OPEN SPACE AND RECREATION PLAN UPDATE: CONSERVATION AND STEWARDSHIP

County of Sussex

Technical Report II: Land Stewardship

Water Resource Priorities

THE LAND CONSERVANCY OF NEW JERSEY

AUGUST 2016

Prepared for:
Sussex County
Board of Chosen Freeholders
Open Space Advisory Committee

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OPEN SPACE AND RECREATION PLAN UPDATE:
CONSERVATION AND STEWARDSHIP

for
COUNTY of SUSSEX

Technical Report II: Land Stewardship

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WATER RESOURCE MODELING

Accompanying the *Sussex County Open Space and Recreation Plan Update* are three *Technical Reports* which include the results of the detailed ArcGIS mapping analysis run to model water resources and prioritize land for preservation and stewardship. These reports are as follows:

- ✓ Technical Report I – Land Preservation (*Maps 1-13*)
- ✓ Technical Report II – Land Stewardship (*Maps A-I*)
- ✓ Technical Report III – Analysis and Recommendations (*Maps I-IV*)

Each report contains a table detailing the metrics, data, and mapping for the water resource areas studied in Sussex County. The final report includes a table detailing the priority lands for preservation, as identified by the water resource model in Sussex County. These are identified on a parcel basis and are ranked by their proximity to already preserved lands. This table, along with the accompanying mapping, provides the tools by which the County Open Space Committee, Board of Chosen Freeholders, and local officials can target their efforts to protect lands in Sussex County – focusing on those properties that support the water resources integral to the County and expand existing public open spaces

Technical Report II - Land Stewardship

The Use of Stewardship Criteria

In addition to preservation priorities, the *Open Space and Recreation Plan Update* addresses stewardship needs. Specifically, many water resources of the county would benefit from additional restoration and stewardship actions within riparian areas, existing or former wetlands, and developed areas that contribute stormwater flows to surface waters.

Criteria have been selected and mapped that identify areas where stewardship activities would provide a material benefit to water quality, water flows and ecological improvements to waters of Sussex County. These criteria generally address:

- Subwatersheds with high levels of impervious surface as well as those with streams that have high peaking rates (indicating flows during rainfall events are much higher than during dry periods). ***Water quantity and quality criteria***

- Impervious surfaces that are in close proximity to streams (providing more direct flow of stormwater into the streams). ***Water quantity and quality criteria***

- Stormwater outfalls directly from impervious areas and as outlets from stormwater basins. ***Water quantity and quality criteria***

- Stream habitat integrity and high slope stream segments, indicating erosion problems and stewardship potential. ***Water quality criterion***

- High density of roads crossing streams. ***Water quality criterion***

- Riparian areas, wetlands, and former wetlands that can be improved or restored. ***Water quality and ecological criteria***

- Existing wetlands and riparian areas in close proximity to developed areas. ***Ecological criterion***

It is important to recognize that these criteria are used as indicators. Stewardship activities would take place only when conditions have been confirmed through field investigations. The purpose of the criteria is to help focus attention on the waters with the greatest potential benefits of stewardship.

The more criteria are relevant to a specific area, the higher the likelihood that restoration and stewardship is necessary to improve water resources. However, a very high incidence of criteria may also indicate that stewardship costs will be very high, perhaps requiring structural engineering projects.

A general approach for the use of stewardship criteria is as follows:

1. **FACTS**: Selection and mapping of stewardship criteria

2. **SCREENING EVALUATON**: Identification of areas that appear viable and high priority for stewardship actions, using different techniques:

    a. Modification of the vegetative cover to improve water resources. These projects shift land from vegetative cover with higher runoff and pollutant loads to those with lower runoff and pollutant loads, through creation of riparian buffers, revegetation of agriculturally-modified wetlands, etc.

    b. Modification of stormwater systems to reduce stormwater volume, rate of discharge, water pollutant loads, or some combination thereof. This approach includes green infrastructure, modification of uncontrolled outfalls, modification of existing stormwater basins (such as changing detention basins to infiltration basins), etc.

    c. Reconstruction of stream channels, stream corridors, riparian areas and flood plains, ponds and lakes. Reconstruction requires physical modification of the land surface, not just the vegetative cover as discussed above.

3. **PARTNERSHIPS**: Identification of viable partners for stewardship activities within high priority areas. There will inevitably be enough high priority areas to greatly exceed available resources. Therefore, it is appropriate to focus efforts on areas that have good partnership potential. It is also likely that within areas with available partnerships, there will be more than one possible project area for stewardship projects.

4. **DETAILED EVALUATION**: Field evaluation of potential stewardship projects within the areas that have good partnerships, to identify the projects that most clearly would benefit water resources and require actions that are appropriate for the skill set of the partners.

5. **PROJECT DEVELOPMENT**: Determine which partner will have responsibility for each aspect of the project. Identify relevant funding and other implementation resources. Funding potential is likely to be an initial screening approach used by the partnerships, but at this point, specific funding needs will be identified and sought.

The following 9 maps illustrate characteristics used to identify opportunities for land stewardship projects to protect water resources in Sussex County. Each map targets a defining characteristic important to water quality and/or quantity. These criteria are used as indicators, to focus attention on areas that will benefit most from stewardship. These are defined in greater detail on the accompanying table and in the Plan Update.

Maps A-C focus on the reduction of direct stormwater flows.

Map D-F focus on the reduction of stream erosion

Maps G-I focus on the restoration of riparian areas and wetlands.

Map A shows the amount of impervious surface within each watershed in Sussex County. The different levels are broken up by percent of impervious surface out of the total surface of the watershed.

Map B further breaks down the percent of impervious surface within riparian areas by subwatersheds.

Map C displays where each stormwater outfall and basin is throughout the county.

Map D marks the AMNET stream habitat scores throughout the county, displaying the integrity of each stream. The different habitat categories are optimal, suboptimal, and marginal.

