

**MASTER PLAN AMENDMENT
FOR THE
AGRICULTURAL AND MOUNTAIN
DISTRICTS**



**Prepared by the Hillsborough Township Planning Board
with assistance of Banisch Associates, Inc.
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Introduction

Hillsborough Township is a study in contrasts. State Highway Route 206, which bisects the Township from north to south, has historically been the conduit for growth, around which major suburban development has been arrayed. Large-scale residential developments, as well as smaller residential neighborhoods, have established a dominant residential character throughout the central and eastern sectors of the municipality. Retail and other non-residential uses have been established along most of the length of the state highway.

Portions of Somerset County, beyond the historic population centers, have witnessed substantial suburban expansion. This has been spurred by improvements to the state highway system and extension of the interstate highway network, which has expanded and refined the arterial circulation system in central New Jersey. These regional growth pressures have exerted an influence on Hillsborough throughout the post-war era.

While the fabric of Hillsborough's neighborhoods and shopping districts has been firmly established in the developed areas, lands within the Agricultural and Mountain districts have not been substantially suburbanized. These lands, which the State Plan classifies as rural and environmentally sensitive, are the Hillsborough "environs", where the State Development and Redevelopment Plan promotes retention of large contiguous areas of farmland and other open lands.

This Master Plan Amendment focuses on the Mountain and Agricultural districts in Hillsborough. A major objective of this plan is to curtail suburban sprawl and promote policy and regulatory approaches that can prevent the substantial development and radical alteration of these areas and to preserve and protect the value and utility of these areas for farming and open space. While the 3-acre and 5-acre zoning of the Agricultural and Mountain districts has not yet induced suburban residential development on a large scale, these districts are becoming increasingly attractive as the areas permitting smaller lot sizes in Hillsborough and beyond have been increasingly developed.

Agricultural lands are frequently attractive targets for development, since they are already cleared, generally well drained, and pose few impediments to suburban tract development. And while the Sourland Mountain poses substantial limitations for community development, the prevailing 5-acre lot size will likely result in irreversible environmental impacts to the quantity and quality of surface and groundwater at full development as currently zoned.

Suburban sprawl is not an accident. It generally follows the dictates of local plans and ordinances, which establish development standards. "If you build it, they will come" is the mantra of post-war suburban expansion. The necessary corollary is "if you zone it, they will build". For suburban sprawl to be curtailed, municipalities must peel away the template mandated in local ordinances that creates sprawl. Instead, municipalities must substitute policies and regulations that can maintain open lands and agricultural activities, environmentally sensitive natural features and irreplaceable cultural assets.

As sprawl advances, landscapes are radically altered, woodlands are cleared, farms are paved over, habitats are destroyed, and the fiscal impacts of sprawl are born by all residents, regardless of their prosperity. For many, high housing costs and rising property taxes prevent entry into a community. For seniors and others whose homes have long been paid off, rising property taxes can drive away those who can no longer afford to live there.

Hillsborough's vision in this Master Plan Amendment is that the resource values that abound throughout the less-developed portions of the community will be enduring. The Planning Board envisions broad open spaces, wooded expanses, undisturbed stream corridors and healthy ecological systems in the areas where they exist today. However, the Planning Board also recognizes the rights of property owners to utilize their property, and seeks to guide land use activities in a manner that is respectful of the environment and conservative of valued land and water resources.

When resources are abundant, conservation sometimes appears optional. However, in the evolving era of scarce resources, communities are wise to err on the side of caution. New Jersey's disappearing landscape is valued for numerous reasons. Forests provide clean air, enhance and protect the soil, and help to maintain water quality. Agricultural fields yield not only bountiful produce close to populated markets, but also offer scenic breathing space and peace of mind. The Sourland Mountain hosts a fragile ecosystem with a delicate balance that can be easily disrupted. In short, this is a landscape of integrity, which merits careful protection. The purpose of this Master Plan Amendment is to protect irreplaceable resources of Hillsborough's natural and cultural landscape, to enhance the quality of life within the Township and the region and to plan in ways that can sustain adequate resources for future generations.

Goals and Objectives

Through the statement of objectives, principles, assumptions, policies and standards the Planning Board articulates the vision for the future development of the municipality. This vision builds upon what has come before, incorporates these conditions, and expresses what the Township wants to be in the future.

The purposes of the Municipal Land Use Law (MLUL) articulate the objectives of the State in providing municipalities with the power to plan and zone. These purposes of the enabling legislation combine with detailed local goals and objectives to guide the development of the Master Plan. The purposes of the Municipal Land Use Law (NJSA 40:55D-2) are as follows:

- a. To encourage municipal action to guide the appropriate use or development of all lands in this State, in a manner which will promote the public health, safety, morals, and general welfare,
- b. To secure safety from fire, flood, panic and other natural and manmade disasters;
- c. To provide adequate light, air and open space;
- d. To ensure that the development of individual municipalities does not conflict with the development and general welfare of neighboring municipalities, the county and the State as a whole;
- e. To promote the establishment of appropriate population densities and concentrations that will contribute to the well being of persons, neighborhoods, communities and regions and preservation of the environment,
- f. To encourage the appropriate and efficient expenditure of public funds by the coordination of public development with land use policies;
- g. To provide sufficient space in appropriate locations for a variety of agricultural, residential, recreational, commercial and industrial uses and open space, both public and private, according to their respective environmental requirements in order to meet the needs of all New Jersey citizens,
- h. To encourage the location and design of transportation routes that will promote the free flow of traffic while discouraging location of such facilities and routes that result in congestion or blight,
- i. To promote a desirable visual environment through creative development techniques and good civic design and arrangements;

- j. To promote the conservation of historic sites and districts, open space, energy resources and valuable natural resources in the State and to prevent urban sprawl and degradation of the environment through improper use of land,
- k. To encourage planned unit developments, which incorporate the best features of design and relate the type, design and layout of residential, commercial, industrial and recreational development of the particular site,
- l. To encourage senior citizen community housing construction;
- m. To encourage coordination of the various public and private procedures and activities shaping land development with a view of lessening the cost of such development and to the more efficient use of land;
- n. To promote utilization of renewable energy sources; and
- o. To promote the maximum practicable recovery and recycling of recyclable materials from municipal solid waste through the use of planning practices designed to incorporate the State Recycling Plan goals and to complement municipal recycling programs.

Objectives of the 2002 Update to the Master Plan

In addition to the MLUL purposes, local goals for rural conservation and resource protection are outlined above in the Introduction. Based on the historic objectives, actual development experience, policy statements to help guide development in the 1996 Master Plan and the new factors identified in the build-out and land use analysis and classification, in the Environmental Resource Inventory and Analysis of State Planning Policy Implications for the Agricultural and Mountain districts and Assessment of Infrastructure in the Agricultural and Mountain districts, the following objectives are refined and expanded to guide the Planning Board's development of policies, strategies and standards for the evaluation and planning of the physical, economic and social development of Hillsborough Township.

Land Use Management

1. Provide a future land use pattern that includes agriculture (farms), recreation, employment, residential, public services and a safe and healthful environment.
2. Continue and expand land use policies that guide development to suitable locations and at appropriate intensities, and provide for higher densities only in areas where the public water and sewers are available, planned or where all other necessary public utilities and infrastructure are available or where there is adequate access provided.

3. Plan for population densities in areas that do not exceed the carrying capacities of natural resources especially groundwater and the ability of the soil to sustain on-lot sewage disposal systems where public water and sewers are not available.
4. Exercise stewardship over the lands and waters of Hillsborough Township to ensure that these resources are available for the sustenance and enjoyment of present and future generations
5. Protect and maintain the prevailing rural character and unique sense of place within Hillsborough, particularly in the Agricultural and Mountain districts, which includes historic settlement areas and scenic landscapes, which result from the natural topography, agricultural lands, woodlands and watercourses.
6. Promote cooperation with adjoining municipalities, particularly the Boroughs of Manville and Millstone, to advance consistent development and open space goals, policies and plans.
7. Advance the goals and objectives of Hillsborough Township through the incorporation of local policies and strategies that respond to the basic premises, intent and purposes of the State Development and Redevelopment Plan and the Somerset County Master Plan.

Community Design

1. Explore opportunities for mixed-use development in a high-density core with commercial services and public facilities surrounded by lower density residential development.
2. Discourage strip commercial development.
3. Encourage the development of employment areas near residential neighborhoods with design that assures the peace and solitude of residents.
4. Planned centers should have coordinated architectural design, landscaping, lighting, signs, and similar design features.
5. Retain to the greatest extent practicable attractive vistas from public rights-of-way, including views of hills, valleys, ridgelines, woodlands, farmlands, hedgerows, stream corridors, flood plains and other natural areas.
6. Promote flexible zoning provisions such as cluster options that may aid in avoiding development in critical areas.
7. Encourage employment areas in close proximity to the railroad corridors and major highway facilities.
8. Provide for employment centers close to residential development to reduce vehicular traffic and encourage alternative modes of transportation.
9. Require all non-residential development (e.g., industrial, office, commercial) to be compatible with nearby residential neighborhoods.

Natural Resources

1. Protect the environment and environmentally sensitive areas of the Township from destruction or degradation, including but not limited to steep slopes, ridgelines, trout streams, wetlands, stream corridors, potable water supplies, watersheds, aquifers, rivers, view sheds, forests and other vegetation, habitats of threatened and

endangered species and unique natural systems, and utilize the findings and recommendations of the Hillsborough Environmental Commission whenever possible to advance this objective.

2. Preclude development in environmentally critical areas by minimizing any intrusion and implement strategies to mitigate impacts.
3. Maintain and enhance biological diversity through the protection of large contiguous tracts and corridors of recreation, forest, flood plain and other open space lands.
4. Protect prime agricultural soils, soils of statewide importance and soils of local importance for their contribution to agricultural production.
5. Promote land use and management policies that provide for clean air and protection from noise and light impacts.
6. Identify and manage stream corridor buffer areas by maintaining undisturbed vegetation in order to protect and improve water quality, and provide wildlife corridors and opportunities for passive and active recreation.
7. Ensure that development involving steep slopes is planned and constructed to minimize steep slope disturbance.
8. Protect groundwater supply and quality through the adoption of aquifer management programs, including relevant standards for wellhead protection programs, and standards to protect groundwater recharge areas, such as impervious coverage limitations.
9. Promote the use of minimal necessary levels of nighttime outdoor illuminance so as to protect and preserve the dark sky quality and starscape of the Agricultural and Mountain districts.
10. Protect and maintain the existing tree canopy during the development process, as well as to promote the replanting of areas where the existing canopy have been lost.

Housing

1. Provide housing types to serve all ages, economic segments and family sizes according to State Law and consistent with available service facilities, schools and infrastructures.
2. Promote and support the development and redevelopment of affordable housing with the intent to address the Township's fair share of the region's lower income housing, particularly in areas served by public transportation which connect to areas of employment.

Agriculture

1. Encourage agricultural preservation throughout the Township, in recognition of the existing agricultural characteristics.
2. Preserve a large contiguous land base to assure that agriculture remains a viable, permanent land use.
3. Coordinate agricultural preservation activities with the State Agriculture Development Committee (SADC), Somerset County Agricultural Development Board and other open space preservation activities in the Township.

4. Recognize agriculture as a significant economic industry in the community and to encourage economic opportunities in this industry.
5. Encourage compatibility between agricultural operations and neighboring non-agricultural development through the right-to-farm ordinance.

Transportation

1. Provide consistency in transportation management to meet the regional requirements and coordinate with other municipalities and governmental bodies for a regional approach to transportation that respects and enhances the character of the community.
2. Plan for improvements to the major street system to create a convenient circulation system sufficient to accommodate anticipated development.
3. In the Sourland Mountain, historic districts, and agricultural districts, promote a road system that remains narrow because of the physical constraints of the terrain and the limited traffic resulting from the restricted development opportunities.
4. Avoid strip frontage development along arterial and collector highways that would result in further uncontrolled access.
5. Establish highway access management plans for major arterial highways.
6. Require access to individual properties from streets with a local classification where feasible.
7. Promote industrial uses that have access to rail service.
8. Encourage public transportation to be readily accessible to residential areas of higher densities for convenient home-to-work travel.
9. Promote the development of future passenger rail service to and from the Township.
10. Discourage further highway development or extension of the highway system into the agricultural, mountain and other scenic areas.
11. Promote transit alternatives in new and existing development to reduce traffic congestion, including ride shares, buses, mass transit, taxis, car/van pools, dial-a-ride, and flextime.
12. Minimize the impacts of transportation systems on the environment, including air and noise pollution.
13. Encourage pedestrian and bike paths within residential developments designed to provide direct, easy access to new shopping areas as an enticement to reduce vehicular travel.

Economic Development

1. Provide expanded employment opportunities by encouraging development in appropriate areas for this purpose and consistent with available infrastructure and supporting services.
2. Promote employment opportunities and commercial services in locations compatible with existing and proposed development.
3. Encourage commercial development or redevelopment in suitable areas of the community that are most economically useful for commercial purposes.

4. Promote the redesign of existing commercial sites to provide a more efficient land use pattern through such approaches as reduced curb cuts, interconnecting driveways, improved pedestrian and bicycle linkages and enhanced landscaping.
5. Promote regional cooperation with adjoining municipalities, with particular reference to the Boroughs of Manville and Millstone, in the development of economic development strategies.

Historic and Cultural Resources

1. Preserve the historic and archaeological sites of Hillsborough Township and coordinate development to incorporate historic features wherever possible.
2. Encourage the preservation of historic districts, in particular those identified in the 1996 Master Plan and continued in this Master Plan.
3. Discourage encroachment on historic structures and sites by uses and buildings that are incompatible or detract in design.
4. Encourage the preservation, rehabilitation or adaptive reuse of historic buildings and structures that protects their architectural integrity and preserves their context within the historic landscape.
5. Promote the development of land use regulations, which acknowledge and permit special treatment for historic landscapes, districts, sites, and structures including setbacks, buffers and other design criteria.
6. Prohibit transportation improvements (local or regional), which do not take into consideration impact on historic districts and sites.

Community Facilities and Utilities

1. Require infrastructure improvements scaled to permit development to protect the health, safety and welfare of the public.
2. Promote utilities to allow higher density development in appropriate locations.
3. Provide for expanded public facilities as part of new developments that reflect population growth and protect natural and historic features.
4. Require educational support, services and facilities to meet the increased demand created by new developments.
5. Program and plan for the expansion of necessary public services, such as utilities, community facilities and recreation, at a reasonable cost in response to the proposals in the land use plan element.
6. Establish a system whereby necessary capital improvements can be programmed and planned in advance.
7. Ensure that the development process acknowledges and addresses the impact on community facilities and utilities through the payment of the fair share of any off-tract improvements for community facilities to the extent permitted by law.
8. Provide healthcare and specific needs of senior citizens.

Recreation and Open Space

1. Require coordinated open space proposals as part of new developments that will be related to population growth and natural and historic features.
2. Prepare and maintain recreation and open space master plans to establish and enhance recreational lands and public open space; to establish linkages of public spaces through the use of greenways, greenbelts, waterways, paths and bikeways; and, to establish as the highest priority for public acquisition, areas of unique recreational, scenic or environmental value.
3. Encourage the public acquisition of areas of exceptional recreational or scenic value, or environmental sensitivity, at all levels of government, with priority given to acquisition of land to meet present and future demand for active and passive recreation.
4. Promote cultural activities that provide recreational opportunities for a broad spectrum of residents and visitors.
5. Assess and provide opportunities for active and passive recreation to meet the needs of all citizens.
6. Devise appropriate strategies for the public and private ownership and maintenance of open space and recreation lands.
7. Encourage private landowners to permit public use through participation in the State's "Leave a Legacy of Land" program.

The Land Use Plan for the Agricultural and Mountain Districts

This Land Use Plan Element for the Agricultural and Mountain Districts in Hillsborough Township is designed to implement the foregoing goals and objectives, in a manner which respects and responds to the capabilities and limitations of the natural conditions -, surface water and groundwater quantity and quality, agricultural use opportunities, soils, steep slopes, woodlands, wetlands and flood prone areas. The Plan generally depicts the proposed location, extent and intensity of development of land to be used in the future, as shown on the amended AG and MZ Districts Map (Figure 1) and the Land Use District Changes (Figure 19). The land use planning proposals become effective change agents when implemented through the Land Use Regulations Ordinance.

This Land Use Plan Amendment represents the Hillsborough Township Planning Board's plan for the future disposition of land and the physical form of the Agricultural and Mountain Districts. The plan reflects the findings of an analysis of potential build-out under prevailing zoning, the Assessment of Infrastructure and the Environmental Resource Inventory and Analysis of State Planning Policy Implications.

To a large extent, this Plan amendment maintains the long-standing policy orientation of the prior Land Use Plan, but refines the orientation to better address evolving conditions and concerns. It also provides a more detailed description of the goals, objectives and intent of the Plan, and suggests new planning initiatives to achieve the Township's objectives.

In general, the residential densities in the Agricultural and Mountain Districts have been modified to address the findings of the land use and natural resource background information. Specifically, residential development potential has been reduced throughout the Agricultural and Mountain districts. These districts encompass most of Hillsborough's undeveloped countryside, which the State Development and Redevelopment Plan characterizes as rural and environmentally sensitive. The SDRP recommends an "environs" strategy designed to deter sprawl and protect natural resources - identified goals of the State Plan. This policy approach responds to the objectives of protecting groundwater and surface water quality, and better accomplishes the goals of rural conservation, environmental protection, agricultural retention and protection of the scenic attributes of Hillsborough Township.

Agricultural District

The existing Agricultural District in Hillsborough occupies 9,297.44 acres in Hillsborough Township (approximately 26% of the total land area). Within that area approximately 45% or 4,195 acres is in agricultural use.

The Agricultural District occurs in three segments. The easterly portion of the AG district extends from Duke Farms, near Route 206 to Beekman Lane and along the South Branch of the Raritan River to South Branch. The westerly segment extends from Clawson Avenue to the Hunterdon County line, flanking Amwell Road, while the

southerly portion of the Agricultural district extends from the Montgomery Township line northward between East Mountain Road and the rail line.

An agricultural mosaic dotted with farmsteads, barns, stream corridors and small clusters of houses typifies most of the district, where the critical mass of open land and cultivated fields imparts a prevailing rural character. Over 80% of the Agricultural District consists of highly productive farmland, including Prime farmland and Soils of Statewide or Local Importance (over 80%).

Farmland Soils	Agricultural Zone (Acres)	Percentage of Agricultural Zone
Prime	3,833.70	41.2%
Local	2,103.58	22.6%
Statewide	1,531.07	16.5%
Non-Class	1,829.09	19.7%
Total	9,297.44	

An analysis of the potential build-out of the Agricultural District indicates that if development proceeded according to the 3-acre zoning standard, an additional 1,450 dwelling units could be constructed on the valuable farmland soils found in this portion of Hillsborough.

Outside of the Agricultural District, there are approximately 4,600 acres in agricultural use. A large portion of this land is found in the Corporate Development Zone (CDZ), adjacent to the southern portion of the existing Agricultural District. The CDZ was created in 1986 with the purpose of providing and promoting suitable corporate development opportunities and promoting improved land use, which is compatible with residential areas and existing and proposed transportation facilities. The major motivation for establishing the CDZ was the proposed realignment of Route 206 through this large agricultural area.

Little development has occurred in the CDZ zone since the adoption of the ordinance, and the realignment of Route 206 is still in design. The majority of the area is farmland-assessed and in active production between Willow Road and just beyond the easterly frontage of existing Route 206. The area south of Hillsborough Road is not in the existing sewer service area, but is in the planned sewer service area. This area, dominated by prime farmland and statewide and locally important soils, may be appropriate for inclusion in the agricultural district. The area to the east of the proposed Route 206 bypass and south of Hillsborough Road would help to provide a green belt of large contiguous open lands surrounding the areas slated for development north and west of this area.

Public Policy Objectives Supporting Hillsborough's Agricultural Future

Agriculture and farmland retention is a significant objective of all levels of government. At the federal level, farm support programs have been fashioned and expanded over the years to make the United States the most productive agricultural economy in the world. Of course, agricultural production assumes unique importance when it occurs, as it does in Hillsborough, in close proximity to the valuable markets that result from high-density populations, where farm fresh products can be delivered with a minimal expenditure of time and energy.

The Municipal Land Use Law (MLUL), through which the State extends its police power to municipalities to regulate land use, includes the preservation of "sufficient space in appropriate locations" for a variety of uses including agriculture and open space "in order to meet the needs of all New Jersey citizens" (NJSA 40:55D-2g). Consistent with this objective, the MLUL also seeks "to promote a desirable visual environment through creative development techniques and good civic design and arrangements" (NJSA 40:55D-2i) as well as "to promote the conservation of...valuable natural resources in the State and to prevent urban sprawl..." (NJSA 40:55D-2j).

New Jersey took early steps to prevent farmland loss with the 1964 Farmland Assessment Act, which provided dramatic tax reductions for qualifying farmland over the last 30 years. New Jersey's Agricultural Retention and Development Act (1983) has promoted continued agriculture through the creation of County Agricultural Development Boards (CADB), the municipally approved Farmland Preservation (8 year) Program and the purchase of development rights. The Right to Farm Act (1982) established the State Agricultural Development Committee to mitigate unnecessary constraints on essential farming practices by recommending agricultural management practices and protecting farmers from over-regulation and nuisance suits. The influx of non-farm uses frequently poses difficulties for farmers, as new residents complain about noise, dust, chemicals and odors. Farmers also suffer from crop and livestock losses from vandalism, stormwater diversions and trespassing.

The State has also made a significant contribution toward the preservation of agricultural land and activities through the Farmland Preservation Bond Act of 1981 and the 1999 Garden State Preservation Trust Act has produced, which to date has retired the development rights to over 96,839 ¹acres of farmland in New Jersey. The substantial costs of this program have largely been born by the State with contributions by counties and municipalities.

The State Planning Act (NJSA 52:18A-196 et seq.) included a finding that as the nation's most densely populated state, New Jersey requires coordinated State, local and regional planning in order to conserve its natural resources. Among the natural resources and qualities, which the State Planning Act was intended to protect, are "agricultural development areas." The State Planning Act also required the State Planning Commission

¹ SADC had permanently protected this amount of acres as of January 1, 2001.

to "coordinate planning activities and establish state-wide planning objectives" for a wide range of areas including "agriculture and farmland retention".

The Agricultural Development Area, which constitutes the Agricultural District, is located within Planning Area 4 (Rural) and Planning Area 4B (Rural/Environmentally Sensitive) and Planning Area 5 (Environmentally Sensitive) as identified in the State Development and Redevelopment Plan.

The Somerset County Agricultural Development Board has identified three Priority Areas for agricultural retention within the County. The Priority Area in Hillsborough includes the Duke Estate, along with agricultural lands extending westward along the river corridor and throughout western Hillsborough. The Somerset CADB Agricultural Master Plan (February 2001) examined the role of farming in the County and recommended strategies for strengthening the agricultural industry. Among the key findings:

- Somerset County farmers had an average age of 58 (in 2001) and only 12% had children involved in farming operations
- Of landowning farmers, 88% did not have any plans for development in 2001
- The rapid development of farmland has exacerbated Right-to-Farm conflicts with non-farm neighbors
- Most farmers in Somerset County depend on off-farm income, and most farms fall into the "residential/lifestyle small farm" category.

Recommendations to make farm operations more viable included:

- A change in commodity mix to produce more value-added products
- Greater access to Rutgers Cooperative Extension information and training
- Reduced Right-to-Farm conflicts
- Changes to create a more intensively farmed operation (irrigation, greenhouses, new value-added products)
- New forms of marketing and advertising, including taking advantage of the internet
- Computers
- Improved financial management and marketing skills
- Improved assistance in implementing new project ideas.

The following recommendation specifically addressed Hillsborough farmland:

- The CADB should concentrate attention on "...the farms around the Duke Estate, and certain farms on the perimeter of the Sourland Mountains."

Benefits of Local Agriculture

Preserving and protecting farmland for the enterprise of farming offers many economic and environmental benefits, not only to local communities but also to the region, the State, and points beyond. These include:

- Protecting sources of food supply.
- Conserving energy by reducing travel distances between points of origin and destination and bringing products closer to markets.
- Lowering the costs of food supply to local markets.
- Providing open space and aesthetic benefits, of particular benefit in the most densely populated state in the nation.
- Providing habitat for wildlife.
- Reducing reliance on chemical fertilizer by retaining prime agricultural soils for agricultural use, thereby reducing deleterious impacts on surface and groundwater.
- Reducing air pollution through the contribution of oxygen from photosynthesis.
- Replenishing aquifers through groundwater recharge with appropriate management practices.
- Providing a variety of sources of recreation (hunting, cross-country skiing, hiking, horseback riding, etc.).
- Maintaining and improving the quality of life and the visual character of the region.
- Maintaining and enhancing the historical, rural economy and character of the agricultural areas of the State.

Regulatory Incentives for Agricultural Business Opportunities

A series of regulatory incentives can help to promote continued agriculture in Hillsborough Township. The following incentives can offer additional opportunities for farmers to make money and/or to remove bureaucratic obstacles, which interfere with farm profitability.

- Simplify the process for farmers to obtain building and zoning permits

- Allow farm-based businesses on large commercial farms
- Support provision of adequate housing for farm labor
- Strengthen the Right to Farm ordinance
- Utilize recommended Best Management Practices, and public education
- Improve citizen awareness

Land Use and Development Regulatory Techniques

Hillsborough's Agricultural District represents a moderate strength farming area. This is an area where farms still exist in relatively large blocks, non-farm development has not intruded significantly, and where there is continued farming of traditional grain crops and ready access to local equipment suppliers. Expanding direct marketing operations by entrepreneurial farmers indicate a response to changing conditions and new opportunities. However, the County has witnessed the loss of some farm infrastructure and there appears to be little optimism among older farmers that farming as they know it will continue.

If the farmland base is not protected in the near term, farming may decline sharply with a critical mass of farmland converted to non-farm uses. Viable agriculture cannot be expected to succeed if new development proceeds according to the current three-acre density. Such zoning permits the entry of large numbers of non-farm residences and the conflicts they inevitably bring.

Recommended techniques for preserving agriculture in moderate strength farming areas include comprehensive planning, agricultural zoning, maximum building lot sizes for non-farm development (i.e., 2 acres), purchase and transfer of development rights and establishment of urban growth or village boundaries. A review of the professional literature and research from the American Farmland Trust, the Smart Growth Network, the American Planning Association and the New Jersey Pinelands Commission indicate that large lot zoning for a minimum lot size of 20 to 45 acres is appropriate as an agricultural protective zoning technique, when non-farm residences are to be permitted. In addition, lot size averaging and off-site clustering can be useful land use techniques, when the proper balance is achieved between permitted densities and lot area requirements.

Hillsborough Township's vision for the future of undeveloped lands in the Agricultural District embodies the smart growth principles of the State Plan intended to deter sprawl. Residential zoning, which has been perceived as a sort of "basic right" of landowners throughout New Jersey's countryside, has proven to be a root cause of sprawl. As efforts to hold back the tide of suburban sprawl have found the support of State planning efforts in New Jersey and around the country, a clearer focus has been brought to the problems created by sprawl, and the benefits to alternative patterns of development.

History shows that suburban development will occur at the permitted density (3 acres/unit) when the market demands in an area justify the cost of such development. Hillsborough Township and surrounding areas have been shaped by several "generations" of suburban development, which have generally occurred during times of a strong economy. Suburban residential zoning standards have evolved from the Euclidean

model, which segregated undesirable commercial and industrial uses from residential uses in order to afford safe and healthy neighborhoods.

When applied to the undeveloped countryside, single-family residential zoning consumes a valuable resource and fails to capitalize on opportunities to retain substantial open lands, provide for non-vehicular travel and enhance the potential for human interaction. If sprawl is to be discontinued, then sprawl zoning must be eliminated. Thus, the underlying residential “by right” zoning, which generates sprawling suburbs throughout the country, must be ended.

While a range of definitions of sprawl is advanced in the planning literature, Webster’s Dictionary puts it clearly - “to spread out in an awkward...way, so as to take up more space than is necessary”. Hillsborough’s Master Plan amendment proposes to achieve the objectives of the State Plan for the Environs through a variety of zoning techniques that avoid sprawl. Each permitted land development option will create a pattern designed to maximize the use of enlightened community design templates to make conservation of open lands a by-product of all residential development. These patterns provide sound management and conservation of environmentally sensitive lands.

Unlike sprawl, the land development options in this Land Use Plan Amendment are fully supportive of the master plan objectives, and maintain and reinforce historic land use and settlement patterns. Providing a range of development options offers a series of alternatives to a property owner, which may more readily meet individual needs or desires, and is less monolithic as a planning template. In addition, the proposed development alternatives offer more diverse design options. In combination with comprehensive acquisition strategies, these options will serve in the district to shape the Township’s growth strategies.

Open Lands Ratio

The Township's Master Plan, like the plans of Somerset County and the State of New Jersey, prioritizes the retention of the large contiguous masses of agricultural lands, which are required if agriculture is to have a viable future in New Jersey.

Open lands ratio zoning is a technique that defines the portion of a tract to remain open and available for farmland or other resource use, and requires that these open lands meet minimum standards of soil quality and useable land. The remaining land is then planned to accommodate the permitted non-farm residential development.

The Municipal Land Use Law directs municipalities to provide "sufficient space in appropriate locations" for agriculture and open space. The MLUL also recommends "creative development techniques and good civic designs and arrangements" to preserve and enhance the visual environment". Notable among the primary objectives of the MLUL is the conservation of valuable natural resources and prevention of urban sprawl.

