

Appendix F



Charles City County



Green Infrastructure Planning



January 2010
November 15, 2010

Charles City County Green Infrastructure Planning



what

- ▶ Green Infrastructure
 - Defined
 - Benefits
 - Identification & Mapping

why

- ▶ Analysis
 - State Model
 - Asset Inventory Methodology
 - Charles City County Green Infrastructure Assets

how

- ▶ Planning for the Future
 - Existing Protection Measures
 - Opportunities
- ▶ Implementation

What is Green Infrastructure?

“**Strategically** planned and **managed** networks of natural areas, working landscapes and other open spaces that conserve ecosystem values and functions and provide associated benefits to human populations”

- Benedict, Mark A. and Edward T. McMahon. *Green Infrastructure: Linking Landscapes and Communities*. Washington, D.C.: Island Press, 2006.





January 2010

Charles City County Green Infrastructure Planning



Infrastructure (n): the substructure or underlying foundation...on which the continuance of growth of a community depends.

Gray



Green



Green Infrastructure Services



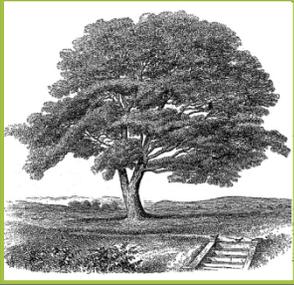
- ▶ Protection of water quality and supply
- ▶ Stormwater management, hazard mitigation
- ▶ Carbon Sequestration
- ▶ Air Quality Protection
- ▶ Temperature Moderation: Heat Island Effect



Green Infrastructure Services

- ▶ Preserves biodiversity and wildlife habitat
- ▶ Conserves historic landscapes
- ▶ Protects working lands, forests and farms
- ▶ Improves quality of life and fitness through access to recreation
- ▶ Preserves rural character





Some Economic Considerations...

- ▶ “Estimated value of all economic benefits generated by a single acre of wetland: **\$150,000 to \$200,000**”.
- ▶ “...every **\$1** appropriated in the annual national parks budget, the national park system generates at least **\$4** for state and local economies.”
- ▶ “...the estimated total value of the world’s ecosystems services is **\$33 trillion** annually.”
- ▶ “ ...when 60 percent of the watershed is forested, average annual (water) treatment costs are **\$297,000**. When only 10 percent is forested, average annual costs rise to **\$923,450**.”
- ▶ “The forestry organization American Forests estimates that trees in the nation’s metropolitan areas contribute **\$400 billion** in stormwater retention alone.”

The Inventory: Mapping Green Infrastructure Assets

▶ Working Lands

- Farms
- Forests
- Fisheries

▶ River & Stream Corridors

▶ Wetlands

▶ Marshes & Swamps

▶ Meadows & Pastures

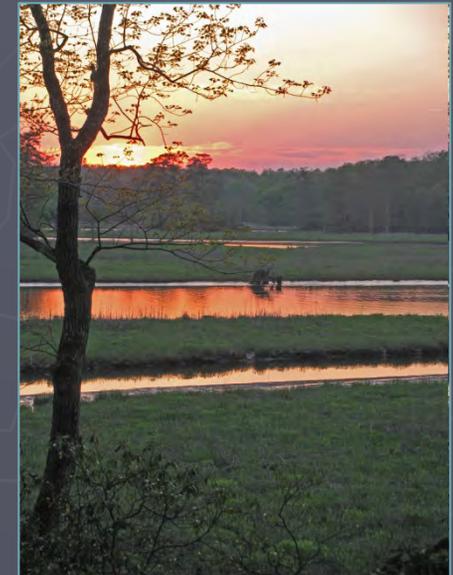
▶ Parks



Photo: Tom Rawinski / © DCR Natural Heritage



<http://www.vcu.edu/rice/natural/harrison.html>



<http://rivermud.blogspot.com/2009/04/chic-kahominy-river-fishing.html>

The Inventory: Mapping Green Infrastructure Assets



<http://www.jamesriverplantations.org/Westover.html>



<http://www.virginiacapitaltrail/html/>



<http://www.flickr.com/photos/andrewbain/2057004713/>

- ▶ Cultural Sites
- ▶ Historic Resources
- ▶ Trails
- ▶ Viewsheds
- ▶ Scenic Rivers
- ▶ Scenic Byways
- ▶ Watersheds
- ▶ Birding and Wildlife Trails

Ecological Composite Model = Ecological Integrity Ranking 1 - 5

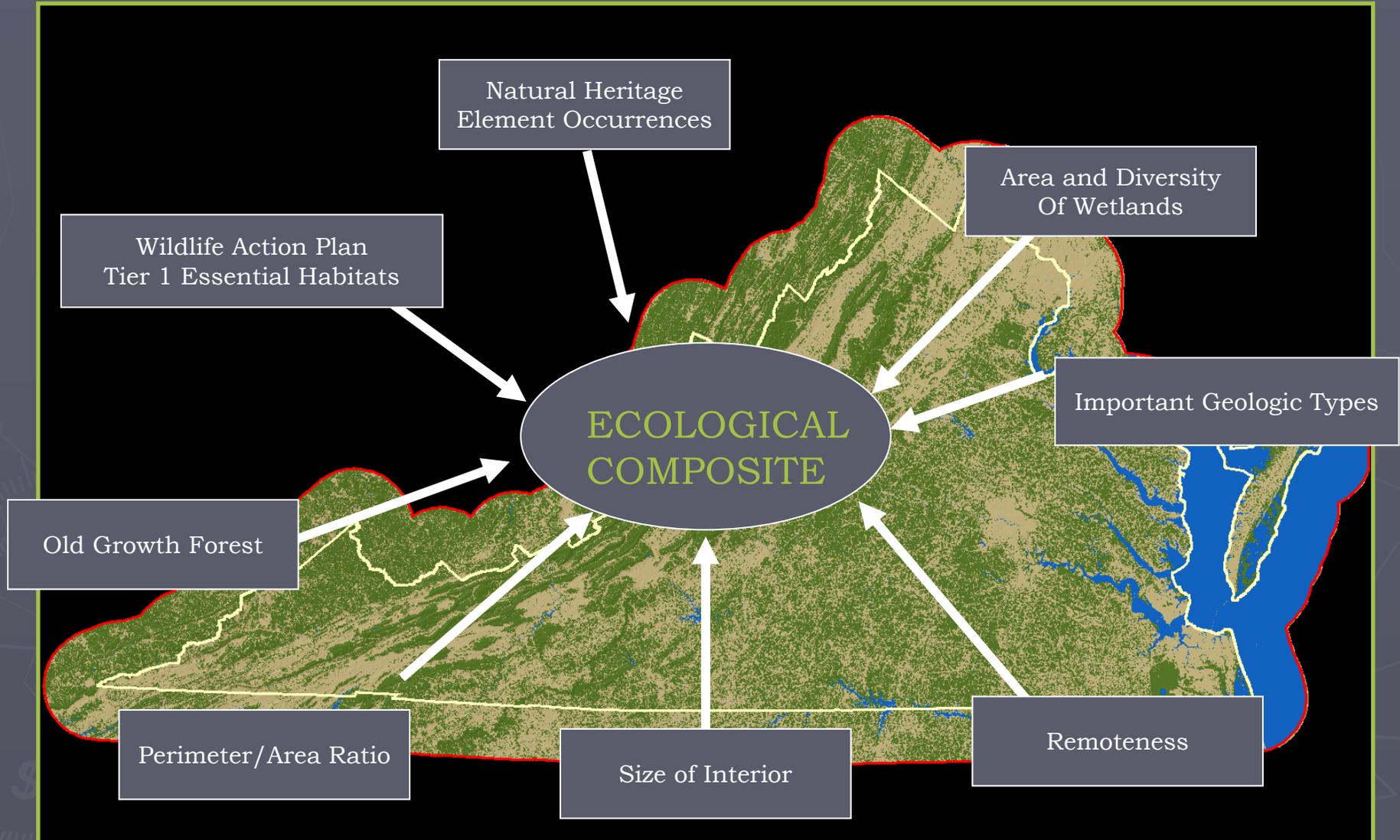


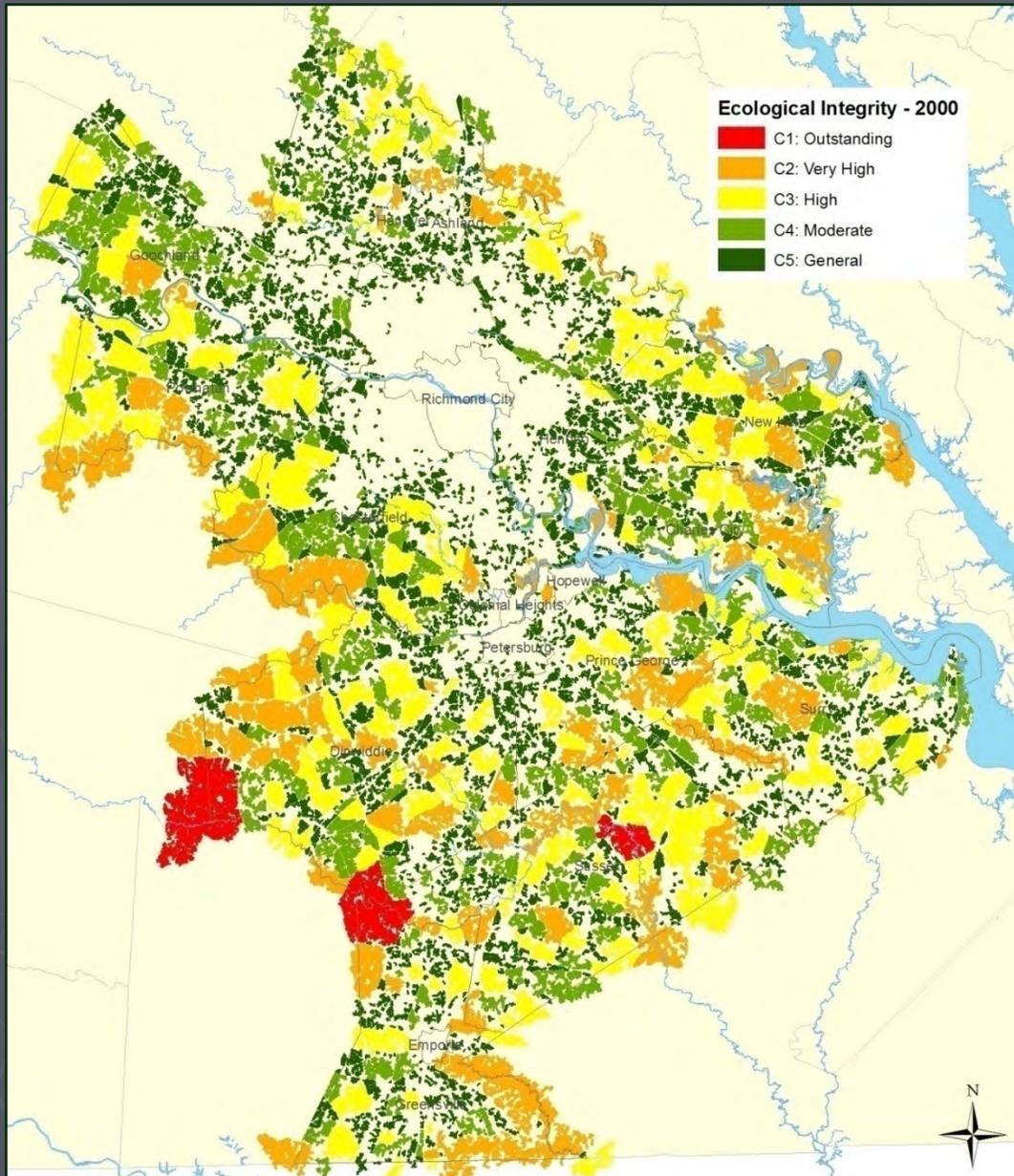
Image Courtesy VA Dept. of Conservation and Recreation

January 2010

Charles City County Green Infrastructure Planning



Richmond & Crater Region Intact Cores 2000



January 2010

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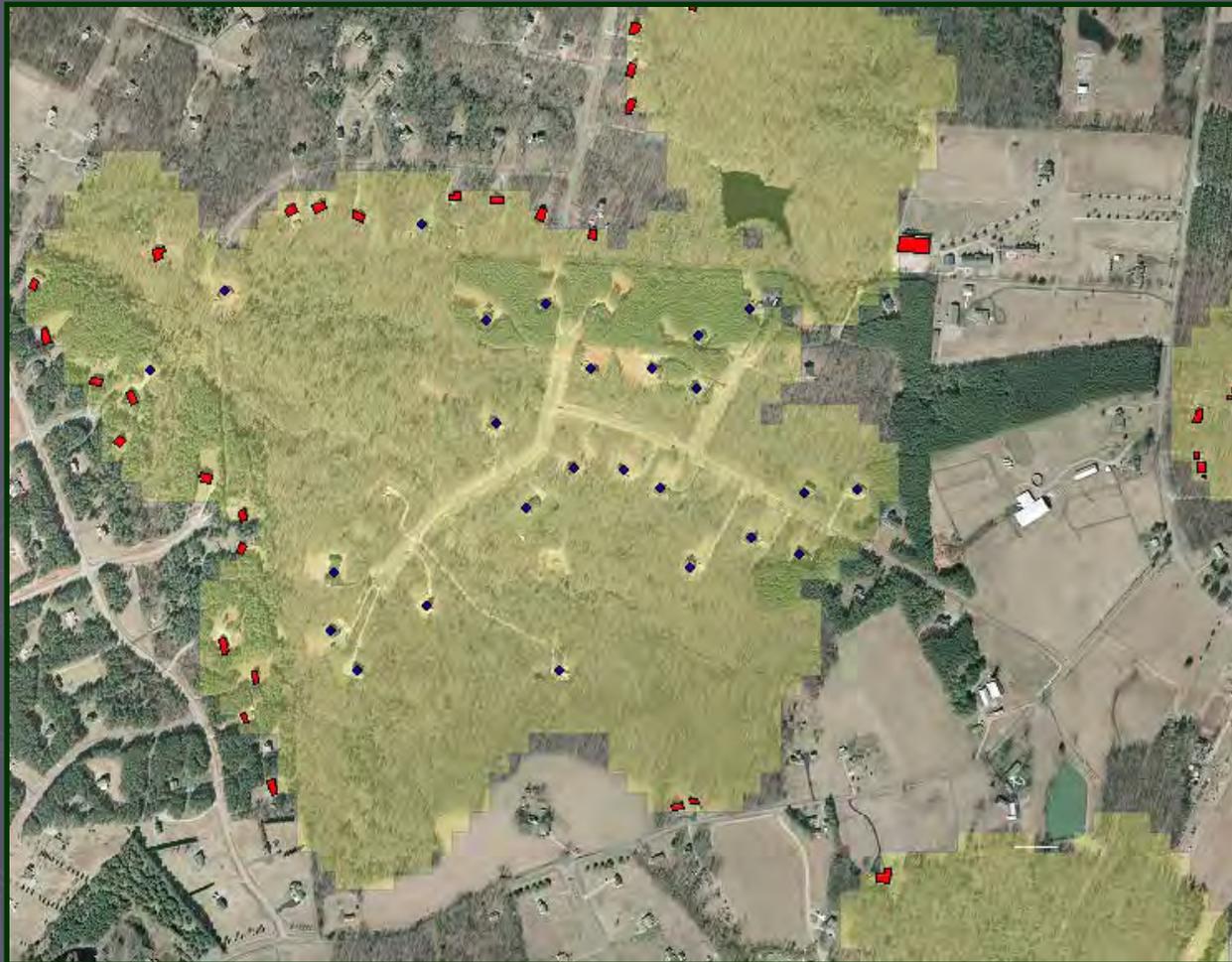


Method to Update Cores

1. Use existing structure data, aerial photography and ecological core GIS data to identify newly constructed structures not accounted for in the model data

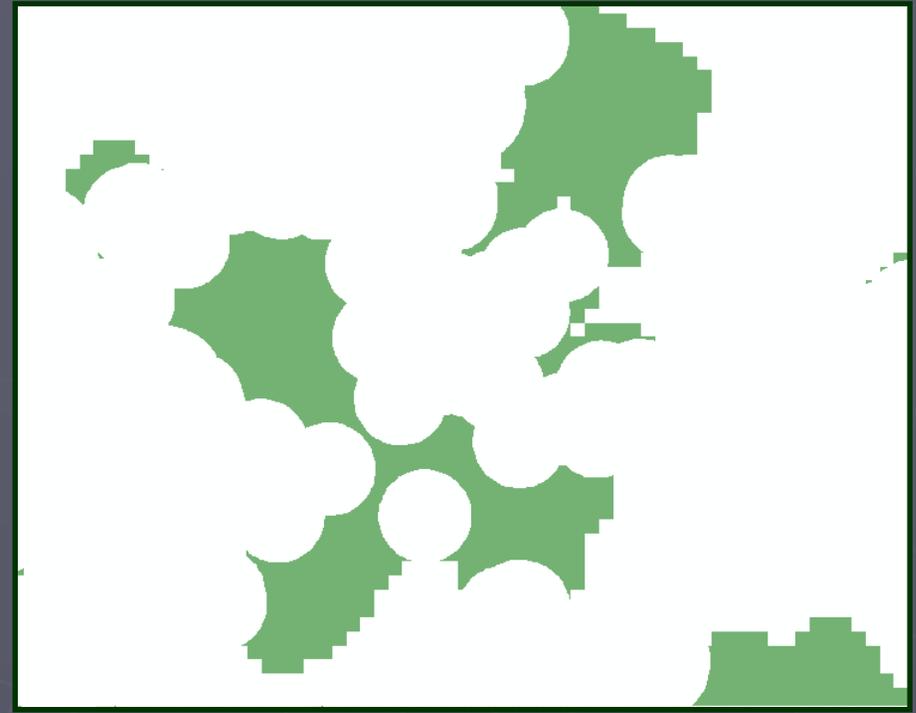
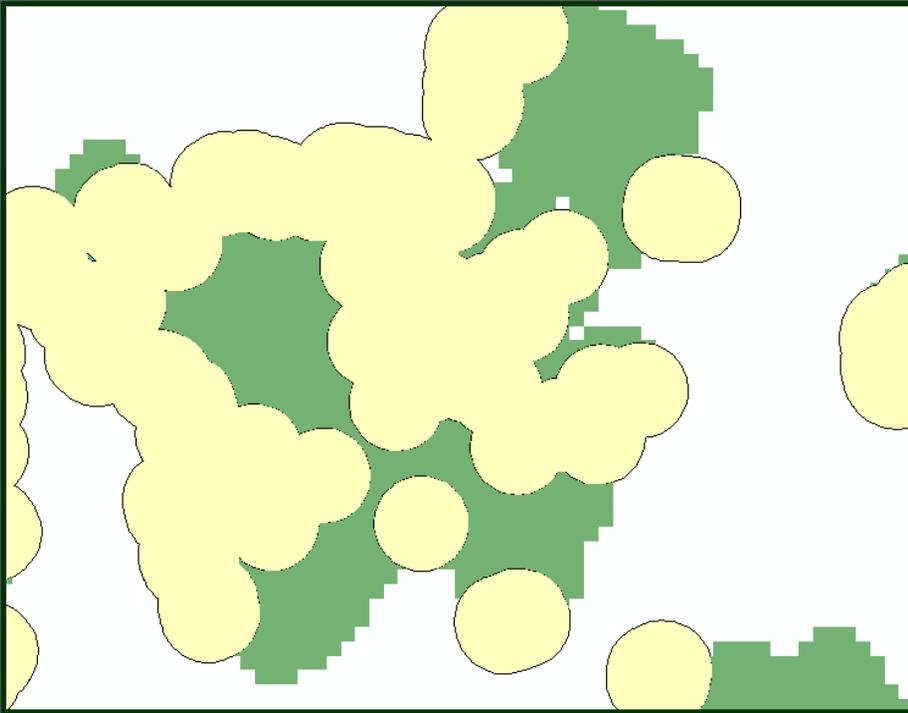


2. Digitize points over newly constructed structures as identified using the aerial photography.



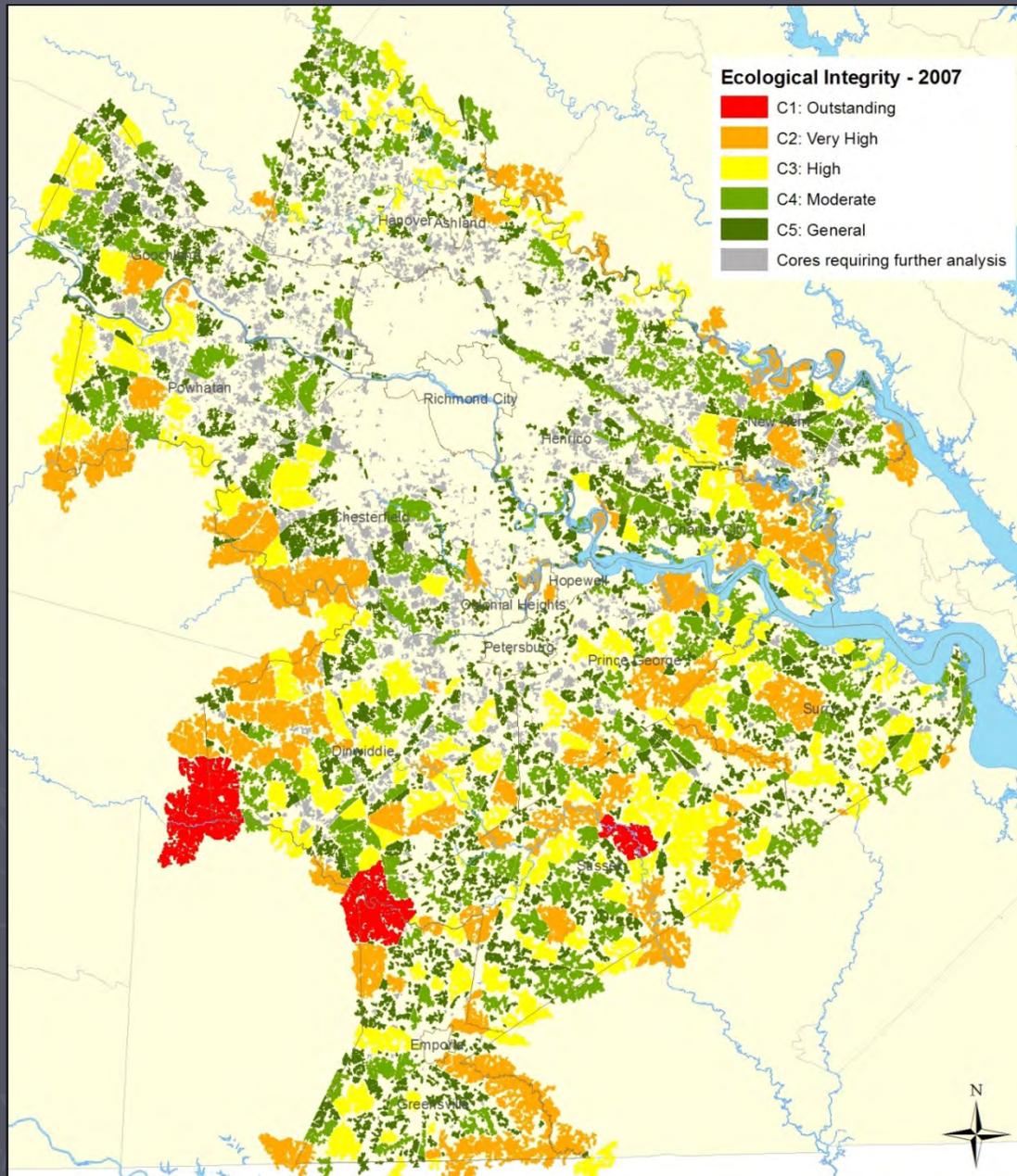
3. Buffer structures that intersect the ecological cores with 100 meter buffers.





4. Remove structure buffers from ecological cores.
5. Recalculate core acreage, eliminate remaining core fragments below acreage threshold.
6. Recalculate ecological integrity score.

