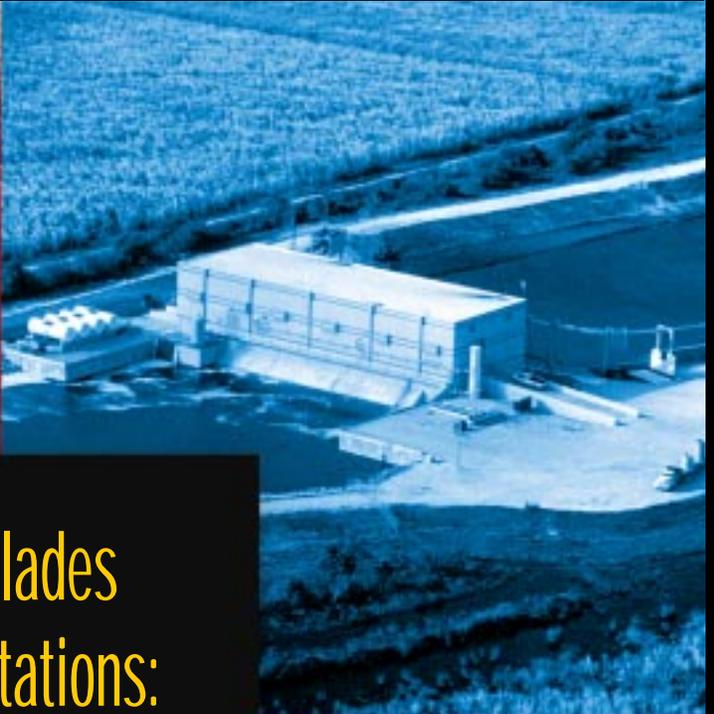
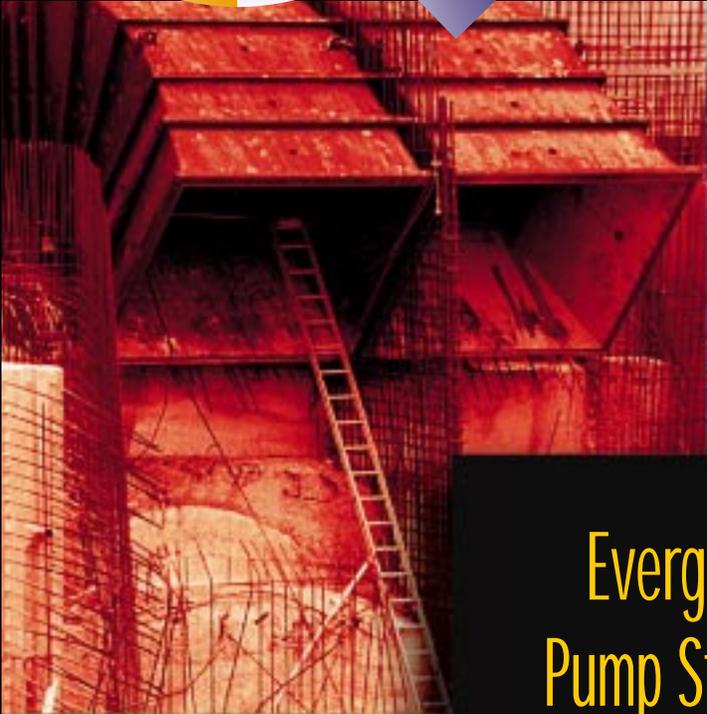


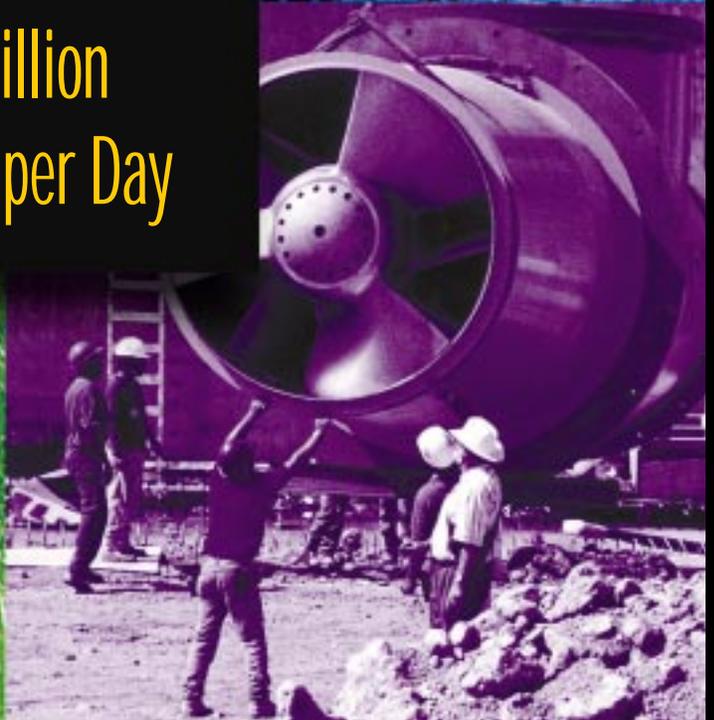
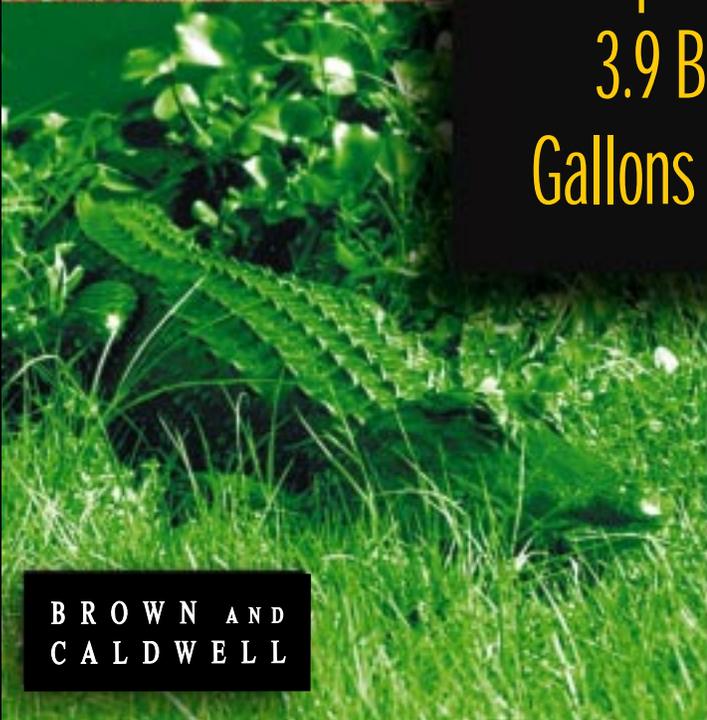
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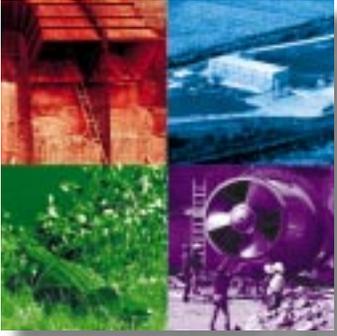
QUARTERLY



Everglades
Pump Stations:
3.9 Billion
Gallons per Day



BROWN AND
CALDWELL



Pump stations G-310 and G-335, newly operational in the Everglades Construction Program, boast the world's largest formed suction inlet pumps.

QUARTERLY

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Wet-Weather Experts Join BC

Brown and Caldwell acquires Moffa & Associates to add capabilities in CSO abatement and expand company's roster of top technologists.

WATER ISSUES *have become* PEOPLE ISSUES

Water resources managers must foster consensus in an era of conflicting needs and values.

The general public has long expected that cheap water will be available when the tap is turned, that rivers will flow freely while floods are contained, and that healthy ecosystems will be restored and maintained. Not only has the reliable supply of clean water been a fundamental expectation, it has been key to the development of the nation.

