

Resilience Planning Recommendations: Vulnerability, Consequences, and Adaptation Planning Scenarios Workshop Brief

City of Hopewell, Virginia

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Background

In 2020, Virginia's Department of Conservation and Recreation (DCR) began establishing guidelines and principles for the state's Coastal Resilience Master Plan, highlighting the need for "a comprehensive path toward long-term resilience to protect people, homes, businesses, infrastructure, and ecosystems from the impacts of coastal flooding." As this Coastal Resilience Master Plan (CRMP) has evolved over the last 5 years, state agencies have begun implementing strategies and recommending ways to address coastal vulnerabilities at regional and local levels. Virginia's DCR also recommends each municipality develop a dedicated local Resilience Plan demonstrating that they are informed on climate science and ready to proactively adapt to coastal hazards, including prioritizing nature-based features for resilience. Regional planning district commissions and localities that incorporate flood prevention and other resilience actions into strategic plans have the chance to qualify for resilience-related funding opportunities, including the Community Flood Preparedness Fund (CFPF) and the Resilient Virginia Revolving Loan Fund (RVRF). In 2023, the Code of Virginia was also amended to recommend incorporation of resilience as an element of the Comprehensive Plan.

Old Dominion University's Institute for Coastal Adaptation and Resilience (ODU ICAR) began partnering with City of Hopewell staff and stakeholders in February of 2023 to utilize the Resilience Adaptation Feasibility Tool (RAFT) to evaluate and address community preparedness for coastal climate hazards. Led by the University of Virginia and in partnership with ODU and Virginia Tech, RAFT has three steps; (1) assess existing resilience measures, (2) set goals in a workshop to evaluate priorities and establish action items, (3) develop implementation plans for those goals and progress them through ongoing support. The RAFT Implementation Team (IT), composed of both City staff and community members, selected four action items for follow-up over the next year. One IT action item was to update the Comprehensive Plan to include resilience language, and the Vulnerability, Consequences, and Adaptation Planning Scenarios (VCAPS, www.vcapsforplanning.org) process was proposed to identify resilience strategies. In August 2024, ICAR engaged city staff using a modified VCAPS workshop to better understand how staff perceive the current priority action items for Hopewell's resilience efforts. Through collecting stakeholder input, evaluating relevant municipal documentation, and analyzing regional climate data, researchers compiled the following report and additional recommendations for resilience planning in Hopewell, Virginia.

What is resilience?

For the purposes of the Comprehensive Plan, the Code of Virginia defines resilience as: *"The capability to anticipate, prepare for, respond to, and recover from significant multi-hazard threats with minimum damage to social well-being, health, the economy, and the environment"* (§ 15.2-2223(F)).

Resilience planning is often associated with and sometimes confused with hazard mitigation, which can be defined as: *"any sustainable action that reduces or eliminates long-term risk to people and property from future disasters"* (FEMA 2024: <https://www.fema.gov/emergency-managers/risk-management/hazard-mitigation-planning>). Hazard mitigation activities may build resilience in a

community, but they are often aimed at reducing physical risk and often seek to bring a community back to its baseline after a disaster.

Resilience planning is also closely tied to the concept of adaptation, which is defined as: *“an adjustment in natural or human systems to a new or changing environment that exploits beneficial opportunities or moderates negative effects”* (Virginia DCR, p. 10).

Adaptation actions think to a future and improving a community’s baseline, especially when a community may experience more severe or more frequent hazards than it has in the past. For example, making a stormwater culvert larger to accommodate today’s 100-year rainstorm might be a hazard mitigation action. But upsizing a culvert to acknowledge that rainstorms may be larger in 2050 than they are today would be an adaptive action. Similarly, a community may be adaptive by strengthening a locality government’s relationships with local faith-based and social services networks, who have different knowledge about which families need more help during a disaster. Building a program that expands partnership capacity over time to get information and resources out to those who need it most is adaptive.

Table 1: Common types of projects, programs, and policies across multiple community elements that take action to build community-wide resilience

Community element	Resilience building projects, programs, and policies
Social and community	Strengthening Faith leaders’ and community services networks; sustaining long term disaster recovery groups
Economic	Developing business continuity plans; economic diversification; upgrading or expanding broadband
Health	Strengthening public education systems; building connected and walkable communities
Housing	Developing affordable and workforce housing; limiting housing and economic development in floodplains; elevating and floodproofing structures; participating in the FEMA Community Rating System
Infrastructure	Minimizing roads, water, wastewater, and energy grid exposure to hazards
Watersheds and waterways	Restoring wetlands; restoring streams; building living shorelines
Natural/biological resources and working lands	Using agricultural practices like cover crops to reduce farm runoff

How do existing City plans address resilience?

When undertaking resilience planning it is important to start with an inventory of existing resilience language and strategies found in current plans. Identifying existing resilience language gives insight into what concerns or goals the city has already given some level of prioritization. It is especially important if those priorities have been formulated into action items or implemented. This existing language provides a starting point for developing the Resilience Plan while also recognizing previous or

current work for which the city is responsible. Although a Resilience Plan is intended to organize future necessary actions, it should also highlight any successes.

Appendix A, Existing Resilience Language, is a compilation of language found in the City of Hopewell's 2018 Comprehensive Plan. Researchers also reviewed the Richmond-Crater Multi-Regional Hazard Mitigation Plan (<https://planrva.org/emergency-management-home/the-alliance/hazard-mitigation/>) but chose to document language from the City's Comprehensive Plan in order to highlight the unique needs and accomplishments of Hopewell specifically. Appendix A organizes the language by section and page number within the comprehensive plan and also attempts to categorize said language for reference purposes. Categories include Land Use, Stormwater, Water Quality, Wastewater, Greenspace, Shoreline, Compliance, Emergency Management, and Education.

The top two categories with the most existing resilience language found were "Compliance" and "Land Use". This is to be expected considering the Comprehensive Plan's focus on land use and Chesapeake Bay Preservation Area compliance. This finding demonstrates that the City of Hopewell is proactively working to be in compliance with the Code of Virginia, DCR, and other related agencies and policies.

The plan is weakest when it comes to "Greenspace" and "Education". Priorities for greenspace investment are a new addition to many strategic plans around the world, meaning Hopewell is not an outlier in this respect. That said, there are opportunities to strengthen the plan as it relates to existing parks, recreation, and open space. Education refers to measures taken by the city to inform and engage with citizens on a range of climate adaptation strategies. It's important to note the plan also does not address climate adaptation for sea level rise and extreme temperatures, which has implications for planning and development throughout the region and should be addressed in future iterations of the Comprehensive Plan.