Richmond & Crater Region Intact Cores 2007

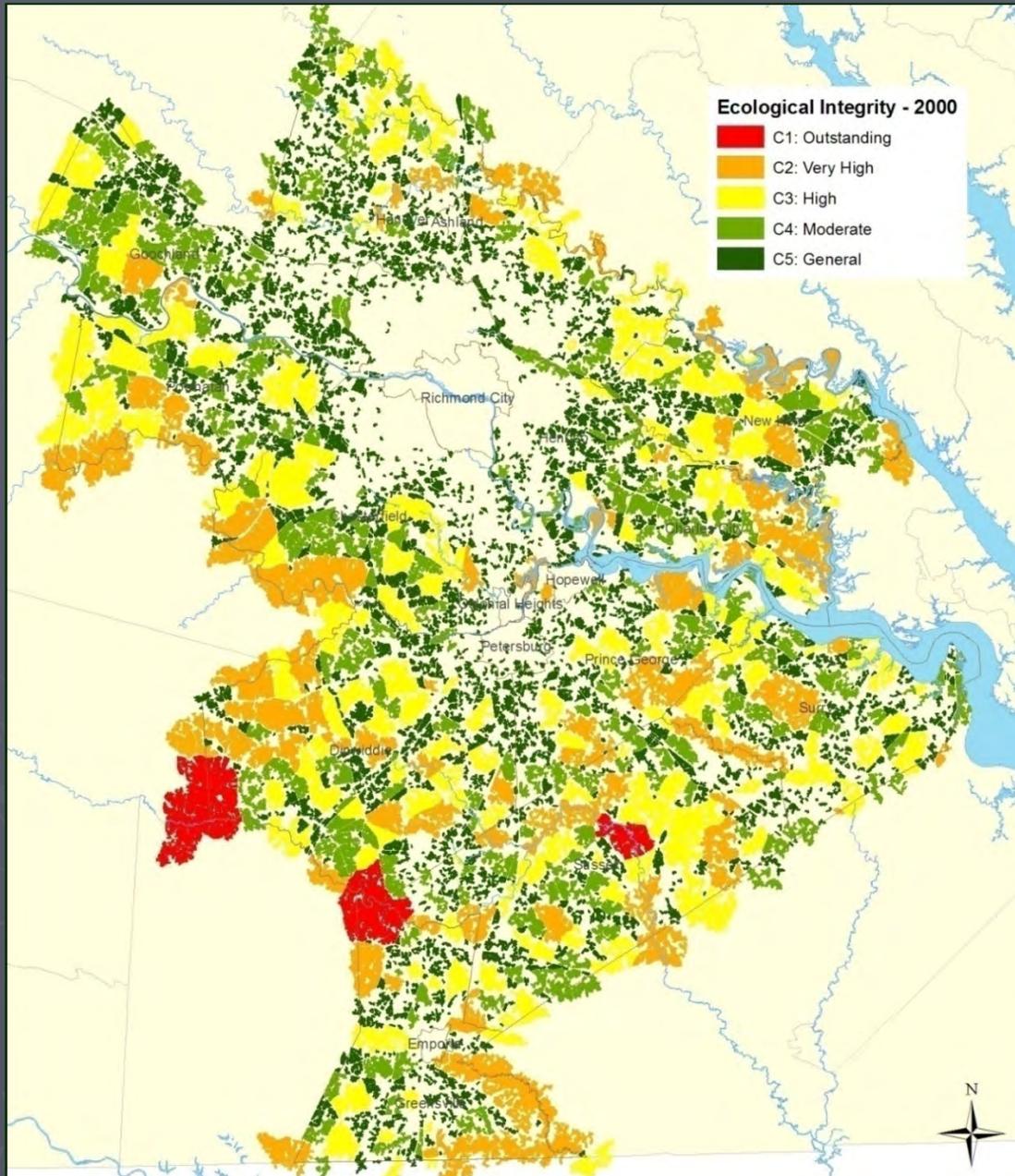


November 15, 2010

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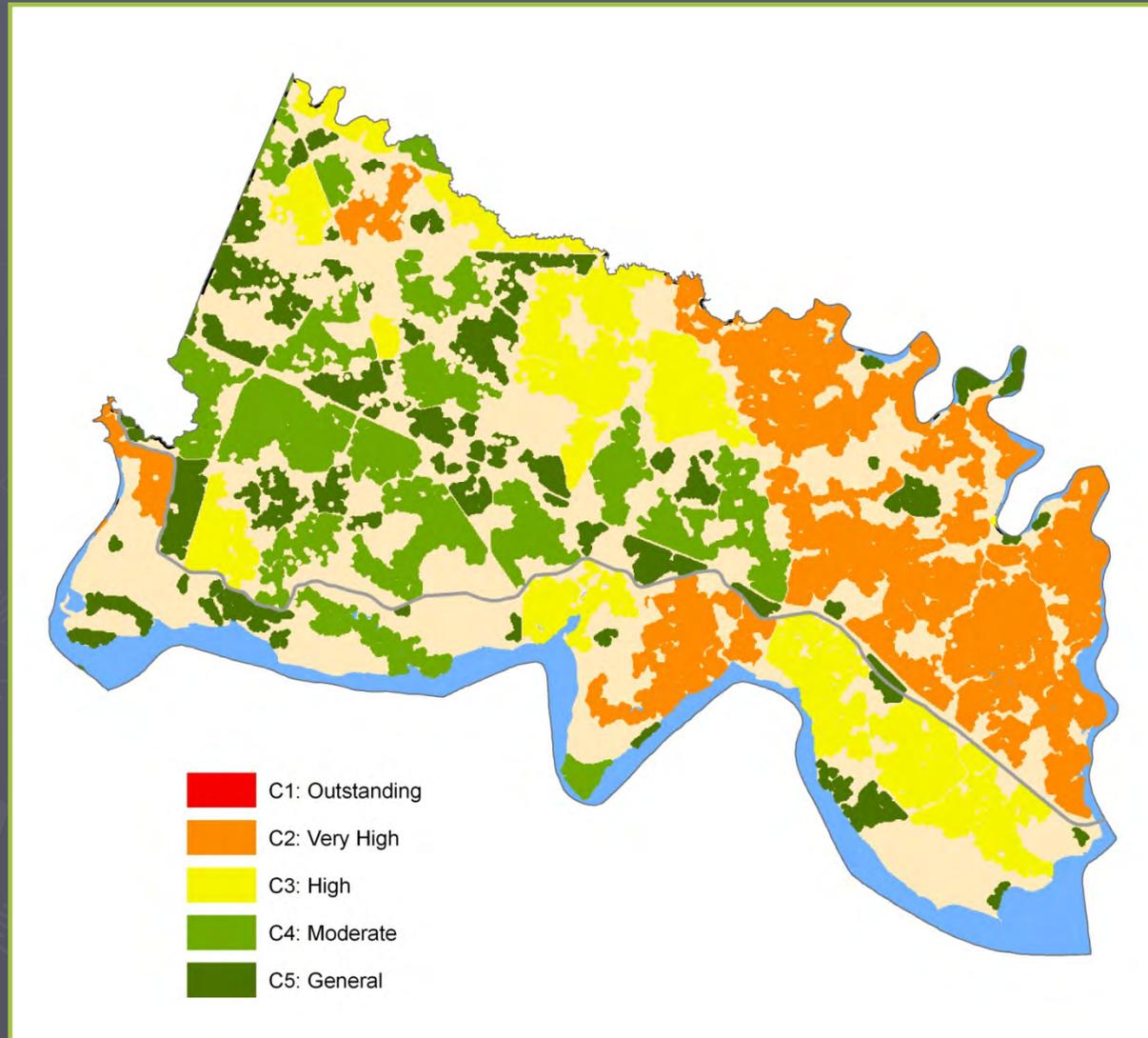


January 2010

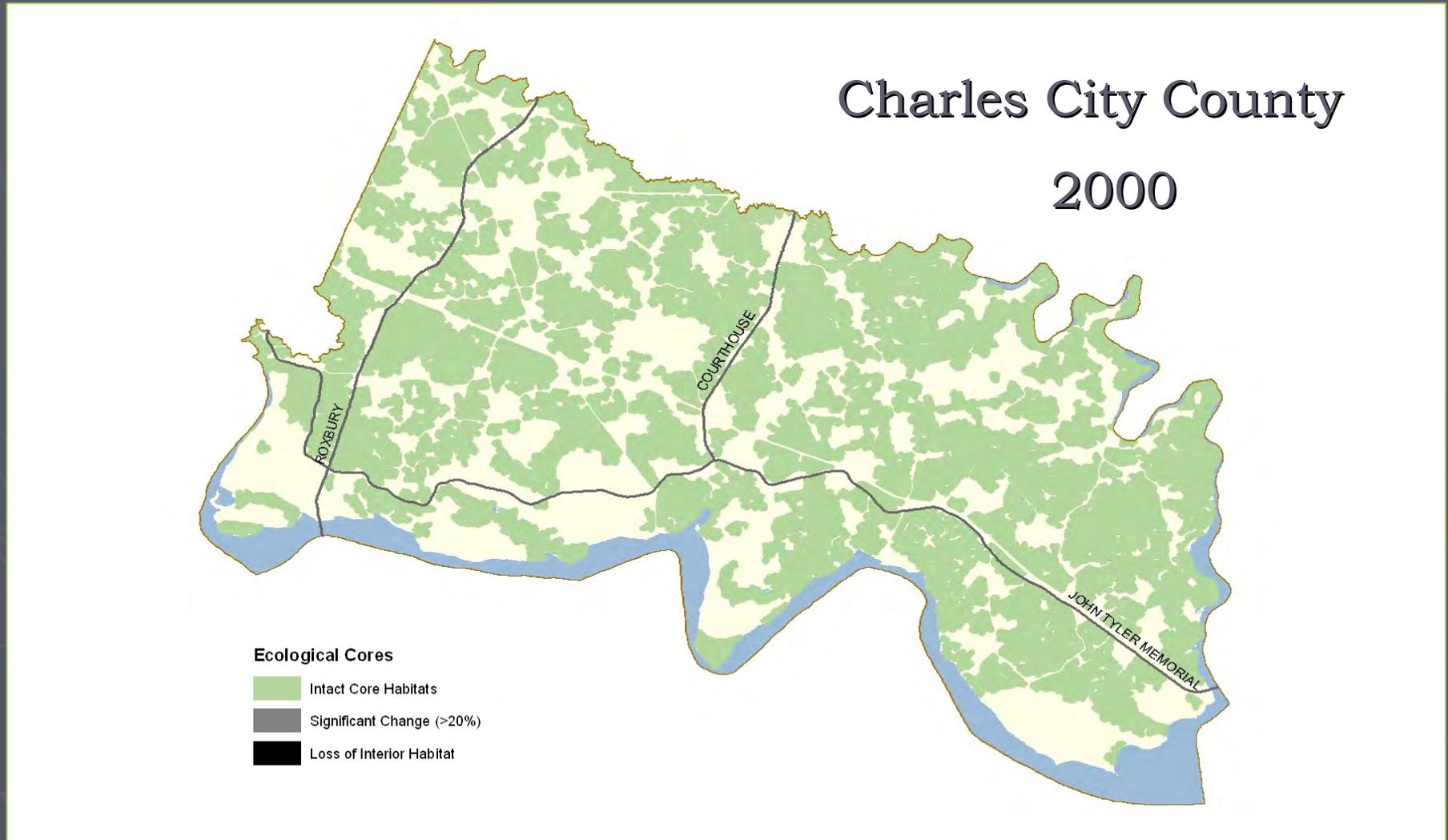
Charles City County Green Infrastructure Planning



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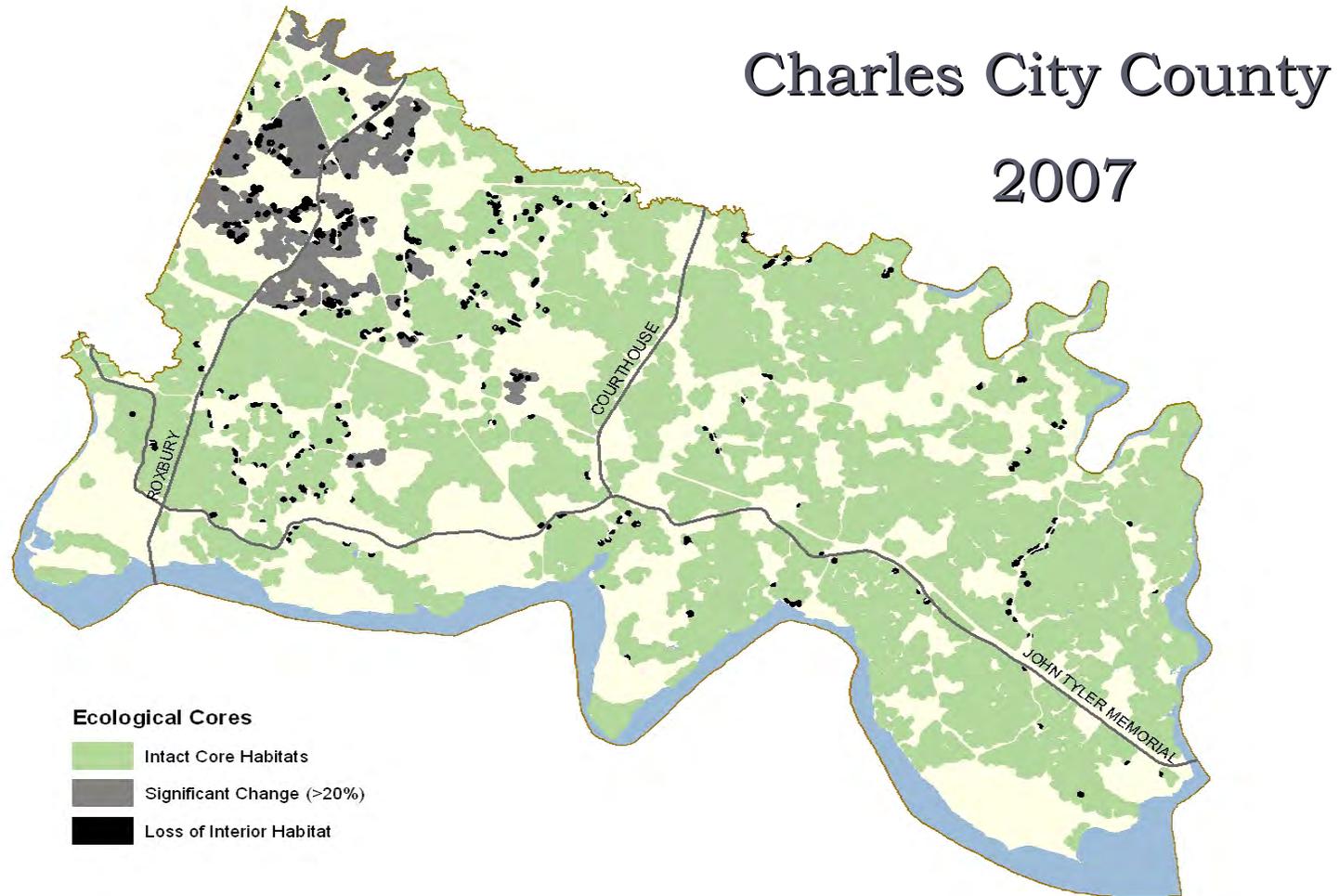


A Unique Opportunity: 7 Years in a Changing Landscape

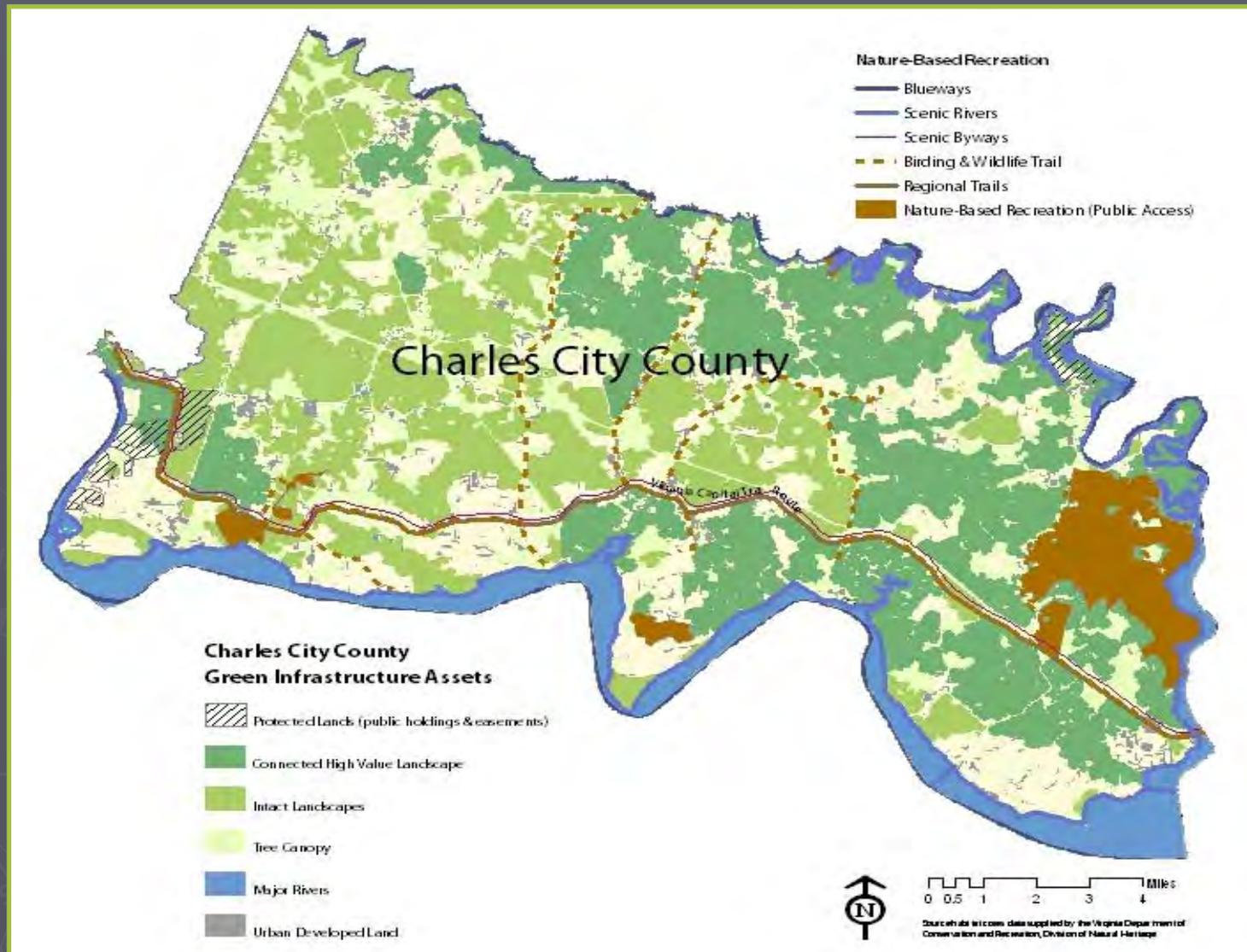


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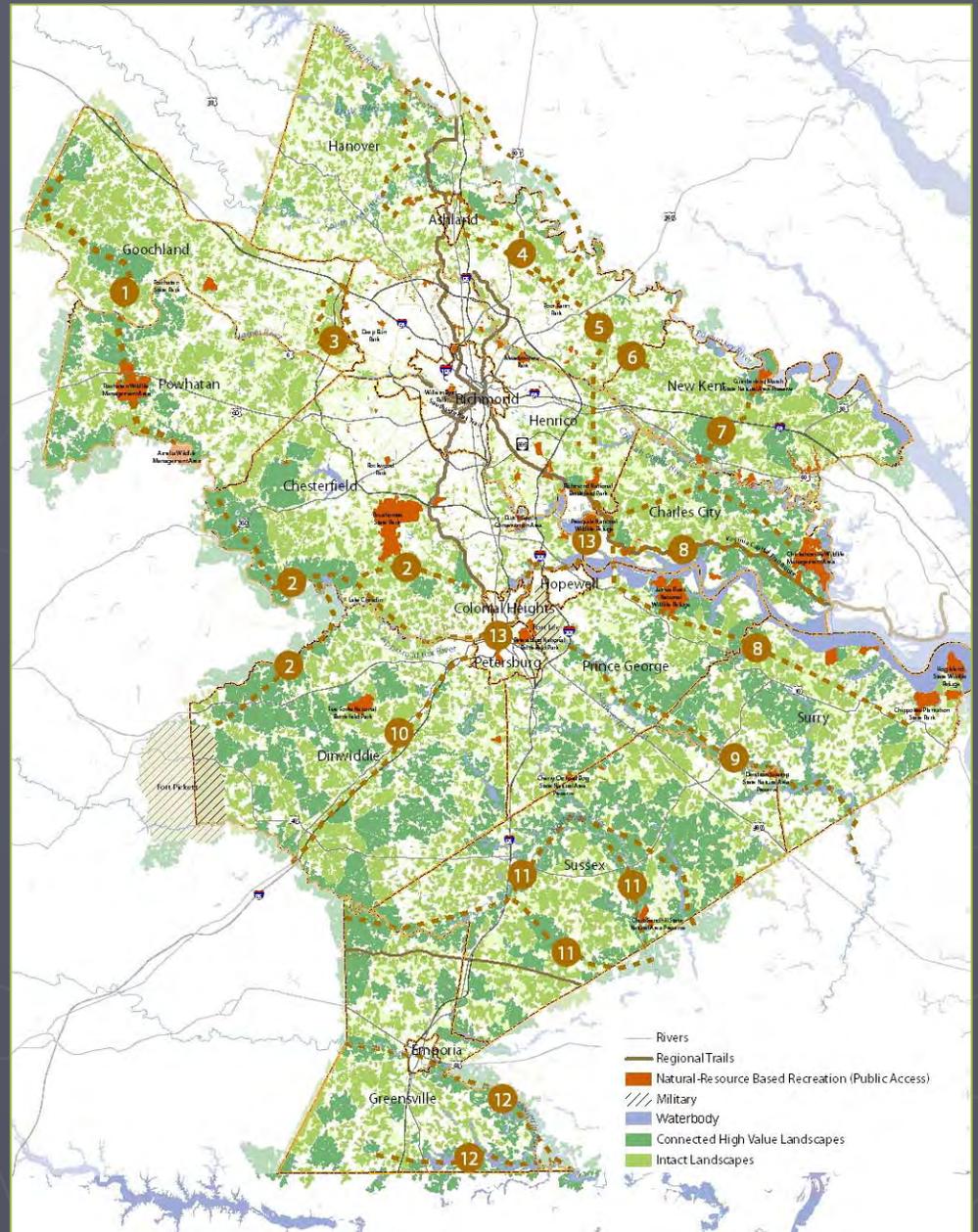
7 Years in a Changing Landscape



County Green Infrastructure Assets



Regional Green Infrastructure Opportunities Map



January 2010

Charles City County Green Infrastructure Planning





Steps for County-Level Planning

- ▶ Phase I: Data Collection & Research
- ▶ Phase II: Asset Mapping (ecological, cultural, economic)
- ▶ Phase III: Risk Assessment (what assets at risk)
- ▶ Phase IV: Opportunities= what kind of community do we want? (what policies, programs, projects can be implemented?)
- ▶ Final Report: Asset maps, opportunities maps, strategies for localities to consider)

Existing Charles City County Measures

- ▶ Chesapeake Bay Protection Act – County ordinance adopted 1983
 - RPA
 - RMA
- ▶ Tidal Wetlands Act – Charles City County Wetlands Board & Regulations
- ▶ Erosion and Sediment Control Ordinance – 1980
- ▶ Floodplain Overlay District
- ▶ Site Plan Ordinance – 1994
- ▶ Wastewater Treatment Systems:
 - 2004: 45 Homes connected
 - 2009: 25 Additional homes connected
- ▶ No-till Farming Systems – Innovative Cropping Systems (ICS)
* 90% of Charles City County farmers NEVER till *



Source: Charles City County Draft Comprehensive Plan, August 2009



Utility of Green Infrastructure Planning

- ▶ Informing local comprehensive plans
- ▶ New ordinance development
 - Basis for up-zoning or down-zoning
- ▶ Trail, greenway, and blueway planning
- ▶ Park and open space planning
- ▶ Heritage tourism and viewshed protection
- ▶ Prioritizing lands for conservation
 - Purchase or Transfer of Development Rights Programs
 - Site design for cluster developments

Informing Land Use Decision-making



FRAGMENTED: Even well-intentioned land use planning approaches can result in the fragmentation of the county's high-value natural assets.

CONNECTED: A green infrastructure planning approach allows for development and growth at the same scale, while also ensuring that the county's natural assets remain intact and well-connected.



For more information, contact

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Robins Foundation





Goochland County



Green Infrastructure Planning



June 16, 2010

Goochland County Green Infrastructure Planning



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 - Defined
 - Benefits
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 - Goochland County Green Infrastructure Assets

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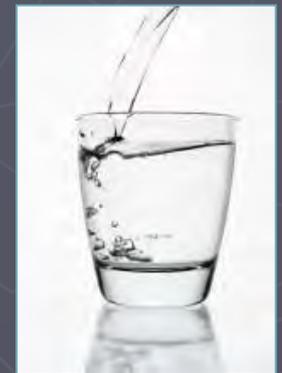
We owe our existence to green infrastructure...



Green Infrastructure Services



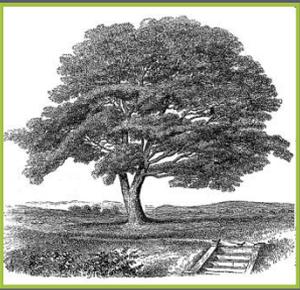
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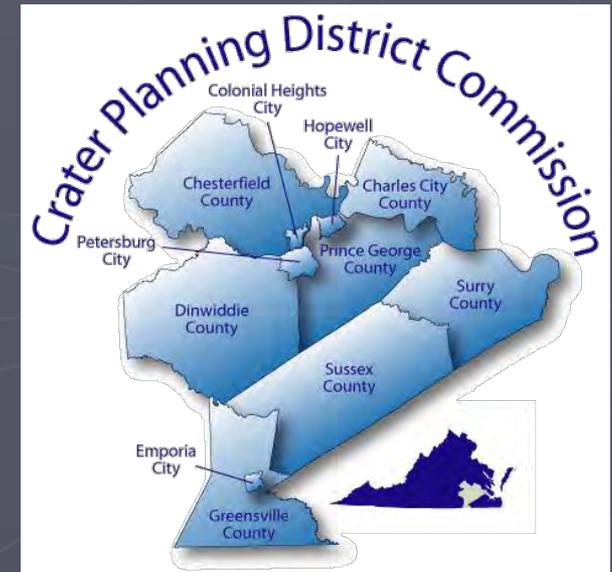


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The Origins of the Project

- ▶ Coastal Zone Management Program Grant – Sustainable Communities
- ▶ Create a regional green infrastructure asset map and prioritized green infrastructure opportunities
- ▶ “Update” state model data



The State Model

- ▶ Identification
- ▶ Inventory: Map existing assets
- ▶ Rank & Prioritize areas to protect
 - ▶ Function
 - ▶ Significance
 - ▶ Vulnerability

State Modeling Tools

- ▶ VA Natural Landscape Assessment – Forest Habitats
- ▶ Cultural Model – Historic Resources
- ▶ Vulnerability Model – Growth Predictions and Trends
- ▶ Forest Economics Model – Economically viable forest
- ▶ Agricultural Model – Lands suitable for farming
- ▶ Recreation Model – Trails, Parks, Hunting and Fishing
- ▶ Watershed Integrity Model
- ▶ Ecological Integrity



VA Conservation Lands Needs Assessment:

Core Prioritization in Virginia

Large Core: A core with at least 10,000 acres of interior cover.
Medium Core: A core with 1,000 to 9,999 acres of interior cover.
Small Core: A core with 100 to 999 acres of interior cover.
Habitat Fragment: A patch of natural land cover with 10 to 99 acres of interior cover.

