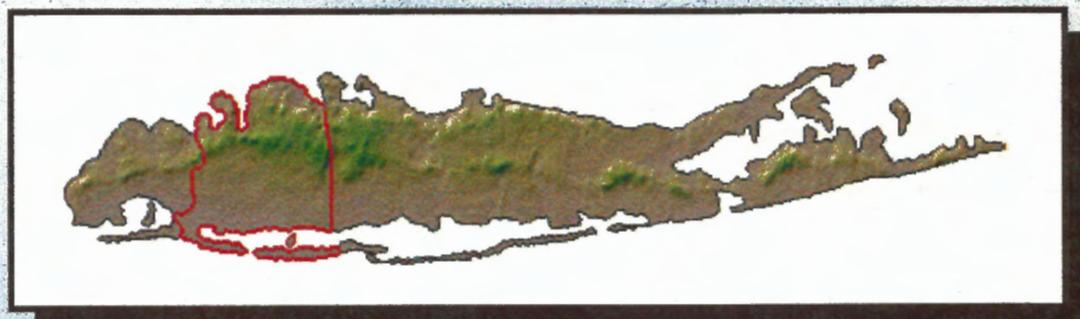
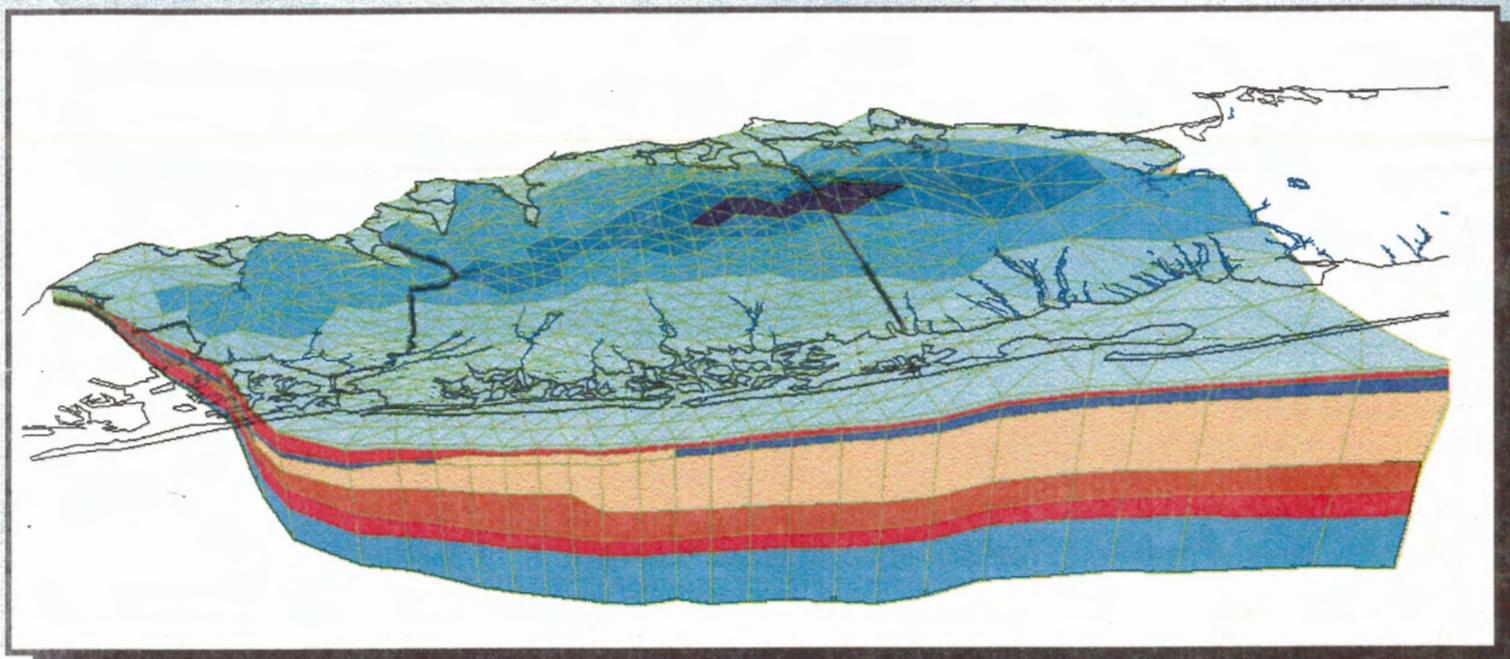


