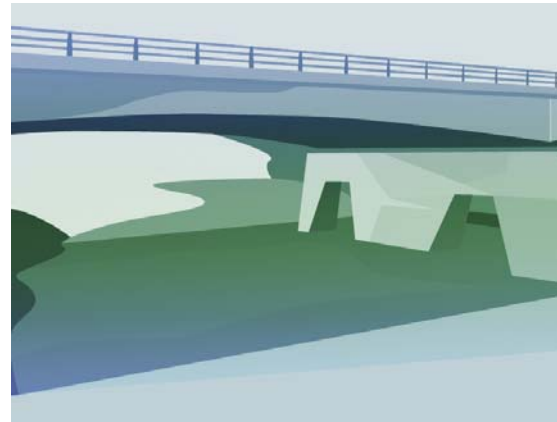# Eco-Logical Free Bridge Area Congestion Relief Project

REF Tool Functionality and Existing Dataset Overview

Thomas Jefferson Planning District Commission

401 E. Water Street • Charlottesville, VA 22902 • (434)979-7310 • www.tjpdc.org

(Blank Page)

Index

(Blank Page)

Objectives for the Free Bridge Area Congestion Relief Eco-Logical Project

The Free-Bridge Area Congestion Relief project has two overriding goals. The first is to use the Eco-Logical process to develop a viable solution to traffic congestion in this area. The Second is to enhance and improve the existing Regional Ecological Framework (REF) tool previously developed by TJPDC.

Transportation modeling has shown that without exploring alternatives, congestion in the vicinity of Free-Bridge will continue to worsen. Modeling has also shown that there is no single solution that will alleviate congestion in the vicinity of Free–Bridge. Whichever solution is developed will have to include a wide range of options. It is important to note that this project is being funded by Federal Highways Administration (FHWA) and is a pilot project that is meant to test the effectiveness of Eco-Logical in the real world. As a result a viable outcome of this process could be a no build option.

Rivanna River Trail passing under the Charlottesville side of the US-250 crossing of the Rivanna River, known locally as Free-Bridge. Not only is the bridge an important vehicular link between the City of Charlottesville and the urbanized area of Free Bridge, but it is also an important junction point between City and County bike, pedestrian and river trails. (Photo courtesy of TJPDC)

The overall objectives for the Eco-Logical component of the Free-Bridge Area Congestion Relief Project are to do the following:

1. Make enhancements that improve the accuracy and functionality of the existing REF tool. Enhancements should include the addition of environmental datasets or supplement existing data with new and more accurate information to increase accuracy and function.

2. Develop a second module similar in function to the REF that adds social and historic features into the overall function of the tool. The new datasets should include information on historic districts, historic properties, archeological sites, important community places and a representation of the existing built environment.

3. Increase the awareness and understanding of Eco-Logical and of TJPDC's REF tool, especially among local governments and state agencies.

This document provides a guide to help facilitate a discussion about the existing REF tool and how the tool can be improved upon. TJPDC staff are asking the stakeholders to help them identify additional datasets that could help fill current data gaps in the tool. Staff are also looking for input on ways to increase the tools utility and usage.

The report provides an overview of the Eco-Logical process as laid out by FHWA. The guide then explains where TJPDC currently is in the Eco-Logical process. This is followed by an explanation of the tool's functionality before providing information about existing datasets included in the tool.

The Eco-logical Approach to Infrastructure Development

Eco-Logical: an Ecosystem Approach to Developing Infrastructure Projects was developed by the FHWA in conjunction with other federal infrastructure and environmental/natural resource agencies in response to the 2002 Executive order (EO)13274 *Environmental Stewardship and Transportation Infrastructure project Reviews*, signed by then President George W. Bush.

The Eco-Logical approach lays out a basic framework for identifying the greatest conservation needs associated with the development of infrastructure projects. It is meant to help transportation planning agencies join in partnership with resource agencies and act as a catalyst for greater stakeholder cooperation and coordination. Using the Eco-Logical approach, infrastructure improvements can be advanced in productive harmony with the restoration of fragmented habitats, reduction of wildlife mortality, and other cooperative conservation goals.

The Process encourages stakeholders to integrate environmental solutions and goals into planning for infrastructure development and to implement an efficient, predictable and open process for the review and management of ecological effects of infrastructure projects. The approach offers a non-prescriptive approach that enables Local, State, Tribal and Federal partners involved in infrastructure planning, design, review, and construction to work together to make infrastructure projects more sensitive to wildlife and their ecosystems. The approach is centered around three defining principals that encourage an open collaborative approach between stakeholders.

1. Integrated planning between natural resource and transportation agencies.

2. Mitigation options that enhance the Regional Ecological Framework. (Mitigation in the context of regional habitats and ecology.)

3. Performance measures that balance predictability and encourage adaptive management of projects.

Ecosystem Approach to project planning and development as depicted by FHWA in Eco-Logical: an Ecosystem Approach to Infrastructure Projects.

Where are We in The Process?

In addition to the three defining principals Eco-Logical lays out an eight step framework for working towards integrated planning. The list below identifies where we are in the Eco-Logical process and what is left to be done.

1. Build and strengthen collaborative partnerships
   A. Formed stakeholder group consisting of concerned citizens, local elected officials, state resource agencies and local government staff.

2. Identify management plans
   A. Plans were identified as part of TJPDC's earlier effort to develop the REF tool.
   B. This project will focus on identifying additional plans and datasets for inclusion in the tool

3. Integration of management plans into the REF

    A. Plans previously identified have been integrated into the REF.

    B. Additional plans will be integrated with existing data

4. Assess effect

    A. The REF tool's ability to assess effects has been demonstrated by conducting analysis on possible transportation alternatives brought forward by the Eastern Connector Study.

    B. The tool will be used to analyze environmental impacts associated with project alternatives identified as part of the Free-Bridge Congestion Relief efforts

5. Establish and prioritize opportunities

    A. This step was done as part of the work TJPDC did in developing the REF tool.

    B. This step will be rerun once changes to the existing tool are finalized

6. Document agreements among stakeholders and resource agencies

    A. As the project continues TJPDC will work with the stakeholders to develop formal agreements as to the effectiveness of the Eco-Logical process

7. Design a final project that is consistent with the Regional Ecosystem Framework

    A. TJPDC will rely on guidance from the stakeholders as to how and what sort of final project should be put forward from this process. Any project identified using the Eco-Logical process will still have to be added to the regions Financially Constrained Long Range Transportation Plan and go through the normal channels of project review.

8. Balance Predictability and Adaptive Management

    A. TJPDC will rely on guidance from the stakeholders as to how and what sort of final project should be put forward.

    B. TJPDC will practice adaptive management to ensure outcomes are in line with expectations of FHWA and the stakeholder group.

Figure 1. FHWA Eco-Logical Approach Framework
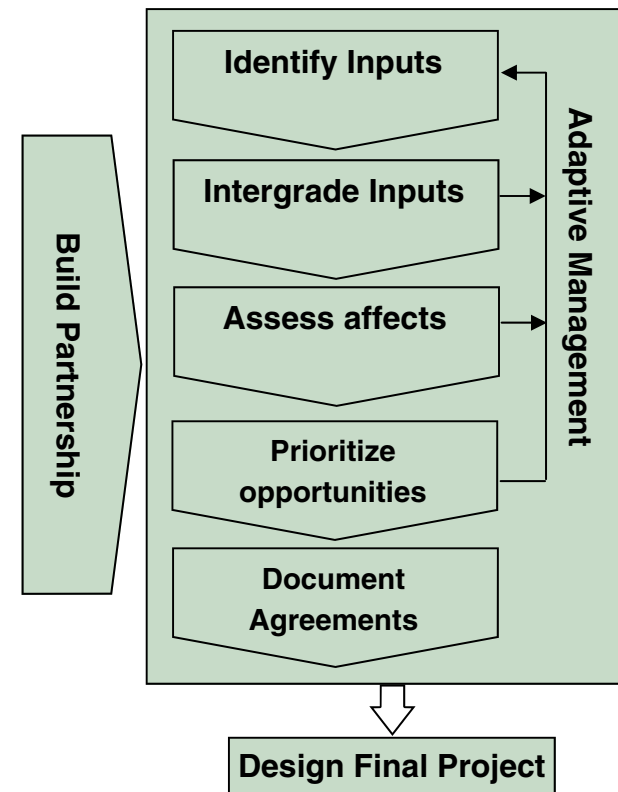
As the Free-Bridge Area Congestion Relief Project moves forward it is important to point out what the Eco-Logical approach does and does not do. The Eco-Logical approach is a planning tool and in no way replaces or reduces any regulatory review or authority.

What does Eco-Logical <u>Do</u>?

1. Eco-Logical provides a framework for integrating environmental solutions and goals into the planning of infrastructure projects.

2. Eco-Logical develops a regional map of ecologically important areas that should be given special consideration when planning and building new transportation or development projects.

3. Eco-Logical creates a tool that contains information on habitats, species and landscapes that can be used to help plan transportation projects.

4. Eco-Logical builds openness and trust among project stakeholders and regulatory agencies.

5. Eco-Logical ensures interagency collaboration in the development of infrastructure projects, in order to foster discussion earlier in the planning and development process.

6. Eco-Logical delivers projects that have greater ecological sensitivity while at the same time are cost-effective.

7. Eco-Logical identifies possible environmental mitigation opportunities at a regional or habitat scale versus an individual project scale.

8. The eco-logical process attempts to reduce permitting burdens by encouraging a project to be designed in the context of the natural environment.

What does Eco-Logical <u>NOT</u> Do?

1. Eco-Logical does not replace or diminish existing regulatory review requirements that a project must go through. Any project identified and developed using the Eco-logical Process still has to go through a NEPA review process. Findings from the Eco-Logical process could aid the NEPA process, but NEPA is still required to be fully executed.

2. Eco-Logical does not obligate a project to be built. A project still has to be added to the MPO's Financially Constrained Long Range Transportation Plan and the Transportation Improvement Program.

3. Eco-Logical does not obligate any agency or regulatory body to accept the outputs or findings associated with the tool.

4. Eco-Logical does not reduce the regulatory authority of any agency that is required to review a project for compliance with laws and regulations.

