For Public Service
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Case No. 06-W-0131 **Witness: Dr. Daniel M. Miller**
Case No. 06-W-0244

STATE OF NEW YORK
PUBLIC SERVICE COMMISSION

IN THE MATTER OF A PROCEEDING ON MOTION
OF THE COMMISSION AS TO THE RATES, CHARGES,
RULES AND REGULATIONS OF

UNITED WATER NEW YORK, INC.

FOR WATER SERVICE

P.S.C. Case No. 06-W-0131
P.S.C. Case No. 06-W-0244

COUNTY OF ROCKLAND
DIRECT TESTIMONY
OF
DR. DANIEL M. MILLER

County of Rockland
11 New Hempstead Road
New City, NY 10956

For Public Service
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DR. DANIEL M. MILLER

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Q. Please state your name, title, affiliation and address.

A. My name is Dr. Daniel M. Miller. I am the Bureau Head for the Water Supply Bureau of the Rockland County Department of Health (RCDOH). My business address is the Dr. Robert L. Yeager Health Center, Sanatorium Road, Building D, Pomona, New York 10970.

Q. What are the duties of your employment?

A. As Head of the Water Supply Bureau, I am directly responsible for the staff that enforces Article II and Article V of the Rockland County Sanitary Code as well as portions of the New York State Sanitary Code that pertain to regulation of public water supplies,

specifically 10 NYCRR Part 5, Subparts 5-1 and 5-4. Reviews and actions taken by the Water Supply Bureau also affect broader mandates of the Rockland County Department of Health, for example implementation and enforcement of New York State Realty Subdivision laws, Article 11, Title II, Public Health Law and Article 17, Title 15, Environmental Conservation Law. The duties of the Water Supply Bureau include regularly testing the quality of the public water supply; regulating the operation, modification or expansion of public water treatment and distribution facilities; regulating the construction of private wells; and implementation and enforcement of Rockland County's private well testing law, § 389-5 of the Laws of Rockland County, New York.

Q. What are your qualifications to perform these duties?

A. I received a Bachelor of Science Degree in Earth Sciences from the University of North Carolina in Charlotte, NC in 1985. I then studied Geology at Columbia University in New York, NY, receiving a Master of Arts in 1987; a Master of Philosophy in 1990; and a Doctor of Philosophy in 1995.

Q. Do you have any Professional Affiliations relevant to your testimony?

A. Yes. I am a registered professional geologist, and a member of the National Ground Water Association, the American Water Works Association, the Geological Society of America and the Sigma Xi Scientific Honor Society.

Q. Please describe your professional experience.

A. During my tenure at Columbia University, I worked as a graduate research and teaching

assistant. I also worked for six months as a visiting scientist at the Max Plank Institute for Chemistry in Mainz, Germany. I began working as an environmental geochemist for EBASCO Environmental, Inc. (now Foster Wheeler Environmental Corporation) in 1991, and joined the Rockland County Department of Health in July of 2000.

Q. Please describe your relevant professional experience in more detail.

A. I have served as a geologist for the Rockland County Department of Health. I have been responsible for the design and coordination of environmental investigations conducted by the Rockland County Department of Health, and for review and oversight of investigations and remedial actions conducted within the County under direction of the NYS Department of Environmental Conservation (NYSDEC) and the U.S. Environmental Protection Agency. I have also conducted hydrogeological assessments related to protection and maintenance of public and private potable water supplies, including development of new rule curves for the Ramapo Valley Well Field (RVWF) to trigger water use restrictions under Article V of the Rockland County Sanitary Code. I am often called upon to prepare technical reviews for both the executive and legislative branches of the County government, and I serve as point-of-contact for public inquires regarding geology and hydrology and water supply issues.

In the nine years prior to my employment with the County, I worked for Foster Wheeler Environmental on a wide range of investigation and remediation projects, most of which required a detailed understanding of hydrogeologic principles and practices.

My role on these projects covered all phases of work, from initial scoping and design of investigative programs, through field implementation and oversight, to data interpretation and report preparation. During my last few years at Foster Wheeler I served primarily as a project manager, but still maintained a technical role on several projects, providing data interpretation and modeling support.

Q. Does your curriculum vitae, which is attached as Exhibit DMM-0 fairly and accurately represent your experience in water supply systems to date?

A. Yes.

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to describe the water supply situation in the United Water New York (UWNY) service area in Rockland County. My focus is on the demand for water, the current capacity of UWNY to supply that demand, the water supply projects needed to meet demand projections and the effectiveness of constructed and proposed capital projects identified in support of the motion for rate increase in meeting the water supply needs of Rockland County residents.

In addition to water demand and supply and their implication for the County and United Water's capital plans, I will discuss certain operations within the United Water New York system and their relationship to the requirements of the Rockland County Sanitary Code as they apply to United Water New York.

Q. Can you describe the demand for water in Rockland County?

A. Water demand is typically evaluated in two different ways. The first is with regard to peak demand. Peak demand describes the demand for water over relatively short periods, during which the need for water is greater when compared with the balance of the year. Peak demand is typically discussed as a rate that water is being used in terms of millions of gallons per day (MGD). In some cases, for example when evaluating the adequacy of a water transmission or distribution system to carry water for fire protection, the instantaneous peak rate of water use is relevant. In other cases, for example when evaluating the adequacy of available supply to meet increased seasonal demand, the largest quantity of water used within a single day in a given year, referred to as the "maximum day" demand, is more relevant.

The second way of looking at water demand is with regard to average demand. Average demand is a convenient way of discussing a sustained demand on water resources over an extended period of time, typically one year. Annual average demand is derived by taking the total quantity of water used over a one-year period and dividing by the number of days to yield a mean or average demand number. Like peak demand, annual average demand is typically expressed as a rate that water is being used in terms of millions of gallons per day (MGD).

