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Florida Water Resources JOURNAL

February 2016

Alternative Sources for Water Supply

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2016 FWPCOA President
– see page ?? –

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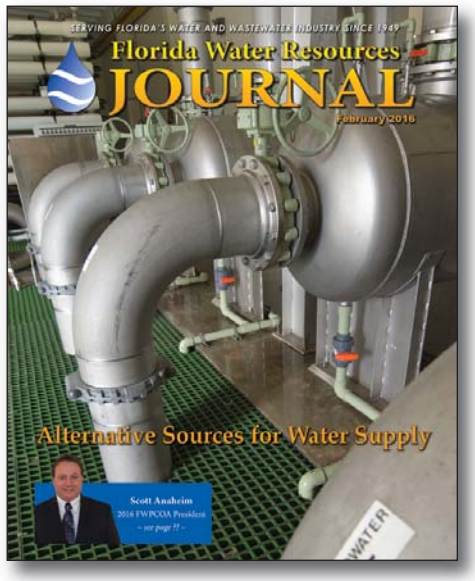

ON THE COVER: The production capacity at the Martin County Utilities Tropical Farms Reverse Osmosis Plant in Stuart was expanded from 2 to 8 mil gal of water per day (mgd). The 6-mgd expansion decreased the plant's dependency on water from the surficial aquifer. Other benefits include limiting the potential for wetland impacts and reducing saltwater intrusion. The plant expansion was completed in 2009 for a total project cost of $11 million, including approximately $2.4 million in South Florida Water Management District funding. (photo: South Florida Water Management District)

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Indirect Potable Reuse: City of Clearwater's Groundwater Replenishment Program

Jeffrey M. Trommer

Since the 1920s, the City of Clearwater has utilized groundwater as a source of potable water supply. The city currently produces approximately 50 percent of its own potable water to supply its11-mil-gal-per-day (mgd) demand. Groundwater for potable supply is withdrawn from the Upper Floridan aquifer, which has limited local recharge and is underlain at relatively shallow depths by more saline water due to the influence of the adjacent saltwater bodies. The withdrawal of additional groundwater is therefore limited by the potential for both upward and lateral migration of more saline water.

Clearwater operates its own wastewater system and produces high-quality reclaimed water for reuse. In order to maximize the beneficial use of its reclaimed water and improve water levels within the area of its well fields, the city is continuing a project to purify reclaimed water and using the purified water to replenish the Upper Floridan aquifer with a 3-mgd groundwater replenishment system. The purification plant and recharge well system will be constructed on city property containing the Northeast Water Reclamation Facility (NEWRF) and adjacent golf courses. The project is cofunded by the Southwest Florida Water Management District (SWFWMD).

Feasibility studies for the project were completed that addressed: 1) the hydrogeologic aspects of direct aquifer recharge; 2) the technologies for treating the water to drinking water standards, including removal of microconstituents, viruses, pharmaceuticals, and low molecular weight organics; and 3) post-treatment of the treated water for compatibility with the aquifer water and rock matrix and prevention of metals mobilization. The feasibility studies indicated that the local hydrogeology is suitable for direct aquifer recharge and that the treatment technologies are available to cost-effectively treat the reclaimed water to the standards required for direct aquifer recharge.

The concept of direct aquifer recharge for this project is to inject the purified water into lower Zone A of the Upper Floridan aquifer. The water will migrate laterally through lower Zone A and slowly upward into upper Zone A. The effect of the recharge is to increase aquifer levels up-gradient of the city's supply wells, and reduce the amount of drawdown induced by the well field.

Hydrogeologic Evaluation

An extensive site-specific hydrogeologic testing program was performed by Leggette, Brashears & Graham (LBG), and a pilot treatment plant was designed and operated by Tetra Tech for one year. The hydrogeologic evaluation consisted of permitting, construction, and testing of a Class V test recharge well and four associated monitoring wells. Rock cores were collected from the recharge zone to use for arsenic leaching analyses using water from various stages of the pilot treatment system. A six-month recharge test using a fluoride tracer was performed to evaluate the aquifer response to recharge and to collect data for refinement of a particle tracking model developed during the feasibility study.

The geology of the area consists in general of a layer of unconsolidated sand, silt, and clayey sand, underlain by a sandy clay-to-clay layer. The clay layer is underlain by a limestone sequence comprised of, in descending order, the Tampa Member and Suwannee Limestone. The surficial sand layer is 10 ft thick at the site and is underlain by 20 to 40 ft of silty to sandy clay.

The sandy clay layer overlies the Tampa Member limestone. The Tampa Member occurs from 50 ft to 230 ft below land surface (bls) at the site, and unconformably overlies the Oligocene-age Suwannee Limestone. The top of the Suwannee Limestone is at a depth of approximately 230 ft bls and the Suwannee Limestone is approximately 280 ft thick at the site.

The Upper Floridan aquifer in Pinellas County is divided into three permeable zones separated by semiconfining units. The zones are alphabetically labeled with increasing depth from A to C. Zone A comprises the Tampa Member and the uppermost part of the Suwannee Limestone and is the shallowest and freshest of the producing zones. Zone A is typically separated into upper Zone A and lower Zone A in Pinellas County.

Upper Zone A is comprised of the Tampa Member and is the primary source for water supply in the north Pinellas County area, including the City of Clearwater's supply wells. Total dissolved solids (TDS) concentration in upper Zone A is less than 500 mg/l. Lower Zone A occurs in the upper part of the Suwannee Limestone. Upper Zone A is present from 40 to 180 ft bls, while lower Zone A is present from 230 to 330 ft bls at the site. The TDS concentration in lower Zone A increases with depth from 600 to 1,200 mg/l.

Aquifer test results indicated that the transmissivity of lower Zone A is approximately 14,000 ft^2/day, which is suitable for groundwater recharge.

Mobilization of metals, primarily arsenic, has been an issue for aquifer storage and recovery (ASR) projects in Florida. As part of the evalua-

Continued on page 6

The ultrafiltration component of the pilot treatment plant. Ultrafiltration removes suspended solids, bacteria, and microconstituents.

Membrane contactors remove dissolved oxygen to prevent arsenic mobilization.

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Continued from page 4
tion of the potential for metals mobilization for this project, rock cores were collected from the recharge zone to perform metals leaching tests and mineralogical analyses. Continuous cores were collected from 230 to 330 ft bls. Core sections to be used for the leaching analysis were transferred to sealed preservation tubes, where the air was vacuum-extracted and replaced with nitrogen to maintain the cores in an anoxic environment.

The preserved cores were subsequently used in column tests for metals leachability. Core sections approximately 1 ft long were emplaced in columns where water from the pilot treatment plant was run through the core and sampled on the output end at timed intervals for water quality analysis. Column tests were run with water from various stages of the treatment process, including various degrees of dissolved oxygen removal.

The final element of the hydrogeologic evaluation was the performance of a six-month recharge test to evaluate aquifer response to injection, and to collect data to update the MODPATH model (a particle-tracking model that computes three-dimensional flow paths using output from groundwater-flow simulations) developed during the feasibility for travel time analysis. Groundwater from a remote supply well was piped to the test recharge well and injected at 300 gal per minute (gpm). A fluoride feed was added to the water to use as a groundwater tracer. Water samples were collected weekly from the four monitoring wells for analysis of water quality parameters. Water levels were recorded in the recharge wells and monitoring wells.

Groundwater modeling, including a MODFLOW groundwater flow and associated MODPATH particle tracking model, was performed during the feasibility study and subsequently updated using data collected from on-site testing. The flow model was used to evaluate the reduction in drawdown from the city's supply well field. Model results indicated that recharge of 3 mgd will reduce drawdown in the City of Clearwater's well field by 1 ft in the northern portion of the well field, and a few tenths of a ft in the southern portion of the well field, including the use of the new RO2 supply wells. Recharge of 3 mgd can be accomplished using three wells, with a fourth as a backup well, with all the wells located on the portion of the city-controlled property to the east of McMullen Booth Road. The particle tracking model was performed to estimate travel time of the injected water, specifically to demonstrate that the travel time to the nearest supply well was greater than six months. The particle-tracking model results indicate that recharge water will remain within the city-controlled property boundary for six months after injection into lower Zone A. The maximum distance traveled in 10 years in lower Zone A is 4,300 ft; the maximum distance traveled in upper Zone A in 10 years is 1,900 ft.

Water Purification System

The water purification system is a three-step multiple-barrier process. The first step, ultrafiltration, removes suspended solids and micro-organisms; secondly, reverse osmosis removes bacteria, some viruses, metals, inorganics, organics, and pharmaceuticals; and finally, an advanced oxidation process (AOP) using hydrogen peroxide and ultraviolet light removes viruses and low-molecular-weight organics, such as N-nitrosodimethylamine (NDMA). A one-year pilot test of the purification process was recently completed. Reclaimed water from the NEWRF was used in a 25-gpm on-site pilot plant to demonstrate the effectiveness of purifying reclaimed water.

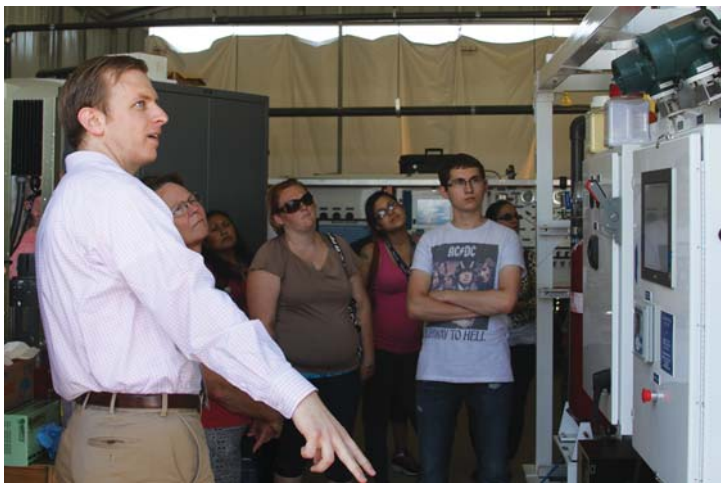
An extensive sampling and analysis program was implemented to demonstrate that the constituents listed could be successfully and reliably removed, and that the system could be operated and maintained in a manner that will be reliable and cost-effective at full scale. The results of the pilot test indicated that:

- The system meets organics removal requirements for total organic carbon and total organic halides.
- Microorganisms, including coliforms, cryptosporidium, viruses, giardia, and helminthes, were effectively removed.
- Haloacetic acids and total trihalomethanes were effectively removed.
- Of the 28 out 175 microconstituents found in the reclaimed (influent) water, only one, analyte–atenolol, was detectable in the finished water.
- Spike testing of the AOP showed that it meets California Department of Public Health draft guidelines for removal of 1,4-dioxane and NDMA.
- Mutagenicity tests showed that the water did not have mutagenic effects.

The other key aspect of the purification process is post-treatment of the purified water to remove dissolved oxygen and make the water chemistry compatible with the native aquifer water and rock matrix. Membrane contactors were used to effectively remove 3.5 log of dissolved oxygen to below 10 parts per bil. Carbon dioxide and calcium were added to balance pH and alkalinity, and sodium bisulfide was added to quench residual hydrogen peroxide from the AOP and reduce the Oxidation-Reduction Potential (ORP) of the water.

The results of the hydrogeologic testing program indicate that lower Zone A has the appropriate water quality and hydraulic parameters for direct aquifer recharge of the proposed 3-mgd purified reclaimed water. The results of geochemical and rock core metals leaching analyses indicate that the post-treatment processes used in the pilot treatment system are appropriate to remove dissolved oxygen to the level needed to maintain arsenic concentrations below the drinking water standard of 10 µg/l, and to make the purified water compatible with the native groundwater and aquifer matrix in lower Zone A. The results of the groundwater modeling analysis indicate that the groundwater replenishment project will provide a net benefit by reduction of drawdown in the city's service area of up to 1 ft. A comprehensive public outreach program is being implemented as part of the project to inform the technical community, public officials, and the general public of the steps involved in the testing and evaluation, and the results of the testing. Public feedback has been very favorable.

Design and permitting is scheduled for completion in 2017, with construction planned to begin in 2018.



The team conducts tours of the pilot system as part of the public information outreach program.

Jeffrey M. Trommer, P.G., is a senior associate with Leggette, Brashears & Graham (LBG) in Tampa, and serves as the primary hydrogeologist for the City of Clearwater's groundwater replenishment project. A Florida-licensed professional geologist, he has 28 years of experience in hydrogeologic investigations, specializing in water supply development, water use permitting, injection well permitting, construction and testing, effluent disposal and reuse, groundwater modeling, and regional groundwater resource evaluations.

Anaheim Elected as FWPCOA President

Scott Anaheim was elected as president of the Florida Water and Pollution Control Operators Association (FWPCOA) for 2016 by the organization's board of directors at the October 2015 meeting.

Anaheim is director, water/wastewater planning and development, for JEA in Jacksonville. He began his career as a water distribution trainee in 1983, advancing to his current position in February 2015. He has been at JEA for 32 years, in charge of managing system planning, engineering, and construction management processes, and his responsibilities include all water, wastewater, reclaimed treatment, grid and capacity, and system planning functions; interlocal and utility service agreements; territorial agreements; and utility acquisitions and new development processes. Anaheim develops and oversees both short- and long-term planning processes and master plans, which account for future water supply, wastewater, and reclaimed needs of base customers and new customers, and coordinates with the operations group's long-term planning of existing grid assets for rehabilitation and refurbishment. He was the operation and maintenance director for collection and delivery for 10 years prior to transferring to system planning, and was responsible for overseeing the maintenance of JEA's water, wastewater, and reuse system, which serves stakeholders in parts of four counties covering 900 square miles.

Anaheim has served FWPCOA at both the regional and state level. At the regional level, he was elected Region 2 director and helped create and instruct CEU courses for the region. He holds a Level 1 water distribution license and a wastewater collection system license.

"I'm truly honored to be serving as the FWPCOA president and look forward to continuing to focus on opportunities to expand our membership, find ways to get our members more involved in the industry, and expand our training programs. I look forward to working with our sister associations and other water-related organizations in the coming year."

You Can be a Published Author!

Florida Water Resources JOURNAL

Rick Harmon

The *Journal* is always interested in receiving any technical or feature articles that deal with Florida water, wastewater, and operator issues to publish in the magazine.

Each issue of the *Journal* has a theme, and the list can be found on the magazine's website at www.fwrj.com, but articles on all topics are welcome. Subjects of interest include, but are not limited to, the following:

- Utility management
- Water conservation and reuse
- Water and wastewater treatment
- Operator training
- Water supply and alternative sources
- Sustainability and environmental stewardship
- Biosolids
- Stormwater
- Water quality and disinfection
- Distribution and collection systems
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- Research

An article doesn't have to be publish-ready; even if you think you're not a great writer, we can edit and polish your article so it meets the standards of the magazine. There's no limit on the length of an article, and photos, graphs, charts, and other illustrations are always helpful to the reader.

Sharing your knowledge with your peers helps to strengthen the water industry. And, regardless of your position in the field, having an article published can maybe help your career.

Other Information

The magazine is looking for other water-related information, too. The News Beat column includes a company's new personnel and promotions, organization and individual awards, and new projects. The New Products column highlights new and innovative water industry products.

If you're a manufacturer, consider submitting an article for Technology Spotlight, which highlights a new product or process and runs alongside your paid advertising. For more information about this, contact Mike Delaney at mike@fwrj.com or at 352.241.6006.

Send completed articles, article ideas, and column information to editor@fwrj.com. If you would like to discuss an article, feel free to email me at the address above or call me at 303.759.4966.

If you like being a reader of the magazine, you'll love being a contributor. I look forward to hearing from you!

Rick Harmon is editor of Florida Water Resources Journal.

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STORMWATER
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webmaster@fwpcoa.org

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  h2oboy2@juno.com
- **Trustee, 2nd Year Jeff Poteet**
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  jpoteet@cityofmarcoisland.com
- **Trustee, 1st Year David Denny**
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- **Member Glenn Whitcomb**
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  backflow@fwpcoa.org

FWEA Hosts WEFMAX 2016 in Orlando

Raynetta Curry Marshall, President, and **Lisa Prieto**, President-Elect, FWEA

We are pleased to announce that in 2016 FWEA will be hosting a WEFMAX meeting in Orlando from March 9–11 at Disney's BoardWalk Resort. A WEF-budgeted annual program, WEFMAX offers association leaders the opportunity to hold discussions on matters of importance to the Federation, the water environment profession, and our communities. Those attending WEFMAX will learn what is new at WEF and will also be able to exchange ideas and information with other member association (MA) leaders.

Every year WEF holds four WEFMAX meetings throughout the country at "destination sites," and MAs put in a request years in advance to be chosen as a site. The FWEA requested to be a WEFMAX sponsor in 2014 and was selected shortly thereafter. In addition to Orlando, the other three meetings this year will be held in Philadelphia; Chicago; and Vail, Colo. Registration is open and filling up quickly as Disney is an attractive location for our colleagues from the Northeast, as well as those interested in making a vacation out of the meeting.

The WEFMAX meetings are broken out into sessions based on topics voted on by the WEFMAX planning committee. This year's topics include:

- Developing Young Professionals
- Alternative Revenue Sources
- Public Education
- Good Ideas

In addition, there will be an MA leaders mini-summit held at the event.

Most of the WEFMAX sessions will be hosted and run by WEF staff and delegates. There are also opportunities for FWEA to host sessions and provide speakers who will discuss areas or subjects of local importance and hopefully generate a discussion that provides feedback and insight from the other associations in attendance. Possible topics we would like to discuss include our mentoring program, Florida Water Resources Conference, our strategic plan, and membership.

In the past, FWEA has received valuable information from WEFMAX meetings, including finding our vendor who redesigned and currently maintains our website. Great friendships and partnerships are formed through these meetings. In addition, WEFMAX gives MAs more interaction with WEF staff and delegates and provides an opportunity for us to understand all that WEF has to offer. Attendees at WEFMAX are also encouraged to attend the delegates meeting that will be held there.

Each MA chooses a special social event at the WEFMAX it sponsors. Our association has chosen to hold our special event on Thursday evening at Disney's EPCOT. The BoardWalk Resort is a short ferry ride to EPCOT, where guests will be given entrance at approximately 8 p.m. to a private area for a dessert reception and special viewing of the EPCOT fireworks show, IllumiNations. We are providing complimentary entrance for each WEFMAX attendee and a guest, and additional tickets can be purchased.

The BoardWalk Resort is located at Walt Disney World's BoardWalk, which is in walking distance from other resorts, shops, and dining. The Magic Express provides complimentary shuttle service from the Orlando airport for guests and also provides valet service for their luggage. Guests staying on the resort property also have access to free shuttles throughout the Walt Disney World Resort and are eligible for Extra Magic Hours (additional hours to spend at the parks).

We chose the Disney property because of the convenience and the attraction to our potential attendees. We felt that March was still too cool to be spending time at the beach, and Disney offered a great package of hotel rooms and meeting space for our special event.

The WEFMAX event is free for FWEA leadership and includes the meals and meetings associated with the conference. Each attendee is responsible for travel and room and board, as well as any incidental meals not included in the meeting. The Federation pays for the majority of WEFMAX; however, there are opportunities for sponsorship. If your company is interested, please email Lisa Prieto at lprieto@brwncald.com for more information.

Overall, WEFMAX should provide our leadership with a great opportunity to further understand WEF and receive valuable peer feedback on important subjects.

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A joint conference of the Florida Section, American Water Works Association,
the Florida Water Environment Association, and the Florida Water and Pollution Control Operators Association.

GAYLORD PALMS RESORT, KISSIMMEE

Attendee Registration 2016

Please PRINT or TYPE legibly

List ONLY ONE PERSON per form

NEW **Online, Mail & Fax Registration closed April 15!**

Onsite Registration opens April 24 @ 12 p.m.

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April 24-27, 2016

Gaylord Palms Resort & Convention Center

6000 W. Osceola Parkway, Kissimmee, FL 34746

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*** YES I AM A MEMBER OF:**

(Must enter member number. Check all that apply)

- ❑ FWEA/WEF Member#_____
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FULL CONFERENCE REGISTRATION*:

INCLUDES: Daily Receptions, Technical Sessions, Exhibits, AM & PM Workshops each day, Monday & Tuesday Luncheon, Technical Proceedings, & Eligibility for Daily Drawings. Earns 0.1 CEUs or 1 PDH at Technical Sessions and Workshops, as approved.

	Before April 15	After April 15	AMOUNT
A ❑ Member/ Utility, State or Federal Employee	$ 385	$ 450	$_____
❑ Non-Member	$ 455	$ 495	$_____
❑ Spouse	$ 100	$ 100	$_____
❑ Retired or Life Member	$ 70	$ 70	$_____

1-DAY-ONLY CONFERENCE REGISTRATION*:

INCLUDES: Technical Sessions, Exhibits, Daily Reception, Proceedings, Lunch that day, AM & PM Workshop, & Eligibility for daily Drawings. Earns 0.1 CEU or 1 PDH at Technical Sessions and Workshops, as approved.

B ❑ **1-Day Monday Registration,** *includes lunch and One (1) AM & (1) PM Workshop*	$ 230	$ 265	$_____
❑ **1-Day Tuesday Registration,** *includes lunch and One (1) AM & (1) PM Workshop*	$ 230	$ 265	$_____
❑ **1-DAY SPEAKER** - *Name must appear in program. Badge required.*	$ 35	$ 50	$_____
❑ **1-DAY MONDAY CONTESTANT PARTICIPANT**, *includes lunch.*	$ 85	$ 95	$_____
1-DAY TUESDAY CONTESTANT PARTICIPANT, *includes lunch.*	$ 85	$ 95	$_____
❑ **1-DAY STUDENTS** - *Free with valid Student I.D.*			No Charge

**Earns 0.1 CEUs or 1 PDH as approved with submittal of completed Green Card and Sign-In Sheet in room.*

C SPECIAL EVENTS & MEAL TICKETS

SUNDAY		
T1 Tour TBA	$ 35	$_____
MONDAY		
M1 FSSSSS Members Breakfast	$ 35	$_____
M3 FWRC Awards Luncheon	$ 38	$_____
TUESDAY		
T6 FWEA Awards Luncheon	$ 38	$_____
WEDNESDAY		
W7 FWEAUC Annual Breakfast	$ 35	$_____

(Add all selections and total here)

TOTAL PAYMENT ENCLOSED $ _____

PAYMENT BY CREDIT CARD

PAYMENT DUE UPON RECEIPT. FORM WILL NOT BE PROCESSED WITHOUT PAYMENT. WRITTEN CANCELLATION MUST BE RECEIVED **NO LATER THAN MARCH 30, 2016.** NO EXCEPTIONS. A $25 HANDLING FEE WILL APPLY. ALLOW ADEQUATE TIME FOR PROCESSING.

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Name on card: _____

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Your information is used solely to process your registration, communicate with you, and to promote the FWRC. This information is shared ONLY with exhibitors who have purchased a booth for this event. If you wish, indicate:
❍ I do not want information available on Final Attendance List.

Technical Program Preview

- Water Resources /Supply
- ASR /Reuse Systems
- Stormwater /Green Infrastructure
- Distribution Systems
- Potable Water Treatment
- Sustainability /Climate Change
- Biosolids Technologies
- Asset Management
- Facilities Operation & Mainteance
- Wastewater Treatment
- Utility Management
- Disinfection /Public Health
- Collection Systems
- Facilities Operation & Mainteance
- Energy/ Resouce Recovery
- ASR /Reuse Systems
- GIS/Automation/ Computer Applications
- Nutrient Removal
- Contractors Forum

Register Online
FWRC.ORG

HOTEL

Gaylord Palms Resort and Convention Center

6000 W Osceola Pkwy, Kissimmee, FL 34746
407-586-0000
Online: FWRC.org/2016fwrc/Hotel Reservations

Easy to book hotel on-line or when calling, identify yourself as a Florida Water Resources Conference Attendee and obtain the discounted room rate, available until April 1, 2016. Reservations received after that date will be accepted on a space-available basis only, and the group rate may not apply.

Everything You Need In One Location

The beauty of the Gaylord Palms Resort is everything needed for a successful business connection during the FWRC is all located on site.

Dining & Entertainment

- Old Hickory Steakhouse
- Moor Restaurant
- SandBar
- Honebells Frozen Yogurt
- New Walk In Cafe soon to open
- Wreckers Sports Bar
- Villa de Flora Buffet
- The Cocoa Bean
- In-Room Dining

And plenty of unique areas, rooms and venues for those private functions and hospitality suites.

Recreation & Amusement

- Relache Spa
- South Beach Pool
- Cypress Springs FamilyFun Water Park
- Celebration Golf Club
- Transportaiton to DisneyWorld
- Relache Fitness Center
- Shopping
- SeaWorld, Discovery Cove

Scheduled Events:

- *President's Reception*
- *Student Design Competition*
- *Operations Challenge Competition*
- *Student Poster Contest*
- *FSAWWA Breakfast*
- *Association Meetings*
- *Top Ops Competition*
- *FWRC Awards Luncheon*
- *FSSSS Shovelers Installation*
- *Best Drinking Water Contest*
- *Monday Networking Party*
- *FWEA Annual Meeting & Awards Luncheon*
- *Utility Council Annual Meeting*
- *Hourly Drawings*
- *Water for People Fundraising Event*

Team Spirit 2016!

"We want to have fun, because you learn more when you are enjoying what you do. We want to learn, to gain new ideas, to proudly represent our sector and our skills."

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Top Ops Contest

The annual Top Ops competition will be held at the 2016 FWRC. Top Ops is the "college bowl" of the water industry. Teams of one, two or three water operators or lab personnel compete against each other in a fast-paced question-and-answer tournament. A team must consist of the same individuals throughout the entire Top Ops Competition, but the team members need not be employees of the same organization or utility. A moderator poses a broad range of technical questions and math problems, and the team scoring the most points in the championship round is awarded the Top Ops Championship. The champion will represent the FSAWWA at ACE16 in Chicago.