Rivanna River flowing under Free-Bridge. View facing the Charlottesville bank of the River. (Photo courtesy of TJPDC)

Dataset Description

The Regional Ecological Framework or (REF) is a major component of the Eco-Logical process. The current iteration of the REF was developed by TJPDC with support from FHWA. The REF is made up of an inventory of significant natural resources in the TJPDC that are important to the region's ecological health. This inventory is made up of ten datasets from various sources that each cover a different aspect of the region's ecology. The ten datasets that were chosen to be part of the REF are described in greater detail in the next section of the document. In order to create this unified dataset each of the ten datasets and attributes were given a numerical value between two and ten. This score represents the relative importance of each attribute and dataset. The score is what allowed all of the different datasets to be combined into a single dataset. In order to combine these datasets each was converted into a raster file and then combined into a single raster file using the cell statistics tool in Esri ArcGIS Spatial Analyst

Crossing Free Bridge from Pantops into Charlottesville (Photo courtesy of TJPDC)

software package. The end result of this process is a rasterized heat map that depicts areas of higher and lower ecological value in the Planning District (Figure 2.). This GIS raster basemap establishes an ecological blueprint that can be used for future transportation and development planning activities.

Tool Functionality

The raster nature of the REF basemap allows it to be used in conjunction with Esri ArcGIS's Spatial Analyst software to conduct various kinds of analysis. Currently, the REF can be used to automatically identify a new project's alignment with the least potential impacts on the Region's ecology. The REF can also be used to compare the ecological impacts for different project scenarios. Finally, the REF tool can be used to identify and prioritize mitigation sites in the region for regulated resources such as, stream and wetland mitigation. This ecosystem-based approach to mitigation provides opportunities for restoring, creating, enhancing, and preserving ecosystem features that might not exist within the typical approach to mitigation. Project alternative scores are achieved by selecting a set of alternative routes and then identifying some basic information about the selected routes. At a minimum information such as the number of vehicle lanes, sidewalk widths, and a start and end point are needed to build a roadway profile that can be fed into GIS. Once the scenarios are constructed in GIS they can be analyzed against the REF using the Esri ArcGIS Spatial Analyst Zonal Statistics tool. The analysis process produces a statistical score depicting a project's potential relative impact on the regions ecological framework. This score can be used to compare scenarios and determine whether a project would have a significant impact on regional ecology. In the following section this methodology was used to analyze scenarios suggested as part of the Eastern Connector Study.

How the Tool Works

There are two additional functions that can be performed using the REF tool. The first is the tool can suggest the least ecologically damaging alternative. The tool models this alternative by using a start and end point and then automatically identifying the path between those points with the least potential ecological cost to the REF. This function is useful for creating a base for comparing other project scenarios and for identifying a least impact alternative for the NEPA process.

The final function of the REF tool is to help identify mitigation opportunities on a regional scale as opposed to a project specific scale. This step was done as part of the previous Eco-Logical study and will be revised once the REF has been updated. Previous efforts focused on identifying stream and wetland mitigation opportunities in the Planning District that would provide the most benefit to the environment as a whole. (More information about this process is available from TJPDC's *Eco-Logical: Integrating Green Infrastructure and Regional Transportation Planning Report).*

Figure 2. Regional Ecological Framework Map

- REF Information -

Data Type: Value based raster geographic dataset

Data Resolution: 1 pixel is equal to 30m^2 (or ~98ft^2)
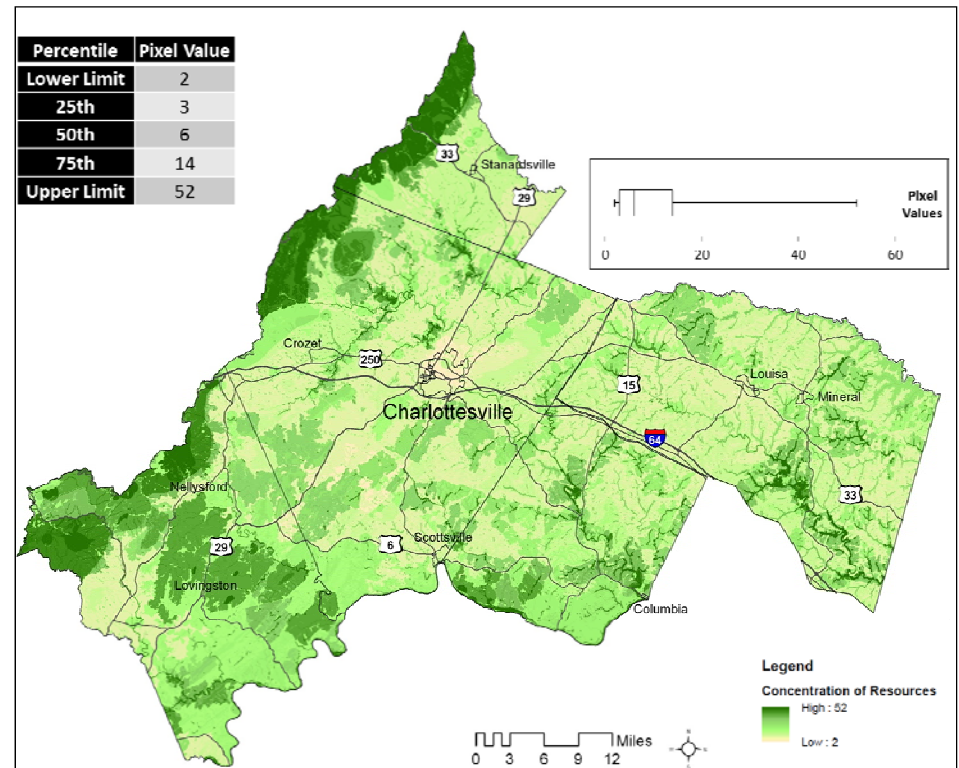
Scale: Planning District

Number of Attributes: 1

Value Range: 2 (low) to 52 (high).

Average Value: 6

Number of Input Datasets: 10

How the Tool Works

This section explores the functionality of the REF tool. The REF tool was used to analyze seven project alternatives put forward as part of the Eastern Connector Study. These projects were analyzed using the REF tool to demonstrate how the tool works. As a result routings, alignments, and roadway widths were approximated based on the information in the Eastern Connector and staff interpretation. Results of the Eco-logical analysis are highlighted in the table below.

The table shows a list of Eco-logical scores for each of the seven options. These scores are derived from the pixel values in the REF map (Figure 2, page 10). The scores were calculated using GIS to overlay each project on top of the REF Map, and then running a set of GIS tools to calculate the pixel values that fall within each of the alternative estimated project alignments.

Figure 3. REF Modeling Results

Project Name	Average Eco-Logical Score (mean)	Score Per Mile	Length (miles)
2 Lane E. Connector	6.45	144.9	0.49
2 Lane E. Connector Pen Park Road Improvements (existing Roadway)	2.00	46.4	0.69
4 Lane E. Connector	5.81	189.8	0.49
4Lane E., Connector Pen Park Road Improvements (existing Roadway)	2.00	72.5	0.69
I-64 Widening (East)	5.10	151.3	6.24
I-64 Widening (West)	5.36	142.4	6.21
Limited Access 250	3.73	113.3	2.7
South Pantops Drive Connector	8.00	222.2	0.18
State Farm Blvd Connector	4.92	96.7	0.61

The results in the table reflect that the various scenarios have a Eco-Logical score that ranges from a high of 8 for a South Pantops Drive connector, to a low of 3.75 for US-250 limited access improvements. The average Eco-Logical score for all existing roads in the MPO is 4.5. This provides a yardstick which can be used to understand the potential impacts of new projects being considered. It is important to note that both the urbanized area (defined by the MPO boundary) and the Regional REF have the same score range of between 2 and 52 and a mean of 7.03. This most likely is do to the availability of high quality habitats close to the urban area.

The map in figure 4 depicts the seven alternatives analyzed against the REF. It also depicts each projects least cost path. At this time the functionality of such an analysis is limited by the data included in the tool. Currently the tool is only populated with ecological information and as a result does not currently have the ability to factor in the built environment into the logic of the least cost path analysis. This results in unexpected paths between points with considerable distance between them. This is clearly evident in the least cost path suggested for the I-64 expansion scenario where the suggested path would take the project through the heart of Charlottesville. This path is the result of the model attempting to avoid concentrations of resources along the Rivanna River and Moores Creek.

As mentioned earlier one of the project goals is to improve the tool to make it more functional and accurate. By adding in additional datasets and building a second module that factors the built environment the tools ability to suggest least impactful alternatives will improve and become more relevant for evaluating projects that have a relatively spread out start and end point.

Figure 4. Map of Eastern Connector Scenarios Analyzed with REF Tool

REF Datasets

The following section looks at the datasets that make up the current REF map and provide the ranking and scoring that allow the REF tool to function. The current version of the tool is focused solely on environmental features and specifically attempts to address regulated environmental resources on a regional scale such as wetlands, water bodies, and State or Federal threatened or endangered species.

The datasets included in the existing REF were identified and ranked by an advisory committee made up of representatives from the Department of Conservation and Recreation, The Department of Game and Inland Fisheries, The Rivanna River Basin Commission, Fluvanna County, Nelson County, City of Charlottesville and the Thomas Jefferson Soil and Water Conservation District. This advisory committee was originally assembled as part of TJPDC's 2009 Green Infrastructure Study and was reassembled to assist TJPDC in developing its existing REF tool and the Eco-Logical: Integrating Green Infrastructure and Regional Transportation Planning report.

The current version of the REF contains ten datasets that cover environmental features such as threatened or endangered species siting's, landscape assessments, watershed models, wetlands and stream locations. A full list of the datasets are provided below:

Tiered Species Habitats (Terrestrial and Aquatic)

Dataset Description

The Department of Game and Inland Fisheries (DGIF's) Tiered Species Habitat data shows the number of Tier 1, 2 or listed species with mapped potential or confirmed essential habitat across Virginia. DGIF developed this dataset as part of the Virginia Wildlife Action Plan (WAP), of the 358 species in these tiers, habitats were mapped for 247 of them, Of the 247 species 149 were terrestrial and 98 were aquatic. This data can be used to highlight conservation opportunities across the State. The tiers are described as follows:

Tier I. Critical conservation needed. Faces an extremely high risk of extinction or extirpation. Populations of these species are at critically low levels, face immediate threats, or occur within an extremely limited range. Intense and immediate management action is needed.

Tier II. Very high conservation needed. Has a high risk of extinction or extirpation. Populations of these species are at very low levels, face real threat(s), or occur within a very limited distribution. Immediate management is needed for stabilization and recovery.

