3.8 Elevation/Hillshade

The elevation relief depiction is supplied by NJDEP, and is based on the reclassified 10-meter Digital Elevation Model, utilizing the ArcGIS 3-D Analyst Module. This modeled view (Figure 8A) is useful for portraying the area's topography and conceptualizing slope, and provides a more advanced image than USGS topographic mapping (Figure 8B). The hillshade image for the Borough is color coded to express relative differences in elevation and slope. Shades of blue and gray are representative of lower elevations, while brown shades are indicative of higher elevations. More uniform areas of color are relatively flat and lack significant topographic relief. Green shades denote a range of mid-elevation values. Areas of changing colors are areas of significant relief, often times slopes in excess of 15%. The importance and relevance of slope is discussed in greater detail in the Steep Slopes section.

Sloping terrain and elevation fluctuations characterize much of the Borough and provide for outstanding view sheds and a variety of ecotypes. The lowest elevations occur along floodplains of the Hohokus Brook and Parson's Pond (elevation 300 ft above mean sea level). These areas are relatively flat characterized by low-lying valleys associated with sedimentary geological formations and agricultural lands. The highest elevations (>650 ft) occur in the in the north near the Saddle Ridge County Park and southern boundary of the Borough near the High Mountain Park Preserve in Wayne Township. The terrain varies from the rolling hills of the Piedmont Province to the rugged uplands of the Highlands Province.

The Borough has adopted an ordinance that restricts development on steeply sloping areas of 15% or more, and protecting these areas from development is important for a number of reasons including excessive stormwater runoff, soil erosion difficult access, and construction costs. The most steeply sloping areas are usually the last areas to be developed, due to inherent development constraints; therefore, they are often the remaining vestiges of open space, scenic vistas, and wildlife habitats.

Steep slopes are also treasured for their scenic and environmental qualities. Ravines and steep hillsides can provide impressive scenic vistas. These resources are important to the overall characteristics of the Borough. Vegetation and forested slopes increase soil stability, reduces runoff, protects water quality, and also provides wildlife habitat. Limited accessibility also enhances the attractiveness of this habitat to a variety of wildlife species, including birds, turtles, and plants. Steep slopes also serve as natural boundaries between land uses and districts within a community.

Scenic View sheds

Preserving scenic resources was identified as a goal in the 1999 Historic Inventory Report prepared for the Borough. Watching the pink hues of a sunset reflected over a lake, or overlooking a valley filled with the mosaic colors of autumn leaves can brighten your day and inspire you. Ensuring that these scenes can be enjoyed in years to come is important to many community members. In 2008, members of the Environmental Commission assisted in conducting a visual assessment of the Borough in order to identify areas that contribute to the scenic and aesthetic quality of the Borough. These areas included scenic vistas from high ridges, vistas of lakes, ponds, wetlands and forested areas. A list of these scenic views is provided in Table 3.

The federal National Scenic Byways a designation is awarded to regional roads that exhibit one or more of six core *intrinsic qualities*-- scenic, natural, historic, recreational, archaeological, or cultural, contributing towards a unique travel experience. In addition, the byway must demonstrate strong community support and develop a corridor management plan that describes strategies for preservation and/or improvements. Strategies for preserving scenic views start by identifying and prioritizing these features. Preserving scenic views can include restrictions on: cell towers, water towers, utility lines, billboards, and building heights within these areas. The preservation of scenic views can also include encouraging conservation easements or the acquisition of lands. In order to support the preservation of local scenic views, the community can also sponsor activities such as community walks, and photograph contests, and encourage voluntary protection measures. http://www.scenic.org/byways

Preliminary surveys of scenic view sheds were conducted during the ERI tour of the community and several areas were noted for their scenic qualities. These scenic views and their descriptions are summarized in the table below and photographs are provided in Appendix E.

Table 3: Scenic Views in the Borough of Franklin Lakes

	Name	Location	Intrinsic Quality
1	Saddle Ridge Road and Park	Northwest	County park, forested areas, scenic aerial mountain view
2	Ridge View Way	Northwest	forested areas, scenic aerial mountain view
3	Galloping Hill Rd	Northwest	forested areas, scenic aerial mountain view
4	Hooper's Crooked Pond and Wetlands, by Franklin Lake Rd.	Southwest	scenic lake view, scenic wetlands and forest
5	Hilltop Terrace	Southwest	forested areas, scenic aerial mountain view
6	Shinneck Terrace/ Hampton Hill Road	Southwest	forested areas, scenic aerial mountain view
7	Franklin Swamp by Indian Trail Drive	South	scenic wetland and forest view
8	Franklin Lake by Scioto Drive	South	scenic lake view
9	Footpath around Franklin Lake	South	scenic lake view, scenic forest and trail
10	Buttermilk Falls, Cherokee Lane	South - on the border with Wayne Township	Scenic waterfalls, forest, and trail
11	Haledon Reservoir by High Mountain Road, and Water View Drive	Southeast	scenic lake view, scenic forest and trail
12	Approximately twenty streams, lakes and ponds are present in the Borough, including the Haledon Reservoir, Molly Ann Brook, Franklin Swamp (Pond Brook wetlands south), Franklin Lake, Hopper's Crooked Lake, Baker's Long Pond, Upper and Lower Lake, Vitale's Pond, Clark Pond, Conrad Pond, Kings Pond, Pond Brook (north), Lawlin's Pond, DeYoe Pond, Tannery Pond, Shadow Lake, Hohokus Brook, Parsons Pond, and Cooke's Pond.	Borough wide	scenic lake views

3.9 Steep Slopes Analysis

The subject of steep slopes is important for two main reasons: the potential for excessive erosion and the physical limitation of development. Steep slopes present concerns for development, and careful planning is essential to avoid adverse impacts to the surrounding environment. Vegetation holds the soils in place and intact, mitigating the erosive forces of precipitation and wind. When vegetation is removed, the soils on steep slopes become less stable and prone to erosion. This erosion in turn degrades water quality through high turbidity/poor clarity, sediment deposition, and additional pollutant loads of contaminants bound to soil particles. Excessive erosion may also lead to slope failure, posing a hazard to surrounding building and/or transportation corridors.