But now the physical limits on our water resources are becoming as evident as the gridlock in our transportation and energy infrastructures.

We may see these limits expressed in a dramatic case, such as when Ohio's polluted Cuyahoga River caught on fire. Or in a more gradual manner, as happened with the loss of Everglades wetlands through encroachment and alteration. Or as a periodic signal, when suburban lawns dry up during droughts. We see growing evidence that our previous approaches to management of water resources must change significantly. In many communities, the change is well underway.

A fundamental change in approaches to public works projects

The last 100 years have seen large public works projects supporting the economic development of the nation—the Hoover and Grand Coulee Dams, the Central Arizona Project, and the Clean Water Act construction loan program, to name a few. The federal government and major water utilities took the lead in developing cheap and reliable water supplies, flood protection, pollution control, and hydroelectric power.

Previously, successful projects were often described as "man taming nature." They were conceived as the conquering of technical challenges, as engineers harnessed the power and value of rivers, lakes, and aquifers.

Today, water managers and engineers understand that the criteria for successful development of projects have changed significantly. Not only have we recognized that water supplies are finite at a time when consumptive demands are increasing; we also have acknowledged the social, aesthetic, environmental, and institutional value and benefits of water. Clean water, wetlands, aquatic environments, instream flows, lakes, sustainable aquifer systems, local economies—each of these considerations has become as important as technical criteria in developing broad-based consensus on whether and how a public works project will be implemented.

At the same time, federal and state governmental agencies have evolved from developers to regulators of water resources projects. Water managers

now face stricter regulations, more complexly defined projects, more elaborate permitting and approval processes, fiscal constraints, and increased public scrutiny.

3 R's of water management: reallocation, re-operation, and regionalization

In the new era of water resources management, the focus is on three R's: reallocation, re-operation, and regionalization. The period of damming, diking, and diverting has been replaced by a period of reallocation of historic uses, re-operation of existing water systems, and regional or watershed management.

Reallocation: Water managers are seeking to optimize already-developed water resources through programs such as conservation, effluent reuse, water banking, and purchase or lease of agricultural and other historic water rights. *Re-operation:* Because it has become increasingly difficult and costly to develop new water sources, today's engineers and water managers are applying optimization, efficiency, and creativity to the operation of existing facilities. *Regionalization:* Various agencies are sharing interruptible water supplies, water systems, and regional infrastructure during droughts to meet short-term needs or to achieve greater efficiency.

To carry out the 3 R's of this water resources era, managers must successfully address many institutional and public policy issues as well as special-interest-group positions. In short, water issues have become people issues. Without consent from diverse groups, today's water managers will not be able to implement the next generation of water development, protection, or management programs.

The engineering community can help, by defining and facilitating the physical and operational enhancements to natural and human-made water resource systems. Engineers also can foster a clear understanding of the required performance of water resources projects and the feasible alternatives to meet those needs. Finally, they can help craft well-structured public involvement and decision-making processes before projects are designed or built.

The real challenge is in identifying which projects the public can support. This calls for programs to increase public awareness, education, and participation, as well as mechanisms to gain public consent—enthusiastic, grudging, or some of both. Only by focusing on reaching consensus will we balance conflicting needs, produce acceptable allocations of water, and prevent acute failures in our water supply systems and environmental protection programs.



—PETER BINNEY, P.E., leads Brown and Caldwell's national water resources practice. He can be reached at (303) 743-5437.

Timely Environmental Services Keep Denver's Transportation Upgrade

On Track



TO ACCURATELY BUDGET AND SCHEDULE ROADWAY IMPROVEMENTS AND RAIL CONSTRUCTION, COLORADO AGENCIES FIRST HAD TO UNCOVER ANY HIDDEN ENVIRONMENTAL PROBLEMS.

For more than 20 years, weary road-warriors have been complaining about Denver's Interstate 25, the most heavily congested stretch of roadway in Colorado. I-25 carries 230,000 cars a day, and the number keeps growing. Now, a solution is in sight. The Colorado Department of Transportation (CDOT) and the Regional Transportation District (RTD) are partnering on an ambitious \$1.6 billion project to improve the 20-mile stretch of roadway, including I-25 and I-225, and add a light-rail system.

The Southeast Corridor Multi-Modal Transportation Project is one of the largest and most visible programs to receive a full-funding grant from the Federal Transit Administration. And its co-managers, CDOT and RTD, realized that any unexpected problems encountered along the corridor during construction could send costs soaring and disrupt the schedule.

So they took steps to reveal hidden environmental conditions long before construction began.

Preventing roadblocks from potential environmental impacts

In ongoing environmental services for the project's prime contractor, Carter & Burgess, Brown and Caldwell assessed the presence of contaminated materials along the entire corridor and at the sites of 13 proposed new light-rail stations. The company also performed a complex risk assessment of a large, former iron-works site, which will be used as a light-rail transit maintenance facility, and recommended a cleanup plan, using industrial as well as residential standards for different parts of the site.

Despite widespread public support, drivers worry about the effect of construction on commuting. "The I-25 corridor is busy beyond the rush hour, and for most of the day. It will only get worse as the Denver metro area grows," says Jim Bumanglag, Southeast Corridor project manager for CDOT. "And it's important for us to minimize the impact to the public. We're hopeful that the eventual design-build contractor will be able to beat the June 30, 2008, deadline for our project to be fully operational, including highways as well as light rail."

In addition to the compressed schedule, the project required exacting, upfront calculation of costs to stay

On Track

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The team pursued a risk-based cleanup strategy, which involves evaluating site conditions and chemical concentrations to determine whether or not a potential health risk exists. Risk-based cleanups, which are strongly supported by the USEPA, protect public health while enabling developers to meet regulatory guidelines, save substantial amounts of money in remediation costs, and turn blighted properties into something desirable for communities. Given the site's two distinct uses—industrial and residential—two types of risk-based cleanup standards were applied.

“Our overarching objective was to quickly determine the extent of cleanup required, then incorporate that work into the site development plan,” said Schatzlein. “That will prove to be very cost-effective.”

Innovative software eases data retrieval for historic site

A thorough environmental assessment typically generates reams of documents. Brown and Caldwell wanted to package information collected about the maintenance facility site so that the City of Englewood, the Colorado Department of Public Health and Environment, EPA, RTD, potential developers, and other involved parties could easily find what they needed. The result is an innovative CD program that graphically depicts the entire site. Users simply click on a spot on the map to view relevant information about that section, including soil borings, monitoring wells, analytical data, and risk-based cleanup standards. “This database makes it very easy to find the piece of data that you're looking for,” says RTD's Genova. “It also makes it easy to compare results to regulatory standards.”