Historical maximum-day demand in Rockland County is illustrated in Exhibit DMM-1. Data from 1970 through 1999 are from the UWNY 2000 Master Plan. Data for years following 1999 are from UWNY reports submitted to the Rockland County

Department of Health. The graph in Exhibit DMM-1 shows that while there is substantial variation in maximum-day demand from year to year, such demands have generally increased from 1970 through the present. A linear regression through the historical data, represented by the heavy black line on the graph in Exhibit DMM-1, is a convenient mechanism to display the overall trend in maximum-day demands, and can be extrapolated to project the most probable maximum day demand in future years. The linear regression, or "best fit" to historical data has increased from approximately 34 MGD in 1970, to approximately 38 MDG in 1990, and to approximately 42 MGD in 2005. Projecting this regression into the future results in a most probable maximum day demand of 43 MDG in 2007; 43.5 MGD in 2010; 44.7 MGD in 2015; and 45.9 MGD in 2020. While these projections illustrate the general trend of increasing maximum day demand, such a regression is not appropriate to use for planning purposes. The maximum day demand is higher than the regression approximately 50% of the time, sometimes substantially higher. For example, in 2001, the regression would suggest a most probable maximum day demand of approximately 41 MGD. The actual was 46.5 MGD.

In order to address this variation in maximum day demand, the graph in Exhibit DMM-1 also shows the result of a statistical evaluation that defines the likelihood that future demands will fall between a high and low limit for any given year. For example, there is an 80% chance that future maximum day demands will fall between the red lines labeled "Upper Limit of 80% Interval" and "Lower Limit of 80% Interval," a 10%

chance that future maximum day demands will be higher than the 80% interval, and a corresponding 10% chance they will be lower than the 80% interval.

Similarly, there is a 90% chance that future demands will fall between the orange lines labeled "Upper Limit of 90% Interval" and "Lower Limit of 90% Interval," a 5% chance that future maximum day demands will be higher than the 90% interval, and a corresponding 5% chance they will be lower than the 90% interval.

It is important to note that years where the annual maximum-day demand was artificially reduced, either by mandatory water use restrictions or by requests for voluntary reductions in use, have not been included in this analysis. Such artificially reduced demands do not accurately reflect normal conditions, and if included in the statistical evaluation, would result in an inaccurate projection of future demands.

United Water New York, using a different methodology, has projected its peak demand for 2006 to be between 47.5 and 48.1 MGD This range is very similar to the Upper80 and Upper90 values for 2006, which are 47.35 and 48.76 MGD, respectively.

Exhibit DMM-1 also shows UWNY's projected peak demands through 2020. The higher rate of increase relative to that previously observed is likely due to the style of development recently experienced in Rockland, i.e., large single-family homes with extensive landscaping and irrigation systems. Note, however, that the UWNY projections are still within the 99% confidence interval based on historical demand.

Average demand in Rockland County is illustrated in Exhibit DMM-2. Data from

1970 through 1999 are from the UWNY 2000 Master Plan. Data for years following 1999 are from UWNY reports submitted to the Rockland County Department of Health. As with the illustration of historical maximum-day demands, a linear regression has been used to represent the overall trend in average demand. In this case, the regression considers only data from 1981 through the present, because the introduction of water conserving plumbing fixtures in 1980 significantly changed the rate of increase in average demand.

Average demands have increased from approximately 20 MGD in 1970, to approximately 27 MGD in 1990, and to approximately 31 MGD in 2005. Projecting this regression into the future results in a most probable annual average demand of approximately 32 MDG in 2007; 32.5 MGD in 2010; 33 MGD in 2015 and 34 MGD in 2020. While this projection illustrates the general trend of increasing average demand, it does not account for the substantial variation in demand from year to year. In fact, the average demand is higher than the regression approximately 50% of the time. For example, as discussed above, the regression illustrates that the most probable average demand for 2005 was approximately 31 MGD, while the actual was 31.7 MGD.

In order to address this variation in average demand, the graph in Exhibit DMM-2 also shows the result of a statistical evaluation that defines the likelihood that future demands will fall between a high and low limit for any given year. For example, there is an 80% chance that future average demands will fall between the red lines labeled

"Upper Limit of 80% Interval" and "Lower Limit of 80% Interval;" a 10% chance that future average demands will be higher than the 80% interval; and a corresponding 10% chance they will be lower than the 80% interval.

Similarly, there is a 90% chance that future average demands will fall between the orange lines labeled "Upper Limit of 90% Interval" and "Lower Limit of 90% Interval;" a 5% chance that future average demands will be higher than the 90% interval; and a corresponding 5% chance they will be lower than the 90% interval.

United Water New York, using a different methodology, has projected average demands between 31.2 and 32.9 MGD for 2010, 32.4 and 33.7 for 2015 and 33.3 and 34.9 for 2020. The upper limits of UWNY's projected ranges, also shown on Exhibit DMM-2, are substantially lower than the upper limit of the 80% confidence interval. This suggests that UWNY's projection does not adequately account for the year-to-year variation, and that there is more than a 10% chance that the actual future demands will exceed the maximum values UWNY has used for planning purposes.

Q. Can you describe Rockland County's water supply?

A. There are 92 public water supplies regulated by the Rockland County Department of Health with approximately 200 sources of water. Private home owners operate an estimated 6,000 to 8,000 wells used for drinking water. There are a number of industrial and commercial water users who operate their own wells for production and non-contact cooling water. In addition, there are a number of private homes, commercial facilities,

nurseries and golf courses that operate their own wells solely for irrigation.

There are four large public water supply systems in the County. United Water New York is the largest, serving approximately 90% of all Rockland County residents. The Villages of Nyack, Suffern and Hillburn each operate their own retail water systems. Hillburn buys its water from United Water New York and so is dependent upon UWNY supply capacity.