The Borough does have specific ordinances restricting development and construction grading on slopes greater than 15%. The traditional development process replaces vegetated, permeable land areas with impermeable roadways, parking lots, driveways, and homes. The volume (or amount), of surface water and the rate of runoff, substantially increases as land development occurs. This in turn increases the rate of erosion and potential mobilization of pollutants such as soil, antifreeze, oil, pesticides, fertilizers and other contaminants. The slopes affect storm runoff and pollutants which can impact the community's wetlands, lakes and streams. The steeply sloping areas also affect the recharge of groundwater resources, and provide wildlife habitats and scenic views

The majority of the Borough, approximately 51% by area, has slopes from 0% to less than 5%, including the wetlands and floodplain areas (Figure 9). Slopes ranging from 5% to less than 15% account for nearly 38% of the land area, which characterized the Borough as gently rolling with areas of high relief. Approximately 11% of the community has slopes greater than 15% slopes, primarily in the north, west and southern boundaries of the Borough. Areas of steep slopes that are greater than 15% include 5% of the land, and 6% of the land have slopes greater than 20%. Much of these steeply sloping areas provide beautiful scenic views and provide wildlife habitats to state endangered species; however, significant housing development has occurred on these ridges. The basalt ridges located in the Borough underlie these slopes and divide the community into three watersheds: the Hohokus Brook, Pond Brook and Molly Ann Brook. Table 4 summarizes the breakdown of the acreage of Borough associated with various slope categories as derived from the GIS soils data.

Table 4: Slope Calculations

Slope	Acreage	Percentage
0 - 4.99%	3214.23	51%
5 - 9.99%	1671.46	27%
10 - 14.99%	710.29	11%
15 - 19.99%	343.75	5%
> 20%	364.35	6%

3.10 Bedrock Geology and Aquifers

The New Jersey Geologic Survey (NJGS) within the NJDEP maintains geological publications and GIS mapping for New Jersey. NJGS reports that New Jersey's landscape has formed during more than a billion years of geologic processes that include mountain building, erosion and deposition. The New Jersey Geologic Survey divided that state into four separate Physiographic Provinces with distinct regional relief, landforms, and geology, including: the Valley and Ridge, Highlands, Piedmont, and Coastal Plain Physiographic Provinces. The boundary between each Physiographic Province is determined by a major change in topography and regional classifications of landform, rock type and structure. This geological information has been incorporated into the NJDEP Geological GIS data layers.

The Piedmont Province includes sandstone, shale, and conglomerates which the foundation of the broad lowlands, and basalt and diabase form the intermittent ridges of the Piedmont. The Piedmont Province is separated from the Highlands by a series of major faults, including the Ramapo Fault. These rocks are of the Late Triassic and Early Jurassic age, 230 to 90 million years old. The rocks reside on a crustal block that dropped during the initial stages of the opening of the Atlantic Ocean. Volcanic activity created erosion-resistant basalt and diabase substrate. Dikes and sills formed and lava cooled and hardened forming the igneous basalt rock. The Piedmont is chiefly a low rolling plain divided by a series of higher ridges. The highest local ridge is High Mountain (885 feet) located in nearby Wayne Township. Ramapo Mountain (1,171 feet) located northwest of the Borough is located within the Highlands Province and these metamorphosed igneous rocks are significantly older, estimated at 1 billion years old.

Geologic Formations
Bedrock geology in the Piedmont Plains that underlies the Borough is illustrated on Figure10 and summarized in Table 5 includes the following formations.

- **The Orange Mountain Basalt,** (Lower Jurassic) underlies 45% of the community, and is described as dark-greenish-gray to greenish-black, hard basalt. This basalt consists of three major flows which are separated in places by a weathered zone of thick bed of red siltstone or by volcanic-clastic rock. The lowest and middle flows are generally massive and have widely spaced columnar joints.
- **The Feltville Formation** (Lower Jurassic) underlies 33% of the community and is described as interbedded with fine to coarse grain sandstone, siltstone and mudstone. Ranging in color and texture from brownish-red to light-grayish red, fine- to coarse-grained sandstone, gray and black, coarse siltstone, and silty mudstone. These formations can be thermally metamorphosed into hornfels where in contact with Preakness Basalt. Near the base are two thin, laterally continuous beds of black, carbonaceous limestone and gray, calcareous siltstone, each up to 3 meters (10 ft) thick. These contain abundant fossils of fish, reptile, anthropod, and diagnostic plants.
- **The Passaic Formation** (Lower Jurassic and Upper Triassic) underlies 14% of the community and is described as reddish-brown to brownish-purple and grayish-red siltstone and shale. At places the formation contains sandy mudstone, sandstone,

conglomeratic sandstone and conglomerate containing clasts of quartzite or limestone. The Quartzite conglomerate unit found in the Borough has a reddish-brown pebble conglomerate. The sandstone is medium to coarse grained, and locally contains pebble and cobble layers.