Since its adoption, the State Development and Redevelopment Plan has called for a growth management strategy which channels development into compact centers, and seeks to protect the "Environs" which are New Jersey's countryside. The "Environs", which include the Agricultural District, are highlighted for protection of "large contiguous areas" of farmland, open space, and forests.

The State Development and Redevelopment Plan defines "Large Contiguous Areas" as the amount of contiguous farmland necessary to permit normal farm operations on a sustained basis, or the undisturbed land required to maintain a desired community of plants and animals". The Open Lands Ratio provides for future land development patterns that promote the objectives of the State, Somerset County and Hillsborough Township.

A key feature in Hillsborough's farmland preservation approach is to retain large contiguous tracts and areas of farmland and open space which are undisturbed by new residential or other development. Toward this end, an open lands ratio of 75% is recommended, to be achieved through a combination of density and lot size standards. This strategy is designed to preserve enough open land so that active farming operations can be continued or initiated without interference from incompatible neighboring development.

Cluster Zoning and Lot Size Averaging

These zoning techniques have been developed to address special land use concerns such as the retention of agriculture, open space and environmentally sensitive areas. The inadequacy of conventional zoning to achieve specialized community goals has prompted the widespread use of these techniques in agricultural and environmentally sensitive areas.

Clustering or cluster zoning is designed to provide useful tracts of open space as a by-product of residential development. This approach generally permits a reduction in the minimum lot size in return for permanent commitments of open space areas. The MLUL provides that clustering may be permitted within a contiguous tract or by arranging development among non-contiguous tracts (NJSA 40:55D-65(c)). Non-contiguous clustering offers the potential to accomplish total preservation of some sites, while allowing a greater measure of development on other sites. However, suitable areas for higher density development must be designated under this approach.

Lot size averaging, a variation on the cluster design concept, permits a reduction in the size of some lots provided that other lots exceed the minimum lot area requirements so that the average lot size meets or exceeds an ordinance standard. This technique has been found particularly useful for preserving farmland, woodland, or for wildlife conservation purposes. It retains the taxable status of all resulting lots and also eliminates questions about long-term maintenance of public open space and any related municipal responsibilities, as all properties remain in private ownership.

Lot size averaging should be designed to facilitate community-planning objectives. For instance, municipal regulations could require that a certain proportion of the site be retained in large lots with the remaining permitted development on small lots. This can retain parcels of adequate size to permit continued farming to have economic utility. Conversely, without such a standard, lot size averaging can still assist resource conservation objectives by including environmentally sensitive lands in oversized lots.

While cluster zoning or lot size averaging can be useful for limited open space preservation and conservation of some rural character with a three-acre density, it clearly will fail to retain agriculture or provide for future agricultural development. If design standards are not developed to provide for new residential development at reduced densities away from the most productive agricultural lands and in locations where they will be least disruptive of farming activities, on- and off-site clustering and lot size averaging can minimize the impact of non-farm dwellings in the Agricultural District.

Design Standards

Land development procedures should be structured to allow a landowner and the Planning Board to determine the pattern and layout of future development through a process that involves significant dialogue and discussion before requiring detailed engineering plans of drainage, grading, and utilities. This process would identify the portions of a parcel that will be devoted to agriculture, roads, open space, houses, and other uses.

The impact of new residential development on the productivity of farming operations and on community character should be mitigated by encouraging it to follow development forms that reflect the rural character of the township through the application of flexible design standards and land use controls. A series of rural conservation design guidelines that could form the basis for ordinance standards are outlined below:

- Locate construction to preserve the better quality soils for agriculture
- Encourage construction on the edge of the fields and orient driveways along hedgerows and woodlands to minimize intrusion on agricultural lands
- Encourage road design and layout to conform to the topography
- Preserve prime woodlands and hedgerows
- Encourage planted buffers using native species arranged to resemble existing woodland patterns
- Locate new development to maintain significant views and vistas and the landscape's rural character

- Encourage common driveways; particularly on wooded or sloped terrain to minimize interruptions to traffic flow

Other Ordinance Considerations

The changing face of agriculture will require new planning and regulatory approaches. Farmers and farm operations are advancing different techniques to prosper in this day and age. Besides the prevalence of off the farm income, New Jersey farmers are looking to new markets for products and new technologies. The New Jersey Farm Bureau is providing a leadership role in bringing about an increase in production opportunities in new use agriculture for farmers in this State. A new movement in American agriculture is underway that seeks to use plant material raised on farms as a new, substitute source of material used in industrial and pharmaceutical products. There are proven technologies available for the conversion of carbohydrate material into many products, as an alternative to a near-exclusive reliance on petroleum products. Any shift in this direction within the American economy would benefit production agriculture, lessen the costs to society from the environmental impact of synthetic products and assist the national security through increased reliance on domestically-produced renewable resources.

Farmers looking to new markets for products and new technologies will require structural solutions at the site of production. In establishing its ordinances for the Agricultural District, Hillsborough Township should examine these techniques and opportunities to provide needed support of current and future farm operations within the Township

Over 2,700 acres in the agricultural district, which were previously consolidated under one ownership by the Duke Family, are presently owned and managed by Duke Farms Foundation (Foundation), and supported by the Doris Duke Charitable Foundation. The Duke Farms Foundation's core mission is to serve as a model of land stewardship and open space preservation for education and public enjoyment, and to provide an environment where visitors may find beauty, inspiration, and a better understanding of the natural and historic resources of Duke Farms. The Foundation also seeks to advance the practice of environmental planning, landscape architecture and resource management on the urban fringe through demonstration, interpretation and education.

The Foundation lands host a series of buildings, structures and activities. Preexisting farmsteads, the Duke mansion, Duke Gardens, and the barns and out buildings are maintained and used to further the public education mission of Duke Farms Foundation. To assure the continued operation and appropriate expansion of its activities, the Foundation will need to maintain, repair and develop facilities supportive of the mission at Duke Farms.

The mission of Duke Farms Foundation is clearly supportive of the Hillsborough Master Plan goals for natural, cultural and historic resource conservation. The Township's hope that the Duke Farms property will be preserved from future large-scale development is advanced by the Foundation's purpose, and should assist in meeting local goals, including the establishment of a permanent green belt along the Raritan River. It is

important to note, however, that the Agricultural District does not contemplate uses like those long established at Duke Farms. Efforts to advance the mission of the Foundation may be hindered unless Hillsborough devises land use regulations that take full account of current activities and provide for the continuing development of facilities that support the educational and interpretive activities of the Foundation. Careful consideration should be given to crafting policies and regulations that assure that Duke Farms can further its objectives in a cooperative and supportive relationship with Hillsborough.

Expansion of the Agricultural District

The Agricultural District boundary remains unchanged by this Land Use Plan Amendment, with one exception. Based on the success of Hillsborough's Farmland Preservation efforts in the southeastern portion of the Township, the Planning Board determined that the Agricultural District should be expanded to include those lands where development easements have been purchased, between Township Line Road and Hillsborough Road. Figure 19 illustrates the boundary of the Agricultural District, including the additional lands along the proposed Route 206 By-pass.

Summary of Recommended Zoning Techniques

Conventional subdivision 20 acres/unit

Open Lands Subdivision 10-acre/unit density

- 1.5-2 acre minimum lot area
- 75% open lands with deed restriction against further subdivision for non-agricultural purposes
- 2/3 of the open lands to include priority farmland soils and/or mature woodlands

Lot Averaging 15-acre/unit density

- 1.5-2 acre minimum lot area

Mountain District

The Mountain District consists of approximately 20% of the land area of Hillsborough Township. The lack of public water and sewer infrastructure throughout the District limits future development potential. Respecting the carrying capacity limitations of the natural systems to provide potable water and treat septic effluent without degrading water quality is therefore of critical concern.

Capacity-based planning involves the measurement of a municipality's ability to accommodate growth and development within limits defined by natural resource capabilities and existing infrastructure. A capacity analysis determines the limiting factors in an area's ability to grow and evaluates the capacity of the limiting factor. With the absence of public water and sewer infrastructure, the limiting factor thus becomes water.

Sustainable development policies provide a land use framework that meets the needs of the present without compromising the ability of future generations to meet their own needs. It responds to capacity limits with a margin of safety, and incorporates the goals of stewardship over land and water resources, and the prolonged maintenance of a healthy and desirable physical environment.

Water Resources

Headwaters

A dominant theme in the planning process is the protection of water resources, with a particular emphasis on surface water and groundwater quantity and quality. The Sourland Mountain, encompassed by the Mountain district in Hillsborough Township, is a resource that plays an important role to the greater region. One of the largest remaining contiguous forests in Central New Jersey, the mountain contains fragile natural resources that combine to form a unique ecosystem. The Sourland Mountain contains several headwater streams located in the Mountain district, including Cat Tail Brook, Rock Brook and a portion of Pleasant Run. Cat Tail and Rock Brooks eventually flow into the Millstone River, while Pleasant Run flows down the Sourland Mountain and empties into the South Branch of the Raritan.

Wetlands

Although the Division of Water Quality classifies none of the watercourses as Trout Maintenance or Trout Production waters, a number play an important role as headwater streams. This is particularly true of the streams in the Sourland Mountain region, where wetlands work in concert with watercourses to purify and slowly feed water off of the mountain. In the perched water systems created by the soils and underlying geology, much of the precipitation that falls on the mountain runs off the surface of the land as soils become saturated quickly and cannot accommodate further infiltration. The

wetlands absorb a majority of this water, feeding it into the streams that flow off of the mountain.

In addition, the Mountain district is dominated by deciduous wooded wetlands, a majority of which is associated with the Sourland Mountain ecosystem. These wooded wetlands comprise a substantial portion of the forest, which covers almost 54% of the district. Of the 6,992.78 acres in the Mountain district, 1,346.54 are deciduous wooded wetlands. Agricultural wetlands account for less than 2% of the district, with none of the remaining categories of wetlands comprising more than 1% of the total acreage in the Mountain district.

The deciduous wooded wetlands found in the Mountain district form the headwaters for all of the streams, which drain Hillsborough's portion of the Sourland Mountain region, either to the Neshanic or Millstone Rivers. The wetlands that surround these streams also contribute to the quality of these waters, making their conservation a priority for water quality.

Geology and Groundwater

About half of the Mountain district is comprised of Passaic and Passaic Gray Bed formations. Jurassic Diabase (Jd) and the Lockatong Formation (Trl) formations that are characterized by poor well yields and subsurface conditions unsuitable for septic systems underlay the southern half of the Mountain district. The diabase is a medium to coarse-grained intrusive rock and is dense, hard and sparsely fractured. Jurassic Diabase forms the Sourland Mountain. From the Sourland Mountain, the Jurassic Diabase spreads under the remaining Passaic Formation

The Lockatong Formation, found primarily in the Mountain district, has an effect on the availability of groundwater and on-site disposal of effluent utilizing a septic system. The Lockatong Formation is composed of dolomite or silty argillite, mudstone, sandstone, siltstone, and minor silty limestone. In areas where it has been intruded by diabase, as in the Sourland Mountain region, the Lockatong has been chemically altered into hornfels, which are fine grained silicate rocks dark gray or even green in appearance. When contact metamorphism occurs at shallow levels, as it has here in the Sourland Mountain region, the lack of pressure produces rocks with little foliation. With little foliation and therefore little fracture, water does not move readily through the rock structure or collect in great quantity in any one particular area. As a result, well yields in the Lockatong Formation are very low in places.

A detailed study of the geology and groundwater availability has not been undertaken for Hillsborough Township, but a number of studies of well yields and aquifer characteristics in the fragile Sourland Mountain ecosystem have been undertaken in adjacent municipalities, including East Amwell Township, Hopewell Township and most recently West Amwell Township, although it is not completed. These studies are directly related to the geologic formations present in the Mountain region, and the effect that these rock formations have on the yields of aquifers. These studies have a direct bearing on the

capacity of the land to sustain development, as water availability from domestic wells drilled into these formations is the only source of drinking water. Additionally, disposal of effluent via septic systems is affected by geologic formation and other related factors.

The East Amwell and Hopewell groundwater studies both contain similar findings in terms of the limited water availability and aquifer recharge, but the East Amwell study has a more detailed analysis of trend factors that could affect water availability. Utilizing well records taken since 1990 under the Township Well Test Ordinance, the East Amwell report and analysis generally indicates that the Diabase and Lockatong formations present in the Sourland Mountain represent some of the poorest yielding aquifers in the State.

The results of East Amwell Township's study of the groundwater resources of the Sourland Mountain region are generally applicable to the Mountain district in Hillsborough Township. The analysis of trends evident in the East Amwell well data and application of statistical methods demonstrates that geologic formation is the controlling factor for groundwater availability, not soils.

The geologic formations of the Sourland Mountain region also have a controlling impact on disposal of effluent utilizing a septic system. While soils have been a controlling factor in determining suitability for septic systems in other areas, the Sourland Mountain geology is the over-riding factor in soil formation and subsurface movement of effluent once it enters the soil.

As mentioned, the bedrock of the Sourland Mountain is hard and sparsely fractured, which contributes to limited availability of water. Wells on the mountain with good yields are generally drilled into fractured areas, where water makes rapid downward movement. It is these fractures, however, that present potential hazards for groundwater contamination from septic effluent.

The shallow soils and hard bedrock create great lateral movement of water, where it seeks out fractures as it moves horizontally. Therefore, flow becomes concentrated in the area of fractures as water creates a gradient, moving towards fractures. Septic systems located close to a fracture can tap into the gradient and potentially move improperly treated effluent into fractures. This permits the rapid vertical movement of potentially contaminated water into the aquifer, where it could be taken up in a domestic well. This effect could be amplified if a number of septic systems are located in close proximity to each other and in close proximity to a fracture. It could be further amplified if the domestic wells serving these homes tapped into the same fracture.

Land Use and Development Regulatory Techniques

The groundwater and surface water management strategy for the Mountain district seeks to limit the degradation of groundwater and surface water while also permitting an appropriate use of land. This Land Use Plan amendment seeks to program uses of land that can conserve limited resources while also permitting development at densities that produce limited degradation and protect the potability and availability of groundwater

and surface water resources. A maximum density of 1 unit per 15 acres has been chosen to address resource management concerns.

In addition to the protection of groundwater and surface water resources, appropriate land development techniques will also address the goal of conserving significant elements of the rural countryside. The rural character embodied in its scenic vistas, wooded hillsides and agricultural fields, is highly susceptible to degradation. Full development of the Mountain District at the prevailing 5-acre density would generate an additional 468 units. In this build-out arrangement, permitted units would likely be situated in a somewhat geometric arrangement that would fail to recognize the natural patterns of the landscape and would eliminate or dramatically alter scenic vistas and natural lands.

Development at permitted densities would also produce dramatic alteration of rural roadways, such as Long Hill Road and Zion Road and bridges, such as the single stone arch over Cat Tail Brook and three arch structures over Rock Brook, to accommodate traffic movements and increased traffic demand. As this alteration occurs, roadside features (trees and stone rows,) and alignments (narrow cartways and winding alignments) would be lost. The rural character undergoes a process of change that results in conversion to a more suburban appearance with the environmental and traffic impacts of this form of development. With an extensive system of scenic roadside views the maintenance of visual quality is particularly important to the overall planning strategy.

Lot Averaging

Another development option, lot averaging, is also recommended for the Mountain district at the same density. Lot averaging will permit some lots less than 15 acres provided that other larger lots are designed to meet specific conservation objectives. This form of lot averaging can shape development so that critical resources are preserved. The taxable status of all resulting lots is retained, and questions about the long-term maintenance of public or homeowners' open space and any related municipal responsibilities are eliminated, since all properties remain in private ownership. The minimum lot area for lot averaging is 5 acres per unit.

Whether conventional or lot averaging subdivisions are used, for development, options for the Mountain district will maintain large contiguous tracts of open lands, and help to maintain the delicate balance among the various components of the natural systems. The Mountain district has been designed to comprehensively address the interrelated goals of protecting groundwater quantity and quality, maintaining surface water resources, conserving the scenic rural character and addressing limiting soil conditions, while also respecting the property rights of landowners.

Creation of the Public Zone

The Planning Board has determined that the portion of the Mountain district adjacent to the Millstone River, which includes lands under the jurisdiction of the State of New Jersey, should be included within a separate zone. This area is part of Delaware and

Raritan Canal extending generally from intersection of Hillsborough Road to the Borough of Millstone.

To reflect the proper use and jurisdiction of this area, the area is included within a Public District.

Summary of Recommended Zoning Techniques

Conventional subdivision 15 acres/unit

Lot Averaging 15 acre/unit density
 5-acre minimum lot area

Changes in the Agricultural and Mountain Districts will create a series of nonconforming lots of less than twenty (20) acres and fifteen (15) acres respectively. It is intended that a grandfather provision be added to the zoning ordinance that will allow development of such undersized lots without an appeal to the Zoning Board, according to reasonable standards for such lots. This will permit the construction of a new dwelling on any vacant lot of less than the required acreage existing at the time of adoption of the Agricultural and Mountain District amendments, or the expansion of the principal building or the addition of permitted accessory structures on an existing developed lot.

The Conservation Plan for the Agricultural and Mountain Districts

Introduction

The Municipal Land Use Law (NJSA 40:55D-1 et seq.) authorizes municipalities to plan and zone to promote the general welfare of its community. The 15 purposes of the MLUL (NJSA 40:55D-2) explain the State legislature's rationale for the statutory authorization for municipal land use planning and regulation. Eight of these purposes highlight the importance of conserving natural resources and maintaining a clean healthy environment.

1. The public health and safety (subsection "a") bear a direct relationship to the use and management of New Jersey's land and water resources.
2. Securing safety from floods and other natural and manmade disasters (subsection "b") and providing adequate light, air and open space (subsection "c") are similarly directed at conserving natural resources.
3. "Preservation of the environment", in part through planning for "appropriate population densities and concentrations" (subsection "e") is a key underpinning of local land use policy.
4. Providing sufficient space in appropriate locations for a variety of land uses is intended, according to their respective environmental requirements, to meet the needs of all New Jersey citizens" (subsection "g").
5. The statute also seeks to promote the conservation of "open space, energy resources and valuable natural resources in the State and to prevent urban sprawl and degradation of the environment through improper use of land" (subsection "j").
6. The conservation of energy is cited in subsection "n" ("promote utilization of renewable energy sources") and subsection "o" ("promote the maximum practicable recovery and recycling of recyclable materials").

Managing land use is an objective of New Jersey's planning and zoning law, which is supported by the related objectives of protecting the natural environment and preventing its degradation.

In furtherance of these conservation objectives, the MLUL provides for preparation and adoption of a Conservation Plan Element (NJSA 40:55D-28b.8.), which reads as follows:

"Conservation plan element, providing for the preservation, conservation and utilization of natural resources, including, to the extent appropriate,

energy, open space, water supply, forests, soil, marshes, wetlands, harbors, rivers and other waters, fisheries, endangered or threatened species, wildlife and other resources, and which systematically analyzes the impact of each other component and element of the Master Plan on the present and future preservation, conservation and utilization of those resources;”

This Conservation Plan Element Amendment for the Agricultural and Mountain districts outlines strategies for this portion of Hillsborough Township to meet the statutory mandate to protect the environment of this area. While it is designed to function in concert with the other plan elements of the full Master Plan, the most important linkage is between the Land Use Plan Amendment and the Conservation Plan Amendment for these unique areas. Together, these plans propose the location, scale and intensity of new development and the resource management strategies needed to protect the unique environment of the Agricultural and Mountain districts.

This Master Plan recognizes that “business as usual” will not meet the conservation objectives of the MLUL. Retaining the existing zoning and other zoning options will overtax the natural environment, with substantial degradation of surface water and groundwater quality. It will also entail the removal of substantial forested areas, which are in short supply, and farmlands, which are particularly vulnerable to suburban sprawl.

The most effective way to protect farmland and natural resource lands is to buy the land or the development rights. This approach permanently preserves these valuable features, and is most effective at limiting the effects of development. The continuing New Jersey voter commitment to open space preservation, evidenced in the approval of the \$1 billion Garden State Preservation Trust, bodes well for such acquisitions. However, hundreds of thousands of acres of undeveloped and “underdeveloped” land will remain beyond the reach of publicly funded acquisitions. Thus, local land use regulations continue to play a controlling role in how the environment is managed, during and after development. Air, water and soil are the essential resources, which support a healthy biota.

The natural ecology finds a balance among its organic and non-organic components, where resources are used, not used up, and cyclical changes return to the point of beginning. Development interrupts these cycles, and places a heavy burden on man to reestablish a natural balance.

The principles of sustainable development demand that resource commitments made during this generation will be sustainable—that is, able to be continued for the benefit of future generations.

Fragmentation and degradation of vegetation, land and water resources has been a byproduct of human activity. Woodlands, initially cleared for agricultural use, have given way to residential neighborhoods easily developed on these high, dry and usable soils. Water quality has been progressively altered and impacted by human activity. A rallying call to protect the environment was sounded nearly half a century ago. However, predictions of staggering consequences have given way to a collective psyche

where incremental loss has been found tolerable. Environmental impact statements (EIS) routinely admit the negative consequences of new development by acknowledging that each new house will produce a "house-worth" of pollution. The EIS assures us that all the conventional safeguards will be employed, and that there are really no other alternatives available. However, it has become increasingly obvious that there are other alternatives available, and that zoning for sprawl does not protect the general welfare, but rather substantially degrades the environment and erodes the quality of life and human interaction.

The quality of the air we breathe and the water we drink determines the health of the human organism and all life forms. This Conservation Plan Amendment for the Agricultural and Mountain Districts seeks to minimize further degradation of these resources and establish an arsenal of environmental health-building tools for the 21st century and beyond. This plan recognizes the inherent limitations of our ability to disassemble the natural world and put it back together again. It argues in favor of a lighter touch on the land, one that is more respectful of natural systems, and that limits the resource commitments and impacts of human intervention. This calls for a systems approach to natural resource conservation, where interconnected natural systems are viewed as a collective resource, not a series of separate features.

The variety of biological species is an indicator of the health of an ecosystem. Maintaining biological diversity requires protection of critical habitat areas. While habitats of endangered or threatened plant or animal species are of special importance, threatened or endangered status may be transient. For instance, the great blue heron and bald eagle have been removed from the protected list, yet their critical habitats remain essential to their continued survival. Additionally, the extirpation of rare species removes elements from the food chain that help maintain ecological balance. The explosive deer population in New Jersey is but one example of the damage that can be wrought when this natural balance is lost.

Protecting biodiversity requires the protection of terrestrial and aquatic habitats that are highly susceptible to degradation. Pristine waters cannot be maintained without protection of their watershed areas. Freshwater wetlands play an important role in filtering contaminants from the surface water and groundwater regime and, while protected by state statutes, are not immune from impacts that occur beyond the regulated areas. Similarly, prime forested areas, including mature stands of native species, are easily lost or damaged through fragmentation, a manmade impact that reduces biodiversity.

The scenic wonder of ridgelines, slopes and ravines is only one aspect of the value of these natural features, without which certain species will not remain. Similarly, grassland habitats are essential to the nesting, feeding and breeding of a variety of grassland bird species, yet such areas are frequently lost to development. The background studies identify woodland areas by forest cover type, as well as critical wetland, water and grassland habitats. Land development should be arranged to maximize the conservation

of substantial masses of critical habitat areas, by limiting the aerial extent of development and promoting conservation techniques targeted to these resources.

Carrying capacity is a planning technique used to establish the maximum population level of a species based on the availability of natural resources. Carrying capacity had its genesis in ecological studies, used to manage wildlife habitat rangeland for grazing. In the context of land use planning, carrying capacity has been defined as the ability of natural and man-made systems to support a level of population growth and ancillary development while maintaining established standards of performance. When applied to regulating land use, an assessment of carrying capacity is useful in establishing *maximum* densities or intensities of development. However, sustainability requires that we provide a margin of safety, and not plan for the maximum development that can currently be supported.

The policies and strategies of the Conservation Plan Amendment for the Agricultural and Mountain districts seek to limit the impacts of development and retain the natural terrain and features to the greatest extent practicable. This plan also promotes the restoration of natural systems that have been degraded by past activities. As new regulatory tools or techniques become available, they should be evaluated for their ability to promote the Conservation Plan objectives and adopted where appropriate. Additionally, open space acquisition priorities should be established to address the goals of the Conservation Plan.

Energy and Air Quality

Protection of the Township's air quality is largely dependent on regional, state, national, and even international factors. Similarly, energy conservation and utilization is shaped by a host of factors. However, local land use regulations determine future land use patterns, which have a direct effect on air quality and energy use. Management approaches that the Township can initiate to mitigate air pollution and promote energy conservation include the following:

- a. Promote alternative means of mobility by providing opportunities and access for alternative transportation systems such as, bicycling, and walking.
- b. Adopt development regulations that provide for compact residential neighborhoods and retain existing wooded areas and large contiguous open land areas.
- c. Encourage energy conservation through subdivision design, building design, building orientation, and the evaluation of microclimate conditions such as solar access and wind direction.
- d. Recommend landscaping standards that provide buildings with maximum solar access, shading, and wind protection.

- e. Encourage the maximum recovery of recyclable materials and the use of renewable energy sources.
- f. Design bikeways, pedestrian walkways and other routes to maximize opportunities for non-motorized travel in existing and new development.

Forest Resources and Native Vegetation

Woodlands and other native vegetation perform a series of important functions related to the ecological balance. Forests produce oxygen, giving them intrinsic value. They reduce soil erosion and surface runoff and promote aquifer recharge, because of the high moisture holding capacity of the forest soils and tree canopy. Forests provide habitats for plant and animals and provide open space and recreation lands. They enhance the visual character of scenic corridors, create a feeling of privacy and seclusion and reduce noise impacts. And they affect local climatic conditions near or within their boundaries, such as the cooling effect on trout streams. Woodlands and other native vegetation also provide visual diversity in the terrain, enhancing the value of property. Removal of trees and other vegetation can result in ecological, hydrological, and economic impacts.

The following approaches are recommended to preserve, protect and improve the forest resources in the Township.

- a. A woodland conservation program, including identification of the floodplain, mesic and upland forest stands on the tract should be required as part of any application for development.
- b. Performance standards should be established limiting the extent of forest removal, based on the quality of the forest type. Priority wooded areas for preservation include unique forest types, woodlands adjacent to public water supply tributaries, habitats critical for endangered and threatened species, 100-year floodplains, wetlands, stream corridors, and slopes of 15% or greater.
- c. Performance standards should encourage the preservation of habitat areas that are as large and circular as possible, gradual and undulating at the edges and connected by wildlife corridors wide enough to maintain interior conditions (i.e. 300' or more).
- d. Hedgerows and forest areas along traveled roadways and established property boundaries should be retained and enhanced, where appropriate.
- e. Woodland areas along open space corridors should be preserved and interconnections among existing woodlands should be promoted.

- f. Reforestation and afforestation of open spaces, resulting from cluster designs, should be required to enhance habitat, promote recharge and reduce surface runoff, erosion and flooding.
- g. Lower density and coverage standards should be considered to promote the retention of forests in the agricultural and mountain districts.

Water Resources

The State Development and Redevelopment Plan states that State, county and municipal governments should “Protect and enhance water resources through coordinated planning efforts aimed at reducing sources of pollution and other adverse effects of development, encouraging designs in hazard-free areas that will protect the natural function of stream and wetland systems, and optimizing sustainable resource use.”

In the Agricultural and Mountain districts water resources form 16.8% and 22.9% (surface water and wetlands) of the land cover and the area with water close to the surface in 30.8% and 71.3% of the districts respectively. These facts call for specific strategies on the part of the Township for groundwater, stream corridors, surface water and wetlands.

Groundwater

The groundwater resources of the Agricultural and Mountain districts provide these areas irrigation and potable water supplies. In addition, groundwater provides the base flow to rivers and streams during low flow periods, and sensitive plant and animal communities are dependent upon this surface hydrology. The following activities are recommended to protect and maintain this critical resource:

- a. A program should be established, or coordinated with an existing County or State program, to ensure that existing septic tanks are regularly pumped and maintained.
- b. Ongoing public education should be directed at preventing the discharge of toxic and hazardous pollutants to groundwater.
- c. The Environmental Commission, in conjunction with the Health Department, should conduct an environmental audit of groundwater quality, including an analysis of existing groundwater samples and an identification of existing facilities, which could adversely impact groundwater. Among the facilities that should be mapped and inventoried are the following:
 - 1. Underground storage tanks.
 - 2. Gas, fuel, and sewer line locations.
 - 3. Large septic systems for commercial/industrial users.
 - 4. Permitted community septic systems.

5. Hazardous substance storage areas and facilities.
 6. Permitted NJPDES groundwater or surface discharge facilities.
- d. The Township should consider the establishment of a wellhead protection program.
 - e. Landscaping standards should require the use of native and locally adapted plants, and designs, which minimize irrigation, maintenance and turf areas and require mulches to preserve soil moisture
 - f. Reductions in residential densities in unsewered areas will serve to protect the availability and potability of groundwater.

Stream Corridors

The Mountain district is laced with a network of headwater tributaries to the Delaware and Raritan Rivers. The Agricultural district is adjacent to the South Branch and the Raritan Rivers. In order to protect stream corridors from development impacts, it is recommended that the Township consider the following management approaches:

- a. Woodlands and other vegetated buffers should be maintained or established along all stream corridors.
- b. Where past land use practices have resulted in the removal of trees along stream corridors, management practices should include the reestablishment of the tree cover.
- c. A stream corridor protection ordinance, modeled after the programs established by the Delaware and Raritan Canal Commission and the Stony Brook Millstone Watershed Association, which seeks to protect the stream corridor and adjacent wetlands, floodplains, and contributory uplands with steep slopes, should be developed.
- d. Management and monitoring strategies should be developed for stream corridor areas.

