

A Sustainable Chesapeake

BETTER MODELS FOR CONSERVATION

Edited by David G. Burke and Joel E. Dunn

THE CONSERVATION FUND



The case study you have downloaded is highlighted below. Other case studies from this Chapter of *A Sustainable Chesapeake: Better Models for Conservation* can be individually downloaded. The editors encourage readers to explore the entire Chapter to understand the context and sustainability principles involved with this and other featured case studies. The full publication contains 6 Chapters in total: Climate Change Solutions, Stream Restoration, Green Infrastructure, Incentive Driven Conservation, Watershed Protection and Stewardship.

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Developing and Protecting Green Infrastructure

A Regional Approach to Conservation in Southeastern Virginia

A joint effort of local governments in the Hampton Roads area demonstrates how a green infrastructure plan evolved to protect valuable ecological services and open space while contributing to the region's economic vitality.

CASE STUDY SUMMARY

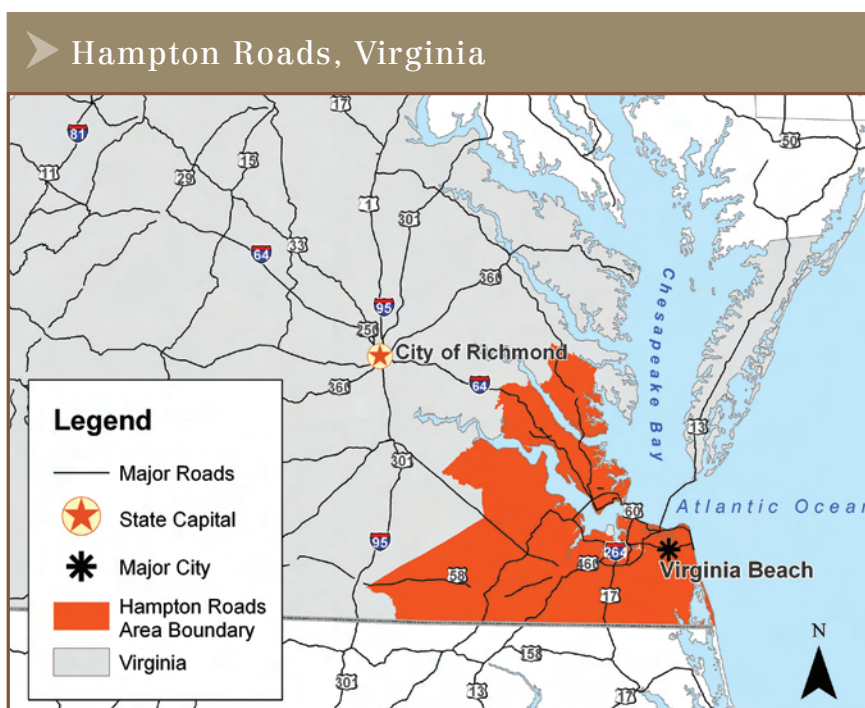
The Hampton Roads green infrastructure network is the first and most fully realized regional conservation planning effort of its kind in Virginia. The name of the region, Hampton Roads, is a reference to the harbor at the center of a highly urbanized region at the confluence of the James River and the southern terminus of the Chesapeake Bay and the Atlantic Ocean. This green infrastructure project was developed to address the need for a comprehensive regional approach to conservation planning in an area of Virginia that is both blessed with a rich array of natural resources and challenged by development pressures and use conflicts. The project is the result of a multi-year team effort among a broad range of stakeholders, including the staff and member localities of the Hampton Roads Planning District Commission, the Virginia Coastal Zone Management Program, and the Virginia Natural Heritage Program. The resulting regional network consists primarily of lands that have high intrinsic value for the protection of water quality and critical habitat.

Implementation efforts have taken many forms.

The regional green infrastructure network is used in several local comprehensive plans, parks and recreation plans, and purchase of development rights programs. The regional network has also been used to prioritize wetlands mitigation sites and to identify lands that have been purchased or placed under

conservation easements to prevent conversion to other uses. Increasingly, the network is being used in conjunction with efforts to buffer military facilities from encroachment by new development.

The Hampton Roads Planning District Commission is one of twenty-one regional planning agencies in Virginia. Its staff coordinates the regional green infrastructure project



in Hampton Roads and is responsible for the majority of the technical work associated with the effort.