Q. Where does United Water New York's water come from?

A. Most of UWNY's water, about 50%, comes from bedrock wells distributed throughout Rockland County. About 20% comes from the Ramapo Valley Well Field, which is located immediately adjacent to the Ramapo River. Another 30% comes from Lake DeForest, a surface water reservoir.

Q. How much water supply is available from UWNY to meet demand?

A. Like water demand, water supply is typically evaluated in two ways, peak supply and average supply.

Peak supply capacity describes the ability of the system to deliver high volumes of water over relatively short periods of time. A number of factors limit the period over which peak supply can be sustained. Peak supply is typically discussed in terms of millions of gallons per day. Peak supply capacity essentially provides a snapshot of how much water can be produced as a maximum, over a very short period - typically only a few days.

UWNY's "normal" peak supply capacity is currently 44.5 MGD. For a very short period, (UWNY claims three days), it is possible for UWNY to supply an additional 3.0 MGD from the Ramapo Valley Well Field. That is to say, UWNY's total peak supply capacity is 47.5 MGD. Exhibit DMM-3 illustrates peak supply capacity from 1990, projected through 2019 on the basis of UWNY's proposed projects. Peak supply capacity is projected to be 48.26 MGD later in 2006; 50.46 MGD in 2007; 51.96 MGD in 2008; 54.46 MGD in 2010 and 59.46 MGD in 2019. Exhibit DMM-4, Engineer's Report for Proposed Expansion of United Water New York's Distribution System Due to the MWD Rt. 9W Golf Subdivision, February 10, 2006, Attachment C, presents a list of UWNY's proposed projects and their projected completion dates. Since the NYSDOH has recently clarified that the Letchworth Water Treatment Plant will only be allowed to operate at 0.4 MGD until additional modifications are proposed, reviewed, approved and constructed, that facility is counted for only 0.4 MGD in the projections shown in DMM-3, rather than 3.0 MGD as proposed by UWNY in DMM-4. If the Letchworth project fails to receive all required permits, or if any of the other proposed projects are delayed, fail to obtain the required permits, are not built or otherwise fail to achieve operation as and when planned, then peak supply will be less than projected.

On the basis of UWNY's assessment, average sustainable UWNY system supply capacity is currently 32 to 34 MGD. Of that, 10 MGD is from Lake DeForest; 7 to 8 MGD is from the Ramapo Valley Well Field, and 15 to 16 MGD is from the bedrock

wells. The actual average daily water demand for 2005 was 31.06 MGD. Exhibit DMM-5 illustrates average sustainable supply capacity from 1990, projected through 2019 on the basis of UWNY's proposed projects. Exhibit DMM-5 is based on information in the UWNY 2000 Master Plan and the Engineer's Report for Proposed Expansion of United Water New York's Distribution System Due to the MWD Rt. 9W Golf Subdivision, February 10, 2006, Attachment C, which is presented as Exhibit DMM-4. Since the NYSDOH has recently clarified that the Letchworth Water Treatment Plant will only be allowed to operate at 0.4 MGD until additional modifications are proposed, reviewed, approved and constructed, that facility is counted for only 0.4 MGD in the projections shown in DMM-5, rather than 1.0 MGD as proposed by UWNY. If the Letchworth project fails to receive all required permits, or if any of the other proposed projects are delayed, fail to obtain the required permits, are not built or otherwise fail to achieve operation as and when planned, then peak supply will be less than projected. Average supply capacity is projected to be 32.76 to 34.76 MGD later in 2006; 33.46 to 35.46 MGD in 2007; 35.96 to 37.96 MGD in 2008; and 40.96 to 42.96 MGD in 2019.

Q. What factors limit UWNY's ability to sustain peak supply capacity?

A. Peak supply capacity is limited by a variety of factors, including limitations on the fundamental water resource, i.e., surface water or ground water that is available to be diverted, treated and used for potable supply. The groundwater resource in most areas within Rockland County has largely been developed to its full potential. In some cases,

the close spacing of UWNY's production wells already results in interference between wells that limits their actual production capacity. In other words, the drawdown of the aquifer level resulting from one well extends into the portion of the aquifer tapped by an adjacent well, reducing the amount of water that can be withdrawn.

NYSDEC water allocation permits also impose limitations on UWNY's use of the waters of New York State. For example, most production wells have an annual average limit on the rate of ground water withdrawal. Some well fields, e.g., the Ramapo Valley Well Field, have additional limitations based on their affect on Ramapo River stream flow. A portion of the water produced by the pumping of the RVWF is derived from induced infiltration of surface water in the Ramapo River. In other words, pumping the wells draws water from the river. Thus, the flow rate in the river can be reduced by production of water from the RVWF. As a result, the NYSDEC water allocation permit for the RVWF requires that production of water from the RVWF be halted when flow in the river drops below 8 MGD.

Surface water reservoirs also have NYSDEC permit limitations on the amount of raw water that can be used. Surface water treatment plants must also have permits from the New York State Department of Health which specify their treatment capacity, i.e., the maximum rate at which they may be operated.

Rockland County is somewhat unique in that nearly all of the water available for our use is derived from precipitation that falls within our borders. As a result, periods of

lower than average precipitation can result in additional, temporary reductions in the fundamental water resource. Lack of precipitation reduces both the recharge of the ground water reservoir, or aquifer, and the refilling of surface water reservoirs.

Q. Is UWNY's supply capacity adequate to satisfy demand?

A. UWNY has an immediate problem in satisfying peak demand. UWNY's projected maximum-day demand for 2006 is 47.5 MGD. UWNY's total current maximum-day supply capacity is 47.5 MGD. The system's "normal" peak capacity is 44.5 MGD, or 3.0 MGD short of peak demand.

Exhibit DMM-1 shows peak demand over a number of years. Exhibit DMM-3 shows UWNY peak supply capacity over the same number of years and compares it to both historical and projected peak demand. This chart clearly illustrates that the available peak supply capacity is inadequate to reliably supply Rockland's peak demand.

