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FINAL REPORT

PHASE I - ASSESSMENT OF THE COST OF SUPPLYING RECLAIMED WATER TO AREAS OF HIGH AGRICULTURAL WITHDRAWALS

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EXECUTIVE SUMMARY

St. Johns River Water Management District (SJRWMD) is investigating alternative water supply strategies within the water resource caution areas identified in the *Water Supply Needs and Sources Assessment* (Vergara 1994). One strategy being investigated by Post, Buckley, Schuh & Jernigan, Inc. (PBS&J) in association with PB Water is the use of reclaimed water for irrigation in areas with high agricultural water withdrawals. These areas were identified by SJRWMD as citrus growing regions along the Lake Wales Ridge in Orange, Lake, and Seminole counties and the fern growing areas of northwest Volusia County and southeast Putnam County.

The first phase of PBS&J's assignment was to evaluate data availability and sufficiency to conduct the study and to develop a methodology for conducting the second phase. The second phase will require an assessment of the availability of reclaimed water in locations that could reasonably serve fern and citrus growing areas, assessment of the water needs for the defined fern and citrus growing areas, and determination of the economic feasibility of using reclaimed water for fern and citrus irrigation in the identified area. This report presents the results of the Phase I study and includes a description of the Phase I methodology, discussion of findings, conclusions, and recommendations for performing the Phase II services.

The Phase I methodology included an assessment of the data available from numerous sources, including a SJRWMD data base on wastewater treatment plant flows and existing reuse systems, SJRWMD records on citrus and fern water use, and the City of Orlando's and Orange County's Water Conserv II reclaimed water citrus irrigation system. In addition, interviews were conducted with SJRWMD staff knowledgeable of irrigation needs, other agricultural experts, and a representative grower. In addition to existing water use data, the Blaney-Criddle model, which is commonly used to estimate

crop irrigation demands, was evaluated as a method to estimate water use.

The wastewater treatment plant data appear to be sufficient to determine the current availability of reclaimed water from plants within and near the study area. Estimates will also need to be made, depending on the type of existing reuse practiced, on peak irrigation needs in order to determine how much reclaimed water may be available to serve agricultural needs. Some of these data are required for another task being performed by PBS&J as part of the *Investigation of Alternative Water Supply Strategies* (Task I - Replacement of Potable Quality Water for Residential Landscape Irrigation).

The water use data reviewed for the fern and citrus areas appear to be sufficient to develop an estimate of irrigation needs. Seasonal water use data are also available that can be used to estimate storage needs, peak flows, and back up disposal requirements for a reuse system serving agricultural users.

From our investigation, it appears that fern irrigation demands are fairly consistent over time due to the need to apply fertilizers and pesticides on a weekly basis. These applications are made through the irrigation system and typically meet the water needs of the ferns. The only exceptions are periods of prolonged drought and freeze protection.

Based on this evaluation, an approach for Phase II is recommended that includes utilizing existing data available from SJRWMD to estimate irrigation needs; using data developed in the separate Task I assignment to estimate reclaimed water availability; developing sizing and cost criteria for RIB back up disposal facilities; estimating costs to provide available reclaimed water to irrigation sites; and preparing a summary report of the Phase II findings.

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INTRODUCTION

BACKGROUND

St. Johns River Water Management District (SJRWMD) is responsible for managing ground water resources in a nineteen-county area of northeastern Florida. Ground water aquifers are currently the primary sources of potable water supply in SJRWMD. The most dependable ground water source is the Floridan aquifer. However, the *Water Supply Needs and Sources Assessment* (Vergara 1994) projected shortfalls in available water supply in certain critical areas throughout SJRWMD boundaries by the year 2010. Areas with existing or 2010 projected water supply problems were designated as water resource caution areas (WRCAs).

As a result of the *Water Supply Needs and Sources Assessment*, SJRWMD embarked on an Investigation of Alternative Water Supply Strategies. Strategies being investigated include using lower quality ground water supplies, surface water, reclaimed water, aquifer recharge, aquifer storage and recovery, mitigation and avoidance, and various water conservation techniques.

SJRWMD contracted with Post, Buckley, Schuh & Jernigan, Inc. (PBS&J) to perform various tasks for the purpose of assessing water conservation and reuse of reclaimed water as effective alternative water supply strategies. This report specifically addresses Task II - *Assessment of the Cost of Supplying Reclaimed Water to Areas of High Agricultural Withdrawals* and has been done in association with PB Water.

PURPOSE

The purpose of this task is to assess the economic feasibility of transporting reclaimed water to areas of major agricultural

withdrawals in order to reduce agricultural use of fresh ground water. Two agricultural uses are to be investigated: fern and citrus irrigation. Specific objectives of the task include:

- Assess the availability of reclaimed water in locations that could reasonably serve fern and citrus growing areas.
- Assess the water needs for the defined fern and citrus growing areas.
- Determine the economic feasibility of using reclaimed water for fern and citrus irrigation in the identified areas.

This task is to be accomplished in two phases. This report represents the findings of the Phase I investigations. The purpose of Phase I was to assess the availability of data, develop methodologies, and estimate a budget for accomplishing the objectives in Phase II.

SCOPE OF SERVICES

Specific tasks performed in the Phase I investigation included the following:

- Assess the availability of data required for implementing the proposed methodologies in Phase II including:
  - Review of fern and citrus water use data provided by SJRWMD.
  - Consultation with agricultural experts and representative growers to determine availability of seasonal water use data for fern and citrus.

- Acquisition of design and operating data for Water Conserv II to determine typical citrus irrigation rates and seasonal and daily water use patterns.

- Recommend sources of alternative or surrogate data, if needed.

- Develop methodologies for performing Phase II.

- Name key staff who would perform the work specified in Phase II.

- Provide an estimated budget to perform the Phase II services.

METHODOLOGY

The following data were collected for review to assist in the development of methodologies for Phase II:

- Wastewater treatment plant and reuse information provided by SJRWMD.
- Flow records over the period of operation for Water Conserv II.
- Consumptive Use Permit (CUP) data provided by SJRWMD for fern and citrus.
- Geographic Information System (GIS) data regarding coverage for ferneries.
- Annual water use for fern and citrus grown on sandy ridge soils
- Rainfall gauging data for the Clermont, Lisbon, Orlando International Airport, and Wekiva State Park stations (these data were collected for Task IV investigations but were also reviewed for their suitability to be used in Task II investigations).
- Daily minimum and maximum temperature records for the Lisbon, Clermont, and Orlando International Airport stations (also collected for Task IV and reviewed for suitability for use in Task II investigations).

Technical references specified in the Discussion section of this report were reviewed to assess available methodologies for estimating crop irrigation demands. Meetings and telephone communications were conducted with several agricultural experts in water use data, primarily from the fern industry. These included experts with SJRWMD and a grower who is also president of the Fern Growers

Association. Details of these contacts and references are included in the Discussion section of this report.

Water use data for the Water Conserv II citrus irrigation and recharge system were evaluated. These data were assessed for suitability for determining average annual, seasonal, and diurnal water use patterns.

