



The Canadian Water Industry

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Canadian Water Industry Spring 2008

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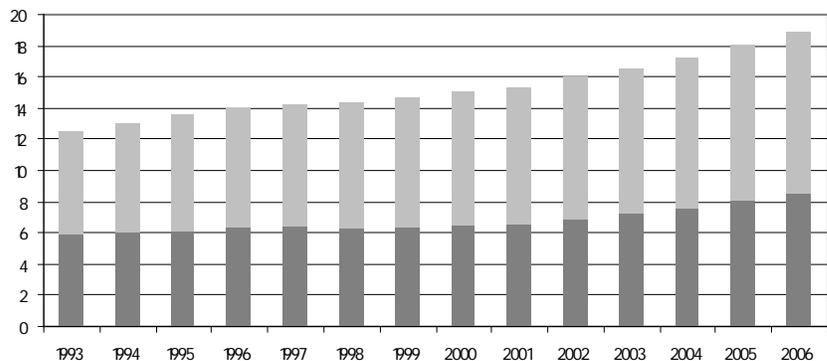
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The Canadian Environmental & Water Industry 1993-2006



Source: Environmental Business International Inc. Water industry is the darker portion. Data derived from research and interviews for Environmental Business Journal and EBI research reports; Industry Canada, Statistics Canada and other government sources; and EBI research funded by Industry Canada.

THE CANADIAN ENVIRONMENTAL INDUSTRY HAS BEEN RECOGNIZED AS A SIGNIFICANT CONTRIBUTOR TO THE CANADIAN ECONOMY for some time. Since the early 90s regional environmental industry trade associations have advocated business climates conducive to growth; provincial, territorial and federal government agencies, including Industry Canada, Environment Canada, Natural Resources Canada, Infrastructure Canada and Statistics Canada, have had programs dedicated to the environmental industry. And thousands of companies, large and small, operating in the Canadian environmental industry, have made Canada an example of progressive environmental policy and a thriving environmental industry.

The largest subcomponent of the Canadian environmental industry is the water industry. Recent research quantifies the Canadian water industry at \$7.8 billion, or 44% of the \$17.9 billion Canadian environmental industry (see table on page 2). Although the overall Canadian water industry operates at a trade deficit mostly due to the financial strength of U.S.- and European-based multinationals like GE and Siemens that have acquired their way to the top, export activity of Canadian companies in key water segments like specialty water treatment equip-

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	Canada Environmental Industry (\$bil)	Canada Water Industry (\$bil)	Canada Water Market (\$bil)
Equipment			
Water Equipment & Chemicals	1.48	1.48	2.14
Air Pollution Control	0.71		
Instruments & Info. Systems	0.08	0.03	0.05
Waste Mgmt Equipment	1.16		
Process & Prevention Tech.	0.08		
Services			
Solid Waste Management	3.56		
Hazardous Waste Mgmt	0.51		
Consulting & Engineering	1.52	0.50	0.55
Remediation/Industrial Svcs.	1.44		
Analytical Services	0.17	0.07	0.06
Water Treatment Works	2.93	2.93	2.91
Resources			
Water Utilities	2.82	2.82	2.80
Resource Recovery	0.84		
Clean Energy Systems & Power	0.61		
Total	17.91	7.83	8.51

SOURCE: Environmental Business International, Inc., San Diego, Calif. Units in US \$bil revenues generated by private and public sector entities. The Canadian environmental market was \$18.9 billion in 2006. Note that Industry+exports+imports=Market. Water Industry is revenues generated by Canadian water companies worldwide. Water Market is revenues generated from Canadian customers by all water companies. Data derived from research and interviews performed by EBI for Environmental Business Journal and EBI research reports; Industry Canada, Statistics Canada and other government sources; credible secondary sources.

ment, instrumentation and consulting & engineering services represents a significant portion of their revenues.

Overall the environmental market in Canada, as portrayed in the chart on page 1 and represented in 14 segments in the table above, accounted for \$18.9 billion in revenues in 2006 (note the industry figure minus exports plus imports equals the market figure), with annual growth over the past five years ranging between 3% and 5%, notably above the growth rate of the economy overall. Wa-

ter markets alone have grown 4-6% over the same time frame and accounted for 45% of the market in 2006.

One of the primary drivers for water and wastewater markets worldwide is the decades of underinvestment in infrastructure spending now coming due. The numbers are huge. A 2007 report by the **Federation of Canadian Municipalities** set the price for eliminating the municipal infrastructure deficit at \$123 billion, including a “sub-defi-

cit” for water and wastewater systems of \$31 billion. In 2006, under its long-term Building Canada program, Canada’s federal government made a historic commitment to infrastructure spending worth \$33 billion between 2007 and 2014. This would provide more funding for provincial, territorial and municipal infrastructure, and for a longer period of time, than any federal government since World War II. Some provincial governments have already taken action. Alberta, for example, has earmarked \$18 billion over three years for infrastructure projects. Respondents to a survey conducted for this review overwhelmingly identified municipal markets as promising the highest short-term growth and federal funding as by far the most crucial business issue in the coming years.

According to a November 2007 report by **Raymond James Equity Research - Canada**, an “unprecedented infrastructure and construction boom” is already underway. The report, entitled “Nation Building: How to Invest in Canada’s Infrastructure and Construction Boom,” identifies publicly traded companies likely to benefit in the water sector. It mentions, among others, the consulting & engineering (C&E) firm Stantec, technology and services provider GLV Inc., Bird Construction and Lockerbie & Hole.

Also standing to benefit from demand in the water/wastewater market are Canada’s water technology companies. Although there’s a consensus that the water industry won’t be characterized by silver bullets or dramatic technological breakthroughs, technology development and sales are being driven by the need for more efficient, less costly and more environmentally sound alternatives to old technologies, especially chemical treatment.

Canadian companies are noted for their role in developing UV disinfection and membrane filtration markets,

The Canadian Water Industry

This report was prepared for Industry Canada by Environmental Business International Inc. (EBI, San Diego, Calif.) It is available on the Internet at the following address: <http://ic.gc.ca/environment>. EBI specializes in defining emerging markets and generating strategic market intelligence for companies, investors and policymakers. EBI gave shape to the environmental industry when it launched Environmental Business Journal in 1988. EBI’s segmentation and quantification was later adopted by the U.S. agencies, OECD and other government and private sources. In 2008, EBI launched Climate Change Business Journal.

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The Canadian Water Industry 2006: Equipment & Services

	CAN ind	CAN mkt	surplus	exports	imports	%export	%import
Equipment							
Water Equipment & Chemicals	1.48	2.14	-0.66	0.28	0.94	19%	44%
Instruments & Info. Systems	0.03	0.05	-0.03	0.01	0.04	39%	70%
Services							
Consulting & Engineering	0.50	0.55	-0.05	0.07	0.12	14%	23%
Analytical Services	0.07	0.06	0.00	0.01	0.00	8%	1%
Water Treatment Works	2.93	2.91	0.01	0.03	0.01	1%	1%
Water Utilities	2.82	2.80	0.01	0.04	0.03	1%	1%
Total	7.81	8.52	-0.71	0.43	1.14	6%	13%

SOURCE: Environmental Business International, Inc., San Diego, Calif., units in US \$bil revenues generated by private and public sector entities. CAN ind is Canadian Industry or revenues generated by Canadian companies worldwide. CAN mkt is revenues generated from Canadian customers by water companies worldwide. Data derived from research and interviews performed by EBI for Environmental Business Journal and EBI research reports; Industry Canada, Statistics Canada and other government sources; credible secondary sources and EBI research funded by the Commission for Economic Cooperation and Industry Canada.

segments experiencing good growth. “A few niche segments are experiencing rapid growth,” observed Rona Fried, one of the authors of “Investing in Water,” a report by **Progressive Investor**, a sustainable investment research firm. “Ultraviolet radiation and membrane filtration are growing 15% a year, as they replace chlorine for disinfection. Metering and monitoring are strong growth areas, as is desalination.”

Canada’s mining, oil and gas and pulp & paper industries have proven good breeding grounds for water and wastewater treatment technologies, some of which are being applied to a wider range of industries. Companies like BioteQ, GLV and Schlumberger, profiled in this review, come to mind.

Technologies with a green appeal are also garnering attention. Some are simply more energy efficient, reducing operational costs and greenhouse gas emissions. Others not only treat but recycle. For example, **Ostara Nutrient Recovery Technologies Inc.** (Vancouver, British Columbia), whose first commercial scale plant began operating in Edmonton in May 2007, is commercializing proprietary technologies that remove phosphorus, ammonia and other nutrients from municipal biosolids and recycle them into environ-

mentally safe commercial fertilizer.

Global Markets Hold Promise

A survey of the Canadian Water Industry conducted for Industry Canada in March 2008 revealed that companies believe municipal wastewater treatment plants and municipal water utilities represent their best growth prospects. However, global water scarcity and the demand for water and wastewater treatment is also driving business overseas. These markets are fueled by rapid economic liberalization and increased demand for clean water from growing middle classes in Brazil, Russia, China and India. China stands out in scope. Asked in an open-ended question in which region or segment of the global water market they believed the Canadian water industry has a competitive advantage, a large portion of respondents mentioned China and India.