- **The Preakness Basalt (Lower Jurassic)** underlies 4% of the community and is described as dark-greenish-gray to black, very-fine grained, dense, hard basalt.

Table 5 : Geologic Formations

Geologic Feature	Acreage	Percentage
Passaic Formation Quatzite-clast Conglomerate facies	866.73	14%
Feltville Formation	2083.52	33%
Orange Mountain Basalt	2807.28	45%
Preakness Basalt	546.54	9%

Groundwater Aquifers

Geologic features affect terrain, drainage, soil, which in turn affects the diversity of plant communities and wildlife habitat. In addition, the surficial and underlying geology directly affects the availability of groundwater recharge, aquifer water supplies, development potential, development density limitations, and pollution vulnerability in the community.

An aquifer is a geologic formation capable of supplying water through wells. Groundwater is stored in fissures, cracks and small interconnections and voids between individual grains in the rocks. The permeability of the bedrock and its ability to serve as an aquifer of significance will largely depend on the extent and degree of interconnection between individual grains of rock or the porosity of the rock. More permeable formations facilitate the travel of groundwater. Conversely "tighter" formations, lacking extensive or well defined interconnection between the rock, basalts and diabase, are considered non-porous. As such, geologic formations play an important role in the location and the yield of groundwater aquifers.

The US Geological Survey (USGS) reports that aquifers present in the Piedmont physiographic province and Newark Basin underlying the Borough consist of shale and sandstone. Water generally is present in weathered joint and fracture systems in the upper 200 or 300 feet. Below a depth of 500 feet, fractures are fewer and smaller, and water availability is reduced, depending on rock type. In coarse-grained sandstones, ground water also is present in inter-granular pore spaces. In several counties, these shale and sandstone aquifers are very productive aquifers. Aquifer characteristics of the various geologic formations occurring within the boundaries of the Borough are described as follows:

- **Brunswick aquifer and the Brunswick conglomerate aquifer** ~ The Brunswick Shale of the Passaic Formation is generally a reliable source of water for most domestic and industrial uses. Groundwater flows through the shale both in nearly vertical features and joints, and also along horizontal fractures along bedding planes. Wells tapping the Brunswick Shale typically have high initial yields which tend to decline as the fractures around the well are de-watered. Therefore, the ultimate yields of wells developed within Brunswick shales can become lower than the initial yields. The Brunswick conglomerates include the geologic grading with sandstone and limestone conglomerate formations. The Brunswick aquifers underlie approximately 47% of the Borough, and three of the four public water supply wells are located in this primary bedrock aquifer (Table 6).

- **Basalt** ~ Basalt is composed of dark-greenish-gray to black, igneous rock. The rock is recognized to be a poor aquifer, with limited porosity or permeability. Groundwater must be transmitted through fractures and joints, which are usually widespread and relatively tight, and one public well is located in the northern section of the community in this aquifer.

The bedrock and aquifer information provided is general and depicts overall constituents of the rock formation. Site specific investigations should be conducted to determine the underlying geology and aquifers for development projects.

Table 6 : Groundwater Aquifers

	Acres	%
Brunswick aquifer	2947.12	47
Basalt	3356.96	53

3.11A Well Head Protection Areas

The 1986 Federal Safe Drinking Water Act amendments (Section 1428, P.L. 93-523) direct all States to develop a Well Head Protection Program (WHPP) for both public community wells and non-community public wells, such as those that service a home owners association, school, church or business. The *NJDEP Guidelines for the Delineation of Well Head Protection Areas* explain that a goal of this plan is to protect water supplies and prevent the contamination of ground water resources and drinking water supplies. Groundwater is vulnerable to the risk of contamination from varied sources including underground storage tanks of gasoline, heating fuel, and septic systems. It is difficult and costly to cleanup or treat polluted groundwater, and these wells are often abandoned. Therefore, preventing ground water pollution through a Well Head Protection Program is the most cost-effective approach.
http://www.state.nj.us/dep/njgs/whpaguide.pdf

The NJDEP has cataloged and field located these public wells and delineated the Well Head Protection Areas (WHPA) on NJDEP GIS datalayers. The WHPA includes the area of land from which a well draws its water, or the horizontal extent of ground water captured by a well pumping at a specific rate over a two-, five-, and twelve-year period of time. The WPHA also depicts three sequential tiers that identify the time of travel (TOT) it takes water to flow to a well and the relative risk of contamination to the well. Each WHPA is dependent on the pumping rate of the well and the local geology.

- Tier 1 TOT = 2 years
- Tier 2 TOT = 5 years
- Tier 3 TOT = 12 years

The WHPA delineations are the first step in defining the sources of water to a public supply well. Within these areas, potential contamination can be assessed and appropriate monitoring undertaken. The delineation of well head protection areas can also help communities to better understand the nature of their groundwater drinking water supplies and the importance of protecting these resources. In New Jersey zoning is the authority of each municipality, and communities are adopting ordinances that restrict future development of certain high risk industries and services, such as gasoline stations, from locating near public well head protection areas.