UWNY has generally been able to meet the historical short-duration peaks, albeit with reduced water quality, by overpumping some of their bedrock wells and/or by requesting either mandatory or voluntary water conservation measures. Overpumping often results in air being entrained in the water distributed to customers. During these periods, the RCDOH receives a barrage of complaints from County residents related to entrained air, which typically manifests as a "milky" appearance as dissolved air comes out of solution. While customers find the milky appearance disturbing, it does not produce any deleterious health affects. However, in the summer of 2005, the air

entrainment problems were so severe that water mains became “air locked” in some portions of the UWNY service area, which compromised fire fighting capabilities and left at least 10 homes with no water service.

As discussed above, UWNY can also request that demands be reduced via either mandatory or voluntary conservation measures when their supply capacity is not adequate to meet unrestricted demand. This situation can result from drought conditions reducing the fundamental water resource available for water supply. However, it is important to note that NYS regulations, §3.1.1, Recommended Standards for Water Works, 2003 Edition, incorporated by reference in 10 NYCRR Part 5, Subpart 5-1.22, require that for a surface water supply the quantity of water at the source shall be adequate to meet the maximum projected water demand of the service area as shown by calculations based on a one in fifty year drought, or the extreme drought of record, and should include consideration of multiple year droughts; and provide a reasonable surplus for anticipated growth. A similar standard for ground water supplies, §3.2.1.1, Recommended Standards for Water Works, 2003 Edition, states that the total developed ground water source capacity, unless otherwise specified by the reviewing authority, shall equal or exceed the design maximum day demand with the largest producing well out of service. The RCDOH analysis of maximum day demand and peak supply shows that UWNY has not met this standard in recent years. Rather, UWNY has depended upon the availability of mandatory water use restrictions pursuant to Article V of the

Rockland County Sanitary Code instead of developing adequate peak supply capacity.

Consistent with the Recommended Standards, UWNY should be able to meet peak demand without compromising water quality at least 90% of the time (i.e., with available supply capacity equal to or above the upper limit of the 80% confidence interval on Exhibit DMM-3). On this basis, UWNY's peak supply capacity has not been adequate since at least 1990. (RCDOH has not compiled supply capacity information for earlier periods).

A similar, but less immediate problem exists on an average supply and demand basis. As I've mentioned before, UWNY reports an average sustainable system capacity of 32 to 34 MGD. The actual annual average demand for 2005 was 31.06 MGD. Thus, for 2005, the average supply was only 0.94 to 2.94 MGD higher than the actual demand. UWNY has projected increases in average demand to 31.2 - 32.9 MGD in 2010; 32.4 - 33.7 MGD in 2015; and 33.3 - 34.9 MGD by 2020. However, these projections do not adequately account for the year-to-year variation in average demand, since they lie well below the upper limit of the 80% confidence interval on Exhibit DMM-2.

Exhibit DMM-2 shows average demand over a number of years. Exhibit DMM-5 shows UWNY's average supply over the same years and compares it to historical and projected demand. On the basis of recent operational experience, UWNY has revised their assessment of the long -term sustainable capacity of their bedrock wells (15 to 16 MGD, versus 19.91 MGD reported in the 2000 Master Plan). These revised capacities

were discussed with the RCDOH during the summer of 2005, and are formally reported in the Engineer's Report for Proposed Expansion of United Water New York's Distribution System Due to the MWD Rt. 9W Golf Subdivision, February 10, 2006, Attachment C, which is presented as Exhibit DMM-4. The available total average capacity of 32 to 34 MGD must now be regarded as either insufficient or marginal, depending upon whether one considers the lower or higher assessment. Even these more recent assessments of system well capacity may be overly optimistic, given that there were problems with overpumping in the summer of 2005 when the annual average supply rate produced from the system wells was only 13.72 MGD. However, if we accept UWNY's lower, presumably more conservative, assessment, there is still more than a 10% chance that demand will exceed supply in 2007 and thereafter, unless UWNY increases its actual permitted and operational supply capacity.

Q. What happens when supply isn't adequate to meet demand?

A. The Rockland County Department of Health has promulgated mandatory water conservation regulations that curtail the legal use of water under certain circumstances. There are five levels of water emergency and five levels of water use restriction.

The various levels of water restrictions are triggered based on any one of several factors, including the amount of precipitation over a two-month to 12-month period; the amount of water remaining in Lake DeForest, UWNY's primary surface water reservoir; and the amount of water remaining in Potake Pond, used to augment flow in the Ramapo

River. In addition, the Commissioner of Health may institute water use restrictions in order to avert a public health emergency, which would result if UWNY was unable to maintain adequate pressure in their distribution system. This could occur if UWNY's supply capacity is insufficient to meet the demand within their service area. Water use restrictions codified in Article V of the Rockland County Sanitary Code range from Stage I, which is referred to as a "Drought Watch," to Stage V, which is referred to as a, "Severe Drought Emergency."

During a Stage I Water Emergency, restaurants cannot serve water unless a patron asks for it. Ornamental water uses, such as fountains, must be turned off unless they use recycled water. Sewers and hydrants can't be flushed unless it is immediately necessary to protect public health and safety. Lawn watering is limited to certain days and hours and is banned entirely if there has been an eighth of an inch of rain in the preceding 24 hours. Export of water outside the County is prohibited. All water leaks must be repaired within 48 hours. If the Stage I Emergency lasts 30 days, all commercial and industrial users must submit a water conservation plan to the RCDOH.

During a Stage II Water Emergency, all the prohibitions and requirements of a Stage I Emergency apply. In addition, nursery and golf course irrigation is limited to 90% of average monthly use. Washing of non-public paved surfaces e.g., patios, sidewalks, driveways, is prohibited. Non-commercial washing of vehicles is prohibited and commercial vehicle cleaning is limited to 90% of average monthly use, as is all

commercial and industrial water use.