China has announced it is planning to invest over \$125 billion by 2010 in building wastewater treatment plants and upgrading nationwide water distribution systems. “Almost everyone you talk to in the industry is doing something in these countries,” said Steve Maxwell, managing director of **TechKNOWLEDGEy Strategic Group** (Boulder, Colorado) and a water industry expert. “There’s hardly

a conversation where China, India, Brazil or Russia doesn’t come up. The feeling is that eventually local providers will take over the basics, like steel pipe, pretty quickly... but the water diversion projects and pollution problems are overwhelming. The globalization of opportunity is definitely there.”

Canadian companies responding to the Industry Canada survey expressed confidence in the ability of Canadian

Growth Rated by Region

Regional Market	Percent Rated High or Very High
Eastern Europe	36%
Middle East	35%
Rest of Asia	29%
Africa	29%
United States	29%
Mexico	26%
Canada	24%
China	21%
India	18%
Western Europe	18%
Latin America	17%
Japan	8%

Source: Canadian water survey conducted by EBI Inc. on behalf of Industry Canada in March 2008. Global markets are ranked by the sum of those whose growth was rated ‘high’ and ‘very high’. Respondents were encouraged to respond only to regions they felt qualified to rate. Survey question was: What growth rate do you anticipate for your water and wastewater business in the following regions in 2008-2010?

Importance of Management and Funding Issues

Management and Funding Issue	Crucial	Very Important	Important	Not Very Important	Meaningless	No Opinion
Small-Scale Point-of-Use Systems	11%	22%	38%	20%	4%	4%
Mid-Scale Point-of-Entry Systems	9%	25%	41%	16%	5%	5%
Large-Scale Centralized Systems	4%	38%	45%	9%	2%	2%
Municipal Ownership	8%	24%	37%	18%	6%	6%
Municipal Management	8%	22%	37%	20%	6%	6%
Private Ownership	6%	33%	38%	19%	2%	2%
Private Management	11%	30%	40%	15%	2%	2%
Federal Funding	21%	25%	30%	13%	6%	6%
Private Funding	10%	31%	37%	12%	6%	6%

Source: Canadian water survey conducted by EBI Inc. on behalf of Industry Canada in March 2008. Management and funding issues are listed in the order presented in the survey. Respondents were encouraged to respond only to management and funding issues they felt qualified to rate. Actual survey question was: Please rate the relevance of each system or business issue to the future of the global water/wastewater industry.

companies to compete internationally. “Very novel solutions have been developed in Canada that have huge export potential,” said one respondent, who identified strong technology development as a competitive advantage. Other respondents cited treatment of salinated and contaminated water by various technologies; optimisation of biological treatment; and a globally strong reputation for engineering, in addition to designing and operating water and wastewater plants. Leadership in the application of UV and membrane technologies in terms of product superiority and applications experience was also cited as a competitive advantage.

While the world’s fastest-growing economies indeed represent a Wild West of opportunities, Canada’s neighbor to the south also remains a huge opportunity. Water infrastructure in the United States will require a \$1 trillion overhaul over the next 20 years and faces a shortfall of a half of a trillion dollars, according to the American Society of Civil Engineers. U.S. companies have indeed made inroads and acquisitions in Canada, but the flow is going both ways in an increasingly competitive and cooperative market.

Results of Canadian Water Industry Survey

In March 2008, 64 Canadian com-

panies responded to a Water Industry Survey fielded by Environmental Business International Inc. on behalf of Industry Canada. Forty-two percent of respondents were from the wastewater treatment equipment & systems segment, 8% from water delivery equipment and chemicals, 7% from water utilities and 20% from the C&E segment with a breadth of other segments and experts responding.

Growth: Perhaps reflecting the knock-on effect of the credit crisis in the United States (51% of respondents do business with the U.S.), one quarter of companies reported flat growth and 10% reported declining revenues in 2007. Median growth was a modest 3%. However, companies across the board were more optimistic about how 2008 is shaping up, with 10% expecting 20-25% growth; 51% forecasting up to 20% growth; and only 10% forecasting flat growth. The median growth forecast was 8%.

Global Business:

After Canada and the United States, Mexico was the country in which most companies did business (18% of respondents), followed by Western Europe (16%), China (14%) and other Asia (12%). Asked to anticipate regional growth rates for their water and wastewater business in 2008-2010, 36% of respondents anticipated high/very high growth for Eastern Europe, followed by the Middle East, Asia and Africa.

Market Drivers: Asked to rate the importance of market drivers to creating business opportunities in water and wastewater, regulations understandably topped the list. Provincial/state regulations rated as crucial/very important by 67% of respondents; federal regu-

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Growth Prospects by Customer Type

Customer Segment	Percent Rated High or Very High
Municipal wastewater treatment plants	61.1%
Municipal water utilities	57.4%
Oil & Gas	44.2%
Private water utilities	35.8%
Food	34.6%
Residential	33.3%
Mining	28.8%
Commercial	28.0%
Other government	23.7%
Power Utilities	22.6%
Chemicals	17.3%
Other manufacturing	17.3%
Electronics	11.5%
Pulp & Paper	11.3%
Steel	9.6%

Source: Canadian water survey conducted by EBI Inc. on behalf of Industry Canada in March 2008. Customer segment are ranked by the sum of those whose growth was rated ‘high’ and ‘very high’. Respondents were encouraged to respond only to customer types they felt qualified to rate. Actual survey question was: Rate the following customers by their growth prospects for your company over the next 2-3 years.

Canadian Companies Expand into Global Markets With UV and Membrane Filtration

Zenon, Trojan, H2O Innovation and UV Pure Technologies explore a growing range of applications for their water and wastewater treatment technologies.

AS DEMAND FOR HIGH-QUALITY WATER BY THE PUBLIC AND INDUSTRY GROWS, AND AS THE TREND TOWARDS TREATING WASTEWATER TO STRINGENT STANDARDS FOR REUSE ACCELERATES throughout the North American continent and other regions of the world, the use of advanced treatment technologies such as membrane filtration and ultraviolet (UV) disinfection continues to expand.

Membranes are finding their way into an increasing number of applications, migrating from the drinking-water arena into wastewater recycling and, in the case of reverse osmosis (RO) membranes, seawater desalination. Meanwhile, UV technology is gradually displacing chemical treatment as the solution of choice for drinking-water disinfection, although UV marketers still encounter resistance to the concept.

Canadian companies can certainly stand with the world leaders in membrane and UV technology. "Canadians are the world leader in the application of ultraviolet and membrane technologies," noted Alan Clark, managing director of the water equipment distributor **Challenger Filtration Ltd.** (Edmonton, Alberta). "Our competitive advantage lies in the superiority of our products and applications experience and in continuing to educate industry on the superiority of UV and membranes in new applications."

In fact, two Canadian firms—**Zenon Environmental** and **Trojan Technologies**—were so dominant in their respective fields that they were prime targets for acquisition during the rampant consolidation of the water treatment sector in the first half of this decade. Zenon, an Oakville, Ontario-based maker of ZeeWeed and other membrane products, was purchased by **GE Water & Process Technologies** (Trevose, Pennsylvania) in 2006 for \$689 million—a hefty premium for a company that

had recorded \$238 million in revenues during 2005. In 2004, Washington, D.C.-based **Danaher Corp.**, a diversified company with businesses in water treatment, medical and environmental instrumentation, and industrial tools and components, purchased the stock of UV leader **Trojan** (London, Ontario) in a transaction valued at \$185 million.

For market growth, it's hard to beat China, which will rank at number two in microfiltration and number four in RO by 2012.

The market opportunity for Zenon and other Canadian suppliers of membrane products, including RO, microfiltration, ultrafiltration and nanofiltration systems, is truly global in scope. According to the market research firm **McIlvaine Co.** (Northfield, Illinois), the global market for RO, microfiltration and ultrafiltration membranes will grow from \$8.8 billion in 2008 to \$12.4 billion in 2012. The RO market, representing about one-third of that total, is especially strong in the United States, Japan, Saudi Arabia, China and Spain. Canada, with essentially no need for seawater desalination—a major application of RO technology—checks in at number 22. It ranks higher on the list of top national markets for microfiltration—at num-

ber 10—because of the growing need to filter municipal drinking water.

McIlvaine estimates that membrane sales to Canada's pulp and paper industry will total about \$45 million in 2008, growing modestly at about 5% per year. The next largest Canadian market for membrane products is the municipal drinking water sector at about \$22 million and growing at a 7% annual rate. A third leading market for membranes in Canada is the \$10-million residential segment, in which homeowners concerned about the quality of their water are installing RO units under their sinks.

For market growth, however, it's hard to beat China, which will rank at number two in microfiltration and number four in RO by 2012—"up from almost nothing five to ten years ago," according to Robert McIlvaine. "The Chinese have a very bad situation in terms of their water supply. It's a very dry country with lots of people, so RO and microfiltration will be in demand, not only for desalination but also for industrial applications requiring high-purity water." Coal-fired power plants also represent a major membrane market in China, which according to many reports is bringing a new facility on line every week to 10 days.