The Well Head Protection Area (WHPA) mapping created for the Borough is depicted in Figure 11, and was based on the NJDEP GIS data. The Wellhead Protection Area mapping for the Borough identifies three public community wells and three non-public community wells within the Borough. Future development or growth near these wellhead protection areas should be carefully evaluated to ensure that the water quality and groundwater recharge of these community wells are not degraded.

3.11B Water Supply

NJDEP regulates all ground and surface water diversions in excess of 100,000 gallons of water per day by issuing water allocation permits. This includes potable water, as well as water for other public water supply purposes, such as industrial facilities, irrigation, sand and gravel operations, remediation and power generation. In addition, agricultural uses capable of withdrawing more than 100,000 gallons per day must obtain permission from the County agricultural agent. Public water suppliers and non-community suppliers that serve schools, offices, restaurants, and institutions are required by law to test for water quality and treat as necessary to comply with federal and surface water quality standards. The County Environmental Health Act (CEHA) agencies implement this enforcement effort on the county level.

Public Water Supplies

The residents and businesses in the Borough rely primarily on groundwater supplies for their drinking water. In 2008, the local Department of Health reported that 1,271 homes within the Borough rely on private well supplies, or approximately 37% of the homes. In addition, the United Water New Jersey reported that in 2008, approximately 2,165 homes in the Borough are serviced by the public community wells, or approximately 63% of the Borough residents.

The United Water New Jersey website reports that water is provided to its customers in the Borough primarily from four wells located throughout that community. In the summer months customers may receive supplemental water from the Haworth Plant which obtains water from the Wanaque and Monksville Reservoirs. United Water New Jersey treats surface water from the Wanaque Reservoir and at the Haworth Water Treatment Plant using a combination of ozone, chlorine and ammonia to purify water.

The United Water provides a website specifically for the water supply for the Borough, which also provides information relative to the susceptibility of the supply to potential pollutants. The water company reported that the water supply generally has a high susceptibility rating for: nutrients, volatile organics, inorganic (metals), radon, and disinfection byproducts. The water company reported that the water supply has a moderate susceptibility rating for pathogens and radionuclides, and a low susceptibility rating for pesticides, based on criteria outlined by the NJDEP.
http://www.unitedwater.com/uwnj/wtrspply.htm
http://www.unitedwater.com/uwnj/pdfs/w_h07franklin.pdf

NJ Private Well Testing Act

http://www.nj.gov/dep/pwta/pwta_report_final.pdf

The New Jersey Private Well Testing Act (PWTA, N.J.S.A. 58:12A-26) became effective in September 2002 to address the drinking water quality of private wells. The PWTA requires well water to be tested prior to the sale of a property. It also requires landlords to test the private well water supplied to their tenants and provide their tenants with a written copy of the results. The PWTA requires that wells be tested for the presence of the following parameters:

- Testing for 29 primary drinking water contaminants: bacteria, nitrate, lead, and 26 volatile organic chemicals.
- Certain areas of the state are also required to test for three additional primary drinking water contaminants: arsenic, mercury and gross alpha particle activity.
- Testing for three secondary parameters (pH, iron and manganese) is also required.

The PWTA requires testing for secondary drinking water parameters: pH, iron, and manganese. These secondary parameters are natural conditions that can cause taste and odor problems and corrode plumbing fixtures, which can affect the water's suitability for laundering and showering. Testing for secondary parameters is used to determine if any treatment is recommended to make the well water aesthetically pleasing to the consumer.

Laboratories are required to directly notify the county or local health authority of well test failures for nitrate and fecal coliform or E. coli because they are considered acute contaminants and may pose immediate health concerns. A well test "failure" is defined as any result that exceeds a maximum contaminant level (MCL) for primary drinking water standards or a recommended upper limit (RUL) for secondary drinking water standards with two exceptions for lead and arsenic. Once the local health authority is notified electronically by NJDEP or directly by the laboratory, the health authorities may (but are not required to) notify property owners within the vicinity of the failing well. However, because these individual tests are considered confidential, the exact location of the well test failure cannot be identified.

PWTA Water Quality Results, 2002 – 2007
http://www.nj.gov/dep/pwta/pwta_report_final.pdf

In July 2008, the NJDEP published a summary of the statewide results from the Private Well Testing Act, which provides an overall summation of groundwater quality throughout the State and for each County. The NJDEP reported that a total of 55,749 well water samples were analyzed from 51,028 separate wells during the period of September 2002 to April 2007, which represents about 13% of the estimated 400,000 private wells used for drinking water in New Jersey. Based on the results, 88 percent of the wells "passed" (did not exceed) all of the required primary standards for drinking water. Approximately 12% (6,369) of the wells statewide exceeded a primary drinking water standard ("failed"), and the *most common exceedances* are listed in Table 7.

The PWTA results from 2002 to 2007 reported that approximately 1,258 wells were tested in Bergen County. Based on these results, 8.7% of the private wells (50 wells) exhibited elevated arsenic levels, which occurs naturally based on the local geology. Approximately 1.5% (19 wells) exhibited elevated levels of fecal coliform or pathogens. While the PWTA requires well testing when a property is being sold, it is equally important for homeowners to periodically test wells and understand their water quality to safeguard their family's health. If arsenic is detected, there are various treatment systems that can be installed. Annual testing for nitrates and fecal coliform and possibly volatile organic compounds (VOCs) should also be considered.

