ORANGE WATER AND SEWER AUTHORITY

Quality Service Since 1977

Discussion Paper

Water and Sewer Capacity Implications of Increased Density in OWASA's Carrboro-Chapel Hill Service Area February 22, 2006

Executive Summary

OWASA can meet the utility needs of increased development density within the currently defined urban services area of Carrboro and Chapel Hill, but meeting those needs while maintaining the level of service expected by OWASA's customers will require additional collaboration among OWASA, local governments, and the development community.

Highly efficient water conservation technologies are readily available that can support increased development density with little or no net increase in water service demands. Many of these advanced efficiency measures can be implemented through existing legal authority and local review and approval procedures that are already in place, but some may require ordinance changes or new enabling legislation. OWASA is ready and willing to provide technical assistance to Carrboro, Chapel Hill, and Orange County if they choose to move in this direction, and we will consider adopting water use efficiency standards for new development that will be served by OWASA.

The ultimate capacity of OWASA's water supply and wastewater treatment facilities are based on projections of future water and wastewater treatment demands that correspond to housing and employment levels that exceed Carrboro's and Chapel Hill's buildout projections by more than 20 percent. We believe that this provides a conservative margin of safety for meeting the capacity needs of future development.

OWASA's existing reservoir/quarry water supply system and its future expansion can meet the buildout needs of the Carrboro/Chapel Hill/University community, including a certain level of additional development density; however, our community will become more vulnerable to severe drought conditions beginning around 2015 and lasting until the Stone Quarry expansion is available for water storage in the mid-2030s. The OWASA/UNC water reuse system, which will initially serve the University's main campus, is an essential tool for reducing that future vulnerability. Other measures include lowering projected water demands through conservation and improved efficiency, and/or by developing additional supply sources. The primary goal of OWASA's long-

range conservation program is to reduce water shortage risks without having to rely on additional sources.

OWASA water sales and reservoir withdrawals for the past four years have remained below the historically high levels observed in 2001 and 2002. This is likely due to a combination of weather factors, more conservative customer consumption, and the recycling of water treatment plant process water that was previously released to an intermittent creek. Water withdrawals from University Lake and Cane Creek were 20 percent less in 2005 than projected in OWASA's 2001 Master Plan.

Substantial reductions in summer peak demands at the Jones Ferry Road Water Treatment Plant indicate that customers are using less water for outdoor irrigation, perhaps in response to OWASA's seasonal rate structure and to year-round conservation standards enacted by Carrboro, Chapel Hill, and Orange County.

Decreasing peak flows at the Mason Farm Wastewater Plant during rainy periods suggest that OWASA's long-term program to systematically identify, repair and replace older sewer lines may be successfully reducing unwanted inflow and infiltration of stormwater into the sewer system.

If these recent trends continue, lower peak demands will delay the need for costly future expansions at both the water and wastewater treatment plants.

Despite significant reductions in overall consumption, the relative water demands of major customer classes have remained virtually unchanged and are nearly identical to those reported in the 2001 Master Plan: Single Family Residential (31%), Multi-Family Residential (24%), University (28%), and Commercial/Other (16%).

The effects of increased development densities on wastewater treatment capacity are more complex than effects on the water system. Treatment capacity is affected by both the volume and quality of wastewater flow. The total maximum daily load (TMDL) restrictions for nitrogen and phosphorus that will be established by Jordan Lake rules that the North Carolina Environmental Management Commission is expected to consider later this year may ultimately limit the amount of development that can be accommodated in the Carrboro-Chapel Hill urban services area.

Introduction and Background

On October 24, 2005, the Chapel Hill Town Council requested that OWASA provide a briefing about the effects of potential increases in allowable development density on OWASA's ability to meet future water supply and wastewater treatment demands. Copies of Council Member Jim Ward's petition and the Town Manager's letter to OWASA are included as Attachments A and B.

This Discussion Paper provides background for that briefing, which is scheduled for February 27, 2006. The paper will also support presentations to the Orange County Board of Commissioners and Carrboro Board of Aldermen on March 2 and March 14, 2006, respectively.

Purpose and Scope

Purpose: To provide information and generate discussion among local elected officials and staff, OWASA Board members, interested citizens, and the development community about OWASA's water and wastewater capacity and our ability to meet future demands if higher development densities are allowed. Topics include:

- Long-term adequacy of the water supply.
- Demand forecasts – how we generate them.
- Options for additional supply.
- Conservation, demand management, and improved water efficiency.
- Wastewater treatment capacity.
- Pipes in the ground.
- Recent and anticipated development trends in Carrboro-Chapel Hill.
- Recent trends in water and sewer service demands.

Scope: This report focuses primarily on issues related to residential, commercial, and downtown development in Carrboro and Chapel Hill. It does not address increased development density *per se* associated with UNC's main campus or Carolina North development, although projections for these facilities have been factored into all demand forecasts presented here. OWASA continues to work closely with the University in supporting on-campus infrastructure needs – including water conservation and reuse strategies for both the main campus and Carolina North – and has incorporated the most up to date University information available in our estimates of long-term water supply and wastewater treatment demands for the OWASA system.

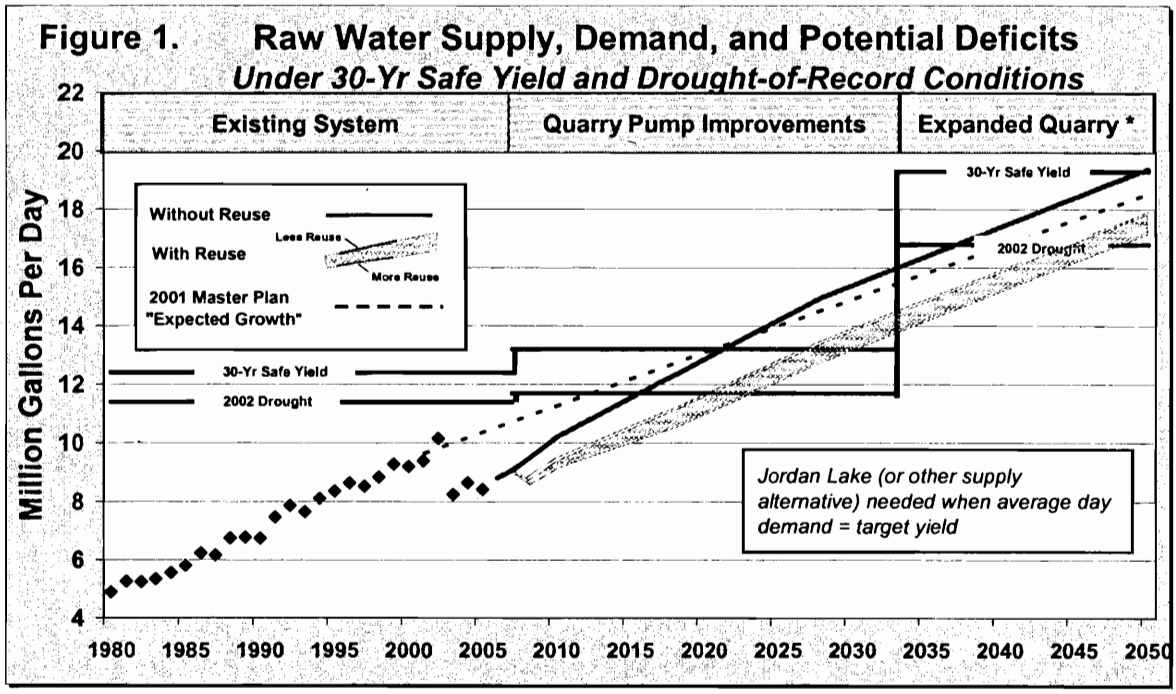
The Question: *Can OWASA continue to meet our community's water and wastewater service needs if development densities are allowed to increase beyond the levels currently permitted by local comprehensive plans and zoning ordinances?*