Size

- Large Core
- Medium Core
- Small Core
- Habitat Fragment

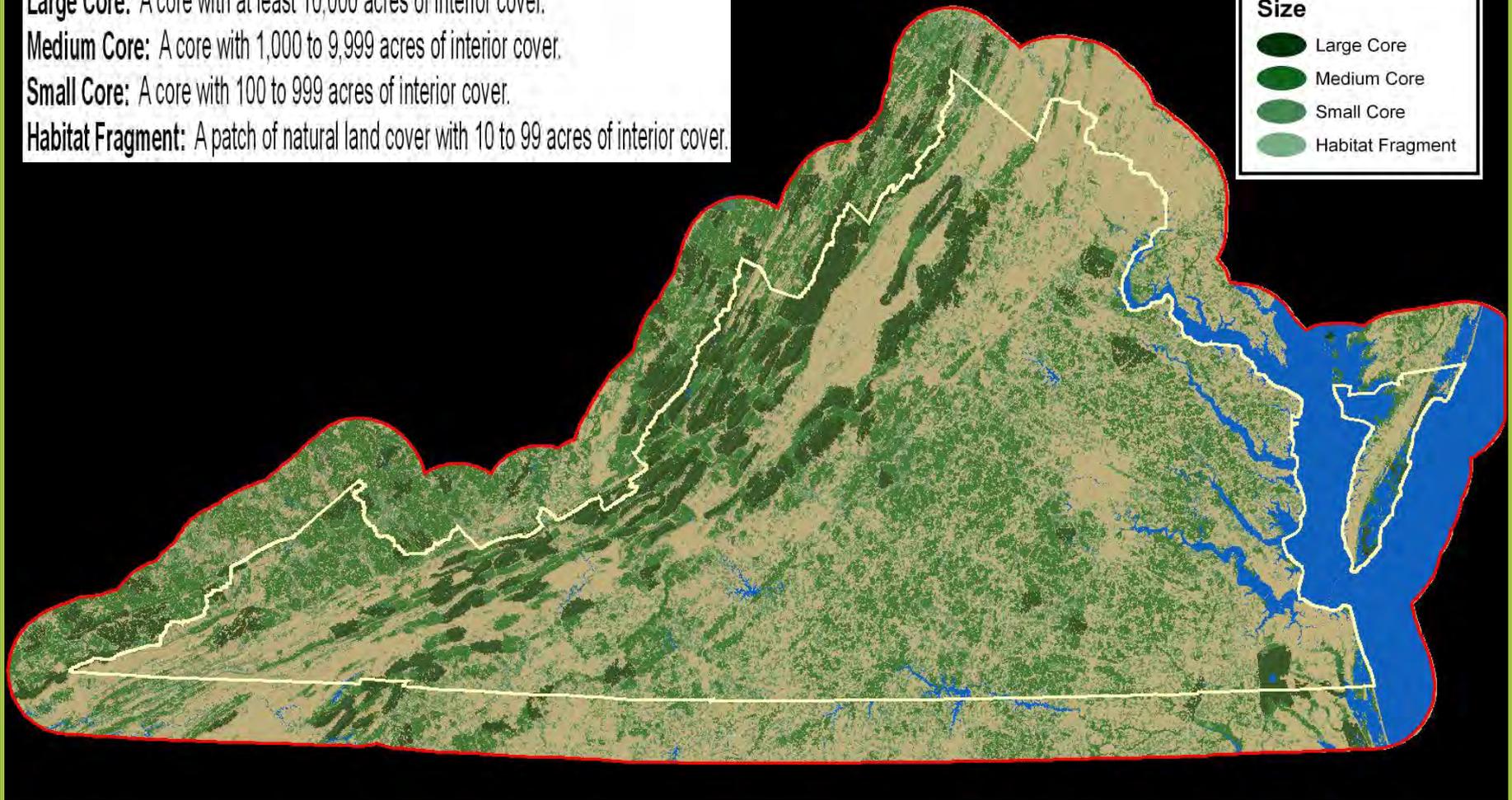


Image Courtesy VA Dept. of Conservation and Recreation

State Model Factors

Ecological Composite Model = Ecological Integrity Ranking 1 - 5

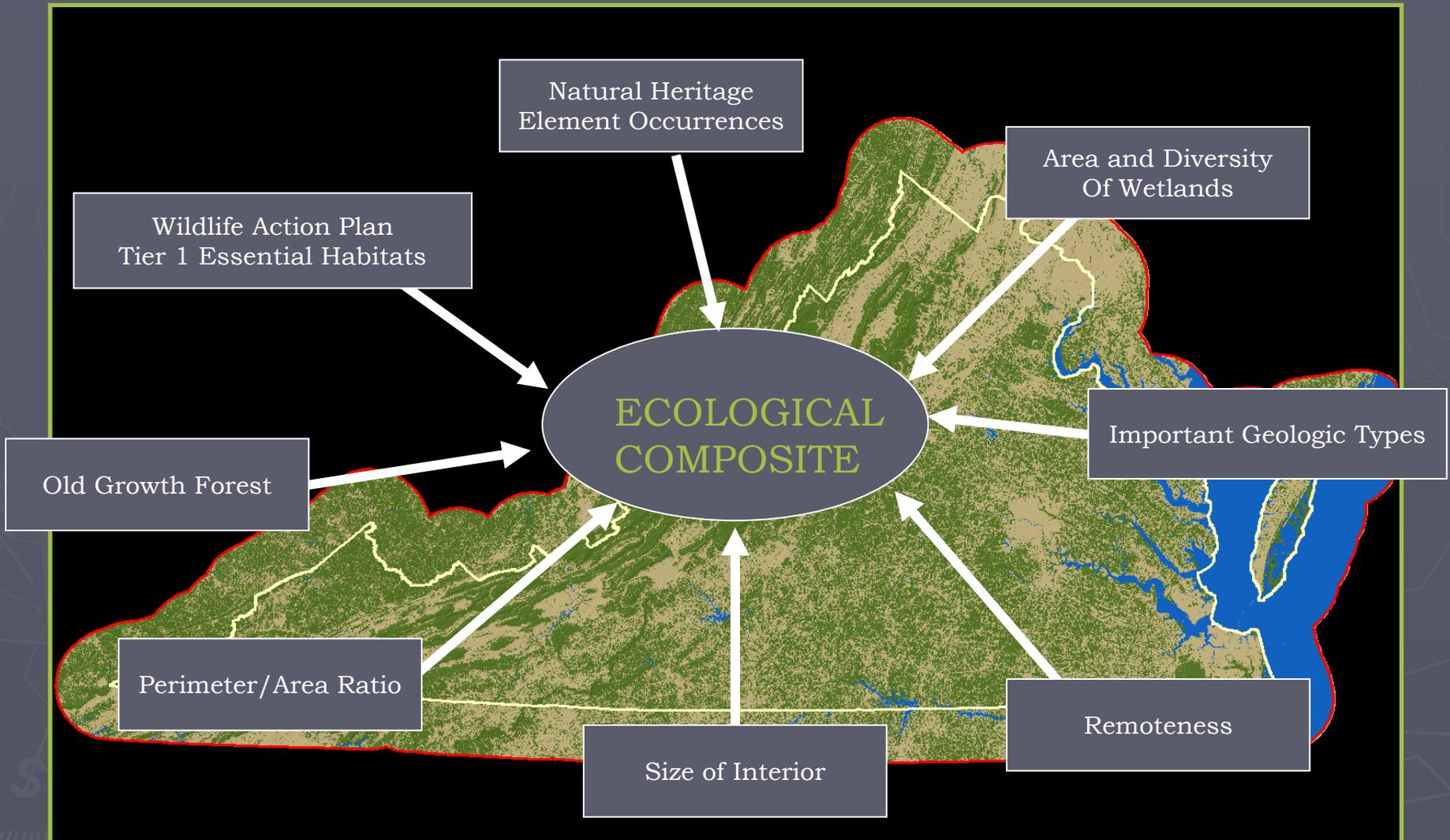
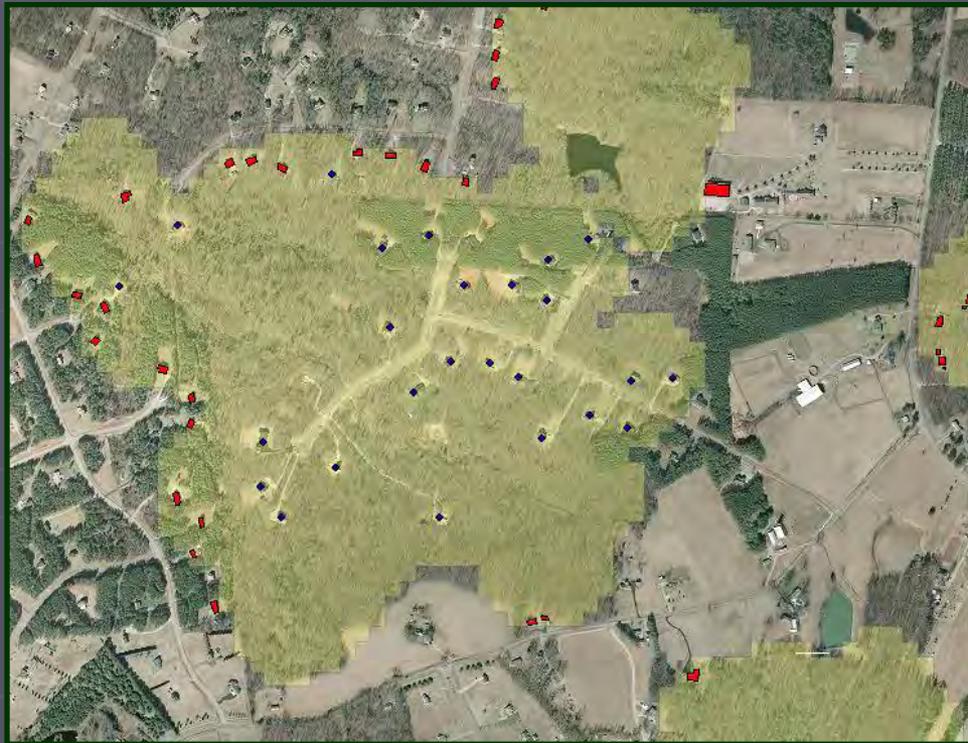


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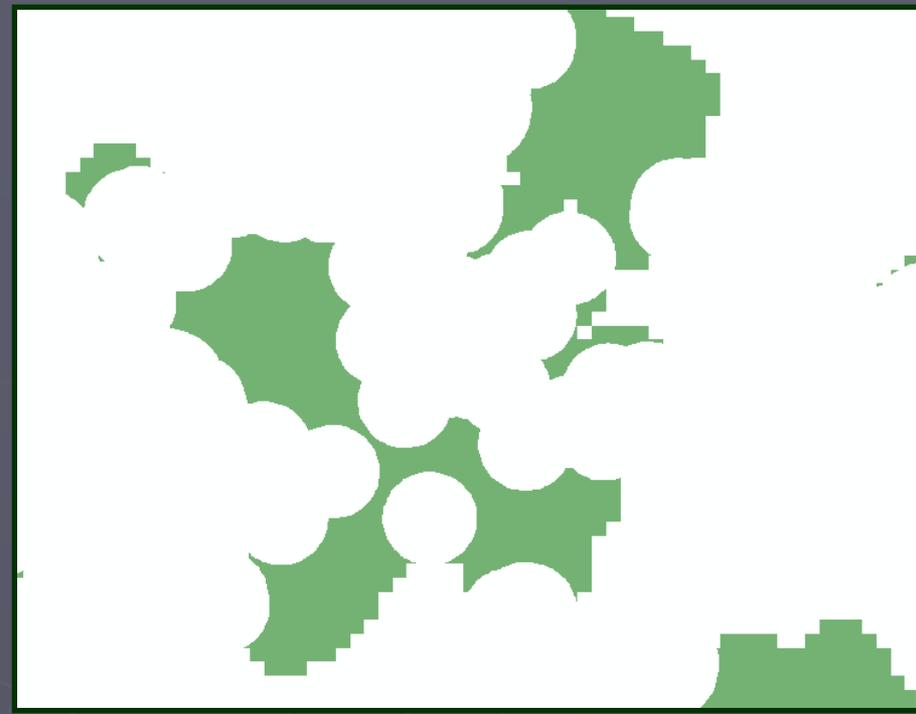
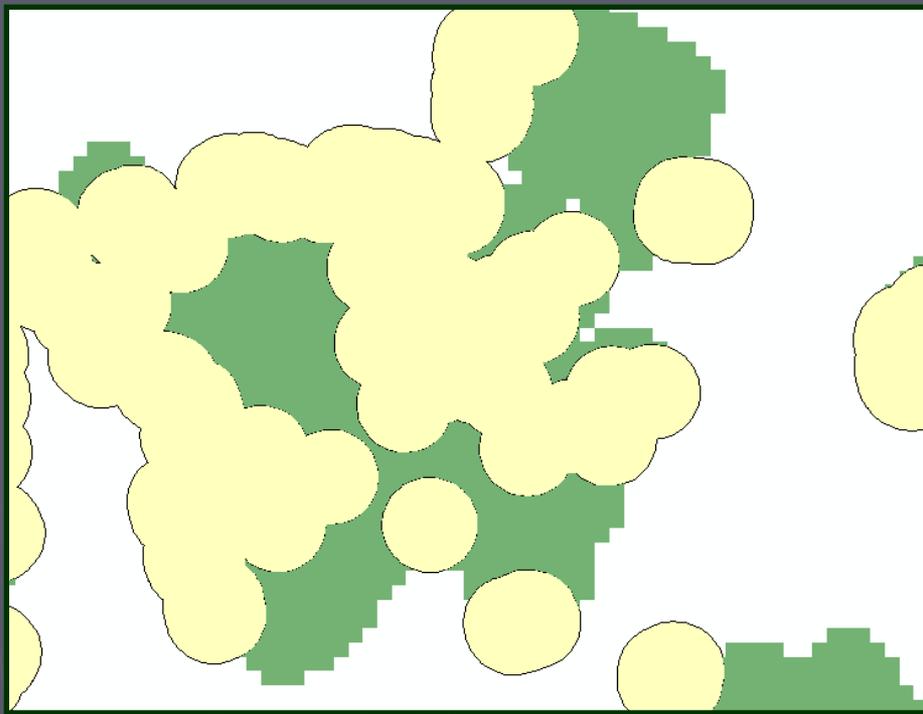
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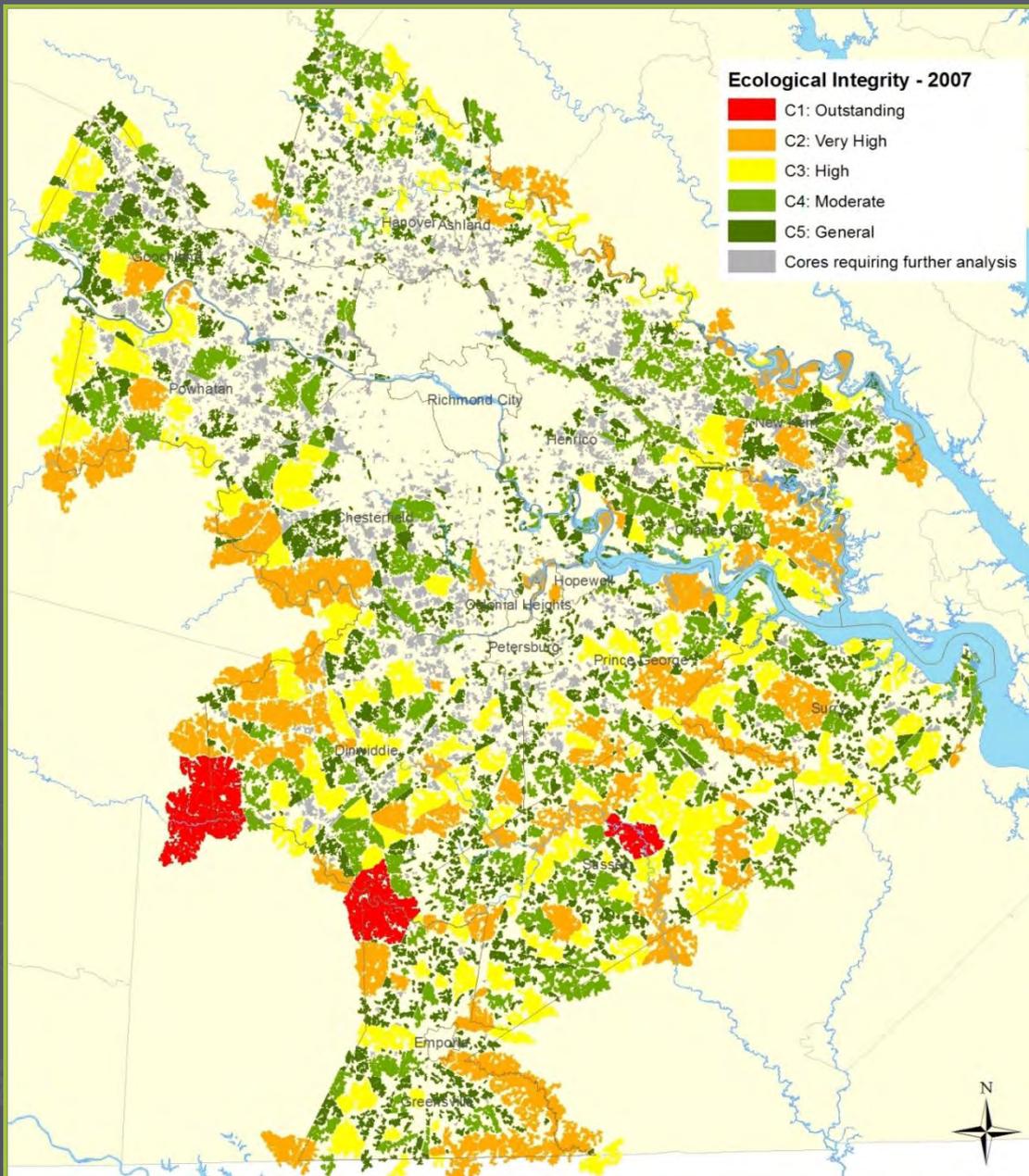


3. Add 100 meter buffer around structures that intersect the ecological cores.





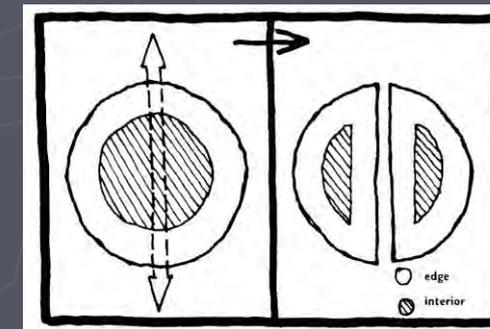
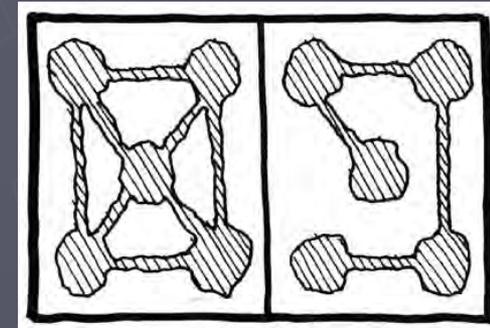
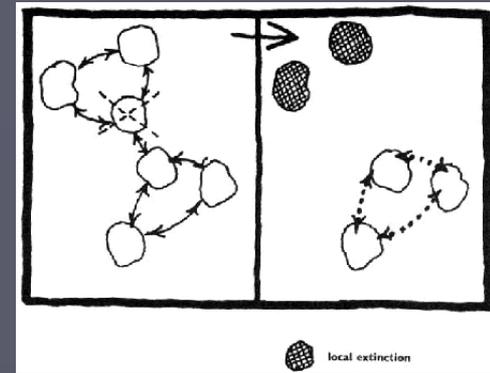
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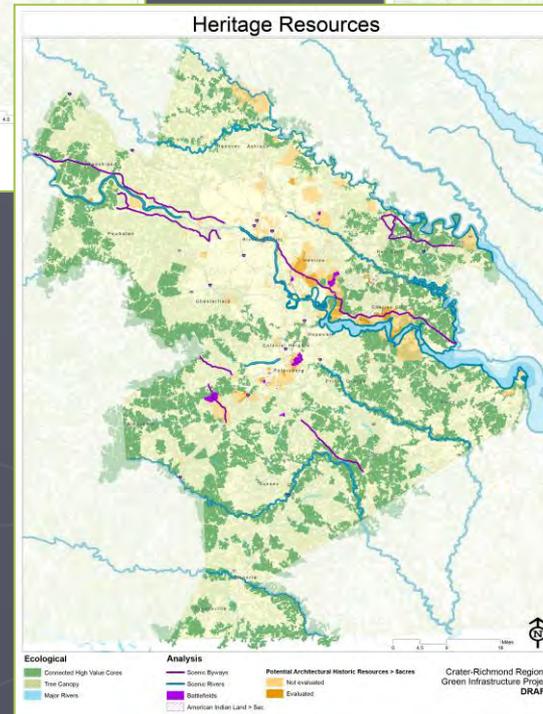
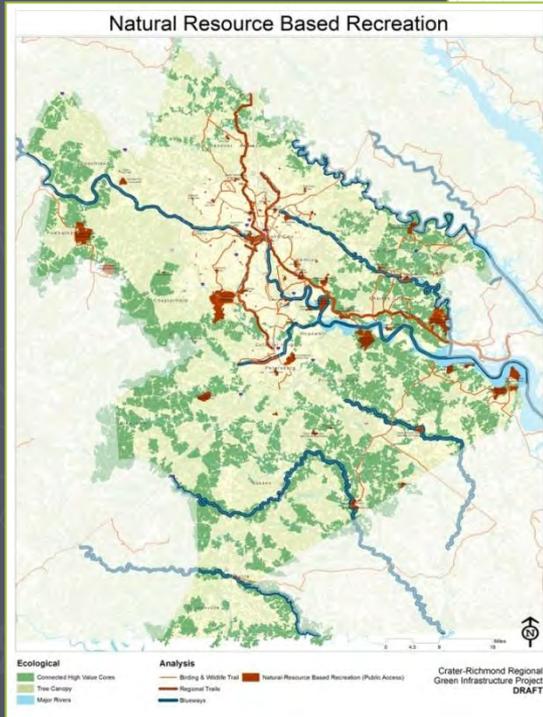
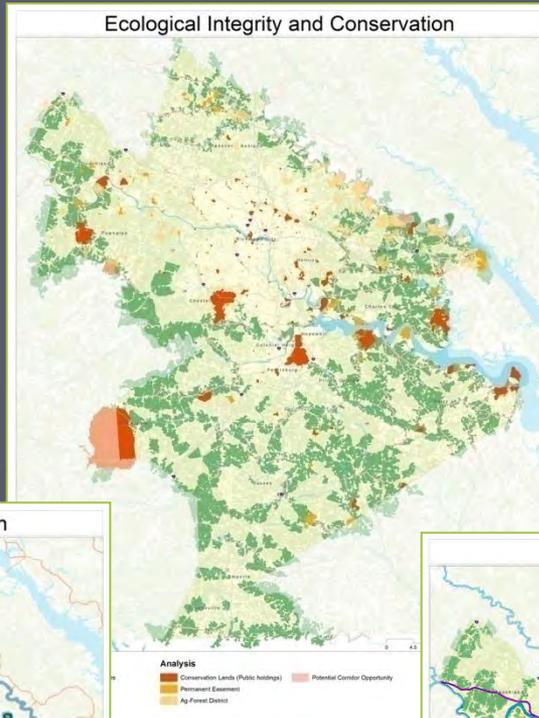
Richmond & Crater Region Intact Cores 2007

Connectivity is key...

- ▶ Removal of 1 patch causes habitat loss, habitat diversity loss, & potential reduction of population or localized extinction
- ▶ With habitat connections, more is always better
- ▶ Splitting of large habitats can have drastic effects on interior species

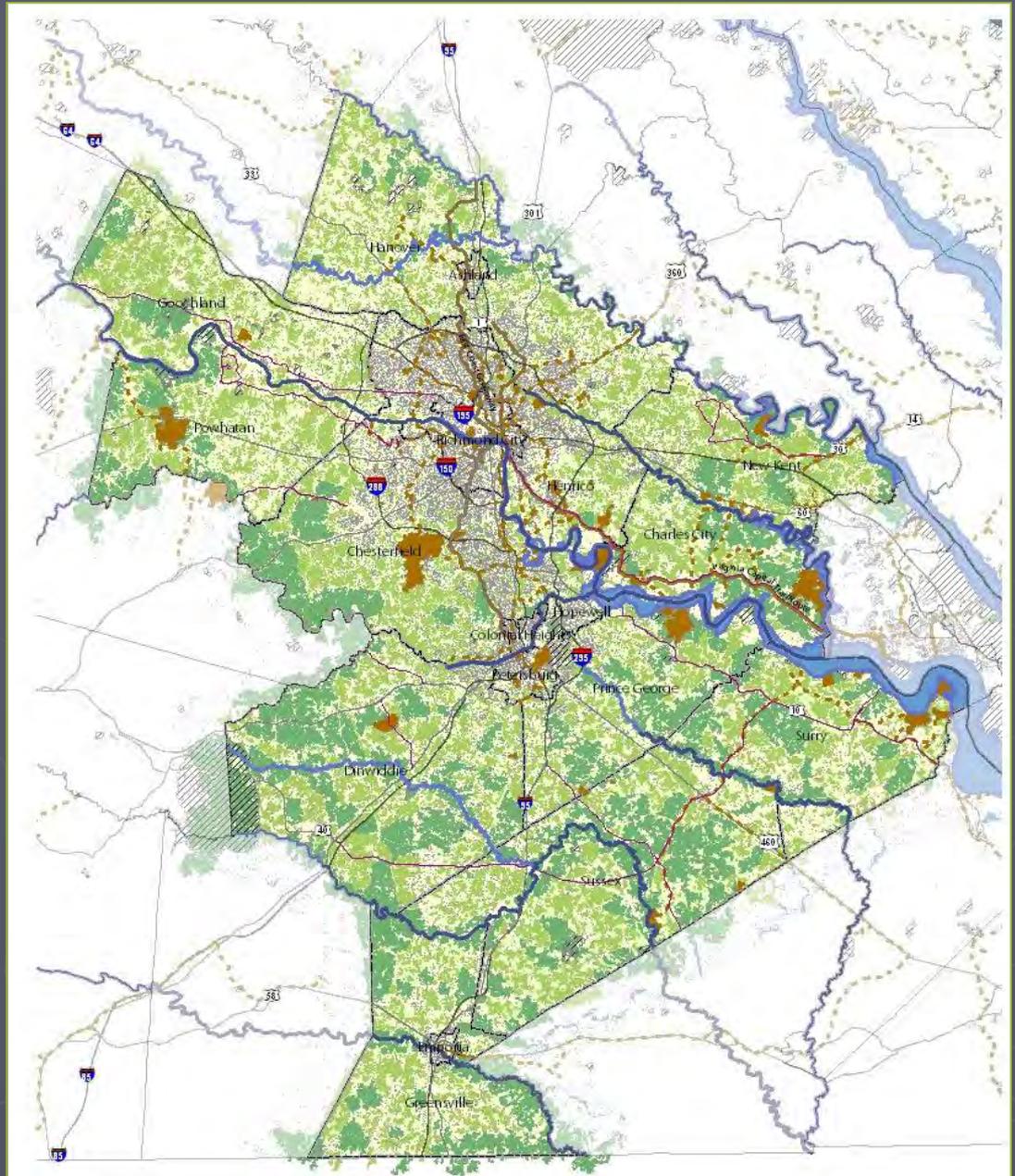


Theme Maps

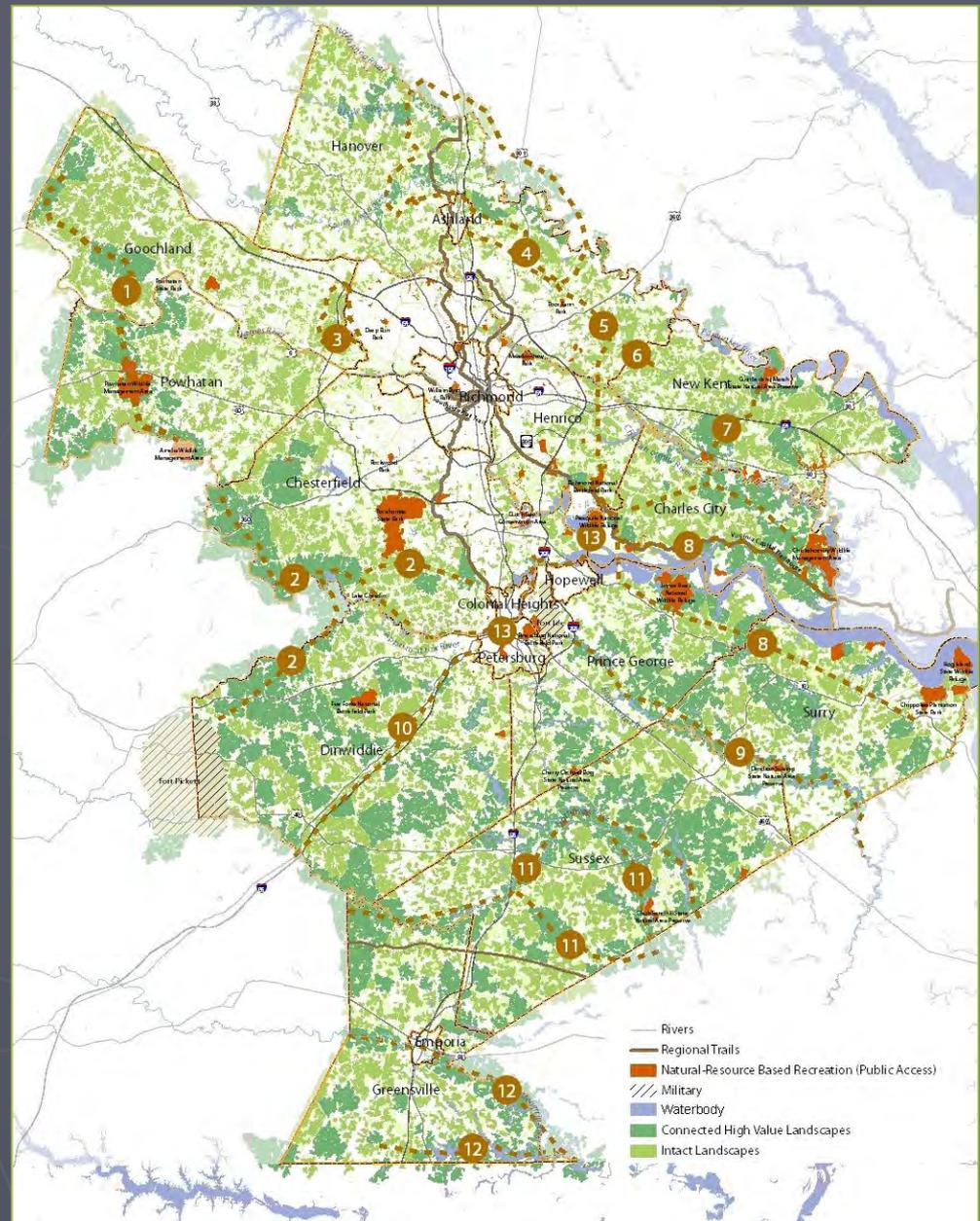


Regional Green Infrastructure Assets

Richmond-Crater Region Green Infrastructure Assets



Regional Green Infrastructure Opportunities



Green Infrastructure Phase II...

