# Numeracy Opportunities in Water Quality PBL (Grades K-12)

Regardless of grade level, students working with numeracy opportunities and demands will also be engaging in some/many of the guiding principles and standards for mathematical practices.

### • Guiding Principles:

- o A clear and effective communicator
- A self-directed and lifelong learner
- A creative and practical problem solver
- o A responsible and involved citizen
- o An integrative and informed thinker

#### • Standards for Mathematical Practice:

- Make sense of problems and persevere in solving them
- Reason abstractly and quantitatively
- Construct viable arguments and critique the reasoning of others
- Model with mathematics
- Use appropriate tools strategically
- Attend to precision
- Look for and make use of structure
- o Look for and express regularity in repeated reasoning

The following pages will provide you with information regarding naturally occurring numeracy opportunities focused on plastic pollution:

- Childhood (K-5)
- Early Adolescence (6-8)
- Adolescence (9-diploma)
- Possible guiding questions

# Childhood (K-5)

#### **Math Focus Strands:**

### Quantitative Reasoning:

- Measurements and Units:: Use appropriate measurement tools (e.g., test kits, sensors) to collect data.
- Measure the temperature from different water sources, and in the case of ponds or lakes, from various depths.
- Using student-built water filters, measure the flow rate through the filter based on the materials.
- Using a daily water quality log to document clarity, pH, temp, salinity, dissolved oxygen, etc., for a period of time.
- Estimate and calculate water use for daily activities (washing hands, brushing teeth, cooking, etc.)

### • Algebraic Reasoning:

#### Operations and Algebraic Thinking:

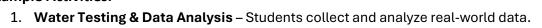
- Sorting water samples by specific characteristics (clarity, temp, pH, etc.)
- Build a water filter and look for patterns and relationships based on the materials used in each layer.
- Look for patterns and relationships between the locations where water samples are collected and the variables present at each site.
- Use the above patterns and relationships to make predictions
- Use data collected on water use for daily activities to calculate the amount used over a set period of time (week, month, year).
- Students track water quality over a period of time to look for patterns and predict changes due to climate events

#### Statistical Reasoning:

#### Measurement & Data:

- Represent data from water use, water samples, filter experimentation, and water quality with charts and/or graphs
- Survey students on their daily water use and represent the findings graphically.
- Collect and analyze rainwater. Record results over time to look for patterns based on seasons and make predictions.
- Collect data on the effects of single-source pollution (for instance, fertilizer causing algae blooms)
- Students collect and analyze data from multiple water sources (tap, stream, river, lake, above a dam, below a dam, bottled water, ect) and show results graphically. Use the results to make predictions.

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# **Early Adolescence (6-8)**

#### Math Focus Areas:

- Quantitative Reasoning:
  - Measurements and Units:
    - Use appropriate measurement tools (e.g., test kits, sensors) to collect data.
    - Convert between different units (ppm, mg/L, mL, liters, etc.).
    - Understand scale, precision, and estimation when measuring.
  - Rates & Ratios:
    - Calculate water flow rates in rivers and streams.
    - Analyze ratios of pollutants to safe drinking standards.
    - Compare concentration levels between different test sites.
- Algebraic Reasoning:

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- Geometric Reasoning:
  - Geometry
- Statistical Reasoning:
  - Statistics and Probability:
    - Record, organize, and analyze data using tables, graphs, and statistical measures.

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### **Example Activities:**

- 1. **Budgeting for Solutions** Students calculate the costs of various water filtration options.
- 2. **Community Presentation** Students use data visualization and argumentation to advocate for local water policies..

# Adolescence (9-diploma)

#### Math Focus Areas:

#### Algebraic Reasoning:

- o Model relationships between pollution levels and human activity.
- o Predict changes in water quality over time using linear and exponential functions.
- o Create equations to represent trends in water contamination.

#### • Statistical Reasoning:

- Data Collection and Analysis: Conduct water testing (pH, dissolved oxygen, turbidity, nitrates, etc.).; Record, organize, and analyze data using tables, graphs, and statistical measures.
- Analyze probability of contamination events based on environmental and human factors.
- o Create statistical models to determine risk factors for water pollution.
- o Interpret trends using mean, median, mode, and standard deviation.

#### Geometric Reasoning:

- Map watershed areas using GIS or hand-drawn maps.
- o Calculate surface area and volume of water bodies.
- Model the effects of runoff and erosion on landscapes.

### • Financial & Economic Literacy:

- O Calculate costs of water filtration, conservation efforts, or cleanup projects.
- o Assess the economic impact of water pollution on local communities.
- o Compare costs and benefits of sustainable water management solutions.

#### **Example Activities:**

- 1. **Trend Modeling** Students apply algebra and statistics to predict water quality changes.
- 2. **Community Presentation** Students use data visualization and argumentation to advocate for local water policies.

### **Alignment with Maine Solutionaries Framework**

- **Systems Thinking** Understanding the interplay between human activities, environmental policies, and water quality.
- **Critical Thinking & Problem-Solving** Evaluating sources of pollution and designing mitigation strategies.
- **Collaboration & Civic Engagement** Partnering with community organizations, government agencies, and scientists.
- **Innovation & Advocacy** Proposing data-driven solutions for water conservation and pollution prevention.

### Some guiding questions about water quality

Note: these questions might be good for all of the age ranges but might be answered differently by them.

- 1. How can we measure it?
- 2. What are some of the different issues pertaining to water quality?
- 3. Are water quality issues more local or more global?
- 4. What are some of the things that have been to address water quality concerns in the past? Are those measures still in place?