McIlvaine also identifies membrane bioreactor (MBR) technology as a major growth segment of the membrane market. MBR systems are being used to remove heavy metals from the wastewater generated by coal-fired power plants, and they are increasingly finding use in municipal wastewater treatment. In fact, their small footprints make them attractive for decentralized treatment applications. "The advantage for, say, a new suburb is that, instead of pumping effluent to a distant wastewater treatment plant, you can install one of these MBR systems on site," noted McIlvaine.

Zenon has been pursuing the MBR market aggressively and can boast some major project wins. In February 2008, it announced that its ZeeWeed MBR ultrafiltration technology was selected as part of a \$250-million upgrade and expansion at the Yellow River Water Reclamation Facility in Gwinnett County, Georgia. According to the company, the compact ZeeWeed technology will contribute significantly to a \$50-million savings in the project's capital costs owing to reduced need for concrete, steel, and labor.

Zenon is not the only Canadian membrane supplier that is succeeding in the United States and in foreign markets. Eight-year-old **H2O Innovation Inc.** (Quebec City, Quebec), a manufacturer and supplier of the full range of membrane products as well as biological treatment systems, enjoyed substantial growth in 2007, a year "book-ended" by acquisitions designed to establish a U.S. presence and expand the company's Canadian and overseas business.

Desalination a Key Growth Market for H2O Innovation

In December 2006, H2O Innovation acquired San Diego-based **Membrane Systems Inc.** (MSI), a deal that brought on board considerable experience and know-how in membrane technology, according to Olivia Dion, H2O Innovation's marketing coordinator. MSI performed design and engineering work for a portion of the Ground Water Replenishment System in Orange County, California, and H2O Innovation is looking to leverage MSI's expertise in microfiltration and ultrafiltration as it pursues the very hot water recycling market in the United States. The integration of MSI helped H2O Innovation increase its sales by 38% during the second half of 2007.

The water recycling market in Canada, by comparison, will take a while

to develop, Dion observed. In Canada, it's still a matter of educating the public about the need and the technology, she noted, but the time will come when the need to reclaim water will be clear. For the time being, however, the best opportunities for membrane sales will be in the United States.

Other highlights of 2007 for H2O Innovation were its listing on the Alternext exchange in Paris—the first North American company to be listed there, according to Dion (the firm is also listed on the Toronto Stock Exchange). In addition, the company raised \$15.5 million in equity financing from the Dutch bank *Amsterdams Effectenkantoor B.V.* (AEK). Dion said that the company will use this financing to support project work and make additional acquisitions.

H2O Innovation finished 2007 with another acquisition, of Calgary-based **Sigma Environmental Solutions Inc.**, another specialist in membrane technology. With the addition of Sigma, H2O Innovation expanded its presence in western Canada, where the firm sells packaged water treatment systems to First Nations and other small communities, and to the oil and gas exploration and mining industries. Sigma also sells membrane systems in India, thereby extending the overseas reach of H2O Innovation, which already had a distributor in Egypt. A partnership formed in July 2007 with S.M. Group International Inc. in Algeria extended that reach even further.

The S.M. Group partnership serves as a platform for H2O Innovation to build a presence in the emerging desalination market, which is a key growth market for the company, according to Dion. "There's a big demand, and it's the future, in the United States and around the world." H2O Innovation also sees the MBR market as very attractive, she said, adding that entry into the MBR busi-

ness would probably come through an acquisition or a partnership.

Dion describes her firm as a water treatment "pure play" that, in addition to manufacturing its products at its 65,000-square-foot facility in Ham-Nord, Quebec, performs all the design, engineering, and installation of its systems. A significant portion of its business is custom work.

Look for membrane technology to command the lion's share of the fast-growing global water recycling market compared with other technologies. According to the market research firm **Frost & Sullivan Inc.** (London, U.K.), membrane-based systems represented 76.4% of the \$676-million water recycling market in 2006, followed by media filtration systems at 17.2% and activated carbon at 6.4%. Rather than undergoing any major breakthroughs, membrane technology is advancing on an incremental basis, sporting ever-smaller footprints, producing higher-quality effluent, and becoming easier to operate and maintain, according to Frost & Sullivan research analyst Prabu Sethuraman. They do, however, suffer from higher installation costs, and there's still a general lack of knowledge about basic membrane mechanisms, he added.

UV Treatment Takes Share From Conventional Systems

Like the membrane market, the UV treatment market is on a solid growth trajectory. **BCC Research** (Norwalk, Connecticut) estimated that the U.S. market for UV disinfection of drinking water totaled about \$29.2 million in 2006 and will grow at a 38.6% average annual growth rate to more than \$149 million in 2011. Deaths caused by waterborne diseases in U.S. and Canadian cities, including Milwaukee, Wisconsin, in 1993 and Walkerton, Ontario, in 2000, alerted water utilities on both sides of the border to the shortcomings conventional wa-

ter treatment and elevated interest in advanced water treatment technologies such as UV, microfiltration and ultrafiltration, according to BCC.

Concern about biological contamination and the formation of disinfection by-products in conventional chlorine treatment is driving increasing sales of UV treatment equipment in Europe as well, according to Frost & Sullivan. "UV systems, in particular, are entering a period of high growth and offering strong competition to the chlorine-based compounds market," Frost & Sullivan said in releasing a report on the European water and wastewater disinfection systems market in May 2007. The firm estimated that UV technology commanded a 29% share of the European disinfection technologies market in 2007 (\$149.2 million U.S.), ahead of the 18% share held by the ozonation segment and growing at a faster pace, but trailing the 40% share held by chlorinated chemicals.

A study released last October by **Helmut Kaiser Consultancy** (Tübingen, Germany) concluded that UV treatment will grow at an even faster pace in Asia than in Europe or North America. The "booming economy and immense scale of infrastructure construction" is one driver, the firm said, along with the warm and humid climate of the south and southeast Asia, which "imposes special requirements on...water disinfection."

Trojan, which claims the largest installed base of UV systems worldwide, has enjoyed success in this exploding Asian market, and in China especially. The company announced in February 2007 that it had been rated number one in the category of "outstanding UV disinfection equipment brand" and "outstanding disinfection equipment brand in the annual "Outstanding Equipment Survey" conducted by China Water Net, an on-line resource for the Chinese water industry.

Up to late 2005, Trojan had focused on the municipal water and wastewater treatment market, but as UV applications in industrial water and wastewater treatment grew, it made a move to strengthen that side of the business through the formation of a partnership with **Aquafine Corp.** (Valencia, California). Aquafine is a maker of UV equipment for industrial and commercial applications and a highly regarded innovator in UV product engineering.

UV technology is gradually displacing chemical treatment as the solution of choice for drinking-water disinfection.

The appeal of UV is growing as the public places increased emphasis on the use of environmentally friendly technologies in water and wastewater treatment, UV suppliers say.

UV Is Established for Water Disinfection, Gaining Acceptance for Wastewater

"Chlorine is losing popularity [because of] the by-products produced," noted Danielle Lee Williams, marketing coordinator at Toronto-based **UV Pure Technologies Inc.**, which markets UV treatment systems based on the company's patented Crossfire technology to the residential, municipal, commercial, and industrial markets. "UV is established as a disinfection method for drinking water worldwide and is gaining acceptance for wastewater applications," she continued. "As the supply of fresh drinking water becomes less available, it becomes vital to have effective and environmentally friendly methods of disinfection."

In Canada, where UV Pure does the majority of its business, the UV business is "strong in Ontario and British Columbia and gaining momentum in Quebec," according to Williams.

In the United States, UV Pure has a good presence in California, New York, Ohio, and Wisconsin, but Williams confided that penetrating these different state markets has presented a challenge. "Every state has different regulations," she explained. "The U.S. and Canadian markets are very different, and we spent much time learning and understanding the U.S. market."

Overseas, "there is much potential in Australia, New Zealand, China and, according to industry experts, the Middle East," Williams said. During 2007, UV Pure established its Upstream line of products for the residential market and is selling those systems in the United States, Australia, New Zealand, China and Brazil. Other highlights of 2007 included the completion of an installation in China, the rollout of the its next-generation Hallett 15xs system, and the formation of a co-marketing initiative with the U.S. water treatment company **Kinetico** (Newbury, Ohio), an arrangement that "put our systems in a retail environment," according to Williams.

UV's displacement of carbon as the technology of choice for disinfecting potable water has not been without its challenges, however. Educating users about the technology's capabilities is ongoing, confided Challenger Filtration's Alan Clark. A supplier of UV systems made by Trojan Technology, Challenger has found the UV market to be fairly flat.

"That's been true for quite a number of years," Clark acknowledged. "We had anticipated that UV would constitute an increasingly large portion of our sales, because it is a disruptive technology and will change the way facilities treat water." Owing in no small part to the growing concerns about worker exposure to chemicals and the liabilities of chemical storage, "we've always believed that there are all types of issues that lend them-

selves to application of UV technology.” Unfortunately, he added wryly, “we tend to be all too visionary. We’ve had this belief since the 1980s.”

The sales effort, then, requires a lot of education, “right from the elementary stage,” Clark continued. “We run into questions such as, ‘how do I know that UV actually kills bacteria?’... We’ve been pioneers in taking UV into a lot of industries and applications, and we frequently find ourselves starting at square one—how UV kills, and how it is superior to chemical products—not just in efficiency but also environmentally.”