- ▶ Began October 2009
- ▶ Incorporate 3D Modeling to expand analysis and planning capabilities of the project
- ▶ Two pronged approach:
 - Urban – Work with City of Richmond on a Green Infrastructure asset map; can be used as a model of other urbanized localities in the region
 - Rural – Work with individual localities to educate and add implementation measures to local plans/ordinances



Steps for County-Level Planning

- ▶ Phase I: Data Collection & Research
- ▶ Phase II: Asset Mapping (ecological, cultural, economic)
- ▶ Phase III: Risk Assessment (what assets at risk)
- ▶ Phase IV: Opportunities= what kind of community do we want? (what policies, programs, projects can be implemented?)
- ▶ Final Report: Asset maps, opportunities maps, strategies for localities to consider)

The Inventory: Map Existing Green Infrastructure Assets

▶ Working Lands

- Farms
- Forests
- Fisheries

▶ River & Stream Corridors

▶ Wetlands

▶ Marshes & Swamps

▶ Meadows & Pastures

▶ Parks



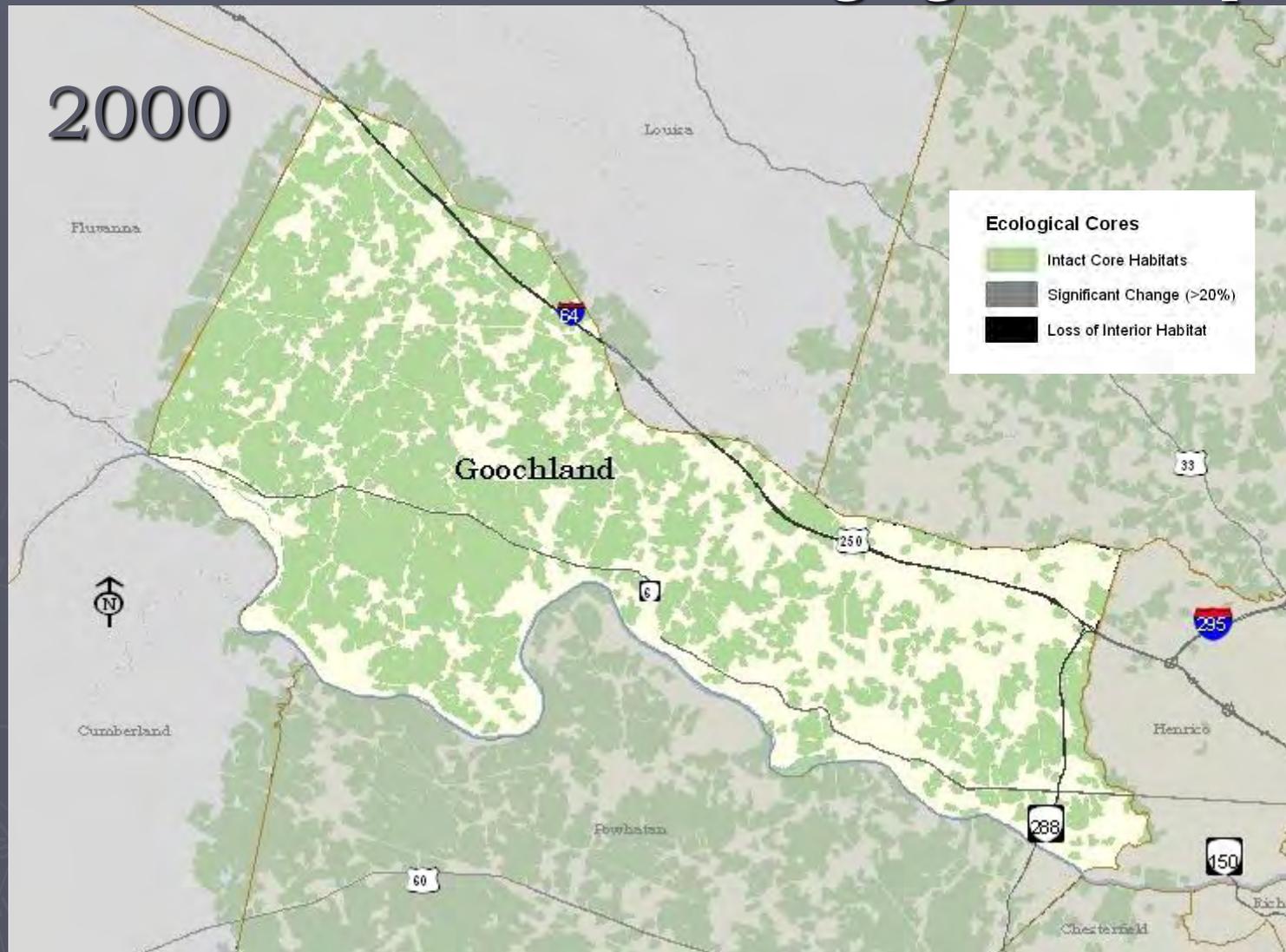
The Inventory: Map Existing Green Infrastructure Assets



- ▶ Cultural Sites
- ▶ Historic Resources
- ▶ Trails
- ▶ Viewsheds
- ▶ Scenic Rivers
- ▶ Scenic Byways
- ▶ Watersheds
- ▶ Birding and Wildlife Trails

A Unique Opportunity:

7 Years in a Changing Landscape



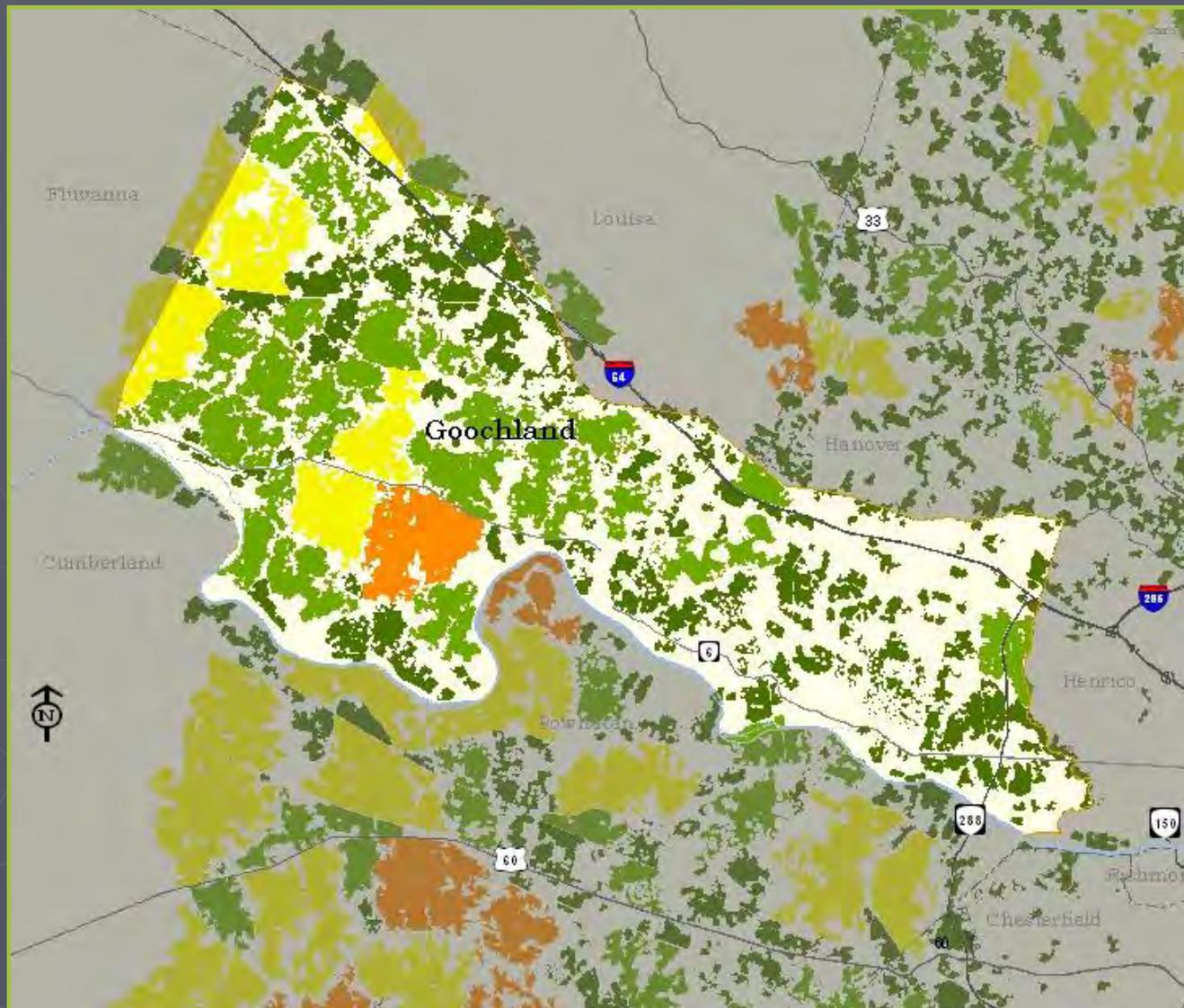
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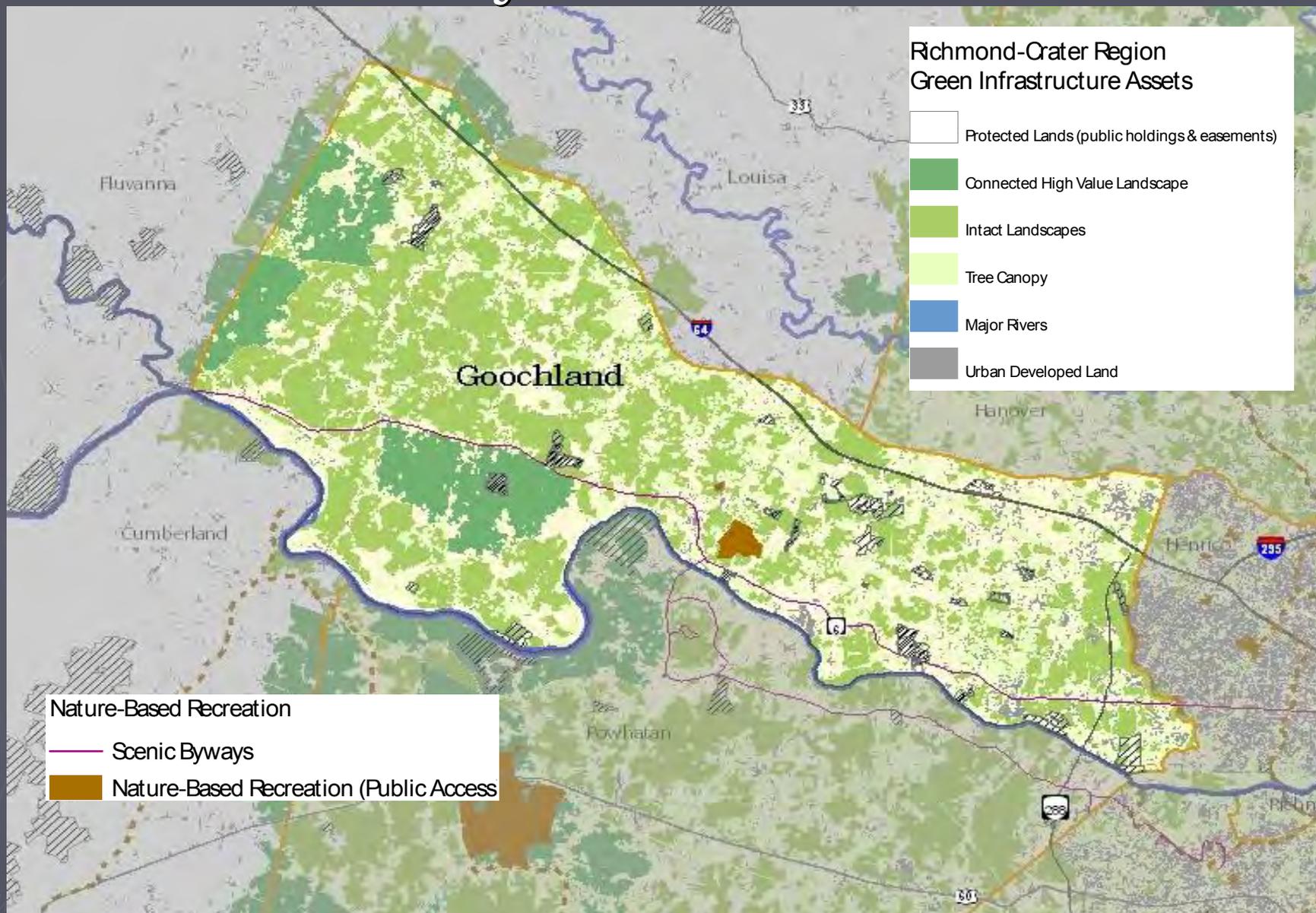


Goochland County Green Infrastructure Assets

Goochland County Intact Cores 2007



Goochland County Green Infrastructure Assets



Existing Goochland County Measures

► Water Quality & Conservation

- Plan of Development Review process
- Stormwater Management planning & permitting (DCR administers)
- Point-source Discharge Permitting
- Wetlands Regulations
- Open space requirement in all but one residential district



Photo credit: Deb Silbert

Source: Goochland County Comprehensive Plan, February 2009

Existing Goochland County Measures

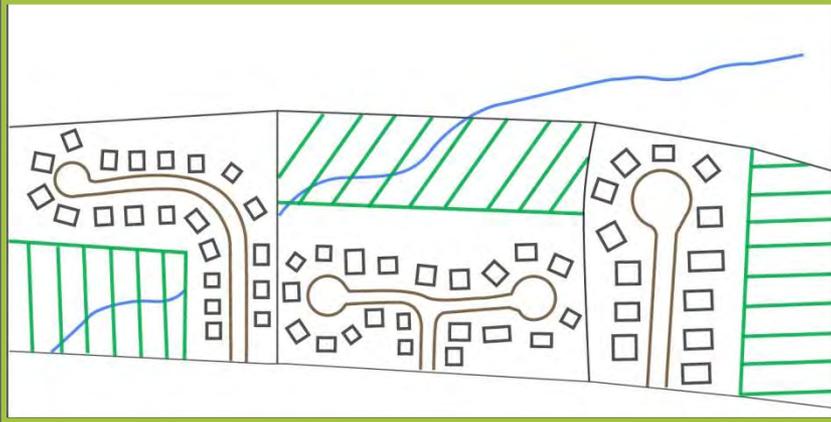
- ▶ Floodplain uses restricted in Zoning Ordinance
- ▶ Comprehensive Plan supports environmental preservation
- ▶ Water Supply Plan being written
- ▶ 2% of land area in conservation easements



Source: Goochland County Comprehensive Plan, February 2009

Potential Goochland County Measures

- Improve how open space requirements can be better integrated with surrounding parcels



FRAGMENTED: Even well-intentioned land use planning approaches can result in the fragmentation of the county's high-value natural assets.

CONNECTED: A green infrastructure planning approach allows for development and growth at the same scale, while also ensuring that the county's natural assets remain intact and well-connected.



Potential Goochland County Measures

- Change current setback requirements that currently range from 75-175 feet which can cause buildings to encroach into potential conservation or buffer space to the rear of a parcel.
- Official designation of the James River as a Scenic River
- Low Impact Development





Applying Green Infrastructure Planning

- ▶ Informing local comprehensive plans
- ▶ New ordinance development
 - Basis for up-zoning or down-zoning
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Remember...



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Town of Ashland



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how

- ▶ Planning for the Future & Implementation

Local land use planning impact on the environment

Traffic Congestion



Photo Credit: Tom Saunders, VDOT, Traffic at I-95 and Downtown Expressway



Photo Credit: Tom Saunders, VDOT, Traffic on I-95 at Broad Street Bridge

Local land use planning impact on the environment

Traffic Congestion

Water Quality



Local land use planning impact on the environment

Traffic Congestion

Water Quality

Air Quality



Local land use planning impact on the environment

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Loss of Critical
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Local land use planning impact on the environment

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Photo Credit: Adventure Hill



Photo Credit: Ashland Berry Farm

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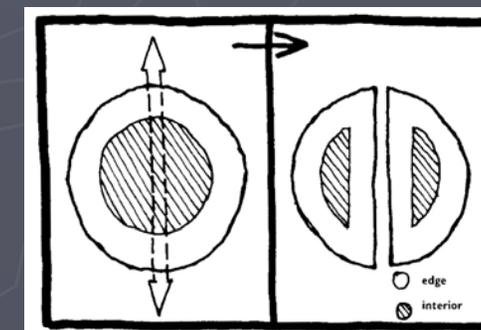
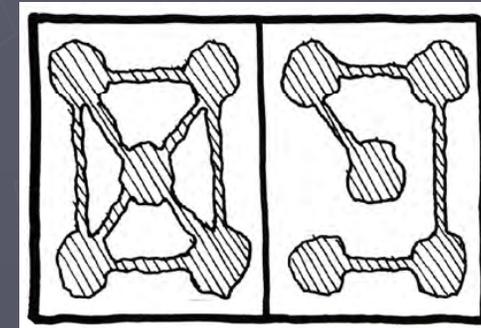
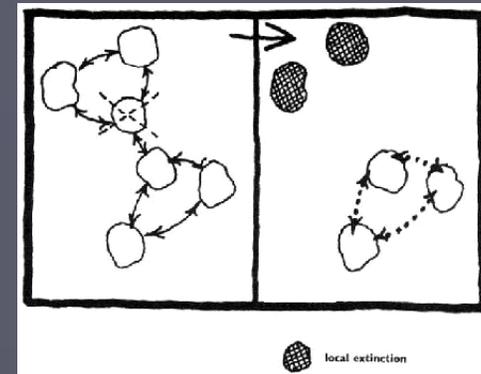
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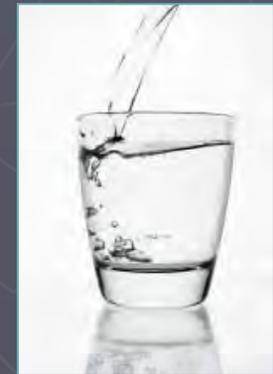
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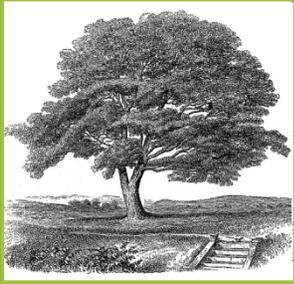
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Town of Ashland Green Infrastructure Planning





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- ▶ Create a regional green infrastructure asset map and prioritized green infrastructure opportunities
- ▶ “Update” state model data



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- ▶ Watershed Integrity Model
- ▶ Ecological Integrity



VA Conservation Lands Needs Assessment: Core Prioritization in Virginia

Large Core: A core with at least 10,000 acres of interior cover.
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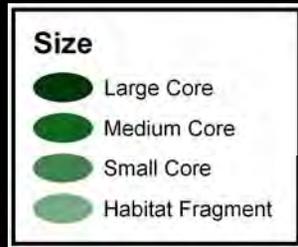


Image Courtesy VA Dept. of Conservation and Recreation

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State Model Factors

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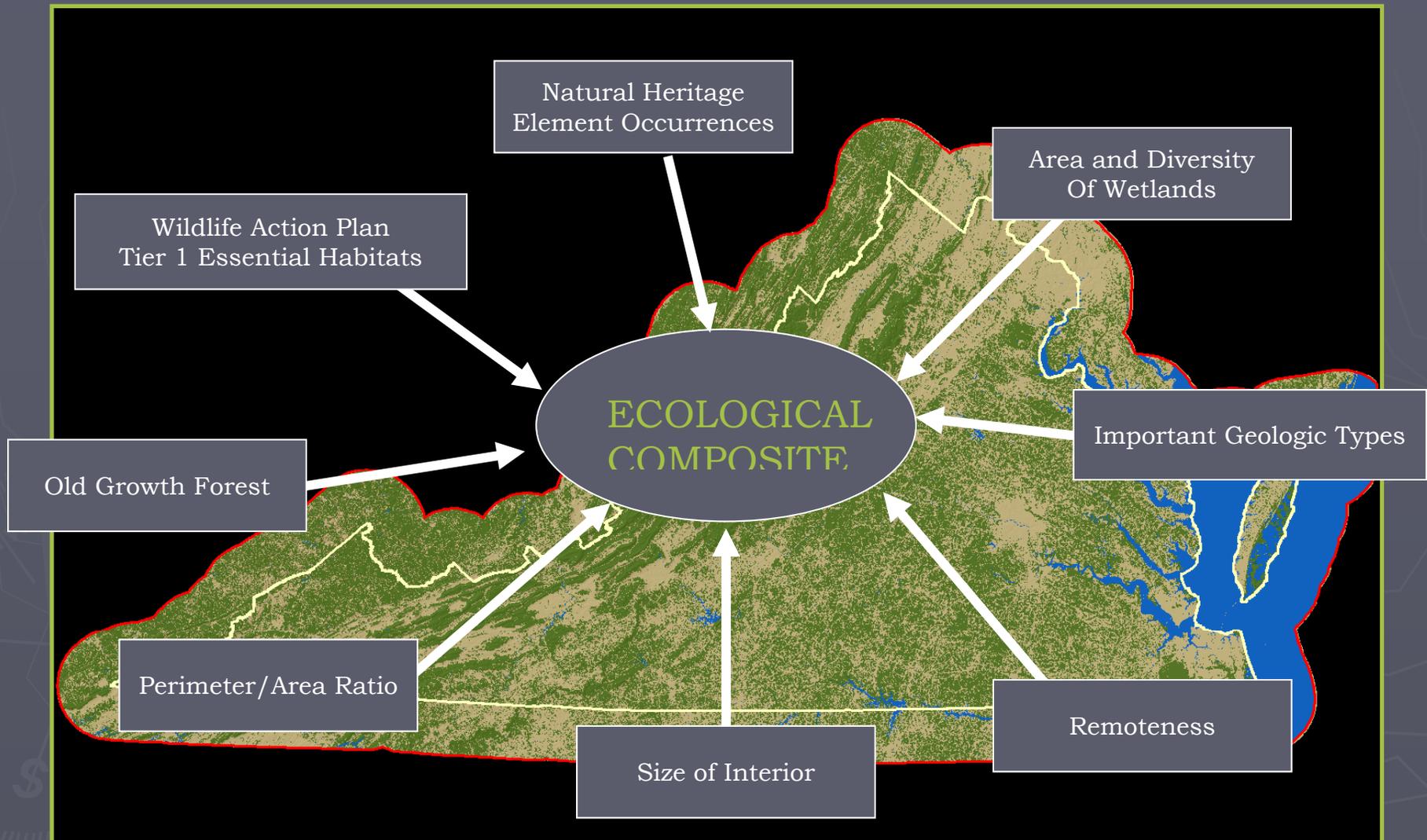


