

CAROLINE COUNTY PUBLIC SCHOOLS

ENVIRONMENTAL LITERACY PLAN



ENVIRONMENTAL LITERACY PLAN

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TO LEARN MORE ABOUT B-WET VISIT:
www.noaa.gov/office-education/bwet

ENDORSEMENTS



Superintendent's Message

Caroline County Public Schools is pleased to have partnered with Friends of the Rappahannock, educators, and community organizations to craft the inaugural Environmental Literacy Plan (ELP). The byproduct of this meaningful collaboration reflects a significant step forward in our collective commitment to empowering CCPS scholars with the essential knowledge, skills, and dispositions needed to address and resolve complex environmental issues.

Caroline County Public School's strategic plan, Achieve 2027 references our division's focus on access and opportunity, community and civic engagement, and authentic learning experiences. The ELP content naturally aligns to these objectives and provides meaningful connections and service opportunities that support and improve the local and regional community. The Environmental Literacy Plan intentionally weaves environmental practices throughout our core curriculum, deepening scientific inquiry, content based literacy, and boosting rigor and relevance through real world application.

CCPS is committed to having our students 3E Ready; Enrolled, Enlisted, or Employed. The Environmental Literacy Plan enables students to participate in teacher-supported experiences, inquiry based instruction, and critical thinking activities about ecological, economic, and social stability throughout the global community. We are confident that this immersive approach will not only "move the needle" in our students' understanding of their impact upon the environment, but also generate greater command of the scientific and technical principles, societal and institutional value systems, and emotional responses that the environment teaches us. Furthermore, having ELP Environmental Literacy Ambassadors available to our classroom teachers will further support the development of a sustainable and systemic environmental literacy program.

We are on the cusp of a unique and timely implementation! With committed partners, community liaisons, state agencies, and knowledgeable educators, we are ready to collectively raise awareness in environmental literacy. CCPS looks forward to continuing the upward trajectory ... it all starts with the PLAN.

Sarah B. Calveric

Sarah Calveric, Ph.D.
Superintendent



CCPS Steering Committee

- Terry Banks**
FORT WALKER
Retired Chief of Environmental and Natural Resources Division

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CHS Art Teacher

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SECTION
2

INTRODUCTION



Students conduct trail maintenance behind Caroline Middle School

Executive Summary

The Caroline County Public Schools (CCPS) Environmental Literacy Plan (ELP) was built out of a desire to create robust, outdoor learning experiences for all students. It is a community forward approach that relies on collaboration between the school division and community partners who provide a bridge to the natural resources in Caroline County. The goals contained in the plan ensure that across their school career, students will discover their local watershed, understand their place in it, grow into active environmental stewards, and ultimately, feel equipped to enter any environmental field. Simultaneously, right next door, in Essex and Middlesex Counties, environmental literacy plans are being published. Once implemented, a regional network across Virginia's Middle Peninsula will exist to share resources, support outdoor learning and contribute to a more resilient community in the face of a changing climate.



WHY AN ENVIRONMENTAL LITERACY PLAN?

I think the Environmental Literacy Plan matters to me because students these days play more inside than outside. Not to mention many students are not able to have some of the experiences working and learning in our environment. They also need to learn the importance of keeping our environment safe and healthy for future generations.

— Michelle Carroll

Environmental Literacy Plans are being adopted across the Commonwealth of Virginia with the most recent plans coming out of Prince William County Public Schools and Richmond Public Schools. Like those plans, the CCPS ELP was created as a result of the Environmental Literacy Goal and Outcomes outlined in the [Chesapeake Bay Watershed Agreement](#) signed in 2014 by the Governors of Delaware, Maryland, New York, Pennsylvania, Virginia, and West Virginia, a Council member from the District of Columbia, and a representative from the Chesapeake Bay Commission. The Environmental Literacy Goal states, “Enable every student in the region to graduate with the knowledge and skills to act responsibly to protect and restore their local watershed.” In order to meet this Goal, the Bay Agreement, as well as the [Virginia Department of Education \(VDOE\)](#) use a [Student Outcome](#), a [Sustainable Schools Outcome](#) and an [Environmental Literacy Planning Outcome](#) to measure success. An Environmental Literacy Plan, such as this one, can provide a school division from its School Board, administrators, teachers, students to its families and communities with an equitable, systemic and sustainable path forward to achieving local, state and regional goals.



WHAT IS ENVIRONMENTAL LITERACY IN CAROLINE COUNTY PUBLIC SCHOOLS?

Environmental Literacy is having the knowledge, skills and willingness to solve problems and resolve issues individually and collaboratively. It equips students with the opportunity to think critically, creatively solve problems, and make environmentally-conscious decisions as they become good stewards of the environment.

As a part of becoming environmentally literate, individuals, particularly students, will:

- Have opportunities to actively engage with environmental issues, allowing students to practice and apply knowledge and skills in real-world contexts.
- Participate in Meaningful Watershed Educational Experiences (MWEE) in grades 5, 6, and 9 in collaboration with community partners.
- Take part in meaningful stewardship or civic action to address environmental challenges within their local community.

CCPS has identified grades 5, 6 and 9 as the placement of full MWEEs which include all four essential elements. By fifth grade, students are ready to apply their science knowledge during real-world, outdoor learning experiences. As a result, students are encouraged to take action through civic engagement. Sixth grade provides a natural fit for a full MWEE due to the alignment with the Virginia Standards of Learning and to honor the existing community partnership between CCPS and the Hanover-Caroline Soil and Water Conservation District. The District's Education Specialist continues to provide high quality MWEE programming to CCPS students by conducting classroom visits, leading water quality stations with community volunteers and assisting classes with action projects. Once students enter 9th grade, they are required to take a 9th grade seminar class. This class is run through Career and Technical Education and has a requirement that all students complete a service learning project. This innovative approach to embed a high school level MWEE into a CTE class creates an opportunity for students to choose a service learning project that can double as an environmental action project. To reinforce science skills, Environmental Science and Biology teachers will also incorporate MWEE elements within their courses. With three established MWEEs before graduation, students gain the skills and knowledge for deeper learning in science, engage with community partners, explore local watersheds and take action. Through this journey, CCPS inspires passionate and responsible environmental leaders within their community.

WHY IS ENVIRONMENTAL LITERACY IMPORTANT TO CAROLINE COUNTY?

Caroline County Public Schools serves students in preschool through grade 12 at six schools. The division contains three elementary schools, one middle school, one high school and an alternative school called Lotus Academy. CCPS enrollment for the 2024-2025 academic year is 4,671 students. In CCPS, 42% of students are people of color; 49.3% are classified as economically disadvantaged, representing almost half of the school population as a vulnerable part of the community (see Appendix 1).

Located on the eastern part of the Commonwealth of Virginia, and adjacent to Virginia's Middle Peninsula, Caroline County is rural with small pockets of development around Lake Caroline and Bowling Green ([Caroline County Comprehensive Plan](#)). It is bordered on the north by the Rappahannock River, notably at the historic town of Port Royal. Situated at the center of the county, near Bowling Green, is U.S. Army Garrison Fort Walker with a commitment to sustainability and environmental policy under its Directorate of Public Works Environmental and Natural Resources Division.

In Caroline County, for many, the tie to natural resources is part of daily life. Agriculture and forestry are major economic factors in this rural county. For this reason, the ELP highlights the importance of community spaces that are accessible for the public and for schools. Visits to these “outdoor classroom” spaces are critical; they allow students to study unique characteristics of their local watershed, discover its rich history and develop a deeper connection and respect for the environment. Students that interact with community partners and experts will be inspired to think creatively about solutions to establish a healthy and thriving ecosystem. The ELP instills environmental awareness early on, and can lead to students returning to conserve and protect their cherished home. Currently, a graduate of Caroline High School works as Fort Walker's natural resources coordinator and served as member of the Steering Committee for the creation of this Plan.

NOAA's Meaningful Watershed Educational Experience (MWEE)
“is a learner-centered framework that focuses on investigations into local environmental issues and leads to informed action.”



THE FRAMEWORK CONTAINS FOUR ESSENTIAL ELEMENTS:



HOW DOES THE ENVIRONMENTAL LITERACY PLAN ALIGN WITH OUR STRATEGIC PLAN?

The Environmental Literacy Plan leans heavily on the Caroline County Public Schools Strategic Plan, Achieve 2027, as a guiding document. Success of the ELP will contribute to the success of the Strategic Plan.

OUR VISION

Empowering a community of life-long learners to be 3E Ready: Enrolled, Enlisted, and/or Employed.



OUR MISSION

We create an inclusive culture where teaching and learning inspire and prepare students to become contributing citizens.

	<h1>Environmental Literacy Plan</h1>
TEACHING & LEARNING Objective 1.3, Key Strategy 1.3.2	<div>GOAL</div> <div>1</div> Career Connections
TEACHING & LEARNING Objective 1.3, Key Strategy 1.3.3 RELATIONSHIPS Objective 2.2, Key Strategy 2.2.2	<div>GOAL</div> <div>2</div> MWEE
RELATIONSHIPS Objective 2.3, Key Strategy 2.3.1	<div>GOAL</div> <div>3</div> Community Collaboration
HEALTH & SAFETY Objective 3.3, Key Strategy 3.3.3	<div>GOAL</div> <div>4</div> Sustainability



The Environmental Literacy Plan matters to me because it allows students to understand and appreciate the world/environment around them to help grow their knowledge of the natural resources with hands on experiences rather than the everyday classroom settings.

— Eric Johnson

Community Focused Approach

WHAT IS PROJECT W²ONDER?



I want to understand and contribute to plans for getting students into nature and teaching them about the interdependence of all ecosystems. I hope that this will inspire them to want to protect our watershed and resources, no matter what field they eventually go into.

— Erika Little

The pandemic highlighted the essential need for all students to spend time outside exploring, wondering and connecting with the natural world. The North American Association of Environmental Education cites research that reinforces the connection between outdoor learning and its benefits including improved physical, mental and social well-being ([NAAEE.org](https://naaee.org)). For some school divisions, an emphasis on outdoor learning can be challenging and disjointed as outdoor experiences may not be distributed equally among classes or schools within the division. In addition, community partners, who facilitate MWEEs, were interested in bringing them to rural school divisions, but wanted to be efficient in their approach. Therefore, PROJECT W²ONDER was formed to bring equitable, systemic and sustainable Environmental Literacy Plans to Essex and Middlesex Public Schools in Virginia's Middle Peninsula and the adjacent Caroline County Public Schools to create a regional effort to inspire stewardship of the lands and waters that ultimately drain to the Chesapeake Bay.

This project was funded by a National Oceanic and Atmospheric Administration (NOAA) Bay Watershed Education and Training (B-WET) grant. PROJECT W²ONDER stands for a "Win-Win on Designing Environmental Relationships". It refers directly to the two-way benefit of having solid, community partnerships that can support schools. Community partners benefit because they have access to students to carry out their missions. Schools benefit because they receive support in activities that build environmental awareness but also meet academic standards of learning. The grant is held by Hanover-Caroline Soil and Water Conservation District, and has included a partner team with representatives of the Alliance for the Chesapeake Bay, Friends of the Rappahannock, each school division, and members of each community.

STEP 1: COMMUNITY COLLABORATION

Meetings with school administrators, teachers and community organizations. Community outreach events and community survey.



Project W²onder Roadmap

STEP 2: PROJECT FRAMING

Teacher survey. Convene Steering Committees and begin meeting to advise create ELP.



STEP 3: GUIDED DRAFTING

Meet with Steering Committees to direct content and advise on ELP.



STEP 4: COMPLETE ELP

Evaluate and refine ELP drafts, come to consensus about final drafts, and present to School Board.



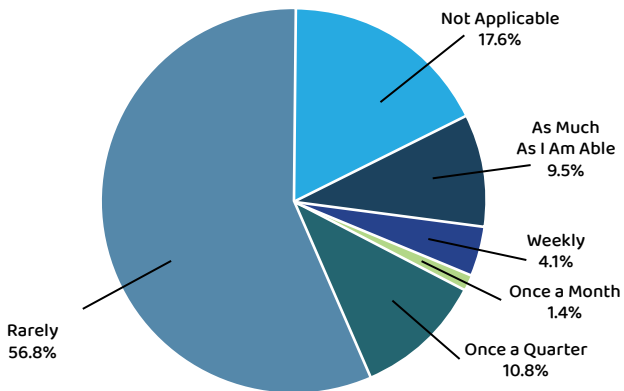
HOW WAS THE ENVIRONMENTAL LITERACY PLAN CREATED?