Because educating municipalities and regulators is so time-consuming, Challenger understandably spends most of its time marketing into other, more lucrative markets, such as plastics manufacturing, large buildings with their cooling tower systems, and the oil and gas industry, which commands an enormous portion of the firm’s business in Alberta. These are all clients with high treatment system maintenance costs, “and when you can convince these clients that they can avoid those maintenance costs, that’s 80% of the battle,” Clark remarked.

Interestingly, the general public is often out in front of the municipal authorities and regulators when it comes to interest in UV, he added. “When we have an event such as Walkerton, the phones light up,” he observed, taking pains to emphasize, however, that this business is cyclical and almost totally unsolicited.

However, the technology is catching on with engineers, even if the progress has been slow. The city of Edmonton now has a UV treatment requirement, for example. It’s a matter of gaining ground on the well-entrenched chlorine industry, according to Clark. “It will take the universal acceptance of the engineering community to realize that UV is a safe thing to do.” §

Integrated Water & Wastewater Technology Companies Grow Organically and By Acquisition

GLV evolves from pulp & paper services and Schlumberger from an oilfield parent to serve a growing range of customers in water and wastewater.

WHILE THE CANADIAN WATER AND WASTEWATER TREATMENT INDUSTRY BOASTS MANY SMALL TO MEDIUM-SIZED ENTERPRISES that target niche markets with proprietary technology and entrepreneurial zeal, the industry also features some very large, integrated companies that offer a wide array of services and products. Two companies that have grown dramatically through acquisition and organic growth over the last several years are **GLV Inc.** and **Schlumberger Water Services.**

GLV Inc. (Montreal), a public company traded on the Toronto Stock Exchange, was founded on May 15, 2007 to carry on the activities of Groupe Laperrière & Verreault Inc.’s (GL&V) Water Treatment Group and Pulp and Paper Group. GLV’s predecessor entered the water and wastewater treatment sector in the 1990s by way of providing process water to clients in pulp and paper manufacturing, food processing, mining and other industries. In 2000, GL&V acquired **Environmental Equipment & Systems**, a specialist in municipal wastewater treatment; and in 2002, it purchased **EIMCO**, which served both municipal and industrial water treatment markets. Six more acquisitions in the water and wastewater treatment sector have been made as of March 2008, providing GLV’s Water Treatment Group with a broad portfolio of advanced technologies and trademarks recognized worldwide, the latest of which was **AJM Environmental Services** (Sydney, Australia), specialists in wastewater treatment and re-use primarily for food and beverage applications. “It’s a sign of the times,” said Michel Masini, general manager for the company’s Water Treatment Group in Canada. “You need to have concentration, rationalization and globalization of resources.”

Schlumberger Water Services (Waterloo, ON, Vancouver, BC) evolved out of its parent company’s Schlum-

berger Oilfield Services. “About five or six years ago, we understood that there was going to be a lot of stress and pressure on water resources worldwide,” said Dominique Pajot, marketing & technical manager. “We also realized that a lot of the technology we’d developed for the oil business would apply well to everything having to do with identifying, assessing and managing groundwater resources.”

Schlumberger has since acquired a number of companies with specific technology, including **WestBay** (Vancouver), which focuses on testing aquifer water quality, **Waterloo Hydrogeologic**, which came out of the University of Waterloo, and **Van Essen “DIVER”** in Holland.

Schlumberger Expands from Water Resources Management into Desalination, Mining Wastes

With its internal and acquired technology, Schlumberger initially focused primarily on water resource management services such as characterizing and monitoring groundwater aquifers. “That’s what we felt we’d immediately be good at,” said Pajot. “It’s mostly public sector work that involves tendering processes and pretty long cycle times for bidding.” In addition to publicly funded projects in Canada and the United States, the water services group also works in developing countries. “Those projects are usually

funded by international funding bodies such as the World Bank, US AID, the European Union and the Canadian International Development Agency.”

“We’ve worked in other specific segments, such as desalination, which I call “new water,” because it is added to the body of freshwater supply,” said Pajot. “We’ve developed some special services such as storing [desalinated] water in the ground—Aquifer Storage & Recovery (ASR)—for regions and countries that rely on desalted water. Either they need to build very big tanks on the surface or they can use smarter techniques like storing water in aquifers, a technique that was first invented in the U.S. and Australia... We’ve developed to a pretty high level of predictability and accuracy how much water will be recovered after it’s injected into an aquifer.”

“Desalination is a big trend for the Middle East, the Mediterranean, the U.S. Southwest, Florida, Australia and Spain,” said Pajot. “In many of these regions, people cannot count so much on their natural water resources. ... There have also been a lot of improvements in desalination techniques, in particular the membrane technologies such as reverse osmosis.”

The mining industry is another major focus for Schlumberger. Mines that use water to recover gold, copper, diamonds, uranium and other minerals need to clean and re-circulate water, according to Pajot. Open-pit mines also require dewatering services. “That involves designing the drainage of the pit using a number of wells and pumps to lower the water table, maintain the slope stability and ensure people and their equipment can work in a dry and safe environment,” he said.

As the company has built out its water practice, it has not gone into the arena of building water treatment plants but instead stays focused on water resource management. “This area is very much based on intervention from

consultants and provision of off-the-shelf technologies,” said Pajot. “We do a combination of consulting services and deploying technology, the latter being a combination of existing oilfield sector technologies and others that we’ve acquired or developed specifically for water. This philosophy will guide future acquisitions as well. We are still looking for companies, particularly technology firms and good consulting firms.”

Looking toward the future, Pajot predicted rapid growth of demand for water services in China and India. “Their water problems are getting very severe,” he said. “It looks as if their key priorities are going to be sanitation and getting proper distribution systems and treatment systems built.”

Pajot also expects climate change to have a growing impact on water resources, with greater call for resource management technology and systems. “Just think of the fact that some of the glaciers are melting. That means storage of freshwater is decreasing because glaciers are big, important agents in storing water,” said Pajot. At the same time, increasing temperatures will mean more water demand for agriculture. “The warmer it gets, the more water you need for irrigation.”

GLV Adds Technologies, Expands Beyond Municipal Base

Incorporated in 1975, GL&V initially specialized in technological solutions for pulp and paper production. As noted above, its growing water and wastewater practice which started in the 1990s has since branched out, largely through acquisition, and is now pursued by GLV. For the fiscal year ended March 31, 2007, the Water Treatment Group’s (Eimco Water Technologies) revenues exceeded \$200 million, about two thirds from the municipal water and wastewater sectors and one third from industrial business, including wastewater, process water and water intake screen-

ing. Forty-seven percent of the group’s business was done in North America, 43% in Europe and Russia and 10% in the Middle East, Asia and Africa.

According to Masini, the several acquisitions in the water and wastewater treatment sector have included companies with more than a century of history. “Brackett Green, which we acquired a few years ago, has been around since 1899 and is a world leader in the power industry,” he said. EIMCO and Dorr-Oliver, GLV’s flagship water services brands, have been in operation since 1884 and 1867 respectively, according to Masini.

Acquisitions have also been strategically guided to focus on key market segments, he said, noting the March 2008 acquisition of AJM Environmental Services in Australia, which has a business focused on food and beverage manufacturers. “We’ll see more acquisitions in specialty fields such as oil and gas, pharmaceuticals and other sectors. Our goal is to leverage off our existing position in municipal markets, which is really the backbone of our business, to grow steadily and cautiously.”

In the municipal wastewater market, Eimco Water Technologies’ submerged membrane bioreactor (MBR) treatment technology allows users to expand their water treatment capacity without adding significant extra space, according to Masini. “They can produce two-and-a-half to three times the effluent in a given footprint,” said Masini. “Automation features also allow the operator to expand while limiting the need for new personnel.”

“Because we have a fairly wide spectrum of products, we can offer MBR, additional accessories for pre-treatment and for dewatering, and also can install the equipment,” said Masini. “Not only do we offer specific solutions for the process at stake but we can also offer a complete solution for the client.”

In terms of trends in the markets it serves, Masini said water discharge guidelines are becoming progressively more stringent. “Canada is moving very slowly to new, more stringent standards [but] in Southern Europe, there are already really stringent requirements. In Spain, Portugal, Southern France, Southern Italy and Greece, water is very scarce. Governments are encouraging water re-use and water recycling for non-potable applications, mainly irrigation.”

“In Southern Europe, it’s a pragmatic issue. They need water. It’s a matter of life and death,” said Masini. “In Southern Spain, there are huge new developments, towns of 30,000 people like green oases right in the middle of the desert thanks to water treatment, water re-use and water recycling.” Southern U.S. states facing similar water shortages are also embracing water re-use as a viable alternative for non-potable water applications.

Aside from complying with regulations, positioning new projects as “green” is also becoming a more common market driver in the United States. “For recreational, commercial or residential projects, more and more developers are approaching us and asking what we have that can help them in achieving either the gold or platinum LEED levels,” said Masini. “Water recycling with MBR can provide them with up to six points in LEED certification.”

