



Mercerville Elementary School

Hamilton Township (Mercer County) Soil Suitability for Stormwater BMPs

Developed by the Rutgers Cooperative Extension Water Resources Program
Funded by Hamilton Township, Mercer County, New Jersey

December, 2013

Acknowledgements

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Introduction

The Rutgers Cooperative Extension (RCE) Water Resources Program assessed Hamilton Township to identify soils that are suitable for various stormwater management best management practices (BMPs). This analysis yielded static maps and an online mapping tool so developers, municipal officials and other interested parties can identify appropriate stormwater BMPs for specific sites. These maps are not intended to limit the use of BMPs on specific sites but rather are intended to inform regulators and developers of potential site constraints, which may require for the collection of additional data prior to designing and installing BMPs.

Based upon NJDEP design parameters, a total of 10 BMPs were evaluated for their suitability in Hamilton Township including:

- Grass Swales
- Sand Filters (Surface and Non-Surface)
- Infiltration Trenches
- Bioretention Areas
- Vegetated Filter Strips
- Porous Pavement
- Dry Ponds
- Wet Ponds
- Stormwater Wetlands
- Rain Barrels

Site Suitability Analysis

The entirety of Hamilton Township was assessed based on criteria set forth by the New Jersey Department of Environmental Protection in their Stormwater BMP manual (http://www.njstormwater.org/bmp_manual2.htm). Data on soil type, slope, and land use were acquired via New Jersey Geographic Information Network (https://njgin.state.nj.us/NJ_NJGINExplorer/index.jsp).

Note that maps generated are for general description of areas within Hamilton Township and do not replace field surveys. The areas determined to be suitable will require ground truthing and field testing (such as permeability tests and soil logs) to ensure the BMPs are appropriate for the areas mapped.

The RCE Water Resources Program compiled the collected data to generate maps using Geographic Information System (GIS) databases highlighting results and locating areas that are suitable for stormwater retrofits. Maps were created for the following BMPs: grass swales, sand filters, infiltration trenches, bioretention areas, vegetated filter strips, porous pavement, dry ponds, wet ponds, stormwater wetlands, and rainwater harvesting systems. The criteria used to determine if a site was suitable for each of these BMPs is discussed below.

Grass Swales:

Grass swales are vegetated open channels that slow, direct, and filter stormwater runoff. Swales are most appropriate along roadways and are also useful in conjunction with other BMPs. When creating the map (Map 2A), areas with slopes of less than 6% were selected as well as areas with hydrologic soil groups A-C. DEP requirements for the installation of a grassed swale include having a slope of less than 6%, to ensure that runoff velocity is manageable, that the soil type falls in the range of hydrologic soil groups A-C, to ensure that filtering and infiltration will occur, and and that the depth to the seasonal high water table is 2 feet or greater. Areas of concern include areas with a slope higher than 6%, a hydrologic soil group of D, or depth to seasonal high groundwater table less than 2 feet.

Sand Filters:

Sand filters include a settling chamber and a filter bed full of sand that settle out large particles to finer particles and pollutants. Sand filters are highly appropriate in ultra urban areas where they take up little space. When creating the map (Map 2B), areas with a slope of less than 10% were selected as suitable as

well as areas with hydrologic soil groups A-D. The DEP requires a slope less than 10%, as most sand filters require some amount of slope. Sand filters can be used in any soil type since they are used as a stand alone BMP, however they should be at least 2 feet or greater from the seasonal high groundwater table. Areas of concern include slopes higher than 10%, and depth to the seasonal high groundwater table less than 2 feet.

Infiltration Trenches:

Infiltration trenches are rock filled trenches that collect stormwater runoff with no outlet. They are typically used with other BMPs such as swales and basins for pretreatment. When creating the map (Map 2C), areas with a slope of less than 15% and with hydrologic soil groups A and B were considered as suitable. Infiltration trenches should be placed on flat ground, but the DEP specifies that they can go up to a 15% slope. Soils are the most limiting factor since they must be permeable for the stormwater to infiltrate quickly to reduce ponding and clogging, however soils that infiltrate too rapidly can cause groundwater contamination. An infiltration trench should be installed at 2-5 feet above the seasonal high groundwater table. Areas of concern include slopes of higher than 15%, hydrologic soil groups C and D and a depth to seasonal high groundwater less than 2 feet.

Bioretention:

Bioretention areas are landscaping features that provide treatment of stormwater runoff via filtration and pollutant removal. Bioretention areas are best suited to urban areas where there are few pervious surfaces and high levels of runoff. When creating the map (Map 2D), areas with a slope of less than 5% and hydrologic soil groups A-D were selected as suitable. Bioretention areas work best with a shallow slope, less than 5%. Bioretention areas can be constructed in any soil, since the system utilizes a man-made soil bed to filter stormwater. When using an underdrain, bioretention areas should be at least 1 foot above the seasonal high water table. Areas of concern are areas with a slope higher than 5%, and depth to seasonal high groundwater table less than 1 foot. When constructing bioretention that will infiltrate into the native soils (Map 2E), the same slope requirements apply but soil groups can only be A and B in order for proper infiltration to occur and the bioretention area must be at least 2 feet from the seasonal high water table. Areas of concern would be considered areas with a slope higher than 5%, hydrologic soil groups C and D, and depth to seasonal high groundwater table less than 2 feet.

Vegetated Filter Strips:

Vegetated filter strips treat sheet flow from nearby surfaces by slowing velocity and filtering out pollutants and particles and allowing for some infiltration. Like Grass swales, filter strips are best used along roadways and parking lots. When creating the map (Map 2F), areas with a slope of less than 10% and with hydrologic soil groups A-C were considered suitable. Any slope higher than 10% would create a concentrated flow with a high velocity that would limit infiltration. Filter strips should be used in permeable soils so that infiltration can occur. Filter strips should also be from 2-4 feet above the seasonal high water table. Areas of concern have higher than a 10% slope, soil group D, and depth to seasonal high groundwater table less than 2 feet.

Porous Pavement:

Porous pavement is standard pavement that has reduced fine particles so that water may infiltrate through it. Porous pavement is recommended for low speed and low volume roadways. When creating the map (Map 2G), areas were chosen that had less than 6% slope and either hydrologic soil group A or B.. Soil should be permeable so infiltration can occur. Porous pavement should be installed at least 2 feet above the seasonal high water table. Areas of concern include those with higher than a 6% slope, soil groups C or D, and depth to seasonal high groundwater table less than 2 feet.

Dry/Wet Ponds and Stormwater Wetlands:

Dry ponds are basins that detain water and allow for settling and flood control. When creating the map (Map 2H) areas with a slope of less than 15% and hydrologic soil groups A-D were considered suitable. A slight slope is required to allow for water to move into and through the basin. Detention ponds can be used in all soil types and must be at least 1 foot above the seasonal high water table. Areas of concern have a slope higher than 15% and depth to seasonal high groundwater table less than 1 foot.

Wet ponds are similar to dry ponds except that they have a permanent pool of water. (Map 2I) Wet ponds have the same requirements as dry ponds except that they do not have to be above the water table due to the constant amount of water.

Stormwater wetlands are similar to wet and dry ponds; they maintain water all year long and include wetland plants that aid in pollutant removal. Stormwater wetlands have the same requirements as wet ponds.

Rainwater Harvesting:

Rainwater harvesting includes stormwater management tools such as rain barrels and cisterns. These tools harvest stormwater and disconnect impervious surfaces, which helps to mitigate flooding and erosion. When creating the priority area map (Map 2J) residential areas of land use were considered. Areas that are high residential are high priority, medium residential is medium high priority, low residential is medium priority, mixed residential is medium low priority, and rural residential is low priority. Priority levels were given based on amount of impervious cover.

Summary and Conclusions

The series of maps created provide a preliminary tool for assessing sites for installation of stormwater BMPs. Areas that were found to be suitable for BMPs should be further investigated. By overlaying the suitable layers with land use and orthographic aerial images it will be possible to further identify the best sites for BMP implementation in Hamilton Township. Before final BMP selection and design, sites should be surveyed and assessed using required methods.

Certain areas of the township were unable to be assessed for suitability due to having soil classified as Urban Complex. These areas have been identified in Map 1B, the areas require extra examination and testing before installation of BMPs.

