

EXECUTIVE SUMMARY

Background

The University of Connecticut (the University) is located in the village of Storrs within the Town of Mansfield, Connecticut. The Depot Campus is located approximately 4.5 miles to the west of the Main Campus, also within the Town of Mansfield. The University is home to approximately 22,500 undergraduate and graduate students and 4,200 faculty at the Storrs and Depot campuses. The University provides water and wastewater services to its on-campus community, as well as some adjacent areas within the Town of Mansfield.

On September 26, 2005, the Connecticut Department of Public Health issued a consent order to the University of Connecticut to address what it characterized as deficiencies in the operation and management of its water supply system. As part of the consent order, the University agreed to develop a Water System Master Plan to identify and evaluate viable options for meeting the University's future drinking water needs. Additionally, the University voluntarily expanded this charge to include evaluation of its wastewater collection and treatment needs as well. The subject document presents the results of this dual water and wastewater assessment and master plan.

This master plan is intended to: convey an understanding of the extent and condition of water and wastewater infrastructure owned and operated by the University of Connecticut; evaluate the capacity of the system to meet current and future water demands and wastewater treatment needs; estimate the value of water and wastewater assets owned by the University; assess management and ownership options for the water and wastewater systems; and develop recommendations relative to future management and operation of the water and wastewater systems.

Throughout the progression of utility planning by the University of Connecticut and the Town of Mansfield, the town and the University have developed an understanding of the importance of working together to address water and wastewater needs in this growing community. Ensuring that these utility services will continue to meet the current and future needs is a shared objective of the Town of Mansfield and the University.

Water Supply System

Until November 2005, the University employed two full-time and two part-time operators to run its water system. In August 2006, the University retained New England Water Utility Services, Inc. (NEWUS) on a two-year contract for the operation, management and maintenance of the University drinking water system at the Main, Depot and Agronomy Farm Campuses.

Water is supplied to the system from the Willimantic River Wellfield located in northwest Mansfield and by the Fenton River Wellfield in northeast Mansfield. Water from the Willimantic River Wellfield serves both the Depot Campus and the Main Campus. The average daily demand on the water system for the Storrs and Depot Campuses is approximately 1.36 million gallons per day (mgd), with a peak demand of 2.2 mgd. Of those totals, University uses are estimated to

comprise approximately 85% of the daily production. Current registered diversions are 2.3077 mgd at the Willimantic River Wellfield and 0.844 mgd at the Fenton River Wellfield.

Water quality of the existing supply sources consistently meets state and federal standards for public drinking water supplies. State regulations regarding aquifer protection and the associated land use regulations apply to both the Fenton and Willimantic River wellfields. As the regulating body of land development within Mansfield, the town must apply the land use regulations through its zoning ordinances and municipal board reviews of proposed development projects. Mansfield has designated a Municipal Aquifer Protection Agency that is charged with the protection of currently utilized aquifers that are subject to the Level A Aquifer Protection regulations.

The University is responsible for complying with the analysis and mapping components of the Level A Aquifer Protection regulations as they apply to the two active wellfields. They have done so, performing analysis and mapping of the Fenton River Wellfield in 2000 and most recently with the submittal of the Willimantic River Wellfield Level A study to DEP on May 15, 2007. The University has significant land holdings within the direct recharge areas to the Fenton and Willimantic River wellfields, including the land immediately adjacent to each of the wellfields. The University has no intention of developing this land, a measure that will afford a level of protection in the areas where the University has direct control.

The existing and future potential drinking water supply aquifers within the Town of Mansfield are important resources that warrant a high degree of protection. Since the University does not have control over land that it does not own, it will be critically important for the University and the Town of Mansfield to continue their cooperative efforts to ensure protection of the aquifers that feed both existing and potential future water supply sources.

The University operates three water treatment facilities for pH adjustment and chlorination. Water is pumped and stored in two underground storage tanks (Fenton Clearwell and Towers Reservoir) and five above-ground storage tanks (Depot 1, Depot 2, and Towers Standpipes 1, 2, and 3).