Climate-Related Hazards in Hopewell

Flooding Conditions and Hopewell

Flooding in Hopewell can start with excess rainfall that overwhelms stormwater drainage (pluvial flooding). It can also come from rises in the river levels of the Appomattox or James Rivers, Bailey Creek, and other small creeks and streams. These river levels can rise due to rainfall elsewhere inland (fluvial flooding) or due to tidal surges up the James River (coastal). Sea levels are rising, and that raises the James River and its tributaries' elevation well inland of the coast. Regular changes in the river level due to tides and rainfall make sea level rise hard to see over time with the naked eye, but it is evident in data showing increasing trends measured at gauges over decades.

The Virginia Coastal Resilience Master Plan's Coastal Resilience Web Explorer (<https://www.dcr.virginia.gov/crmp/cr-web-explorer>) provides the City of Hopewell with maps of how increasing sea levels over time will change the floodplains adjacent to rivers, creeks, and streams (**Figure 1**). This web explorer assumes the NOAA Intermediate High sea level curve, DCR's benchmark planning

scenario for the state. In the boundaries of Hopewell, DCR anticipates that land area vulnerable to up to the 0.2% annual chance flood (the “500-year” flood) will increase from 323 acres in 2020 to 480 acres by 2080. The acreage inundated at mean high tide will increase to 140 acres in 2040 and 236 acres by 2080. It is important to note that much of the James and Appomattox River frontage in Hopewell is river bluffs. While Hopewell has a much higher elevation river front than many communities in Virginia, little is scientifically known about how sea level rise will affect river bluff erosion in Virginia.

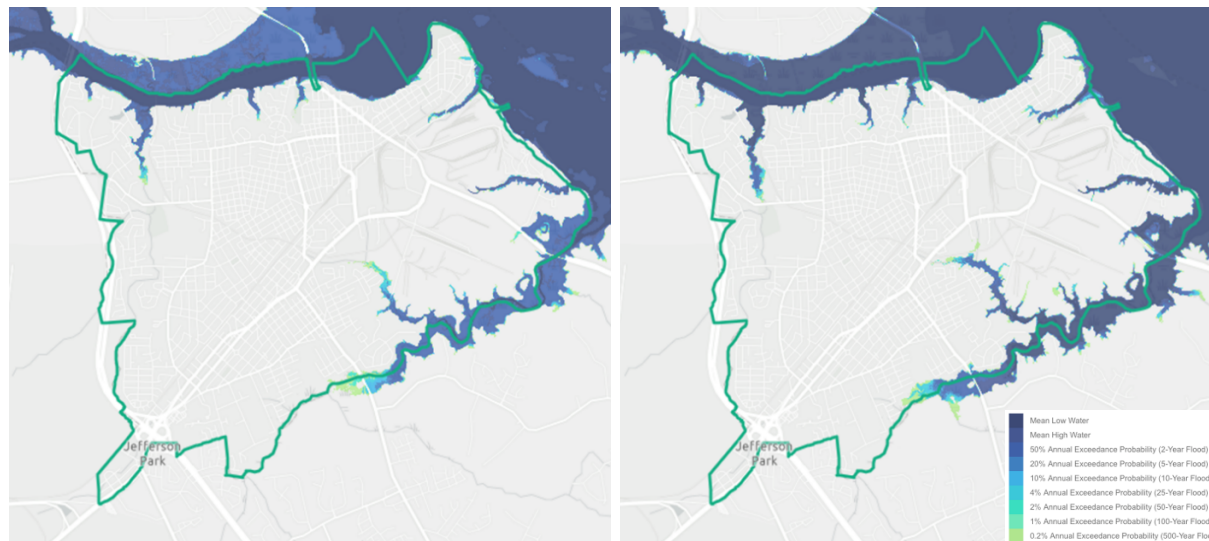


Figure 1: A comparison of floodplain areas in Hopewell in 2020 (a) and 2080 (b), from the Virginia Coastal Resilience Master Plan Coastal Web Explorer. Source: <https://www.dcr.virginia.gov/crmp/ResilienceExplorer>.

Of note are expanded floodplain areas along Route 156 along Baileys Creek, as well as along Poythress Run between the Norfolk Southern Railroad lines and Station Street. Marshes along Baileys Creek near Hwy 10/E. Randolph Road that are currently experiencing tidal flooding (50% annual exceedance probability) would become permanently inundated (under mean low water) by 2080, meaning that structures in that industrial area could lose the marsh that currently buffers them from erosion and flooding unless sediment builds in those marshes fast enough to keep them above water.

Unfortunately, models that tell us how rainfall affects both pluvial and fluvial flooding are less available in Virginia. The next iteration of the Coastal Resilience Master Plan, anticipated December 2024, and the forthcoming statewide Flood Resilience Plan will include more information, but these are evolving areas of scientific modeling. We can look to climate projections to determine how rainfall may change, but how that input alters flooding depends on factors including stormwater drainage systems and the amount of impervious surface in a watershed.

The Fifth U.S. National Climate Assessment, which assesses the state of climate science, impacts, and responses in the United States every four years, outlines four global warming scenarios compared to pre-industrial averages: one in which the Paris Agreement successfully limits warming to 2.7°F above

pre-industrial average, then scenarios for if warming continues to 3.6°F, 5.4°F, and 7.2°F above pre-industrial average (Marvel et al. 2023; <https://nca2023.globalchange.gov/chapter/2#key-message-3>).

The Fifth U.S. National Climate Assessment's NCA Interactive Atlas (<https://atlas.globalchange.gov>) provides climate information downscaled to the local level throughout the United States, including for Hopewell. This includes several maps that describe how precipitation may change in the future. One metric important to consider for flooding is the number of extreme rainfall events, defined as a daily rainfall total in the top 1% of all historical events (**Figure 2**). So far in the 2020s, Earth's average global temperature has increased 2°F compared to the global average temperature in the pre-industrial average global temperature from 1851-1990. If Earth's global average temperature rises an additional 1.6°F above this baseline (3.6°F total increase), then the number of days each year that Hopewell experiences extreme rainfall will increase by 18% compared to the number of events 1991-2020 (<https://atlas.globalchange.gov/maps/5574d4b483f641deb172e141a281aa58>). The total amount of precipitation received in these extreme events would increase by 14% compared to the amount of precipitation recorded in these events from 1991-2020 (<https://atlas.globalchange.gov/maps/31c60fbe135842e79a2066342231b685>). This is the most conservative projection: the Atlas also maps calculations for scenarios of total global average temperatures of 5.4°F and 7.2°F above pre-industrial baselines, which each produce greater changes. This means that Hopewell's stormwater systems will need to accommodate that much more rainfall during its most extreme events as the temperature rises, and these systems will have to accommodate large rainfall events more often.