Resource Maps

Map 1A – Wetlands and Waterways

Map 1B – Unknown Soil Areas

Map 1C – Hydrologic Soil Group

Map 1D – Seasonal High Water Table Depth

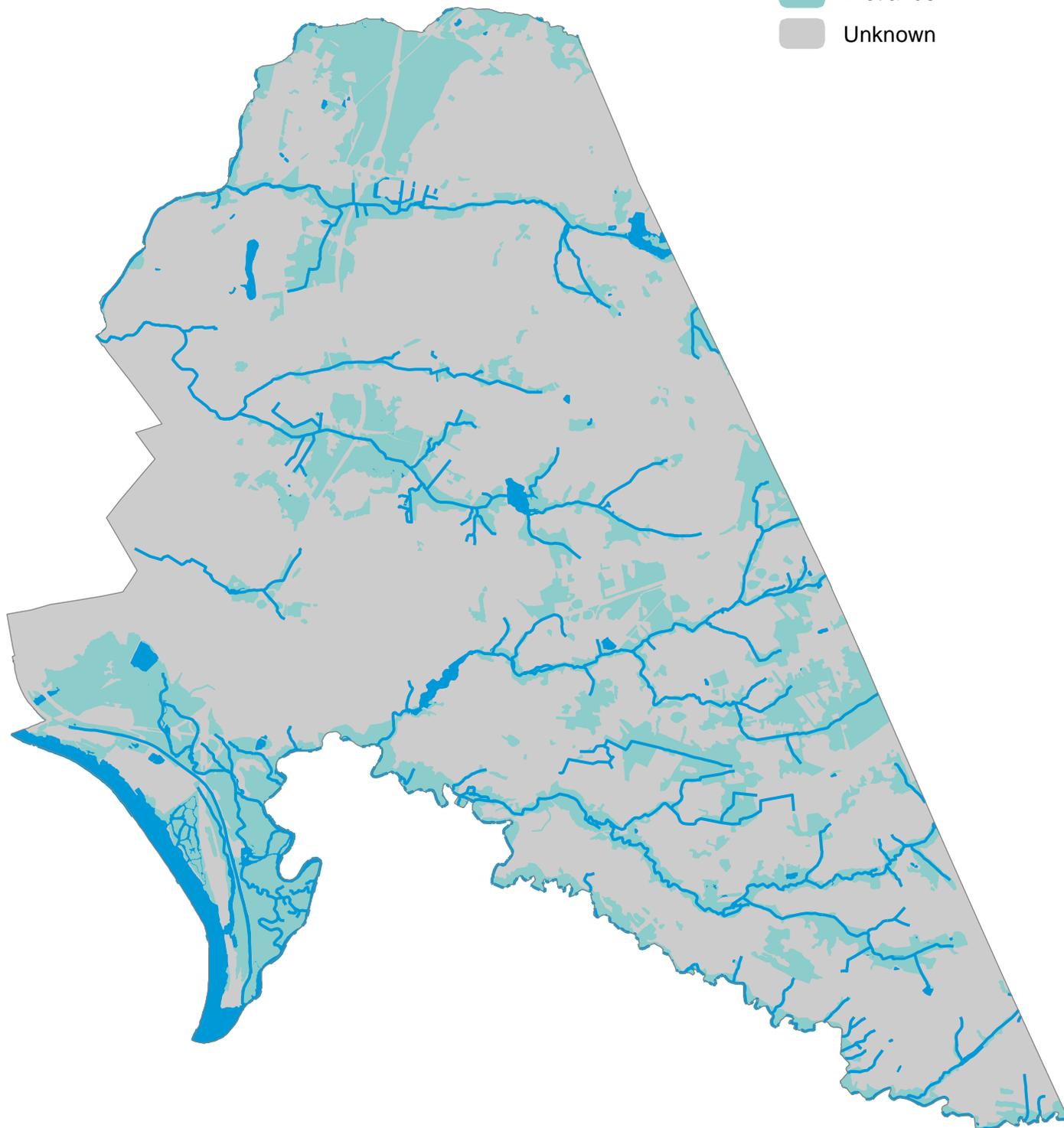
Map 1E – Drainage Class

Map 1F – Slope

Wetlands and Waterways in Hamilton Township, New Jersey

Map 1A

-  Rivers & Streams
-  Water
-  Wetlands
-  Unknown

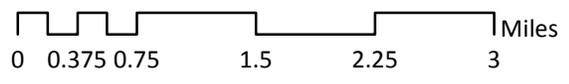
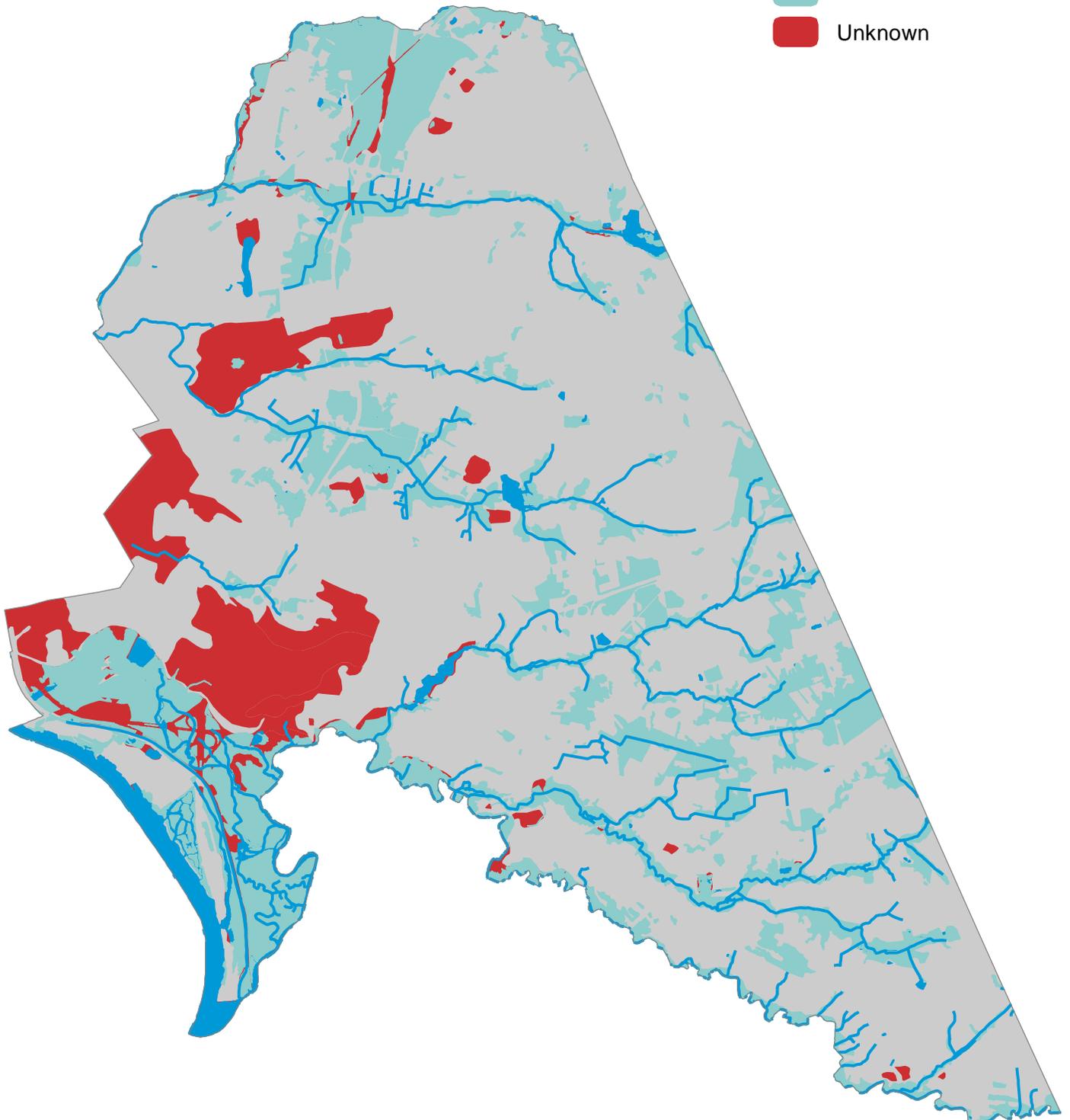


0 0.375 0.75 1.5 2.25 3 Miles

Unknown Soil Areas in Hamilton Township, New Jersey

Map 1B

-  Rivers & Streams
-  Water *
-  Wetlands
-  Unknown



* Indicates soils that are classified as 'Urban' with limited characteristic information available.

