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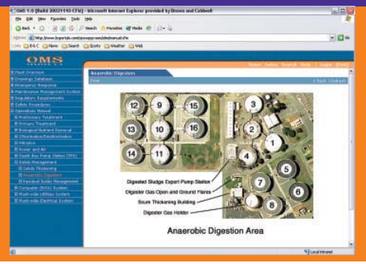

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Fall 2003, Vol. 32

QUARTERLY

QUARTERLY

With record numbers of veteran workers nearing retirement, utility managers and staff are looking to new strategies and systems to capture and leverage organizational knowledge and know-how.

Marketing Communications Director	Terry Peckham
Editor	Susan Wels
Art Director	Calvin Ng
Design Assistant	Radhika Abhyankar
Illustration	Pete McDonnell U.S. Geological Survey
Photography	Jeff Alexander Francisco Loureiro
Writers	Susan Wels Terry Peckham Dan Foscalina
Distribution	Kristy Oshiro

To speak with a Brown and Caldwell representative, call us at (800) 727-2224 or visit our Web site at www.brownandcaldwell.com.

Brown and Caldwell provides environmental engineering and consulting services to public agencies, the federal government and industry.

Quarterly is published by Brown and Caldwell, P.O. Box 8045, Walnut Creek, CA 94596-1220; tel. (925) 937-9010. Subscriptions are free.

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Issues & Ideas

CAPTURING CRITICAL KNOWLEDGE

Smart O&M manuals preserve operator know-how and experience

With retirement looming for legions of baby-boom plant operators, water and wastewater utilities face the daunting challenge of capturing essential staff knowledge before it leaves the plant.

According to Brown and Caldwell's Jim Chitty and Bill Young, new electronic operations and maintenance (O&M) manuals are effective vehicles for capturing and preserving key operator knowledge and experience. They can also be updated quickly and easily as staff and technology needs change.

With nearly 60 years of plant experience between them in water and wastewater utility operations, Young and Chitty shared their insights into the importance and challenges of knowledge capture.

Do you think "brain drain" could be a serious problem for the industry as many veteran operators approach retirement?

Bill Young: Many utilities are starting to realize that these retirements could create a crisis. Three decades ago, after the Clean Water Act was passed, there was a tremendous influx of people into the water and wastewater industry. Now 30 years later, a lot of those veterans are retiring. Compounding the problem is that many utilities can't hire new staff to replace them because of the economy and a general lack of interest in this industry, which isn't the most glamorous in the world.

"Brain drain" could be a serious problem for the industry as many veteran operators near retirement

It's a serious problem. One of our municipal clients will lose more than 40 senior operators—essentially half the staff—to retirement in the next few years. They've hired us to come in and develop an online O&M manual in order to capture all the key knowledge and experience that the senior staff accumulated.

Jim Chitty: The impending loss of staff may not be a shock or surprise for some utilities, but most don't know the best way to respond. In our experience, an updated O&M manual is the best way to get the knowledge out of those brains before they leave the plant. The most valuable information is often about unusual occurrences or historic details. For instance, an operator might have been present when a particular pipe was put in the ground decades ago. The engineering drawing might be inaccurate, but he knows the exact location of that pipe.

Is it challenging to get 30-year veterans to share their knowledge?

Young: Most long-time operators are actually very willing to share information. It's usually a positive experience. In some cases, though, operators may be reluctant to share knowledge because they have concerns about their job security. Others hold back because they may feel hostile or bitter toward the utility. But if we address their concerns and can gain their confidence, they'll almost always share their information.

Chitty: The key is making sure they feel appreciated. If a long-time employee didn't make it to the top of the heap, he may feel like he owns the knowledge and isn't going to share it. His attitude might be, "Nobody ever asked me my opinion

Continued on Page 16

Illustration by **Pete McDonnell**

As veteran workers retire, utilities risk a huge loss of knowledge, manpower and know-how

Plugging the Brain Drain

Last year, the Anchorage Water and Wastewater Utility (AWWU) surveyed personnel, based on age, years of service and predicted retirement dates. The results were unexpected and alarming.

"Our analysis showed that 40 percent of our employees and fully 60 percent of all our supervisors would be eligible for retirement in the next four to five years," says Brian Crewdson, assistant to the utility's general manager. "In the last nine months," he adds," we've been hit by the first wave of those retirements. It's dawned on us that this is just the beginning of a major problem."

It's a trend that's affecting not just AWWU, but almost every public and private utility in the country. "It's a potentially catastrophic problem for the industry," states John Salo, head of the Business Consulting Practice for Brown and Caldwell (BC). The reasons for the looming loss of personnel are demographic and economic.

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Intensive training programs and formal mentoring are critical strategies for bridging knowledge gaps.

Hiring booms and busts

Some 30 years ago, when many baby boomers were first entering the workforce, the water/wastewater industry was on the rise. With the passage of the Clean Water Act in 1972, federal funding was flowing into new public- and private-sector treatment plants. The growing industry was staffed by ranks of young, new employees, who often learned their skills hands-on and on the job, working their way up the ranks and accumulating years of knowledge.

The expansion of the 1970s, however, was followed by hiring contractions in the 1980s and '90s. "Many utilities downsized for efficiency," explains BC Senior Vice President Jack Warburton. Partly as a result of last-in, first-out layoffs, few employees were rising up the ranks behind the baby boomers. Compounding the gap was a shrinking labor pool, as well as stricter industry-wide requirements for hiring. It all adds up, Warburton says, to the impending loss of large numbers of valuable employees and the vast institutional knowledge they possess.

