Alignment of proposed 5th grade activities at BBR to Science EALRs

Science GLEs, p. 12 – "In third grade, students begin to explore more complex systems and make **inferences** about their **observations**. Students are **developing an understanding of systems** and are able to identify individual parts and how they work together. In order to understand how **connections** between the parts interact, students begin to manipulate one part and look for a change in the system."

"In fourth grade, students use their developing investigative skills to begin to **compare systems**. They examine **cause and effect** and ask **what is a fact and what is an opinion**. They are primarily **exploring more complex systems in a more complex manner**, such as the changes of earth systems over time.

"In fifth grade, students become more sophisticated in their analysis of the **interconnections** within systems. When investigating, students **use data to support their conclusions** and logical arguments. They begin to determine factors that contribute to **scientific bias**."

Essential Questions

3rd Grade—How do we use our understanding of **patterns and connections** (interdependence) to describe systems in our natural world?

4th Grade—How do we investigate **cause and effect** in the earth system over time?

5th Grade—How does our investigative process lead to new questions about the **flow of matter and energy** within a system?

Recurring Themes

Weather/Climate/Climate Change
- C—climate & weather
- W—water cycle & snow characteristics
- P—photosynthesis, respiration, carbon & nitrogen cycles

Landforms & Watersheds
- L—land planning & dams
- O—orienteering & mapping
- R—river/stream/pond & soil components

Energy Transfer and Matter Cycling
- P—photosynthesis, respiration, carbon & nitrogen cycles
- W—water cycle & snow characteristics

Snow Science
- S—winter safety & survival
- W—water cycle & snow characteristics

Environmental Tolerance and Adaptations
- A—animal tracking
- K—dichotomous keys & classification (evergreens, beetles)
- T—environmental tolerance

Key to proposed activities & concepts:

A—animal tracking
C—climate & weather
D—digital cameras
K—dichotomous keys & classification (evergreens, beetles)
L—land planning & dams
O—orienteering & mapping
P—photosynthesis, respiration, carbon & nitrogen cycles
R—river/stream/pond & soil components
S—winter safety & survival
T—environmental tolerance
W—water cycle & snow characteristics
X—XC skiing & snowshoeing

"Big ideas" in environmental science within the GLEs below are in boldface type.

GLEs—*bullets are often paraphrased*

EALR 1—Systems: The student knows and applies scientific concepts and principles to understand the properties, structures, and changes in physical, earth/space, and living systems.

Component 1.1—Properties

1.1.1 Understand how to use properties to sort natural . . . materials
- Use physical properties (e.g. temperature, foot characteristics) to classify
- Identify and describe the state of water as solid, liquid, or gas in different situations (e.g. water vapor, liquid water, ice)

A, C, K, P, W

1.1.2 Understand the relative position and motion of objects
- Measure and describe the position of one object relative to another using positional language and a distance scale (e.g. "2 km north")
- Describe the motion of an object in terms of distance, time, and direction as the object moves in a straight line (e.g. measuring stream flow—meters per seconds)

L, O, X

1.1.4 Understand that energy comes in many forms
- Describe the forms of energy present in a system (e.g. heat, light, chemical, sound)

C, L, P, T, W

1.1.5 Understand physical properties of Earth materials

- Describe and sort soils based on physical properties (e.g. particle size, ability to retain water, mineral types)
- Describe the forms water takes on Earth (e.g. fog, clouds, dew, rain, snow)
- Describe the common conditions or properties of air (e.g. % of oxygen, water, carbon dioxide, warm, cold, moist)

C, P, R, S, W

1.1.6 Understand how to distinguish living from nonliving and how to use characteristics to sort common organisms into plant and animal groups

- Describe the characteristics of organisms (e.g. foot shape, type of locomotion)
- Describe and sort organisms using multiple characteristics (e.g. hibernation vs. migration, producers vs. consumers)
- Classify and sort common organisms into plant and animal groups (deciduous vs. evergreen, pines vs. firs vs. cedars, cats vs. dogs vs. weasels)

A, D, K, T, X

Component 1.2—Structures

1.2.1 Analyze how the parts of a system go together and how these parts depend on each other

- Identify the parts of a system and their functions (e.g. producer, consumer, decomposer, habitat, niche)
- Explain how one part of a system depends upon the other parts of the same system (e.g. animals depend on plants for energy)
- Predict/explain how a system would work without one of its parts (e.g. what if there were no decomposers?)
- Describe inputs and outputs of a system (e.g. food to scat)
- Describe the effect on a system when an input is changed (e.g. how does a smaller snowpack affect agriculture?)

