Environmental Literacy Model

Title	Water Quality Investigations
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School, District	High Schools in Allegany County Public Schools
Audience (grade, course)	Earth & Space Science (general and honors)

Defining the Learning Objectives and Curriculum Connection

Curriculum indicators, performance expectations, and/or learning objectives.

NGSS

HS-ESS2-5: Plan and conduct an investigation of the properties of water its effects on Earth materials and surface processes.

HS-ESS3-4: Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

MD E. Lit. Standards

STANDARD 1 ENVIRONMENTAL ISSUES : The student will investigate and analyze environmental issues ranging from local to global perspectives and develop and implement a local action project that protects, sustains, or enhances the natural environment.

STANDARD 5 HUMANS AND NATURAL RESOURCES:
The student will use concepts from chemistry, physics, biology, and ecology to analyze and interpret both positive and
negative impacts of human activities on earth's natural systems and resources.

Reading Informational Text Standards

RI.9-10.3: Analyze how the author unfolds an analysis or series of ideas or events, including the order in which the points are made, how they are introduced and developed, and the connections that are drawn between them.

Writing Standards

W.9-10.6: Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.

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Students will understand that:

- Some land uses have a negative impact on stream water quality by changing the physical and chemical composition. Other land uses have a positive impact by absorbing physical and chemical compositions.
- Water runoff of pollutants, weathering, erosion, sedimentation, and deposition are major issues of the watershed quality and affect the health of watersheds.

Students will know that …

- The land use affects sediment transportation, deposition, erosion, water movement, and weathering.
- Mining, agriculture, industrial, transportation, construction, infrastructure, sewage water

management, and impervious surfaces, have a negative impact on water quality.

- Levels in the water and soil; pH, nitrate, phosphorus, potassium, dissolved oxygen, turbidity, etc. are indicators of pollutants
- Native vegetation; wetlands, riparian buffers, rain gardens, etc. improve water quality and mitigate human impacts.

Students will be able to …

- Plan and investigate the properties of water and its effects on Earth materials and surface processes
- Collect and record measurements or indications of the predicted effect of a property of water on Earth's materials or surface.

Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

Describing the Local Context

The life-relevant issue that will serve as the context for learning.

Evergreen Heritage Center- location at EHC spring, pond
Stream near schoolyard-
Fort Hill- Evitts Creek
Allegany- (stream behind parking lot)
Mt. Ridge- (along rt. 936 head waters of Georges Creek)

Note: All schools will attend the field experience at EHC, and complete one school yard field study (teacher and students may choose another water source. Listed are examples for each high school)
collecting water and soil samples before and after mitigation.

Identifying the Driving Question

A broad, open-ended, life-relevant question that is based on the standards/learning objectives. Guides inquiry for the investigation(s), prompts the development of actionable claims.

How do we mitigate the impact human activities have on water quality?

Issue Investigation

Asking Questions, Defining Issues and Problems

Students define the issue, problem, or phenomenon to be investigated and develop supporting questions that are relevant for investigation.

Issue Investigation 1	Issue Investigation 2	Issue Investigation 3
What is causing the water quality in the Chesapeake Bay Watershed to decline?	What do humans do that potentially impact the water quality in a negative way?	How can we mitigate these negative impacts in a natural way?

Planning and Conducting Investigations

Students plan and conduct investigations and classroom activities (indoor and outdoor) that actively address students' supporting questions. Students collect data that will be used to inform actionable claims.

Issue Investigation 1	Issue Investigation 2	Issue Investigation 3
Research the decline of the Bay water quality using the State of the Bay Report and other resources. Complete lessons to support prior knowledge and extend into further understating of the topic. Lesson 1: State of the Bay Report - (45-65 minutes) at School Site State of the Bay Lesson Plan State of the Bay Student Sheet	Learn how the land is being used currently and historically in our area and resource how that contributes to the water quality. Lesson 2-5: **These lessons will be completed at Evergreen** Pre/ Post test EHC activity- Land Use-Walk About Investigate anthropogenic sources that may contribute to negative water quality (observe personally and electronically with maps). How do we measure water quality? How does vegetation impact watershed? How do bioretention areas impact watershed? 2. Land Use- Sum of the Parts (River front property Activity) 3. Design your own experiment (module after BTW) - Impact of fertilizers on water- at EHS and School Site 4. Water Runoff different surfaces- (Runoff Race)	Research ways farmers, real estate developers, public works mitigate for water quality. Research the ways EPA requires public use property (public schools) to improve grounds to improve water quality.