Map E counts the amount of road crossings per stream mile. The individual crossings are shown, as well as the density of road crossings per each subwatershed.

Map F identifies high slope stream segments that are 500 feet or above.

Map G shows riparian areas in altered conditions, to identify former riparian areas that can be improved or restored.

Map H illustrates agriculturally altered wetlands as well as other wetlands and preserved farms within the county. This results in the identification of areas with high potential for wetlands restoration.

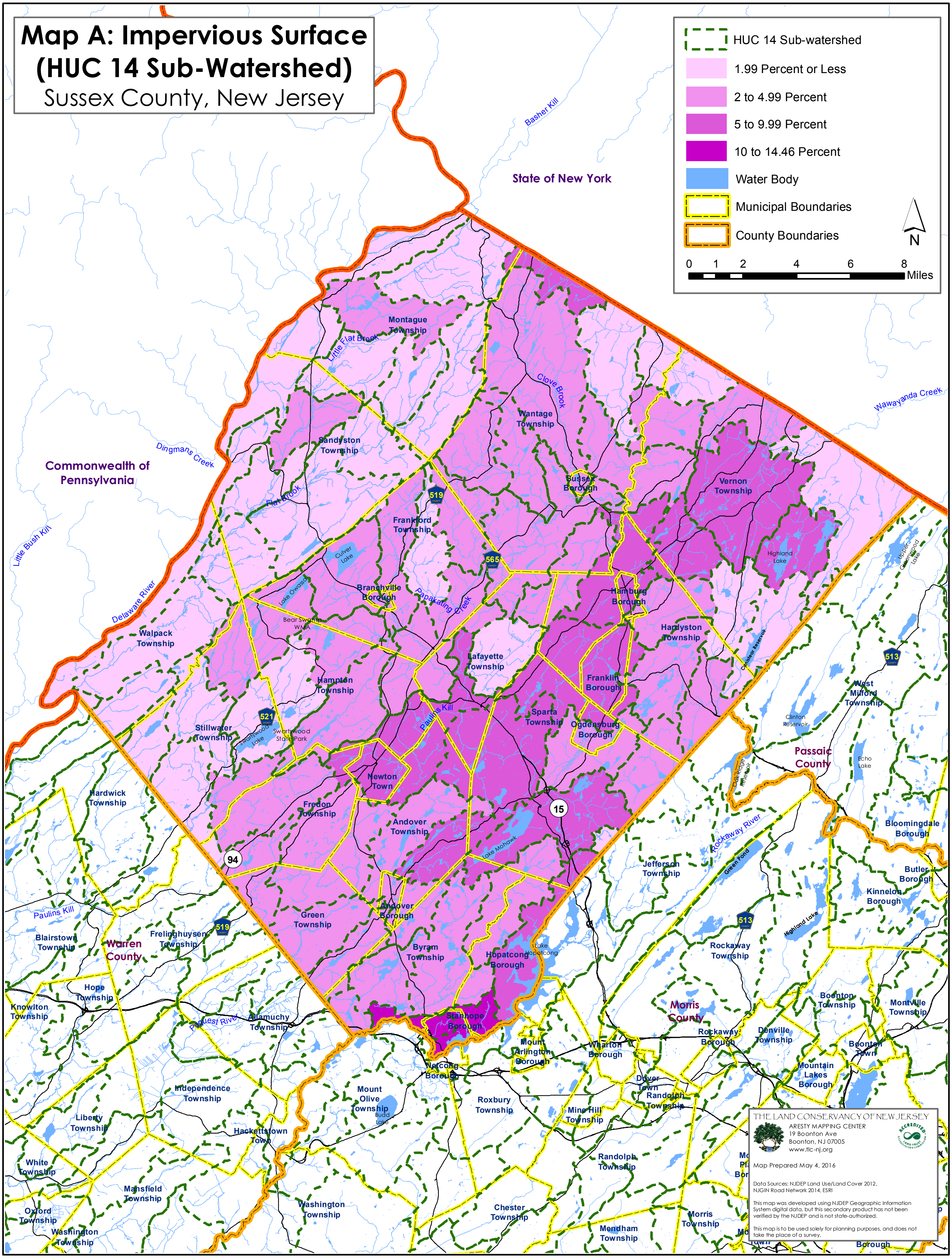
Map I identifies wetlands and riparian areas within 200 meters of developed lands. Due to their proximity to development, these areas are likely to be disrupted.

Water Priorities for Land Stewardship in Sussex County

The Sussex County Open Space Plan Update will include a set of maps that provide information about important water-related characteristics. The following table provides the three "focus" areas, measurable characteristics, purpose, metrics and data. These maps identify opportunities for land management (stewardship) projects in Sussex County using water quality and/or quantity as the measuring foundation for assessment.

Characteristics	Purpose	Metrics and Data	Map
Focus Area 1. Protecting the Resources – Hydrology			
Stewardship: Reduce Direct Stormwater Flows	Implementation of stormwater management practices to slow or avoid direct runoff, discharge from older stormwater basins at rates that exceed current standards, etc. Green infrastructure and modifications to gray infrastructure.	• Map A: Subwatershed % impervious surface using NJDEP 2012 LULC. Identification of streams with high peaking rates using USGS stream gauging stations, where statistical information is available, as a check on percentage estimates (tabular evaluation, not mapped). • Map B: Subwatershed analysis of impervious surface in proximity to streams • Map C. Municipal mapping of stormwater outfalls per MS4 permits. There are four Tier A towns. County Engineering has county outfalls. County mosquito commission mapped catch basins in parts of the county, for Lake Hopatcong Commission, others. • Map C. SCD or other mapping of existing stormwater detention basins www.Hydro.rutgers.edu – SCD has added basins from 1976 on (approximately 251).	• Map A. Impervious Surface (HUC 14 Subwatershed) • Map B. Impervious Surface Riparian Areas • Map C. Stormwater Outfalls and Basins
Focus Area 2. Protecting the Resources – Stream and Aquifer Quality			
Stewardship – Reduce Direct Stormwater Flows	Implementation of stormwater management practices to filter direct runoff, improve water quality discharged from detention stormwater basins, etc. Green infrastructure and modifications to gray infrastructure.	• Map A. Subwatershed % impervious surface using NJDEP 2012 LULC. Identification of streams with high peaking rates using USGS stream gauging stations, where statistical information is available, as a check on %IS estimates (tabular evaluation, not mapped). • Map B. Subwatershed analysis of impervious surface in proximity to streams • Map C. Municipal mapping of stormwater outfalls per MS4 permits. There are four Tier A towns. County Engineering has county outfalls. County mosquito commission mapped catch basins in parts of the county, for Lake Hopatcong Commission, others.	• Map A. Impervious Surface (HUC 14 Subwatershed) • Map B. Impervious Surface Riparian Areas • Map C. Stormwater Outfalls and Basins