RESOURCE MANAGEMENT CHALLENGE

The Hampton Roads region consists of the central cities of Chesapeake, Hampton, Newport News, Norfolk, Virginia Beach, and Portsmouth arrayed around the port of Hampton Roads. Moving out of the urban core, land use patterns become more rural and feature a mix of low-density residential uses, agriculture, and forestry operations. Population growth, redistribution of population, and the development of open space, farms, and forests is the primary challenge in maintaining the ecological vitality of southeastern Virginia.

The sprawling development pattern in the region has resulted in fragmentation of natural areas and an increase in impervious surface, resulting in impaired waters. According to the Virginia Department of Environmental Quality's 2008 Water Quality Assessment, 66% of the assessed river miles in Virginia are impaired.¹ Nearly 95% of the assessed estuary acres are impaired. Many pollution sources, including atmospheric deposition, point sources and nonpoint sources, contribute to water quality problems in the region. In addition, significant wetland acreage in Hampton Roads has been ditched and drained for agriculture or filled for development. A sophisticated green infrastructure plan was needed to prioritize land conservation activities that address regional land and water issues.

CONSERVATION VISION

The Hampton Roads green infrastructure plan identifies opportunities to protect ecological services, provide open space and recreational opportunities, and maintain economic vitality through quality community planning

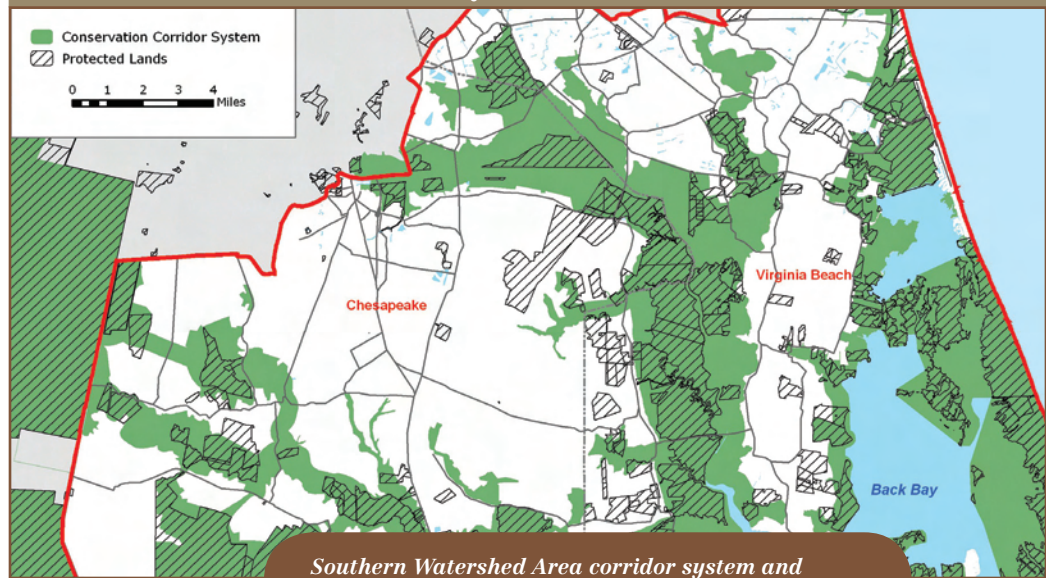
SOUTHERN WATERSHED AREA MANAGEMENT PROGRAM

The Southern Watershed Area Management Program (SWAMP), developed by the cities of Chesapeake and Virginia Beach in partnership with the Hampton Roads Planning District Commission and the Virginia Coastal Zone Management Program, is designed to protect natural resources, sensitive lands, and water supplies in the headwaters of the Albemarle-Pamlico system and to facilitate wetland mitigation.² The development of a conservation corridor system and an associated conservation plan for SWAMP was the precursor for the regional green infrastructure network.

During the time period when the corridor was under development the term "green infrastructure" was not yet in common use. The corridor system has been used in comprehensive planning efforts, the creation of a purchase of development rights program in the city of Chesapeake, and is the target area for wetlands mitigation.

The system was designed to capitalize on the existing network of protected lands and highlight opportunities for connectivity. The corridor system provides a framework for the protection of the rich set of natural heritage resources found in the Southern Watershed Area.

Southern Watershed Area Conservation Corridor System



and minimal encroachment on military facilities. The primary considerations for the regional green infrastructure design included: maintaining and improving the connectivity and viability of the remaining natural areas; watershed protection; and watershed management.