Issue Investigation con't.

Analyzing and Interpreting Data

Students analyze data through graphs, models, and other methods to reveal patterns and relationships. Students synthesize and apply evidence from their investigations to draw conclusions that address the supporting questions.

Issue Investigation 1	Issue Investigation 2	Issue Investigation 3
Lesson 6: Map Activity Teacher Sheet the Chesapeake Watershed (45 minutes) Map Activity Student Sheet Map of the Chesapeake Bay Watershed Option Lesson: Mapping activity from EHC	5. Complete field report including water testing (Q-value) at **EHC** • Water testing • All 3 site results • Class Totals and Questions **School site documents-** *(Teacher would need to collect water sample for this to be done in one class pd.)* • Water testing • Site results • Class Totals and Questions	Lesson 7: Weathering, Erosion, and Deposition Activity, Post-Questions, and Warm-up Questions (45-65 minutes) Lesson 8: Groundwater Infiltration Lab Activity (45- 65 minutes) Lesson 9: Stream Conditions-Action Plan (45 minutes) Stream Conditions-Action Plan Cards & Chart • Identify possible/ likely sources of pollution or stresses in the schoolyard. • Identify potential solutions for these sources. Predict how schoolyard mitigation will impact water quality- See School Site Documents Above

Constructing and Communicating a Claim

Students draw on the conclusions from their investigations to make a claim about the driving question and communicate these evidence-based claims to internal and/or external audiences.

Issue Investigation 1	Issue Investigation 2	Issue Investigation 3
Explore EHC site and the water sources. Navigate to the closest water source near school yard. - See Field Report Lesson Plan above	Student's created video collaborative platform https://padlet.com/ google classroom discussions prezi or Google PowerPoint	After field experiences and school site lessons (1-9), propose ways to mitigate water quality using collaborative platform and/or google classroom discussions. Lesson 10: Collaboration/ Report/Presentation Rubric (Brainstorm, create presentation, present in class; total of (3) 45 minute class periods)

Environmental Literacy Model

Stewardship and Civic Action

Identifying Solutions

Students identify and explore solutions that directly address the problem, challenge, or opportunity reflected in their claim.Students use decision making processes to identify the solution(s) to implement.

Students come to a consensus on the best way, for their site location, to mitigate the water quality (e.g. bioretention ponds/ riparian buffers, rain gardens, adding plants) based off the example at the control site (Evergreen Heritage Center).

Designing a Plan and Taking Informed Action

Students design a plan for implementing solutions through informed action in their classrooms, schools, and/or communities. The plans should include criteria for determining the extent to which the action successfully addresses the problem, challenge, or opportunity reflected in the claim. Students implement their plans.

Students will discuss their results with each other at their site AND with the other high schools. Possibly through an online (google) discussion board, classroom.

Students will design the bioretention plan for their site and present through video presentation to each other at their site AND to other high schools.

Students at each high school will share their presentations (webinar) and can invite county officials, school board, etc. to share with the community.

Each level of presenting can be an opportunity for the students to discuss and vote on the best suited plan for their site, and defend it at the community or school board meeting.

Evaluating Action

Students reflect on the action and determine the extent to which it successfully addresses the problem, challenge, or opportunity reflected in the claim. Students communicate their findings and share proposals for sustaining or extending the action.

Performance Tasks

In a Water Quality Investigations Video Presentation (See Lesson 10 for rubric), students will identify how human activities within their school sites and the surrounding Allegany County landscapes impact water quality and recommend a remediation plan for their school site locations.

Other Evidence

Students will be evaluated through answering questions about runoff, erosion, sediment deposition, and water quality. Students will also be evaluated through presentation and summarize what they have learned.