"In many organizations," he says, "these long-term employees carry in their heads the only detailed knowledge that exists of utility infrastructure and procedures. When these people retire, that knowledge will be lost unless it's passed on and documented in a retrievable form."

Fortunately, the water/wastewater industry is beginning to recognize that "brain drain" is a looming problem. An Association of Metropolitan Sewerage Agencies (AMSA) conference in February focused on the issue and a range of possible solutions, but, as Rick Arbour, vice president of BC's Business Consulting Practice, observes, "we're just at the beginning stages of awareness in the industry." A handful of utilities, Crewdson agrees, are starting to focus on it, "but not everyone yet is recognizing the problem. If they don't address it," he predicts, "they'll see their productivity drop and their problems go up."

"It's a potentially catastrophic problem for the industry."

Training and documentation

Utilities, Salo says, should start taking steps now to avoid widespread loss of skills and knowledge when large numbers of long-time employees retire. Succession planning, he notes is an important step. "It's critical," he says, "to look ahead, see where the management and skills gaps will be and start planning now for ways to fill them."

In Anchorage, for example, the AWWU is preparing more employees for supervisor and management positions through its "Leaders of Change" (LOC) initiative. The program, originally established to engage all supervisors in continuous improvement efforts, was expanded to address the issues of retirement and succession. The two-session class trains foremen, supervisors and managers in productive hiring practices to ensure that new employees are a good match for the utility's culture. Recently, Crewdson explains, they opened up the class to lower-level employees who showed a high level of interest in the training. By cultivating the skills and knowledge of these workers, he says, the utility can help prepare them to replace some of the retiring supervisors.

Across the board, adds Warburton, training and mentoring are critical strategies for bridging the potential knowledge gap. "It used to be," he says, "that employees had years of on-the-job training to prepare them for senior positions." Traditionally, for example, the journeyman learned from watching the foreman, who learned from watching the general foreman. Now, in many cases, the foreman and general foreman may both be close to retiring and, as a result, journeymen below them won't have nearly enough time to learn the ropes.

One solution is to define training needs and provide more formal, intensive training now to ensure that employees gain skills that would have otherwise taken them years to learn. In Anchorage, for example, the general foreman for the AWWU's Water Distribution Operations developed a 10-week, 200-hour training course to teach operations employees everything they normally would have learned from senior workers over a period of five to eight years.

John Salo, head of Brown and Caldwell's Business Consulting Practice: "It's critical to look ahead, see where the management skills gaps will be and start planning now for ways to fill them."

In a major effort, the utility is also defining necessary skills for all positions and assessing the current skill levels of all employees. This information will identify skill gaps and help the AWWU schedule and budget targeted training in 2004 and in the future.

Another crucial strategy is to manage the knowledge within the organization. This involves documenting everything that experienced employees know and do, so that information can readily be shared with others. By compiling standard operating procedures and easy-to-update operations and maintenance (O&M) manuals, utilities can capture critical knowledge before it's lost. New, interactive, online O&M manuals can be especially useful, notes Scott Bash, BC's vice president for Information Technology.

By creating easy-to-update, online operations manuals, utilities can capture critical knowledge before it's lost.

The Orange County Sanitation District, for example, is going through a formal needs analysis, with BC's help, to develop, maintain, update and access comprehensive electronic operating manuals and procedures for its 250 million-gallon-per-day (mgd) wastewater system. The City of Meridian, Idaho, is also working with Brown and Caldwell to develop a new, online operations manual that is easy to update in real time. Although the goal of these projects is to upgrade and update existing documents, the technologies and approaches can easily be applied to knowledge capture.

Recruiting and retention

Another vital strategy for plugging the brain drain is the recruitment of new, qualified people into utilities. In recent years, young people largely ignored utility careers, attracted to more visible and lucrative jobs in the high-tech, biotech and financial services industries. In the wake of the dot-com bust, however, utilities can present themselves as more attractive, stable and competitive employers.

The AWWU, for example, started recruiting employees at job fairs and home shows. "Before," Crewdson remarks, "nobody knew that we existed. But now we attend all the job fairs and actively talk to people about career opportunities with the utility."

Once new employees are on the job, adds Brown and Caldwell's Jim Courchaine, Vice President Infrastructure Services, it's important to keep them motivated with competitive wages and benefits and, just as importantly, a work environment where they can flourish. "We need to be able to show new recruits a clear path to their futures, 10 years down the road," he states, "with mentoring and training to build their knowledge and morale."

"Utilities can help stem the brain drain by retaining retired employees."

At the other end of the employment cycle, utilities can help stem the brain drain by retaining retired employees. These experienced hands can help them through transition periods—by doing their old jobs or mentoring others. Crewdson has personally seen the appeal of this approach. Two years ago, the State of Alaska approved a pilot program allowing retirees to go back to work, while continuing to receive their retirement checks. He and three other AWWU employees have taken advantage of this opportunity, staying at the utility even after they've officially retired. "It helps slow down the pace at which people leave," Crewdson says, "and buys time for the utility to adapt."

Jim Courchaine, Vice President, Infrastructure Services: "We need to be able to show new recruits a clear path to their futures,10 years down the road, with mentoring and training to build their knowledge and morale."

GROWING STRONG

Georgia's Gwinnett County is meeting the challenge of fast growth with a $1.2 billion water/wastewater capital improvement program

Some 30 miles northeast of Atlanta, Georgia's Gwinnett County is a fast-growing region known for livability, good schools and strong employment. Thanks to these attractions, the county's population is expected to soar from 654,000 to 1.2 million by 2005, straining the capacity of its water and wastewater infrastructure.