Based on these data reviews and communications with SJRWMD staff, an approach was developed for conducting the Phase II services. Key staff were identified and budgets for performing the Phase II services were estimated.

DISCUSSION

RECLAIMED WATER AVAILABILITY

Districtwide wastewater treatment plant (WWTP) information was provided by SJRWMD. Data for facilities located in Orange, Seminole, Lake, and Volusia counties were reviewed to assess the suitability of this data base for performing Phase II services. Printouts from the spreadsheet data base for these counties are included in Appendix A.

The data base provides a summary of the WWTP name, owner, location (including latitude and longitude), population served, permitted capacity, average flow, treatment level, and disinfection level for 82 facilities with permitted treatment capacities of 0.1 million gallons per day (mgd) or greater in the four county area. In addition, it includes the type of primary disposal method for each facility and a summary of the distribution of existing flows to various reuse systems. The reuse system categories are as defined in the Florida Department of Environmental Protection's reuse inventory and include agricultural reuse (AI), commercial and industrial reuse (C/I), environmental enhancement (EN), ground water recharge (GR), public access reuse (PA) for golf courses and other uses, fire protection (FP), and other (OT) reuse. A total existing reuse flow is also included. The spreadsheets do not include total permitted reuse capacity or future reuse plans of the utilities.

SJRWMD is developing a GIS data base for the WWTP information. Locations of some facilities need refinement; however, this information should be useful to assess facility location in relation to potential irrigation sites. Many of the facilities appear to be package plants with small capacities. Of the 82 facilities, only 48 have permitted capacities of 0.5 mgd or more, and 30 have capacities of 1.0 mgd or more.

Nearly all of the facilities are currently practicing some form of reuse. Based on direction received from SJRWMD, flows that are committed

to reuse generally are to be considered unavailable for agricultural reuse for the purposes of this study. The only exceptions are flows committed to ground water recharge and environmental enhancement reuse systems which are to be considered available for agricultural reuse.

The WWTP data base appears to be a good source of information to determine commitments based on existing flows; however, it does not provide information on future reuse commitments. The future commitments are important since utilities may have already incurred capital expenses to accommodate future reuse flows or, through ordinances and agreements, may have legally committed to provide reclaimed water to other users.

The reuse flows provided in the data base appear to be annual averages; however, reuse flows can vary considerably on a seasonal basis. It may be more appropriate to assess the volume of uncommitted reclaimed water based on the excess available during peak seasonal demand periods rather than average daily demand periods. A review of several reuse systems (Jackson 1995) found that to meet peak demand requirements without supplementing reclaimed water flows with another water supply the capacity of a reuse system should be no more than 70 percent of the annual average WWTP flow. This "rule of thumb" was also the basis of the Florida APRICOT Act which allows for discharge under specific conditions of up to 30 percent of the permitted reuse capacity. Under this scenario, a 10 mgd WWTP with a 7 mgd annual average reuse system may have no excess capacity during peak season demand periods. The percentages were based on urban reuse systems in well drained soils and may change for utilities with differing characteristics.

Each of the treatment facilities will need to be evaluated to determine if additional levels of treatment are necessary to serve agricultural users with reclaimed water. SJRWMD data base provides summaries of existing levels of treatment and disinfection that should be sufficient for making this general determination. Based on our understanding of

the state's reuse rule (Chapter 62-610, F.A.C.) and personal communication in relation to this project with Dr. David York, P.E., the Florida Department of Environmental Protection's (FDEP's) State Reuse Coordinator, reclaimed water used for irrigation of citrus groves will require secondary treatment and high-level disinfection (which includes filtration). Reclaimed water for irrigation of ferneries that are not accessible to the general public will require secondary treatment and basic disinfection.

Another consideration regarding WWTPs is the diurnal flow pattern. Typically, wastewater flows do not correspond directly to periods of irrigation demand. Operational storage is used to store reclaimed water so that it is available on demand to the users. WWTP diurnal flow patterns are unique for the service area being served (i.e., the flow pattern for a residential service area will vary from one that serves a mix of residential, commercial, and industrial areas). Typically, a minimum storage capacity equal to the daily annual average reuse flow is used for planning purposes to accommodate these fluctuations.

IRRIGATION REQUIREMENTS

Predictive Methods

An approach based on the Blaney-Criddle equation was evaluated as a potential methodology for estimating crop irrigation needs. Several technical documents were reviewed (Shih, et al, 1981, USDA SCS 1981, USDA SCS 1992, SFWMD undated). The *Supplemental Crop Requirement and Withdrawal Calculation* document (SFWMD - undated) presents one method of predicting irrigation needs. It is a refinement of the standard Blaney-Criddle approach to estimating crop irrigation requirements. Input parameters are based on temperature, rainfall, and soil type. Coefficients are provided by crop type and include citrus, but not fern. The model is based on the assumption that the water table is below the root zone. A correction is available for high water tables. The model generally works best in well-drained soils,

which are typical of citrus grown in the ridge areas of Orange and Lake counties.

Historical Water Use Information

Existing sources of data were also evaluated. From consultation with agricultural water use experts at SJRWMD (Moore 1995 and Singleton 1995) several data sources were identified and provided by SJRWMD for review. These include the Benchmark Farm data collected by SJRWMD for ferneries, citrus acreage as obtained from the Florida Agricultural Statistical Service, GIS data on fern coverage by growing condition (hammocks versus sarans), and Consumptive Use Permit (CUP) information in GIS format. In addition, in-house data bases provided by PB Water were reviewed for the Water Conserv II citrus irrigation/ground water recharge system. A meeting was held with the President of the Fern Growers Association to discuss fern irrigation needs.

Fern Water Use Information

The primary area of concern with water use for the fern industry is in northwest Volusia County in the vicinity of Pierson and in southeast Putnam County (Moore 1995, Singleton 1995, and Lawrence 1995). Historically, it was believed that the ferneries required as much as 65 inches of water annually. Investigations associated with the Benchmark Farms suggest that irrigation requirements are much lower, in the range of 25 to 30 inches per year (Lawrence 1995).

New water use permits for ferneries (for new farms or expansions to existing farms) require a storage pond with 72-hours storage capacity to serve freeze protection needs. In general, ferneries are irrigated for one and one-half hours once per week. The system is used to provide fertilizers and pesticides and, except for extended dry periods, this system meets the irrigation needs of the ferns.

Contacts identified as additional data sources for fern irrigation requirements include representatives of the Volusia and Putnam county agricultural extension offices, representatives of a Volusia county public interest group called Citizens for Water, the Volusia Soil Conservation Service office, the Institute of Food and Agricultural Sciences Apopka Research Center (evapotranspiration data for ferneries), and other fernery owners.