Table 7: PWTA Most Common Exceedances 2002-2007

Parameter	Statewide Wells	Bergen County Wells
gross alpha particle activity	2,209 wells	0
arsenic >5 ug/L	1,445 wells	50 wells, 8.7%
nitrates	1,399 wells	12 wells, 1.0%
fecal coliform or E. coli	1,136 wells	19 wells, 1.5%
volatile organic compounds (VOCs)	702 wells	21 wells, 1.7%
mercury	215 wells	0

Statewide Wells with Exceedances 12% or 6,369 wells
Bergen County Wells with Exceedances 8.1% or 102 wells of 1,258 wells sampled

Radioactive Substances – Testing and Treatment
The NJDEP Division of Water Supply reports that naturally occurring radioactive substances are found in ground water in New Jersey. Some of the NJDEP information is *conflicting* regarding radioactivity levels in groundwater. For example, the results of the Private Well Testing Act for radioactivity levels measured by the gross alpha tests indicated that exceedances were detected in Hunterdon and Warren County wells, but wells in much of the Highlands and the northeast region did not identify a significant concern. In fact, Bergen County is not required to test for radioactivity under the PWTA. However, the information in the NJDEP guidance for radioactivity in groundwater specifically report that sources of naturally occurring radioactivity levels are found in the Highlands Province and neighboring regions of North Jersey, including Bergen County. NJDEP guidance on radioactive substances in groundwater can be viewed at the website. http://www.state.nj.us/dep/rpp/radwater.htm

Water Supply and Drought
Water supply is an important statewide concern, and after the prolonged drought conditions experienced in 1998, and 2001 it has come under closer scrutiny by State officials. The NJDEP is currently developing an updated Statewide Water Supply Plan that will discuss current and projected water supplies and demand. In addition, the NJDEP initiated the Drought Watch website which is updated routinely. A Declaration of Drought "Warning" or "Emergency" is based on the analysis of precipitation during the preceding months and reservoir levels. Precipitation records from 2007-2008 indicate that Bergen County was above the yearly normal precipitation.
http://www.state.nj.us/dep/drought/

The NJDEP Division of Water Supply provided the following information on the permitted water supplies for the Borough.
http://www.nj.gov/dep/rpp/download/urwater.pdf

UNITED WATER NJ-FRANKLIN LAKES, Bergen County
PWSID: 0220001
Last Updated: 03/04/08

Water Supply Firm Capacity: 4.186 MGD
Available Water Supply Limits

	Allocation	Contract	Total
Monthly Limit	53.700 MGM	70.000 MGM	123.700 MGM
Yearly Limit	644.000 MGY	548.000 MGY	1192.000 MGY

Water Demand

	Current Peak	Date	Committed Peak	Total Peak
Daily Demand	2.831 MGD	08/2005	0.591 MGD	3.422 MGD
Monthly Demand	87.760 MGM	08/2005	17.686 MGM	105.446 MGM
Yearly Demand	538.175 MGY	2007	205.738 MGY	743.913 MGY

Water Supply Deficit or Surplus

Firm Capacity	Water Allocation Permit
0.764 MGD	18.254 MGM
	448.087 MGY

Note: Negative values (a deficit) indicate a shortfall in firm capacity and/or diversion privileges or available supplies through bulk purchase agreements.

Bureau of Water System and Well Permitting Comments:
3.0 MGD is supplied by UWNJ-Haworth system. 75% of the Monthly and 50% of the annual maximum supply amounts from UWNJ have been utilized in this table.

UNITED WATER NJ –HAWORTH, Bergen County
PWSID: 0238001
Last Updated: 08/26/08

Water Supply Firm Capacity: 172.000 MGD

Available Water Supply Limits

	Allocation	Contract	Total
Monthly Limit	4860.000 MGM	217.000 MGM	5077.000 MGM
Yearly Limit	43084.000 MGY	2555.000 MGY	45639.000 MGY

Water Demand

	Current Peak	Date	Committed Peak	Total Peak
Daily Demand	146.194 MGD	08/2005	12.967 MGD	159.161 MGD
Monthly Demand	4532.000 MGM	08/2005	283.428 MGM	4815.428 MGM
Yearly Demand	42566.594 MGY	2007	2003.213 MGY	44569.807 MGY

Water Supply Deficit or Surplus	
Firm Capacity	Water Allocation Permit
12.839 MGD	261.572 MGM
	1069.193 MGY

Bureau of Water Allocation Comments:
Bulk purchases from JCMUA at 7 MGD; 217 MGM and 2555 MGY.
Contractual commitments for the bulk sale of water may reduce any water supply surplus

Allocation Limit: The maximum allowed by a valid Water Allocation Permit issued by the Bureau of Water Allocation. This may be surface or ground water, and may be expressed in MGD, MGM, MGY or some combination thereof. Withdrawals may also be limited by other factors and have seasonal or other restrictions such as passing flow requirements.

Committed Peak Demand: The demand associated with projects that have been approved for ultimate connection to the system, but are not yet constructed as indicated through the submission of construction certifications or certificates of occupancy. This is calculated by totaling the demand as included in Water Main Extension (WME) permits and the demand associated with projects not requiring a WME permit. For various review purposes this quantity may be represented as MGD, MGM and/or MGY.

Current Peak Demand: This is the average day of the highest recorded demand month occurring within the last five (5) years. (For the purpose of this table, the calculation for current peak demand was based on 31 days. Systems will be reviewed on an individual basis.) This includes water from a system's own sources and all other sources of water (i.e. purchased water).