There are limited opportunities in Hampton Roads to protect large tracts of interior forest. Instead, the greatest potential for conserving and restoring green infrastructure is associated with critically important wetlands habitat and riparian areas. Riparian areas are transitional envi-



ronments found between terrestrial and aquatic ecosystems. They often have high biodiversity, a prevalence of wetlands, and offer potential for water quality enhancement, other ecological services, and recreation amenities such as greenways and trails. Urban development patterns in Hampton Roads, particularly in the older central city areas, have fragmented habitat to the extent that riparian areas now represent the best means of achieving a linked corridor system. The vision of conserving riparian corridors originated with a project called the Southern Watershed Area Management Program (SWAMP) in the cities of Chesapeake and Virginia Beach.

IMPLEMENTATION RESOURCES

The costs associated with the green infrastructure project in southeastern Virginia can be divided into two categories: planning and implementation.

Planning: The regional green infrastructure project was funded through a combination of grants from the Virginia Coastal Zone Management Program and matching funds from the Hampton Roads Planning District Commission. Total funding for the project was approximately \$70,000, with \$40,000 in grant money and \$30,000 in match. The budget also included the development of an educational video on the regional green infrastructure effort for use by the member localities. Production of the video consumed approximately 15% of the total project budget.

Implementation: There are a wide variety of state and federal conservation incentive programs and funding sources available to landowners and local governments in Virginia. This backdrop of assistance and incentives serves as the principal mechanism for conserving the green infrastructure network. In addition, the efforts of the City of Virginia Beach and the

City of Chesapeake are particularly noteworthy. Both cities have used funding from a variety of sources for land acquisition. In addition, they have implemented other incentives, such as purchase of development rights programs. The location of lands within the green infrastructure network is one of the criteria considered when candidate parcels are reviewed for potential purchase through these various programs.

CONSERVATION STRATEGY

A regional green infrastructure network for southeastern Virginia was developed based on the experience and utility of the conservation corridor system in the SWAMP. Data analysis and mapping techniques using a Geographic Information System (GIS) helped to produce a map of a green infrastructure network. A stakeholder involvement process then identified areas of emphasis. The network is meant to complement existing conservation initiatives in Hampton Roads, including compatible land use planning with military facilities—such as buffering the installations from encroachment by new development—and a wetlands mitigation agreement between the Cities of Chesapeake, Virginia Beach, and others. Subsequently, the Hampton Roads Planning District Commission conducted green infrastructure workshops and worked closely with local government staff to include the network in local planning efforts and with agencies and conservation organizations doing land acquisition. The conservation strategy moved through a stepwise process described below.

Data Acquisition and Green

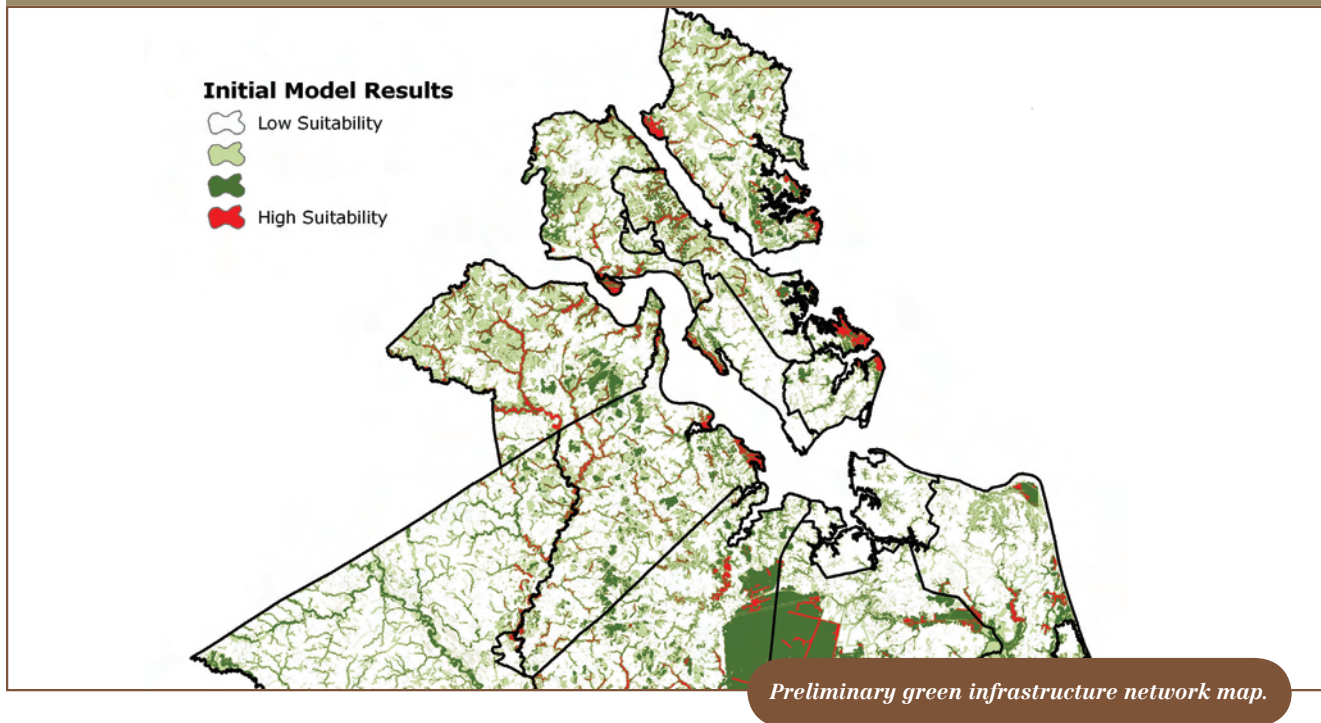
Infrastructure Model Development:

