Memo

Date: June 2, 2011
To: BVSD Curriculum Committee Members
From: BVSD Sustainability Education Task Force Members
CC: Joe Sleeper, Assistant Superintendent of Operations, Ellen Miller-Brown, Chief Academic Officer, BVSD Cabinet Members, BVSD Board of Education (via Friday Report on June 10)
Re: Recommendations for Incorporating Sustainability into BVSD Essential Learning Documents and Standards
Priority: High

Dear Members of BVSD's Science and Social Studies Curriculum Committees,
This past spring, BVSD's Office of Sustainability and Curriculum and Instruction created a Task Force with the purpose of providing recommendations for integrating sustainability into BVSD curriculum. The formation of this Task Force was a strategy outlined in our Sustainability Management System (SMS). The SMS is supported by BOE policy, and outlines a vision and path for achieving district-wide sustainability.

The Sustainability Education Task Force met four times in early 2011 and was comprised of teachers, BVSD staff and local and state environmental education experts. The efforts of this Task Force were designed to coincide with BVSD's alignment of District standards to the new State standards, which will begin in the summer of 2011.

The goals of the task force were the following:

- Address overarching questions: What should a BVSD student know about sustainability by the time they graduate? What should this look like on a K-12 continuum?
- Identify opportunities and discuss options for integrating sustainability into the BVSD curriculum.
- Provide recommendations for updating BVSD Curriculum Essentials Documents to include concepts of sustainability. Give these to the Curriculum committees who will be reviewing BVSD standards this summer (copy BOE, Superintendent, Assistant Superintendents and Cabinet).
- Provide recommendations for more training and resources for staff in concepts of sustainability, while leveraging the expertise of community partners. Give these to Chief Academic Officer.

In order to address these goals, we relied on the expertise of the task force members and on resources from other organizations and states working to create sustainability related standards and curriculum for K-12.

Results of the Task Force

- Established a Vision for a Sustainably Literate Graduate. (Attachment A)
- Thoroughly reviewed the new State Standards for Pre-School through High School in Science and Social Studies.
- Developed the following three categories as a way to highlight areas within the new State Standards with overlaps to sustainability: 1) Direct link to sustainability (highlighted in yellow) 2) Example of sustainability could be used to teach specific standard (highlighted in green) 3) Core knowledge required for sustainably literate

graduate (highlighted in red). (State Standards Documents for Science and Social Studies with Task Force Highlights can be found in Attachment D.)
- Created a document with all of the direct links to sustainability (item one above) found in the Science and Social Studies documents, and reorganized them by grade level, in order to get a sense of the continuum of learning. (Found in Attachment B)
- Included recommendations for expanding sustainability concepts in BVSD standards. (Found in Attachment B)
- Discussed strategies for providing teachers with this information, and offering resources to help meet sustainability related standards. (Summary in Attachment C)

Findings

We were pleased to find many links to sustainability in the new State Standards. Therefore, should BVSD adopt the State Standards as they are, there will be ample opportunities for teachers to include concepts of sustainability, while meeting State Standards. ***However, we did find some areas worthy of expanding to truly meet the vision for a sustainably literate graduate.*** We have offered recommendations to further expand sustainability in BVSD's essential learning documents and standards. These recommendations can be found in **Attachment B**. Some overarching themes are as follows:

- We recommend including more opportunities for connecting students with the natural world. We believe engaging students, particularly in the younger grade levels, will result in an excitement about science and nature which ultimately creates sustainably literate students. This opportunity should be consistent and available at all grade levels.
- We recommend linking sustainable concepts across disciplines whenever possible.
- We recommend identifying more opportunities for students to form and evaluate personal views around sustainable practices.
- Examples of sustainability can be used to teach many of the standards found in science, social studies, literacy and math.

We thank you for your serious consideration of these recommendations and appreciate your time to integrate these recommendations into the work you are doing with the curriculum committees this summer. Please do not hesitate to contact Ghita Carroll or Sam Messier with questions.