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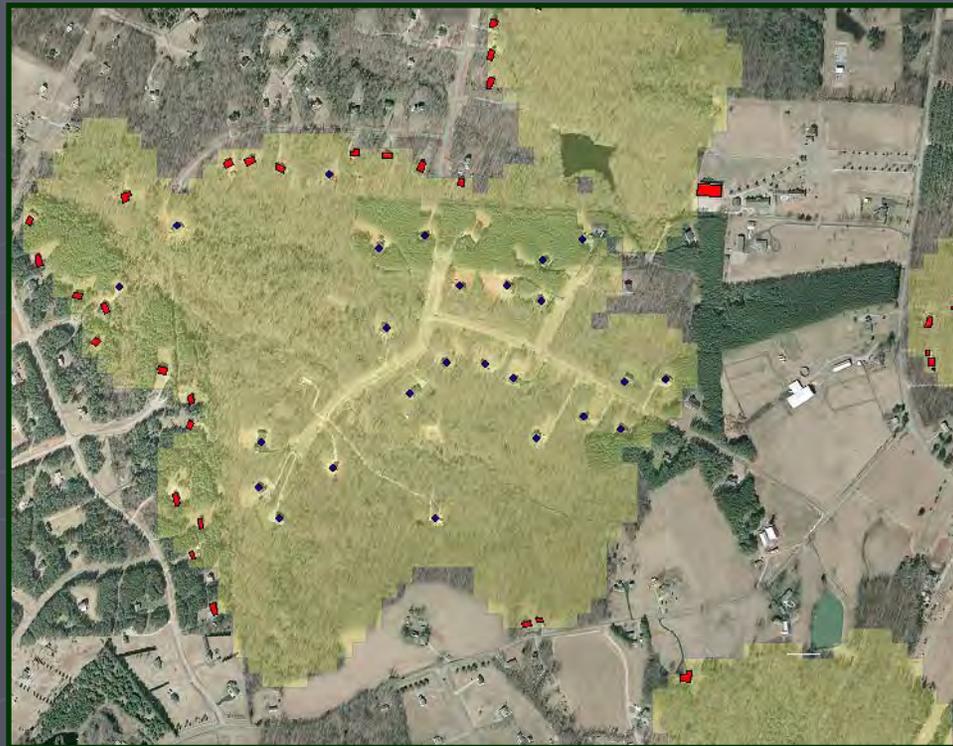
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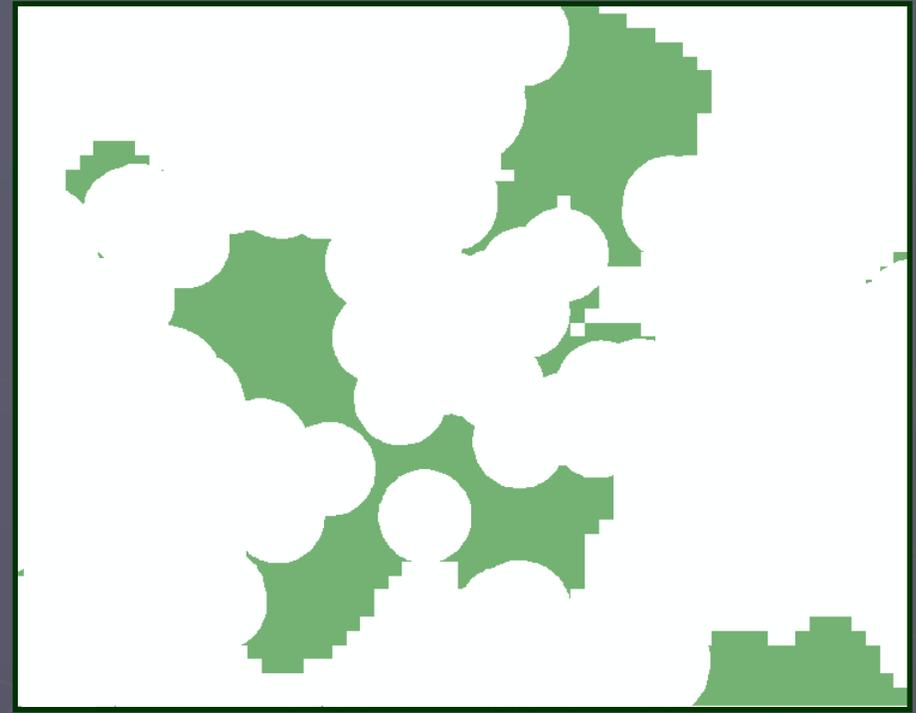
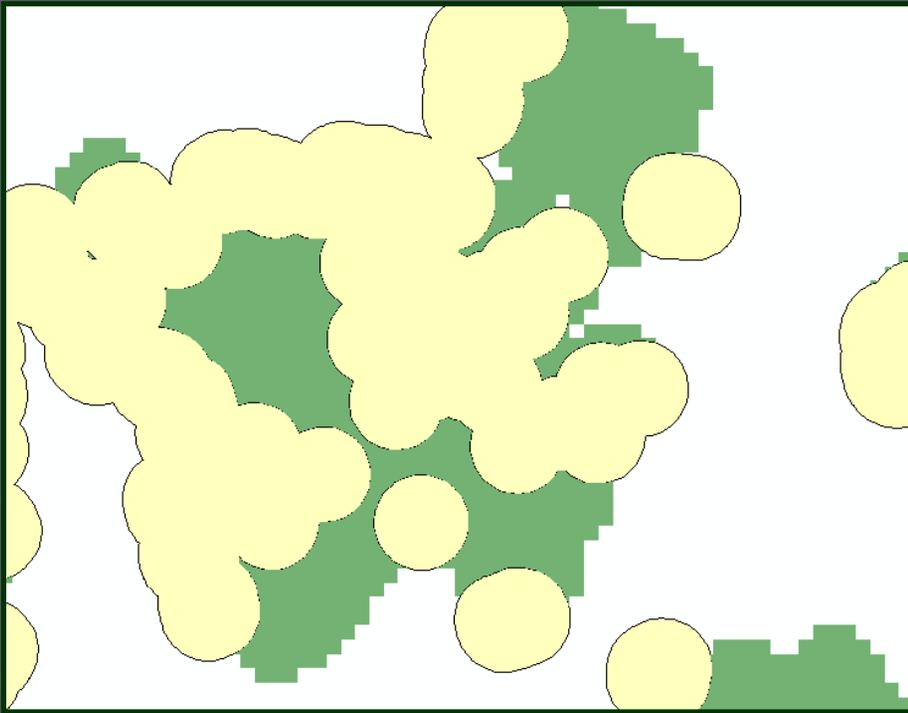
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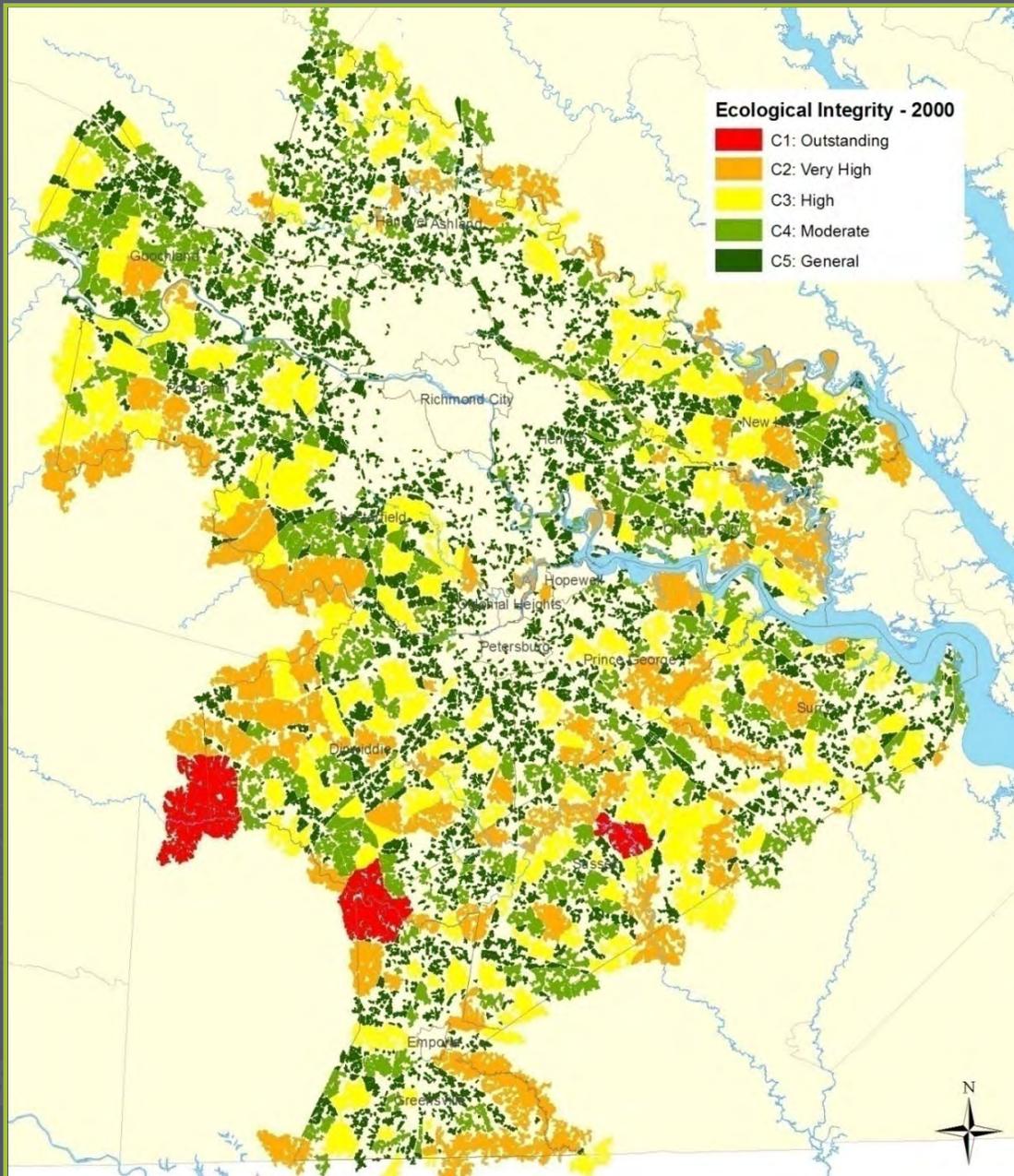
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Richmond & Crater Region Intact Cores 2000

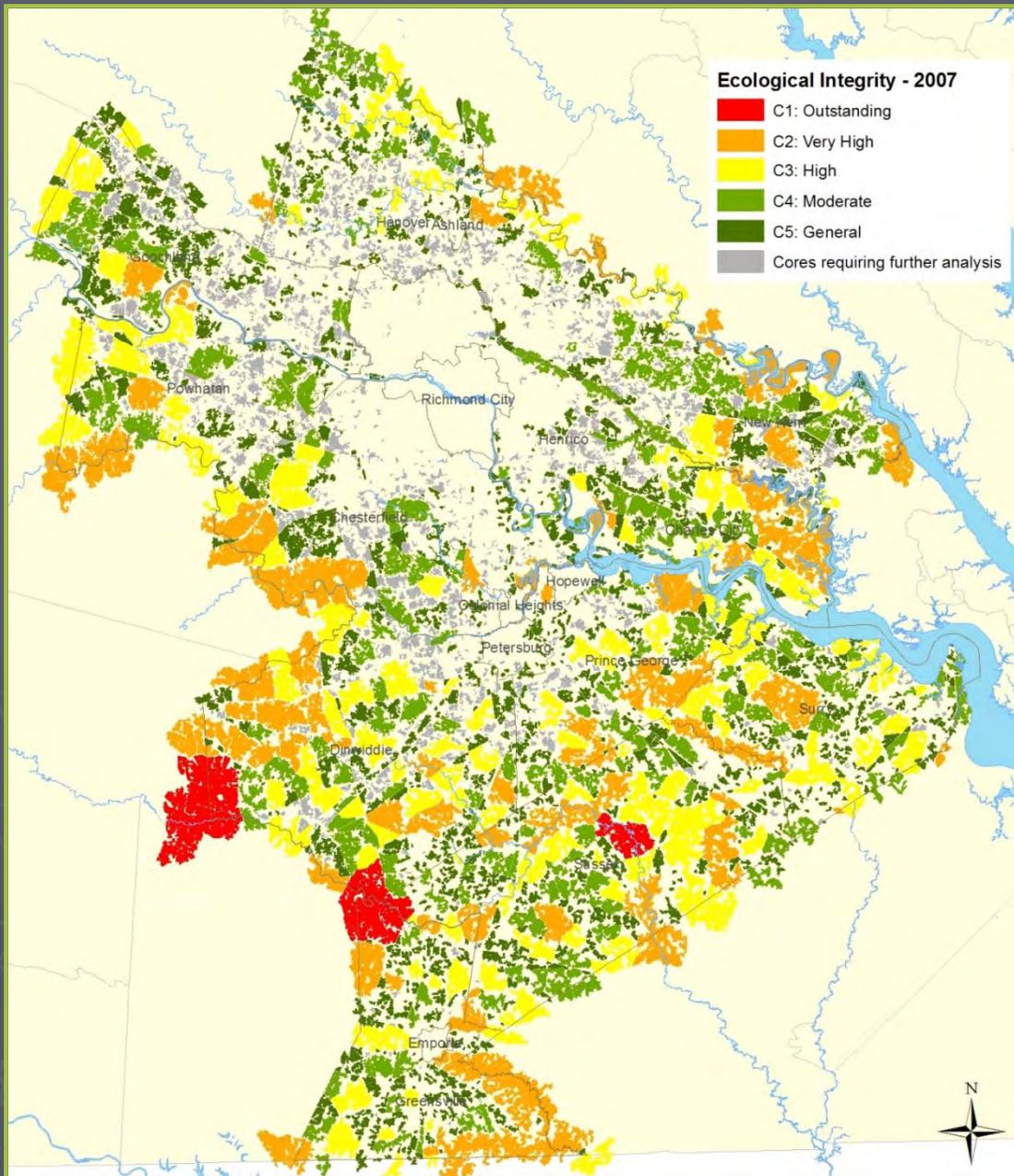


January 2010

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Richmond & Crater Region Intact Cores 2007

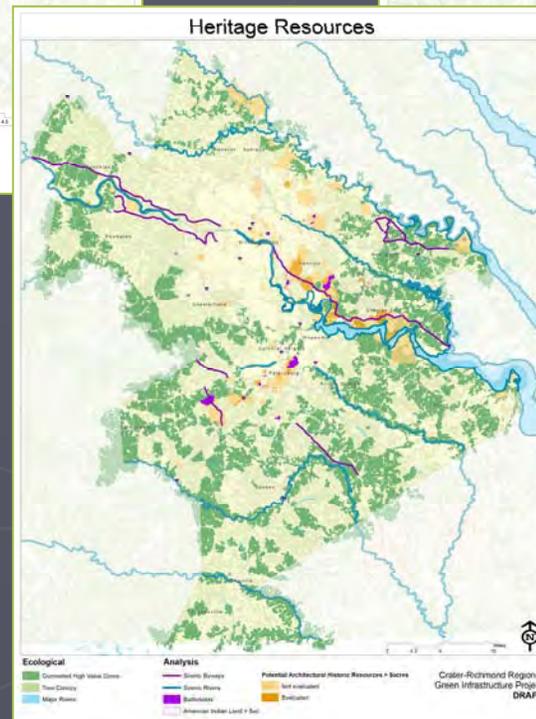
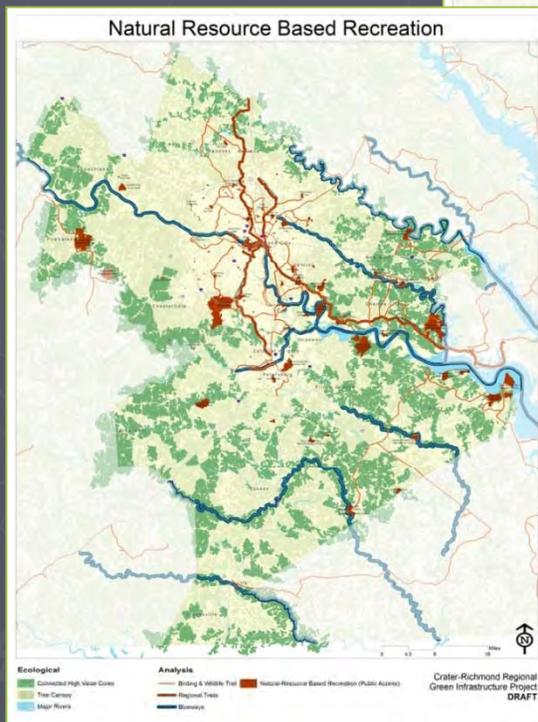
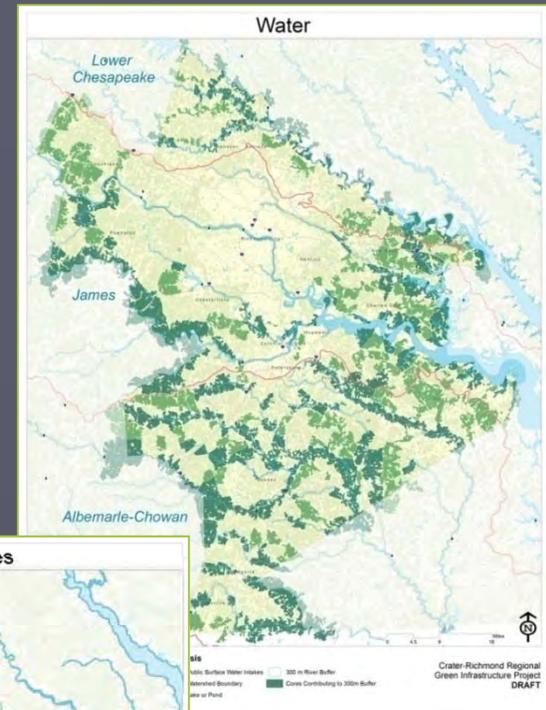
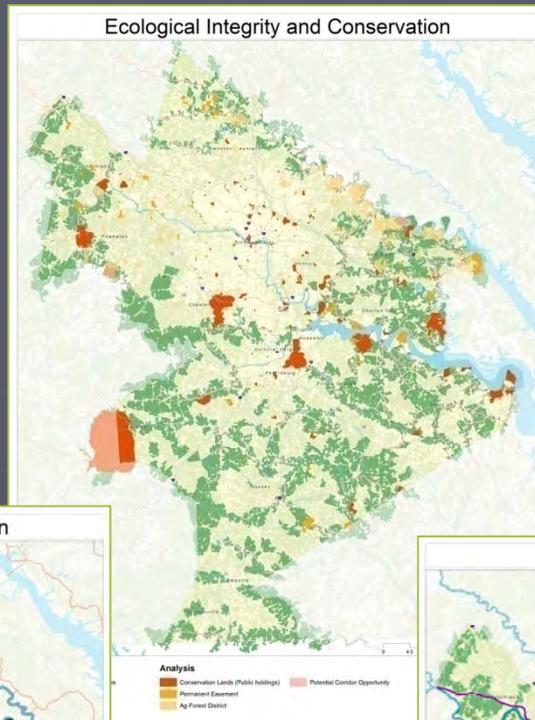


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Theme Maps



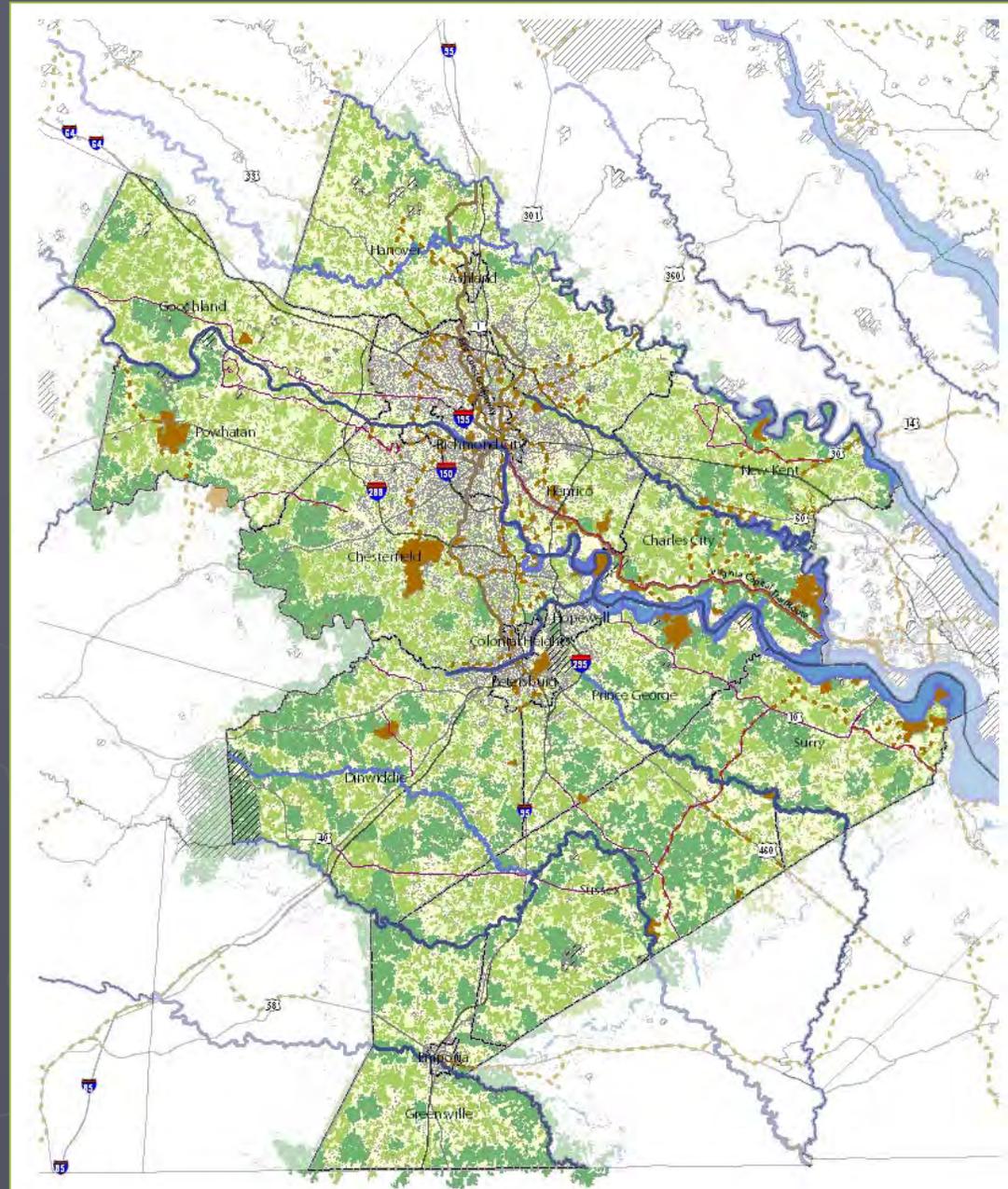
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Town of Ashland Green Infrastructure Planning



Regional Green Infrastructure Assets

Richmond-Crater Region Green Infrastructure Assets

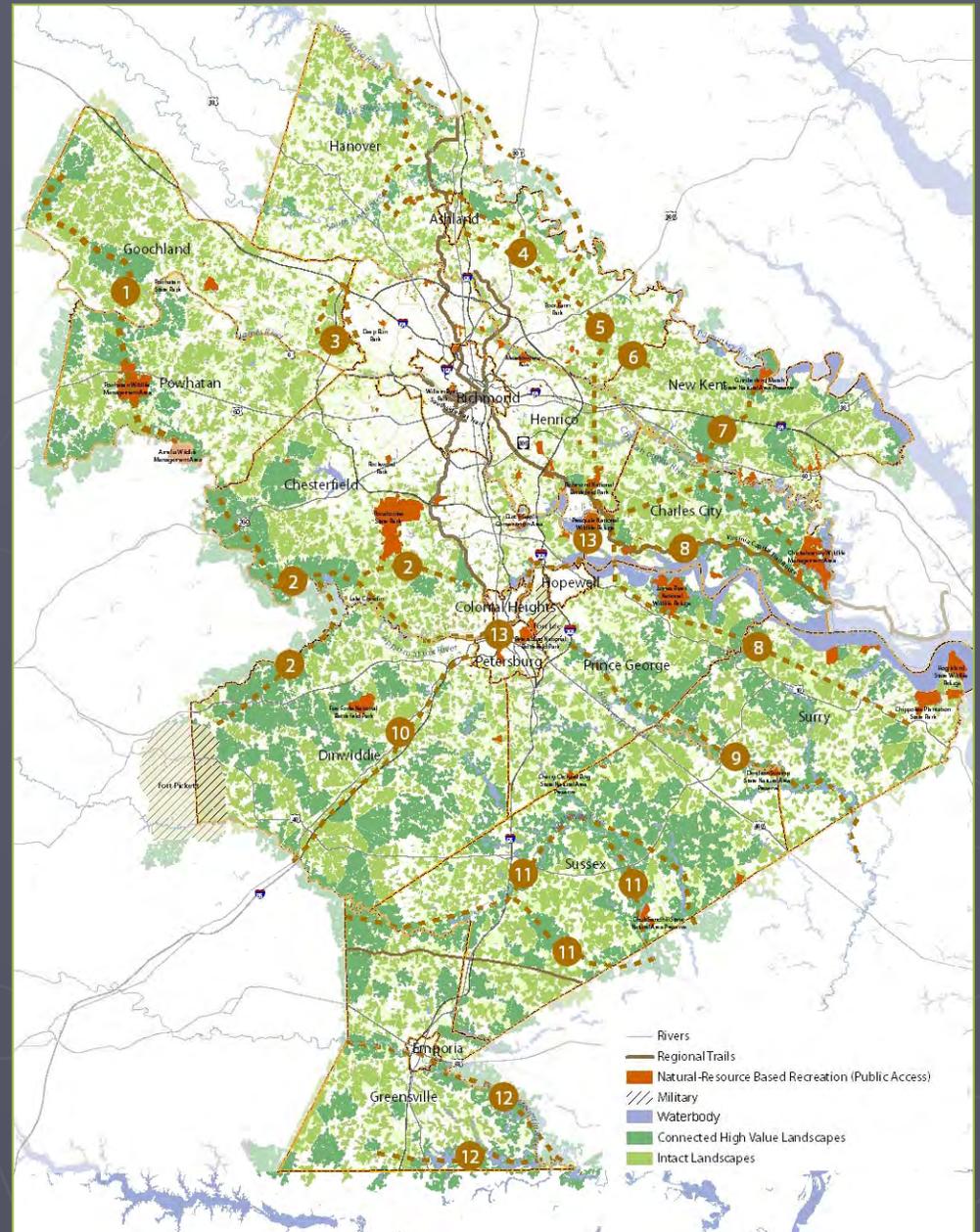


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Regional Green Infrastructure Opportunities



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Green Infrastructure Phase II...

