ENVIRONMENT

GOAL

Recognize and retain the multiple values provided by land resources, ecosystem services, open spaces, and water resources while responsibly mitigating the hazards posed by natural geologic features, topography, natural disasters, major storms, and climate change.

Sustainability Goal

Responsibly manage the urban and rural environments of Blacksburg to ensure that public health, natural beauty, ecosystems, biodiversity, and natural resources continue to support Blacksburg's high quality of life for current and future generations.

Community Engagement

Meaningful community engagement is key to the Town's ethic of governance. To foster an inclusive planning process, the Town should ensure that all community members feel welcome and empowered to participate. This can be achieved by providing a wide range of convenient opportunities, providing transparent and responsive communication, and applying innovative engagement methods. In addition, there are a number of standing committees and working groups that advise staff and Town Council on environmental topics such as the Climate Action Plan Working Group, the Climate Vulnerability Assessment Advisory Team, the Corridor Committee, the Recreation Advisory Board, and Planning Commission. Residents of Blacksburg can also support community efforts to advance environmental issues by joining or volunteering with organizations that pursue an array of sustainability objectives. A list of environmentally-focused community organizations is maintained on the Town of Blacksburg website under Sustainability: Community Engagement.

OVERVIEW

The beautiful natural environment of the region, including the mountains, valleys, agricultural land, and water resources, contribute to Blacksburg's character and mix of cultural and recreational options. Along with the amenities offered by life in a college town, residents also have ready access to surrounding natural areas, including the Jefferson National Forest, the New River, Town parks and trails, and the Virginia Tech campus, all of which contribute to the high quality of life enjoyed by Town residents.

This chapter highlights the critical natural systems and assets found within the Town as well as features that can present hazards and challenges for the community. These include **air quality and climate** such as sources of air pollution that impact human health and greenhouse gas emissions that impact the stability of our local and global climate; **land resources** such as open space, green infrastructure, habitats that support biodiversity, greenways, forests and tree canopy, and soils that support agriculture; **geologic features** such as karst, topography, and mineral resources; and **watershed resources** such as groundwater, springs, and streams.

Taken together, the topics described in this chapter encompass the natural systems and non-renewable assets that should be protected, renewable resources that should be wisely managed, known hazards that should be carefully considered and planned for, as well as hazards that are newly emerging or accelerating due to climate change.

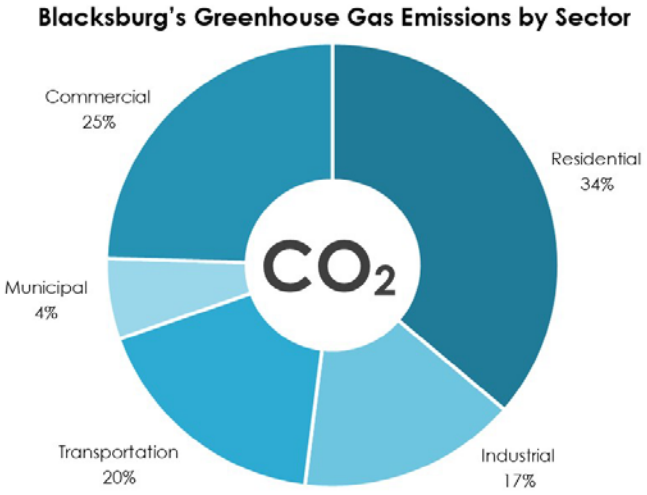
AIR QUALITY & CLIMATE

Pollution & Greenhouse Gas Emissions

Blacksburg's air quality is a major asset to the environment, the health of residents, and the scenic beauty of the Town. Air quality is primarily affected by combustion of fuels for transportation and energy production as well as chemical processes associated with industrial operations. The U.S. Environmental Protection Agency (EPA) establishes air quality standards for six criteria pollutants: carbon monoxide, lead, ground-level ozone, nitrogen dioxide, sulfur dioxide, and particulate matter, which are monitored by the Virginia Department of Environmental Quality (DEQ). Blacksburg lies in a geographic area that meets or exceeds national ambient air quality standards for these pollutants and is designated as an "air quality attainment area." It is critical to maintain this designation since localities designated as "non-attainment areas" are required to complete a plan and take steps to improve air quality, but more importantly, because the Town values the benefits to the community and overall public health associated with this designation. The Town currently lacks data for other known or suspected pollutants of community concern stemming from local commercial or industrial activities.

When fossil fuels are used to produce energy for homes and vehicles, an array of air pollutants are created which are detrimental to human health, damage ecosystems and wildlife, and are the primary drivers of climate change. Federal standards have not yet been established for carbon dioxide and methane emissions, which are the two greenhouse gases believed to contribute the most to climate change. Nevertheless, Blacksburg is taking action to dramatically reduce these emissions in the residential, commercial, industrial, municipal, and transportation sectors, as further detailed in the *Sustainability* chapter and the Town's Climate Action Plan.

Fossil fuels are still the primary means of producing energy for buildings and vehicles and this negatively affects Blacksburg's air quality. Air pollutants created by the combustion of fossil fuels come from stationary and mobile sources, originating locally and from other areas. These include coal- and natural-gas fired boilers, power plants, industrial operations, and motor vehicle emissions. The primary way to maintain and enhance Blacksburg's air quality and to conserve resources is to reduce energy use from these fossil-fuel sources, thus decreasing air pollution and greenhouse gas emissions.



Blacksburg Climate Action Plan – Introduction: Greenhouse Gas Emissions Inventory

The Town relies on energy sources from a limited number of energy suppliers. Because the energy supplied by our electric and gas utilities currently come from carbon-intensive sources, the energy consumed by residential and commercial buildings accounts for 59% of emissions in the Town, as shown in the **BLACKSBURG CLIMATE ACTION PLAN** graph above. To achieve its sustainability and emissions reduction goals, the Town will need to pursue multiple strategies including:

- Working toward state-level changes to energy policy
- Advocating for utilities to accelerate their transition to clean energy technologies
- Providing financially appealing options to retrofit existing buildings for energy-efficiency
- Offering incentives to homebuilders and developers to pursue green building practices
- Expanding access to renewable energy to residential and commercial customers

After buildings, the transportation sector represents the second largest source of air pollution and greenhouse gas emissions within the Town of Blacksburg. The Town can improve its transportation energy efficiency and reduce criteria pollutant emissions by pursuing land use policies that reduce car-dependency, adding new public electric vehicle charging infrastructure, expanding its transit system, and by creating strategic new connections to the greenway, bikeway, and walkway systems. Implementation strategies to achieve these outcomes are detailed in the Town's Climate Action Plan, the Bicycle Master Plan, and are further described in the *Transportation* chapter.

Roam NRV bike share and Blacksburg Transit offer two options for reducing car-dependency

Finally, land use patterns and strategic site planning can enhance the efficacy of natural heating and cooling and reduce residents' transportation energy needs. Some of the land use patterns and site development techniques include:

- Orienting buildings and landscaping choices to maximize passive solar potential and options for future solar photovoltaic installations
- Planting deciduous trees species and other landscaping materials to provide summer shade for buildings while allowing sunlight through for passive heating in winter months
- Prioritizing and promoting safe and convenient options for residents to walk, bike, or use transit for daily trips
- Reducing trip generation by redeveloping infill sites with a mix of uses or clustering development

Climate Vulnerability, Adaptation & Resiliency

As detailed in the *Sustainability* chapter, Blacksburg's Climate Action Plan establishes a set of ambitious strategies to sharply reduce community-wide greenhouse gas emissions by mid-century. While Blacksburg is proud to be counted among the hundreds of local governments taking action to address climate change, the Town also recognizes that reducing emissions, although critically important, will not be enough. The global community has been burning fossil fuels at an ever-accelerating pace since the advent of the industrial revolution. Those emissions are already in our atmosphere and are driving changes to the climate that are clear and measurable today. These changes are expected to accelerate in the years ahead, and are likely to disrupt our lives and livelihoods in numerous ways.

Starting in 2019, the Town assembled an advisory team of topic-area climate experts and community practitioners to analyze the best available data and climate modeling and use those findings to assess what Blacksburg can do now to prepare and adapt to a changing climate. Blacksburg completed this assessment in September 2020 and identified three primary climate hazards of concern for the region: hotter summers, warmer winters, and changing precipitation patterns. Blacksburg's Climate Vulnerability Assessment Report details the **CRITICAL COMMUNITY SYSTEMS** that are potentially at risk under both a low- and high-emissions scenario.