Sincerely,

BVSD's Sustainable Education Task Force Memebrs

Ghita Carroll, BVSD Sustainability Coordinator, Task Force Co-Chair
Samantha Messier, BVSD Science Director, Task Force Co-Chair
Curry Rosato, City of Boulder, Water Outreach
Cyndra Dietz, Eco-Cycle, School Program Coordinator
Erin Saunders, Thorne, Education Programs Director
Jack Ganse, BVSD Teacher, Eldorado K-8
Kary Schumpert, Eco-Cycle
Kate Hartman, BVSD Teacher, New Vista H.S.
Katie Navin, Colorado Alliance for Environmental Education, Director
Keith Desrosiers, Thorne, Director
Kelly Simmons, University of Colorado, Boulder, Sustainable Practices Program

Attachment A

Vision for a Sustainably Literate Graduate (with associated mastery grade levels)

As stewards of the planet, a sustainably literate graduate:

- Recognizes and understands the dynamic interconnections and interdependency of ecological, economic, and social systems [RECOGNIZE/UNDERSTAND] (Elementary School)
- Possesses knowledge and skills necessary to critically evaluate the potential positive and negative consequences of personal and collective actions on the natural and human environment [EVALUATE] (Middle School)
- Uses this knowledge to make conscious choices and create solutions which support a healthy and vibrant life for present and future generations [ACTION] (High School)

Attachment B

Kindergarten – Sustainability in the State Standards

Science

1. Objects can be sorted by physical properties.
2. Organisms can be described and sorted by their physical characteristics.
    a. There are patterns in the natural world.
3. The Sun provides heat and light to Earth.
    a. Decisions about activities to do on school grounds can be based on the light and heat from the sun.
    b. People make decisions about where to live based on temperature and how much sun that place gets.

Recommendation: Add an Evidence Outcome "Explain that the sun is an energy source for food and all living things."
Recommendation: Add a Relevance and Application statement on seasons and seasonality "Depending on the season, days are shorter and sunlight and heat are less available."
Recommendation: Add an Inquiry Question "How do the physical characteristics of something help us make decisions (for example: what type of material to use)?"
Recommendation: Add a Relevance and Application statement "The properties of objects can be used to sort items for recycling."
Recommendation: Add an Evidence Outcome: "Describe the characteristics of the living and nonliving things around your school."

Social Studies

1. Civic participation takes place in multiple groups.
    a. Individual actions can make the community better. For example, people clean up the highways or volunteer in shelters.
2. Discuss how purchases can be made to meet wants and needs.
3. People belong to different groups and live in different places around the world that can be found on a map or globe.

Recommendation: Add one or more examples under 1a about individual actions that improve the environment for the community, e.g. cleaning up local waterways.
Recommendation: Add an Inquiry Question under 3 "Why is this place special?"
Recommendation: Add a Relevance and Application example "Sometimes people make decisions not to buy things because they want to save money and resources."

First Grade – Sustainability in the State Standards

Science

1. Earth's materials can be compared and classified based on their properties.
    a. Analyze the impact of reducing, reusing, and recycling various materials.
    b. Humans use natural resources in our daily lives and in a variety of ways. For example, wood for building and furniture.
    c. There are limits on resources and materials extracted from the natural environment.

Recommendation: Add Relevance and Application statement "Everyday items are made from natural resources."
Recommendation: Revise 1c to add limits on resources for all living things (not just humans).

Social Studies

1. People in different groups and communities interact with each other and with the environment.
    a. Give examples of how people use and interrelate with Earth's resources.
    b. Give examples of how schools and neighborhoods in different places are alike and different (exploring place).
    c. How are places like communities similar to and different from where you live?
    d. How do people use resources in the local community?
    e. How do individuals in the community use the environment?

Recommendation: Add Relevance and Application statement in Social Studies/Civics "Responsible community members minimize the negative impacts of extracting resources from the natural environment."
Recommendation: Add Inqury question "How do people take care of the environment in different places?"

Second Grade – Sustainability in the State Standards

Science

1. Organisms depend on their habitat's nonliving parts to satisfy their needs.
    a. How do living things depend on their environment?
    b. Living things depend on the health of their habitats.
2. Each plant or animal has different structures of behaviors that serve different functions.

Recommendation: Add an Inquiry Question "What makes a habitat healthy?"
Recommendation: Add an Inquiry Question in "How are livings things interconnected?"