Characteristics	Purpose	Metrics and Data	Map
		• Map C. SCD/other mapping of existing stormwater detention basins. *Hydro.rutgers.edu* – SCD has added basins from 1976 on (c.251).	
Stewardship – Reduce Stream Erosion	Stream erosion from excessive stormwater, stream encroachments and agriculture can contribute the majority of sediment and phosphorus loads in a stream (as much as 80%).	• Map D. AMNET results for stream habitat integrity (not total score) • Map E. Evaluation of number of road crossings per stream mile by HUC 14 (bridges tend to have uncontrolled stormwater discharges and create breaks in habitat) • Map F. High slope stream segments (LIDAR data with National Hydrologic Data Set)	• Map D. AMNET Stream Habitat Integrity Scores • Map E. Road Crossing per Stream Mile (HUC 14 Subwatershed) • Map F. High Slope Stream Segments
Stewardship – Restore Riparian Areas and Wetlands	Restoration of riparian areas, floodplains and wetlands to natural vegetation can reestablish water quality benefits to streams, as the most directly connected lands.	• Map G. Riparian Area evaluation to identify former riparian areas that can be improved or restored, including farmlands (for agriculture and barren lands) • Map H. Agriculturally modified wetlands, to identify areas with high potential for wetlands restoration (NJDEP LULC data, NRCS SSURGO database)	• Map G. Riparian Areas in Altered Conditions • Map H. Agriculturally Modified Wetlands
Focus Area 3. Protecting Aquatic Ecosystem Functions			
Stewardship – Restore Riparian Areas and Wetlands	Former wetlands and riparian areas may be candidates for restoration to mitigate past losses. Existing wetlands and riparian areas in close proximity to developed areas are likely to have been impaired by that development, and may be candidates for improvement projects to enhance their current ecosystem services to natural levels.	• Map G. Identify former wetlands and riparian areas that are in land uses subject to modification, especially former or existing agricultural areas that are transitioning from agriculture or are of minimal agricultural value. • Map H. Agriculturally modified wetlands, to identify areas with high potential for wetlands restoration • Map I. Identify existing wetlands and riparian areas in close proximity to developed areas. We could use any value here – the point is to see what areas are likely disrupted because they are so close to development.	• Map G. Riparian Areas in Altered Conditions • Map H. Agriculturally Modified Wetlands • Map I. Wetlands and Riparian Areas within 200 meters of Developed Lands