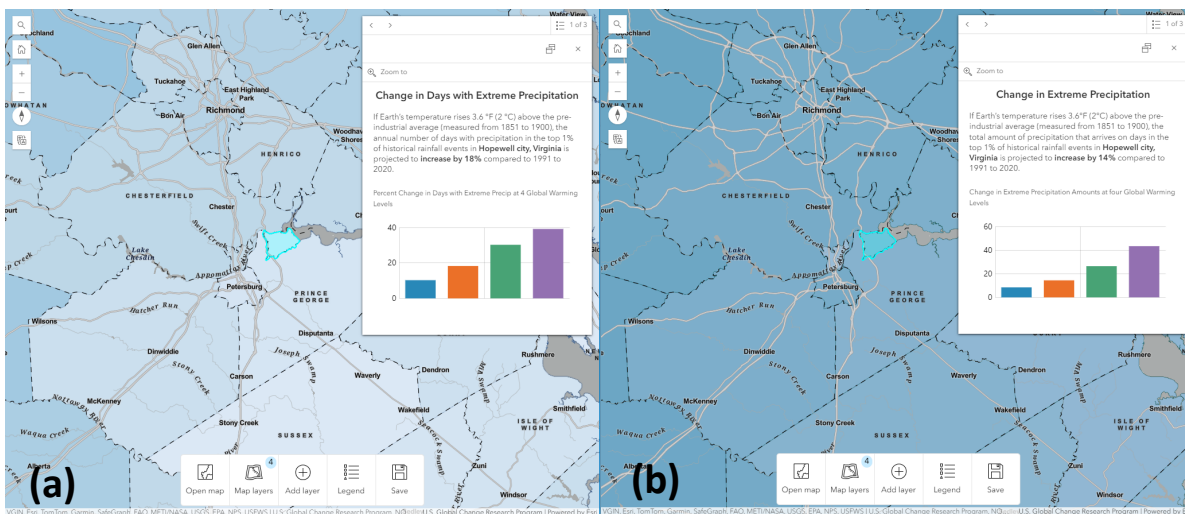


Figure 2: The U.S. National Climate Assessment Atlas contains maps of the change in the number of days on which extreme precipitation occurs each year (a, left) and the projected increase in the amount of precipitation received during the heaviest 1% of precipitation events (b, right). All maps assume a total global average temperature increase of 3.6°F above the pre-industrial baseline, or an additional 1.6°F warming compared to 1991-2020. Source: <https://atlas.globalchange.gov>

Extreme Temperatures and Hopewell

As global average temperatures rise, the patterns of temperature extremes will also change in Hopewell, and the Fifth U.S. National Climate Assessment's Atlas calculates these effects at the local level throughout the United States, including for Hopewell. Regionally, seasonal average temperatures can be expected to affect agriculture and water supply. Locally, the City will need to plan for extreme heat and cold temperatures (**Figure 3**). Under National Climate Assessment scenarios, if Earth's global average temperature rises an additional 1.6°F above the same baseline above (the 3.6°F total increase scenario), the number of days in Hopewell with recorded temperatures over 95°F will increase by 17 days, and the number of nights where the temperature remains above 70°F will increase by 29 days. This can lead to rising energy costs for residents. People without air conditioning (or who cannot afford adequate air conditioning) will be exposed to greater heat stress, particularly when temperatures do not cool enough at night to provide relief. During the winter, with a global average temperature rise of an additional 1.6°F above the baseline, there will be 20 fewer days per year where the temperature is below freezing (32°F). This is the most conservative warming scenario, and greater global average temperature increases lead to higher numbers of warm days and nights and lower numbers of days with the temperature below freezing. This can be a net positive for people who are exposed to cold due to inadequate heat, and it may lower winter heating costs. Some research suggests that warmer winters may increase the risk that precipitation that would have fallen as snow in decades past may be more likely to occur as ice storms; science has not progressed enough to quantify this risk for Virginia.