Surface Water

Surface water is impacted by both point and non-point source pollution. Non-point source pollution, which has become a major concern, can be mitigated by local land use strategies and management approaches. Non-point source pollutants include septic system effluent, agricultural runoff, stormwater runoff, and construction activities. In order to mitigate potential impacts to the Township's surface waters, the following management approaches are recommended:

- a. Water quality best management practices should be adopted or refined, to protect the quality of surface waters and promote maximum habitat values. These include:
 - Clustering development on the least porous soils, to promote infiltration
 - Buffer strips and techniques to maximize overland flow, such as grassed swales and filter strips
 - Wet ponds (retention basins) and wetland or marsh creation
 - Detain runoff using infiltration practices, including trenches, basins, drywells and other structural solutions
- b. Reductions in development densities and coverage can reduce the potential impact to surface waters from non-point pollution.

Wetlands

Since the State and Federal governments regulate wetlands, the Township is preempted from adopting conflicting regulations. However, management of protected wetlands and transition areas remains an important issue, and site design decisions will affect wetlands ecosystems.

- a. A system to periodically monitor and enforce conservation easement restrictions should be developed.
- b. Permitted development should be arranged to avoid all significant wetlands, and when road crossings are unavoidable, they should be located at the point of minimum impact.

Scenic Resources

Scenic character is an important element in the general perception of the quality of life in the Agricultural and Mountain districts. The protection of scenic vistas, particularly those seen from public rights-of-way, will serve to maintain the area's rural character. Since the local development review process plays a primary role in shaping new land use patterns, local review agencies are the appropriate administrative authority to encourage conservation of scenic characteristics. The following activities are recommended:

- a. Scenic roads and corridors should be identified and categorized in terms of the scenic elements that contribute to their quality.
- b. Design standards should be developed to guide the location and configuration of development, in order to protect the various categories of attractive views, including enclosed roadside views, extended roadside views, and distance views.

Steep Slopes

Development of steep slopes produces a variety of environmental impacts, including increased soil erosion and sedimentation, decreased surface water quality, decreased soil fertility, increased overland flow, decreased groundwater recharge, and altered natural drainage patterns. In order to reduce the potential for these negative impacts, the Township should:

- a. Develop standards that relate the intensity of development to the slope gradient.
- b. Develop standards that limit tree removal and soil disturbance on steep slopes.

Threatened and Endangered Wildlife Species

Threatened and endangered wildlife species are indicators of ecological diversity and environmental quality. Like the canaries on the coal miners' helmets, they warn us when we are spoiling the quality of the environment beyond natural tolerances. The presence of rare species in the Township is a testament to the historical emphasis on land stewardship. In order to protect and maintain these species, the Township should:

- a. Conduct an ongoing inventory of threatened and endangered species.
- b. Prohibit development, which will result in adverse impacts on the survival of threatened and endangered species.
- c. Develop a list of habitat requirements for endangered species.
- d. Preserve critical habitats, either through the open space acquisition or the development review process.
- e. Riparian wildlife corridors should be preserved, expanded or established.
- f. Preserve significant uplands areas where unique associations of habitats (some rare, some not) combine to promote biodiversity.
- g. Preserve nodes of biodiversity wherever they occur.

Reductions in permitted residential density can also promote the preservation of critical habitats.

Relationship to Land Use Plan

The Conservation Plan Amendment for the Agricultural and Mountain districts identifies natural resource protection strategies, which support the Land Use Plan Amendment for these areas. The resource management standards outlined in the Conservation Plan Amendment will serve to shape the development permitted by the Land Use Plan Amendment in a manner that will preserve and protect the district's natural resources. In addition, the Conservation Plan Amendment for the Agricultural and Mountain is intended to involve local agencies, other than the Planning Board, in a comprehensive program to conserve critical resources.

Summary

The future face of the Agricultural and Mountain districts in Hillsborough Township will be shaped, in large measure, by this Master Plan amendment. The open fields and meadows, the calming influences of free flowing streams and rivers, and the beauty of forested slopes are a legacy intended for future generations. Faithful adherence to the policies outlined in this Conservation Plan Amendment, combined with a broad concept of stewardship where all citizens contribute, will protect and enhance the special character of the landscape, and the healthy ecology with which Hillsborough Township is blessed.

BACKGROUND STUDIES

Environmental Resource Inventory for the Agricultural and Mountain Districts

Introduction

Hillsborough Township is rich with a variety of irreplaceable natural resources. Beyond the influence of suburban development, the Township is a tapestry of rolling fields, forested hills and winding streams and rivers, all of which require careful management in the face of continuing development. Identifying these resources is the first step towards affording them protection and ensuring that they remain a viable resource to the Township and its residents in the future.

The focus of this Environmental Resource Inventory (ERI) is the Agricultural and Mountain districts, depicted on Figure 1. These two zoning districts contain many critical resources that merit long-term protection through the Master Plan. This ERI provides an inventory of relevant natural resource information and suggests a range of management considerations.

This ERI makes use of Geographic Information System (GIS) digital data, compiled from sources including the New Jersey Department of Environmental Protection (NJDEP), the New Jersey Department of Transportation, the United States Department of Agriculture (USDA) Soil Conservation Service (SCS) and the Somerset County Geographic Information System. The GIS data provides detailed information on natural resource factors including critical habitat for threatened and endangered species, bedrock geology, topography, surface waters, wetlands, floodplains, forests and soils. Soils data is interpreted to indicate depth to bedrock, depth to seasonal high water, soil suitability for on-site disposal of effluent using a septic system and agricultural capability. Analyzing the above factors and understanding their role in community development and resource conservation and preservation is the primary goal of this document. This background information aids in the structuring of the goals and policies that will shape the face of development in the future.

Information is also provided on the State Development and Redevelopment Plan and its characterization of Hillsborough Township. The State Plan provides important policy guidance in the area of natural resource protection in the Environs. Most of the sensitive resource area in the Mountain district is classified as PA-5 - Environmentally Sensitive Planning Area, while the agricultural land in the Agricultural district is classified as PA-4 - Rural Planning Area. The policies of these planning areas, as they apply to these zoning districts, are detailed later in this document.

The Sourland Mountain, encompassed by the Mountain district in Hillsborough Township, is a resource that plays an important role in the greater region. One of the largest remaining contiguous forests in Central New Jersey, the mountain contains fragile natural resources that combine to form a unique ecosystem. Identification of these resources through the ERI is a first step toward affording them appropriate protection.

Formulation of policies, which will serve to promote sustainability of these resources, is a vital continuation of the planning process.

Funded by a Smart Growth Planning Grant from the State Planning Commission, the municipalities that share the Sourland Mountain have joined together to study the ecosystem. Under the leadership of the Sourland Mountain Planning Council, planning strategies will be developed as an information resource to municipalities. This Environmental Resource Inventory and the Township's planning efforts will complement this process.

Land Use/Land Cover

The New Jersey Department of Environmental Protection has released land use/land cover data photo-interpreted from aerial photography flown in 1995/1997. This photography, and the resulting land use/land cover information, provides the best available source of detailed land use information for New Jersey communities to date. The data is broken down to six major categories, including urban, agriculture, wetland, forest, barren land and water. It is further disaggregated into subcategories within each of the six major categories, with fifty-one possible designations. The more detailed view provides a more accurate picture of what is physically present. The categories mapped on Figure 2 provide a reorganization of the fifty-one designations.

The Agricultural and Mountain districts are clearly distinguished by their land use/land cover composition and the character that led to their zoning designations is clearly evident. The Agricultural district is primarily composed of agricultural land and the Mountain district is generally forest and wetlands. The Mountain district, however, does contain a layer of agricultural land cover where it abuts the Agricultural district. Agricultural land uses historically penetrated as far into what is the current Mountain district as they could, leaving a defined forest edge as a demarcation. These agriculturally productive soils are a result of the underlying geology, which affects the depth to water table and soil depth and thus the ability to cultivate the land.

The Agricultural district is predominantly farmed, although wooded areas, which include wooded wetlands, account for over 20% of the district. The wooded areas are primarily located along stream corridors. Residential land uses account for 13% of the Agricultural district. With low-density residential making up 9% of the district, residential uses are generally low intensity and rural in nature. The Duke Estate, in the northeastern corner of the Township, is a portion of the Agricultural district that is an enclave of agriculture, wetlands and recreational land. The southern portion of the Agricultural district east of the Mountain district (see Figure 2) is a fairly even mix of agriculture, wetlands and woodlands.

Large contiguous blocks of land in agricultural production characterize the Agricultural district; many of these blocks are still made up of large lots under single ownership. This indicates that the land is still viable for agricultural production and can probably remain so if not converted for competing land uses. Sparse residential land cover, primarily

concentrated along arterial roads and not intruding into the core of the contiguous agricultural lands, also characterizes the Agricultural district.

Over 72% of large, contiguous blocks of forested land and wooded wetlands occupy nearly $\frac{3}{4}$ of the Mountain district. Land in agricultural production, which makes up 15% of the district, totals approximately 1,063 acres in the northern portion of the Mountain district adjacent to the Agricultural district and along the Millstone River in the northeastern corner of the Township. Moving south from where the Mountain district abuts the Agricultural district in the western half of the Township, deciduous wooded wetlands define an edge where agriculture ceases to exist. The southern half of the Mountain district is comprised entirely of deciduous forest and deciduous wooded wetlands, with intermittent rural residential uses. This area is the heart of the Sourland Mountain region in Hillsborough Township.

The portion of the Mountain district in the southeastern part of the Township is composed mainly of agricultural uses and wetlands. The wetlands form the banks of the Millstone River, flanked by agricultural land cover on the west. There are two pockets of agricultural wetlands, which abut the river directly, indicating that these lands were likely modified for purposes of cultivation. With respect to land cover, this portion of the Mountain district is similar to the Agricultural district.

Steep Slopes and Topography

Hillsborough Township is characterized by two general landforms; flat to gently rolling expanses in the lower elevations and the higher elevation areas of the Sourland Mountain, a prominent feature in the landscape of the Township. Since most of Hillsborough is relatively flat, the mountain is clearly visible on the southwestern horizon as seen from the east. Figure 3, which depicts the topography of the Township, was derived from a digital elevation model and “hill shaded” to add depth to the visualization. The Sourland Mountain, in the southwestern portion of the Township, has its highest elevation around 568’ in the central portion of the mountain, where the topography is generally flat. There is also a prominent ridge where the mountain terminates just to the west of East Mountain Road. This abrupt ridge is the most significant topographic element of the mountain. In contrast, the topographic transition on the north side of the Sourland Mountain is gradual, slowly fading into the valley.

Steep slopes are not confined to the Mountain district, where one might expect. While there are numerous areas with slopes greater than 25% present on the east side of the Sourland Mountain, as shown on Figure 4, steep slopes are also found in the Agricultural district in the northwestern part of the Township as well. A majority of these slopes are along stream banks and coincide with the agricultural lands of Hillsborough.

The occurrence of steep slopes and their relationship to other features in the landscape give rise to a number of concerns. There is an identified relationship between steep slopes and increased sedimentation in surface water runoff. This factor is amplified when forested steep slope areas are cleared, and erosion and sedimentation cause a decrease in

water quality. Another potential area of concern relates to agricultural operations near steep slopes and stream courses. As mentioned, many of the steep slopes that occur outside of the Mountain district are adjacent to streams and surface waters. In the Agricultural district, agricultural operations include the grazing of animals and use of pesticides and fertilizers. Where grazing occurs along steep stream banks, animals can seriously degrade and destabilize these banks when seeking water. Animals accessing streams through areas of steep banks can destroy vegetation while increasing erosion and sedimentation and introducing manure directly into surface waters.

The Township currently regulates development on slopes greater than 12%, in part to alleviate potential impacts to water quality from increased runoff and erosion. With the occurrence of steep slopes along waterways in areas with agricultural operations, the Township should explore stewardship programs for protecting water quality from sedimentation and fertilizer and pesticide application. Rather than regulating agricultural activities and requiring landowners to comply with requirements, the Township could offer incentives to participate in voluntary programs provided in conjunction with educational programming.

Wetlands

The Agricultural and Mountain districts together include 2,928.17 acres of wetlands. This accounts for about 18% of their combined acreage. The types of wetlands found in these districts are consistent with their agricultural and forested nature, described in detail below and depicted on Figure 5.

The Agricultural district (9,297.44 acres) is largely agricultural in nature, with 14.7% of the district covered by wetlands. Deciduous wooded wetlands are the type most commonly found, comprising 5.7% of the total wetland acreage. Modified agricultural wetlands are the second most common (3.4%). Herbaceous wetlands and deciduous scrub/shrub wetlands each comprise 2%. None of the remaining wetland types depicted on Figure 5 account for more than 0.5% of the wetland acreage respectively. The greatest concentration of wetlands in the Agricultural district is located in the southern part of the Township. These wetlands are primarily agricultural, deciduous scrub/shrub and deciduous wooded wetlands and are headwaters to Pike Run.

The other major concentrations of wetland areas are found in the northeastern and western portions of the Agricultural district, along the Neshanic and Raritan rivers. The Neshanic flows into the Raritan in the western portion of the district, and most of the deciduous wooded and deciduous scrub/shrub wetlands of the district are found here. These wetlands form linear corridors, which run parallel to the Neshanic. The same is true for the wetlands along the Raritan River, which forms the northern border of the Agricultural district in the northern half of the Township. The wetlands along the Raritan River are comprised of herbaceous and deciduous wooded wetlands. There are also a large number of agricultural wetlands along the Raritan, reflecting the history of agricultural use within the river corridor.

The Dukes Brook, located almost entirely on the privately preserved Duke Estate, is another corridor of wetlands where deciduous wooded and herbaceous wetlands stretch its length to where it empties into the Raritan River. The Duke Estate also contains other significant pockets of wetlands, which altogether total just over 18% of the Estate and this portion of the Agricultural district.

The Mountain district, which is quite different in character from the Agricultural district, is dominated by deciduous wooded wetlands, a majority of which are associated with the Sourland Mountain ecosystem. These wooded wetlands comprise a substantial portion of the forest, which covers almost 54% of the district. Of the 6,993 acres in the Mountain district, 1,346.54 are deciduous wooded wetlands. Agricultural wetlands account for less than 2% of the district, with none of the remaining categories of wetlands comprising more than 1% of the total acreage in the Mountain district.

The deciduous wooded wetlands found in the Mountain district form the headwaters for all of the streams, which drain Hillsborough's portion of the Sourland Mountain region, either to the Neshanic or Millstone Rivers. The wetlands that surround these streams also contribute to the quality of these waters, making their conservation a priority for water quality.

In the portion of the Mountain district where the southeastern corner of the Township borders on the Millstone River, wetlands are primarily deciduous wooded, herbaceous and agricultural. The extent of agricultural wetlands indicates that agriculture has substantially penetrated the river corridor as wetlands have been modified for farming. While agriculture has traditionally settled in and around river corridors, the conversion of wetlands to agriculture and the close proximity of these uses to the river raise potential concerns over water quality impacts from farming practices. The use of fertilizers can impact water quality and cause build-up of algae, and pesticides can contaminate fish. Wetlands act as a buffer to agricultural uses through the filtering and absorption of fertilizers and pesticides. The ability of wetlands to filter these byproducts, as well as wastewater and wide variety of non-point source pollutants has long been known. The key is to strike a balance between agricultural and water quality needs. Stewardship practices such as the use of vegetated stream corridor buffers or educating landowners on the potential water quality impacts of agriculture are valuable management approaches.

Wetlands serve a vital role in the ecosystem. This is especially true in Hillsborough, where wetlands act as buffers to river and stream corridors. They also act as the collection points and headwaters to a number of streams that flow out of the fragile Sourlands ecosystem. While state regulations provide some protection to wetlands, presentation of new research findings and the interest of local officials and the public can help to educate landowners on their continued importance and function.

Surface Waters

The Agricultural and Mountain districts are drained by a number of rivers and streams, which are depicted on Figure 5 along with detailed wetland types. Viewing these two

features together provides an excellent picture of the complete and synergistic hydrology network found in these two districts.

The Agricultural district has two rivers, which flow through it; the South Branch of the Raritan River on the northern boundary of the Township and the Neshanic River, flowing into the Agricultural district through the western boundary of Hillsborough. In addition to these rivers, there are a number of streams, which flow through the district and eventually drain into these rivers. These include Duke's Brook and Pleasant Run, which drain into the South Branch of the Raritan River and Pike Run, which eventually drains to the Millstone River.

The Mountain district contains a number of headwater streams on the Sourland Mountain, including Cat Tail Brook, Rock Brook and a portion of Pleasant Run. Cat Tail and Rock Brooks eventually flow into the Millstone River, while Pleasant Run flows down the Sourland Mountain and empties into the South Branch of the Raritan. The Millstone River, at the eastern boundary of the Township, bound the easterly segment of the Mountain district

Although none of the watercourses depicted on Figure 5 are classified as Trout Maintenance or Trout Production waters by the Division of Water Quality, a number play an important role as headwater streams. This is particularly true of the streams in the Sourland Mountain region, where wetlands work in concert with watercourses to purify and slowly feed water off of the mountain. In the perched water systems created by the soils and underlying geology, much of the precipitation that falls on the mountain runs off the surface of the land as soils become saturated quickly and cannot accommodate further infiltration. The wetlands absorb a majority of this water, feeding it into the streams that flow off of the mountain.

It is important that the Township continue to offer protection to these streams and wetlands through development regulations. With the increased runoff and lack of infiltration that occurs in the Mountain district, development must be carefully planned for and monitored to ensure that impacts are minimized. This can be accomplished through limiting vegetative clearing and impervious cover in the district, reducing non-point source pollution and instituting the use of water quality basins for development projects.

AMNET Biological Monitoring

The Bureau of Freshwater Biological Monitoring, a division of the NJDEP, currently conducts monitoring of freshwater rivers and streams in New Jersey. The Ambient Biomonitoring Network (AMNET) has an average of 165 monitoring sites in the major drainage basins of the State.

AMNET monitoring focuses on populations of macroinvertebrates (benthic communities) present in freshwaters. These biotic communities, which are mainly stationary and cost effective to monitor, integrate the effects of changes in water quality into their life cycle,

providing effective indicators of change over time. AMNET has eight monitoring stations for waterways in or near the Township, providing data from 1993-1994 and 1998-1999. Figure 6 depicts the location of these monitoring stations, with two along the South Branch of the Raritan River and additional stations along the Millstone River, the Neshanic River, Dukes Brook, Royce Brook, Six Mile Run and Pike Run.

The AMNET data for the Hillsborough Township shows that one of the eight sites depicted on Figure 6 have non-impaired benthic communities, while the remaining seven sites showed moderate benthic impairment. The one non-impaired site is located along the South Branch of the Raritan River, with the numeric impairment rating improving from 27 to 30 between the 1993/94 sampling to the 1998/99 sampling. And while the remainder of the sampling sites showed moderate levels of impairment, none have experienced a decrease in score between sampling periods. In fact, with the exception of two sampling locations where scores were unchanged (Pikes Run and Millstone River), all have experienced an increase in the health of benthic communities present.

The data for AMNET monitoring also includes an assessment of habitat within a 100-200 foot radius of the sampling site. This assessment provides information on in-stream substrate, channel morphology, bank structural features and riparian vegetation. Habitat assessment is done independent of biological monitoring and did not factor into the final impairment score for the monitoring sites for Hillsborough. The Rock Brook site, on the border with Montgomery Township, scored 161 (out of 200) in the habitat assessment, indicating optimal habitat. The remainder of the sites scored in the range of sub-optimal habitat (110-159), with ratings ranging from 135 at the Neshanic River site to 148 in the Pikes Run monitoring site.

With data collected every five years, the AMNET monitoring program will continue to provide useful data for assessing the health of waterways statewide. With samples to be collected within the next two years, the Township can continue to assess the health of surface waters through comparative assessment of macroinvertebrate communities. Once this data is released from the NJDEP, the Township should assess changes in water quality and determine if regulatory guidance at the local level is appropriate. This could take the form of storm water management regulations, restrictions on impervious coverage, reassessment of public road improvement standards and use of water quality detention basins.

FEMA Floodzones

The Federal Emergency Management Agency (FEMA) has prepared maps of the 100-year floodplain found along most of the streams and rivers in the Township, as depicted on Figure 7. This mapping is done in order to provide information to homeowners, floodplain managers, engineers and flood insurance providers on the flooding risks associated with the location of dwellings and structures.

Hillsborough Township participates in the National Flood Insurance Program (NFIP), whereby the Township has adopted standards regarding development in the floodplain.

A Flood Hazard Study was completed for the Township in 1981, initiating their participation in the Program. Hillsborough has implemented development regulations to prohibit or limit development in the floodplain to reduce the risk of flood damage and protect public safety.

FEMA strongly recommends that all persons within a special flood hazard area shown on the Flood Insurance Rate Maps (FIRM) purchase flood insurance. They also recommend that even those not directly in a flood hazard area purchase insurance, as flood damage can occur outside the flood hazard areas as well.

The mapping of floodplains provided by FEMA carries a number of different designations. The 100-year floodplain is delineated for most streams though some do not have base flood elevations (BFE's) determined, as indicated. Streams that do not have BFE's determined have not been subject to detailed hydraulic study to determine potential flood extent, and water levels during the 100-year storm have not been determined.

The South Branch of the Raritan River has an expansive 100-year floodplain, spanning 2,500' in some areas of the Township. The Neshanic River also has a broad 100-year floodplain, as wide as 1,300' in places. The Millstone River, which forms the eastern border of the Township, also has an expansive floodplain. Most of the land uses in the floodplains of these larger rivers are agricultural in nature, as fertile alluvial soils are typically located within the floodplain.

Many of the smaller streams in the Township also have a delineated 100-year floodplain, including Cat Tail Brook, Rock Brook, Pike Run, Royce Brook, Dukes Brook and Ten Mile Run. The smaller tributary streams that drain into larger rivers also have 500-year floodplains indicated. With the exception of sections of Royce Brook and Pikes Run, many of the smaller streams in the Township do not have base flood elevations determined.

The FIRM mapping of the 100-year floodplain is an essential resource that identifies the hazard of flood associated with these areas. Clearly the extent of the 100-year flood plain imposes severe limitations on development and a sound policy is to prohibit development throughout these mapped areas, as the Township generally tries to do.

Critical Habitat for Threatened and Endangered Species

The Department of Environmental Protection's Endangered and Non-Game Species Program (ENSP), along with the Center for Remote Sensing and Spatial Analysis (CRSSA) at Rutgers University, undertook the New Jersey Landscape Project (NJLP) in order to assess New Jersey's ability to continue to support populations of threatened and endangered species. This scientific project categorized habitat suitable for or with occurrences of species on the state and federal threatened and endangered lists. NJLP data, which was released late in 2001, is being provided in the hope that governing agencies will integrate it into proactive planning approaches. These could include local

habitat protection ordinances, zoning to protect critical habitat, management guidelines for rare species protection on public and private lands and land acquisition projects.

Contiguous patches of habitat are critical to the survival of all species, but especially those on the state and federal threatened and endangered lists. The NJLP utilized satellite information to identify habitat patches suitable for these species and then developed a priority ranking based on the documented presence of threatened and endangered species on those patches. The threatened and endangered species data was taken directly from the Natural Heritage Program's Biological Conservation Database, representing sightings from a variety of sources, including ENSP reports and the general public. The priority-ranking scheme is based on a scale of 1 through 5, with 5 being the highest priority, as follows:

- Rank 1** – Patches that meet the minimum size requirements, but have not been surveyed for species presence
- Rank 2** – Patches with non-listed state priority species present
- Rank 3** – Patches with state listed threatened species present
- Rank 4** – Patches with state listed endangered species present
- Rank 5** – Patches with federally listed threatened and endangered species present

The Agricultural and Mountain districts possess significant amounts of valuable habitat for state threatened and endangered species, as shown in Figure 8. Both zoning districts contain land that is uniquely suited to their zoning designations, including land that is cultivated and land that is mountainous and forested. Approximately 47% of the Agricultural district is designated as Rank 1 or Rank 4 grassland habitat. Conversely, 70% of the Mountain district is covered by Rank 3 and Rank 4 forest habitat. Also of note is the fact that over 14% of Rank 1 and Rank 3 grasslands also cover Mountain district. Combined with the forest cover, almost 85% of the Mountain district has habitat that is suitable for or contains threatened and endangered species. This highlights the special concern that should be paid to habitat protection on the Sourland Mountain.

The Agricultural district contains abundant land that is actively farmed for hay; this land is often uniquely suited to provide habitat for nesting and migrating birds. The mapping on Figure 8 indicates that much of the significant grassland habitat in the Agricultural district is contiguous and comprises some of the larger undeveloped parcels that remain in the Township. A good portion of this farmland is in the northwestern portion of the Township, on the Duke Estate. The Duke Estate is categorized as a private open space preserve in the Township's 2000 Open Space Plan.

The portion of the Agricultural district located in the eastern part of the Township bordering Raritan Township in Hunterdon County contains parcels of significant size, some of which are permanently preserved as open space and farmland. These parcels also contain grassland habitat that is suitable for or has documented presence of threatened and endangered species. This provides reasonable future opportunities to link open space preservation efforts with habitat protection, maintaining these areas in

perpetuity not only for the public, but also for the species that rely on the habitat that is present.

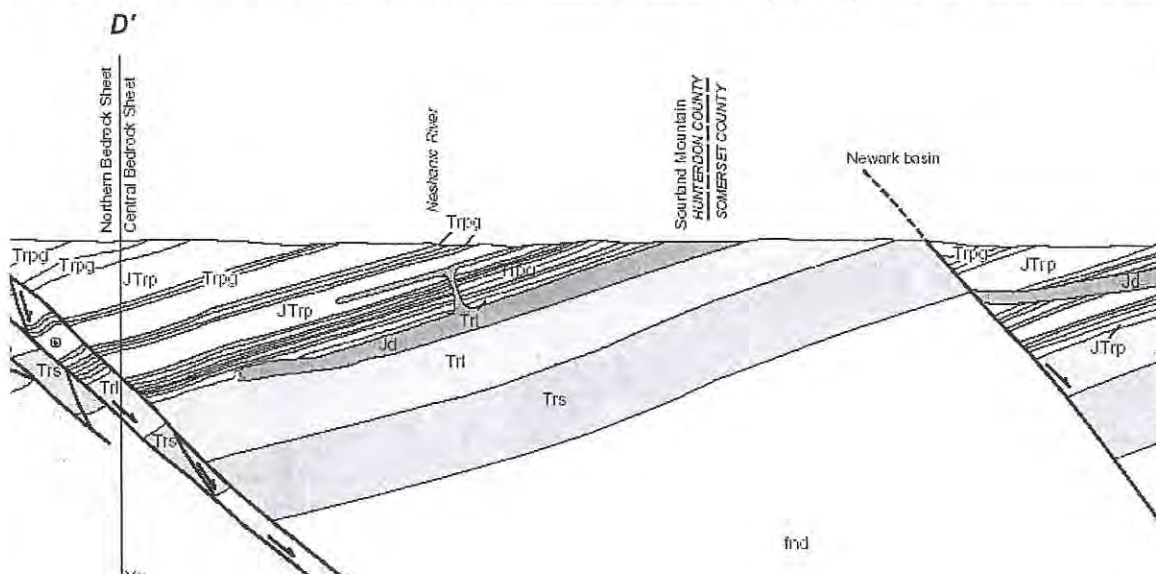
The Mountain district, as mentioned previously, is comprised of significant Rank 4 forest resources, indicating the presence of state-listed endangered species. The Mountain district is part of one of the largest remaining contiguous forests in Central New Jersey, which stretches along the Sourland Mountain. Generally, the Sourland Mountain region spans from Hillsborough and southern neighboring Montgomery Township west into Hopewell, East Amwell and West Amwell Townships. It terminates at Baldpate Mountain in Hopewell Township, overlooking the Delaware River and eastern Bucks County. The NJLP mapping for the region, which is being reviewed as part of an ongoing regional project for the Sourlands Planning Council, shows that the Rank 4 forest habitat straddles the Sourland Mountain's entire expanse. This makes the Mountain district part of a larger, regional concern and indicates the potential for cooperative efforts.

Roughly 40% of the Mountain district is already preserved through private and public easements. The Township and County have taken proactive roles in assuring that the valuable forest resources of the Mountain district are protected from further development. The release of the NJLP data has provided even more compelling reasons to further open space preservation efforts, aggressively seeking potential development rights from landowners.

Bedrock Geology

The bedrock underlying the Agricultural and Mountain districts has a varied composition, as indicated on Figure 9. The Agricultural district is generally underlain by the Passaic Formation, which also underlies the rest of the Township with the exception of a portion of the Mountain district. The Passaic Formation consists of reddish brown siltstone and shale.

About half of the Mountain district is characterized by geology that is quite different



from that of the Agricultural district, with the remainder comprised of the same Passaic and Passaic Gray Bed formations. Jurassic Diabase (Jd) and the Lockatong Formation (Trl) lie beneath the southern half of the Mountain district and are characterized by poor well yields and subsurface conditions unsuitable for septic systems. The diabase is a medium to coarse-grained intrusive rock and is dense, hard and sparsely fractured. Jurassic Diabase forms the Sourland Mountain, as shown in the cross section above. From the Sourland Mountain, the Jurassic Diabase is oriented to the northwest at an angle of approximately 20 degrees, spreading slowly under the remaining Passaic Formation that stretches to the boundary of the northern and central bedrock sheets (D').