During a Stage III Water Emergency, all the prohibitions and requirements of the Stage I and Stage II Water Emergencies apply. In addition, washing of all paved surfaces, including roads, is prohibited. Golf course and nursery irrigation is limited to 80% of average monthly use, as is commercial vehicle washing and the commercial use of water or steam for the clearing of building exteriors (including decks) and all other commercial and industrial use. Watering public athletic fields, landscaping and non-agricultural gardens is limited. Lawn sprinkling is prohibited as is the non-commercial use of water or steam for deck cleaning or cleaning of other building or structure exterior; and the refilling of recreational swimming pools is also limited as is use of non-recycled water for commercial vehicle washing.

During a Stage IV Water Emergency, all the prohibitions and requirements of Stage I, II and III Water Emergencies apply. In addition, a wide range of water uses are limited to 75% of their average monthly use. These include all commercial and industrial water uses; golf course and nursery irrigation; commercial cleaning of building exteriors; and the commercial cleaning of vehicles.

The filling of swimming pools, irrigation of landscaping and non-agricultural gardens is limited. The use of water from any stream, creek or other surface supply is prohibited, as is watering public athletic fields and the use of non-recycled water in water-cooled air conditioning units. Fountains and other ornamental water uses must be

shut down.

During a Stage V Water Emergency all the prohibitions and requirements of Stage I through IV Water Emergencies apply. Residential water usage is restricted to 50 gallons per resident per day or to 70% of average winter use. Agricultural uses are prohibited in excess of the average daily consumption for the preceding 12 months. Use of swimming pools and ice rinks is prohibited, as is the irrigation of landscapes and non-agricultural gardens; the use of water for cleaning building exteriors; and the use of even recycled water for washing vehicles. Watering of golf course greens by hand is limited to once per day. Nursery irrigation is limited to 2 hours per day.

This system of water use restrictions, including the specific criteria for declaration of each stage, is fully described in Article V of the Rockland County Sanitary Code, Exhibit DMM-6.

Q. How often are water emergencies declared?

A. Requests for voluntary conservation were made in 1981, 1982, and 1985, before Article V of the Rockland County Sanitary Code was promulgated. Since then, the RCDOH has operated in an intense "observation" mode during the summers of 1991, 1993, 1995, 1997, 1999, 2001, 2002, and 2005, during which we track demand, precipitation and reservoir levels on a daily basis in preparation for the potential declaration of a water emergency. Mandatory Water use restrictions were actually declared pursuant to Article V in 1995, 1999 and 2002.

Q. What else happens when supply isn't adequate to meet demand?

A. Beyond the imposition of legally mandated use restrictions, there are other serious consequences of inadequate peak supply capacity. For example, the maximum day demand in 2005 occurred on August 5th, before a two-month dry period. Maximum day demand reached 43.5 MGD. Lake Deforest was at 86% of full capacity, Potake Pond was at 92% full capacity, and UWNY's peak supply capacity was supposed to be at least 44.5 MGD. Therefore, none of the criteria for declaration of water use restrictions on the basis of precipitation or source capacity had been met. Nonetheless, emergency measures were required to maintain the integrity of the water system. Emergency pumps and fire hoses were used to re-route water to areas where the installed water system couldn't deliver an adequate supply.

In September of 2005, also prior to meeting the criteria for declaration of mandatory water use restrictions, overpumping some wells to meet system-wide demand resulted in significant entrained air in the water produced. Water mains in some areas of the county became completely air locked and residents were left with no water service and no fire protection. The Letchworth Water Treatment Plant, which was not yet ready for full-scale operation, was pressed into service in a "pilot" mode to produce desperately needed water.

We received complaints regarding problems with air entrainment from at least 38 residential customers, 10 of which reported that they had no water service at all. Air

entrainment is the inclusion of "excess" air in the distribution system, more air than will remain in solution at a given pressure. It tends to be more of a problem when water levels in portions of the aquifer are depleted by overpumping. Portions of the aquifer that are usually saturated with water are dewatered or partially dewatered. Additional air is therefore mixed into the water that flows through these dewatered zones and recharges the deeper portions of the aquifer from which supply wells are taking water. Water can dissolve more air when it is under higher pressure. Therefore, water that has a large percentage of dissolved air when it is pumped from great depths within the aquifer, may release that air in the form of bubbles when the water flows through the distribution system and pressure is reduced. A relatively small quantity of entrained air will produce an objectionable "milky" appearance when it comes out of the tap, for example to fill a glass, and reaches atmospheric pressure. However, larger amounts of air may be released as bubbles at pressures which occur within the distribution system, and can result in intermittent spurts of air being delivered to the tap. In the extreme case, portions of the distribution system can become completely filled with air, or "air locked," and no water will be delivered to the customer's tap, or to fire hydrants.

Q. Does the margin between demand and UWNY system supply capacity have implications for public health and safety?

A. Loss of pressure in the distribution system, which can happen as a result of inadequate supply capacity, can have deleterious effects on public health for a variety of reasons.

First, water will not be available for culinary and general sanitation uses, e.g., preparing food, washing dishes and flushing toilets. Second, a loss of pressure in the distribution system can allow infiltration of bacteria-laden or otherwise contaminated surface water and/or shallow ground water, rendering whatever water may be left in the system unpotable.

In addition to public health issues, lack of pressure in the UWNY distribution system would severely compromise fire-fighting capabilities in Rockland County, resulting in extreme public safety risks.

Q. In your professional opinion is UWNY consistently capable of delivering an adequate and reliable supply of water to Rockland County?