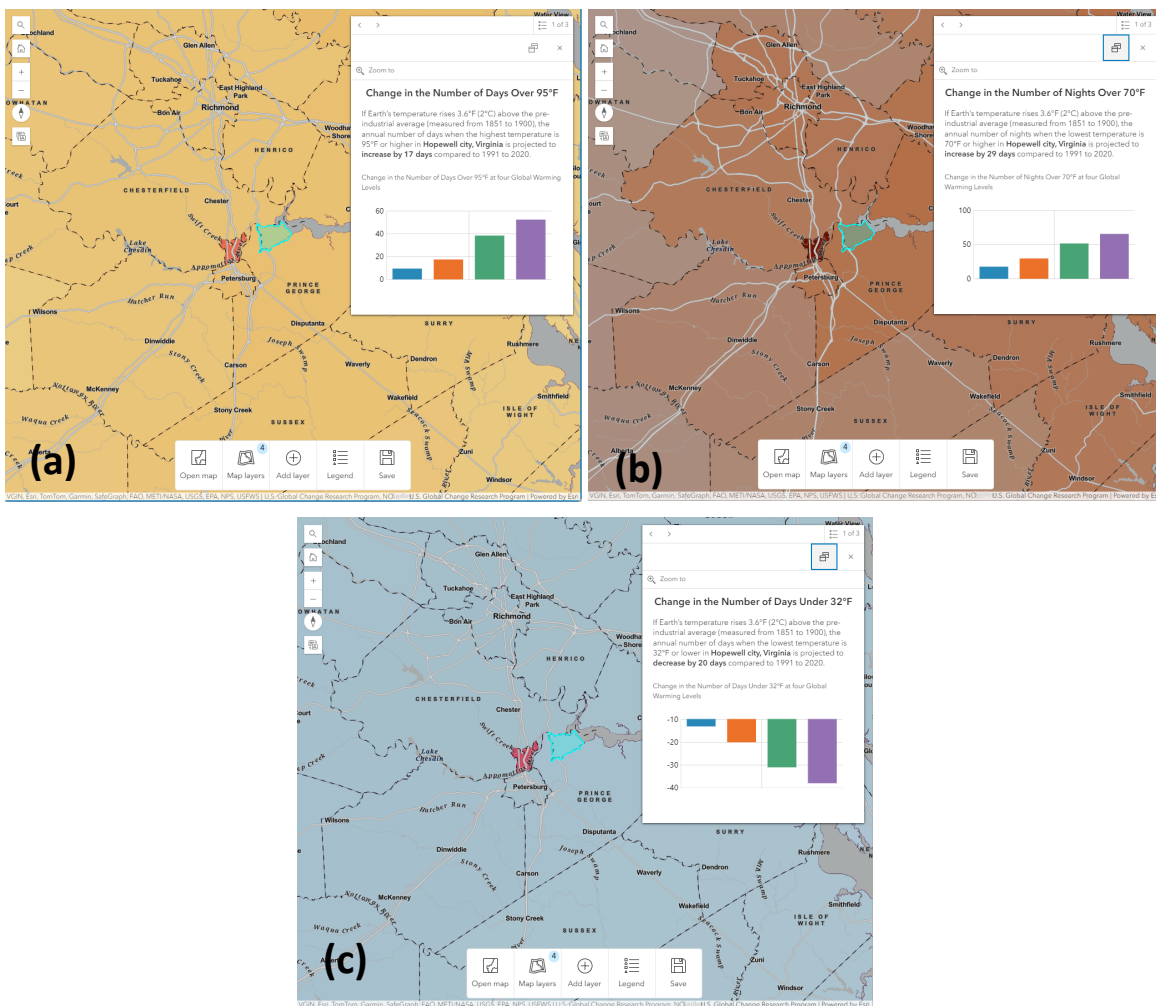


Figure 3: The U.S. National Climate Assessment Atlas contains maps of the change in the number of days on where temperatures meet or exceed key thresholds: (a) change in the number of days over 95°F; (b) change in the number of nights temperatures remain above 70°F; (c) change in the number of days the temperature is below 32°F. All maps assume a total global average temperature increase of 3.6°F above the pre-industrial baseline, or an additional 1.6°F warming compared to 1991-2020. Source: <https://atlas.globalchange.gov>

Hopewell Resilience Workshop

In partnership with the City of Hopewell Planning and Development Department, ICAR facilitated a 3-hour workshop at the City of Hopewell's Municipal Building on August 13, 2024. The workshop included 12 participants from the City of Hopewell, consisting of city staff, public school system staff, a Dominion Energy liaison, and 4 research staff from ICAR for facilitation and documentation. Prior to the VCAPS Exercise, Dr. Bryce Corlett of ICAR presented workshop participants with an overview of climate data to ensure everyone had appropriate context and a clear understanding of discussion topics. ICAR RAFT Program Assistant Jesse Palma presented results from the RAFT Implementation Team and a crosswalk of resilience language already existing in the Hopewell

Comprehensive Plan (**Appendix A**). Following any questions on the presented information, Dr. Jessica Whitehead, Executive Director of ICAR and a co-creator of the VCAPS process, facilitated two sessions where participants discussed potential vulnerabilities and adaptation strategies for Hopewell. The group focused their discussion on two stressors of greatest concern: flooding and extreme temperatures.

Addressing Flood Hazards

During the VCAPS workshop participants (comprised of city staff and operational partners) were given the opportunity to share what they felt were potential vulnerabilities to flooding in the Hopewell community. As a group, participants agreed "aging infrastructure" was a priority and discussed the possible outcomes and consequences if flood conditions were to affect the City's aging infrastructure. Participants were then asked how the City and its staff could feasibly react to that outcome or consequence. Staff-identified priorities and strategies can be found in **Table 2** below.

Addressing Temperature Extremes

During the second half of the interactive workshop, participants were invited to share their thoughts on any perceived vulnerabilities there might be in Hopewell during instances of extreme temperatures. The group then discussed the possible consequences of those vulnerabilities being faced with extreme temperature scenarios, where participants emphasized stressed energy systems and public safety. In response, city staff suggested several resilience actions that could mitigate said consequences, highlighting tree canopy implementation and energy system upgrades/maintenance. Staff-identified priorities and strategies can be found in **Table 3** below.

Table 2: Vulnerabilities of Hopewell to flooding, outcomes of those vulnerabilities, and actions suggested by Hopewell VCAPS workshop participants

Vulnerability/Outcome	Consequence	Action
Increased stormwater volume from heavy rainfall causes flash flooding	<ul style="list-style-type: none"> Increased complaints of localized flooding Increased traffic and public safety demand due to road closures Possible increase in emergency response times Water lines rupture; electrical infrastructure at risk of damage EOC location may be compromised due to flooding 	<ul style="list-style-type: none"> Reduce impervious surfaces in new and existing construction (e.g., reduce parking requirements) Complete and implement Tree Canopy Master Plan to improve absorption of stormwater Use parks and conservation areas to capture and treat runoff Re-use public rights of way for green infrastructure and nature-based features Explore grant opportunities like Community Flood Preparedness Fund Increase offsite accessibility for employees to log-in to a virtual EOC to

		preserve municipal system access during emergency events
Heavy precipitation with pipes that are old and/or cracked increases inflow and infiltration into water and wastewater systems	<ul style="list-style-type: none"> • Roads collapse when underground stormwater lines fail (e.g., Winston Churchill Rd.) • Cascading utility collapse <ul style="list-style-type: none"> ○ Financial hit - damage more expensive than prevention ○ No internet available to conduct state services including social services ○ Public safety disrupted due to access 	<ul style="list-style-type: none"> • Conduct a stormwater infrastructure assessment • Develop and implement an inflow and infiltration reduction plan • Public Works and Water can align plans based on location to achieve cost savings on projects • Work with Dominion to get utility lines underground (<i>Note: Dominion has since followed up that Hopewell is not a candidate for their undergrounding program due to limited outages</i>)
Local flooding and sea-level rise affects Marina	<ul style="list-style-type: none"> • Risk of flooding is inhibiting redevelopment of site for economic development 	<ul style="list-style-type: none"> • Explore resilient building practices • Conduct education for the public and elected leaders to help people understand risks and how to address them
Structure of neighborhood roads/infrastructure undersized, contributing to flooding	<ul style="list-style-type: none"> • See Flash Flooding above • Lack of public investment deters private investment and increases need for code enforcement 	<ul style="list-style-type: none"> • Update roads/infrastructure to withstand localized flooding • Improve project management/coordination across departments to take advantage of opportunities to reduce costs • Increase community investment in stormwater improvements

Table 3: Vulnerabilities of Hopewell to extreme heat and cold temperatures, outcomes of those vulnerabilities, and actions suggested by Hopewell VCAPS workshop participants.