The Lockatong Formation, found primarily in the Mountain district, has an effect on the availability of groundwater and on-site disposal of effluent utilizing a septic system. The Lockatong Formation is composed of dolomitic or silty argillite, mudstone, sandstone, siltstone, and minor silty limestone. In areas where it has been intruded by diabase, as in the Sourland Mountain region, the Lockatong has been chemically altered into hornfels, which are fine grained silicate rocks dark gray or even green in appearance. When contact metamorphism occurs at shallow levels, as it has here in the Sourland Mountain region, the lack of pressure produces rocks with little foliation. With little foliation and therefore little fracture, water does not move readily through the rock structure or collect in great quantity in any one particular area. As a result, well yields in the Lockatong Formation are very low in places.

A number of studies on well yields and aquifer characteristics in the fragile Sourland Mountain ecosystem have been undertaken in adjacent municipalities, including East Amwell Township, Hopewell Township and most recently West Amwell Township, although it is not completed. These studies are directly related to the geologic formations present in the Mountain region, and the effect that rock formation has on the yields of aquifers. These studies have a direct bearing on the capacity of the land to sustain development, as water availability from domestic wells drilled into these formations is the only source of drinking water. Additionally, disposal of effluent via septic system is affected by geologic formation and other related factors, as will be discussed.

A detailed study of the geology and groundwater availability has not been undertaken for Hillsborough Township. The studies of other communities, though, are relevant, particularly in the Sourland Mountain region. The Jurassic Diabase and Lockatong formation form the spine of the Sourland Mountain from the easterly foothills in Montgomery Township to the Delaware River in Hopewell Township.

The East Amwell and Hopewell groundwater studies both have similar findings in terms of the limited water availability and aquifer recharge, but the East Amwell study has a more detailed analysis of trend factors that could affect water availability in other places. Utilizing well records taken since 1990 under the Township Well Test Ordinance, the East Amwell report and analysis generally indicates that the Diabase and Lockatong formations present in the Sourland Mountain represent some of the poorest yielding aquifers in the State. Additionally, the report also found that aquifer recharge to these

formations is expected to be less than 2.1 inches per year. This is in stark contrast to a 1995 USGS finding, indicating groundwater recharge of 4.96 inches per year.

The results of East Amwell Township's study of the groundwater resources of the Sourland Mountain region are applicable to the Mountain district in Hillsborough Township. Analysis of trends evident in the East Amwell well data and application of statistical methods show that geology formation is the controlling factor for groundwater availability, not the soils.

The geologic formations of the Sourland Mountain region also have a controlling impact on disposal of effluent utilizing a septic system. While soils have been an over-riding factor in determining suitability for septic systems in other areas, the Sourland Mountain geology is the over-riding factor in soil formation and subsurface movement of effluent once it enters the soil.

As mentioned, the bedrock of the Sourland Mountain is hard and sparsely fractured, which contributes to limited availability of water. Wells on the mountain with good yields are generally drilled into fractured areas, where water makes rapid downward movement. It is these fractures, however, that present potential hazards for groundwater contamination from septic effluent.

The shallow soils and hard bedrock create great lateral movement of water, where it seeks out fractures as it moves horizontally. Therefore, flow becomes concentrated in the area of fractures as water creates a gradient, moving towards fractures. Septic systems located close to a fracture can tap into the gradient and potentially move improperly treated effluent into fractures. This permits the rapid vertical movement of potentially contaminated water into the aquifer, where it could be taken up in a domestic well. This effect could be amplified if a number of septic systems are located in close proximity to each other and in close proximity to a fracture. It could be further amplified if the domestic wells serving these homes tapped into the same fracture.

The Township will need to exercise caution regarding ground water withdrawals and septic system installations in the Mountain district in the future. There is valuable information available from studies already completed, and partnering with regional agencies to study this relationship can be productive as well.

Soil Characteristics

The soils in the Agricultural and Mountain districts are varied in terms of their agricultural suitability, depth to bedrock and seasonal high water and suitability for on-site disposal of effluent. All of these characteristics are related by way of soil associations, as mapped in the "Soil Survey of Somerset County", published by the USDA Soil Conservation Service.

There are six soil associations present in the Agricultural and Mountain districts, each of which are categorized based on the parent material from which they were formed. They can be described as follows:

Soils formed mainly in glacial till or material weathered from granitic gneiss, diabase or basalt – The nearly level to very steep soils that make up these associations are dominantly gravelly, very stony, or rocky and are underlain by granitic gneiss, diabase, or basalt bedrock. The depth to bedrock is mainly 4 or more feet. In some areas of the steep and very steep soils, outcrops of bedrock are common. The soils of these associations are on ridges and are mostly wooded.

Neshaminy-Mount Lucas-Amwell Association: gently sloping to very steep, deep, well drained to somewhat poorly drained, loamy, gravelly and very stony soils that have bedrock mainly below a depth of 4 feet. This association is found in the Mountain district, specifically, in the Sourland Mountain region.

Soils formed in material weathered mainly from shale, siltstone, or sandstone but partly from conglomerate and argillite- The nearly level to very steep soils that make up these associations formed mainly in material weathered from red shale. In places they formed in material weathered from sandstone, siltstone, argillite, or conglomerate. The soils are mainly nearly level to strongly sloping. They have a surface layer of silt loam. The main farming areas of Somerset County are in these associations.

Arendstville-Penn-Pattenburg Association: nearly level to moderately steep, deep and moderately deep, well drained loamy, gravelly, and shaly soils underlain mainly by quartzite conglomerate and red shale. This association is found in the Agricultural district, in the northeastern corner of the Township.

Penn-Klinesville-Reaville Association: nearly level to very steep, moderately deep and shallow, well drained to somewhat poorly drained loamy and shaly soils underlain mainly by red shale. This association is found in both the Agricultural and Mountain districts, but is primarily found in the Agricultural district.

Bucks-Abbottstown-Readington Association: nearly level to strongly sloping, deep, well drained to somewhat poorly drained loamy soils underlain mainly by red shale. This association is found in the northwestern corner of the Township, only in the Agricultural district.

Royce-Penn-Klinesville Association: Gently sloping to very steep, deep to shallow, well-drained loamy and stony soils underlain mainly by red shale. This association is found in the central portion of the Township, in the Agricultural district located in the southern portion of the Township.

Soils formed in recent alluvium and old alluvium- The nearly level to strongly sloping soils that make up these associations are on the flood plains and terraces along the major

streams. They were formed predominantly in stream sediment and glacial outwash material. The soils of these associations are mainly farmed or are in pasture.

Rowland-Birdsboro-Raritan Association: nearly level to strongly sloping, deep, well drained to somewhat poorly drained loamy soils formed in alluvial sediment, on floodplains and terraces. This association is present in the Agricultural district, along the banks and floodplains of the Neshanic and Raritan Rivers.

Farmland Capability

Figure 10 shows the farmland capability of the soils and highlights the Agricultural and Mountain districts. Generally, there is a predominance of highly capable agricultural soils in the Agricultural district, which includes statewide important soils and soils of local importance. The following descriptions of prime farmlands, soils of statewide importance and farmland of local importance are taken from the "New Jersey Important Farmlands Inventory", prepared by the State Agriculture Development Committee in 1990. Not included in this description is the category for unique farmlands, the generally poorly drained soils used for specialty crops such as cranberries and blueberries, which do not occur in the Township.

Prime Farmlands-Prime Farmlands include all those soils in Land Capability Class I and selected soils from Land Capability Class II. Prime Farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber and oilseed crops and is also available for these uses. It has the soil quality, growing season, and moisture supply needed to economically produce sustained high yields of crops when treated and managed according to acceptable farming methods. Prime Farmlands are not excessively erodible or saturated with water for a long period of time, and they either do not flood frequently or are protected from flooding.

Soils of Statewide Importance-Farmlands of statewide importance include those soils in Land Capability Classes II and III that do not meet the criteria as Prime Farmland. These soils are nearly Prime Farmland and economically produce high yields of crops when treated and managed according to acceptable farming methods. Some may produce yields as high as Prime Farmland if conditions are favorable.

Farmland of Local Importance-Farmland of local importance includes those soils that are not prime or statewide importance and are used for the production of high value food, fiber or horticultural crops.

Soils are a finite resource. Once converted to developed uses, they are unlikely to be returned to agricultural use. In addition, agricultural soils and the farming that they support are a prized part of Hillsborough Township's agrarian history. Evidence of this history is seen in the present day Agricultural district, which retains 45% agricultural land cover.

The portion of the Agricultural district in the northeastern corner of the Township is mainly comprised of prime soils, which have the highest agricultural value. A mass of locally important soils is found along the Raritan River and Dukes Brook. While these soils are agriculturally productive, they are limited in terms of crop production as compared to prime and statewide important soils and are focused on certain crops.

The western portion of the Agricultural district is composed of prime, statewide important and locally important soils, with the prime soils accounting for most of the acreage. The prime and statewide important soils are generally contiguous, and are the land base for active farming. This indicates that these soils are important for continued agricultural production to remain viable.

The southern part of the Agricultural district, to the east of the Mountain district, is comprised almost entirely of prime and statewide important soils. Only half of this land is in active agricultural production, with a significant portion of the acreage in wetland and forested wetlands.

The Mountain district is comprised of all three farmland capability soil designations, as indicated on Figure 10, with statewide important soils as the predominant type. Geology plays a large role in determining agricultural productivity in the Mountain district, where the diabase of the Sourland Mountain is a dominating feature in the southern part of the district. The bedrock geology map, (Figure 9) shows that the diabase and the Lockatong formation clearly define the extent of the statewide important soils. And although a significant portion of the statewide important soils in the Mountain district are affected by high water tables and have only moderate depth to bedrock, they are still agriculturally significant.

The portion of the Mountain district along the Millstone River exhibits characteristics much like those of the Agricultural district in the western side of the Township. The diabase that dictated soil formation in the Sourland Mountain region is not present here. This area of the Mountain district is comprised mainly of locally important soils, formed along the banks of the Millstone River, along with pockets of prime and statewide important soils.

On-Site Disposal of Effluent

Another property of soils related to community development potential is their ability to dispose of effluent on-site utilizing a septic system. Both the Somerset County Soil Survey and the Standards for Individual Subsurface Sewage Disposal Systems (N.J.A.C. 7:9A) classify soils based on their ability to properly dispose of effluent utilizing a septic system. The latter statute, adopted by the NJDEP in 1999, represents the most recent scientific information from the Department and is considered the appropriate source when considering suitability for on-site septic disposal. Both are mapped and presented for comparison.

The Somerset County Soil Survey (December of 1976) presents information on the limitations of soils to dispose of effluent from septic systems, which is depicted on Figure 11. Generally, none of the soils found in either district are suitable for on-site disposal of effluent, with a few exceptions in the Agricultural district near the Duke Estate. An overwhelming number of the soils have severe limitations for disposal of effluent. The two most important factors that combine to dictate the ability to process effluent are depth to bedrock and depth to seasonal high water, shown on Figures 14 and 15. Other factors that influence the ability of a soil to dispose of septic effluent are permeability, shrink and swell capacity and clay content. While all of these factors contribute to limitations, depth to bedrock and depth to seasonal high water are the key factors.

The soils in the northeastern portion of the Agricultural district near the Duke Estate are almost evenly split between those with severe limitations for on-site disposal of effluent, and those with slight limitations. The soils along the Raritan River are subject to frequent stream overflow, thereby creating the potential for surface water contamination from septic systems. The other principal limiting factor in this area is rippable bedrock at a depth of 1.5' to 3.5'. This means that the soil profile cannot adequately provide the zones of treatment and disposal needed to remove contaminants from effluent. Other soils in the area have slow permeability in the subsoil, creating further limitations. Even the soils in this portion of the Agricultural district with slight limitations present problems that could be significant, as there is a hazard of groundwater pollution where a high water table is present.

The Agricultural district has similar subsurface conditions that contribute to their severe limitations designation. The areas along the Raritan River are subject to flooding frequently enough that surface water contamination can occur. The same holds true for soils that is immediately adjacent to the streams that flow through the Agricultural district out of the Sourland Mountain region. Other limiting factors on a number of soils are shallow water table (perched at 1.5' to 3.5'), and soils that are strongly sloping.

Similar factors are present in the portion of the Agricultural district directly east of the Mountain district. Two streams flow through this part of the district, where overflow is a hazard that could cause surface water contamination. There are also perched water tables in a number of the soils, presenting the possibility of groundwater contamination. Pervious shale bedrock and rippable bedrock underlay portions of the district.

The Mountain district is characterized by soils that have many of the same limiting factors found in the Agricultural district. All of the soils have either moderate or severe limitations for on-site disposal of effluent, with a majority having severe limiting factors. Shallow bedrock underlies a significant portion of the district, perching water at depths anywhere from 0.5' to 4' below the surface. This creates potential for groundwater contamination and results in limitations for the installation of septic systems. With bedrock at depths of 1.5' in places, adequate soil profiles are not available for processing of effluent.

With the adoption of N.J.A.C. 7:9A “Standards for Individual Subsurface Sewage Disposal Systems”, the NJDEP essentially rewrote the book on classifying soils for their suitability to dispose of effluent via a septic system and the appropriate system to be used given certain limitations. In the absence of detailed on-site soil investigation, the Soil Survey mapping is used to determine the location of soil series, and the newly adopted standards specify the types of limiting zones that may be present and the type of system to be used, if any. Figure 12 shows the soils of the Agricultural and Mountain districts as classified by Appendix D of N.J.A.C. 7:9A and Table 1 below lists the system type permitted given the suitability class. System types include conventional systems, soil replacement bottom-lined systems, soil replacement fill-enclosed systems, mound systems and mounded soil replacement systems.

Table 1

Type of Limiting Zone	Depth ² , ft.	Suitability Class	Type of Installation Permitted ³
Fracture Rock or Excessively Coarse Substrata	>5 0-5	I IISc	C, (SRB, SRE, M, MSR) SRE, M, (MSR)
Massive Rock Hydraulically Restrictive Substratum	>9 4-9 <4	I IISr IIISr	C, (SRB, SRE, M, MSR) M, (MSR) UNSUITABLE
Hydraulically Restrictive Horizon, Permeable Substratum	>9 4-9 <4	I IIHr IIIHr	C, (SRB, SRE, M, MSR) SRB, SRE, M, (MSR) SRB, SRE, (MSR)
Excessively Coarse Horizon	>5 0-5	I IIHc	C, (SRB, SRE, M, MSR) SRE, M, (MSR)
Zone of Saturation, Regional	>5 2-5 <5	I IIWr IIIW _r	C, (SRB, SRE, M, MSR) M, (MSR) UNSUITABLE
Zone of Saturation, Perched	>5 2-5 <5	I IIWp IIIW _p	C, (SRB, SRE, M, MSR) C ⁴ , (SRB, SRE, M, MSR) C ⁴ , (SRB, SRE, M, MSR)

C = Conventional Installation

SRB = Soil Replacement, Bottom-lined Installation

SRE = Soil Replacement, Fill-enclosed Installation

M = Mound Installation

MSR = Mounded Soil Replacement Installation¹

(1) Mounded soil replacement systems are generally required only in cases where several limiting zones are present as, for example, in compound soil suitability classes such as IIScWr, IIHr (IISr) or IIHr (IIWr).

(2) Depth is measured from the existing ground surface to the top of the limiting zone. In the case of disturbed ground, the depth to the limiting zone shall be measured from the pre-existing natural ground surface, identified as prescribed in N.J.A.C. 7:9A-5.10(c), or the existing ground surface, whichever is lowest.

(3) Installations shown in parentheses are allowed but are generally not the most cost-effective type of installation for the soil suitability class unless other soil limitations are present.

(4) An interceptor drain or other means of removing the perched zone of saturation is required. Note: In soils with a compound soil suitability class, where more than one limiting zone is present in the soil, a disposal field installation shall not be approved unless the type of installation proposed is listed in Table 10.1 as an acceptable option for each of the soil suitability classes, which apply.

The 1999 standards adopted by the Department indicate there are certain types of soils with limiting zones that create situations unsuitable for any type of septic system installation. A number of these soil types are present in the Agricultural and Mountain districts and are mapped in Figure 13. These soils cover approximately 29.3% of the Agricultural district and 52.6% of the Mountain district. Figure 13 is a generalization of soil types based on the mapping in the Soil Survey, with the suitability classes from N.J.A.C. 7:9A applied. This is the prescribed method in N.J.A.C. 7:9A for making initial determination of soil suitability. Only detailed site investigation, however, can verify the presence or absence of the limiting zones. However, this map is extremely useful for planning purposes, and gives an excellent picture of the types of limitations that may

exist and how policy should be shaped to accommodate them and protect the health and safety of residents.

Depth to Seasonal High Water

Figure 14 depicts depth to seasonal high water for the soils in the Agricultural and Mountain districts. Depth to seasonal high water indicates the highest level below the surface that groundwater reaches. This typically occurs between December and April. The depth to seasonal high water is an important factor in determining the limitations to development. Potential impacts from a shallow depth to seasonal high water include flooding of basements, weakening of foundations and serious limitations for on-site disposal of effluent. Shallow seasonal high water tables, while presenting limitations for development, also support diverse plant and wildlife communities. Therefore, these factors are a good indicator of lands, which deserve protection in order to limit destruction of property and protection of diverse plant and animal communities.

A good portion of the soils throughout the Agricultural and Mountain districts have depths to seasonal high water greater than 4' and 5', which are classified as generally deep on Figure 14. These soils are found mainly in the Agricultural district, away from the rivers and streams. The geologic influence on depth to seasonal high water of the diabase in the Mountain district is also seen in Figure 14, where a majority of the soils in the southern half of the Mountain (where the diabase is present) have depths of 1.5' to 4' to seasonal high water.

The Agricultural district is comprised of soils that generally have depths to seasonal high water greater than 4' and 5'. These depths allow these soils to be productive for agricultural purposes, and underlay most of the land that is in agricultural production in the Township.

In the northeastern portion of the Agricultural district, depths to seasonal high water are generally deep, with some areas exhibiting variable tendencies. A few areas in this portion of the district have perched water tables with groundwater directly below the surface as a result of an impermeable soil layer deeper in the horizon of the soil.

The Agricultural district shows a predominance of soils with depths to seasonal high water greater than 4 and 5 feet. There are also pockets of soils having shallow and variable characteristics, especially in and around streams and rivers.

The Mountain district soils have varied depths to seasonal high water. The Sourland Mountain geology played a controlling role in soil formation and depth to seasonal high water. The delineation of the diabase geology is apparent in the Mountain district (see Figure 14), where the yellow indicates variable depth to seasonal high water. This area is a pocket surrounded by soils with generally shallow depths to seasonal high water. The Neshaminy and Mount Lucas soils that were created from the weathered diabase have deeper profiles than the surrounding soils formed from different parent material. The diabase, being older than the surrounding formations, has been subjected to millions of

years more weathering. It also weathers into different material, mainly sand, gravel, pebble and boulder sized fragments. The surrounding parent material weathers into clay and silt sized fragments. This difference in weathering and parent material creates soils with different properties, especially with respect to depth to seasonal high water, due to the larger nature of weathered fragments. Figure 15 shows that the greatest depths to bedrock are found in the Sourland Mountain, reflected in the deeper soils found on the Mountain.

Figure 14 also shows depths to seasonal high water increasing to the north, further from the Sourland Mountain. This is due to the fact that the Passaic Formation, acting as parent material, is weathered into poorer draining soils made up of silts and clays. Figure 15 shows that depths to bedrock get shallower as you move north away from the Sourlands, which is a contributing factor to depth to seasonal high water. With a soil profile not as deep as those found in the Sourlands, there is less room for water to move through the soil, bringing it in closer contact with the surface.

Depth to Bedrock

Depth to bedrock is an important factor for consideration in a number of areas, including community development, septic suitability and as a contributing factor in depth to seasonal high water. The Agricultural and Mountain districts exhibit a wide variety of depths to bedrock, with the deepest in the Mountain district in the area of the Sourland Mountain. Depth to bedrock is depicted on Figure 15.

The portion of the Agricultural district in the northeastern corner of the Township exhibits depths to bedrock, which are variable, ranging from 1 to greater than 5 feet. There is a pocket of deep soils that run through the center of this part of the Agricultural district, flanked by the soils adjacent to the Raritan River and the Dukes Brook. There are some occurrences of soils with shallow depths to bedrock intertwined.

The Agricultural district is underlain by soils that are variable, with depths ranging from 1 to greater than 5 feet. Most of the soils in the southern portion of this part of the Agricultural district have shallow depths to bedrock, with the exception of the stream corridors and adjacent to the Neshanic and Raritan Rivers. Some of the soils even exhibit deep depths to bedrock, at greater than 5 feet.

The portion of the Agricultural district directly east of the Mountain is characterized by soils with shallow and variable depth to bedrock, some with depths greater than 3.5 feet. The deepest soils in this part of the district are generally found in areas that are wooded and adjacent to streambeds.

The Mountain district contains some of the deepest soils in terms of depth to bedrock. The portion of the Mountain district that is underlain by the Jurassic Diabase formation exhibits soils that are generally deep, ranging from 4 to greater than 6 feet. This is due primarily to the amount of weathering that the diabase has gone through, being rock of an older period and therefore subjected to longer weathering. The forest cover on the

Sourland Mountain also provides more organic material to aid in continued weathering and break up of the rock, feeding additional organic material into the soil and further changing its composition and depth. As you move north through the Mountain district, depths to bedrock decrease dramatically, ranging from variable to shallow at the northern edge of the district adjacent to the Agricultural district. Interestingly, some of the better agricultural soils are underlain by shallow bedrock (see Figure 10).

Analysis of State Planning Policy Implications

New Jersey State Development and Redevelopment Plan

The New Jersey State Development and Redevelopment Plan (SDRP) is a planning policy guidance document that was adopted by the New Jersey State Planning Commission, originally in 1992 and again in March of 2001. Adopted pursuant to the State Planning Act, the SDRP divides the state into Planning Areas depicted on the State Plan Policy Map and enumerates goals and policies for these Planning Areas. Planning Areas are delineated based on criteria set forth in the SDRP, generally founded on the existing land uses, infrastructure and natural resources.

The Agricultural district in Hillsborough Township is primarily mapped as Planning Areas 4 (Rural Planning Area) and 5 (Environmentally Sensitive), as depicted on Figure 16. A small portion of the Agricultural district is designated as PA-3 (Fringe Planning Area). The PA-4 designation reflects the agricultural nature of this district; where over 50% of the land can be classified as agricultural. The areas designated as PA-5 are those immediately adjacent to the corridors of the South Branch of the Raritan River and the Millstone River, resulting from a County-wide initiative undertaken by the Somerset County Planning Board during the last round of Cross-Acceptance of the SDRP.

Planning Areas 4 and 5 together “serve as the greensward for the larger region and are not currently nor are they intended to be urban or suburban in nature”.² Planning Area 4 contains the prime agricultural soils and other resources of the state that are necessary to maintain large contiguous areas for agriculture and protect community character and land cover diversity throughout New Jersey. But the resources of Planning Area 4 are often under siege, as they are lands that are easily converted to suburban development. This is especially true in Hillsborough, where rapid suburbanization threatens to expand into the agricultural valley.

The policies in the State Development and Redevelopment Plan for Planning Area 4 are intended to:³

- ☐ maintain the Environs as large contiguous areas of farmland and other lands;
- ☐ revitalize cities and towns;
- ☐ accommodate growth in Centers;
- ☐ promote a viable agricultural industry;

² “The New Jersey State Development and Redevelopment Plan”, New Jersey State Planning Commission, March 2001, page 205.

³ IBID, page 208.

- protect the character of existing, stable communities; and
- confine programmed sewers and public water services to Centers.

Protection of rural character while maintaining the land base and economic viability of agricultural operations is the underlying intent for PA-4. This should occur in conjunction with the establishment of appropriate land use and development patterns that accommodate housing needs while ensuring continued economic growth. To this end, the SDRP recommends a number of land use and equity mitigation tools. Density transfers, land banking, purchase of development rights, and clustering are all appropriate strategies for communities to utilize in order to achieve goals and objectives.

SDRP policy objectives for PA-4 that are relevant to the Agricultural district include the following:⁴

1. Land Use: Enhance economic and agricultural viability and rural character by guiding development and redevelopment into Centers. In the Environs, maintain and enhance agricultural uses, and preserve agricultural and other lands to form large contiguous areas and greenbelts around Centers. Development and redevelopment should use creative land use and design techniques to ensure that it does not conflict with agricultural operations, does not exceed the capacity of natural and built systems and protects areas where public investments in farmland preservation have been made. Development and redevelopment in the Environs should maintain or enhance the character of the area.

2. Housing: Provide for a full range of housing choices primarily in Centers at appropriate densities to accommodate projected growth, recognizing the special locational needs of agricultural employees and minimizing conflicts with agricultural operations. Ensure that housing in general—and in particular affordable, senior citizen, special needs and family housing—is developed with maximum access to a full range of commercial, educational, recreational, health and transportation services and facilities in Centers. Focus multi-family and higher-density, single-family housing in Centers. Any housing in the Environs should be planned and located to maintain or enhance the cultural and scenic qualities and with minimum impacts on agricultural resources.

3. Economic Development: Promote economic activities within Centers that complement and support the rural and agricultural communities and that provide diversity in the rural economy and opportunities for off-farm income and employment. Encourage tourism related to agriculture and the environment, as well as the historic and rural character of the area. Support appropriate recreational and natural resource-based activities in the Environs. Any economic development in the Environs should be planned and located to maintain or enhance the cultural and scenic qualities and with minimum impacts on agricultural resources.

4. Transportation: Maintain and enhance a rural transportation system that links Centers to each other and to the Metropolitan and Suburban Planning Areas. Provide appropriate access of agricultural products to markets, accommodating the size and weight of modern agricultural equipment. In Centers, emphasize the use of public transportation systems and alternatives to private cars where appropriate and feasible, and maximize circulation

⁴ IBID, page 209-210.

and mobility options throughout. Support the preservation of general aviation airports as integral parts of the state's transportation system.

5. Natural Resource Conservation: Minimize potential conflicts between development, agricultural practices and sensitive environmental resources. Promote agricultural management practices and other agricultural conservation techniques to protect soil and water resources. Protect and preserve large, contiguous tracts and corridors of recreation, forest or other open space land that protect natural systems and natural resources.

6. Agriculture and Farmland Preservation: Guide development to ensure the viability of agriculture and the retention of farmland in agricultural areas. Encourage farmland retention and minimize conflicts between agricultural practices and the location of Centers. Ensure the availability of adequate water resources and large, contiguous tracts of land with minimal land-use conflicts. Actively promote more intensive, new-crop agricultural enterprises and meet the needs of the agricultural industry for intensive packaging, processing, value-added operations, marketing, exporting and other shipping through development and redevelopment.

7. Recreation: Provide maximum active and passive recreational and tourism opportunities at the neighborhood and local levels by targeting the acquisition and development of neighborhood and municipal parkland within Centers. Provide regional recreation and tourism opportunities by targeting parkland acquisitions and improvements that enhance large contiguous open space systems and by facilitating alternative recreational and tourism uses of farmland.

8. Redevelopment: Encourage appropriate redevelopment in existing Centers and existing developed areas that have the potential to become Centers, or in ways that support Center-based development to accommodate growth that would otherwise occur in the Environs. Redevelop with intensities sufficient to support transit, a broad range of uses, efficient use of infrastructure, and design that enhance public safety, encourage pedestrian activity, reduce dependency on the automobile and maintain the rural character of Centers.

9. Historic Preservation: Encourage the preservation and adaptive reuse of historic or significant buildings, Historic and Cultural Sites, neighborhoods and districts in ways that will not compromise either the historic resource or the ability for a Center to develop or redevelop. Outside Centers, coordinate historic preservation needs with farmland preservation efforts. Coordinate historic preservation with tourism efforts.

10. Public Facilities and Services: Phase and program for construction as part of a dedicated capital improvement budget or as part of a public/private development agreement the extension or establishment of public facilities and services, particularly wastewater systems, to establish adequate levels of capital facilities and services to support Centers; to protect large contiguous areas of productive farmlands and other open spaces; to protect public investments in farmland preservation programs; and to minimize conflicts between Centers and surrounding farms. Encourage private investments and facilitate public/private partnerships to provide adequate facilities and services, particularly wastewater systems, in Centers. Make community wastewater treatment a feasible and cost-effective alternative.

11. Intergovernmental Coordination: Coordinate efforts of various state agencies, county and municipal governments to ensure that state and local policies and programs support rural economic development, agriculture, and the rural character of the area by

examining the effects of financial institution lending, government regulation, taxation and other governmental policies and programs.

Implementation at the local level of the SDRP policy objectives will help to preserve, protect and enhance the agricultural nature of the Agricultural district. These policy objectives give rise to a number of potential policy initiatives that the Township could undertake, presumably with the blessing of the State Planning Commission. In any event, the Township's efforts to support the continuation of agriculture in Planning Area 4 are clearly supported by the SDRP.

The Mountain district is primarily mapped as Planning Area 5, Environmentally Sensitive Planning Area, with a small portion designated as PA-4 in the southeastern corner of the Township. The PA-5 designation reflects the predominance of fragile natural resources located in this district, including wetlands, large contiguous tracts of forest, habitat for threatened and endangered species, steep slopes and headwater streams. The resources of PA-5 that define it also make it attractive for residential development.