Hydrologic Soil Group for Soils in Hamilton Township, New Jersey

Map 1C

 Rivers & Streams

 Water

 Wetlands

Hydrologic Soil Group

 A

 B

 B/D

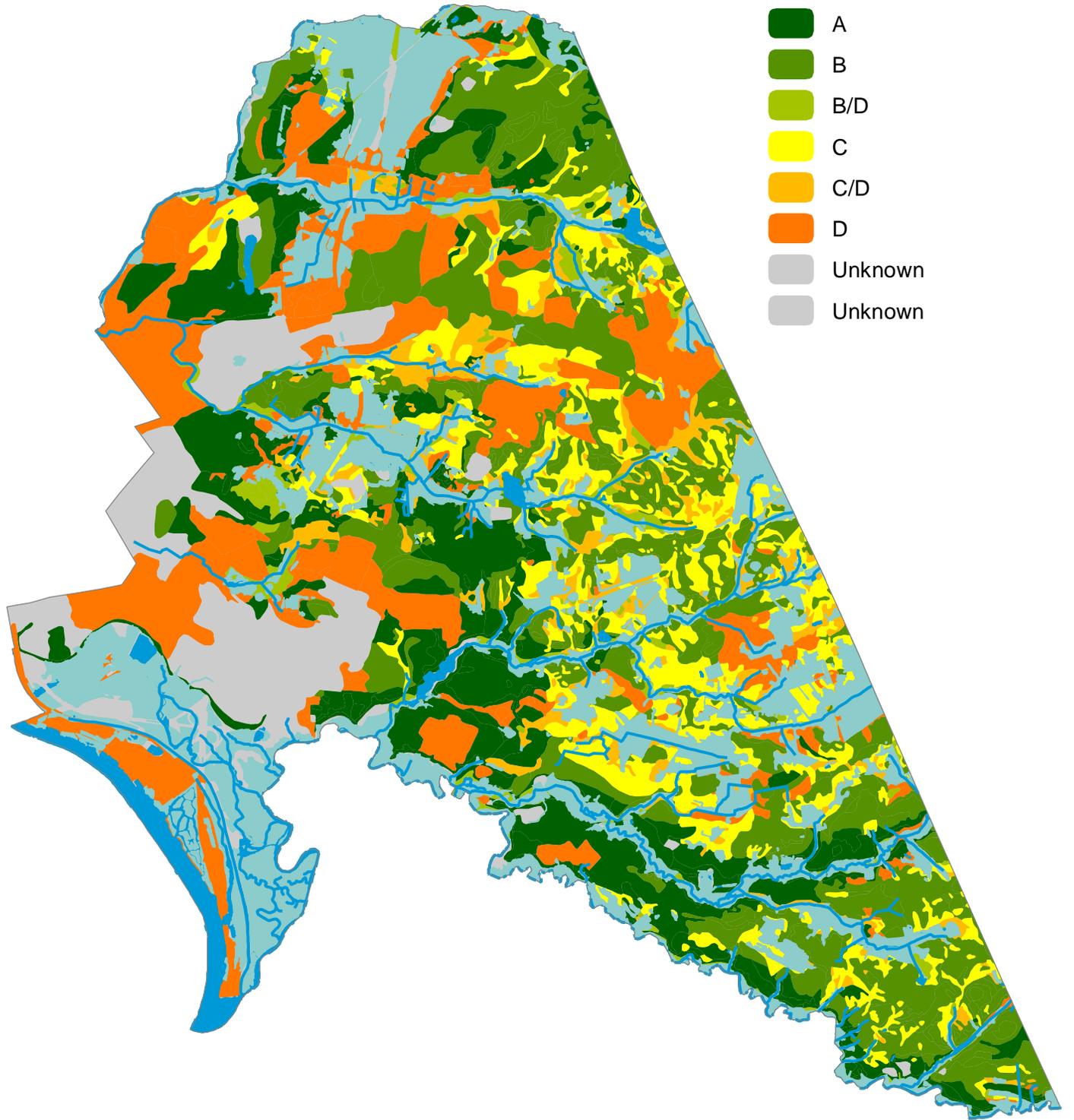
 C

 C/D

 D

 Unknown

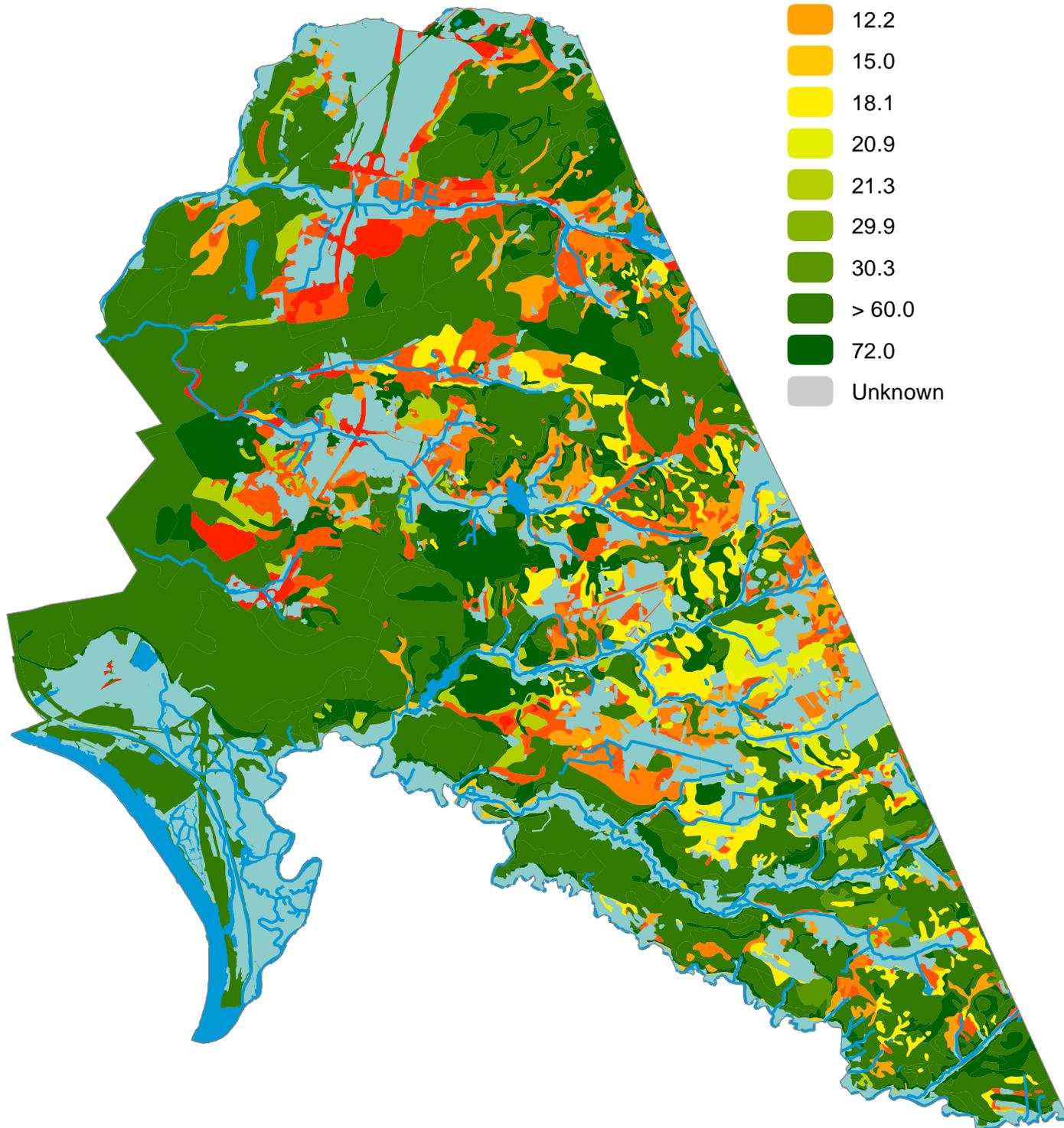
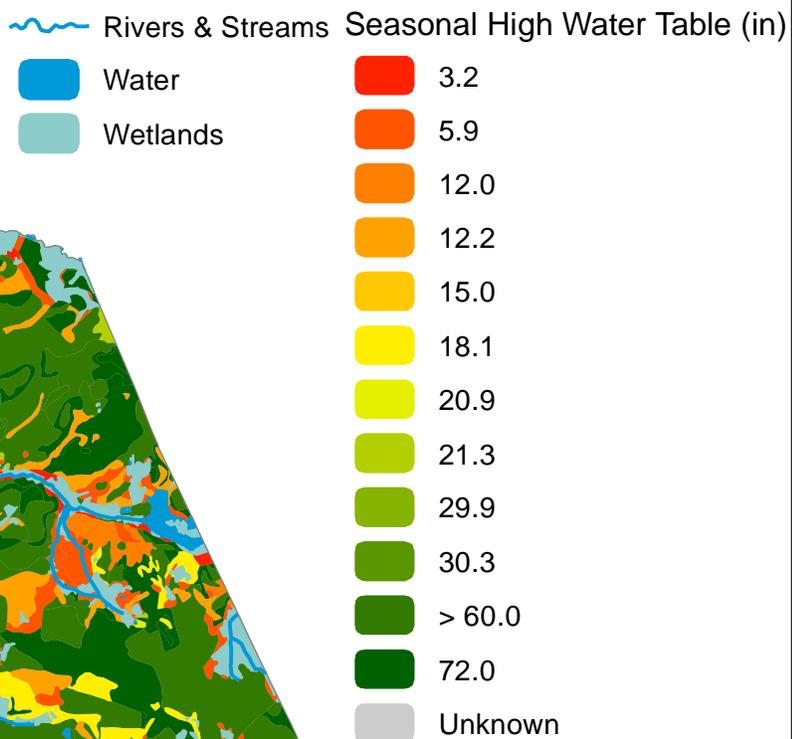
 Unknown



0 0.375 0.75 1.5 2.25 3 Miles

Seasonal High Water Table Depth for Soils in Hamilton Township, New Jersey

Map 1D



0 0.375 0.75 1.5 2.25 3 Miles

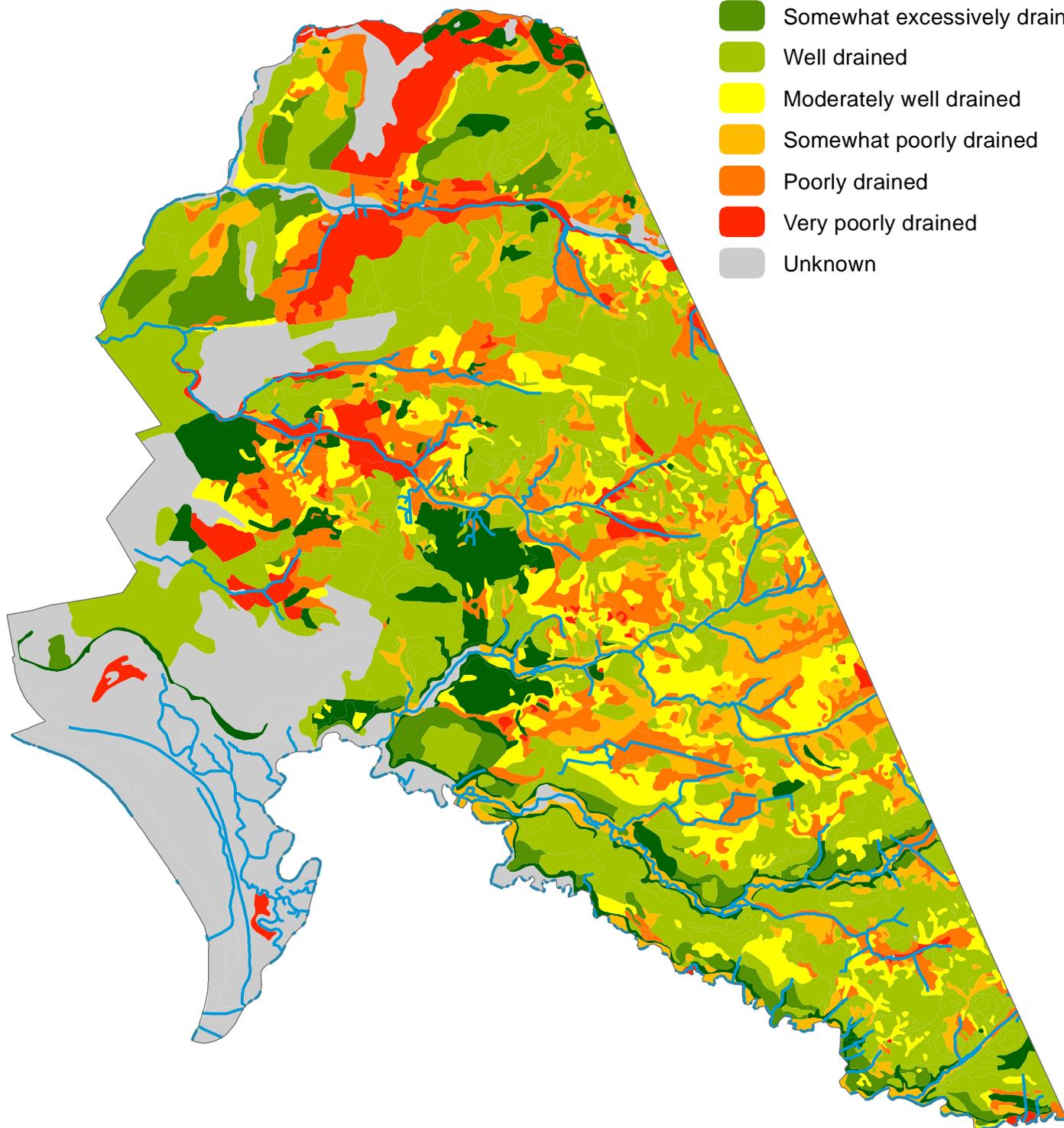
Drainage Class for Soils in Hamilton Township, New Jersey