Vulnerability/Outcome	Consequence	Action
Drought and heat	<ul style="list-style-type: none"> • Park use down or impacted from dry and hot conditions • Leaves from stressed vegetation fall into stormwater system • Heat and dry conditions stress asphalt 	<ul style="list-style-type: none"> • Add tree canopy to provide shade • Improve tree maintenance, including removing and replacing old trees that are aging out • Study northward movement of USDA hardiness zones and update development standards for future tree viability in Hopewell (native/drought resistant) • Comment/advocate for state agencies to restore TMDL credit for street sweeping • Add nets at city parks to reduce leaf debris and reduce maintenance demand
Overhead lines freeze	<ul style="list-style-type: none"> • Lines down/power outage 	<ul style="list-style-type: none"> • Work with Dominion to get lines underground

Increased energy use/need during hot or cold temperatures	<ul style="list-style-type: none"> • Stressed system (energy grid) • School closings - HVAC system insufficient for demand; corresponding impacts to education 	<ul style="list-style-type: none"> • Improve and expand energy grids, and support different energy sources to improve reliability • Communicate with Dominion as they use system to monitor weather 1 week in advance of anticipated weather events <ul style="list-style-type: none"> ○ Dispatch information in advance as needed
Old housing stock	<ul style="list-style-type: none"> • Housing may not be well insulated or weatherized • Potential for mold from flooding and/or heat intrusion • Increased energy demand for heating/cooling 	<ul style="list-style-type: none"> • Connect homeowners with existing weatherization programs through Project Homes • Apply for additional federal and state grants to assist residents with energy efficiency improvements, as available. • Explore partnership with Project Homes to improve mobile home communities
Public safety for people who need heating/cooling centers	<ul style="list-style-type: none"> • Establish or expand heating/cooling centers 	<ul style="list-style-type: none"> • Research why people are not using existing centers when opened <ul style="list-style-type: none"> ○ Do people know they are open? ○ Do they need additional hours (have other places during day)? ○ Are current shelters not accessible enough? • Redesign recreation centers for heating/cooling safety divisions • Examine establishing Resilience Hubs: make One Hopewell facility more accessible, explore other locations and options

Summary Recommendations

During the Summer of 2024, the Crater Planning District Commission announced that it received funding in the 4th round of the Virginia DCR Community Flood Preparedness Grants to prepare a Regional Resilience Plan, hire a new PDC Environment and Resilience Planner and Certified Floodplain Manager (<https://craterpdc.org/building-resilience-in-the-crater-region/>). Crater PDC has hired the position and announced that an RFP would be released for an 18-month regional resilience planning process. Based on this development, ICAR recommends the following steps to expand on resilience progress:

1. Continue supporting items in the Comprehensive Plan that help with resilience. Where items are suggested but not tasked to a particular department, evaluate who can be designated as point for maintaining progress on the action item.
2. Maintain active engagement with the Crater PDC Regional Resilience Plan and ensure that items identified as action items in the Hopewell staff resilience workshop (above) are fed into the

Crater PDC plan. Including items in the plan, particularly those which improve the use of natural and nature-based features, may allow those projects to become eligible for CFPF funding.

3. Given the productivity of this short workshop, expand opportunities for Hopewell departments to have further discussions about resilience items as identified above. Further meetings between staff can refine these items and generate new action times as staff understand more. Old Dominion University's ICAR could provide continuing support under its Commonwealth appropriation to provide resilience technical assistance to localities.
4. Consider applying for CFPF funding to support a dedicated Hopewell resilience plan and stormwater infrastructure assessment that meets all DCR requirements, as per its grant manual, including increased use of nature-based features in projects (<https://www.dcr.virginia.gov/dam-safety-and-floodplains/dsfpm-cfpf>). This ensures that an eligible plan exists that is localized enough to support Hopewell's needs despite the Crater PDC regional plan, and is consistent with combined regional/local plan approaches being taken on the Eastern Shore and elsewhere.
5. Dedicate a section in the next update of the Hopewell Comprehensive Plan to resilience. While many actions across sections of the Comprehensive Plan are already supporting resilience goals, dedicating a section that tracks items for Hopewell – particularly those that emerge from the Crater PDC Resilience Plan process – will make it easier to cite the Comprehensive Plan to obtain additional state and federal funding for further action and to ensure that responsible departments are able to collaborate effectively on actions that implement goals.
6. Continue to support staff and the community in learning about threats from extreme temperatures and ways to address them. This was the first time many staff had discussed temperature extremes in Hopewell, and there are many examples of ways other cities and small towns are building resilience to heat. For future reference, ICAR compiled the Heat Action Toolkit Comparison (**Appendix B**) to assist staff with building out ideas introduced in the VCAPS workshop.
7. If resilience is a priority for the community, create a dedicated staff position that can lead resilience planning, education, and implementation efforts for the City. This follows movement in larger cities, like Norfolk and Hampton, to establish resilience officers, and in cities like Richmond who have sustainability offices. As briefly mentioned in Table 2, several city staff members expressed a desire for increased interdepartmental coordination to achieve greater efficiency. This coordination and collaboration both across departments and within the community is time intensive and requires understanding of how all departments operate. Climate resilience and adaptation strategies cross many departments and a dedicated resilience staff could coordinate, and therefore expedite, resilience efforts in Hopewell.