One of the challenges of choosing the data layers to include in the regional model was finding data that both encompassed the entire Hampton Roads region and was consistent in

quality and scale across jurisdictional boundaries. Only four datasets met these criteria and were ultimately chosen for use in the modeling effort:

1. **National Wetlands Inventory (NWI)** was chosen for this model because it is the most comprehensive wetlands data layer available for all jurisdictions in Hampton Roads. The inventory is produced by the U.S. Fish and Wildlife Service. Wetlands in this dataset were extracted from interpretation of aerial photography and classified into numerous categories. For the purposes of this project, a data layer was derived from the original that depicts simply whether an area is classified as a wetland or not.
2. **National Land Cover Dataset (NLCD)** was chosen to represent land cover in the model. It was developed by the United States Geologic Survey using Landsat Thematic Mapper satellite data. The National Land Cover Dataset uses a 21-class land cover classification scheme. The data was captured at a 30-meter resolution for the entire United States and therefore is the best land cover dataset available for working on a regional scale.
3. **Virginia Conservation Lands Needs Assessment (VCLNA)** was chosen to identify unfragmented “cores,” which are interior patches of habitat (mainly forest and wetlands) that are greater than 100 acres in area. The VCLNA is a landscape-scale GIS analysis that identifies, prioritizes, and links natural habitats in Virginia. The VCLNA is a product of the Natural Heritage Program in the Virginia Department of Conservation and Recreation. A core prioritization model was developed and used to assess the ecological significance of each core based on various factors such as rare species and habitats, species diversity, and stream quality. The cores were ranked on a scale of one to five,

► Preliminary Hampton Roads Conservation Corridor Map



with one representing “outstanding ecological significance” and five representing “general ecological significance.”

- Riparian Area Buffers** were developed to represent the riparian corridor system in the model. The riparian corridor data layer was derived from the hydrology dataset included in the 2002 Virginia Base Mapping Project. This dataset was created from the project’s aerial imagery and is more accurate than other available hydrology datasets. Several steps were undertaken to make the data compatible with GIS for input into the model. In summary, the hydrology features were extracted and buffers were created in GIS for 100, 200, 300, 400, and 500 feet. The 100-foot buffer directly adjacent to the shoreline was ranked highest in the modeling with the ranking decreasing with distance from the water’s edge.

A weighted overlay analysis in GIS was used to create the initial version of the corridor system for Hampton Roads. The two major steps in the

weighted overlay analysis process are ranking and weighting the data layers. For this project, the four approved datasets were incorporated into the model to produce one final suitability dataset.

Preliminary Green Infrastructure Network Map: The initial modeling effort was used to refine the green infrastructure network. A preliminary map (Preliminary Hampton Roads Conservation Corridor Map) was produced and shown to professionals in the field of natural resource conservation, planning, and government for review and comment. Issues raised included possible conflicts between the draft corridor system and future land use plans, opportunities for linkage of the corridor system across locality boundaries, and possible linkage of the corridor system with existing or planned parks and open space features. Stormwater management and Total Maximum Daily Load requirements were identified as elements to consider in the design of the regional system.