Map A: Impervious Surface
(HUC 14 Sub-Watershed)
Sussex County, New Jersey
HUC 14 Sub-watershed
1.99 Percent or Less
2 to 4.99 Percent
5 to 9.99 Percent
10 to 14.46 Percent
Water Body
Municipal Boundaries
County Boundaries
N
0 1 2 4 6 8 Miles
State of New York
Commonwealth of Pennsylvania
Basher Kill
Wawayanda Creek
Dingmans Creek
Little Bush Kill
Delaware River
Flat Brook
Little Flat Brook
Clove Brook
Paulins Kill
Pequest River
Rockaway River
Montague Township
Sandyston Township
Wantage Township
Sussex Borough
Vernon Township
Frankford Township
Branchville Borough
Hamburg Borough
Hardyston Township
Walpack Township
Lafayette Township
Franklin Borough
Hampton Township
Sparta Township
Ogdensburg Borough
Stillwater Township
Newton Town
Fredon Township
Andover Township
Andover Borough
Green Township
Byram Township
Hopatcong Borough
Stanhope Borough
Culver Lake
Lake Owassa
Bear Swamp WMA
Swartswood Lake
Swartswood State Park
Highland Lake
Lake Mohawk
Lake Hopatcong
Passaic County
Warren County
Morris County
West Milford Township
Jefferson Township
Rockaway Township
Hardwick Township
Blairstown Township
Frelinghuysen Township
Hope Township
Knowlton Township
Allamuchy Township
Netcong Borough
Mount Arlington Borough
Wharton Borough
Bloomingdale Borough
Butler Borough
Kinnelon Borough
Boonton Township
Montville Township
Rockaway Borough
Denville Township
Boonton Town
Mountain Lakes Borough
Dover Town
Randolph Township
Mine Hill Township
Roxbury Township
Mount Olive Township
Budd Lake
Independence Township
Liberty Township
Hackettstown Town
White Township
Mansfield Township
Oxford Township
Washington Township
Chester Township
Morris Township
Mendham Township
519
565
521
513
94
15
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19 Boonton Ave
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www.tlc-nj.org
Map Prepared May 4, 2016
Data Sources: NJDEP Land Use/Land Cover 2012, NJGIN Road Network 2014, ESRI
This map was developed using NJDEP Geographic Information System digital data, but this secondary product has not been verified by the NJDEP and is not state-authorized.
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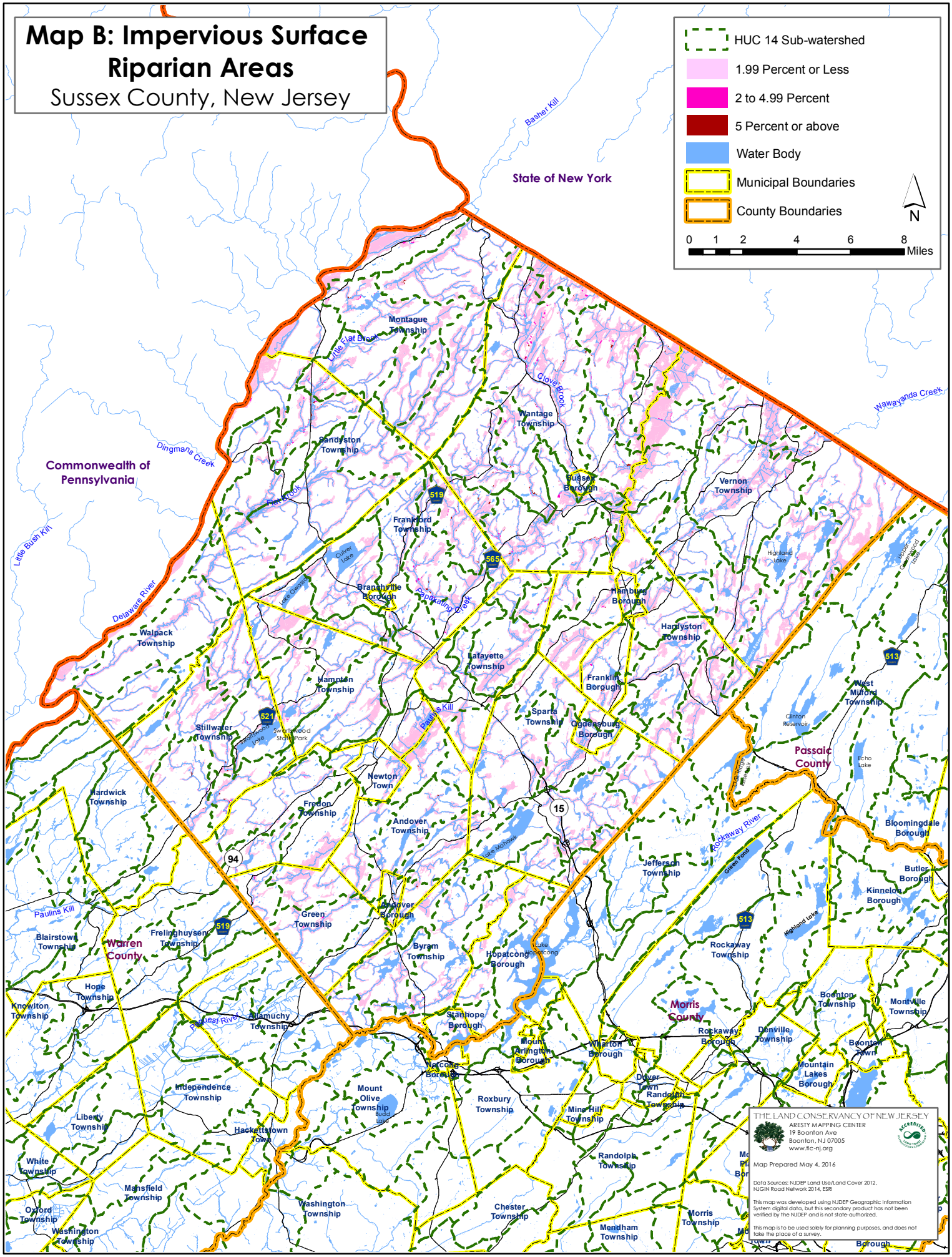
Map B: Impervious Surface Riparian Areas