Each step of the Environmental Literacy Plan creation process, the partner team gave equal voice to the school division and the community. In 2022, PROJECT W²ONDER kicked off with the Partner Team listening to the needs of CCPS administrators and listening to the needs of the community through tabling events, STEM nights and ultimately collecting feedback through a Community Survey. Additional community needs, potential partners, and interested parents were identified through the survey and the results were shared back to CCPS and eventually used to inform membership for the CCPS Steering Committee.

Enthusiasm for environmental literacy led to CCPS Superintendent, Dr. Calveric, including a MWEE outdoor field experience to the division-wide, professional learning days for senior administrators in summer 2023. The theme of the event was "Seeing Through the Eyes of a Student" and it allowed the attendees to participate in the activities from the student perspective and also included a visit to the Career Technical Education (CTE) camp. The PROJECT W²ONDER team was invited to facilitate the MWEE portion. Sixteen attendees, including Dr. Calveric rotated through stations including: water quality testing, wetlands nature hike, Enviroscape model, kayaking on the Rappahannock River and a table to explore environmental education kits and curriculum. At the end of the event, participants had a chance to reflect on their experience and share why this event reinforced the importance of MWEEs for CCPS students.

Following the "Seeing through the Eyes of a Student" event, the partner team presented a progress update to the Caroline County School Board in September 2023. Next, with the recommendation of CCPS administrators, the partner team created and distributed a Teacher Survey to the CCPS teachers to identify their successes, needs and barriers related to existing environmental programming, specifically, MWEEs. Data from the survey underscored the importance of community partner support and an Environmental Literacy Plan.

How often do teachers use the outdoors to teach?



Survey results from the teacher survey indicated that 74.4% of respondents indicated either "not applicable" or "rarely" when asked "How often do you use the outdoors to teach?" The ELP was created based on this response and other teacher concerns discovered through the survey results including access to and knowledge of outdoor spaces, community partnerships, and teacher training.



The answers are in the room! Collaboration is a powerful practice.

— Event Attendee

Collaboration between CCPS and the community continued as the partner team used input from administrators and results from the Community Survey to form a CCPS Steering Committee. The committee included administrators, teachers, community partners, parents, and a school board member. Steering committee meetings were held monthly from January through June 2024. Members contributed and edited ELP content, shared their lived experience, connections, and deep knowledge of Caroline County. On March 11, a region-wide "Seeing Through the Eyes of a Student" event was held at Dragon Run, in Middlesex County with steering committee members attending from all three school divisions involved in PROJECT W²ONDER. Friends of Dragon Run volunteers collaborated with the partner team to facilitate the morning stations including a nature walk, and water quality testing. After lunch, only administrators remained for the networking portion of the event, including Superintendents from all 3 school divisions who shared their experiences related to professional learning, funding, and developing Environmental Literacy Plans. This unique opportunity to gather Superintendents and Science Specialists in an outdoor setting worked to boost the regional network for MWEEs and ELPs.



Science Instructional Specialist Becca Scheiber and Superintendent Dr. Calveric with painted, reflection postcards.

In Fall 2024, the partner team reviewed and refined ELP content, as directed by the Steering Committee. A small celebration potluck was held at a local park to pause and appreciate the collaborative work accomplished by the Steering Committee. A graphic designer was brought on board to assist the partner team in creating the final document that you are reading today.

I would love to have a small garden to teach kids about fruit and vegetables.

— Teacher Survey Respondent

GOALS



School staff kayak at Hick's Landing on the Rappahannock River as a part of a professional development experience.

GOAL 1

Students will explore skills at each grade band in order to make career connections related to environmental literacy.



OBJECTIVES:

- Have an opportunity to practice project management skills
- Opportunity for service learning
- Participate in hands-on experiences and action projects related to real life and their community in a variety of classes
- Learn from experts and speakers in their community
- Opportunities to participate in peer learning

GOAL 2

All students in CCPS will have at least three fully integrated Meaningful Watershed Educational Experiences (MWEEs) that use the natural resources of Caroline County in 5th, 6th and 9th grades.



OBJECTIVES:

- Include place-based learning concepts
- Have a shared archive for what teachers have done in the past
- Provide opportunities for collaboration

GOAL 3

CCPS will sustain and collaborate with at least three community partners to facilitate two professional learning opportunities for educators in relation to MWEEs and environmental education per year.



OBJECTIVES:

- Sustain and expand partner list through collaborative quarterly meetings
- Offer MWEE 101 as a professional learning opportunity and part of onboarding for all science teachers in MWEE years

GOAL 4

CCPS schools should investigate and pursue certification through a sustainable school programs, such as Project Learning Tree, Virginia Naturally, Green Ribbon Schools, etc.

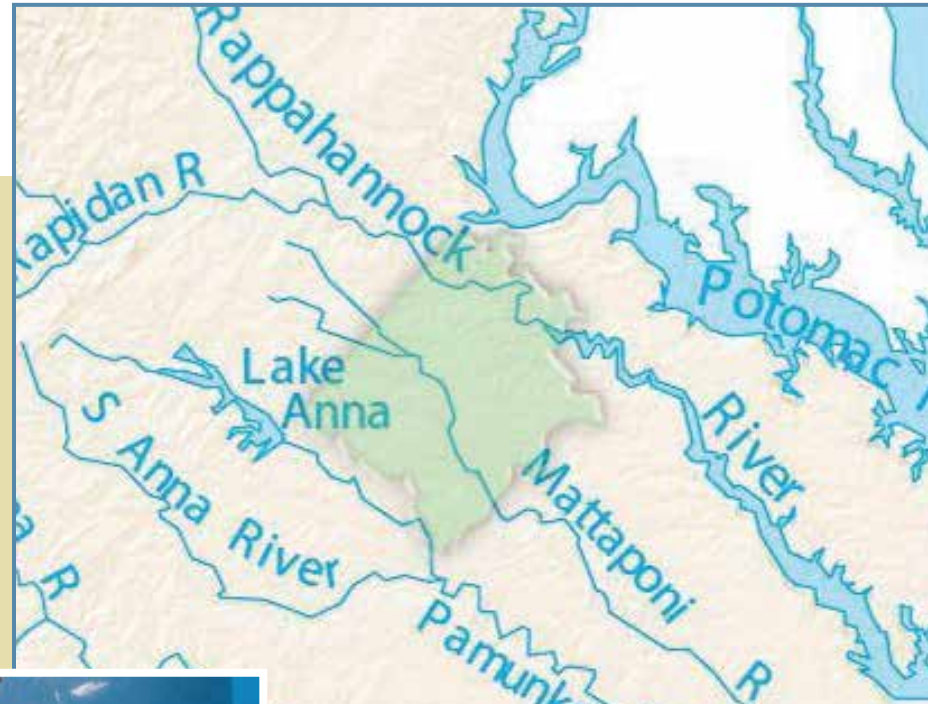


OBJECTIVES:

- By 2026, identify a certification program to address an individual school need regarding environmental literacy
- By the end of the 2026-2027 school year, schools have begun an application for certification

SECTION
4

ENVIRONMENTAL LITERACY ACTIVITY GUIDE



Working on the environmental literacy plan matters to me because I think it is integral to incorporate plans like this in education to help improve all people's motivation and awareness of environmental care. I think the kinds of experiences that an ELP will create for Caroline County will facilitate long-lasting and unmatched learning opportunities that will stick with students for many years to come. In turn, I believe this will allow the students to grow up understanding the importance of being good stewards of our environment.

— Reilly McNamara




The Environmental Literacy Plan matters to me because it allows students to understand and appreciate the world/environment around them to help grow their knowledge of the natural resources with hands on experiences rather than the everyday classroom settings.

— Eric Johnson

Environmental Literacy Activity Guide

Welcome to the Environmental Literacy Guide. This tool is designed for educators interested in exploring a subject through the lens of environmental literacy. The guide is organized by grade level, aligned to Virginia Department of Education Standards of Learning (SOL) and accompanied by suggested activities based in two categories. Classroom/Schoolyard Activities take place within the walls of the school building or outdoors surrounding the school building. Outdoor Field Experiences transport students to a different location (Appendix 2). Each activity also contains associated Community Partners (Appendix 3). A majority of activities were sourced from nationally recognized environmental education curriculum that require educator training, including Project WILD, Project WILD Aquatic, Project WET, and Project Learning Tree. This guide highlights SOLs that are considered by VDOE to be Environmental and Sustainability Standards

According to the goals outlined by Caroline County Public Schools, all students in CCPS will have at least 3 (one per level) fully integrated Meaningful Watershed Educational Experiences (MWEEs) that use the natural resources of Caroline County by graduation.



Look for this icon next to grade levels where the full MWEE will occur.



KINDERGARTEN

Using my senses to understand my world



K.10 The student will investigate and understand that change occurs over time.		
KEY IDEAS INCLUDE: <ul style="list-style-type: none">a) natural and human made things change over timeb) living and nonliving things change over timec) changes can be observed and measuredd) changes may be fast or slow	SOL ESSENTIAL KNOWLEDGE AND PRACTICES In order to meet this standard, it is expected that students will: <ul style="list-style-type: none">K.10a describe things in nature that change over timeK.10a describe things in nature that change over timeK.10a describe human-made things that change over timeK.10b identify some changes that people experience over timeK.10c use observations to describe the change of an object or living thing over timeK.10d classify examples as fast changes or slow changes	
CLASSROOM/SCHOOLYARD ACTIVITIES Common activities used to support this standard include making observations outdoors and using description to identify how living things change over time. For example, in the Growing Up WILD activity, Grow as We Go (K.10b,c) , students explore life cycles of familiar wildlife by classifying what they find as a “baby” or “adult.”	OUTDOOR FIELD EXPERIENCES Visit a local botanical garden, public garden, or other natural area with a wide diversity of plants and animals.	COMMUNITY PARTNERS Robin Didlake, Friends of the Rappahannock DCR Park Superintendent, Caledon State Park, Lake Anna State Park, Westmoreland State Park Staff, Meadowview Biological Research Station Donnell Howard, Caroline County Parks and Recreation Sites Courtney Hallacher, Project WILD

K.11 The student will investigate and understand that humans use resources.		
KEY IDEAS INCLUDE: <ul style="list-style-type: none">a) some materials and objects can be used over and over againb) materials can be recycledc) choices we make impact the air, water, land, and living things	SOL ESSENTIAL KNOWLEDGE AND PRACTICES In order to meet this standard, it is expected that students will: <ul style="list-style-type: none">K.11a,b describe the difference between recycle and reuseK.11a identify materials that can be reusedK.11b give examples of objects that can be recycledK.11c explain why recycling and reusing resources is good for the communityK.11c communicate solutions that will reduce the impact of humans on the land, air, water, and on other living things in the local environment	
CLASSROOM/SCHOOLYARD ACTIVITIES Natural resources make up the common objects and materials we use so students can investigate how to best conserve and protect these resources. An example activity is Project Learning Tree: GreenSchools for Early Childhood -Waste & Recycling Investigation (K.11a,b) where students investigate their waste and recycling practices at their school, and from their investigation they can develop an action plan.	OUTDOOR FIELD EXPERIENCES Visit the Caroline Convenience Site Visit Caroline County Closed Landfill	COMMUNITY PARTNERS Eric Johnson, Caroline Solid Waste Lesley Newman, Project Learning Tree

FIRST GRADE

How I interact with my world



1.4 The student will investigate and understand that plants have basic life needs and functional parts that allow them to survive		
KEY IDEAS INCLUDE: a) plants need nutrients, air, water, light, and a place to grow b) structures of plants perform specific functions; c) plants can be classified based on a variety of characteristics	SOL ESSENTIAL KNOWLEDGE AND PRACTICES In order to meet this standard, it is expected that students will: 1.4a describe the basic life needs of plants 1.4a with guidance, plan and conduct an investigation to determine if plants need sunlight and water to grow 1.4b explain the functions of the root, stem, and leaf 1.4b identify create and interpret a physical model/drawing of a plant, including roots, stems, leaves, and flowers to identify and explain the functions of each plant part 1.4c classify plants by characteristics	
CLASSROOM/ SCHOOLYARD ACTIVITIES To support this standard, teachers can focus on the structures of plant systems and the specific characteristics of plants. For example, Project Learning Tree's activity, Tree Factory (1.4b) where students act out different parts of a tree to learn their role in how a tree grows.	OUTDOOR FIELD EXPERIENCES Visit a natural area to collect natural objects that could be sorted into the parts of plants and trees (Ex. acorns, fallen leaves, twigs, pieces of bark) Visit Lewis Ginter Botanical Garden and participate in one of their in-person educational programs .	COMMUNITY PARTNERS Robin Didlake, Friends of the Rappahannock Anna Moreau, Hanover-Caroline Soil and Water Conservation District DCR Park Superintendent, Caledon State Park, Lake Anna State Park, Westmoreland State Park Donnell Howard, Caroline County Parks and Recreation Sites Staff, Lewis Ginter Botanical Garden Lesley Newman, Project Learning Tree