Citrus Water Use Information

PB Water has in-house records of water use for the Water Conserv II project. Water Conserv II is a reuse system that combines citrus irrigation with ground water recharge that is owned and operated by the City of Orlando and Orange County. Water from the City's Conserv II facility and the County's Sand Lake Road facility is pumped to a distribution center located approximately 18 miles from the treatment facilities. The distribution center includes 20 million gallons of storage, chlorination facilities, booster pumps, and computerized controls for the entire distribution system. Nearly 8,000 acres of citrus are irrigated within a 30-square mile area of Orange and Lake counties. Several nurseries are also served by the reclaimed water system. Rapid infiltration basins (RIBs) are located on four sites in the area for ground water recharge. RIB capacity is 16 mgd. In 1995, the average annual daily flow to the entire system was approximately 30 mgd. The system also includes 25 Floridan aquifer wells to provide supplemental flows for drought and freeze protection. Currently reclaimed water is provided to users on demand (i.e., no scheduling of flows) and at no cost. Reclaimed water is delivered to individual sites through turnouts on the main distribution system that include computer-controlled valves and flow metering.

Data available from this facility that are pertinent to this study include, in digital format, weekly flows at each turnout, weekly flows to the RIBs, daily rainfall at eight rain gauges located at RIB sites throughout the service area, and RIB "on" and "off" times that can be used to calculate daily flows from weekly totals. In addition, irrigation "on"

and "off" times that can be used to create daily records are available as paper records.

The Water Conserv II data provide sufficient information to establish water use for the citrus groves within the service area. The irrigation and RIB data are also sufficient to assess back up disposal requirements for large scale irrigation systems.

Because reclaimed water is provided to the Water Conserv II irrigation sites at no cost, it is thought that current water use exceeds what was used prior to implementation of the project. Water use records prior to Water Conserv II are not available to verify this assumption.

ALTERNATE DISPOSAL

Another major consideration is the need for backup disposal. Irrigation reuse systems cannot always meet the complete effluent disposal needs of the treatment facility. A disposal mechanism is needed during periods of extended low demand for irrigation water (winter months and extended wet periods). Storage alone, as has been demonstrated by the City of Sarasota and Brevard County South Central Regional reuse programs (Jackson 1995), does not provide a reliable backup. Existing WWTPs may have disposal systems that could serve the alternate disposal needs of an agricultural reuse system. Options for backup can include other reuse mechanisms, such as RIBs for ground water recharge, or disposal to surface waters.

Surface waters in the vicinity of areas with high water withdrawals for citrus irrigation are limited. Since this area is one with sandy ridge soils, similar to Water Conserv II, a RIB system could be a viable backup option. In the fern areas, surface water discharge, possibly in conjunction with additional treatment via a constructed wetlands, and RIBs could be viable.

ECONOMIC FEASIBILITY

Assessment of the economic feasibility of agricultural reuse will require development of estimated costs for reclaimed water treatment (as discussed above), storage, transmission, pumping, and distribution. The cost of backup (alternate) disposal for water that cannot be used for irrigation must also be developed.

Storage, transmission, pumping, and distribution costs will depend on the needs of the crops being irrigated and on possible operating scenarios. Storage can be located at each individual treatment facility; however, if located in the vicinity of sites to be irrigated, transmission costs can be reduced since the transmission systems would then not need to be sized for peak flow requirements. Distribution system costs will also vary depending on whether reclaimed water is offered "on demand" or on an irrigation schedule. On demand would mean that agricultural sites could irrigate whenever needed, with the potential that all sites could irrigate simultaneously. The system would then need to be sized to accommodate this simultaneous demand. The alternative is to allow irrigation according to a predetermined schedule which would prevent the need to size the system for simultaneous demand, thus reducing pipe sizes and storage volumes, but increasing the need for computerized controls. Despite the benefits, flow scheduling can be difficult to implement with the users. Water Conserv II was designed initially based on flow scheduling, but because of changes in the service area because of freeze damage to groves and a reduced number of irrigation sites, the schedule has never been implemented. Scheduling may be required in the future as the system expands. In general, the preference of the agricultural community will be to provide reclaimed water on demand while the preference of those funding and operating the transmission/ distribution system will be to provide reclaimed water based on a scheduling system.

Alternate disposal system costs will depend on the availability of existing disposal systems and the seasonal variability in irrigation needs.

CONCLUSIONS

RECLAIMED WATER AVAILABILITY

Reclaimed water data provided by SJRWMD will be useful for Phase II investigations; however, the data reflect only current conditions and do not project future reuse plans. The best data source for permitted reuse capacity and future reuse plans will be the respective utility. These data are most important for utilities with current reuse flows that are significantly less than the permitted wastewater treatment capacity; however, it may not be practical or cost effective to collect additional data for each of the 82 utilities in Orange, Lake, Seminole, and Volusia counties.

Several of these facilities are also being evaluated for Task I - Replacement of Potable Quality Water for Residential Landscape Irrigation. There may be an ability to combine the data collection activities for these two tasks.

It will not be practical to develop diurnal wastewater flow patterns for each of the WWTPs in the study area. For planning purposes, it can be assumed that one day of storage capacity will be sufficient for diurnal fluctuations in flow.

Seasonal peak reuse flow information may not be available from all utilities. An alternative would be to identify up to three facilities with different type reuse systems to estimate seasonal peak factors. For example, data from a public access reuse system, a golf course irrigation system, and an agricultural reuse system could be evaluated to estimate seasonal peaks for each. This seasonal peak factor could then be applied to other utilities with similar reuse systems so that the available reclaimed water capacity for each system could be estimated.

IRRIGATION REQUIREMENTS

Additional data sources should be contacted to verify and supplement data collected to date on fern irrigation requirements. With verification, the existing data appear to be adequate to estimate fern irrigation demands. Data appear to be adequate from SJRWMD and Water Conserv II to estimate citrus irrigation demands.

COST INFORMATION

Cost elements that must be evaluated to develop the Phase II assessment of the economic feasibility of supplying reclaimed water to areas of high agricultural withdrawals include:

- Additional levels of treatment needed to serve agricultural systems - All the Volusia County facilities meet the secondary treatment/basic disinfection requirement for irrigation of restricted access ferneries. Additional levels of treatment may be required for many of the treatment facilities in Orange, Lake, and Seminole County to meet the secondary treatment/high-level disinfection requirement for irrigation of edible food crops (citrus).

- Operational storage facilities - Storage facilities will be required either at the wastewater treatment plant sites or in the vicinity of the irrigation sites to meet daily operational requirement of the reuse system. For a large regional reuse system modeled after Water Conserv II, it would be most appropriate to locate storage facilities in the vicinity of irrigation sites. With this scenario, pumping facilities will be necessary at each WWTP and repumping systems will be necessary at the storage sites.

- Transmission systems - Sizing transmission and distribution systems will depend on diurnal and seasonal flow requirements to establish peaking factors. Providing sufficient capacity to

meet freeze protection requirements in addition to irrigation requirements is impractical. It would be more practical to use existing systems (existing wells and, in the case of ferns, storage ponds) to continue to serve the requirements for freeze protection. Location of operational storage facilities in the vicinity of irrigation sites will reduce the overall cost of transmission by reducing the need to provide peak flow capacity in the transmission system. Based on the evaluation of citrus and fern irrigation requirements, general peak factors can be developed. Whether reclaimed water is provided on demand or on a flow schedule will be important to transmission system sizing.