Sussex County, New Jersey



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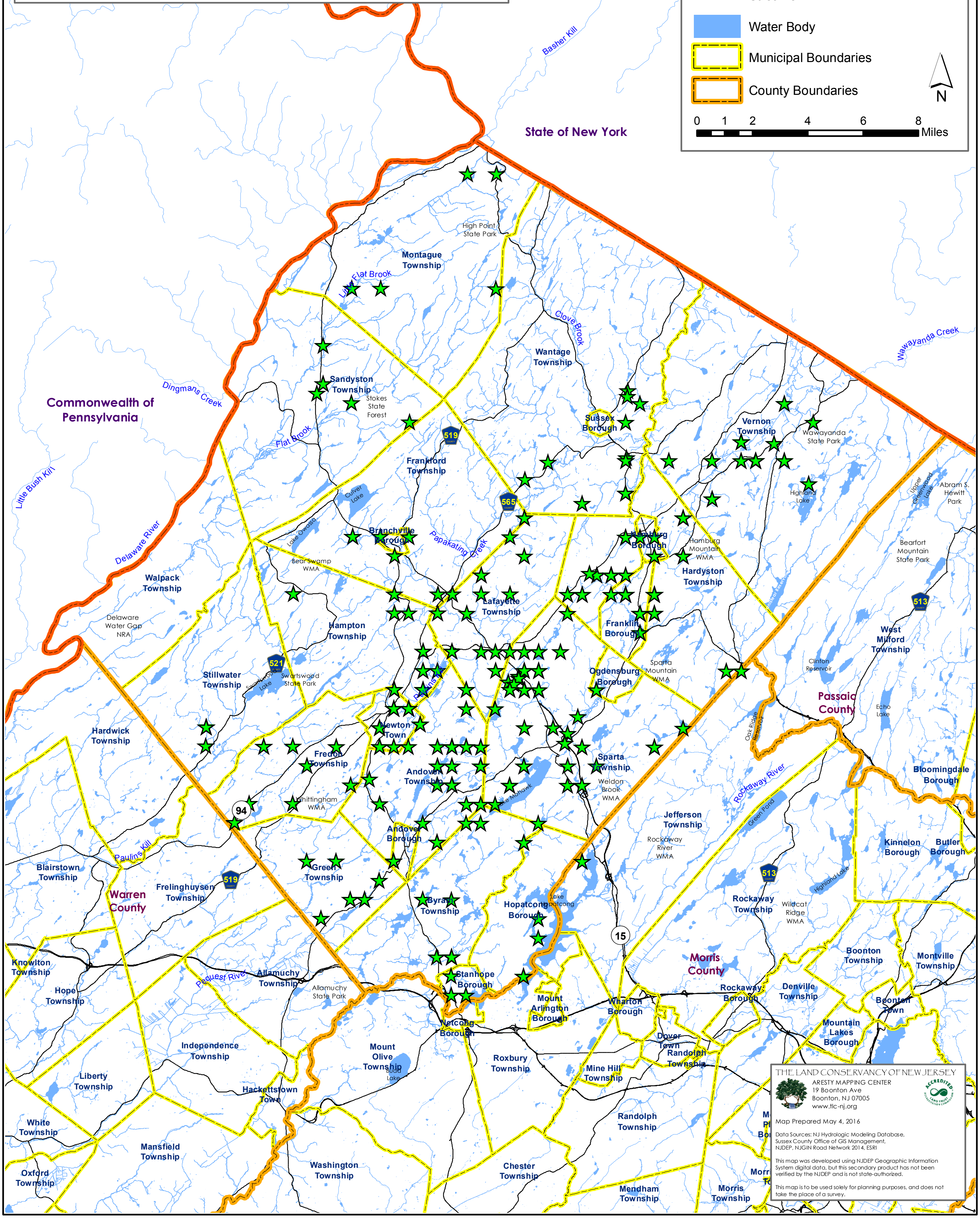
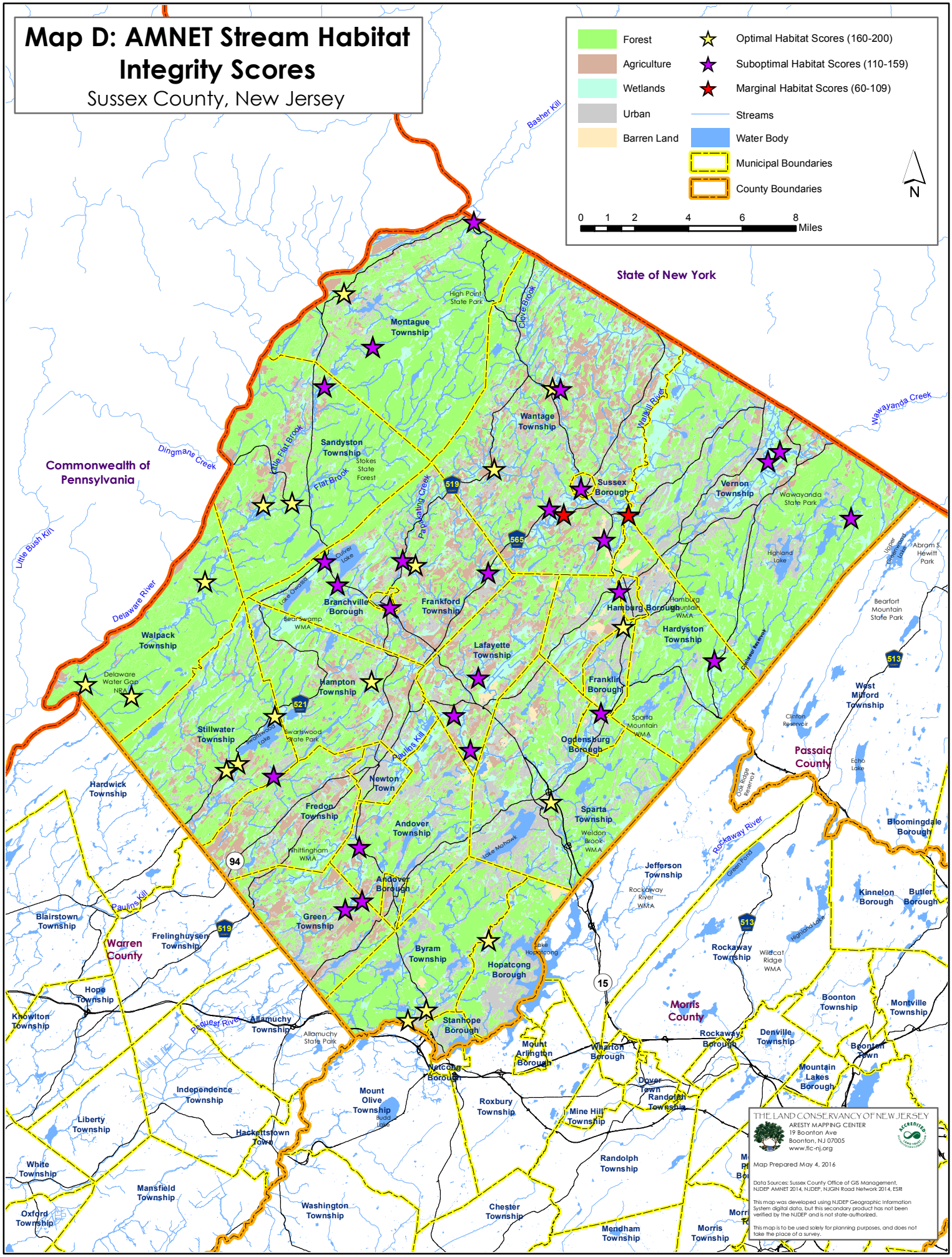
Map C: Stormwater Outfalls & Basins