The Short Answer is Yes – To a Degree: *We can and will meet the utility needs of increased development density within the defined urban services area of Carrboro and*

Chapel Hill, but achieving this while still maintaining the level of service desired by OWASA's customers will require additional and continued collaboration among OWASA, local governments, and the development community. A more complete answer is provided below.

Long-Term Adequacy of OWASA's Water Supply

An overview of historic and projected water demands, current and future supply capacities, and potential deficits is provided in Figure 1 and explained below.



* Eventual quarry storage volume: 2.4 - 3.0 billion gallons.
Reuse Demands per McKim & Creed Technical Memorandum #3 (9/8/05).

- **Solid Diamonds:** actual raw (untreated) water pumped from University Lake and the Cane Creek Reservoir from 1980 through 2005. The substantial decrease during the past three years reflects reduced customer demands since 2002 and the recycling of water treatment process water, first implemented in 2002. (Water that was formerly discarded as part of the normal treatment process is now recycled back through the water treatment plant.)

- **Dashed Black Line:** raw water demands as originally projected in OWASA's 2001 *Comprehensive Water and Sewer Master Plan.*

- **Solid Red Line:** our current estimate of future demands if the OWASA/UNC wastewater reuse project for the main campus is not implemented. (The reuse project will enable UNC to use highly treated OWASA wastewater instead of

drinking water for certain non-potable purposes, such as heating and cooling, on the main campus.)

- **Green Lines:** future demands with the OWASA/UNC reuse project on the main campus in place and operating in 2008. The "Less Reuse" and "More Reuse" boundaries indicate the likely range of future demands. OWASA's projections reflect all information currently available about ongoing and planned development on the University's main campus and Carolina North, but do not include any allowance for demands that could be met by water reuse at Carolina North. The basis for these projections is discussed later in this report.

- **Black Stepped Horizontal Lines:** the capacity of OWASA's University Lake/ Cane Creek/Stone Quarry reservoir system as currently configured, with planned pump improvements, and with the Quarry's eventual expansion in the early 2030s. The upper stepped line is the reliable "safe yield" of the system under drought conditions that would be expected to occur approximately once in 30 years. The lower stepped line is the safe yield under the drought-of-record conditions that occurred in 2001-2002.

The intersection of the diagonal demand lines in Figure 1 with the horizontal capacity lines represent periods when anticipated demand will equal or exceed the estimated safe yield of the reservoir/quarry system. *This does not mean that we will run out of water at that time; but, the system will only be able to provide the indicated amount of water if the 30-year or 2002 drought-of-record should recur.* On the basis of nearly 80 years of hydrologic records, the probability that 30-year drought conditions will not occur in any given year is 29 out of 30, or nearly 97 percent. In other words, there is a 97 percent chance that the reservoir/quarry system will produce more than the specified safe yield in any given year. The probability of exceeding the record drought yield (which is less than the 30-year yield) is even greater.

The probability of depleting OWASA's reservoir/quarry system under various conditions of supply and demand is illustrated in Figures 2, 3, and 4. These figures also provide graphic guidelines for determining when to invoke different levels of OWASA's water conservation standards.

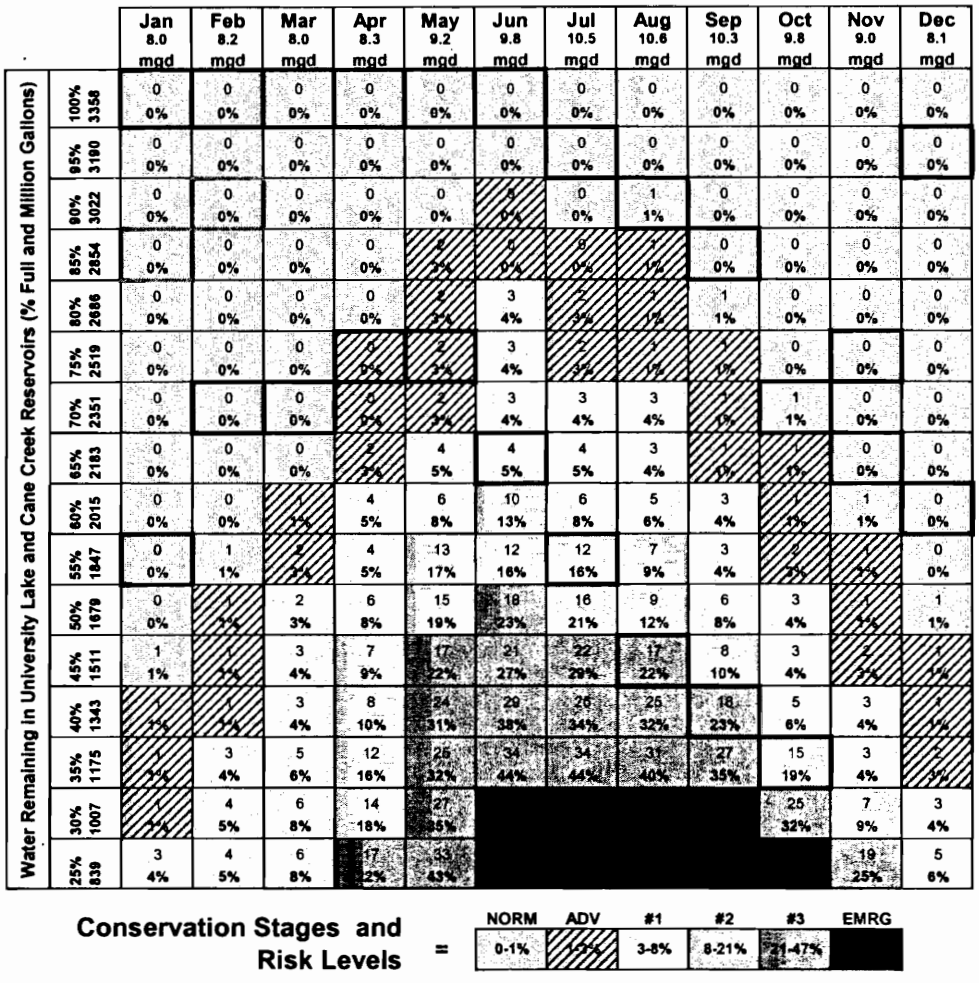
- Each cell of the table contains an integer and a percentage, which represent the probability that reservoir levels will decline to 20 percent or less of full capacity during the following 18 months. These results were derived from spreadsheet model runs of almost 80 years of daily streamflow data, updated through January 2003, and driven by monthly water demand and reservoir storage at the beginning of each month. Calculations were based on average annual raw water withdrawals of 9.15 million gallons per day (mgd) for Figure 2; 10 mgd for Figure 3; and 11 mgd for Figure 4, and adjusted with shorter term demand ratios, which are reflected in monthly demands shown at the top of each column. (Actual reservoir withdrawals during 2005 averaged 8.4 mgd.)