Gwinnett, with its county seat in Lawrenceville, is undertaking a vast array of water production, water distribution, wastewater treatment and wastewater collection projects.

"We've been adding 10,000 new accounts to our system every year for the last decade, and we see that trend accelerating," says Frank Stephens, Deputy Director of Engineering and Construction in the Gwinnett Department of Public Utilities (DPU). To stay ahead of surging growth and demand for services, the county government has launched a six-year, $1.2 billion capital improvements program (CIP) to expand its water and wastewater infrastructure.

Huge program

"This is one of the largest programs of its type in the nation, especially for a community this size," states Aron Aront, program manager with Jacobs Civil, Inc. The firm is partnering with Brown and Caldwell to manage the capital improvements program—identifying project needs, planning the work and coordinating with the county's agency and interdepartmental requirements.

"Over the next five years," Aront adds, "Gwinnett County will be spending up to $300 million a year to complete 288 different projects and subprojects in the CIP. This is an unusual program because of its complexity and size."

As part of its program management activities, Brown and Caldwell is developing the consulting engineer's scope of work, the work plan for the CIP projects and detailed design schedules. BC is also reviewing and monitoring design and construction and reporting to stakeholders on expenditures and project completion.

"It's a huge program," says BC Project Manager Bill Gilman. "Our job is to help the county by meeting its CIP targets and schedule over the next five years. We're bringing a wealth of project controls, information technology and management experience to bear on these complex and demanding infrastructure improvements."

"This is one of the largest programs of its type in the nation, especially for a community this size."

The CIP projects fall into four broad categories: water production, water distribution, wastewater treatment and wastewater collection. "Together," Stephens says, "they'll enhance the county's infrastructure at a pace that's commensurate with demand."

Complex projects

As part of its water production program, the county is focusing on installing new pipes, pumps and filters and making other improvements to its existing water treatment operations. The county is also constructing a new 300-million-gallons-per-day (mgd) water filtration plant. When completed, the new Shoal Creek facility will nearly double the county's current production of potable water. The new facility, Gilman adds, will also add backup capacity to the county's drinking water system, ensuring that the growing population has continuous access to adequate supplies.

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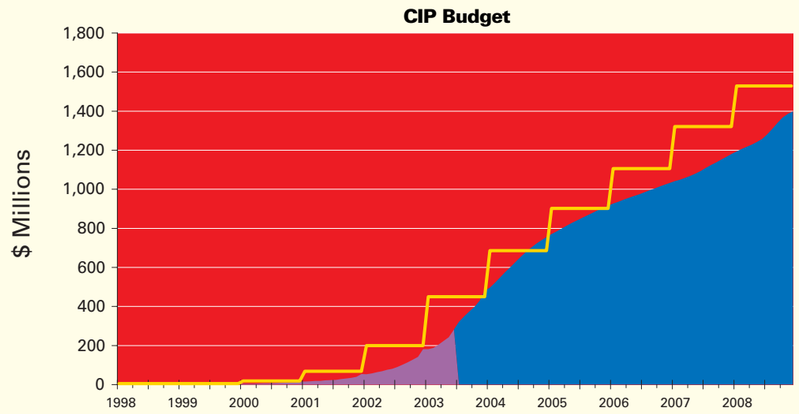


The county will be spending up to $300 million a year to complete the program.

The challenge of density

Water distribution improvements, too, will be extensive. Gwinnett County is a largely rural area, and some parts of the county still lack water service connections. The CIP will, for the first time, provide water lines to every corner of the county. In addition, Gilman says, "we'll be putting in redundant pipeline, so that citizens won't be without water if lines burst or break."

Wastewater collection is also a key focus. Currently, about half the county's residents rely on septic tanks, many of them aging and subpar. "As part of the CIP," Gilman says, "we'll be providing sewage capacity to many more areas of Gwinnett County."

One of the biggest challenges in this fast-growing region, he adds, is the placement of wastewater pipes. In addition to acquiring more than 1,200 easements—"a major challenge," he notes—the county is exploring trenchless technologies such as pipe bursting and microtunneling to avoid disruption in high-density areas.

"In many cases," Gilman explains, "it's easier to put in deep-rock tunnels to convey wastewater to treatment plants than it is to get easements for the pipelines." Gwinnett County, he adds, sits on top of good granitic bedrock, making tunneling a feasible approach.

The county will also be expanding its wastewater treatments plants. Gwinnett County already benefits from the most advanced water reclamation facility in the Southeast—the F. Wayne Hill Water Resources Center, currently permitted at 40 mgd. As part of the CIP, the county will spend $400 million to expand the facility—$160 million in 2003 alone—doubling its capacity to 80 mgd.

The reclamation plant will employ a wide range of advanced technologies—including membrane filtration, ozone disinfection and carbon adsorption—to treat wastewater to a high level of purity. Gwinnett County will use its new supplies of reclaimed water, Gilman adds, for recreational, residential and industrial landscape applications.

As part of the upgrade and expansion, the county will also dedicate more than 300 acres of the plant's 700-acre site to a new park. In addition, Gilman says, the county will be expanding and upgrading its 12 mgd Yellow River Water Reclamation Facility. When completed, the plant will reclaim 22 mgd of water, treated to the same high level of purity as supplies produced by the F. Wayne Hill facility.