A, C, D, K, L, O, P, R, S, T, W, X (all)

1.2.2 Understand that energy can be transferred from one object to another and can be transformed from one form of energy to another

- Identify when a system has the greatest or least amount of energy (e.g. food pyramids)
- Describe transfers of energy (e.g. solar to chemical to heat in ecosystems)
- Identify sources of energy in systems (e.g. sun in photosynthesis, food energy in respiration)
- Describe transformations of energy (e.g. solar to chemical in photosynthesis)

C, P, R, S, T, W

1.2.3 Know that substances are made of small particles

- Observe and describe that some particles can only be seen with magnification (e.g. cell layers inside pine trees—cambium, xylem, phloem—that are colonized by bark beetles)
- Describe objects that are made of only one kind of material and objects made of several kinds of materials (e.g. the difference between oxygen gas and air or river water)

K, P, R, W, X

1.2.4 **Understand that Earth's system includes . . . landforms, bodies of water, and an atmosphere**

- Identify and describe land masses, bodies of water, and landforms (e.g. rivers, mountains, canyons) using a map [and actual experience]
- Describe how one part of Earth's system depends on or connects to another (e.g. Cascades provide water to arid Wenatchee Valley)
- Construct models to demonstrate Earth system interactions (e.g. how water flow causes erosion and deposition)

C, L, O, P, R, T, W, X

1.2.6 Understand that organisms can be a single cell or many cells that form parts with different functions

- Observe with a microscope (e.g. plant cells, pond protozoa)
- Describe how plant and animal cells are similar and different (e.g. chlorophyll in plants, cilia and flagella in animal-like protozoa)
- Describe the survival function of a part of a living thing (e.g. needles on an evergreen)

D, K, P, R, T

1.2.7 Understand the life cycles of plants and animals and the difference between inherited and acquired characteristics

- Observe and describe the life cycle of a plant or animal (e.g. bark beetle)
- Distinguish between inherited and learned characteristics (e.g. how do organisms adapt to a changing climate?)

A, C, D, K, P, R, T

Component 1.3—Changes

1.3.3 Understand that a substance remains the same substance when changing state; understand that two or more substances can react to become new substances

- Observe and describe water changing states (e.g. ice to liquid)
- Describe how two different substances can form a simple chemical reaction to produce new substances (e.g. baking soda reacts with vinegar to form carbon dioxide)

C, P, R, S, W, X

1.3.4 Know processes that change the surface of Earth

- Describe . . . weathering and erosion (e.g. runoff in watersheds)

C, L, O, P, R, W

1.3.5 Understand that fossils provide evidence of plants, animals, and environments that existed long ago

- Know that fossils provide evidence about . . . the nature of the environment at that time (e.g. extinct animal has adaptations suited to a warmer climate)

A, C, D, K, P, T

1.3.6 Understand . . . how water cycles through the atmosphere

- Describe the effects of water cycling (e.g. rain, rivers, photosynthesis, decomposition)

C, L, P, R, S, T, W

1.3.8 Understand that living things need constant energy and matter

- Identify sources of energy and matter used by plants (e.g. sun, minerals)
- Identify sources of energy and matter used by animals (e.g. food)
- Explain how plants and animals obtain food (e.g. photosynthesis, predation)

A, D, K, P, R, T

1.3.9 Understand that plant and animal species change over time

- Describe the basic concepts of evolution through natural selection
    - Individuals differ with respect to inherited (genetic) characteristics
    - Some characteristics give organisms a better chance of surviving in a particular environment
    - Over time, species change to exhibit these adaptations

- Explain environmental tolerance and that organisms in nature will find optimal conditions; organisms survive best when their characteristics match the requirements of a particular ecosystem (e.g. pocket mice can survive in the desert because they don't have to drink water—they get all the water they need in their food)

A, C, D, K, P, R, T. W

1.3.10 Understand that an organism's ability to survive is influenced by the organism's behavior and the ecosystem in which it lives

- Describe the characteristics of organisms that allow them to survive (e.g. behavioral adaptations such as hibernation and migration)
- Describe the role [niche] of an organism (e.g. scavenger, decomposer)
- Understand food chains and food webs
- Describe the paths of substances (e.g. cycling of matter through food chains)

A, C, D, K, L, O, P, R, S, T, W, X (all)

EALR 2—Inquiry: The student knows and applies the skills, processes, and nature of scientific inquiry.

Component 2.1—Investigating Systems

2.1.1 Understand how to ask a [scientific] question

- Ask questions . . . based on observations of the natural world (e.g. why did a beach form in this particular area?)