To take part in the competition, you must be an individual, active operator member of AWWA, an employee of a utility member or organization member of AWWA.

Operations Challenge Competition

The Operations Challenge is a skills-based competition consisting of five timed events that showcase the knowledge and expertise of wastewater treatment plant operators. The teams display their proficiency in process control, maintenance, safety, collections, and the laboratory.

The Winning Team travels to participate at the Water Environment Federation annual WEFTEC Operations Challenge representing Florida. For more information contact Chris Fasnacht, City of St. Cloud, 407-957-7198 or cfasnacht@stcloud.org.

Best Drinking Water Contest

At the 2016 FWRC, the Best Tasting Drinking Water contest brings together the twelve FSAWWA regional drinking water champions from across the State of Florida. Samples are judged on taste, color, odor, and clarity. The judging is all subjective and is not scientific in any way. Once the judging is complete, the winner will be announced and the Best Tasting Drinking Water Champion of the State will be crowned.

We invite you to join us for this prestigious event and watch as the State comes together for some healthy competition in providing the best tasting drinking water in Florida! For more information, contact: Peggy Guingona at peggy@fsawwa.org, 407-418-5026 - Admin@fsawwa.org

Contests Entry Form & Rules/Regs can be found @ http://fwrc.org/2016-fwrc/contest-entry-form/

See Attendee Registration Form for discounted competitor registration in order to be eligible to earn CEUs/PDHs for participation

Exhibit Floor Layout 2016

April 24-27, 2016

Gaylord Palms Resort & Convention Center

6000 W. Osceola Parkway, Kissimmee, FL 34746

407-586-6000

Register Online

FWRC.ORG

SETUP

Sunday, April 24, 2016

- **Exhibit Hall D&E @ 8:00 AM to 4:30 PM**
- **Exhibit Floor Opens @ 5:00 PM with The President's Reception**

BREAKDOWN

Tuesday, April 26, 2016 4:00 to 9:00 PM

All exhibit materials must be completely removed from the exhibit hall by 11:45 PM Tuesday.

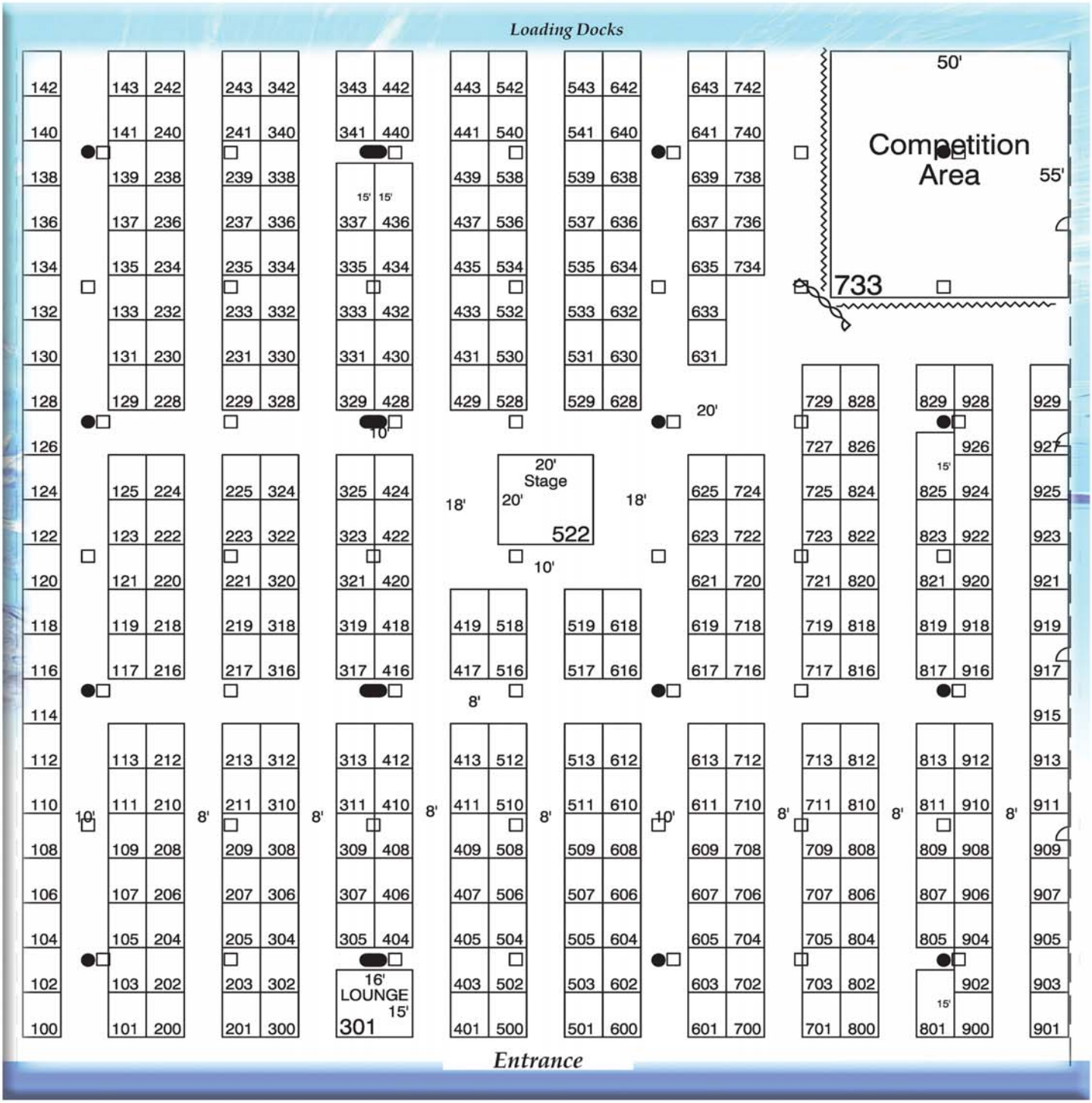

Exhibit Registration 2016

NEW Online, Mail & Fax Registration closed April 15!
Onsite Registration opens April 24 @ 12 p.m.

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List **ONLY ONE ADDRESS** where information is to be sent.

Please **PRINT** or **TYPE** legibly:

Company Name: _____

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Contact INDIVIDUAL'S information (*if different from above, i.e.: Main Office, etc.*)

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City: _____ State: _____ Zip: _____

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TERMS OF AGREEMENT:
Application is hereby made for exhibit space in the 2016 Florida Water Resources Conference. Enclosed is our completed contract information and booth preference. Payment in full will be made in the full amount required per number of booths requested. **Reps who purchase multiple booths, EVERY COMPANY MUST SUBMIT A COMPLETED FORM.** Payment is due via check or credit card within 60 days of receiving invoice. No exceptions. FWRC reserves the right to assign booth spaces and modify the floor plan. **All displays must be positioned so as to not block or infringe on neighboring booth(s) visual range**. This positioning especially affects end booths and location of front of booth. ***No food or beverage, including bottled water, may be served unless approved by FWRC management.*** Reservations for booth space will be accepted upon receipt of this completed application. Submission of this form indicates concurrence with Terms of Agreement.

BOOTH INCLUDES:
Booth includes one 8' x 10' booth with 8' high backdrop, 3' high side dividers, 6' table, 1 chair, trash bin, booth sign, security, up to 10 Staff Exhibit Hall Registrations per booth, and free on-line guest registration.
*Provisions for electrical or Internet service is not included in exhibit fee. Forms for these and additional services are available at ***www.fwrc.org***. Decorator can receive shipment of display or freight. You and/or your organization are solely responsible for all shipping & handling charges incurred. Most facilities do not accept shipment or delivery of any kind.

APPLICATION MUST HAVE BOTH FORM AND FEE REMITTED TO BE ACCEPTED. ONLY CHECK OR CREDIT CARD ACCEPTED.

BOOTH CANCELLATION POLICY:
Written cancellation is required and must be received no later than March 30, 2016. NO REFUNDS REQUESTED AFTER THIS DATE WILL BE GIVEN. Allow processing time. A $75 handling fee will be applied to all cancellation requests.

SEND COMPLETED FORM AND PAYMENT TO:
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Your information is used solely to process your registration, communicate with you, and to promote the FWRC. This information is shared ONLY with exhibitors who have purchased a booth for this event.
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☐ do not publish name/information,
☐ do not make information available

Payment must be received with contract submission. A $75 handling fee will apply to all cancellations after March 30, 2016.

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April 24-27, 2016

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Yes, I/we are a MEMBER of:
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EXHIBIT BOOTH SPACE

MEMBER COST	☐ $950
NON-MEMBER	☐ $1,200
BOOTH+ Full-Page, Color Ad Conference FWR Journal*	Awesome Deal! ☐ $1,880

Rate is for 1 time, Conference Issue Only and 20% off Open Rate. Prepared artwork required. Design services extra.

Number of booths needed: _____

Preferred Booth Location:

1st Choice: _____ 2nd Choice: _____

Do not want to be near: _____

_____

TOTAL BOOTH AMOUNT $_____

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☐ M3	FWRC Awards Lunch	$38
☐ T5	FSAWWA Breakfast	$35
☐ T6	FWEA Awards Lunch	$38
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PAYMENT ENCLOSED $_____
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From wef hq Leading-edge updates from the Water Environment Federation

From Rainfall to Results

A Water Environment Federation report details a new vision for meeting the challenges of stormwater management—and the resulting opportunities

Heather Harris and Chris French

Stormwater is currently the only growing source of water pollution in many watersheds across the United States, and it is a rising challenge for communities around the world. In 1970, 85 percent of water quality impairments in the U.S. were associated with point-source pollution, and the remaining 15 percent came from nonpoint sources, such as agriculture and urban stormwater. Today, after significant advancements in wastewater treatment, these values have flipped—85 percent of impairments now stem from nonpoint and urban stormwater discharges. The first administrator of the U.S. Environmental Protection Agency (EPA), William Ruckelshaus, alluded to these facts in a 2010 *Wall Street Journal* opinion article in which he called stormwater runoff "the water quality issue of the day."

A recent comprehensive report by the Water Environment Federation Stormwater Institute, entitled "Rainfall to Results: The Future of Stormwater," presents a vision for the future in which all stormwater is transformed from a pollutant source to a resource.

The report is a product of a meeting of stormwater professionals convened by WEF in July 2015 at The Johnson Foundation at Wingspread in Racine, Wisc. The report was released at WEFTEC 2015 in Chicago to coincide with the launch of the WEF Stormwater Institute, a new center of excellence and innovation created to address stormwater challenges.

Vision for the Future of Stormwater

In the vision presented in the report, stormwater is managed through an optimized mix of green, gray, and natural infrastructure, and pollutant source control is pursued as a complement to infrastructure solutions. In this vision, stormwater infrastructure is fully funded and managed by a dedicated utility with a comprehensive asset management program. Additionally, stormwater management is adaptive based on new science, experiences, technical innovations, and responsive regulations. Stormwater management is part of doing business and part of community resiliency and quality of life. As such, a community values and understands the many benefits of stormwater infrastructure.

The report identifies six key objectives and a set of concrete actions intended to achieve this vision and improve the future of stormwater in the U.S.

1. Work at a watershed scale

All communities will have integrated, watershed-scale assessments of their water resources needs and challenges to better align stormwater management efforts with larger watershed priorities. This means long-range planning across jurisdictions within watersheds. Planning and decision-making will account for the many benefits of stormwater controls, which go beyond water quality improvements to increased property values, expanded public education, improved air quality, and more.

2. Transform stormwater governance

The second objective is to transform stormwater governance so that regulations are integrated and adaptive. Regulations will stimulate stormwater control innovation and improve performance by focusing on program outcomes. By exploring ways to emphasize stormwater program outcomes in permits and design and maintenance requirements, the water sector can develop permitting frameworks that, for the first time, embrace the long-term nature and potential cost efficiencies of solving stormwater challenges.

3. Support innovation and best practices

Evaluating stormwater programs can provide a wealth of information. By sharing these experiences, the sector can ensure that up-to-date best practices are available, advance the necessary tools and methods to support ongoing improvements in stormwater management, and increase the ability to analyze and value stormwater management on a multibenefit basis.

4. Manage assets and resources

The next objective is to achieve stormwater systems that are maintained through robust asset management programs and supported by innovative information technology. Inadequate attention to operations and maintenance (O&M) and a lack of effective planning for repair and replacement are the biggest current weaknesses of stormwater management. The key to improving maintenance and developing a robust asset management program is developing a well-trained, multidisciplinary workforce. Also important is integrating O&M into project planning so that projects are properly designed and installed for easier operations, repair, and timely replacement.

5. Close the funding gap

Many of the opportunities to improve the stormwater sector invariably require financial resources. Communities can start by better understanding their funding needs and looking at ways to reduce the costs of stormwater management. However, sustainable stormwater management requires a dedicated funding source. Education and understanding by elected officials are important, as they play a significant role in supporting the investments needed to meet stormwater objectives. Additionally, there are opportunities to access untapped sources of capital and innovative financing mechanisms.

6. Engage the community

The stormwater sector must improve its ability to engage various audiences and encourage information sharing among public officials. With increased communication and collaboration, communities can better value the role of stormwater management in providing clean and safe water, reducing flood risks, and making neighborhoods more resilient to the effects of climate change.

Better Ways to Address Stormwater Challenges

The actions and objectives outlined in the report are meant to help communities tackle stormwater issues caused by urbanization, aging infrastructure, and climate change, while overcoming regulatory hurdles. Beyond achieving a healthier water environment, stormwater management presents an opportunity to make communities more vibrant, livable, and resilient. The report marks the beginning of an ongoing dialogue. It is a call to action for communities, companies, governments, and organizations to work together to move from rainfall to results.

To read more about current challenges and future opportunities in stormwater, download the report at http://wefstormwaterinstitute.org/rainfall-to-results/.

Note: The information provided in this article is designed to be educational. It is not intended to provide any type of professional advice including, without limitation, legal, accounting, or engineering. Your use of the information provided here is voluntary and should be based on your own evaluation and analysis of its accuracy, appropriateness for use, and any potential risks of using the information. The Water Environment Federation (WEF), author and publisher of this article, assumes no liability of any kind with respect to the accuracy or completeness of the contents and specifically disclaims any implied warranties of merchantability or fitness of use for a particular purpose. Any references included are provided for informational purposes only and do not constitute endorsement of any sources.

Heather Harris is chair of the Stormwater Committee of the Water Environment Federation (WEF; Alexandria, Va.) and the Water Environment Association of Texas Stormwater Committee. She serves as the Central Texas operations lead for the Austin office of CH2M (Englewood, Colo.), where her focus includes stormwater management and stream restoration. Chris French is director of stormwater programs at WEF and is guiding its newly launched Stormwater Institute through member, stakeholder, and practitioner engagement. He can be reached at CFrench@wef.org.

2015 "We Are One Water" FSAWWA Fall Conference: Another Successful Event by the Manufacturers/Associates Council!

The Florida Section of the American Water Works Association (FSAWWA) hosted its fall conference November 29 through December 3 at the Renaissance Orlando at SeaWorld. The yearly event, which attracted more than 1390 people, included water utility executives and managers, engineers, educators, manufacturers, consultants, operators, and others from the water profession.

There were plenty of opportunities to meet old colleagues and make new friends at the continental breakfasts, lunches, meet-and-greet receptions, golf tournament, the Poker Night and Happy Hour, and the annual BBQ challenge and reception to welcome the incoming chair, Kim Kunihiro.

Opening General Session

Back by popular demand was the opening general session on Monday afternoon. Our keynote speaker, Chad Pregracke, who was named the 2013 CNN Hero of the Year, is the president and founder of Living Lands & Waters (LL&W), the world's only "industrial strength" not-for-profit river cleanup organization. Chad formed LL&W at the youthful age of 23, after spending his life growing up and working on the Mississippi River. Early on, he became appalled by the amount of garbage in the river and decided that if no one else was going to do something about it, he would.

Over the last 18 years, Chad and his crew—and over 94,000 volunteers—have removed over 8.5 million pounds of garbage out of our nation's rivers. He's also broadened his mission to include a MillionTrees and an Adopt-A-River Mile Project, as well as a new floating classroom aboard a barge that he and his crew live on seven months of the year, teaching students, educators, and individual citizens about the value of our rivers and natural resources.

Other speakers included visiting officer Gene Koontz, AWWA president, and Jackie Torbert, the association director.

BBQ Challenge and Incoming Chair's Reception

On Monday evening, the conference held the second BBQ Challenge, which was open to all attendees. It was also an opportunity to introduce and welcome incoming chair Kim Kunihiro.

Technical Program

The excellent technical program is successful every year through the dedicated volunteerism of Dr. Fred Bloetscher.

In 2015, to attract more participation on Monday, the Monday workshops were included in the registration. The workshops offered were: Funding Infrastructure Improvements, Water Quality Improvements, and Data Management, and a specialty symposium, Addressing Loss in Distribution Collection and Stormwater Systems

Tuesday and Wednesday technical sessions focused on the conference's theme, "We Are One Water!" Topics included: Solutions to Improve Utility Operations, Membranes, Direct/Indirect Potable Reuse and Other Alternative Water Supply Options, Water Treatment Plant Solutions, Management Tools for Water Utilities, Wastewater Treatment and Collection Systems Solutions, Groundwater, Disinfection Byproducts, Granular Activated Carbon and Nutrient Control, and Distribution System Issues and Solutions. There was also a symposium on water conservation.

Exhibits

The exhibit hall, which had 180 booth spaces, gave attendees another chance to network and learn about the latest and most innovative products and services in the water industry. Company personnel were available each day to help attendees pick the products that will help them solve their problems and meet future challenges.

"Best of the Best" People's Choice Tasting

This was the second year this event was held at the conference. Water stations were located in the exhibit hall and attendees tasted water samples from the 10 participating regions and voted for the best tasting water. Votes were tallied and the declared 2015 People's Choice Tasting winner was Bay County Utilities—also the 2014 winner!

Meetings

The FSAWWA Executive Committee held its meeting on Sunday morning, followed by the Board of Governors meeting in the afternoon, with 33 board members present. This is where the real work of the section is planned for the following year. Other meetings were also held by the organization's councils and committees. There's a group for almost every water topic. Meetings are also held at other section events throughout the year.

Water Summit

The seventh annual Florida 2030 Water Summit topic was "What is the Implementation Process for Florida's Water Future?" The summit agenda also included The "Capitol Report" by Tommy Holmes and a state legislative update by Anfield Consulting and the FSAWWA Utility Council.

Awards

The section's annual business luncheon and awards ceremony celebrated the current roster of statewide officers and inducted the new officers for 2016. Awards were also given for the best papers and to the outstanding volunteers in the water field. See page 26 for award recipients.

Contests

Several contests, with both team and individual competitors, were held.

Water Bowl

Winner: University of Central Florida

The University of Central Florida regained the title of Water Bowl champions at the 2015 Young Professionals Water Bowl. The winning team consisted of Paul Biscardi, Samantha Jeffery, and Erin Reed. The university provided three teams to compete for the title in the single elimination competition format. Three teams from the University of Florida also participated in the contest.

The contest is modeled after the classic "College Bowl" television quiz show. Team members were asked questions related to the water industry, encompassing water chemistry, operations, and design of treatment systems.

The event was moderated by Jordan Walker (incoming FSAWWA Young Professionals Committee chair) and Jose Cueto (FSAWWA Young Professionals Committee chair) served as judge.

Poster Contest

Winner: University of Central Florida

Paul Biscardi, from the University of Central Florida, was the 2015 Fresh Ideas Poster Contest winner. He presented his poster entitled, "Understanding the Impacts of Recycling Hydraulic Membrane Backwash Water." Paul's win was impressive because he competed with 19 other poster presentations.

By winning the competition, Paul receives a trip to ACE16, AWWA's annual conference and exposition, to be held in June in Chicago, to compete with contest winners from across North America.

Continued on page 22

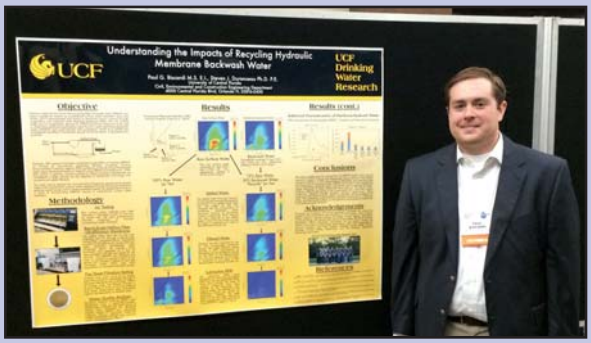
And the winners are:

Ductile Iron Tap
St. Cloud Soldiers
from the City of St. Cloud

Fun Tap
St. Cloud Soldiers
from the City of St. Cloud

Backhoe Rodeo
Daniel Merratante,
City of St. Cloud

Water Bowl - The UCF students display their trophy.



Poster Contest
Paul Biscardi, from the University of Central Florida, with his poster.

Meter Madness

Winner Brian Rodriguez

PASSING THE GAVEL

Mark Lehigh receives a plaque for his service as 2015 section chair.

Kim Kunihiro, the incoming section chair for 2016, receives the gavel from outgoing chair, Mark Lehigh.

Continued from page 21

Operator Events

Meter Madness

Back as the 2014 Meter Madness champion was Brian Rodriguez of the Florida Keys Aqueduct Authority. He assembled a water meter in 37 seconds, beating last year's record of 49 seconds, ahead of Bruce Miller and Matt D'Andrea. Brian qualifies to go to ACE16 in Chicago to compete in the national contest.

Meter Madness is a competition where participants receive a bucket of meter parts for a specific water meter to assemble against the clock. To make is more interesting, three to six miscellaneous parts are included in the bucket. After assembly, the meter must work correctly and not leak.

Tapping Contests

Using skill and dexterity, as well as speed, teams of four compete for the fastest time while they perform a quality drill and tap of pipe under available pressure. Two taps are allowed per team. The Fun Tap is the simpler version of the two contests.

The judge and moderator for these events was Mike George.

Ductile Iron Tap Winners
First Place: St. Cloud Soldiers, City of St. Cloud
Second Place: Bonita Springs Utilities Inc.
Third Place: City of Clearwater

Fun Tap Winners
First Place: St. Cloud Soldiers Team 1
Second Place: St. Cloud Soldiers Team 2
Third Place: City of Clearwater

Backhoe Rodeo

Backhoe operators show their expertise by executing challenging lifts and drops of various objects in the fastest time.
First Place: Daniel Merratante, City of St. Cloud
Second Place: David Kloor, Charlotte County
Third Place: Jeff Newbell, Manatee County

All four operator contests have been held for a very long time and are open to public and commercial field operators working in the state of Florida. Contact Mike George at (352) 200-9631 for more information.

CONFERENCE SPONSORS

The FSAWWA thanks all of the sponsors for their generous support of the conference.

– PREMIER SPONSORS –

Ferguson Waterworks
Sigma Corporation
Wager Company of Florida Inc.

Kim Kowalski, Wager Company of Florida with Kevin Stine, Sigma Corporation.

– PLATINUM SPONSORS –

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Blue Planet Environmental Inc.
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CS3 Waterworks
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US Water Services Corporation
Tetra Tech
Trihedral Inc.

American Water Works Association
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Second Annual BARBEQUE Event Honors Incoming Chair

Monday's Second Annual Barbeque Cook-Off Competition and Incoming Chair's Reception was a huge success. The event was a fantastic networking opportunity for conference attendees, exhibitors, and guests to mingle, make new acquaintances, and catch up with old friends. It was also a chance to honor Kim Kunihiro, incoming chair, who will lead the section in 2016.

The highlight of the event was, of course, the barbeque competition. This year featured 10 teams competing for the honor of "Grand Champion." Grill masters from Haskell, Hillsborough County, Garney Construction, Stanley Hydraulic Tools, Reiss Engineering, HDR Inc., Peace River Manasota Regional Water Supply Authority, Cardno, GHD, and Insituform competed for top honors in four categories: chicken, pork, ribs, and brisket. As the conference attendees socialized and feasted on the barbeque, judging took place to determine the best in each category and overall grand champion!

Results were revealed at the end of the evening, with HDR taking honors in ribs, GHD winning the chicken category, Stanley Tools was tops in pork, and Haskell scoring first in brisket. The overall grand champion trophy was awarded to HDR Inc. with first-, second-, and two third-place finishes in each category.

A special thank you to American Water Resources for sponsoring the beverages for the event. There is nothing like an ice cold beer to go with good barbeque!

New this year at the event was simultaneous fundraising opportunities for Water For People hosted by four teams that accepted donations at their tents: Garney Construction, HDR Inc., Insituform, and Hillsborough County. To attract more people to their tent, Garney donated a GoPro camera, with each donor receiving a ticket for the drawing.

At the HDR tent, "Pies for Past Chairs" donations were placed in four containers named for four FSAWWA past chairs: Jeff Nash, Richard Anderson, Jason Parrillo, and Mark Lehigh (pies in the face were going to await the two chairs that had the most number of tickets). The "unlucky" winners were Jeff Nash and Richard Anderson. Both courageously (and with good humor) accepted their fate.

Overall, this year's event was a tremendous success that featured great food and fun in a fantastic locale. Watch for news for the Third Annual Barbeque Cook-Off Competition at this year's Fall Conference at Renaissance Orlando at SeaWorld. You don't want to miss it!

HDR taking honors in Ribs

Stanley Tools was tops in Pork

Overall winner: HDR

GHD winning the Chicken category

Haskell scoring first in Brisket

Kim's induction (from left: Kunihiro; Mark Lehigh, outgoing section chair; and Grace Johns, chair-elect)

Annual Section Awards

On Dec. 2, 2015, the Florida Section AWWA honored outstanding individuals and organizations in the state's water industry at the annual awards luncheon. Some of the recipients of this year's awards are noted and/or pictured on the following pages. *(photos: Patricia Delaney)*

Rick Ratcliffe with his wife, Helen.

Rick Ratcliffe receives his award pin from Gene Koontz, AWWA president.