Map 1E

 Rivers & Streams

Drainage Class

-  Excessively drained
-  Somewhat excessively drained
-  Well drained
-  Moderately well drained
-  Somewhat poorly drained
-  Poorly drained
-  Very poorly drained
-  Unknown



0 0.375 0.75 1.5 2.25 3 Miles

Slope of Soils in Hamilton Township, New Jersey

Map 1F

 Rivers & Streams

 Water

 Wetlands

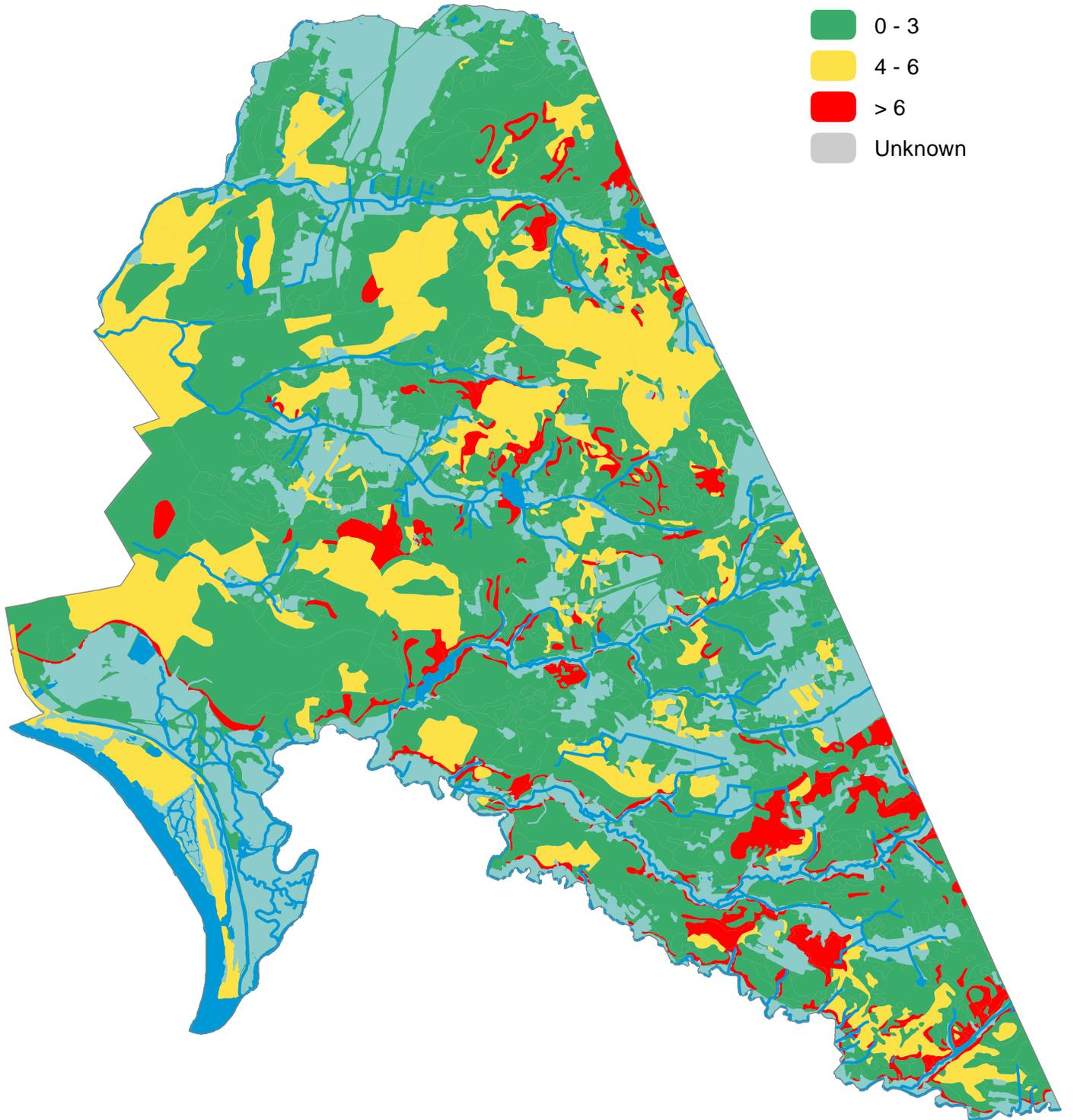
Slope (%)

 0 - 3

 4 - 6

 > 6

 Unknown



0 0.375 0.75 1.5 2.25 3 Miles

Soil Suitability Maps

Map 2A – Grassed Swales

Map 2B – Sand Filters

Map 2C – Infiltration Trenches

Map 2D – Bioretention

Map 2E – Bioretention (Infiltration)

Map 2F – Vegetated Filterstrips

Map 2G – Porous Pavement

Map 2H – Dry Ponds

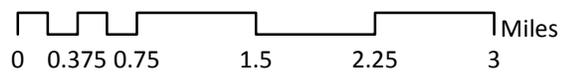
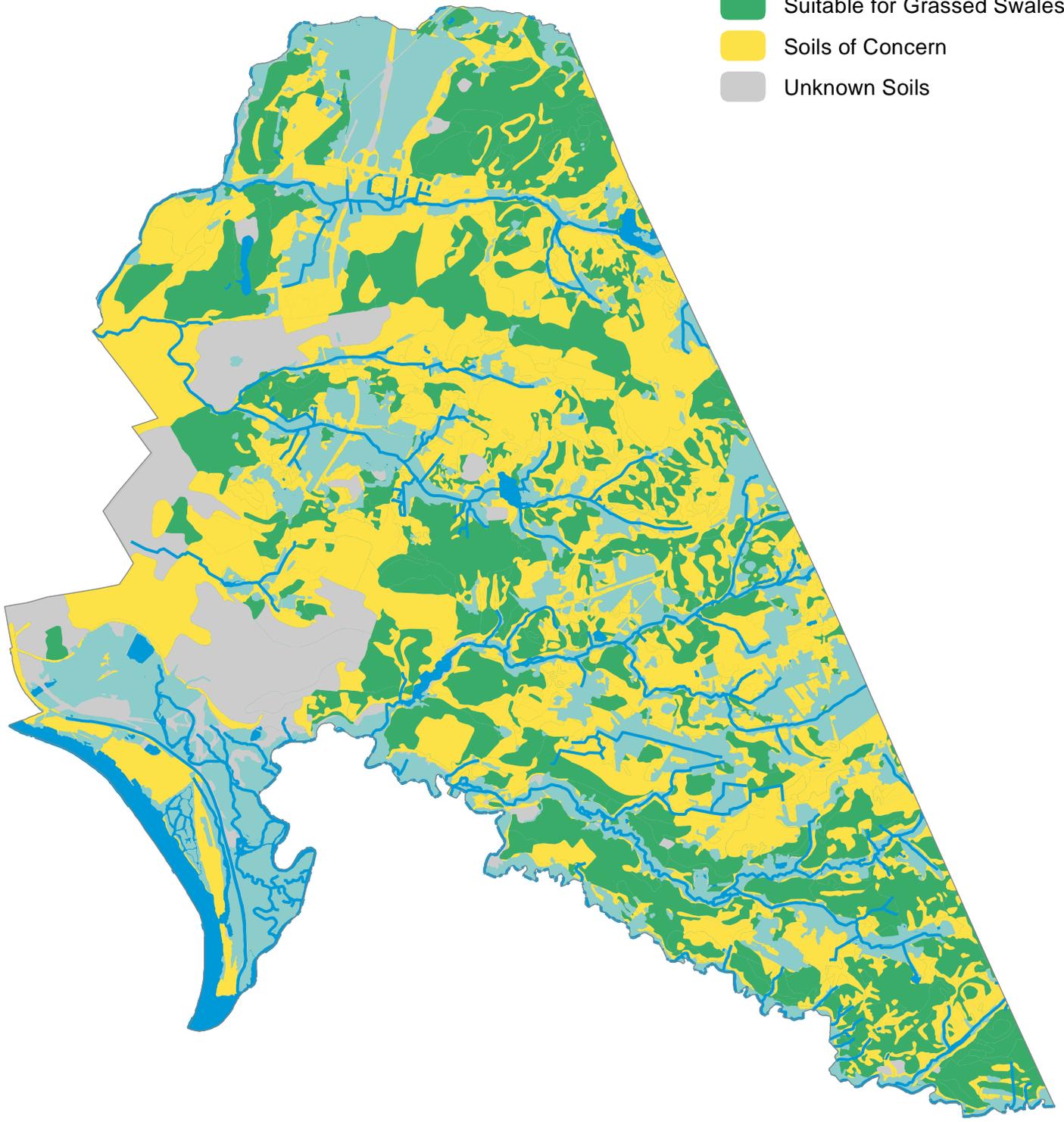
Map 2I – Wet Ponds