Firm Capacity: Refers to adequate pumping equipment and/or treatment capacity (excluding coagulation, flocculation and sedimentation) to meet peak daily demand, when the largest pumping unit or treatment unit is out of service. The value is represented in MGD.

Firm Capacity Deficit or Surplus (Firm Capacity - Total Peak Daily Demand): The difference between the Firm Capacity and the sum of the peak daily demand and committed daily demand. This is a measure of the physical ability to provide treated water at adequate pressure when the largest pumping unit or treatment unit is out of service. Negative values indicate a shortfall in Firm Capacity.

Total Peak Water Demand: The sum of the public water system's current peak demand and committed peak demand. The value is represented in MGD, MGM, and MGY.

Total Available Water Supply: The sum of the Allocation Limit and Contract Limit. This value is represented in MGM and MGY.

Water Supply Deficit or Surplus (Total Water Allocation Permit Limit- Total Peak Demand): The monthly and/or annual limitations of an Allocation Permit minus the sum of the monthly and/or annual demands recorded based on the water use records plus the monthly and/or annual demand projected for approved but not yet constructed projects. Negative values indicate a shortfall in diversion privileges or available supplies through bulk purchase agreements.

3.12 Groundwater Recharge Areas

Groundwater recharge represents the net amount of water that infiltrates through the soil below the root zone. The ability for water to infiltrate through soils into the underlying aquifer is directly influenced by the amount of impervious cover that includes roof tops, parking areas and roadways, which can preclude infiltration. Infiltration is naturally influenced by the type and density of vegetation, the amount of impervious cover, slope and soil properties. The quantity of groundwater that ultimately infiltrates into the aquifer is based on the characteristics of the underlying geology, such as the permeability and porosity of the formation. Bedrock aquifer recharge is a function of the groundwater recharge rates, but it is also influenced by geology and fractured rock, and is affected by aquifer pumping rates and groundwater withdraw rates.

Groundwater recharge is important to approximately 50% of the state's population that receives its drinking water from groundwater, and the Borough residents who are serviced by public community well supplies and private wells. The Borough Groundwater Recharge Areas are illustrated on Figure 12. The data for this map was is obtained from the New Jersey Geological Survey (NJGS) GSR-32 methodology. This methodology estimates groundwater recharge based upon modeling land use land cover data, soil characteristics, and precipitation data to estimate of groundwater recharge in inches per year. A single soil unit may have several rates based on slope, proximity to wetlands, and land use. Hydrogeological experts recognize that the volume of water that will actually recharge the deeper potable groundwater aquifers is likely less than the volumes estimated using the GSR-32 method. Some will naturally seep or discharge as baseflow into streams and surface water features, and wetland resources. As such, the data presented in Figure 12 is not a reflection of the amount of bedrock aquifer recharge but merely the potential shallow groundwater recharge.

New Jersey receives approximately 43 inches of precipitation each year, and approximately 50% can return to the atmosphere through evaporation and through transpiration from plant leaves. Water will runoff the land into receiving surface waters; and only a small percentage can infiltrate into the ground. The data provided through the NJGS to prepare Figure 12, reflects the amount of precipitation estimated to percolate through the upper soil horizons to a point below the root zone. Recharge values of 11-15 inches were identified for 59% of the Borough. Recharge rates for soils disturbed by development cannot be determined and 16% of the Borough is depicted as 0 inches of recharge for these unclassified disturbed soils (Table 8).

Table 8: Groundwater Recharge

Recharge Rate	Acres	%
>16 inches per year	787.51	12%
11-15 inches per year	3714.65	59%
1-7 inches per year	35.44	1%
0 inches per year/ Developed lands	977.37	16%
Low: Hydric soils	128.40	2%
W: water, wetlands	660.70	10%

3.13 NRCS SSURGO Soils

In the Borough the soils are derived largely from the weathering of underlying geologic formations of basalt, shale, siltstone and sandstone. Soil characteristics such as particle size (e.g., sand, silt, and clay), water-holding capacity and nutrient content are factors determined by the underlying bedrock, topography, and hydrology. In turn, microorganisms, plants, and other biotic communities affect and contribute to soil formation. The United States Department of Agriculture (USDA), Natural Resource Conservation Service (NRCS) publication entitled the "Soil Survey of Bergen County, New Jersey" (USDA, 1995) describes the soil series present in Bergen County, and the Borough. These soil units have been illustrated on Figure 13.

SSURGO stands for the Soil Survey Geographic Database maintained by the Natural Resources Conservation Service (NRCS), an office with the US Department of Agriculture. The corresponding soils figure depicts the SSURGO soil unit data for the Borough (Figure 13). The SSURGO mapping provides a detailed geographical characterization of soils at a unit level.

Soil materials consist of a variable and complex mixture of organic matter, sand, silt, and clay particles. Strata of similar physical and chemical composition form distinct soil horizons. Soil formation occurs under the influence of climate, parent materials including bedrock, topography, hydrology, flora and fauna and time. Soil units are the base classification code of soil nomenclature. The soil characterization process is directed by nationwide uniform procedures that account for particulate composition and size (clay, silt, and sand), stratification, and topography. These soil units are also characterized by crop suitability, compaction, strength, shrink-swell potential, available water capacity, erodibility, and permeability.

Soil properties affect the suitability for plant growth, moisture storage, and nutrients, which in turn affects uses for agriculture, industry, development, recreation, and preservation. Soil properties affect farming practices, woodland management, and engineering projects such as roads, buildings, septic systems, and other structures. Soils play a vital role in ecosystem function and filter stormwater; serve as the matrix for groundwater storage and store large amounts of organic carbon.