- Dataset Information -

Data Source: Dept. of Game and Inland Fisheries
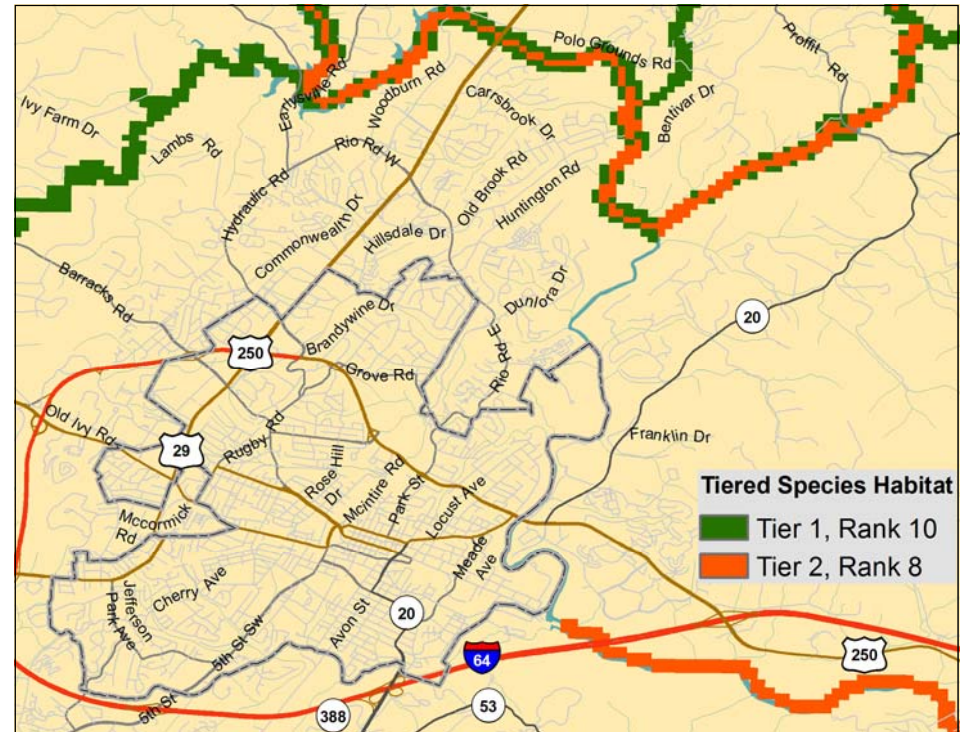
Date Published: 2009

Assessment Scale: Virginia Wide

Number of Attributes: 2

Types of Species and Habitats: Plants animals and their habitats.

Link: http://www.dgif.virginia.gov/gis/werms.asp
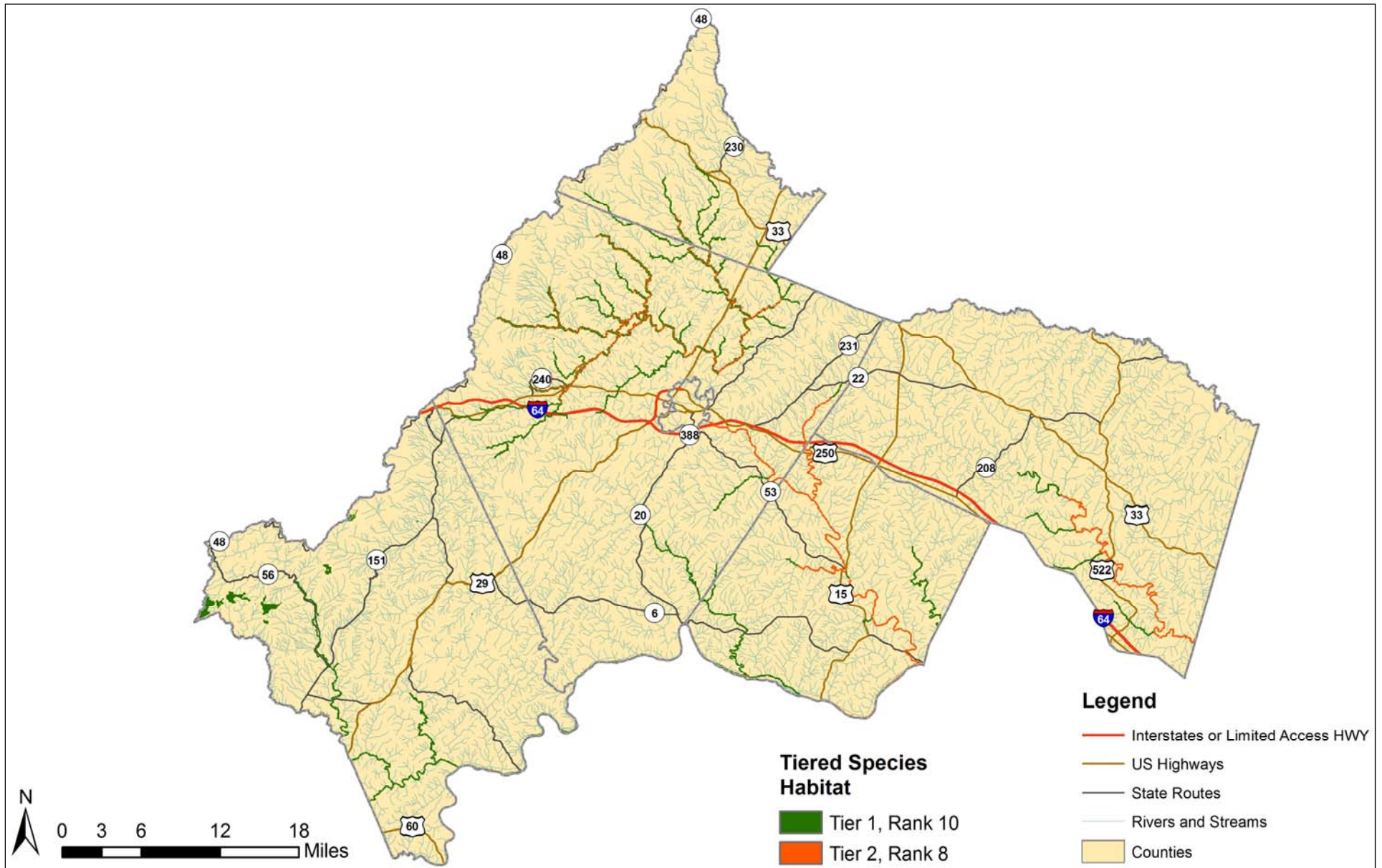
Free-Bridge Area Map

Attributes	Existing Ranking*
Tier 1	10
Tier 2	8

*Ranking scale goes from 2 (low) to 10 (high)

Legend

Interstates or Limited Access HWY
US Highways
State Routes
Rivers and Streams
Counties

Tiered Species Habitat

Tier 1, Rank 10
Tier 2, Rank 8

N
0 3 6 12 18 Miles

Threatened and Endangered Species Waters

Dataset Description

DGIF's Threatened and Endangered Species Water dataset identifies water bodies that contain documented occurrences of federal or state listed threatened or endangered species (i.e. the James River Spinymussel). Each water body included in the dataset contains descriptive fields that identify the stream name, the upstream and downstream boundaries of observed distribution, listing status (federal or state) and the length of the stream. Species included in this dataset are limited to species inhabiting primarily lotic, or riverine, habitats including fish, mollusks, crayfish, snails and the wood turtle. Tier descriptions are as follows:

Tier I. Critical conservation needed. Faces an extremely high risk of extinction or extirpation. Populations of these species are at critically low levels, face immediate threats, or occur within an extremely limited range. Intense and immediate management action is needed.

Tier II. Very high conservation needed. Has a high risk of extinction or extirpation. Populations of these species are at very low levels, face real threat(s), or occur within a very limited distribution. Immediate management is needed for stabilization and recovery.

- Dataset Information -

Data Source: Dept. of Game and Inland Fisheries

Date Published: 2009

Assessment Scale: Virginia Wide

Number of Attributes: 2

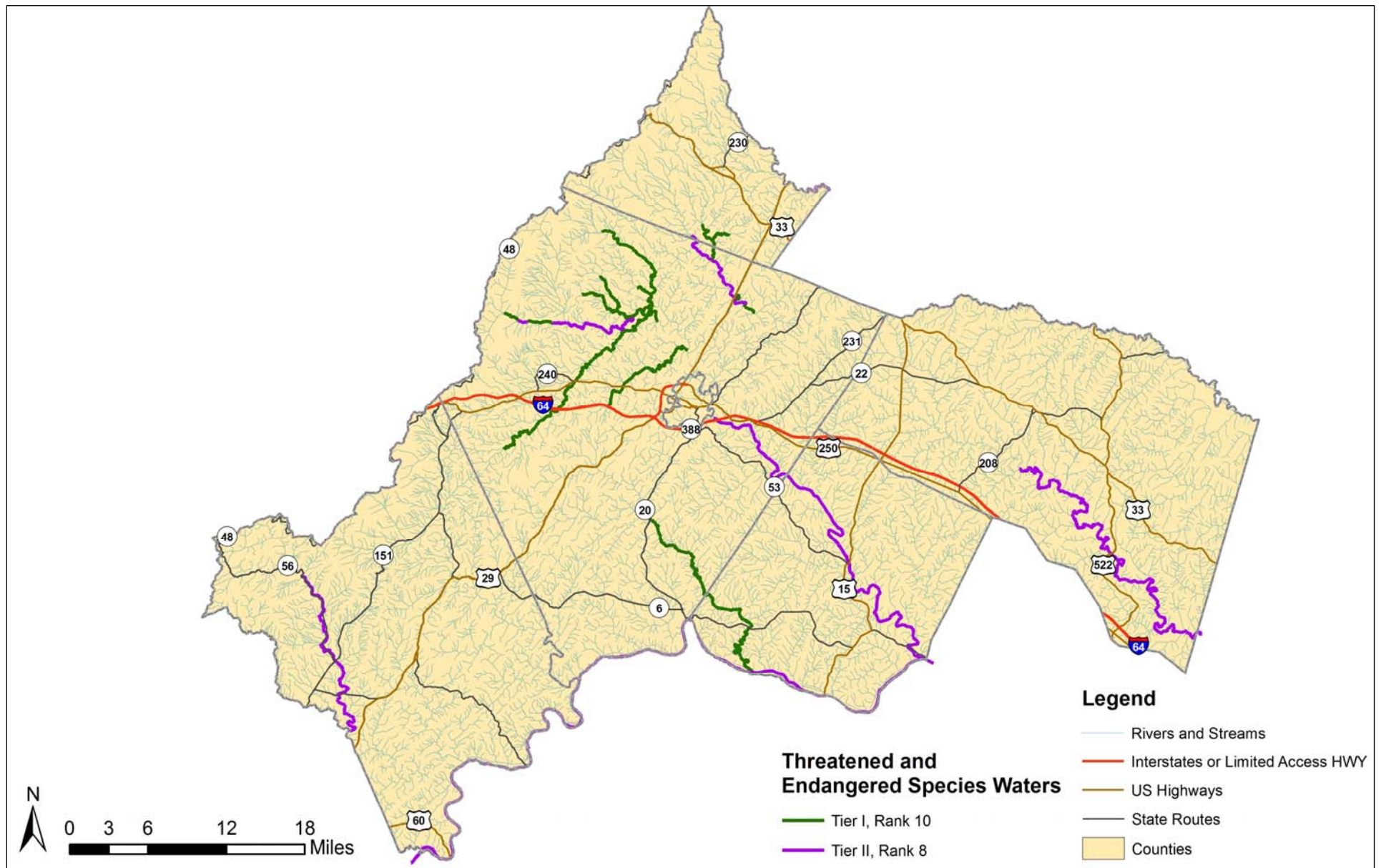**Types of Species and Habitats:** Plants animals and their habitats.