AWWA GEORGE WARREN FULLER AWARD

The George Warren Fuller Award is presented annually by the American Water Works Association (AWWA) to the sections' respective selected members for their distinguished service to the water supply field in commemoration of the sound engineering skill, the brilliant diplomatic talent, and the constructive leadership that characterized the life of George Warren Fuller.

Richard S. Ratcliffe is the recipient of this distinguished award. Rick has served AWWA and the Florida Section unselfishly for many years, holding many positions, including section chair and multiple terms as Manufacturers/Associates Council (MAC) and Fall Conference chair. His dedication to MAC and FSAWWA has helped provide financial stability to the association for years to come. He is the recipient of the Allen B. Roberts Award, the first MAC DADDY award winner, and in 2014, was honored with AWWA's highest MAC association award, the John Lechner Award of Excellence.

ALLEN B. ROBERTS JR. AWARD FOR OUTSTANDING SERVICE TO FLORIDA SECTION AWWA

This award is named in honor of Allen B. Roberts Jr., who worked diligently as the section's executive director to improve the status of the Florida Section by providing valuable leadership.

Frederick Bloetscher, Ph.D., P.E., received this award for his outstanding service as a member. Fred has contributed most to the section by providing valuable support of FSAWWA programs through outstanding leadership, creativity, and service in the water-related fields, particularly in the resolution of problems and the implementation of activities within FSAWWA and the association.

ROBERT L. CLAUDY AWARD

This award is named in the honor of Robert L. Claudy, who was a past chair of FSAWWA. He dedicated his time and efforts in furthering the importance of water quality in the industry, community, and the Florida Section. Claudy is also a big supporter and is still active in the Likins Scholarship program. The award is presented by the Manufacturers/Associates Council of FSAWWA.

Jacqueline Torbert was the recipient of the award for her efforts in promoting water quality in the industry, the community, the section, and in the association.

CHARLES HOGUE AWARD

Kent Wager was honored by the Manufacturers/Associates Council (MAC) with the Charles Hogue Award as the MAC individual member of the year.

FSAWWA SERVICE AWARDS

The following were honored for their service to the Florida Section.

Christopher Jarrett
Region III Chair
2014-2015

Emilie Moore
Region IV Chair
2013-2015

Juan Aceituno
Region VII Chair
2012-2015

Don Hamm
Region XII Chair
2008-2015

Christine Ellenberger
Trustee
2011-2015

Not Pictured

Michael Bailey
Region VI Chair
2012-2015

Donnie Belloit
Contractors Council Chair
2013-2015

Roberto Denis
Technical and Education Council Chair
2011-2015

Jose Cueto
Young Professionals Chair
2013-2015

COUNCIL CHAIR AWARDS OF EXCELLENCE

(Awards were presented at the Opening General Session on Nov. 30, 2015)

This award honors distinguished service by a council or committee chair who has made the most significant contribution to the council.

Manufacturers/ Associates Council
Rob Cavallaro

Administrative Council
Jerome Madigan

Operators/ Maintenance Council
Ron Cartwright

Public Affairs Council
Kristopher Samples

Technical and Education Council
Pamela London-Exner

MAC DADDY

This award honors the Manufacturers/Associates Council member who has contributed the most to the success of the Fall Conference.

Carlos Gonzalez

YOUNG PROFESSIONAL OF THE YEAR

Jordan Walker was named the young professional of the year for his contribution to the success of students and young professionals activities.

REGION CHAIRS VOLUNTEER OF THE YEAR AWARD

(Awards were presented at the Opening General Session on Nov. 30, 2015)

This award honors individuals who have contributed their time and talent to the success of the region.

Michael Condran
Region IV

Reshma Thummadi
Region V

Glen Tyler Davis
Region VI

Robert Regalado
Region VII

Bryan Veith
Region X

– NOT PICTURED –

Jeremy O'Neal
Region II

Yvonne Picard
Region III

Valerie Schulte
Region VIII

Alicia Keeter
Region IX and XII

Daryl Lord
Region XI

American Water Works Association
FloridaSection

MEMBERSHIP TENURE AWARDS: GOLD/SILVER/LIFE MEMBER

The AWWA honors significant membership tenure with the following awards. The recognition received builds with the years with the association. To be eligible, qualifications for each must be met as detailed below.

GOLD WATER DROP AWARDS

Recipients are honored for 50 years of AWWA membership.

- W. Jack Markel
- H.E. Puder

SILVER WATER DROP AWARDS

Robert Teegarden

Recipients are honored for 30 years of AWWA membership.

- Stephen E. Moler
- Harold C. Nantz
- Donald Thompson
- Ronald Parker
- Alejandro Toro
- David Zusi

The following achieved life member status:

- Paul Chadik
- H. Lamar Rowe
- Partha Vohra
- James Wakem

Thomas Hogeland

LIFE MEMBER AWARDS

Awardees have 30 years of AWWA membership and are 65 or older.

- Noel Grant
- William Johnson
- William Leseman

Juan Aceituno

AWARD FOR DEDICATED SERVICE TO THE EXECUTIVE COMMITTEE

This award is given by the FSAWWA Executive Committee to a board member for dedicating time and talents to a program or initiative that far and away exceeds the duties and obligations in service to the FSAWWA Board of Governors.

LANDMARK AWARDS

The FSAWWA gives this award to various facilities or structures serving as components of water systems that have historical significance and, as such, may be candidates as an American Water Works Association Landmark or a Florida Water Landmark. The facility or structure should have been in service and operational for 50 or more years to qualify for this important recognition. Wells, pumps, and piping may quality if deemed to be of important significance.

City of Destin
Destin Water Users Water Tower 1
Dedicated 1964

City of Dunedin
Well House 1
Dedicated 1915

BEST PAPER AWARDS

"Defining the Cost-Benefit of Inflow Removal before Infiltration Exploration"
Frederick Bloetscher, Ph.D., P.E., Florida Atlantic University (pictured); Trent van Allen, E.I., and Nadia Locke, P.E., E Sciences; Dominic F. Orlando, P.E., and Ronnie Navarro, P.E., City of Dania Beach; Mike Bailey, P.E., Cooper City; Lloyd Wander, Greg Smith. and Dion Valsak, USSI.

"Piloting Granular Activated Carbon for Disinfection Byproduct Control in Central Florida Groundwater Containing Sulfide"
Benjamin A. Yoakum and Dr. Steven J. Duranceau, P.E., (pictured) University of Central Florida

"Using Mixed Bed Ion Exchange for the Simultaneous Removal of Multiple Drinking Water Contaminants"
Jerrine Foster (pictured) and Treavor Boyer, Ph.D., University of Florida

Water For People Exhibitor Fundraiser Recognition of Gold Sponsors

Blue Planet Environmental Systems Inc.
Data Flow Systems
Hazen and Sawyer
Moss Kelley Inc.
Rangeline Tapping Services Inc.
R & M Services

American Water Works Association
FloridaSection

WATER DISTRIBUTION SYSTEM AWARDS

An award is given to a utility with outstanding performance during the preceding year that deserves special recognition by the section. The criteria for these awards shall be based on, but not limited to, the following:

- Must be a member of AWWA (organization or individual)
- Actively supports the activities of the Florida Section
- Has completed the questionnaire
- Demonstrates high standards and integrity

The following utilities earned the first-place award in their respective divisions:

Presented by Todd Lewis, MAC chair

Division 1 – (no award)
Division 5 – (no award)

Division 2 – Destin Water Users Inc.

Division 3 – City of Coral Springs

Division 4 – Bonita Springs Utilities Inc.

Division 6 – Charlotte County Utilities

Division 7 – Pinellas County Utilities

Division 8 – Miami-Dade Water and Sewer Department

ROY W. LIKINS SCHOLARSHIP

The scholarships are awarded each year by the section to outstanding graduate or undergraduate college students enrolled in an accredited Florida institution who are pursuing a degree related to the drinking water industry. The scholarship is named for the late Roy Likins, former president of Palm Coast Utility Corporation and a lifelong member of AWWA, who served as section chair and secretary/treasurer, as well as Region IX chair with the Florida Water and Pollution Control Operators Association.

- **Richard Gallant**, Florida Atlantic University - $5,000
- **Kelly Landry**, University of Florida - $5,000
- **Ann Sager**, University of South Florida - $5,000
- **Jerrine Foster**, University of Florida - $2,500
- **Ryan Graydon**, University of South Florida - $2,500
- **Carlyn Higgins**, University of Central Florida - $2,500
- **Lindsey Koren**, University of Florida - $2,500

(left to right): Jerrine Foster, University of Florida (UF); Kelly Landry, UF; Ann Sager, University of South Florida (USF); Marjorie Craig, Likins Scholarship Committee chair; Ryan Graydon, USF; Carlyn Higgins, UCF; Lindsey Koren, UF.

OPERATORS SCHOLARSHIP

The Operators Council provides scholarships to students upgrading a drinking water or distribution system operator license or pursuing a degree related to the drinking water industry.

Larry George Edmonds

John Holdman

Jacqueline Torres

WATER CONSERVATION AWARDS FOR EXCELLENCE

Public Education

Best in Class – Medium Utility
City of Ocoee
AquaHawk

Show of Excellence – Medium Utility
Toho Water Authority
Toho Water Works Summer Camp

Research
Best in Class – Mega Utility
Orange County Utilities Water Division
Smart Irrigation Technology Study

Comprehensive Program
Best in Class – Medium Utility
City of Tavares
Water Conservation Comprehensive Program

Demand Management
Show of Excellence – Large Utility
North Miami Beach
Public Utilities Department
Advanced Metering Infrastructure

Supply Management
Show of Excellence – Large Utility
North Miami Beach
Public Utilities Department
Leak Detection Device

American Water Works Association
FloridaSection

A Challenging Site for Aquifer Recharge: Keystone Heights Rapid Infiltration Basins Feasibility Study

Fatih Gordu, Michelle Hays, and Louis H. Motz

The Florida Department of Environmental Protection, Suwannee River Water Management District, and St. Johns River Water Management District (SJRWMD) initiated the North Florida Regional Water Supply Partnership (NFRWSP) in 2011 (Figure 1). The NFRWSP consists of state agency partners, as well as local governments and stakeholders in north Florida. The goal of NFRWSP is to form collaborative solutions that ensure sustainable water supplies for north Florida, while protecting waterways and natural systems. Aquifer recharge is one of many tools available to achieve NFRWSP's goal. The use of rapid infiltration basins (RIBs) for aquifer recharge has been successfully implemented in several areas throughout Florida. In 2013, SJRWMD funded a study to assess suitability of RIBs as a method to recharge the Upper Floridan aquifer (UFA) in the Keystone Heights area of southwest Clay County.

Study Background

An aquifer recharge investigation was conducted at three sites in the Keystone Heights area in southwest Clay County to examine the benefits of indirectly recharging the UFA and the minimum flows and levels (MFLs) lakes via RIBs. The three sites identified by SJRWMD in southwest Clay County are the South DuPont site, the North Blanding site, and the Southwest Blanding site (Figure 2).

The study area is in the Upper Etonia Creek Basin where multiple lakes have developed from collapse or subsidence sinkholes. Near the study area, water flows from the DuPont mine area via a pipe to Blue Pond, through Lowry Lake, Magnolia Lake, and into Brooklyn Lake via Alligator Creek. During extreme wet periods, Brooklyn Lake discharges to Lake Geneva through Alligator Creek and Keystone Lake; however, Brooklyn Lake is currently not discharging, and the last discharge was in 1998.

Fatih Gordu, P.E., is a senior hydrologist with St. Johns River Water Management District in Palatka; Michelle Hays, P.G., is a project scientist at Jones Edmunds and Associates Inc.in Gainesville; and Louis H. Motz, P.E., Ph.D., D.WRE, is an associate professor at the University of Florida in Gainesville.

The study area may not appear to be suitable for aquifer recharge due to the existence of a thick, low-permeability confining layer, which is contrary to a typical aquifer recharge site where recharge occurs through vertical leakage to the UFA; therefore, recharge to the UFA by means of vertical leakage at the potential RIB sites was expected to be limited. However, because most of the lakes in the study area are connected to the UFA through sinkhole features, the most efficient way to recharge the UFA was expected to be through the lakes. This makes the evaluation of

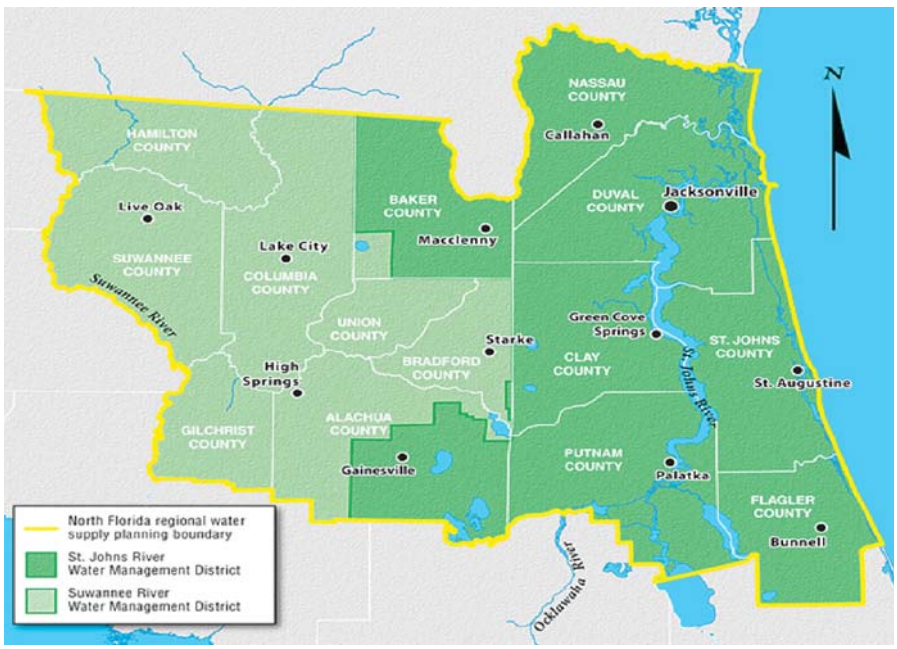

Figure 1. North Florida Regional Water Supply Planning Area

Figure 2. Study Location

the feasibility of the site for aquifer recharge and the analysis of potential benefits of indirect aquifer recharge to the UFA very challenging. A thorough and accurate understanding of not only the vertical, but also the lateral, movement of groundwater in the aquifer system and the interaction of the surface water features with the groundwater system was required. Figure 3 shows the possible movement of groundwater and the interaction between the lakes and the groundwater system in the study area.

The study included extensive data collection, desktop and field investigations, and development of a calibrated fully three-dimensional subregional groundwater model covering 65 sq mi.

The objectives of the study were:

- Preliminary evaluation of the suitability of three sites in southwest Clay County for aquifer recharge through RIBs.
- A comprehensive field investigation of the hydrogeology and suitability of RIBs at one site selected for further investigation.
- Quantification of sustainable potential recharge rate for the selected site.
- Quantification of potential benefits to the UFA and MFLs lakes.

It was important to conduct the aquifer recharge evaluations in phases. After the completion of each phase, depending on the findings of work performed, the approach to conduct the following phase was reevaluated and modified as needed.

This study was conducted in four phases; each phase was intended to build on the previous phase with regard to the technical information developed. The phases for this study were identified and are further described in the following sections.

- Phase 1 – Preliminary Site Assessment
- Phase 2 – Field Exploratory Program
- Phase 3 – Field Investigation
- Phase 4 – Sustainable Recharge Benefit Analysis

The first phase of the study included the preliminary assessment of the three potential RIB sites in the study area in southwest Clay County (Figure 2). Building on the preliminary site assessment, a detailed field exploratory program was prepared for a field investigation at the Southwest Blanding RIB area site. The field investigation included deep borings, the installation of surficial aquifer and UFA wells, geophysical surveys, multiwell aquifer performance tests, and extensive long-term groundwater level and stream flow monitoring. Using the information gathered in the preliminary site assessment and field investigation, a subregional MODFLOW groundwater model (based on the U.S. Geological Survey modular finite-difference flow model) was developed and calibrated to evaluate the potential for recharging the UFA via RIBs and the potential benefit to the MFLs lakes in the area. To better evaluate the benefit of aquifer recharge to a series of connected lakes and streams, the lakes and the streams in the study area were modeled explicitly in MODFLOW.

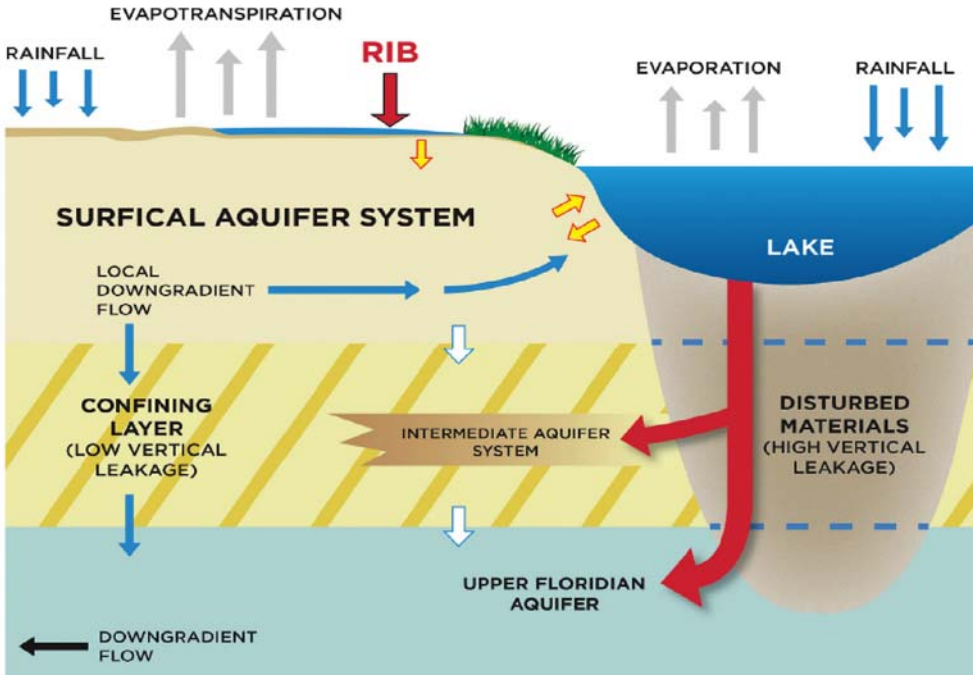

Figure 3. Possible Groundwater Movement in the Study Area (modified from Merritt, 2001)

Phase 1: Preliminary Site Assessment

The objective of the preliminary site assessment was to summarize the available information, select the preferred site, and provide a background for preparing the field exploratory program and performing a more detailed recharge benefit analysis for the preferred site in the subsequent tasks.

A significant amount of information, including the results of previous investigations, was collected and reviewed, and a site visit was conducted. High-resolution water-table maps were developed, and a preliminary groundwater modeling analysis was performed to provide a preliminary assessment of the three potential RIB sites identified by SJRWMD.

The long-term average annual rainfall at nearby stations (Gainesville and Starke) is 51 in.; the annual average potential evapotranspiration (PET) for the period of record is 50–52 in. per year.

The preliminary site assessment evaluated the three RIB sites identified by SJRWMD in southwest Clay County: the South DuPont site, the North Blanding site, and the Southwest Blanding site.

A detailed site investigation was recommended at the Southwest Blanding site for the following reasons:

- Most of the area is covered by soils with high infiltration capacities.
- The site is close to the most critical MFLs lakes (e.g., Brooklyn Lake and Lake Geneva).
- The site surrounds Alligator Creek, the main conveyance channel in the area, which can provide the most efficient way of transmitting the additional flow to the MFLs lakes.
- Surface water inflow is the largest component of the water budget in most of the Alligator Creek chain of lakes, including Lowry, Magnolia, and Brooklyn. The water levels of lakes with high vertical seepage, such as Brooklyn Lake and Lake Geneva, drop sharply during dry years, mainly due to lack of surface inflow from upstream lakes. Providing a constant surface water inflow to these lakes, especially during dry years, will significantly benefit the lakes. Recharging the surficial aquifer system (SAS) at the Southwest Blanding site could saturate the SAS surrounding Alligator Creek and minimize the loss of surface water flow through seepage along Alligator Creek during dry years.
- An extensive SAS monitoring network is already in place.

Phase 2: Field Exploratory Program

A field exploratory program was developed to provide guidelines for a detailed field investi-

Continued on page 34

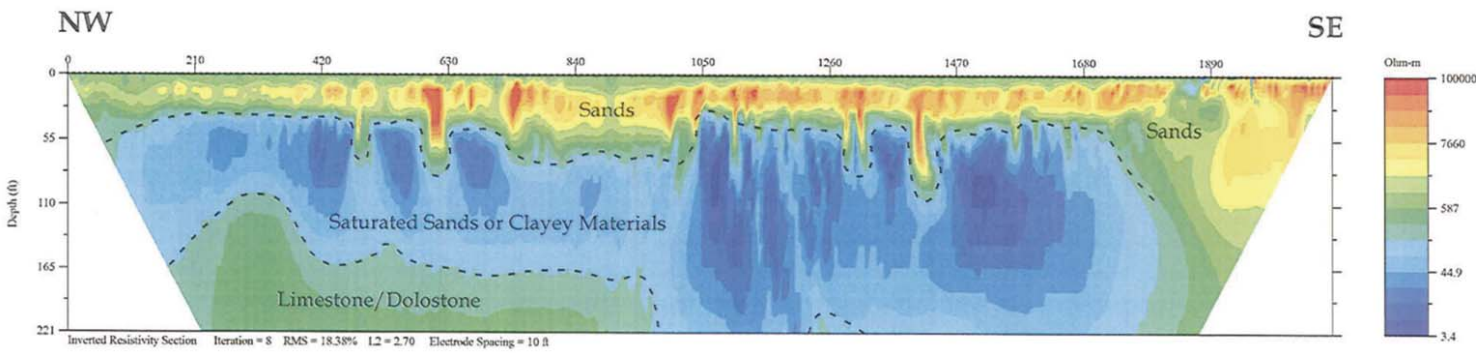

Figure 4. Two-Dimensional Electrical Resistivity Profile

Continued from page 33
gation, including the objectives and procedures of field tests, proposed locations for additional monitoring wells and borings, and data collection plans. The field program described the proposed construction and testing activities and the methods used to analyze the data collected at the site during field investigations.

The objectives of the field exploratory program were to:

- Summarize field investigation objectives
- Develop data collection plans
- Develop field test procedures, including aquifer performance testing
- Develop groundwater modeling approach to obtain information for the recharge benefit analysis

Phase 3: Field Investigation

The purpose of the field investigation was to gather the information required to further study the subsurface conditions at the Southwest Blanding site. All data collected were processed and analyzed to support a determination of the potential suitability of the site evaluated for developing RIBs to beneficially recharge the SAS and/or the UFA.

The field investigation included installing eight surficial aquifer wells/piezometers and one UFA well. Additionally, a geophysical investigation, using electrical resistivity, was conducted and two confirmatory borings were completed to better characterize the SAS and intermediate aquifer system (IAS). Also, one surface water gauge was installed in Alligator Creek north of Magnolia Lake to collect flow and stage data for the evaluation of flow exchange between Alligator Creek and the groundwater system.

Figure 4 shows one of the two-dimensional electrical resistivity profiles developed from the electrical resistivity survey.

The review of the borings and geophysical survey results, as well as the water level data, confirmed that three distinctive aquifer systems occur in the study area: the SAS, the IAS, and the Floridan aquifer system (FAS). The SAS consists of fine-grained sand and clayey sand, with an approximate thickness of 40 to 100 ft. The IAS consists of saturated sand, clayey materials, and limestone/dolostone units associated with the Hawthorn Group. The thickness of IAS varies from approximately 150 to 200 ft in the study area. The water level data obtained from the SAS and the IAS wells indicate that SAS water levels were about 15 to 20 ft higher than the IAS water levels during the data collection period. The limestone of the UFA was encountered at 238 ft below land surface at UFA-PW-1. None of the confirmation borings, with a total depth of 200 ft, or geophysical survey traverses, with a penetration depth varying from 144 to 221 ft, showed indication of the UFA. Therefore, the top of the UFA is most likely more than 220 ft deep in the study area. The water-level data obtained from the UFA and the IAS wells indicate that the IAS water levels were more than 20 ft higher than the UFA water levels during the data collection period.

The SAS water levels are typically between 85 and 175 ft North American Vertical Datum (NAVD) 88. The depth of water at the site ranges from approximately 0–64 ft below land surface during the wet season and 11–80 ft below land surface during the dry season. Based on two continuously monitored SJRWMD well clusters completed in the SAS, IAS, and UFA near the study site, SAS levels are typically 15 to 20 ft higher than IAS levels, and the IAS levels are typically 10 to 20 ft higher than the UFA levels, indicating that the SAS recharges the UFA in this area. The long-term water level trends in the IAS wells are generally similar to the SAS trends. The study site is near the potentiometric high of the sandhill lakes. In general, groundwater in the UFA flows radially outward to the north, west, and east from the study area. UFA water levels are typically between 70 and 85 ft NAVD 88.

Slug tests and the surficial aquifer performance test (APT) were performed to estimate the SAS properties. The saturated hydraulic conductivities estimated from the slug tests were lowest in the northwest portion of the site and highest in the wells and piezometers near Alligator Creek, varying from 0.4 to 34 ft/day. A relatively low average saturated hydraulic conductivity of 1.7 ft/day was estimated from the analysis of the surficial APT. The estimated specific yield was 0.1, which is within the range of literature values for clayey fine sands.

A multiwell upper Floridan APT was conducted to obtain estimates of the transmissivity and storativity of the UFA and, if possible, the leakance of the overlying IAS. During the upper Floridan APT, water was pumped from the production well and water levels were monitored at nearby SAS, IAS, and UFA monitoring wells. An average transmissivity of approximately 32,000 sq ft per day (ft^2/day) and an average storativity of $2.3x10^{-4}$ were estimated for the UFA. An average leakance value of $6.5x10^{-4}$ day^{-1} was estimated, which is similar to the values for the leakance between Magnolia Lake and the UFA previously estimated (Watson et al, 2001 and Merritt, 2001). As a result, due to the proximity of the pumping well to Magnolia Lake, the leakance values estimated in this study most likely represent the leakance between Magnolia Lake and the UFA rather than leakance through the IAS.