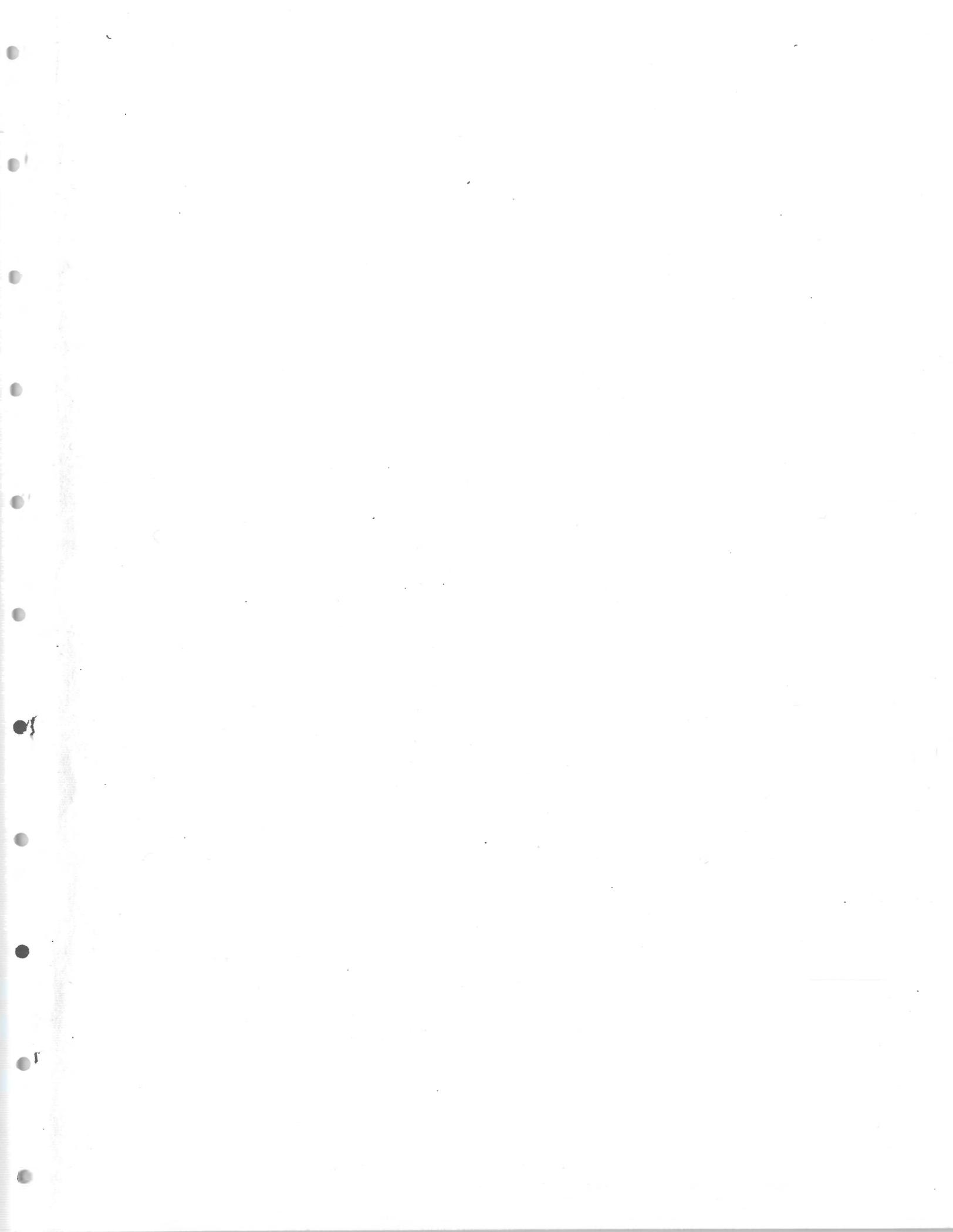
Nassau County 1998 Groundwater Study



Summary Report

Thomas S. Gulotta
County Executive





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John M. Waltz
Commissioner
Department of Public Works

1998
Camp Dresser & McKee

Cover

Top - A three-dimensional representation of Nassau County produced by our computerized groundwater model (see page 2-7 for description). The faint, green triangular-shaped sections correspond to the mathematical grid of the model, while the various colored layers represent the major aquifers and confining units.