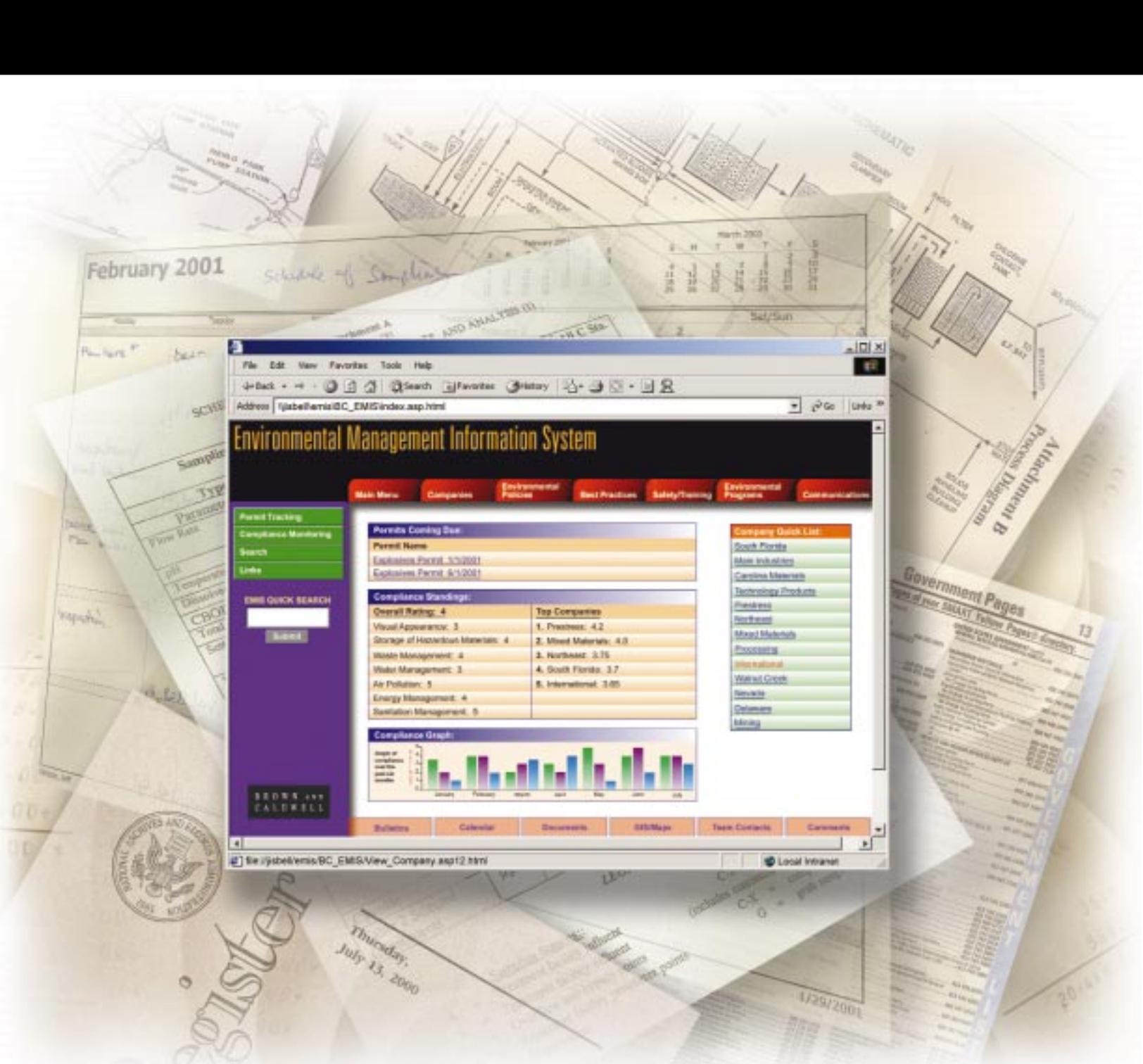
In the next phase of the project, Brown and Caldwell will be putting together an application for cleanup of the old iron-works site under Colorado's Voluntary Cleanup Program. Once that's approved, the team can begin working with contractors to implement the soil and groundwater remediation plan. It will also continue other site assessment work along the corridor.

“It's a joy working with this team to meet our environmental goals. Everything has been on time and has stayed within budget, and we've appreciated the tremendous efforts of Brown and Caldwell,” says CDOT's Jim Bumanglag.

For more information on environmental services for transportation projects, contact Deborah Schatzlein at (303) 743-5400 or dschatzlein@brwncald.com.

The EMIS: What the Newest Technology Can Do for You

More varied and versatile, the new environmental management information systems expertly manage environmental risk for a range of industries and forward-thinking public agencies.



The landscape for environmental management information systems (EMIS) has changed dramatically since they emerged in the early '90s.

“Less than five years ago, few U.S. chemical or pharmaceutical company managers I spoke with knew what an environmental management system was,” says Scott Bash, Brown and Caldwell’s director of information technology. “Of those who did, none understood how an EMIS could save them money. That’s changed, as companies switch from a reactive approach to a proactive one. The leaders in environmental health and safety are asking how they can stop budgeting \$200 million for fines and lawyers—how they can *measure* environmental activities so they can *manage* them, and avoid a violation, fine, or disaster.”

What is an EMIS?

As Hendrik van Brenk, director of environmental health and safety for RMC Industries Corp., puts it, “An EMIS is nothing more than an automated system for environmental management. To handle environmental policies and procedures, you need a system. In today’s world, that means an EMIS.”

As is true for many other U.S. companies on the EMIS forefront, RMC Industries’ commitment dovetails with its efforts to comply with ISO 14000, the international framework for environmental management. RMC’s parent company, headquartered in Europe, is the world’s largest producer of ready-mix concrete.

Scott Bash sums up another description: “Really, an EMIS is an

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What can an EMIS accomplish?

The EMIS is being used to meet broadened goals: cutting supply-chain costs, decreasing the cost of environmental compliance, enhancing business processes, and supporting strategic decisions. A well-rounded system typically performs the functions listed below. A customized system can heighten the integration of these functions as well as global and local interactivity.

Permit requirements, tasks, and schedules

Distribution of environmental health and safety (EHS) policies and procedures

Air emissions inventories

Water data management and National Permit Discharge Elimination System reporting

Waste characterization and reporting

Chemical inventory management

Emergency Planning and Community Right-to-know Act (EPCRA) and Superfund Amendments and Reauthorization Act (SARA) reporting

Materials Safety Data Sheet (MSDS) management

Environmental accounting, including labor, capital, costs, and environmental releases

EMIS

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environmental accounting system. If you can understand your environmental activities in terms of cash, you can manage your environmental liability.”

Those are a couple of broad-brush definitions of an EMIS. Specifically, how does it work?

One type of EMIS is an off-the-shelf spreadsheet or database software program. More than one hundred licensed programs can be purchased to handle particular functions—water data management, waste shipment tracking, and chemical inventory control, for example. These programs are written in a locked source code that only the originating software company can change. This type of EMIS can serve as a building block, which environmental managers can link with others to create a multi-function system.

The second type of EMIS integrates many functions into one database application, which is deployed over a company's intranet. Written in HTML, this system is accessed via a company's intranet server and maintained by its own information technology (IT) department. This type of EMIS can be modified easily. Brown and Caldwell is one of only a few consultants building and customizing such applications for companies and agencies.

Off-the-shelf software or web-deployed solution?

“Web-based software is ideal for organizations with multiple facilities or issues who want to keep their IT costs low,” explains Greg Stevens, Brown and Caldwell's manager of environmental information services. “First of all, you decrease maintenance costs because special software doesn't have to be installed on individual computers. Second, data can be shared. Third, you enter data only once, reducing errors and effort. And as you integrate it into other business systems, you can save even more.”

According to RMC's van Brenk, “A web-based system is the only thing that makes logistical sense. We have over 300 facilities in the U.S., each with over 10 operating permits, each of these having 10 date triggers of some kind. How do they get managed consistently? We need global access and standards, but we also need local control. After we implement the EMIS that Brown and Caldwell recently designed for us, each company and facility will have full web-based access to their permits, but they will all be handled consistently.”

Success stories

Defending the cost of an EMIS can be a challenge, especially if the environmental department is not seen as a direct contributor to the business. But, says Stevens, “In my recent experiences implementing systems for a variety of industries, I've learned firsthand about documented cost savings.” Stevens cites the following:

- A petrochemical company replaced over 200 separate software systems and reduced regulatory reporting time by 75 percent
- Another major petrochemical company avoided \$1 million in fines by instituting an EMIS in response to a consent decree
- A global pulp and paper company reduced time spent on data management by 65 percent
- In 1999, Coors Brewing Company realized a return on investment of more than 30 percent using a centralized MSDS database
- A major chemical manufacturer saved \$10,000 per reporting cycle by automating SARA 312 Tier II reports at one site
- A plywood manufacturer reported a 90 percent reduction in the time needed to report annual air emissions
- A large pulp and paper facility saved 88 hours per year in time spent to produce discharge monitoring reports
- A major chemical manufacturer's automated preparation and printing of waste manifests saved \$50,000 per year per site

Decentralizing needs assessment

The first step for companies and public agencies that are creating an EMIS—whether customized or off-the-shelf applications—is to accurately assess the organization's needs. Usually, this key task calls for outside help.