- Backup Disposal - Backup disposal systems may not be needed for all systems, particularly those with existing disposal facilities. General cost information for developing RIBs as backup would be useful for utilities without existing backup capacity.

RECOMMENDATIONS

PHASE II SCOPE OF SERVICES

The following subtasks are recommended for the Phase II scope of services to assess the cost of supplying reclaimed water to areas of high agricultural withdrawals:

- Subtask 1 - Fern irrigation requirements
- Subtask 2 - Citrus irrigation requirements
- Subtask 3 - Cost estimates
- Subtask 4 - Report of Findings
- Subtask 5 - Project Progress Meetings

The following describes each of these tasks in further detail.

Subtask 1 - Fern Irrigation Requirements

Fern irrigation requirements are needed to 1) determine the volume of water from the Floridan aquifer that potentially can be saved by using reclaimed water and 2) establish sizing criteria for estimating the cost of a reclaimed water distribution system.

Average annual fern irrigation requirements will be determined by using the fern water use information and fern coverage data provided in Phase I by SJRWMD. To simplify the study, it will be assumed that reclaimed water will be provided to the ferneries at an average rate (i.e., no seasonal peaks) and that any additional requirements for seasonal peak irrigation demands and freeze protection will be supplied by existing fern water supplies (storage ponds and wells).

The estimated irrigation demand will represent the maximum potential water savings that can result from the implementation of a program to irrigate ferneries with reclaimed water. Actual water savings may be constrained by reclaimed water availability.

The following steps will be performed to complete this Subtask:

1.1 Fern water use data will be evaluated to develop an annual average irrigation demand. The average will be based on the period of record and will not be adjusted to account for variations in rainfall, freezing conditions, type of fern (leather leaf, ming, etc.), and other factors that could cause variations in demand.

1.2 GIS coverage data provided by SJRWMD in Phase I will be used to identify the location, size, and type (hammock versus saran) of ferneries.

1.3 Irrigated acreage will be calculated from the coverage data and a potential average daily reclaimed water irrigation demand will be developed by site.

1.4 Estimated reclaimed water availability (as determined under separate Task I assignment) will be compared to the potential irrigation needs of the ferneries. Areas within the fern growing region will be identified that can be most cost effectively served by reclaimed water, either by proximity to major roadways or by higher concentrations of ferneries in a given area. An exhibit will be developed that identifies the general area.

Subtask 2 - Citrus Irrigation Requirements

Citrus irrigation requirements are needed to 1) determine the volume of water from the Floridan aquifer that potentially can be saved by

using reclaimed water and 2) establish sizing criteria for estimating the cost of a reclaimed water distribution system.

Water use data provided by the SJRWMD for citrus areas will be used to estimate the potential volumes that can be served through irrigation with reclaimed water. The land use coverage for citrus will be determined for the study area (areas of concentrated citrus production in Orange, Lake, and Seminole Counties) using the GIS coverage data provided in Phase I by SJRWMD. Maximum potential reclaimed water use will be calculated based on this area.

As with ferneries, it will be assumed that peak season demands and freeze protection requirements will be met by existing water supplies. It will also be assumed that during excessive droughts, these water supplies can be used to supplement reclaimed water.

The following steps will be performed to complete this Subtask:

2.1 Citrus water use data provided by SJRWMD will be evaluated to develop an annual average irrigation demand. The average will be based on the period of record and will not be adjusted to account for variations in rainfall, freezing conditions, age of grove, and other factors that could cause variations in demand.

2.2 GIS coverage data provided by SJRWMD in Phase I will be used to identify the location and size of citrus groves.

2.3 Irrigated acreage will be calculated from the coverage data and a potential average daily reclaimed water irrigation demand will be developed by site.

2.4 Estimated reclaimed water availability (as determined under separate Task I assignment) will be compared to the potential irrigation needs of citrus. Areas within the citrus growing region will be identified that can be most

cost effectively served by reclaimed water, either by proximity to major roadways or by higher concentrations of citrus in a given area. An exhibit will be developed that identifies the general area.

Subtask 3 - Cost Estimates

Cost components will include: transmission from the identified WWTPs to a distribution site, remote operational storage and pumping, distribution to the agricultural sites, metering and flow controls at individual irrigation sites, and unit cost for alternate disposal via RIBs. Sizing of facilities will be based on the following general assumptions:

- For both ferneries and citrus, operational storage will be provided in the vicinity of the irrigation sites, similar to the Water Conserv II distribution center.

- Operational storage system sizing will be based on providing storage for the equivalent of one day of reclaimed water demand.

- Transmission and pumping system sizing will be based on reclaimed water availability, and average agricultural reuse demand needs. It will be assumed that reclaimed water will be provided on demand, such that all sites may irrigate simultaneously.

- Typical costs for RIBs and the reclaimed water distribution system will be developed based on Water Conserv II cost data and other available in-house cost information.

- Unit costs for pipelines will be developed using cost information supplied by Law Engineering under a separate task assignment. Other costs will be developed using in-house cost

data bases and actual construction and operating costs of the Water Conserv II system.

- Total costs as well as cost per 1,000 gallons will be developed.

Subtask 4 - Report Preparation

The following will be provided in the final report of findings of the Phase II investigation:

4.1 A report will be prepared which summarizes the methodologies, results, and conclusions of the Phase II study.

4.2 Estimated potential annual average agricultural water use in the study area.

4.3 Estimated potential annual average agricultural water use that can effectively be replaced by reclaimed water.

4.4 Estimated cost of supplying reclaimed water to areas of potential agricultural water demand.

4.5 Estimated cost of RIB systems in agricultural areas.

Subtask 5 - Project Progress Meetings

For budgeting purposes, this task is based on up to two progress meetings in Palatka with PBS&J and SJRWMD task team members. Periodic conference call meetings may also be held, as needed, through the course of the work and these are included in association with the development of each subtask.

Coordination meetings to be held with members of other consulting teams involved in other task assignments of the Investigation of Alternative Water Supply Strategies, utility presentations and meeting

not specifically identified in this scope of services will be considered additional services and budgeted separately.

KEY STAFF ASSIGNMENTS

The key staff assignments shown in Table 1 are recommended for the Phase II Assessment of the Cost of Supplying Reclaimed Water to Areas of High Agricultural Withdrawals.

Table 1 - Key Staff Assignments

Key Staff Assignment	Project Role
Jo Ann Jackson, P.E. (PBS&J)	Project Manager
David MacIntyre, P.E. (PB Water)	Agricultural Reuse Assessments
Edward H. Talton, P.E. (PBS&J)	Project Engineer
Robert A. Morrell, P.E. (PBS&J)	Project Director/Quality Control Manager

REFERENCES

Jackson, Jo Ann. 1995. Seasonality of reuse demands and the need for alternate disposal. *Proceedings of the Florida Water Resources Conference*, Jacksonville, FL.

Lawrence, Tommy. 1995. Meeting, Fern Growers Association and Owner of Lawrence Farms. De Land, FL.

Moore, Cynthia. 1995. Telephone Communication. SJRWMD, Palatka, FL.