Bottom - A topographical map of Long Island with Nassau County outlined in red.

Nassau County is totally dependent on groundwater for all its water needs. Because the groundwater supply is critically important to the health and well being of all County residents, it has been studied intensively over several decades.

In early studies, projections of dramatic population growth and of vastly increased demand for water raised serious questions about both the quantity and the quality of the water supply. "Would there be enough water to meet the growing demand?" and "Would the water remain safe to drink?" were common questions. Public concern grew as studies projected that demand would eventually exceed supply, and reported a trend in deteriorating groundwater quality as a result of on-site wastewater disposal systems.

This picture has changed markedly in recent years. To reduce groundwater contamination, the County began a comprehensive, multi-year program of installing sanitary sewer systems in the 1950s. By the mid-1980s, more than 90 percent of County residents and most commercial and industrial facilities were connected to these sanitary sewer systems. The sanitary sewers, along with public awareness and a broad range of federal, State and local regulatory programs, have greatly reduced the amount of contaminants entering the groundwater. As a result of the decrease in contaminants discharged to the ground, groundwater quality in the County has shown marked improvement in recent years and is expected to continue to improve.

Over the last several years, the County has

Groundwater Quantity — Supply Exceeds Demand

Over the past two decades, census figures have shown a stabilized County population and planners have revised their estimate of Nassau County's future population for the year 2010.

utilized computerized groundwater models to study its water resources. These efforts have led to a more accurate assessment of various issues and have enabled the County to determine that the groundwater resource, if properly managed, is more than sufficient to meet future water demand.

The groundwater system has tremendous ability to adjust to the stresses imposed by population growth and development. Increased rates of groundwater withdrawal and the installation of sanitary sewers have permanently

lowered the water table and changed groundwater flow patterns within the groundwater system. These changes have resulted in two environmental impacts. First, the lower water table is causing diminishing flows in streams and declining water levels in lakes, ponds, and freshwater wetlands. Some stream-

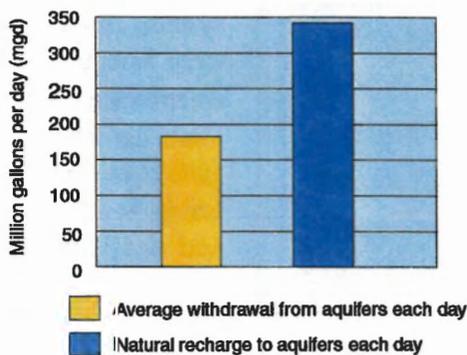
beds are now entirely dry except for stormwater runoff during and after rainfall events. Second, changes in the groundwater system caused by water supply withdrawal and the installation of sanitary sewers are contributing to intrusion of saltwater into portions of freshwater aquifers. This poses a threat to some water supply wells located near the shorelines in several public water supply systems.

The *1998 Groundwater Study* includes an evaluation of groundwater conditions through the year 2010. It is the first County-commissioned study to conclude that proper management of the County's groundwater resource will assure a safe and adequate water supply into the future.

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year 2010. Based on the stabilization of population and a relatively stable water demand pattern, Nassau County's water demand is expected to average about 180 million gallons per day (mgd) through the year 2010.

The groundwater system that supplies the County's water is continually being recharged at an average rate of 341 mgd. As long as recharge exceeds the amount of groundwater withdrawn for water supply, the quantity of groundwater available for public supply will be more than adequate. The balance of recharged water travels through the groundwater system and is ultimately



Natural recharge to the aquifers greatly exceeds the amount withdrawn for public water supply.

discharged to the surrounding saltwater bodies as streamflow or underflow.

Nassau County has pioneered the installation of recharge basins to collect stormwater runoff since the 1930s. The basins have proved invaluable in preventing flooding and in recharging the groundwater system. In fact, the recharge basins are responsible for a slight increase in recharge to the groundwater system when compared to that of pre-development times.

Current groundwater withdrawal, combined with the County's sanitary sewer system, have caused an average drop in the water table of 4 to 5 feet when compared to pre-development levels. This drop corresponds to a loss in storage of less than 1 percent when compared to all water stored in the groundwater system; certainly a negligible decline when considering the availability of groundwater for public water supply.