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- ▶ Incorporate CITYgreen modeling to expand analysis and planning capabilities of the project
- ▶ Two pronged approach:
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The Inventory: Map Existing Green Infrastructure Assets

▶ Working Lands

- Farms/Community Gardens
- Forests
- Fisheries

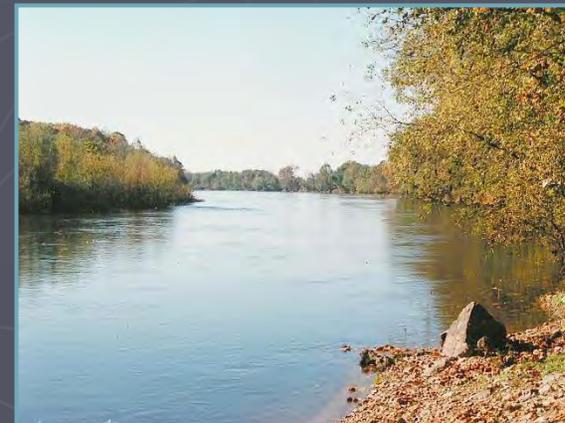
▶ River & Stream Corridors

▶ Wetlands

▶ Marshes & Swamps

▶ Meadows & Pastures

▶ Parks



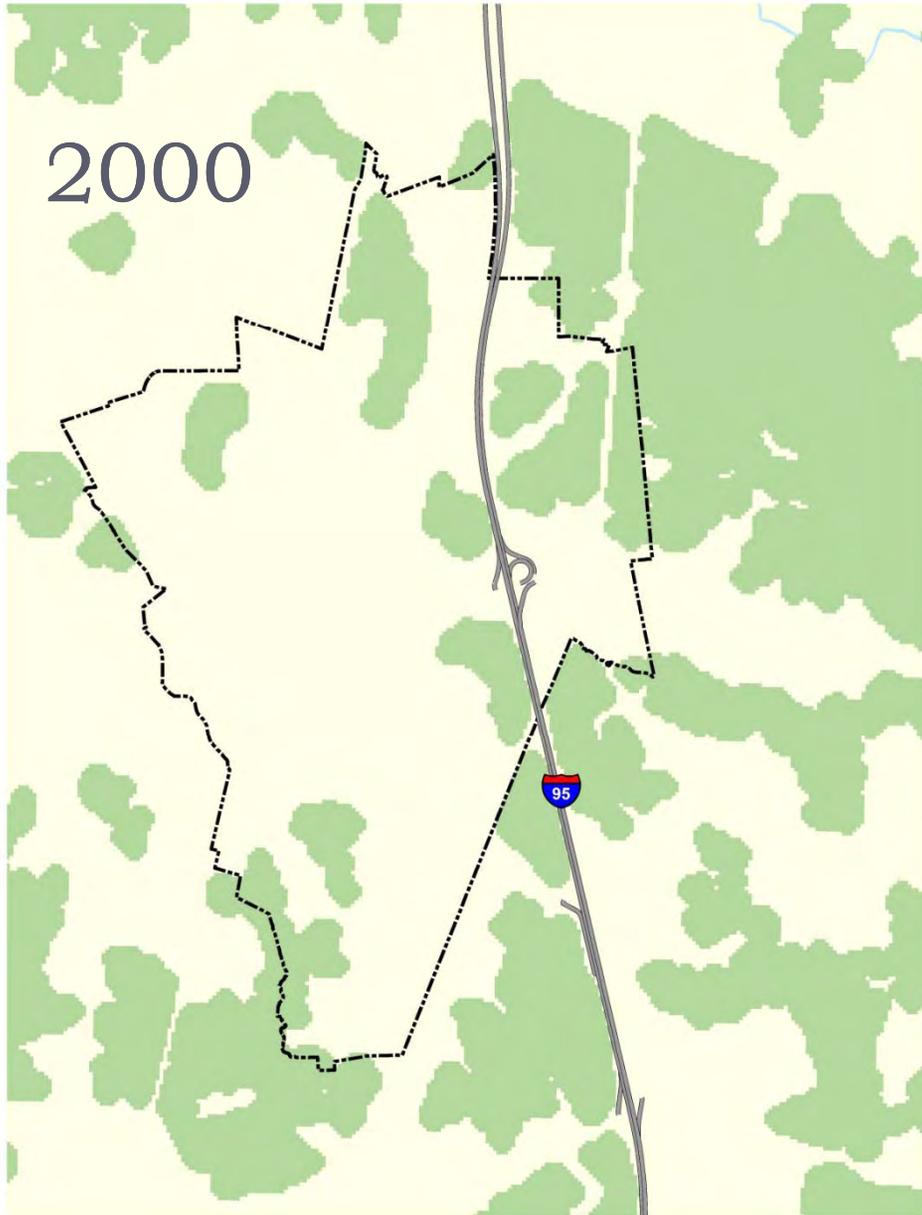
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- ▶ Cultural Sites
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- ▶ Trails
- ▶ Viewsheds
- ▶ Scenic Rivers
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- ▶ Watersheds
- ▶ Birding and Wildlife Trails



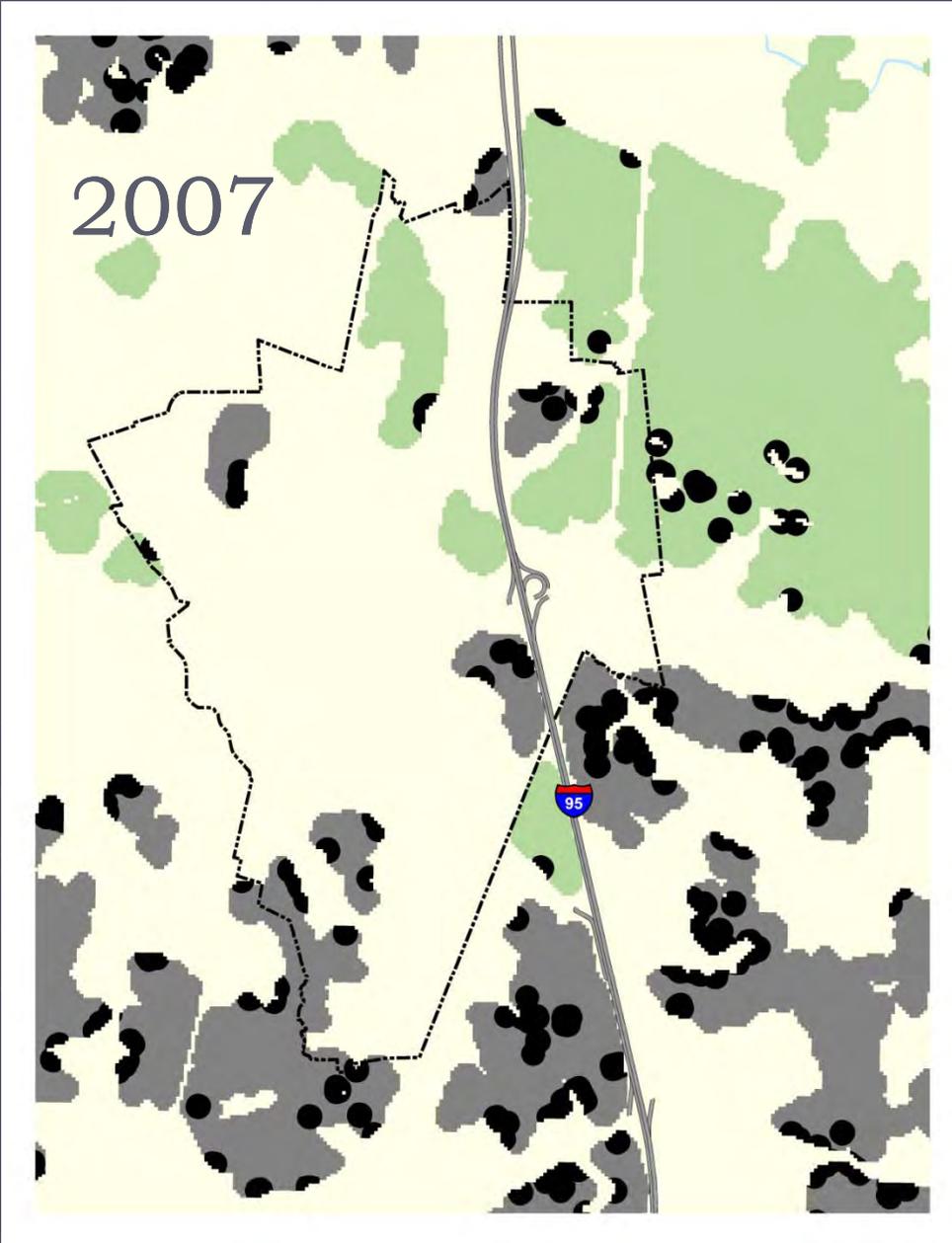
2000



7 Years in a Changing Landscape

Ecological Cores

 Intact Core Habitats



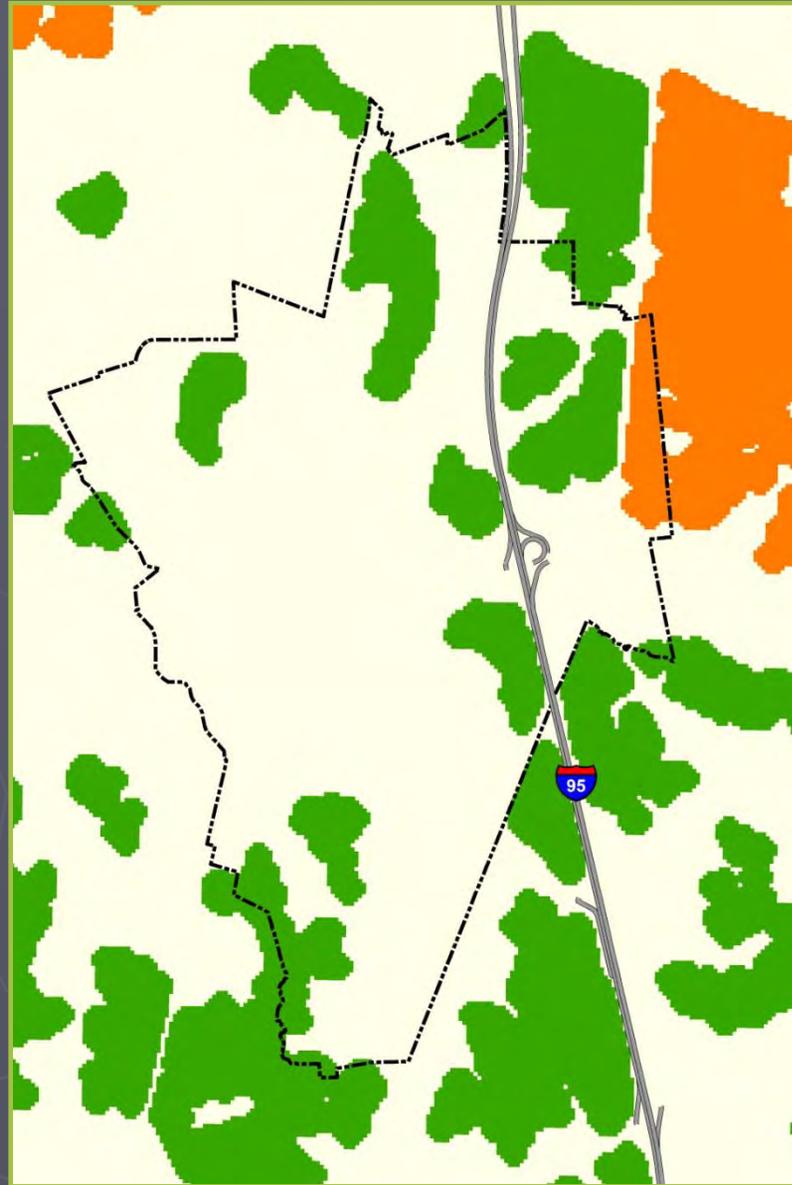
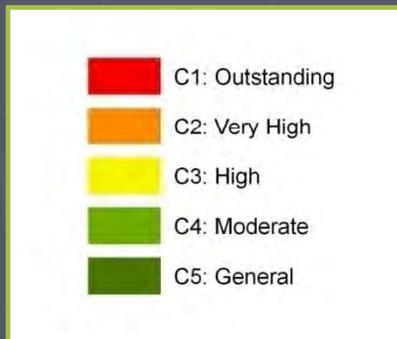
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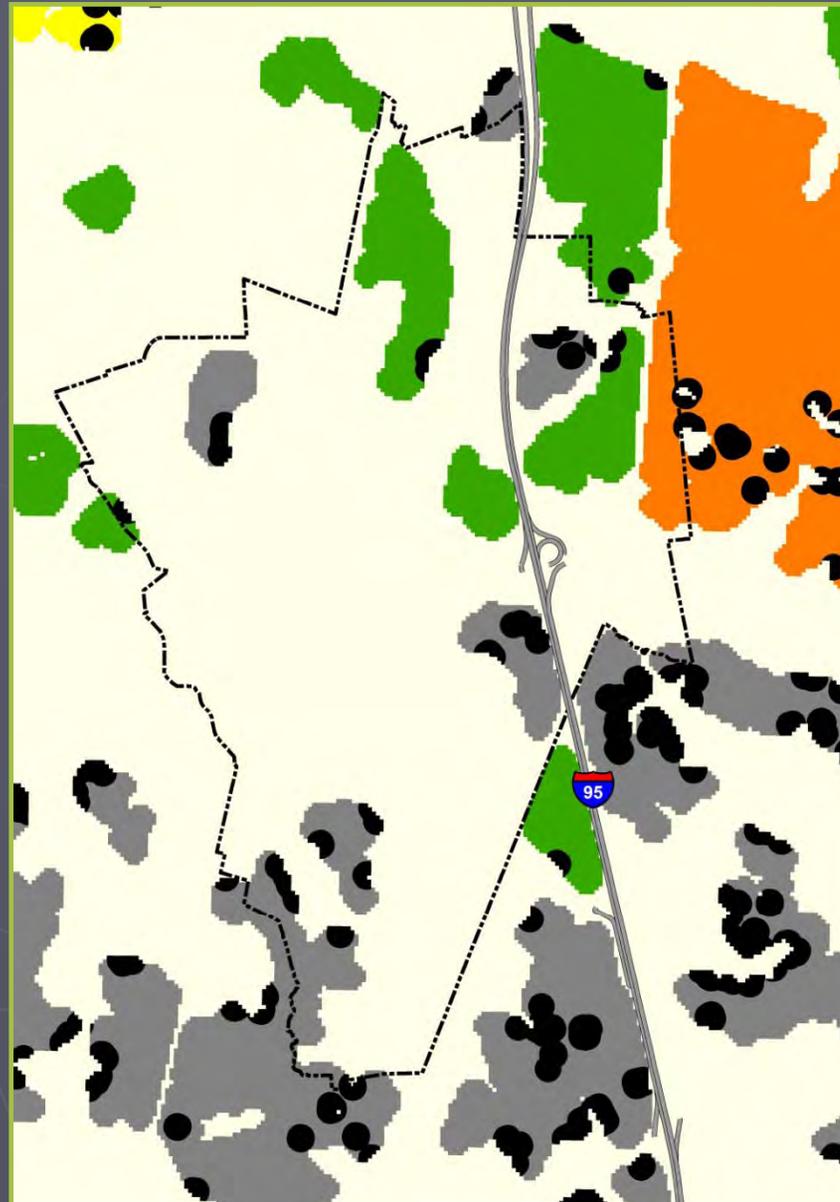
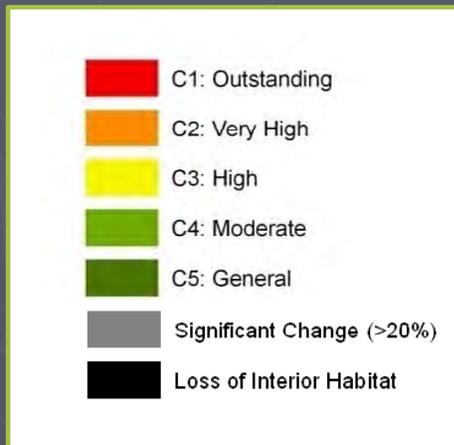
Town of Ashland Green Infrastructure Assets

Town of Ashland Intact Cores 2000



Town of Ashland Green Infrastructure Assets

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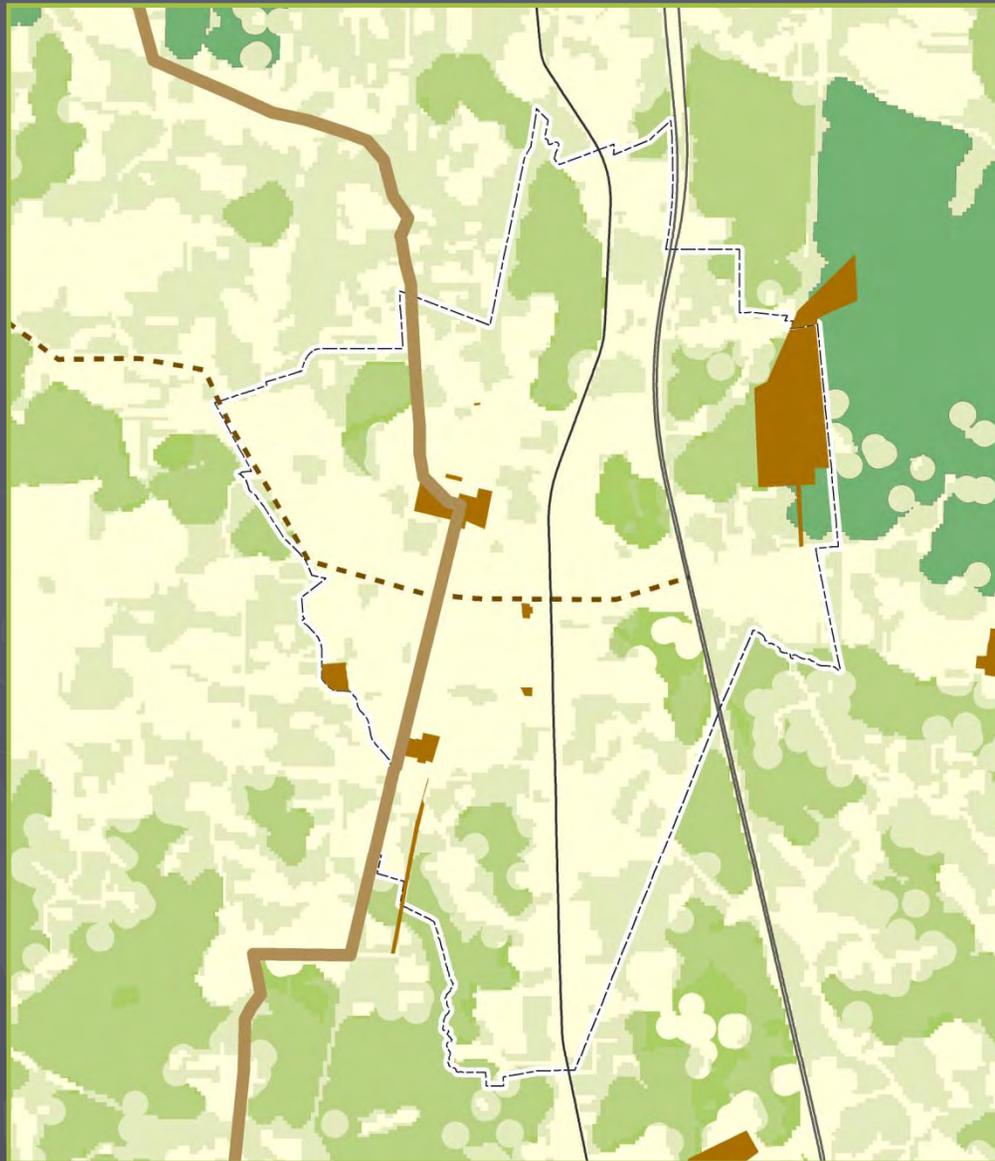


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Town of Ashland Green Infrastructure Planning



Town of Ashland Green Infrastructure Assets



Richmond-Crater Region Green Infrastructure Assets

-  Protected Lands (public holdings & easements)
-  Connected High Value Landscape
-  Intact Landscapes
-  Tree Canopy

Nature-Based Recreation

-  Scenic Byways
-  Nature-Based Recreation (Public Access)

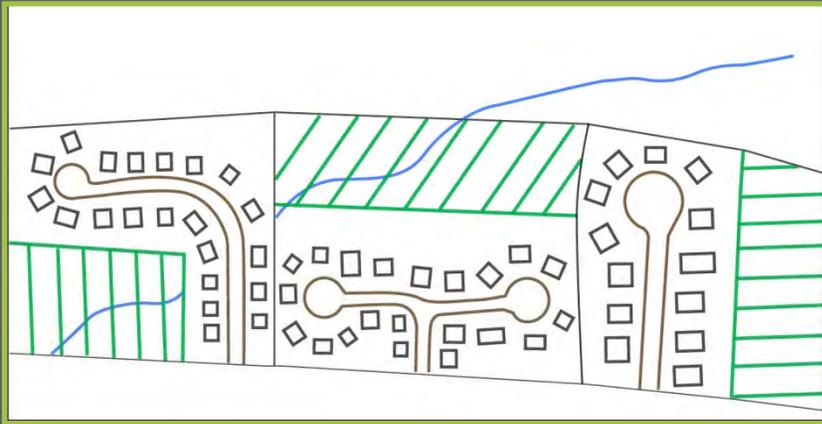


Applying Green Infrastructure Planning

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Remember...



We owe our existence to green infrastructure...

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Town of Ashland Green Infrastructure Planning



For more information, contact

Sarah Stewart
Senior Planner
RRPDC

(804) 323-2033

ssewart@richmondregional.org

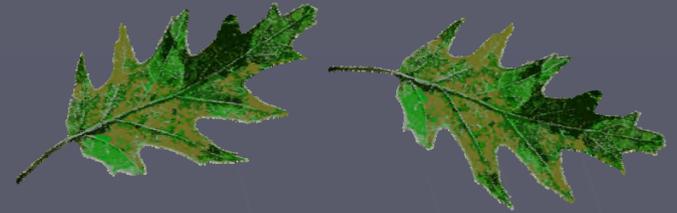
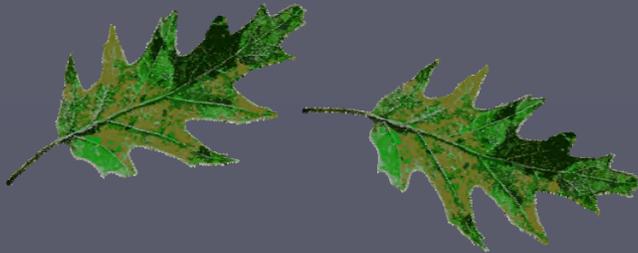


Robins Foundation

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Town of Ashland Green Infrastructure Planning





Green Infrastructure Planning



November 9, 2010

Chesterfield County Green Infrastructure Planning

Robins Foundation



what

- ▶ Green Infrastructure
 - Definition
 - Benefits
 - Identification & Mapping

why

- ▶ Analysis
 - State Model
 - Asset Inventory Methodology
 - Chesterfield County Green Infrastructure Assets

how

- ▶ Planning for the Future & Implementation

Local land use planning impact on the environment

Traffic Congestion



Photo Credit: Tom Saunders, VDOT, Traffic at I-95 and Downtown Expressway

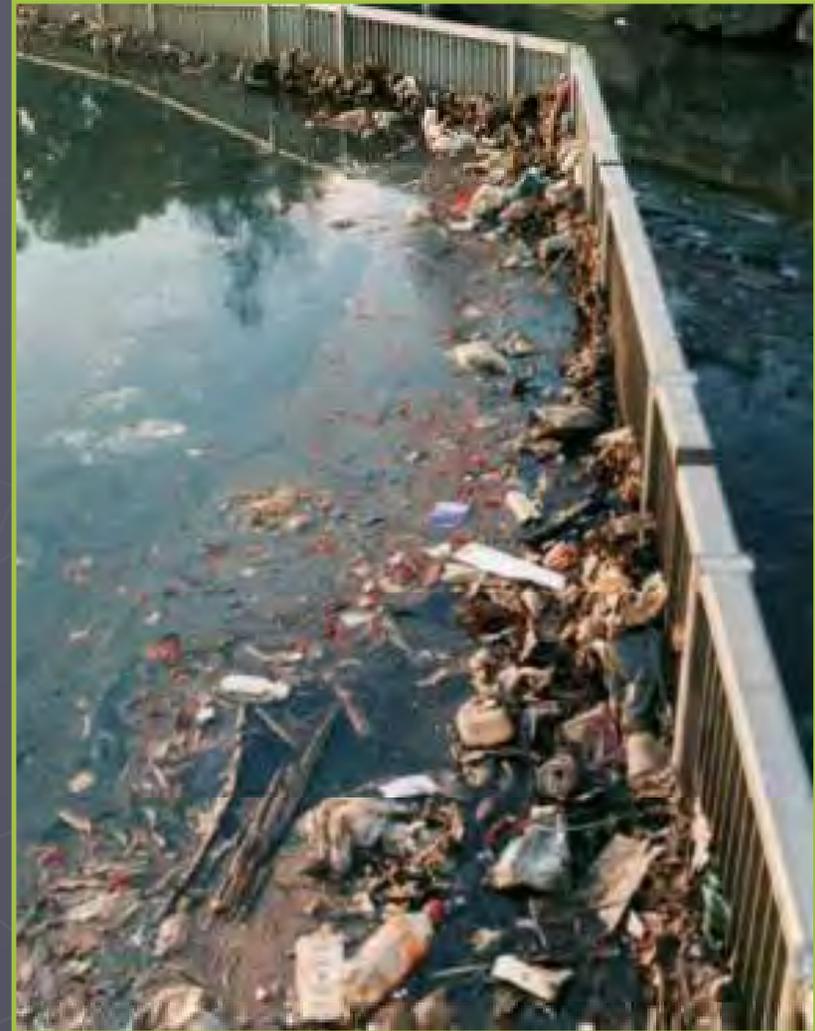


Photo Credit: Tom Saunders, VDOT, Traffic on I-95 at Broad Street Bridge

Local land use planning impact on the environment

Traffic Congestion

Water Quality



Local land use planning impact on the environment

Traffic Congestion

Water Quality

Air Quality



Local land use planning impact on the environment

Traffic Congestion

Water Quality

Air Quality

Loss of Critical
Habitat



Local land use planning impact on the environment

Traffic Congestion

Water Quality

Air Quality

Loss of Critical
Habitat

Loss of Working
Lands



Photo Credit: Adventure Hill

Infrastructure (n): the substructure or underlying foundation...on which the continuance of growth of a community depends.

Gray



Green



What is Green Infrastructure?

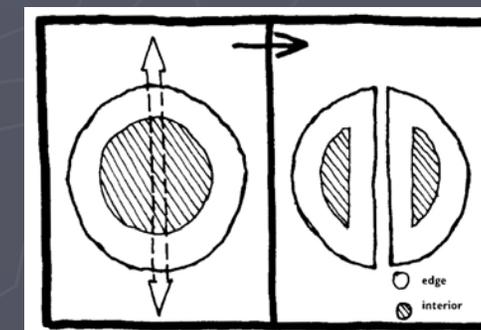
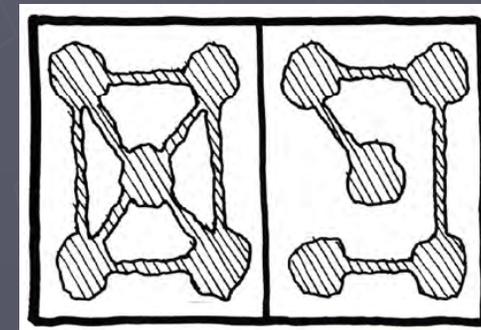
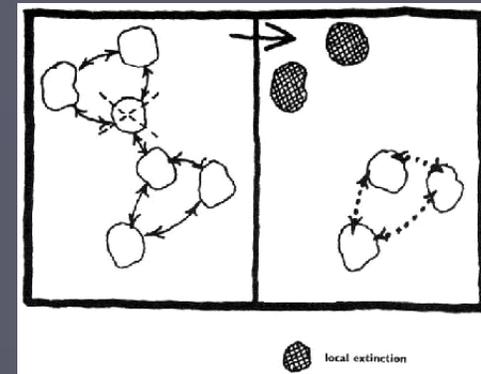
“**Strategically** planned and **managed** networks of natural areas, working landscapes and other open spaces that conserve ecosystem values and functions and provide associated benefits to human populations”

- Benedict, Mark A. and Edward T. McMahon. *Green Infrastructure: Linking Landscapes and Communities*. Washington, D.C.: Island Press, 2006.



Connectivity is key...

- ▶ Removal of 1 patch causes habitat loss, habitat diversity loss, & potential reduction of population or localized extinction
- ▶ With habitat connections, more is always better
- ▶ Splitting of large habitats can have drastic effects on interior species



Green Infrastructure Services



- ▶ Protection of water quality and supply
- ▶ Stormwater management, hazard mitigation
- ▶ Carbon Sequestration
- ▶ Air Quality Protection
- ▶ Temperature Moderation: Heat Island Effect



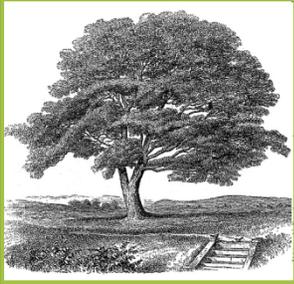
Green Infrastructure Services

- ▶ Preserves biodiversity and wildlife habitat
- ▶ Conserves historic landscapes
- ▶ Protects working lands, forests and farms
- ▶ Improves quality of life and fitness through access to recreation
- ▶ Preserves rural character



We owe our existence to green infrastructure...





Some Economic Considerations...

- ▶ “Estimated value of all economic benefits generated by a single acre of wetland: \$150,000 to \$200,000”.
- ▶ “...every \$1 appropriated in the annual national parks budget, the national park system generates at least \$4 for state and local economies.”
- ▶ “...the estimated total value of the world’s ecosystems services is \$33 trillion annually.”
- ▶ “ ...when 60 percent of the watershed is forested, average annual (water) treatment costs are \$297,000. When only 10 percent is forested, average annual costs rise to \$923,450.”
- ▶ “The forestry organization American Forests estimates that trees in the nation’s metropolitan areas contribute \$400 billion in stormwater retention alone.”