Shih, S.F., L.H. Allen, Jr., L.C. Hammond, J.W. Jones, J.S. Rogers, and A.G. Smajstrla. 1981. *Comparison of Methods of Evapotranspiration Estimation*, American Society of Agricultural Engineers Paper No. 81-2015, Orlando, FL.

Singleton, Vince. 1995. Telephone Communication, SJRWMD, Palatka, FL.

South Florida Water Management District. Undated. *Supplemental Crop Requirement and Withdrawal Calculation*. South Florida Water Management District Water Use Division. West Palm Beach, FL.

United States Department of Agricultural Soil Conservation Service. 1992. *Florida Irrigation Guide*. Gainesville, FL.

United States Department of Agricultural Soil Conservation Service, *Irrigation Water Requirements*, Technical Release No. 21, 1970.

Vergara, Barbara (ed.). 1994. *Water Supply Needs and Sources Assessment*. St. Johns River Water Management District, Palatka, FL.

Appendix A

Wastewater Treatment Plant/Reuse Data Base Information for Orange, Lake, Seminole and Volusia Counties

Table A11. Orange County waste water treatment facilities with permitted capacity of 0.1 mgd or greater. (PART 1 OF 2)

Owner or Oper	Facility Name	Location	Latitude	Longitude	Pop. Served	Permit Capacity mgd	Daily Flow mgd	Treat-ment Level	Disin-fection Level
Angeles Real	Zellwood Sta./Grassmere	US 441, Zellwood D	284302	813508 D	1,000 *	0.300 D	0.086 K	2 M	BA M
Apopka, City	Apopka	Park Ave./Clevela D	283906	813015 D	1,300 D	4.000 D	1.514 R	2 R	HI R
Econ Utility C	Wedgefield Subdivision	Bancroft Blvd & N D	283000	810500 D	768 D	0.200 S	0.165 S	2 S	HI S
Fairways MHP	Fairways MHP Village	14205 E Colonial D	283400	811045 D	1,800 S	0.150 D	0.124 R	2 M	HI R
Gulfstream Ha	Gulfstream MHP	4505 S Goldenrod D	282908	811629 D	1,000 D	0.100 D	0.086 *	2 M	BA M
Kirkland Mgmt	Quality Hotel	3835 Beeline Expr D	282710	811854 D	922 x	0.130 D	0.079 x	2 M	BA M
Ocoee, City of	#2	1800 A.D. Mims R S	293459	813420 D	10,000 D	2.000 S	0.800 S	2 S	BA R
Ocoee, City of	#4	Mims Rd West, O D	283459	813419 D	10,000 D	1.000 D	0.860 *	2 M	BA M
Orange Count	Easterly Subregional	1621 Alafaya Trail S	283046	811205 D	98,837 *	13.500 S	8.500 S	3 S	HI S
Orange Count	*Meadow Woods	1707 Rhode I. Wo S	283614	812656 D	22,000 D	0.714 S	0.400 S	3 S	HI S
Orange Count	Northwest	701 McCormick R S	283744	813119 D	248,000 D	3.000 S	2.000 S	2 S	BA S
Orange Count	*Cypress Walk	11900 N SR 535, S	282335	813045 D	10,000 D	1.000 S	0.400 S	3 S	HI S
Orange Count	*Sand Lake Road	4760 Sand Lake S	282652	812624 D	189,535 *	30.500 S	16.300 S	3 S	HI S
Orange Count	*Southeast (Lake Nona)	7500 Dowden Rd, S	282520	811645 D	3,300 D	0.330 S	0.025 S	3 S	HI S
Orlando Partn	*Quality Inn, Jetport	3835 McCoy Rd, S	282710	811854 D	10,000 D	0.130 S	0.085 S	2 S	BA S
Orlando, City	*CONSERV I	11401 Boggy Cr R D	282402	811950 D	154,000 D	7.500 D	2.520 R	3 R	BA R
Orlando, City	*McLeod Rd./CONSERV II	5100 LB McLeod D	283010	812711 D	4,500 S	25.000 D	13.380 R	2 P	HI R
Park Manor W	Park Manor Estates	1545 Park Manor S	283359	811331 D	1,300 S	0.350 S	0.270 S	3 S	BA S
Reeco Propert	Rock Springs MHP	Rock Sprs rd, N o D	284241	813100 D	2,750 D	0.150 S	0.130 S	2 S	IM S
Reedy Creek I	Reedy Creek	Bear I. Rd., Lk. B D	282230	813530 D	150,000 D	15.000 D	7.200 R	2 M	HI R
Southern Stat	University Shores #1	2600 Jarrell Rd, O D	283445	811618 D	5,000 D	0.275 D	0.174 K	3 D	BA M
Southern Stat	University Shores #2	2600 Jarrell Rd, O D	283445	811616 D	5,495 S	1.000 D	0.409 K	2 D	BA M
Starlight Ranc	Starlight Ranch MHP	6000 E Pershing D	282919	811800 D	1,000 D	0.120 D	0.086 *	2 M	BA M
Univ. of Centr	Univ. of Central Fla.	UCF Campus, Ala S	283500	811300 D	20,000 D	0.500 S	0.428 S	2 S	IM S
Winter Carden	Winter Garden	101 E Crest Ave S	283435	813555 D	20,000 D	2.000 S	1.200 S	3 S	BA S
Winter Park, C	Winter Park	Balfort Dr & Bong D	283623	811857 D	5,698 *	0.750 D	0.490 R	2 M	HI R
SJRWMD ont	0.100 - 0.499 mgd				15,540	1.775	1.200		
	0.500 mgd and greater				569,330	42.750	23.401		
	Total				584,870	44.525	24.601		
Whole county	0.100 - 0.499 mgd				28,840	2.235	1.310		
	0.500 mgd and greater				949,365	107.464	56.401		
	Total				978,205	109.699	57.711		

* Indicates wastewater treatment facilities outside of SJRWMD.

Table A11. Orange County waste water treatment facilities with permitted capacity of 0.1 mgd or greater. (PART 2 OF 2)