Social Studies

1. Apply decision-making processes to financial decisions (PFL).
    a. Personal financial decisions are based on responsible evaluation of the consequences.
    b. Purchase decisions are based on such things as quality, price, and personal goals.
2. People have influenced the history of neighborhoods and communities.
3. People in communities manage, modify and depend on their environment (most of the green).
4. The scarcity of resources affects the choices of individuals and communities. (Economics)
5. Responsible community members advocate for their ideas. (Civics)
    a. Individuals collaborate to responsibly advocate for the ideas they think will improve society. For example, a group lobbies the city council to create a new park or employ more fire fighters.

Recommendation: Add an example in Social Studies about how people have influenced the history of their neighborhoods and communities by influencing the health of local habitats.

Recommendation: Add examples in PFL 1b: (buying recycled materials, etc.)

Third Grade – Sustainability in the State Standards

Science

1. Earth's materials can be broken down and/or combined into different materials such as rocks, minerals, rock cycle, formation of soil, and sand – some of which are usable resources for human activity.
    a. Many of Earth's materials are usable building or energy resources. Extended processes and time are required to convert fossil fuels and soil into useful material.
2. Matter exists in different states such as solids, liquids, and gases and can change from one state to another by heating and cooling.
    a. Water is distributed on Earth in different forms such as vapor, ice or glaciers, rivers, and freshwater or saltwater oceans.
    b. There is only a certain amount of water available for human use.
3. All living organisms have similar characteristics but they also have differences that can be described and classified.

Recommendation: Add Inquiry Question "How do you make responsible choices about resources to use?
Recommendation: Add Evidence Outcome "Describe the sources of water in Colorado?"
Recommendation: Add Inquiry Question "How do Coloradans use water on a typical day, week, month, year?"

Social Studies

1. Respecting the views and rights of others is a key component of a democratic society.
    a. Respect for the views of others helps to learn and understand various perspectives, thoughts, and cultures. For example, environmentalists, industry, and government work together to solve issues around energy and other resources.
2. Describe producers and consumers and how goods and services are exchanged.
    a. Production, consumption, and the exchange of goods and services are interconnected in the world. For example, vegetables from California are sold at a Colorado markets and an ice storm in Florida affects orange juice supplies for the world, ingredients from different areas of the United States are shipped to one area for a business to create a candy bar which is then shipped throughout the world.

Recommendation: Add an Inquiry Question "How does the shipment of raw materials and processed goods affect the natural environment?
Recommendation: Add a Relevance and Application statement "A map following the life cycle of a typical food item can show the associated impact it has on the environment."
Recommendation: Add Inquiry Question "How do patterns of production and consumption change from season to season?"
Recommendation: Add Inquiry Question "How does production and trade influences the decisions you make about what to buy?"

Fourth Grade – Sustainability in the State Standards

Science

1. There is interaction and interdependence between and among living and nonliving components of ecosystems.
    a. Use evidence to develop a scientific explanation on how organisms adapt to their habitat.
    b. Identify the components that make a habitat type unique.
    c. Compare and contrast different habitat types.
    d. Create and evaluate models of the flow of nonliving components or resources through an ecosystem.
    e. Make a plan to positively impact a local ecosystem.
    f. Examine, evaluate, question, and ethically use information from a variety of sources and media to investigate endangered habitats.
    g. How are resources shared among organisms in a specific ecosystem or habitat?
    h. How do nonliving components of an ecosystem influence living components?
    i. What would happen if the Sun's energy no longer reached Earth?
    j. What would happen if water were removed from an ecosystem?
    k. Humans can have positive and negative impacts on an ecosystem.
    l. Nonliving components are cycled and recycled through ecosystems and need to be protected and conserved.
    m. Understand that models are developed to explain and predict natural phenomena that cannot be directly observed because they happen over long periods of time.
    n. Evaluate models that show interactions between living and nonliving components of ecosystems, identifying the strengths and weaknesses of the model in representing what happens in the real world.
2. Energy comes in many forms such as light, heat, sound, magnetic, chemical, and electrical.
    a. Use multiple resources – including print, electronic, and human – to locate information about different sources of renewable and nonrenewable energy.
    b. There are multiple energy sources, both renewable and nonrenewable.
    c. Create plans to decrease electrical energy use for one week and evaluate the results.