1.7 The student will investigate and understand that there are weather and seasonal changes.		
KEY IDEAS INCLUDE: a) changes in temperature, light, and precipitation occur over time b) there are relationships between daily weather and the season c) changes in temperature, light, and precipitation affect plants and animals, including humans	SOL ESSENTIAL KNOWLEDGE AND PRACTICES In order to meet this standard, it is expected that students will: 1.7a identify types of precipitation as rain, snow, and ice and describe the temperature conditions of each type of precipitation 1.7a, b observe, record, and compare seasonal data throughout the year, including relative temperature, amount of precipitation, and relative amount of sunlight 1.7b represent data in tables and graphic displays to describe typical weather conditions during a season 1.7c observe and record seasonal changes in plants, including budding, growth, and losing leaves; recognize the seasons during which budding and losing leaves will most likely occur 1.7c compare the physical characteristics of some common plants during summer and winter 1.7c compare the activities of some common animals during summer and winter by describing changes in their behaviors and their body coverings 1.7c infer the season based on humans' dress and recreational activities	
CLASSROOM/SCHOOLYARD ACTIVITIES In this standard, students participate in activities that examine how changes in temperature, light and precipitation can help predict weather. They can also note how these changes may affect plants and animals in an ecosystem. For example, using the Project Learning Tree activity Tree Cookies (1.7c) to allow students to make connections between the changes in weather and how a tree grows.	OUTDOOR FIELD EXPERIENCES Request a tour at the Wakefield National Weather Service office. Visit a natural area and collect data about the type of weather observed for several weeks to notice seasonal differences. Request a field trip to the Science Museum of Virginia for a Science on the Sphere program about weather.	COMMUNITY PARTNERS Staff, National Weather Service, Wakefield DCR Park Superintendent, Caledon State Park, Lake Anna State Park, Westmoreland State Park Donnell Howard, Caroline County Parks and Recreation Sites Guest Services, Science Museum of Virginia Lesley Newman, Project Learning Tree

1.8 The student will investigate and understand that natural resources can be used responsibly.		
KEY IDEAS INCLUDE: a) most natural resources are limited b) human actions can affect the availability of natural resources c) reducing, reusing, and recycling are ways to conserve natural resources	SOL ESSENTIAL KNOWLEDGE AND PRACTICES In order to meet this standard, it is expected that students will: 1.8a identify natural resources such as plants, animals, water, air, land, forests, minerals, and soil 1.8c compare ways of conserving resources 1.8a,b,c determine a resource in the school or home that may be conserved, brainstorm solutions, and implement a plan to address the conservation concern	
CLASSROOM/ SCHOOLYARD ACTIVITIES This standard has a focus on our natural resources, including air, and undeveloped land. Students will learn how these resources are limited and how to act responsibly to protect them. For example, Project Learning Tree: GreenSchools for Early Childhood - Waste & Recycling Investigation (1.8c) allows students to conduct an audit in their school and take action based on their findings.	OUTDOOR FIELD EXPERIENCES Visit the Caroline Convenience Site to examine the variety of materials that can be recycled. Contact Tidewater Oyster Growers Association for programming on oyster shell recycling Connect with local environmental groups to participate in a trash cleanup.	COMMUNITY PARTNERS Anna Moreau, Hanover-Caroline Soil and Water Conservation District Robin Didlake, Friends of the Rappahannock Eric Johnson, Caroline Solid Waste Andrew Satterwhite, U.S. Army Garrison Fort Walker Lesley Newman, Project Learning Tree Richard Sicilian, Tidewater Oyster Growers Association

SECOND GRADE

Change occurs all around us



2.4 The student will investigate and understand that plants and animals undergo a series of orderly changes as they grow and develop.			
KEY IDEAS INCLUDE: a) animals have life cycles b) plants have life cycles		SOL ESSENTIAL KNOWLEDGE AND PRACTICES In order to meet this standard, it is expected that students will: 2.4a,b explain how animals and plants change as they grow 2.4a analyze a model of the life cycle of an insect and describe the changes that occur within the life cycle 2.4a analyze a model of the life cycle of a mammal and describe the changes that occur with the life cycle 2.4a compare life cycles of an insect and a mammal 2.4b investigate the question, “What is the life cycle of a flowering plant?” and record observations using a table and/or graph; explain the results of the investigation 2.4a,b compare life cycles of a plant and an animal) 2.4a,b develop models to describe the concept that organisms have unique and diverse life cycles but they all have in common birth, growth, reproduction, and death	
CLASSROOM/SCHOOLYARD ACTIVITIES Activities in this standard build students’ knowledge of animal and plant life cycle. In Project Learning Tree’s activity Tree Lifecycle (2.4b) , teachers can use the variation called Plant Personification to have students use movements to act out the life cycle of a tree.	OUTDOOR FIELD EXPERIENCES Visit Lewis Ginter Botanical Garden and participate in one of their in-person educational programs . Take a nature hike and allow students to use phones or other technology devices to photograph the steps in the lifecycle of the living things they observe.	COMMUNITY PARTNERS DCR Park Superintendent, Caledon State Park, Lake Anna State Park, Westmoreland State Park Donnell Howard, Caroline County Parks and Recreation Sites Staff, Lewis Ginter Botanical Garden Lesley Newman, Project Learning Tree	

2.5 The student will investigate and understand that living things are part of a system.			
KEY IDEAS INCLUDE: a) plants and animals are interdependent with their living and nonliving surroundings b) an animal's habitat provides all of its basic needs c) habitats change over time due to many influences		SOL ESSENTIAL KNOWLEDGE AND PRACTICES In order to meet this standard, it is expected that students will: 2.5a explain how living things are part of a system composed of living and nonliving components 2.5b analyze a model of a habitat and describe the living and nonliving components 2.5b describe how a habitat provides for an animal's or plant's needs 2.5c predict and describe natural changes in habitats and their effects on plants and animals 2.5c describe the changes in a habitat due to various influences	
CLASSROOM/SCHOOLYARD ACTIVITIES Living organisms interact with other living organisms and their surroundings. With this standard, activities should explore how living organisms have their basic needs met. For example, students can investigate a field study plot in their schoolyard to observe plant and animals interactions using Field Study Fun from Project WILD’s Growing Up WILD (2.5b, c).	OUTDOOR FIELD EXPERIENCES Visit a natural area and locate a decomposing log to investigate the interactions of living organisms. Visit Lewis Ginter Botanical Garden and participate in one of their in-person educational programs .	COMMUNITY PARTNERS Courtney Hallacher, Project WILD DCR Park Superintendent, Caledon State Park, Lake Anna State Park, Westmoreland State Park Donnell Howard, Caroline County Parks and Recreation Sites Staff, Lewis Ginter Botanical Garden	

2.6 The student will investigate and understand that there are different types of weather on Earth.		
KEY IDEAS INCLUDE: a) different types of weather have specific characteristics b) measuring, recording, and interpreting weather data allows for identification of weather patterns c) tracking weather allows us to prepare for the weather and storms		SOL ESSENTIAL KNOWLEDGE AND PRACTICES In order to meet this standard, it is expected that students will: 2.6a identify and describe common types of storms, including the precipitation that may be associated with each 2.6a compare droughts and floods 2.6b observe, describe, and record daily weather conditions using weather instruments; graph and analyze data to identify patterns; predict weather based upon identified patterns 2.6c observe and describe seasonal weather patterns and local variations 2.6c describe how tracking weather data helps to prepare for storms and other weather conditions
CLASSROOM/SCHOOLYARD ACTIVITIES In this standard, students investigate different types of weather on Earth and learn how weather data can be used to identify and predict weather patterns and storms. For example, Project WET’s Blue River (2.6a,b,c) examines how water flow and seasonal weather changes are related by simulating stream flow using ping pong balls.	OUTDOOR FIELD EXPERIENCES Request a field trip to the Science Museum of Virginia for a Science on the Sphere program about weather. Visit a public natural area and rotate through stations using tools to collect and record weather data. Request a tour at the Wakefield National Weather Service office .	COMMUNITY PARTNERS DCR Park Superintendent, Caledon State Park, Lake Anna State Park, Westmoreland State Park Donnell Howard, Caroline County Parks and Recreation Sites Staff, National Weather Service, Wakefield Guest Services Staff, Science Museum of Virginia

2.7 The student will investigate and understand that weather patterns and seasonal changes affect plants, animals, and their surroundings.		
KEY IDEAS INCLUDE: a) weather and seasonal changes affect the growth and behavior of living things b) wind and weather can change the land c) changes can happen quickly or slowly over time		SOL ESSENTIAL KNOWLEDGE AND PRACTICES In order to meet this standard, it is expected that students will: 2.7a identify growth and behavioral responses of plants and animals to weather and seasonal changes 2.7a identify animals that migrate, hibernate, or show other changes due to seasonal weather changes 2.7a compare the responses of plants and animals to weather and seasonal changes 2.7a explain how an animal's behavior may change throughout the year due to food source availability 2.7b model the effects of weathering and erosion on the land surface 2.7b design and construct a model of a structure that can withstand changes in land due to erosion or weathering 2.7c identify examples of weather and seasonal changes that happen slowly and quickly
CLASSROOM/SCHOOLYARD ACTIVITIES This standard enhances the students’ understanding of weather conditions and the seasons. An example activity is using soil runoff boxes (2.7b) to compare and contrast erosion using a demonstration of pouring water (simulating stormwater runoff) over land with exposed soil and land with cover crops.	OUTDOOR FIELD EXPERIENCES Request a tour at the Wakefield National Weather Service office . Investigate a local natural area using the Schoolyard Report Card criteria, and compare the results from school to the natural area Request a field trip to the Science Museum of Virginia for a Science on the Sphere program about weather. Attend the State Fair of Virginia’s Ed Expo to explore demonstrations and exhibits about natural resources and agriculture.	COMMUNITY PARTNERS Anna Moreau, Hanover-Caroline Soil and Water Conservation District DCR Park Superintendent, Caledon State Park, Lake Anna State Park, Westmoreland State Park Donnell Howard, Caroline County Parks and Recreation Sites Staff, National Weather Service, Wakefield Guest Services, Science Museum of Virginia Sarah Jane Thomsen, Meadow Event Park/State Fair of Virginia

SECOND GRADE

Change occurs all around us



2.8 The student will investigate and understand that plants are important natural resources.		
KEY IDEAS INCLUDE: a) the availability of plant products affects the development of a geographic area b) plants provide oxygen, homes, and food for many animals c) plants can help reduce the impact of wind and water.	SOL ESSENTIAL KNOWLEDGE AND PRACTICES In order to meet this standard, it is expected that students will: 2.8a describe useful plant products and the region in which they are grown in Virginia 2.8a identify where crops are grown in Virginia and predict the impact they have on the area's development 2.8b explain the roles of plants in meeting the life needs of animals 2.8b compare different ways animals use plants as homes and shelters 2.8b construct and interpret a chart illustrating plant foods 2.8b consumed by different animals 2.8c construct and interpret models as to how plants help reduce the impact of wind and water	
CLASSROOM/SCHOOLYARD ACTIVITIES This standard provides students with the idea that plants have many roles in a system, including providing food for animals and reducing the impact of weather on land. For example, in the Project Learning Tree's Trees&Me activity, " Follow Your Nose ", (2.8b) students can explore how plants and trees provide food for humans and practice using their sense of smell and taste.	OUTDOOR FIELD EXPERIENCES Visit a natural area to observe and collect data about what types of foods animals eat. Visit Lewis Ginter Botanical Garden and participate in one of their in-person educational programs .	COMMUNITY PARTNERS DCR Park Superintendent, Caledon State Park, Lake Anna State Park, Westmoreland State Park Donnell Howard, Caroline County Parks and Recreation Sites Staff, Lewis Ginter Botanical Garden Lesley Newman, Project Learning Tree