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For more information visit The RAFT website: raft.ienvirginia.edu

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Appendix A

Existing Resilience Language City of Hopewell August 2024

Resilience language identified in 2018 Comprehensive Plan

Category	Chapter - Page #	Resilience Action/Goal (quoted)
General	2-12	Improve the overall health of Hopewell's environmental resources and achieve increased compliance with all governmental requirements to protect and upgrade public and private properties within the City.
Land Use	2-12	Encourage future development that carefully considers terrain, soils, and geologic features; revise site plan criteria, erosion and sediment control standards, landscape and tree canopy requirements, and other code provisions to ensure more thoughtful protection of land during and after development.
Shoreline	2-12	In conjunction with the riverfront trail system project, coordinate design recommendations and implementation strategies to protect the City's river shorelines that are susceptible to erosion as well as other designated Chesapeake Bay Preservation Act areas.
Stormwater	2-12	Develop and implement a City-wide stormwater management (SWM) master plan; focusing on regional/multi-site SWM solutions as opposed to individual SWM facilities in areas where consolidation of properties and/or where intensive development and redevelopment are planned.
Water Quality	2-12	Promote and maintain the health and cleanliness of the Appomattox River and take continued steps to ensure cleanliness of the river around the fresh-water intake plant.
Wastewater	2-12	Mitigate pollution caused by underground storage tanks and the remaining septic systems in the City; Increase enforcement efforts.
Greenspace	2-12	Evaluate the feasibility of community gardens on underutilized properties, to be coordinated with the implementation of "healthy food" initiatives and education programs.
Land Use	2-13	Adopt a coordinated growth management administrative strategy that ensures that all new development and redevelopment throughout the City adhere to high quality land use planning and growth management principles
Stormwater	2-14	Given Hopewell's historical development patterns, place emphasize on policies, action plans, and implementation efforts that reduce the contribution of stormwater pollutants and water runoff issues originating in its existing developed areas.
Education	2-14	Pursue public education efforts that better inform the public and stakeholders of the expectations and mandatory requirements of the Chesapeake Bay Preservation Act.

Category	Chapter - Page #	Resilience Action/Goal (quoted)
Compliance	2-14	Incorporate necessary and sufficient initiatives to address Resource Protection Area goals as well as to meet all Department of Environmental Quality expectations for specific Chesapeake Bay Preservation Area policies, ordinance refinements, guideline preparation, data collection, resource inventories, resource mapping, and implementation measures.
Compliance	2-14	In conjunction with the zoning ordinance update, replace old zoning districts with new districts and contemporary regulations that... (d) successfully implement the City's updated CBPA-O District regulations.
Land Use	2-14	Update the City's site development plan regulations to ensure compatibility and coordination with the other City growth management regulations, and, in particular, the CBPA-O District regulations, zoning map, and plat and plan application process. Due to the lack of environmental protection for much of the City's land that is potentially subject to redevelopment, all land situated outside of the RPA should be designated by the zoning ordinance as Resource Protection Area.
Compliance	2-15	Ensure that the City's site plan and subdivision review process is fully coordinated with the DEQ regulatory requirements for City-wide runoff quality management and the Chesapeake Bay Preservation Areas; including coordination with planning recommendations of the applicable coastal resource management plans that address Hopewell.
Compliance	2-15	Actively monitor City progress on the implementation of the Phase I and II TMDL programs; monitor City departments review and coordinate individual responsibilities under the program.
Compliance/ Land Use	2-15	<p>Strengthen the City's regulatory oversight and planning responsibilities for the implementation of Chesapeake Bay Preservation Act requirements and local environmental design guidelines, ensuring that for all land use activities the following objectives are met (see Chapter XI.) These should include, but not be limited to, the following:</p> <ul style="list-style-type: none"> • no more land area for a project be disturbed than is otherwise necessary to provide for the proposed land use, development or land disturbing activity; • land use planning emphasis and guidance is placed on higher density projects that create a smaller total site disturbance footprint with reduced overall land disturbance; • indigenous vegetation on properties subject to land disturbance activities be preserved to the maximum extent practicable; • the impervious cover of proposed development and redevelop projects is minimized to the maximum extent feasible;

Category	Chapter - Page #	Resilience Action/Goal (quoted)
		<ul style="list-style-type: none"> • project approvals are tied to creative and highly effective environmental design standards related to any justifiable RPA encroachments or for the removal of vegetation within a RPA. • a small area plan is prepared for all of the City's designated IDA properties to focus on expectations for new and redevelopment within Intensely Developed Areas (IDAs); • the City's erosion and sediment control program is more thoroughly unified and coordinated with the site development process; • periodically update the inventory of septic systems with the objective of phasing out these systems where it is feasible to connect to public sewer; • develop a capital improvements plan for environmental protection measures that prioritizes funding for critical RPA maintenance, mitigation and remediation that cannot be otherwise satisfied by regulatory enforcement or private financial means; • develop a capital improvements plan for environmental protection measures that prioritizes selected BMP/LID retrofitting projects on City owned properties; and • pursue continued grant and investment support from State and Federal agencies to implement pollutant reduction efforts.
Education	2-16/17	...incorporate environmental education and river and water safety programs into the youth education curriculum.
Land Use	2-19	Implement new zoning and subdivision regulations that include requirements for civic, recreational, and open space improvements within new and redevelopment projects.; require all new and re-development projects to include sidewalks, curb and gutter, landscaping, trash removal, street lighting, and adequate drainage facilities.
Land Use	2-22	Develop a consolidated Public Improvement Design and Construction Standards manual to provide a single-source document for ease of use by the development and building community; provide comprehensive standards to address traffic and transportation planning guidelines, street and pavement design, sidewalk and pedestrian improvements, right of way, water and sewer, drainage, stormwater management (SWM), Best Management Practices (BMP), trash collection, street lighting, easement specifications, traffic accommodation measures, and other site plan and subdivision related items; review City design standards to ensure compatibility with contemporary development practices and industry standards.
Stormwater	2-23	Require sidewalks, curb and gutter, and contained storm drainage conveyance on all new public and private streets.