A. No.

Q. In your professional opinion is UWNY consistently capable of delivering a safe supply of water?

A. In terms of water quality, yes. Temporary reductions in water quality during periods of high demand have not, to my knowledge, compromised the safety of the water supplied. In terms of safety issues that can result from an inadequate supply capacity, I would have to say that UWNY's system-wide capabilities are marginal, and that there may already be safety issues, e.g., deficiencies in fire-fighting capabilities, in localized areas. If any of the short-term projects that UWNY has proposed to increase supply capacity are significantly delayed for any reason, safety issues will become more wide spread.

Q. Does the margin between demand and UWNY supply system capacity have implication for the economy of Rockland County?

A. Mandatory water use restrictions, if implemented, apply to commercial and industrial water users as well as residential users. For example, declaration of Stage I water use restrictions requires all Commercial/Industrial users to submit a revised Water Conservation Plan. Stage II requires them to cut water use by 10%, Stage III by 20 %, Stage IV by 25% and Stage V by 30%. Some industries, e.g., nurseries/landscape companies, golf courses, pool companies, and car washes may be particularly hard hit by the more severe stages of water use restrictions.

Q. Are there other effects resulting from the margin between demand and UWNY supply system capacity?

A. Not having enough water to meet demand also has other wide ranging and serious long term implications for the County as a whole. Lack of adequate water supply may soon result in severe limitations on growth and economic development in the County.

The Rockland County Department of Health functions as an agent of the New York State Department of Health to implement and enforce certain Public Health laws related to water supply and realty subdivisions, including 10 NYCRR Part 5 (New York State Sanitary Code) and Article 11, Title II of the Public Health Law (Realty Subdivision Law). As such, before the RCDOH can issue an approval for expansion of the UWNY distribution system, it must be demonstrated that there is adequate supply

capacity to serve not only the proposed expansion, but to do so while meeting the standards for service in the entire system. Furthermore, for RCDOH to grant approval for a major subdivision, the applicant must demonstrate that there will be an adequate and satisfactory water supply. Therefore, if a proposed subdivision is dependent upon expansion of the UWNY system to provide an adequate water supply, subdivision approval will also be contingent upon RCDOH approval of UWNY's ability to demonstrate an adequate supply capacity. Because there are often delays, many of which are unavoidable, in the permitting and/or completion of planned water supply projects, only fully permitted and operational water supply sources can be considered. RCDOH now requires an engineering report for any water system expansion. That report must provide a substantiated estimate of the additional peak and average demand that would result from the proposed project and must show that there is sufficient peak and average supply capacity available to meet the additional demand. Moreover, the system expansion report must show that the new development can be adequately served without adversely affecting the ability of the entire water system to meet state standards. With each expansion of the water distribution system, it becomes more difficult to show that there is adequate supply capacity to meet peak and average water demand.

The margin between demand and supply capacity is now so small that RCDOH is tracking all new additions to the system to monitor their peak demand and their effect on system performance.

Q. Is there a plan to address water supply capacity?

A. In 2000, UWNY published a 20 year Master Plan. Exhibit DMM-7 is a copy of the UWNY Master Plan (hereinafter, 2000 Master Plan). The 2000 Master Plan identified approximately $50 million in capital projects that would be required over the following 20 years to build supply, storage and transmission projects. Six major water supply projects aimed primarily at increasing peak supply capacity were proposed. Five of these projects were scheduled to be completed between 2000 and 2003, with a combined projected increase in peak capacity of 8.9 MGD. To date, the total net increase in peak capacity resulting from these proposed projects has been 3.4 MGD, only 38% of the projected increase.

Acquisition of Potake Pond, combined with construction of an air stripper at the Ramapo Valley Well Field, was proposed to ensure an additional 3 MGD of peak supply capacity from the RVWF. Potake Pond is located in the Ramapo River watershed and forms the headwaters of Nakoma Brook, which is tributary to the Ramapo River. Potake Pond has a volume of approximately 800 million gallons (MG). In 2000, UWNY had rights to release water from Potake and adjacent Cranberry Pond to augment flow in the Ramapo River. These releases are necessary in order to operate the RVWF during dry summer periods, which is located adjacent to the Ramapo River and downstream of the two ponds. According to a New York State Department of Environmental Conservation permit that incorporates a stipulation with the State of New Jersey, UWNY can only

operate this well field when flow in the Ramapo River is above 8 MGD measured at a gauging station in the Ramapo River. If flow in the Ramapo River drops below 8 MGD, the RVWF must be shut down and UWNY loses approximately 20% of its supply capacity. Hence, river flow augmentation is critical to system supply.

These augmentation rights were insufficient to ensure full use of the RVWF throughout the year. By acquiring Potake Pond and obtaining a water supply permit to release water from the upper 10 feet (approx. 300 MG, 110 MG more than previously available), UWNY expected to increase the reliable summer yield of the RVWF from approximately 5 to 8 MGD, through flow augmentation to the Ramapo River.

UWNY also planned to construct an air stripper unit at RVWF in 2000. Its purpose would be to remove trichlorfluoromethane contamination caused by a nearby refrigerant recycling facility. The air stripper was thus meant to ensure that limitations on pumping individual wells within the RVWF would not reduce the available peak supply capacity.

To date, UWNY has acquired Potake Pond, acquired a permit to release only 190 MG from Potake (in lieu of 190 MG from Potake and Cranberry combined), and constructed the air stripper to treat water produced from the RVWF. There is no additional water available for augmentation. Furthermore, as a result of additional operating experience and improved modeling, UWNY's assessment of the reliable maximum day capacity of the RVWF has been reduced from 5 MGD to 4 MGD.

Therefore, while a 3 MGD increase was planned, a 1 MGD decrease has occurred.

