Water Conservation Plan

University of South Florida
Water Use Permit Renewal Application
Water Use Permit No. 20001960.016

Prepared for:

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1.0 Introduction

The University of South Florida (University/USF) maintains an Individual Water Use Permit (WUP) (No. 20001960.016) that regulates groundwater withdrawals from twenty-seven (27) wells and two (2) surface-water withdrawals that are located within the USF service area. These wells supply potable, irrigation, and HVAC (Heating and Cooling) water for the main USF Tampa campus and associated facilities. The well uses include eighteen (18) irrigation wells, four (4) combination public supply and HVAC (Heating/Cooling plant) wells, and another five (5) wells that are dedicated solely to the HVAC needs. The two surface- water withdrawals provide for irrigation. The withdrawal locations are shown on **Figure 1**.

As part of the WUP renewal, the University is required to submit a Water Conservation Plan (WCP) that documents that all environmentally, technically, and economically feasible water conservation measures have been or will be implemented. Water conservation best management practice (BMP) guidelines have been developed by the Southwest Florida Water Management District (SWFWMD / District), and this plan is designed to address applicable sections of the BMP guidance. The initial WCP for USF was developed in 1993 and this document provides a renewed look at that plan, a general status of measures that have been implemented, and conservation measures to be continued or pursued in the future.

2.0 Goals and Objectives

The primary goals of this plan are to identify areas where water savings can be reasonably achieved and to develop strategies for realizing these savings. A component of this plan is the improvement of water use monitoring and metering systems so that areas of high use and unaccounted losses can be more accurately identified and addressed. Because the USF water permit manages water for irrigation, potable supply and HVAC uses, the following objectives are broken into these three areas.

2.1 Irrigation Objectives

- Evaluate well and coverage areas where irrigation rates exceed model estimates and determine modifications or repairs that will reduce usage.
- Evaluate golf course water storage and re-pump systems for optimal efficiency.
- Evaluate University landscaping plans and guidelines, with emphasis on using native and drought-tolerant plants and enhanced mulching.
- Evaluate expanded use of weather station or related irrigation control systems.
- Develop a comprehensive irrigation system master plan for guidance to interdepartmental operations.
- Evaluate potential improvements to flow metering within the irrigation zones.
- Identify potential sources of lower quality or reuse water, such as storm cisterns and A/C condensate.

2.2 Potable Supply Objectives

- Reduce unaccounted system losses
- Notify University residents of water conservation measures.
- Provide adequate flow metering of residential facilities.
- Require low-flow fixtures for all new construction and retrofit older systems as feasible.

2.3 HVAC Supply Objectives

- Require high efficiency cooling units for all future construction and evaluate retrofit potential for lower efficiency systems.
- Evaluate potential of re-using cooling tower discharge as irrigation water. Blow down could be stored in cisterns and re-used (currently pending permit).
- Evaluate system operation and tower efficiency based upon campus cooling load requirements and ambient enthalpy.

3.0 Historical Use and Conservation Opportunities

Conservation measures discussed in this plan are related to irrigation, potable water use, and HVAC water uses (primarily air conditioning cooling tower use). The current water use permit authorizes 872,100 gallons per day (gpd) (both groundwater and surface-water), for irrigation, 1,138,500 gpd for the combined use of public supply and HVAC building needs (not including standby well 17), and another 363,400 gpd that is specifically for HVAC use (2,374,000 gpd total annual average). During the past three years (2007 through 2009), the average irrigation quantities have been slightly over the permitted quantities at 926,549 gpd, while the combined potable/HVAC and HVAC only withdrawals have been notably below the permitted quantities at 693,105 gpd and 139,978 gpd, respectively (**Table 1**). Additionally, while above the previously permitted quantities, the irrigation quantities used are below AGMOD irrigation modeling results of (987,270 gpd) (**Table 2**). The irrigation acreage estimation map used for AGMOD modeling is shown on **Figure 2**.