A, C, D, K, L, O, P, R, S, T, W, X (all)

2.1.2 Understand how to . . . conduct simple investigations

- Make predictions (e.g. which area of the river is flowing fastest?)
- Design and carry out a simple controlled investigation (e.g. using variables, data collection and organization, prediction)
- Design a field investigation with multiple variables (e.g. different birds eating different seeds or berries)
- Identify and use simple equipment and tools (e.g. magnifier, compass, stop watch, dissecting scope, thermometer)

C, P, R, S, T, W

2.1.3 Understand how to construct a reasonable explanation using evidence

- Describe a reason for a given conclusion using evidence from an investigation (e.g. comparing the water-holding capacity of different soil components)
- Generate a scientific explanation of observed phenomena using given data (e.g. what is a possible reason that there is 1/3 more carbon dioxide in the air now than there was in 1750?)

C, L, P, R, S, T, W

2.1.4 Understand how to use simple models to represent objects, events, systems, and processes

- Describe reasons for using a model to investigate certain phenomena (e.g. global climate, chemical reactions in cells)

C, L, O, P, R, W

2.1.5 Understand how to report investigations

- **Report observations or data** . . . without making inferences (e.g. in journals, separating feelings/opinions from observations based on the five senses)

A, C, D, K, L, O, P, R, S, T, W, X (all)

Component 2.2—Nature of Science

2.2.2 Understand that scientific facts are measurements, and observations of phenomena in the natural world are repeatable [reliability] and/or verified by . . . scientists [validity]

- Describe whether a report of an observation is a scientific fact or an interpretation (e.g. distinguishing between "what, where, and when" questions and "why" questions—differences between observations or measurements and explanations)

A, C, D, K, L, O, P, R, S, T, W, X (all)

2.2.3 Understand why similar investigations may not produce similar results

- Describe reasons why two similar investigations can produce different results (e.g. types of tracks present, stream velocity measurements)
- Explain whether sufficient information has been obtained to make a conclusion (e.g. extra carbon dioxide in the atmosphere is warming the earth)

C, P, R, S, T, W

2.2.5 Understand that scientific comprehension of systems increases through inquiry

- Describe how scientific inquiry results in facts, unexpected findings, ideas, evidence, and explanations (e.g. how moose are not native to the Cascades but may be expanding their range)
- Explain how ideas about the . . .world have changed because of scientific inquiry (e.g. some dinosaurs did not become extinct; they evolved into birds)

A, C, D, K, L, O, P, R, S, T, W, X (all)

EALR 3—Application: The student knows and applies science concepts and skills to develop solutions to human problems in societal contexts.

Component 3.1—Designing Solutions

3.1.1 Understand problems found in ordinary situations in which scientific design can be or has been used to design solutions

- Ask appropriate questions
- Describe how science and technology could be used a particular situation
- Describe the scientific concept behind a proposed solution
- Describe possible data collection methods

C, L, O, R, S

3.1.3 Analyze how well a design or product solves a problem

- Identify several acceptable solutions
- Use scientific concepts to explain why a solution might work
- Discuss possible consequences resulting from implementation of a proposed solution
- Describe how a change to a system could solve a problem
- Evaluate and suggest improvements to a proposed solution

C, L, O, R, S

Component 3.2—Science, Technology, and Society

3.2.2 Understand that people have invented tools for everyday life and for scientific investigations

- Describe specific scientific tools (e.g. thermometers, rulers , microscopes, graphing)
- Describe how tools are used to help solve problems
- Describe how tools help people adapt to different environments
- Describe how scientific ideas and discoveries are used to design tools

A, C, D, K, L, O, P, R, S, T, W, X (all)

3.2.3 Understand how knowledge and skills of science, mathematics, and technology are used in common occupations

- Identify the various scientific skills used in various occupations/careers

A, C, D, L, O, R, S, X

3.2.4 Understand how humans depend on the natural environment and can cause changes in the environment that affect humans' ability to survive

- Describe resource conservation (reuse, reduce, recycle) and how it benefits the environment
- Describe human effects on ecosystems, including how human activities can reduce the livability of the earth
- Describe how the limited nature of natural resources affects humans

A, C, D, K, L, O, P, R, S, T, W, X (all)

J. Marquardt, Barn Beach Reserve, December 20, 2007

Tentative Schedule—5th Grade Field Days

January 24:	Orientation to snowshoes (outside)—Susan Thomas Weather, climate, and climate change (inside & outside)—Jody Marquardt
January 31:	All about snow (outside)—Patty Morrison (Stevens Pass) Water and carbon compounds (inside)—Jody Marquardt
February 7:	Orienteering and tracking (outside)—Gail Roberts, Lynann DeJarnett Nature Photography (inside)—Eleanor Culling, Reed Carlson
February 14	Scavenger hunt with digital cameras (outside)—Gail Roberts, Susan Thomas Photosynthesis and winter adaptations (inside)—Jody Marquardt
February 28	Geology/landforms (outside)—Brent Cunderla Weather, climate, and climate change (inside & outside)—Jody Marquardt