Map 2J – Rainwater Harvesting

Soil Suitability for Grassed Swales in Hamilton Township, New Jersey

Map 2A

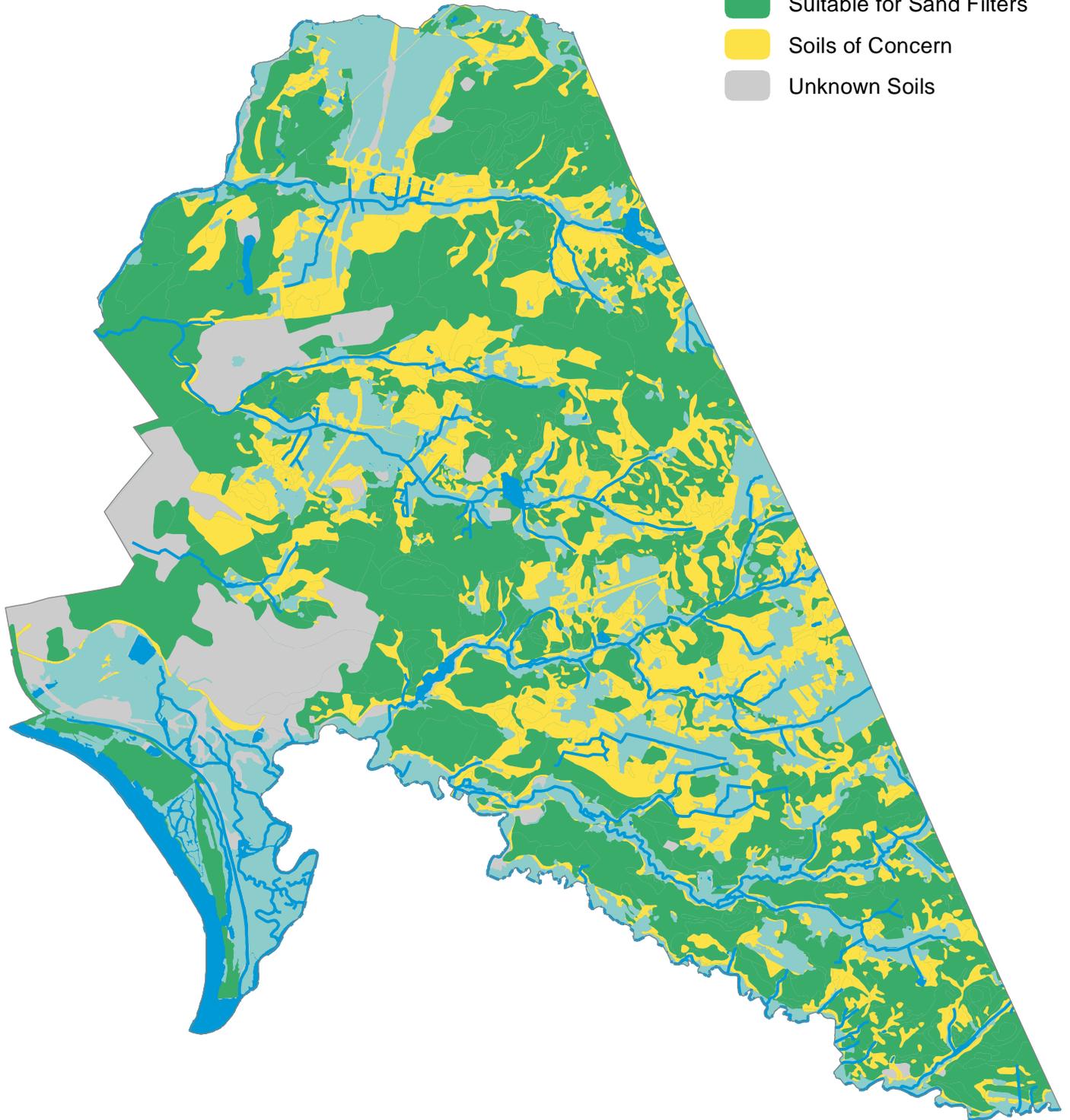
-  Rivers & Streams
-  Water
-  Wetlands
-  Suitable for Grassed Swales
-  Soils of Concern
-  Unknown Soils



Soil Suitability for Sand Filters in Hamilton Township, New Jersey

Map 2B

-  Rivers & Streams
-  Water
-  Wetlands
-  Suitable for Sand Filters
-  Soils of Concern
-  Unknown Soils

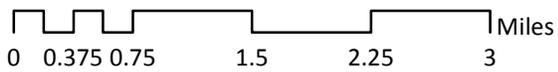
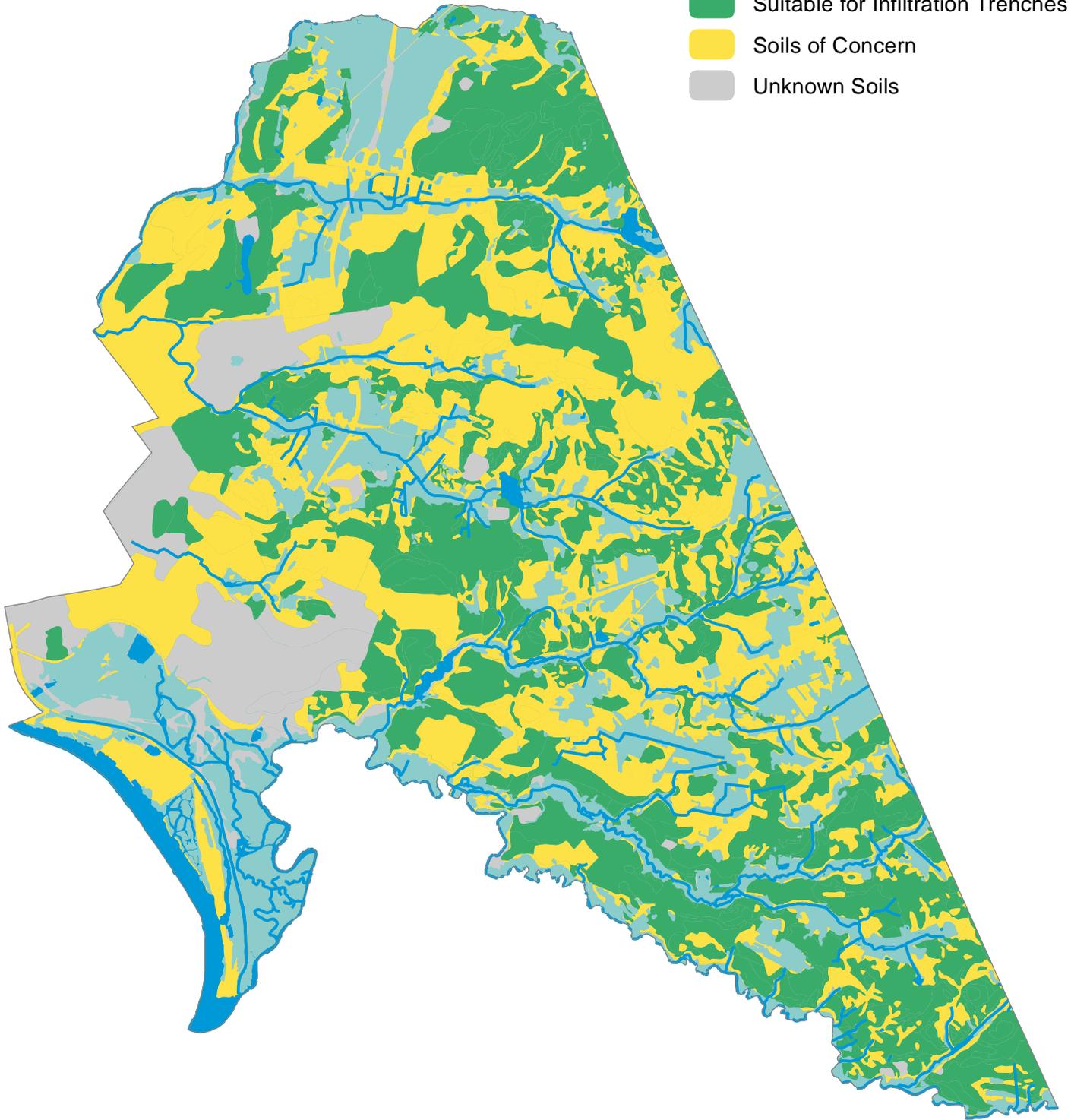