RMC is an example, with 16 different operating companies in the U.S. alone. “If you're a decentralized company, like most are, the key to success is buy-in. You can't just decide what to do at the corporate level and then implement it. Instead, you have to involve as many people as possible in the needs assessment,” says van Brenk. “I pulled together all the companies' EHS managers and brainstormed with Brown and Caldwell to agree on environmental components where we needed to standardize our approach.”

The trends ahead

Experts see these upcoming advances in EMIS technology and services:

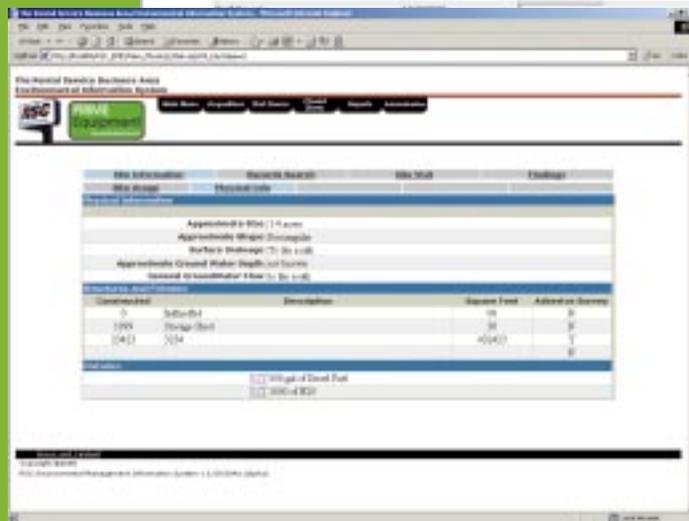
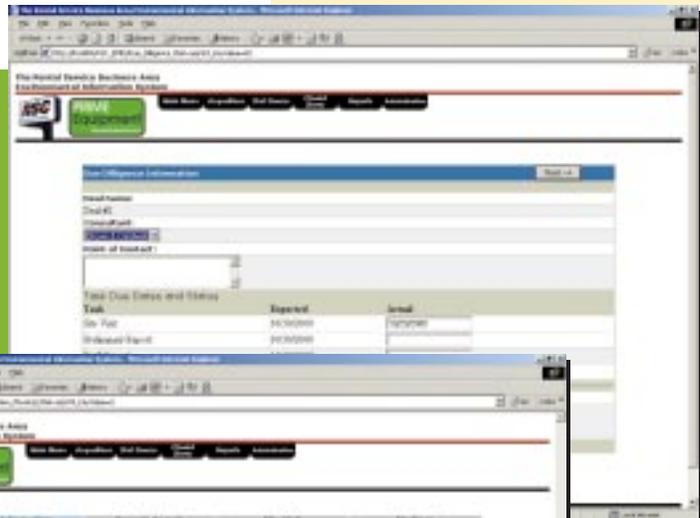
- Wireless technology, which will automate data collection, inspections, work orders, and responses to findings via handheld PCs in the field
- Automated indicators that will alert people to the need for a more detailed investigation
- Heightened collaboration through networks and project web sites
- Web-based customer service, training, and support
- Further integration of systems into business processes
- Third-party hosting to outsource server and maintenance costs



The EMIS

Rental Service Corporation (RSC), the country's second-largest equipment rental company with nearly 600 stores in 41 states and five Canadian provinces, turned to Brown and Caldwell to deploy an EMIS that would help track findings from site investigations. The company needed to switch from its legacy, Access-based, stand-alone system, developed for RSC several years ago, to one that would speed up communication and improve access to historical findings. The new system had to work well with their existing environmental management program, which included extensive employee training.

Brown and Caldwell converted and expanded the existing application to a web application that can now be used by anyone with access to the company network. The web application tracks Phase I site evaluations, Environmental Agreement Letters, and environmental conditions at current and closed sites. Before the upgrade, RSC would wait weeks before they could see results from their Phase I evaluations contained in formal reports. Now they can view results in near-real-time, speeding along decisions related to site acquisitions and closures.



QUARTERNOTES

Proving the Power of Capacity Assessment Tools at Chambers Creek Wastewater Treatment Plant

The capacity re-rating of the Chambers Creek Wastewater Treatment Plant, Pierce County, Wash., has saved the Public Works and Utilities Department \$40 to \$50 million in avoided capital expenditures. And in the assessment that led to the re-rating, Brown and Caldwell advanced the state of the art by applying a unique medley of tools for the first time.

A wake-up call for more capacity

Serving one of the fastest-growing regions in the Puget Sound Basin, in 1998 the Chambers Creek plant was fast approaching 85 percent of its permitted capacity of 18 million gallons per day (mgd). To forestall a lapse in service, the utility asked Brown and Caldwell to both design additional primary clarifier capacity and assess the facility's total capacity, which the utility believed had been underrated by regulators.

Not only did Brown and Caldwell's assessment prove to regulators that the existing plant had even more capacity than the utility had hoped for—it also showed that long-term capital improvement dollars would be better spent in ways other than adding primary clarifier capacity. "We consequently sacrificed a contract we had already won," explains Project Manager **Chris Cleveland, P.E.**

A favorable re-rating and more

The original Chambers Creek plant, which began operating in 1984, was rated at 12 mgd. In the '90s, the utility expanded the facility to an extent that was expected to double the rating. But regulators rated the expanded plant only 18 mgd.

"The utility was in a real capacity bind—looking at a full-plant expansion and being three years behind," recalls Cleveland. But Brown and Caldwell's analyses demonstrated to regulators that the existing facility was already capable of operating at 27 mgd, and that with small operational changes, it could handle 28.6 mgd, adding years to the time when new capacity would be needed. State regulators recently approved the 28.6 mgd capacity.

An important aspect of optimization was the plant operators' involvement in the testing and modeling that showed which modifications would increase efficiency. "Working with our staff, the operators became familiar with the analytical tools. Now they can use them to help monitor and correct plant performance," says Cleveland.

Robin Ordonez, the wastewater utility's supervisor

of engineering, calls the assessment results "completely satisfying. The study not only allowed us to re-allocate millions of dollars to other capital improvements, it also helped us identify bottlenecks and plan more effectively for treatment plant expansion."

The sixpack of optimization tools

Henryk Melcer, P.E., the project's lead process engineer, has been spearheading development of the suite of computer-based tools and field tests for a number of years. "This is the first time Brown and Caldwell bundled all of these services into a package like this," he comments. "It allows our clients to evaluate the true capacity of their facilities and to identify additional capacity that can be retrieved from existing infrastructure." The package includes:

Hydraulic Profiling – Brown and Caldwell's proprietary PROFILE application finds potential hydraulic bottlenecks and quantifies them.

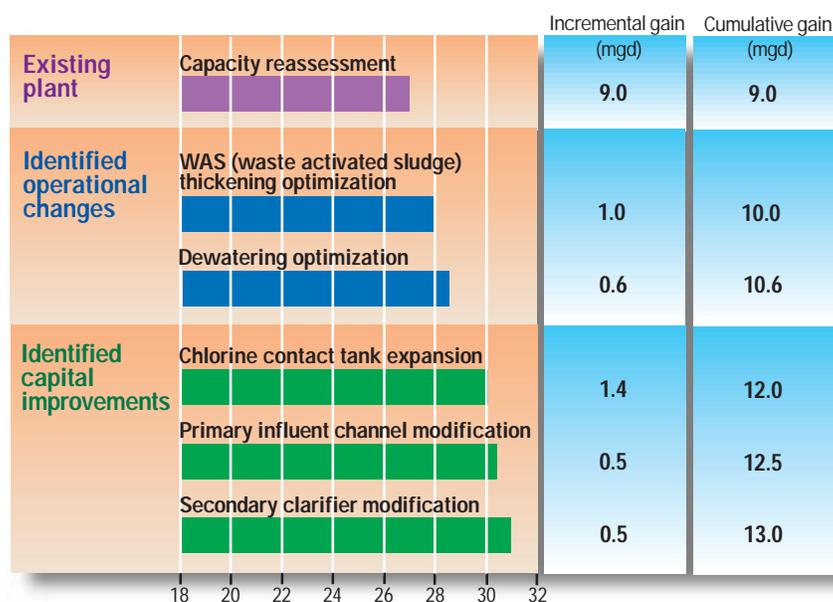
Primary Clarifier Hydraulic Modeling – A testing sequence measures what the maximum performance of the primary clarifiers might be and compares it to actual performance.