Total system storage at the University system is 8.6 mgd, with 7.5 mgd of hydraulically usable storage. This is reflective of a "storage rich" system. The Connecticut Department of Public Health design guidelines recommend system storage equivalent to one day of average daily demand. Actual storage is more than six times the DPH design guideline.

Given the history and age of the University system, detailed data such as pipe materials, age, and condition has not been well documented for much of the system, particularly those components associated with the Depot Campus, which was acquired by the University in the 1990s.

The water system is not adequately metered. However, the University has embarked on a four-phase metering program, whereby 90% of the system is expected to be metered by the year 2011, thereby enabling careful monitoring and identification of specific conservation opportunities. The goal is 100% metering.

The University has engaged in a number of targeted conservation initiatives through new and more water efficient development, adoption of Sustainable Design Guidelines, requiring water conservation practices for new off-campus connections, and completion of an eight-month study identifying large and small opportunities to incorporate additional conservation measures both on- and off-campus.

Wastewater Collection and Treatment System

The University owns and operates a collection and treatment system for wastewater that is generated both on and off campus. The operation of the wastewater collection and treatment system is managed by the Facilities Operations Department at the University.

The wastewater system includes a water pollution control facility (WPCF), collection system pump stations, and collection system piping. The sewer service area is approximately equivalent to the water service area. The WPCF was upgraded in 1995 to provide additional capacity, increasing treatment capacity from 2.0 mgd to 3.0 mgd. In recent years (2004 through 2006), the average daily flow to the WPCF averaged 1.21 mgd, or about 41% of its design capacity for average flow. Wastewater flows are currently averaging 85% of the water supplied by the University's water system.

The University's 2006 infrastructure conditions analysis indicated that the sewage collection system on the Main Campus dates back to the 1940s and consists of clay pipe and brick manholes ranging from three feet deep to over 18 feet deep. The Depot Campus dates back even earlier.

Future Projected Water Demands

The following potential future water demands have been estimated:

- Committed Service (North Campus, Downtown Storrs, North Eagleville Road/King Hill Road PBA, new development at the Depot Campus, and Keystone Apartments) – 404,600 gpd
- Areas Identified in the Mansfield Water Supply Plan (uncommitted) – 170,600 gpd
- Additional Areas Identified in Mansfield's Plan of Conservation and Development (uncommitted) – 118,900 gpd

Table ES-1 presents a summary of existing and future potential demands. This data indicates that the University system currently has an available margin of water for average day and peak monthly conditions using its registered diversion withdrawals at the Fenton and Willimantic River wellfields. This amount is above and beyond what is needed to serve the existing and future projected on-campus demands, committed off-campus water demands (including the Downtown Storrs development), and uncommitted off-campus water demands, while maintaining an adequate margin of safety. However, intermittent seasonal low flow conditions have the potential to cause voluntary limits on withdrawals to rates that are less than the registered diversions as described below.

TABLE ES-1
Existing and Potential Future Demands vs. Supply

| <i>Parameter</i> | <i>Existing Conditions</i> | <i>Existing Plus Future Committed Demands</i> | <i>Existing Plus Future Committed & Uncommitted Demands</i> |
|--|----------------------------|---|---|
| Average Day Demand | 1.36 mgd | 1.76 mgd | 2.05 mgd |
| Average Day Demand +15% margin of safety | 1.56 mgd | 2.02 mgd | 2.36 mgd |
| Peak Month Demand | 1.66 mgd | 2.15 mgd | 2.50 mgd |
| Peak Month Demand +15% margin of Safety | 1.91 mgd | 2.47 mgd | 2.88 mgd |
| Registered Diversion | 3.15 mgd | 3.15 mgd | 3.15 mgd |

Most notably, the University has modified withdrawal management protocols at the Fenton River Wellfield to incorporate the recommendations of the Fenton River study. To date, stream flow conditions have not required their implementation. Consistent with the study recommendations, the University's management protocols include ceasing pumping of the Fenton River wells if stream flow conditions continue to be less than 6.0 cfs for greater than 15 days or less than 5.0 cfs for five consecutive days. Should these curtailments jeopardize public health at any time in the future, the management protocol indicates that the University will seek further guidance from DEP and DPH.