- Each row of the table corresponds to a month, and each column corresponds to reservoir storage at the beginning of that month. Storage is subdivided into five-percent increments and also expressed as millions of gallons of total storage.

- Colors indicate the corresponding conservation stage or risk level implied for each condition. Colored borders around selected cells represent actual reservoir storage conditions at the beginning of that month during the severe drought year of **2002 (black),** last year **2005 (blue),** and the current year 2006 (orange).

Figure 2. Reservoir Drawdown Frequency and Guidelines for Conservation Triggers, Average Demand = 9.15 mgd

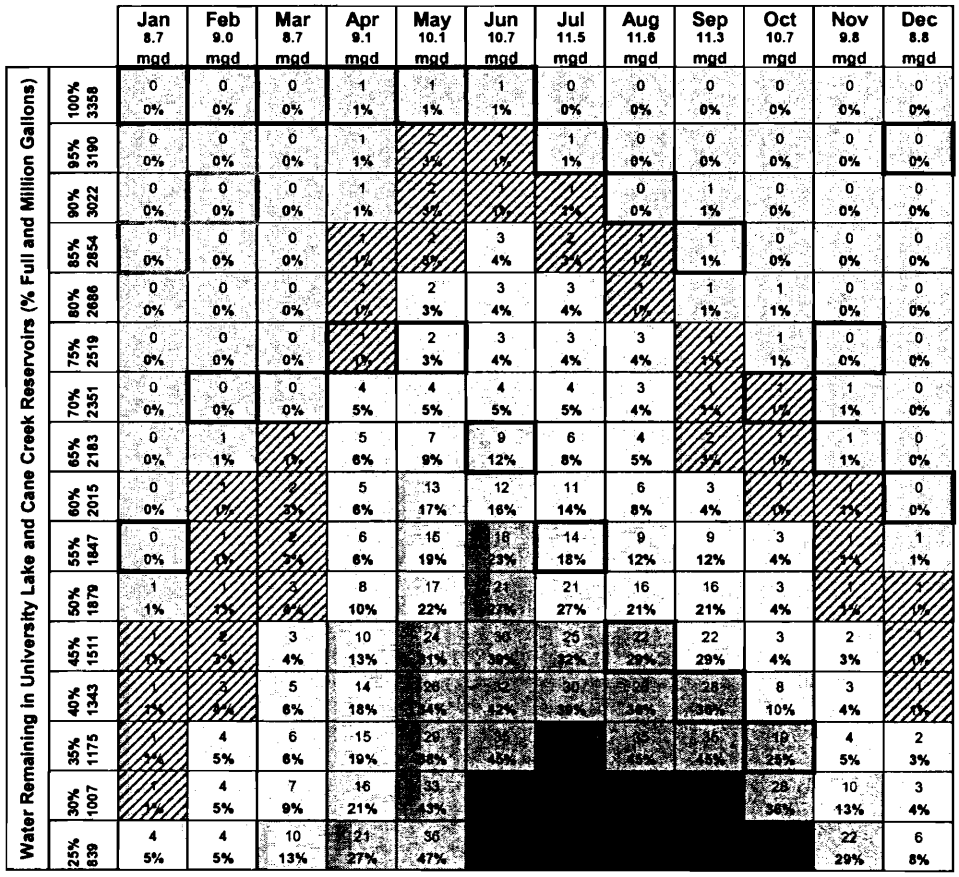
Number of times (or percent of years) during the 77-year streamflow record in which reservoir storage would have declined to 20% or less during the following 18 months.



2002 Reservoir Levels **2005 Reservoir Levels** **2006 Reservoir Levels**

Figures 3 and 4 illustrate the relative risks and conservation guidelines of the current reservoir/quarry system under demand conditions of 10 mgd and 11 mgd.

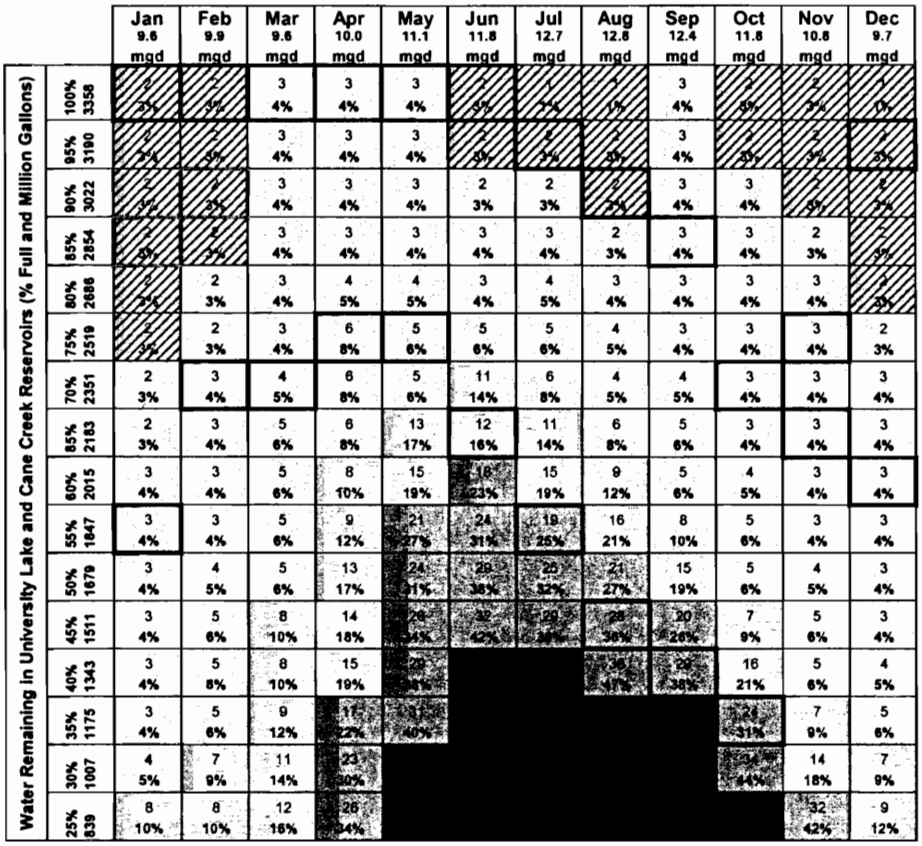
Figure 3. Reservoir Drawdown Frequency and Guidelines for Conservation Triggers, Average Demand = 10 mgd