“In Canada we see similar trends, and of all the provinces we see B.C. as being a very strong leader in that field,” said Masini. He highlighted the water treatment system that Eimco Water Technologies is developing for Cultus

Relevance of Technologies to the Future of the Water Industry

Water Technology	Crucial	Very Important	Important	Not Very Important	Meaningless	No Opinion
Biotreatment	15.2%	41.3%	34.8%	0.0%	4.3%	4.3%
Ultraviolet	14.6%	39.6%	20.8%	12.5%	6.3%	6.3%
Membranes/Reverse Osmosis	20.0%	28.9%	31.1%	11.1%	4.4%	4.4%
Automation & Instrumentation	17.4%	30.4%	32.6%	10.9%	4.3%	4.3%
Membranes: Ultrafiltration	16.3%	30.2%	34.9%	14.0%	2.3%	2.3%
Advanced Oxidation	20.0%	25.0%	35.0%	15.0%	2.5%	2.5%
Aeration	13.6%	27.3%	38.6%	11.4%	4.5%	4.5%
Desalination	13.6%	25.0%	25.0%	27.3%	4.5%	4.5%
Information Sys. & Software	12.8%	25.5%	34.0%	19.1%	4.3%	4.3%
Membranes: Nanofiltration	13.6%	20.5%	36.4%	15.9%	6.8%	6.8%
Ozonation	8.3%	25.0%	31.3%	22.9%	6.3%	6.3%
Anaerobic Digestion	4.5%	25.0%	52.3%	9.1%	4.5%	4.5%
Chlorine & Chemicals	10.6%	12.8%	31.9%	31.9%	6.4%	6.4%
Ion Exchange	7.3%	14.6%	24.4%	39.0%	7.3%	7.3%
Dissolved Air Flotation	7.7%	10.3%	46.2%	20.5%	7.7%	7.7%
Thermal Treatment	2.5%	7.5%	20.0%	50.0%	10.0%	10.0%

Source: Canadian water survey conducted by EBI Inc. on behalf of Industry Canada in March 2008. Technologies are ranked by the sum of ‘crucial’ and ‘very important’. Respondents were encouraged to respond only to technologies they felt qualified to rate. Actual survey question was: Please rate the relevance of each technology to the future of the global water/wastewater industry.

Country Resort in the mountains east of Vancouver. “It’s a recreational center, so they’re going to have ups and down in terms of population, with weekends seeing more people. The membrane technology is capable of stopping and shutting down in a short period of time.” For the Cultus project, Eimco Water Technologies partnered with **Corix** (Richmond, B.C.), a firm that specializes in building and operating water and wastewater treatment plants. “Corix is the executing and operating arm, and Eimco Water Technologies is the equipment supplier,” said Masini.

On large projects, GLV generally partners with engineering, procurement and construction (EPC) firms. As the company approaches the opportunity to treat water from the fast-growing Canadian oil sands sector, such partnerships will be mandatory, according to Masini. “We’ve been approached by a number of large oil companies asking us what we can do,” said Masini. “We can certainly do something, but owing to size of the projects, in the \$100-million range, we need partners that are

able to look at financial aspects as well as the long-term legal implications. We’re in discussions with a number of potential partners.” Masini anticipates that design, build, operate (DBO) contracts will be preferred by some clients, so GLV is seeking partners with the relevant experience to project costs from 10 to 20 years into the future.

Many manufacturing clients are also best served with such partnerships, according to Masini. “The client doesn’t necessarily want to buy equipment, it wants to receive a full solution,” he said. “We as the equipment supplier have to find partners that offer not only engineering solutions but to a certain extent financing, even to the point of managing the overall operation of the water treatment plants on a cost per gallon basis. ... That model is very widespread in Europe, but just beginning to occur in Canada. Industrial investors don’t necessarily want to invest and take on legal liability [for wastewater management]. They’re in business to make chemicals, food, etc., not to manage wastewater.” §

Canadian Water Engineering Firms Take Leading Roles In Getting More From A Stressed Resource

In the following profiles, C&E firms Stantec, AMEC Earth & Environmental and Jacques Whitford share perspective on the water and wastewater business.

WHETHER YOU'RE IN CANADA, THE UNITED STATES, OR ALMOST ANY OTHER POPULATED REGION OF THE WORLD, the fundamental challenge of water management is to squeeze every available drop for growing residential, agricultural, commercial, or industrial use while ensuring the high quality that users increasingly demand.

In this context, the meaning of "availability" has understandably evolved, as innovators find ways to husband the resource at the front end and better treat and reuse the resource at the back end. All this must take place as water managers and their consultants and engineers struggle with grossly inadequate budgets, thus compelling another level of innovation.

Scarcity has long been the fundamental driver for the stable, steady water business, and not just in the arid regions of the world, such as Australia, the Middle East, and the American Southwest. Population growth and migration strain water supplies even in rain-rich areas like the eastern part of North America.

Even Canada must make critical judgments in the face of scarcity, brought on by a growing population (largely through immigration) and an increasing need to assign the available water resource to environmental ends as well as human ones. Blessed with the fourth largest source of fresh water of any nation in the world, Canada is regarded by many as water rich and not in any imminent danger of running out of fresh water. Some resource experts, however, argue a much more conservative view.

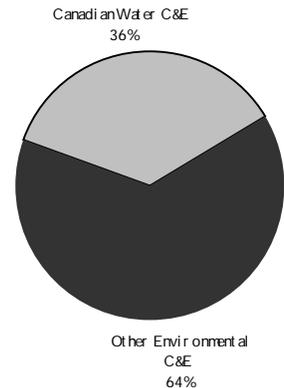
"Canada is not water rich," writes geologist Harvey Thorleifson in the January/February 2008 issue of *Canadian Water Treatment*. "Any water trans-

fer or impact on water quality has consequences for users downstream that increasingly are unlikely to be tolerated, especially as climate change raises concerns for our future water supply," noted Thorleifson, who is a former president of the Geological Association of Canada and the Canadian Federation of Earth Sciences. "We therefore have recognized the need to have a comprehensive understanding of our water, especially the little understood groundwater resources that provide drinking water for nearly one-third of all Canadians, and we see the broader water agenda that governs our economy, health, vulnerability, and heritage."

As Thorleifson points out, strains on water resources are compounded as the changing climate potentially leads to more extreme and radically altered weather patterns. Several months of drought in the southeastern United States, for example, may or may not be related to rising global temperatures, but the situation is certainly an extraordinary and perilous one, and one that has prompted a bitter battle among the states of Georgia, North Carolina, Tennessee, Alabama, and Florida over control of river resources in the region.

Georgia legislators even went so far, earlier this year, to propose the movement of its border with Tennessee by about one mile north to gain greater control of an important river resource, claiming flawed surveyors' findings from the 19th Century as the proximate justification for the move.

Water Represents 36% of Canada's \$1.5-Billion Environmental C&E Business



It's not just about the dryness, either. Flooding afflicts cities and other vulnerable areas with property damage and threats to water quality. As is increasingly understood, uncollected and managed runoff also represents a waste of an eminently tappable resource—an understanding that affects the choice of management solutions, with the most progressive communities looking at green roofs and other innovative building and landscaping options. Both Canada and the United States are in the midst of implementing major regulatory programs aimed at controlling urban stormwater runoff, with water quality protection a key regulatory goal. Stormwater issues are likely to be exacerbated as rising global temperatures lead to more frequent and intense weather events.

The United States and Canada share another issue—limited financial resources to address not merely the stormwater issues but the whole panoply of measures required to maintain, upgrade, and rehabilitate municipal water and wastewater infrastructure. In the United States, the U.S. Environmental Protection Agency (EPA) issued in 2005 its Drinking Water Infrastructure Needs Assessment and Survey, pointing to a \$277-billion U.S. investment need over a 20-year period for the drinking-water infrastructure and claiming that the rates paid

by users will fall short of meeting this need to the tune of billions of dollars. Comparable numbers characterize the wastewater infrastructure need. Not much has changed in these numbers.

In Canada, the situation is comparable. In Ontario, for example, an expert panel commissioned by the Ontario Ministry of Public Infrastructure has estimated that \$30 billion to \$40 billion of capital investment will be needed to upgrade the province's water and wastewater infrastructure over the next 15 years.

"There is definitely a gap between what's invested and what's required just to maintain the system," noted John Cigana, vice president of business development and marketing at Veolia Water's Quebec-based subsidiary John Meunier Inc., a manufacturer and supplier of water, wastewater, and stormwater treatment and control equipment. "You hear stories about failing pipes, so it's definitely a big topic," he noted, adding that efforts on the part of Canada's water utilities to close the funding gap do not appear to be quite so well-organized as those in the United States.

With these kinds of issues on the plates of water resource managers on both sides of the border, is it any wonder that engineering firms with Canadian origins, such as AMEC Earth & Environmental, Jacques Whitford and Stantec, have ventured beyond their borders to search for opportunities continent-wide?