Improving business practices

To keep the 288 CIP projects on track, the BC and Jacobs Civil teams are headquartered right in the county offices, where they work in close collaboration with the client. In addition to program management services, they're providing Gwinnett County managers with new processes, procedures and tools to help them achieve their multiple objectives.

BC's business consultancy, for example, is conducting an efficiency and cost-effectiveness audit for the county and analyzing the CIP's strengths, weaknesses, opportunities and threats. The team is also improving standard operating procedures and developing a comprehensive employee manual.

"Because of this program's complexity and size," Aront says, "county managers knew they needed help—not just in program management, but in making their tools and processes efficient enough to complete the work."

It's an approach, Stephens says, that's paying off. "The program management team," he states, "is on target and well integrated with our staff. With their help, we're improving our delivery of the water and wastewater portions of the CIP and staying ahead of our county's rapid growth."

For more information, contact Bill Gilman at (678) 376-6733 or bgilman@brwncald.com.

NOTES

A Decade of Client Satisfaction

BC's Columbus, Ohio, team celebrates 10 years of work for the Erie County Department of Environmental Services

Over the past 10 years, Brown and Caldwell's Columbus office staff has continued building client satisfaction, completing a series of important projects for the Erie county, Ohio, Department of Environmental Services. In the last three years alone, BC has successfully completed more than a half dozen solid waste projects for the county, including development of 35 acres for future landfill expansion.

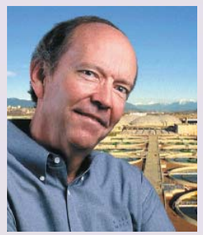
Other completed projects include a vertical expansion permit for a 20-acre unit, a lateral expansion permit for a 60-acre unit, various soil investigations and several design and construction projects. Brown and Caldwell is currently overseeing the capping of a 20-acre landfill unit and construction of a new 6-acre unit. "Our project team has had a great, long- standing relationship with Erie County," says BC's Mike Nuhfer, "and we're proud of the decade of work that we've produced."

Contact Mike Nuhfer at (614) 410-3069 or mnuhfer@brwncald.com.

Brown and Caldwell has completed several landfill expansions for Erie County.

Passion for Process Innovation

Denny Parker wins WEF medal for flocculator clarifier and TF/SC research

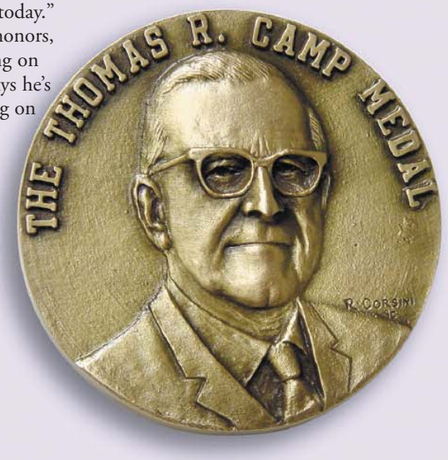


For more than 30 years—while consulting on hundreds of wastewater-related investigation, design and planning projects—Denny Parker, Ph.D., P.E., has built an unprecedented reputation for process innovation.

In recognition of two of his major innovations, the Water Environment Federation (WEF) recently named Parker the winner of its 2003 Thomas R. Camp Medal for Basic Research Contributions to Wastewater Applications.

Parker was honored for his research in developing the floccula or clarifier and the Trickling Filter/Solids Contact process, both of which are used in more than 100 plants across North America. He will receive the medal in October during a reception at WEFTEC 2003 in Los Angeles. "While this is an individual honor," Parker says, "these processes could not have been developed without help from a long list of my colleagues at Brown and Caldwell, as well as staff members in our client organizations." The company itself deserves credit, he adds. "Brown and Caldwell's working environment has valued innovation since the early days, and that philosophy is very much alive here today."

Despite the honors, Parker isn't resting on his laurels. He says he's currently working on a new bioflocculation process for the treatment of wet-weather overflows. Stay tuned.



"Brown and Caldwell's working environment has valued innovation since the early days, and that philosophy is very much alive here today."

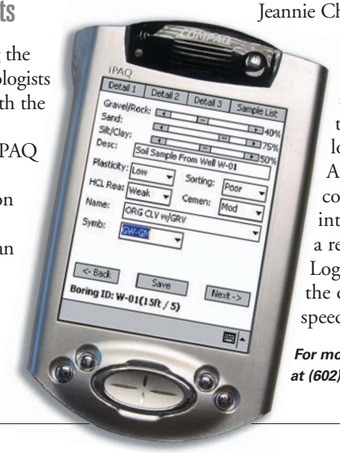
Data to Go

BC's new pocket logger tool boosts quality, cuts costs

Instead of filling out reams of paper logs when analyzing the characteristics of soil and rock, Brown and Caldwell geologists and engineers can now speed the process electronically with the new BC Logger they developed.

The electronic soil classification tool, installed on an iPAQ Pocket PC, eases the task of describing soil and rock encountered in soil borings and construction of production or monitoring wells. The BC Logger enables a field technician to quickly input descriptions, using a thorough checklist and the American Society of Testing Materials Standard Practice for Description and Identification of Soils.

"This new data collection tool has increased efficiency and eliminated the manual reentry of field observations from the old paper forms," says Dr. Peter Kroopnick, who developed the logger with BC's Derek Colanduno, Dennis Mulacek, Harry Brenton, Matt Nation, Steve Rakowski, Jeannie Chang and Mary Klinginsmith.