THIRD GRADE

Interactions in our world



3.4 The student will investigate and understand that adaptations allow organisms to satisfy life needs and respond to the environment.		
KEY IDEAS INCLUDE: a) populations may adapt over time b) adaptations may be behavioral or physical c) fossils provide evidence about the types of organisms that lived long ago as well as the nature of their environments	SOL ESSENTIAL KNOWLEDGE AND PRACTICES In order to meet this standard, it is expected that students will: 3.4a provide an example of how an environmental change may affect the ability of a population to survive 3.4a explain how populations may adapt over time in response to changes in the environment 3.4b differentiate between physical and behavioral adaptations 3.4b explain how an animal's behavioral adaptations help it live in its habitat (3.4 b) 3.4b compare the physical characteristics of animals and explain how they are adapted to their environment 3.4b design and construct a model of a habitat for an animal with a specific adaptation 3.4c explain the role of fossils in making inferences about organisms and the environment from long ago	
CLASSROOM/SCHOOLYARD ACTIVITIES This standard covers students' understanding of how populations of organisms change and adapt over long periods of time and some of those changes are due to the genetics of the populations. In the Project WILD activity, " Bottleneck Genes " students can simulate the gene-pool of a population of black-footed ferrets using colored beads to understand how the animal can survive in different scenarios. (3.4a)	OUTDOOR FIELD EXPERIENCES Visit a natural area to compare the population of species that appear today to what appeared in the space historically. Visit a local waterway to examine the impact of pollution on aquatic species.	COMMUNITY PARTNERS Courtney Hallacher, Project WILD DCR Park Superintendent, Caledon State Park, Lake Anna State Park, Westmoreland State Park Donnell Howard, Caroline County Parks and Recreation Sites

3.5 The student will investigate and understand that aquatic and terrestrial ecosystems support a diversity of organisms.		
KEY IDEAS INCLUDE: a) ecosystems are made of living and nonliving components of the environment b) relationships exist among organisms in an ecosystem	SOL ESSENTIAL KNOWLEDGE AND PRACTICES In order to meet this standard, it is expected that students will: 3.5a describe basic living and nonliving components in different types of terrestrial and aquatic ecosystems 3.5a compare plant and animals that compose aquatic and terrestrial ecosystems 3.5b differentiate among producers, consumers, and decomposers and identify examples of each within aquatic and terrestrial ecosystems 3.5b construct and analyze a food chain that models the relationships and the flow of energy within an ecosystem 3.5b explain how a change in one part of a food chain might affect the rest of the food chain 3.5b identify the sun as the source of energy in food chains	
CLASSROOM/SCHOOLYARD ACTIVITIES This standard explains that ecosystems have a diversity of living and nonliving components that are interdependent. Project Learning Tree's Web of Life activity allows students to simulate a food web of their choosing by making connections with yarn/string and discover ways the components of the system are connected. (3.5b)	OUTDOOR FIELD EXPERIENCES Visit a natural area for a hike to identify living components in a food web. Visit Lewis Ginter Botanical Garden and participate in one of their in-person educational programs . Request a field trip to the Science Museum of Virginia to visit the Animal Lab to discuss animals within specific ecosystems.	COMMUNITY PARTNERS Lesley Newman, Project Learning Tree DCR Park Superintendent, Caledon State Park, Lake Anna State Park, Westmoreland State Park Donnell Howard, Caroline County Parks and Recreation Sites Staff, Lewis Ginter Botanical Garden Guest Services, Science Museum of Virginia



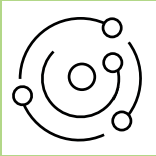
3.7 The student will investigate and understand that there is a water cycle and water is important to life on Earth.			
KEY IDEAS INCLUDE: a) there are many reservoirs of water on Earth b) the energy from the sun drives the water cycle c) the water cycle involves specific processes.		SOL ESSENTIAL KNOWLEDGE AND PRACTICES In order to meet this standard, it is expected that students will: 3.7 identify the ways organisms get water from the environment 3.7a compare major waterways including rivers, lakes, ponds, oceans, groundwater, and wells 3.7a identify and locate major water sources in the local community 3.7b identify the origin of energy that drives the water cycle 3.7c describe the processes of evaporation, condensation, and precipitation as these relate to the water cycle 3.7c construct and interpret a model of the water cycle	
CLASSROOM/SCHOOLYARD ACTIVITIES Water has its own cycle that is important to life on Earth. In this standard, students explore and compare sources of water and what type of processes occur during the water cycle. One activity to highlight the water cycle is the online game called The Blue Traveler (3.7b, c) in which students can follow the journey of a water droplet through various parts of the water cycle.	OUTDOOR FIELD EXPERIENCES Take a nature hike in a natural area to find evidence of the different parts of the water cycle. Visit Lewis Ginter Botanical Garden and participate in one of their in-person educational programs. Take a paddle on a local waterway and investigate what role it plays in the water cycle. Then create a piece of artwork to show the water cycle.	COMMUNITY PARTNERS Katie Boltz, Art Teacher at Caroline County Public Schools Robin Didlake, Friends of the Rappahannock DCR Park Superintendent, Caledon State Park, Lake Anna State Park, Westmoreland State Park Donnell Howard, Caroline County Parks and Recreation Sites Staff, Lewis Ginter Botanical Garden	

3.8 The student will investigate and understand that natural events and humans influence ecosystems.		
KEY IDEAS INCLUDE: a) human activity affects the quality of air, water, and habitats b) water is limited and needs to be conserved c) fire, flood, disease, and erosion affect ecosystems d) soil is a natural resource and should be conserved		SOL ESSENTIAL KNOWLEDGE AND PRACTICES In order to meet this standard, it is expected that students will: 3.8a analyze the effects of human influences on the quality of air, water, and habitats 3.8c describe the effects of fire, flood, disease, and erosion on organisms and habitats 3.8a explain how conservation efforts can reduce the negative impacts of human activity on a habitat 3.8a,c propose a solution or design a device that will reduce the impact of a human activity or a natural event on an ecosystem
CLASSROOM/SCHOOLYARD ACTIVITIES Ecosystems are influenced by natural events and humans. Students will explore the different influences and explain solutions that exist or can be implemented to reduce the impact of a harmful activity. For example, in the activity, The Litter We Know (3.8a) students have an opportunity to collect and analyze litter from their schoolyard and then take an action such as organizing a trash cleanup.	OUTDOOR FIELD EXPERIENCES Connect with local environmental groups to participate in a trash cleanup. Visit the Caroline Convenience Site to examine the variety of materials that can be recycled.	COMMUNITY PARTNERS Anna Moreau, Hanover-Caroline Soil and Water Conservation District Robin Didlake, Friends of the Rappahannock Eric Johnson, Caroline Solid Waste Andrew Satterwhite, U.S. Army Garrison Fort Walker



FOURTH GRADE

Our place in the solar system



4.2 The student will investigate and understand that plants and animals have structures that distinguish them from one another and play vital roles in their ability to survive.		
KEY IDEAS INCLUDE: a) the survival of plants and animals depends on photosynthesis b) animals have different structures and processes for obtaining energy c) plants and animals have different structures and processes for creating offspring	SOL ESSENTIAL KNOWLEDGE AND PRACTICES In order to meet this standard, it is expected that students will: 4.2a explain the critical role of photosynthesis in the survival of plants and animals within an ecosystem 4.2a,b create a model or diagram illustrating the parts of a plant in terms of obtaining energy; explain the role of roots, stems, and leaves 4.2b plan and conduct an investigation to determine how the amount of sunlight a plant receives affects plant growth compare methods by which plants and animals obtain energy 4.2b and describe how these processes are related 4.2c compare plant characteristics used for attracting pollinators 4.2c create and explain a model of a flower, illustrating the parts of the flower and its reproductive processes 4.2c understand that for animal populations to survive, the animals must be able to successfully reproduce	
CLASSROOM/SCHOOLYARD ACTIVITIES Living things have structures that differentiate them from other species, allowing them to survive and reproduce. Students also explore photosynthesis and the flow of energy. For example, students can complete a flower dissection (4.2 a, b, c) or the activity “ Here We Grow Again, Variation: Grades 3-5 ” (4.2 a, b) where they conduct an experiment to determine what plants need to grow and compare growth under different conditions.	OUTDOOR FIELD EXPERIENCES Visit a local botanical garden, public garden, or other natural area with a wide diversity of flowering plants.	COMMUNITY PARTNERS Anna Moreau, Hanover-Caroline Soil and Water Conservation District Robin Didlake, Friends of the Rappahannock Staff, Lewis Ginter Botanical Garden Caroline High School Arboretum DCR Park Superintendent, Caledon State Park, Lake Anna State Park, Westmoreland State Park Staff, Meadowview Biological Research Station Donnell Howard, Caroline County Parks and Recreation Sites Leslie Newman, Project Learning Tree



4.4 The student will investigate and understand that weather conditions and phenomena affect ecosystems and can be predicted.		
KEY IDEAS INCLUDE: a) weather measurements create a record that can be used to make weather predictions b) common and extreme weather events affect ecosystems c) long term seasonal weather trends determine the climate of a region	SOL ESSENTIAL KNOWLEDGE AND PRACTICES In order to meet this standard, it is expected that students will: 4.4a analyze and report data on temperature and precipitation 4.4a differentiate among the types of weather associated with high-pressure and low-pressure air masses 4.4a differentiate among cloud types (i.e., cirrus, stratus, cumulus, and cumulonimbus clouds) and the weather associated with each 4.4a use weather instruments (thermometer, barometer, rain gauge, anemometer) and observations of sky conditions to collect, record, and graph weather data over time; analyze results and determine patterns that may be used to make weather predictions 4.4a discuss the importance of monitoring weather data to make weather predictions 4.4b recognize a variety of storm types and the conditions and types of precipitation associated with each; explain when these storms occur 4.4b research and analyze the effects of extreme weather events on the environment 4.4c explain the difference between weather and climate and the effect climate has on an ecosystem	
CLASSROOM/SCHOOLYARD ACTIVITIES Tools can be used to measure weather conditions and records of those conditions can be used to make weather predictions. Weather has an impact on ecosystems and regions over time. Students can create weather journals (4.4 a) by using weather tools to record weather patterns over time.	OUTDOOR FIELD EXPERIENCES Visit a public natural area and rotate through stations using tools to collect and record weather data. Request a tour at the Wakefield National Weather Service office .	COMMUNITY PARTNERS Staff, Wakefield Nat'l Weather Service Office DCR Park Superintendent, Caledon State Park, Lake Anna State Park, Westmoreland State Park Donnell Howard, Caroline County Parks and Recreation Sites

4.8 The student will investigate and understand that Virginia has important natural resources		
KEY IDEAS INCLUDE: a) watersheds and water b) plants and animals c) minerals, rocks, and ores d) forests, soil, and land	SOL ESSENTIAL KNOWLEDGE AND PRACTICES In order to meet this standard, it is expected that students will: 4.8a describe characteristics of Virginia's waterways (including rivers, bays, lakes, and the Atlantic Ocean), name an example of each, and discuss the importance of the waterways to Virginia 4.8a create and interpret a model of a watershed 4.8a use evidence to explain the statement, “We all live downstream.” 4.8b explain the importance of Virginia's animals and plants to humans 4.8c research a Virginia mineral, ore, and/or rock and communicate its use in everyday applications 4.8d describe a variety of important land uses in Virginia, including natural and cultivated forests 4.8a,b,c,d investigate the school yard or local ecosystem to identify questions, problems, or issues that affect a natural resource in that area and determine a possible solution to an identified problem	
CLASSROOM/SCHOOLYARD ACTIVITIES Virginia's natural resources include water, plants, animals, minerals rocks, ores, forests, soils, and land. Students can investigate these resources and analyze their use and importance by completing the Schoolyard Report Card (4.8 a, b, c, d) where students evaluate their school's infrastructure and community habits to determine a “grade” of the schoolyard health.	OUTDOOR FIELD EXPERIENCES Investigate a local natural area using the Schoolyard Report Card criteria, and compare the results from school to the natural area. Visit Lewis Ginter Botanical Garden and participate in one of their in-person educational programs .	COMMUNITY PARTNERS Anna Moreau, Hanover-Caroline Soil and Water Conservation District Robin Didlake, Friends of the Rappahannock Staff, Lewis Ginter Botanical Garden Caroline High School Arboretum DCR Park Superintendent, Caledon State Park, Lake Anna State Park, Westmoreland State Park Donnell Howard, Caroline County Parks and Recreation

FIFTH GRADE

Transforming matter and energy



5.9 The student will investigate and understand that the conservation of energy resources is important.		
KEY IDEAS INCLUDE: a) some sources of energy are considered renewable and others are not b) individuals and communities have means of conserving both energy and matter c) advances in technology improve the ability to transfer and transform energy	SOL ESSENTIAL KNOWLEDGE AND PRACTICES In order to meet this standard, it is expected that students will: 5.9a compare energy sources, including their benefits and limitations 5.9a identify the type(s) of energy used in the home or school to power devices and research the origin of the identified energy, including how long it takes to form, and classify it as either a renewable or nonrenewable resource 5.9b analyze and interpret data showing human consumption of energy over the last century and infer what might happen if the trend in energy consumption continues 5.9b create and implement a plan to conserve energy in the home or school 5.9c provide examples of current technology that use energy efficiently	
CLASSROOM/SCHOOLYARD ACTIVITIES Energy resources can be classified as renewable or nonrenewable, and energy resources can be conserved through individual and community actions. New technologies can improve the ability to transform and transfer energy. Students can explore these concepts in “ Sustainability: Then, Now, Later ” (5.9 a, b) where students model resource consumption in a simulation activity and discuss the connections between the simulation and real-world resources. Then, students analyze three “letters” from students in different time periods, and compare their resource consumption from then to today.	OUTDOOR FIELD EXPERIENCES Tour a Dominion Energy Power Station.	COMMUNITY PARTNERS Kathy Ash, Chesterfield Power Station Courtney Hallacher, Project WILD