Plant Owner o	Facility Name	Primary Disposal		Receiving water body for surface discharge		DEP reuse codes AI Agr	CI C/I	EN Env Enhn	GR Gr Wat Rech	PA Non Golf	PA Golf	FP&OT Fire & Other		
Angeles Real	Zellwood Sta./Grassmere												0.000	G
Apopka, City	Apopka	Reuse	R			0.900					0.650		1.550	P
Econ Utility C	Wedgefield Subdivision	Reuse	S								0.165		0.165	S
Fairways MHP	Fairways MHP Village	Evap./Perc.	D								0.124		0.124	R
Gulfstream Ha	Gulfstream MHP	Evap./Perc.	D										0.000	D
Kirkland Mgmt	Quality Hotel	Reuse	D						0.079				0.079	D
Ocoee, City of	#2	Reuse	D						0.800				0.800	S
Ocoee, City of	#4	Reuse	D						0.860				0.860	D
Orange Count	Easterly Subregional	Reuse	S				3.000	3.000	1.500			1.000	8.500	S
Orange Count	*Meadow Woods	Reuse	S								0.300		0.300	S
Orange Count	Northwest	Reuse	S						2.000				2.000	S
Orange Count	*Cypress Walk	Reuse	S								0.400		0.400	S
Orange Count	*Sand Lake Road	Reuse	S			12.500	0.100		2.500		0.700	0.500	16.300	S
Orange Count	*Southeast (Lake Nona)	Reuse	S								0.025		0.025	S
Orlando Partn	*Quality Inn, Jetport	Reuse	D						0.065				0.065	R
Orlando, City	*CONSERV I	Reuse	R			0.200			2.315			0.005	2.520	R
Orlando, City	*McLeod Rd./CONSERV II	Reuse	R			7.180			4.700		1.500		13.380	R
Park Manor W	Park Manor Estates	Surf. Disch.	S	Wetland/Lit E	S								0.000	D
Reeco Proper	Rock Springs MHP	Evap/Perc	S										0.000	D
Reedy Creek I	Reedy Creek	Reuse	R			0.440	1.240			3.910	1.600		7.190	R
Southern Stat	University Shores #1	Surf. Disch.	D	Little Econ. Ri	D								0.000	D
Southern Stat	University Shores #2	Reuse	D							0.409			0.409	K
Starlight Ranc	Starlight Ranch MHP	Evap./Perc.	D										0.000	D
Univ. of Centr	Univ. of Central Fla.	Reuse	S							0.428			0.428	S
Winter Carden	Winter Garden	Underdrain to Lake Apopka			D								0.000	S
Winter Park,	Winter Park	Reuse	R							0.225	0.170		0.395	R
SJRWMD only	0.100 - 0.499 mgd					0.000	0.000	0.000	0.079	0.000	0.289	0.000	0.368	
	0.500 mgd and greater					1.340	4.240	3.000	5.160	4.972	2.420	1.000	22.132	
	Total					1.340	4.240	3.000	5.239	4.972	2.709	1.000	22.500	
Whole county	0.100 - 0.499 mgd					0.000	0.000	0.000	0.144	0.000	0.314	0.000	0.458	
	0.500 mgd and greater					21.220	4.340	3.000	14.675	4.972	5.320	1.505	55.032	
	Total, whole county					21.220	4.340	3.000	14.819	4.972	5.634	1.505	55.490	

* *Indicates wastewater treatment facilities outside of SJRWMD.*

Table A8. Lake County waste water treatment facilities with permitted capacity of 0.1 mgd or greater. (PART 1 OF 2)

Owner or Operator	Facility Name	Location		Latitude	Longitude		Pop. Served		Permit Capacity mgd		Mean Flow mgd		Treat-ment Level		Disin-fection Level	
American Sunlake	Sun Lake Estates	1045 Great Lakes Blvd., Grand Island	D	285681	814654	D	1,000	D	0.150	D	0.086	*	2	M	BA	M
Boll, John	Oak Springs MHP	12 Highland Ave., Sorrento	D	284723	813152	D	1,150	D	0.150	D	0.099	*	2	M	BA	M
Clerbrook RV Resorts	Clerbrook MHP	US 27, 6 mi. N of Clermont	D	283810	814730	D	600	D	0.120	R	0.050	R	2	M	BA	R
Clermont, City of	Clermont	Osceola/12th St., Clermont	D	283308	814636	D	9,500	D	0.950	R	0.728	R	2	M	BA	R
De Anza Mid-Fla. Lakes	Mid-Florida Lakes	SR 44, Leesburg	D	285215	814612	D	1,000	D	0.180	D	0.086	*	2	M	BA	R
Eustis, City of	Eustis Main	801 Bates Ave., Eustis	D	285130	814035	D	9,858	D	1.800	R	1.651	R	2	M	BA	R
Groveland, City of	Groveland	Sampy Road, Groveland	D	283410	815040	D	1,773	x	0.250	D	0.153	x	2	M	BA	M
Lady Lake, Town of	Lady Lake	398 Rex Dr., Lady Lake	D	285521	815623	D	5,466	D	0.500	D	0.437	K	2	M	BA	M
Lakewood Devs.	Plantation at Leesburg	US 27, 2 mi. S of SR 48, Leesburg	D	284241	815243	D	960	D	0.200	D	0.083	*	2	M	BA	M
Leesburg, City of	Leesburg	608 N Canal St., Leesburg	D	284829	815230	D	11,000	D	3.500	R	2.746	R	2	M	IM	R
Mount Dora, City of	Mount Dora	SR 19A, Mt. Dora	D	284824	814025	D	15,000	D	1.500	R	0.586	R	2	M	HI	R
Sunbelt Utilities	Orange Blossom Gardens	US 441/27 N., Lady Lake	D	285652	815650	D	10,000	D	1.000	D	0.452	R	2	M	HI	R
Southern States Util.	Sunshine Parkway	US 27/SR 19, Minneola	D	283837	814752	D	1,047	*	0.250	D	0.090	K	2	M	BA	R
Southlake Dev. Group	Southlake	US 27, S of SR 474, Clermont	D	282339	814357	D	3,050	x	0.430	D	0.262	x	2	M	BA	M
Taveres, City of	Caroline Street	525 Caroline St., Tavares	D	284819	814354	D	5,500	D	0.750	R	0.542	R	2	M	BA	R
Taveres, City of	Woodlea Road	Woodlea Road, Tavares	D	284730	814500	D	7,000	D	1.000	R	0.380	R	2	M	BA	R
Thousand Trails, Inc.	Thousand Trails	7175 US 27 S, Clermont	D	282230	814020	D	700	D	0.140	R	0.026	R	2	M	BA	R
Umatilla, City of	Umatilla	Golden Gem Dr./Cemetery Rd., Umat.	D	285458	814101	D	3,000	D	0.300	R	0.155	R	2	M	BA	R
Water Oak Util. Inc.	Water Oaks	US 27 N, Lady Lake	D	285548	815446	D	3,054	D	0.200	D	0.263	*	2	M	BA	M
Wekiva Falls Resort	Wekiva Falls Campground	Wekiva Road, Sorrento	D	284734	812503	D	1,991	D	0.100	D	0.171	*	2	M	BA	M
	0.100 - 0.499 mgd						19,325		2.470		1.523					
	0.500 mgd and greater						73,324		11.000		5.815					
	Total						92,649		13.470		9.045					

Table A8. Lake County waste water treatment facilities with permitted capacity of 0.1 mgd or greater. (PART 2 OF 2)