People and Community	Natural Systems	Economy and Employment	Infrastructure and Basic Services
Financial Wellbeing	Agriculture/Farming	Business Continuity	Emergency Services
Food Systems/Security	Ecosystem Services	Employment Continuity	Energy Access/Delivery
Homes & Buildings	Forests/Tree Cover	Industrial Operations	Internet/Communications
Human Health/Wellbeing	Hydrology/Watershed	Tourism	Law & Order
Population Displacement	Invasives/Species Shift		Stormwater Infrastructure
Public Safety			Transportation System
			Water Supply
			Water Infrastructure

Critical community systems with greater potential for vulnerability highlighted

Among these community systems, several were identified as having a high potential for vulnerability as shown above: food systems and food security, human health and wellbeing, agriculture and farming, ecosystem services, forests and tree cover, invasives and species shift, energy access delivery, and stormwater infrastructure. These identified systems will warrant special attention and focus for climate adaptation policy-making. This chapter of the Comprehensive Plan offers objectives and policies related to anticipated climate impacts to biodiversity, habitat, urban forestry, tree canopy, local agriculture, hazard mitigation, watersheds, and flooding hazards. Climate vulnerabilities and adaptation policy options for food systems and food security; human health and wellbeing; and infrastructure and basic services are addressed in the *Sustainability* chapter, the *Utilities* chapter, and the *Public Safety & Community Facilities* chapter, respectively.

Hazard Mitigation

The federal Disaster Mitigation Act of 2000, as amended, requires that local governments develop, adopt, and routinely update natural hazard mitigation plans in order to receive certain types of Federal Emergency Management Agency (FEMA) federal assistance. These plans must be updated every five years. FEMA describes hazard mitigation as "sustained actions taken to reduce or eliminate long-term risk from hazards and their effects." Events, both nationally and locally, in the past decade have shifted some of the focus of natural hazard mitigation to include planning for climate adaptation and mitigation of human-caused hazards.

The 2017 update to the New River Valley Hazard Mitigation Plan was led by the NRV Regional Commission. The original plan was adopted and approved by FEMA in May 2005 and updated in 2011.

The Town of Blacksburg adopted the 2017 update to the plan, which serves as the Town's Hazard Mitigation Plan.

In the 2017 update, new data and analysis have improved identification of hazards related to geological features and helped refine a ranked assessment of risks. These are used to determine mitigation strategies regionally and locally. The plan focuses primarily on the previously discussed natural hazards, such as karst, landslides and rock falls associated with steep slopes. Hazards can also include other natural events such as earthquakes, high winds, freezing temperatures, heat waves, wildfire, flooding, drought, snow and ice storms. Prior to the 2017 update, the Town of Blacksburg had completed projects identified in the 2011 Hazard Mitigation Plan, and updated its list of specific mitigation opportunities for the next five years. Going forward, the Town of Blacksburg will advocate for integration of climate hazards and climate adaptation strategies into future updates of the NRV Hazard Mitigation Planning process and resulting plan.

LAND RESOURCES

Open Space, Green Infrastructure, Biodiversity & Habitat

There are a number of open space areas within the Town limits including meadows, wetlands, wooded areas, and agricultural lands. These minimally developed, or less urbanized areas, provide valuable **ECOSYSTEM SERVICES** that directly contribute to Blacksburg's quality of life and resilience. These services can be grouped into four broad categories: provisioning, regulating, supporting, and cultural with examples of each detailed in the following graphic.

Ecosystem Services

Ecosystem services are a collection of benefits that humans freely gain from the natural environment and properly-functioning ecosystems. These services generally fall into four broad categories:

Taken together, the open and natural spaces that support these ecosystem services form the community's green infrastructure. This green infrastructure is as essential to the Town as its traditional gray infrastructure such as roads, power lines, and water systems.

Open space planning in this region began with the development of a document entitled *Open Space Planning, an Initiative for Our Future*, dated 1994. Primary themes identified in that early open space initiative included:

- Conservation of farmland
- Protection of water resources
- Protection of scenic views
- Preservation of historic sites and structures
- Preservation of rural community and landscape
- Identification of recreational locations

Open Space in Heritage Park, one of 20 parks owned and managed the Town of Blacksburg

Since that time, Blacksburg has integrated open space planning into land use policies such as the minimum open space requirements within the Zoning Ordinance, and the creation of the Creek Valley Overlay Zoning District, which strengthened protections for wetlands, stream banks, and sensitive areas adjacent to floodplains. Additionally, the Town supports the work of conservation organizations such as the New River Land Trust, which collaborates with landowners and local governments across the region to protect lands of particularly high conservation value.

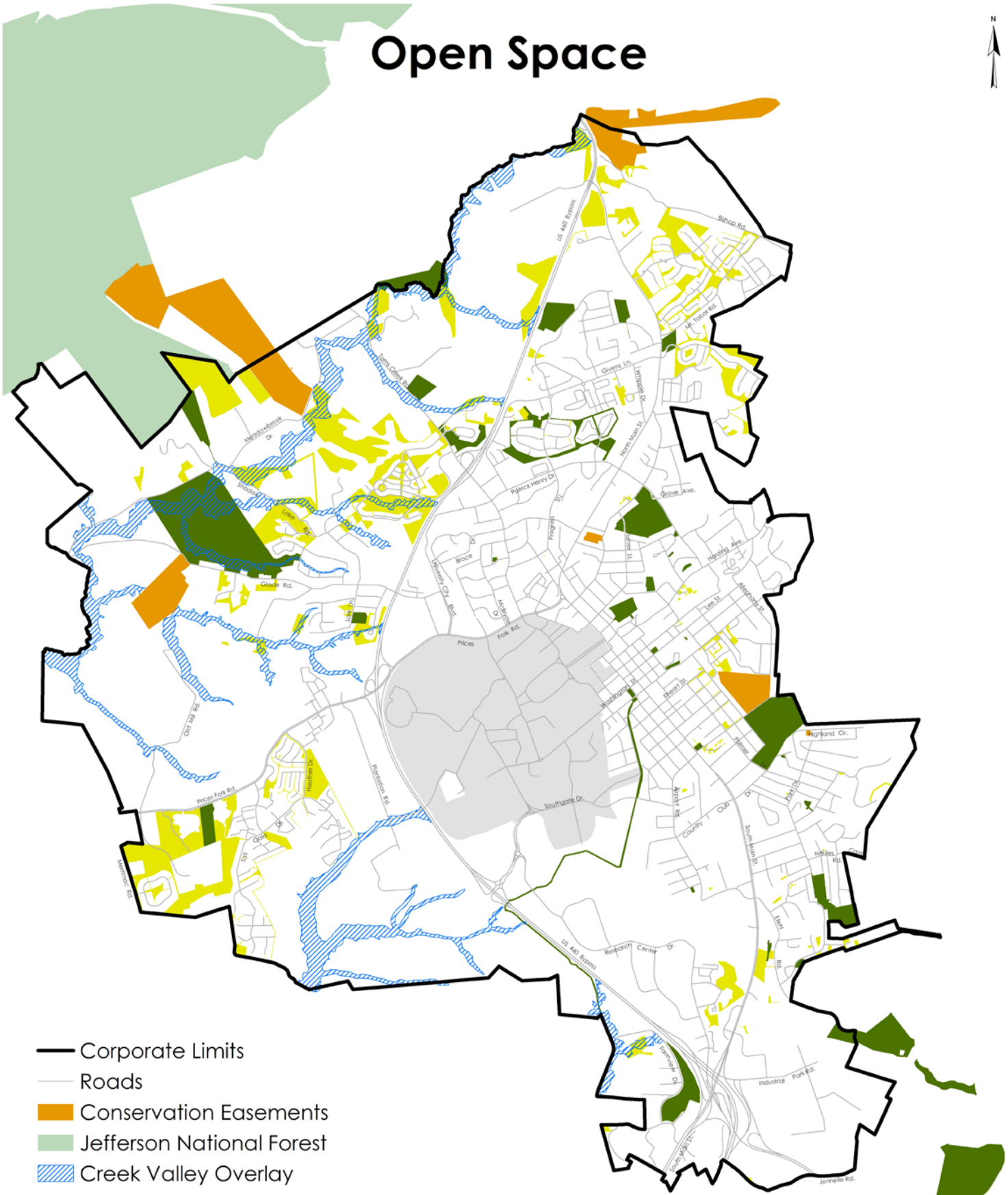
Open space in the Town of Blacksburg can be categorized in the following ways:

(1) Privately-owned open space associated with a farm or a home that is usually not open to public access or has very limited public access. This includes conservation easements.
(2) Common open space land in a development that is reserved for use by that development's residents.
(3) Undeveloped recreational property publicly owned by the Town that includes open space land intended for passive recreational use by the entire community or where active future recreational amenities are planned.
(4) Developed recreational property publicly owned by the Town that includes land currently used for active recreational activity by the entire community or intended for future active recreational uses.

All four types of open space are important and each contributes to the overall quality of life in Blacksburg. Also of significant value to the community are scenic views, ridgelines, hilltops; lands adjacent to existing public parks; existing preserved open space; and the Creek Valley Overlay.

The protection of open space will play an important role in guiding the future sustainability of our community. Access to natural amenities is a growing factor in the decision-making process for young professionals and retirees as they choose where to live. Opportunities to preserve and improve open spaces, viewsheds, outdoor recreation amenities, biodiversity, and agricultural viability should be carefully considered as part of the development proposal process.