Final Green Infrastructure Network

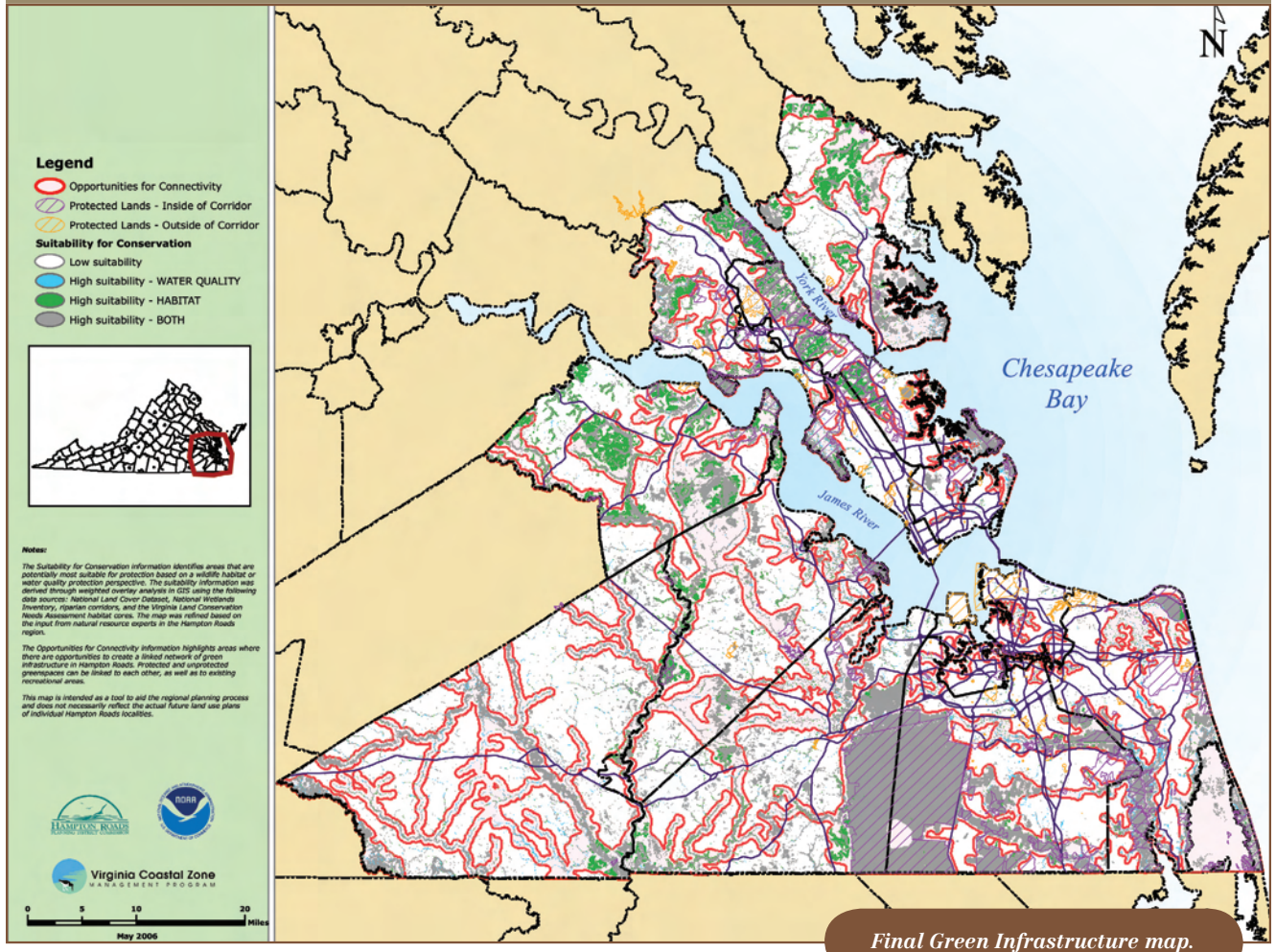
Map: The green infrastructure network map was refined based upon stakeholder input and a final map was developed (Final Hampton Roads Conservation Corridor Map). The final map depicts areas that are important for water quality protection and habitat protection, as well as places in which these two attributes overlap. It also highlights protected lands and areas where there are opportunities to create a linkage in the green infrastructure network. Since the corridor system is primarily riparian-based, most of the recommended conservation areas are connected via streams.