With slight regional differences, both countries present the same needs and drivers—population growth and movement, oversubscribed water resources, aging infrastructure, and new regulatory programs—that create, effectively, a single market ripe for the kinds of innovation that these firms provide. The following company profiles (pp.12-15) take a closer look. \$

C&E Profile:

Stantec Combines Internal Growth With Acquisitions

CLAIMING TO BE THE PREMIER WATER ENGINEERING FIRM IN CANADA, STANTEC HAS BEEN VERY AGGRESSIVE IN PUSHING ITS FOOTPRINT INTO THE UNITED STATES, engaging in a fast-paced acquisition campaign to penetrate every U.S. region. Designed to build out all of its approximately 20 practice areas, several of the acquisitions have bolstered Stantec's water/wastewater business, which was the firm's original business when it was founded in 1954 and remains a significant portion of its environmental infrastructure practice today.

Recent acquisitions that have bolstered Stantec's water/wastewater business include the purchase in December 2007 of **R.D. Zande** (Columbus, Ohio) and **Fuller, Mossbarger, Scott & May Engineers** (FMSM; Lexington, Kentucky), both deals strengthening Stantec's presence in the Midwest. The addition of R.D. Zande brought on board 300 engineers, planners, environmental scientists, landscape architects, surveyors, and construction administrators providing services principally in water and wastewater treatment facility design, environmental management, and transportation, as well as complementary services in planning, landscape architecture, surveying, and land development. FMSM added another 300 people with expertise in geotechnical and water resource engineering.

Growth in Stantec's water/wastewater practice has been substantial even without the acquisitions, according to Reno Fiorante, vice president of the firm's Environmental Infrastructure Group. "Our business in the water/wastewater area generated about \$150 million in revenues in 2007, and we're growing organically at about 15%," he said. This growth rate is evenly matched by the respective businesses in the United States and Canada, he added. (Stantec's total gross revenues in 2007 were \$954.6 million.)

"On both sides of the border, there are similar types of projects, but with different drivers in different areas," Fiorante observed.

For example, "in Florida, you're looking at treating brackish water that's been impacted by salt-water intrusion. By comparison, we in Canada have good raw water resources, so you don't see the same types of drivers. In Canada, regulatory issues are driving growth, along with population growth and the need for infrastructure rehabilitation." The overall U.S. market exhibits these same drivers, but "it is about 15 times larger," Fiorante pointed out.

In Canada, the Canadian Council of Ministers of the Environment (CCME) is in the process of upgrading the federal water regulations, Fiorante noted, and a major priority is nutrient removal from wastewater. With a strength in water and wastewater treatment facility design, Stantec has undertaken several major projects designed to meet these requirements, including the South End Wastewater Treatment Plant upgrade in Winnipeg. The province of Manitoba has imposed new phosphorus limits on wastewater treatment facilities, so the South End facility is adopting biological treatment for nutrient removal, according to Fiorante, who added that the city of Regina is going the same route for its wastewater treatment plant.

Other major wastewater projects in Canada for Stantec are driven primarily, but not exclusively, by population growth. This include projects in Kelowna and Vancouver, B.C., the latter involving an upgrade to 475 million gallons per day, making the Vancouver

facility the largest wastewater treatment plant in Canada, according to Fiorante. Currently under construction, the Vancouver upgrade was made necessary not only by population growth but also by the need to add filtration capability to screen out microbial pollutants such as cryptosporidium and giardia.

Nutrient removal is also a top driver for wastewater treatment plant upgrades in the United States, and Stantec is undertaking major projects in several locations, including Nogales, Arizona (a design-build job), and Howard County, Maryland. In Maryland, Stantec has been engaged in several phases of the upgrade at the Little Patuxent Water Reclamation Plant, which discharges into the severely impaired Chesapeake Bay, so “we’re trying to get down to very low levels of nutrients,” Fiorante said.

In terms of treatment technology deployment, “on the water side, we’re seeing a lot more membranes, and we’re seeing them on the wastewater side in retrofit applications or areas where they want high-quality reclaimed water,” Fiorante noted. “There’s also a lot of UV [ultraviolet] disinfection on the water side, as well as different types of oxidation treatment.”

In addition, many water utility clients are taking a serious look at their resource recovery options. “Pretty much every wastewater project has a biosolids management component, and we’re often extracting heat from the treated effluent and using pumps to heat the facilities or adjacent buildings,” said Fiorante. For example, for the Kelowna job, “we installed a heat recovery facility to heat a college located next to the plant.” Fiorante added that the “green” or “sustainability” aspect of facility design is becoming very popular. “Clients are asking that we consider green technologies, including renewable energy, low chemical usage, and power optimization.”

Financing these project has become a major challenge for municipalities on both sides of the border. U.S. and Canadian communities with debt limits are increasingly turning to alternative project delivery vehicles such as design-build-operate (DBO) and design-build-operate-finance, according to Fiorante. “In Canada, you see lots of DBO and DBOF, particularly the latter on major projects.” For example, he noted, the city of Victoria, B.C., is preparing a business case evaluation for a major \$1-billion project to upgrade the Capitol Regional Wastewater Treatment District to secondary treatment.

Nutrient removal is also a top driver for wastewater treatment plant upgrades in the United States, and Stantec is undertaking major projects in several locations.

The larger balance of Stantec’s water/wastewater work is with the public sector, but the firm is seeing growing opportunities on the private side, particularly the petrochemical and industrial markets on both sides of the border. Stantec has also undertaken water-related work in overseas markets, such as China, Australia, and the Caribbean Basin. Although work outside North America probably constitutes only 5% of the firm’s overall revenues in the water arena, Fiorante estimated, the company does have long-term plans to boost its international presence.

And in this rapidly consolidating sector, acquisition will be a major part of its expansion strategy, both in North America and beyond. “As you look at these major projects and different kinds of financing, it’s very difficult for the smaller firms to compete,” Fiorante said. “They’ll have to combine.” §

C&E Profile

AMEC Builds Strong Business on Both Sides of the Border

CLAIMING EXPERTISE AT THE PLANNING AND DESIGN END OF WATER RESOURCE MANAGEMENT, formerly Calgary-based AMEC Earth & Environmental has successfully moved to penetrate the U.S. market. Today, the company has 60 offices in the United States, including its headquarters in Plymouth Meeting, Pennsylvania, and 45 in Canada and boasts a strong and growing water/wastewater business on both sides of the border.

According to John Slater, vice president of water resources and civil projects in AMEC’s Western Canada region, the firm’s Canadian operations are focused on the water side rather than the wastewater side of the business because the wastewater market “market is very competitive here in Canada, and margins are tight.” In the area of water resources management, AMEC generates about 40% of its revenues from municipal clients, 40% from the private sector, and the remaining 20% from private developers “and other clients who come to us with different problems.”

The mining industry is a major client on the private side, in North America and throughout the world (AMEC Earth & Environmental has 25 offices off the continent), while in Alberta, oil sands work is generating significant business. Overall, Slater estimated that AMEC’s water-related business is growing at rates of 10 to 20% annually, varying according to client sector. One service area driving that growth is AMEC’s skills in what Slater describes as “limited-im-

pact design,” an offering in water resource management that he regards as a differentiator for the company.

For municipal clients, including major urban centers such as Calgary and Edmonton, AMEC is applying limited impact design to stormwater management, a major issue as Canada seeks to implement regulations modeled on the U.S. National Pollutant Discharge Elimination System (NPDES) program. “We’re doing wetland treatment solutions and specially designed settlement ponds, and are using use high-tech mathematical modeling programs, such as computational fluid dynamics, to develop these solutions,” Slater noted. “The stormwater market is big and growing, because the regulations are new, and the cities have to adapt their infrastructure. It’s also fairly interesting work—not just banging out designs.”

In his territory of responsibility, Slater hasn’t seen the pace of consolidation in the water market that is taking place in other geographies, but “I see it coming. Companies are so short of staff they are willing to pay a premium to buy a company. The market is growing, by 10 to 15 percent, and we and our competitors can’t keep up.” The big challenge, he stressed, is finding people with up-to-date knowledge of new technologies and the ability to bring those technologies to new market areas. “If you have been away from this industry for five years and you came back, we probably wouldn’t hire you.”

Slater’s colleague in AMEC’s Denver office Bob McGregor described the firm’s U.S. water resources practice as heavily engaged on both the dry and wet ends of the water management spectrum. As a provider of wet-weather planning and management services, “we do a lot of floodplain mapping, performing work for the likes of the Federal Emergency Management Agency [FEMA] with sophisticated mapping techniques,” said McGregor, a prin-

cipal engineer and AMEC’s Southwest Region water program manager.

In addition to doing the usual civil design work, McGregor noted, “we do program development and financial planning for our municipal clients.” U.S. water utilities fund their stormwater management programs through property taxes rather than water rates and often find themselves severely short-handed, McGregor explained, so “we help the utilities find the funding.” AMEC will assess the need for upgrades, help develop the appropriate financing mechanisms, and then assist the municipality in securing the public buy-in.

McGregor estimated that AMEC has performed this type of work in about 40 U.S. cities, primarily in the east. More recently, however, the company has served nine municipalities in Colorado in this capacity. “The whole concept is moving west. People have been recognizing the adverse water quality impacts of inadequately managed runoff. That’s an unfunded mandated that they have to figure out how to fund, so there are now the water quality problems that are being addressed in addition to the flooding.”