Quick graphics

The logger tool also interfaces with a graphical package called gINT® to automatically print the boring log—eliminating the need for AutoCAD drawings and speeding construction of cross-sections for interpreting geologic conditions. As a result, Kroopnick adds, "the BC Logger reduces the cost and increases the quality of producing lithologic logs and speeds up the site-assessment process."

For more information, contact Dr. Peter Kroopnick at (602) 567-3850 or pkroopnick@brwncald.com.

Smart Security

Advanced hand-held technology speeds a vulnerability assessment for the Honolulu Board of Water Supply

According to new legislation passed by Congress, all water systems serving more than 100,000 people have to complete vulnerability assessments. In Honolulu, Brown and Caldwell is performing an extensive assessment for the Honolulu Board of Water Supply (BWS)—saving time and project costs by using hand-held computer technology to collect assessment data and create a master database.

According to Project Manager Woodie Muirhead, the new technology is enabling the BC team to quickly assess the physical security of BWS's wide-ranging Honolulu-Windward-Pearl Harbor and Waipahu-Ewa-Waianae water systems. "Instead of focusing only on critical assets, BWS chose to physically assess every one of its 450 facilities," Muirhead says. This first-time use of new, hand-held computer technology—with software programming by BC—saved "a tremendous amount of time," he says, in cataloguing the system's existing security measures and conditions.

Expert strategies

Brown and Caldwell has partnered with Versar, Inc., to perform vulnerability assessments for clients including the United States Air Force Academy and one of the nation's largest water utilities in the Southeast. BC and Versar experts include instructors licensed in the Sandia National Laboratories Risk Assessment Methodology for Water Utilities. Brown and Caldwell has also been certified as a "secure" member of the FBI's Infragard organization, which is responsible for maintaining sensitive infrastructure information.

In Honolulu, Muirhead adds, the next step is to recommend "quick fixes" that can immediately enhance security, as well as prioritized approaches to prevent security breaches, monitor the system and respond quickly and effectively to emergencies. "The best overall defense against any problems," he explains, "is a well-run utility. The assessment process will help strengthen BWS's security position, reduce risk, mitigate consequences and improve the detection, delay and response capacity of its critical facilities and assets."

Contact Woodie Muirhead at (808) 523-8499 or wmuirhead@brwncald.com.

Hot Ideas

In the Sunshine State, utilities are taking creative approaches to wastewater treatment challenges

From Florida's northeast corner to its southern Keys, wastewater utilities are using innovative methods to improve their systems and environmental stewardship.

Brainstorming in Jacksonville

In Jacksonville, for example, the city's fast-growing utility, JEA (formerly Jacksonville Electric Authority), is putting creative thinking to work to upgrade its four wastewater facilities at the lowest cost.

All four plants discharge into the St. Johns River. As part of JEA's efforts to be a proactive steward of the environment, the utility is seeking to cut the current nitrogen levels of its effluent by half. To evaluate effective, cost-efficient approaches, JEA convened a blue-ribbon panel of five expert firms, including Brown and Caldwell, to review the plants and provide recommendations.

Efficient solutions

BC's Denny Parker serves on the panel, which is analyzing ways to achieve JEA's goal without spending as much money as the utility had originally estimated. Other cities, including Atlanta and New York, have used this multifirm approach with good results, says BC Project Manager Ted Hortenstine.

"It's somewhat unusual to have competing firms working together on a project,with common goals," he states. "It can be an effective way, however, to maximize creative thinking on a complex project that has many stakeholders."

Protecting Key Largo's Coral Reefs

Environmental challenges are also facing the local utility in Key Largo, one of 1,700 islands in the archipelago off Florida's south coast. The Key's utility is developing an advanced, environmentally sound waste water treatment plant to protect coral reefs in the Florida Keys National Marine Sanctuary that surrounds the island.

Many local residents currently rely on septic tanks and cesspits, which are

damaging the fragile coral reefs. To address this problem, the Key Largo Wastewater Treatment District is developing one of the first advanced wastewater treatment plants in the archipelago. Brown and Caldwell, as subcontractor to the Haskell Co., is designing the new 183-mgd facility.

Green approach

"Key Largo has a shallow water table, along with lime cap rock that makes gravity sewers very expensive," says BC Project Manager Stuart Oppenheim. "As a result, the wastewater system we're designing will feature innovative vacuum sewer technology." The system consists of a gravity service lateral, which transmits wastewater from dwellings to a vacuum pit. Vacuum mains then collect the wastewater and transfer it to a vacuum tank. A separate pumping system transmits the wastewater from the tank to the treatment facility.

"This system," Oppenheim says, "is one of the first of its kind in the region and will help Key Largo go to a greener way of doing things." The new treatment plant is expected to be online in 2005.

Contact Ted Hortenstine at (407) 661-9536, thortenstine@brwncald.com, or Stuart Oppenheim at (305) 418-4090, soppenheim@brwncald.com.

One person's garbage is now another's ...Quarterly!

Veteran *Quarterly* readers will no doubt notice this issue's different "feel." We've switched to a new paper that's made from 100 percent recycled fiber and processed chlorine free, and 50 percent of the fiber is pulled directly from the waste stream. It's these "post-consumer-waste" fibers that have long been the bane of printers and papermakers alike. They're shorter and have less bulk than virgin fibers and, until recently, have been both difficult and expensive to make into a high-quality sheet.