Table 9: SSURGO Soil Survey Data	
Mapped Soil Unit	**Description**
AdrAt	Adrian muck, 0 to 2 percent slopes, frequently flooded
BohB	Boonton moderately well drained gravelly loam, 3 to 8 percent slopes
BohBb	Boonton moderately well drained gravelly loam, 0 to 8 percent slopes, very stony
BohC	Boonton moderately well drained gravelly loam, 8 to 15 percent slopes
BohCb	Boonton moderately well drained gravelly loam, 8 to 15 percent slopes, very stony
BohD	Boonton moderately well drained gravelly loam, 15 to 25 percent slopes
BohDb	Boonton moderately well drained gravelly loam, 15 to 25 percent slopes, very stony
BohE	Boonton moderately well drained gravelly loam, 25 to 45 percent slopes
BorC	Boonton moderately well drained-Rock outcrop complex, 8 to 15 percent slopes
BorD	Boonton moderately well drained-Rock outcrop complex, 15 to 25 percent slopes
BorE	Boonton moderately well drained-Rock outcrop complex, 25 to 45 percent slopes
BouB	Boonton-Urban land complex, 0 to 8 percent slopes
BouC	Boonton-Urban land complex, 8 to 15 percent slopes
BouD	Boonton-Urban land complex, 15 to 25 percent slopes
CarAt	Carlisle muck, 0 to 2 percent slopes, frequently flooded
DuoB	Dunellen loam, 3 to 8 percent slopes
DuoC	Dunellen loam, 8 to 15 percent slopes
DuoD	Dunellen loam, 15 to 25 percent slopes
DuuB	Dunellen-Urban land complex, 3 to 8 percent slopes
DuuC	Dunellen-Urban land complex, 8 to 15 percent slopes
DuuD	Dunellen-Urban land complex, 15 to 25 percent slopes
FmhAt	Fluvaquents, loamy, 0 to 3 percent slopes, frequently flooded
HamB	Haledon gravelly loam, 3 to 8 percent slopes
HamBb	Haledon gravelly loam, 0 to 8 percent slopes, very stony
HasB	Haledon-Urban land complex, 3 to 8 percent slopes
HcsAb	Hasbrouck loam, 0 to 3 percent slopes, very stony
OtsD	Otisville gravelly loamy sand, 15 to 25 percent slopes
OtsE	Otisville gravelly loamy sand, 25 to 35 percent slopes
PbuA	Pascack silt loam, 0 to 3 percent slopes
PHG	Pits, sand and gravel
PrnAt	Preakness silt loam, 0 to 3 percent slopes, frequently flooded
RkrB	Riverhead sandy loam, 3 to 8 percent slopes
RkrC	Riverhead sandy loam, 8 to 15 percent slopes
UdkttB	Udorthents, loamy, 0 to 8 percent slopes, frequently flooded
UdwB	Udorthents, wet substratum, 0 to 8 percent slopes
UdwuB	Udorthents, wet substratum-Urban land complex (SSURGO1)
UR	Urban land

3.14 Septic Suitability

Onsite wastewater treatment (septic) systems are the dominant form of wastewater treatment in many rural and suburban areas throughout the region. Septic effluent is nutrient rich, high in minerals and salts, has elevated organic content, and is laden with pathogens. If improperly treated, the seepage of wastewater into surface waters can negatively impact water quality, and its recreational uses. Septic discharge is also regarded as a threat to drinking water (both from surface or groundwater sources), due to the presence of bacteria (fecal coliform or E coli) that pose a risk to human health.

The performance of a septic system is largely a function not only of its design, but the nature and characteristics of the soils to which the effluent is discharged. It is within the soil horizon that bacteria are removed, nutrients reduced or bound, and the volume of the treated effluent attenuated or recharged. Both the US Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) and the NJDEP recognize that not all soils have the attributes needed to adequately renovate wastewater. Additionally site conditions owing to slope, depth to bedrock and depth to groundwater (seasonal high water table) may also impact the ability of soils to adequately renovate wastewater. As such, both the USDA and the NJDEP provide can provide guidance language pertaining to the septic treatment capabilities of soils. This section of the ERI examines and maps the septic suitability, meaning the ability of native soils to adequately renovate wastewater.

Where onsite wastewater treatment is required, the septic suitability of the native soils can be a key factor in determining whether a parcel of land may be developed for residential or other purposes. Septic restrictions are based upon those factors that limit the performance of the native soils in the construction or operation of septic systems. Septic system performance is limited by a variety of factors, most of which are linked to local soils and geologic properties including: proximity to surface waters, slope, depth to seasonal high water tables, depth to bedrock, and soil composition. Soil composition is an important factor in determining wastewater percolation rates, which is the movement of water infiltrating the soil to groundwater sources. Soil percolation can be limited by heavy clay content, which reduces permeability, a fragipan or a stratified dense clay layer, coarse rock fragments, or compaction.

The NJDEP utilizes the USDA -NRCS classifications to describe soil properties that limit septic suitability within N.J.A.C. 7:9A. Septic Restrictions are classified as slight, moderate, severe, or undefined based on six (6) specific limitations as follows: 1)

coarse horizon, 5) regional zone of saturation, or 6) perched zone of saturation.