Nevertheless, groundwater withdrawal and the decline in water levels have caused localized environmental conditions that include diminished streamflow and saltwater intrusion. It is, therefore, important to continue to monitor groundwater withdrawal and implement appropriate actions to address the streamflow and saltwater intrusion problems.

Groundwater Quality — Has Improved and is Expected to Improve Further

The drinking water delivered to County residents by the public water suppliers meets all federal, State, and local standards for drinking water quality.

While all drinking water meets the quality standards, it is important to distinguish between raw groundwater and drinking water. The raw, or untreated, groundwater that is the source of the County's water supply may not always satisfy the quality standards for drinking water. In such instances, treatment is installed on public supply wells to remove any contamination that is present, thereby making the water suitable for public consumption.

The County, regulatory agencies, and water suppliers continue to take appropriate actions to ensure that safe drinking water is provided. To

protect public health, both the raw groundwater and the drinking water delivered to the consumer are continuously monitored. If contamination is found, corrective action is immediately taken by either installing treatment to meet the rigorous drinking water standards or by removing the water source from service. Because the cost to install and operate water treatment systems has only resulted in a very small increase in the cost of water to the consumer, drinking water throughout the County remains very affordable at an average cost of approximately \$2.00 per 1000 gallons.

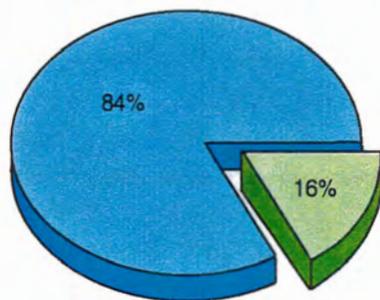
Fortunately, Nassau County's raw groundwater supply is of exceptionally high quality. The sandy materials that comprise the County's aquifers naturally filter out bacteria, viruses, and other undissolved contaminants that trouble other

water supplies. As a result of this natural filtering action, water from the majority of the County's public supply wells may be used without treatment for health related substances.

During the 1950s and 1960s, nitrate and detergent contamination were the major water quality problems facing the County. The main sources of these contaminants were on-site wastewater disposal systems and agricultural fertilization. With the decline in agriculture and installation of the County's sanitary sewer systems which serve over 90 percent of the County's population, nitrate and detergents have largely been eliminated as water quality concerns.

Since the 1970s, volatile organic chemicals (VOCs) have become the priority water quality issue in Nassau County. Although many VOCs are known or suspected human carcinogens, the VOCs found in the County's raw groundwater usually occur at low concentrations that are easily treatable. In 1994, water from 84 percent of the County's public supply wells met drinking water standards without treatment for VOCs. There are, however, several highly contaminated aquifer segments in localized areas of the County that are currently being addressed by the regulatory agencies.

The major sources of VOCs in the



- Public supply wells not treated for VOCs
- Public supply wells treated for VOCs

Nassau County's groundwater is of exceptionally high quality. Most public water supply wells require little or no treatment for VOCs.

Streamflow and Surface Water — A Condition that is Being Addressed

At the turn of the century, before Nassau County was extensively developed, streams were fed predominantly by groundwater seeping

groundwater are solvents, degreasers, gasoline, and other petroleum products that have been improperly disposed of or accidentally spilled. The sanitary sewers have virtually eliminated on-site wastewater disposal systems as a significant contributor of VOCs to the groundwater, in those areas serviced by sewers. Existing regulatory programs intended to reduce the amount of VOCs entering the groundwater include: underground storage tank testing and replacement, regulation of the use and disposal of hazardous materials, underground injection control, and STOP (Stop Throwing Out Pollutants) programs. These programs are very effective as evidenced by improving groundwater quality trends that have been observed in recent years. Such trends are expected to continue into the future as a further result of these programs.

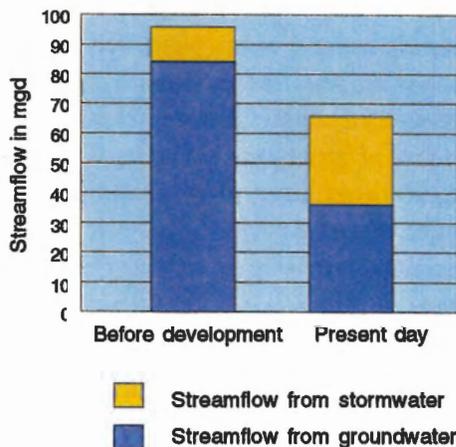
Testing conducted to date indicates that pesticides are not a significant problem in Nassau County groundwater. Pesticides have not been found in the overwhelming majority of monitoring wells tested to date. Although a few pesticides have been detected in the raw groundwater, concentrations have either been well below the drinking water standards or present at low levels that are easily treatable. Based on these findings, the absence of agriculture in Nassau County, and the regulations governing pesticide usage, pesticides are not expected to become a concern in Nassau County groundwater as testing continues.