Modeled, sustainable yield at the Willimantic River Wellfield is 1,400 gpm (2.016 mgd), whereas the current total authorized diversion at this wellfield is 1,600 gpm (2.3077 mgd). This master plan is not recommending a reduction in the University's legal diversion rate at the Willimantic River Wellfield. The University intends to conduct an instream flow study of the Willimantic River to evaluate the effects of aquifer pumping on the river, with plans to initiate the study in fiscal year 07/08. The instream flow study scope of work is subject to approval and currently being developed for further review by DEP. The study has considered the currently modeled sustainable yield of 1,400 gpm as a factor in understanding the adequacy of long-term supply.

Under normal flow conditions with all demands realized, the University would have an adequate amount of water under both average and peak month conditions with the full registered withdrawals from the Fenton and Willimantic River wellfields. However, should all future demands be realized and assuming no further efficiency gains from the University's conservation efforts, supply deficits coinciding with annually occurring low seasonal stream flows could occur and require additional sources of potable and/or non-potable supply.

An important element of this analysis is the timing of new water demands. While it is possible that half of the predicted additional demand could be realized in the next five to 10 years, the full projection may not be realized for 20 years. Nevertheless, the University should not consider renegotiating its authorized water diversion registrations until a plan is in place to secure an additional source that could maintain a margin of safety of 15%, regardless of the timing of the potential new water demands. Otherwise, the University and the Town of Mansfield could be in a position where carefully planned growth would not be possible due to a lack of supply.

Water Reuse Options

Given the possible options for wastewater reuse at the University, the reuse of WPCF effluent as a source of reclaimed water for use on campus appears to be the most viable option for further study. The plant effluent provides a single central location of a substantial flow of water that can be further treated to produce reclaimed water for use on campus.

The University's water system has its highest demand at the end of the summer when students return to campus and coincident with high water usage at the University's Central Utilities Plant (CUP) as well as irrigation water use. It is also at this time that the University's water supply tends to be most stressed. It therefore makes sense to focus on wastewater reuse options that will reduce water demand during the summer and late summer. This means focusing on irrigation and the CUP. Fortunately, the CUP is located within 4,000 feet of the water pollution control facility. The athletic fields are slightly farther away in a different direction.

The University plans to complete a feasibility and engineering analysis of using treated wastewater effluent to supply the processing needs of the Central Utilities Plant. Funds for this work and for the initiation of construction have been included in the preliminary FY08 capital budget proposal (for the period from July 2007 to July 2008) to be considered by the University's Board of Trustees.

System Valuation

Determining the monetary value of the water and wastewater assets that are owned by the University will become a critical data point should the University elect to transfer or share ownership of one or both systems to another entity. Table ES-2 presents a summary of the water system valuation analysis, and Table ES-3 presents a summary of the wastewater system valuation analysis. These numbers reflect the value of the infrastructure assets only and do not include the value associated with potential future water sales and sewer collection fees. Additionally, while Table ES-2 reflects the replacement cost for the wellfields, these facilities are essentially priceless, given the current regulatory environment.