Conservation Stages and Risk Levels =

2002 Reservoir Levels **2005 Reservoir Levels** **2006 Reservoir Levels**

Figure 4. Reservoir Drawdown Frequency and Guidelines for Conservation Triggers, Average Demand = 11 mgd



2002 Reservoir Levels | 2005 Reservoir Levels | 2006 Reservoir Levels

Figures 1 through 4 indicate that our community will become more vulnerable to severe drought conditions, especially beginning around 2015 until the expanded Stone Quarry is available for water storage sometime in the mid-2030s. We can lessen that vulnerability by reducing projected water demands and/or by developing additional water supply sources. The primary goal of OWASA's conservation and demand management program, as adopted by the Board of Directors in April 2005, is to reduce water shortage risks without having to rely on water from additional sources. Suggestions about how this might be achieved through increased water use efficiency, especially in new development, are discussed later in this report.

How Does OWASA Estimate Future Demands for Water and Wastewater Service?

Future demand projections are generated from currently available information about plans for major new development activities (such as UNC's main campus and Carolina North), changes in local building trends, recent water consumption data and trends, reuse projections from the University, and assumptions about future water conservation among all customer classes. A list of key assumptions and information sources on which OWASA's most current projections are based is presented in Attachment C. Wastewater demand projections are generated by applying an empirically derived factor of 0.923 to corresponding drinking water demand projections, reflecting the fact that only a portion of the drinking water used in the community is returned as wastewater. A spreadsheet with detailed calculations and results is available on request.

Long-term demand forecasts extend through 2050, when we assume that build-out will have occurred; i.e., forecasts for 2050 represent OWASA's best guess at "ultimate" capacity needs. We recognize that Carrboro's and Chapel Hill's projections of future population and employment, as reflected in Transportation Analysis Zone (TAZ) data, do not extend beyond 2030 or 2035, and that both towns expect to be substantially built out by then. *OWASA's projections of future water and wastewater treatment demands therefore correspond to housing and employment levels that exceed Carrboro's and Chapel Hill's buildout projections by more than 20 percent.* We believe that this provides a conservative margin of safety for meeting the capacity needs of future development.

We also recognize that the actual pace and timing of growth in the community and the University may result in short-term departures from our projected demand trends, but such departures are not expected to affect long-term estimates of water and sewer system capacity needs. As more detailed growth plans are developed by Carrboro, Chapel Hill, and UNC, OWASA will continue to revise and refine our projected demands accordingly. We expect, for example, that the more or less linear pattern assumed for future growth (as depicted in Figure 1), will likely bend upward in the middle years before leveling off at or below projected buildout levels.

Are There Any Options for Additional Water Supply Sources That Could Reduce Our Vulnerability to Severe Droughts Before the Expanded Stone Quarry Is Available in the 2030s?

OWASA's 5 percent allocation of the Jordan Lake water supply storage capacity will yield an average of about 5 mgd. If used by our community, this could substantially reduce our vulnerability to severe droughts until the expanded Quarry Reservoir is available in the 2030s. However, constructing facilities to obtain and transport water from Jordan Lake to OWASA's water treatment plant in Carrboro would cost approximately $45 million in today's (2006) dollars – an expensive investment for a

relatively small amount of additional capacity that OWASA would no longer need after the expanded quarry is developed.

A more viable scenario might be to obtain supplemental water through a partnership with neighboring utilities, such as Durham, Cary, or Chatham County, who already have developed – or plan to develop – water supply facilities at Jordan Lake. One option would be for OWASA to buy in to the construction or expansion of facilities could jointly serve two or more entities. We would then receive treated water directly through our existing interconnection with Durham. Contractual agreements could be appropriately structured to guarantee a desired amount of water under specified terms. (Any such agreements would be subject to local approval per the *Water and Sewer Management, Planning and Boundary Agreement* to which OWASA is a party along with the Towns of Carrboro, Chapel Hill, Hillsborough, and Orange County.) A special study is currently underway through the UNC Water Resources Research Institute's Urban Water Consortium to analyze the overall treatment, transmission, and interconnection capacities needed for OWASA, Durham, and Cary to meet their long-term demands with supplemental water from Jordan Lake. The study will also outline a range of potential terms and agreements that might accomplish that goal.

Conservation, Demand Management, and Improved Water Efficiency

In April 2005 OWASA's Board of Directors adopted a *Goal and Objectives for OWASA's Long-Term Water Conservation and Demand Management Program.* For the first time, this policy identifies conservation as a key element of our overall water supply planning process and commits to the creation of a long-term conservation and demand management program. Highlights of the policy include:

Overall Goal: "To develop, fund, and implement a cost-effective water conservation and demand management program that will meet our community's long-term water supply needs (through 2050) by making the highest and best use of our local water resources and eliminating the need for costly new water supply sources and facilities."

For Water Supply Sources: "To assure that annual average day raw water demand does not exceed the reliable capacity of OWASA's existing and planned supply sources (Cane Creek Reservoir, University Lake, and the Stone Quarry Reservoir), where "reliable capacity" is the estimated yield of the system under extended periods of low streamflow conditions, such as those that recur approximately once every 30 years, or under more extreme conditions, such as those of the 2001-2002 "drought of record."

For Treatment, Storage, and Distribution Facilities: "To manage peak day treated water demands in ways that will allow the deferral of major capital projects, such as expansion of the Jones Ferry Road Water Treatment Plant and associated finished water pumping and storage facilities."

A key objective is to pursue conservation measures that are acceptable to and cost-effective for current and future customers.

Improved Water Use Efficiency Is Part of the Answer

With effective planning, existing water conservation technologies can support increased development densities with little or no net increase in water service demands. By reducing expected water use by 25 percent, a given volume of water can accommodate 33 percent more units, where a "unit" may be a dwelling unit, plumbing fixture, square foot of developed area – or any other unit to which a rate of water use can be assigned. Let's assume, for example, that each unit of a 50-unit multi-family residential project uses 100 gallons of water per day (gpd), for a total of 5,000 gpd. If water use is reduced by 25 percent (to 75 gpd per unit), the same 5,000 gallons of water can support a total of 67 units rather than just 50, representing a "density increase" of 33 percent with no net increase in the projected water needs. Greater or lesser improvements in water efficiency could accommodate greater or lesser density increases.

