MICHIGAN'S K-12 SCIENCE CONTENT STANDARDS: CORRELATED TO THE ROUGE EDUCATION PROJECT

The following document contains a list of content standards and performance expectations from Michigan's K-12 Science Content Standards that correlate to the Rouge Education Project's K-12 water quality monitoring program.

According to the dictionary, a standard is "something considered by an authority or by general consent as a basis of comparison." Today's world is replete with standards documents such as standards of care, standards of quality, and even standard operating procedures. These various sets of standards serve to outline agreed-upon expectations, rules, or actions, which guide practice and provide a platform for evaluating or comparing these practices.

One such set of standards is the academic standards that a governing body may have for the expected outcomes of students. In Michigan, these standards, are used to outline learning expectations for Michigan's students, and are intended to guide local curriculum development and assessment of student progress. The Michigan Science Standards are performance expectations for students. They are not curriculum and they do not specify classroom instruction. Standards should be used by schools as a framework for curriculum development with the curriculum itself prescribing instructional resources, methods, progressions, and additional knowledge valued by the local community. Since Michigan is a "local control" state, local school districts and public school academies can use these standards in this manner to make decisions about curriculum, instruction, and assessment.

At the state level, these standards provide a platform for state assessments, which are used to measure how well schools are providing opportunities for all students to learn the content outlined by the standards. The standards also impact other statewide policies, such as considerations for teacher certification and credentials, school improvement, and accountability, to name a few. (Michigan K-12 Standards – Science – November, 2015)

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Please note that while science may be the most natural fit for the Rouge Education Project, it also fits well with standards for other subjects as well.
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Contents

Kindergarten Science

Interdependent Relationships in Ecosystems: Animals, Plants and Their Environment

K-LS1-1	Use observations to describe patterns of what plants and animals (including humans) need to survive.
K-ESS2-2	Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs.
K-ESS3-1	Use a model to represent the relationship between the needs of different plants and animals (including humans) and the places they live.
K-ESS3-3	Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment.

Weather & Climate

K-PS3-1	Make observations to determine the effect of sunlight on Earth's surface.
K-PS3-2	Use tools and materials to design and build a structure that will reduce the warming effect of sunlight on an area.
K-ESS2-1	Use and share observations of local weather conditions to describe patterns over time.
K-ESS3-2	Ask questions to obtain information about the purpose of weather forecasting to prepare for, and respond to, severe weather.

Engineering Design

K-2-ETS1-1	Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
K-2-ETS1-2	Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
K-2-ETS1-3	Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

1st Grade Science

Structure, Function, and Information Processing

1-LS1-1	Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.
1-LS1-2	Read texts and use media to determine patterns in behavior of parents and offspring that help offspring survive.

Engineering Design

K-2-ETS1-1	Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
K-2-ETS1-2	Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
K-2-ETS1-3	Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

2nd Grade Science

Interdependent Relationships in Ecosystems

2-LS4-1	Make observations of plants and animals to compare the diversity of life in different habitats.

Earths Systems: Processes that Shape the Earth

2-ESS1-1	Use information from several sources to provide evidence that Earth events can occur quickly or slowly.
2-ESS2-1	Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.
2-ESS2-2	Develop a model to represent the state of Michigan and the Great Lakes, or a more local land area and water body.
2-ESS2-3	Obtain information to identify where fresh water is found on Earth, including the Great Lakes and Great Lakes Basin.

Engineering Design

K-2-ETS1-1	Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
K-2-ETS1-2	Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
K-2-ETS1-3	Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

3rd Grade Science

Interdependent Relationships in Ecosystems: Environmental Impacts on Organisms

3-LS2-1	Construct an argument that some animals form groups that help members survive.
3-LS4-3	Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.
3-LS4-4	Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.

Weather & Climate

3-ESS2-1	Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.
3-ESS2-2	Obtain and combine information to describe climates in different regions of the world.
3-ESS3-1	Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.

Engineering Design

3-5-ETS1-1	Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
3-5-ETS1-2	Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
3-5-ETS1-3	Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

4th Grade Science

Earth's Systems: Processes that Shape the Earth

4-ESS2-1	Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.
4-ESS2-2	Analyze and interpret data from maps to describe patterns of Earth's features.
4-ESS3-2	Generate and compare multiple solutions to reduce the impacts of natural Earth processes on Michigan's people and places.

Engineering Design

3-5-ETS1-1	Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
3-5-ETS1-2	Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
3-5-ETS1-3	Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

5th Grade Science

Structure and Properties of Matter

5-PS1-1 Develop a model to describe that matter is made of particles too small to be seen.

5-PS1-4 Conduct an investigation, to determine whether the mixing of two or more substances results in new substances.

Matter & Energy in Organisms & Ecosystems

5-PS3-1. Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.

5-LS1-1. Support an argument that plants get the materials they need for growth chiefly from air and water. [Clarification Statement: Emphasis is on the idea that plant matter comes mostly from air and water, not from the soil.]

5-LS2-1. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

Earth's Systems

5-ESS2-1. Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact in Michigan and the Great Lakes basin.

5-ESS2-2. Describe and graph the amounts and percentages of water and fresh water in the Great Lakes to provide evidence about the distribution of water on Earth.

5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

Engineering Design

3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

6th – 8th Grade Science

Ecosystems: Interactions, Energy, and Dynamics

MS-LS2- 1 Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

MS-LS2- 2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

MS-LS2- 3 Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

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

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

Earth's Place in the Universe

MS-ESS1- 4 Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.

Earth & Human Activity

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

MS-ESS3- 2 Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.

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

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

MS-ESS3- 5 Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

Earth's Systems

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

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

MS-ESS2- 3 Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.

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

MS-ESS2- 5 Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions in Michigan due to the Great Lakes and regional geography.

MS-ESS2- 6 Collect data to provide evidence for how the motions and complex interactions of air masses

results in changes in weather conditions in Michigan due to the Great Lakes and regional geography.

Engineering Design

MS-ETS1- 1	Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account, relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
MS-ETS1- 2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
MS-ETS1- 3	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
MS-ETS1- 4	Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

9th – 12th Grade High School Science

Relationships in Ecosystems

HS-LS2- 1	Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
HS-LS2- 2	Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
HS-LS2- 6	Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions but changing conditions may result in a new ecosystem.
HS-LS2- 7	Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
HS-LS2- 8	Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.
HS-LS4- 6	Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.

Earth's Systems

HS-ESS2- 2	Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.
HS-ESS2- 3	Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.
HS-ESS2- 5	Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
HS-ESS2- 6	Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.
HS-ESS2- 7	Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.

Weather & Climate

HS-ESS2- 4	Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.
HS-ESS3- 5	Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.

Human Sustainability

HS-ESS3- 1	Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
HS-ESS3- 2	Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.
HS-ESS3- 3	Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.

HS-ESS3- 4	Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
HS-ESS3- 6	Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

Engineering Design

HS-ETS1- 1	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
HS-ETS1- 2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
HS-ETS1- 3	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.
HS-ETS1- 4	Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.