0 0.375 0.75 1.5 2.25 3 Miles

Soil Suitability for Infiltration Trenches in Hamilton Township, New Jersey

Map 2C

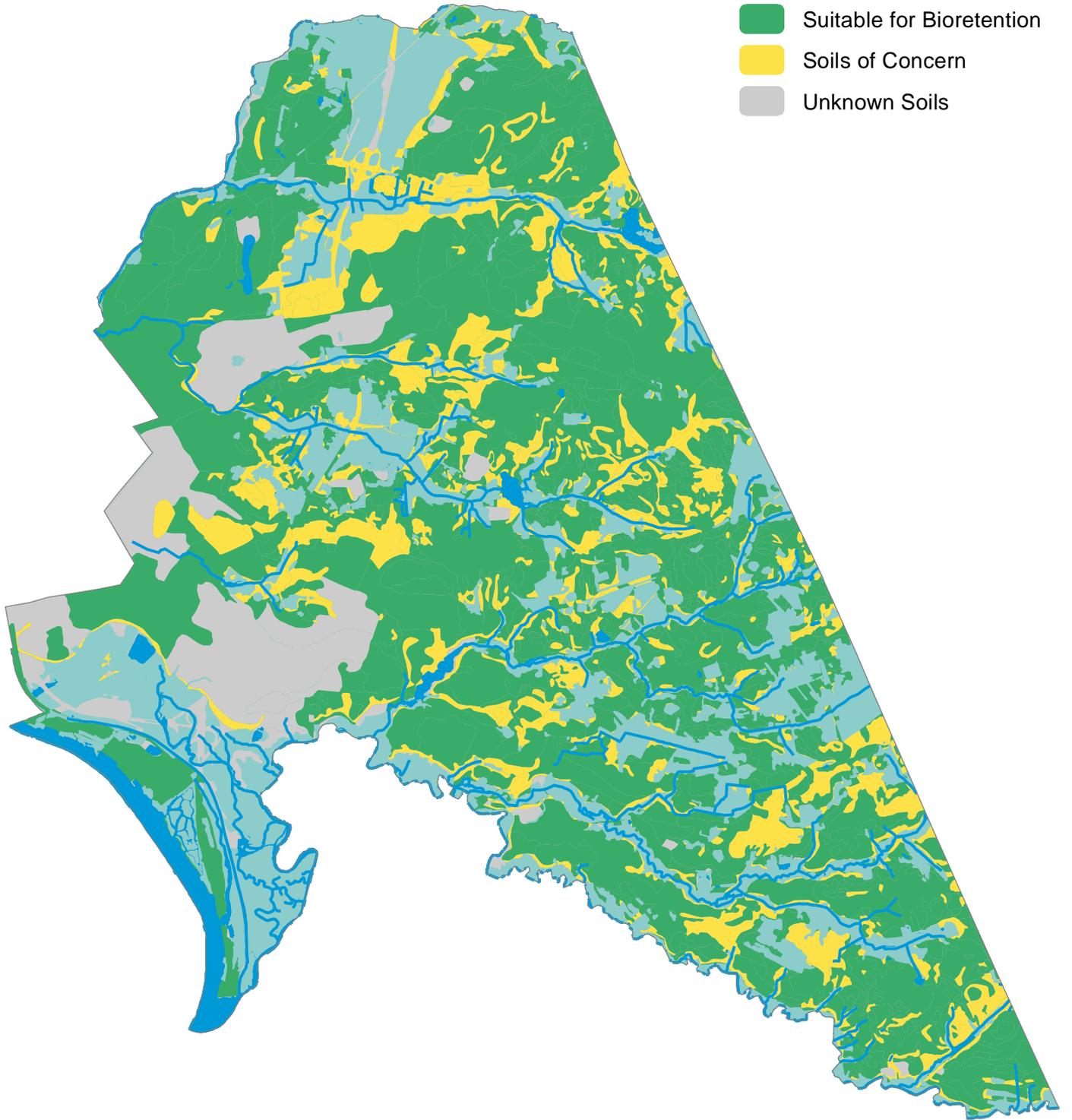
-  Rivers & Streams
-  Water
-  Wetlands
-  Suitable for Infiltration Trenches
-  Soils of Concern
-  Unknown Soils



Soil Suitability for Bioretention in Hamilton Township, New Jersey

Map 2D

-  Rivers & Streams
-  Water
-  Wetlands
-  Suitable for Bioretention
-  Soils of Concern
-  Unknown Soils

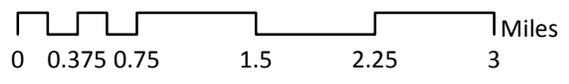
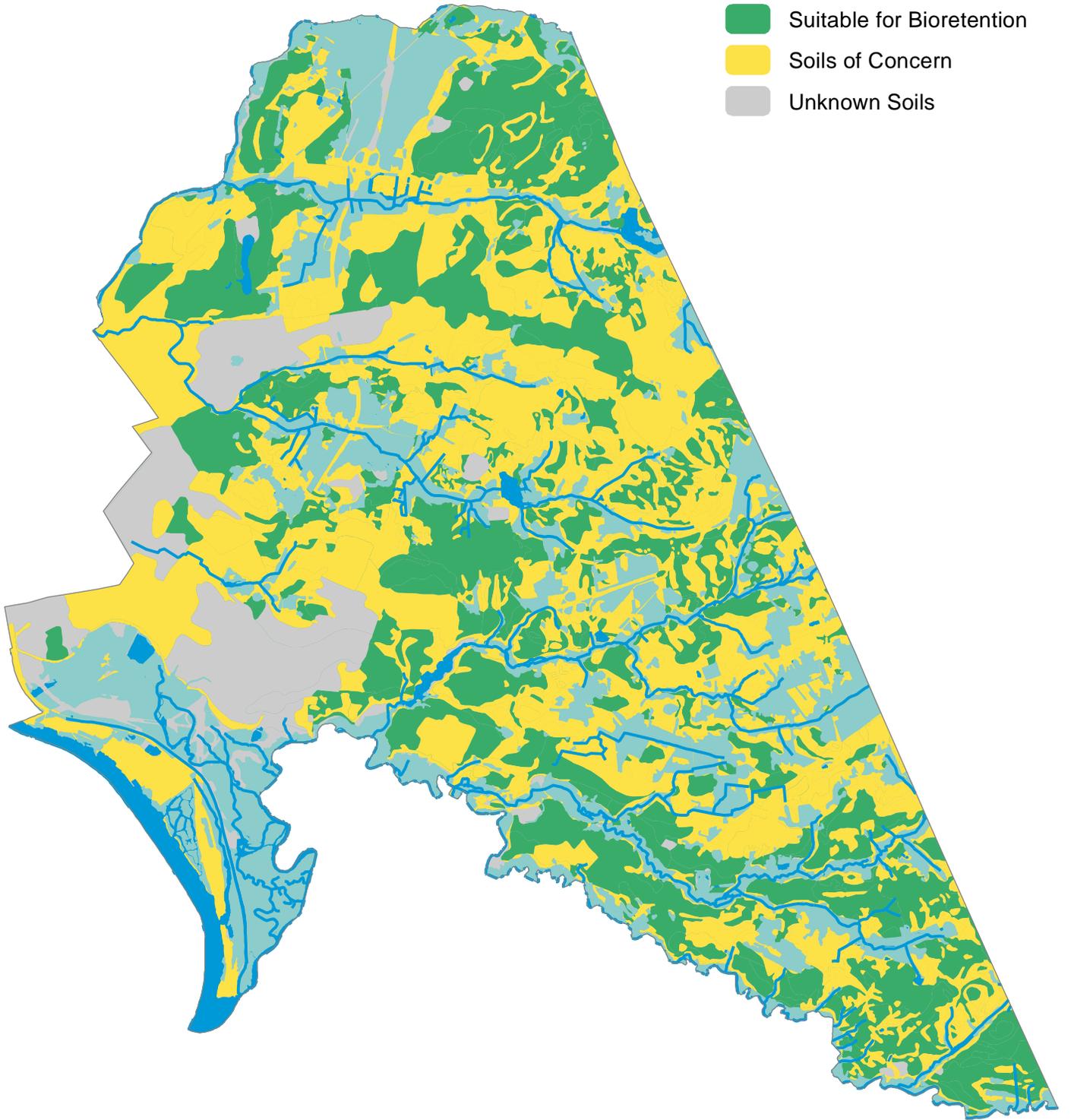


0 0.375 0.75 1.5 2.25 3 Miles

Soil Suitability for Bioretention (Infiltration) in Hamilton Township, New Jersey