Based on the above data, sub-metering of the public supply and comparison to outgoing wastewater flows, approximately 52% of the actual usage profile is used for irrigation, 23% is used for HVAC purposes, and the remaining 25% is used for potable (public supply) purposes. Therefore, the highest potential for savings would be expected to come from irrigation and public supply practices. However, as noted previously, current irrigation rates are below the AGMOD model quantities and the per capita water use amounts for pubic supply are relatively low at approximately 21 gpd per capita (gpcd) (based on non-pro-rated water use of a combination of residential student, non-residential student, and staff populations). Lastly, the HVAC water is used on an as-needed basis to provide heating and cooling of the buildings and this use is not only somewhat seasonal due to notable changes in temperature and humidity in this part of Florida (see attached **Figure 3**), but also uses the state-of-the-art practices of the industry. Based on these factors, water conservation measures employed by the University to date have demonstrated significant benefits, making it more challenging to obtain notable additional benefits through other cost effective conservation measures.

Discussions for the following conservation options are separated into the three primary use categories.

3.1 Irrigation Systems

The quantity of water requested for irrigation throughout the USF campus is based on modeling of irrigated acreages using the SWFWMD agriculture model (AGMOD), with irrigation rates based on three different categories: Golf Course, Sports Fields, and General Landscape. The following items represent water conservation measures that are ongoing for all irrigation systems at the University, regardless of the irrigation category.

- The water distribution and irrigations systems are repaired on a continual basis to address leaks or inefficient application or distribution of water.
- Daytime irrigation is avoided.
- Irrigation schedules are utilized that are designed to deliver the correct quantity of water to root zone at the times needed. This includes schedule variations for wet and dry seasons and reductions during drought restrictive periods (note – the University follows the City of Tampa water restrictions when applicable).

- Mowing schedules are adjusted to promote self seeding for dense turf development which shades soil and retains moisture.
- Systems are adjusted to avoid irrigation onto roads and parking areas.
- Mulch and Florida friendly drought tolerant landscaping is used as much as practicable.

The following sections provide information related specifically to the three primary irrigation categories; general landscape irrigation, golf course, and sports fields.

3.1.1 General Irrigation

At the time of the initial water conservation plan (1993), the main campus irrigation systems consisted primarily of rotary heads in large open areas and spray heads in smaller, confined or heavily planted areas. The control systems were based on manual timers and the systems were not sufficiently metered. Since that time, the University has installed a Rain Bird Maxicom^2 irrigation control system, which utilizes rain sensors and provides remote monitoring and control of system operation. Additionally, planting bed and turf irrigation areas have been separated so that irrigation application can be optimized.

The primary additional conservation options identified for main campus irrigation include ongoing equipment and operational improvements of the irrigation systems, as well as identifying and utilizing alternative sources of irrigation water. Examples of the former include optimal sizing of irrigation areas to minimize waste and updating of systems to include, for instance, micro irrigation in planter areas. Examples of the later include evaluation of methods for capturing and storing HVAC wastewater and condensation to augment the irrigation systems. At this time, the University is pursuing engineering designs for cistern systems at several new buildings that are under construction. This concept is to provide capture of various waste streams; including rainwater, AC condensate, and cooling tower blow down water. A preliminary estimate of potential condensate quantities that could be captured from a grouping of three major buildings could approach 100,000 gallons per day (gpd). Once captured in cisterns, water could be used in existing or planned water features to offset the use of irrigation water for these purposes or integrated directly into the existing irrigation distribution systems.

3.1.2 Golf Course

Irrigation of the USF Golf Course is currently provided by two groundwater withdrawal wells (Wells 9 and 10), that are located in the interior portion of the golf course. These wells withdraw groundwater and pump it into an interior lake for storage, where it is re-pumped by Well-41 into the irrigation systems. Additional details of the golf course irrigation system and operational procedures are included in the Golf Course Conservation Guidelines questionnaire, which is provided as **Appendix A** of this plan.