Plant Owner or Operator	Facility Name	Primary Disposal		Receiving water body for surface discharge	DEP reuse codes AI Agr	CI C/I	EN Env Enhn	GR Gr Wat Rech	PA Non Golf	PA Golf	FP&OT Fire & Other	Reuse Total	
American Sunlake	Sun Lake Estates	Reuse	D					0.086				0.086	*
Boll, John	Oak Springs MHP	Evap/Perc.	D									0.000	D
Clerbrook RV Resorts	Clerbrook MHP	Reuse	R					0.500				0.500	R
Clermont, City of	Clermont	Reuse	R		0.560							0.560	R
De Anza Mid-Fla. Lakes	Mid-Florida Lakes	Reuse	R		0.086							0.086	*
Eustis, City of	Eustis Main	Reuse	R		1.200			0.451				1.651	R
Groveland, City of	Groveland	Reuse	D		0.153							0.153	D
Lady Lake, Town of	Lady Lake	Reuse	D		0.437							0.437	KD
Lakewood Devs.	Plantation at Leesburg	Reuse	D		0.083							0.083	*
Leesburg, City of	Leesburg	Reuse	R		2.746							2.746	R
Mount Dora, City of	Mount Dora	Reuse	R						0.586			0.586	R
Sunbelt Utilities	Orange Blossom Gardens	Reuse	R							0.452		0.452	R
Southern States Util.	Sunshine Parkway	Surf. Disch.	D									0.000	D
Southlake Dev. Group	Southlake	Reuse	D					0.262				0.262	D
Taveres, City of	Tavares	Reuse	R					0.542				0.542	R
Taveres, City of	Woodlea Road	Reuse	R					0.380				0.380	R
Thousand Trails, Inc.	Thousand Trails	Reuse	R					0.026				0.026	R
Umatilla, City of	Umatilla	Reuse	R		0.155							0.155	R
Water Oak Util. Inc.	Water Oaks	Reuse	D					0.263				0.263	*
Wekiva Falls Resort	Wekiva Falls Campground	Evap/Perc.	D									0.000	D
	0.100 - 0.499 mgd				0.476	0.000	0.000	1.137	0.000	0.000	0.000	1.613	
	0.500 mgd and greater				4.943	0.000	0.000	1.373	0.586	0.452	0.000	7.354	
	Total				5.419	0.000	0.000	2.510	0.586	0.452	0.000	8.967	

Table A14. Seminole County waste water treatment facilities with permitted capacity of 0.1 mgd or greater. (PART 1 OF 2)

Owner or Operator	Facility Name	Location		Latitude	Longitude		Pop. Served		Permit Capacity mgd		Mean Flow mgd		Treat-ment Level		Disin-fection Level	
Alafaya Utilities, Inc.	Alafay PUD	1057 McKinnon Rd, Oviedo	D	283824	811116	D	12,000	D	2.400	D	0.623	R	3	R	HI	R
Altamonte Spr, City of	Altamonte Springs	Keller Rd, Altamonte Sprs	D	284000	812100	D	125,000	D	12.500	D	6.300	R	3	R	HI	R
Casselberry, City of	Casselberry	700 N Winter Park, Casselberry	D	284114	811852	D	3,167	D	0.643	D	0.635	R	3	R	HI	R
Longwood Utilities, Inc.	Shadow Hills	910 Longwood Hills Rd, Longwood	S	284254	812143	D	6,000	D	0.500	S	0.425	S	2	S	BA	S
Orlando, City of	Iron Bridge Road Regional	Iron Br Rd, W of Alafaya, Oviedo	D	283720	811310	D	270,000	D	40.000	R	25.180	R	3	D	HI	R
Palm Valley Association	Palm Valley MHP	3751 Alafaya Tr, Oviedo	D	283720	811145	D	1,409	D	0.126	D	0.113	D	2	M	BA	M
Sanford, City of	Sanford	1201 W Seminole Blvd, Sanford	S	284826	811645	D	34,000	S	7.300	S	6.100	R	3	S	HI	S
Sanlando Utility Corp.	Wekiva Hunt Club	144 Ledbury Dr, Longwood	S	284142	812558	D	25,542	S	2.900	S	2.374	S	2	S	BA	S
Sanlando Utility Corp.	Woodlands des Pinar	125 Western Fork Ave, Longwood	S	284215	812229	D	5,210	S	0.500	S	0.495	S	2	S	BA	S
Seminole County	Greenwood	Greenway Blvd, S of Lake Mary	D	284400	812049	D	35,000	D	3.500	R	1.803	R	2	M	BA	R
Seminole County	Northwest Regional	SR 36, 3.5 mi. W of I-4	D	284950	812344	D	22,500	D	2.500	D	1.800	K	2	M	BA	D
Southern States Util.	Chulota	4th & C Ave, Chuluota	D	283846	810730	D	1,000	D	0.100	D	0.086	*	2	M	BA	D
Utilities Inc.	Lincoln Heights	20th St, off Arpt. Blvd, Sanford	S	284736	811811	D	865	S	0.120	D	0.080	S	2	S	BA	S
Utilities Inc.	Weathersfield	200 Weathersfield Ave, Altamonte Spr	S	283930	812230	D	3,206	D	0.360	S	0.105	S	2	S	BA	S
Winter Springs, City of	East (Tuscawilla)	1560 Winter Spr Blvd, Winter Springs	S	284035	811438	D	10,957	S	2.012	R	0.736	R	2	S	HI	S
Winter Springs, City of	West	1000 W SR 434, Winter Springs	S	284231	811912	D	11,289	S	1.345	R	0.913	R	2	S	HI	S
	0.100 - 0.499 mgd						6,480		0.706		0.384					
	0.500 mgd and greater						560,665		76.100		45.829					
	Total						567,145		76.806		47.768					

Table A14. Seminole County waste water treatment facilities with permitted capacity of 0.1 mgd or greater. (PART 2 OF 2)

Plant Owner or Operator	Facility Name	Primary Disposal		Receiving water body for surface discharge		DEP reuse codes AI Agr	CI C/I	EN Env Enhn	GR Gr Wat Rech	PA Non Golf	PA Golf	FP&OT Fire & Other	Reuse Total	
Alafaya Utilities, Inc.	Alafay PUD	Reuse	R								0.448		0.448	R
Altamonte Spr, City of	Altamonte Springs	Reuse	R				1.24			1.320			2.560	R
Casselberry, City of	Casselberry	Reuse	R						0.285		0.350		0.635	R
Longwood Utilities, Inc.	Shadow Hills	Perc. Ponds	S						0.425				0.425	R
Orlando, City of	Iron Bridge Road Regional	Reuse	D	Little Econ. River	D			25.180					25.180	R
Palm Valley Association	Palm Valley MHP	Reuse	D						0.113				0.113	D
Sanford, City of	Sanford	Reuse	R			2.000				0.482	1.100		3.582	SR
Sanlando Utility Corp.	Wekiva Hunt Club	Surf. Disch.	Se	Sweetwater Cr	S								0.000	Sa
Sanlando Utility Corp.	Woodlands des Pinar	Reuse	S						0.495				0.495	S
Seminole County	Greenwood	Reuse	R							1.700			1.700	R
Seminole County	Northwest Regional	Reuse	D						1.800				1.800	K
Southern States Util.	Chulota	Perc. Pond	D						0.086				0.086	D
Utilities Inc.	Lincoln Heights	Surf. Disch.	S	Canal/St Johns	S								0.000	S
Utilities Inc.	Weathersfield	Surf. Disch.	S	Little Wekiva Riv	S								0.000	S
Winter Springs, City of	East	Reuse, spra	S			0.200			0.260	0.020	0.400		0.880	R
Winter Springs, City of	West	Pond, Reus	S			0.280			0.265		0.350		0.895	R
	0.100 - 0.499 mgd					0.000	0.000	0.000	0.199	0.000	0.000	0.000	0.199	
	0.500 mgd and greater					2.480	1.240	25.180	3.530	3.522	2.648	0.000	38.600	
	Total					2.480	1.240	25.180	3.729	3.522	2.648	0.000	38.799	

a Sanlando Utilities - Wekiva Hunt club will have reuse to 3 golf courses by 12/96.