A water budget analysis was also performed to better understand the interaction between Alligator Creek and the aquifer system, and to estimate streambed leakance values for the creek. Although Alligator Creek appears to be receiving water from the SAS due to the high water table elevation in the study area, it lost water along both segments during the data collection period. The flow loss occurring along the creek, similar to the lakes in the area, could be due to one or more sinkholes that may have breached the semiconfining layer between the SAS, the IAS, and possibly, the UFA under the creek. The thickness of the confining unit between the

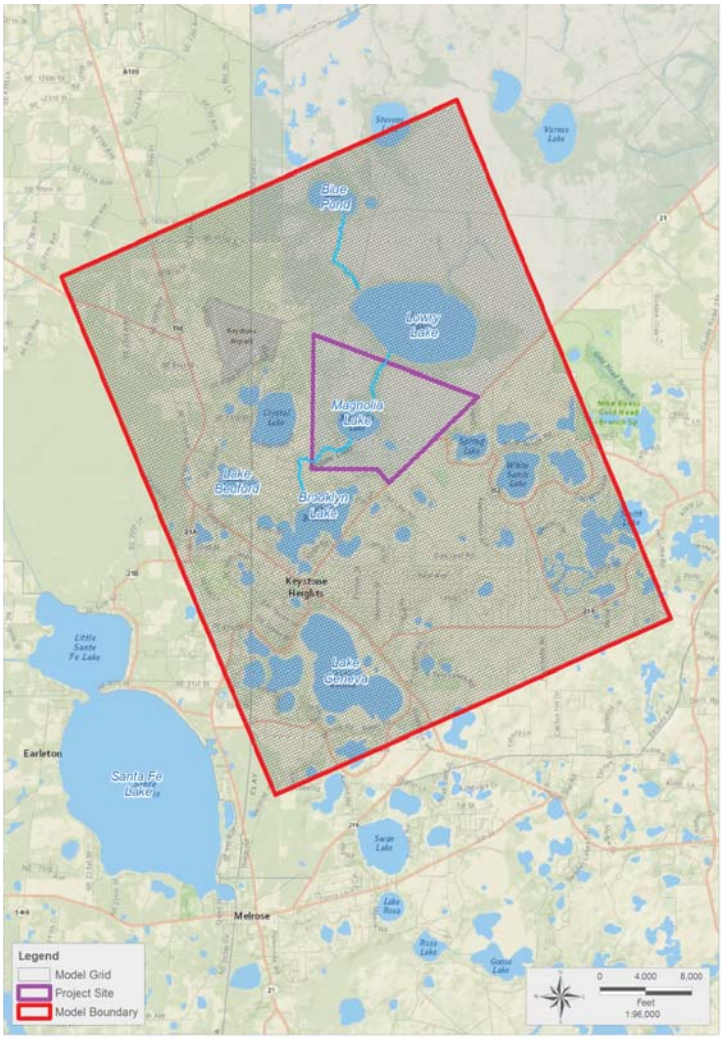

Figure 5. Groundwater Model

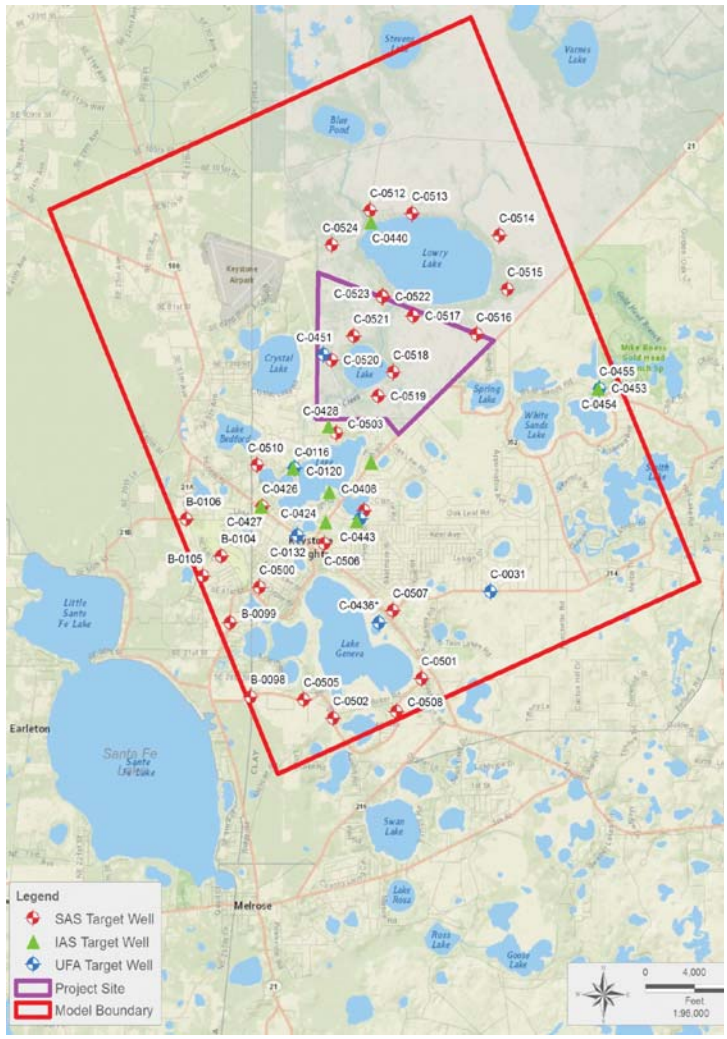

Figure 6. Target Well Locations

creek bottom and the IAS most likely becomes very thin (less than 20 ft) in some locations, which makes the creek bottom more susceptible to breaches. The connectivity could have even extended to the UFA; however, not enough information is available to determine the extent of the connectivity between the creek and the aquifer system below. Because most previous studies (Merritt, 2001) estimated leakance values for the confining unit between the lakes and the UFA, leakance values were calculated for the confining unit between the creek and the UFA using the estimated hydraulic conductivities in this study for comparison purposes. The equivalent leakance values were estimated to be $9.2x10^{-3}$ and $1.3x10^{-2}$ day^{-1} for segments 1 and 2, respectively, which are within the range of the estimated leakance values for lakes reported by Merritt (2001). The equivalent leakance values estimated beneath the lakes in this area by Merritt (2001) range from $1x10^{-3}$ to $3x10^{-2}$ day^{-1}.

The findings of the field investigation are summarized as follows:

- The estimated hydraulic conductivity values from the surficial APT and slug tests and the review of boring logs indicate that the loading capacity of the RIBs could be higher if the RIBs were located closer to Alligator Creek due to relatively higher SAS hydraulic conductivity values and steep horizontal hydraulic gradient near the creek.
- A relatively thick IAS in the study area significantly restricts the flow interaction between the SAS and the UFA.
- The flow loss occurring along Alligator Creek, similar to the lakes in the area, could be due to sinkhole(s) that may have breached the semi-confining layer among the SAS, the IAS, and possibly, the UFA under the creek. Thus, Alligator Creek may not only help with conveying the flows from the RIBs to the lakes but may also provide recharge to the UFA.
- The field investigation confirmed that most of the recharge to the UFA likely occurs through Alligator Creek and the lakes in the area.
- The results of the surficial and upper Floridan APTs, Alligator Creek water budget analysis, and previous investigations (Merritt, 2001; Watson et al, 2001) indicate that the lateral flow in the SAS that discharges into Alligator Creek and Magnolia Lake is also an important source of recharge to the UFA. In the subsequent phase of this study, lateral flows to these surface water features and vertical leakage from these features and SAS to the IAS were taken into account in evaluating the loading capacity of the RIBs and the benefits of the recharge to the UFA.

Phase 4: Sustainable Recharge Benefit Analysis

The groundwater model was developed using MODFLOW Version 2005 (Harbaugh, A.W., 2005) to evaluate the beneficial recharge potential of the Southwest Blanding site. Figure 5 shows the extent of the groundwater model domain.

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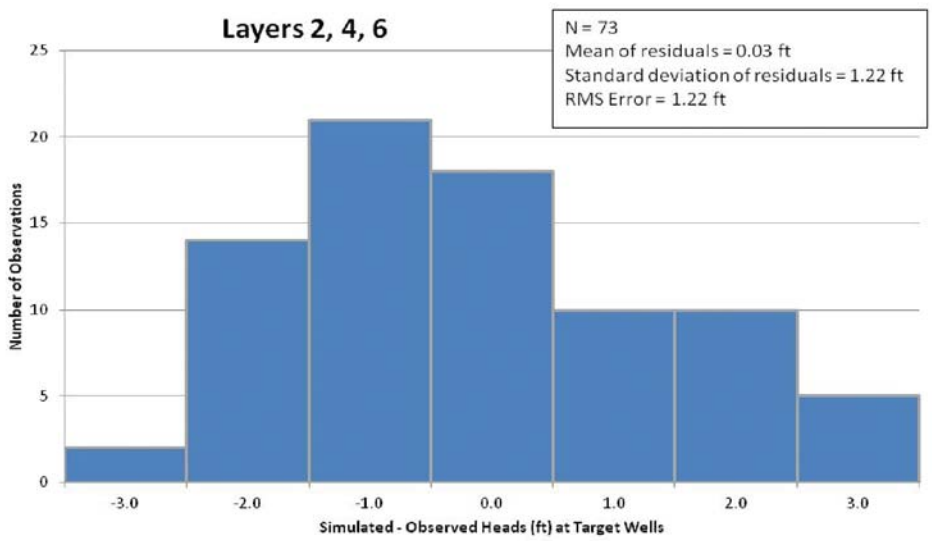

Figure 7. Residual (Simulated – Observed Water Level) Histogram

Table 1. Calibration Results for Lake Levels

Lake Station	Observed Stage (ft)	Computed Stage (ft)
Lake Lowry	130.44	130.74
Lake Magnolia	123.01	122.10
Brooklyn Lake	104.61	105.14

Table 2. Calibration Results for Vertical Water Level Differences

Site	Wells (SAS,IAS,UFA)	SAS/IAS Observed Difference	SAS/IAS Computed Difference	SAS/IAS Residual	IAS/UFA Observed Difference	IAS/UFA Computed Difference	IAS/UFA Residual
Site 1	C-0455, C-0454, C-0453	15.32	13.35	1.97	2.54	5.01	-2.47
Site 2	C-0452, C-0116, C-0120	16.23	14.72	1.51	6.15	6.86	-0.71
Site 3	C-0426, C-0427, NA	7.32	7.57	-0.25	–	–	–
Site 4	NA, C-0443, C-0442	–	–	–	10.75	11.14	-0.39

Continued from page 35

Data collected during the preliminary site assessment and the field investigation phases were used to develop and calibrate the model. The primary objective of the model calibration was to ensure that the regional and local groundwater movement was accurately simulated and the regional and local aquifer properties were understood. The model was calibrated to average 1997 water levels, as this was the only year within the period-of-record that the water levels in the SAS, UFA, and lakes appear to be stable (not much change in water levels during the year). During this period, the average annual rainfall of 48 in. was close to the long-term average of 51 in.

The groundwater model is a fully three-dimensional model with eight layers that represent the SAS, IAS, UFA, and Lower Floridan aquifer (LFA), as well as the associated confining units. The model was developed using the lake and stream packages for the Alligator Creek segments within the study area and the connecting lakes (Lowry, Magnolia, and Brooklyn) so that water could be routed through the creek segments and water level changes in the lakes could be calculated. The observation groups for model calibration included 46 SAS well, 18 IAS wells, 9 UFA wells, stream flows, lake levels, and the vertical water level difference targets (Figure 6). The model calibration results are summarized in Figure 7 and Tables 1 and 2.

After the model was calibrated, model scenarios were set up to evaluate the recharge potential of the site during dry and wet seasons. Multiple scenarios were run to evaluate the maximum recharge potential of the site and to evaluate the benefit of additional RIB area versus RIB location.

The maximum capacity of the site was assumed to be reached when groundwater mounded within 3 ft of the ground surface. The model results indicate that the site capacity ranges from 1.75 to 2.9 mil gal per day (mgd) during the wet and dry seasons, respectively. The calibrated model agrees with previous studies (Motz et al, 2001; Watson et al, 2001; Merritt, 2001; Goodrich, 1999; and Kuniansky et al, 2012) that have shown that most leakance to the UFA occurs through the lakes within this area. Because the leakance of the IAS is low under the RIB areas, the majority of the benefit to the UFA comes from flow that reaches Alligator Creek and flows to Brooklyn Lake, which has the highest IAS leakance value and provides the majority of the benefit to the UFA. Figure 8 shows the mounding underneath Lake Brooklyn and the groundwater flow movement from artificial recharge.

The recharge to the UFA ranged from 1.1 to 2.2 mgd in the wet and dry simulations, respectively, which resulted in 0.5 to 0.9 ft of mounding

Continued on page 38

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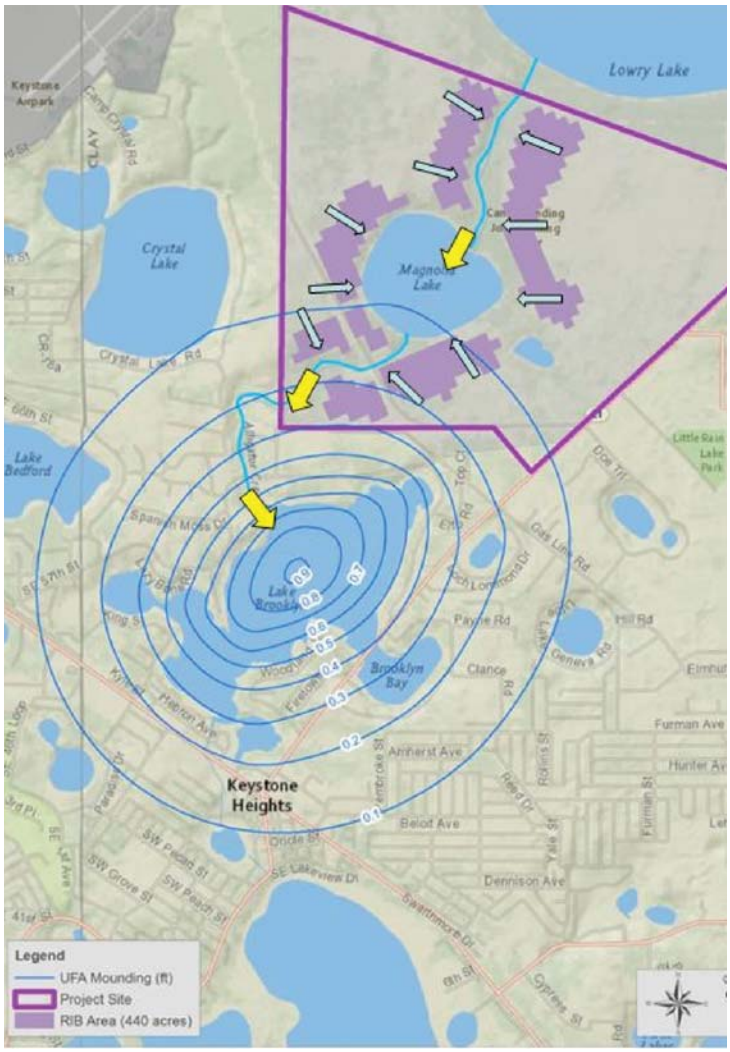

Figure 8. Groundwater Model Results

Table 3. Summary of the Results of Model Recharge Scenarios for Dry Condition

Dry Condition Scenario - A constant flow of ~ 2.9 mgd for 5 years		
Water body	**Rise in Lake Level**	**Rise in UFA Beneath Lake**
Lake Brooklyn	~3 ft	~0.9 ft

Table 4. Summary of the Results of Model Recharge Scenarios for Wet Condition

Wet Condition Scenario - A constant flow of ~ 1.75 mgd for 5 years		
Water body	**Rise in Lake Level**	**Rise in UFA Beneath Lake**
Lake Brooklyn	~2 ft	~0.5 ft

Continued from page 36

in the UFA (Tables 3 and 4). Lake Lowry is upgradient of the recharge area and was generally not affected by the loading scenarios. Levels at Lake Magnolia also were not significantly affected because additional flow to this lake is routed to Brooklyn Lake through Alligator Creek. The water level in Brooklyn Lake increased approximately 3 ft during the dry season scenarios. The starting water level at Brooklyn Lake during the wet condition scenario is 114.9 ft, which is near the outfall elevation of 115.5 ft.

The model results indicate that the water levels will rise above this during the loading simulations and Brooklyn Lake would discharge to Alligator Creek, which flows to Lake Geneva.

Conclusions

The results of the groundwater modeling show that the areas closer to Magnolia Lake and Alligator Creek have higher recharge capacity and provide most of the flow to the lakes and benefit to UFA. The groundwater model results are consistent with previous studies that show that most of the leakage to the UFA occurs through the lakes. Because of the presence of the relatively low-permeability confining layer beneath the potential RIB sites, the majority of the benefit to the UFA would come from lateral groundwater flow that would discharge into Alligator Creek and be conveyed to Brooklyn Lake, which has the highest degree of vertical connection to the UFA in the area.

The model scenarios indicate that the potential RIB site's capacity ranges from 1.75 mgd under wet conditions to 2.9 mgd under dry conditions. The recharge to the UFA would result in 0.5 to 0.9 ft of mounding in the UFA beneath Brooklyn Lake. The model results also indicate that recharging the aquifer in the study area via RIBs would result in increased water levels in Brooklyn Lake, not only due to mounding in the UFA, but also due to increased surface water inflow from Alligator Creek and upstream Magnolia Lake. Moreover, identification of a reliable, long-term water source of sufficient magnitude (1.75-2.9 mgd) is necessary to achieve the aquifer recharge benefits estimated in this study.

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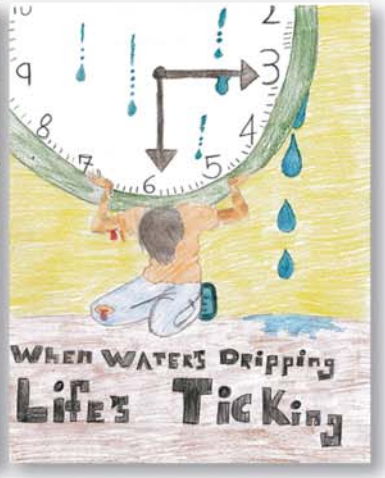
Utilities Invited to Host Local "Drop Savers" Contests

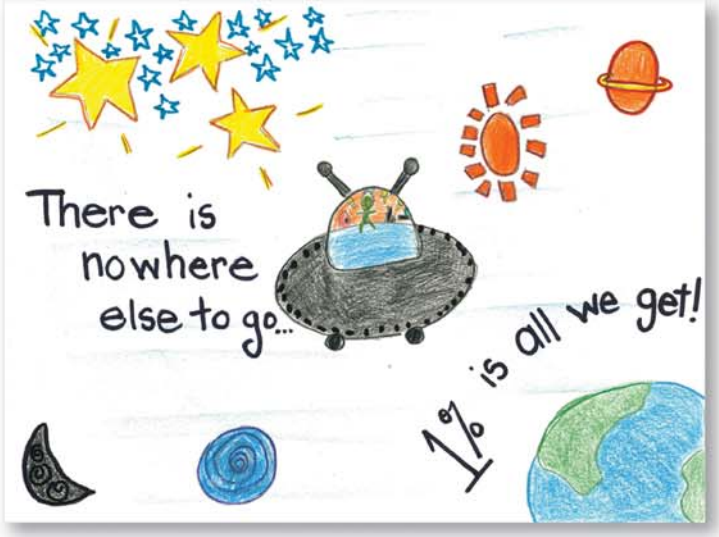
The Florida Section of the American Water Works Association will again sponsor the statewide "Drop Savers" Water Conservation Poster Contest during National Drinking Water Week, scheduled for May 1 - 7, 2016. Submission deadline is March 14, 2016, for local winners to be submitted for judging at the state level, Florida utilities are encouraged to begin preparations for showcasing the creativity of their local school children.

The contest gives children from kindergarten through high school the opportunity to design a poster about water conservation. Early in the year, local winners are chosen in five different age groups, with winning entries advancing for statewide judging. Utilities publicize the local contests, distribute the contest materials to local schools, coordinate the judging, recruit prize sponsors, and arrange local awards ceremonies.

Although the state winners will be announced in mid-April prior to Drinking Water Week, utilities should start planning their local celebration now. Interested utilities may download the complete package of "Drop Savers 2016" start-up materials from the "Drop Savers" Florida Section web site at http://fsawwa.org/dropsavers. If you have questions or problems downloading the materials, please contact state coordinator Melissa Velez at (954) 756-4496 or by email at mvelez@fsawwa.org.

Looking forward to seeing your utility represented this year!





American Water Works Association
Florida Section

This column highlights a committee, division, council, or other volunteer group of FSAWWA, FWEA, and FWPCOA.

Water Resources, Reuse and Resiliency (WR3) Committee

Affiliation:
Florida Water Environment Association (FWEA)

Current officers:

Director at large Sondra W. Lee, P.E., is a program engineer for the City of Tallahassee's Underground Utilities Wastewater Treatment Department where she manages projects for the City's water reclamation facility system. She previously worked at the Thomas P. Smith Water Reclamation Facility for 10 years.

Cochair Lynn Spivey is a principal engineer with Arcadis U.S. Inc. in Tampa with over 20 years of design and project management experience related to water and wastewater treatment, water resources, and reclaimed water treatment and distribution.

Cochair Ricky Q. Ly, P.E., is a civil drainage engineer at Stantec Consulting Engineers in Orlando. His work experience includes stormwater/drainage design; environmental permit applications; hydrologic/hydraulic modeling; and stormwater management for state, county, and city municipality clients. He previously served as chair of the FWEA Integrated Water Resources Committee.

Secretary Lillie E. Thomas, E.I., E.P.I., is a senior staff engineer with Geosyntec Consultants Inc. in Orlando. Her work experience includes real-time nutrient monitoring to evaluate best management practices performance in agricultural and residential areas throughout Florida, hydrologic and hydraulic modeling, and stormwater and drainage design for municipal clients.

Treasurer Nita Naik, P.E., ENV SP, is a project engineer at Greeley and Hansen in Tampa. She has more than seven years of experience in the field of water/wastewater treatment, design of pressure pipelines, collection and stormwater systems, and pumping stations.

Webmaster Mike Knowles, P.E., is a project engineer with Greeley and Hansen and has more than 13 years of experience in the water, wastewater, and reclaimed water engineering fields. He is experienced in various aspects of the environmental engineering field from design development

Mike Knowles

Sondra Lee

Ricky Ly

Nita Naik

Shanin Speas-Frost

Lynn Spivey

Elizabeth Thomas

Lillie Thomas

through construction administration.

Awards coordinator Shanin Speas-Frost, P.E., oversees the Drinking Water State Revolving Fund (DWSRF) Program in the Division of Water Restoration Assistance. The DWSRF program provides financial savings for projects that benefit protection of public health and disadvantaged communities with their drinking water needs.

Newsletter editor Elizabeth T. Thomas, P.E., M.S., BCEE, has over 35 years of experience in a wide range of areas, including water resources planning and permitting, water and water reclamation process and operation, and utility management and operation. She has worked in both the public and private sectors and is currently the senior professional engineer at SMW Geosciences.

Year group was formed:
The WR3 Committee was created by the merger of the Water Reuse Committee and Integrated Water Resources Committee in 2015. The two original committees, Water Reuse and Integrated Water Resources (originally Stormwater), were formed in the early 1990s.

Scope of work:
The focus of the WR3 Committee is both technical and broad, encompassing the following areas of practice within water resources:

- Water reuse
- Water quality
- Watershed and stormwater management
- Water supply
- Water conservation and resiliency
- Ecological and hydrologic restoration
- Groundwater recharge
- Hydrologic and hydraulic modeling
- Funding and grant opportunities
- Regulations and policies

The committee organizes technical seminars and luncheons and produces a quarterly newsletter called "The Droplet." The goals of the committee are to:

- Further the dialogue among water professionals throughout Florida to meet the growing needs in all areas of water resources.
- Provide timely, high-quality information and education on water as a valuable resource that can be used to meet current and future water resources and water supply challenges throughout Florida.
- Provide rewarding leadership opportunities to water professionals at all levels of experience.