Recommendation: 1c Add the Inquiry Questions "How does using energy impact the environment?" and "How does this change when using more/or using less energy?"

<u>Social Studies</u>

1. Analyze and debate multiple perspectives on an issue.
    a. Responsible community members recognize opportunities to study the effectiveness of various ways to influence state public policy or help industry create an environmentally conscious development.
2. The relationship between choice and opportunity cost. (PFL)
3. People respond to positive and negative incentives.
    a. How have natural, human, and capital resources had both positive and negative impacts on the development of Colorado?
4. Connections within and across human and physical systems are developed.
    a. Analyze how people use geographic factors in creating settlements and have adapted to and modified the local physical environment.
    b. How did Colorado settlers alter their environment to facilitate communication and transportation?
    c. How does human activity affect the environment?

    d. Individuals and businesses adapt to and modify the environment. For example, businesses and resorts have been created near hot springs throughout the state.
5. The historical eras, individuals, groups, ideas and themes in Colorado history and their relationships to key events in the United States.
    a. Describe the impact of various technological developments. Topics to include but not limited to the state of Colorado, including changes in mining technology; changes in transportation; early 20th century industrial changes; and mid- to late 20th century nuclear and computer technological changes.
    b. Technological developments continue to evolve and affect the present. For example, environmental issues have had an impact on Colorado from the Gold Rush to modern pollution.

Recommendation: Give an example of choice and opportunity cost and positive and negative incentives as it relates to the environment or to sustainability.
Recommendation: 4b Add Inquiry Questions "How does settlement impact water availability and water rights?" and "How does the availability of water impact settlement?"
Recommendation: Include deforestation and later efforts towards reforesting in late 19th and early 20th century western settlement- relationship between mining and deforestation, connections to ecosystem health, runoff and erosion.

Fifth Grade – Sustainability in the State Standards

Science

1. Earth's surface changes constantly through a variety of processes and forces.
    a. How do changes on Earth's surface impact humans?
2. Earth and Sun provide a diversity of renewable and nonrenewable resources.
    a. Develop and communicate a scientific explanation addressing a question of local relevance about resources generated by the sun or Earth.
    b. Analyze and interpret a variety of data to understand the origin, utilization, and concerns associated with natural resources
    c. How can the Sun be used as an energy source?
    d. How can wind be used as an energy source?
    e. What types of energy sources exist on Earth?
    f. Mining operations provide nonrenewable resources.
    g. Resources are not distributed evenly and require transportation systems to move them to where they are needed.
    h. Review and analyze scientific explanations about natural resources presented by their peers, and provide feedback to push their peers to be scientifically accurate and base their claims on adequate and reasonable scientific evidence, not opinion.

Recommendation: Add Inquiry Question "What types of and how much renewable and nonrenewable energy are being produced in Colorado?"
Recommendation: Add Evidence Outcome "Compare and contrast different sources of energy, the resources involved in using them, their reliability, and cost-e.g. mining, transportation, infrastructure, environmental impact."
Recommendation: Add inquiry question: "How do you make choices about energy every day?"

Social Studies

1. The foundations of citizenship in the United States.
    a. How might citizens view an issue differently because of their backgrounds?
    b. What is the most important right of a citizen?
    c. What is the most important responsibility of a citizen?
    d. How does government meet its responsibility to citizens?
2. Causes and consequences of movement.

Recommendation: Give example examples of the responsibilities and rights of individuals and governments with regards to the environment (e.g. clean water, clean air, access to food)

Sixth Grade – Sustainability in the State Standards

Science

1. Mixtures of substances can be separated based on their properties such as solubility, boiling points, magnetic properties, and densities.
    a. Materials are sorted based on their properties in a variety of applications. For example, water filtration systems rely on the solubility, density, and physical sizes of substances and recycling facilities use the properties of materials to separate substances in single-stream recycling systems.
    b. Mining and oil refining processes use properties to separate materials.
2. There are different forms of energy, and those forms of energy can be changed from one form to another – but total energy is conserved
    a. There are ways of producing electricity using both nonrenewable resources such as such as coal or natural gas and renewable sources such as hydroelectricity or solar, wind, and nuclear power.