Sussex County, New Jersey



Map D: AMNET Stream Habitat Integrity Scores

Sussex County, New Jersey



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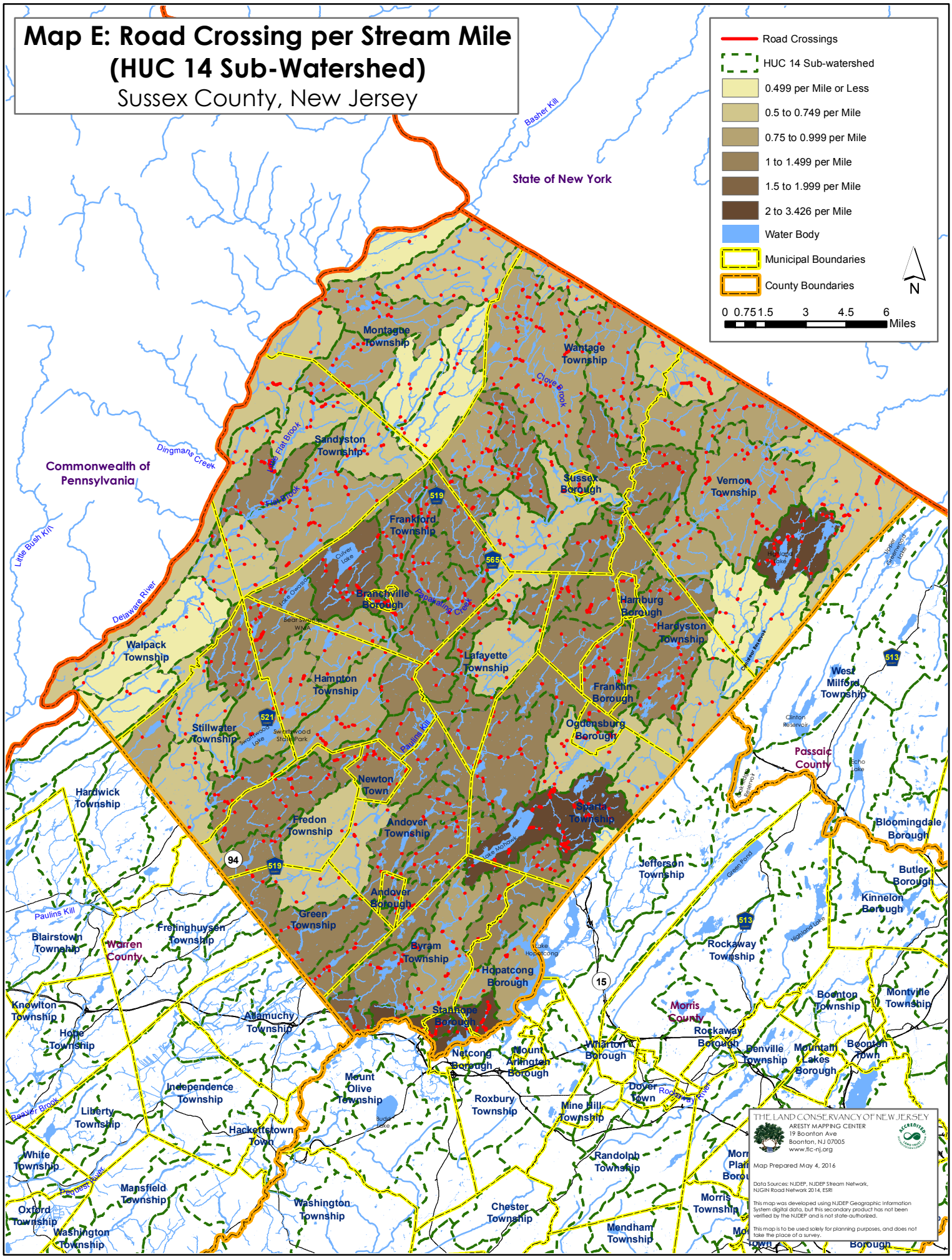
Map E: Road Crossing per Stream Mile
(HUC 14 Sub-Watershed)
Sussex County, New Jersey
Road Crossings
HUC 14 Sub-watershed
0.499 per Mile or Less
0.5 to 0.749 per Mile
0.75 to 0.999 per Mile
1 to 1.499 per Mile
1.5 to 1.999 per Mile
2 to 3.426 per Mile
Water Body
Municipal Boundaries
County Boundaries
N
0 0.751.5 3 4.5 6
Miles
State of New York
Commonwealth of Pennsylvania
Basher Kill
Dingmans Creek
Little Bush Kill
Delaware River
Clove Brook
Lake Flat Brook
Flat Brook
Montague Township
Wantage Township
Sandyston Township
Sussex Borough
Vernon Township
Frankford Township
Branchville Borough
Lake Owassa
Culver Lake
Bear Swamp WMA
Swartswood Lake
Swartswood State Park
Walpack Township
Hampton Township
Stillwater Township
Lafayette Township
Hamburg Borough
Hardyston Township
Franklin Borough
Ogdensburg Borough
Newton Town
Fredon Township
Andover Township
Andover Borough
Green Township
Sparta Township
Lake Mohawk
Hardwick Township
Paulins Kill
Blairstown Township
Warren County
Frelinghuysen Township
Byram Township
Hopatcong Borough
Lake Hopatcong
Stanhope Borough
Knowlton Township
Hope Township
Allamuchy Township
Independence Township
Liberty Township
Beaver Brook
White Township
Oxford Township
Mansfield Township
Washington Township
Hackettstown Town
Mount Olive Township
Budd Lake
Netcong Borough
Mount Arlington Borough
Roxbury Township
Mine Hill Township
Wharton Borough
Dover Town
Rockaway River
Randolph Township
Chester Township
Mendham Township
Morris Township
Morris County
Rockaway Township
Rockaway Borough
Denville Township
Mountain Lakes Borough
Boonton Township
Boonton town
Montville Township
Jefferson Township
Green Pond
Rockaway Township
Highland Lake
Bloomingdale Borough
Butler Borough
Kinnelon Borough
West Milford Township
Clinton Reservoir
Passaic County
Echo Lake
Clinton Reservoir
Upper Greenwood Lake
Highland Lake
Greenwood Lake
519
565
521
513
94
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Map F: High Slope Stream Segments