Green Infrastructure Workshops:

The Hampton Roads Planning District Commission organized and hosted two workshops on green infrastructure topics in 2006. The workshops were intended to:

- Provide a forum for discussion of green infrastructure topics among professionals involved in the field

► Final Hampton Roads Conservation Corridor Map



- Provide an opportunity for education and involvement of local, regional, and state agency staff involved in land use planning and natural resource management
- Provide an opportunity for education and involvement of a broader stakeholder community including private non-profit groups and citizens
- Foster discussion on the future of green infrastructure in Hampton Roads

Green Infrastructure Video: The Hampton Roads Planning District Commission produced a video, titled *Make the Connection: Green Infrastructure for the Future of Hampton Roads*. The video provides

an introduction to basic green infrastructure concepts and discusses SWAMP and the subsequent regional green infrastructure program. The language in the video is nontechnical and accessible to a general audience. The video has been used in public meetings and on local public access cable TV stations to introduce the concept of green infrastructure. The video is currently being used as the basis for the development of a similar video for use statewide in Virginia.

Local Government Planning: A key goal of the regional green infrastructure project has been the development of a set of tools that is useful and applicable at the local government level. The regional

network was developed with the input of local government staff to enhance compatibility between the regional network and future local land use plans. All of the GIS products and associated technical reports were delivered to the Hampton Roads Planning District Commission's member localities.

RESULTS

Plan Implementation at the Local Level: The green infrastructure network is used in local planning programs in the Southern Watershed Area and in buffering military facilities.

- The City of Chesapeake included the green infrastructure network in its most recent comprehensive plan and on its future land use map.



Conservation Lands				
Property	Acres	Buyer	Price (millions)	Year
Stumpy Lake Area				
Stumpy Lake Property	970	City of Virginia Beach	\$13.0	2001
Graves Property	47	City of Virginia Beach	\$1.17	2007
Wilson Property	140	City of Chesapeake	\$14.0	2007
Sawyer Property	314	City of Chesapeake	\$0.5	2008
Additional Properties	105	City of Virginia Beach	\$3.40	2008
Knight and Tye Properties				
Knight easement	62.5	City of Chesapeake	\$0	2007
Tye easement	35	City of Chesapeake	\$0	2008

- The City of Virginia Beach included the Southern Watershed Area conservation corridor system in its comprehensive plan by reference.
- The regional green infrastructure network was recently used in the development of a Parks and Recreation Plan for Southampton County.
- The Cities of Chesapeake and Virginia Beach, in conjunction with the U.S. Department of Defense, are using the green infrastructure network as an element in the selection of lands to buffer Oceana Naval Air Station, Naval Auxiliary Landing Field Fentress, and the Northwest Annex in Chesapeake and Virginia Beach from encroachment.

Land Conservation: The most significant result associated with the regional green infrastructure network program has been the fee-simple purchase and acquisition of development rights on lands within the green infrastructure network (see Conservation Lands table). Several entities have been involved in the purchase of land and development rights, including The Conservation Fund, The Nature Conservancy, Department of Defense, Virginia Department of Conservation and Recreation, U.S. Fish and Wildlife Service, and the Cities of Chesapeake and Virginia Beach. These purchases, totaling tens of millions of dollars

and involving thousands of acres, are intended to accomplish a variety of goals, including protecting water quality and habitat, buffering of military facilities from encroachment by development, and providing open space and recreational opportunities for localities. The degree to which the green infrastructure network drives the decision to purchase these parcels varies from case to case.

- **Southern Watershed Area:** This area's green infrastructure network was initially developed in 2000, so there has been considerably greater time and effort expended on implementation in this part of the region. As a result, the percentage of protected land within the network is higher in the Southern Watershed than the network as a whole. Approximately 50% of the land in the corridor system in the Southern Watershed is protected from development. The corridor system is 94,901 acres in size and 45,729 acres are protected from development. A significant portion of the protected land has been purchased by The Nature Conservancy and the Cities of Chesapeake and Virginia Beach since the establishment of the corridor system.
- **Regional Green Infrastructure Network:** The green infrastructure network was expanded to cover the entire Hampton Roads region in 2006. Mostly as a result of previous

conservation efforts, approximately 25% of the land within the regional network is protected. The regional network is 860,212 acres in size and 212,344 acres are protected from development.

While it is not possible to provide a complete account of all of the land purchases associated with the green infrastructure network in this publication, the following examples demonstrate the type of work that is underway. Both cities have purchased land or easements in the green infrastructure network to meet a variety of planning goals, including the protection of critical habitat areas and provision of passive and active recreation opportunities. Three focal areas are summarized below.

Stumpy Lake Area: The area surrounding Stumpy Lake is on the boarder of the Cities of Chesapeake and Virginia Beach and in is the green infrastructure network. It also happens be in the Interfacility Traffic Area between the Naval Air Station Oceana and Naval Auxiliary Landing Field Fentress. Both cities have purchased land in this area to meet a variety of planning goals, including the provision of passive and active recreation opportunities and protection of critical habitat areas. This entire area was identified as a part of the initial



conservation corridor system designated under the SWAMP program and was ranked as a high priority for protection and proper management (Stumpy Lake Area Conservation Corridor System).