The Origins of the Regional Project

- ▶ Coastal Zone Management Program Grant – Sustainable Communities
- ▶ Create a regional green infrastructure asset map and prioritized green infrastructure opportunities
- ▶ “Update” state model data



The State Model

- ▶ Identification
- ▶ Inventory: Map existing assets
- ▶ Rank & Prioritize areas to protect
 - ▶ Function
 - ▶ Significance
 - ▶ Vulnerability

State Modeling Tools

- ▶ VA Natural Landscape Assessment – Forest Habitats
- ▶ Cultural Model – Historic Resources
- ▶ Vulnerability Model – Growth Predictions and Trends
- ▶ Forest Economics Model – Economically viable forest
- ▶ Agricultural Model – Lands suitable for farming
- ▶ Recreation Model – Trails, Parks, Hunting and Fishing
- ▶ Watershed Integrity Model
- ▶ Ecological Integrity



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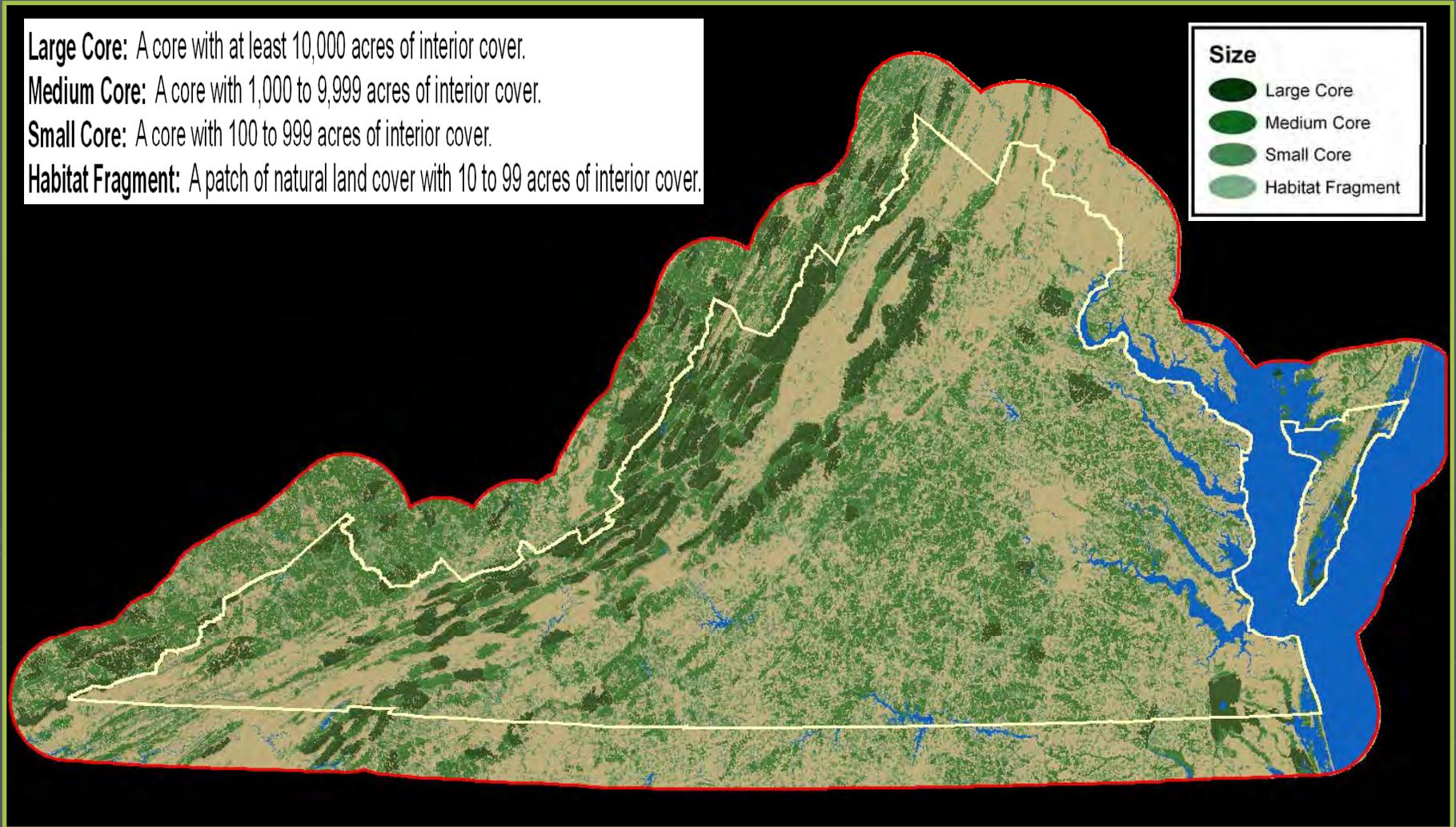
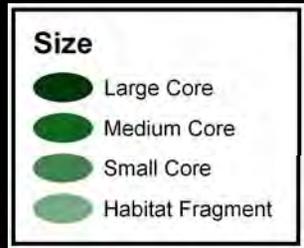


Image Courtesy VA Dept. of Conservation and Recreation

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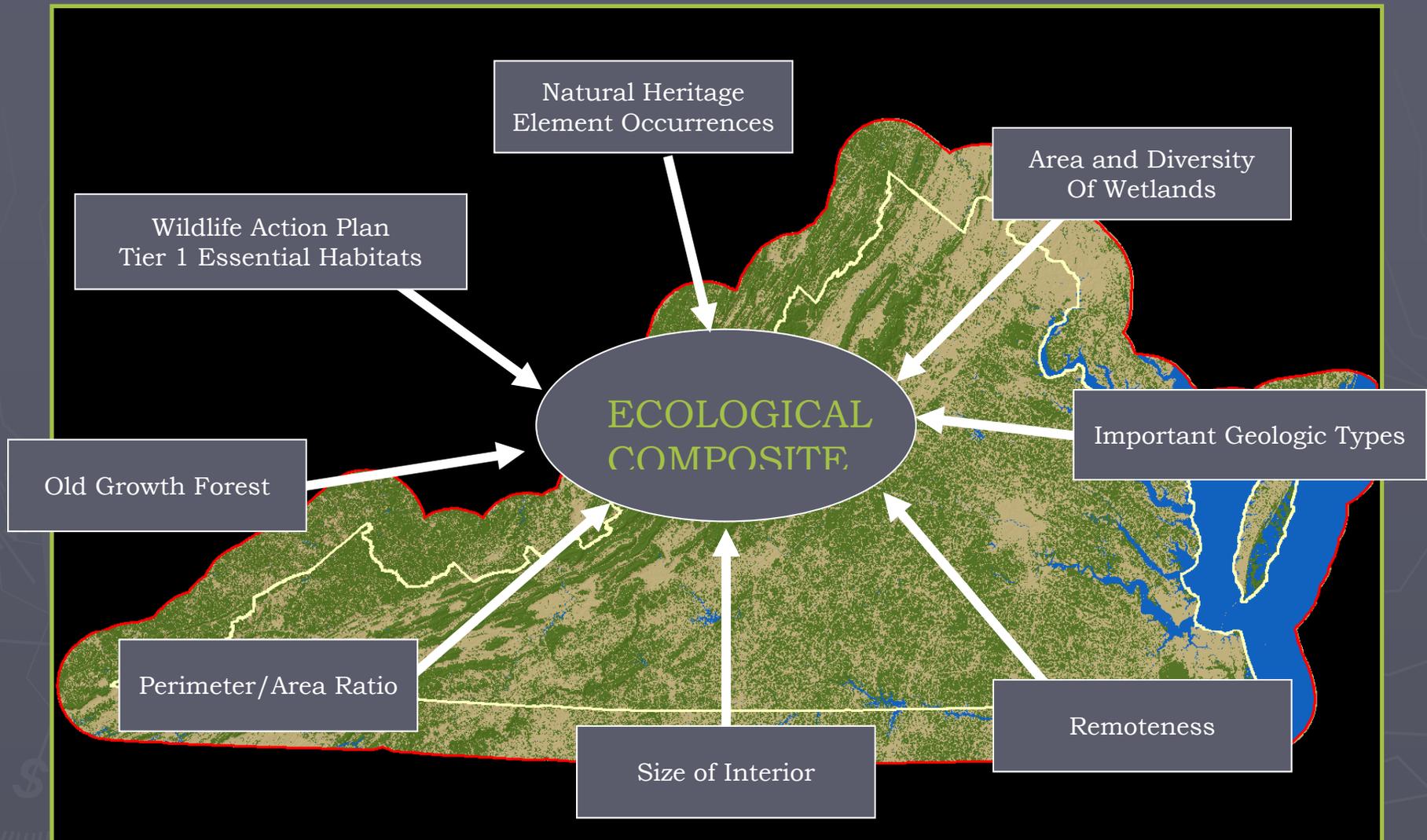


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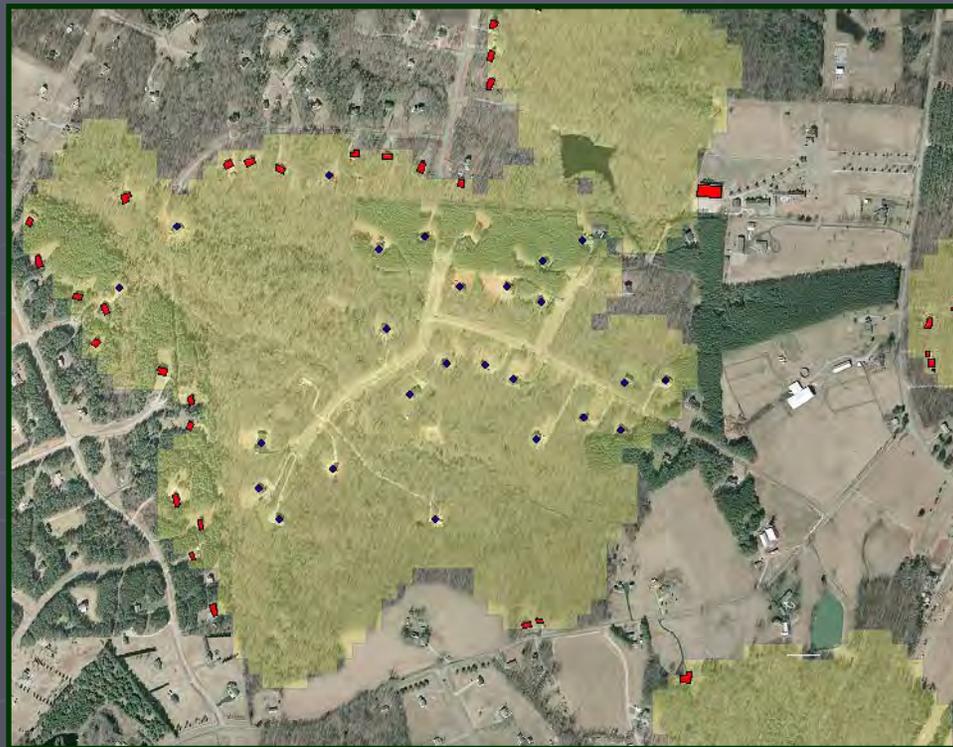
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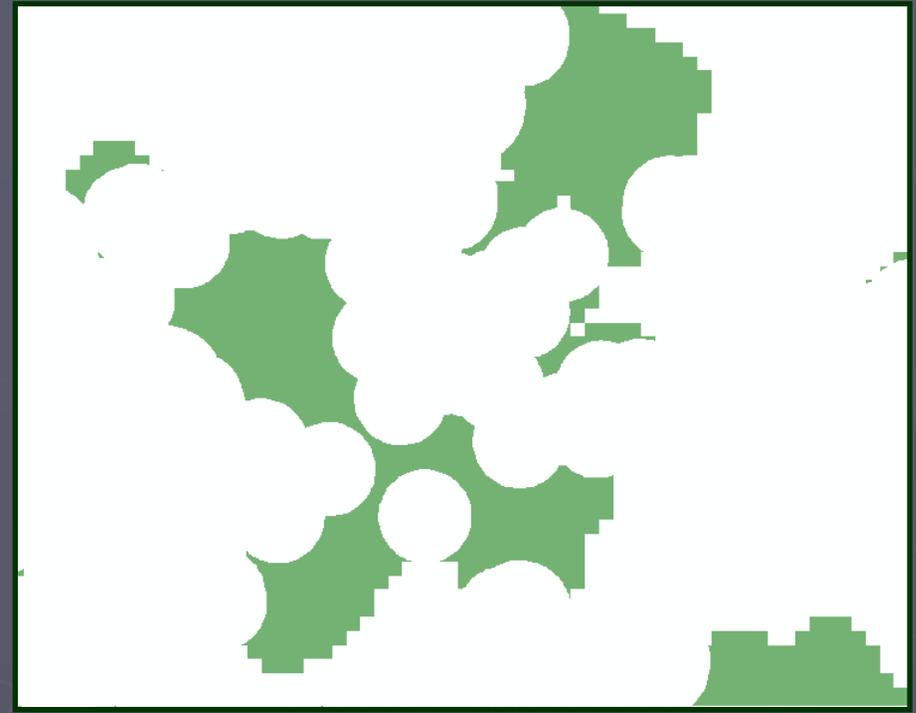
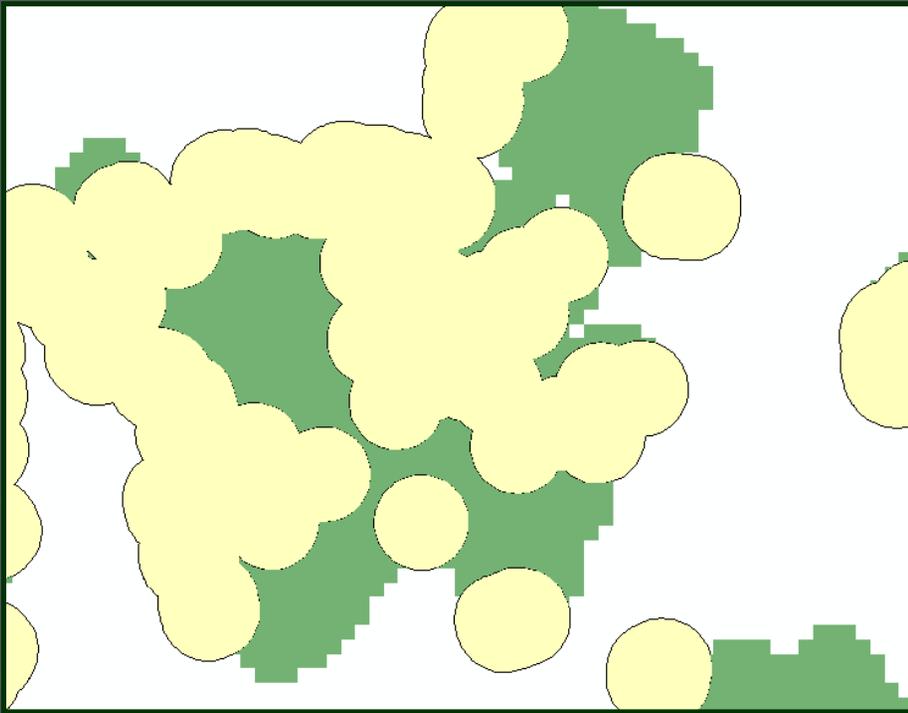
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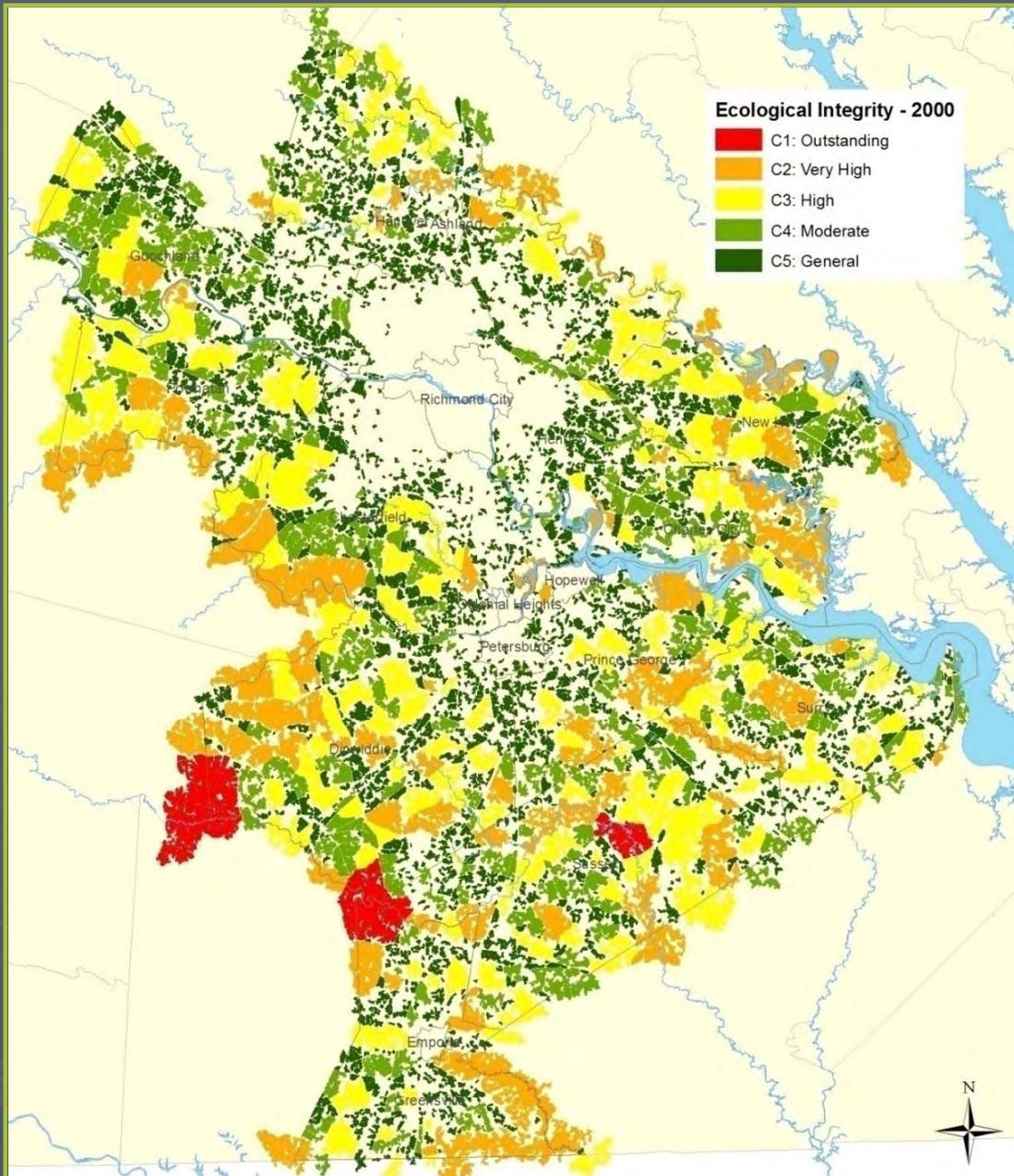
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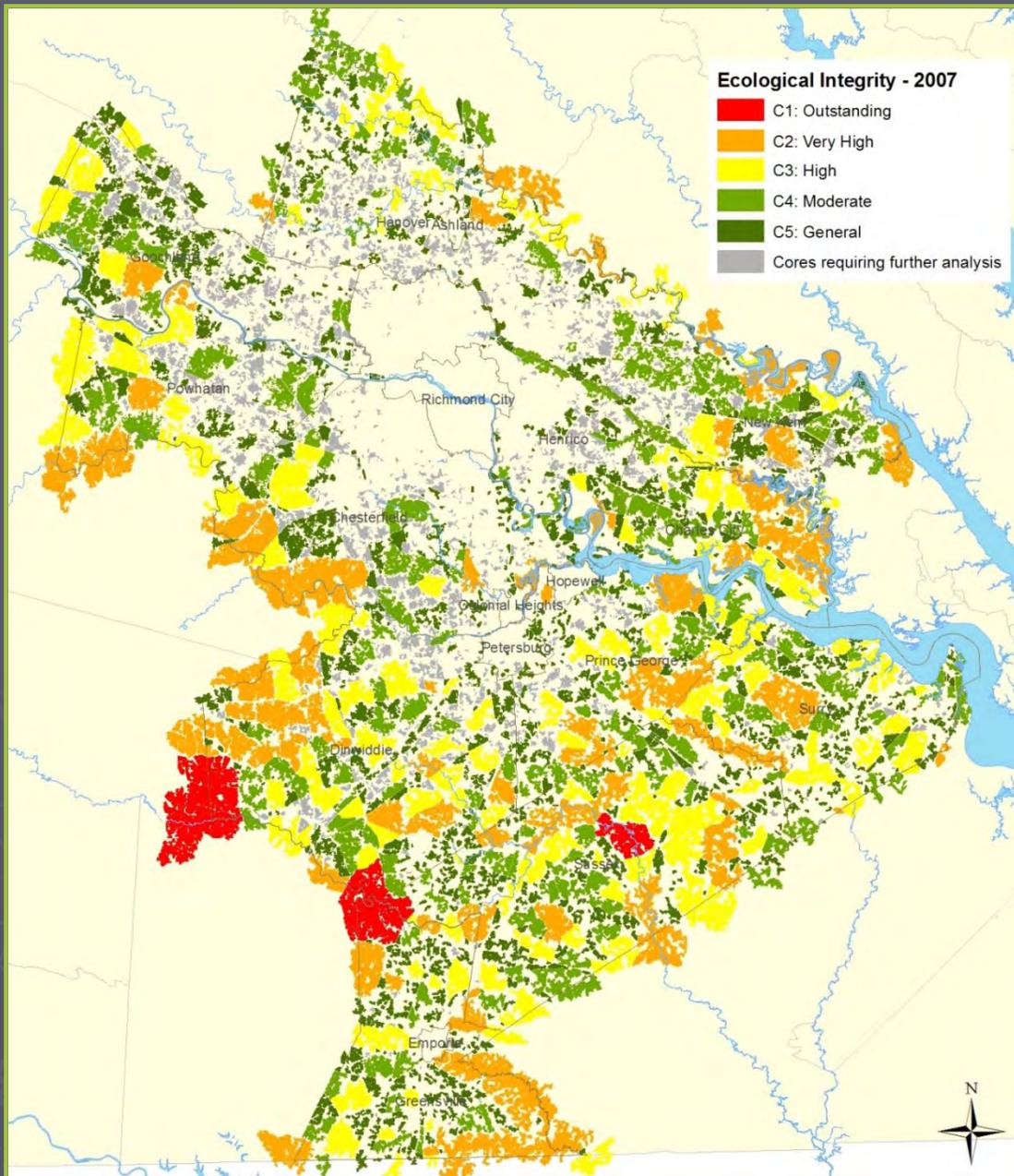


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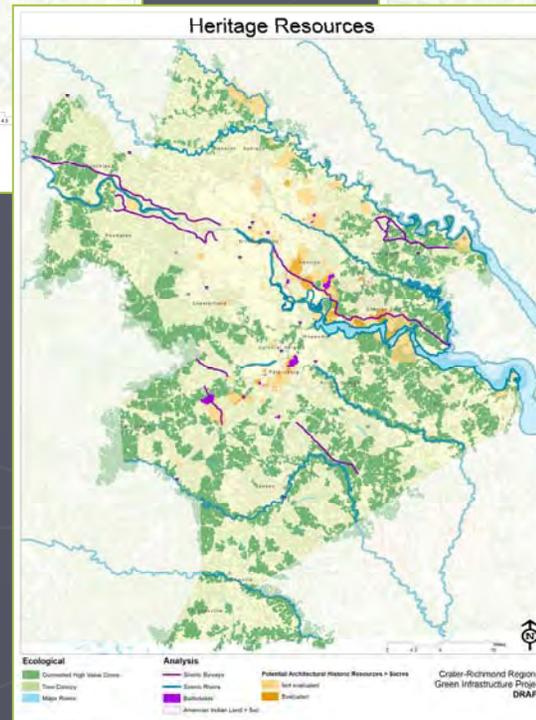
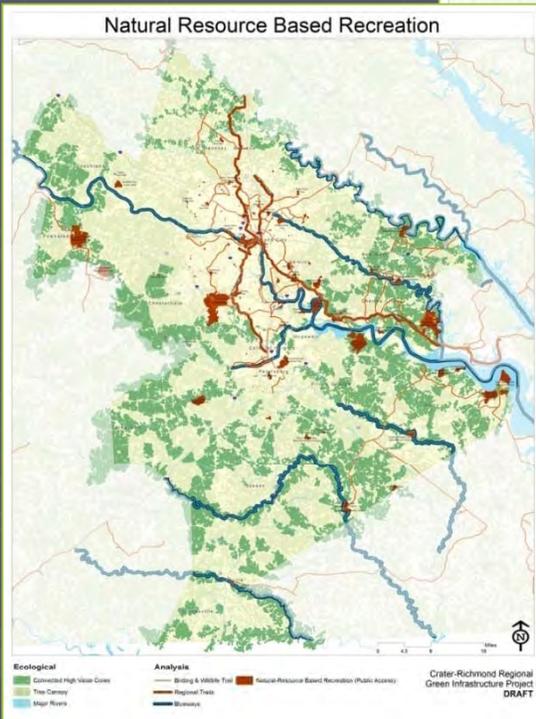
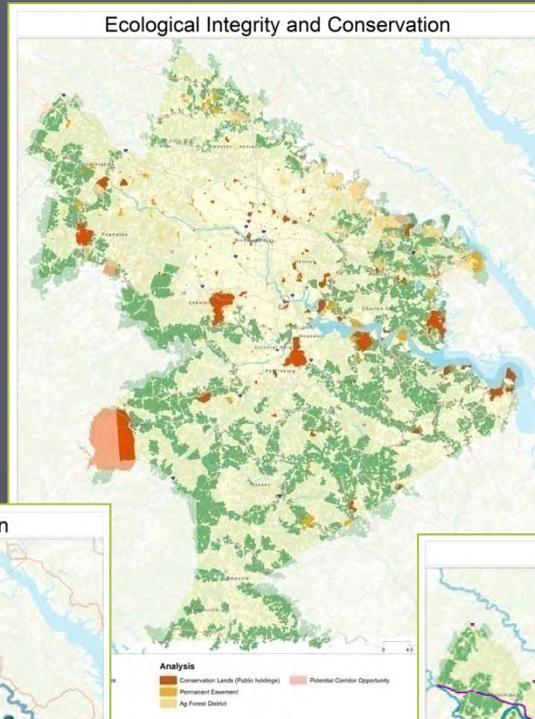