Open Space



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Map is Not to Scale

Greenways

Greenways are linear stretches of open space that can include recreational, cultural, and natural areas such as parks, trails, and other "green" spaces. The development and use of the greenway system in Blacksburg is an outgrowth of community interest in conservation of natural resources, outdoor recreation opportunities, and viable alternatives to motorized transportation. Greenways are also an important part of Blacksburg's green infrastructure, providing natural buffer areas to improve water, soil and air quality; serving as wildlife habitat and corridors; reducing the impacts of flooding; and adding aesthetic and viewshed protection. Greenways typically follow natural or manmade features such as streams, railways, or roads, and they benefit the community by providing opportunities for transportation, recreation, education, and environmental protection.

Greenways also help promote economic development and tourism while increasing the beauty of neighborhoods, contributing to community health, and bringing value to surrounding properties. Blacksburg's system of public and private trails is highly valued by residents and visitors alike. The Town actively plans to extend this trail system and create new connections going forward as detailed in the Brush Mountain Properties Concept Plan, the Bicycle Master Plan, the Parks and Recreation Master Plan, and the Paths to the Future map, several of which are discussed further in the *Transportation* chapter.

Urban Forestry & Tree Canopy

Blacksburg has been designated a Tree City USA community each year since 1990, which speaks to the Town's longstanding commitment to urban forest growth and preservation. Urban tree canopy provides many benefits to the community:

- Carbon sequestration and removal of pollutants from the air, soil, and water
- Provision of shade and mitigation of heat-island effect
- Reduced velocity of stormwater runoff
- Controlled infiltration of precipitation into soil and groundwater aquifers
- Mitigation of noise and light pollution
- Provision of habitat and food sources for wildlife
- Overall community beautification and increased property values

According to 2008 spatial data collected by the Virginia Department of Forestry (VDOF), Blacksburg has 30.2% tree canopy coverage, mostly on privately held property. The Town should continue monitoring its percentage of tree canopy coverage in the years to come with a goal of maintaining or increasing that percentage, while accommodating population growth and future development. The Town has ordinances in place requiring new developments to plant street trees and parking lot trees, and to provide buffer vegetation between varying land uses. The Town has also established a goal to plant two trees on public property for each tree that must be removed. A municipal tree nursery was established in 2007 to provide cost-effective nursery stock for this effort. The community also participates in urban forestry initiatives such as the Community Arbor Day Celebration, which includes an annual community tree planting in one of the Town's parks. In recent years, the Town has partnered with the American Chestnut Foundation in an effort to re-introduce blight-resistant variants of this valuable native tree to municipal parks. The recent findings of the Climate Vulnerability Assessment point to a need to evaluate future tree plantings with an eye toward species that will be

more tolerant to warmer and wetter conditions year-round and are resistant to blights and pest insects that may become more prevalent in our areas in the years to come.

Annual Arbor Day Tree Planting Event at one of the Town's 27 Public Parks

Dark Skies

Plants and animals depend on cycles of light and dark to govern life-sustaining behaviors such as nourishment, sleep, reproduction, and protection from predators. Human health is also impacted by **NIGHTTIME LIGHTING**. In highly urbanized areas, humans have disrupted the cycle of light and dark by lighting up the night, often far more than is needed for safety and navigation. Nighttime lighting is also responsible for a large portion of the Town's energy use and greenhouse gas emissions, and represents our single largest municipal energy expense. To address these multiple challenges, the Town supports International Dark Sky Association standards for new residential and commercial development. Through zoning regulations, the development review process and outdoor lighting decisions for Town-owned facilities, the Town continues to seek ways to balance nighttime visibility and security needs while reducing greenhouse gas emissions, protecting human health, and minimizing disruptions to the natural environment and animal habitats.

Light pollution can occur due to over-lighting, or poor design that directs lighting where it is not needed.
Source: City of Fort Collins. www.fcgov.com/nightsky/best-practices

Agriculture & Local Food Systems

Residents of Blacksburg place a high value on locally-grown food and other agricultural products, and agricultural lands provide economic value and contribute to the unique character of the Town. According to the Web Soil Survey operated by the USDA Natural Resources Conservation Service,

approximately one-sixth of the land within the Town boundaries is classified as Prime Farmland by soil type. In keeping with its roots as a land-grant university, Virginia Tech owns and operates large areas of farmland both within and outside of Town limits for agricultural purposes. However, over the years, large tracts of farmland have become less common as the economic challenges of family farming have increased. Another challenge in supporting this land use, and its associated economic and aesthetic characteristics, is the fact that lands suitable for agricultural use also tend to be well-suited for residential and commercial development. Climate change poses a new challenge to local agricultural production and food systems. In order to remain resilient, Blacksburg's local agricultural economy and food systems will need to adjust to the changes that are anticipated for our region: hotter summers, warmer winters, and changes to seasonal precipitation patterns.

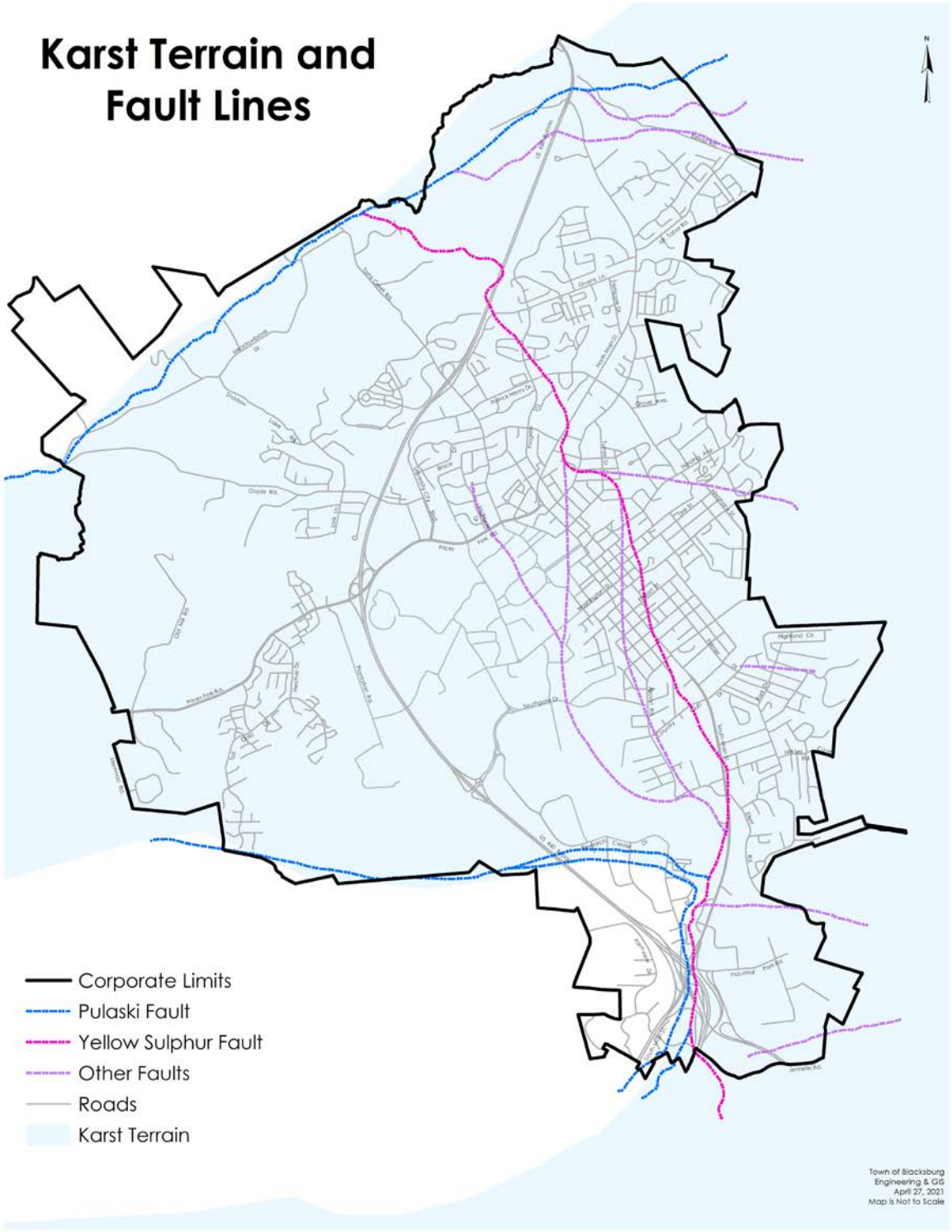
There is a growing appreciation for the value of local food production and the importance of access to local healthy foods. While the amount of local farmland within the Town limits may not be large, the Town has another role to play in supporting agriculture. As the Town's population grows, the Town government, Virginia Tech, private restauranteurs and residents will collectively become a major market that can increase demand for locally grown foods and products as well as agritourism. This places the Town and residents in a position to support organizations and businesses such as the Blacksburg Farmers Market, community and neighborhood gardens, Community Supported Agricultural (CSA) programs, sustainable food procurement programs and restaurants that support locally grown food. The Town can also support regional efforts to improve processing and transportation facilities for agricultural products. This can be smaller scale regional operations such as the Millstone Kitchen, which is a commercial kitchen facility in the old Prices Fork Elementary School, as well as other larger regional operations in the future.