Such efficiency improvements (conservation) are achievable through existing and readily available technologies. If desired, many of these can be implemented through development review and approval procedures that already exist locally. Examples include:

- Rainwater "harvesting" for non-potable uses, such as irrigation or toilet flushing.
- Specifications for drought tolerant and sustainable landscaping and/or irrigation system design.
- Requirements for effective ultra-low flow (high efficiency) plumbing fixtures that are more efficient than required under the National Energy Policy Act of 1992.
- Required retrofit of older plumbing fixtures to high efficiency fixtures upon resale or redevelopment of existing properties (may need enabling legislation).
- Individual metering or sub-metering of new multi-family construction.
- Requirements to extend or connect to OWASA's reclaimed water system, where such service becomes available.
- Other conservation management practices, as may be appropriate

Many of these and other water efficiency measures can be implemented through existing Town and County review and approval procedures – both at the administrative and policy level – without the need for local ordinance changes or new enabling legislation. OWASA is ready and willing to provide technical assistance to the Towns and County if they choose to move in this direction. Additionally, we will consider the feasibility of adopting "water use efficiency standards of service" for new developments that will be served by OWASA.

Does Conservation and Improved Efficiency Save Capacity at the Wastewater Plant?

The effects of increased development densities on wastewater treatment capacity are more complex than on the water system. Wastewater plant capacity is substantially affected by both the volume of flow (which is mostly water) and the strength or amount of the waste contained in that flow. Using water more efficiently through practices such as those outlined above can help reduce the volume of wastewater, but the amount of pollutants in the untreated sewage that must be treated will remain the same. Waste loads (the actual amount of pollutants) will generally increase with increased development density.

OWASA addresses wastewater treatment and capacity issues through the selection of specific processes or combinations of processes needed to produce a high quality effluent (treated wastewater released to the environment) that meets applicable environmental and water reuse standards. Those decisions are made in the context of capital improvement projects needed to periodically increase treatment capacity and/or to respond to new or anticipated regulatory requirements. The estimated buildout capacity and future plans for OWASA's Mason Farm Wastewater Treatment Plant are based on our best projections of future flow, wastewater strength, and regulatory requirements. Long-term plans for the wastewater plant will continue to evolve as treatment technology evolves and as other assumptions change or become better defined.

Although increased development density may increase the amount of waste that OWASA must ultimately treat, it is unlikely that this will affect total capacity or future treatment plant decisions as significantly as new or more stringent regulatory requirements, such as the total maximum daily load (TMDL) restrictions for nitrogen and phosphorus that will be set forth in Jordan Lake rules that the North Carolina Environmental Management Commission is expected to consider later this year.

Pipes in the Ground

OWASA's overall water and sewer infrastructure – the pipes in the ground – is adequate to accommodate reasonable increases in development density.

The water distribution system (pumps, pipes, and storage tanks) is generally designed to meet fire flow requirements that are substantially higher than everyday needs. The wastewater collection system, with a minimum pipe diameter of eight inches, is able to accommodate flows from most foreseeable residential or commercial development. The capacity of downstream sewer outfalls and interceptors is reviewed systematically through capital improvements projects such as those underway or about to begin in the Morgan Creek and Upper Bolin Creek sewer subbasins. These evaluations rely extensively on existing or proposed land use, zoning, and density scenarios to estimate the capacity needs of downstream sewers.

As with other components of the OWASA system, our water distribution and wastewater collection needs are reviewed and updated as new requirements or revised information, such as anticipated development density, become available.

Recent and Anticipated Development Trends

The planning staffs of Carrboro, Chapel Hill, and OWASA recently convened to discuss local development trends, water and sewer utility implications, and information issues related to growth and buildout forecasts for OWASA's Carrboro-Chapel Hill service area. Staff participants were in general consensus on the following:

- Recent trends reflect the decreasing supply of raw land available for new residential and commercial development in the Carrboro-Chapel Hill Urban Services Area. Traditional patterns are shifting toward infill and redevelopment at higher densities than we have historically experienced.

- The number of detached single family homes constructed on relatively large undeveloped lots appears to be declining from the very stable rate of about 350-400 new homes per year observed since the early 1980s. More single family residential construction is occurring on smaller (undeveloped) lots; a greater number of older homes are being renovated and/or expanded; and, more requests are being filed for tear-down re-development and/or subdivision of existing in-town lots.

- Similar trends toward buildout are occurring in both Carrboro and Chapel Hill. Although there are still large tracts of currently open land in Carrboro's Transition Area, development plans already exist or have been approved for a large portion of that area. The areas already spoken for include properties in perpetual conservation easements, large-lot subdivisions, public school/park property, a Town of Carrboro public works site, and several locations where development applications are under review. Approximately half or less of the undeveloped/underdeveloped properties in Carrboro's Transition Area are not included in any of these categories and are therefore considered to be available for new development.

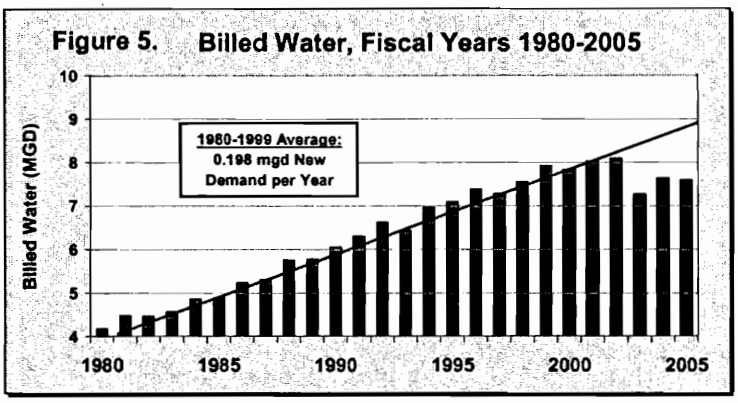
- Consistent with these observations is an increasing proportion of new attached, townhouse style residential construction as well as applications for mixed-use (residential/commercial) projects.

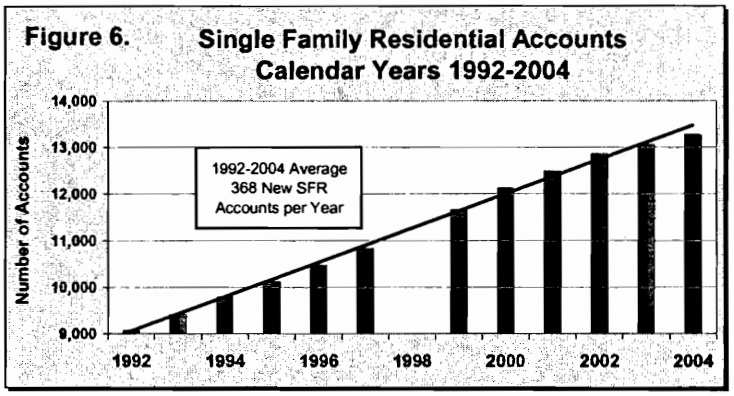
- Based on existing water use data, OWASA staff expects the shift toward smaller residential lot sizes and more townhouse/multi-family construction to result in decreased demands per unit for water and wastewater service.

