or group to communicate with you (email, phone number, letter, etc.)?



ENVIRONMENTAL ACTION PLANNING WORKSHEET

TASK MANAGEMENT

Name: _____ Class: _____

List out the major tasks, in order, that need to happen to complete your action project. Start with the planning and go through completion. Decide when each task needs to be completed for the project to keep moving forward. Assign one or two people to each task. The Task Manager(s) is in charge of making sure their assigned task has happened by the completion date and for sharing updates back to the group or class.

Task	Completion Date	Task Manager(s)



ENVIRONMENTAL ACTION PLANNING WORKSHEET

BUDGET

Name: _____ Class: _____

What is your budget? Do you need to raise money or look for donations? List all the supplies and equipment you will need to complete your action project.

Item	How many?	Total Cost	Will this item be bought, donated, or borrowed? From whom/where?



ENVIRONMENTAL ACTION PLANNING WORKSHEET

MAINTENANCE

Name: _____ Class: _____

Many action projects are not one-and-done deals—they require someone to take care of them for years to come. Use the maintenance table to plan out what needs to happen for the next couple years to keep this project a success. Add additional pages of detailed task instructions or contact information if needed.

Maintenance Manager: Who will be in charge of this maintenance schedule? Make plans for at least the first year of maintenance. Will it be a student (one of you?), a teacher/staff, a class, or a club?

Maintenance Task	How often? <i>(weekly, monthly, seasonal, etc.)</i>

NOTES



**An Educator's Guide to the Meaningful
Watershed Educational Experience (MWEE)**