By working cooperatively, the Town can support existing regional farms by helping to protect key agricultural lands. This can be done by working with local organizations coordinating voluntary conservation easements of adjacent properties located on the Town/County jurisdictional lines. This protects cohesive tracts of agricultural lands. This same approach can be utilized by continuing with the County and Town's Agricultural and Forestal District (AFD) designation. AFDs were established as a tax relief district to conserve, to protect, and to encourage the development and improvement of the Commonwealth's agricultural and forestal lands for the production of food and other agricultural and forestal products. The districts are also designed to conserve and protect these lands as valued natural and ecological resources that provide essential open space for watershed protection, for wildlife habitat, and for aesthetic purposes. Please refer to the Town's official Zoning District map for current locations of AFDs.

GEOLOGIC FEATURES

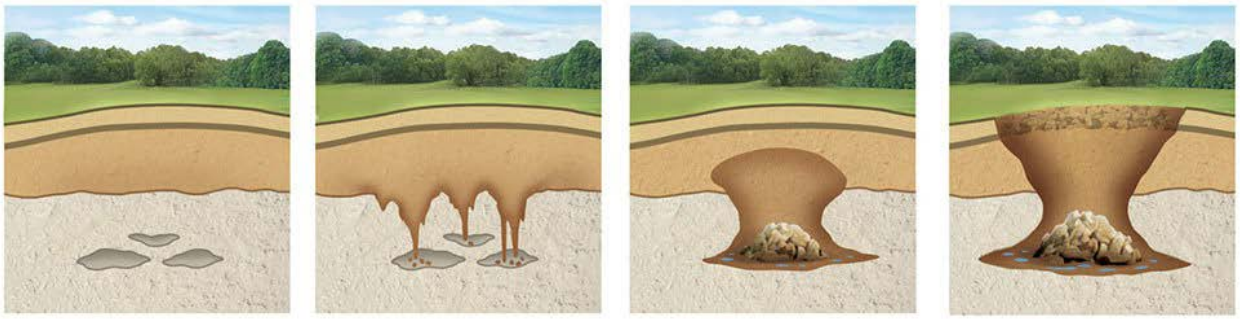
Karst

Blacksburg's geologic features include karst terrain. Karst areas are defined by the mineral composition of sub-soil rock formations, such as limestone or dolomite, that tend to be water soluble over long periods of time. This can result in sinkholes, caves, and underground streams, which can pose potential hazards for development. However, there are no sinking streams, and most known sinkholes are broad, shallow, and stable in Blacksburg. The following map, Karst Terrain and Fault Lines, identifies karst areas and fault lines, showing that most of the Town includes karst terrain.



The nature of **KARST TERRAIN** can contribute to underground caverns and sinkholes, posing a potential risk to buildings and infrastructure as shown in the graphic on the next page. Locations of individual sinkholes from a variety of data sources should be maintained and considered during development, however, the majority of protection and monitoring efforts should concentrate on known karst areas as shown in the map on this page.

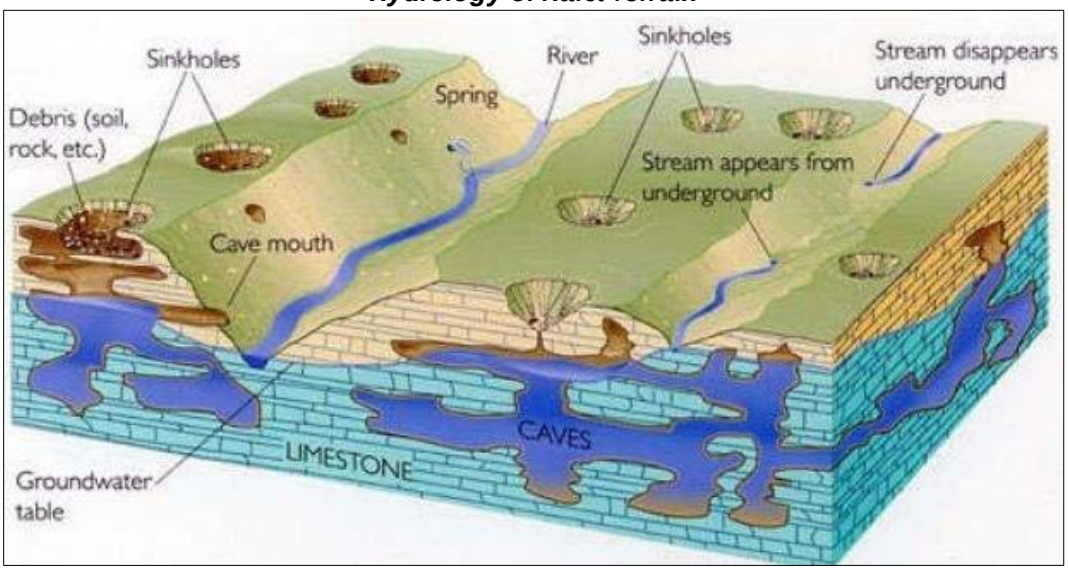
Karst Terrain and Sinkhole Formation



Source: Escalmel, François. Natural. 1 June 2014. Canadian Geographic.
www.canadiangeographic.ca/article/how-sinkholes-form.

In addition to the hazards that karst terrain poses to buildings and infrastructure, development on and around sensitive karst terrain is likely to produce a negative impact on the region's groundwater resources. This occurs because rainwater is able to move quickly through the porous subsurface of karst formations taking surface pollutants directly into the aquifer without the natural filtration provided by deeper soils and mineral layers. The graphic below illustrates the **HYDROLOGY OF KARST TERRAIN**, which allows surface pollutants to directly impact groundwater and subsurface aquifers. Land disturbance and impervious surfaces around sinkholes should be avoided to maintain natural drainage patterns and minimize groundwater contamination or flooding.

Hydrology of Karst Terrain



Source: Huggins, Donald G. and Debra Baker. *Diagnostic Study of Three Lakes in Southern Haiti.* Kansas Biological Survey Report #181, 2015.

As detailed in the Natural Heritage Program coordinated by the Virginia Department of Conservation and Recreation, the Town is also traversed by several geologic faults as also shown on Geologic Features map. These may present another area of vulnerability, both for buildings and to groundwater pollution.

Topography

Downtown Blacksburg is relatively flat. These older, settled parts of Town have slopes of 5% or less and may lie within natural floodplains. Approximately 90% percent of the remaining area has between 5% and 15% slopes. Throughout the Toms Creek Basin watershed and east of Town down to the Ellett Valley, slopes often exceed 15%. Additionally, there are some steeply sloping lands along the sides of Brush Mountain. These steep slopes add to the visual character of the community. However, development on these slopes can result in landslides, increased peak stormwater flows, erosion, siltation and sedimentation of waterways. Responsible development in this type of topography can be a challenge. Cluster-style housing, also known as conservation development, is one option that may be suitable for properties with steep slopes. This development style groups residential properties in a neighborhood closer together in order to conserve the remainder of the site for open space, outdoor recreation, or to avoid development of environmentally sensitive areas or wildlife habitat. Another type of development suitable for steep slopes is large lot style development that leaves significant portions of a site in an undeveloped state.

Minerals

Mineral resources are still mined in and around Blacksburg. A prominent quarry lies at the Town's corporate limits near Highland Circle and provides the university with the signature Hokie Stone used for academic buildings and residence halls on campus. Additionally, a former sandstone quarry lies east of Ellett Road just inside the Town's corporate limits.