5 FULL MWEE		
CLASSROOM/SCHOOLYARD ACTIVITIES Watershed education that occurred through science SOLs in third and fourth grade culminate in the full MWEE, which takes place in fifth grade. In these activities, students connect watershed ecosystems, human impacts, and natural resources specific to Caroline County.	OUTDOOR FIELD EXPERIENCES Complete a MWEE Field Experience, suggested activities include: -Guided nature hike -Water quality testing Suggested locations suitable for a MWEE Field Experience include: -Camp Hanover -Friends of the Rappahannock Nature Preserve	COMMUNITY PARTNERS Anna Moreau, Hanover-Caroline Soil and Water Conservation District Robin Didlake, Friends of the Rappahannock Reilly McNamara, Camp Hanover

SIXTH GRADE

Our world; our responsibility



6.6 The student will investigate and understand that water has unique physical properties and has a role in the natural and human-made environment.		
KEY IDEAS INCLUDE: a) water is referred to as the universal solvent b) water has specific properties c) thermal energy has a role in phase changes d) water has a role in weathering e) large bodies of water moderate climate f) water is important for agriculture, power generation, and public health	SOL ESSENTIAL KNOWLEDGE AND PRACTICES In order to meet this standard, it is expected that students will: 6.6a plan an investigation to demonstrate the ability of water to dissolve materials 6.6b describe the properties of water and identify examples of cohesion, adhesion, and surface tension 6.6c compare the effects of adding or subtracting thermal energy to the states of water 6.6c relate the three states of water to the water cycle 6.6d model the action of freezing water on rocks 6.6d plan and conduct an investigation to determine the action of acidified water on building materials such as concrete, limestone, or marble 6.6d chart, record, and describe evidence of chemical and physical weathering in the local environment 6.6e analyze and explain the difference in average winter temperatures among areas in central and western Virginia and cities and counties along the Chesapeake Bay and Atlantic coast 6.6f explain the role of water in power generation 6.6f describe the importance of careful management of water resources	
CLASSROOM/ SCHOOLYARD ACTIVITIES Water has unique physical properties that allow it to play a role in weathering, moderating climate, and in human activities. Students will also explore the properties of water. For example, students can complete the “ H2Olympics ” (6.6 a, b) activity where students compete in several challenges to test the properties of water.	OUTDOOR FIELD EXPERIENCES Visit a local hiking trail or natural area with a stream or creek running through it. On a nature walk, look for evidence of erosion.	COMMUNITY PARTNERS Anna Moreau, Hanover-Caroline Soil and Water Conservation District Robin Didlake, Friends of the Rappahannock DCR Park Superintendent, Caledon State Park, Lake Anna State Park, Westmoreland State Park Donnell Howard, Caroline County Parks and Recreation Sites



6.7 The student will investigate and understand that air has properties and that Earth’s atmosphere has structure and is dynamic.			
KEY IDEAS INCLUDE: a) air is a mixture of gaseous elements and compounds b) the atmosphere has physical characteristics c) properties of the atmosphere change with altitude d) there is a relationship between air movement, thermal energy, and weather conditions e) atmospheric measures are used to predict weather conditions f) weather maps give basic information about fronts, systems, and weather measurements		SOL ESSENTIAL KNOWLEDGE AND PRACTICES In order to meet this standard, it is expected that students will: 6.7a identify the composition and physical characteristics of the atmosphere 6.7b analyze and interpret charts and graphs of the atmosphere in terms of temperature and pressure 6.7b measure and record air temperature, air pressure, and humidity, using appropriate units of measurement and tools 6.7b,e predict weather conditions based on air temperature, barometric pressure, and humidity 6.7c differentiate among the layers of the atmosphere in terms of general characteristics and changes in altitude 6.7d explain the impact of the addition of thermal energy on air movement compare types of precipitation 6.7e compare weather-related phenomena, including thunderstorms, tornadoes, hurricanes, and drought 6.7f interpret basic weather maps, including the identification of warm and cold fronts 6.7f map the movement of cold and warm fronts and interpret their effects on observable weather conditions	
CLASSROOM/SCHOOLYARD ACTIVITIES Air and Earth's atmosphere have unique properties and structure that change with altitude, thermal energy, and weather. Weather maps and atmospheric measures can be used to make predictions about weather. Students can use real time weather maps and historic weather data to explore the interaction of weather and characteristics like pressure, temperature, wind, humidity, and dew point. Students can record the characteristics in real time in a weather journal and can compare them to a weather map (6.7 b, e, f).	OUTDOOR FIELD EXPERIENCES Visit a site periodically throughout the year and record the air temperature, pressure, and humidity in weather journals. Visit a downtown area to infer the impact of impermeable surfaces during a rain event, and can compare it to that of an area with more permeable surfaces.	COMMUNITY PARTNERS Anna Moreau, Hanover-Caroline Soil and Water Conservation District Robin Didlake, Friends of the Rappahannock DCR Park Superintendent, Caledon State Park, Lake Anna State Park, Westmoreland State Park Donnell Howard, Caroline County Parks and Recreation Sites	

6.8 The student will investigate and understand that land and water have roles in watershed systems.

KEY IDEAS INCLUDE: a) a watershed is composed of the land that drains into a body of water b) Virginia is composed of multiple watershed systems which have specific features c) the Chesapeake Bay is an estuary that has many important functions d) natural processes, human activities, and biotic and abiotic factors influence the health of a watershed system		SOL ESSENTIAL KNOWLEDGE AND PRACTICES In order to meet this standard, it is expected that students will: 6.8a,b identify abiotic and biotic features in the students' local watershed 6.8b use maps to determine the location and size of Virginia's regional watershed systems 6.8b locate the local watershed and the rivers and streams associated with it 6.8c explain the importance of the Virginia watersheds 6.8d explain and appraise the value of wetlands to ecosystems, including humans 6.8d explain the importance of estuaries, including their importance to people 6.8d propose ways to maintain water quality within a watershed 6.8d explain the factors that affect water quality in a watershed and how those factors can affect an ecosystem 6.8d forecast potential water-related issues that may become important in the future 6.8d locate and critique a media article or editorial (print or electronic) concerning water use or water quality and analyze and evaluate the science concepts involved 6.8d argue for and against commercially developing a parcel of land containing a large wetland area 6.8d design and defend a land-use model that minimizes negative impact 6.8d measure, record, and analyze a variety of water quality indicators and describe what these mean to the health of an ecosystem	
CLASSROOM/SCHOOLYARD ACTIVITIES Watersheds are areas of land where water drains to a common point. There are multiple watersheds in Virginia, and some of them drain to the Chesapeake Bay. Human activities can impact the health of a watershed. Students can investigate their local watershed via models, in-person investigations, and by analysis of resource use. For example, by completing a field-based macro invertebrate survey and round of water quality tests or by completing " Watered Down History " (6.8 a, b, d) where students investigate the history of a local waterway, and analyze changes to the waterway and what they expect will impact the waterway in the future.	OUTDOOR FIELD EXPERIENCES Complete a MWEE Field Experiences, suggested activities include: <ul style="list-style-type: none">• Guided nature hike• Water quality testing• Macro invertebrate sampling• Watershed mapping activity Suggested locations suitable for a MWEE Field Experience include: <ul style="list-style-type: none">• Caroline Recreation Park, Woodland Trail• U.S. Army Garrison Fort Walker• Camp Hanover	COMMUNITY PARTNERS Anna Moreau, Hanover-Caroline Soil and Water Conservation District Robin Didlake, Friends of the Rappahannock Donnell Howard, Caroline County Parks and Recreation Sites Reilly McNamara, Camp Hanover Andrew Satterwhite, U.S. Army Garrison Fort Walker Courtney Hallacher, Project WILD	



6.9 The student will investigate and understand that humans impact the environment and individuals can influence public policy decisions related to energy and the environment		
<p>KEY IDEAS INCLUDE:</p> <p>a) natural resources are important to protect and maintain</p> <p>b) renewable and nonrenewable resources can be managed</p> <p>c) major health and safety issues are associated with air and water quality</p> <p>d) major health and safety issues are related to different forms of energy</p> <p>e) preventive measures can protect land-use and reduce environmental hazards</p> <p>f) there are cost/benefit tradeoffs in conservation policies</p>	<p>SOL ESSENTIAL KNOWLEDGE AND PRACTICES</p> <p>In order to meet this standard, it is expected that students will:</p> <p>6.9a construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources affect Earth's systems (e.g., climate, oceans, rainforest)</p> <p>6.9b differentiate between renewable and nonrenewable resources</p> <p>6.9b describe the role of local and state conservation professionals in managing natural resources, including wildlife protection; forestry and waste management; and air, water, and soil conservation</p> <p>6.9f analyze resource-use options in everyday activities and determine how personal choices have costs and benefits related to the generation of waste</p> <p>6.9b analyze how renewable and nonrenewable resources are used and managed within the home, school, and community</p> <p>6.9c describe ways that water and air pollution affect human health and safety</p> <p>6.9d compare energy sources and their effects on human health and safety</p> <p>6.9e investigate practices that can reduce environmental hazards or improve land use</p> <p>6.9f analyze reports, media articles, and other narrative materials related to waste management and resource use to determine various perspectives concerning the costs and benefits in real-life situations</p> <p>6.9f evaluate the effects of resource use, waste management, and pollution prevention in the school and home environment</p>	
<p>CLASSROOM/SCHOOLYARD ACTIVITIES</p> <p>Human impact, through individual and collective actions, can impact the environment. People can also influence public policy that relates to energy and the environment. Common activities used to support this standard include those that simulate investigations of the interconnected nature of the environment, and challenge students to balance competing needs for resources. An example of these activities includes “Color Me a Watershed” (6.9 a, e, f) where students map a watershed and calculate the change over time for the percentage of land in different applications (agriculture, forest, urban, etc.) and then calculate the amount of runoff for each land application type over time, combined with “Decisions, Decisions” (6.9 b, f) where students balance different priorities and engage with different perspectives as they develop brief proposals to address a chosen “problem” scenario.</p>	<p>OUTDOOR FIELD EXPERIENCES</p> <p>Visit a local utilities site, park, water treatment facility, or waste transfer station to explore ways individual actions have an impact on a community-level scale. Before visiting, reach out to site staff members to schedule a tour or talk about their role managing the natural resources. This can also include a career exploration component for students.</p> <p>Partner with Friends of the Rappahannock to conduct a Stormwater STEM Activity and MWEE Issue Definition activity.</p> <p>Partner with Friends of the Rappahannock to conduct an oyster dissection and restoration lesson.</p> <p>Visit Caroline County Closed Landfill.</p>	<p>COMMUNITY PARTNERS</p> <p>Anna Moreau, Hanover-Caroline Soil and Water Conservation District</p> <p>Robin Didlake, Friends of the Rappahannock</p> <p>Eric Johnson, Caroline Soil Waste</p> <p>Leslie Newman, Project Learning Tree</p>