Link: http://www.dgif.virginia.gov/gis/gis-data.asp

Free-Bridge Area Map

Attributes	Existing Ranking*
Tier 1	10
Tier 2	8

*Ranking scale goes from 2 (low) to 10 (high)

16

Threatened and Endangered Species Waters

Legend

Threatened and Endangered Species Waters
— Tier I, Rank 10
— Tier II, Rank 8

— Rivers and Streams
— Interstates or Limited Access HWY
— US Highways
— State Routes
Counties

Species Observations

Dataset Description

DGIF's Species observations database contains species observations data derived from ten different sources, including: the Virginia Breeding Bird Atlas Project; Cold Water Stream Survey; WMA Bird Surveys; Rare Bird Sittings: Mid-winter Bald Eagle survey; Bald Eagle Nest Database; VDGIF Scientific Collections, TE, and salvage permit data; Colonial Waterbird locations: and Colonial Waterbirds 2003 data. In order to make the data compatible for the REF, areas with clusters of species were dissolved so as not to overvalue areas where the same species is observed multiple times in close proximity.

- Dataset Information -

Data Source: Dept. of Game and Inland Fisheries
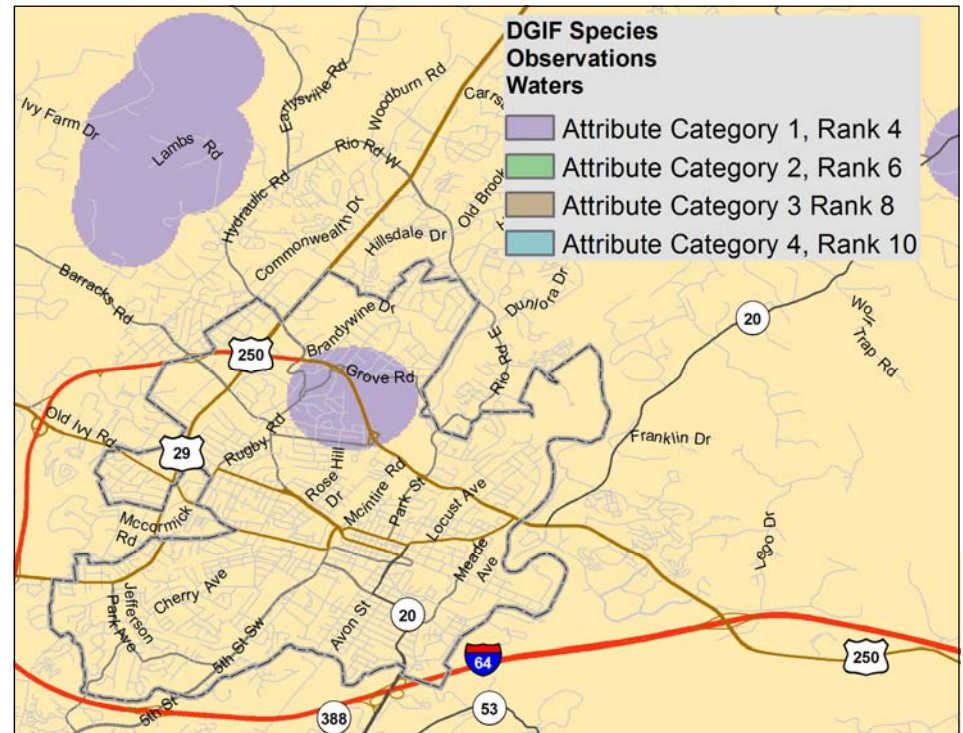
Date Published: 2009

Assessment Scale: Virginia Wide

Number of Attributes: 2

Types of Species and Habitats: Rare and endangered species

Link: http://www.dgif.virginia.gov/gis/werms.asp

Free-Bridge Area Map

Attributes	Existing Ranking*
1	4
2	6
3	8
4	10

*Ranking scale goes from 2 (low) to 10 (high)

Virginia Natural Landscape Assessment (VaNLA)

Dataset Description

The VaNLA is the ecological component of DCR's Virginia Conservation Lands Needs Assessment (VCLNA). It is a landscape-scale geospatial analysis tool for identifying, prioritizing, and linking natural lands in Virginia. The tool was developed from satellite derived land cover data. The data identifies unfragmented patches of natural land with at least one hundred acres of natural cover, these large patches are known as cores and start 100 meters in from a patch edge. The dataset classifies cores based on ecological integrity with C1 being the highest and C5 being the lowest. All C1 and C2 cores are connected by landscape corridors and nodes that create a statewide network of natural lands. The tool identified corridors through an analysis process by which landscape barriers to wildlife movement were identified and overlaid onto high value cores (C1 and C2). The tool then analyzed the easiest route between all C1 and C2 cores.

- Dataset Information -

Data Source: Dept. of Conservation and Recreation

Date Published: 2007

Assessment Scale: Virginia Wide

Number of Attributes: 6

Types of Species and Habitats: Landscapes and Habitat

Link: http://www.dcr.virginia.gov/natural_heritage/vclnavnla.shtml

Free-Bridge Area Map

Attributes	Existing Ranking*
C1 Cores (Outstanding)	10
C2 Cores (Very High)	8
C3 Cores (High)	6
C4 Cores (Moderate)	4
C5 Cores (General)	2
Corridors	2

*Ranking scale goes from 2 (low) to 10 (high)

Priority Conservation Sites

Dataset Description

The Virginia Natural Heritage Program (VNHP) has developed a number of GIS planning tools to facilitate land conservation with the ultimate goal of biodiversity protection. The Priority Conservation Site database is made up of natural heritage conservation sites, stream conservation units and general locations. The layer documents key areas of the landscape that are worthy of protection and stewardship because of the natural heritage resources and habitats they support. stream conservation units identify stream reaches that contain aquatic natural heritage resources and extend upstream and downstream of identified reaches. Conservation site and stream conservation units in this dataset are ranked here to coincide with DCR's Biodiversity Need ranking, with B1 being "critical" and B5 being "moderate". Note no B1 habitat areas were identified in the Planning District. As a result, B2 with a rank of 9 is the highest scoring category of conservation site in the Planning District.

- Dataset Information -

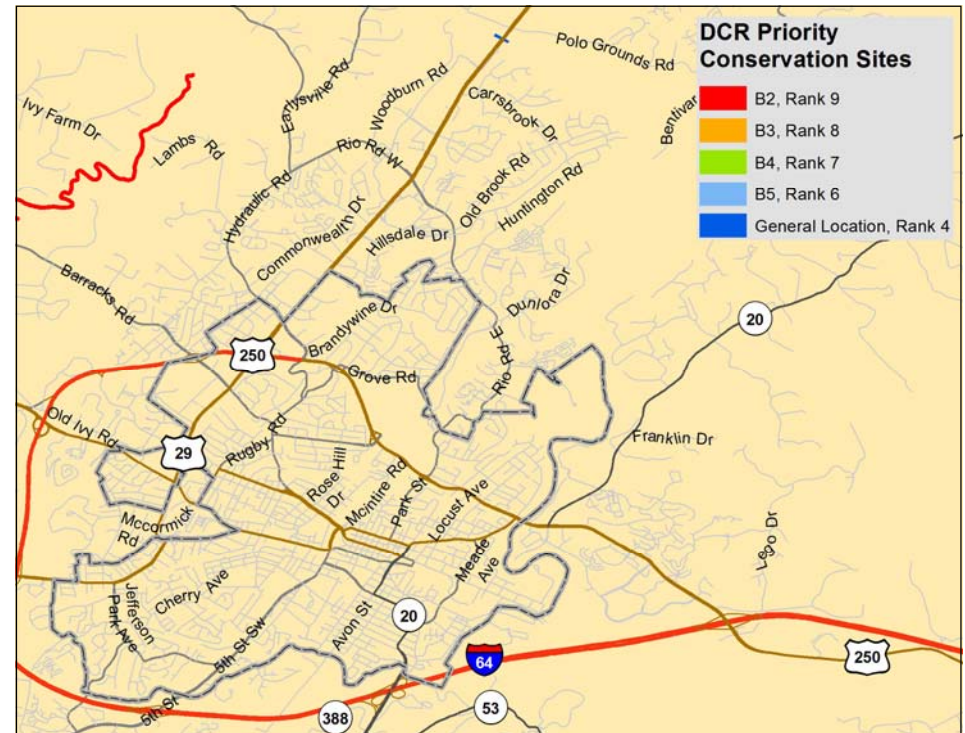**Data Source:** Dept. of Conservation and Recreation

Date Published: 2007

Assessment Scale: Virginia Wide

Number of Attributes: 6

Types of Species and Habitats: Conservation Sites

Link: http://www.dcr.virginia.gov/natural_heritage/

Free-Bridge Area Map

Attributes	Existing Ranking*
B1	n/a
B2	9
B3	8
B4	7
B5	6
General Location	4

*Ranking scale goes from 2 (low) to 10 (high)

DCR Priority Conservation Sites

- B2, Rank 9
- B3, Rank 8
- B4, Rank 7
- B5, Rank 6
- General Location, Rank 4

Legend

- Interstates or Limited Access HWY
- US Highways
- State Routes
- Counties

Audubon Important Bird Areas

Dataset Description

The National Audubon Society's Important Bird Areas (IBA) Program identifies and attempts to conserve areas that are vital to birds and their biodiversity. IBA's include sites that provide essential habitat for one or more species of bird. Such sites include important areas for bird breeding, wintering and/or migratory bird routes. IBA's range in scale from a few acres up to areas of several thousand acres. IBA's include lands that are in both public and private ownership and can be protected or unprotected. IBA sites must satisfy one of the following criteria to be listed.