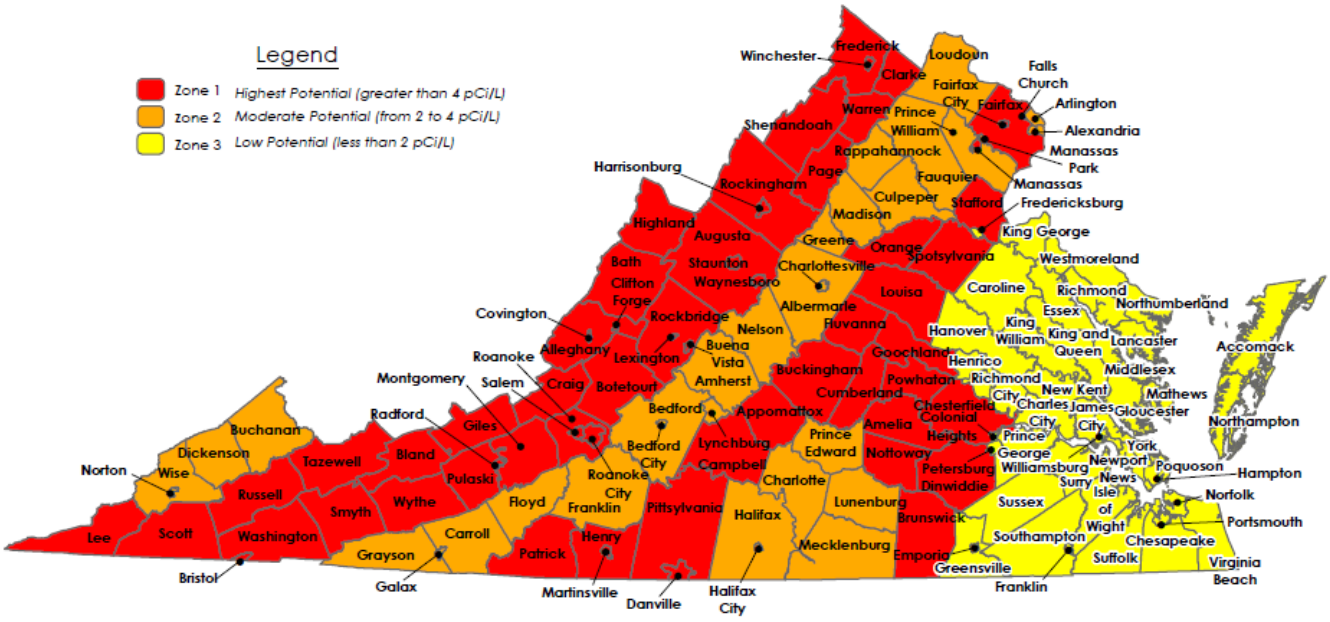
Virginia Tech's emblematic Hokie Stone - Burruss Hall

Radon

Geologic conditions in the region produce radon at a higher than average rate for the state. Radon is a heavier-than-air, colorless, odorless gas that occurs naturally and is a known risk factor for lung cancer. It comes from the natural radioactive breakdown of uranium in soil, rock, and water. It can occur in any type of building and build up to dangerous levels if not remediated. The U.S. EPA and the Surgeon General recommend testing buildings for radon due to concerns that all areas below the third floor are

vulnerable. The EPA provides information regarding the risks of living with radon, how to test homes for radon, what testing results mean, and how to remediate high radon levels.

Radon Risk Map for Virginia
Montgomery County is in Zone 1, which presents the highest potential risk



U.S. Environmental Protection Agency, Virginia – Radon Zones.
www.epa.gov/sites/production/files/2015-02/documents/r3-va-riskmap-largefont.pdf

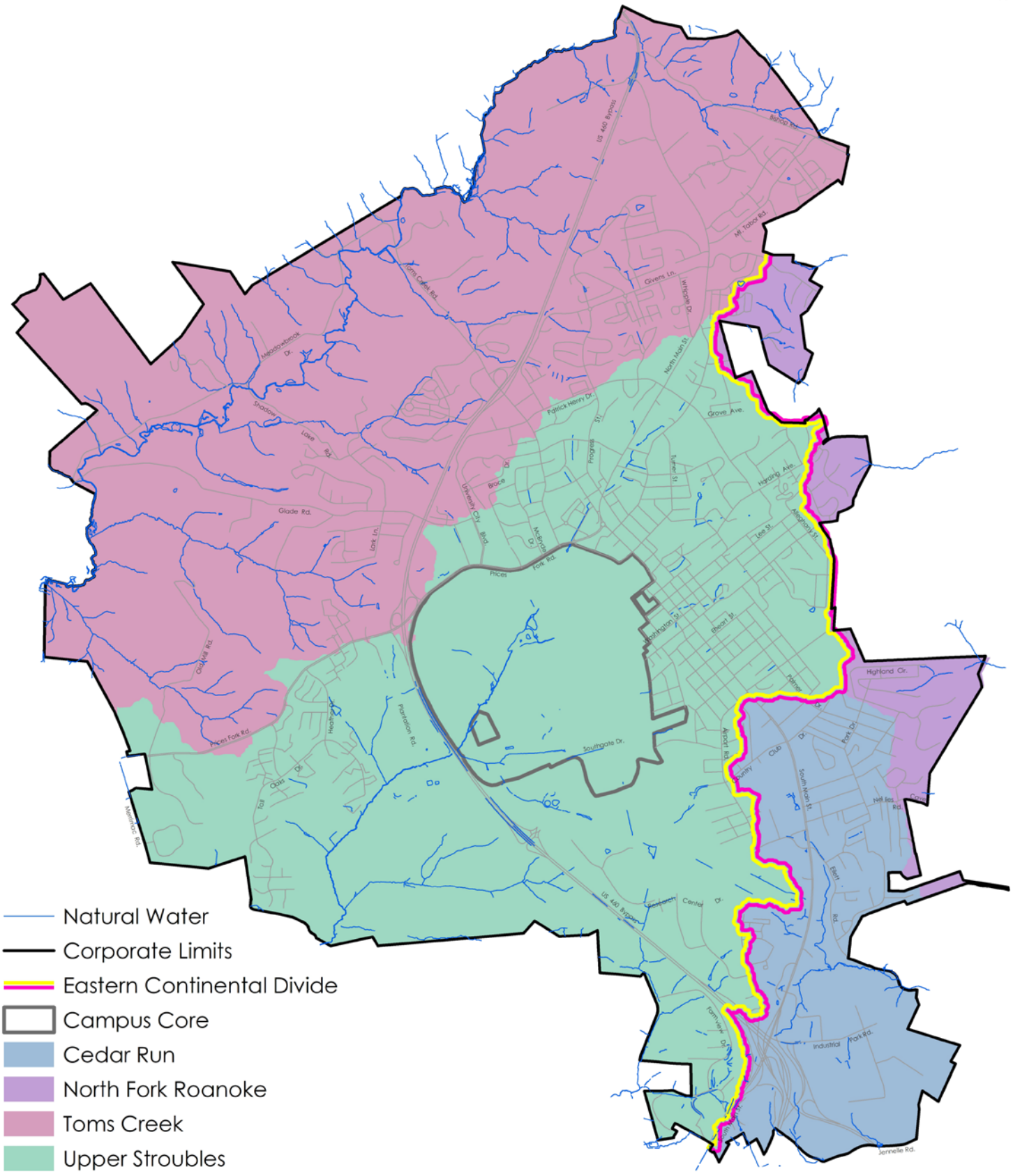
WATERSHED RESOURCES

Watersheds

Blacksburg is predominantly a headwaters community. This means that the Town is situated at the starting point of several waterways that all flow outward. Blacksburg, in fact, is situated along the eastern continental divide, and the rain that falls here drains either eastward towards the Roanoke River and the Atlantic Ocean, or westward to the New River and eventually the Mississippi River and the Gulf of Mexico.

The five regional watersheds whose headwaters begin within Town limits include Toms Creek, Upper Stroubles Creek, the Slate Branch of Stroubles Creek, Dry Run of the North Fork Roanoke River, and Wilson Creek of the North Fork Roanoke River. As a result, Blacksburg receives little surface runoff from outside its boundaries. These watersheds, shown on the map on the following page, recharge the region's aquifer through sinkholes and infiltration and discharge at springs and creek beds. In addition, these waters provide the water supply for innumerable downstream communities. Several natural watershed features, such as wetlands, ephemeral stream channels, and water impoundments, are located throughout the Town.

Watersheds



- Natural Water
- Corporate Limits
- Eastern Continental Divide
- Campus Core
- Cedar Run
- North Fork Roanoke
- Toms Creek
- Upper Stroubles

Yellow Drains to the New River then to the Gulf of Mexico
Pink Drains to the Roanoke River then to the Atlantic Ocean

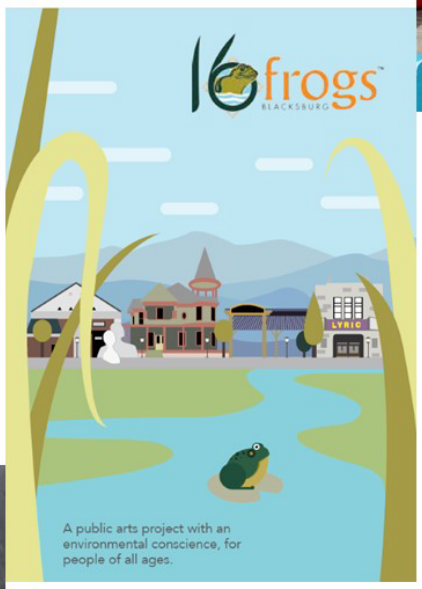
Town of Blacksburg
Engineering & GIS
April 27, 2021
Map is Not to Scale

Given the importance of these watersheds and water resources, both to Blacksburg and to downstream communities, the Town has worked to raise awareness of factors that can impact the watershed and degrade water quality. Two of these initiatives seek to engage residents of all ages through public art: the 16 Frogs and Storm Drain Mural projects.