Solids Mass Balance Analysis – Brown and Caldwell's MABLE software accounts for a plant-wide inventory of solids mass, determines the accuracy of plant functions such as flow monitoring, and verifies the accuracy of routine analyses of solids.

Biological Process Modeling – Brown and Caldwell utilizes the BioWin biological process simulator to look at the configuration of the facility and wastewater characteristics in order to predict effluent quality, oxygen demand, and solids production.

Secondary Clarifier Mass Flux Analysis – Brown and Caldwell's secondary clarifier testing protocols and patented equipment examine clarifier limitations relating to peak hydraulic loads and flocculation, settlement, and thickening of mixed liquor.

Stress Testing – When possible, Brown and Caldwell takes units (clarifiers, tanks, etc.) out of service to stress the similar units remaining in service, then evaluates the limitations on the unit process.



Plant capacity, million gallons per day (mgd) based on peak-month flow

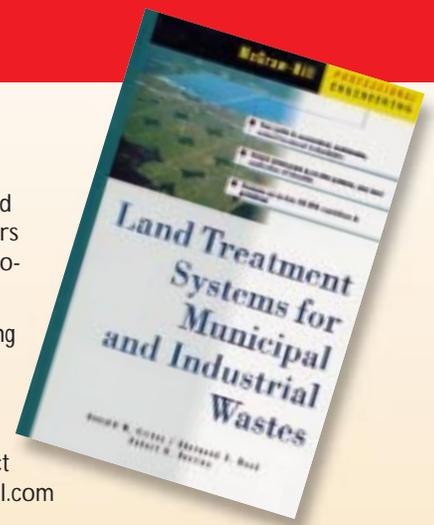
The existing Chambers Creek Wastewater Treatment Plant in Pierce County, Wash., recently received a re-rating of its permitted capacity, from 18 mgd to 28.6 mgd for peak-month flow, as a result of Brown and Caldwell's assessment and optimization.

New Book on Land-Based Waste Treatment Systems

Ron Crites, P.E., is the principal author of the new book "Land Treatment Systems for Municipal and Industrial Wastes." A guide to tested economical, sustainable, and natural technologies, the book covers small-scale and on-site treatment systems as well as land application of biosolids. It also contains up-to-date USEPA regulations and guidelines.

"This text should be required reading in civil and environmental engineering classes and classes dealing with natural resource management," according to the "California Water Environment Association Bulletin." "Experienced and novice practicing professionals and regulatory agency professionals will benefit...[from] the valuable materials presented in this book."

Based in Sacramento, Calif., Crites is Brown and Caldwell's service leader for natural systems. Contact him at rcrites@brwnncald.com or (916) 853-5355. You can order the book via www.books.mcgraw-hill.com or your bookseller.



Model Program for Tenant Environmental Audits

The Port of Houston Authority recently established a model program to gain environmental compliance by tenants. "We see the new program as precedent-setting for all ports in tenant-port authority relationships," says **Shari Baldrige**, the Port's environmental compliance assistant. Brown and Caldwell developed the new, non-adversarial approach to environmental audits and corrective action.

The first of its kind to join USEPA's Project XL

The Port's work built on a 1998, USEPA-funded "Environmental Management Handbook" completed by the American Association of Port Authorities, which included a section on managing environmental issues with port authority tenants. To help ports respond to the handbook's recommendations, the EPA's Project XL funded the Port of Houston to deploy a tenant environmental program that could be a model for others. The Port is the first entity of its kind to participate in Project XL, which allows companies and facilities to develop innovative policies to comply with environmental regulations.

The Port Authority turned to Brown and Caldwell to revamp its existing checklist for environmental audits and to audit the Port's 150 tenants, which include vehicle maintenance facilities, a flour mill, a natural gas pipeline compressor station, and chemical blending and soap manufacturing facilities. Most important, the Port wanted help in smoothing the adversarial relationships that had sprung up between the Port and some of its tenants in the wake of previous audits by other consultants—a typical, unfortunate result of environmental audits.

"We're not there to tattle"

Brown and Caldwell Project Manager **Madeline Mauk, P.E.**, suggested augmenting the checklist with a guide, so that tenants would have a chance to gather requested information, learn more about applicable regulations, and ask questions before and during the audit.

"The tenants weren't thrilled with us having to be there," explains Mauk. "To help overcome that response, we sent them this material



With support from the USEPA's Project XL, the Port of Houston Authority created a non-adversarial program to conduct environmental audits of port tenants and assist in corrective action. The Port leases facilities to 150 industrial users in addition to serving more than 100,000 vessels each year from its own terminals.

ahead of time. Also, we made it clear that the Port and its auditors were there to work with them. Often auditors are seen as the bad guy coming in to look at what sites are doing wrong. But we're not there to tattle, we're there to resolve problems."

Extending a good compliance program from owner to tenants

The Port of Houston, which extends 25 miles south of Houston, conducts its own thriving operations, serving more than 7,000 ships and 100,000 barges every year from public as well as private terminals. And, like most port authorities, it leases facilities to tenants. Under this arrangement, environmental compliance rests with the tenant.

The Port of Houston had already implemented an award-winning environmental compliance program for its activities, explains **Laura Fiffick**, Port environmental affairs manager. "Our concept was to figure out how a port with a good program can extend it to its tenants."

Eighty of the Port's 150 tenants have been audited. For those out of compliance—most issues involved stormwater permitting, air quality, and waste management—the checklist and guide identified key issues and steps for corrective action.

The audits often revealed simple solutions to seemingly complex problems. In one case, Mauk explains, a tenant submitted a notice of intent to the EPA regarding stormwater associated with industrial activity. The EPA responded that the tenant could discharge stormwater under the General Permit if a stormwater pollution prevention plan were prepared and implemented. In her audit, Mauk noticed the EPA condition and helped the tenant prepare the plan. Mauk assisted other tenants by suggesting possible changes in operations to avoid triggering specific regulations.

"The new checklist and guide help our tenants avoid fines," comments Baldrige. "And they also let us address the right compliance issues on future audits."

For more information, contact Madeline Mauk at (713) 759-0999 or mmauk@brwnncald.com.

ROCKDALE COUNTY, GA., CREATES A COMPLETE WATER SYSTEM IN 29 MONTHS

By January 1, 2002, Rockdale County, Ga., will stop buying water from neighboring counties and start treating its own—avoiding \$14,000 per day in surcharges.

Over only 29 months, the County must complete design and construction of a water intake; treatment plant; raw-water and transmission pipelines, storage tanks, and mains; and two pumping stations.

"Each of the elements is a manageable project, but the challenge is to complete them collectively in a short time frame," says **Laurie Ashmore, P.E.**, the County's director of water resources. "In addition, our staff has to modify existing operations and systems to work with the new, highly automated facilities."

Construction Dynamics Group/Brown and Caldwell (CDG/BC) kickstarted design and construction management of the \$68 million program in August 1999. Through savvy planning, painstaking quality reviews, and aggressive schedule control, the team has saved the County millions and kept the project on course.

All elements are now under construction.