Recommendation: Add the Inquiry Questions "What type and how much energy produced in Colorado?" and " What type and how much energy is consumed in Colorado?"
Recommendation: Add an inquiry question "How do you make decisions about energy use?"

Social Studies

1. The historical eras, individuals, groups, ideas and themes in regions of the Western Hemisphere and their relationships with one another.
    a. Why have civilizations succeeded and failed?
2. Use geographic tools to solve problems.
    a. Technology is used by individuals and businesses to answer geographic problems such as the spread of disease, migration patterns, and distribution and loss of resources like water supplies.
3. Understand the allocation of scarce resources in societies through analysis of individual choice, market interaction, and public policy.
4. Human and physical systems vary and interact.

Recommendation: Add an Inquiry Question "How might the relationship between civilizations and the environment influence whether civilizations succeed or fail?"

Recommendation: Add an Inquiry question #3 "How does human interaction with the environment impact the availability of resources?" (also applies to #4)
Recommendation: Add an Inquiry question "How do scarce resources impact the choices you make about purchases?"
Recommendation: Add an Evidence Outcome "Evaluate the costs and benefits of renewable and non-renewable sources or energy."

Seventh Grade – Sustainability in the State Standards

Science

1. Human activities can deliberately or inadvertently alter ecosystems and their resiliency.
    a. Develop, communicate, and justify an evidence-based scientific example of how humans can alter ecosystems.
    b. Analyze and interpret data about human impact on local ecosystems.
    c. Recognize and infer bias in print and digital resources while researching an environmental issue.
    d. Use technology resources such as online encyclopedias, online databases, and credible websites to locate, organize, analyze, evaluate, and synthesize information about human impact on local ecosystems.
    e. Examine, evaluate, question, and ethically use information from a variety of sources and media to investigate an environmental issue.
    f. Do humans have a unique responsibility to the ecosystems in which they live?
    g. How can a young person be a steward of an ecosystem?
    h. Human activities such as cutting down forests and polluting water or covering deserts with fields of solar panels are constantly changing various cycles and habitats in the natural world.
    i. There are laws that preserve and protect wilderness areas such as national parks and other natural areas but such laws also limit the utilization of the natural resources in those areas.
    j. Critically evaluate scientific claims in popular media and peer generated explanations regarding interactions in ecosystems, and determine if the evidence presented is appropriate and sufficient to support the claims.
2. Multiple lines of evidence show the evolution of organisms over geologic time.
    a. There is growing concern over the current extinction of organisms around the world – and the consequences of these extinctions.
    b. Cite various scientific arguments regarding the causes and effects of mass extinctions.
3. Changes in environmental conditions can affect the survival of individual organisms, populations, and entire species.
    a. Interpret and analyze data about changes in environmental conditions – such as climate change – and populations that support a claim describing why a specific population might be increasing or decreasing.
    b. Develop, communicate, and justify an evidence-based explanation about how ecosystems interact with and impact the global environment.
    c. Model equilibrium in an ecosystem, including basic inputs and outputs, to predict how a change to that ecosystem such as climate change might impact the

organisms, populations, and species within it such as the removal of a top predator or introduction of a new species.
    d. Examine, evaluate, question, and ethically use information from a variety of sources and media to investigate how environmental conditions affect the survival of individual organisms.
    e. How do ecosystem changes affect biodiversity?
    f. How does biodiversity contribute to an ecosystem's equilibrium?
    g. Ask testable questions and make a falsifiable hypothesis about how environmental conditions affect organisms, populations, or entire species and design a method to find the answer.
    h. Use models and technology tools to show what might happen to individuals, populations, and species as environmental conditions change.
4. Organisms interact with each other and their environment in various ways that create a flow of energy and cycling of matter in an ecosystem.
    a. Humans use an understanding of the cycling of matter and energy to help mitigate environmental problems. For example, they treat waste water and clean up oil spills.
    b. Generate solutions to help mitigate environmental problems based on an understanding of the cycling of matter and energy.
    c. Create and evaluate models that show how interactions create a flow of energy and a cycling of matter in an ecosystem.
5. Photosynthesis and cellular respiration are important processes by which energy is acquired and utilized by organisms.