- Species of conservation concern (threatened or endangered species).
- Restricted-ranges species (species vulnerable because they are not widely distributed).
- Species that are vulnerable because their populations are concentrated in one general habitat type or biome.
- Species, or groups of similar species (such as waterfowl or song birds), that are vulnerable because they occur at high densities do to their congregatory behavior.

- Dataset Information -

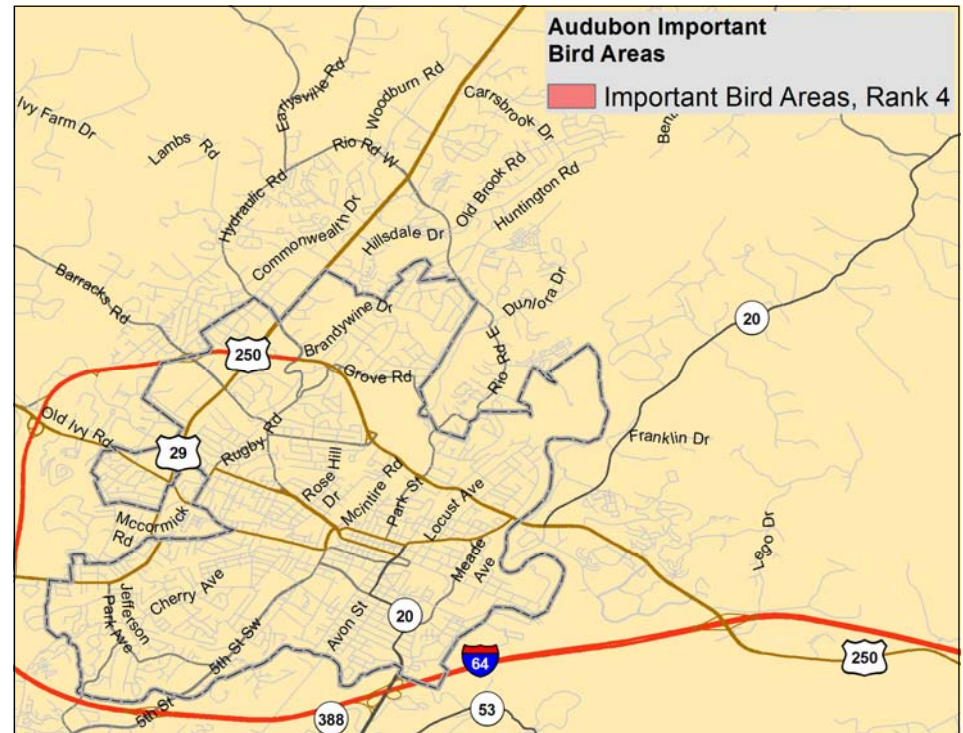**Data Source:** National Audubon Society

Date Published: 2007

Assessment Scale: Virginia Wide

Number of Attributes: 6

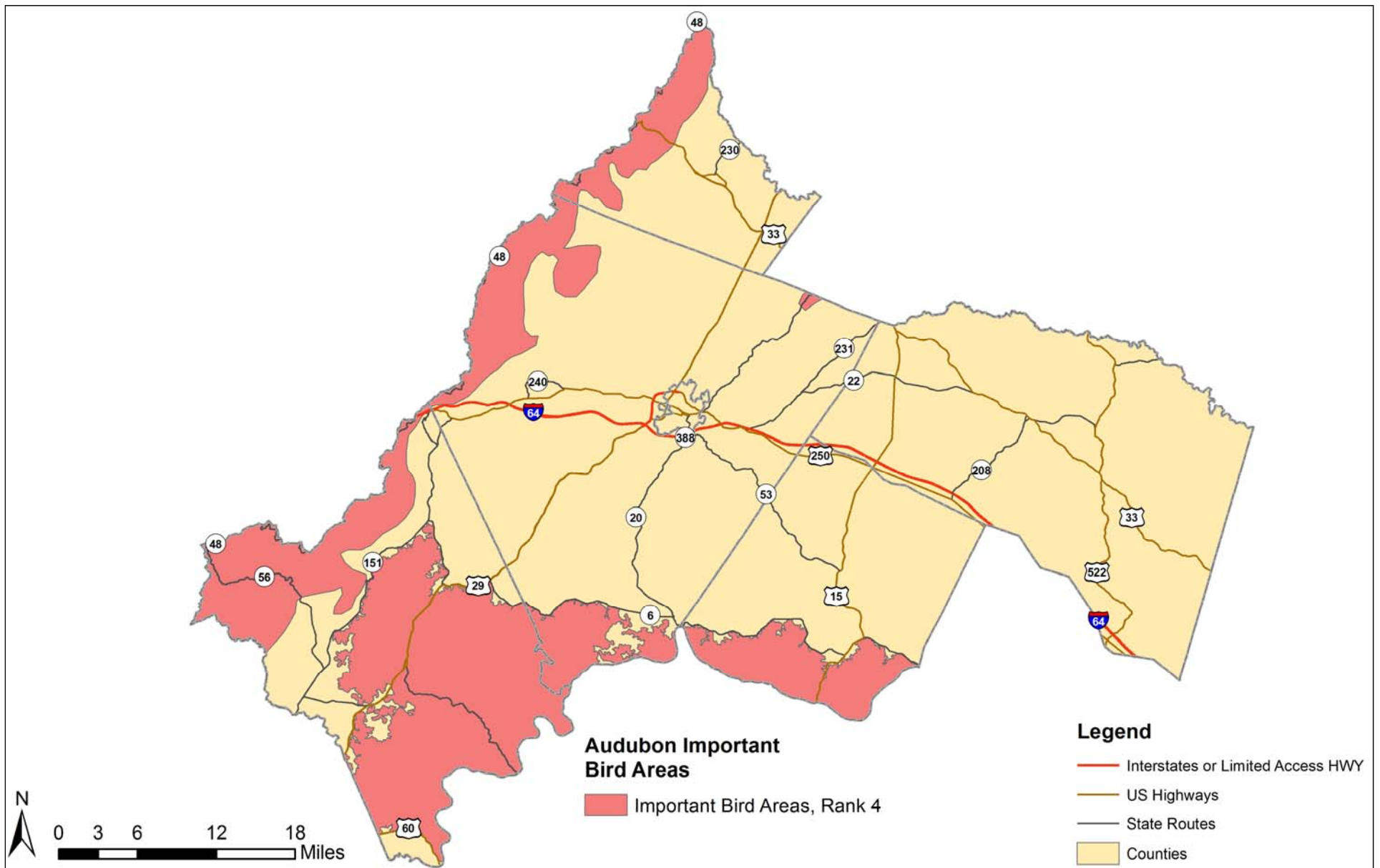**Types of Species and Habitats:** Birds

Link: http://web4.audubon.org/bird/iba/virginia/

Free-Bridge Area Map

Attributes	Existing Ranking*
Important Bird Areas	4

*Ranking scale goes from 2 (low) to 10 (high)

24

Audubon Important Bird Areas

Audubon Important Bird Areas

Important Bird Areas, Rank 4

Legend

— Interstates or Limited Access HWY
— US Highways
— State Routes
▢ Counties

N

0 3 6 12 18 Miles

National Wetlands Inventory

Dataset Description

The U.S. Department of the Interiors Fish and Wildlife Service, National Wetlands Inventory dataset provides current geospatially referenced information on the status, extent, characteristics, and function of wetlands, riparian, deepwater, and related aquatic habitats in the contiguous United States. The data delineates the areal extent of wetlands and surface waters in conformance with the wetland definitions established by *Classification of Wetlands and Deepwater Habitats of the United States;* Cowardin et al. (1979). By policy, the Database excluded certain types of "farmed wetlands" as may be defined by the Food Security Act of 1985, or that do not coincide with the Cowardin et al. definition. Note: Due to the scale and method by which the NWI data was derived it's primarily intended to be used for regional analysis and display rather than site specific analysis. "The [NWI] map products were neither designed nor intended to represent legal or regulatory products" (USFWS 2010). The dataset used in creating the REF also included a 200 foot buffer around wetland sites. The 200 foot buffer area size and rankings are similar to those used in previous wetland studies.

- Dataset Information -

Data Source: U.S. Fish and Wildlife Service
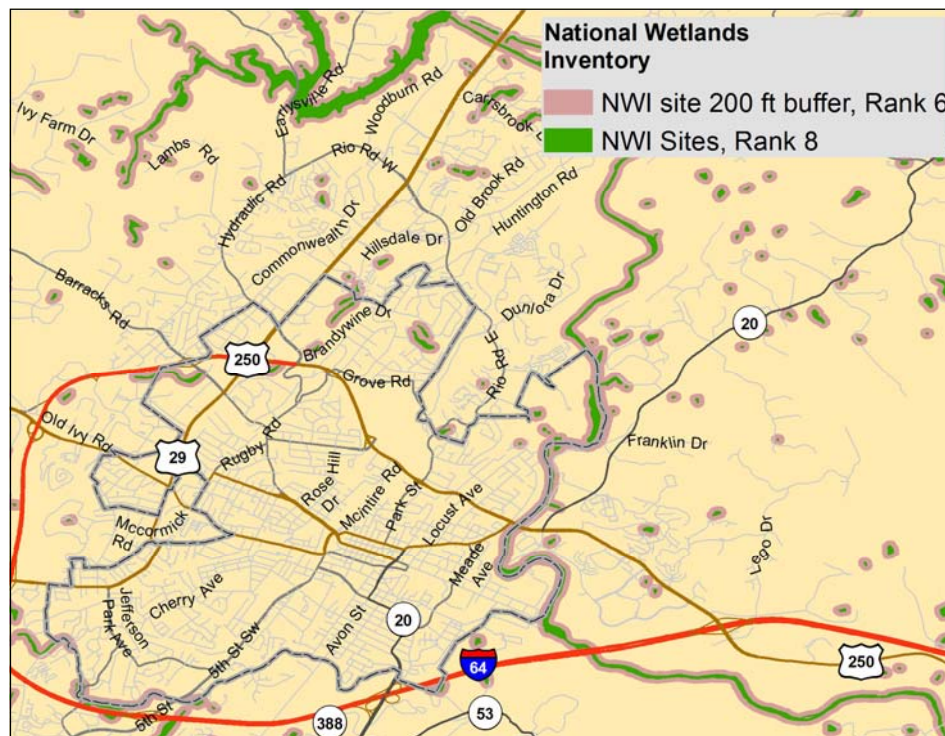
Date Published: 1984 (TJPDC Region)