It is beyond the scope of the 1998 *Groundwater Study* to make any connection between environmental factors and how such factors may relate to breast cancer incidence rates in Nassau County. This is a health issue that is being addressed by health officials. However, emphasis is made on the fact that the drinking water supplied to the residents of Nassau County by the various water suppliers meets all federal, State, and County health standards to assure drinking water quality.

continuously through the stream beds and stream banks. About 87 percent of the flow in the County's streams and water courses came from

groundwater with the remaining 13 percent from stormwater runoff. Today, most of the groundwater withdrawn for public use is discharged as wastewater into the sanitary sewer systems. It is then treated and discharged directly into the surrounding saltwater bodies. This has permanently lowered the water table, leaving many streams and ponds with little or no flow during dry weather. The problem is most acute on the south shore because of the longer stream lengths and flatter slopes characteristic of south shore streams. While streamflow in the north shore streams has declined over the years, the reduction has not been as dramatic since streambeds are typically shorter and steeper than along the south shore.

Almost half of all streamflow now comes from stormwater runoff during and following rainfalls. Stormwater flow is very different from groundwater flow and has changed the character of south shore streams and surface water features. Stormwater flow is intermittent, not



Replacement of groundwater flow by stormwater flow has completely altered the character of south shore streams.

Saltwater Intrusion — A Localized Condition

The fresh groundwater in Nassau County's aquifers flows naturally towards the Atlantic Ocean on the south shore and the Long Island Sound on the north shore, where it eventually encounters saltwater. The underground boundary where the fresh groundwater meets salty groundwater is called the freshwater/saltwater

interface. If the salty groundwater moves too far landward, it can contaminate water supply wells. If this should happen, expensive treatment systems would be needed to make the water drinkable again.

continuous like groundwater flow, and it tends to occur in swift, sporadic bursts, causing erosion and scouring of streambeds, and damaging the ability of the ecosystem to support aquatic plants and animals. Because stormwater is warmer than groundwater, and does not flow continuously, most south shore streams can no longer sustain fish populations of sensitive fish species such as trout.

Land development has drastically altered the composition and volume of streamflow in all County streams. Before development, stormwater represented only 13 percent of total streamflow. Today, stormwater is 46 percent of total flow. The groundwater portion of streamflow has decreased from 84 mgd to 35 mgd and total streamflow — from both sources — has decreased, from 97 mgd under natural conditions to 65 mgd today. Although saltwater wetland areas will nevertheless remain in spite of the reduction in streamflow, a pronounced effect has occurred at the northern reaches of streams and associated freshwater lakes and ponds along the south shore. The County is taking steps to cost effectively improve conditions since to do nothing would result in streamflow impacts within the next few years. These northern inland areas would continue to experience a loss of freshwater wetlands, associated wildlife habitats, and recreational and aesthetic value of parks that are centered around stream and pond features.

Many opportunities are available to enhance conditions in stream corridors. They range from simple, low-cost approaches, such as improved recharge of stormwater, to more costly and involved solutions, such as construction of instream control structures or relocation of water supply wells.

The position of the interface depends on the pressure of the freshwater and the saltwater

beneath the ground. If the freshwater pressure diminishes sufficiently, the interface moves landward. If the freshwater pressure increases sufficiently, the interface moves seaward. At present, saltwater is moving landward into the freshwater system in some areas while the interface is stable in other areas. The increase in water supply withdrawal that has occurred due to development has lowered the pressure significantly in certain localized segments of the groundwater system, thereby drawing the saltwater landward.

Landward saltwater intrusion is already occurring in southwest Nassau County and on the Great Neck and Manhasset Neck peninsulas on the north shore. In southwest Nassau County, thirteen public supply wells will be affected in about 50 years. These wells are primarily located within the Long Island Water Corporation service area; some are located in the area serviced by the Village of Rockville Centre.