Recommendation: 1g Add Inquiry Question "What does it mean to be a steward of an ecosystem?"
Recommendation: Include a Relevance and Application statement "Ecosystems exist in populated areas such as on school grounds or in parks. These ecosystems can be studied through direct observation."
Recommendation: Add an Evidence Outcome "Compare and contrast various ways humans have deliberately altered ecosystems that were more sustainable or less sustainable – ie human interactions and alterations in ecosystems are not synonymous with degradation (biochar in Central America, food forestry by natives along eastern seaboard, etc)."

<u>Social Studies</u>

1. Use geographic tools to gather data and make geographic inferences and predictions.
    a. Describe the characteristics and distribution of physical systems, cultural patterns and economic interdependence to make predictions. Topics to include but not limited to environmental issues and cultural diffusion.
2. Regions have different issues and perspectives.
    a. Regional access to resources affects individual perceptions, what they value, and how they react. For example, water consumption may be based on availability.
    b. Spatial thinkers evaluate the use of resources in a region to predict and propose future uses.
3. Different forms of government and international organizations and their influence in the world community.
    a. For example, scientists from different nations work together to help solve the global warming issues and charitable organizations send aid to areas of need.
4. The distribution of resources influences economic production and individual choices.

Recommendation: 2a Add an Inquiry Question "How do economic systems also affect regional access to resources?"
Recommendation: Add an inquiry question "How do regional values and perspectives impact the choices you make about the environment?"

Eighth Grade – Sustainability in the State Standards

Science

1. Earth has a variety of climates defined by average temperature, precipitation, humidity, air pressure, and wind that have changed over time in a particular location.
    a. What evidence supports and/or contradicts human influence on climate change?

Recommendation: Include Relevance and Application statements "Changes in climate conditions can affect the health and function of ecosystems and the survival of entire species" and "Climate is determined by the long-term pattern of temperature and precipitation averages and extremes at a location" and "Climate is not the same as weather."

Recommendation: Add an Inquiry Question "How do sources of water influence climate?" and "What are natural and human processes that add and remove carbon dioxide and relative speed of these processes?"

Recommendation: Add an Evidence Outcome "Use carbon calculators to calculate carbon footprints; brainstorm ways to minimize carbon footprints."

Social Studies

1. Economic freedom, including free trade, is important for economic growth.
    a. How does where and how you purchase products affect the social, economic, and environmental conditions?
2. Use geographic tools to analyze patterns in human and physical systems.
    a. Nations are working cooperatively or are engaged in conflict over the division and control of land, water, and other resources.
    b. Calculate and analyze population trends.
    c. Technology is used to find, plot, and express the patterns found in human and physical systems that affect society such as population density and growth analyses, impact of deforestation, and human and environmental changes that affect world health.
3. Conflict and cooperation over space and resources.
4. The place of law in a constitutional system.

Recommendation: Add an Inquiry Question "What are the implications of living in a semi arid region?"
Recommendation: Add an Inquiry Question "How is human population growth related to planetary sustainability?"
Recommendation: Add an Inquiry Question "How does conflict and cooperation over space and resources positively and negatively impact the environment?"