Water wars provide big incentive

"Right now we depend on the supplying county's system pressure, and we take water from the Chattahoochee Basin. This program affords us the opportunity to become independent," explains Rockdale Water Resources Chief Engineer **Scott Emmons, P.E.**

Thirty miles southeast of Atlanta, Rockdale County purchases wholesale potable water from Gwinnett and DeKalb counties. But it has been caught in the middle of a decade-long lawsuit among Florida, Alabama, and Georgia over interbasin water transfer. Gwinnett County, which provides water to burgeoning metropolitan Atlanta, wants to cut off its supply to Rockdale—hence, the \$14,000/day premium to begin in 2002.

To fund water independence, citizens approved a special sales tax in March 1999. Brown and Caldwell's 1997 master plan had identified how much money was needed. The company also helped Rockdale prepare the engineering report for a bond issue to pay for some of the improvements.

From retail distribution to complete transport, treatment, and distribution

The program consists of a new 16-million-gallon-per-day (mgd) water treatment plant, which can be expanded to 32 mgd; a 1-mg steel elevated storage tank; a 5-mg ground storage tank with a booster pumping station; raw-water intake, pipeline, and pumping station; and 19 miles of large-diameter water transmission mains. The plant will include two super-pulsator clarifiers, ozone disinfection, and granular activated carbon for filtration.

According to Emmons, "The greatest technical challenges—and we knew this upfront—are in withdrawal and transport of raw water. Building a plant is relatively straightforward. But you need to put a lot of effort into getting raw water to the plant, including a Corps permit and wetlands considerations. We used a hydraulic modeling program on our own and with Brown and Caldwell to fine-tune transmission main and storage facility locations."

"Taking a fresh look" and aggressively controlling quality

CDG/BC had to plan out nearly every program detail in advance—and convince many doubters that the schedule was achievable.

The key to their approach was to take a fresh look at assumptions and procedures. For instance, explains Brown and Caldwell

program design manager **Bill Gilman, P.E.**, "the County initially considered a design/build program, but we saw that it would cost them more. Instead of hiring someone to do a 50 percent design and negotiating with a contractor to complete it, we rode herd on the design engineers to create 100 percent plans and specs, which we put out for bid."

Gilman and his team aggressively managed quality and costs as they oversaw the three selected design firms. "Our value engineering studies saved the county \$4 million on just the water treatment plant," says Gilman. "Constructability reviews on the other projects saved at least \$8 million." The Georgia Environmental Protection Division was invited to the value engineering sessions and constructability reviews, which expedited approvals.

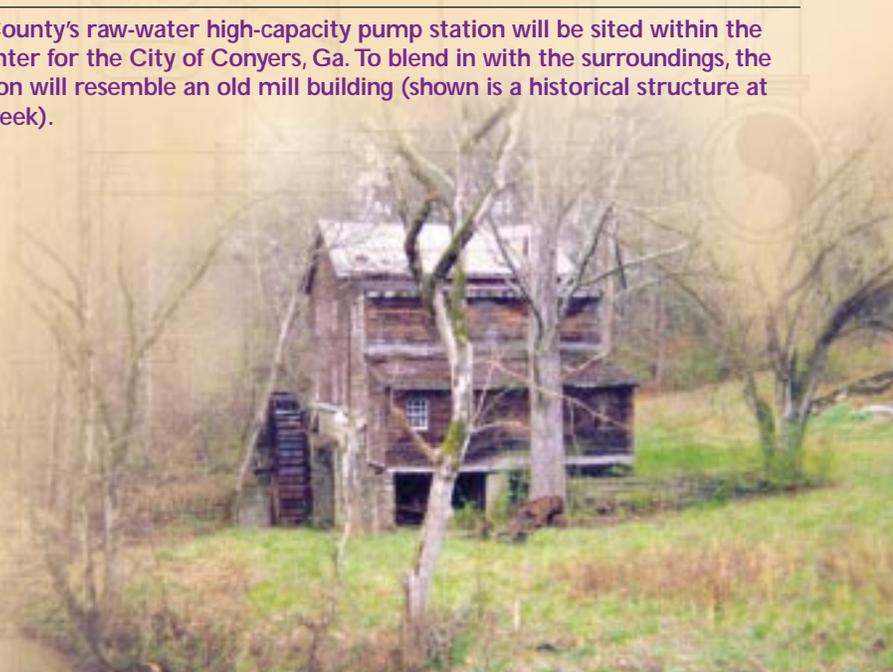
Gaining more savings, even electrical power supply was competitively bid out to independent companies.

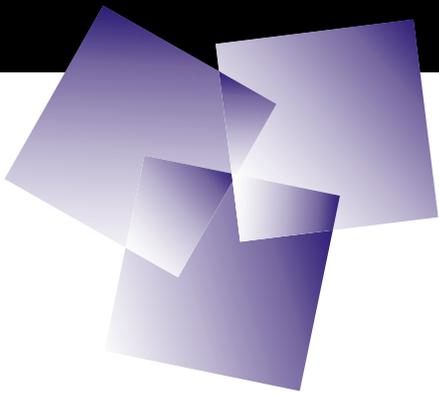
The program includes nine separate construction contracts.

All along, the team has been a part of an active public-participation program. "We're always in the press and on the forefront," says Gilman.

What helps the County keep hitting its program milestones? "BC/CDG working right in our offices—I can't imagine how we could have succeeded without that," says Ashmore. "We resolved issues in the hallway and at the coffee pot rather than waiting for meetings."

Rockdale County's raw-water high-capacity pump station will be sited within the Nature Center for the City of Conyers, Ga. To blend in with the surroundings, the pump station will resemble an old mill building (shown is a historical structure at a nearby creek).





Brown and Caldwell Launches Business Consulting Practice

John Salo, P.E., senior vice president, has been appointed national director of Brown and Caldwell's Business Consulting Practice, a new unit that will help utility managers create more efficient and competitive organizations.

"Being competitive has become more complex," says Salo. "It's not just a matter of reducing operating costs. Utilities must now assess their capital programs and apply a comprehensive asset management approach. This allows long-term life-cycle costs to be considered, as improvements resulting from reengineering evaluations are implemented."

The new Practice will take a highly tailored approach to consulting on business processes and strategic planning for water and wastewater utilities, working with them to assess their unique situations and implement the measures best suited to their particular organizations.

In the last five years, Brown and Caldwell has completed more than 100 competitiveness projects for public agencies nationwide. These have entailed helping utilities to integrate best practices from the private sector in a way that preserves and promotes high-quality service and environmental protection.

Three utilities for which the company serves as competitiveness consultant have achieved substantial operating cost reductions following very different approaches:

- Atlanta is contracting out portions of its operations.
- Nashville's comprehensive five-year reengineering program is addressing all core and support functions in the water and wastewater utility.
- Kansas City, Mo., is developing a Competitive Business Plan for its water and wastewater operations that is part of a competitiveness program encompassing 22 city departments.

The Business Consulting Practice offers the expertise of the company's most senior managers, from a wide range of disciplines. For more information, call John Salo at (770) 673-3639.

World's Largest Formed Suction Inlet Pumps

In November 2000, pump stations G-310 and G-335 were deemed ready for operation in South Florida. The fully automated sister stations—the first in a series—house the largest formed suction inlet pumps in the world.

Each station can pump 3,040 cubic feet per second (cfs), or almost 2 billion gallons per day. And they can do so during the worst hurricane expected in 50 years, with-standing winds of 155 miles per hour.

"The stations are so massive, you don't even see the first 14 months' worth of construction—it's underwater," comments Brown and Caldwell Project Manager **Angela Berry**.

The substructure would have been 9 feet deeper, and more costly, with a conventional shoebox inlet, where the pump is set in a rectangular box, instead of the formed suction inlet.

The project is part of the South Florida Water Management District's multimillion-dollar Everglades Construction Program, which will build more than 47,000 acres of wetlands, canals, and pumping stations to reduce contaminant inflow into the Everglades, provide hydropattern restoration, and improve flood protection.