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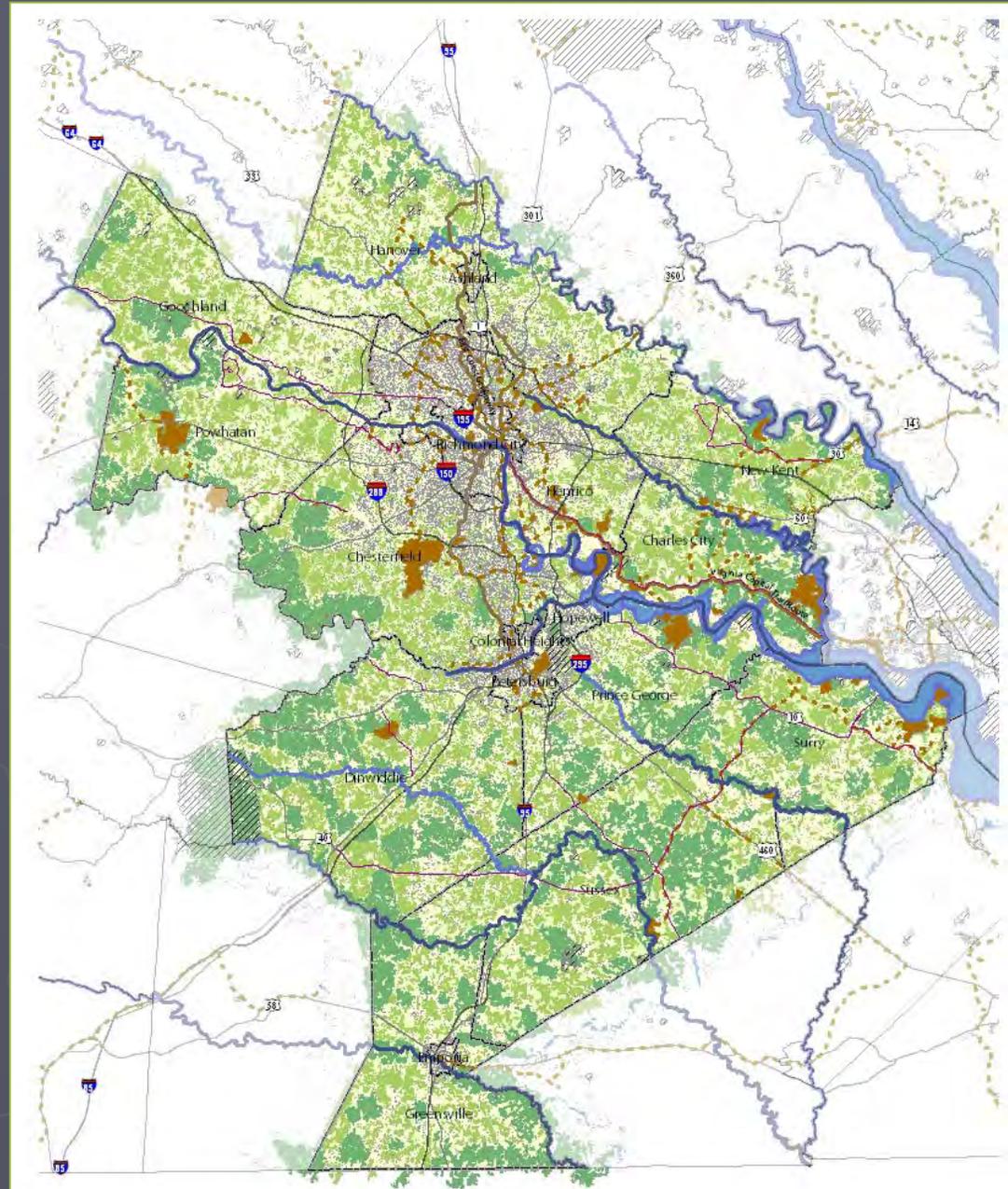
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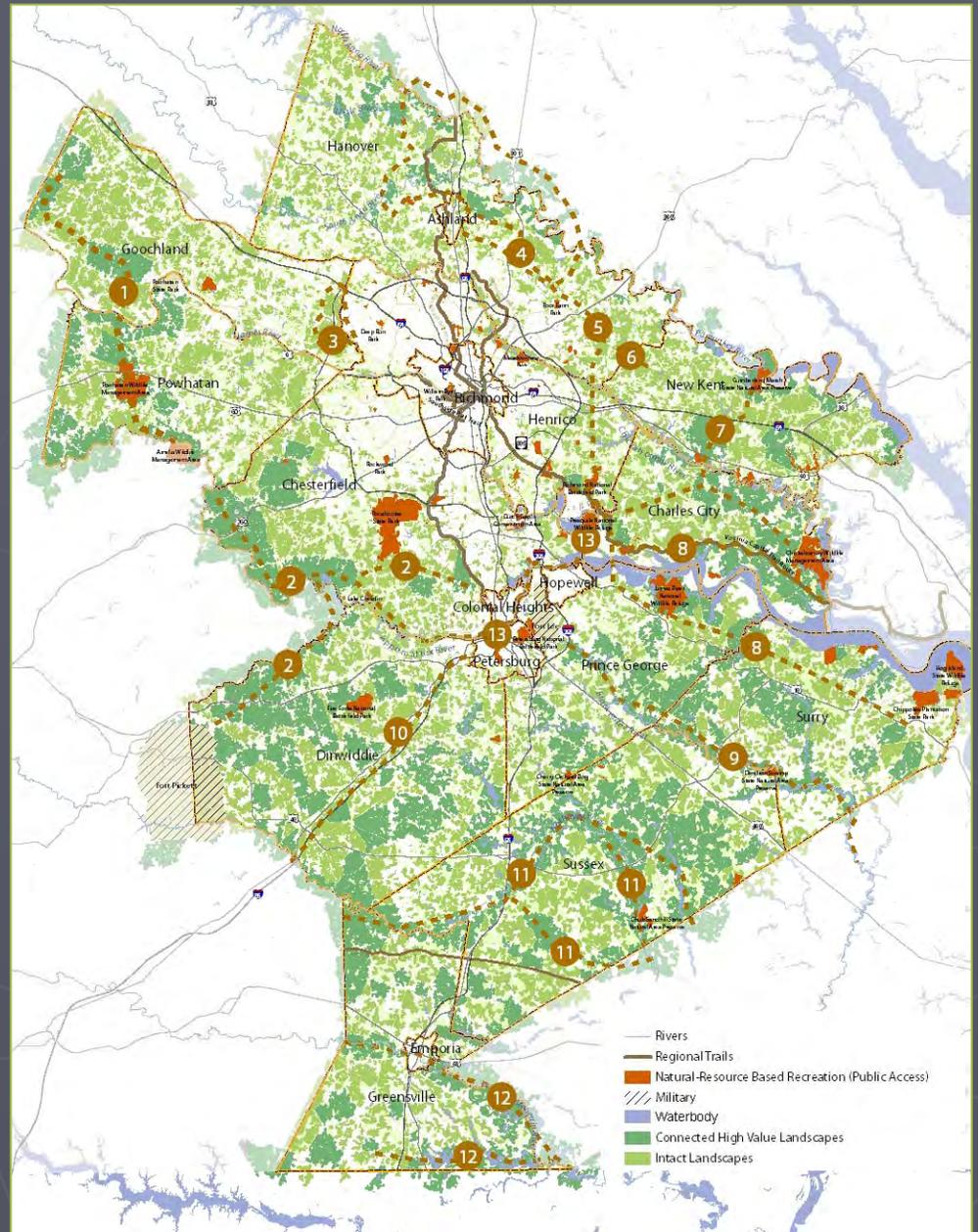


Regional Green Infrastructure Assets

Richmond-Crater Region Green Infrastructure Assets



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Chesterfield County Green Infrastructure Planning



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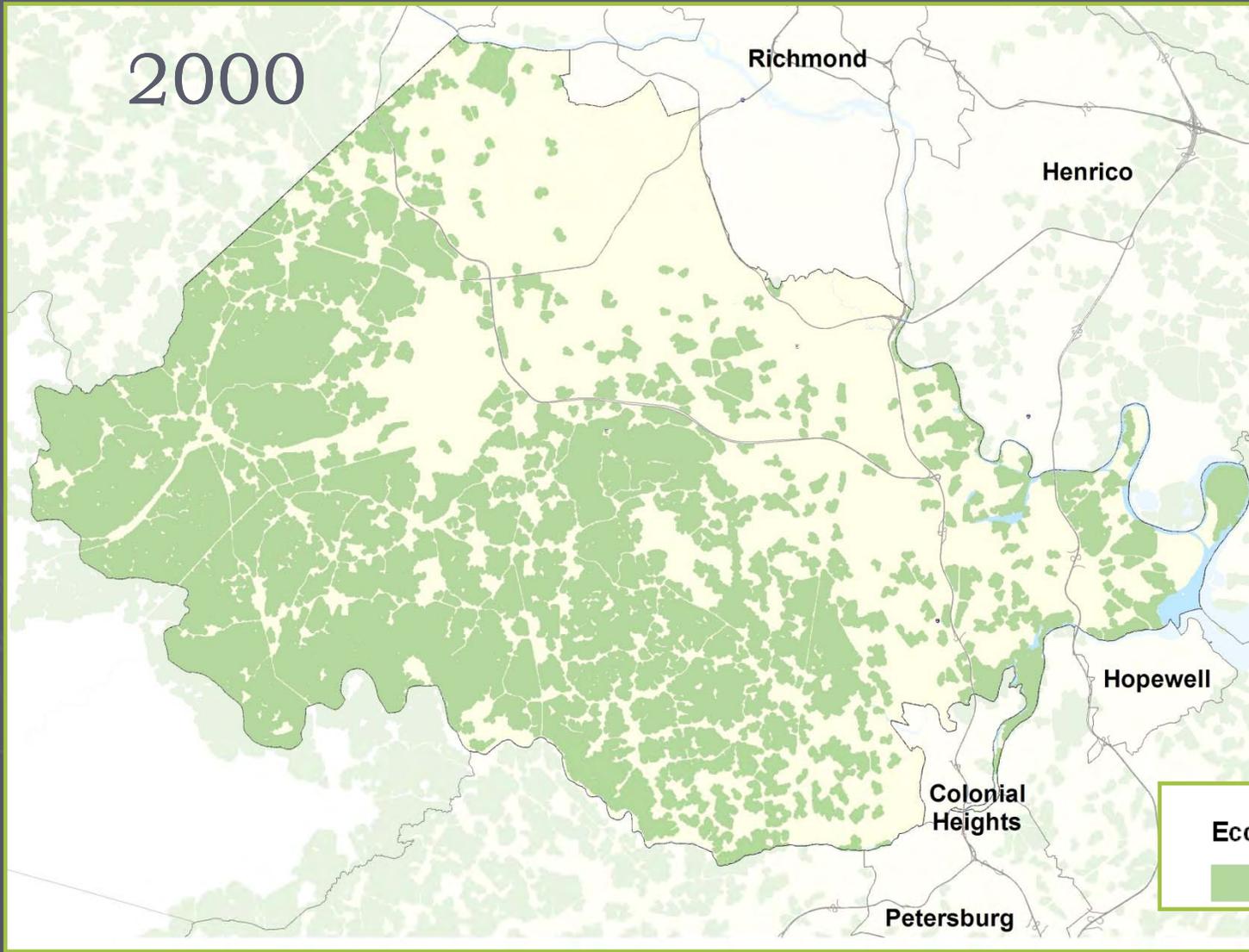


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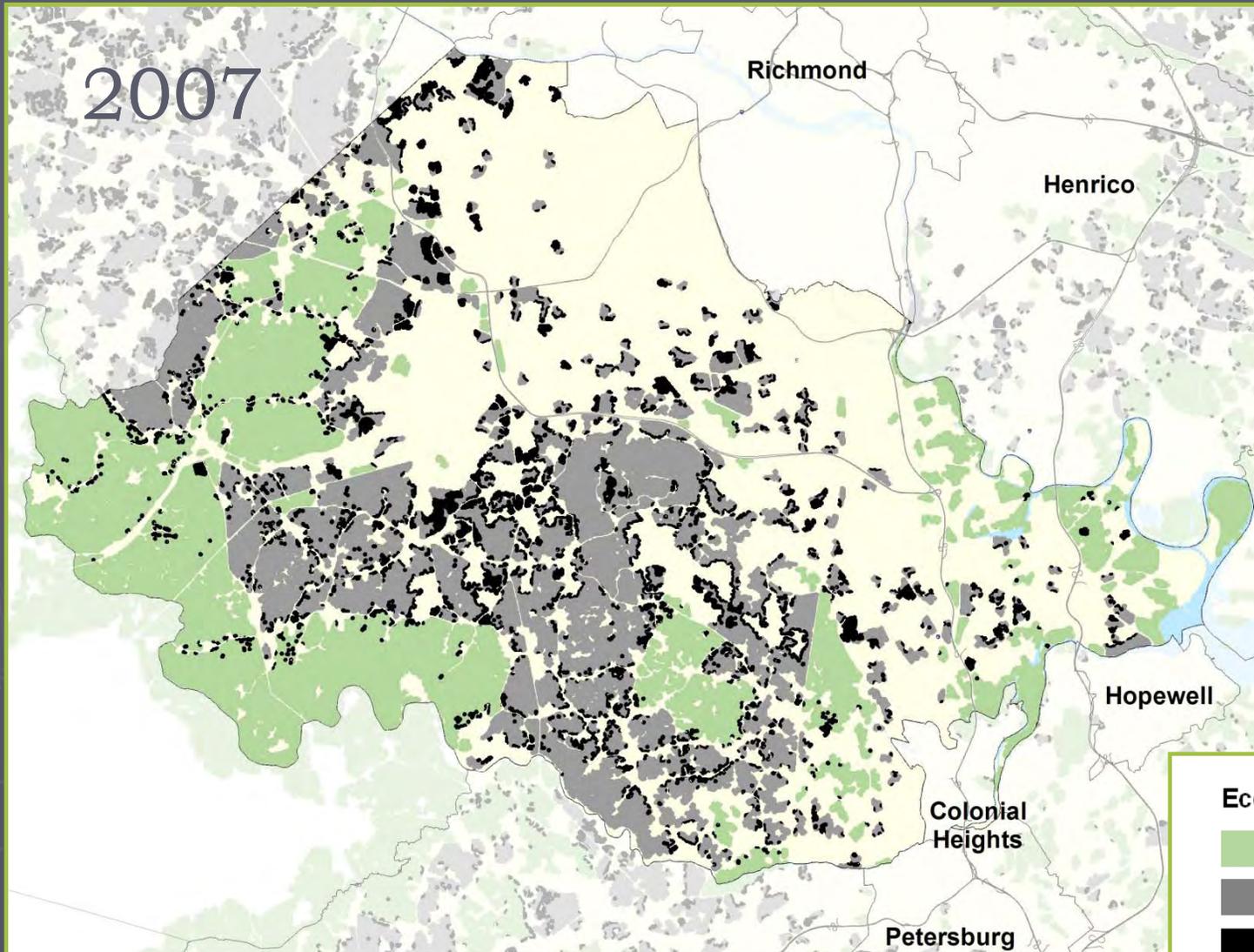
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 Intact Core Habitats



2007



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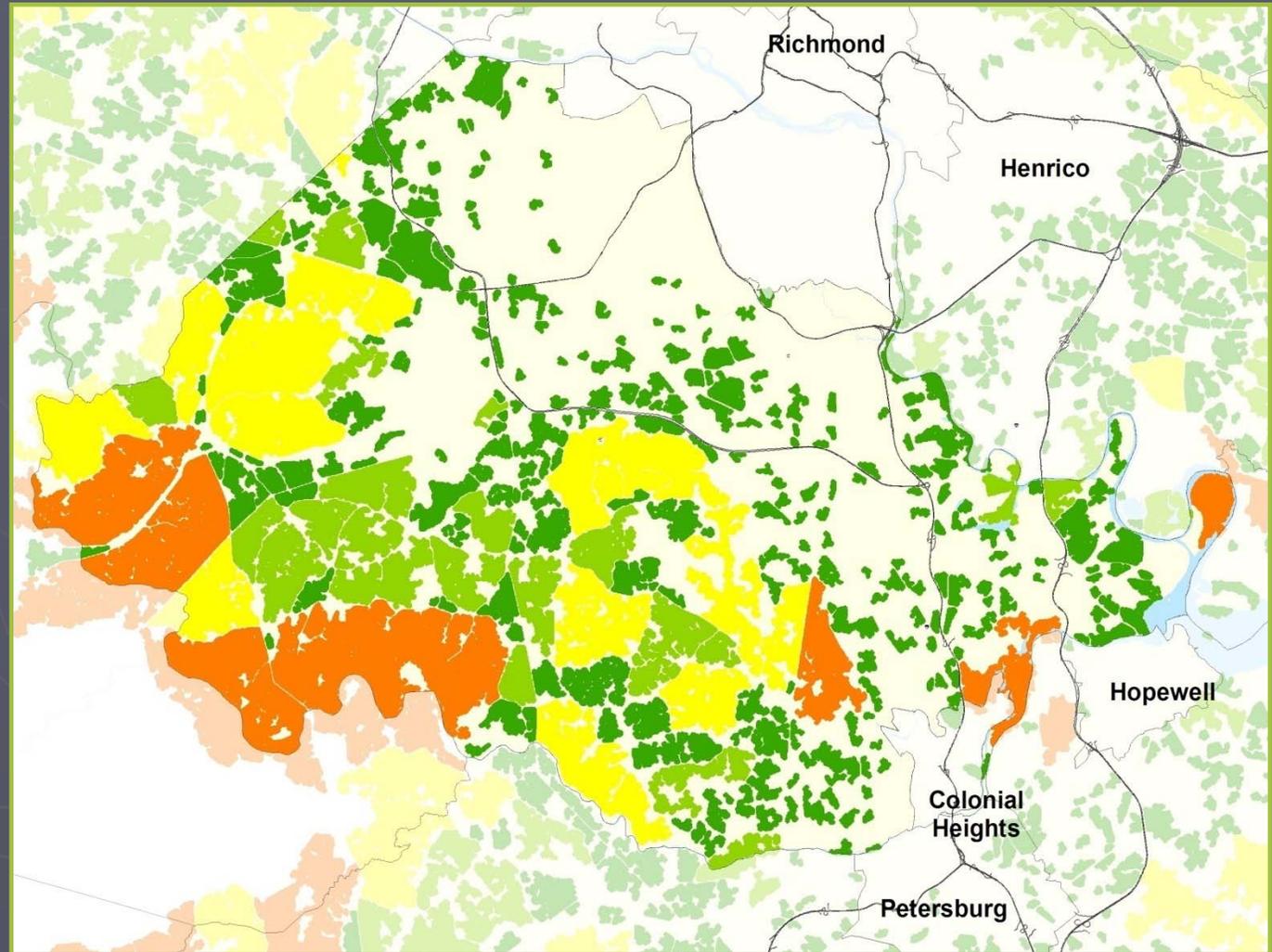
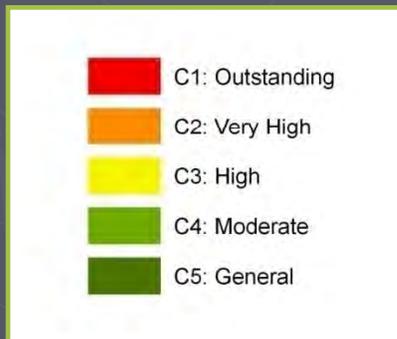
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Chesterfield County Green Infrastructure Assets

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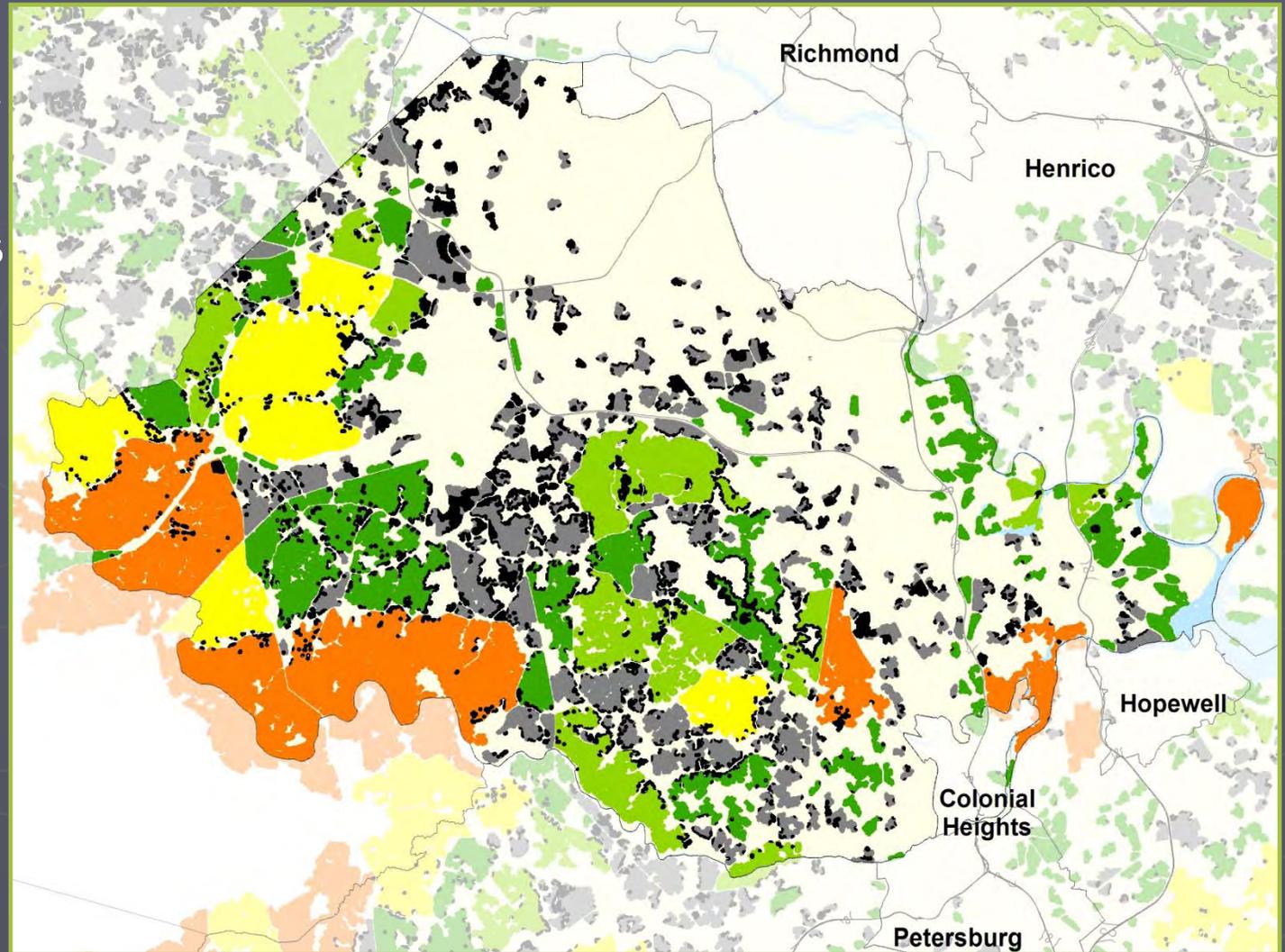
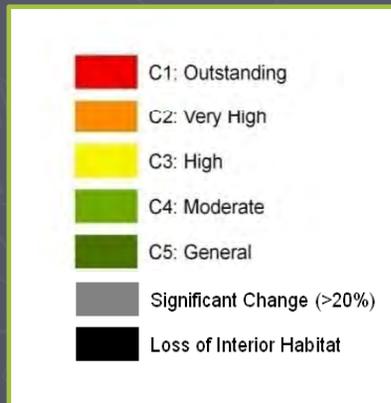
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Goochland County Green Infrastructure Planning



Chesterfield County Green Infrastructure Assets

Chesterfield County Intact Cores 2007

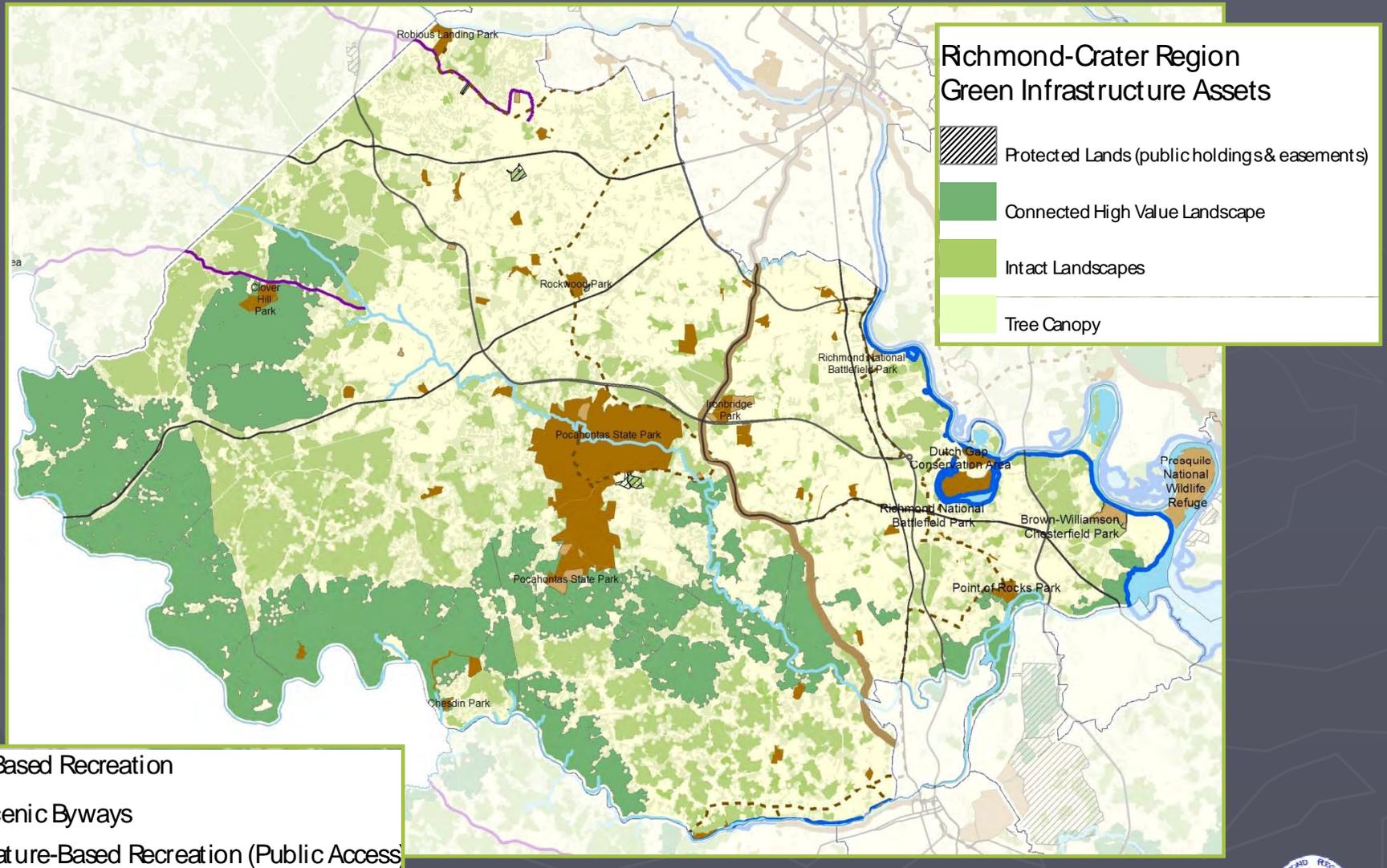


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Goochland County Green Infrastructure Planning



Chesterfield County Green Infrastructure Assets



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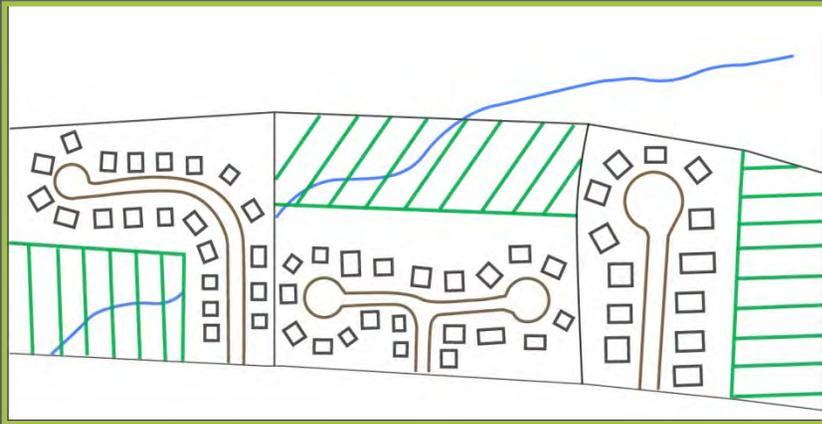


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Robins Foundation

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