The policies in the State Development and Redevelopment Plan for Planning Area 5 are intended to:⁵

- ☐ protect environmental resources through the protection of large contiguous areas of land;
- ☐ accommodate growth in Centers;
- ☐ protect the character of existing stable communities;
- ☐ confine programmed sewers and public water services to Centers; and
- ☐ revitalize cities and towns.

Protection of critical natural resources while balancing beneficial economic growth is the underlying theme for Planning Area 5. Accommodating growth in centers is the preferred form of development, in order to protect critical habitat and other natural resources that are present in the environs of PA-5.

The SDRP outlines a number of policy objectives for PA-5 relevant to the Mountain district. These include the following:⁶

1. Land Use: Protect natural systems and environmentally sensitive features by guiding development and redevelopment into Centers and establishing Center Boundaries and buffers and greenbelts around these boundaries. Maintain open space networks, critical habitat and large contiguous tracts of land in the Environs by a variety of land use techniques. Development and redevelopment should use creative land use and design techniques to ensure that it does not exceed the capacity of natural and infrastructure systems and protects areas where public investments in open space preservation have been made. Development and redevelopment in the Environs should maintain and enhance the natural resources and character of the area.

⁵ IBID, page 217.

⁶ IBID, page 209-210.

2. Housing: Provide for a full range of housing choices primarily in Centers at appropriate densities to accommodate projected growth. Ensure that housing in general—and in particular affordable, senior citizen, special needs and family housing—is developed with access to a range of commercial, cultural, educational, recreational, health and transportation services and facilities. Focus multi-family and higher-density, single-family housing in Centers. Any housing in the Environs should be planned and located to maintain or enhance the cultural and scenic qualities and with minimum impacts on environmental resources.

3. Economic Development: Support appropriate recreational and natural resource-based activities in the Environs and locate economic development opportunities that are responsive to the needs of the surrounding region and the travel and tourism industry in Centers. Any economic development in the Environs should be planned and located to maintain or enhance the cultural and scenic qualities and with minimum impacts on environmental resources.

4. Transportation: Maintain and enhance a transportation system that protects the Environs from scattered and piecemeal development and links Centers to each other within and between Planning Areas. Encourage alternatives to the single-occupancy vehicle whenever feasible. Accommodate the seasonal demands of travel and tourism that support recreational and natural resource-based activities. In Centers, emphasize the use of public transportation systems and alternatives to private cars where appropriate and feasible and maximize circulation and mobility options throughout.

5. Natural Resource Conservation: Protect and preserve large, contiguous tracts and corridors of recreation, forest or other open space land that protects natural systems and sensitive natural resources, including endangered species, ground and surface water resources, wetland systems, natural landscapes of exceptional value, critical slope areas, scenic vistas and other significant environmentally sensitive features.

6. Agriculture: Promote agricultural practices that prevent or minimize conflicts with sensitive environmental resources. Guide development to ensure the viability of agriculture and the retention of farmland in agricultural areas. Encourage farmland retention and minimize conflicts between agricultural practices and the location of Centers. Ensure the availability of adequate water resources and large, contiguous tracts of land with minimal land use conflicts. Actively promote more intensive, new-crop agricultural enterprises and meet the needs of the agricultural industry for intensive packaging, processing, value-added operations, marketing, exporting and other shipping through development and redevelopment.

7. Recreation: Provide maximum active and passive recreational and tourism opportunities at the neighborhood and local levels by targeting the acquisitions and development of neighborhood and municipal parkland within Centers. Provide regional recreation and tourism opportunities by targeting parkland acquisitions and improvements that enhance large contiguous open space systems. Ensure meaningful access to public lands.

8. Redevelopment: Encourage environmentally appropriate redevelopment in existing Centers and existing developed areas that have the potential to become Centers or in ways that support Center-based development to accommodate growth that would otherwise occur in the Environs. Redevelop with intensities sufficient to support transit, a range of uses broad enough to encourage activity beyond the traditional workday,

efficient use of infrastructure, and physical design features that enhance public safety, encourage pedestrian activity and reduce dependency on the automobile to attract growth otherwise planned for the Environs.

9. Historic Preservation: Encourage the preservation and adaptive reuse of historic or significant buildings, Historic and Cultural Sites, neighborhoods and districts in ways that will not compromise either the historic resource or the ability for a Center to develop or redevelop. Outside Centers, coordinate historic preservation needs with open space preservation efforts. Coordinate historic preservation with tourism efforts.

10. Public Facilities and Services: Phase and program for construction as part of a dedicated capital improvement budget or as part of a public/private development agreement the extension or establishment of public facilities and services, particularly wastewater systems, to establish adequate levels of capital facilities and services to support Centers; to protect large contiguous areas of environmentally sensitive features and other open spaces; to protect public investments in open space preservation programs; and to minimize conflicts between Centers and the Environs. Encourage private investments and facilitate public/private partnerships to provide adequate facilities and services, particularly wastewater systems, in Centers. Make community wastewater treatment a feasible and cost-effective alternative.

11. Intergovernmental Coordination: Coordinate efforts of state agencies, county and municipal governments to ensure that state and local policies and programs support environmental protection by examining the effects of financial institution lending practices, government regulation, taxation and other governmental policies and programs.

Implementation strategies to protect the critical natural resources of the Mountain district, such as those that are recommended in the SDRP, are readily implemented at the local level. The Environmental Resource Inventory is an important tool towards implementation, identifying and describing the resources that merit protection and preservation. It will be up to the Master Plan to interweave the findings of this document into goals and policy objectives.

Assessment of Infrastructure in the Mountain and Agricultural Districts

For purposes of planning and land development the major components of infrastructure are potable water, wastewater treatment and circulation. Major influences on these items in the Agricultural and Mountain Zones are the Utility Service Plan and the Circulation Plan Element of the Master Plan for Hillsborough Township, Somerset County's Wastewater Management Plan, the plans of Elizabethtown Water Company, Somerset County's Transportation Plan, capital improvement program of the North Jersey Transportation Authority and New Jersey Department of Transportation and natural resources of the region as a limiting factor.

Wastewater Management

The Utility Service Plan identifies the community wastewater area as the service area of the Township of Hillsborough Municipal Utilities Authority (HTMUA). With some minor exceptions, this service area encompasses the Royce's Brook Drainage Basin. The Royce's Brook Drainage Basin has been and continues to be the logical area for wastewater service because of its proximity to water service, major highways, and existing development patterns. Based on these existing characteristics, the Utility Service Plan in particular, and the entire Master Plan in general, continues to focus future development in the remaining areas within the Royce's Brook Drainage Basin as opposed to the Agriculture and Mountain Zones. (See Figure 17)

Significant actions by Hillsborough have included the expansion of the Somerset Raritan Valley Sewerage Authority (SRVSA) service area to encompass areas within the Township requiring sewers and the service areas of the Veterans Depot, River Road, Fieldhedge and GSA Depot wastewater treatment plants which were targeted for decommissioning. In addition, Hillsborough deleted areas from previously proposed sewer service areas within the Agricultural zone north of Amwell Road.

The January 2002 Sewerage Facilities Plan of the Township's Municipal Utilities Authority shows the limits of collection lines within the Township. According to this plan, portions of Starview Drive and Murray Court are within the collection system and are located in the Mountain Zone. This area is subdivided into small lots and is built out.

Another area of the Agricultural zone crossed by wastewater facilities is a portion of Dukes Parkway East, which is bisected by the Hillsborough-Somerville Trunk Line of the SRVSA.

The intent of the Utility Service Plan is to concentrate efforts for the extension of the sewer and water lines in logical enlargements of the present system in order to encourage development in the core area along the existing distribution systems supported by the distribution plan of the HTMUA. Major extensions through undeveloped land, such as the Agricultural and Mountain Districts to provide service to these peripheral areas are discouraged. Not only are costs increased for such long extensions, but the resulting land

use pattern compounds the need to provide community-wide services such as police protection, school busing, spot storm water management solutions, and highway improvements to a scattered development pattern.

By concentrating wastewater treatment in the developed portion of the Township, the alternative for other areas such as the Agricultural and Mountain zones is on-site disposal of effluent, which may or may not support utilization of septic systems.

An important factor is the property of soils related to community development potential, and its ability to dispose of effluent through on-site utilization of septic systems. Both the Somerset County Soil Survey and the Standards for Individual Subsurface Sewage Disposal Systems (N.J.A.C. 7:9A) classify soils based on their ability to properly dispose of effluent utilizing a septic system. The latter statute, adopted by the NJDEP in 1999, represents the most recent scientific information from the Department and is considered the appropriate source when considering suitability for on-site septic disposal.

According to the Somerset County Soil Survey (December of 1976) information on the limitations of soils to dispose of effluent from septic systems, generally, none of the soils found in the Agricultural or Mountain district are suitable for on-site disposal of effluent, with a few exceptions in the Agricultural district near the Duke Estate. An overwhelming number of the soils have severe limitations for disposal of effluent. The two most important factors that combine to dictate the ability to process effluent are depth to bedrock and depth to seasonal high water. Other factors that influence the ability of a soil to dispose of septic effluent are permeability, shrink and swell capacity and clay content. While all of these factors contribute to limitations, depth to bedrock and depth to seasonal high water are the key factors.

The soils in the northeastern portion of the Agricultural district near the Duke Estate are almost evenly split between those with severe limitations for on-site disposal of effluent, and those with slight limitations. The soils along the Raritan River are subject to frequent stream overflow, thereby creating the potential for surface water contamination from septic systems. The other principal limiting factor in this area is rippable bedrock at a depth of 1.5' to 3.5'. This means that the soil profile cannot adequately provide the zones of treatment and disposal needed to remove contaminants from effluent. Other soils in the area have slow permeability in the subsoil, creating further limitations. Even the soils in this portion of the Agricultural district with slight limitations present problems that could be significant, as there is a hazard of groundwater pollution where a high water table is present.

The Agricultural district has similar subsurface conditions that contribute to their severe limitations designation. The areas along the Raritan River are subject to flooding frequently enough that surface water contamination can occur. The same holds true for soils that is immediately adjacent to the streams that flow through the Agricultural district out of the Sourland Mountain region. Other limiting factors on a number of soils are shallow water table (perched at 1.5' to 3.5'), and soils that are strongly sloping.

Similar factors are present in the portion of the Agricultural district directly east of the Mountain district. Two streams flow through this part of the district, where overflow is a hazard that could cause surface water contamination. There are also perched water tables in a number of the soils, presenting the possibility of groundwater contamination. Pervious shale bedrock and rippable bedrock underlay portions of the district.

The Mountain district is characterized by soils that have many of the same limiting factors found in the Agricultural district. All of the soils have either moderate or severe limitations for on-site disposal of effluent, with a majority having severe limiting factors. Shallow bedrock underlies a significant portion of the district, perching water at depths anywhere from 0.5' to 4' below the surface. This creates potential for groundwater contamination and results in limitations for the installation of septic systems. With bedrock at depths of 1.5' in places, adequate soil profiles are not available for processing of effluent.

With the adoption of N.J.A.C. 7:9A "Standards for Individual Subsurface Sewage Disposal Systems", the NJDEP essentially rewrote the book on classifying soils for their suitability to dispose of effluent via a septic system and the appropriate system to be used given certain limitations. In the absence of detailed on-site soil investigation, the Soil Survey mapping is used to determine the location of soil series, and the newly adopted standards specify the types of limiting zones that may be present and the type of system to be used, if any.

Potable Water

About one-third of the land area in Hillsborough is provided with public water service by the Elizabethtown Water Company. The remainder of the Township, including much of the Agricultural and Mountain Zones, obtains water from private wells.

Hillsborough is one of 44 municipalities served by the Elizabethtown Water Company whose sources of water are 140 wells located in various areas throughout its system. The water plant, which provides complete treatment for the water supply is located outside the Township. The primary water for use within the Township is residential. Water flow and pressure is excellent and a water storage tank with a one million gallon capacity is located in neighboring Montgomery Township. It provides not only water storage, but also serves as a back-up supply if there is a break in the system. The system is fairly new and considered completely adequate. Water service in the northern section of the Township is provided by the Borough of Manville.

With Elizabethtown Water Company policy of no extension, the burden falls upon private developers to put in new lines. The Township through its regulations encourages development in the third of the Township where wastewater, roads and development has taken place.

As identified in the Natural Resources Analysis the bedrock underlying the Agricultural and Mountain districts has a varied composition. The Agricultural district is generally

underlain by the Passaic Formation, which also underlies the rest of the Township with the exception of a portion of the Mountain district.

The Passaic Formation consists of reddish brown siltstone and shale. About half of the Mountain district is characterized by geology that is quite different from that of the Agricultural district, with the remainder comprised of the same Passaic and Passaic Gray Bed formations. The Jurassic Diabase (Jd) and the Lockatong Formation (Trl) underlie the southern half of the Mountain district (Sourland Mountains). These are formations that are characterized by poor well yields and subsurface conditions unsuitable for septic systems. The Lockatong Formation, found primarily in the Mountain district, has an effect on the availability of groundwater and on-site disposal of effluent utilizing a septic system.

A number of studies on well yields and aquifer characteristics in the fragile Sourland Mountain ecosystem have been undertaken in adjacent municipalities, including East Amwell Township, Hopewell Township and most recently West Amwell Township, although it is not completed.

The East Amwell and Hopewell groundwater studies both have similar findings in terms of the limited water availability and aquifer recharge, but the East Amwell study has a more detailed analysis of trend factors that could affect water availability in other places. Utilizing well records taken since 1990 under the Township Well Test Ordinance, the East Amwell report and analysis generally indicates that the Diabase and Lockatong formations present in the Sourland Mountain represent some of the poorest yielding aquifers in the State. Additionally, the report also found that aquifer recharge to these formations is expected to be less than 2.1 inches per year. This is in stark contrast to a 1995 USGS finding, indicating groundwater recharge of 4.96 inches per year.

The results of East Amwell Township's study of the groundwater resources of the Sourland Mountain region are applicable to the Mountain district in Hillsborough Township. Analysis of trends evident in the East Amwell well data and application of statistical methods show that geology formation is the controlling factor for groundwater availability, not soils.

The geologic formations of the Sourland Mountain region also have a controlling impact on disposal of effluent utilizing a septic system. While soils have been an over-riding factor in determining suitability for septic systems in other areas, the Sourland Mountain geology is the over-riding factor in soil formation and subsurface movement of effluent once it enters the soil.

As mentioned, the bedrock of the Sourland Mountain is hard and sparsely fractured, which contributes to limited availability of water. Wells on the mountain with good yields are generally drilled into fractured areas, where water makes rapid downward movement. It is these fractures, however, that present potential hazards for groundwater contamination from septic effluent.

The shallow soils and hard bedrock create great lateral movement of water, where it seeks out fractures as it moves horizontally. Therefore, flow becomes concentrated in the area of fractures as water creates a gradient, moving towards fractures. Septic systems located close to a fracture can tap into the gradient and potentially move improperly treated effluent into fractures. This permits the rapid vertical movement of potentially contaminated water into the aquifer, where it could be taken up in a domestic well. This effect could be amplified if a number of septic systems are located in close proximity to each other and in close proximity to a fracture. It could be further amplified if the domestic wells serving these homes tapped into the same fracture.

The Township will need to exercise caution regarding ground water withdrawals and septic system installations in the Mountain district in the future. There is valuable information available from studies already completed, and partnering with regional agencies to study this relationship can be productive as well.

Circulation

The third component in capacity analysis is transportation, which involves a large number of agencies involved. State Highway - U.S. Route 206 bisects the Township. The County System includes Routes such as 514 (Amwell Road) and 533 (River Road) and the road system includes important municipal roads, such as Beekman Lane, Auten Road, East Mountain Road, Falcon Road and Hillsborough Road to identify a few.

Besides the private automobile, you have various methods of personal movement include pedestrian movement by way of trails and sidewalks, transit and bicycling. There are also demand management systems either provided by employers, social service agencies or transportation management associations.

There methods of goods movement within the Township include several freight railroads as well as Route 206 a major north south State Highway that connects major interstate highways in the State providing access to the New York City and Philadelphia metropolitan region. There are two major overhead transmission lines and two underground pipelines. Finally, there is a reliever airport in the State's Airport System and a private personal use airport.

At the same time there are physical issues that confront the circulation system in the Township. Rivers bound approximately two-thirds of the Township (South Branch of the Raritan River and Millstone River). The topography within the Township is another significant factor, with the Sourland Mountains to the south. A prominent ridge is found just west of East Mountain Road. Additionally, steep slopes also affect the northwestern Agricultural zone generally in the form of steep slopes along stream banks.

Finally, there are located throughout the Township settlements of human activity, which require the interfacing of many modes of travel, such as bicycling, walking, goods movement and personal vehicle usage. A few of these higher density areas are found within the Agricultural zone including the hamlets of Neshanic and Clover Hill along

Route 514. It is not usual to encounter automobiles, bicyclists and farm equipment all trying to compete for the narrow cartways through these hamlets, with houses in close proximity with the roadway.

State System and Coordination of Planning

The State of New Jersey is responsible for the major through route in the Township Route 206. This route is a major north-south corridor extending from Hammonton in Atlantic County to the Pennsylvania border at Montague in northwestern New Jersey. It is part of the National Highway System.

It is also the focus of development in the Township, and functions as a major arterial route in that the North Jersey Transportation Authority identified the eight miles south of Route 28 on 206 as one of the top 40 congested locations in the State. This has led the State to make major investments in the highway. Project 15 J is underway from the Somerville Circle to Brown Avenue in the northern portion of the Township. This project involves widening by adding a new lane in each direction, building new structures to replace the New Jersey Transit Bridge and the Raritan River Bridge and the constructing a middle barrier along the entire length of the project. In addition, intersections are being improved with new signals and jughandles.

The next two phases (15N and 14A – 15A) are in design and differ in that 15N will be similar to the section underway presently. It will involve widening the area in the Township from Brown Avenue to Old Somerville Road. This section will include the crossing of a tributary of Royce's Brook and will intersect with a number of important local streets, which feed traffic into Route 206 such as Valley Road, Falcon Road and Triangle Road. In addition, this is a major area of commerce within the Township. The plan preparation is currently in the Initial Design stage and Right of Way acquisition process has started.

The other improvement will involve a realignment of 206 from Old Somerville Road to Belle Mead- Griggstown Road in Montgomery Township. The realignment on the Township's Zoning Map shows the route running east of the present route paralleling Royce's Brook intersecting with Amwell Road, Hillsborough Road and Township Line Road. The new segment of the roadway will consist of four 12-foot travel lanes, two 12-foot outside shoulders, two 5-foot inside shoulders, a 26-foot grass median, and two 15-foot outside borders, for a total right of way width of 138 feet. The plan preparation is currently in the Initial Design stage and the Right of Way acquisition process has started.

The latter improvement has incurred one significant problem. The dilemma is with neighboring Montgomery Township and the lawsuit settlement agreement reached with them by NJDOT regarding 206. Alternatives may need to be examined in the context of the realignment of 206 especially at this point since there are discrepancies between the design speeds that the designer has used for some of the intersecting side streets and the currently posted speed limits. Some of the intersecting side street overpasses may need to be re-designed to conform to a higher design speed. Montgomery Township is now

concerned that the designed portion in the northern portion of the Township may be inconsistent with plans being advanced in the Township further south along 206.

Improvements to Route 206 will eventually lead to an achievement of the Desirable Typical Sections (DTS) of the Highway Access Code. The northern portion of 206 will be 4 travel lanes, divided with shoulders. The bypass portion DTS is 6 travel lanes, divided with shoulders.

Only the northern portion of the Agricultural district is impacted by the improvements to Route 206. Specifically, the improvements presently underway with the widening on the west side impact the district. Overall, the improvements are in the zones that the Township has identified for development.

Beyond Route 206 there are other aspects of mobility in the Township that the State has a direct impact. The State through New Jersey Transit is the major provider of mass transportation in the State. In Hillsborough Township one major route traverses the Township. Wheels 989 is a linear route running from the Township to Bedminster with four time points within the Township. It is an AM service to Bedminster and PM service to Hillsborough, which travels through the major residential areas of the Township. The four schedule points are the Redwood Square Shopping Center which serves as a park and ride facility, South Triangle Road and Triangle Road, Veterans Administration Depot and New Camplain Road at Route 206. Through Manville and Somerville it extends to Bridgewater Commons, Bridgewater Office Complex, Hoescht Celanese, T Corporate Drive, Bell Atlantic Mobile and AT&T Longlines.

There is no passenger rail service although there is a major freight line, which runs north and south in the Township paralleling Route 206 to the east. This former Conrail line is now part of the 647 miles of class 1 rail freight service in the State provided by CSX. As a former commuter line and connecting with SEPTA service at West Trenton this line has been under study by NJ Transit and local officials to reinstate passenger service. The project is undergoing conceptual planning and an environmental analysis.

The only other form of public transportation in the Township is provided by Ridewise of Raritan Valley which is Somerset County's Transportation Management Association (TMA). Before the repeal of the Employer Trip Reduction Program (ETRP), Ridewise provided employers rideshare matching, park and ride commuter parking (There are 18 facilities in the County.), Bike/Pedestrian events and Smart Moves for Business Program which was means for employers to state corporate tax efforts for expenditures to promote commute options to their employees. The TMA still continues to partner with local businesses and operators such as NJ Transit to reduce congestion by promoting bicycling, vanpools (45 in 1998), a guaranteed ride home program for employees and vanpools for Work First New Jersey Clients to identify a few.

Transit service is limited in the Agricultural and Mountain zones to transportation demand management strategies as carried out by Ridewise. These zones do not and will not the density to support fixed route services such as Wheels.

Another responsibility of the State is the maintenance of the New Jersey Airport System Plan. This Plan is in the process of being updated and identifies three general service aviation facilities in Somerset County. One of those facilities is on the Hillsborough Township and Manville border. The Central Jersey Regional Airport (Kupper Field) was developed in 1967 and changed to its present owners in 1996. Located on 119 acres it is host to a number of aviation businesses that provide services to aircraft owners/pilots. Approximately 133 aircraft are housed at the facility.

Hillsborough has established two Airport Safety zones within the Township. The Safety one for Central Jersey Regional Airport has an underlying zoning, which is predominantly in the corporate development zone and light industrial zone. A small portion overlaps residential agricultural zone (RA).

The second zone is for a private airfield, which is largely located in the Agricultural district. It does not provide service to general aviators. Hillsborough Township Land Development Ordinance maintains standards on airport hazard area (§ 77-103-111) in terms of purpose, delineation criteria, development and obstruction standards, permitted uses, variances and penalties.

County System and Coordination of Planning

The County roadway system includes a number of road miles, which provide a significant role in supplying mobility in the Township. The functions of the various County roads vary in Hillsborough from minor arterials, which serve to interconnect and augment the major arterial road system and distribute traffic to the collector system, to major collectors, which serve to collect traffic from the local street system and channel it to the arterial system, to minor collectors which serve the same role as major collectors but at much lower volumes. The following table gives the function of the various County roadways that are in Hillsborough along with standards for the roads.

COUNTY ROADWAY FUNCTIONAL CLASSIFICATION

NAME	CO. RT. #	FUNCTION	ROW	CARTWAY	# OF LANES
Amwell Road	514	Minor Arterial	66 ft.	46 ft.	2-4
Millstone River Road	533	Minor Arterial	66 ft.	46 ft.	2-4
River Road	567	Major Collector	60 ft.	40 ft.	2
Studdiford Drive	606	Major Collector	60 ft.	40 ft.	2
Dukes Parkway East	608	Major Collector	60 ft.	40 ft.	2
South Branch & River Rd.	625	Major Collector	60 ft.	40 ft.	2
New Centre Road	627	Major Collector	60 ft.	40 ft.	2
Amwell Road	677	Minor Collector	50 ft	30-36 ft	2

The official functional classification for highways filed with the U.S. Department of Transportation by the State varies slightly from the system presented by the County⁷. In the case of Amwell Road the State classifies it as a Rural Major Collector. The State system also shows East Mountain Avenue as Rural Major Collector connecting it to Trent Road and Reading Boulevard into Route 206 in Belle Mead.

The State's functional classification additionally makes a distinction between urban and rural areas. Although the data establishing the urban cordon line is based on 1990 data, the defined urban area is primarily where the Township and other agencies have made other infrastructure investments.

The limited traffic counts available for the Agricultural and Mountain zones suggest the logic of maintaining the area as rural. For example, the Average Annual Daily Traffic (AADT) is 2870 vehicles on Amwell Road in the Clover Hill area. At the same time a road feeding into Amwell Road has a count 414 vehicles (Cider Mill Road, Raritan Township, Hunterdon County). East Mountain Road between the Montgomery Township line and Mountain View Road had an ADTC of 1,560 vehicles. This is in contrast to the portion of the Township targeted for development where counts are between 27,690 and 30,438 vehicles a day. Local roads within this area show counts of 5, 152 (Hillsboro Road) and 3,322 (Triangle Road).

⁷ It should be noted that the Functional Classification is for 1990. In 2003 the classification will be updated based on year 2000 information.

In terms of accident data, a review of approximately 280 accident reports filed with the State showed only 16 occurred within in the Agricultural and Mountain zones. The majority of these accidents occurred at intersection points with Amwell Road.

A new alignment through the Agricultural and Mountain zones was proposed and is still being considered by the County. West County Drive in Branchburg, Hillsborough and Montgomery Townships is an improvement to provide an alternate north south to Route 206 in the southwestern part of the County. According to the County, West County Drive would utilize existing roadways and new alignments to provide a direct connection between Route 202 in Branchburg and County Route 601 (Belle Mead-Blawenburg Road) in Montgomery Township. A portion of the roadway connecting County Route 567 (South Branch Road) and Route 202 in Branchburg has been completed.

In the Agricultural district there are a number of bridge deficiencies. Amwell Road Bridge over the Neshanic River is scheduled for replacement. On the South Branch between Branchburg and Hillsborough there are other deficiencies. They are the Opie/River Road Bridge, constructed in 1921, is structurally deficient due to the poor condition of the substructure as well as a low structural evaluation rating. The bridge is also functionally obsolete due to low structural evaluation rating and poor deck geometry. The bridge also has a low sufficiency rating of 14.6 and has a weight restriction of 10 tons. The County proposes to replace the existing bridge with a new structure.

Finally, the Woodfern Road crossing of the South Branch of the Raritan River consists of three bridges in series, two through trusses (constructed in 1902) and one reinforced concrete arch (constructed in 1916). The bridges are structurally deficient and functionally obsolete. Two of the bridges received an overall condition rating of serious due to the condition of their superstructures. The third bridge is in poor condition due to the condition of its substructure. The County proposes to rehabilitate or replace one bridge, as well as rehabilitate the other two bridges.

There are a number of bridges that are historically significant and have been identified on the National and New Jersey Register of Historic Places. Two iron truss bridges were built at least 100 years ago, spanning the South Branch of the Raritan (Opie/River Road at Neshanic/Neshanic Station and Woodfern/Higginsville Road). The County has targeted two for replacement mainly because of structural deficiencies of the substructure, which creates a weight restriction.

The replacement of these structures is of concern since they reflect the historic and rural integrity of the district.

Historic structures in the Mountain district include a single stone arch bridge on East Mountain Road over Cat Tail Brook, and on Long Hill Road a three arch stone bridge is located over Rock Brook. Both of these structures date back to 1825.

In 1992 the County conducted a Scenic Corridor and Roadways Study in response to a report it developed for River Road (The River Road Corridor Report) and the State Development and Redevelopment. Both recommended the development of a scenic roads program.

The report recommended that municipalities, in updating their master plans and ordinances, ensure that the policies contained in the circulation, conservation and historic preservation elements are consistent with the goals of scenic protection and enhancement along scenic corridors and roadways. To assist municipalities the County developed a scenic road designation criterion through evaluating several programs from other states. With its rating system the County evaluated 31 County roads. Several County roads in the Township received scores of 15 or more.

Beyond the point of rating, the report identifies a number of issues, which can be undertaken to improve the settings in terms of the location of signs, lighting, landscaping and the placement of utility lines. In addition, there are various funding programs, which can implement these improvements, such as Transportation Enhancement Program and the Local Aid for Centers of Place Transportation Program. New Jersey Department of Transportation (NJDOT) administers both programs.

Considering the conservation and the historic issues within the Agricultural and Mountain districts and the efforts of its open space program, Hillsborough should embark on a Scenic Roads program for the Districts. In fact, this could be merged with a bicycle system plan where again assistance can be obtained from the County and NJDOT.

Another important part of the transportation network in Hillsborough is bicycle and pedestrian facilities. Sidewalks are an integral part of advancing a pedestrian system. The improvement of sidewalks is guided by several policies.

The County's sidewalk policy for county roads is not to build or maintain any sidewalks. Any improvements made are the responsibility of the Township. The County will construct sidewalks where they impact a county road improvement. But their maintenance then becomes the responsibility of the Township.

The Residential Site Improvement Standards (RSIS) adopted by the Department of Community Affairs establishes policies for sidewalk development for residential projects. If a development has a density of one or more units per acre or is within 2500 feet of a train station, public or school bus route or property zoned or used for recreation, business or retail purposes must have sidewalks on both sides of the street. Developments having a density of one unit per two acres which are situated within two miles of a school are required to have sidewalk on one side unless designated a rural lane.