Quarterly has for years been printed on a sheet made from 10 percent recycled fiber—long considered the maximum for the type of printing that's involved. That is, until our printer introduced us to the folks at San Francisco-based New Leaf Paper. They've been working with mills in the United States and Europe to develop affordable, high-performance papers that are raising the bar on what can be accomplished with post-consumer fibers.

NEW LEAF PAPER

The higher the percentage of reclaimed fiber, the more waste that's diverted from our landfills. For this issue of *Quarterly*, that's 1,136 pounds.

Contact Terry Peckham at (925) 210-2514 or tpeckham@brwncald.com.

Setting a New Standard

Improved soil cleanup model realistically predicts risks and costs

Brown and Caldwell expert Wei Chen, Ph.D., P.E., has developed a new, more accurate model to predict the adsorption and desorption of contaminants in soils and sediments. His findings are important for industrial clients as well as regulators, since they show that it is generally impractical and often unnecessary to remove all traces of contaminants.

"Wei's model helps predict how much of a contaminant you can realistically remove from soils and sediments, and when it makes sense for clients to cease costly remediation efforts," explains BC's Steve Figgins. Chen, an environmental scientist and engineer in Houston, published his findings in the March-April 2002 issue of *Ground Water* and presented them in June at Battelle's Seventh International In Situ and On-Site Bioremediation Symposium in Orlando, Fla. He conducted the research for his model at Rice University with his Ph.D. advisor, Dr. Mason Tomson.

Cost-saving discovery

As a graduate student, Chen discovered that the conventional mathematical models for desorption of common contaminants in soils and sediments were not very accurate. At the same time, he explains, "those models were crucial in many aspects of environmental risk assessment and remediation. I realized we needed a better standard to guide our work."

The new model, he adds, "works much better than the old ones. It can also save clients money, since it demonstrates that the risk of soil and sediment contamination is often lower than the older models indicate."

For more information, contact Wei Chen at (713) 759-0999 or wchen@brwncald.com.

"Wei's model helps predict how much of a contaminant you can realistically remove from soils and sediments, and when it makes sense for clients to cease costly remediation efforts."

Pristine Planning

A new, combined water and wastewater treatment facility in Vail, Colo., will minimize space and protect the town's gold-medal trout stream

Gore Creek–thick with brown, brook, rainbow and cuthroat trout–runs through the mountain town of Vail, Colo., drawing avid fly fishermen with its clear waters and rich catch. Protecting the flow of this gold-medal trout stream is a top priority for the Eagle River Water and Sanitation District.

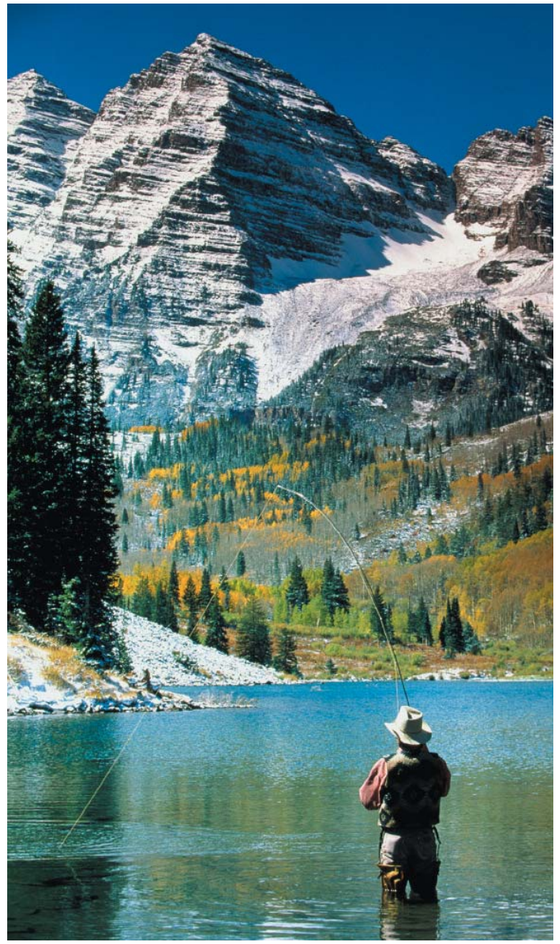
To keep up with new resort development in the area, the district needs to expand its existing wastewater treatment plant and construct a new 3-million-gallon-per-day (mgd) microfiltration water treatment facility. To safeguard the stream flow of Gore Creek, the new plant will draw water from the creek downstream and pump it upstream—through an existing snow-making pipeline—to the facility, instead of lowering stream flow with an upstream well.

Space-saving design

Another challenge facing the project is the need to minimize space, due to the extremely high value of real estate in Vail. As a result, Brown and Caldwell is designing and managing expansion and construction of the plants with innovative approaches that reduce space requirements.

"The new potable water plant," explains BC Project Manager Dave Myers, "will actually be co-located with the existing wastewater treatment plant, sharing a common wall in the same building envelope." The Colorado Department of Health and Environment, Myers adds, has already agreed to approve this design, the first of its kind in Colorado, along with a strict set of safety features to separate the facilities and protect drinking water from contamination.

Contact Dave Myers at (303) 239-5400 or dmyers@brwncald.com.



Fast-Track Tunnel

Austin, Tex., is speeding design and construction of a new 10,000-ft. sewer tunnel

Spurred by a U.S.E.P.A. Administrative Order, the City of Austin, Texas, is working quickly to eliminate sanitary sewer overflows in its wastewater conveyance system by December 31, 2007.