Three public supply wells on the Great Neck peninsula have been closed and several others show rising chloride concentrations indicative of saltwater intrusion. The Water Authority of Great Neck North is addressing the problem by limiting withdrawal from certain wells, by seeking alternate well sites and by imposition of aggressive water conservation measures. On the Manhasset Neck peninsula, which is serviced by the Village of Sands Point and the Port Washington Water District, saltwater is near three well fields,

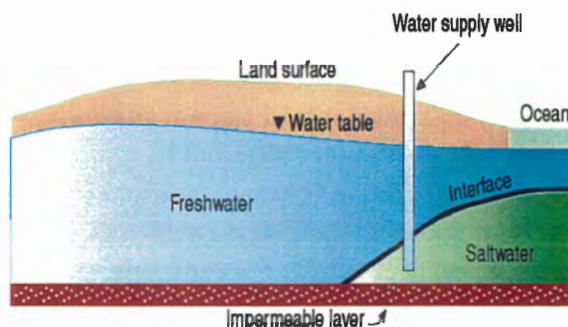
indicating that as many as nine public supply wells could be impacted in the future.

At the present rates of groundwater withdrawal, the aquifers will eventually reach a new equilibrium, and movement of the interfaces will cease. The County is using computer modeling and chloride measurements in monitoring wells to track the movement and positions of the interfaces, and is recommending solutions to saltwater impacts on public supply wells.

Several approaches exist for dealing with saltwater intrusion problems on both the north and south shores. These approaches include reducing withdrawal from public supply wells located near

the shorelines, relocation of affected wells with new wells located outside the zone of saltwater intrusion, purchasing water from adjacent water suppliers, and treating brackish water at the well.

Because the water suppliers are responsible for dealing with the effects of saltwater



If the freshwater/saltwater interface moves too far landward, saltwater can contaminate water supply wells, making the water undrinkable.

intrusion, they must decide on the appropriate course of action since each situation will be unique for their supply. The New York State Department of Environmental Conservation (NYSDEC) must concur in most, if not all, instances since withdrawal permits will need to be modified. Data from the County's monitoring wells and information from the computer models will greatly assist the suppliers in making the most cost-effective decisions. Regional approaches to the problem are not warranted at this time given the localized nature of the intrusion phenomena.

Recommendations

This Study has found that the County's groundwater system can sustain present and future water demand, although localized

streamflow, saltwater intrusion and water quality problems may occur in certain localized areas. Therefore, major actions recommended by

previous water management plans to address the predicted water supply deficiencies are not necessary. It is recommended, however, to continue existing programs for protecting the groundwater resource and to use and update the County's groundwater model to continue to manage the problems of streamflow reductions and saltwater intrusion.

Recommendations addressing water quantity include continued water conservation efforts by both the County and water suppliers and ongoing monitoring of groundwater withdrawal to track trends in water demand and changes in groundwater levels. Additionally, the County should, through use of the groundwater model, work in concert with NYSDEC to evaluate existing groundwater withdrawal patterns and any newly proposed public supply well sites. Revised groundwater withdrawal permits for the public water suppliers should consider variable water demand, saltwater intrusion and streamflow in setting allowable withdrawal rates.

Water quality recommendations include continued monitoring of groundwater quality and control of potential contamination sources through education and enforcement of existing regulations. Regulatory programs governing the use and disposal of hazardous chemicals should be strengthened in light of State and County work

force reductions that have occurred in recent years.

Under the County's streams and wetlands management programs, as well as federal and State programs, cost-effective measures should be taken in order to continue improving conditions at streams and other surface water bodies that have a high recreational and ecological value. Such measures include improved stormwater management practices, construction of instream control structures, and flow augmentation using shallow wells for critical stream reaches and wetland areas. The County's groundwater model should be used to investigate optimum pumping patterns for public supply wells to help minimize further declines in streamflow and surface water levels. The State, County and water suppliers can then use these results for determining possible changes in pumping patterns to enhance surface water conditions.

Saltwater intrusion recommendations include continued monitoring and study of saltwater movement along both the north and south shores through chloride measurement in monitoring wells, field investigations and use of the County's groundwater model. The County should continue to provide technical assistance to the water suppliers and NYSDEC in the assessment and management of localized saltwater intrusion problems.