LS.5 The student will investigate and understand that biotic and abiotic factors affect an ecosystem.		
<p>KEY IDEAS INCLUDE:</p> <p>a) matter moves through ecosystems via the carbon, water, and nitrogen cycles</p> <p>b) energy flow is represented by food webs and energy pyramids</p> <p>c) relationships exist among producers, consumers, and decomposers</p>	<p>SOL ESSENTIAL KNOWLEDGE AND PRACTICES</p> <p>In order to meet this standard, it is expected that students will:</p> <p>LS.5a differentiate among key processes in the water, carbon, and nitrogen cycles and provide examples to illustrate how they support life</p> <p>LS.5a develop and/or use a model to illustrate the cycling of matter and flow of energy among living and nonliving parts of an ecosystem</p> <p>LS.5a analyze local aquatic and terrestrial ecosystems, identify biotic and abiotic components, and describe their roles in the cycling of matter and flow of energy</p> <p>LS.5a explain and provide examples to illustrate the cause-and-effect relationship of human activity on the cycling of matter and flow of energy in an ecosystem</p> <p>LS.5b explain matter and energy transfer as modeled through food webs and energy pyramids</p> <p>LS.5b determine the relationship between a population's position in a food web and its size</p> <p>LS.5b interpret energy pyramids to determine the relative amount of energy available at each trophic level</p> <p>LS.5b, c develop and/or interpret a model of a food web using organisms found in a local ecosystem and classify organisms as producers or first-, second-, or third-order consumers</p> <p>LS.5c recognize examples of common producers, consumers, and decomposers and explain the role of each in the flow of energy and cycling of matter through an ecosystem</p> <p>LS.5c provide examples to illustrate the effects of human activity on the activity of producers, consumers, and decomposers in an ecosystem</p>	
<p>CLASSROOM/SCHOOLYARD ACTIVITIES</p> <p>Matter and energy are transferred through food webs. Students will model and simulate local food webs using the local ecosystem. An example of this is the Web of Life (LS.5 c) activity from Project Learning Tree. In this activity, students create a physical web and model the interconnectedness of organisms in an ecosystem. The learners will see how one organism is connected to other organisms in an ecosystem and use a model to understand the interdependence of organisms in an ecosystem.</p>	<p>OUTDOOR FIELD EXPERIENCES</p> <p>Visit the Caroline Recreation Park, Woodland Trail to make observations and inferences about the local food web in the forest ecosystem.</p>	<p>COMMUNITY PARTNERS</p> <p>Lesley Newman, Project Learning Tree</p> <p>Donnell Howard, Caroline County Parks and Recreation Sites</p>

LS.6 The student will investigate and understand that populations in a biological community interact and are interdependent.		
KEY IDEAS INCLUDE: a) relationships exist between predators and prey and these relationships are modeled in food webs b) the availability and use of resources may lead to competition and cooperation c) symbiotic relationships support the survival of different species d) the niche of each organism supports survival	SOL ESSENTIAL KNOWLEDGE AND PRACTICES In order to meet this standard, it is expected that students will: LS.6a explain how the interactions of populations form communities within an ecosystem LS.6a formulate inferences based on graphs and other data about predator-prey populations LS.6a argue based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors help them to obtain resources LS.6b analyze and interpret data to predict and explain the effects of resource availability on organisms and populations in an ecosystem LS.6b predict the effect of limiting factors on organisms, populations, and/or communities in a food web/ecosystem LS.6b provide examples to illustrate how organisms cooperate and/or compete with one another for resources LS.6a analyze and interpret data about the effects of resource availability on organisms and populations of organisms in an ecosystem LS.6c differentiate among the types of symbiosis and recognize and/or provide examples of each LS.6d infer the niche of organisms from their physical characteristics	
CLASSROOM/SCHOOLYARD ACTIVITIES Resources are limited within an ecosystem. Students will analyze and interpret data on population changes. Activities used to support this standard include activities that provide opportunities for data collection to show changes in populations through the many ecosystem processes. An activity that supports this standard is Every Tree for Itself (LS.6 a). Through an active modeling exercise, learners explore how trees compete with each other for nutrients, sunlight, space, and water. In this activity, learners model how trees compete to meet their essential needs and describe how varying amounts of light, water, and nutrients affect tree growth.	OUTDOOR FIELD EXPERIENCES Visit the Caroline Recreation Park, Woodland Trail to make observations and collect data on forest succession.	COMMUNITY PARTNERS Lesley Newman, Project Learning Tree Donnell Howard, Caroline County Parks and Recreation Sites

LS.7 The student will investigate and understand that adaptations support an organism’s survival in an ecosystem.		
KEY IDEAS INCLUDE: a) biotic and abiotic factors define land, marine, and freshwater ecosystems b) physical and behavioral characteristics enable organisms to survive within a specific ecosystem	SOL ESSENTIAL KNOWLEDGE AND PRACTICES In order to meet this standard, it is expected that students will: LS.7a compare the biotic and abiotic factors that distinguish land, marine, and freshwater ecosystems LS.7a ,b analyze and describe how physical characteristics and behaviors enable organisms to survive in an ecosystem LS.7b investigate how structural adaptations among populations allow organisms to survive with ecosystems	
CLASSROOM/SCHOOLYARD ACTIVITIES Animals and plants adapt over time to changes to their ecosystem. In the activity Adaptive Artistry (LS.7 b) where students will design and construct a bird and describe the creations’ adaptations and habitat.	OUTDOOR FIELD EXPERIENCES Visit the Caroline Recreation Park, Woodland Trail to make observations and collect data on how organisms have adapted to the ecosystem.	COMMUNITY PARTNERS Lesley Newman, Project Learning Tree Donnell Howard, Caroline County Parks and Recreation Sites Courtney Hallacher, Project WILD

LS.8 The student will investigate and understand that ecosystems, communities, populations, and organisms are dynamic and change over time.		
KEY IDEAS INCLUDE: a) organisms respond to daily, seasonal, and long-term changes b) changes in the environment may increase or decrease population size c) large-scale changes such as eutrophication, climate changes, and catastrophic disturbances affect ecosystems	SOL ESSENTIAL KNOWLEDGE AND PRACTICES In order to meet this standard, it is expected that students will: LS.8a categorize responses as daily, seasonal, or long-term LS.8a construct a scientific explanation based on evidence to explain the benefit(s) of daily, seasonal, and/or long-term responses of organisms to their enhanced survival LS.8b classify as long-term, short-term, or seasonal the various types of changes that occur over time in ecosystems, communities, populations, and organisms LS.8b predict the effect of changes to living and/or nonliving factors on the size and distribution of populations in an ecosystem LS.8b compare the factors that increase or decrease population size LS.8b argue, citing evidence, that changes to physical or biological components of an ecosystem affect populations LS.8c predict the effect of large-scale changes on ecosystems and communities LS.8c analyze data to determine the effect of a catastrophic event on a community LS.8c predict the environmental effects of large-scale changes, such as climate change, ocean acidification, and sea-level rise	
CLASSROOM/SCHOOLYARD ACTIVITIES Ecosystems, communities, populations, and organisms are dynamic and change over time by both natural and human events. The following activities allow students to use the physical characteristics of the organism for identification and prediction of how humans have impacted the ecosystem. Two activities that support these standards are Critter Cubes (LS.8 b, c) and Stroud Online Leaf Pack Simulation (LS.8 b, c). Both of these activities can complement outdoor field experiences of water quality testing and macro invertebrate studies. Other activities include water quality testing in the creek by school with a focus on temperature and dissolved-oxygen (LS.8 c).	OUTDOOR FIELD EXPERIENCES Visit the Caroline Recreation Park, Woodland Trail to collect macroinvertebrate and water samples in the creek. Students will make predictions as to the water quality based on macroinvertebrate study over several weeks.	COMMUNITY PARTNERS Anna Moreau, Hanover-Caroline Soil and Water Conservation District Robin Didlake, Friends of the Rappahannock Donnell Howard, Caroline County Parks and Recreation Sites

LS.9 The student will investigate and understand that relationships exist between ecosystem dynamics and human activity.		
KEY IDEAS INCLUDE: a) changes in habitat can disturb populations b) disruptions in ecosystems can change species competition c) variations in biotic and abiotic factors can change ecosystems	SOL ESSENTIAL KNOWLEDGE AND PRACTICES In order to meet this standard, it is expected that students will: LS.9a describe ways that human interaction has altered habitats positively and negatively LS.9a describe the relationship between human food harvest and habitat stability LS.9a debate the pros and cons of human land use vs. ecosystem stability LS.9b compare population disturbances that affect competition among species and species survival LS.9c use evidence to describe the impact of human activity on the biotic and abiotic factors within an ecosystem LS.9a,b,c interpret data obtained through observations and electronic and print resources to determine the effects of human interaction on local ecosystems LS.9a,b,c plan an investigation examining relationships between ecosystem dynamics and human activity (it may be a complete experimental design or may focus on systematic observation, description, measurement, and/or data collection and analysis) LS.9a,b,c analyze and critique the experimental design of basic investigations related to the relationships between ecosystem dynamics and human activity	
CLASSROOM/SCHOOLYARD ACTIVITIES Relationships exist between ecosystem dynamics and human activity. Both natural and human events can change a habitat can disturb populations. Common activities used to support this standard include activities that show how humans have altered the ecosystem in both negative and positive ways. In A Plume Problem AKA A Grave Mistake (LS.9 a) students will analyze data to solve a mystery and identify a potential polluter. Other activities include use of an Enviroscape (LS.9 a), a three dimensional model of a watershed. Students can create situations and model human activities on the watershed and learn about best management practices (BMPs).	OUTDOOR FIELD EXPERIENCES Visit the Caroline Recreation Park, Woodland Trail to make observations of human impacts on the watershed and develop action projects to share this knowledge with the community.	COMMUNITY PARTNERS Anna Moreau, Hanover-Caroline Soil and Water Conservation District Robin Didlake, Friends of the Rappahannock Donnell Howard, Caroline County Parks and Recreation Sites



LS.11 The student will investigate and understand that populations of organisms can change over time.		
KEY IDEAS INCLUDE: a) mutation, adaptation, natural selection, and extinction change populations b) the fossil record, genetic information, and anatomical comparisons provide evidence for evolution c) environmental factors and genetic variation, influence survivability and diversity of organisms	SOL ESSENTIAL KNOWLEDGE AND PRACTICES In order to meet this standard, it is expected that students will: LS.11a interpret data from simulations that demonstrate natural selection LS.11a explain the relationship among mutations, variations in traits in a population, and natural selection LS.11a compare natural selection and extinction LS.11a explain how mutations differ from adaptations LS.11a construct an evidence-based explanation about how genetic variations in traits in a population increase some individuals' probability of surviving and reproducing in a specific environment LS.11b describe the role of fossils in determining events in Earth's history LS.11b explain the evidence for evolution from a variety of sources of scientific data LS.11b apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships LS.11c explain how genetic variations in offspring, which leads to variations in successive generations, can result from the same two parents LS.11c construct an evidence-based explanation about how environmental factors and genetic variation can influence a species' survival, reproduction, and diversity LS.11a,c explain what is meant by the phrase, "survival of the fittest"	
CLASSROOM/SCHOOLYARD ACTIVITIES Populations of organisms can change over time. Environmental factors and genetic variation, influence survivability and diversity of organisms. Activities that support this standard include activities that allow students to make observation and nature, collect data, and report their results. The student should also be able to interpret and create cause-and-effect scenarios. In the Project Learning Tree Activity, Trees in Trouble (LS.11 a) , students will recognize symptoms of unhealthy trees and describe possible causes of their poor health and perform investigations to determine the effects of crowding and fertilization on plant growth.	OUTDOOR FIELD EXPERIENCES Take a hike in a local forested area to observe tree health and the impact of humans on the health of the trees.	COMMUNITY PARTNERS Lesley Newman, Project Learning Tree Donnell Howard, Caroline County Parks and Recreation Sites

ES.11 The student will investigate and understand that the atmosphere is a complex, dynamic system and is subject to long-and short-term variations.			
KEY IDEAS INCLUDE: a) the composition of the atmosphere is critical to most forms of life b) biologic and geologic inter- actions over long and short time spans change atmospheric composition c) natural events and human actions may stress atmospheric regulation mechanisms d) human actions, including economic and policy decisions, impact the atmosphere		SOL ESSENTIAL KNOWLEDGE AND PRACTICES In order to meet this standard, it is expected that students will: ES.11a describe the role of different atmospheric components in supporting life ES.11b analyze atmospheric change over geologic time and assess the role and evidence of photosynthetic organ- isms in this transformation (e.g., ice cores, stromatolites, red beds) ES.11c explain how volcanic activity or meteor impacts could affect the atmosphere, and life on Earth ES.11c explain how biologic activity, including human activities, may influence global temperature and climate ES.11c research historical information and scientific data on the impact of major volcanic eruptions and other natu- ral events on the atmosphere ES.11d research data on the effect of human activities and public policy on Earth's ozone layer since chlorofluorocarbons (CFC) were banned ES.11d research and analyze the effects of the development of fossil fuels and other human activity on atmospheric com- position; develop a suggestive set of steps or sample policies to monitor and mitigate potential issues and concerns	
CLASSROOM/SCHOOLYARD ACTIVITIES The atmosphere is a complex, dynamic system and is subject to long-and short-term variations. Natural events and human actions may stress atmospheric regulation mechanisms; and human actions, including economic and policy decisions, impact the atmosphere. Activities used to support this standard include case studies and community science projects that give students a sense of place and voice in environmental decision-making in their community. Students should complete a problem-based assessment which leads to a better understanding of atmosphere science. For example, a study of how acidification of the ocean is due to an increase in atmospheric carbon dioxide. The NOAA website suggests some lessons. Other Activities include Ocean acidification Lessons (ES.11 a,b,d) and Hands-On NASA Science Lessons (ES.11 a,b,d) .		OUTDOOR FIELD EXPERIENCES Field trip to the Virginia Institute of Marine Science	COMMUNITY PARTNERS Staff, Virginia Institute of Marine Science



ES.12 The student will investigate and understand that Earth’s weather and climate are the result of the interaction of the sun’s energy with the atmosphere, oceans, and the land.