The Township's policy on sidewalks (§77-74) states that sidewalks are not required, but may be installed at the direction of the approving authority (Planning Board in most cases). The policy continues with location guidance, which coincides with RSIS in terms

of bus stops, schools, parks, other public places or other populated areas and high vehicular traffic.

The various policies would most likely not apply in the Agricultural and Mountain districts since the densities should be greater than two acres per unit to maintain its rural integrity. The only areas where it may apply would be in the hamlets of Neshanic and Clover Hill.

During the previous State administration NJDOT had made a commitment to construct 2000 miles of bike paths and/or bike compatible roadways by 2010. It made the funding of bicycle and pedestrian projects a priority. Hillsborough Township received funding for three projects over the period of 1999 to 2001. Two bike projects and one sidewalk implementation project along 206, Amwell Road and Hamilton Road received funding.

Ridewise, the County TMA retained a consultant to develop a methodology and design a County bike suitability map. In the effort, a number of roads in the Township were identified including the Agricultural and Mountain districts. In the latter a number of roads were found to be pleasant to bike and to have predominantly low traffic volume and speed. At the same time some roads were found to offer problematic or difficult conditions.

The Township should pursue funding for signing in the Agricultural and Mountain districts to advance their use by bicyclists.

Summary

The findings of the infrastructure assessment suggest the following recommendations that relate to the Agricultural and Mountain Districts.

1. The Township should continue to focus the extension of sewer and water lines in the core development area around Route 206.
2. Because of questionable soil suitability to septic disposal of effluent, the Township should continue to require on-site investigations and use of DEP newly adopted standards to specify the types of limiting zones that may be present and the type of system to be used.
3. Hillsborough should consult with a groundwater hydrologist to determine whether additional groundwater studies should be conducted in the Mountain District in addition to the findings of East Amwell and Hopewell Townships.
4. Hillsborough should exercise caution regarding groundwater withdrawals in the Mountain District and local land use policy should recognize the limitations of the geologic formations of the area.

5. The Township should work closely with the County to limit the number of lanes on Amwell Road (Co. Rte. 514) to two lanes from Mill Lane to Hunterdon County.
6. Because of the impact of the improvements of Route 206, especially on the northern portion of the Agricultural district, the Township should partner with NJDOT in conducting an access management plan for Route 206 with the goal of strictly limiting access in the northern Agricultural District to prevent undesirable impacts on these valuable agricultural lands.
7. Hillsborough should lobby Somerset County to eliminate the proposal to extend West County Drive through the Agricultural and Mountain districts.
8. The Township should coordinate transportation planning efforts with Montgomery Township, especially in regard to Route 206.
9. The Township should voice its opposition to the replacement of iron truss bridge structures, because of their role in the historic and rural integrity of the Agricultural and Mountain District and advocate that the County only address the substructure and decking of the bridge.
10. Hillsborough should embark on a Scenic Roads program for the Agricultural and Mountain Districts utilizing Somerset County's experience and findings.
11. The Township should pursue funding for signage in the Agricultural and Mountain districts to provide safer use by bicyclists.

Land Use Influences on Long-Term Agricultural Viability

Attempts to balance the competing farm and non-farm interests were examined in “Holding our Ground – Protecting America’s Farms and Farmland” (Daniels, Bowers). In what was described as “a wake-up call” for farmland protection, the authors cited the cycle of decline that results as development expands into the rural-urban fringe. This process was highlighted in seven steps as follows:

1. Developers bid up land prices beyond what farmers can afford and tempt farmers to sell their land for development.
2. The greater number of people living in or next to the countryside heightens the risk of confrontation between farmers and non-farmers.
3. Complaints increase from non-farm neighbors about manure smell, chemical sprays, noise, dust and slow-moving farm machinery on commuter roads.
4. Farmers suffer crop and livestock loss from trespass, vandalism and dog attacks, stormwater runoff from housing developments washes across farmland, causing erosion, and competition for water supplies increases.
5. As farmers become more of a minority in their communities, nuisance ordinances may be passed, restricting farming practices and in effect making farming too difficult to continue.
6. As farms are developed, farm support businesses are pushed out. Remaining farmers stop investing in their farms as they expect to sell their land for development in the near future.
7. Open space becomes harder to find, the local economy changes and rural character fades.

Daniels and Bowers cite the irony that, while farmland is valued for providing open space and scenic vistas, protecting air and water quality, providing wildlife habitat and maintaining the sense of rural character in an area, “newcomers can destroy the farms and farmland that they value”.

Clearly, there is no better farmland preservation program than one that permanently retires development rights and saves all of a tract for farming. Hillsborough has recognized this fact and is participating in the State’s farmland preservation program purchasing development easements.

In addition to permanent preservation, land use policy should be designed to assure that suburban development will not permeate the fabric of these productive agricultural lands with incompatible land uses, converting farmland to non-farm housing and discouraging long-term prospects for viable farming.

When new residential neighbors move into an agricultural setting, they are frequently attracted by the scenery, but unfamiliar with agricultural practices. When exposed to the noise from heavy machinery, and the dust and odors that result from chemical sprays, animals and manure spreading, the perception of a bucolic natural environment begins to transform into an attitude of resentment toward those activities which compromise the idealized rural lifestyle. And as new residents travel long distances frequently on narrow country roads, slow-moving farm machinery can tie up traffic, raising tempers and creating safety hazards. And as farm equipment becomes increasingly difficult to move along local roads, and the land base becomes more fragmented, amassing a viable farm enterprise may require travel over substantial distances to rented farm parcels.

These conflicts have resulted in the adoption of right-to-farm laws in states around the country, designed to limit interference by non-farm neighbors with accepted agricultural practices and to retain viable agriculture. Agriculturally compatible zoning, which deters suburbanization, complements right-to-farm protections by limiting the rapid conversion of agricultural land and non-farm interference with farming.

While zoning cannot assure farmland retention or farm profitability, land use planning and zoning can facilitate compatible juxtapositions of land uses, which minimize the negative impacts of non-farm development. Strategies, which preserve the agricultural land base for management in larger parcels, should promote the long-term viability of farming in Hillsborough.

The conversion of land from farming to non-farm uses is the most permanent negative impact of suburbanization. Additionally, speculative increases in land value, prompted by suburban residential zoning, prevent farmers from purchasing farmland for continuing agricultural use. And when farmland is viewed more as a financial asset than an agricultural resource, farmers may stop investing in the enterprise of farming. It is ironic that it is the very profit, resulting from suburban residential zoning that frequently signals the end of farming.

Figure 18 illustrates the extent of farmland-assessed lands and preserved farmland within Hillsborough Township and the extent of preserved open space as of 1999, when the latest open space plan was prepared. The mosaic of preserved lands includes a substantial portion of the prime farmland and other highly productive farmlands, as well as much of the rugged mountain landscape found in Hillsborough Township. Hillsborough's 2000 Farmland Preservation Plan calls for a comprehensive farmland preservation program; farmland preservation Planning Incentive Grants have been awarded for preservation efforts in the Mill Lane area and in the southeastern sector near the proposed Route 206 By-pass. Acquisitions of development easements to hundreds of acres have been completed in the southeastern sector, and continuing negotiations will likely result in further easements at this location. Additionally, Hillsborough has recently negotiated the purchase of easements for nearly 300 acres in the Mill Lane area, where the Greenbriar retirement housing project was previously proposed.

The Farmland Preservation Plan also sets as its objective the preservation of significant farmland along the South Branch of the Raritan River, and in the western sector, south and west of Neshanic, at the eastern end of the Amwell Valley. The American Farmland Trust (AFT) has advanced suggestions for “agricultural protection zoning” (APZ), which is designed to minimize the negative impacts of non-farm development on remaining agricultural uses. As suggested by AFT, APZ provides for a minimum lot size of at least 20 acres per non-farm dwelling unit. The combination of appropriate land use and regulatory techniques and an aggressive agricultural preservation program will help to maintain a viable agricultural climate in Hillsborough Township.

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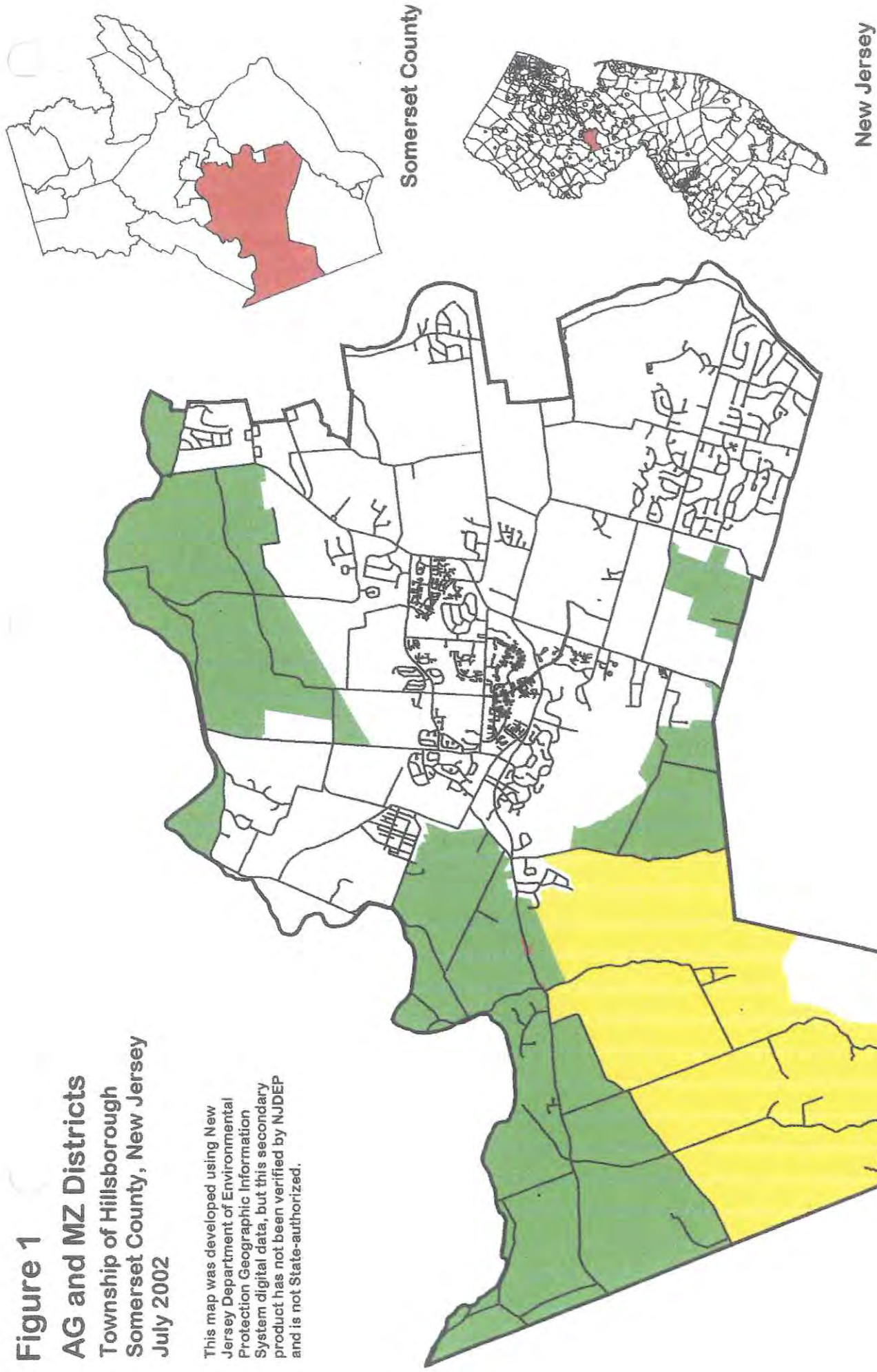
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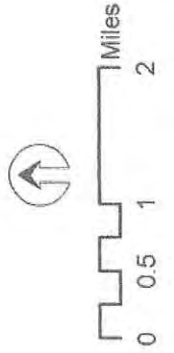
Figure 1

AG and MZ Districts
Township of Hillsborough
Somerset County, New Jersey
July 2002

This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not State-authorized.



- Legend**
- AG District
 - MZ District
 - C1 District
- Data Source:**
 NJDEP



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 Planning/Design
 P.O. Box 154, Sergeantsville, New Jersey 08557
 (908) 782-0835 fax banisch@aol.com

Figure 2

1995 Land Use/Land Cover

Township of Hillsborough
Somerset County, New Jersey
July 2002

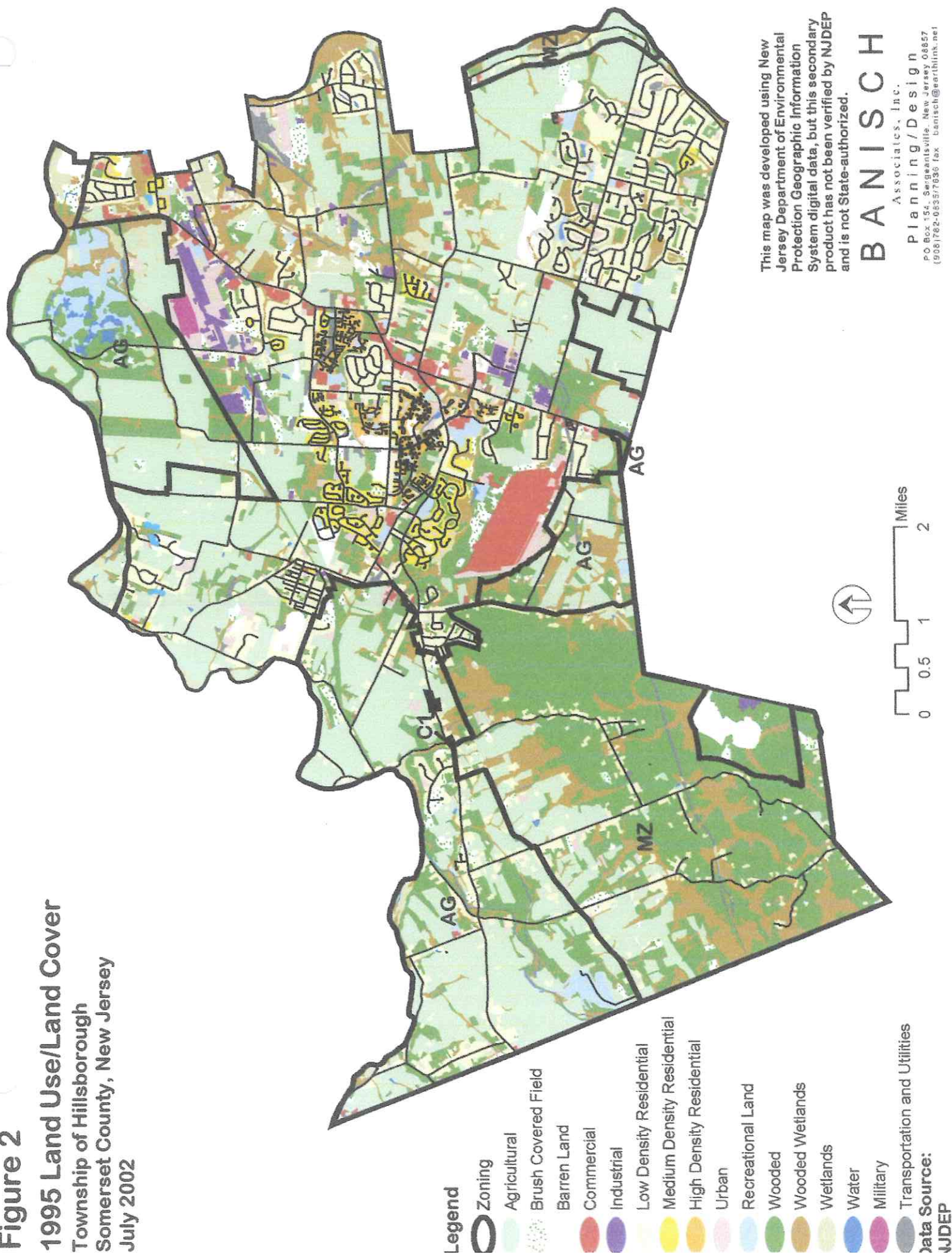


Figure 3
Topography
 Township of Hillsborough
 Somerset County, New Jersey
 July 2002

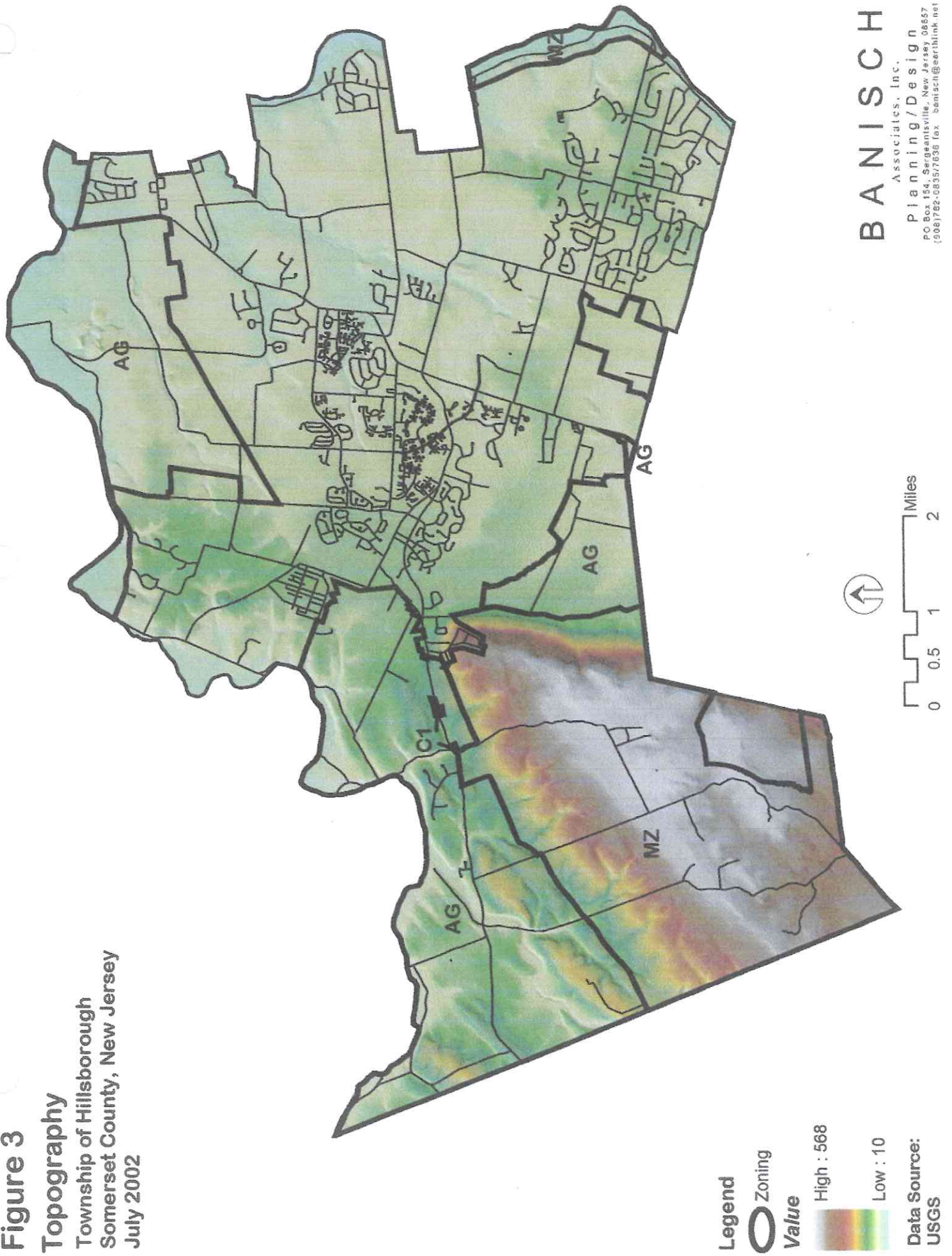
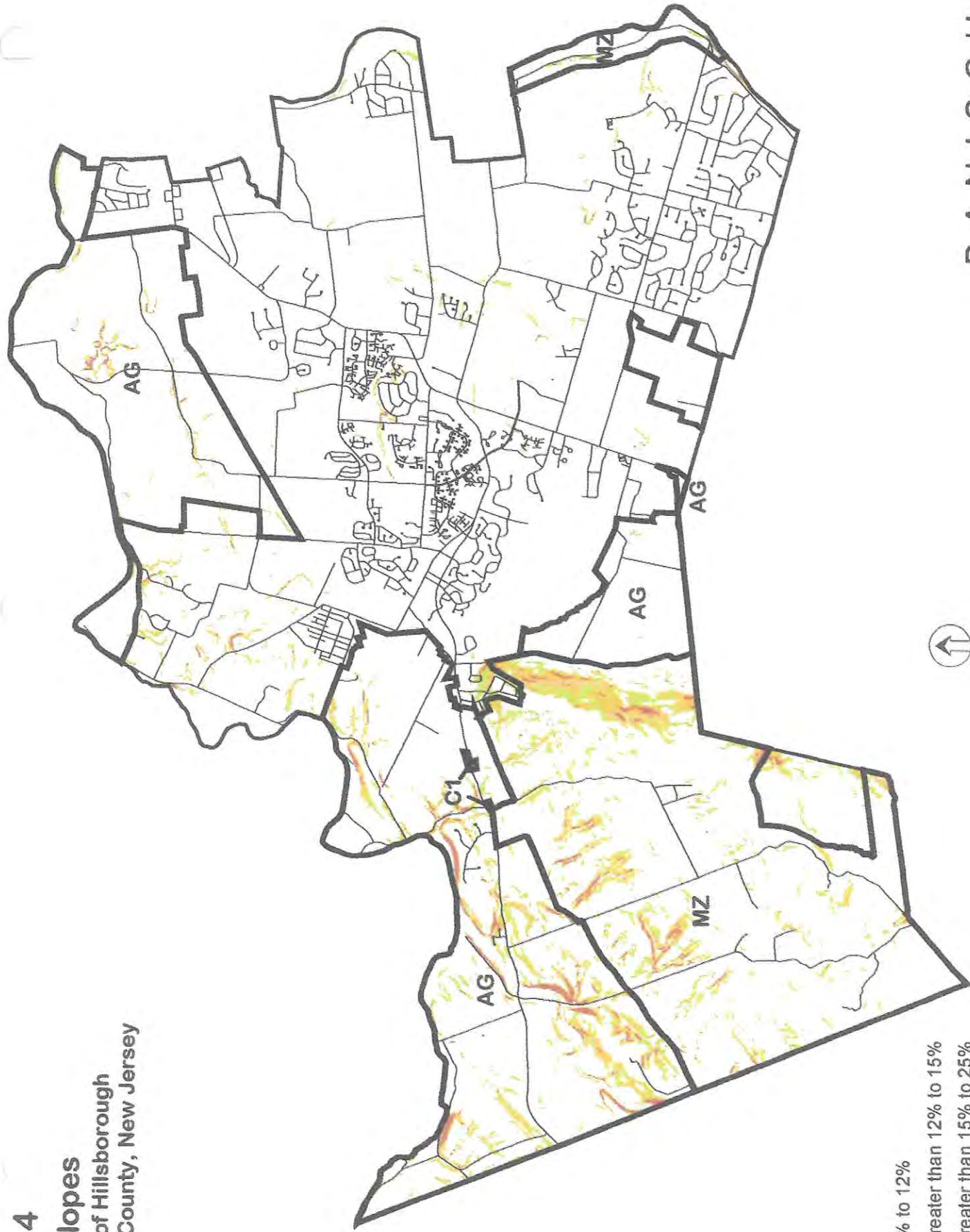


Figure 4
Steep Slopes
 Township of Hillsborough
 Somerset County, New Jersey
 July 2002



- legend**
- Zoning
 - Slopes 0% to 12%
 - Slopes Greater than 12% to 15%
 - Slopes Greater than 15% to 25%
 - Slopes Greater than 25%

Data Source:
 JSGS



Figure 5
Surface Waters and Wetlands
 Township of Hillsborough
 Somerset County, New Jersey
 July 2002

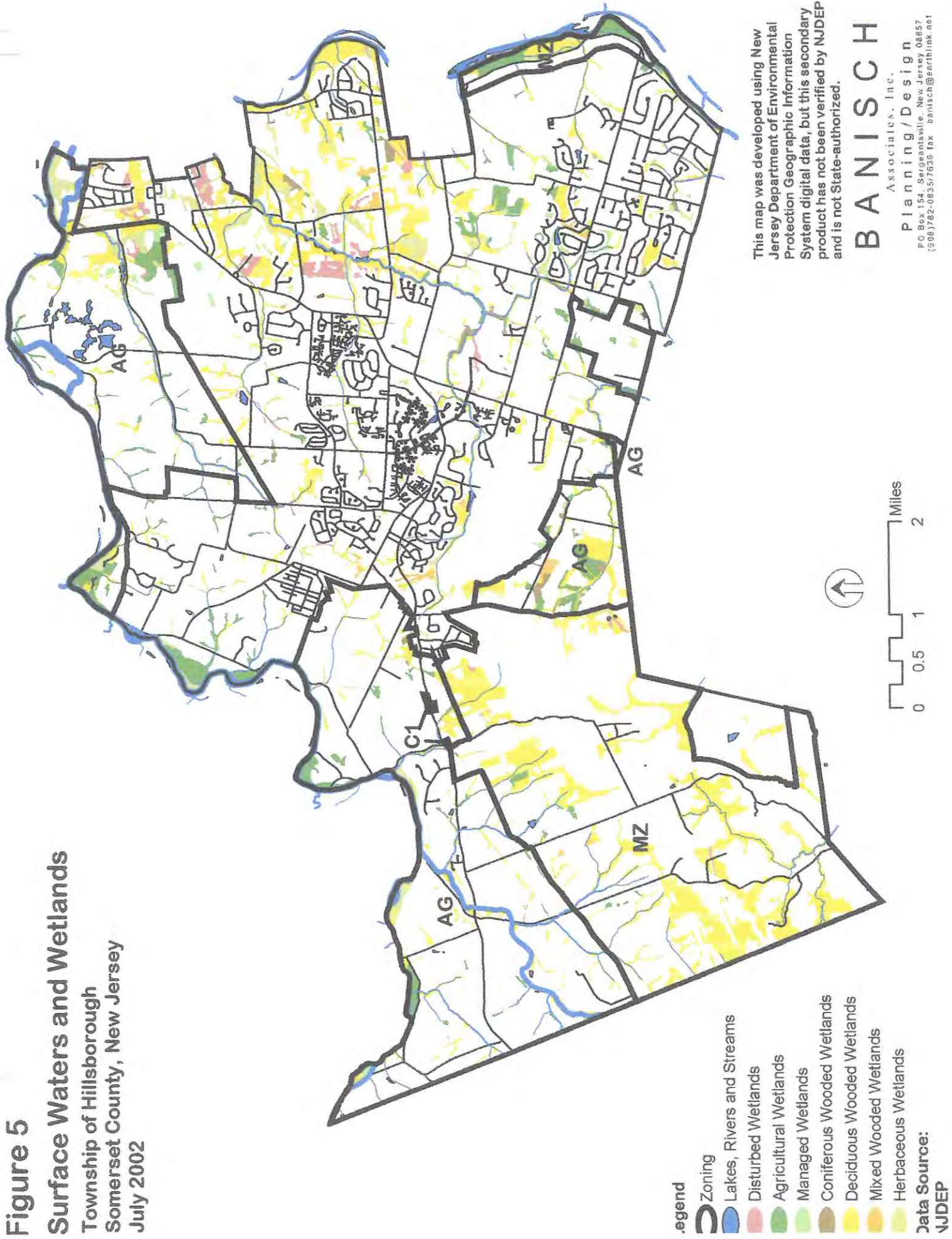
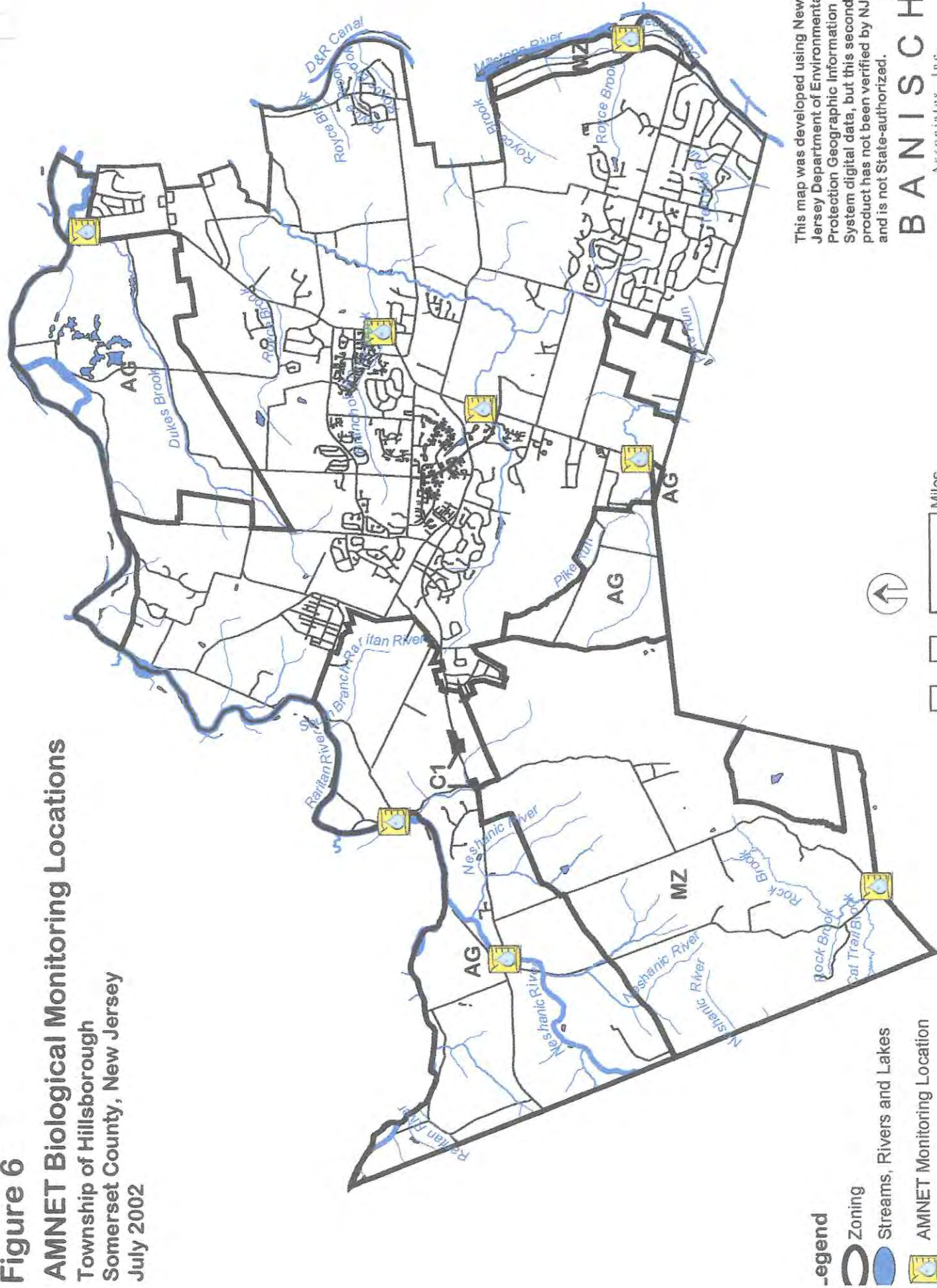


Figure 6

AMNET Biological Monitoring Locations

Township of Hillsborough
Somerset County, New Jersey
July 2002



This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not State-authorized.