In the drier areas of the States, AMEC engages with municipalities and water districts in the development of new water sources—a challenging and growing business segment. “You have to develop water resources very efficiently, because a lot of people want that water,” he remarked. “The supplies are static and in some cases shrinking. There’s a lot of work that goes into making sure that the systems are properly conceived, properly permitted, and properly constructed, and then managed in a way that’s efficient. And climate change is a new factor, along with population growth.”

The low-impact development that Slater alluded to is very much in demand in the western United States, Mc-

Gregor continued. Once thought of as a nuisance, storm runoff is increasingly seen as a potential resource, and water engineering firms are increasingly called upon to develop drainage designs with “green” parkways, wetlands, and other landscaping features that become urban amenities. This growing movement is taking place not only in urban areas but also on military bases, McGregor pointed out. “Breweries, agricultural facilities, mining operations have these needs as well, and we serve them.”

With the pressing demand for more efficient water management, AMEC is understandably enjoying a growing number of water recycling design projects as well. McGregor characterizes this business as “more institutionally driven” than technology driven. “We’ve had the technology to reclaim water for a long time, through membranes and chemical processes. It’s not easy to get more water, so municipalities turn to recycling to improve the effective supply. It’s not a matter of people inventing new widgets. You simply have to be more and more efficient with your use, either by reducing demand or by making better use of the water available through recycling.”

Information technology, and in particular, satellite imagery, is having a big impact on AMEC’s work, according to McGregor. “With the special cameras that are available, you can look at rather large areas at a time and identify stressed vegetation or poor agricultural practices or municipal practices that are causing pollution,” he said. “We’ve used remote sensing to measure water quality in lakes, and to measure the effectiveness or the robustness of vegetation, and that becomes an indirect measure of erosion potential. You can very effectively come up with improved grazing and planting practices basin-wide to minimize erosion. And you can use this imagery to measure ground subsidence, which can occur when you over-pump.”§

C&E Profile:

Jacques Whitford Focuses on Water Asset Management

NAWE adds capabilities in decentralized natural wastewater treatment.

ALSO ENGAGED IN CROSS-BORDER ACQUISITION TO BUILD ITS WATER PRACTICE IS JACQUES WHITFORD, a \$50-million multi-disciplinary consulting firm operating more at the assessment and planning end of the water resource management continuum than in the design and engineering segment.

In April 2007, the firm purchased Minnesota-based **North America Wetland Engineering LLC** (NAWE) and its affiliate, **EcoCheck**, to build its capabilities in decentralized, natural wastewater treatment (NAWE) and small water/wastewater facility operation (EcoCheck).

Affirming that water recycling is both growing and necessary—“recycling absolutely has to happen in Canada”—NAWE and EcoCheck cofounder Curtis Sparks, now a Jacques Whitford principal, pointed to the decentralization of wastewater treatment, particularly at city edges and for new suburban development, as “one of the biggest emerging trends.” Even as the larger wastewater treatment systems undergo upgrades, there’s a growing recognition that “the big-pipe systems are getting really expensive,” and that other, more cost-effective alternatives will be required to handle the pressures on the water resource imposed by new development.

“For the fringe areas around the cities, why not treat on site and not burden the bigger pipe systems, which can be saved for industrial and commercial capacity?” Sparks asked rhetorically. “All my life I was building big-pipe systems, until I saw the water quality in rivers getting worse and worse. There wasn’t enough dilution, which isn’t sustainable. We need to be thinking about what can happen 200 years from now.”

It was the need to provide decentralized wastewater treatment that in-

spired Sparks to launch EcoCheck, which manages some 90 small water and wastewater facilities, some combined, serving the likes of 100-home residential communities.

“We found that we were able to provide treatment more cheaply than mechanical or activated systems.”

Its sister company, NAWE, offers decentralized wastewater treatment through the use of natural systems—another emerging trend, according to Sparks. NAWE developed and patented an engineered wetland technology based on forced bed aeration that has been adapted for use in the colder climates of the northern United States and Canada through innovations in system insulation. The pipes used in ordinary engineered wetlands are often installed on top of gravel and will often freeze in this type of climate, Sparks explained. The NAWE technology uses a mulch insulating layer to prevent this freezing.

“When we developed the technology and patented it, we started applying it to higher strength wastes, such as wastes from cheese plants and food processing facilities,” said Sparks. “We then started looking at landfill leachate and mining wastes, and then groundwater contaminated with gasoline. We found that we were able to provide treatment more

cheaply than mechanical or activated systems. Now we have this natural system with a little bit of process control that can treat all sorts of things.”

Sparks and his partner Scott Wallace had a vision of spreading the technology around the world, but “you can’t do that as a small company, so we started teaming with the likes of CH2M and Jacques Whitford. And we started winning a lot of these projects.” With its acquisition by Jacques Whitford in April 2007, NAWE “acquired 47 offices,” Sparks remarked.

Despite a recent lull in business owing to the problems in the U.S. residential real estate market, NAWE’s business has “grown phenomenally,” he declared. “We have the right product, the right philosophy, and people are listening. We’ve turned the corner in Minnesota, Wisconsin, and Iowa.” In Canada, the concept is catching on rapidly as well, and NAWE, through Jacques Whitford, is also winning jobs overseas, in Australia and Israel. “Partly by acquiring us, and partly through some capability they had before, Jacques Whitford should be considered the world leader in engineered wetlands technology,” Sparks claimed.

As NAWE’s recent experience in the residential market shows, the water industry hasn’t been entirely immune to the recent economic slump in the United States. Yet new regulations, the public demand for excellent water quality, and the need to rehabilitate, upgrade, and expand water/wastewater infrastructure in a climate of increasing scarcity and demand has water engineering firms feeling that they won’t take much of a hit on the down side of the economic cycle. As one C&E executive put it, “these problems are sufficiently endemic that they don’t seem to go up and down with the economy. The business is on a constant upward growth curve.” §

EnviroTower Systems Reduce Operating Costs, Water Consumption, and Greenhouse Gas Emissions

WITH A PROPRIETARY MECHANICAL WATER TREATMENT SYSTEM, TORONTO-BASED ENVIROTOWER PROVIDES AN ALTERNATIVE for companies to switch to clean cooling tower water treatment to maximize the energy and water efficiencies of large air conditioning systems.

The company is armed with data showing that its technology improves performance and reduces costs, according to Shelley Cornforth, vice president of marketing. “Our patented water treatment solution has been adopted by some of North America’s largest commercial real estate owners,” she said. “They’re realizing typical savings of about 15% on their systems’ energy usage and 20% on water consumption.”

EnviroTower is expanding from its base of Canadian customers into the United States, especially the southwest regions where there is high demand for cooling services, high electricity costs and water scarcity issues. “We have some European operations right now, but our main business is in North American market,” said Cornforth. “Our U.S. business will continue to become a larger proportion of our overall sales.”

As it builds its business in the United States and at home, EnviroTower is seeking to gain market share in a segment that is still thoroughly dominated by chemical treatment. “We’re in a nascent phase of our market opportunity right now,” said Cornforth. “The upside potential is enormous. The market uptake [for mechanical water treatment] is growing rapidly.”

“Companies that install our system tend to be owners or managers of large facilities who are looking to improve the operation of their cooling system and drive down costs,” said Cornforth. Hotels and hospitals are some of EnviroTower’s largest customers. “We focus a lot on big office towers

and large hotel chains,” she said. One Canadian client is SNC-Lavalin Profac, a large engineering and construction company with a substantial facilities operation and management business, including contracts to run buildings owned by the Government of Ontario.

“In the commercial real estate market, there’s definitely a huge demand to save operating costs, and energy is a major bottom line item,” said Cornforth. “Building owners are looking for new technology and approaches to get additional energy savings in buildings where they’ve already run through most of their opportunities.”

Energy service companies (ESCOs) that make their living by cutting clients’ energy bills are also buying EnviroTower systems. “They’re also looking to diversify what they offer and add product solutions, and it’s increasingly difficult for them to find technology with which they can take new dollars out of energy spending,” said Cornforth.

Food and beverage, pharmaceutical, and auto manufacturers are other key market segments for the company. “There are a lot of potential applications in industries where we can offer energy and water savings and production efficiencies, especially for operations that are very water intensive,” said Cornforth. A case study provided by the company shows that a 2006 EnviroTower installation at Sapporo beer manufacturer Sleeman Breweries (Guelph, Ontario) enabled plant managers to remove a water softener from their cooling system’s condenser and redeploy the \$40,000 as-

set to pasteurization. In addition, by using EnviroTower the brewer improved operator safety by eliminating the storage and manual labor associated with the use of chemicals.

Other companies have offered mechanical filtering solutions for cooling units in the past, but until now have not offered a complete solution or provided dependable results over the long term, said Cornforth. “Our approach is unique in that we’re providing a core technological solution, our electrostatic device, that we have rounded out with a full system that addresses all the problems that a building owner has with cooling water treatment needs.”

One important piece of the company’s overall system is remote monitoring. “We measure key water quality parameters that allow us to see that the system is operating properly,” said Cornforth. “These cooling systems are very expensive assets, and it’s important to know exactly how they’re functioning. We can also measure water savings remotely as well, and that helps us validate the water savings that we deliver to our customers.”