High School – Sustainability in the State Standards

Science

1. Matter has definite structure that determines characteristic physical and chemical properties.
    a. Consumers can make informed decisions regarding the purchase of household chemicals when they understand chemical properties and their implications. For example, choosing lead based versus non-lead based paints weighs safety concerns against color and durability in applications.
2. Matter can change form through chemical or nuclear reactions abiding by the laws of conservation of mass and energy.
    a. The use of chemicals can have both positive and negative environmental effects. For example, the use of lime to make acidic soils more productive or the use of CFCs causing the ozone hole.
    b. When using radioactive substances, there are benefits such as medicine and energy production as well as dangers such as environmental and health concerns.
3. Energy exists in many forms such as mechanical, chemical, electrical, radiant, thermal, and nuclear, that can be quantified and experimentally determined.
    a. Society and energy providers must conduct a cost-benefit analysis of different ways to provide electricity to our society.
    b. An understanding of energy transformations is necessary when designing clean energy systems that convert any type of energy into electricity such as wind generators and solar cells.
    c. There are advantages and disadvantages to using various energy sources such as gasoline, diesel, ethanol, hydrogen, and electricity as transportation fuel.
    d. Politics plays a role in shaping energy policy such as balancing conflicting stakeholder needs.
4. When energy changes form, it is neither created not destroyed; however, because some is necessarily lost as heat, the amount of energy available to do work decreases.
    a. Incremental strides have been made in improving the efficiency of different forms of energy production and consumption. For example, today's engines are much more efficient than those from 50 years ago, and batteries are more powerful and last longer than those from just a few years ago.
    b. Different technologies such as light-emitting diodes, compact fluorescent lights, and incandescent light bulbs have different efficiencies and environmental impacts.
5. Matter tends to be cycled within an ecosystem, while energy is transformed and eventually exits an ecosystem.
    a. Evaluate the potential ecological impacts of a plant-based or meat-based diet.
    b. Analyze and interpret data from experiments on ecosystems where matter such as fertilizer has been added or withdrawn such as through drought.
    c. How does a change in abiotic factors influence the stability or progression of an ecosystem?
    d. What happens when the cycling of matter in ecosystems is disrupted?
    e. How does the process of burning carbon-rich fossil fuels compare to the oxidation of carbon biomolecules in cells?

    f. Address differences between experiments where variables can be controlled and those where extensive observations on a highly variable natural system are necessary to determine what is happening – such as dead zones in the Gulf of Mexico.
6. The size and persistence of populations depend on their interactions with each other and on the abiotic factors in an ecosystem
    a. Analyze and interpret data about the impact of removing keystone species from an ecosystem or introducing non-native species into an ecosystem.
    b. Evaluate data and assumptions regarding different scenarios for future human population growth and their projected consequences.
    c. How does the introduction of a non-native species influence the balance of an ecosystem?
    d. How is the succession of local organisms altered in an area that is disturbed or destroyed?
    e. Earth's carrying capacity is limited, and as the human population grows, we must find ways to increase the production of resources all people need to live.
    f. The extraction of resources by humans impacts nature ecosystems.
7. Physical and behavioral characteristics of an organism are influenced to varying degrees by heritable genes, many of which encode instructions for the production of proteins.
    a. There are benefits and risks to having genetically modified organisms in the food supply.
8. Multicellularity makes possible a division of labor at the cellular level through the expression of select genes, but not the entire genome.
    a. Debate the advantages and disadvantages of bioengineering – cloning or genetically modifying – organisms in the food supply.
9. Climate is the result of energy transfer among interactions of the atmosphere, hydrosphere, geosphere, and biosphere.
    a. How have climate changes impacted human society?
    b. Human actions such as burning fossil fuels might impact Earth's climate.
    c. Technological solutions and personal choices such as driving higher mileage cars and using less electricity could reduce the human impact on climate.
    d. Examine how computer models are used in predicting the impacts of climate change.
    e. Critically evaluate scientific claims in popular media and by peers regarding climate and climate change, and determine if the evidence presented is appropriate and sufficient to support the claims.
10. There are costs, benefits, and consequences of exploration, development, and consumption of renewable and nonrenewable resources.
    a. Develop, communicate, and justify an evidence-based scientific explanation regarding the costs and benefits of exploration, development, and consumption of renewable and nonrenewable resources.
    b. Evaluate positive and negative impacts on the geosphere, atmosphere, hydrosphere, and biosphere in regards to resource use.
    c. Create a plan to reduce environmental impacts due to resource consumption.
    d. Analyze and interpret data about the effect of resource consumption and development on resource reserves to draw conclusions about sustainable use.