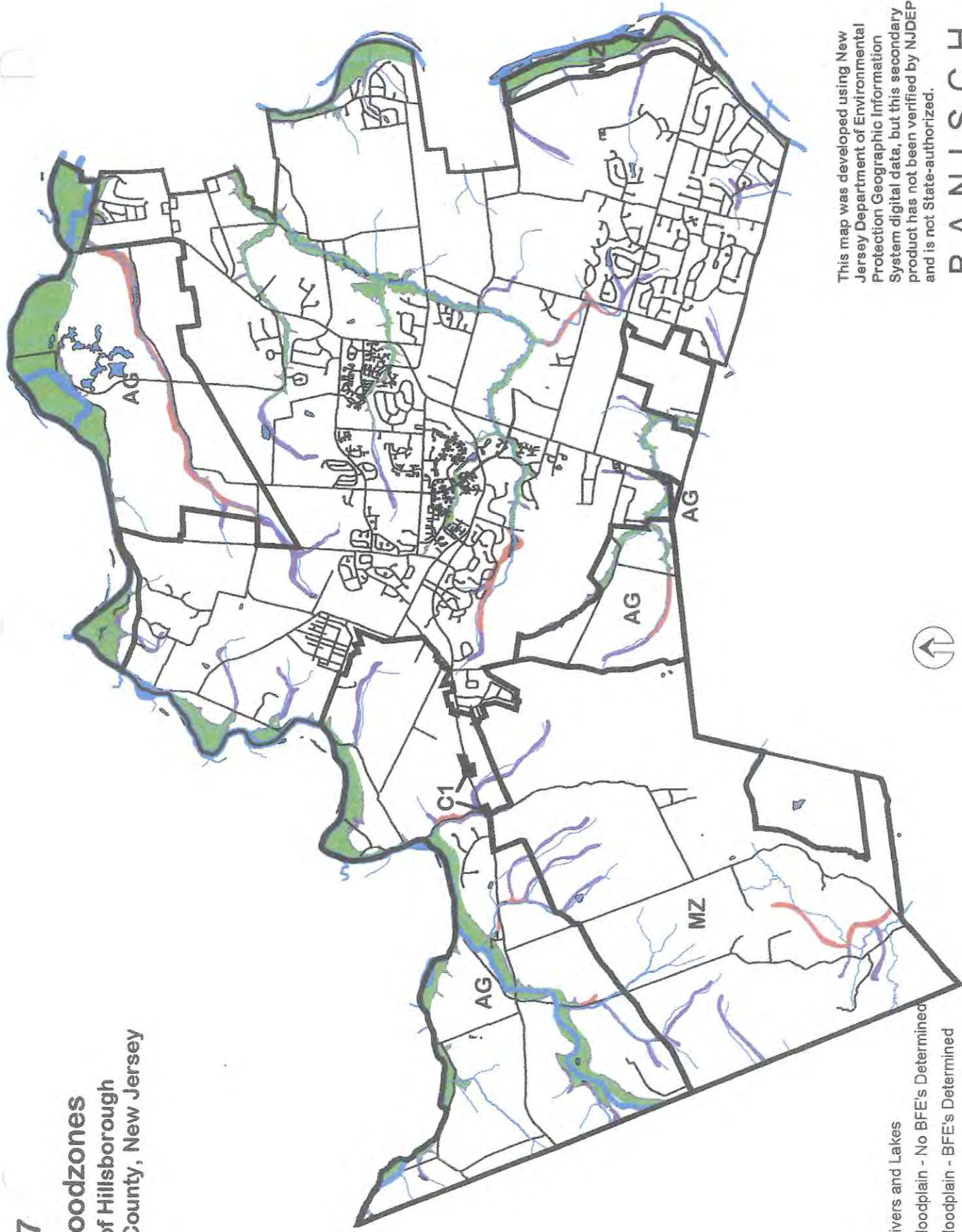
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- Legend**
- Zoning
 - Streams, Rivers and Lakes
 - AMNET Monitoring Location

Data Source:
NJDEP

Figure 7

FEMA Floodzones
 Township of Hillsborough
 Somerset County, New Jersey
 July 2002



Legend

Zoning

Streams, Rivers and Lakes

100 Year Floodplain - No BFE's Determined

100 Year Floodplain - BFE's Determined

500 Year Floodplain

Data Sources:

NJDEP
 FFMA

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Figure 8
NJ Landscapes Project Critical Habitat Data
 Township of Hillsborough
 Somerset County, New Jersey
 July 2002

Rank	Indication
1	Suitable habitat with no field survey conducted
2	Habitat patch with State special concern species present
3	Habitat patch with State threatened species present
4	Habitat patch with State endangered species present
5	Habitat patch with Federal threatened or endangered species present

- Legend**
- Zoning
 - Rank 1 Emergent Habitat
 - Rank 1 Grassland Habitat
 - Rank 2 Grassland Habitat
 - Rank 4 Grassland Habitat
 - Rank 3 Forest Habitat
 - Rank 4 Forest Habitat
 - Rank 1 Wetland/Forest Habitat
 - Rank 3 Wetland/Forest Habitat

Data Source:
 NJDEP

This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not State-authorized.

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 P.O. Box 154, Sergeantsville, New Jersey 08957
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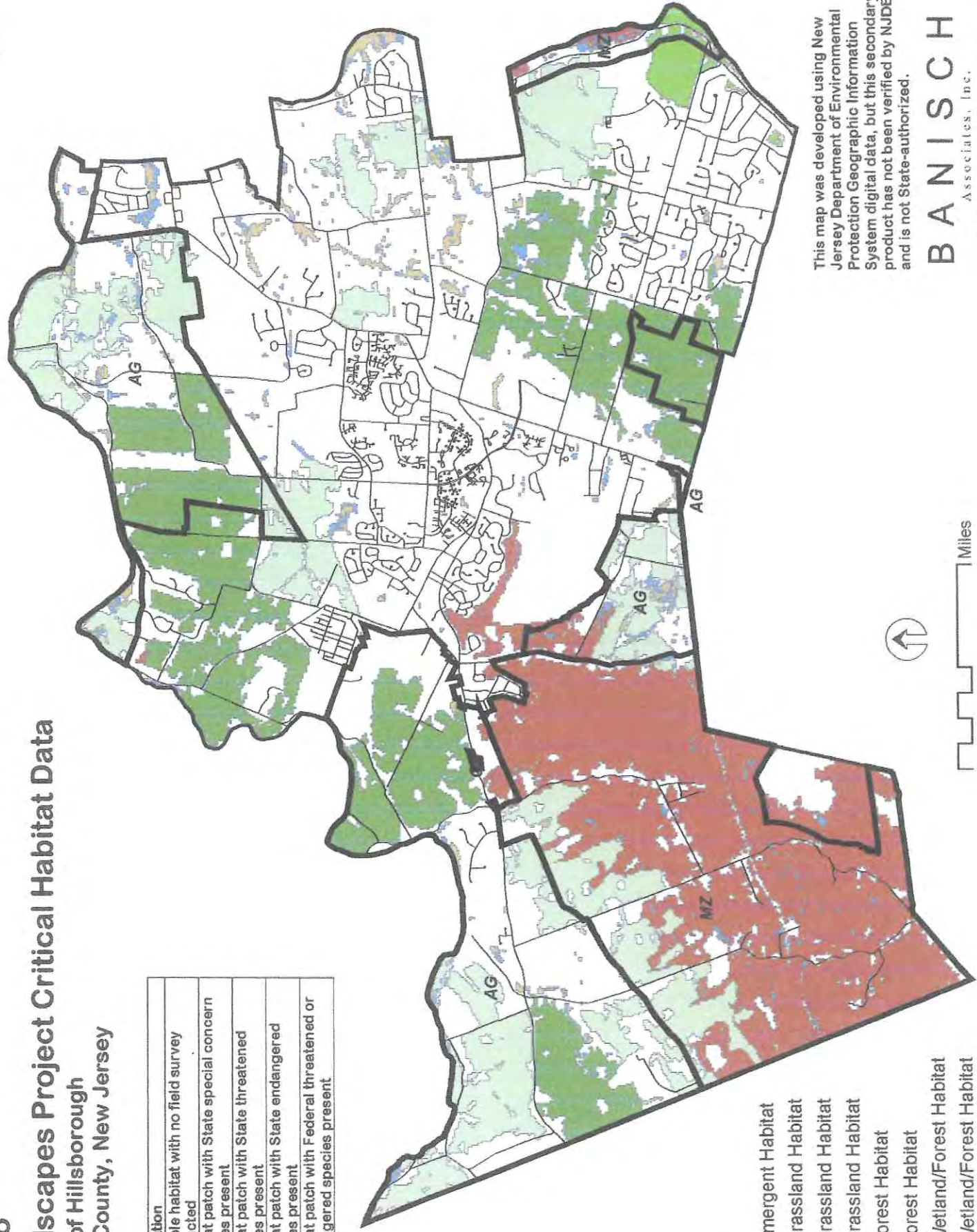
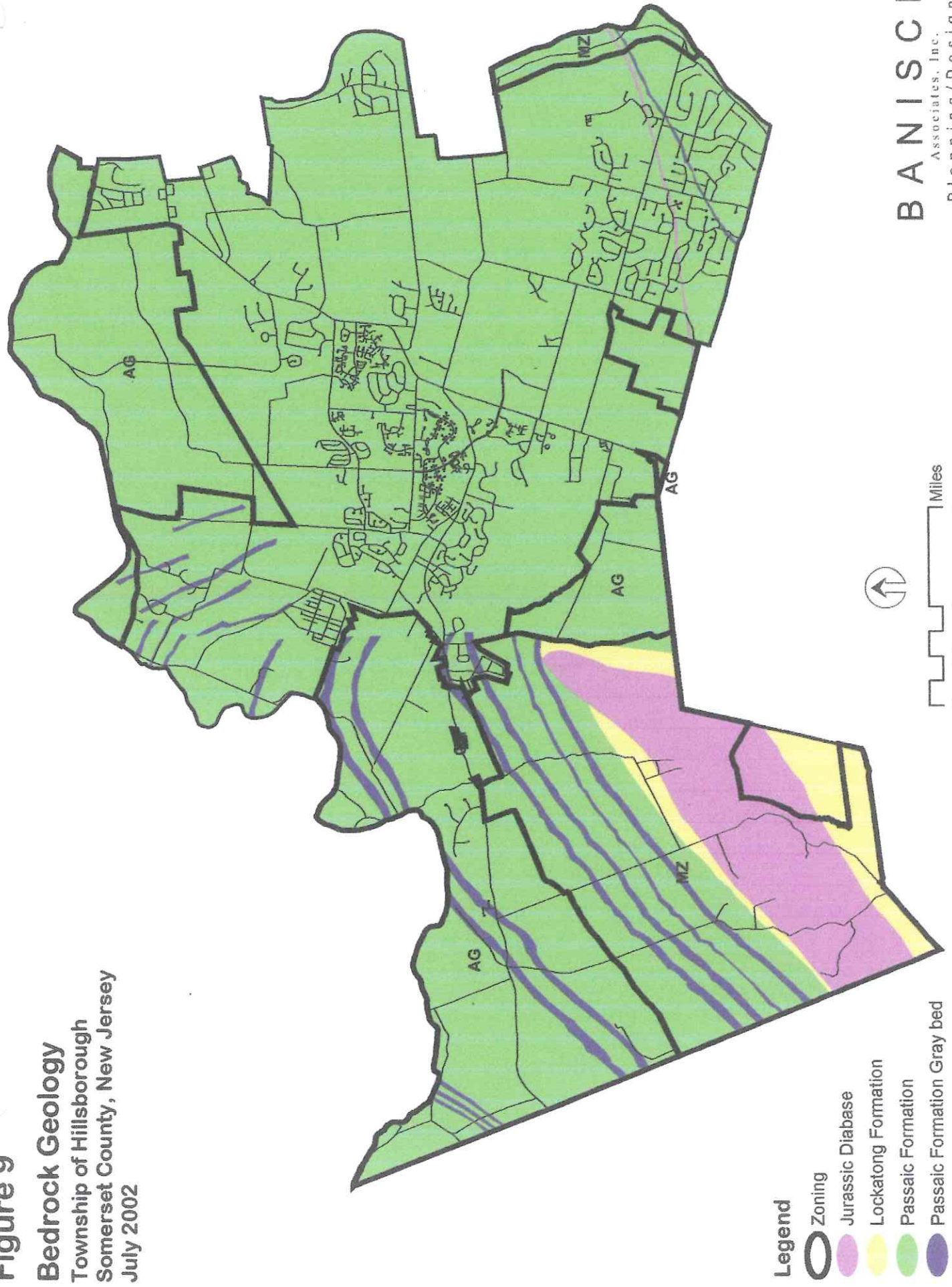


Figure 9

Bedrock Geology
 Township of Hillsborough
 Somerset County, New Jersey
 July 2002



Legend

Zoning

Jurassic Diabase

Lockatong Formation

Passaic Formation

Passaic Formation Gray bed

Data Source:

NJGS CD Series CD 00-1

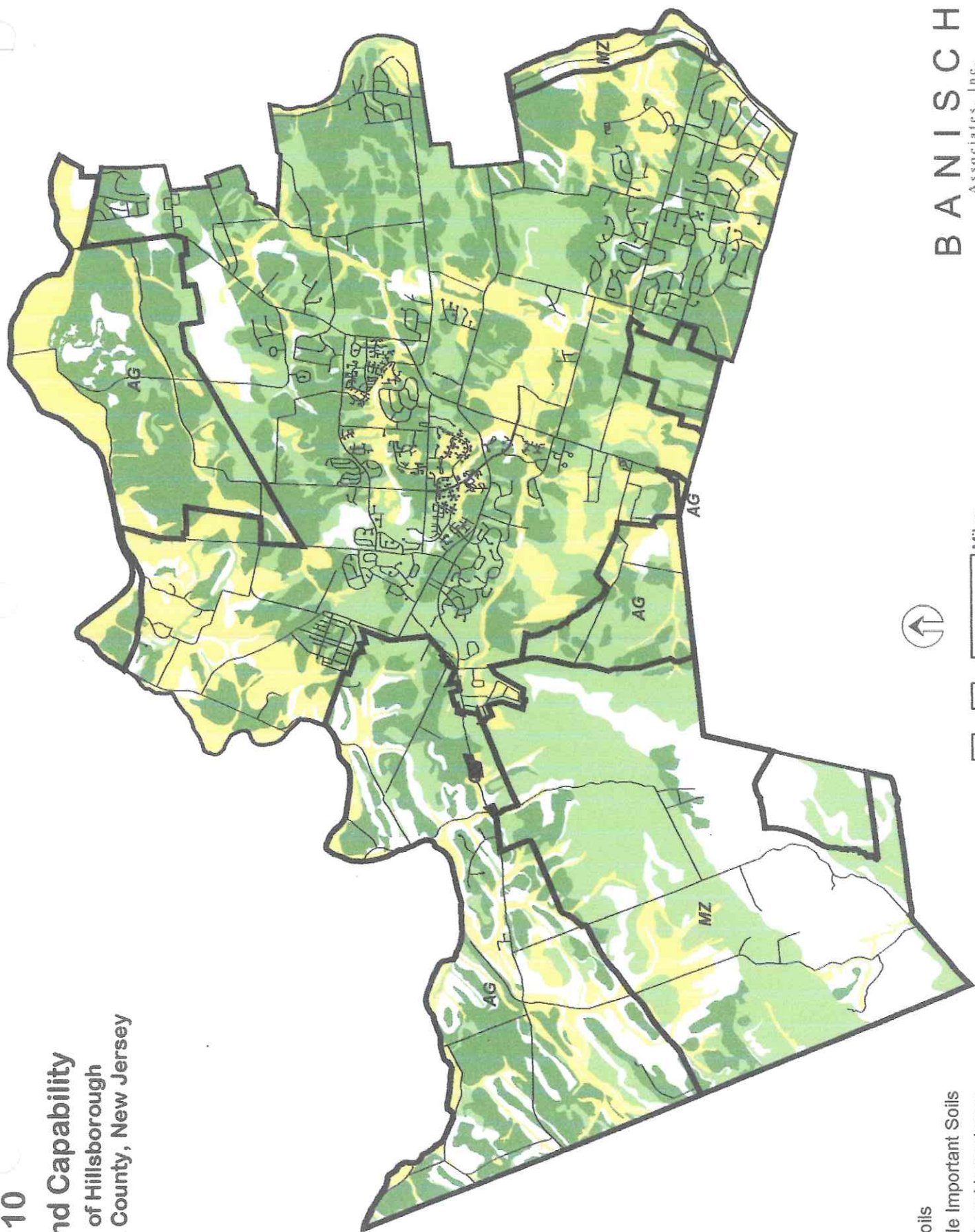
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Associates, Inc.

Planning/Design

P.O. Box 154, Sargeantville, New Jersey 08857
 (908) 782-0635/77336 fax banisch@earthlink.net

Figure 10
Farmland Capability
 Township of Hillsborough
 Somerset County, New Jersey
 July 2002



Legend

Zoning

- Prime Soils
- Statewide Important Soils
- Soils of Local Importance

Data Source:
 USDA SCS



0 0.5 1 2
 Miles

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 Planning/Design
 P.O. Box 154, Sergeantville, New Jersey, 08857
 (908) 762-0835 / 7630 fax banisch@earthlink.net

Figure 11

**Somerset County Soil Survey
Soil Suitability for On-Site Septic Systems
Township of Hillsborough
Somerset County, New Jersey
July 2002**

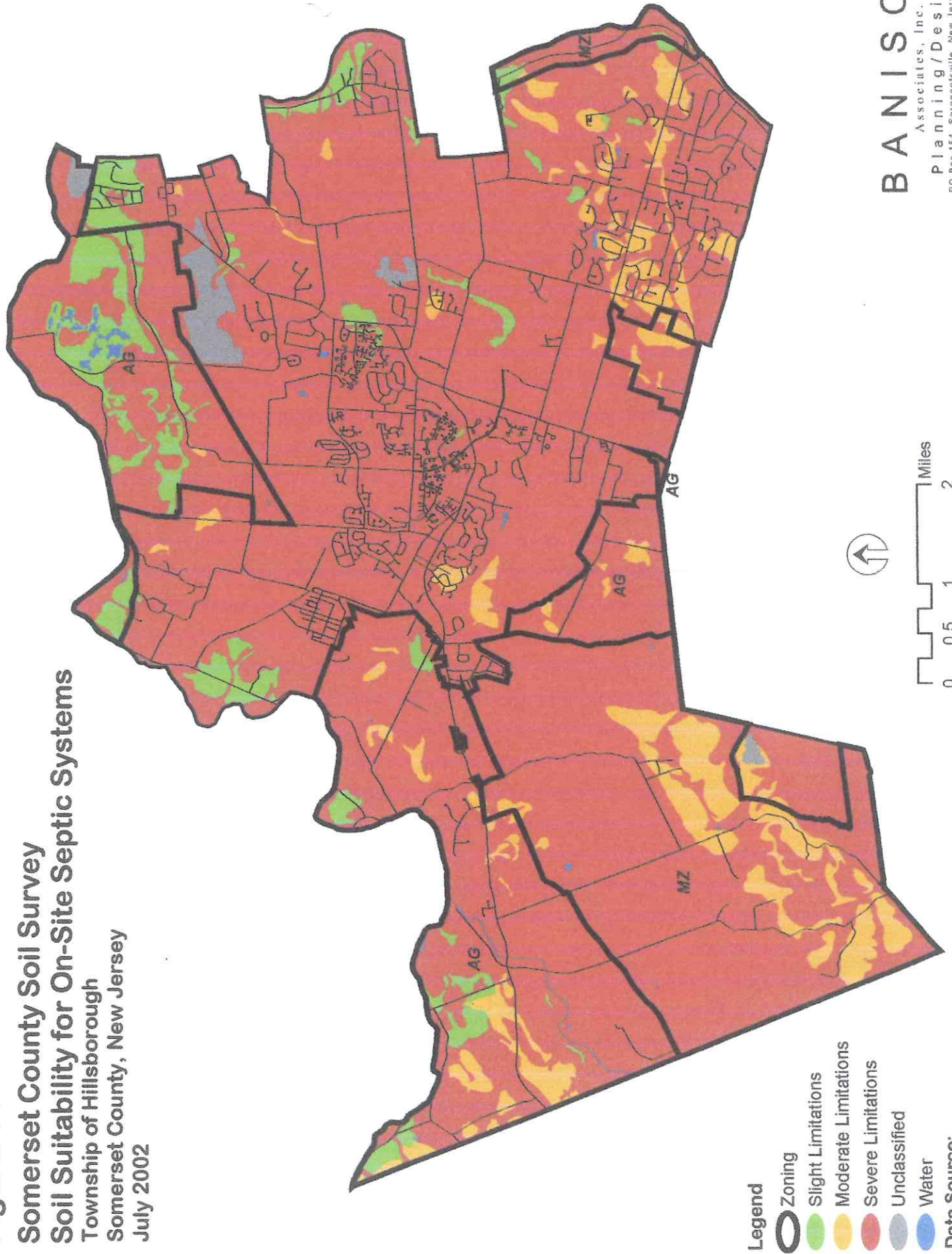


Figure 12

**Soil Classifications by Potential
Presence of Limiting Zone N.J.A.C. 7:9A**
Township of Hillsborough
Somerset County, New Jersey
July 2002

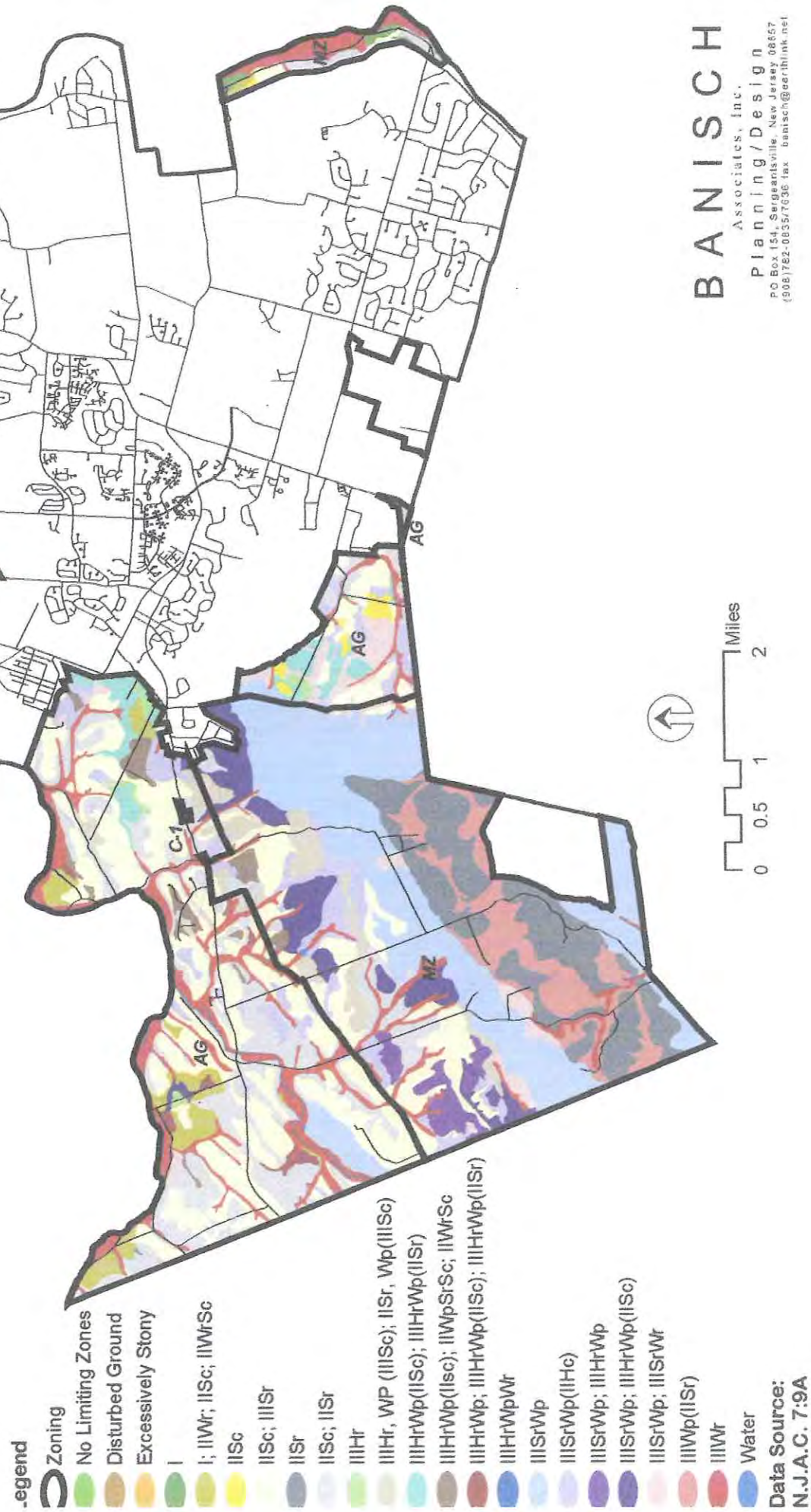
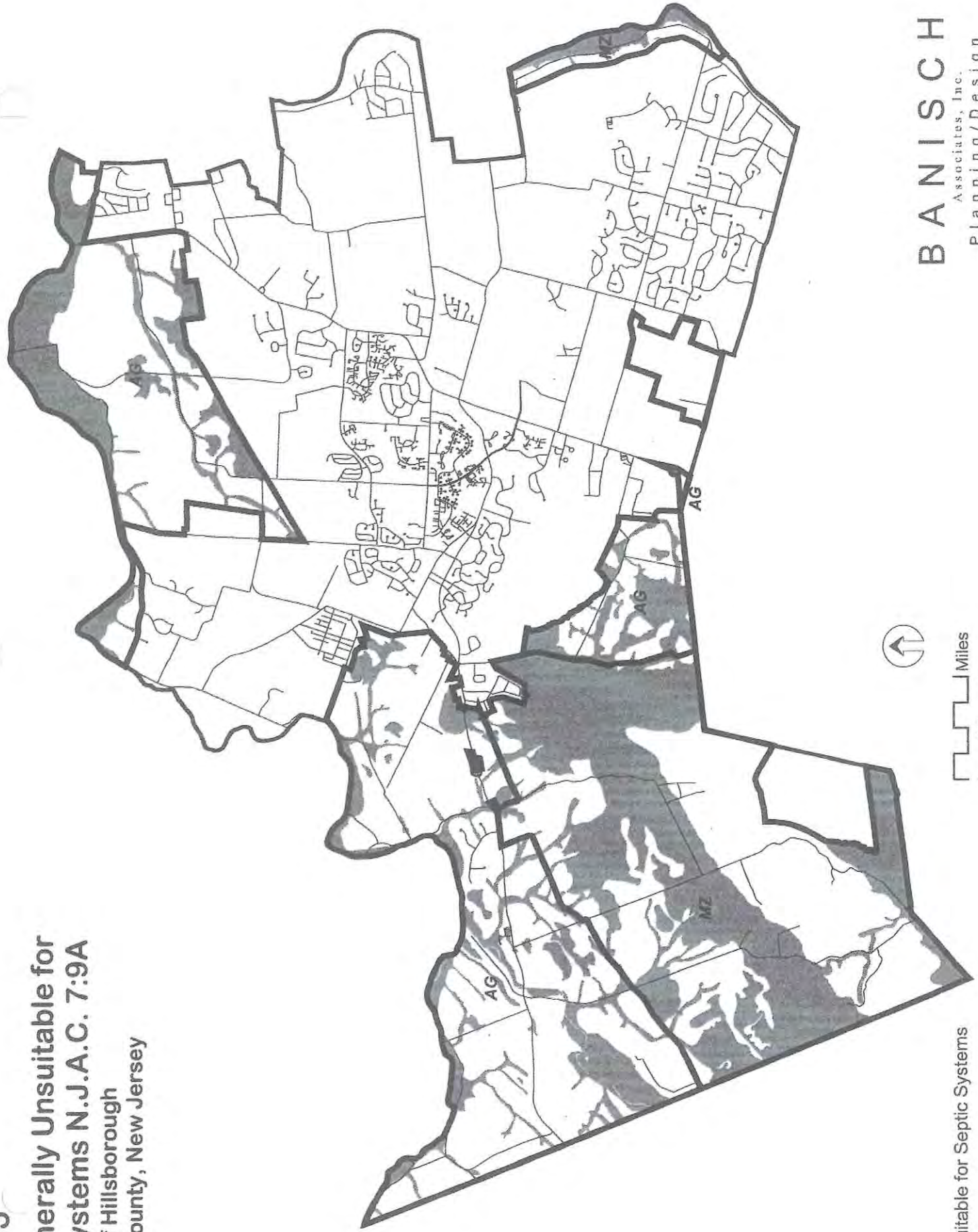