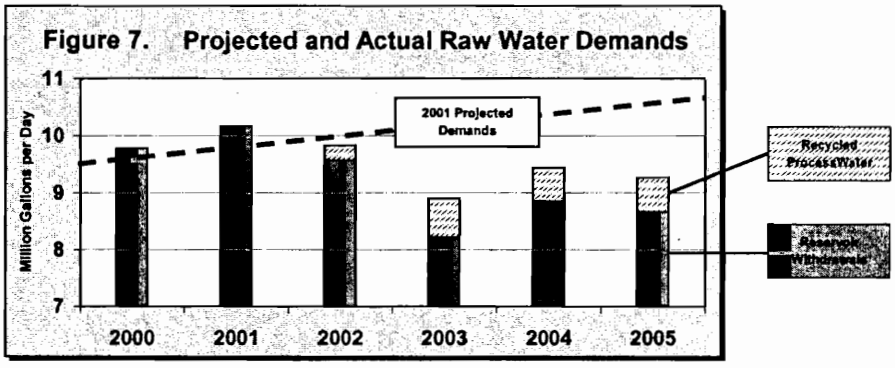
- Detailed plans are underway for mixed use redevelopment projects in Carrboro (the new Arts Center complex, Butler property, Calvin Mellott property, Concrete Plant Site (the undeveloped portion)) and in Chapel Hill (Wallace Parking Deck, Lot 5 Redevelopment, University Village, Greenbridge, and more).

Recent Trends in OWASA Water and Sewer Demands

- **Water sales have remained below historical highs** recorded in 2001 and 2002 even though single family home construction has increased at a stable rate (Figures 5 and 6). **Withdrawals** from the University Lake/Cane Creek Reservoir/Stone Quarry system during 2005 **were 20 percent lower** than projected in OWASA's 2001 *Comprehensive Water and Sewer Master Plan* (Figure 7).

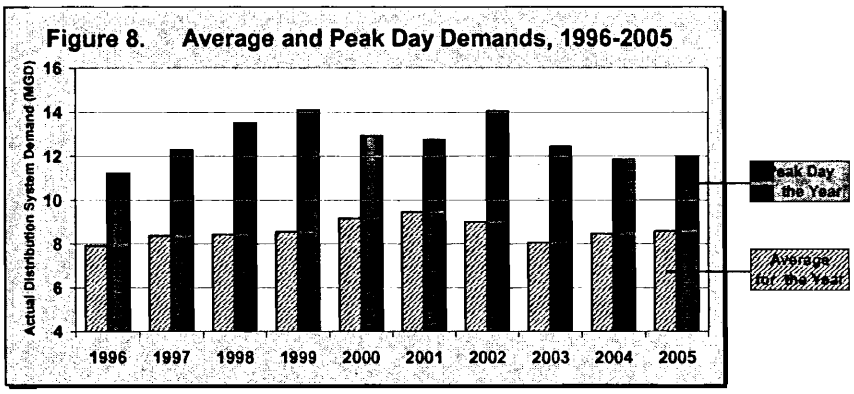


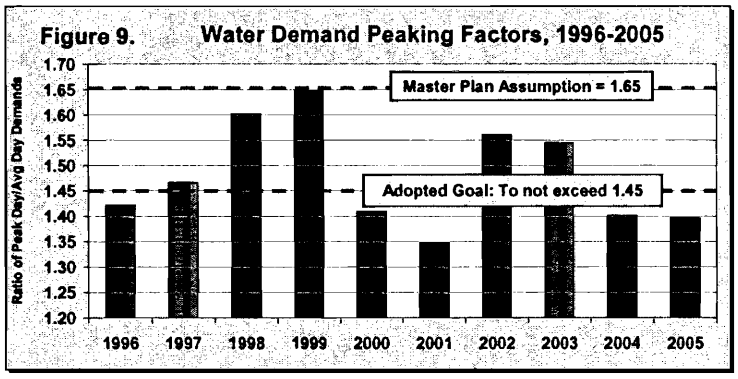




Projected Demands: per OWASA's 2001 Master Plan.
Recycled Process Water: Water that was formerly discarded as part of the normal treatment process is now recycled through the water treatment plant.
Reservoir Withdrawals: Total water pumped directly from reservoirs to the treatment plant.

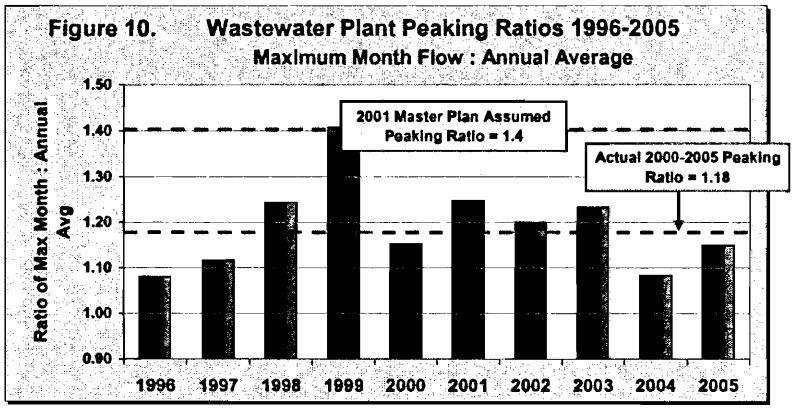
- Substantial **reductions in summer peak demands** at the Jones Ferry Road Water Treatment Plant indicate that customers are using less water for outdoor irrigation, perhaps in response to OWASA's seasonal rate structure and to year-round conservation requirements enacted by Carrboro, Chapel Hill, and Orange County (Figures 8 and 9).