16 Frogs

This project features 16 bronze frog statuettes, one for each of the Town's original 16 squares. These are placed strategically throughout the Town, calling attention to the freshwater under and around the streets of Blacksburg while also noting places of particular historic or cultural importance. Each frog is named for an individual who played an important role in shaping the community we live in today. Modeled after the native Green Frog, (Lithobates clamitans), the frogs range from 6-12 inches in size, and can be found tucked away in key locations around Town.

Visit https://16frogs.org/ to learn more.



Storm Drain Mural Project

It is a common misconception that the water that enters a storm drain goes through some type of treatment process. In reality, stormwater goes directly underground enabling surface pollution to enter the groundwater unimpeded. To raise awareness of these water quality impacts, Blacksburg has partnered since 2018 with local artists on create original murals in the downtown area that highlight the following themes:

Blacksburg's Freshwater Heritage

The Protection of Stroubles Creek

Wildlife, Watersheds & Healthy Habitats

Whether as groundwater or surface water, these natural water assets are protected through the Virginia Water Protection Permit Program that is administered jointly by the Virginia Department of Environmental Quality (DEQ) and the U.S. Army Corps of Engineers (COE). Problems that can result from poor protection of watershed assets include excessive stormwater runoff and flooding, increased non-point source pollution, habitat destruction, and impairment of stream water quality. Additional information on the Town's stormwater management system can be found in the *Utilities* chapter.

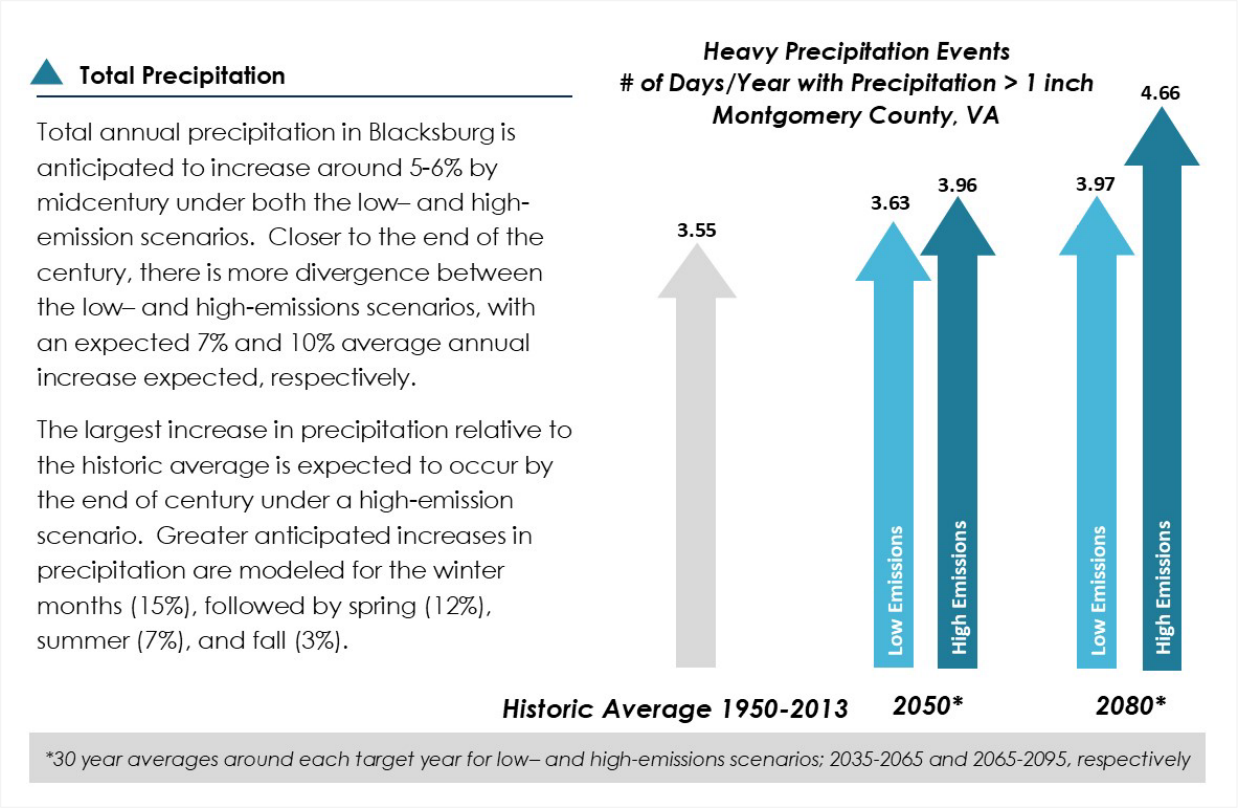
A section of Stroubles Creek running through one of Virginia Tech's agricultural properties
Source: Vejlenser. *Stroubles Creek near Plantation Road in Blacksburg, Virginia.* 30 June 2016. commons.wikimedia.org/wiki/File:Stroubles_Creek_4.jpg

Flooding Hazards

The Town experiences two types of flooding hazards: flooding along natural floodplains and more widespread flooding throughout the community during severe storm events. The first type of flooding occurs in natural floodplains running along Toms Creek, Stroubles Creek, and Cedar Run. Strategies to mitigate this type of flooding are detailed in the following section on Floodplain Overlay and Creek Valley Overlay. The second type, widespread community flooding due to intense or prolonged precipitation, can create dangerous conditions and do costly damage to the built environment. Strategies to mitigate this second type of flooding are detailed in the following section on stormwater infrastructure.

Climate Change & Flooding Risk

One of the key findings of Blacksburg's Climate Vulnerability Assessment is that changes to **PRECIPITATION PATTERNS** are modeled for this area under both a low- and high-emissions scenario. Specifically more precipitation overall, measured by inches of rainfall per year, and an increase in the number of heavy precipitation events, measured by number of days with rainfall greater than 1 inch, are expected. These changes increase the likelihood of both types of flooding hazards.



Blacksburg Climate Vulnerability Assessment Report – Chapter 3: Changing Precipitation Patterns

Floodplain Overlay & Creek Valley Overlay

To address and mitigate flooding risk within naturally occurring floodplains, the Town has established two overlay zoning districts within the Zoning Ordinance that provide more specific regulations regarding development in riparian areas and floodplains. The Creek Valley Overlay District regulates development for the protection of the natural riparian resources while the Floodplain Overlay District provides regulations to protect property from flood damage.

Both of these Districts are based upon areas within the 100-year floodplain. The Creek Valley Overlay District specifically limits most construction and grading activities within the district. The Floodplain Overlay District is intended to retain floodplains in their natural state, to mitigate flooding, to protect water quality, and to provide for open space and wetland habitats. While not subject to other Town regulations, Virginia Tech must adhere to the Town's Floodplain Overlay District.

Stormwater

The second type of flooding occurs during severe or prolonged storm events in areas that are densely developed or where a significant portion of land is covered by impervious surfaces. This type of flooding is particularly common in portions of the Stroubles Creek basin in the vicinity of Downtown and the Virginia Tech campus. This flooding is partially attributed to the covering of the natural floodplain and main creek channel with buildings and impervious surfaces dating back to the early 1800s, which began to constrain natural water flow and infiltration in these areas. As Blacksburg grew, this process accelerated, with more parts of Stroubles Creek and its tributaries increasingly covered or piped by development. These cumulative changes eliminated many of the environmental, ecological,

and visual amenities of these waterways, and have contributed to the degradation of downstream water quality. Constraining natural stormwater drainage within the watershed creates a flooding hazard, which is exacerbated by impervious surfaces associated with the continued urban development of the drainage basin. The Town receives little storm runoff from outside the jurisdiction because of its location along the continental divide, offering the Town and Virginia Tech the opportunity to control runoff impacts within their own storm drainage system and protect watersheds downstream.

While older developments in Town met the stormwater management standards at the time of construction, these standards have advanced significantly over the years. Current stormwater drainage and detention systems constructed in new developments are designed for smaller and more frequent storms. However, larger storm events often result in yard, street, and sometimes structural flooding. Anticipating future changes to precipitation volume and frequency due to climate change is another element of stormwater management that should be considered going forward. A long-term regional stormwater management plan at the watershed scale would be advantageous in that it would allow the Town to strategically plan stormwater detention areas and rebuilding of natural channels to best benefit the watershed as a whole, rather than piece by piece as the land develops. Mapping and modeling of current watershed conditions can enable the Town to plan and implement stormwater facilities more efficiently.