Recent accomplishments:
One Drop of Water, Many Uses – Winter Seminar, Jan. 22, 2016 (see flyer)

Committee members:

- Sondra W. Lee, P.E., City of Tallahassee – Director at Large
- Shanin Speas-Frost, P.E., MBA, Florida Department of Environmental Protection – Awards Coordinator
- Lynn Spivey, Arcadis U.S. Inc. – Cochair
- Ricky Ly, P.E., Stantec – Cochair
- Lillie Thomas, EI, EPI, Geosyntec Consultants Inc. – Secretary
- Nita Naik, P.E., ENV SP, Greeley and Hansen – Treasurer
- Elizabeth Thomas, P.E., BCEE, SMW Geosciences Inc. – Droplet Newsletter Editor
- Mike Knowles, P.E., Greeley and Hansen – Committee Webpage

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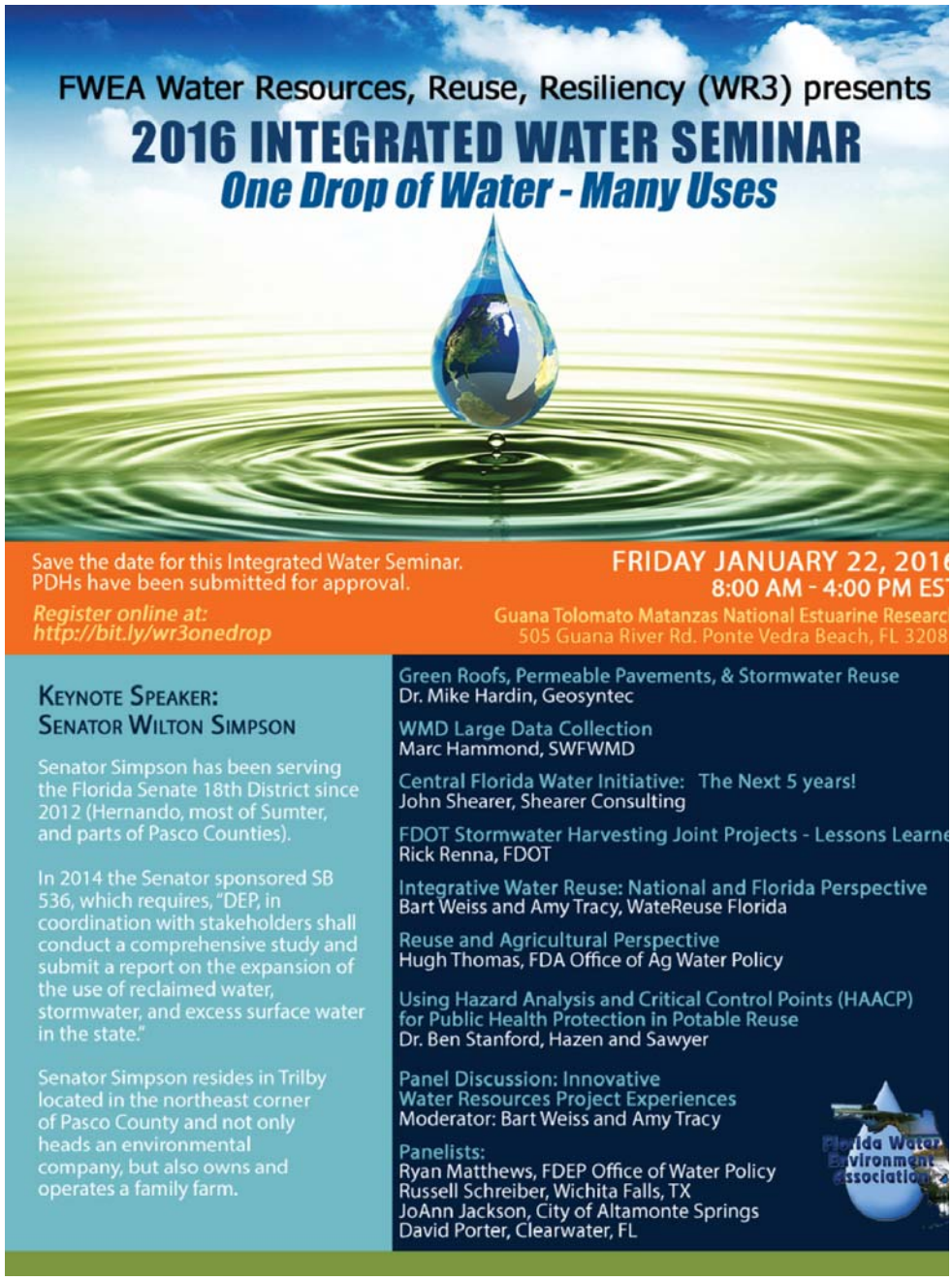

Leveraging Conjunctive Use to Develop a Cost-Effective Regional Alternative Water Supply Project

Brian J. Megic, Oscar Vera, Kevin Felblinger, Deb Beatty, Michael Hudkins, Mark Addison, and Ted McKim

Central Florida has historically utilized fresh groundwater as its primary potable water supply source. Over the past decade, the South Florida Water Management District (SFWMD), the St. Johns River Water Management District (SJRWMD), and Southwest Florida Water Management District (SWFWMD), whose boundaries meet in central Florida, have individually and collectively determined that fresh groundwater from the Floridan aquifer is a limited resource and cannot meet all future public water supply needs of the region. Surface water and groundwater levels, and spring flows, are some of the environmental measures the water management districts use to assess the environmental effects associated with groundwater withdrawals.

Local utilities have been developing plans and implementing projects to address the potential limitations on fresh groundwater supplies being identified by the water management districts. Utilities have implemented robust conservation programs and extensive reclaimed water reuse systems, including public-access reuse irrigation and aquifer recharge (among other programs). However, as growth continues in the central Florida region, conservation and beneficial reclaimed water reuse will not be able to keep up with increases in future water demands before the sustainable limits on traditional fresh groundwater supplies are reached in some areas. Due to this, the implementation of alternative water supply (AWS) projects will be needed to meet a portion of central Florida's future water demands.

To meet these future water supply needs in an environmentally sustainable manner, the City of St. Cloud (STC), Toho Water Authority (TWA), Orange County Utilities (OCU) and Polk County Utilities (PCU), comprising the Water Cooperative of Central Florida and Reedy Creek Improvement District (RCID), are cooperatively implementing the Cypress Lake AWS Project, a 37.5-mil-gal-per-day (mgd) annual average daily flow (AADF) Lower Floridan aquifer (LFA) brackish groundwater supply project. These utilities were issued a 30-year, 37.5-mgd AADF water use permit (WUP) by SFWMD to withdraw groundwater from the Cypress Lake wellfield in 2011.

Considering the anticipated use of membrane treatment technology, and the estimated recovery associated with lowering the dissolved solids of the brackish groundwater supply, the Cypress Lake project is anticipated to deliver at least 30 mgd of finished (potable) water. Once a WUP for the project was obtained, the utilities developed a preliminary design report for the raw water system and water treatment plant, and a conceptual design report for the finished water transmission system and integration of Cypress Lake Project finished water supplies into the utilities' existing potable water distribution systems. This article summarizes the conjunctive-use modeling performed in support of the development of a conceptual design report for the finished water transmission system.

Conjunctive Use

The term "conjunctive use" is commonly applied to mean the use and management of multiple water supply sources to increase the available supplies while reducing the potential adverse effects associated with their use. The term is commonly applied to systems that utilize both surface water and groundwater sources where the surface water source may be seasonally unavailable and groundwater sources are overutilized to meet demands when surface water supplies are not available. However, the conjunctive use can apply to the management of many different types of water supplies.

For the Cypress Lake project, brackish groundwater from the LFA is the AWS source being implemented by the utilities. As a groundwater supply source, water from the Cypress Lake wellfield is available from a resource perspective to meet both average and daily peak demands of the utilities (unlike surface water sources that are sometimes seasonally unavailable). However, the utilities' WUP for the Cypress Lake project includes a maximum month allocation that is equal to the annual average allocation for the project. This limitation will cause it to be more challenging for the utilities to meet peak demands from the Cypress Lake project, while staying in compliance with current WUP conditions.

In addition, the Cypress Lake project requires advanced treatment to reduce chlorides, total dissolved solids, and other constituents present in the raw water to meet drinking water standards. Through a parallel project to develop the preliminary design of the Cypress Lake water treatment plant, it was determined that membrane treatment was the preferred technology for the Cypress Lake project and that it would not be cost-effective to design the facility to meet peak daily demands. Instead, the Cypress Lake water treatment plant is being designed to provide a constant supply of finished water (i.e., base-loaded supply).

These regulatory and cost considerations will result in the water treatment plant for the

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project being designed to not fully meet the utilities' peak demands associated with the Cypress Lake project. Conjunctive use in this case would include developing a plan to utilize existing fresh groundwater supplies, storage, or other sources to meet peak demands associated with the Cypress Lake project.

Conjunctive Use Model Overview

Though one of the primary objectives of the overall project was to develop a plan for implementing the Cypress Lake project, the initial phase of this project (Phase I) entailed development of a plan to interconnect the utilities' distribution systems prior to the implementation of the Cypress Lake project (Phase II). One benefit of these interconnects would be to allow the utilities to convey water among their individual systems to meet demands, thereby increasing operational flexibility; this concept is referred to herein as "water wheeling." Conjunctive use in Phase I included developing a plan for interconnecting the utilities' distribution systems to allow them to convey finished potable water to one another to meet the demands of the group as a whole.

In order to facilitate conjunctive use among the utilities, the Coop-RCID Water Supply (CRWS) Model was developed. The CRWS model is a time-series or continuous-simulation model based on 121 years of climatic conditions that allows for the statistical evaluation of the water balance between the utilities' demands and water supplies throughout the planning period. The CRWS model was developed to simulate the utilities' overall water supply system, including the conjunctive-use needs being assessed as part of this project.

For Phase I of the Cypress Lake project, the CRWS model was developed to simulate the following:

1. Daily customer demands for each utility
2. Fresh groundwater supplies for each utility (including WUP limitations)
3. Service area transfers of water conveyed through interconnects among the utilities

The magnitude, frequency, and timing of the need to transfer existing water supplies among utilities was developed using the CRWS model. The model results facilitated the conceptual design of the interconnects among the utilities and indicated the need to consider notably higher peaking factors than typically used in facility design to meet the conjunctive-use needs of Phase I of the project.

As part of Phase II of this project, the CRWS model was expanded to incorporate the use of water from the Cypress Lake water treatment plant. Based on the results of the water supply modeling, it was determined that leveraging the use of the utilities' existing fresh groundwater supplies to meet the peak demands associated with the Cypress Lake project was the preferred conjunctive-use method for the group to implement. The results of the Phase II water supply modeling were also used to:

1. Estimate the design peak flows to use for transmission pipelines associated with the project.
2. Refine the capacity of the interconnects identified in Phase I to accommodate the required transfer of water from the Cypress Lake project among the utilities as part of Phase II.
3. Identify the magnitude, frequency, and timing of projected water supply needs resulting from supply and regulatory constraints.
4. Estimate potential increased capacity required in the utilities' existing potable water system facilities (e.g., fresh groundwater treatment plants, diurnal storage, etc.) to meet the conjunctive-use needs of the project.

The water supply modeling demonstrated how, by working together, the members of the Water Cooperative of Central Florida and RCID reduced the overall costs associated with implementing the Cypress Lake project by fully utilizing existing resources and infrastructure in a cooperative manner.

Table 1. Water Use Permit Allocation Summary

Entity	Service Area	WUP #	Average (MGD AADF)	Maximum Month (MGM)
STC	Entire	SF #49-00084-W	9.70	412.80
TWA	Main	SF #49-00103-W	36.50	1,555.90
	Poinciana	SF #49-00069-W	6.25	283.10
	O&S	SF #49-01207-W	0.66	27.28
OCU	South, Southwest	SF #48-00134-W	32.40	1,674.43
	and West	SF #48-00059-W	3.00	7.14 (max day)
PCU	Northeast	SF#53-00126-W SW#6509	13.95	N/A
RCID	Entire	SF #48-00009-W	22.20	933.89

Phase I Model Development

The CRWS model has been developed to simulate the utilities' overall water supply system, including the conjunctive-use needs being assessed as part of this project. A brief discussion of the Phase I version of the CRWS model follows.

Annual Demands

The potable water demand projections used for the CRWS model were based on the demand projections developed for the overall project. Demands were projected through 2045 and represent demands associated with long-term average climatic conditions.

Rainfall

Potable water demands are directly correlated to rainfall, particularly outdoor or landscape irrigation demands met with potable water sources. During periods of below-average rainfall, demands tend to be above average, and vice versa. In fact, climatic conditions tend to be one of the greatest drivers contributing to the variation in water demands. To account for the effect of rainfall on demand variability, the demand modules for each utility were developed to account for variations in rainfall. Rainfall data were collected from the utilities, National Oceanic and Atmospheric Administration (NOAA) rain gauges, United States Geologic Survey (USGS) rain gauges, and SFWMD rain gauges.

For the calibration of the demand module of the CRWS model, the selection of a rain gauge was based on the proximity of it to each utility's potable water distribution system and existing fresh groundwater treatment plants, and on the available period-of-record associated with each gauge. Rain gauges located within or near each utility's service area were given priority. Rain gauges with period-of-records coincident with each utility's available fresh groundwater pumping data (typically 10 to 15 years through 2012) were also given priority. Composite rainfall series were developed where necessary using data from the next closest gauge (e.g., gap filling).

The CRWS model was developed to use NOAA rainfall data for Orlando from 1892 through 2012 as the basis for the predictive simulations. Using historical rainfall data to perform predictive (future) simulations as-

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sumes that the wide range of rainfall conditions observed over the past 121 years encompasses potential future conditions. Sensitivity analyses to assess changes in rainfall magnitude or variability associated with climate change or other factors were not performed as part of the Phase I analysis.

Daily Demands

The CRWS model calculates a normalized daily demand series considering multiple factors that affect water demand for each utility's service areas. Individual demand models were developed to generate the normalized demand series for each service area. These models were based on the following factors:

- *Seasonal Variation by Day-of-Year*: Deterministically represents seasonal variations in demand resulting from causative factors, such as seasonally variable rainfall, evaporation/evapotranspiration, temperature, and water use (e.g., seasonal customers).
- *Cross-Correlation with Rainfall (varying lags by service area)*: Deterministically defines the direct relationship between daily demand and rainfall.
- *Autocorrelation (varying lags by service area)*: Autocorrelation is the cross-correlation of a signal (e.g., a time series of data) with itself. It is a statistical method used to identify repeating patterns within a time series of data.
- *Statistical Noise*: Represents the portion of the time series of data that could not be represented with other deterministic or statistical factors.

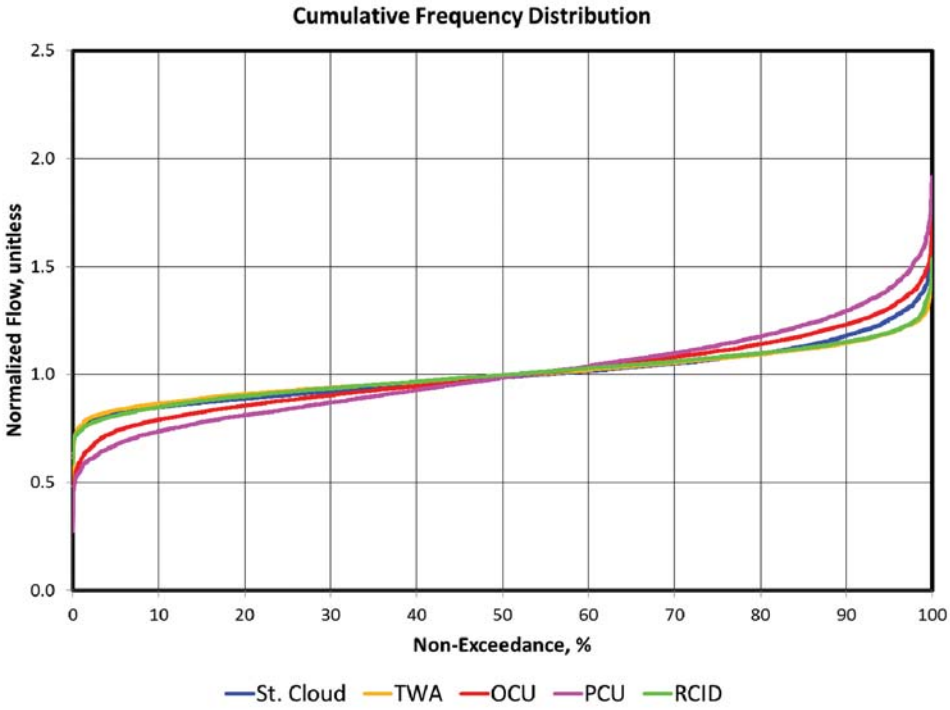

Figure 1. Historical Normalized Daily Peaking Factors

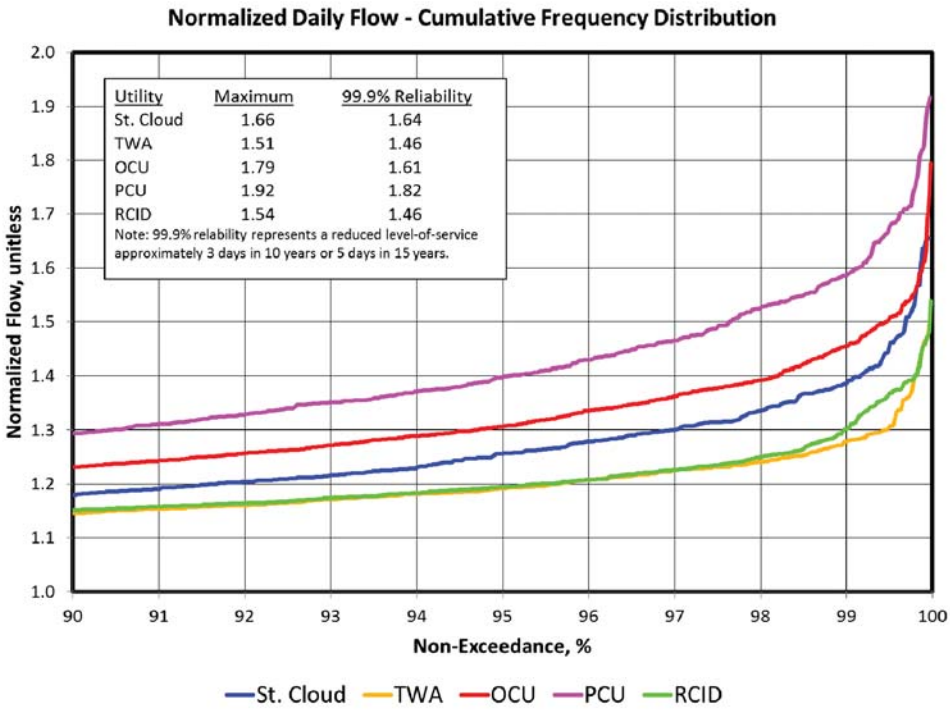

Figure 2. Historical Normalized Daily Peaking Factors (Top 10 Percentile)

Observed daily potable water demand data for each utility and a rainfall data series selected for each utility (typically 10 to 15 years through 2012) were used to calibrate the utility demand models. These models were used to generate a normalized daily potable water demand that could be used to generate a daily potable water demand series for any annual average demand condition.

Once the daily demand models were calibrated, they were used to predict 121 years of daily normalized potable water demands for each service area; daily rainfall in Orlando for 1892 through 2012 was used as the basis for the predictive simulations. The predictive normalized demand series were multiplied by the future annual average demand for each service area. The result is a long-term prediction of potential daily demands for each utility's service area for a selected annual average demand condition (e.g., year). The results of the demand models are presented in Figures 1 and 2.

Fresh Groundwater Water Use Permit Allocations

The CRWS model was developed to include a fresh groundwater module. This module was developed to represent each utility's fresh groundwater supplies within the conditions specified in each utility's WUP. A summary of the WUP allocation limitations is provided in Table 1. The CRWS model compares the daily demand series developed for

each utility to that utility's WUP allocation to calculate a deficit in fresh groundwater supplies.

Interconnects

The CRWS model compares the utilities' fresh groundwater supply surpluses and deficits to determine if available surplus supplies could be transferred among the utilities to meet demand deficits. If surplus supplies are available to meet demand deficits, the CRWS model quantifies the magnitude, frequency, and timing of these potential transfers.

Phase I Model Summary

The predicted flows transferred through potential interconnects among the utilities as predicted by the Phase I CRWS model can be used to facilitate the utilities developing a potential plan to wheel water to maximize the use of existing available fresh groundwater sources. Phase I water wheeling results in the deferment of capital expenditures associated with implementing the Cypress Lake project.

The results can be used to develop potential agreements among utilities for the interim purchase of bulk fresh groundwater supplies to meet potential supply deficits that some utilities may experience in the short term before the Cypress Lake project is implemented. It can also be used to develop preliminary pipe sizes for the potential interconnects among utilities. However, it should be noted that Phase I is an interim step in the overall plan to implement the Cypress Lake project. As part of Phase II, water from the Cypress Lake water treatment plant will be conveyed to the utilities. This water may also be "wheeled" or conveyed among the utilities in lieu of each utility having a direct connection to the Cypress Lake delivery system. As a result, the magnitude, frequency, timing, and direction of flows through the potential interconnects among utilities may change. This will affect the design of the interconnect systems.

Table 2. Finished Water Supply from Cypress Lake Water Treatment Plant

Finished Water Supply Variability	Maximum Daily Flow[1], MGD	Average Flow, MGD AADF
Base-loaded	30	30
Variable	38.1	30

Note: Represents maximum daily flow associated with 99 percent frequency of occurrence for simulations performed.

Table 3. Range of Finished Water Supply Delivered to Utilities

Utility	Capacity Share, MGD AADF	Range of Maximum Daily Flow[1], MGD	Range of Average Flow, MGD AADF
STC	5.0	1.8 to 6.6	1.8 to 5.0
TWA	12.0	12.0 to 18.0	12.0 to 14.7
OCU	9.0	9.0 to 16.1	9.0 to 11.7
PCU	3.0	0.8 to 4.5	0.8 to 3.0
RCID	1.0	0.95 to 1.3	0.95 to 1.0

Note: Represents maximum daily flow associated with 99 percent frequency of occurrence for simulations performed.

Table 4. Range of Fresh Groundwater Use by Utilities

Utility	WUP Allocation, MGD AADF	Range of Maximum Daily Flow[1], MGD
STC	9.7	8.0 to 18.5
TWA	43.4	50.3 to 84.2
OCU	35.4	45.0 to 65.2
PCU	14.0	21.9 to 28.7
RCID	22.2	31.3 to 33.3

Note: Represents maximum daily flow associated with second highest daily groundwater use for simulations performed.

Phase I Modeling Results

Planning Increments

The intent of Phase I is to develop a plan for water wheeling among the utilities before the Cypress Lake project is needed. The utilities' WUP allocations sum to approximately 125 mgd average annual daily demand (AADD). This represents the maximum annual average demand that can currently be met with the utilities' combined fresh groundwater supplies. Potable water demands in excess of 125 mgd AADD will need to be met by other sources, including water from the Cypress Lake project. Since the intent of Phase I is to develop a plan to wheel water before the Cypress Lake project is implemented, the 125-mgd demand condition was selected as the final Phase I planning condition.

A 110-mgd AADD condition was selected as the second or interim Phase I planning increment. A demand of 110 mgd represents the initial stages at which Phase I water wheeling could be required according to preliminary conjunctive-use modeling.

Deficit Analysis

Based on the previous information, 110-mgd and 125-mgd demand conditions were evaluated using the CRWS model to identify the quantity of water that may need to be transferred through potential utility interconnects as part of Phase 1 of the project. The CRWS model simulates a demand condition, such as 110-mgd average demand, but allows the demands to vary based on climatic conditions and other factors affecting utility demands over a 121-year simulation period. The result is 121 years of predicted daily demands and supply surpluses/deficits (44,196 days). It was determined that up to 4-mgd maximum daily flow may need transferred among the utilities by the 110-mgd demand condition. However, this corresponds to an annual aver-

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age transfer of up to 0.2 mgd, resulting in a much higher peaking factor than pipes are typically designed for. By the 125-mgd demand condition, the flow transfers among the utilities increased to up to 13-mgd maximum daily flow and 5.2-mgd annual average daily flow, which more closely resembles a standard pipeline design peaking factor.

It's important to note that these results are based on the demand projections assumed for this project. As previously noted, many factors can change, depending on the growth that occurs within a utility's service area. Utilities can implement other projects, such as additional conservation efforts and nonpotable water projects beyond those currently planned for, including retrofitting, and implementing additional water supply projects sooner than previously anticipated.

The water supply modeling results were provided as input and evaluation in the regional hydraulic model. The model, which contains a spatial distribution of demands, was used to evaluate the adequacy of existing interconnects to convey potential flow transfers among utilities, refine the distribution of flows transferred among utilities in order to better address the spatial distribution of potential supply deficits, and develop preliminary interconnect concepts for new Phase I interconnects among utilities.

Phase II Modeling Results

The CRWS model developed as part of Phase I of this project was expanded as part of Phase II to integrate the use of water from the Cypress Lake project. Simulations were performed on a wide array of potential project supply and demand configurations, termed "scenarios" herein, using the CRWS model. The intent of performing multiple scenarios was to evaluate varying project configurations and their potential effect on the following components of the project:

- Maximum daily flows from the Cypress Lake Water Treatment Plant (WTP).
- Maximum daily flows delivered to the utilities through transmission piping or interconnects.
- Maximum daily fresh groundwater supply required to meet the conjunctive-use needs of the project. Conjunctive use for this project is considered the use of fresh groundwater to meet the peak demands potentially not met by the Cypress Lake project.

The results of the scenarios are presented in Table 2, Table 3, and Table 4. The results of the water supply modeling as presented in the tables were incorporated into the hydraulic model to determine the infrastructure required to convey flows to and among the utilities.

Facility Capacity Deficit Identification

The intent of the facility capacity deficit task was to determine if the utilities' existing fresh groundwater facilities were of sufficient capacity to meet the potential increase in fresh groundwater use that could occur once the Cypress Lake project is implemented. A macrolevel comparison of the potential peak daily groundwater use calculated for the 12 water supply scenarios evaluated using the CRWS model (Table 4) and the existing Florida Department of Environmental Protection (FDEP)-permitted capacity of the utilities' fresh groundwater treatment plants are presented in Table 5.

The results of the CRWS model indicate that RCID currently has sufficient existing fresh groundwater permitted WTP capacity to meet anticipated future peak groundwater demands.

The OCU currently has sufficient existing fresh groundwater capacity under all but one scenario evaluated. An additional 1.1-mgd of treatment would be required to meet all predicted daily peak groundwater uses.

The results of the CRWS model simulation indicate that PCU's fresh groundwater demands may be in excess of its FDEP permitted capacity in three of the 12 simulations performed. However, PCU currently has capital improvement projects planned that would likely accommodate this additional capacity need.

The results of the CRWS model simulations indicate STC's predicted daily fresh groundwater use was in excess of its FDEP-permitted capacity in five of 12 simulations performed. Based on a review of STC's WTP infrastructure, its FDEP-permitted capacity appears to be constrained primarily by treatment capacity. The STC may consider increasing the treatment capacity at its existing fresh groundwater facilities to address potential future conjunctive-use needs associated with the Cypress Lake project.

Similarly, the results of the CRWS model simulation indicate that TWA's fresh groundwater demands may be in excess of its FDEP permitted capacity in seven of the 12 simulations performed. However, TWA's existing well capacity at its WTPs is sufficient to meet predicted daily fresh groundwater needs. Based on this, TWA may consider increasing the treatment capacity at its existing fresh groundwater facilities to address potential future conjunctive-use needs associated with the Cypress Lake project.