Since the initial WCP submittal in 1993, various system improvements have been made. For instance, the irrigation quantities for wells 9 and 10, and for two transfer pumps are now metered and water usage is tracked on a daily basis for monthly submittal to the physical plant. A leak detection system was also implemented, with each pump being equipped with a high flow sensor that recognizes excessive flow and shuts the system down. Irrigation of the "roughs" was also eliminated and the tee and green irrigation systems were separated from the fairway irrigation system to allow reduced irrigation frequency in the fairways compared to the smaller tee and green areas. The current system

has a priority of scheduling as follows: front 9 greens, miscellaneous tees, front 9 fairways, back 9 fairways, and the practice areas. Sprinkler heads are also continually replaced with more efficient models and to allow for more efficient water distribution.

Conservation potentials for future consideration at the USF golf course include the following:

- An evaluation of water losses within the storage pond(s) and potential storage system improvements.
- Revamp existing computer control system with weather station input of rainfall and evapotranspiration monitoring.
- Recovery of irrigation water via closed loop drainage systems.
- Soil improvements or amendments to enhance moisture holding capabilities.
- Evaluation of mowing practices to minimize turf moisture requirements.

3.1.3 Sports Fields

Sports field requirements at the University have continued to expand as the USF sports programs have grown in size and prominence. As a result, previously un-irrigated acreage has been converted to practice fields, and additional expansions are anticipated. At this time, irrigation wells associated with sports field irrigation are all metered and the usage is recorded for reporting by Physical Plant managers. Also, leak detection is a continual practice in the operation of the irrigation systems at the University.

3.2 Potable Supply

The primary historical conservation objective within the potable supply systems in previous permits for USF was to reduce the per capita use for students living on campus from an initial starting point of approximately 80 gpd. To achieve this goal, approximately 40% of meters and 60% of backflow prevention devices were installed by 2002, along with additional valve systems to better control flow patterns. Zinc polyphosphate water treatment is also added to reduce piping corrosion and the need for system flushing, and a new 1.2 million gallon water tower was installed. A program in upgrade fixtures to low flow devices was also initiated. These changes have resulted in an estimated (non-prorated) per capita water use residential students, staff and commuter students of approximately 17 gpcd, which is very low. Previous (full time equivalent [FTE]) estimates of water use have been as high as 50 gpcd.

These programs have been continued since 2002 and it is estimated that approximately 60 % of student housing connections are currently metered. Additionally, approximately 75 % of the older campus lavatory fixtures have been replaced with automatic low flow fixtures, and all new construction includes a requirement for low flow fixtures. An estimated 80% of the flush valves for the older water closets and urinals have been changed out with automatic valves. However, due to the expense of changing out the whole fixture, those fixtures still flow at the older rates so they will function properly. This offers another area for increased savings if funding can be obtained.

3.3 Industrial Supply

Industrial supply water is used solely for the chilled and heating hot water closed loop make-up and cooling tower make-up throughout the campus. The greatest use of the process water is cooling tower make-up. To conserve water use for this HVAC purpose, the University has evaluated alternative water

treatment methods for the cooling towers; however, due to chiller manufacturer references, general industry standards and technical data published, a viable option to reduce tower make-up water via emerging technology, increased cycles of concentration and other similar methods has not proven successful. Additionally, the University has required and continues to require purchasing of high efficiency systems (using LCCA) that can operate within the conditions of the existing water use permit. Finally, the units are operated at the lowest capacity possible in order to save both water and electricity. No reliable data are available to quantify potential savings related to cooling tower operation. While the net campus growth has been substantial over the past five years, the plant make-up has not seen a dramatic increase based upon increased square footage. Further, it should be noted that all campus cooling plants currently meter water make-up as well as blow-down from towers. This serves to provide an accurate measure of tower evaporation and drift.