Stormwater Utility

Initiated in January of 2015, the Town of Blacksburg adopted a stormwater utility fee, which created a dedicated funding source to address the flooding problems, water quality concerns and provided for preventative maintenance of the storm drain system. Portions of this fund are dedicated to community projects that will enable quick and flexible repairs of urgent problems in addition to the long-term planning and design of the more complex systematic upgrades that are needed.

Groundwater

Groundwater is used only minimally as a drinking water source within Town limits, on Old Mill Road and a small section of Bishop Road. However, the Town does impact regional aquifers that are a source of drinking water for residents who live in neighboring counties, through land use activities near recharge areas and karst features. Therefore, care must be taken to mitigate and minimize these potential downstream impacts.

Water Reuse

Water reuse is becoming an important component of water resources management. While the Town is fortunate to have a reliable water supply, water should not be wasted when it can be reused. Water reuse can include collection of stormwater, reuse of graywater in homes and businesses, and reuse of treated wastewater. Water can be reused for irrigation, vehicle washing, toilet flushing, and industrial purposes. The Town supports water reuse, particularly as a regulatory framework is developed to protect human health and the environment and as public acceptance of this practice grows. Water reuse is consistent with the Town's environmental and sustainability goals.

AIR QUALITY & CLIMATE

E.1. Support implementation of the Climate Action Plan (CAP).

- E.1.1. Integrate goals and strategies from the CAP into other community-wide plans.
- E.1.2. Aligning budgetary decisions to reduce community-wide emissions in the residential, transportation, commercial, municipal, and industrial sectors.
- E.1.3. Advocating for state policies that will enable Blacksburg and other Virginia localities to fully transition to a clean energy future.
- E.1.4. Advocate for an acceleration of energy utilities expanding their portfolio of green energy sources while simultaneously de-commissioning high-carbon energy production.
- E.1.5. Collaborate with the University and other stakeholders to advance implementation of the Virginia Tech Climate Action Commitment.

E.2. Implement appropriate mitigation measures now mandated in non-attainment areas to keep Blacksburg from falling into non-attainment status. Monitor air quality through periodic testing.

E.3. Maintain or improve air quality in the region to be healthy for people, wildlife, vegetation, and water resources by reducing criteria pollutants and other pollution sources of local concern.

- E.3.1. Educate residents, decision-makers, and businesses about air quality impacts and mitigation/removal of such impacts.
- E.3.2. Support efforts to measure and mitigate pollutants of community concern.

E.4. Limit the negative effects of vehicle traffic on air quality, and set an example for the private sector by using low-emissions, alternative-fuel vehicles in the Town's municipal fleet and Blacksburg Transit and by encouraging fuel-efficient operation practices and incentives.

- E.4.1. Develop a plan to transition the municipal light duty vehicle fleet to all electric vehicles (EVs).
- E.4.2. Evaluate opportunities to transition municipal heavier duty vehicles and equipment to electric as appropriate.
- E.4.3. Develop EV charging infrastructure for municipal vehicles at all municipal buildings with five or more full-time staff.

E.5. Support local employers in establishing and reaching vehicle travel reduction goals to reduce air pollution through policies including:

- Encourage participation in contests and events that promote clean and active commuting modes.
- Offer telecommuting and flex-time policies.
- Offer car-pooling and public transit incentives.
- Expand access to services online.

- Increase availability of bike parking outside of local businesses and other key destinations around Town.

E.6. Support increased coordination with Virginia Tech to limit and reduce vehicular traffic to, from, and on-campus.

E.6.1. Support greater coordination with Virginia Tech to ensure walking and biking routes to and from campus are well-designed to integrate with Town roads and sidewalks.

E.6.2. Encourage Virginia Tech to limit the number of on-campus residents with cars.

E.7. Support community members in establishing and reaching vehicle travel reduction goals to reduce air pollution using the following methods:

- Request telecommuting and flex time policies from employers.
- Car-pool and combine trips.
- Walk, bike and use public transit.
- Utilize services available online.
- Consider vehicle travel costs and impacts when making housing choices.
- Encourage families to use the school bus.

E.8. Limit the negative effects of air pollution from local power producers.

E.8.1. Work with Virginia Tech to identify less polluting alternatives to the operation of the in-Town, coal-fired boilers for power production.

E.8.2. Encourage Virginia Tech Electric Service (VTES) and American Electric Power (AEP) to implement utility incentive programs for conservation, efficiency, demand-side management and peak load reduction in Blacksburg.

E.8.3. Encourage VTES and AEP to facilitate resident and local business participation in power generation through small-scale wind and solar facilities.

E.8.4. Encourage VTES and AEP to purchase or develop wind, solar, and hydro generated power as part of the local provision of power.

E.8.5. Encourage VTES and AEP to implement smart grid technology.

E.8.6. Encourage VTES and AEP to implement time-of-day electricity pricing or other smart rate designs that incentivize conservation, efficiency and peak-load reduction while protecting lower-income rate payers.

E.9. Amend the Zoning Ordinance to promote wind and solar power where appropriate.

E.10. Support energy conservation, energy efficiency, and renewable energy programs and incentives in partnership with local clean energy firms and non-profit organizations to reduce energy use in single-family homes and multi-family housing units.

Climate Vulnerability, Adaptation & Resiliency

E.11. Convene policy and program teams to develop climate adaptation strategies aligned with the key findings of the Climate Vulnerability Report to include:

- Food systems & food security
- Human health & wellbeing

- Biodiversity & ecosystem services
- Infrastructure & basic services

Hazard Mitigation

E.12. Participate in the New River Valley Regional Commission's Hazard Mitigation Plan and advocate for integration of climate hazards in the next regional hazard mitigation planning process.

LAND RESOURCES

Open Space, Green Infrastructure, Biodiversity & Habitat

E.13. Identify opportunities to retain biodiversity and habitat in the Town's open spaces and natural areas.

E.13.1. Prioritize protection of climate resilient landscapes to serve as a reservoir for biodiversity.

E.13.2. Develop invasive species management plans for public lands to address invasive species territory expansion due to climate change.

E.13.3. Encourage private landowners to adopt invasive species management practices to increase the climate resiliency of their property.

E.13.4. As part of development review, use data sources to determine environmentally sensitive areas and alert the applicant and regulatory agency.

E.14. Emphasize collaborative planning and communications between jurisdictions, including the NRV Regional Commission, Virginia Tech, Montgomery and Giles Counties, Christiansburg, and the U.S. Forest Service.

E.14.1. Provide community access to information about the natural resources and open spaces of Blacksburg.

E.14.2. Work with NRV Regional Commission and others to identify and preserve the region's green infrastructure for its environmental and ecosystem functions as well as assets to ecotourism.

E.14.3. Work with Virginia Tech, the U.S. Forest Service, the NRV Regional Commission, private landowners, and advocacy groups to investigate and promote practices that improve biodiversity at both the local and the regional scale.

E.15. Work with such programs as the Virginia Natural Heritage program, the New River Land Trust's Green Infrastructure & Conservation Lands Prioritization project, the Nature Conservancy's Climate Resilient Land Mapping Tool and other data sources to acquire up-to-date information to be considered during the development review process to include:

- Wildlife habitats
- High conservation value land areas and natural corridors
- Perennial surface water sources
- Prime agricultural soils
- Historic resources
- Wetlands
- Threatened and endangered species
- Species of special concern

- Climate resilient landscapes

E.16. Conserve, protect and manage networks and corridors of natural vegetation, forested areas, wildlife habitat, and undeveloped steep slopes.

E.17. As part of the development review process, seek opportunities to preserve and improve open spaces, outdoor recreational amenities, agricultural viability, biodiversity and native habitat for threatened and endangered species.

E.18. Promote and educate the public about the value of natural resources, green infrastructure, open spaces, wildlife habitat, and biodiversity.

E.19. Work with outside partners such as the New River Land Trust to identify areas of Town with multiple high conservation values and explore opportunities to work with landowners on conservation options.

E.20. Collaborate across Town departments to identify opportunities to improve biodiversity, wildlife habitat, and ecosystem services on Town-owned properties, while still meeting these sites' functional purposes and meeting the community's needs and expectations.

Greenways

E.21. Protect the region's natural character and scenic views through preservation of open spaces, ridgelines, forests, and rural lands.

E.22. Work with Montgomery County, the U.S. Forest Service, private landowners, land conservation organizations, and utility companies to protect ridgelines identified as important visual resources from unnecessary clear-cut timbering, utility placement, and other highly visible landscape-marring activities.

E.23. As part of the development review process, address the protection of viewsheds. Ensure that subdivision of any land respects adjacent or affected open space features, and plan for connections to open spaces and greenways within and outside the subdivision.

E.24. Work to expand equitable public access to area natural resources, parklands, open spaces, waterways, and views.

E.24.1. Encourage the provision of greenway connections from key residential and commercial areas of Town to the natural resources in the Tom's Creek basin and to the Jefferson National Forest.

E.24.2. Accelerate efforts to expand safe access for pedestrians, cyclists, and horseback riders to trail amenities and parklands in the Tom's Creek Basin (Huckleberry Extension, Mountain Bike Skills Park, Brush Mountain Properties).