TABLE ES-2
Summary of Results – Water System Valuation

| <i>Item</i> | <i>Replacement Value (2007\$)</i> | <i>Asset Value (2007\$)</i> |
|------------------------|-----------------------------------|-----------------------------|
| Wells | \$ 6,200,000 | \$ 280,000 |
| Treatment Facilities | \$ 12,025,000 | \$ 687,000 |
| Pumps and Generators | \$ 1,236,000 | \$ 794,000 |
| On-Campus Water Mains | \$ 4,464,000 | \$ 2,711,000 |
| Off-Campus Water Mains | \$ 3,191,000 | \$ 2,207,000 |
| TOTAL | \$ 27,116,000 | \$ 6,679,000 |

**TABLE ES-3
Summary of Results – Wastewater System Valuation**

| <i>Item</i> | <i>Replacement Value (2007\$)</i> | <i>Asset Value (2007\$)</i> |
|---------------------------------------|-----------------------------------|-----------------------------|
| Main Collection System | \$ 13,315,000 | \$ 1,914,000 |
| Main Collection System Pump Stations | \$ 4,635,000 | \$ 1,865,000 |
| Water Pollution Control Facility | \$ 16,340,000 | \$ 8,470,000 |
| Outfall Discharge Piping | \$ 3,819,000 | \$ 179,000 |
| <i>SUBTOTAL</i> | <i>\$ 38,109,000</i> | <i>\$ 12,428,000</i> |
| University Collection System Laterals | \$ 12,585,000 | \$ 502,000 |
| University Pump Stations | \$ 910,000 | \$ 496,000 |
| <i>TOTAL</i> | <i>\$ 51,604,000</i> | <i>\$ 13,426,000</i> |

Future Ownership and Management Options

The following forms of ownership and management of the University's water and wastewater systems were evaluated with regard to framework of operations, potential service area, regulatory implications and requirements, and advantages and disadvantages.

1. Continued operation by the University;
2. Town of Mansfield ownership and operation;
3. Privatized service;
4. Establishment of a regional utility;
5. Establishment of a non-regional utility; and
6. Private – public lease arrangement.

Certain issues are common in all of the ownership options evaluated. For instance, economic development opportunities within the town of Mansfield will be enhanced by any future arrangement whereby off-campus service is extended to areas that have been identified as being in need of public water and sewer service. However, this benefit could be realized under any number of future ownership and management structures, whether through continued service by the University, ownership by the Town of Mansfield, private ownership, or through a non-regional utility entity. The benefit, or lack thereof, lies with the commitment to ensure a reliable source of supply and expansion of the existing service area. This is not an ownership-specific issue but one that would need to be evaluated under any of the ownership options.

Other common elements of the identified alternatives include the following:

- Under any of the ownership options, permitting and regulatory requirements will be imposed through programs administered by the Connecticut Department of Public Health and the Connecticut Department of Environmental Protection. Neither state-owned nor municipally owned systems are regulated by the DPUC, a distinct advantage of these two options.

- Under any of the ownership structures evaluated, operations could be conducted "in house," assuming adequate staffing provisions were made, or the system could be operated through a contract operations agreement as is currently the case with NEWUS.
- Linking the ownership, operation, and decision making relative to the water and wastewater utilities is an essential aspect of future operation and management. While possible, purchase of a public wastewater utility by a private entity has never occurred in Connecticut and may not be a viable option for the University system. Additionally, private ownership has a number of distinct disadvantages as compared to other alternatives.
- A public-private lease agreement could be undertaken through ownership by the University, ownership by the Town of Mansfield, or through a public water and sewer authority and should be evaluated separately once future ownership is determined.

Remaining options include continued ownership by the University, ownership by the Town of Mansfield, or creation of a special public water and sewer authority. The critical differences in these alternatives come down to the following: (1) position of authority in planning and decision making; (2) willingness to take on the financial, administrative, and legal responsibilities and burden of operating a water and/or sewer utility; (3) position relative to state and federal funding; (4) cost of service; and (5) ability to effectively own, manage, and operate the systems.

Tables ES-4 and ES-5 attempt to summarize advantages and disadvantages of the primary ownership options from the vantage point of the University (Table ES-4) and the Town of Mansfield (Table ES-5). The subject master plan provides a framework from which discussions and further analysis may ensue regarding this issue. The financial and logistical ramifications as well as the many intricacies and implications of ownership of the water and wastewater systems at the University and in surrounding areas within the town of Mansfield need to be further defined and evaluated by all parties involved. Similarly, the merit of a potential public-private lease arrangement should be further explored, both for the University and the Town of Mansfield.