As part of its fast-track sewer rehabilitation efforts, the city is augmenting an existing, 48-inch relief sewer located in a creekbed with the rapid design and construction of a 10,000-foot tunnel.

The $1.4 million design of the Little Walnut Creek Tunnel project, led by Brown and Caldwell, will be completed in only six months in order to meet the E.P.A. deadline. The project, in northeast Austin, will address the neighborhood's high incidence of sanitary sewer overflows and high sanitary sewer flow rates in wet weather. It is the largest project in the city's sewer rehabilitation program and will minimize construction impact on the surrounding environment.

Low-impact project

"By augmenting the existing sewer line with a tunnel," explains BC's Principal in Charge Pervez Jameel, "we'll impact the fewest residential properties along the creek and minimize risks associated with creek crossings and open-trench construction in the creek bed."

The 10- to 12-foot-diameter tunnel will be constructed by a tunnel boring machine and road header. A 60-inch or larger pipeline will be placed inside the tunnel, and an additional 3,500 feet of 60 inch pipeline will be built using open-cut methods. Construction of the tunnel, estimated to cost $17 million, will be completed by September 2005.

Contact Pervez Jameel at (512) 652-1177 or pjameel@brwncald.com.

Joining Assets

BC allies with top Australian asset-management firm

Brown and Caldwell and Australian utility Hunter Water have signed an exclusive agreement to jointly pursue water-and wastewater-related asset-management projects throughout North America. With nearly a half-million customers in New South Wales, Hunter Water has earned international recognition for its innovative approaches to asset-management implementation.

"This partnership raises the bar on what it means to be a top-level asset management consultant," says Craig Goehring, Brown and Caldwell C.E.O. "Our clients now have access to unparalleled expertise in asset management through this alliance, which melds BC's comprehensive asset-management experience with Hunter Water's implementation innovations."

Since adopting asset-management in 1990, Hunter Water has reduced customer rates by 30 percent in real terms and costs per customer account by 40 percent.

Independently, the United States Environmental Protection Agency estimates that a typical U.S. utility can reduce overall costs by 20 percent through effective asset-management practices. Asset management offers these utilities a way to meet rising infrastructure costs while continuing to provide affordable services to their customers.

Hunter Water

an Australian Water and Wastewater Utility

Population served	500,000
Total asset value	$2 billion
Total annual revenue	$126 million

Drinking Water

Treatment plants	5
Reservoirs	77
Pumping stations	74
Mains	2,700 miles

Waste Water

Treatment plants	17
Pumping stations	364
Sewer mains	2,760 miles

No Hunter Water employees are scheduled for weekend or evening shifts.

Sustainability Drives New Seattle Office Design

When Brown and Caldwell's Seattle staff decided to move from their outmoded quarters into the downtown Convention Center complex, they wanted their new space to reflect a commitment to sustainable urban development. The results proved that environmental sensitivity can mean good business. The efficient nature of sustainable design produced a better facility at well below the expected cost.

The design team vetted manufacturers to ensure that new furniture and supplies were produced in an environmentally responsible manner. And, while it was a given that carpeting, wall coverings and the like would be at least partially made of recycled and recyclable materials, the team wanted to go farther—

The efficient nature of sustainable design produced a better facility at well below the expected cost

reconfiguring existing doors, doorframes, cabinets, recessed lights and even gypsum board from the previous tenant.

"They were beautiful, high-quality materials that the building manager would have otherwise sent to the dump," says Seattle Business Unit Manager Nancy Walker, who led the effort. "The end result is so polished and contemporary that folks are surprised when we tell them the degree to which energy efficiency and reuse influenced the overall design."

The new space exceeds the City of Seattle's sustainability requirements, as well as guidelines set forth by both the city and the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED). What's more, the team's insistence that so much existing material be reused helped pursuade the building's management to pay for the entire build out. Wow, a sustainable design that beat the budget–a win-win from an environmental and business point of view!

Contact Nancy Walker at (206) 749-2235 or nwalker@brwncald.com.

Continued from Page 1

Brown and Caldwell's Bill Young (left) and Jim Chitty bring nearly 60 years of plant experience to their work creating easily updatable online O&M manuals.

before, so I'm not going to give it now." It's our job first of all, to make it easy for staff to participate and secondly, to pay attention to their needs. Some of them may be gruff, but most are proud of themselves and what they do. Usually, if we ask a longtimer about the changes he's seen over the years and let him take pride in what he's participated in, he'll work with us and express his knowledge. Making staff feel appreciated and important to the process is the key. The fact is, we can't do this job without them. It can really be an opportunity for them to show off what they know.

What's the process for creating the new O&M manuals?

Chitty: We usually start by talking to the resident expert on a small part of the wastewater treatment process. It can take days or weeks to document a sophisticated process, depending on the individual and task at hand. We leave no stone unturned. And, of course, it's a very different challenge for a facility with three operators than it is for a plant with 50 operators.

Young: After we capture the information on camcorder or laptops, we develop schematics and step-by-step standard operating procedures (SOPs), design data, and information templates for instrumentation, alarms and alarm responses. Our process descriptions use easy-to-read and accessible smart graphics and text, not lengthy narratives. We'll go into as much information and detail as the client wants. We'll also create links to other information categories, like safety, emergency operations and computerized maintenance management systems.

Chitty: Once we draft standard operating procedures, we hand them back to people and ask, "Is this correct? How can we make it better? Have you seen situations where this procedure didn't work?" We often get very valuable troubleshooting information that way. We revise the SOPs until they're fully accurate, and we do whatever it takes to gather the information that we need.