    e. How do humans use resources?
    f. How can humans reduce the impact of resource use?
    g. How are resources used in our community?
    h. What are the advantages and disadvantages of using different types of energy?
    i. Technologies have had a variety of impacts on how resources are located, extracted, and consumed.
    j. Infer assumptions behind emotional, political, and data-driven conclusions about renewable and nonrenewable resource use.
    k. Critically evaluate scientific claims in popular media and by peers, and determine if evidence presented is appropriate and sufficient to support the claims.
11. The interaction of Earth's surface with water, air, gravity, and biological activity causes physical and chemical changes.
    a. Human activities such as agricultural practices have impacts on soil formation and soil loss.)
12. Natural hazards have local, national and global impacts such as volcanoes, earthquakes, tsunamis, hurricanes, and thunderstorms.
    a. How is climate change expected to change the incidence of natural hazards?
13. Evolution occurs as the heritable characteristics of population changes across generations and can lead populations to become better adapted to their environment.
14. The energy for life primarily derives from the interrelated processes of photosynthesis and cellular respiration. Photosynthesis transforms the suns light energy into the chemical energy of molecular bonds. Cellular respiration allows cells to utilized chemical energy when these bonds are broken.

<u>Social Studies</u>

1. The key concepts of continuity and change, cause and effect, complexity, unity and diversity over time.
    a. For example, human interaction with the environment has been a critical issue throughout history and continues to be a factor in pollution, climate change, and resource management.
2. The significance of ideas as powerful forces throughout history.
    a. Investigate the historical development of and impact of major scientific and technological innovations. Topics to include but not limited to the Industrial Revolution and environmentalism.
    b. How have scientific and technological developments affected societies?
    c. The world is interconnected through the exchange of ideas as evident in science, technology, and economies.
3. Productive resources – natural, human, capital – are scarce; therefore, choices are made about how individuals, businesses, governments, and societies allocate these resources.
    a. The availability of natural resources, such as fossil fuels and blood diamonds, has an impact on economic decisions made in a global economy.
    b. Natural resources can be scarce in the world or specific regions, impacting markets and creating innovation such as projects developed to provide clean drinking water around the world, lack of water in the Middle East created significant desalination research).
4. Economic policies affect markets.

    a. Economic behavior is modified based on positive and negative incentives such as tax credits on alternative energy and increases in payroll taxes.
5. Research, formulate positions, and engage in appropriate civic participation to address local, state, and national issues or policies.
6. The interconnected nature of the world, people and places.
7. Explain and interpret geographic variables that influence the interactions of people places and environments.

Recommendation: Add an Inquiry Question "What are the factors that may lead an individual or county to make decisions to reduce human impacts on climate?"

Attachment C

Resources for Incorporating Sustainability into Curriculum

There are many organizations and resources supporting sustainability in the standards and curriculum. The challenge is not bombarding teachers with websites and links, and rather providing useful, ready to go, hands on, data driven, authentic and accessible resources for teachers. In 2009, BVSD's Office of Sustainability created a data base of organizations offering environmental/sustainability programming in BVSD. Each organization lists the standards they meet with their programs, and the topics covered. The results of this work can be found in a matrix here:

http://www.bvsd.org/green/Pages/EnviroEducationPrograms.aspx

When the new State Standards are adopted, BVSD's Office of Sustainability will update the matrix, and ask organizations to provide linkages to the new standards.

Thorne Ecological Institute is currently working to determine which schools are getting access to these organizations and programs, how many students in each school are being reached on an annual basis and at what grade level. This will help BVSD understand which schools are not receiving access to these organizations, so we can target the schools more effectively.

The Colorado Association for Environmental Education (CAEE) is creating a state-wide data bank/ resource directory. They can create a BVSD portal, so BVSD teachers can log on to see organizations with resources and programming around sustainability available for our schools. This resource directory can include information about what standards the various organizations can help meet.

We recommend one or more of the following training opportunities, which should align with rollout of new standards (January 2012)

- District sanction for time in staff meetings, or staff development to discuss the sustainability links in the new state standards and available resources.
- And/or training upon request.
- And/or one event to present to teachers interested in the topic.
- Presentations upon request during PLC time.
- The Office of Sustainability could organize a Sustainability Speakers Bureau, including people qualified to discuss sustainability in the standards and resources for teaching to the standards.

Questions for Further Exploration:
How can the district offer more support for partner organizations, such as Thorne and Eco-Cycle, where the district has contracts with the organizations to provide environmental education programming?

Should there be a separate guide for implementing sustainability in the classroom, made available to teachers?