Assessment Scale: Nation Wide

Number of Attributes: 2

Types of Species and Habitats: Wetlands

Link: http://www.fws.gov/wetlands/Data/index.html
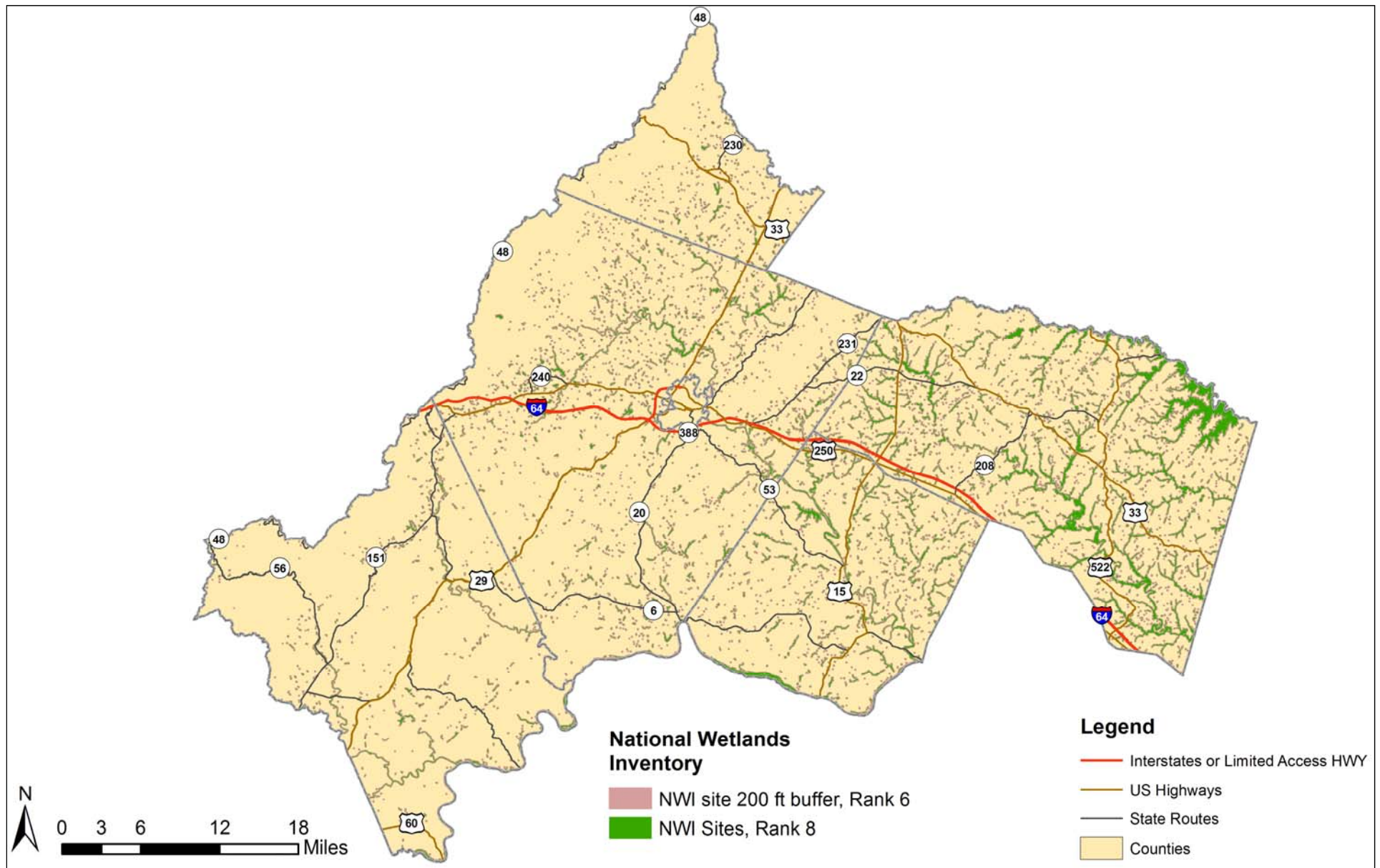
Free-Bridge Area Map

Attributes	Existing Ranking*
National Wetlands Inventory	8
200 Foot Buffer	6

*Ranking scale goes from 2 (low) to 10 (high)

National Wetlands Inventory

Legend

National Wetlands Inventory
- NWI site 200 ft buffer, Rank 6
- NWI Sites, Rank 8

Legend
- Interstates or Limited Access HWY
- US Highways
- State Routes
- Counties

VCLNA Watershed Integrity Model

Dataset Description

The Virginia Watershed Integrity Model was developed by DCR to show the relative value of land as it contributes to watershed and water quality integrity. It is the water quality component of the Virginia Conservation Lands Needs Assessment (VCLNA). The input parameters used in creating this model focused on identifying important terrestrial features that contribute to water resources, and therefore watershed integrity as a whole. The model uses a variety of datasets including: slope, wetlands, streams, cores/forested areas, and a terrestrial and aquatic index. Note: The Planning District contained no areas with a Watershed Integrity Value of five. As a result the highest watershed value in the Region was 4 with a highest possible rank of 8.

- Dataset Information -

Data Source: VA Dept. of Conservation and Recreation
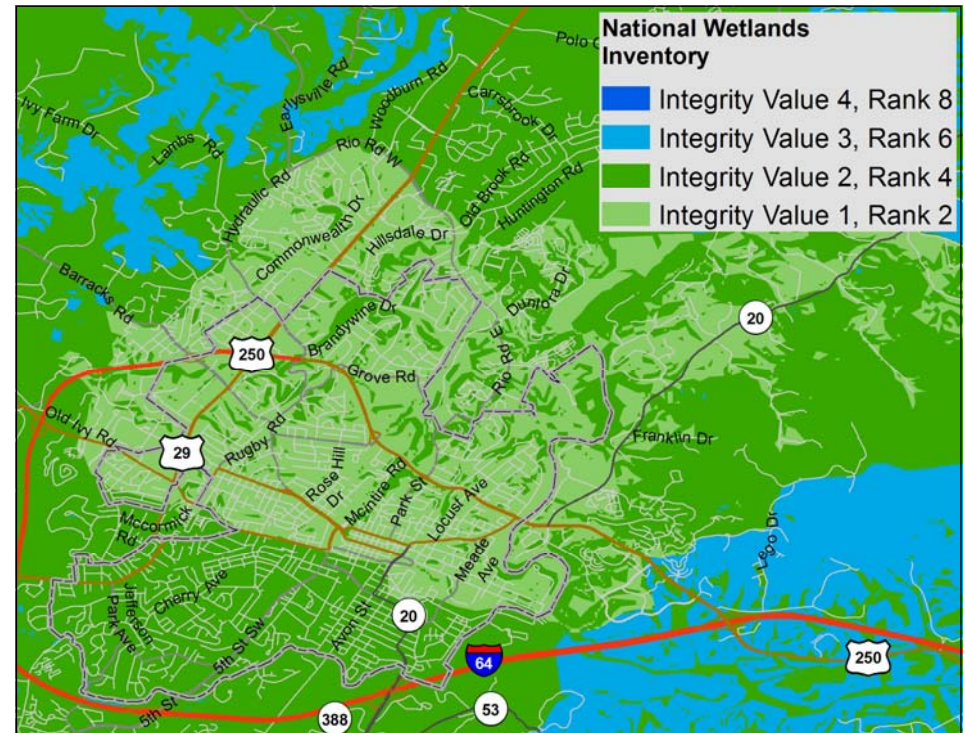
Date Published: 2007

Assessment Scale: State Wide

Number of Attributes: 5

Types of Species and Habitats: Wetlands

Link: http://www.dcr.virginia.gov/natural_heritage/vclnawater.shtml

Free-Bridge Area Map

Attributes	Existing Ranking*
Watershed Integrity Value 5	n/a
Watershed Integrity Value 4	8
Watershed Integrity Value 3	6
Watershed Integrity Value 2	4
Watershed Integrity Value 1	2

*Ranking scale goes from 2 (low) to 10 (high)