Can utilities easily update the online manuals?

Chitty: Electronic O&M manuals make updating a much easier task than it has ever been. Before, updating paper manuals was a daunting process. Every little change could cause big logistical and printing problems, and the manuals were often outdated or incomplete. Pages often went missing, and that could affect job satisfaction and performance.

Young: Now the manuals are extremely easy to update. Utilities usually assign one or two senior operators or shift supervisors to maintain the manuals. Those staff have editing rights to add information and update tables and graphics as needed, in real time. In addition, any person who can view the manual can use a special note function to add or correct information. Those notes are automatically flagged, so that those with editing rights can review them and decide whether to incorporate them as formal changes.

Lost knowledge, as simple as the location of a pipe, has big potential financial and environmental consequences

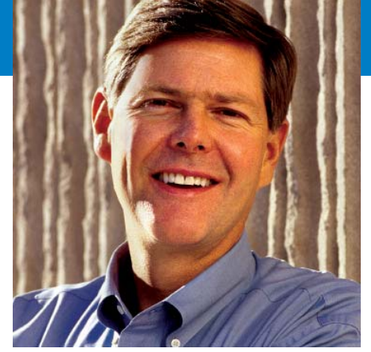
Is it worth it to put the time and energy into creating an electronic O&M manual?

Chitty: It's absolutely worth it. If this critical information base leaves the facility, lost knowledge, as simple as the location of a pipe, can have big potential financial and environmental consequences. That's a huge risk for a utility. Maintaining accurate and up-to-date O&M manuals is also important for job satisfaction. People have to have confidence in the availability and accuracy of the information and tools they need to do the job.

Young: The paybacks in this process include the knowledge captured from senior staff and the ability to give operators key information right at their fingertips. With these manuals, if an engineer wants to know the volume of a tank, he can just click on the information instead of hunting through volumes of design data. Online manuals are consistent and easy to use. They're great tools to help clients keep up with their changing organizations.

The Smart Solution

Utilities can benefit from the experience of successful operations and employees



Craig Goehring, P.E., CEO

Hands-on operating and asset management (AM) experience. Benchmark utility performance. Continuous improvement. That's what the Australian water/wastewater firm Hunter Water (HW) brings to the table.

And at that table are Brown and Caldwell's U.S. clients. We're pleased to announce that Hunter Water and BC are joining forces to deliver leading-edge asset management consulting. Our partnership will accelerate the progress of utilities looking to make fundamental reforms and boost service levels while cutting costs. I can already report that our work together has fostered new ways of thinking, innovation and results that our clients expect of us.

Because the application of AM principles touches every part of utility operation—from business strategy to equipment maintenance and workforce development — Hunter Water's dozen years of actual operating and AM experience is invaluable. Serving 500,000 water and wastewater customers, HW introduced the AM operating model in 1990 (see profile on page 15). Previously, Hunter Water ran its operations much differently:

- Capital and operating functions had separate and distinct approval streams
- Service levels for the community and the environment were not well understood
- HW had ad-hoc approval processes for cost streams.

Twelve years later, Hunter Water has completely transformed its operations. With an efficient and streamlined workforce that is significantly slimmer than its prior size, it employs AM practices such as:

- Business-case analysis for capital projects, accounting for life-cycle costs and service levels
- Independent audit of service performance
- Competitive benchmarking of in-house service providers.

Benchmark performance

Hunter Water has realized the gains in efficiency and competitiveness that most U.S. utilities are hoping to achieve. "Since adopting asset management in 1990, we have reduced customer rates by 30 percent in real terms and costs per customer account by 40 percent," says Kevin Young, HW's manager of Corporate Planning. "The results are compelling. We have improved customer service and system performance, while at the same time reducing our capital program by $220 million."

Interestingly, over time HW has also created a workforce with skills of commercial value to other utilities. Consequently, Hunter Water formed a consulting subsidiary—now our partner—that in 2001-02 had over 100 employees involved with work on commercial projects. Obvious benefits of this move are employee development and retention, as well as continuous reinforcement of business competitiveness.

Common challenges

The challenge facing U.S. utilities that we highlight in this issue—the brain drain—is also very real and "on-the-screen" with Hunter Water. And like most challenges, brain drain presents an opportunity if one chooses to view it this way… the old, lemonade-from-a-lemon story.

Based on discussions with thought leaders in the industry, we saw that involving experienced workers is an essential part of the solution. Those individuals are so important, we believe, that we depicted a long-time utility employee on *Quarterly*'s cover as a powerful hero with an important legacy and pride. Why? Because a motivated and proud utility employee who's nearing retirement will participate in and contribute to proactive brain-drain solutions at much higher levels. Everyone wants to feel that they have made an impact in their work and that what they know is valued by others.

Hunter Water recommends a proactive approach to solving the brain-drain problem that includes:

- Documenting key information that experienced workers hold in their heads. (See "Issues and Ideas" on p. 16 for more details about knowledge capture.)
- Establishing mentoring programs to allow the next generation to learn from experienced workers.
- Through computer models and operating processes, developing "smart systems" to facilitate field decision making.
- Setting up electronic-response tools on SCADA, based on special workshops with experienced workers.

Note that the experienced worker is front and center in HW's approach to developing the next generation of valued, skilled and competitive utility employees. Given the importance and reliability that we've come to expect from our water and wastewater service providers, it's not much of a stretch to see long-term, seasoned, experienced workers as real heroes that utilities depend on.