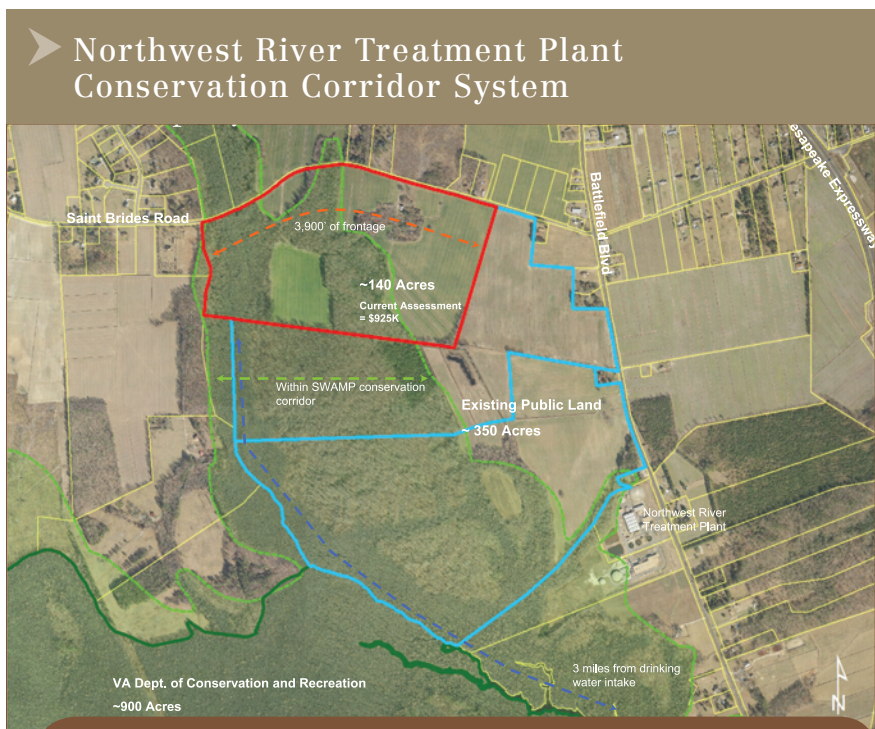
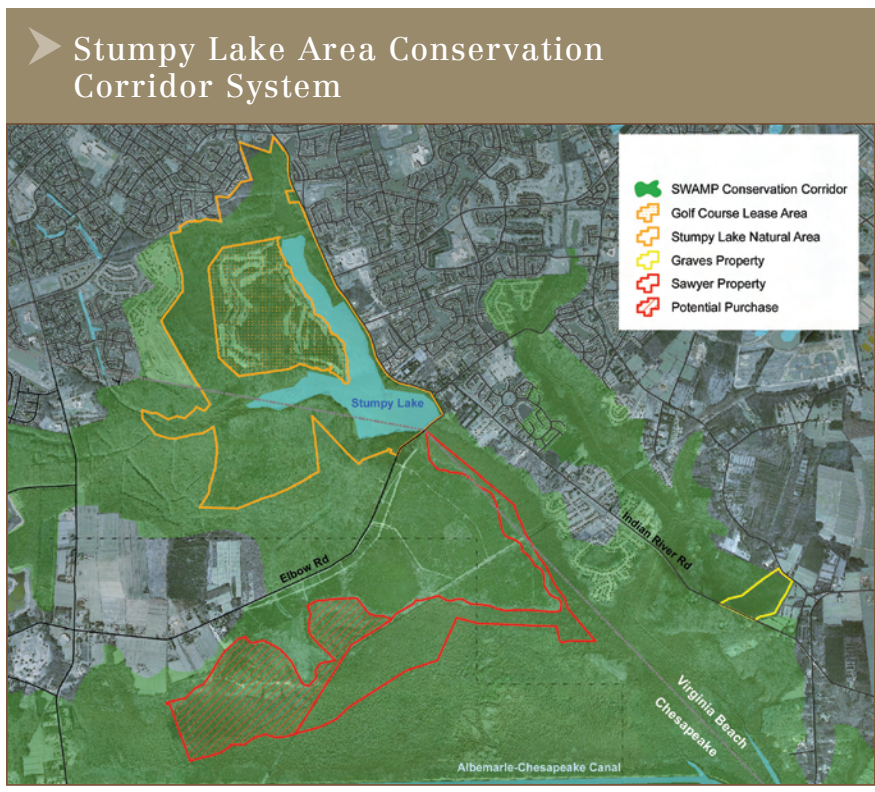
Northwest River Treatment Plant: The area to the north of the Northwest River Treatment Plant is a valuable addition to the green infrastructure network in that it will both protect a critical habitat area