In addition to daily treatment and well capacity, the peak-hour, high-service pumping capacity at the utilities' fresh groundwater

Table 5. Daily Fresh Groundwater Use by Utilities versus Florida Department of Environmental Protection Permitted Capacity

Utility	FDEP Permitted WTP Capacity, MGD	Maximum Daily Groundwater Use, MGD
STC	15.8	18.5
TWA	70.4	84.2
OCU	64.1	65.2
PCU	26.2	28.7
RCID	35.4	33.3

Table 6. Estimated Peak Hour Fresh Groundwater Use Versus Existing High-Service Pumping Capacity

Utility	Total High Service Pumping Capacity, MGD	Peak Hour Flow[1], MGD
STC	25.6	33.2
TWA	137.6	168.2
OCU	106.3	126.6
PCU	49.1	47.6
RCID	76.2	41.6

facilities was evaluated for adequacy to meet future demands associated with the Cypress Lake project (Table 6). Based on the results of the peak-hour flows listed in Table 6, STC, TWA, and OCU may need additional high-service pumping capacity in the future at their WTPs to address the predicted conjunctive-use needs associated with implementing the Cypress Lake project.

Summary

The Water Cooperative of Central Florida and RCID are meeting future water supply challenges through regional cooperation. One of their key initiatives, the Cypress Lake project, will provide an additional 30 to 36 mgd of alternative water supply to the group. Challenges associated with planning a Cypress Lake transmission system were met by providing a detailed water supply evaluation using a water supply model (the CRWS model) and a detailed hydraulic evaluation using a combined regional hydraulic model to develop the conceptual design. Based on the preliminary findings of the WTP project and the 37.5-mgd WUP to withdraw water from the brackish groundwater wellfield, the utilities made the following consensus water supply decisions to maximize utilization and flexibility of the Cypress Lake project transmission design:

- Utilize water wheeling, prior to the implementation of the Cypress Lake project, to leverage the use of existing groundwater supplies and potentially forestall Cypress Lake project capital costs.
- The Cypress Lake project supply is to be analyzed as base-loaded or supplied at a constant rate equal to the AADD associated with the project.
- The utilities' existing fresh groundwater facilities are planned to conjunctively supply maximum day demands (MDD) and peak hourly demands (PHD). Leveraging the use of the utilities' existing fresh groundwater facilities to meet projected peak demands and conjunctive-use needs associated with the Cypress Lake project was determined to be more cost-effective than implementing seasonal storage
- The Phase II (build-out) Cypress Lake transmission was analyzed to accommodate a design flow of up to 36.6 mgd AADD, with defined allocations for each utility.

Through regional cooperation, the utilities are cost-efficiently implementing the Cypress Lake project, one of the largest AWS projects in central Florida, in an environmentally sustainable manner.

Safety is as Safety Does

Thomas King
President, FWPCOA

When writing these tidbits of wisdom and mirth, I try to enlighten and entertain you all. While safety is no laughing matter, I will always share stories that may serve as a comical example of what to do or what not to do. I figured after falling from a 20-foot roof, several trees, and more recently, a narrow set of stairs, I may not be an expert at the protection part, but I a damn good faller. I say this because I'm still walking.

The first of my rules of safety is to listen to your inner self. The one common statement I have felt and heard from others who have fallen is "I knew better." How many times have you made a life-changing mistake and afterwards made this statement? As part of my daily safety message to my crew, I leave them with this: "What is the worst thing that can happen from what I am about to do?" Listen to your inner voice and make good choices to prevent having to ask yourself this question.

The holidays are over and hopefully none of you had a hoverboard accident. It seems like yesterday we were taking skates apart to make skateboards. I grew up watching the movie *Back to the Future* with a hoverboard that flew. A flying hoverboard would be great advantage in the utility business.

My family watched the YouTube videos of famous (and some not so famous) people falling off this newest form of mobility. Funny as they were to us, I'm sure there is a not-so humorous side, such as injured wrist, elbows, hips, and backs, that last much longer than the warranty on the toy. I have been guilty of playing with my kids and wanting to show them that trick I was so good at when I was a child; the next thing I know we are leaving the ER with instructions to keep the injured part elevated. I can speak from experience that when it's your bottom that's injured, it's hard to keep it elevated.

All of this falling from very low heights brings to mind how far we have come on fall protection. When we think of fall protection, we never think of the falls we take while walking or stepping off a curb. Just think of the number of times your poor wrist has kept your bottom or back from hitting the ground. It's no wonder we have shoulder problems as we age.

Just imagine all the falls we take in the course of our lives. As a child, and many times into adulthood, we take falls in the course of our play. I remember diving for the football, falling off a trampoline, tumbling out of a tree, and many other falls like the ones that you might remember as you read this. Many of us have worked around the potential for falls on a daily basis: working at heights with little or no fall arrest system while brushing weirs or cleaning tanks; walking the wall of the clarifier while holding a brush as your only safety equipment; or climbing the water tank to change the light bulb. Compare this to today's OSHA rules on fall protection and what we know about the potential for injury; as it's said many times: "Knowing is only half the battle."

The second of my personal safety rules is "You are your brother's keeper." We can make a difference in the lives of others when safety becomes such a big part of who and what we are that we have a positive influence on those around us. Today, children would not think of pulling out of the driveway without their seat belts on. Some of us began to drive at a time when there were no seat belts in cars, or if there were, they were rarely used. Now it's automatic to put on a seat belt, and if you don't, the car will remind you. If you see your fellow worker in an unsafe situation, it's your responsibility to say something. It's much harder to live with the regret after an injury of a friend than to speak up.

Utility companies have spent many hours and lots of money to bring us into the world of safety we know and practice today. We will have truly made it when all of the personal protective equipment (PPE) is used without hesitation and we continue to look for ways to eliminate the need for last-resort methods of safety protection. Through the development of safety plans, employee-assisted safety committees, and a commitment to continuous improvement, a company can reach a zero-incident goal.

You can also reach this goal by having everyone sit in the shop and watch safety films—instead of working at all. I will say from experience that even this has its hazards. I once filled out an accident report for a guy who fell asleep during a safety meeting and fell backwards from his chair, breaking his arm. This was only eclipsed by an accident report (on me) for an eye injury from flipping the charts we were reviewing and the edge of the chart scratched my cornea. Not only was this very embarrassing, but it's also difficult to fill out a report with one eye bandaged.

I once had a technician report to the health office with ticks from working in an area we never sprayed. The ticks were removed and the bite areas were treated, but while filling out the accident report, I joked that I would have him wear a flea and tick collar to prevent a reoccurrence.

The employee thought it would be funny to wear a flea collar and say I made him do it. It was 94 degrees the next day and by noon he was back at the health clinic with a horrible rash that was much worse than the ticks. He told the doctor I made him wear the collar as PPE. I will admit I did not see the humor in this initial statement, even though he recounts it as an attempt at humor. I also found out that some people have a pretty bad allergy to the chemicals in flea collars made for dogs or cats.

That's enough for the humor part of the article. Safety is nothing to laugh at and should be a part of every plan you put together. Start each day with a personal safety moment and share it with your team or your crew. There are a multitude of websites dedicated to tailgate talks and safety tips. You will find, after a while, that the pursuit of a safety topic will get you in a safety zone each day. We are starting a new year—let's try to eat healthier, drive with a defensive attitude, and be a safety leader.

Test Your Knowledge of Water Supply and Other Miscellaneous Topics

Roy Pelletier

1. What is the flow rate in cu ft per second (cfs) of a 0.5-mil-gal-per-day (mgd) stream of water?
   a. 0.77 cfs
   b. 8.34 cfs
   c. 2.32 cfs
   d. 92.84 cfs

2. What is the term used to describe bacteria, viruses, or other organisms capable of causing disease?
   a. Pathogenic
   b. Endogenous
   c. Facultative
   d. Coliform

3. In what units is the presence of suspended and colloidal matter that imparts a cloudy appearance to the water expressed?
   a. Specific ultraviolet absorption (SUVA) units
   b. Threshold odor number (TON) units
   c. Turbidity units
   d. Conductivity units

4. Algal blooms may create several problems, such as tastes and odors, depletion of oxygen in the source water, and additional organic loadings. What is another problem associated with algal blooms?
   a. Increased pH
   b. Decreased diatoms
   c. Reduced trihalomethanes formations
   d. Aerobic conditions

5. What suspected carcinogen is created when source water containing organic material is chlorinated?
   a. Trihalomethanes
   b. Nitrate
   c. Diquat
   d. Styrene

6. What is the weight relationship of chlorine liquid compared to water?
   a. Water weighs more than liquid chlorine.
   b. Liquid chlorine weighs 2.5 times more than water.
   c. Water weighs 1.5 times more than liquid chlorine.
   d. Liquid chlorine weighs 1.5 times more than water.

7. What will the pressure gauge read on the suction of a pump if the pump is located at floor elevation of the tank and the tank has 15 ft of static water level?
   a. About 58 pounds per sq in. (psi)
   b. About 9.5 psi
   c. About 6.5 psi
   d. About 17 psi

8. What term is used to describe when water travels from the inlet of a tank directly to the outlet with little detention time?
   a. Radial flow
   b. Conical flow
   c. Alluvial flow
   d. Short circuiting

9. Which has a higher pH: sodium hydroxide or aluminum sulfate?
   a. Aluminum sulfate
   b. Sodium hydroxide
   c. They are both the same.

10. In general, what pH level will increase the corrosion rate in a distribution system?
    a. A high pH
    b. A low pH
    c. A neutral pH
    d. The pH has no effect on the rate of corrosion.

Thanks to Scott Ruland, water and wastewater manager with City of Deltona, for providing many of these questions.

Answers on page 70

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Under Drought Conditions, Use of Analytical and Modeling Methodologies Helps an Indirect Potable Reuse Project Move Forward

Tina M. Petersen and Richard Wagner

In 2011, Texas entered an unprecedented drought period. While the entire state experienced significant drought, the City of Wichita Falls, located approximately 150 mi northwest of Dallas, was particularly hard hit. Wichita Falls experienced record temperatures that year, exceeding 100°F on more than 100 days (when 28 days is typical) and received only 13 in. of rain, less than half of the average rainfall of 28.5 in. This made 2011 the most extreme year on record for the city in terms of temperature and rainfall, and the drought continued through 2015. Levels in the city's Lake Arrowhead drinking water supply reservoir dropped precipitously to only 23.5 percent reservoir capacity available. This put the city within one year of running out of water.

To minimize water shortfalls, the city implemented a short-term solution to the emergency: direct potable reuse (DPR), which involves the introduction of reclaimed water directly into a drinking water treatment plant. For the city, this involved piping the effluent from the River Road Wastewater Treatment Plant (WWTP) to its Cypress water treatment plant, which has advanced treatment capabilities, including microfiltration and reverse osmosis. This short-term strategy allowed the city time to implement a long-term indirect potable reuse (IPR) solution. The IPR involves supplementing a drinking water source with reclaimed water, but differs from DPR in that it uses an environmental buffer prior to drinking water treatment. Implementation of IPR for the city focused on piping wastewater effluent to Lake Arrowhead, which served as the environmental buffer prior to withdrawal from the lake and treatment at the city's Jasper water treatment plant. A map of Lake Arrowhead and its pipeline routes is shown in Figure 1.

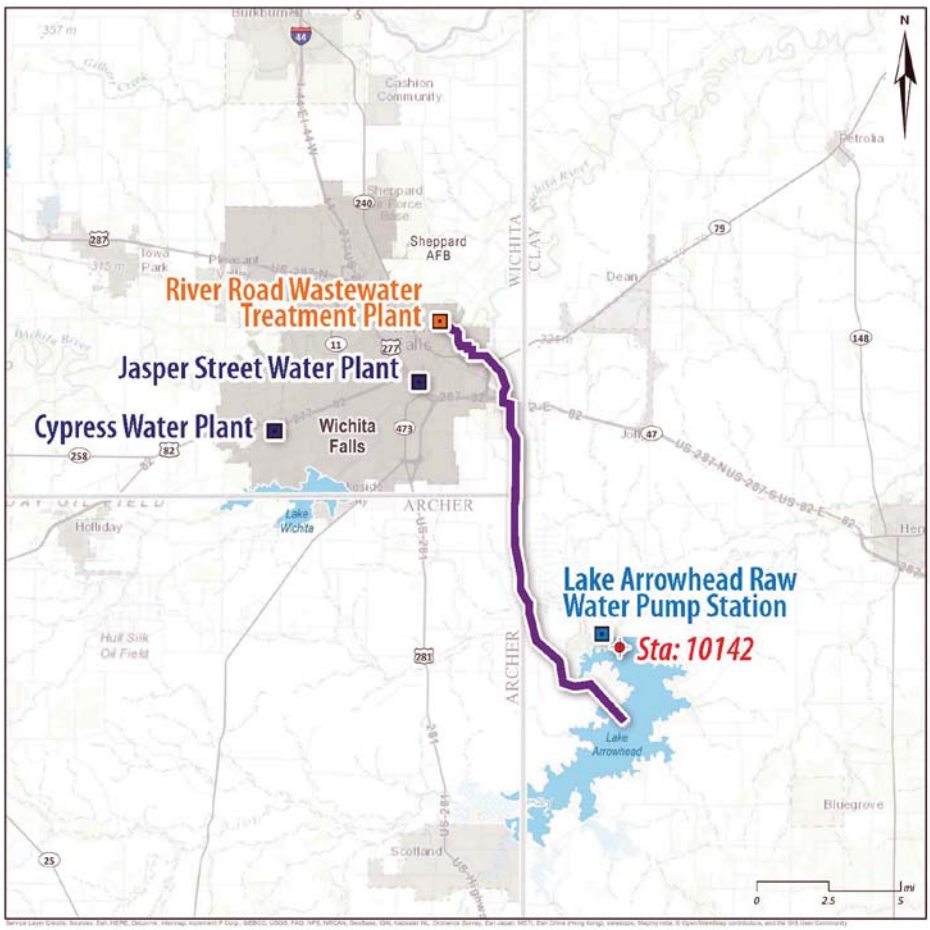

Figure 1. Pipeline Route for Lake Arrowhead

Early in the project, one of the concerns raised regarding this approach was related to total dissolved solids (TDS), which are a natural component of surface waters throughout the world. The TDS is comprised of cations and anions (principally calcium, magnesium, potassium, sodium, bicarbonates, chlorides, and sulfates) and some small amounts of organic matter that are water soluble. Preliminary discussions with the state regulatory agency, the Texas Commission on Environmental Quality (TCEQ), indicated that there was the potential for a TDS permit limit. This would require membrane treatment of the effluent prior to reuse and ultimately would have made the project cost-prohibitive for the city.

The city, in conjunction with CDM Smith, determined that advanced analytical and modeling methodologies could be used to effectively evaluate the need for a permit limit for a discharge from the River Road WWTP into Lake Arrowhead for the purposes of indirect potable reuse. This ultimately led

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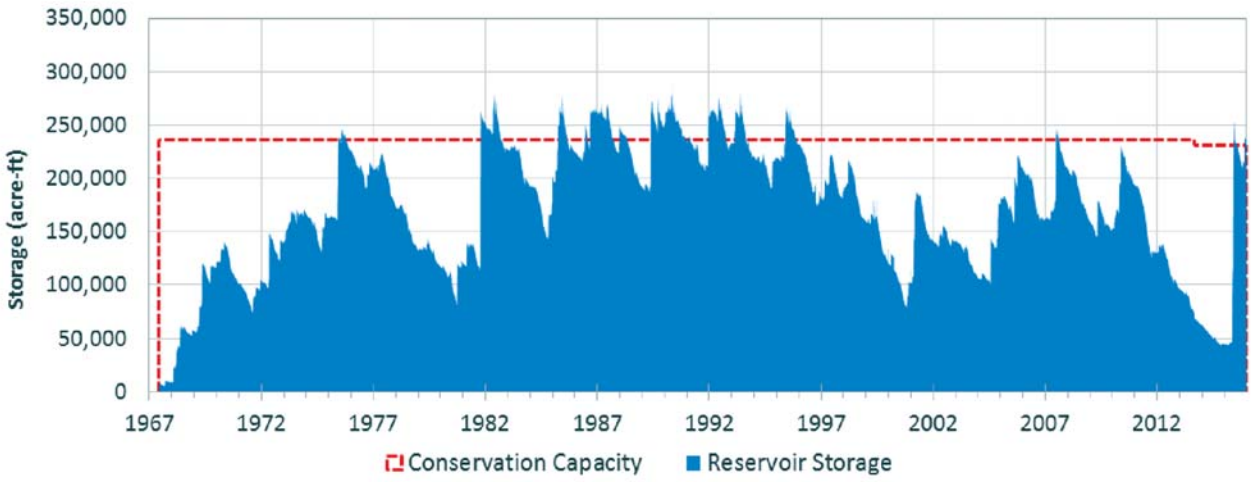

Figure 2. Volume of Lake Arrowhead from 1968 to present (Texas Water Development Board, 2015)

to a negotiation to avoid a TDS limit on the discharge.

Is a Total Dissolved Solids Permit Limit Necessary?

Lake Arrowhead is currently one of three drinking water sources for the City of Wichita Falls. It also serves as a sole source of drinking water for several communities in the area. The lake was primarily designed and constructed for water supply and recreational purposes. A permit to construct the reservoir was issued in 1962 and deliberate impoundment began in October 1966. The city owns the water rights to Lake Arrowhead and also owns and maintains the dam and appurtenant structures. When full, Lake Arrowhead holds 230,359 acre-ft (more than 75 bil gal) of water. Storage over time for Lake Arrowhead is shown in Figure 2.

While the Lake is currently 100 percent full, as of Dec. 21, 2015, the situation was much different only seven months prior, when the drought was at its worst. In April 2015, the Lake was only 19 percent full—the lowest levels since deliberate impoundment. Following torrential rainfall that was experienced across Texas in May and June 2015, the drought was broken and the lake dramatically rebounded to 100 percent of the conservation pool.

Water Quality Standards

Lake Arrowhead is considered to be suitable for primary contact recreation, high aquatic life, and domestic public water supply uses. The corresponding Texas water quality standards are shown in table format in Figure 3.

In addition to TDS, water quality criteria are established for sulfate and chloride, which are considered individual constituents of TDS. These parameters are typically evaluated when they are determined to be a potential concern. For Lake Arrowhead, based on the limited available data, there was no reason to consider either parameter a potential concern; thus, the analysis focused on TDS only. As noted previously, one of the major concerns raised early on by TCEQ was related to the potential need for TDS limits. The TCEQ has an established screening process to evaluate WWTP discharges to a classified lake as defined in its implementation procedures (2011) and has incorporated these procedures into a series of screening spreadsheets.

To evaluate the discharge from the River Road WWTP into Lake Arrowhead, the TCEQ implementation procedures dictate that the effluent load is calculated based on the effluent TDS concentration (CE) and the effluent fraction (EF) at the edge of the human health (HH) mixing zone, based on critical conditions. Then, the concentration at the edge of the mixing zone within the lake is calculated based on the ambient TDS concentration (CA). These values are then compared to the TDS criterion (CC) as shown in Equation 1:

Equation 1

$$CC \geq (EF) * (CE) + (1 - EF) * (CA)$$

A permit limit may be assigned if the effluent concentration is more than 70 percent of the estimated daily average TDS in the lake, which is defined in Equation 2:

Equation 2

$$Daily\ Average = \frac{[\ CC - (1 - EF) * (CA)\ ]\ *1.37}{EF}$$

Therefore, the permit limit evaluation requires an understanding of ambient water quality, the effluent water quality, and the mixing characteristics within the lake.

Ambient Water Quality

Water quality in Lake Arrowhead is monitored frequently by TCEQ. The primary monitoring point is near the city's raw water intake at monitoring station 10142. The TDS has been monitored in Lake Arrowhead since the early 1970s and the TDS values over time are shown in Figure 4.

The TCEQ screening procedures include recommended site-specific values for TDS concentrations, among other parameters. The values for TDS are typically based on the median concentration for the segment. In some cases, the state chose to use a conversion between specific conductance and TDS to supplement the dataset used to calculate the median TDS concentration, which for the Lake Arrowhead segment was calculated to be 494 mg/L. This is shown in Figure 4 as a solid red line. This value, however, is not representative of recent ambient conditions. Additionally, using this value in a permit screening evaluation would not provide adequate assimilative capacity for the proposed discharge.

Fortunately, the implementation procedures allow the permittee to propose an alternative ambient TDS concentration based on the most recent five years of TDS in the water

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quality monitoring database. This value of 360 mg/L is shown in Figure 4 as a red dashed line, and is more representative of current lake water quality and was therefore used in the permit screening evaluation.

Effluent Total Dissolved Solids Characteristics

As previously discussed, the city maintains the River Road WWTP, located north of Arrowhead Lake on the Little Wichita River. Historically, the plant has been permitted to discharge a daily average of up to 19.91 mil gal per day (mgd) to the river and a two-hour peak flow of 43.86 mgd. The plant uses an activated sludge process with fine bubble diffusion, followed by chlorination, dechlorination, and reaeration. For permitting of the new indirect potable reuse discharge to Lake Arrowhead, a maximum flow of 16 mgd was requested.

Wastewater effluent monitoring data were collected by the city from August to November 2012 to support the IPR permitting efforts. Based on that monitoring, TDS concentrations ranged between 640 and 937 mg/L, with a median TDS concentration of 721 mg/L.

Mixing Characteristics

Based on TCEQ screening evaluations, using the ambient TDS concentrations and effluent flow and TDS concentration, it was determined that the discharge needs to achieve an EF of 0.09 or greater to ensure adequate mixing within the lake and obviate the need for a TDS permit limit. To achieve the required mixing, a diffuser has been proposed at the end of the WWTP outfall.

The CORMIX model, which is a U.S. Environmental Protection Agency (USEPA)-supported mixing zone model and decision support system for environmental impact assessment of regulatory mixing zones resulting from continuous point source discharges, is most commonly used to design diffusers and evaluate mixing near outfalls, and this model was applied to evaluate conditions from the River Road WWTP into Lake Arrowhead and propose an initial diffuser design.

The CORMIX model input includes the following categories:

- Ambient conditions defining the current, density, and water depth conditions at the outfall structure.
- Effluent characteristics, including density and discharge rate.
- Configuration of outfall diffuser, including the discharge orientation and dimensions.

The ambient conditions evaluated in the diffuser design included normal pool elevation of the lake (826 ft), which corresponds to a lake depth of 30 ft at the diffuser location. Runs were also conducted at a historically low water level of 912 ft, which corresponds to a lake depth of 16 ft to evaluate the mixing under low water conditions. For both lake level conditions, runs were conducted for summer and winter water density conditions, considering both the 5th and 95th percentile seasonal values based on available lake data. For the winter condition, there was little variation between top and bottom values, and therefore, an unstratified condition was evaluated. In contrast, the summer data did show some stratification and so separate density values for top and bottom water were specified.

Several effluent flow rates for the diffuser design were considered, ranging from 10 mgd, which is reflective of current discharge rate, to 20 mgd, which is the permitted flow rate for the original WWTP. The buildout flow rate was used in the design of the diffuser. The effluent density for winter and summer were calculated based on the average measured TDS concentration of the effluent (721 mg/l) and the average seasonal effluent temperature (18.3°C in winter, 28.2°C in summer).

Configuration of Outfall Diffuser

The diffuser that was designed for the outfall discharge includes the following characteristics:

- *Port openings.* The number and size of port openings were established such that the velocity of discharge from each port is less than 8 ft/s for a 20 mgd discharge. The resulting design included five openings, each with a 12-in. (0.305 meter) diameter.
- *Port opening orientation.* To avoid bottom scour by the effluent jets, the port openings are directed upward at a 45 degree angle to the lake bottom.

Figure 3. Water Quality Standards for Lake Arrowhead

Parameter	Criterion
TDS	500 mg/L
Sulfate	50 mg/L
Chloride	250 mg/L
Dissolved oxygen	5.0 mg/L
pH range	6.5 to 9 standard units
Indicator bacteria (*E. coli*)	126 cfu per 100 mL
Chlorophyll *a*	In negotiation with US EPA

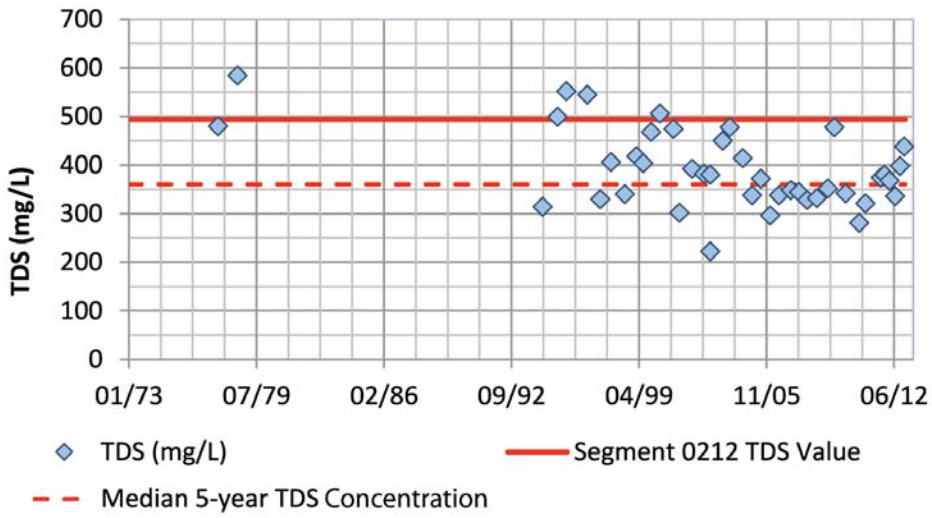

Figure 4. Total Dissolved Solids Values in Lake Arrowhead

- *Diffuser length.* To accommodate these openings, a diffuser length of 30 ft (4 meters) was established.
- *Diffuser location.* The diffuser is located about 1100 ft offshore, where the lake bottom elevation is between 898 and 899 ft National Geodetic Vertical Datum (NGVD). Accounting for revetment of the lake bottom with a riprap pad, the pipe invert elevation is assumed to be at 899 ft NGVD 29.
- *Diffuser orientation.* The diffuser is mounted horizontally above the lake bed such that the ports discharge downstream towards the dam.
- *Diffuser pipe diameter.* A pipe diameter of 36 in. (0.92 meters) would be appropriate for conveying the flow and distributing flow among the ports.