Brown and Caldwell has worked with the District on Everglades restoration since 1992. The joint venture of Prescott Follett & Associates, Inc./Brown and Caldwell designed the stations and their elements, helped the District procure pumps, gears, and engines, and provided full-time engineering support and coordination during construction.

Massive elements, deep construction

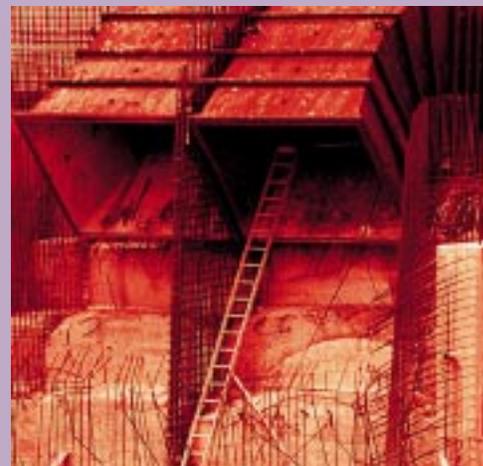
The program uses a network of filter marshes, or stormwater treatment areas (STAs), to reduce phosphorus inflow. Two of the STAs are regulated at their outflow by G-310 and G-335, whose immense power was needed to handle large stormwater flows and create enough lifting power to move the treated waters into adjacent, water-conservation areas.

Each station includes six vertical axial-flow drainage pumps: two 950-cfs diesel-driven pumps, two 470-cfs diesel-driven pumps, and two 100-cfs electric motor-driven pumps. The eight largest pumps—four with 112-inch impellers and four with 80-inch impellers—were made to order by Flowserve Pump Division, formerly Ingersoll-Dresser Pump Company.

The 16 months of substructure construction began in 1998. General contractor Harry Pepper & Associates had to excavate two 30-foot-deep holes the size of four football fields in the swampy Everglades, using a complex dewatering and perimeter collection system to facilitate construction and protect adjacent farms.

Modeling to refine design

No performance data existed for pumps this large. "To prove that the pumps met our specifications, we insisted on modeling how they worked with the inlets. We discovered that the pumps functioned very handily—but that the inlets were problematic," explains **Garr Jones, P.E.**, engineer of record for pump station and hydraulic design. "We had used an Army Corps of Engineers inlet design promoted (by others) as not requiring a physical modeling study. Luckily, we found out in time that it did need modifications."



CONTINUED ON NEXT PAGE

Extended Thermophilic Anaerobic Digestion A Success at Annacis Island

The innovative thermophilic anaerobic digestion process pioneered by a Brown and Caldwell-led team at the Annacis Island wastewater treatment plant has proved successful in producing Class A biosolids there.

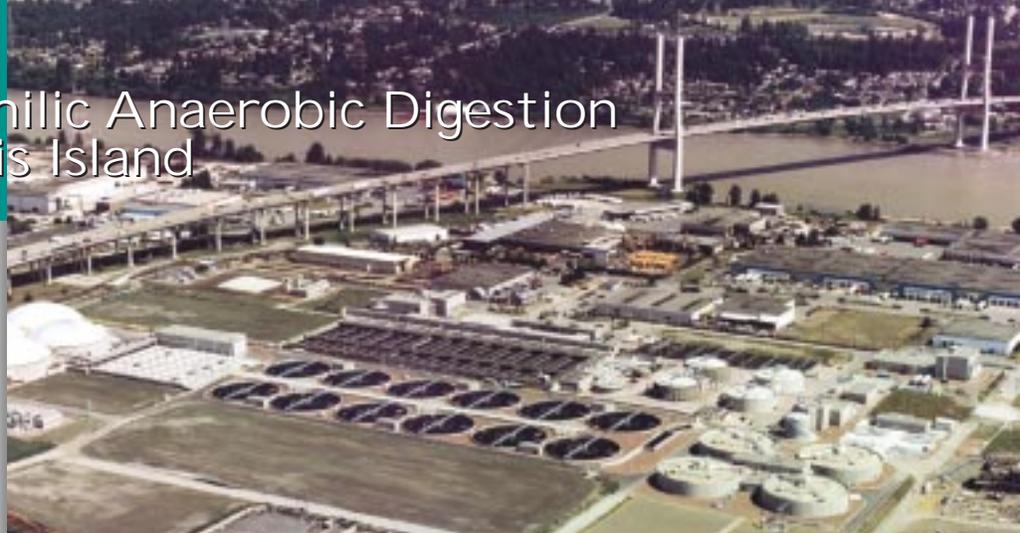
"Many wastewater treatment facilities are interested in using some form of advanced digestion; the Annacis digesters are the first in North America reliably producing Class A sludge," explains Brown and Caldwell Project Manager **Steve Krugel, P.E.**

After almost two years online at the Annacis Island plant in British Columbia, the process has increased pathogen destruction, with fecal coliform counts as low as 100 to 200 MPN (Most Probable Number) per gram. The standard for fecal coliform counts for Class A biosolids is 1,000 MPN per gram.

"We are very happy with the quality of the sludge and the pathogen kill level" since the conversion from mesophilic to extended thermophilic anaerobic digesters, reports **Brian Hystad**, the facility operations manager.

According to project Technical Coordinator **Lloyd Slezak, P.E.**, the unique process has the added benefit of being energy efficient. As high temperatures destroy pathogens, the system recovers that heat from hot sludge exiting the process and uses it to heat incoming cold sludge.

Further, says Slezak, "what has been done to improve pathogen removal has also helped



A new extended thermophilic anaerobic digestion process has proved to be successful not only in producing Class A biosolids, but also in improving reduction of volatile solids. Pioneered by Brown and Caldwell, the process has been online at Annacis Island for two years. In the foreground are four new thermophilic digesters. Slightly behind them to the left are extended thermophilic digesters, which were converted from mesophilic digesters to work in series with the new digesters.

us improve volatile solids reduction, the main objective of sludge digestion processes." Volatile solids reduction usually hovers around 50 percent, but the new process has increased it to nearly 60 percent, resulting in more methane production. The methane is used in the plant's 3.2-megawatt cogeneration system.

Stricter biosolids criteria imposed in Canada and stringent EPA standards in the United States have created a huge incentive to reduce pathogens in biosolids and make Class A sludge, which can be moved off site and distrib-

uted without restriction as a fertilizer and other useful products.

In evaluating methods to produce Class A biosolids at Annacis Island, the Brown and Caldwell team examined pasteurization of sludge before the digestion process and several modes of thermophilic, or high-heat, digestion. The team decided to concentrate on development of a new process, extended thermophilic anaerobic digestion. This process uses continuous-flow tanks in series to prevent pathogens from short-circuiting into the exiting biosolids—a significant problem with more common, single-tank digestion methods.

Lab-scale experiments with the method showed considerable pathogen die-off rates; mathematical modeling and a full-scale, long-term demonstration at another Greater Vancouver Sewerage and Drainage District plant proved it to be cost-effective and reliable.

The new process is part of a \$600 million (Canadian dollars) program to upgrade the District's plants at Annacis and Lulu islands to secondary treatment. A Brown and Caldwell-led joint venture, including Canadian firms Associated Engineering (B.C.), Ltd., and Reid Crowther and Partners, Ltd., planned, designed, and managed the upgrade. It has won awards from the Consulting Engineers of British Columbia and Canadian Consulting Engineers. Annacis Island is the largest and most technically advanced trickling filter/solids contact facility in the world, designed to serve about one million people.

Several wastewater treatment facilities are moving towards using an advanced digestion system, according to Krugel. Among them is a treatment plant in Duluth, Minn., for which Brown and Caldwell designed a temperature-phased digestion system, scheduled to start up in spring 2001.