and help to limit development in close proximity to the City of Chesapeake's drinking water intake on the Northwest River. The Wilson Tract is 140 acres in size and was purchased in December of 2007 by the City of Chesapeake for approximately \$14 million (Northwest River Treatment Plant Conservation Corridor System).

Knight and Tye Properties: In addition to land purchases, the City of Chesapeake is accepting donated easements on lands within the green infrastructure network. The Knight easement (62.5 acres in 2007) and the Tye easement (35 acres in 2008) allow continued agricultural and forestry use of the land while extinguishing the development rights associated with these properties. In exchange the land owners benefit from a state tax credit and federal tax deduction.

KEYS TO SUCCESS

- ▶ **Partnerships and Teamwork:** The regional green infrastructure project is based on solid partnerships with stakeholders at the local, regional, state, and federal levels.
- ▶ **Longevity:** The initial conservation corridor work associated with the SWAMP began in 1999 and the work on the regional green infrastructure network began in 2005. It is essential that this type of regional planning effort be maintained over a number of years to allow sufficient time for refinement and integration with local planning efforts.
- ▶ **Science-Based Analysis:** The regional green infrastructure network is based on landscape ecology principles and uses a combination of satellite imagery and field work to identify critical features for habitat and water quality protection. This science-based approach has been critically important in the acceptance of the project.



Land conservation adjacent to the Northwest River Treatment Plant.

- ▶ **Multiple-Benefits Approach:** The identification of opportunities for the achievement of multiple benefits through strategic conservation planning continues to be an important factor in implementation of the regional green infrastructure network.
- ▶ **Regional Vision for Open Space Protection and Restoration:** The articulation of a vision of a regional open space network for Hampton Roads was essential. Prior to this effort local governments in Hampton Roads had little in the way of a blueprint for a regional system of open space.
- ▶ **Technical Assistance and Project Support:** A broad range of stakeholders provided GIS analysis and data, analysis of local development controls, and critique of the regional green infrastructure network. The broad range of expertise of participants from state and local government and academia helped to insure that the regional program is well balanced and structured to address the wide range of planning and natural resource management concerns present in Hampton Roads.

All figures by Hampton Roads Planning District Commission; except page 73, Burke Environmental Associates/The Conservation Fund

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¹Virginia Department of Environmental Quality. 2008. Final 305(b)/303(d) Water Quality Assessment Integrated Report. Virginia Department of Environmental Quality, Richmond, VA. Available online at: <http://www.deq.state.va.us/wqa/ir2008.html>.

²Hampton Roads Planning District Commission. 2005. A Partnership to Protect the Southern Watershed. Environmental Planning Special Report. Hampton Roads Planning District Commission, Chesapeake, Virginia. Available online at: <http://www.hrpdcva.gov/Documents/Phys%20Planning/Special%20Reports/EPSR%20swamp2005.pdf>.

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Hampton Roads Planning District Commission: John Carlock, Claire Jones, Sara Kidd and Eric Walberg.

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City of Chesapeake: Brian Ballard and Jaleh Shea.

Virginia Department of Conservation and Recreation: Joseph Weber.

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PHOTOS AND FIGURES

All photos by Chris Bonney, Lynnhaven River NOW



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Further Reading:

A web page with information on the regional green infrastructure program is located at http://www.hrpdc.org/PEP/PEP_Green_Infras_Plan.asp.

A summary report on the regional green infrastructure project is available for downloading:
Walberg, E. 2007. *Green Infrastructure in Hampton Roads*. Hampton Roads Planning District Commission, Chesapeake, VA. Available online at: http://www.hrpdc.org/Documents/Phys%20Planning/Green_Infrastructure_in_HR.pdf

A technical report on the regional green infrastructure project is available for downloading:
Carlock, J., C. Jones, S. Kidd and E. Walberg. 2006. *The Hampton Roads Conservation Corridor Study*. Hampton Roads Planning District Commission, Chesapeake, VA. http://www.hrpdc.org/Documents/Phys%20Planning/HRCCS/HRCCS_web.pdf