Category	Chapter - Page #	Resilience Action/Goal (quoted)
Shoreline	2-23	Advance the City's segment of the regional Riverfront Walk concept plan....prepare detailed master plans and engineering evaluations (including floodway and wetlands inventories)...
Emergency Management	2-24	Annually review and update ongoing plans, programs, staffing, and capital improvements requirements for police, fire, judicial operations, public real estate, and other governmental properties, facilities and other City services. This would include specific annual reviews with manufacturing facilities' management teams regarding emergency plan preparedness.
*Emergency Management	2-24	Annually review and assess quasi-public and non-City service providers (e.g. cable, telephone, electric, internet) to ensure that the City is receiving performance and service levels comparable to other jurisdictions within the Richmond Metropolitan Area; update and coordinate plans of individual service providers.
Emergency Management	2-25	Annually review the City's emergency preparedness plan; ensure City agencies have coordinated internal plans to ensure effective responsiveness as well as recovery operations in the event of natural or human-caused disasters.
Water Quality	2-25	Update water quality plans and programs; continue to monitor all aspects of water quality and mitigate deficiencies at the fresh-water intake at the water treatment plant; ensure that the private water company implements and maintains best practices in all plant operations, treatment technology, and distribution operations.
Emergency Management	2-25	Develop a comprehensive strategy and action plan to address water supply emergencies; identify options and adopt an action plan to provide emergency water distribution within the community.
Wastewater	2-25	Require remaining septic systems to connect to City sewer; provide engineering assistance where needed.
Emergency Management	2-25	Monitor and implement emergency communications system compatible with the new public safety building.
Land Use	3-19	Reduce subdivision street widths and turning radii at street intersections, and provide standards for enhanced street landscaping, pedestrian improvements, and pavement design;
Land Use	3-19	Ensure the preservation or enhancement of natural areas and open space in conjunction with the TND planning process; include creative ways to utilize these areas for Low Impact Development (LID) and Stormwater Management (SWM) improvements, with a focus on designated RPAs and IDAs.
Greenspace	6-17	"This plan promotes pedestrian activity with a new green alley, wayfinding, and programming. The Broyhill Green Alley will create a connection within the downtown to shorten the block distance between Broadway Avenue and Poythress Street, while also integrating stormwater infrastructure, providing pedestrian amenities such as seating and space for gathering..."

Category	Chapter - Page #	Resilience Action/Goal (quoted)
Land Use/ Shoreline	11-2	From a Chesapeake Bay protection perspective, land not classified as Resource Protection Area or Intensely Developed Area is recommended for Resource Management Area designation. The Plan recognizes that constraints on development include: steep slopes, highly erodible soils, areas subject to flooding, historic features, unmanaged properties with shoreline access, and other sensitive environmental areas.
Compliance	11-2	In addition to the WQPP, the Comprehensive Plan includes the recommendations for a more thorough integration and refinement of the City land use regulations, addressing the Zoning Ordinance (including the CBPA-O District), the Subdivision Ordinance (to include a residential lot development component), the Stormwater Management Ordinance, the Erosion and Sediment Control Ordinance, and proposals for Environmental Development Guidelines. The Comprehensive Plan also addresses the key policy elements for the update of the City's Chesapeake Bay Protection Area Overlay zoning district and maps and other recommendations to bring the zoning ordinance into compliance with the Chesapeake Bay Preservation Act.
Land Use	11-7	... the Comprehensive Plan recommends revisions to the site plan regulations that ensure that adequate soils and geologic testing is conducted for new and redevelopment activities.
Land use	11-8	The City has implemented regulations to eliminate, over time, the use of private septic systems. Programs to convert private septic to public systems have been implemented. The Comprehensive Plan strongly promotes Best Management Practices and Low Impact Development measures to lessen non-point source pollution by maximizing the value and conservation of highly permeable soils to capture precipitation that otherwise would run off into the waterways carrying possible water contaminants.
Wastewater	11-9	In keeping with the City's commitment to environmental responsibility as well as the Chesapeake Bay Act, septic system management (and eventual total phase-out) are an essential objective of the 2018 Comprehensive Plan. The City's Septic Pump-Out Program and regulations regarding septic system maintenance and replacement are addressed in the zoning ordinance and other environmental documents.
Wastewater	11-9	The City will review and approach manufacturer specifications for effluent filters and any maintenance requirements associated with these filters.
Wastewater	11-9	To support the septic pump-out program, the City will maintain a database to document all affected septic systems and to serve as a tracking mechanism.
Wastewater	11-9	The Department of Development will monitor the program (septic pump-out program) through mailings to be forwarded, on each five-year anniversary of the last due date, to affected property owners to request documentation that the five-year pump-out has been completed.
Wastewater	11-9	In addition to regulatory oversight, the City shall pursue, to the extent feasible, continued grant and financing opportunities to assist property owners in abandoning and converting on-site private (septic) systems to public systems.

Category	Chapter - Page #	Resilience Action/Goal (quoted)
Water Quality	11-11	It is the City's responsibility to implement and maintain adequate pollution-control measures at the marina to minimize the risk of pollution so near the pumping facility.
Compliance	11-14	... the 2018 Comprehensive Plan incorporates the desired range of goals and initiatives for the most effective management of the City's environmental resources (see Goal #4, Chapter II). The dominant environmental priorities are placed on: (1) ensuring the effective implementation of Chesapeake Bay Preservation Area policies and regulations, and (2) introducing enhanced environmental site design pollutant treatment measures, and land management requirement for all of the City's developed and redeveloping areas.
Compliance	11-16	Hopewell has developed an Action Plan consistent with the Chesapeake Bay Action Plan Guidance Memo (Memo No. 15-2005) provided by the Virginia Department of Environmental Quality (DEQ). As outlined on the following pages, the guidance was used to determine the required pollutant load reductions and identify the means and methods for achieving 5% of the reductions required by the current MS4 General Permit. Hopewell has elected to implement and document street sweeping practices in order to demonstrate compliance with the first 5% reduction requirements. An estimation of the achieved load reductions is consistent with the TMDL Action Plan guidance under the "qualifying street lanes method."
Compliance	11-16	Hopewell's current MS4 Program provides appropriate policies and procedures to implement a compliant program aligned with the goals and requirements of the Chesapeake Bay TMDL. The City's collective efforts are described in the Action Plan. These efforts result in a significant reduction of pollutants that may be discharged from its regulated MS4. Hopewell has relied on a range of mechanisms that are applicable to reducing nitrogen, phosphorus and sediment. These include the following "minimum control measures" per the Action Plan document: <ul style="list-style-type: none"> • Public Education and Outreach • Illicit Discharge Detection and Elimination • Construction Program Compliance • Post-Construction Maintenance and Inspections • "Good Housekeeping"
Compliance	11-24	As required by Article 62.1-44.15:69 of the Code of Virginia, Hopewell has reviewed and revised the 2018 Comprehensive Plan to ensure adequacy of the following basic elements: (1) Data collection and analysis, (2) Policy discussions, (3) Future land use map, and, (4) Implementation measures. (See Plan for details)
Compliance	11-25	The 2018 Plan incorporates a Future Land Use Map, corresponding land use designations that reflect City land use policies and land development objectives, land use planning exhibits (including Priority Planning Area concept plans) that identify key urban development locations, and generalized graphics that depict the location of the intended Bay Act waterfront protection areas. With grant assistance from DEQ, the City has concurrently updated its CBPA-O district text, Chesapeake Bay Preservation Area Overlay Map, and other site development regulations to more specifically address the CBPA within the