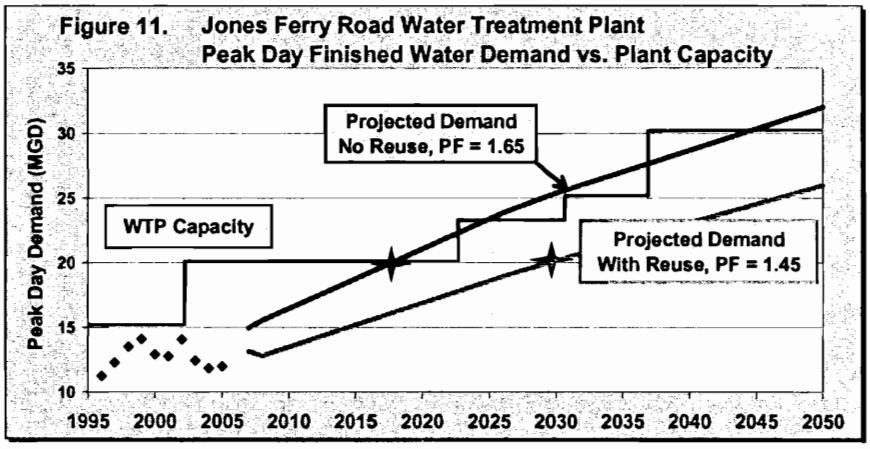


Peaking Factor = Maximum One-Day Demand Divided by Average Annual Demand

- **Decreasing peak flows** at the Mason Farm Wastewater Plant during rainy months suggest that OWASA's long-term program to systematically identify, repair and replace older sewer lines is successfully reducing unwanted inflow and infiltration of stormwater into the sewer system (Figure 10).

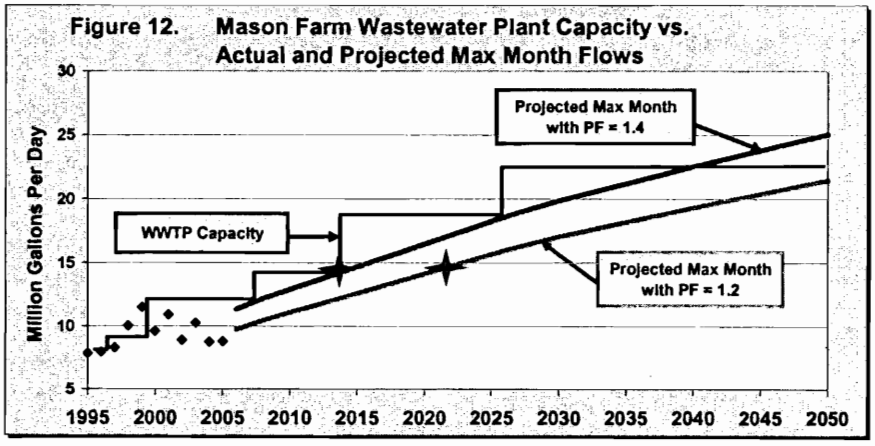


- If these recent trends continue, lower peak demands at both the water and wastewater treatment plants will **delay the need for costly future expansions**. The red and green stars in Figures 11 and 12 illustrate the substantial effects that demand management or peak flow reductions can have on the timing of major expansions at both plants.



Present Treatment Capacity = 20 MGD
PF = Peaking Factor = Ratio of Peak Day to Average Day

The **red line** in Figure 11 represents peak day demand projections for OWASA's Jones Ferry Road Water Treatment Plant assuming a higher one-day peaking factor of 1.65, as proposed in OWASA's 2001 *Master Plan,* and no OWASA/UNC reuse project. The **green line** represents demand projections with a lower peaking factor of 1.45, which was adopted as a long-term goal by the OWASA Board of Directors in April 2005, and assuming the reuse project is in place. As noted by the **red** and **green** stars, implementing the wastewater reuse program with UNC and reducing the peak day demand factor from 1.65 to 1.45 is expected to defer the next major expansion of OWASA's water treatment plant by more than 10 years.

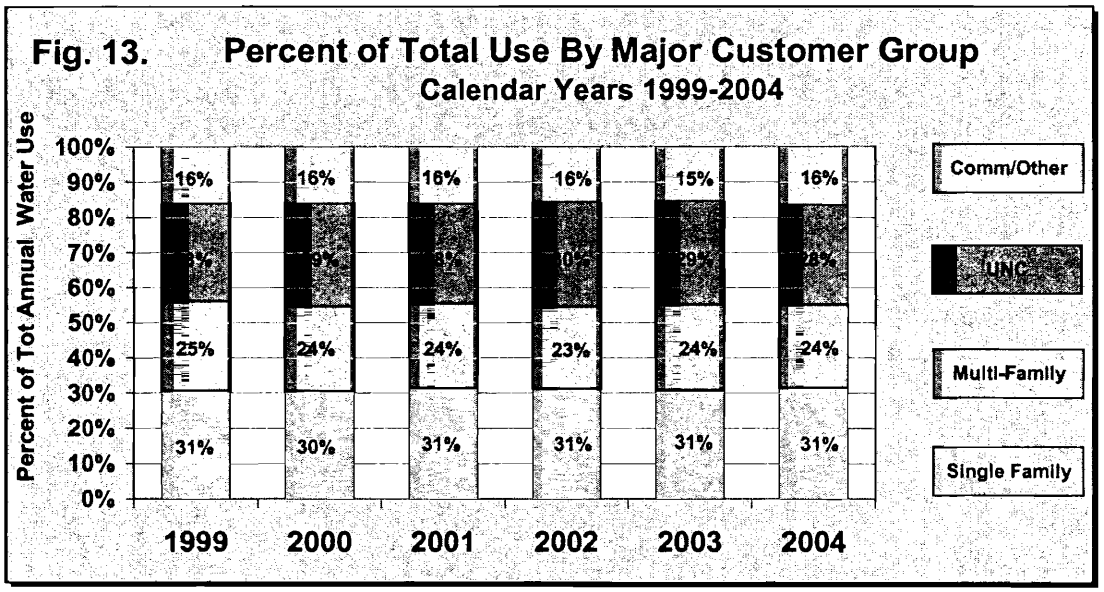


Present Treatment Capacity of 12 MGD Will Be Increased to 14.5 MGD
When Current Upgrade is Completed In 2008

PF = Peaking Factor = Ratio of Max Month to Annual Average

Similarly, the **red line** in Figure 12 represents maximum-month flows at the wastewater treatment plant projected with a maximum month peaking factor of 1.4, as proposed in the 2001 *Master Plan*. The **green line** represents projections at a lower peaking factor of 1.2, which appears to be more typical of actual maximum flows in recent years, perhaps reflecting the results of OWASA's long-term program to reduce stormwater infiltration and inflow. As with the water treatment plant, these peak flow reductions could allow substantial deferrals of the next major wastewater plant expansion.

- Despite significant reductions in overall consumption when compared to pre-drought levels, the relative water demands by major customer classes (Single Family Residential, Multi-Family Residential, UNC, and Commercial/Other) have remained virtually unchanged from those reported in the 2001 Master Plan (Fig. 13).



Summary

A combination of factors and trends support the conclusion that OWASA can meet the utility needs of increased development density within the currently defined urban services area of Carrboro and Chapel Hill.