Map 2E

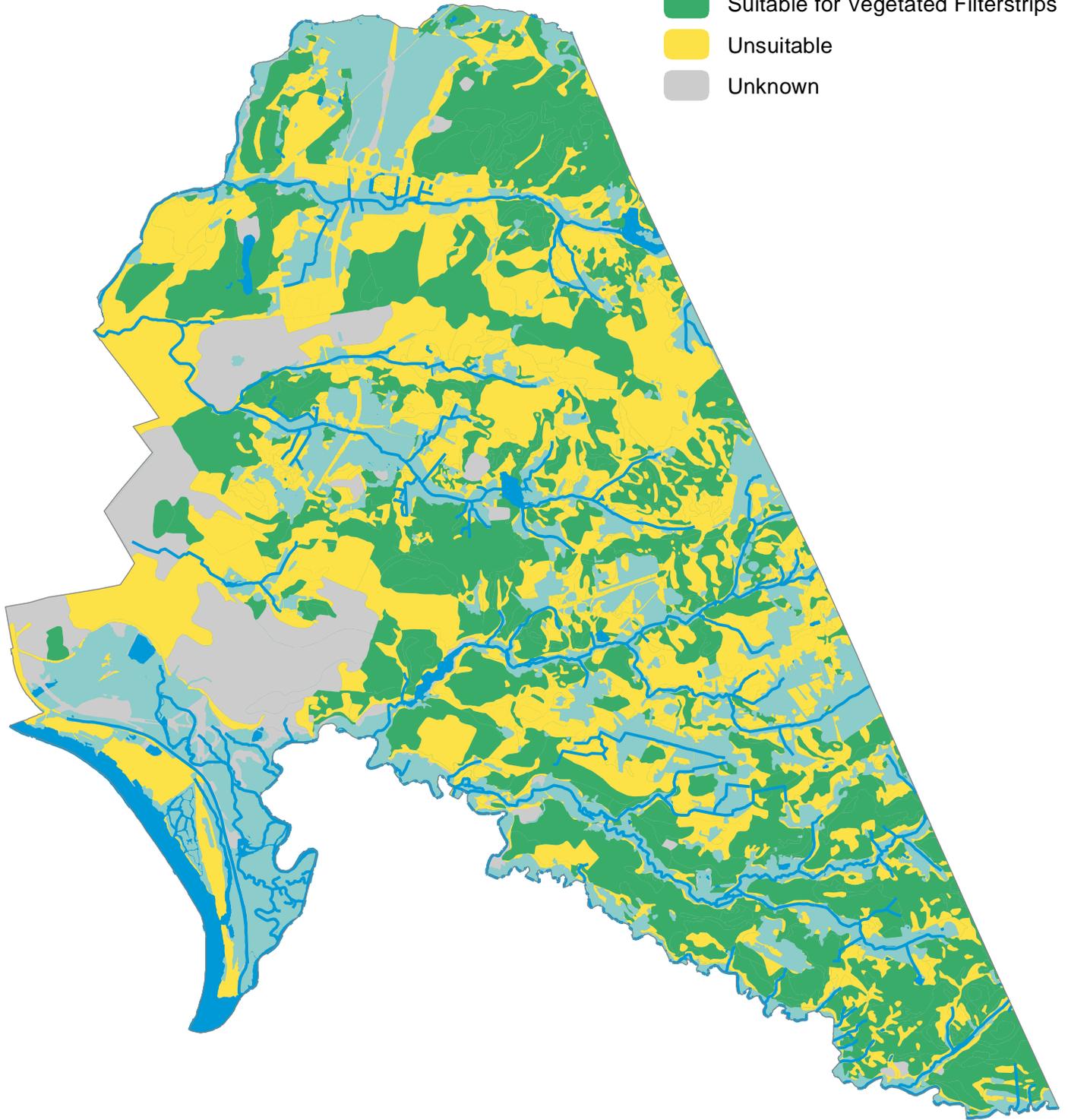
-  Rivers & Streams
-  Water
-  Wetlands
-  Suitable for Bioretention
-  Soils of Concern
-  Unknown Soils



Soil Suitability for Vegetated Filterstrips in Hamilton Township, New Jersey

Map 2F

-  Rivers & Streams
-  Water
-  Wetlands
-  Suitable for Vegetated Filterstrips
-  Unsuitable
-  Unknown

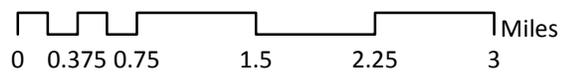
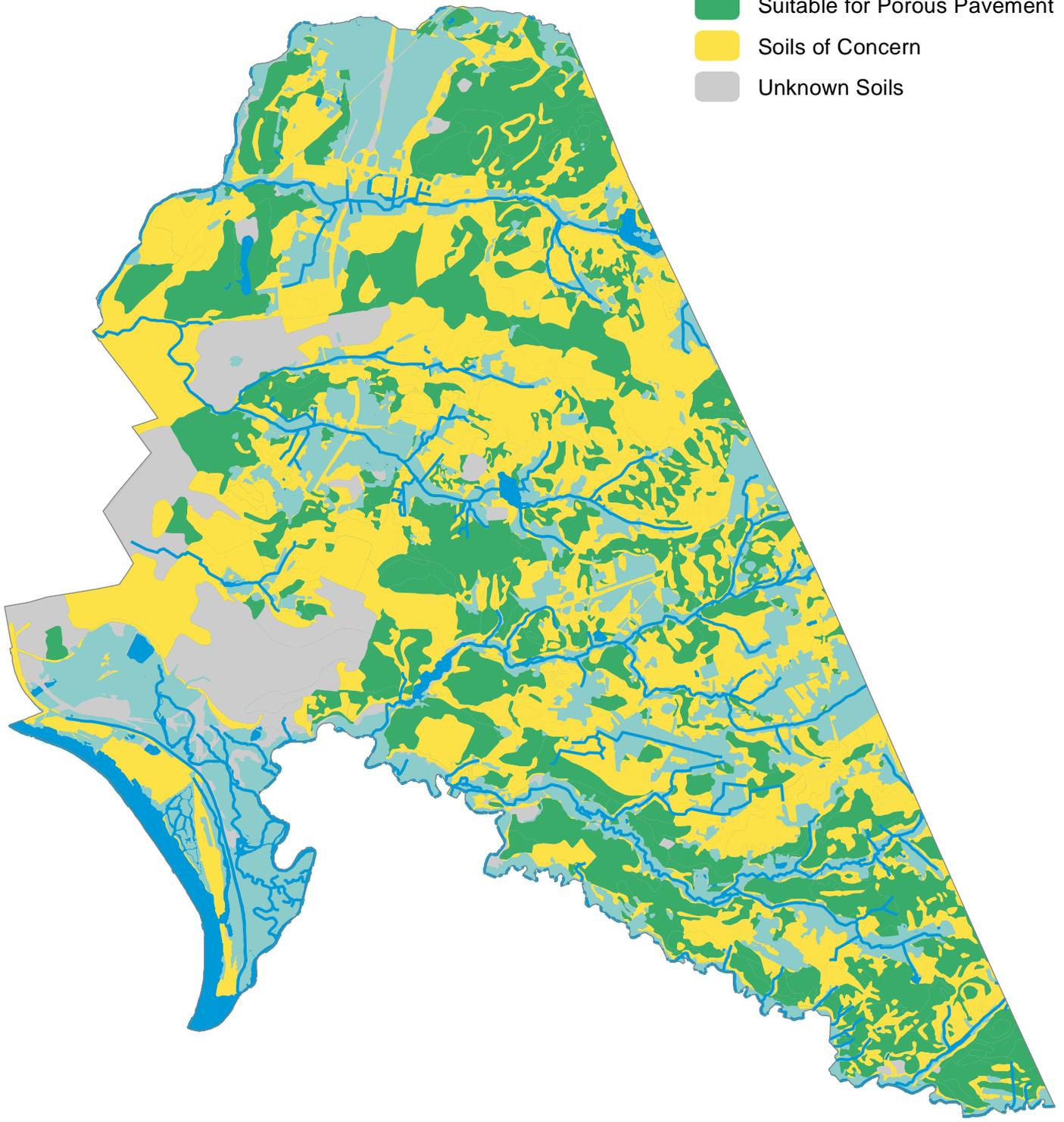


0 0.375 0.75 1.5 2.25 3 Miles

Soil Suitability for Porous Pavement in Hamilton Township, New Jersey

Map 2G

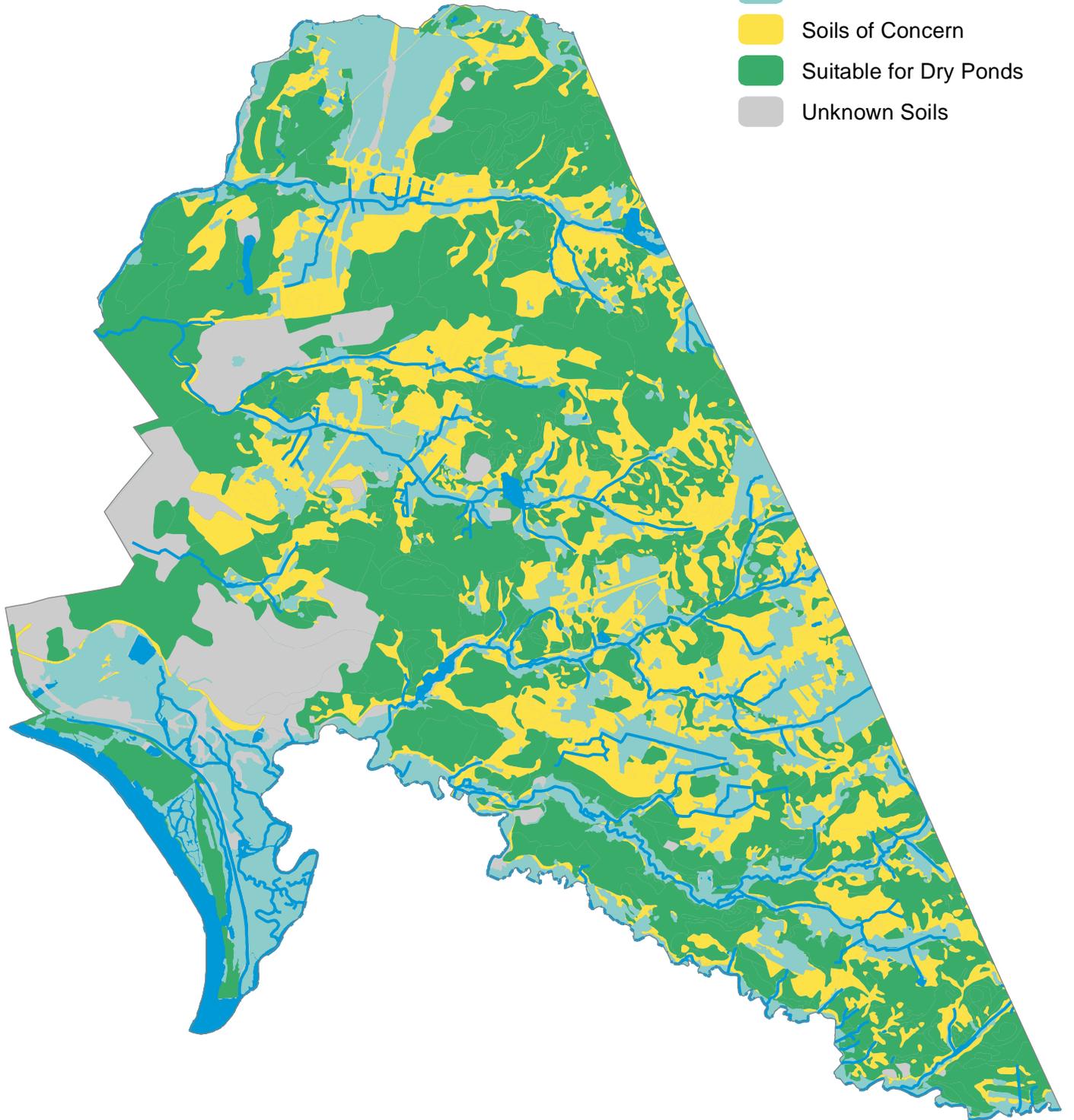
-  Rivers & Streams
-  Water
-  Wetlands
-  Suitable for Porous Pavement
-  Soils of Concern
-  Unknown Soils