Table A15. Volusia County waste water treatment facilities with permitted capacity of 0.1 mgd or greater. (PART 1 OF 2)

Owner or Oper	Facility Name	Location	Latitude	Long	Pop. Served	Permit Capacity mgd	Mean Flow mgd	Treat-ment Level	Disin-fection Level
Daytona Beac	Bethune Point	1 Shady Place, D S	291205	810031 D	45,000 S	12.000 S	8.000 S	3 P	HI S
Daytona Beac	Westside Regional	11th St & W US 9 D	291031	810641 D	45,000 P	10.000 R	8.000 R	2 P	HI R
Deland, City o	Regional	1032S Amelia Ave S	290034	811756 D	16,000 D	4.000 S	2.660 R	3 S	HI S
Deland, City o	Brandy Trails	465 E Lake Mame P	290502	811930 D	3,150 D	0.630 P	0.120 P	2 P	BA P
Edgewater, Cl	Edgewater	500 W Ocean Ave S	285826	805455 D	7,000 S	2.250 R	0.878 R	3 S	HI R
Holly Hill, City	Holly Hill	453 11th St, Holly S	291426	810240 D	11,141 S	2.400 S	2.010 S	3 S	HI S
Indian River U	Hacienda del Rio	US 1, S of Edgew D	285527	805222 D	600 D	0.116 D	0.052 *	2 M	BA M
N. Peninsula	Seabridge Subdiv.	SR A1A N of Orm D	292300	810500 D	545 D	0.150 D	0.047 *	2 M	BA M
New Smyrna	New Smyrna Beach	20 N Causeway S D	290150	805503 D	17,500 D	4.000 D	2.550 R	3 M	BA M
Ormond Beac	Breakaway Trails	N of SR 40, E of I D	291500	810704 D	3,000 D	0.300 R	0.106 R	2 M	HI R
Ormond Beac	Ormond Beach	450 N Orchard St, D	291720	810426 D	38,400 D	6.000 R	3.830 R	2 M	BA R
Port Orange,	Port Orange	817 Oak St, Port S	290812	805949 D	37,500 S	12.000 S	5.600 R	3 S	HI S
Southern Stat	Sugar Mill Country Club	Hwy 40A W & Clu D	290224	805906 D	300 D	0.270 D	0.118 K	2 M	BA M
Southern Stat	Deltona Lakes	Fisher & Provident D	285227	811507 D	11,858 D	0.900 D	0.887 R	2 M	BA M
Terra Mar Wat	Terra Mar Village	US 1, Oak Hill D	285448	805150 D	1,000 D	0.100 D	0.086 *	2 M	BA M
Tymber Creek	Tymber Creek Subdiv.	Serv. road off San D	291554	810738 D	414 D	0.131 D	0.036 *	2 M	BA M
Volusia Count	Deltona North	Wolf Pack Run, D D	285510	811510 D	1,419 *	0.500 R	0.122 R	2 M	BA M
Volusia Count	Four Townes	Iris Dr, Orange Cit D	285545	811710 D	3,244 *	0.600 D	0.279 K	2 M	BA M
Volusia Count	Spruce Creek	Taylor Rd & Lindy D	290443	810318 D	3,500 D	0.350 D	0.187 K	2 M	BA M
Volusia Count	Southwest Regional	US 17/92 & Enter D	285430	811933 D	350 D	0.500 Pa	0.280 P	3 P	HI M
0.100 - 0.499 mgd					9,359	1.417	0.631074		
0.500 mgd and greater					235,562	55.780	33.528		
Total					244,921	57.197	35.847074		

a Volusia County Southwest Regional is permitted to expand to 5 mgd. Current data are for Phase I.

Table A15. Volusia County waste water treatment facilities with permitted capacity of 0.1 mgd or greater. (PART 2 OF 2)

Plant Owner o	Facility Name	Primary Disposal		Receiving water body for surface discharge		DEP reuse codes AI Agr	CI C/I	EN Env Enhn	GR Gr Wat Rech	PA Non Golf	PA Golf	FP&OT Fire & Other	Reuse Total	
Daytona Beac	Bethune Point	Surf. Disch.	Sa	Halifax Riv	S								0.000	Sa
Daytona Beac	Westside Regional	Surf. Disch.	Pb	Halifax Riv	P						1.910		1.910	Rb
Deland, City o	Regional	Surf. Disch.	S	St Johns Riv	S						0.266		0.266	R
Deland, City o	Brandy Trails	Reuse	P			0.120							0.120	P
Edgewater, Ci	Edgewater	Reuse	S	N Mosquito L	S					0.878			0.878	R
Holly Hill, City	Holly Hill	Surf. Disch.	Sc	Halifax riv	S								0.000	Sc
Indian River U	Hacienda del Rio	Reuse	D			0.0258			0.0258				0.052	
N. Peninsula	Seabridge Subdiv.	Evap./Perc.	K						0.04687				0.047	D
New Smyrna	New Smyrna Beach	Surf Disch	C	Indian Riv	D					0.500			0.500	R
Ormond Beac	Breakaway Trails	Reuse	R							0.106			0.106	R
Ormond Beac	Ormond Beach	Reuse	D							1.915	1.915		3.830	X
Port Orange,	Port Orange	Surf. Disch.	S	Halifax Riv	S		0.010			0.120	0.240	0.450	0.820	S
Southern Stat	Sugar Mill Country Club	Reuse	D						0.118				0.118	D
Southern Stat	Deltona Lakes	Reuse	R								0.887		0.887	R
Terra Mar Wat	Terra Mar Village	Evap./Perc.	D										0.000	D
Tymber Creek	Tymber Creek Subdiv.	Reuse	D						0.035604				0.036	D
Volusia Count	Deltona North	Reuse	R						0.122				0.122	R
Volusia Count	Four Townes	Evap./Perc.	D										0.000	D
Volusia Count	Spruce Creek	Evap./Perc.	D										0.000	D
Volusia Count	Southwest Regional	Reuse	p						0.140		0.140		0.280	P
0.100 - 0.499 mgd						0.0258	0	0	0.226274	0.106	0	0	0.358074	
1.000 mgd and greater						0.120	0.010	0.000	0.262	3.413	5.358	0.450	9.613	
Total						0.1458	0.01	0	0.488274	3.519	5.358	0.45	9.971074	

a Daytona Beach - Bethune Point is being upgraded to AWT to continue surface discharge.

b Daytona beach will maximize reuse from the Westside regional plant. Reuse will replace discharge to the Halifax River.

c Holly Hill states plans to do reuse "in the near future."