4.0 Reuse Water Feasibility Analysis

The University currently operates a wastewater collection and transmission system; however, wastewater treatment is handled by the City of Tampa (City). Once collected, wastewater is routed to either Lift Station #1 or Lift Station #3, where it is pumped to City treatment facilities. Wastewater effluent from the University service areas averaged approximately 496,000 gpd during 2009. At this time, the City does not utilize a reclaimed water system. Based on discussions with City of Tampa Water Resources Department, construction of a wastewater facility with reuse water capabilities in the New Tampa area (north of the University) have been considered; however, there are currently no established plans to construct such a system. The primary treatment plant for the City is near downtown Tampa and City staff have indicated that the cost to develop a transmission system from this area to the USF area is cost prohibitive.

In addition to the City of Tampa, Hillsborough County maintains several wastewater treatment facilities throughout the County; however, the closest one identified for this study is the Delwood facility near the intersection of Fletcher Avenue and Casey Road, west of Dale Mabry Highway. While the County does provide reuse water to portions or northwest Hillsborough County, the demand for this reuse water in that area exceeds what is currently available and there are no plans to add transmission lines to the USF area.

Another possibility available to USF is construction and operation of its own wastewater treatment plant. In accordance with Florida Department of Environmental Protection (FDEP) rules, such a facility must meet Class I reliability requirements and include filtration as a treatment step in order to provide public access spray irrigation. Based on initial 1993 estimates of wastewater discharges, a 1.5 MGD facility would be required to meet projected high level flow periods. A preliminary cost estimate to construct such a facility at that time was $3.0 million. This estimate did not include irrigation system modifications and interconnects. Additionally, a method to address wet weather and potential substandard effluent storage and discharge presents additional challenges and costs. These additional factors resulted in a $4.0 million estimate for construction only in 1993, which would equate to approximately $15 million total project cost today. Also, limited land is available at the University to construct such a facility.

In addition to construction costs for a wastewater treatment facility, USF would be required to provide full time, 24-hour per day operation and maintenance staff pursuant to Chapter 62-610, F.A.C. Based on these costs, along with construction costs, construction, operation, and maintenance of a waste water treatment facility by the University is not considered economically feasible, and no Capital Improvement allocations are slated for this.

As a final option, the City of Temple Terrace (City) is a medium size municipality immediately adjacent to the USF campus. In 2001, the City conducted a reuse feasibility study, which concluded that it would be beneficial to pursue construction of a water reclamation facility to advanced water treatment standards. USF entered into preliminary discussions with the City of Temple Terrace about potentially accessing reuse water from this system, if constructed. In 2002, plant design was taken to 30% completion and the City filed a permit application for the facility with the FDEP. Permit negotiations continued for more than three years and issues regarding wet weather discharge into the Palm River

could not be resolved to the satisfaction of the FDEP. The permit application was officially withdrawn in August 2004. However, we understand that the City of Temple Terrace is once again evaluating the potential wastewater plant construction and operation. USF will make contact with the City of Temple Terrace to follow the progress of these negotiations, and to determine if reclaimed water could become available to the University if such a plant is constructed.

In addition to wastewater reuse for irrigation, the University has evaluated the potential for using stormwater storage for irrigation water. The only significant ponds on University property include a lake in the southwest portion of the campus and ponds within the golf course boundaries. At this time, the southwest pond is used for irrigation water for the Moffitt Cancer Center and a single pond at the golf course is used for irrigation, when excess water is available. Additional stormwater storage with a mix of HVAC discharges (cooling tower blow down and condensate) for irrigation use is currently being evaluated by USF.