The ultimate capacity of OWASA's water supply and wastewater treatment facilities are based on projections of future water and wastewater treatment demands that correspond to housing and employment levels that exceed Carrboro's and Chapel Hill's buildout projections by more than 20 percent. This provides a conservative margin of safety for meeting the capacity needs of future development. Recently declining trends in water consumption, as well as the shift toward smaller residential lot sizes and more

townhouse/multi-family construction with lower demands per unit for water and wastewater service, may offer additional margins of safety.

The existing reservoir/quarry water supply system and its future expansion can meet the buildout needs of the Carrboro/Chapel Hill/University community, including a certain level of additional development density; however, our community will become more vulnerable to severe drought conditions beginning around 2015 until the Stone Quarry expansion is available for water storage in the mid-2030s. This vulnerability can be lessened by reducing projected water demands – especially through such essential programs as the OWASA/UNC reuse project – and/or by developing additional supply sources. However, the primary goal of OWASA's long-range conservation program is to reduce water shortage risks without having to rely on additional sources.

The effects of increased development densities on wastewater treatment capacity are more complex than effects on the water system. Wastewater treatment capacity is affected by both the volume and quality of wastewater flow. The total maximum daily load (TMDL) restrictions for nitrogen and phosphorus that will be set forth in Jordan Lake rules that the North Carolina Environmental Management Commission is expected to consider later this year may ultimately limit the amount of development that can be accommodated in the Carrboro-Chapel Hill urban services area.

Meeting the needs of additional density while still maintaining the level of service desired by OWASA's customers will require additional and ongoing collaboration among OWASA, local governments, and the development community.

Edward A. Holland, AICP
Planning Director

MEMORANDUM

TO: Mayor and Town Council

FROM: Jim Ward, Council Member

SUBJECT: Comprehensive Plan

DATE: October 24, 2005

Recently the Council briefly discussed the possibility of revisiting all or portions of the Comprehensive Plan, to consider in greater detail, areas within the Town's zoning jurisdiction, where additional density may be appropriate. The Council requested that the Manager prepare a report with options for the Council's consideration about how the Council might approach updating segments or all of the Comprehensive Plan.

As one of our considerations, I believe we need to understand the effects of denser development on demand for water supply and wastewater treatment. I believe the density changes considered by the Council to date (i.e., downtown economic development initiative and University Village) will not have a significant effect on either water supply or waste water treatment capacity. However, as we advance the broader issue of increased density within our urban services boundary, it is important that we schedule early and ongoing input from the Orange Water and Sewer Authority (OWASA) in order to ensure the adequacy of water and sewer services for the long term.

Therefore, I request that the Council seek a briefing from the Orange Water and Sewer Authority about projected capacities of water supply and waste water treatment systems and the assumptions upon which their projections are based, along with discussion of the potential effects of allowing greater density within the Town's zoning jurisdiction.

ATTACHMENT A-20

NOV 10

Town of Chapel Hill

November 8, 2005

Mr. Ed Kerwin
Executive Director
Orange Water and Sewer Authority
400 Jones Ferry Road
Carrboro, NC 27510

Dear Mr. Kerwin:

At its October 24, 2005 meeting, the Town Council requested that we communicate with you to request a briefing about the effects of increases in development density on the ability of the Orange Water and Sewer Authority to meet water supply and wastewater treatment demand. More specifically, the Council has considered certain development proposals that would increase development densities at specific sites, and has expressed interest in considering increases in development densities at other sites throughout Town, principally at the present locations of commercial development. The Council wishes to hear from OWASA about the potential impact of such actions before it makes further decisions.

I will be pleased to discuss the Council's interests as you desire. We hope that you would be able to prepare materials for the Council's consideration at a meeting in January or February, 2006. A brief presentation also would be useful.

Please let know your preferences so that we may agree on a specific schedule.

Sincerely,

W. Calvin Horton
Town Manager

405 Martin Luther King Jr. Blvd., Chapel Hill, NC 27514-5705 (919) 968-2743 (919) 969-2063 fax
www.townofchapelhill.org

OWASA Water Demand Projections
Basic Assumptions and Information Sources

(The following assumptions and information were used to generate demand projections in March 2005. Modifications will be made, as appropriate, when revised projections are produced in the near future.)

1. Water sales to all **non-UNC** customers were assumed to increase at a constant rate of 0.145 mgd/year, which is intermediate between the historic rate (1980-2002) of 0.1907 mgd/year for all OWASA customers and the long-term projected rate of 0.106 mgd/year with passive conservation, assumed in Technical Memorandum 3.3 of the 2001 *Comprehensive Water and Sewer Master Plan.* Staff believes that the 0.145 mgd/year rate reflects a degree of permanent conservation that has occurred during recent years.

2. **UNC Main Campus** demand assumptions were based on Brown & Caldwell's 2002 *UNC Water and Sewer Master Plan,* which contains specific Main Campus demand forecasts for 2008 and final buildout, for which no fixed date was specified. OWASA's demand forecasts assumed that Main Campus buildout will occur in 2026, which is the same assumption used in our previous demand forecasts. It should be noted that UNC Main Campus demand projections were subject to a higher degree of uncertainty than other customer classes, due to the intense level of facility construction and rehabilitation either planned or underway, as well as the dynamic nature of the University's development process.

3. **UNC Carolina North** demands were based on building category estimates of the *Ayers/Saint Gross Carolina North Master Plan* and water usage factors of the 2002 *Brown & Caldwell UNC Water and Sewer Master Plan.* Carolina North water use was assumed to begin in 2008 and to increase by 0.037 mgd/year until buildout, which was assumed to be in 2050. However, specific plans for Carolina North remain highly uncertain. Although we anticipate that highly treated wastewater will be reused for non-potable purposes at Carolina North, that assumption has not been applied to current projections; i.e., current projections assume that no reuse will occur Carolina North.

4. Projections for non-potable **Water Reuse** on UNC's Main Campus were based on University staff's best estimates for reclaimed water demands for four individual chiller plants. The reuse system was assumed to begin operating in FY 2008. The **Lesser Reuse** projections include currently programmed uses that were expected to reach 0.9 mgd by 2026 and, include only the four existing chiller plants located on the south side of the campus. The **More Reuse** projections include approximately 1.0 mgd of additional demand for other facilities and uses (Cogeneration Plant cooling towers and boiler makeup, new Northeast Chilled Water Plant, new Manning Drive Steam Plant, existing UNC Hospitals chilled water plant, and irrigation of certain athletic fields), but plans and commitments for these have been less definite. (Note: revised reuse forecasts that were provided by the University in September 2005 are not reflected in the numbers discussed above.)

5. All **Raw Water Equivalent** demand forecasts assume an "unbilled" treated water fraction of 10 percent; i.e., OWASA pumps and treats 10 percent more raw water from our reservoirs than is accounted for in metered billing records. The raw water projections assume that treatment plant process water at the Jones Ferry Road Water Treatment Plant continues to be fully recycled and not discarded.