Contact Brown and Caldwell/ABR Project Manager Steve Krugel at (206) 624-0100 for information on the Annacis Island project.

Inlet Pumps, CONTINUED FROM PREVIOUS PAGE

The modified inlet is very similar to one used by Brown and Caldwell for decades. "We found that little engineering details and the right geometric relationships made the difference," says Jones.

Partnering keeps costs down

"We faced many challenges in construction management, including having a prime contractor doing the major construction and two other contractors furnishing equipment directly to the District," says the District Director of the Everglades Construction Project **Joe Schweigart, P.E., P.L.S.** "To help ensure success, we asked Brown and Caldwell to assign Engineer **Ed Basham** to the project as an assistant resident engineer and member of our own construction management team. That turned out to be a very wise move."

The biggest lesson for others embarking on a project of similar scale? Schweigart cites the non-adversarial, partnering approach used in the construction contract. "Along with a solid construction management team, it's one of the key reasons our program claims and change orders remain under 2 percent," Schweigart adds proudly.

Unique design features

The pump stations' unique design also includes:

- Discharge conduits of combination fabricated steel and cast-in-place reinforced concrete on the 470- and 950-cfs pumps, designed to recover energy
- A customized trash-raking system to remove debris from water pumped out of the weedy, alligator-filled canals
- Automated instrumentation and control systems that can be monitored from miles away
- Backup generators to permit operation during hurricane power outages
- Forced-air ventilation with special intake screening to keep the stations cool and minimize insect infestations

Wet-Weather Experts Join BC

- ◆ *Gained agreement* by all parties on a CSO abatement consent-order plan—and reduced its cost from \$396 million to \$144 million. How did they do it? By applying better science, sophisticated modeling, and strong advocacy to account for actual impacts.
- ◆ *Cut detention time* by more than half for an 8.4-billion-gallon-per-day (bgd) CSO disinfection facility. How? By using ground-breaking research and hydraulic modeling to prove the merits of high-rate disinfection.
- ◆ *Authored* “Wet Weather Protocols, 2000,” soon to be published by WERF, a detailed framework for wet-weather abatement and compliance by communities.

These are just some examples of the work of Moffa & Associates, based in Syracuse, N.Y., leading experts in wet weather and combined sewer overflow (CSO)—and now, a part of Brown and Caldwell.

Acquisition of Moffa & Associates Adds Top Capabilities in CSO Abatement

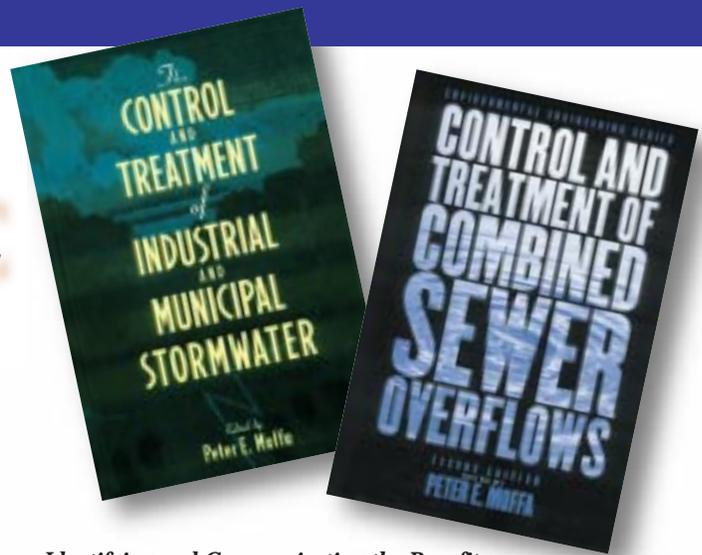
In my view, our January acquisition of Moffa & Associates hits the mark because it gives clients access to more top environmental solution-makers. M&A has earned a national reputation for being able to assess all solutions, from state-of-the-practice to state-of-the-art, and to apply the one that's most cost-effective.

As Peter Moffa says, “Understanding the full context of water-quality impacts before jumping to the needs-and-solution step often minimizes the cost of solving a difficult problem.” To get at solutions that make sense, Moffa advocates evaluation and benchmarking, framework modeling, and current working knowledge of the specifics of a watershed. And Moffa has shown that achieving all this doesn't have to take years.

Now Senior Vice President and CSO Technical Director for Brown and Caldwell, Peter Moffa has been a pioneer of CSO and stormwater solutions since the early 1970s, beginning with the USEPA's earliest CSO demonstration projects. He formed M&A in 1986. Through planning, design, and startup of many full-scale CSO abatement facilities, he established the firm as a market leader. He continues to serve as an EPA and WERF reviewer of wet-weather regulations, guidelines, and control strategies.

Here is some more detail on the value M&A has delivered to clients and the industry:

Benchmarking Decision Criteria for Urban Wet Weather Abatement, 1999. A WERF project that summarizes the experiences and best practices of more than 200 communities in abating stormwater, CSOs, and sanitary sewer overflows (SSOs).



Identifying and Communicating the Benefits and Risks of Disinfecting Wet Weather Flows. Another WERF project now underway to address the critical issues in wet-weather disinfection. This work is pivotal to impending EPA guidelines.

Vortex Demonstration Project for New York City. The NYC Demonstration Facility comprises three 43-foot-diameter units that represent different versions of vortex separation technology (USEPA, British, and German). M&A helped develop the work plan and conceptual design for the entire project and is currently evaluating data for a cost-effectiveness assessment. URS is prime consultant.

High-Rate Disinfection of Wet Weather for Detroit. Perhaps the largest wet-weather treatment facility of record, this Detroit plant will treat flows of 8.4 bgd at a satellite location. M&A innovated the conceptual design and hydraulic modeling that resulted in a 5-minute disinfection system instead of a system running at more conventional durations of 10 to 15 minutes. Hazen and Sawyer is prime consultant.

The Business's Best Technologists Merge Science and Solutions

Brown and Caldwell's passion for innovation drives the company to develop and engage the best technologists in the business. Time and time again, breakthroughs that creatively unite science and its practical application have yielded tremendous value to our clients. This passion for innovation is the force uniting our two companies.

M&A's approach to high-stakes problems has been very similar to ours: maintain confidence in basic science, show the courage to press for innovation, and keep your eye on the practical.

Our joining forces is particularly well timed with the recent passage of H.R. 828, the Wet Weather Water Quality Act of 2000. This bill signals the likely appropriation of billions of dollars for control of CSOs, SSOs, and stormwater discharges beginning in 2002.

But while H.R. 828 represents progress in recognition of wet-weather issues, it's only a start. Now, as ever, communities need help in forging workable answers to infrastructure needs. We are delighted that M&A's experts have joined our nationwide network of top technologists, whose answers include the smartest, soundest, and most cost-effective environmental solutions.

— CRAIG GOEHRING, P.E., CEO

Sharpen your competitive **EDGE** with easy-to-use, web-enabled **EMIS** solutions

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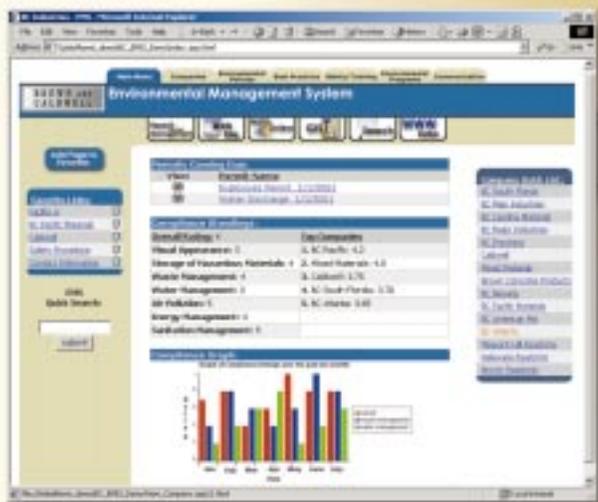
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