5.0 Potential Savings Based on Conservation Measures

A well by well withdrawal comparison has identified irrigation wells that are notably above and below the recently completed AGMOD modeling. Some of these discrepancies are likely due to a mismatch of acreage to certain wells and the interconnectivity of a looped system. Additionally, one well (well 20), also includes an industrial (HVAC) use component that is not reflected in this comparison. However, even with this consideration taken into account, select irrigation wells appear to be irrigating beyond the appropriate quantity. As a result, these wells will be evaluated to ensure that system leaks or other maintenance issues are not causing water losses. Additionally, an evaluation of potential over-irrigation of these areas will be made. Because the total irrigation use for the USF WUP is slightly below the AGMOD calculated quantities, it is difficult to predict specific savings that will be achievable based on this evaluation. However, it is possible that limited irrigation savings may be achievable.

While other irrigation areas usage rates appear to be in line with those anticipated after conservation measures have been fully implemented, most of the irrigation water is still obtained by groundwater withdrawals. Therefore, capture of industrial wastewater could provide an alternative source of irrigation water at the main campus areas. As stated previously, the University is pursuing engineering designs for cistern systems at several new buildings that are under construction. This concept is to provide capture of various waste streams; including rainwater, AC condensate, and cooling tower blow down water. A preliminary estimate of potential condensate quantities that could be captured from a grouping of three major buildings could approach 100,000 gallons per day (gpd). Once captured in cisterns, water could be used in existing or planned water features to offset the use of irrigation water for these purposes or integrated directly into the existing irrigation distribution systems.

Also discussed previously is an ongoing program to upgrade fixtures to low flow devices. It is estimated that these programs have resulted in a reduction in an estimated total per capita water use of approximately 50 gpcd to approximately 17 gpcd for all residential, commuter student, and commuter staff (non-prorated). It is estimated that the residential dorm students utilization rate is slightly above 20 gpcd. These programs have been continued since 2002 and it is estimated that approximately 60% of student housing connections are currently metered. Additionally, approximately 75 % of the older campus lavatory fixtures have been replaced with automatic low flow fixtures, and all new construction includes a requirement for low flow fixtures. An estimated 80% of the flush valves for the older water closets and urinals have been changed out with automatic valves. However, due to the expense of changing out the whole fixture, those fixtures still flow at the older rates so they will function properly. As a result, minimal additional savings are anticipated as a result of cost effective fixture upgrades.

In addition to planned internal expansion at the University, USF has recently signed an agreement with the City of Tampa to expand the USF service area, taking over supply of potable water to the Florida Mental Health Institute and surrounding areas to the northwest. While this expansion will require increases in the potable water withdrawals over those of recent years, this impact will be directly removed from the City of Tampa water use. This modification could be considered a water conservation measure because of USF's location within the Northern Tampa Bay Water Use Caution Area (NTBWUCA). This WUCA exists primarily due to concerns of water levels within the Hillsborough River, where the City of Tampa obtains the majority of their potable water. An equal quantity of groundwater withdrawal from the USF area will offset what would have been withdrawn from the river

by the City. The additional quantity of water anticipated for FHMI potable use is approximately 20,000 gpd.

6.0 Schedule for Implementing Conservation Measures

The conservation measure deemed most likely to provide water use reductions will be the comparison of irrigation zone usage compared to AGMOD modeling results. This modeling has been conducted recently as part of the WUP permit renewal process and the results will be evaluated over the coming year to determine where irrigation savings might be achieved.

A feasibility evaluation of HVAC condensate capture and reuse is currently underway as part of the construction of the new Interdisciplinary Science Building (ISA). The results of this preliminary evaluation are anticipated within the next six months. If determined to be feasible, design and construction of the collection system(s) and irrigation system retrofits will likely require between one to three years (assuming funding is available). If this program proves beneficial and economically attainable, this approach can be expanded into other areas and buildings during the 10-year permitting period.

Finally, the low flow fixture retrofit program has been ongoing throughout the University; however, most retrofits are being implemented as maintenance schedules require system replacement. Therefore, unless 50/50 matching funds are allocated for grant opportunities, this program will continue primarily as an ongoing maintenance process.