UWNY also proposed to acquire the Letchworth Water System. Letchworth is a former state facility located in northern Rockland County with its own water system. Water supply originates from three (3) reservoirs located in Harriman Park. The 2000 Master Plan stated that the Letchworth system would provide an average yield of 1.0 MGD with peaking capacity up to 1.5 MGD. To date, UWNY has secured a lease agreement for water rights and operation of the water treatment plant and received an endorsement from the New York State Department of Health to operate the treatment plant under the existing permit, with a treatment capacity of 0.4 MGD. They still await a water allocation permit from the New York State Department of Environmental Conservation to allow use of raw water from the Letchworth reservoirs. Consequently, UWNY currently has no additional average or peaking capacity as a result of the Letchworth acquisition. Furthermore, even upon receipt of the water allocation permit, this system will add only 0.4 MGD rather than the planned 1.5 MGD of peak supply capacity. Additional modifications to the treatment plant will be required to increase the treatment capacity to 1.5 MGD.

The addition of water treatment systems to two (2) high production wells, for air entrainment in Viola 106, and for volatile organic constituents in Nanuet 14, was completed as planned in 2001 and 2003, respectively, resulting in an additional 1.4 MGD of peak supply capacity.

UWNY also planned and constructed a major upgrade of the Lake DeForest Water Treatment Plant in 2003. This project was required primarily to address new federal surface water treatment standards, which could not be met with the earlier plant configuration. In the 2000 Master Plan, UWNY reported that the Lake DeForest Plant could reliably be operated at only 17 MGD, compared to the 20 MGD peaking capacity reported in 1990. In 2002, after the New York State Department of Health conducted a comprehensive performance evaluation at the Lake DeForest water treatment plant, the maximum treatment capacity was further reduced to 10 MGD. Therefore, completion of the system upgrades in 2003 became critical for UWNY to meet even moderate summer water demands. At present, the Lake DeForest water treatment plant is permitted to operate at a peak rate of 20 MGD, but is still limited to an annual average production rate of only 10 MGD. These permitted capacities represent a 3 MGD increase in peak supply capacity over that reported in the 2000 Master Plan. However, they are identical to those reported in UWNY's 1990 Master Plan.

Since the early 1980's, UWNY has planned to construct a major water supply project at the Ambrey Pond site. Construction of the Ambrey Pond reservoir was proposed in a permit application in 1979, and was approved for construction by the New York State Department of Environmental Conservation in 1987. [2000 Master Plan, page 1-6] In the 1980's, water demand trends strongly indicated the need to construct this project in the 1990's. Even in the previous 1990 Master Plan, it appeared that the

Ambrey project would be required in early 2000. In 2000, however, instead of building the planned Ambrey Pond project, UWNY changed the plan to a project considerably smaller than the originally conceived Ambrey project and put off the construction date to 2010. The original project involved construction of a 2.0 billion gallon (BG) reservoir with two dams, and would yield approximately 12 MGD in additional supply capacity. The Modified (smaller) Ambrey Pond project (MAP) would entail the construction of a new water treatment plant (WTP) at the Stony Point plant site; construction of a 300-MG reservoir with a single dam, and a gravity diversion from Tiorati Brook to Ambrey Pond. MAP would provide a peak supply capability of about 4 MGD [2000 Master Plan, page 1-6].

The original "trigger" to begin development of the Ambrey Project was for UWNY's average demand to exceed 27.9 MGD for two consecutive years. This trigger was formally adopted in the January 6, 1987 decision of the NYSDEC approving an application to construct the Ambrey Project. In 1993, UWNY submitted to NYSDEC a letter and supporting documentation requesting that the Ambrey trigger be changed from exceeding the average of 27.9 MGD for two consecutive years to 32.8 MGD. UWNY's request to modify the trigger was not acted on by NYSDEC and was not actively pursued by UWNY. UWNY withdrew the request to modify the trigger until after a re-evaluation of water supply needs was performed. The 2000 Master Plan provided that re-evaluation of the trigger, and set it at an average demand between 31 to 33 MGD (consistent with

the 1993 letter), which was not anticipated to occur until about 2010 [2000 Master Plan, page 1-6].

Q. Would these planned projects increase water supply capacity?

A. As discussed above, although each of these projects was described in the 2000 Master Plan as being planned to increase peak water supply capacity, this effect was true only in part. Some of the anticipated gains from these projects would merely return maximum capacity to the levels reported 10 years earlier, in 1990. For example, Lake DeForest is currently permitted to operate at a peak capacity of 20 MGD, which is the same capacity as reported in the 1990 Master Plan. Similarly, treatment systems have been added to several production wells to return them to service following contamination. Supply capacity is increased over the levels reported in the 2000 Master Plan, but this does not represent new capacity.

In 1990, the Ramapo Valley Well Field was reported to have an annual dependable yield of 8 to 10 MGD, and a maximum day capability of 11.8 MGD. This was based on the anticipated effectiveness of river flow augmentation using Cranberry and Potake Pond water rights, which had not been obtained at that time. In 2000, the maximum day capability was reported to be 5 MGD, based on practical experience between 1990 and 1999. During dry summer periods, UWNY had to use Cranberry and Potake Ponds (water rights were first used in 1993) as well as diversion of a portion of RVWF capacity to the Ramapo River in order to maintain river flow above the 8 MGD

regulatory requirement. Additionally, contamination of two (2) of the ten (10) wells comprising RVWF had diminished production capacity.

Although UWNY has now acquired Potake Pond, they still have rights to release only the upper 190 MG. Therefore, there is no additional water available for augmentation of flow in the Ramapo River. Furthermore, as a result of additional operating experience and improved numerical modeling, UWNY has decreased the reported maximum day capability of the RVWF to 4 MGD. UWNY has applied for a NYSDEC permit to release a total of 300 MG from Potake, and their modeling suggests that this will result in a reliable maximum day capacity of 5.5 MGD. Therefore, the best-case scenario for the RVWF would be to increase the actual maximum day capacity to 5.5 MGD, less than half of the reported capacity in 1990, and 2.5 MGD lower than proposed in 2000. Even this scenario is far from certain, since the New Jersey Department of Environmental Protection has argued strongly against approval of a permit to allow additional water diversion from Potake.