28
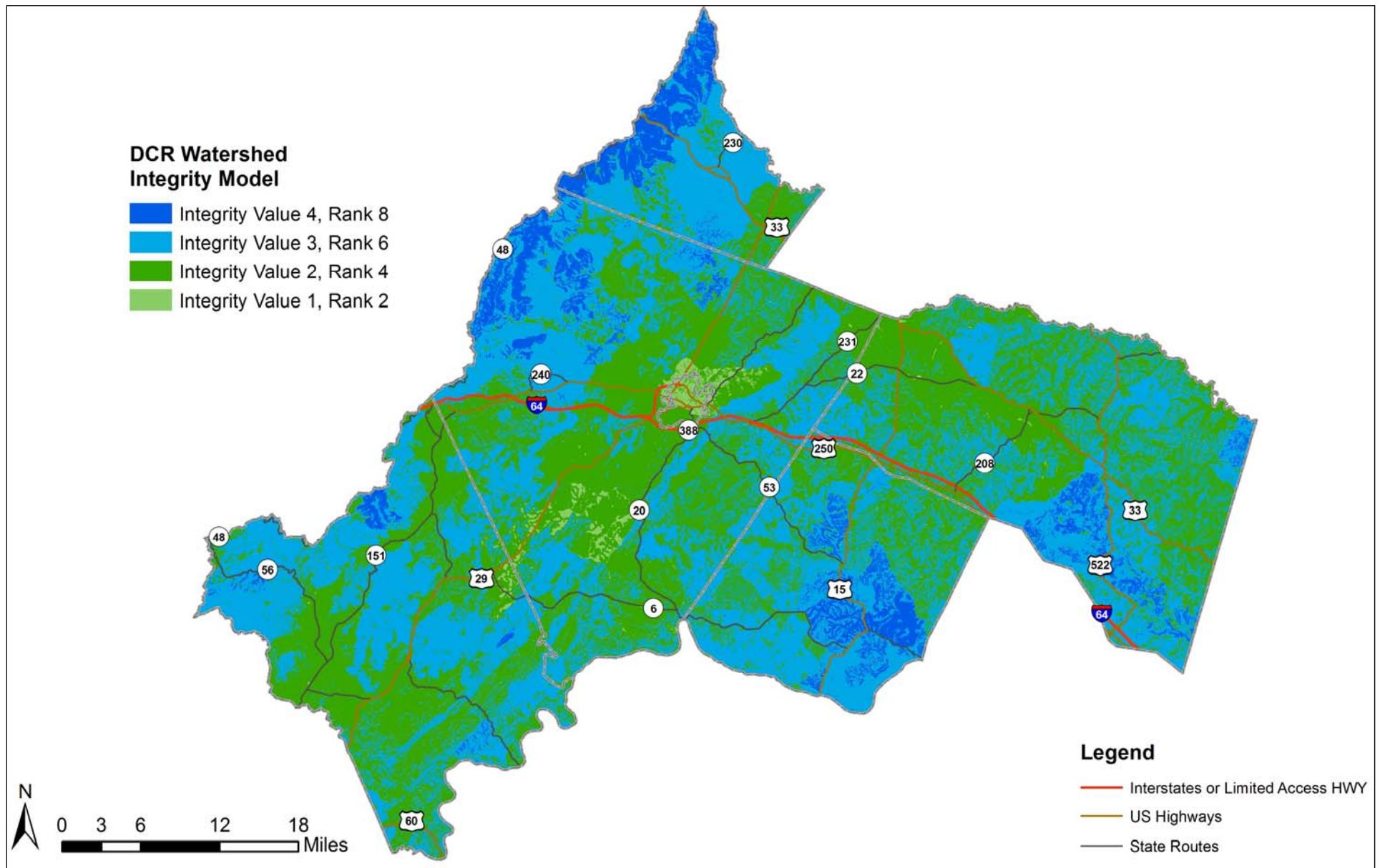
National Hydrographic Dataset

Dataset Description

The National Hydrography Dataset is a comprehensive set of digital spatial data containing information about surface water features in the United States. The dataset contains features such as lakes, ponds, streams, rivers, canals, dams and streamgages. For the REF stream centerline data at the medium or, 1:100,000 scale was mapped according to Strahler Stream Order. This allowed for different buffer widths based on a streams order in the watershed.

Stream order is a method of identifying stream size based on a hierarchy of tributaries. First order tributaries are headwater streams that have no branches flowing into them. These are followed by second order streams that are fed by two or more first order streams. This continues in a downstream direction until streams and rivers reach the outlet of a watershed. In the case of the REF stream orders were categorized into first order, second order and third order or above.

- Dataset Information -

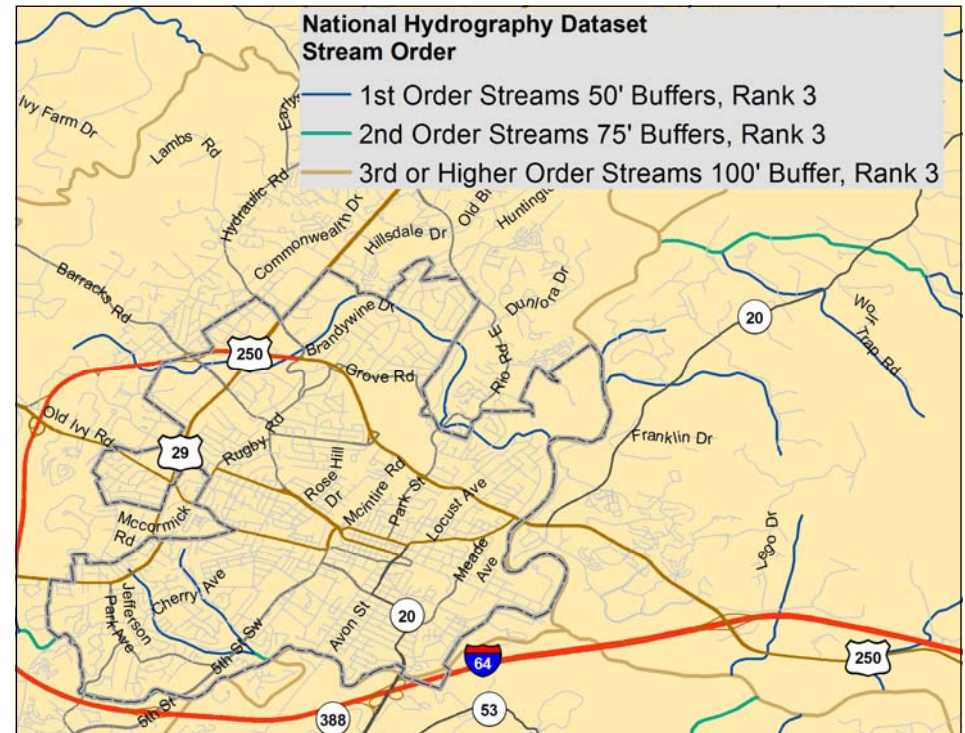**Data Source:** U.S Geological Survey

Date Published: 2008

Assessment Scale: Nation Wide

Number of Attributes: 3

Types of Species and Habitats: Streams and Rivers

Link: http://nhd.usgs.gov/

Free-Bridge Area Map

Attributes	Existing Ranking*
First Order Stream 50' Buffer	3
Second Order Stream 75' Buffer	3
Third Order Stream 100' Buffer	3

*Ranking scale goes from 2 (low) to 10 (high)

National Hydrography Dataset
Stream Order

— 1st Order Streams 50' Buffers, Rank 3
— 2nd Order Streams 75' Buffers, Rank 3
— 3rd or Higher Order Streams 100' Buffer, Rank 3

Legend

— Interstates or Limited Access HWY
— US Highways
— State Routes
Counties

Cold Water Stream Survey

Dataset Description

The Virginia Department of Game and Inland Fisheries Cold Water Stream Survey represents the departments suitable trout stream survey data in spatial form. In addition to stream reach location, the dataset included biological and physiochemical data about each classified stream reach or specific sample location. DGIF biologists have identified all the reaches in this dataset as wild (class I-IV) or stackable (class V-VI). The classifications give these streams and of the tributaries that lead to them special management considerations and protections.

Free-Bridge Area Map

Attributes	Existing Ranking*
Class I	7
Class II	6
Class III	5
Class IV	4

*Ranking scale goes from 2 (low) to 10 (high)

- Dataset Information -

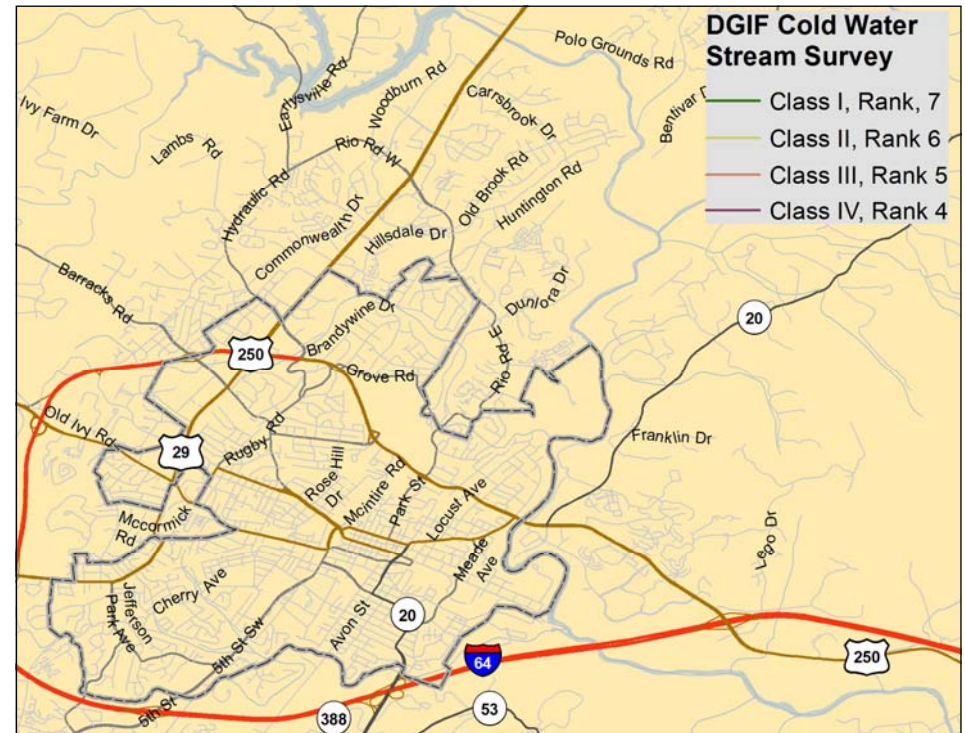**Data Source:** VA Dept. of Game and Inland Fisheries

Date Published: 2011

Assessment Scale: Virginia

Number of Attributes: 4

Types of Species and Habitats: Cold water fisheries habitat (Trout)