E.24.3. Develop and maintain financing options, including a land-banking fund, to purchase high priority open spaces (e.g. parks, greenways, dry or wet ponds for stormwater detention, etc.) where dedication of land as open space through development is unlikely.

E.25. Acquire land easements or utilize other conservation measures along the entire length of Toms Creek, Stroubles Creek, and Cedar Run to create a large greenway that also serves to enhance the riparian buffer.

E.26. Develop a greenway system that protects the biological diversity of plant and animal species, provides wildlife corridors, integrates the area's history and cultural diversity, and preserves linear stretches of open space.

E.27. Coordinate the greenway system with area stormwater management and maximize opportunities to uncover and restore natural features of channeled and piped urban streams.

E.28. Expand environmental functions of greenways such as preservation of wildlife corridors and habitats, preservation of pervious surfaces and soil, buffering of riparian areas, management of stormwater, and protection of floodplain areas.

E.29. Support greenway funding, acquisition, and maintenance.

E.29.1. Encourage private development of greenways.

E.29.2. Retain public access or greenway easements as appropriate when the Town disposes of property.

E.29.3. Support private non-profit entities, such as the New River Land Trust and the Friends of the Huckleberry in acquiring greenways.

E.29.4. Make use of private, local, state, and federal funding programs to advance this objective.

E.30. As part of the development review process, evaluate opportunities and incentives to expand greenways to provide a connected system and improve equitable access to priority destinations.

E.31. Acquire land and/or trail easements to preserve and reclaim natural floodplains to enhance water quality; protect and restore wildlife habitats and open space; and provide recreational, educational, and alternative transportation opportunities.

E.32. Highlight the value of natural resources, biodiversity, and ecosystems through local educational and outreach such as Seek Education, Explore, Discover (SEEDs) and New River Land Trust Youth Education programs.

E.33. Identify and record threatened and endangered species, specimen trees, and other important natural features within greenway corridors, and minimize disturbance of these during trail design and construction, and/or maintenance.

E.34. As part of the development review process, evaluate a proposed development's impact and proposed mitigation measures for the following:

- Open space
- Urban forest canopy

- Viewsheds
- Mineral resources
- Cultural resources
- Threatened and endangered species
- Watersheds

Urban Forestry & Tree Canopy

E.35. Promote, protect and enhance the Town's urban forests through Town initiatives and in the development process.

E.35.1. Investigate tree species that will be climate resilient for this region; prioritize planting these species for municipal tree plantings; evaluate opportunities to prioritize native tree species that are also anticipated to be climate resilient for this region.

E.35.2. Develop a tree canopy and forestland transition plan to diversify tree species in the community and increase the proportion of climate resilient species.

E.35.3. Monitor the total community-wide tree canopy coverage to ensure Blacksburg retains a minimum of 30% total tree canopy as a percentage of land area as population grows.

E.35.4. Evaluate opportunities to expand community-wide urban tree canopy to 40% (not including areas zoned agriculture, airport, or Virginia Tech campus) as recommended by the Virginia Department of Forestry.

E.35.5. Identify potential planting areas on all town properties and increase the public property urban tree canopy by 10% by 2025.

E.35.6. Offer guidance and resources to help residents, landowners, and businesses increase trees and forested areas on private property.

E.35.7. Offer incentives to plant tree species on private lands that are climate resilient for this region.

E.35.8. Minimize site disturbance to protect existing tree canopy, native vegetation, native biodiversity and wildlife habitats, and pervious surfaces.

E.35.9. Explore options to incentivize retention of mature trees through the development process.

E.35.10. Continue work and improvements to receive the annual "Tree City USA" recognition from the National Arbor Day Foundation.

Dark Skies

E.36. Support dark sky regulations and programming as articulated in the International Dark Sky Association's Standards.

E.36.1. Establish a policy to require downward directed lighting on all new outdoor lighting fixtures to limit upward glare.

E.36.2. Seek funding to retrofit old lighting and review and amend the Town Code to require retrofit of lighting in redevelopment projects.

E.36.3. Ensure safety considerations in lighting design, consulting with other communities and universities for safe solutions.

E.36.4. Partner with Montgomery County, Virginia Tech, VDOT, and other agencies and localities in the effort to reduce light pollution and address resident concerns about light intrusion into residential and natural areas

E.36.5. Continue to work with Virginia Tech Electric, as a willing partner, on a conversion of the Town's streetlights that meets International Dark Sky Association standards.

E.37. Foster greater public awareness of light pollution issues.

E.37.1. Participate in annual light pollution and energy conservation events such as the Power Down/Earth Hour.

E.37.2. Offer guidance, information and resources to residents, neighborhoods, and businesses to help reduce light pollution.

E.38. Investigate metrics and develop a process to perform a periodic community-wide assessment of light pollution.

Agriculture & Local Food Systems

E.39. Identify and foster agricultural climate adaptation best practices in collaboration with Virginia Tech Agricultural Extension and local farmers.

E.40. Encourage both private and public efforts to preserve and manage agricultural and open lands through land trusts, conservation easements, participation in the Agricultural and Forestal Districts (AFDs) and fee simple acquisition.

E.41. Increase the viability of local and regional agricultural production. Increase community engagement and consumer demand for locally grown food.

E.41.1. Support local agricultural viability through community engagement that increases demand for locally-grown food and other agricultural products.

E.41.2. Help connect institutional, restaurant, and wholesale opportunities with agricultural producers and food-based entrepreneurs.

E.41.3. Work with regional economic development entities and local governments to give local agriculture a higher priority and more visibility.

E.41.4. Support local food producers by helping to protect agricultural lands through policies including land use and taxation.

E.41.5. Help to broaden markets to include such places as the Blacksburg Farmers Market, Community Supported Agriculture programs and suppliers to local restaurants and grocery stores.

E.41.6. Support regional efforts to advance retention of farmland and economic viability of farming including small start-up agricultural operations, agritourism, access to local foods, small start-up farms, and innovative forms of agriculture.

GEOLOGIC FEATURES

E.42. Retain open space and restore natural features as the preferred land use in fragile terrain. As a part of the development review process in these areas, the Town will:

- Prohibit development on steep slopes exceeding 25%

- Restrict development on karst topography
- Require stabilization on steep slopes
- Periodically re-assess the extent of known or suspected karst terrain

Karst

E.43. Educate the public about the vulnerability of groundwater in sensitive karst terrain in cooperation with the Virginia Cooperative Extension Service and the Department of Conservation and Recreation's Karst Program.

E.44. Ensure that development in karst terrain does not impact groundwater or karst environments and ecosystems.

E.44.1. Protect karst areas and groundwater flows by minimizing surface water, drainage, and structural impacts near sensitive karst areas.

E.44.2. Avoid use of septic systems and discourage use of fertilizers, pesticides, herbicides, and other chemicals in areas of sensitive karst terrain.

E.44.3. Study the area's subsurface relationship between geology and groundwater to aid in developing future protection measures and monitoring techniques.

E.44.4. Identify karst areas that may facilitate contamination of the subsurface.

Radon

E.45. Educate the public on radon testing and remediation measures. Ensure all Town properties meet radon testing regulations.

E.46. Investigate requiring radon testing for renter-occupied buildings with any bedroom that is below the third floor.

WATERSHED RESOURCES

Watersheds

E.47. Recognize, map, preserve, and restore watershed assets so that surface and groundwater quality and quantity can meet state standards, and meet the needs of the human and natural systems in our community. Protect and preserve streams and water quality from further deterioration.

E.48. Encourage daylighting and restoration of the natural features of channeled and piped urban streams.

E.49. Consider working with regional agencies and other localities to develop a regional watershed management plan; identify areas of increased flooding risk due to climate change.

Flooding Hazards

E.50. Evaluate stormwater policies and infrastructure and identify climate adaptation strategies to mitigate risk of flooding from increased intensity and frequency of precipitation events.

E.50.1. Offer incentives for land and property owners to reduce flood risk for existing structures.

E.50.2. Evaluate and amend land use policies and gray/green infrastructure to reduce flooding hazards for existing and future buildings.

E.50.3. Expand gray and green stormwater infrastructure in areas prone to repeated or flash flooding.

E.50.4. Expand gray and green stormwater infrastructure to reduce non-point source pollution and restore riparian habitat

E.51. Retain open space and restore natural features as the preferred land use in fragile terrain. As a part of the development review process in these areas, the Town will:

- Prohibit development in wetlands and floodplains in the Creek Valley Overlay
- Restrict development in riparian buffer zones
- Restrict grading and earthwork in Creek Valley Overlay

E.52. Consider limiting the use of nutrient credits for stormwater quality management compliance to those that directly benefit Blacksburg's water resources.

E.53. Explore opportunities to incentivize property owners to implement small stormwater management projects that directly benefit Blacksburg's water resources.