Q. How do the capital projects in the UWNY rate request relate to those in the 2000 Master Plan?

A. The testimony of UWNY witness Donald Distante addresses water supply projects and makes reference to the 2000 Master Plan. Some of the currently proposed projects also appeared in the 2000 Master Plan, but have never come to fruition.

Potake Pond is among the projects discussed in the 2000 Master Plan, with a

planned completion date in 2001. By acquiring Potake Pond and obtaining a water supply permit to release approximately 300 MG, UWNY planned to increase the summer yield of RVWF from approximately 5 to 8 MGD, through augmentation to the Ramapo River [2000 Master Plan, pg. 1-5]. Mr. Distante explains that the additional supply (300 MG) would add approximately 1.5 MGD of peak capacity to RVWF. Distante, pg. 10, line 3. This is only half of the 3 MGD increase predicted in the 2000 Master Plan and as discussed earlier, the 1.5 MGD would now be added to the current assessed maximum day capacity of 4 MGD to provide a total maximum day capacity of 5.5 MGD. This project, originally planned for 2001, is now planned for completion in 2007. Moreover, because the New Jersey Department of Environmental Protection opposes the allocation of 300 MG to UWNY, "The Company is unsure of the outcome". Distante, pg. 10, line 5. In other words, there is no assurance UWNY will ever get a permit for a 300 MG allocation, and the current net "benefit" of the Potake Pond acquisition is that the current reliable maximum day capacity of the RVWF is 1.0 MGD less than reported in the 2000 Master Plan.

Acquisition of the Letchworth Water System was also discussed in the 2000 Master Plan, with a planned completion date in 2001. Letchworth was supposed to provide an average yield of 1.0 MGD with a peaking capacity of 1.5 MGD. UWNY is now taking credit for a maximum capacity of 1.5 MGD at Letchworth, and stating they will increase the maximum day capacity to 3.0 MGD in 2006. As discussed above,

however, UWNY still awaits a water allocation permit from the NYSDEC, and will only be permitted by the NYSDOH to operate the plant at 0.4 MGD until additional treatment modifications are proposed, approved, installed and tested.

Finally, UWNY proposes further study of the Ambrey Reservoir project, Distante, pg. 11, line 1-3, and $2.5 million in Ambrey Plant additions in 2008. Distante Exhibit DFD-1, pg. 5. The currently proposed Ambrey project is similar to the smaller, Modified Ambrey Project described in the 2000 Master Plan. It includes a new Water Treatment Plant at the Stony Point Plant site, and a reduced size Ambrey Dam and Reservoir.

The 2000 Master Plan's Modified Ambrey Pond (MAP) project was expected to provide a peak supply capability of about 4 MGD but the Ambrey project now planned for 2008 includes only a 2.5 MGD treatment plant; replacement of the existing dam; and the dredging of the small reservoir impounded by the dam. Distante, pg. 11, line 14-17. Today's Ambrey Pond project is 1.5 MGD short of even the scaled back project proposed in the 2000 Master Plan. Moreover, Ambrey Pond remains just one of several options being studied. Distante, pg. 11, line 1-3, 23. There is no assurance that even the Modified Ambrey Project will ever be built.

Q. UWNY has identified conjunctive use as a system reliability strategy. In this case, conjunctive use means increasing surface water use from DeForest Dam spillage to increase system well reliability. Will this increase system supply or reliability?

A. During years when Lake DeForest is completely full, such a plan, if approved, may allow

UWNY to leave more water in storage within the ground water reservoir or alternatively to maximize ground water recharge by "resting" the system wells. This could potentially increase the quantity of ground water available to be extracted by wells during a subsequent dry period. However, under United Water's current interpretation of the NYSDEC water allocation permit for Lake DeForest, and more recently under the NYSDOH permit for operation of the Lake DeForest water treatment plant, UWNY is limited to producing an annual average of 10 MGD. Therefore, until all applicable permits have been granted, this proposal to "rest" key system wells by using surface water from Lake DeForest cannot be considered to provide either greater water supply or greater system reliability.

When this pending rate request was filed, UWNY had not yet applied for the required permit modification. Distante, pg. 7, line 2-4. Moreover, opposition from the State of New Jersey was anticipated and even UWNY conceded that the outcome of the permitting process is uncertain. Distante, pg. 7, line 17-19.

Q. UWNY also plans to study aquifer storage and recovery in 2006. Does this have the potential to increase peak or average supply capacity?

A. Aquifer storage and recovery could potentially increase peak capacity by making more water available for extraction by wells during peak demand periods. The magnitude of such an increase will depend on a variety of factors including the coefficient of storage and transmissivity of the aquifer, as well as the allowable increase in water table

elevation without causing flooding in the vicinity of the recharge wells. It could only increase average supply capacity if "excess" surface water, e.g., from a conjunctive use strategy as discussed above, can be used for the artificial aquifer recharge.

Q. Would it be appropriate to include these projects in the rate base?

A. There is no direct benefit to the rate payers until a given project is permitted and operational.

Q. Are you familiar with UWNY operations?

A. Yes. As discussed above, the duties of the Water Supply Bureau include regulating the operation as well as the modification or expansion of public water treatment and distribution facilities.

Q. Do you have any observations regarding UWNY system operations or operating costs that are relevant to the pending rate request?

A. Yes. UWNY submits water treatment plant operator duty logs to RCDOH on a monthly basis. These duty logs indicate that UWNY routinely has a IIA assistant water treatment operator on duty at the Lake DeForest Water Treatment Plant during the same period that the IA water treatment operator is on duty. Such double coverage is not required by New York State or Rockland County regulations.

Q. Does that conclude your direct testimony on behalf of Rockland County?

A. Yes.