Figure 13

Soils Generally Unsuitable for
Septic Systems N.J.A.C. 7:9A
Township of Hillsborough
Mercer County, New Jersey
July 2002



Legend

☐ Zoning

■ Soils Unsuitable for Septic Systems

Data Source:
N.J.A.C. 7:9A

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PO Box 154, Sergeantsville, New Jersey 08857
(908)732-0635/7036 fax banisch@earthlink.net

Figure 14
Depth to Seasonal High Water
 Township of Hillsborough
 Somerset County, New Jersey
 July 2002

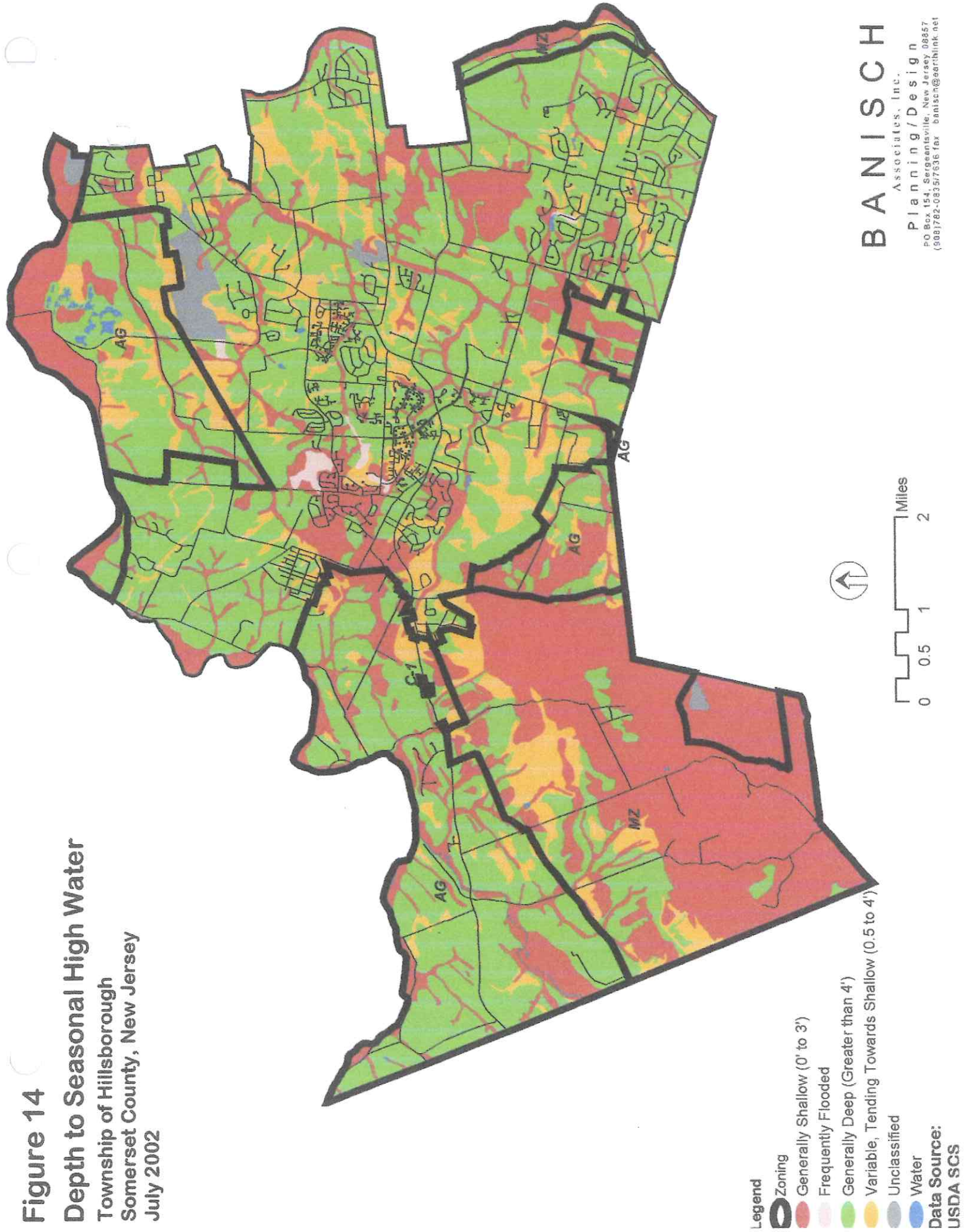


Figure 15
Depth to Bedrock
 Township of Hillsborough
 Somerset County, New Jersey
 July 2002

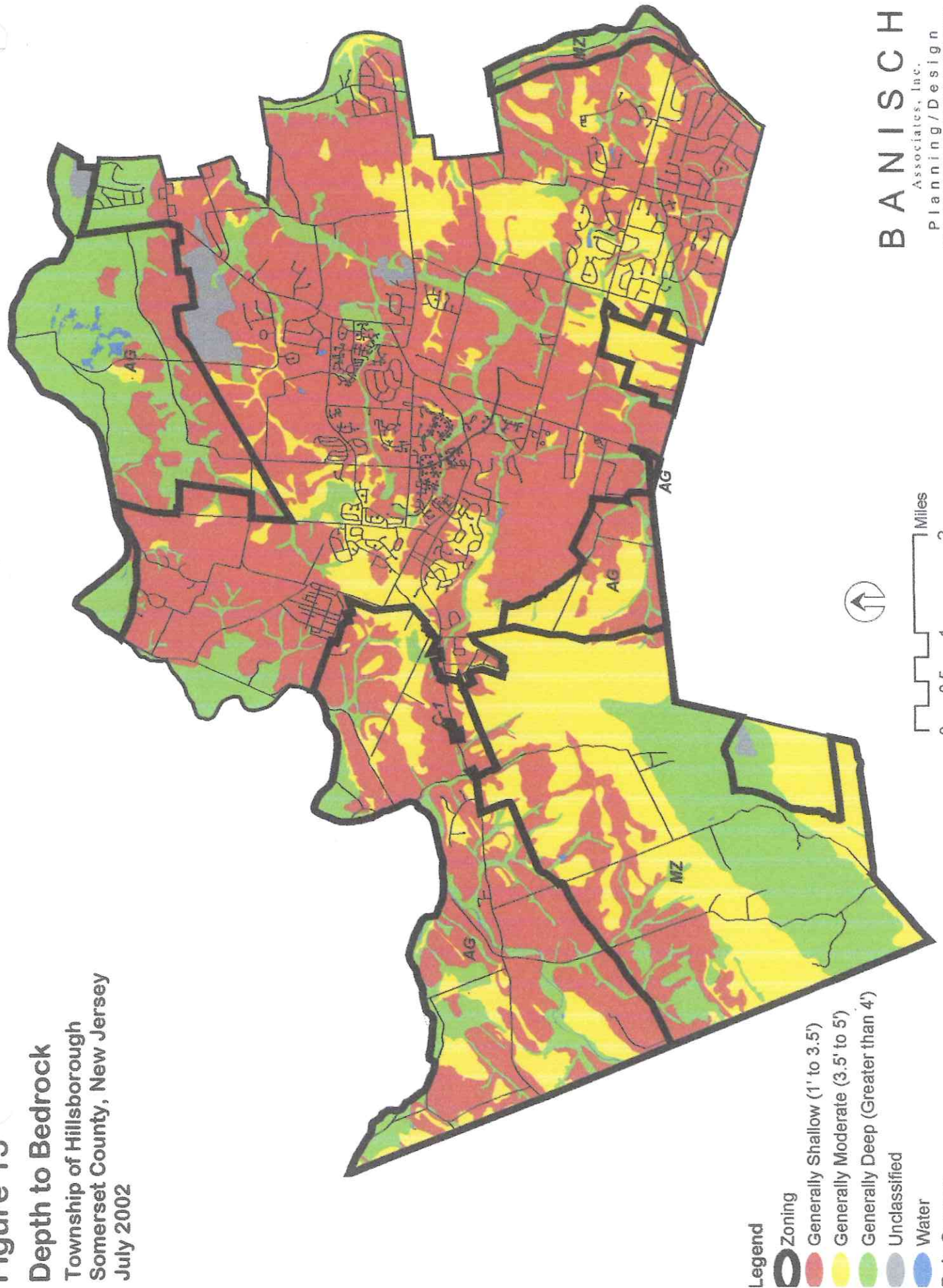
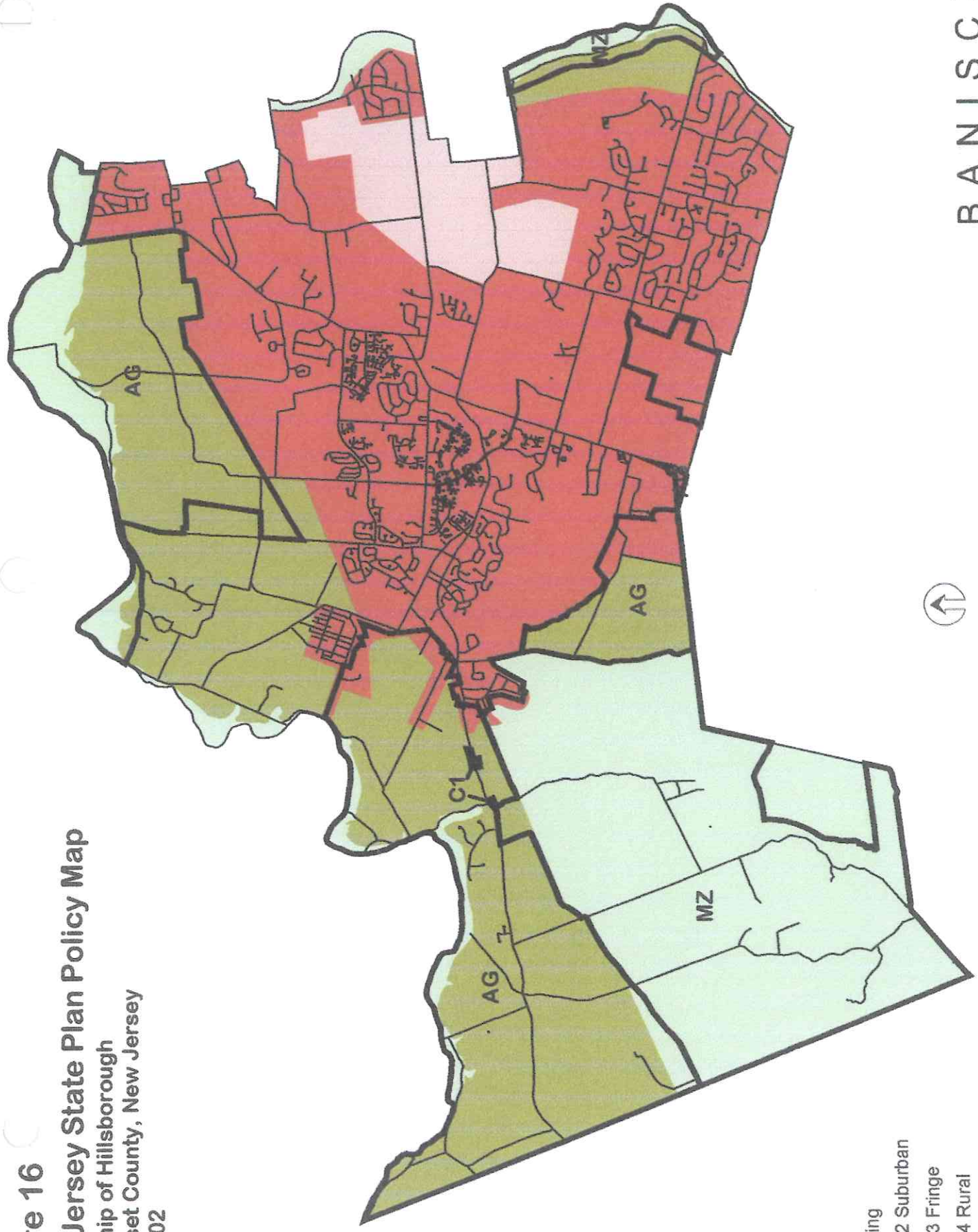


Figure 16

New Jersey State Plan Policy Map

Township of Hillsborough
Somerset County, New Jersey
July 2002



Legend

-  Zoning
-  PA-2 Suburban
-  PA-3 Fringe
-  PA-4 Rural
-  PA-5 Environmentally Sensitive

Data Source:
NJOSP

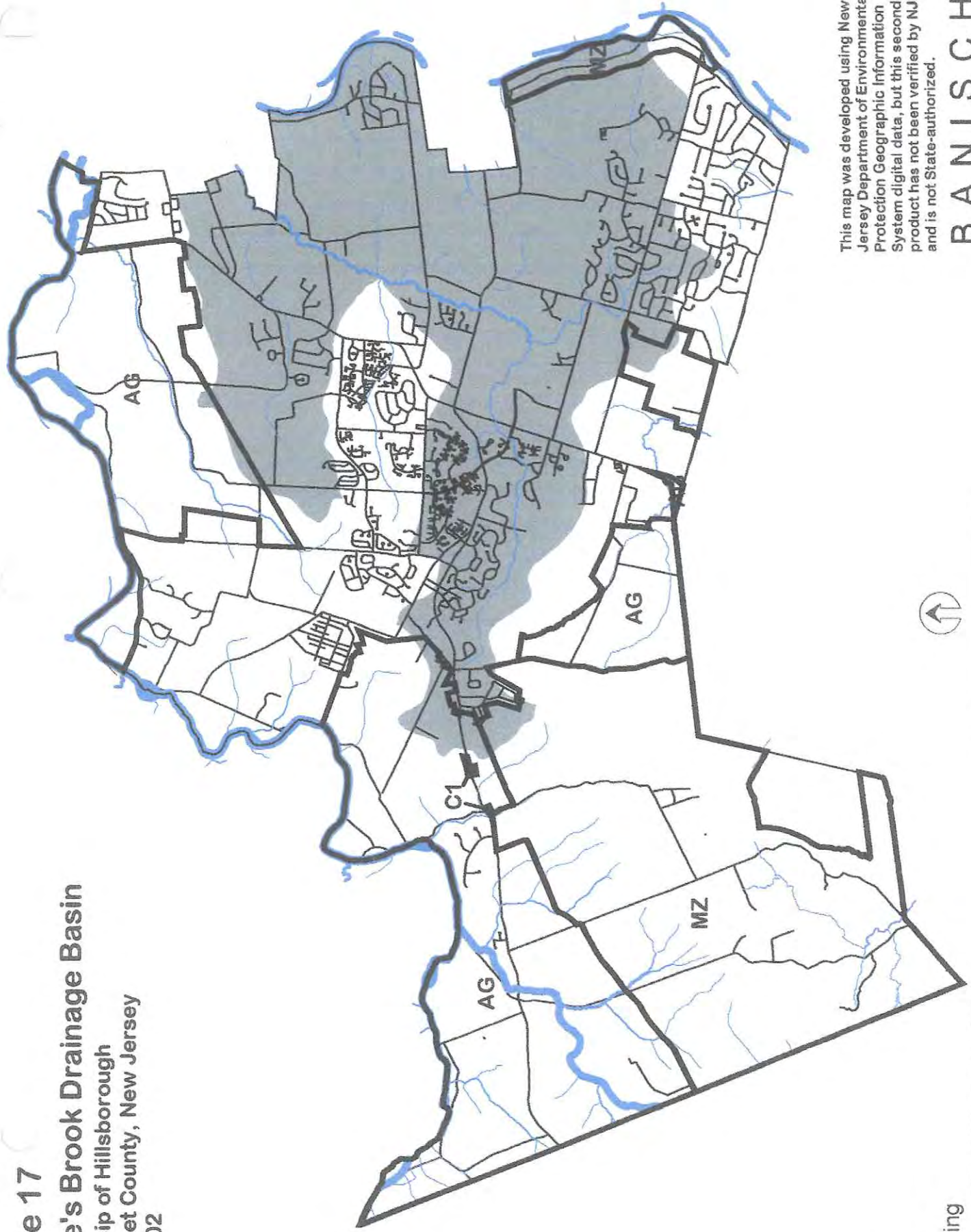


0 0.5 1 2 Miles

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(908) 782-0835/7636 fax banisch@earthlink.net

Figure 17
Royce's Brook Drainage Basin
 Township of Hillsborough
 Somerset County, New Jersey
 July 2002



Legend

Zoning

 Royce's Brook Drainage Basin

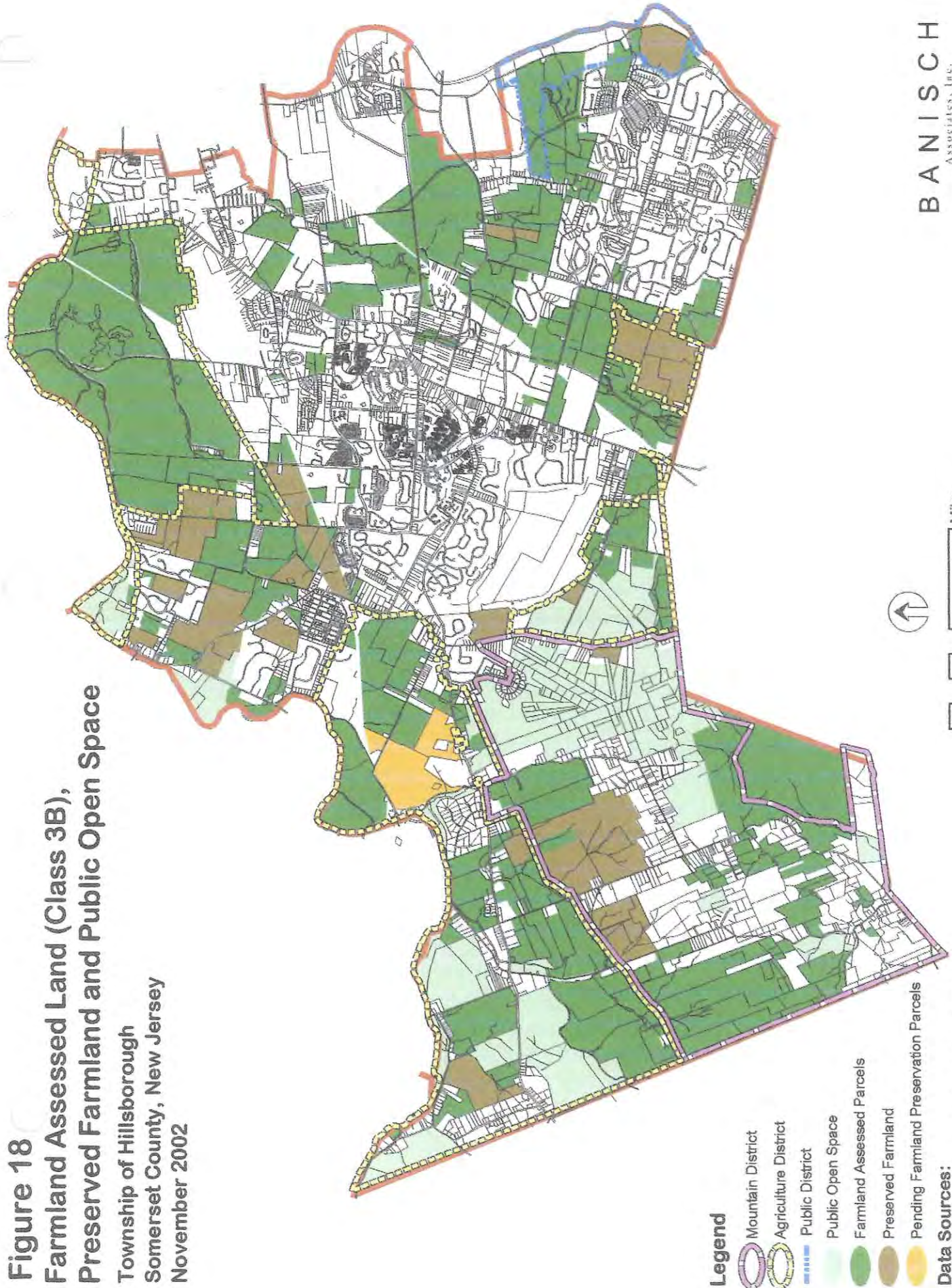
Data Source:
 NJDEP

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 Associates, Inc.

Planning/Design
 P.O. Box 154, Sergeantsville, New Jersey 08857
 (908) 782-0835 / 7030 fax banisch@earthlink.net

Figure 18
Farmland Assessed Land (Class 3B),
Preserved Farmland and Public Open Space
 Township of Hillsborough
 Somerset County, New Jersey
 November 2002



Legend

- Mountain District
- Agriculture District
- Public District
- Public Open Space
- Farmland Assessed Parcels
- Preserved Farmland
- Pending Farmland Preservation Parcels

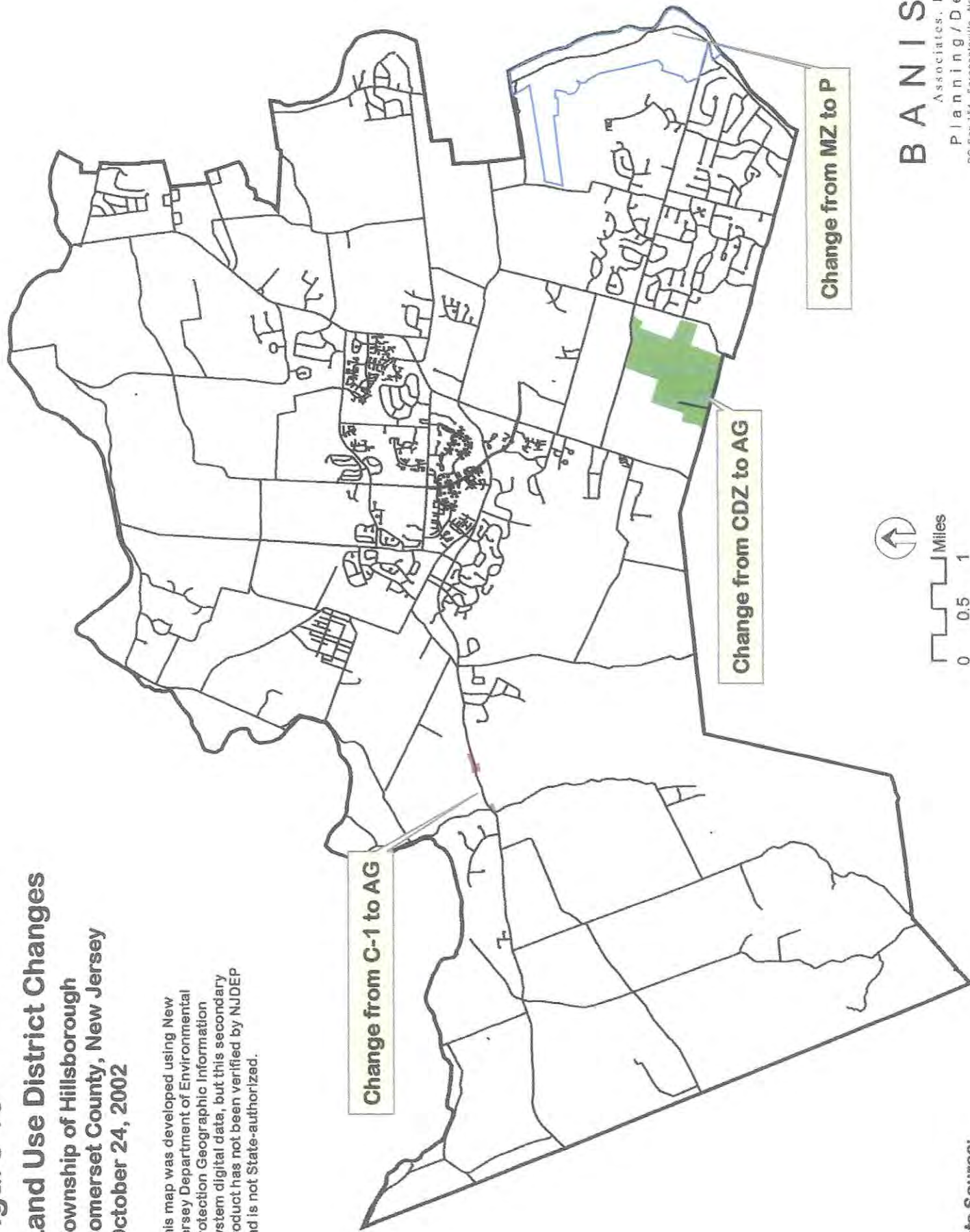
Data Sources:

Hillsborough Twp. Engineering Dept.
 Somerset Co. Ag. Development Board

BANISCH
 ASSOCIATES, INC.
 Planning/Design
 P.O. Box 154, Somerset, New Jersey 08877
 (732) 782-0615/0355 fax banisch@banish.net

Figure 19
Land Use District Changes
Township of Hillsborough
Somerset County, New Jersey
October 24, 2002

This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not State-authorized.



Data Source:
NJDEP

BANISCH
 Associates, Inc.
 Planning/Design
 P.O. Box 154, Sargeantville, New Jersey 08837
 (908) 762-0835 / 7036 fax banisch@earthlink.net



Township of Hillsborough

COUNTY OF SOMERSET
MUNICIPAL BUILDING
379 SOUTH BRANCH ROAD
HILLSBOROUGH, NEW JERSEY 08844

TELEPHONE
(908) 369-4313

www.hillsborough-nj.org

RESOLUTION OF THE HILLSBOROUGH TOWNSHIP PLANNING BOARD

WHEREAS, N.J.S.A. 40:55D-28 authorizes the Planning Board to prepare and, after public hearing, adopt or amend a Master Plan to guide the use of lands within the municipality in a manner which protects public health and safety and promotes the general welfare; and

WHEREAS, the Hillsborough Township Planning Board previously adopted a Land Use Plan Element and Conservation Plan Element on December 5, 1996; and

WHEREAS, the Hillsborough Township Planning Board conducted a study of the Agricultural and Mountain Districts and determined that the Land Use Plan Element and Conservation Plan Element should be amended as they relate to the Agricultural and Mountain Districts; and

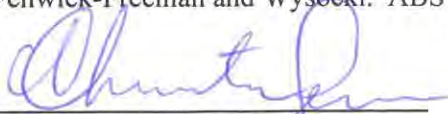
WHEREAS, notice of a hearing on adoption of the aforesaid Land Use Plan Element and Conservation Plan Element amendments for the Agricultural and Mountain Districts of the Hillsborough Township Master Plan was published and served in accordance with the requirements of N.J.S.A. 40:55D-13, and hearings were held by the Hillsborough Township Planning Board on October 17, 2002, October 23, 2002 and October 24, 2002 at which all interested parties were given the opportunity to speak;

NOW THEREFORE, BE IT RESOLVED by the Hillsborough Township Planning Board that the Land Use Plan Element and Conservation Plan Element for the Agricultural and Mountain Districts, prepared by the Board in consultation with Banisch Associates, Inc. and dated September 27, 2002 and as amended on October 24, 2002 be and the same is hereby adopted as an amendment to the Hillsborough Township Master Plan; and

BE IT FURTHER RESOLVED that a certified copy of this resolution and the Master Plan Amendments referred to above, shall be filed with the Hillsborough Township Clerk and that a certified copy of this resolution and the Master Plan shall be forwarded by the Hillsborough Township Planning Board Secretary to the Somerset County Planning Board not more than 30 days after the date of the adoption of this resolution.

CERTIFICATION

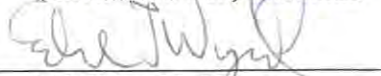
I HEREBY CERTIFY that the above is a true copy of a resolution evidencing action taken by vote of the Hillsborough Township Planning Board at its meeting of October 24, 2002, by a vote of seven in favor, two opposed and none abstained. IN FAVOR: Chaucer-Levine, Gelardi, Lawton, Pugh, Tricarico, Wells and Jensen. OPPOSED: Fenwick-Freeman and Wysocki. ABSTAINED: None.



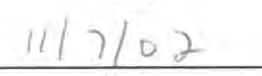
Christian Jensen, Chairman



Date

Attest: 

Ed Wysocki, Secretary



Date