Soil Suitability for Dry Ponds in Hamilton Township, New Jersey

Map 2H

-  Rivers & Streams
-  Water
-  Wetlands
-  Soils of Concern
-  Suitable for Dry Ponds
-  Unknown Soils

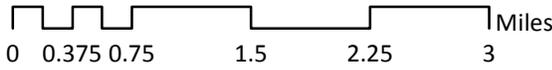
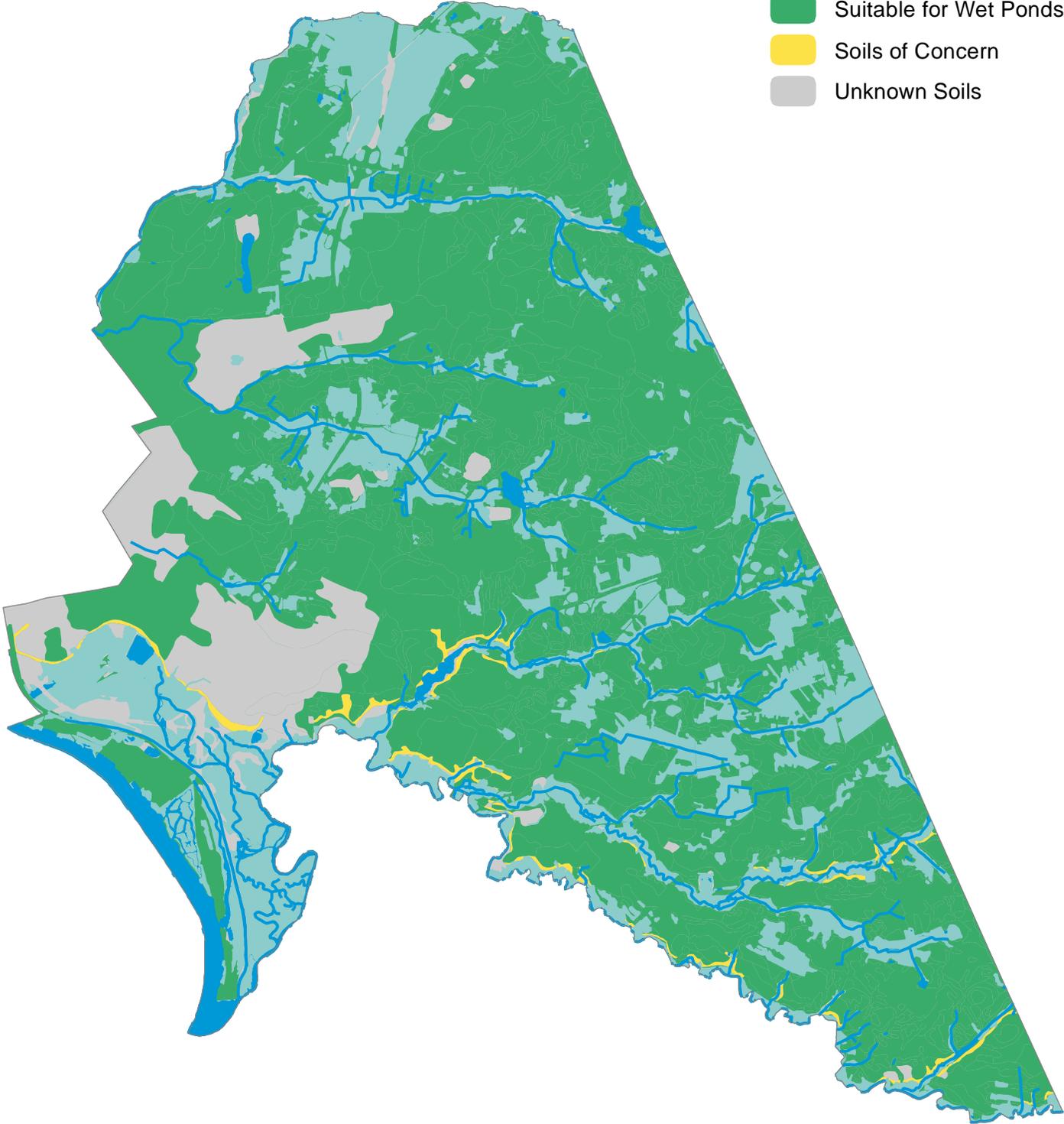


0 0.375 0.75 1.5 2.25 3 Miles

Soil Suitability for Wet Ponds in Hamilton Township, New Jersey

Map 21

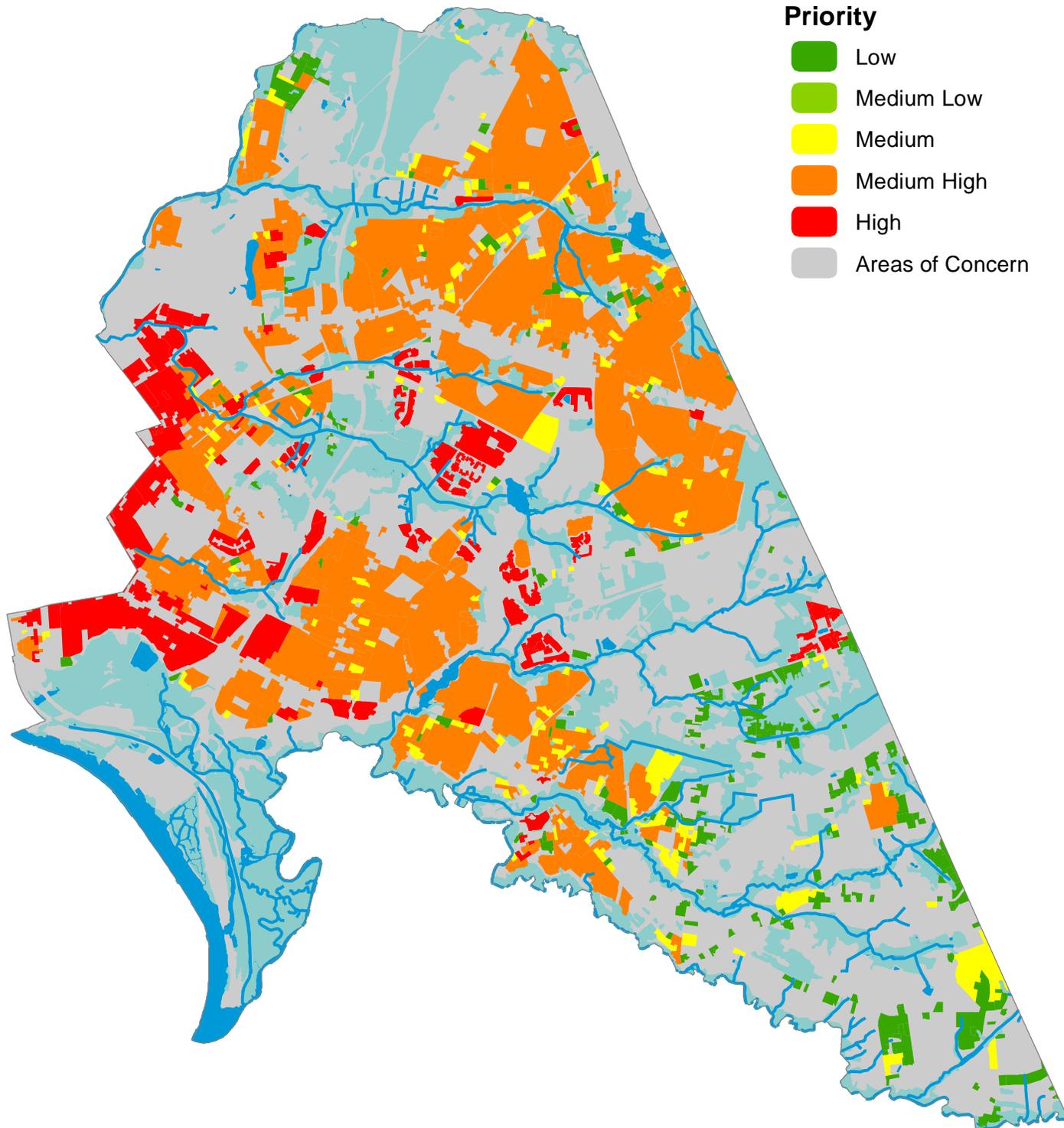
-  Rivers & Streams
-  Water
-  Wetlands
-  Suitable for Wet Ponds
-  Soils of Concern
-  Unknown Soils



Priority Areas for Rainwater Harvesting in Hamilton Township, New Jersey

Map 2J

-  Rivers & Streams
-  Water
-  Wetlands
- Priority**
-  Low
-  Medium Low
-  Medium
-  Medium High
-  High
-  Areas of Concern



0 0.375 0.75 1.5 2.25 3 Miles

Note: This map was created based on Land Use/Land Cover Data