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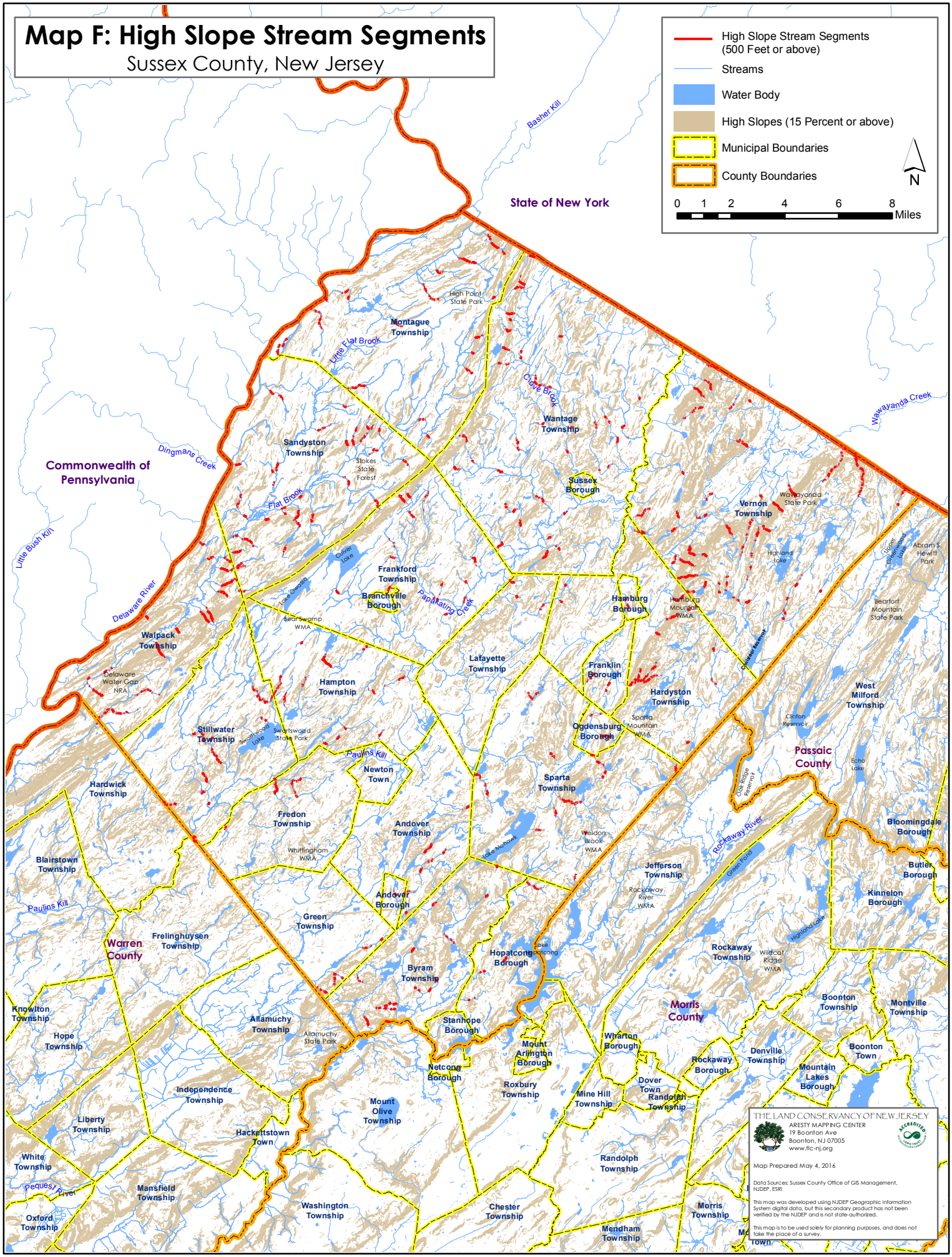