Category	Chapter - Page #	Resilience Action/Goal (quoted)
		context of the underlying zoning districts. Continued CBPA area planning studies (namely Small Areas Plans) are recommended.
Compliance	11-26	<p>Given Hopewell's direct geographical proximity to the James and Appomattox Rivers and vulnerability of its Resource Protection Area:</p> <p>(1) ensure that all new and redevelopment throughout the City adheres to high quality planning and growth management principles,</p> <p>(2) introduce environmental design guidelines and site plan regulations to reduce the contribution of stormwater pollutants originating in its existing developed areas, and</p> <p>(3) fully implement the requirements of the Chesapeake Bay Preservation Act and related local ordinances and design guidelines.</p>
Compliance	11-26	<p>(1) Ensure that the update of the City's Comprehensive Plan incorporates necessary and sufficient initiatives to address Resource Protection Area goals as well as meet all Department of Environmental Quality expectations for specific Chesapeake Bay Preservation Area policies, ordinance refinements, guideline preparation, data collection, resource inventories, resource mapping, and implementation measures.</p> <p>(2) Update the Comprehensive Plan on a five (5) year basis in a manner consistent with the State enabling statutes, with an emphasis on enhanced land use, transportation, environmental, and infrastructure plans (via Small Area Plans) on the potential redevelopment areas that are designated as preservation areas.</p>
Compliance	11-27	<p>Conduct a comprehensive rewrite of the City's zoning and subdivision ordinances; replace old zoning districts with new districts and a set of contemporary growth management regulations that...</p> <p>(6) places emphasis on the critical importance of integrating innovative water quality and water quantity control measures with all new development and redevelopment, and</p> <p>(7) undertakes continued environmental planning studies to evaluate the feasibility of designating the entire geographical area of Hopewell as a Resource Management Area.</p>
Compliance	11-27/28	<p>Ensure that the City establishes a Development Review Process program through the office of the Director of Development that...</p> <p>(4) is fully coordinated with the DEQ regulatory requirements for City-wide runoff quality management and the Chesapeake Bay Preservation Area,</p> <p>(4) provides flexibility for the Director of Development to require Water Quality Impact Statements for land disturbance activities in environmentally vulnerable areas lying outside of the Resource Protection Area, and</p> <p>(5) promulgates updated site development guidelines per the City's environmental objectives.</p>

Category	Chapter - Page #	Resilience Action/Goal (quoted)
Land Use	11-29	<p>Minimize Land Disturbances:</p> <p>(1) no more land area for a project be disturbed than is otherwise necessary to provide for the proposed land use, development or land disturbing activity, and (2) land use planning emphasis and guidance is placed on higher density projects that create a smaller total site disturbance footprint with reduced overall land disturbance.</p>
Land Use	11-29	<p>Ensure that indigenous vegetation on properties subject to land disturbance activities be preserved to the maximum extent practicable that is:</p> <p>(1) consistent with the proposed use or development, (2) adheres to updated landscape planning guidelines, and (3) fully consistent with the CBPA-O District regulations.</p>
Land Use/ Stormwater	11-29/30	<p>Minimize Impervious Cover:</p> <p>(1) the impervious cover of proposed development and redevelop projects is minimized to the maximum extent feasible, (2) land use planning emphasis is placed on higher density projects that create a smaller building footprint, (3) implementation of contemporary approaches to achieve maximum infiltration, and (4) minimization of required parking with reduced overall impervious surfaces.</p>
Land Use	11-30	<p>Ensure that project approvals are tied to creative and highly effective environmental design standards for any justifiable RPA encroachments as well as introducing landscape design conditions and criteria aimed at limiting the removal of vegetation within a RPA.</p>
Land Use	11-30	<p>Ensure the site plan regulations and CBPA-O plan of development requirements include...</p> <p>(3) contemporary BMP/LID systems employing enhanced technology and criteria for the restoring vegetation within the IDA sites, and</p> <p>(4) City-initiated coordination with IDA landowners to achieve new and retrofitted BMP/LID improvements.</p>
Land Use	11-32	<p>Ensure that the City's erosion and sediment control program is:</p> <p>(1) unified and coordinated with the site development process, (2) mandates enhanced controls where warranted by terrain and location characteristics, and (3) adequately implemented for any land disturbing activities of more than 2,500 square feet.</p>

Category	Chapter - Page #	Resilience Action/Goal (quoted)
Wastewater	11-32	<p>Prepare an updated inventory of septic systems with the objective of phasing out these systems where it is feasible to connect to public sewer; Ensure that adequate administrative measures, inspection personnel, and maintenance procedures are in place to:</p> <p>(1) require mandatory 5-year pump-out cycle for the remaining septic systems in the City, and (2) ensure that no new development or redevelopment septic systems are permitted.</p>
Land Use	11-33	<p>Ensure that the City develops a capital improvements plan for environmental protection measures that:</p> <p>(1) prioritizes funding for critical Resource Protection Area maintenance, mitigation and remediation that cannot be otherwise satisfied by regulatory enforcement or private financial means, (2) implements selected BMP/LID retrofitting projects on City owned properties, (3) supports the funding and preparation of Small Areas Plans in key areas of environmental vulnerability, with specific emphasis on requirements for Small Area Plans in designated Intensely Developed Areas, and (3) pursues continued grant and investment support from State and Federal agencies to implement prioritized pollutant reduction projects.</p>
Water Quality	11-34	<p>The previously adopted Water Quality Protection Plan (WQPP) remains consistent with the requirements of the Virginia Code. Based on current input from DEQ, the prior WQPP is updated in the following sections and adopted as a key element of 2018 Comprehensive Plan.</p>
Water Quality	11-35	<p>WQPP Policies:</p> <p>A. Physical Factors that Influence or Constrain Development</p> <p>B. Protection of the City's Potable Water Supply</p> <p>C. Shoreline Preservation</p> <p>D. Access to State Waters</p> <p>E. Potential Conflict Between the Land Use Plan and the Water Quality Protection Plan</p> <p>(See Plan for further details)</p>
Compliance	12-4	<p>Introduce a "Point Source" Development Administration Program</p>
Compliance	12-5	<p>Complete Phase II Objectives for the TMDL Program</p>

Appendix B: Heat Action Toolkit Comparison