When a diffuser is implemented, it is anticipated that the mixing zone will be rectangular in shape and centered about the diffuser, as shown in Figure 5. In this case, with the diffuser directing the discharge away from the diffuser in a parallel direction to the lake shoreline, the rectangular mixing zone was assumed to begin at the diffuser and extend downstream, with dimensions specified such that the width of the rectangle represented a downstream distance and the length of the rectangle represented the diffuser length plus twice the downstream distance.

The model results were evaluated to determine the minimum amount of dilution at the edge of the mixing zone.

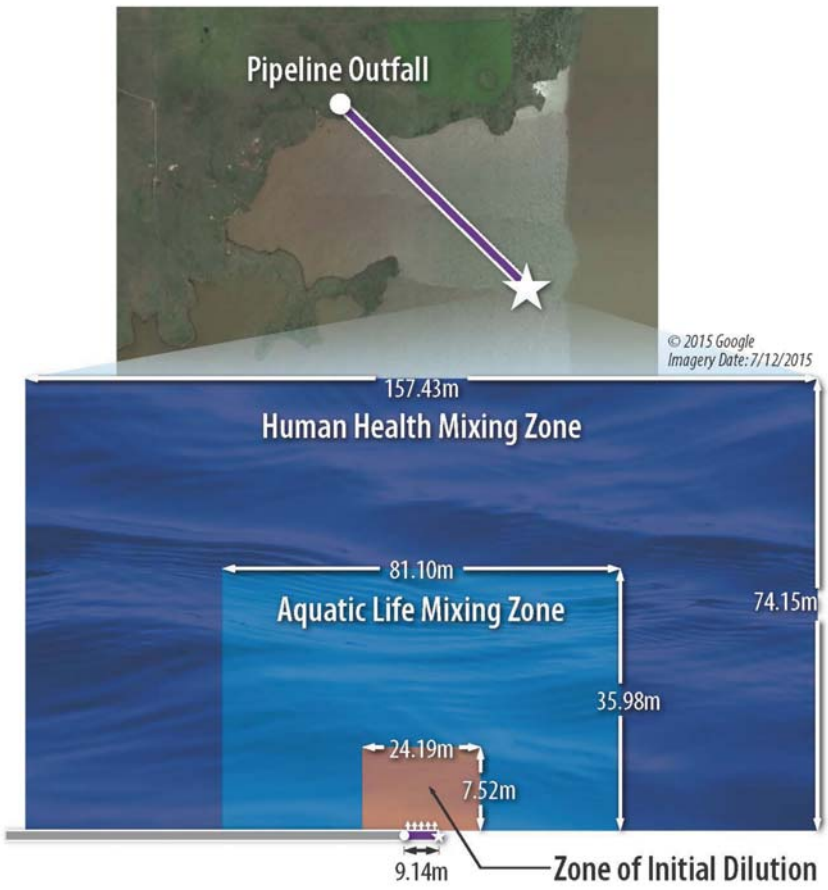

Figure 5. Lake Arrowhead Proposed Diffuser Location and Regulatory Mixing Zones

Model Results

The model results for the CORMIX simulations are summarized in table format in Figure 6. For each simulation, the table presents the EF for each mixing zone. The value of EF is in the inverse of the dilution value S that is presented in the CORMIX output. For example, a CORMIX output value of 2 represents a condition with one part effluent and one part ambient lake water, which would be equivalent to an EF value of half, or 0.5.

In the table, both the winter- and summer-month evaluations included consideration of the following scenarios for establishing the range of EF values:

- 5T or 95T = based on 5th or 95th percentile water temperature
- 5S or 95S = based on 5th or 95th percentile salinity (calculated from TDS)
- Q1-Q3 = effluent flow (Q1 = 10, Q2 = 16.49, Q3 = 19.91 mgd)

Figure 6. Lake Arrowhead CORMIX Results Summary

	Range of Calculated Effluent Fraction (EF) at Mixing Zone Boundary		
CORMIX Scenario	ZID	AL	HH
Winter Runs at Normal Pool Elevation	0.104 – 0.105	0.072- 0.073	0.056
Summer Runs at Normal Pool Elevation	0.104 – 0.105	0.072- 0.073	0.056
Winter Runs at Historically Low Pool Elevation	0.143 – 0.205	0.099	0.076
Summer Runs at Historically Low Pool Elevation	0.143	0.099	0.076

The table presents EF values at the downstream end of the mixing zone, as results showed that the dilution at that point was the critical value (i.e., dilution at the point that the plume passes through the rectangular mixing zone either to the left or right of the diffuser was greater than the downstream dilution).

The table shows that the modeled dilution (EF) at the edge of the HH mixing zone is always greater than the required mixing based on the screening evaluation. For both summer and winter conditions, there is little or no difference in results for the different ambient conditions and different WWTP flows.

When the low lake depth is considered, the modeled EF value for the AL and HH mixing zones is greater than corresponding values with the lake at normal pool elevation. However, the resulting EF values are still achieving the required mixing based on the screening spreadsheet.

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Project Takeaways

There were several key lessons learned throughout the project that may be useful to others facing similar permitting challenges. First, site-specific data is key to ensure that the data sets are representative of the current ambient water quality. Another key lesson is that mixing models are important tools for the evaluation process. Through the use of the CORMIX model, the project team was able to demonstrate that proper mixing was achieved during both normal pool and historic low pool elevations. This provided confidence that the discharge will be protective of HH and aquatic life based on standards that have been set by TCEQ. Finally, maintaining open lines of communication with the regulators helps ensure clear understandings and can increase project success. For this project, the magnitude of the drought required quick reaction times. Close coordination with regulators provided the opportunity to hear feedback prior to the evaluations being completed, and this helped advance the process more quickly.

Employing advanced analytical and modeling methodologies to evaluate the need for a permit limit for a discharge from the River Road WWTP into Lake Arrowhead for the purposes of indirect potable reuse helped the city avoid TDS permit limits on the discharge. The potential for a TDS limit to be imposed on this discharge would have required membrane treatment and caused the IPR strategy to become too expensive, putting the future water supply for the city at risk. The process used by the project team to successfully negotiate and avoid TDS permit limits on the discharge allowed the IPR project to move forward at a critical time while under extreme drought conditions. It has also served to improve the reliability and resilience of the city's water supply.

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FWRJ READER PROFILE

Shirley Reaves
Shirley Reaves Services Inc., Titusville

Work title and years of service.
My company was formed in 2008 in order to continuing to work for FWPCOA after the organization left Brevard Community College. I'm the FWPCOA training coordinator and have worked for the association since 1997.

What does your job entail?
I handle all of the training office duties for FWPCOA, including all 13 regions. I oversee one full-time employee, Michelle Reaves, who works for me. We handle all of the processing of application forms for the classes that are being held throughout the state of Florida: processing applications forms, receiving payments, grading exams, and making certificates if students pass the exam. We also process continuing education units (CEUs) for the Florida Department of Environmental Protection.

What do you like best about your job?
Office technology training, accounting, word processing, and computer classes.

What organizations do you belong to?
FWPCOA

How have the organizations helped your career?
It has helped me learn about the environment and care about the water and wastewater industry, which I had taken for granted and never really thought about until I went to work for the association.

What do you like best about the industry?
I like the people that I am involved with in the FWPCOA organization. I like the people that we help by getting them in the classes that they need in order to advance with their jobs.

What do you do when you're not working?
I like to spend time with my family; go camping, fishing, and bike riding; walk on the beach; and just enjoy life. I love watching the sun come up each day.

Above: FWPCOA headquarters

At left: Michelle Reaves

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Optimizing Existing Facilities to Provide Additional Capacity at Low Cost

Douglas H. Eckmann and Kevin Morris

The Peace River Manasota Regional Water Supply Authority (Authority) owns and operates a regional surface water treatment facility located in DeSoto County and adjacent to the Peace River. The Peace River Regional Water Treatment Plant (facility) provides an alternative to brackish groundwater in southwest Florida and allows for the regional transfer of potable water derived from the Peace River among Charlotte, DeSoto, Manatee, and Sarasota counties, as well as the city of North Port. The entire facility was permitted for a production of potable water at a rate equivalent to 48 mil gal per day (mgd). This capacity has subsequently been increased and is now permitted for 51 mgd, an increase of 3 mgd. This new capacity was achieved for a low capital cost through mining the existing facilities for opportunities to rerate unit processes at higher flows. This was accomplished by analyzing existing systems for process capacity opportunities and elimination of hydraulic restrictions.

The facility was constructed in stages and consists of Unit 1 rated for 12 mgd (built by General Development Utilities Inc., or GDU, in the late 1970s), Unit 2 rated for 12 mgd (built by the Authority as the Peace River Option in 2001) and Units 3 and 4 rated for 24 mgd (also built by the Authority as the Regional Expansion Program in 2009). Unit 1 was being renovated (1991 Peace River Facility Rebuild Project).

The facility had a total permitted capacity equivalent to 48 mgd of treated water production and has an excellent track record for production of high-quality potable water. The Florida Department of Environmental Protection (FDEP) participated in an areawide optimization program (AWOP) that benchmarked the performance of surface water treatment facilities in the state and identified the Peace River facility as one of the top performing surface water treatment plants in Florida, achieving a filtered water turbidity goal of <0.1 nephelometric turbidity units (NTU) 95 percent of the time and a maximum filtered water turbidity of less than 0.3 NTU. This is approximately three times better than the current regulatory requirements for filtered water turbidity of <0.3 NTU 95 percent of the time and a maximum filtered water turbidity of 1 NTU.

The facility is also designed for optimized powdered activated carbon contact for taste and odor control and has won the regional American Water Works Association Annual Taste Test competition on multiple occasions. The primary surface water treatment process used at the facility is enhanced coagulation with alum (aluminum sulfate), followed by dual-media gravity filtration.

Douglas H. Eckmann, P.E., BCEE, D.WRE, F.ASCE, is chief operating officer and engineering manager at TKW Consulting Engineers Inc. in Fort Myers. Kevin Morris, P.E., BCEE, CPPO, is science and technology officer with Peace River Manasota Regional Water Supply Authority in Lakewood Ranch.

It was observed by the project team (Authority and TKW Consulting Engineers Inc.) that a careful analysis of the various process units might reveal units with inherent excess capacity, and that, with some modifications, the capacity of the facility might be increased while not only meeting all requirements for drinking water standards, but without degrading the history of excellent water quality that has historically substantially exceeded regulated standards. The project team believed that it could be demonstrated, with some modifications to be determined by analysis, that the treatment plant designated as Unit No. 1 (incorporating Treatment Trains No. 1 and No. 2, the oldest part of the facility), could effectively treat additional raw water at a rate equivalent to a production of 15 mgd, an increase of 3 mgd from the current permitted production capacity of

New 316 stainless steel effluent launders installed in Unit 1, Process Train 2 increasing hydraulic capacity of the Train 2 solids contact unit (SCU) from 6 mgd to up to 8 mgd. Note the pentagon structure on the left side. *(photo: Kevin Morris, PRMRWSA)*

12 mgd for Unit No. 1. This unit consists of the original treatment facilities acquired in 1991 by the newly formed Authority from GDU, a private utility serving communities originally developed by the General Development Corporation.

Florida Department of Environmental Protection Rerating Requirements

In order to apply for a rerating of capacity, FDEP requires an analysis and report complying with the requirements of FAC 62-555.528. The analysis and engineering report addressing the capacity of Unit 1 included the following sections:

1. Information about the facility; general description; raw source, including discussion and evaluation of the reservoir pumping capacity to supply raw water to the facility; and discussion of the proposed new design capacity and general statement of the objective of the rerate study.
2. Discussion of raw water quality inclusive of seasonal variations and water quality data.
3. Discussion of applicable primary and secondary drinking water standards, including discussion of disinfection criteria and management of disinfection byproducts.
4. A flow diagram depicting all unit processes (mixing, solids contact, disinfection and chemical conditioning, and filtration), including recycle flows and backwash, residuals management (sludge blowdown, thickening, and dewatering) transfer pumping and storage, and high-service pumping.
5. An evaluation of the hydraulic capacity of the unit processes, interconnecting piping, and pumping systems. The evaluation is to be performed for the flow rates at the proposed new design capacity and is to include a preparation of a hydraulic profile at the proposed new design capacity.
6. An evaluation of the quantity of residuals and the capacity to manage and dewater the higher volume of residuals to be performed.
7. An evaluation of all water treatment facilities and unit processes, including chemical feed and storage systems, residuals management facilities, water pumping facilities, disinfection systems, and ancillary equipment, to be performed to confirm that the facilities and equipment will meet pertinent design requirements listed in Rule 62-555.320 FAC when operating at the proposed new design capacity.
8. For surface water treatment plants, a confirming contact time (CT) analysis at the proposed new design capacity, confirming that disinfection criteria are met at the higher flows and identifying any facility improvements that may be needed to meet CT criteria.

Depending on the results of the analysis, FDEP may require preparation of a demonstration plan for approval and the subsequent performance of a full-scale performance demonstration before granting a permit for the increased capacity. In this case, the results of the analysis were sufficiently compelling that, combined with the years of exceptional operating data, FDEP waived the requirement for a full-scale demonstration.

Results

Since rehabilitation work on the older facilities was already underway and those facilities were offline, the project team saw an opportunity to implement minor design changes without operational impacts. The team believed the treatment trains designated as Unit No. 1 could effectively treat additional raw water at a rate

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equivalent to a production of 15 mgd, an increase of 3 mgd from the current permitted production capacity of 12 mgd. This increase in treatment rate would be accomplished while maintaining the exceptional quality of finished water produced at the facility. The rationale for this was partially based on the observation that the original filters were oversized, likely designed for 15 mgd, as part of a former plan to expand the original GDU facility to 30 mgd by building a second filter structure and three more 6-mgd-capacity solids contact units (SCU) around a pentagon-shaped flow distribution structure, thereby increasing the original capacity from 12 to 30 mgd. The resulting filter rate, as measured by gpm/sq ft (sf) was conservative. With one filter out of service for backwashing, the filter rate for the Unit 1 filters at 12 mgd was 2.45 gpm/sf. Therefore, at the proposed higher water production rate, the filter rate would still be a conservative 3.06 gpm/sf. By comparison, the new filters constructed in the expansions of 2001 and 2009 have a design filter rate of 4.0 gpm/sf.

The conclusion of the analysis was that Unit 1, with some reasonable modifications, would be capable of reliably producing finished water at a process rate equivalent to 15 mgd. These improvements included:

- Replacing the effluent launders for both of the two SCUs in Unit 1, each rated originally for 6 mgd (Train 1 and Train 2) with new 316 stainless steel launders upsized for a hydraulic throughput of up to 8 mgd.
- Adjustments to lower the new weir elevations planned for the flow distribution structure, commonly referred to as the pentagon structure, to allow for higher flow rates.
- Replacement of the existing filter flow control orifices with slightly larger orifices. (All of the filters in the facility use the concept of interfilter backwash with gravity flow on the influent. To assure equal distribution of settled water to the filter cells, there are restrictions in the inlet piping sized to create a head condition that overrides any differences in friction losses in the gravity influent piping or influent channels.)

This analysis was submitted to FDEP for consideration, and following subsequent approval by the agency, these modifications were then incorporated into the ongoing rehabilitation project, which was then completed in 2015.

Other facility improvements implemented as part of this project included improved chemical storage/chemical feed, replacement of the filter media, a new supplemental filter backwash system, and two new high-service pumps. Unit 1 (the subject of the rerate analysis) and the facility overall are now permitted and capable of reliably producing high-quality finished water at an increased production rate equivalent to 15 mgd. This increases the total production rate of the facility to 51 mgd, a 3-mgd increase over the previously permitted 48 mgd. This increase in allowable production capacity will give the Authority greater operational flexibility when other process units are removed from service for maintenance.

The total cost of the rehabilitation project was approximately $12 million, of which about $3 million was associated with the cost of increasing the treatment capacity by 3 mgd. Therefore, conservatively, the capital cost associated with the new 3-mgd of capacity was about $1 per gal.

For comparison, in a study conducted by the Authority on the feasibility of new brackish water treatment for supplementing the capacity of the facility (CH2M, 2013), the projected capital cost for developing 5 mgd of additional capacity colocated at the facility was $34 million, or the equivalent of $6.80 per gal. Additionally, the Authority recently completed the Integrated Water Supply Master Plan Update (2015). This study identified new potential sources of supply within the region for 11 alternative projects (not colocated at the facility) and capital investment cost in terms of dollars per gal ranged from $8 to over $27 per gal.

Conclusion

Effective Jan. 14, 2015, the Authority was permitted for an additional 3 mgd of treatment capacity based on the engineering analysis of the existing Unit 1 facility and implementation of hydraulic improvements incorporated in the rebuild project. Highlights of the permit language include the following:

- To construct rerating of the existing 12-mgd Peace River Facility 1991 (Unit 1) water treatment plant to a 15-mgd water treatment plant, for a total combine increase flow of 51 mgd at the existing Peace River Regional Water Treatment Plant.
- Proposed construction includes rerating of the existing 12-mgd water treatment plant at the Peace River Facility 1991 (Unit 1) to a 15-mgd water treatment plant for a rerated overall design permit capacity of 51 mgd at the existing Peace River Regional Water Treatment Plant.
- To construct in accordance with the TKW Consulting Engineers Inc. engineering report, dated Nov. 10, 2014, along with additional design information last received on Jan. 7, 2015. The engineering report was submitted in support of the construction application dated Nov. 6, 2014.

As shown, the incremental cost of capacity for the new water supply resulting from technical analysis, followed by reasonable hydraulic improvements, is an order of magnitude lower than the cost of new construction. This favorable "rate of return" was achieved by mining an existing facility for opportunities, followed by careful analysis of unit processes, removal of hydraulic restrictions, and subsequent repermitting for higher capacity.

This restoration project successfully restored a 40-year-old treatment facility and easily added another 20 years to its useful life. At the same time, the additional 3 mgd in treatment capacity was achieved in an extremely cost-effective manner by systematically looking for opportunities to not just restore facilities, but to generate additional value by increasing their capacity as well. The careful analysis of opportunities for increased process flow rates and elimination of hydraulic restrictions generated the new treatment capacity for a capital cost of about $1 per gal versus alternative projects estimated to range from about $7 to over $27 per gal for capacity.

Utilities are stewards of the public trust and have an obligation to plan, manage, operate, and maintain infrastructure to provide essential services to society in a reliable, cost-effective manner. Consultants use their experience and expertise to help guide and advise utilities in making myriad decisions along the continuum from daily to long-term strategic decisions. Finally, the regulatory agencies ensure order, quality, and accountability in these processes. At its best, the collaboration of utility, consultant, and regulatory interests comprise to promote reliable, robust infrastructure systems to support public needs. This project represents such an ideal outcome.

Acknowledgments

The authors thank Mike Coates, P.G., deputy director with the Authority, for his contributions to the article. Thanks also go to Richard Anderson, system operations manager with the Authority. Mike McGee, P.E., and Carl Edquist, P.E., with TKW Consulting Engineers Inc., were instrumental in the capacity expansion analysis. Finally, thanks to the many staff at FDEP's South District Office in Fort Myers for their insight and direction on this project.

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- Peace River Facility Capacity Expansion Phase I Engineering Report, TKW Consulting Engineers Inc., November 2014. Prepared for and with the assistance of the Peace River Manasota Regional Water Supply Authority.

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Members of the Florida Water & Pollution Control Association (FWPCOA) may earn continuing education units through the *CEU Challenge*! Answer the questions published on this page, based on the technical articles in this month's issue. Circle the letter of each correct answer. There is only one correct answer to each question! Answer 80 percent of the questions on any article correctly to earn 0.1 CEU for your license. Retests are available.

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Optimizing Existing Facilities to Provide Additional Capacity at Low Cost

Douglas H. Eckmann
(Article 1: CEU = 0.1 DS/DW)

1. The regulatory turbidity unit for water treatment plants of Peace River's size, source water, and treatment type is
   a. <0.1 nephelometric turbidity units (NTU) 95 percent of the time.
   b. 0.3 NTU filtered water maximum.
   c. 1.0 NTU 95 percent of the time.
   d. 1.0 NTU filtered water maximum.

2. Which of the following measures were not taken in uprating Unit No. 1?
   a. Aerator expansion
   b. Weir elevation adjustment
   c. Replace filter flow control with a unit having larger orifices
   d. Replace effluent launder

3. Of the capacity enhancement alternatives discussed, which was found to be the most costly?
   a. Alternative water supply sources
   b. Brackish water treatment
   c. Improvements to treatment Unit 1
   d. Improvements to treatment Unit 3

4. This facility is designed for taste and odor control using
   a. alum.
   b. powdered activated carbon.
   c. dual media gravity filtration.
   d. force draft aeration.

5. To uprate a surface water treatment plant, Florida Administrative Code chapter 62-555 requires a confirming _____ analysis.
   a. Occupational Safety and Health Administration (OSHA)
   b. diversity
   c. contact time (CT)
   d. historical water quality

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Small Systems: Are They That Much Different Than the Big Ones?

Kim Kunihiro
Chair, FSAWWA

This month I would like to focus on a segment of the water community that may be underserved and underappreciated. Community water systems have many different sizes and structures; they include mobile home parks, homeowners associations, and restaurants, as well as more traditional structures under both public and private ownership. A check of the EPA Office of Water website reveals that the largest segment of the drinking water community is the small system.

There are more than 155,000 public water systems in the United States and 97 percent of them are small. It may surprise you to know that this number continues to grow and has increased by 12 percent since the re-authorization of the Safe Drinking Water Act (SDWA) in 1996. The EPA defines a small system as one that has least 15 connections and serves greater than 25 people but less than 10,000. The Florida Department of Environmental Protection (FDEP) data indicate that Florida is very similar to the nation: of the 1687 statewide public water systems, 85.7 percent are water systems that serve less than 10,000 people.

Historically, there has been a perception that much of the focus of water research, water management, EPA, regulators, and even membership organizations such as AWWA, seems to be on medium and large systems. However, the same day-to-day issues and concerns of large systems apply to small systems.

The mission of any water supplier is to provide a safe and reliable product at a reasonable cost. Contaminants, including arsenic, pathogens, and microbes, show no favorites based on the size of the system they inhabit. Their occurrence and the technologies that are effective against them on a large scale are often just as effective on a small scale; ultraviolet technology is an example of a technology that works very well on a small scale.

The Water Research Foundation (WRF) conducted over $8 million in research on arsenic treatment and health effects prior to the change in the maximum contaminant level to 10 parts per billion (ppb). This research greatly affected small systems by giving EPA data and treatment technologies that impacted the final rule; therefore, the benefits of research sponsored by larger systems also benefited small systems. Another way a small system can directly benefit from the work of WRF is to volunteer to participate in research by collecting samples of its water system or by sitting on a project advisory committee. Go to http://www.waterrf.org to learn more.

Operator certification is an important component in ensuring a well-run system and providing safe water. The duties of a licensed operator don't change based on system size; the level of a license is determined by the complexity of the treatment process. Both small and large systems may have simple or complex treatment processes. All states are required to ensure that all community water systems and nontransient, noncommunity water systems have properly trained and certified operators. These operators must demonstrate that they have the knowledge, skills, ability, and good judgment to properly operate and maintain the treatment facilities and distribution systems.

A failure in a treatment process at a small system may affect fewer people, but all customers are affected more quickly than in a larger system where part of the system may be able to be isolated. There is often limited redundancy in small facilities, so a failure has dire consequences and may cause long-term impacts. In 2013, Scott Rubin, an attorney and consultant, evaluated SDWA violations and compared system size to the frequency and type of violation. He found that smaller water systems are no more likely than larger systems to violate health-related requirements. They may be more likely, however, to violate monitoring, reporting, and notification requirements (Rubin, 2013). This may be due to limited staff or limited understanding of the required frequency of monitoring, or what to do if something falls through the cracks.

The Florida Section AWWA takes operator training and support very seriously. Our Operator and Maintenance Council and Technical and Education Council are constantly reviewing and improving training opportunities for operators. Our on-demand training classes are held throughout the state, and even though they may held at a large utility, there are seats available for small system operators to join us.

Small systems may not have the financial resources to afford training for operators or managers, so AWWA, in conjunction with the Environmental Finance Center Network and the Rural Community Assistance Partnership, held two free training classes in Florida in 2015 geared toward small systems. We will be doing this again in 2016; plans are underway for the first session, which will be held in late February or early March. Watch for email notifications and advertising on the FSAWWA website (www.fsawwa.org). In addition, AWWA has free online training for small systems, including an outstanding course on the Revised Total Coliform Rule, which can be accessed at http://www.awwa.org/resources-tools/water-knowledge/small-systems/2015-small-systems-training.aspx.

Additional challenges faced by small systems include system capacity development and finances. The SDWA requires that utilities ensure technical, managerial, and financial capacity to comply with the regulations and provide safe water. The state, through FDEP, operates capacity development programs to help water systems improve their finances, management, and infrastructure to ensure a sustainable system for the future.

Even with trained and knowledgeable operators, some systems will not be able to maintain compliance if decision makers do not make funding available for infrastructure improvements and upgrades. They must understand and support their systems' needs and effectively communicate with their owners, boards, and customers. Having good communication with customers can go a long way to garner support for rate increases that may be necessary to pay for treatment changes or infrastructure replacement in response to new regulations or system age. Small systems have fewer customers to pass on the costs to and repayment of debt is more difficult.