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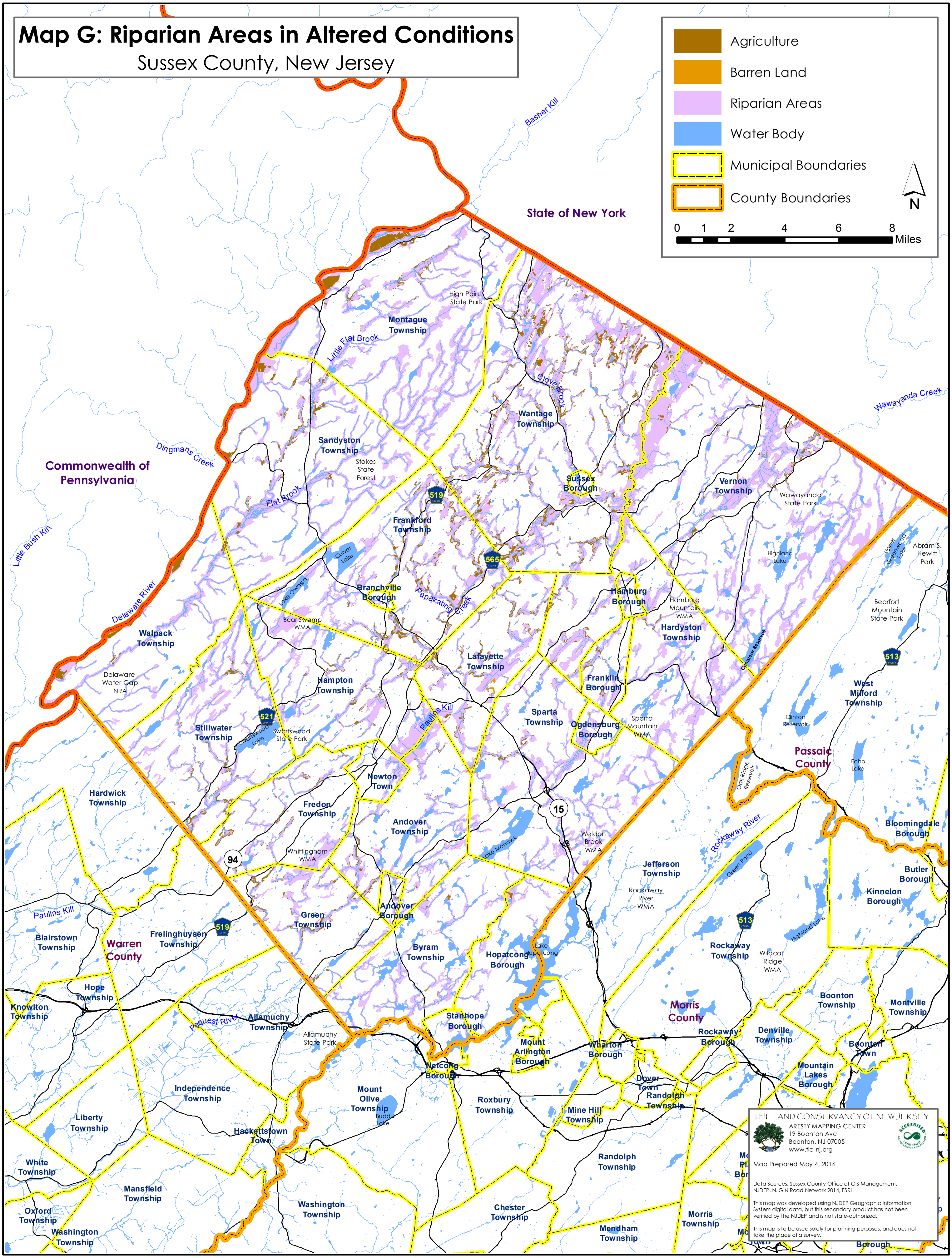
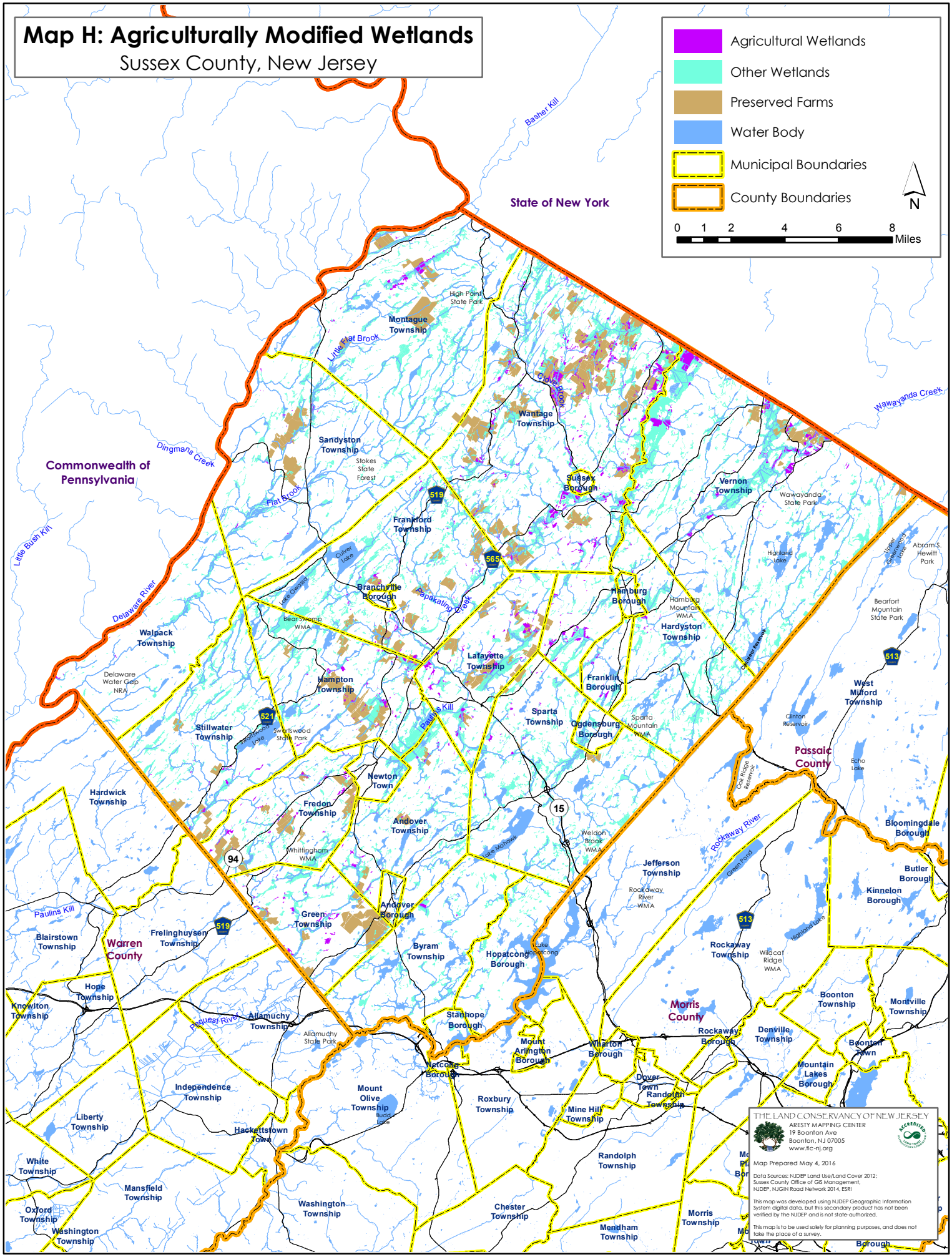
Map G: Riparian Areas in Altered Conditions

Sussex County, New Jersey



Map H: Agriculturally Modified Wetlands

Sussex County, New Jersey



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Map I: Wetlands & Riparian Areas within 200 meters of Developed Lands

Sussex County, New Jersey