Link: http://www.dgif.virginia.gov/gis/gis-data.asp
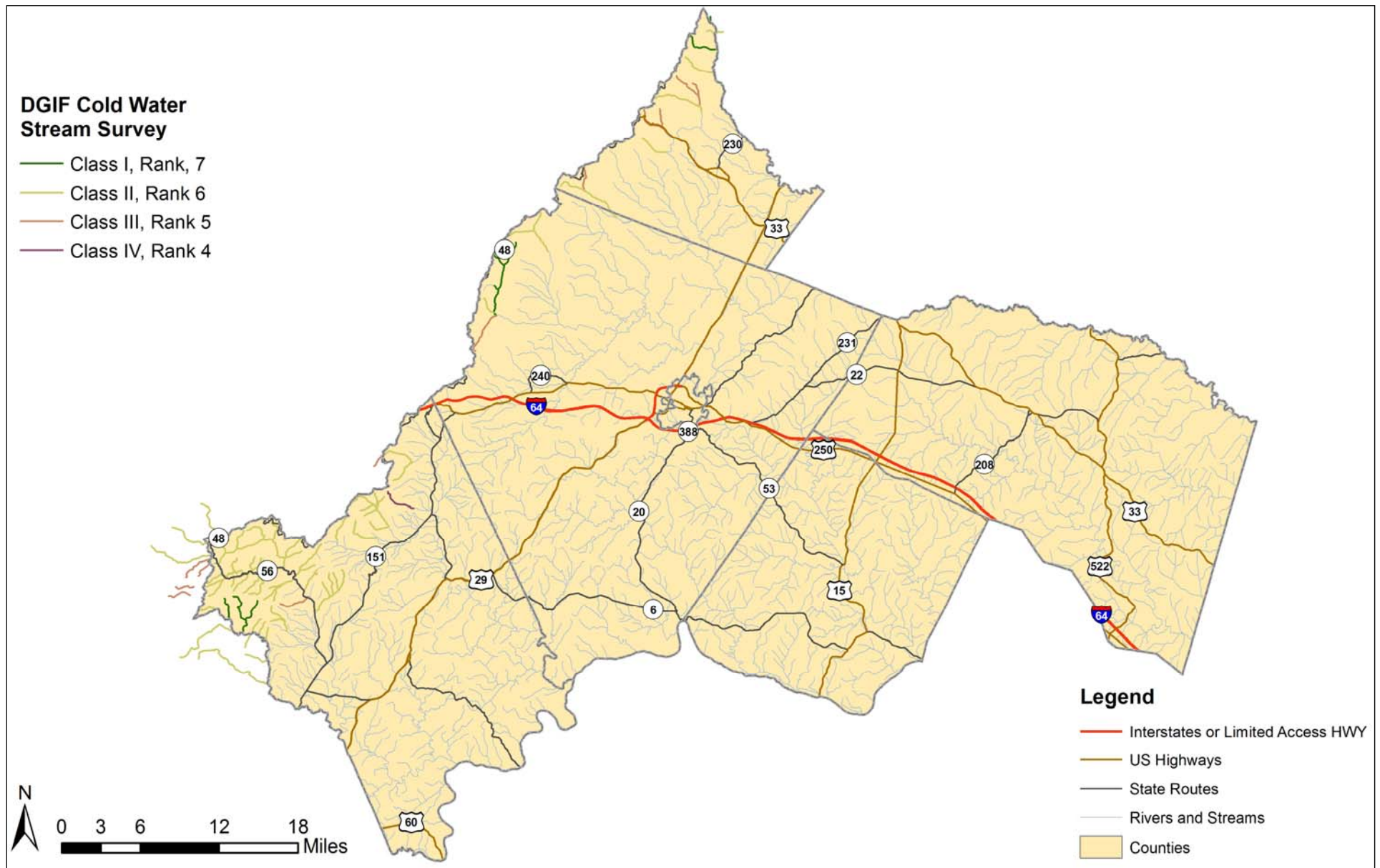
DGIF Cold Water Stream Survey

— Class I, Rank, 7
— Class II, Rank 6
— Class III, Rank 5
— Class IV, Rank 4

Legend

— Interstates or Limited Access HWY
— US Highways
— State Routes
— Rivers and Streams
☐ Counties

Existing Dataset Attribute Ranking Summary

Dataset	Attribute	Rank	Description
DGIF Tiered Species Habitat (terrestrial and aquatic)	2	10	The dataset highlights wildlife conservation opportunities in the Commonwealth. The data focuses on tier I and tier II listed species with mapped potential habitat.
	1	8	
DGIF Threatened & Endangered Species Waters	Tier I	10	The dataset Identifies water bodies that contain documented occurrences of Federal or state listed threatened or endangered specie.
	Tier II	8	
DGIF Species Observations - Diversity, # of Species Present	1	4	The dataset contains species observation data derived from various data sources and surveys.
	2	6	
	3	8	
	4	10	
DCR Virginia Natural Landscape Assessment (VaNLA)			The dataset contains statewide information on natural lands. The dataset was derived from satellite imagery and identifies large cores of intact habitat. Cores are ranked based on size and ecological integrity
Habitat Cores	1	10	
	2	8	
Habitat Corridors		2	
Cores 3 - 5 that intersect corridors	3	6	
	4	4	
	5	2	
DCR Priority Conservation Sites	B1	N/A	The dataset is a tool for identifying key areas that are worthy of protection stewardship action because of the natural heritage resources that they contain.
	B2	9	
	B3	8	
	B4	7	
	B5	6	
	General Location	4	
Audubon Important Bird Areas		4	The dataset identifies areas that are vital to birds and their biodiversity.
USFWS National Wetlands Inventory	wetlands	8	The dataset provides current geospatially referenced information on the location and extent of wetlands.
	200' buffer	6	
DCR VCLNA Watershed Integrity Model	5	N/A	The dataset shows the relative value of land as it contributes to watershed or water quality integrity.
	4	8	
	3	6	
	2	4	
	1	2	
NHD 1:100,000 streams			The dataset is a comprehensive database that contains information about the location and type of water bodies in the United States.
1st order	50' buffer	3	
2nd order	75' buffer	3	
3rd order and above	100' buffer	3	
DGIF Cold Water Stream Survey - Classes I - IV - 100' buffer	Class I	7	The dataset is the results of DGIF's efforts to survey streams for trout suitability.
	Class II	6	
	Class III	5	
	Class IV	4	

Terms and Abbreviations

Terms

Aquatic species:
Aquatic species are species that live predominantly or entirely in the water.

Buffer:
A buffer is an designated area around an object or a location of interest. When analyzing projects using the REF a 500 foot buffer is used to represent the area of potential impact.

Extinction:
In ecology, Extinction is considered the end of a species. It is generally considered to occur after the death of the last individual of that species.

Extirpation:
Is a term used in ecology and biology to identify a species as being locally extinct form a particular geography of range that the specie once inhabited.

Geospatial analysis:
Geospatial analysis is an approach that applies statistical analysis and other information techniques to data which has been geospatially linked or referenced.

Pixel:
In the case of the REF pixels are square cells containing the values that represent the ecological value of a location. Each pixel has a resolution of 30 meters or 98 feet.

Patch:
A habitat patch is any discrete area with a definite shape that is occupied by species for breeding and obtaining resources.

Terrestrial species:
Terrestrial species are species that live predominantly or entirely on land.

Watershed:
A watershed is an area of land that drains to a common point on the landscape.

Abbreviations

VaNLA:
Virginia Natural Landscape Assessment of 2007. http://Website: www.dcr.virginia.gov/natural_heritage/vclnavnla.shtml

DCR:
Virginia Department of Conservation and Recreation

DGIF:
Virginia Department of Game and Inland Fisheries

USFWS:
U.S. Fish and Wildlife Service

NHD:
National Hydrography Dataset. http://nhd.usgs.gov/

GIS:
Geographic Information System

VCLNA:
Virginia Conservation Lands Needs Assessment

FHWA:
Federal Highways Administration

Links

Audubon Important Bird Areas: http://web4.audubon.org/bird/iba/virginia/

DCR Priority Conservation Sites: http://www.dcr.virginia.gov/natural_heritage/

DCR VCLNA Watershed Integrity Model: http://www.dcr.virginia.gov/natural_heritage/vclnawater.shtml

DCR Virginia Natural Landscape Assessment: http://www.dcr.virginia.gov/natural_heritage/vclnavnla.shtml

DGIF Cold Water Streams: http://www.dgif.virginia.gov/gis/gis-data.asp

DGIF Species Observations: http://www.dgif.virginia.gov/gis/werms.asp

DGIF Threatened and Endangered Species Waters: http://www.dgif.virginia.gov/gis/gis-data.asp

DGIF Tiered Species Habitat: http://www.dgif.virginia.gov/gis/werms.asp

National Hydrography Dataset: http://nhd.usgs.gov/

TJPDC's 2009 Green Infrastructure Study: http://www.tjpdc.org/pdf/Environment/Green%20Infrastructure%20Report%2012-22-09.pdf

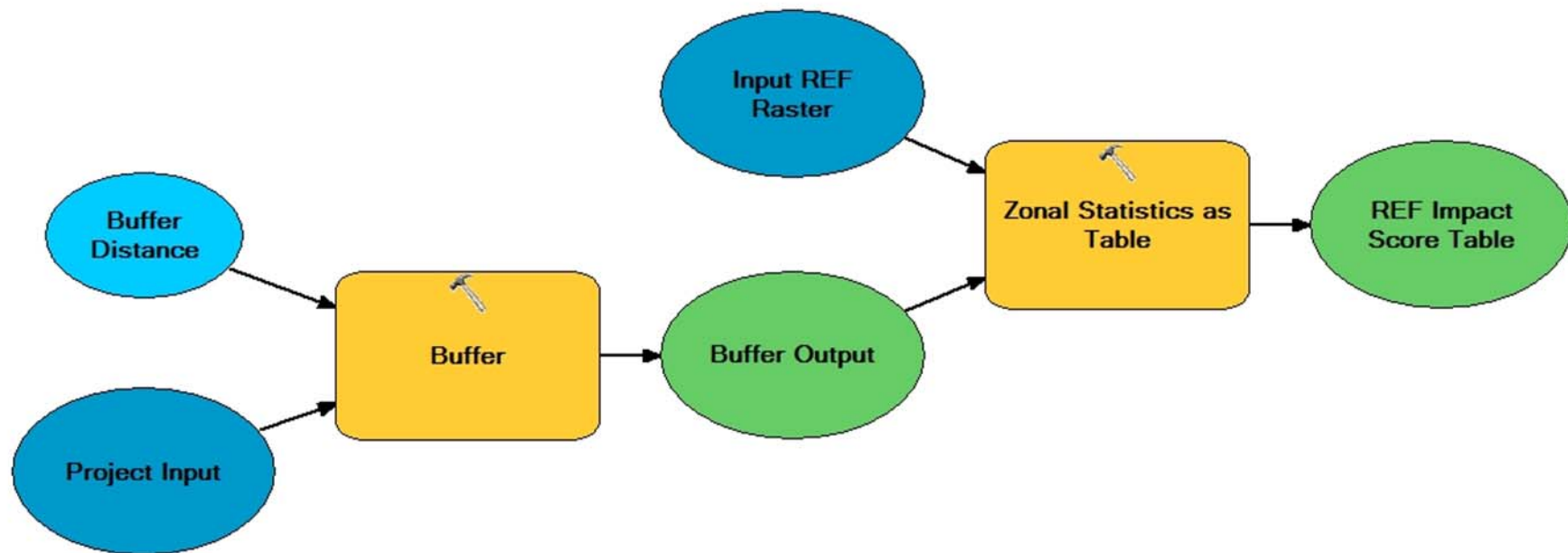**TJPDC's 2011 Eco-Logical: Integrating Green Infrastructure and Regional Transportation Planning:** http://www.tjpdc.org/pdf/Environment/Ecologic%20Final%20Report.pdf

USFWS National Wetlands Inventory: http://www.fws.gov/wetlands/Data/index.html

Appendix

Flow Chart Depicting how the Project Impact Model Analysis is Run

Flow Chart Depicting how the Least Cost Path Model Is Run