KEY IDEAS INCLUDE: a) weather involves the reflection, absorp- tion, storage, and redistribution of energy over short to medium time spans; b) weather patterns can be predicted based on changes in current conditions; c) extreme imbalances in energy distribution in the oceans, atmosphere, and the land may lead to severe weather conditions; d) models based on current conditions are used to predict weather phenomena; and e) changes in the atmosphere and the oceans due to human activity affect global climate.	SOL ESSENTIAL KNOWLEDGE AND PRACTICES In order to meet this standard, it is expected that students will: ES.12a research and construct a diagram that demonstrates the interaction of solar radiation, Earth's atmosphere, and energy transfer (conduction, convection, and radiation) ES.12b predict the direction of local winds and relate these to the presence of fronts and high- and/or low-pressure systems or other atmospheric phenomena ES.12b over a multi-day period, read and interpret data from a thermometer, a barometer, and a psy- chrometer; determine if there is a correlation between the data and observed weather phenomena ES.12b identify types and origins of air masses, fronts and the accompanying weather conditions ES.12b collect evidence for how the motions and complex interactions of air masses results in changes in weather conditions ES.12b plan and conduct an investigation to predict weather based on cloud type, temperature, jet stream location, relative humidity, and barometric pressure read and interpret a weather map containing fronts, isobars, and isotherms and relate these factors to ES.12b potential weather conditions occurring at specific locations ES.12c analyze the conditions that lead to severe weather events such as tornadoes and hurricanes. ES.12d describe the effect of satellite technology on weather prediction and storm tracking, including hurricanes, and evaluate the costs and benefits in terms of lives and property saved; predict the im- pact on storm preparedness if there were no weather satellites ES.12e describe human and natural factors that have led to the rise in global temperature over the past century ES.12e analyze geoscience data and the results of global climate models to make an evidence-based forecast of the current rate of global and regional climate change and associated future effects on Earth systems
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BIO.8 The student will investigate and understand that there are dynamic equilibria within populations, communities, and ecosystems.

KEY IDEAS INCLUDE:

- a) interactions within and among populations include carrying capacities, limiting factors, and growth curves
- b) nutrients cycle with energy flow through ecosystems
- c) ecosystems have succession patterns
- d) natural events and human activities influence local and global ecosystems and may affect the flora and fauna of Virginia

SOL ESSENTIAL KNOWLEDGE AND PRACTICES

In order to meet this standard, it is expected that students will:

- BIO.8a** use mathematical representations such as charts, graphs, histograms, and population change data, to support explanations of factors that affect carrying capacity of ecosystems
- BIO.8a** make predictions about changes that could occur in population numbers as the result of population interactions
- BIO.8a** graph and interpret a population growth curve and identify the carrying capacity of the populations
- BIO.8b** interpret how the flow of energy occurs between trophic levels in all ecosystems in a food chain, food web, pyramid of energy, and pyramid of biomass
- BIO.8b** develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere
- BIO.8c** evaluate 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
- BIO.8c** recognize and understand the cause-and-effect relationship between changes in the abiotic and biotic conditions in an ecosystem and succession
- BIO.8c** describe the patterns of succession found in aquatic and terrestrial ecosystems of Virginia
- BIO.8c** identify factors leading to primary and secondary succession
- BIO.8c** describe the characteristics of a climax community
- BIO.8d** provide examples to illustrate and explain how habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change can disrupt an ecosystem and threaten the survival of species
- BIO.8d** design, evaluate, and refine a solution for reducing the negative effects of human activity on a Virginia watershed or ecosystem

CLASSROOM/SCHOOLYARD ACTIVITIES

Natural events and human activities influence local and global ecosystems and may affect the flora and fauna of Virginia. Common activities used to support this standard include activities that allow students to evaluate the effects of human activities on Virginia's watersheds and ecosystems. The [Schoolyard Report Card \(BIO.8 d\)](#) is a good starting point; it allows students to gain a sense of place and responsibility. Other activities include use of an Enviroscope where students can create situations and model human activities on the watershed and learn about best management practices (BMPs), macro invertebrate sampling, leaf pack examination, a Bioblast, [Critter Cubes \(BIO.8 a\)](#), or the [Stroud Online Leaf Pack Simulation](#).

OUTDOOR FIELD EXPERIENCES

Visit the Caroline Recreation Park, Woodland Trail to conduct Bioblast and collect macro invertebrate. This activity repeated over several weeks will give the students data to make predictions on the impact of humans on the local ecosystems.

COMMUNITY PARTNERS

Anna Moreau, Hanover-Caroline Soil and Water Conservation District
Robin Didlake, Friends of the Rappahannock
Donnell Howard, Caroline County Parks and Recreation Sites





ENV.5 The student will investigate and understand that the Earth is one interconnected system through which energy and matter flow.		
KEY IDEAS INCLUDE: a) Earth's terrestrial and aquatic biomes have distinct characteristics and components b) ecosystem is composed of both biotic and abiotic factors c) energy and matter flow within an ecosystem d) the movement of energy through the living world to include food webs, food chains, trophic levels e) biotic and abiotic factors may limit population growth in a given area (carrying capacity)		
CLASSROOM/SCHOOLYARD ACTIVITIES Earth is one interconnected system through which energy and matter flow and is made up of both abiotic and biotic factors. Activities that support this standard encourage students to observe, identify, and collect data on populations. In the Project WILD activity Environmental Barometer where students observe, identify, and count wildlife in two separate outdoor study areas, compare and contrast abiotic and biotic inventories at both study sites, and construct an argument as to how the presence of wildlife can be seen as an indicator of environmental quality.	OUTDOOR FIELD EXPERIENCES Visit the Caroline Recreation Park, Woodland Trail to conduct a Bioblast and collect macroinvertebrates. This activity repeated over several weeks will give the students data to make predictions on the impact of humans on the local ecosystems. Visit the U. S. Army Garrison Fort Walker for an Earth Day educational field trip.	COMMUNITY PARTNERS Anna Moreau, Hanover-Caroline Soil and Water Conservation District Robin Didlake, Friends of the Rappahannock Courtney Hallacher, Project WILD Donnell Howard, Caroline County Parks and Recreation Sites Andrew Satterwhite, U.S. Army Garrison Fort Walker

ENV.9 The student will investigate and understand how human actions impact the environment.		
KEY IDEAS INCLUDE: a) advantages and disadvantages of balancing short term interests with long term welfare of society; b) individual activities and decisions can have an impact on the environment; c) people affect their environment through the use of natural resources to include how agriculture, d) forestry, ranching, mining, urbanization, transportation, and commercial fishing impact the land, water, air, and organisms e) the allocation of state and federal lands impacts environmental decisions.		
CLASSROOM/SCHOOLYARD ACTIVITIES Human actions impact the environment. Activities that support this standard focus on developing a sense of place and how your actions impact the ecosystem. In the Aquatic WILD activity, Migration Heahache , students will describe the effects of habitat loss and desegregation on populations of migration waterbirds. Other activities include Stormwater STEM.	OUTDOOR FIELD EXPERIENCES Complete a MWEE Field Experiences, suggested activities include: -Guided nature hike -Water quality testing -Macroinvertebrate sampling -Watershed mapping activity Location suggestions: -U.S. Army Garrison Fort Walker -Hicks Landing -Caroline Recreation Park, Woodland Trail	COMMUNITY PARTNERS Anna Moreau, Hanover-Caroline Soil and Water Conservation District Robin Didlake, Friends of the Rappahannock Donnell Howard, Caroline County Parks and Recreation Sites Andrew Satterwhite, U.S. Army Garrison Fort Walker Courtney Hallacher, Project WILD

ENV.12 The student will investigate and understand that their actions as an environmentally literate citizen will play a role in environmental policies.		
KEY IDEAS INCLUDE: a) consumer choices in Virginia impact jobs, resources, pollution, and waste here and around the world b) environmental justice is the study of the impact of environmental policy including resource allocation c) pollution regulations, and waste disposal across all communities d) political, legal, social, and economic decisions may affect global and local ecosystems e) the media impacts public opinion and public policy f) individuals and interest groups influence public policy g) environmental decisions should include a cost-benefit analysis and may lead to trade-offs in conservation policy h) different methods are used by local, state, national, and international governments and organizations with varying results to protect the environment		
CLASSROOM/SCHOOLYARD ACTIVITIES Environmentally literate citizens can play a role in environmental policies. To meet this guideline students should research, plan, and complete an action project as part of the MWEE. Guest speakers and students completing a problem-based assessment are key to this guideline. Students should identify an issue, plan an experiment to collect data to synthesize, and complete an action project.	OUTDOOR FIELD EXPERIENCES Complete a MWEE Field Experiences, suggested activities include: -Guided nature hike -Water quality testing -Macroinvertebrate sampling -Watershed mapping activity Location suggestions: -U.S. Army Garrison Fort Walker -Hicks Landing -Caroline Recreation Park, Woodland Trail	COMMUNITY PARTNERS Anna Moreau, Hanover-Caroline Soil and Water Conservation District Robin Didlake, Friends of the Rappahannock Donnell Howard, Caroline County Parks and Recreation Sites Andrew Satterwhite, U.S. Army Garrison Fort Walker

CONCLUSION



Conclusion

Already, in CCPS, environmental learning is underway. First, through established partnerships that reach beyond classroom walls with Friends of the Rappahannock and the Hanover-Caroline Soil and Water Conservation District, students are already participating in MWEEs during the school year. We are hopeful that the ELP will encourage CCPS to continue to foster their partnership with the U.S. Army Garrison Ft. Walker's Environmental and Natural Resources Division through Earth Day activities and future career pathways.

Through a newly formed Garden Committee, CCPS will work on connecting students to safe outdoor learning spaces at each school. In the years to come, we hope this idea and others will continue to carry on the goals laid out in the ELP.

As we look forward, it is intended that the steering committee will continue to meet and review and refine the ELP each time the VDOE adopts new science SOLs, and each time CCPS revises the strategic plan. The ELP is intended to be a "living document." This is the first draft of this plan, which is intended to change and grow as Caroline County changes and grows. Our hope is that this Plan celebrates the ongoing efforts of dedicated educators and inspires appreciation and wonder in the outside world.



Working on the Environmental Literacy Plan matters to me because the future of our environment depends on young people learning in a deep and thoughtful manner how ecosystems work and what they need to do to preserve these systems.