TABLE ES-4
Summary of Ownership Advantages and Disadvantages to the University

| <i>Advantages/Disadvantages</i> | <i>UConn Ownership</i> | <i>Town of Mansfield Ownership</i> | <i>Non-regional Utility Ownership</i> |
|--------------------------------------|----------------------------|--|---|
| <i>Advantages</i> | | | |
| Staff experience with the system | ✓ | | |
| Multiple utility operation benefit | ✓ | | |
| Favorable decision-making position | ✓ | | ✓ |
| Control of rates charged | ✓ | | |
| <i>Disadvantages</i> | | | |
| Distraction from core mission | ✓ | | |
| Liability of system failure | ✓ | | |
| Potential conflict with Town mission | ✓ | | |
| Segregation of the on-campus system | | ✓ | ✓ |
| Potential increase in rates | | ✓ | ✓ |

TABLE ES-5
Summary of Ownership Advantages and Disadvantages to the Town of Mansfield

| <i>Advantages/Disadvantages</i> | <i>UConn Ownership</i> | <i>Town of Mansfield Ownership</i> | <i>Non-regional Utility Ownership</i> |
|------------------------------------|----------------------------|--|---|
| <i>Advantages</i> | | | |
| Staff experience with the system | ✓ | | |
| Multiple systems operation benefit | ✓ | | |
| Favorable decision-making position | | ✓ | ✓ |
| Control of rates charged | | ✓ | |
| <i>Disadvantages</i> | | | |
| Local legislation required | | ✓ | ✓ |
| New regulatory permit requirements | | ✓ | |
| Liability of system failure | | ✓ | |
| Potential increase in rates | ? | ✓ | ✓ |

Priority Recommendations

The following priority recommendations are proposed:

1. Develop a method of tracking and documenting system improvements and expansions and continually update the existing system infrastructure database coincident with ongoing work, repairs, and future studies.
2. Continue to work cooperatively with the Town of Mansfield to ensure protection of the aquifers that feed both existing and potential future water supply sources.
3. Undertake, as planned, the instream flow study of the Willimantic River.
4. Continue to implement the modified withdrawal management protocols at the Fenton River Wellfield.
5. Utilize the hydraulic model of the distribution system (currently under development) to identify deficiencies in system hydraulics and to evaluate the impact of future modification to or expansion of the system.
6. Conduct a fire demand needs study to determine fire demands and storage requirements and to better identify any deficiencies in system hydraulics related to fire suppression capabilities.
7. Provide emergency power to Willimantic Wells #2 and #4 and critical treatment facilities. This is critically important, given the significance of this supply source.
8. Continue the program that is currently underway to achieve 100% customer metering both on and off campus.

9. Continue to contract operation of the water system until or unless an alternative operational scheme is developed.
10. Undertake a capital improvement program to address the priority system recommendations by ISES in its 2006 Infrastructure Condition Analysis, including replacement of two of the three Towers standpipes, water main replacement, and a SCADA system for the wastewater treatment system.
11. Continue to implement water conservation measures and replace aging infrastructure with water efficient components.
12. Develop a treated water effluent supply for nonpotable uses, including most notably uses at the Central Utilities Plant, possibly irrigation of the athletic fields, and other potential uses both on and off campus.
13. Pursue an additional ground water supply source in the Willimantic River basin to meet future off-campus water demands within approved Planned Development Areas and to serve as an emergency supply source. The Planned Development Areas are close to the University and are well positioned to serve University students as well as Mansfield businesses and residents.
14. Evaluate modifications to the wastewater treatment plant to support phosphorus removal.
15. Conduct an inflow and infiltration study of the wastewater collection system.
16. Institute a more effective means of tracking the costs of operating the water and wastewater systems to assist in future planning and potential transfer of one or both of these utilities.
17. Continue to evaluate future ownership options.

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