The Borough residents are primarily served by individual on-site septic, yet the local soils, slopes, shallow bedrock and/or shallow water tables pose various limitations for use of the native soils in treatment and disposal of septic suitability. Based on the NRCS soil classifications, the soils underlying approximately 50% of the community is designated as most severe for septic suitability; 11% of the community is designated as severe for septic suitability; and 20% of the community is designated as less severe for septic suitability as depicted on Figure 14 and in illustrated in Tables 10 and 11. Much of the Borough soils are also listed as unclassified (18%), primarily because these areas are disturbed by development and septic suitability will need to be determined by site specific conditions.

In these areas of the Borough where the native soils are determined by NJDEP (N.J.A.C 7:9A, Appendix D) septic treatment and disposal systems must be designed and constructed in accordance with the requirements for a soil replacement system (N.J.A.C 7:9A-10.1). Essentially, this means in areas of the Borough where the native soils are determined to be too restrictive for septic use, the resulting treatment and disposal field must be constructed using imported soils that meet specific design and performance characteristics. Thus, although these areas are mapped as having poor or limited septic suitability, this does not mean that these areas cannot be developed nor does it mean that the septic systems in operation in these areas are necessarily operating at a sub-optimal level or are failing. Conversely, in areas characterized by soils of severe or most-severe septic suitability homeowners should take all precautions to ensure that their system is correctly maintained and is properly operating. This can be as simple as avoiding the disposal of highly organic materials (kitchen wastes, etc.), use of water conserving fixtures, and care in what is dumped down drains or flushed down toilets. Additionally, regardless of whether or not the soils are mapped as severe, all homeowners should be pumped out, and even inspected, once every three years.

Table 10: Soil Septic Suitability

Soils	Acreage	Percentage
Least Severe	1220.95	20%
Severe	688.99	11%
Most Severe	3005.00	50%
Unclassified	1105.69	18%

Table 11: Soil Development Characteristics

Soil Series	Mapping Units	Soil Descript	Slope %	Depth to SHWT* (feet)	Depth to Bedrock (feet)	Erosion Potential	Septic System Limits	Limitations for Building Foundations
Adrian	AdrAt	muck, frequently flooded	0 to 2%	1	>5	2-Slight	Severe	Severe
Boonton	BohB	mod well drained gravelly loam	3 to 8%	2-3	>5	3-Slight	Severe	Severe
	BohBb, stony		0 to 8%					
	BohC		8 to 15%			4-Moderate		
	BohCb, v stony		8 to 15%					
	BohD		15 to 25%			4-Moderate		
	BohDb, v stony		15 to 25%					
	BohE		25 to 45%			5-Severe		
Boonton	BorC	mod well drained-Rock outcrop complex,	8 to 15%	2-3	>5	3-Slight	Severe	Severe
	BorD		15 to 25%			4-Moderate		
	BorE		25 to 45%			5-Severe		
Boonton	BouB	Urban land complex	0 to 8%	2-3	>5	3-Slight	Variable	Variable
	BouC		8 to 15%			4-Moderate		
	BouD		15 to 25%			4-Moderate		
Carlisle	CarAt	muck, frequently flooded	0 to 2%	0.5-1	>5	3-Slight	Severe	Severe
Dunellen	DuoB	loam	3 to 8%	>6	>5	4-Moderate	Mod	Slight
	DuoC		8 to 15%			4-Moderate		
	DuoD		15 to 25%			5-Severe		
Dunellen	DuuB	Urban land complex	3 to 8%	>6	>5	4-Moderate	Variable	Moderate
	DuuC		8 to 15%			4-Moderate		
	DuuD		15 to 25%			5-Severe		
Fluvaquent	FmhAt	loamy, frequently flooded	0 to 3%	0-1	>5	4-Moderate	Severe	Severe
Haledon	HamB	gravelly loam	3 to 8%	0.5-1.5	>5	4-Moderate	Severe	Severe
	HamBb,	v stony	0 to 8%					

Soil Series	Mapping Units	Soil Descript	Slope %	Depth to SHWT* (feet)	Depth to Bedrock (feet)	Erosion Potential	Septic System Limits	Limitations for Building Foundations
Haledon	HasB	Urban land complex	3 to 8%	0.5-1.5	>5	4-Moderate	Variable	
Hasbrouck	HcsAb	loam, very stony	0 to 3%	0-0.5	>5	4-Moderate	Severe	Severe
Otisville	OtsD	gravelly loamy sand	15 to 25%	>6	>5	5-Severe	Severe	Severe
	OtsE		25 to 35%			5-Severe		
Pascack	PbuA	silt loam	0 to 3%	1-2	>5	4-Moderate	Severe	Severe
Pits, sand and gravel	PHG			>6	>5	5-Severe	Severe	Slight
Preakness	PrnAt	silt loam, frequently flooded	0 to 3%	0-1	>5	4-Moderate	Severe	Severe
Riverhead	RkrB	sandy loam	3 to 8%	>6	>5	4-Moderate	Severe	Slight
	RkrC		8 to 15%			4-Moderate		
Udorthents	UdkttB	loamy, frequently flooded	0 to 8%		Variable	Variable	Variable	Variable
Udorthents	UdwB	wet sub stratum	0 to 8%		Variable	Variable	Variable	Variable
Udorthents	UdwuB	wet sub stratum-Urban land complex			Variable	Variable	Variable	Variable
Urban land	UR		Variable		Variable	Variable	Variable	Variable

* SHWT = seasonal high water table