— Marty Brooks

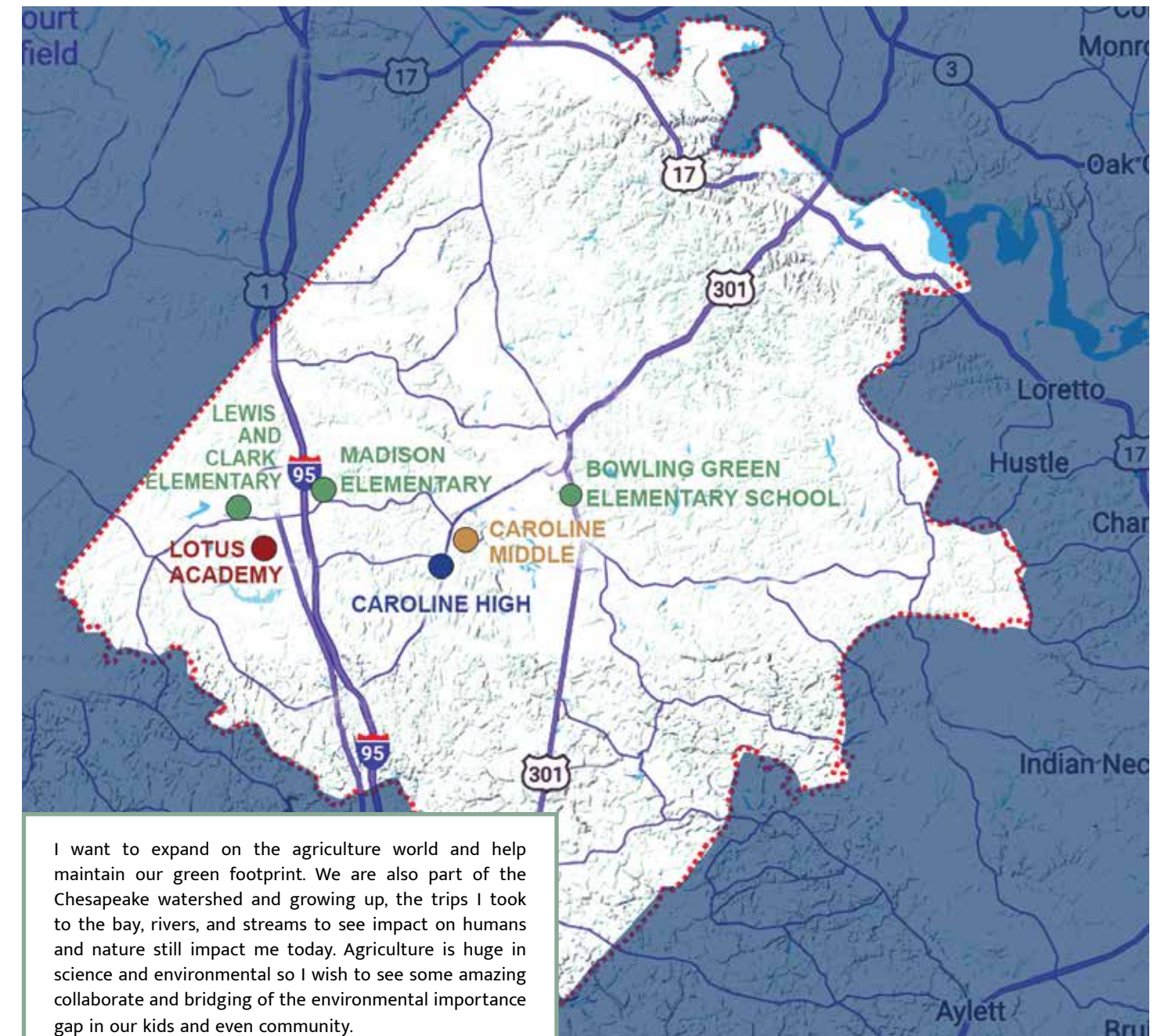
APPENDICES



APPENDIX 1

Map of Public Schools in Caroline County

Caroline County is located within two major river watersheds; the Rappahannock River and the York River; both of which are major tributaries of the Chesapeake Bay. The York River Watershed has three major sub-watersheds; the North Anna/Pamunkey River, the Mattaponi River, and Maracossic Creek. The Mattaponi subwatershed has several major tributaries, including: Polecat Creek, Reedy Creek, and the South River. The York River Watershed covers the southern two-thirds of the County.



I want to expand on the agriculture world and help maintain our green footprint. We are also part of the Chesapeake watershed and growing up, the trips I took to the bay, rivers, and streams to see impact on humans and nature still impact me today. Agriculture is huge in science and environmental so I wish to see some amazing collaborate and bridging of the environmental importance gap in our kids and even community.

— Kendall Rogers

Outdoor Community Spaces in Caroline County

Natural Resources:

Water 


Forest 

Wetlands 

Wildlife 

Trees 


Plants 

Trail 






















Stream 

Field 

Insects 

Garden Plants 

Flowers 

Community Space	What Audience does it Reach?	Approximate Location? (proximity to schools)	Possible Activities in the Space	Natural Resources in the Space	Other Logistical Information
Caroline County Closed Landfill	9-12 adult community members	Bowling Green Convenience Site	Explore a closed landfill and the restraints used to keep the environment safe. Learn how a solid waste convenience site works.	   	Restrooms on site
Caroline High School Arboretum	K-12	Green space between the parking lot and bus loop at Caroline High School	Planting and maintenance, biodiversity/plant/wildlife identification	  	On school grounds
Caroline Middle School Garden Area	K-12	Between the two parking areas off the west wing of the school	Gardening, tree identification	   	On school grounds
Caroline Middle School Nature Trail	K-12	Behind Caroline Middle School, by bus area	Tree and plant identification, water and soil testing, outdoor classroom, half mile hike, social-emotional learning and mental wellness area	    	On school grounds
Caroline Recreation Park, Woodland Trail	Community Members	Caroline Recreation Park across the street from Caroline Middle School	Hiking, plant identification	   	facebook.com/Caroline-Woodland-Trail-Park-1922212614561237
Caroline Wildlife Management Areas	Community Members	Located around the county	Kayaking, fishing, plant identification	 	co.caroline.va.us/1315/Wildlife-Management-Areas-WMA
Lewis and Clark Elementary Garden	K-12	Near the bus loop	Gardening (area in progress)	  	On school grounds
Lotus Academy	K-12 Community Members	Ladysmith 7278 Ladysmith Rd, Ruther Glen, VA 22546	Gardening, recreation	  	Site also includes playgrounds, track, ball field. Adjacent to school grounds.
Lowe-Massey Park	Community Members	Dawn 6403 Dawn Blvd, Hanover, VA 23069	Recreation space, playground	 	co.caroline.va.us/Facilities/Facility/Details/LoweMassey-Park-2
Meadowview Biological Research Station	Anyone with an appointment	Near Bowling Green 8390 Fredericksburg Turnpike, Woodford, VA 22580	Tours of plants (pitcher plants) and wildlife	 	pitcherplant.org must have an appointment to visit
Port Royal Landing	Community Members	Port Royal	Boating, kayaking, fishing	   <small>Rappahannock River</small>	chesapeakeconservancy.org/what-we-do/explore/find-your-chesapeake/public-access/port-royal
Robert Farmer Park	K-12 Community Members	Bowling Green Behind the Caroline County School Board Office	Walking track, recreation	 	co.caroline.va.us/Facilities/Facility/Details/Robert-Farmer-Park-3

APPENDIX 3

Community Partners

Community partners are available to support your environmental literacy related activities. You will find community partners highlighted for particular SOLs throughout the Activity Guide but others are listed below who will be able to assist you with your program.

ORGANIZATION	WEBSITE	NAME	RESOURCES OFFERED
Alliance for the Chesapeake Bay	allianceforthebay.org	Meredeth Dash	<ul style="list-style-type: none">• K-12 programming specific to environmental education and watershed education• Professional learning opportunities• Facilitator for Project WET• Project Learning Tree and Flying WILD
Camp Hanover	camphanover.org	Reilly McNamara	<ul style="list-style-type: none">• K-12 outdoor/environmental education• MWEE support• Community Programs• Site for outdoor exploration• Teaching experience in science
Caroline County Public Schools	ccps.us	Michelle Carroll	<ul style="list-style-type: none">• Teaching experience in 4th grade• STEM Committee Chair
Caroline County Public Schools	ccps.us	Becca Schieber	<ul style="list-style-type: none">• Teaching and leadership experience in science and history• Information on school gardens
Caroline County Public Schools	ccps.us	Katie Boltz	<ul style="list-style-type: none">• Teaching experience in nature and art
Caroline County Public Schools	ccps.us	Terrie Haley	<ul style="list-style-type: none">• Teaching and leadership experience in elementary education• Teacher training opportunities
Caroline County Public Schools	ccps.us	Dr. Autumn Nabors	<ul style="list-style-type: none">• Teaching and leadership experience in secondary education• Teacher training opportunities• Curriculum development
Caroline County Public Schools	ccps.us	Kelly Shields	<ul style="list-style-type: none">• Teaching experience in high school environmental science
Caroline County Public Schools	ccps.us facebook.com/carolinemsffa	Kendall Rogers	<ul style="list-style-type: none">• Teaching experience in middle school agriculture• Middle School Future Farmers of America advisor
Caroline County Public Schools	ccps.us	Catherine McHenry	<ul style="list-style-type: none">• Teaching experience in first grade
Caroline Parks and Recreation	co.caroline.va.us/238/Parks-Recreation	Donnell Howard	<ul style="list-style-type: none">• Access to and information on county-owned facilities
Caroline County Solid Waste Division	co.caroline.va.us	Eric Johnson	<ul style="list-style-type: none">• Guest speaking opportunities on the following topics: community litter, environmental programs, recycling, solid waste (transfer stations, collection, siting, etc.)

ORGANIZATION	WEBSITE	NAME	RESOURCES OFFERED
Community member	N/A	Lisa Hart	<ul style="list-style-type: none">• Volunteer for school activities
Community member	N/A	Erika Little	<ul style="list-style-type: none">• PTA board member (vice president)• Knowledge of NOAA programs and activities
Community member	N/A	Brittney Vaughan	<ul style="list-style-type: none">• PTA board member (secretary)
Department of Conservation and Recreation	dcr.virginia.gov/environmental-education/	Cassi Camara	<ul style="list-style-type: none">• Teacher training• State-level environmental education resources• State Environmental Literacy Plan (coming soon!)
Department of Conservation and Recreation	dcr.virginia.gov/state-parks	Park Superintendent	<ul style="list-style-type: none">• Connection to field trip venue at Caledon State Park, Lake Anna State Park, Westmoreland State Park
Department of Wildlife Resources	dwr.virginia.gov/wma	Staff	<ul style="list-style-type: none">• Wildlife management areas that offer a variety of recreational opportunities
Dominion Energy, Chesterfield Power Station	dominionenergy.com/our-company/customers-and-community/educational-programs/talks-and-tours	Kathy Ash	<ul style="list-style-type: none">• Presentations that help educate the public about energy and how Dominion creates electricity from nuclear energy. Tours last 1-2 hours and are free.
Friends of the Rappahannock	riverfriends.org	Robin Didlake	<ul style="list-style-type: none">• K-12 programming• MWEE support (including Action Projects)• Community programs• Professional Learning Opportunities• MWEE 101 Facilitator• Facilitator for Project Learning Tree and Project WILD• Teaching experience in high school science
Germanna Community College	germanna.edu	Tamara Muldrow	<ul style="list-style-type: none">• Instructor of environmental science• Provides support with K-12 programming• MWEE support (including Action Projects)• Community programs• Professional Learning Opportunities
Hanover-Caroline Soil and Water Conservation District	hanovercounty.gov/313/Hanover-Caroline-Soil-and-Water	Anna Moreau	<ul style="list-style-type: none">• K-12 programming• MWEE support• Community programs• Lending library of activities/kits• Connections with local resource professionals and state and federal agencies
Lewis Ginter Botanical Garden	lewisginter.org/learn/teachers-schools/elementary-school-field-trips	Staff	<ul style="list-style-type: none">• Educational field trips
Meadowiew Biological Research Station	pitcherplant.org	Staff	<ul style="list-style-type: none">• Guest Speaker• Educational field trips
National Geodetic Survey Training Center	geodesy.noaa.gov/corbin	Staff	<ul style="list-style-type: none">• Guest Speaker• Educational field trips

ORGANIZATION	WEBSITE	NAME	RESOURCES OFFERED
National Weather Service, Wakefield Office	weather.gov/akq/TourRequest	Staff	<ul style="list-style-type: none"> • Facility tours • Weather information
Project Learning Tree	plt.org/network/virginia	Leslie Newman	<ul style="list-style-type: none"> • Project Learning Tree workshops
Project WILD	dwr.virginia.gov/education/project-wild	Courtney Hallacher	<ul style="list-style-type: none"> • Project WILD workshops
Rappahannock Community College	Rappahannock.edu	Marty Brooks	<ul style="list-style-type: none"> • Teaching and leadership experience at the college level • Connection to other college level staff • Curriculum development expertise
Science Museum of Virginia	smv.org/groups/field-trips	Guest Services	<ul style="list-style-type: none"> • Museum exhibits • STEM learning experiences and demonstrations • The Dome for IMAX movies and Science on a Sphere
State Fair of Virginia	statefairva.org/p/other/educational-expo	Sarah Jane Thomsen	<ul style="list-style-type: none"> • Demonstrations, exhibits and education related to natural resources, animals and agriculture
Tidewater Oyster Growers Association	oystergardener.org	Richard Siciliano	<ul style="list-style-type: none"> • Oyster gardening education and public outreach, newsletter, Master Oyster Gardener classes
U.S. Army Garrison Fort Walker	home.army.mil/walker	Andrew Satterwhite	<ul style="list-style-type: none"> • Guest speaking opportunities • Local natural resources expert
United States Fish and Wildlife Service	fws.gov/refuge/rappahannock-river-valley	Marcie Kapsch	<ul style="list-style-type: none"> • Connection to field trip venue at Rappahannock River Valley National Wildlife Refuge (Port Royal Unit) • Guest speaking opportunities
Virginia Institute of Marine Science	vims.edu/engage/high-school	Staff	<ul style="list-style-type: none"> • Guest Speaker • Field trips

Acknowledgments



Working on the environmental steering committee was important to me because environmental literacy is one of the most critical skills needed by our students. We need to educate our students and future leaders to respect, understand, and protect the ecosystems that sustain life on our planet.

— Katie Boltz

This Plan is the result of collaborative work among schools, the community and the Partner Team. We are grateful to each person who spoke with us, responded to a survey, participated in the Steering Committee or contributed to the Plan in another way. We look forward to continuing to listen and learn from you.