The states have revolving loan programs that are often funded through the passing down of federal funding. This provides another opportunity for small system owners and managers to participate with FSAWWA in the Utility Council and influence legislative and regulatory changes in Tallahassee. Costs to participate in the Utility Council are based on utility size. Contact Rob Teegarden, the council chair, at rteegarden@ouc.com, or www.fsawwa.org to get more information.

Last, but certainly not least, are the customers of small utilities. Without customers we don't have a mission. Customers of both large and small utilities have the same expectation that safe and clean drinking water will always be available, but that is only true if the system is properly operated, maintained, and funded, and therefore, sustainable.

Talking to our customers helps to keep the water safe through their compliance with backflow and cross connection programs, and when we need

Continued on page 69

UF | TREEO Center
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Excellence in Environmental Education

Upcoming Courses

Water Class C Certification Review
Mar. 1-4, 2016
Gainesville, FL

Effective Utility Leadership Practices
Mar. 15-16, 2016
Gainesville, FL

SCADA & Electrical Training:
What Utility Staff Need to Know
Mar. 22-24, 2016
Gainesville, FL

Pumping Systems Operation & Maintenance
Mar. 23-24, 2016
Orlando, FL

Microbiology of Activated Sludge
Mar. 29-31, 2016
Kissimmee, FL

Activated Sludge
Process Control & Troubleshooting
Apr. 12-14, 2016
Gainesville, FL

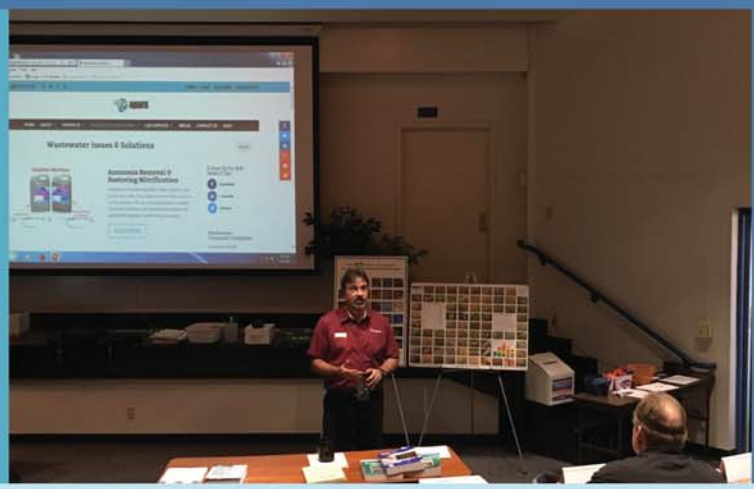
Introduction to Electrical Maintenance
Apr. 18-20, 2016
Kissimmee, FL

DEP SOPs for
Water Sampling & Meter Testing
Apr. 26, 2016
Gainesville, FL

Registration Information:

Taylor Greene
tgreene@treeo.ufl.edu
352-392-9570 ext. 212

www.treeo.ufl.edu



Training You Can Understand

FWPCOA TRAINING CALENDAR

SCHEDULE YOUR CLASS TODAY!

February

15-19	**Wastewater Collection C, B**	Deltona	$225/255
8-11	**Backflow Tester**	Deltona	$375/405
26	**Backflow Tester recert*** **	Deltona	$85/115

March

14-18	**Spring State Short School**	Ft. Pierce	
28-31	**Backflow Tester***	St. Petersburg	$375/405

April

4-6	**Backflow Repair***	St. Petersburg	$275/305
29	**Backflow Tester recert*** **	Deltona	$85/115

Course registration forms are available at http://www.fwpcoa.org/forms.asp. For additional information on these courses or other training programs offered by the FWPCOA, please contact the FW&PCOA Training Office at (321) 383-9690 or training@fwpcoa.org.

* *Backflow recertification is also available the last day of Backflow Tester or Backflow Repair Classes with the exception of Deltona*

** *Evening classes*

*** *any retest given also*

YOU ARE REQUIRED TO HAVE YOUR OWN CALCULATOR AT STATE SHORT SCHOOLS AND MOST OTHER COURSES.

ENGINEERING DIRECTORY

EQUIPMENT & SERVICES DIRECTORY

EQUIPMENT & SERVICES DIRECTORY

EQUIPMENT & SERVICES DIRECTORY

CLASSIFIEDS

Positions Available

Utilities Treatment Plant Operations Supervisor
$55,452 - $78,026/yr.

Utilities System Operator II
$37,152 - 52,279/yr.

Water-Reuse Distribution Supervisor
$55,452 – 78,026/yr.

Apply Online At: **http://pompanobeachfl.gov** Open until filled.

REISS ENGINEERING
PLANNING · DESIGN · CONSTRUCTION

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Are you looking for an opportunity with a company that is poised for growth? Reiss Engineering stands as one of the most prominent Civil and Environmental engineering firms in the State of Florida and the Bahamas. Our main focus is water and wastewater, serving both public and private sector clients with integrity, technical excellence and a commitment to performance. At Reiss Engineering, we are committed to making success happen for our clients, our employees and our firm.

Reiss Engineering offers a competitive compensation and benefits package, as well as a stimulating and fast paced work environment. Reiss Engineering is continuously searching for highly talented individuals and welcomes resumes from those with an interest in joining our team. For a list of our current openings, or to submit a resume for a potential opportunity, please visit our website at **www.reisseng.com**.

City of Temple Terrace

Technical work in the operation of a water treatment plant and auxiliary facilities on an assigned shift. Performs quality control lab tests and other analyses, monthly regulatory reports, and minor adjustments and repairs to plant equipment. Applicant must have State of Florida D.E.P. Class "A", "B", or "C" Drinking Water License at time of application. SALARY RANGES: $16.59 - $24.89 per hour • w/"C" Certificate $18.25 - $27.38 per hour • w/"B" Certificate (+10% above "C") $20.08 - $30.12 per hour • w/"A" Certificate (+10% above "B"). Excellent benefits package. To apply and/or obtain more details contact City of Temple Terrace, Chief Plant Operator at (813) 506-6593 or Human Resources at (813) 506-6430 or visit **www.templeterrace.com**. EOE/DFWP.

Utilities Positions

City of Haines City is accepting applications for Wastewater Operators, Plant Maintenance, Pipeline & Pump/Motor Repair and Lead positions. Visit **www.hainescity.com**

Wastewater Treatment Plant Operator "C"
Salary Range: $45,379. - $65,800.

The Florida Keys Aqueduct Authority's WASTEWATER DIVISION IS GROWING, and we need a WWTP Operator with a Florida "C" license or higher. You will perform skilled/technical work involving the operation and maintenance of a wastewater treatment plant (the majority of our plants are brand new, state of the art plants). Must have the technical knowledge and independent judgment to make treatment process adjustments and perform maintenance to plant equipment, machinery and related control apparatus in accordance with established standards and procedures. Benefit package is extremely competitive! Must complete on-line application at **www.fkaa.com** EEO, VPE, ADA

City of Wildwood
Water Treatment Plant Lead Operator:

Looking for a licensed operator to join our professional team at one of the fastest growing cities in Florida. Must hold at least a Class "C" license. Valid Driver's license a must. High school diploma or GED equivalent, plus Two (2) years technical training in biology, environmental science, chemistry, or a closely related field (two year college degree preferred) and Three (3) years of experience in a water utility as a supervisor/lead operator capacity, or any equivalent combo. Pay Range: Class 113 ($16.83 – 26.09/hour) DOE Open Until Filled. Visit our website for more information (**www.wildwood-fl.gov**)

City of Deerfield Beach - Chief Water Operator

The position of Chief Water Operator reports to the Environmental Services Director. The Chief Water Operator plans, supervises, coordinates, and controls the City's water treatment plants; this can include but not be limited to ensuring proper maintenance and regulation of plant equipment and ensuring proper employee staffing levels. SALARY RANGE: $61,343 - $92,016
APPLY ONLINE: **www.deerfield-beach.com**

City of Winter Garden - Senior Engineer

The Sr. Engineer is involved in the planning, design, construction and inspection of streets, stormwater improvements, and water and wastewater utilities projects. Salary DOQ. The City of Winter Garden is an EOE/DFWP that encourages and promotes a diverse workforce. Please apply at **http://www.cwgdn.com**.

Minimum Qualifications :
- Bachelor of Science in Civil Engineering
- Florida PE license or ability to obtain license within 6 months of hire
- 10 years of progressively responsible professional/administrative public works experience
- Valid Florida driver's license
- Thorough knowledge of stormwater and utility system design, construction, and maintenance; engineering design; drafting; computer aided drafting systems; and design software (i.e., Auto CAD, AdICPR, ASAD, Ponds, Hydraflow, Networx)

City of Tallahassee
UNDERGROUND UTILITIES
"Setting the Standard for Excellence"

Assistant Manager - Wastewater Operations

If there is a perfect place to live, work, and play, the City of Tallahassee has it all! Named in 2014 as one of the most livable cities in the nation, Tallahassee was also awarded the 2015 All American City Award. The City of Tallahassee provides a solid base of services with the convenience of a perfect location that eliminates the daily challenge of commuting to work.

The Florida Sterling Council, through the Executive Office of the Governor awarded the City of Tallahassee's Underground Utilities Department the 2015 Governor's Sterling Award (GSA). This coveted award is Florida's highest honor that an organization can receive for organizational performance and management excellence. Recipients are considered role models by which other public and private organizations throughout the state can evaluate themselves. Through strong leadership, teamwork, a motivated work force, career progression training and holding ourselves accountable, the Underground Utilities Department strive to provide the highest level of customer service.

The City's wastewater operations division serves approximately 75,000 accounts with over 1,000 miles of gravity and sewer force mains. The wastewater treatment facility was recently upgraded to meet advanced wastewater treatment standards and utilizes state of the art technology with a capacity of 26.5 million gallons per day. The wastewater treatment plant was the recipient of the 2014 FWEA Phelps Award in the AWT category and the 2015 FWEA Biosolids and Reuse Awards for the state of Florida.

Assistant Manager Wastewater Operations is professional and administrative work assisting the Manager-Wastewater Operations in directing the activities of the wastewater pumping systems, municipal wastewater treatment and disposal systems, reclaimed water treatment and water reuse, bio-solids treatment and disposal, maintenance support and inventory management for the Underground Utilities Department

Qualifications: Possession of a bachelor's degree in civil or environmental engineering or a related scientific field and four years of professional experience in wastewater collection and treatment operations, or an equivalent combination of training and experience. Two years of the required experience must have been in a supervisory capacity. Must obtain a valid Florida Department of Environmental Protection Wastewater Plant Operator Class A or a State of Florida Professional Engineer (P.E.) license within one year of appointment, as a condition of continued employment.

Salary range- $58,489 - $134,368

HOW TO APPLY:

A completed City of Tallahassee employment application is required. A resume may be attached to the application but will not be accepted in lieu of a completed application. Applicants must apply on-line via the internet at **http://www.talgov.com/hr/openings.cfm**. If you have any questions, please contact the Human Resources Department at (850) 891-8214.

Deadline: Friday, February 26, 2016

City of Groveland
Class C Wastewater Operator

The City of Groveland is hiring a Class "C" Wastewater Operator. Salary Range $30,400-$46,717 DOQ. Please visit **groveland-fl.gov** for application and job description. Send completed application to 156 S Lake Ave. Groveland, Fl 34736 attn: Human Resources. Background check and drug screen required. Open until filled EOE, V/P, DFWP

Deputy Public Works Director City Engineer

Deputy Public Works Director / City Engineer
City of Orange City, Florida - Volusia County
Pay Range $72,342-$110,000 (DOQ):
Professional/technical/administrative position. Requires a high level of skills in civil and environmental engineering and other related administrative duties. Must possess and maintain a valid Florida Driver's license. Registration as a Professional Engineer in the State of Florida required.
http://www.ourorangecity.com/about-our-city/employment/

CITY OF HOLLYWOOD, FL
PUBLIC UTILITIES MANAGER – UNDERGROUND

This position is responsible for the planning, budgeting, staffing, organizing and directing of activities for a municipal water distribution and waste water collection system. The incumbent manages subordinate personnel engaged in planning, installing, repairing and maintaining the municipal water and waste water systems and appurtenances. Salary range starts at $68,850.30 to a maximum salary of $110,160. Starting salary is dependant on qualifications and includes an excellent benefit package. Must have a Bachelor's Degree in Business or Public Administration, Engineering, or the Sciences and eight (8) years of progressively responsible experience in construction and maintenance of water distribution and/or wastewater collection systems, including four (4) years working in a supervisory or administrative capacity, or an equivalent combination of training and experience. Candidates must possess a Level 1 water distribution operator license issued by the State of Florida. EOE M/F/D/V

Apply ASAP to:
http://agency.governmentjobs.com/hollywoodfl/default.cfm

Water Plant Operator

The Coral Springs Improvement District is currently accepting applications for the position of water treatment plant operators. Applicants must have a valid Class C or higher water treatment license and experience in Reverse Osmosis/Nano Filtration treatment processes preferred however not required. Position requirements include knowledge of methods, tools, and materials used in the controlling, servicing, and minor repairs of all related R.O. water treatment facilities machinery and equipment. Must have a valid Florida drivers license, satisfactory background check and pass a pre-employment drug screening test.

The minimum starting salary for this position is $42,000. Salaries to commensurate relative to level of license and years of experience in the field.

The District has excellent company paid benefits including a 6% non-contributory investment money purchase pension plan, and voluntary 457 plan with match up to 5%. EOE.

Applications may be obtained by visiting our website at **www.csidfl.org/resources/employment.html** and fax resume to 954-753-6328, attention Jan Zilmer, Director of Human Resources.

City of St. Cloud, Florida – has an exciting job opportunity. Full-time regular employees are eligible for City paid Medical and Dental coverage, paid vacations, paid holidays, sick leave, life and accidental death insurance, tuition reimbursement, pension plan, and more!

JOIN OUR TEAM!

ENGINEER I-IV
The Engineer Group of positions are responsible professional positions engaged in the planning, design, and construction of city facilities and infrastructures, and in the enforcement of city codes and standards of design and construction. These positions generally report to the City Engineer / Engineering Manager although alternative assignments (i.e. Engineer 1 assigned to Engineer III or IV) may be made to support department operations. This grouping is a professional track intended to provide employee development from an entry level (Engineer I) to an advanced role (Engineer IV) having substantial technical and financial responsibility within the organization. Generally, employees within this track will provide technical functions consistent with State of Florida Professional Engineering requirements and project management and personnel management functions as defined herein.
SALARY FOR POSITION WILL BE BASED ON QUALIFICATIONS
Engineer I: $50,550.28
Engineer II: $53,077.79
Engineer III: $55,731.68
Engineer IV: $58,518.26

Apply: City of St. Cloud, Human Resources
1300 9th Street, St. Cloud, FL 34769
Phone: 407-957-7220 - Fax: 407-957-7273
Job Posting and Application available on our website: www.stcloud.org -
Email: humanresources@stcloud.org
M / F / EOE / D / V

Operations Supervisor

Personable, energetic, self-starter with a min. of 5 years combined exp. in the wastewater field with recent supervisory exp. in wastewater treatment. Applicants must possess a current State of Florida Class "A" Wastewater Cert. and valid FL Driver's Lic. Exc. benefits, great working conditions, promotional opportunities.
Complete app. on line at **www.fpua.com**

FORT PIERCE UTILITIES AUTHORITY
P.O. Box 3191
Fort Pierce, FL 34948
EOE – DFWP

Wastewater Plant Operator

The City of Winter Haven is seeking a Wastewater Plant Operator, class C, B or A. Depending on experience, the minimum hourly rate is $16.03 - $19.48 with benefits. The Wastewater Operator performs manual and mechanical work of ordinary difficulty and responsibility in connection with wastewater plant operations. Requires a high school diploma or equivalent and possession of a valid Class "C", "B" or "A" certificate for wastewater treatment plant operators. Position may close without notice. Please find other details and application online at **http://www.egovlink.com/winterhaven/postings_info.asp?posting_id=3204&dlistid=621&listtype=JOB&sc_category_id=&sc_status_id=134&sc_show_expired=N**

Water Distribution, Sewer Collection, and New Construction Supervisor

The Utilities Commission, City of New Smyrna Beach is seeking qualified applicants for a Water Distribution, Sewer Collection, and New Construction Supervisor in the Water Resources Department. This is responsible technical supervisory work in the construction and maintenance of water distribution, reclaimed water distribution and sewer collection systems. Visit www.ucnsb.org for a full job description. **Education/Experience**: Valid Florida Class C, in both Water & Sewer Distribution. **Starting Salary**: $30.80/hr/$64,064.00 annually.
Qualified applicants may apply online at **www.ucnsb.org** or email resume to jobs@ucnsb.org or mail resume to Human Resources, PO Box 689 New Smyrna Beach, FL 32170. EOE/DFWP

TREATMENT PLANT OPERATOR

The Dunes Community Development District located in Palm Coast is seeking qualified Applicants for a Certified Treatment Plant Operator to work at the District's RO water treatment plant, wastewater treatment plant and reclaimed water systems. Applicant must have a minimum FL Class "C" Water or Wastewater Operator Certification (dual water/wastewater preferred, but not required). Must have high school diploma/GED, valid Florida driver's license. Salary Range: $35,000-$55,000/yr DOQ, plus full benefits package. Job description and application for employment is available at **www.dunescdd.org**
Send completed job application along with resume to: Utilities Manager, Dunes CDD, 5000 Palm Coast Pkwy S.E., Palm Coast, FL 32137; by fax at 386-447-9858; or e-mail at **tsheahan@dunescdd.org**. EOE/DFWP.

BESH
BOOTH ERN STRAUGHAN AND HIOTT, INC

BESH Engineering seeks experienced utility design engineer for all aspects of water and wastewater design, including treatment plants, pump stations, and collection/transmission/distribution systems. Water and wastewater treatment plant design and permitting experience a plus, and experience with hydraulic modeling, specification writing, Autocad drafting, project bidding, construction oversight and project funding preferred. Applicant must possess State of Florida E.I. with minimum 4 years experience. Florida P.E. a plus. Salary commensurate with experience. Come join a great team! Drug Free Workplace and an Equal Opportunity Employer. Please email resume to: **info@besandh.com**

Utility Infrastructure Superintendent

The City of Casselberry is seeking a Utility Infrastructure Superintendent responsible for the administrative, operational and maintenance duties associated with the Water Distribution and Reclamation Systems and the Lift Stations.

Requirements: Education: An Associate's Degree (AA/AS) in business or related field required. Experience: A minimum of five (5) years' experience in water/wastewater industry, lift station maintenance, utilities or related field, including a minimum of two (2) years' supervisory experience is required. Must possess and maintain a valid Florida driver's license.

For additional information regarding responsibilities or qualifications and to apply, please visit our website at **www.casselberry.org**

Orange County, Florida is an employer of choice and is perennially recognized on the Orlando Sentinel's list of the Top 100 Companies for Working Families. Orange County shines as a place to both live and work, with an abundance of world class golf courses, lakes, miles of trails and year-round sunshine - all with the sparkling backdrop of nightly fireworks from world-famous tourist attractions. Make Orange County Your Home for Life.

Orange County Utilities is one of the largest utility providers in Florida and has been recognized nationally and locally for outstanding operations, efficiencies, innovations, education programs and customer focus. As one of the largest departments in Orange County Government, we provide water and wastewater services to a population of over 500,000 citizens and 62 million annual guests; operate the largest publicly owned landfill in the state; and manage in excess of a billion dollars of infrastructure assets. Our focus is on excellent quality, customer service, sustainability, and a commitment to employee development. Join us to find more than a job – find a career.

We are currently looking for knowledgeable and motivated individuals to join our team, who take great pride in public service, aspire to create a lasting value within their community, and appreciate being immersed in meaningful work. We are currently recruiting actively for the following positions:

Senior Engineer	$69,118.40 - $108,555.20 / year
Engineer I, II, III	$43,284.80 – $81,556.80 / year
Industrial Electrician I	$36,732.80 – $48,464.00 / year

Apply online at: **http://orangecountyfl.net**.
Positions are open until filled.

City of Winter Garden
Construction Projects Manager

The position acts as the City's project manager for all capital improvement construction projects including water, wastewater, roadways, parks, stormwater systems and other facilities; inspection of private development projects; and supervision of 3 construction inspectors. Salary DOQ. The City of Winter Garden is an EOE/DFWP that encourages and promotes a diverse workforce. Please apply at **http://www.cwgdn.com**.

Minimum Qualifications:
- High school diploma or GED equivalent and two years of college coursework.
- 10 years of field experience in utilities and/or structural construction management
- Working knowledge of general construction of above and below ground utilities.
- Valid driver's license

Position Wanted

DEVON DAVIES – Has completed the C Water & Wastewater test and is seeking a Trainee Position to add to 220 current in plant hours. Available for immediate employment. Prefers St. Petersburg, Tampa Bay, Pasco, Bradenton or Sarasota Counties. Contact at 1020 Alcazar Way, So., St Petersburg, Fl. 33705. 727-320-2073

ANTHONY JONES – Has completed Wastewater course level C and is seeking a trainee position. Has enrolled in C Water Distribution course and will be available for employment in February 2016. Prefers St. Petersburg area of the state. Contact at: Anthony Jones R53801, Lake Correctional Institution, 19225 US Hwy 27, Clermont, Fl. 34715

Speaking Out

Continued from page 60

a rate increase, they may have a better understanding of the value of water. The FSAWWA has an active Water Use Efficiency Division in the Technical and Education Council and its members walk the talk on conservation. In addition, we are developing a customer service-related committee to help the first-line customer service representatives be more than just a contact about a customer's bill—they are our advocates for water.

There are so many opportunities for participation in the water industry and FSAWWA for both large and small utilities. I encourage you to reach out to me or the staff for help and guidance and to use some of the free resources available for small systems.

REFERENCE: *Evaluating violations of drinking water regulations*, Scott J. Rubin. http://dx.doi.org/10.5942/jawwa.2013.105.0024.

Florida Water Resources JOURNAL

Editorial Calendar

January .....Wastewater Treatment
February ....Water Supply; Alternative Sources
March .....Energy Efficiency; Environmental Stewardship
April.....Conservation and Reuse
May .....Operations and Utilities Management; Florida Water Resources Conference
June .....Biosolids Management and Bioenergy Production
July .....Stormwater Management; Emerging Technologies; FWRC Review
August.....Disinfection; Water Quality
September..Emerging Issues; Water Resources Management
October .....New Facilities, Expansions, and Upgrades
November ..Water Treatment
December ..Distribution and Collection

Technical articles are usually scheduled several months in advance and are due 60 days before the issue month (for example, January 1 for the March issue).

The closing date for display ad and directory card reservations, notices, announcements, upcoming events, and everything else including classified ads, is 30 days before the issue month (for example, September 1 for the October issue).

For further information on submittal requirements, guidelines for writers, advertising rates and conditions, and ad dimensions, as well as the most recent notices, announcements, and classified advertisements, go to www.fwrj.com or call 352-241-6006.

Display Advertiser Index

Certification Boulevard Answer Key

From page 49

1. **A) 0.77 cfs**
1,000,000 gal per day (gpd) divided by 86,400 seconds/day divided by 7.48 gal/cu ft x 0.5 mil gal per day (mgd) = 0.775 cfs
OR
1.55 cfs per mgd x 0.5 mgd = 0.775 cfs

2. **A) Pathogenic**
Pathogenic organisms are capable of producing disease in host organisms. Diseases that are transmitted through the water (waterborne) include typhoid, cholera, and dysentery. Organisms that do not cause disease are referred to as nonpathogenic.

3. **C) Turbidity units**
Turbidity is a measure of the amount of light reflected by suspended particles; it is not a measure of the concentration of solids because white particles reflect more light than dark particles. Often expressed as nephelometric turbidity units (NTU), water having turbidity greater than about 5 NTU is clearly visible with the naked eye.

4. **A) Increased pH**
Photosynthesis by algae reduces carbon dioxide in water; as the carbon dioxide is reduced, the pH will increase. This occurs mainly during the day; at night, respiration by algae will increase the carbon dioxide in the water and lower the pH. Changes in pH levels will impact the treatment process, including coagulation and disinfection.

5. **A) Trihalomethanes**
Trihalomethanes are a group of volatile organic compounds that are formed when chlorine, added to the water during the treatment process for disinfection, reacts with naturally occurring organic matter in the water. It is suspected to cause problems with the liver, kidneys, or central nervous system after many years of exposure (chronic effect).

6. **D) Liquid chlorine weighs 1.5 times more than water.**
Chlorine is a clear amber-colored liquid, about 1.5 times heavier than water. Gaseous chlorine is greenish-yellow, about 2.5 times heavier than air. Uses include water purification, sanitation of industrial waste, disinfection of wastewater treatment effluent, swimming pools, bleaching of pulp and textiles, and manufacture of carbon tetrachloride, glycol and numerous other organic compounds, and phosgene gas.

7. **C) About 6.5 psi**
Each ft of water generates 0.433 psi
15 ft of water x 0.433 psi = 6.495 psi
OR
Each psi = 2.31 ft of water
15 ft of water divided by 2.31 psi/ft = 6.493 psi

8. **D) Short circuiting**
Short circuiting is the term used when little mixing and a direct in-and-out flow pattern occurs in a treatment tank. It is generally addressed with the use of baffles to force the water to travel in a specific pattern within a tank, thereby increasing the detention time and minimizing short circuiting.

9. **B) Sodium hydroxide**
Sodium hydroxide (caustic) is an alkaline with a pH typically greater than 12. Aluminum sulfate (alum) is an acid with a pH typically less than 4.0.

10. **B) A low pH**
A low pH will increase the rate of corrosion. Acidic waters have lots of hydrogen (H+) ions in the water to react with the electrons of metallic pipe, so corrosion is enhanced. In contrast, water with a higher pH lowers the solubility of calcium carbonate so that the calcium carbonate is more likely to precipitate out as scale and protect the pipes from corrosion.

Blue Planet
Environmental Systems, Inc.
PO Box 60790
Palm Bay, FL 32906

Toll Free: 888-859-9726
Fax: 321-255-3947
email: info@blueplanetenv.com
web: www.blueplanetenv. com

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