“The bulk of the overall market is in the retrofit area, although we’re expecting a lot of growth in the green building segment, a positive trend since we’re a green building product and can contribute significantly toward organizations obtaining LEED certification,” said Cornforth. For retrofits, financing is usually done as a capital purchase. “Given the rapid return on investment from the technology, it’s quite a strong business case,” said Cornforth. “Our payback period tends to be less than two years, much shorter than average.”

With Canadian and U.S. corporations looking for ways to reduce their greenhouse gas emissions, EnviroTower is providing some potential customers with estimates of the carbon emis-

Continued on page 24

Pure Technologies' Monitoring Devices Enable Utilities to Target Repair Budgets Where Needed

Business model emphasizes service contracts rather than product sales for this sophisticated leak detection hardware.

A SEVEN-INCH BALL THAT ROLLS UNTETHERED THROUGH WATER, WASTEWATER AND OIL PIPELINES LOOKING FOR LEAKS is the latest innovation in the “infrastructure surveillance and management” technology offered worldwide by Calgary-based **Pure Technologies Ltd.** This clever device, named SmartBall, became Pure Technologies’ third major technology product for inspecting water and wastewater pipelines last year.

The company’s other core products are its P-Wave electromagnetic device and SoundPrint acoustic monitoring product, both of which detect impending failures in pre-stressed concrete pipelines. The company deploys these technologies as well as visual inspections conducted by operators and other data in its Pipeline Risk Management System (PRMS) for water and wastewater operators.

“PRMS takes information from many sources, our technology as well physical inspection surveys, soil surveys, previous repair data and other things,” said Peter O. Paulson, president and CEO. “It assesses which areas of a pipeline system need attention most urgently. All the data comes to our server rooms here in Calgary, with the data also going to customers directly if they want.”

While SoundPrint is also deployed to monitor buildings, bridges and other infrastructure, its application to water and wastewater systems is increasing rapidly in response to increasing demand, according to Paulson. “All over the planet, water infrastructure is aging. Ten to twenty percent of all produced water is lost to leaks. One southern U.S. city is losing about 20% of its water in about 10 miles of lines,” he said. “The realization that budgeting and maintenance are becoming more critical is sweeping across the whole water and wastewater industries. Some of the failures

that are occurring are preventable with enough information about the pipes.”

“Water and wastewater utilities are increasing their maintenance budgets simply because they need to keep their systems together while their pipes are getting older and failing at faster rates,” said Paulson. “In the absence of knowledge about what’s happening underground, they have to look at replacement programs that are extremely expensive. With better monitoring they can target repair dollars and in many cases avoid costly replacement efforts.”

Pure Technologies’ business model emphasizes service contracts rather than product sales. “Our hardware is extremely sophisticated, and most of our clients don’t want to own something that’s complex and difficult to calibrate and maintain,” said Paulson. To serve an increasingly international client base, Pure Technologies licenses its products to third-party entities that in turn serve clients. “We have a group that does nothing but train licensees on how to use our technology. We have already concluded an agency agreement in China and we are currently negotiating a similar arrangement in the United States, Australia, France and Spain. All of these are in the water sector. We currently have no licensees for the Oil & Gas sector.”

According to Paulson, the United States is Pure Technologies’ dominant market, but he anticipates rapid

growth in France and the United Kingdom. “France and the U.K. have not had a viable choice for finding these leaks and deteriorating pipes up to now. We’ve been spending a lot of time demonstrating our capability to [French and British operators],” said Paulson. “We’ve done work and continue to seek out licensees and opportunities in Southeast Asia, Australia, South America, Mexico, Canada, the U.S., Portugal and Spain and of course North Africa and in the Middle East.”

And in all these markets, Paulson expects SmartBall to be a leading product. “Our largest market opportunity has historically been inspecting the feeder mains and large diameter water supply pipelines and wastewater forced mains,” he said. “SmartBall is changing that because it’s capable of operating in very small distribution lines. We’ve already seen growth in that area with SmartBall.”

“We also expect SmartBall will have considerable application in force mains, which are wastewater mains that are under pressure,” said Paulson, noting that wastewater force mains are common since treatment plants tend to be located at the edge of populations centers. “Currently there’s just nothing that these folks can do with their force mains except acoustic monitoring in which we install sensors at points where we have access to the pipe. That works with pre-stressed concrete pipes, but most forced mains are not pre-stressed. SmartBall will work in those.”

“We do require four-inch access and egress if we’re going to be using net retrieval,” said Paulson. “We also need the operator to stop the flow on any tangential pipes that are leaving the pipe we’re inspecting, and we require a certain minimum flow depending on the grade, typically about one foot per second.” Costs of deploying SmartBall depend on the length of the pipeline to be inspected and other factors. §

Smaller Footprint and Lower Operating Costs Are Important Value Propositions for Eco-Tec

Power plant operators are core customers for this niche player's technology.

APPROACHING ITS 40TH YEAR IN THE WATER TREATMENT, GAS PROCESSING, AND CHEMICAL RECOVERY BUSINESS, ECO-TEC (Pickering, Ontario) is increasingly serving international clients in energy, mining and chemical-intensive manufacturing. "We produce high-purity water for industrial use from municipal water, raw water and increasingly from tertiary wastewater," said President Mike Dejak.

"In chemical recovery and purification, we treat acids used primarily in metallurgical industries as well as the oil and gas segment." The company also has a biogas processing technology with applications for gas from landfills, animal feeding operations and other sources.

In water treatment, Eco-Tec deploys proprietary technologies in two areas—microfiltration and demineralization—and integrates reverse osmosis where necessary to offer customers the ability to meet their treatment and purification needs in a smaller footprint with less maintenance and lower operating costs than competing systems.

"The water treatment systems we sell are best suited for power plant feed waters," said Dejak. "We track new power plant construction or retrofits and upgrades to existing power plants, and last year we saw a fair amount of activity from a number of coal plant operators that were adding capacity or replacing aging capacity." Eco-Tec systems are also deployed in natural gas fired power plants and nuclear generating stations.

Driven largely by demand from power plants, Eco-Tec's water treatment business grew by 60% in 2007. "We went on an aggressive campaign to look at improved designs with cost reduction to get us more competitive in the marketplace, and we were able to gain acceptance with leading clients on some technologies that we had introduced the prior year," said Dejak.

A prime example is a 625 MW combined cycle natural gas plant near in Mexico. "We installed a water treatment system on that power plant that treats tertiary wastewater and upgrades it to high-purity boiler feedwater," said Dejak. The system uses a combination of Eco-Tec's Spectrum Micro Media Filter, a reverse osmosis system, and Eco-Tec's Recoflo Demineralizer.

As of spring 2008, the company had installed water treatment on one operating nuclear plant and was providing quotes to replace water treatment plants on at least one other operating nuclear plant and one planned nuclear generating station, according to Dejak.

Another market segment for Eco-Tec is coal bed methane producers. "There's development of CBM in the Powder River basin, the largest coal deposit in the United States," said Dejak. "Within those coal deposits there's a lot of methane gas that's being recovered. In the process of doing that, the producers have to drill down and take out water that is not suitable for land disposal or irrigation. We treat that water to meet discharge requirements with a combination our Spectrum Micro Media Filter and our ion exchange system."

Dejak estimates that at least 85% of Eco-Tec's business is international, with the United States accounting for at least 50%. The rest of the company's trade is focused in Japan, China, India and Europe. With economic woes besetting the United States in early

2008, Dejak reported that Eco-Tec was emphasizing its marketing to potential clients in Asia, Eastern Europe, the Middle East and elsewhere. "We're starting to see more industrial activity in Africa. And in the United Kingdom we have a wholly owned subsidiary."

In Asia, the company is seeing great interest in its acid purification systems from companies in stainless steel production and purification of amine chemicals. It also serves these types of companies in Eastern Europe, in addition to providing systems to companies purifying chemicals for mineral refining and hydrometallurgical applications. Eco-Tec recently sold a system in Kazakhstan to a copper refinery. "We're also getting a large amount of interest from the oil and gas industry in Russia, which is investing in upgrading facilities," said Dejak.

"A lot of people consider industrial chemical purification to be pollution abatement as it's preventing chemicals from getting into the water," said Dejak. "Instead of dumping a contaminated chemical, we remove the contamination and let the operator keep the chemical for use or, after appropriate treatment, to dispose of it."

Eco-Tec is playing in a market segment where large companies such as Siemens and GE are growing through acquisition. "They're looking mostly at the municipal water treatment markets. They recognize that water is undervalued and that as time goes on, the market will have to adjust how it values water and what its real costs are. At that time they'll be big players."

"From our standpoint, the fact that they've stepped in and rolled up all these companies is not necessarily a disadvantage," said Dejak. "They're still trying to integrate their acquired companies, while as a small niche player we can target specific parts of the market and go after them aggressively." §

Biorem's Biofiltration System Wins Acceptance Among Operators of Wastewater Treatment Plants

Data shows inorganic media filtration system performs better, lasts longer.

WHEN IT COMES TO TREATING WASTEWATER, PLANT OPERATORS HAVE TO BE CONCERNED NOT ONLY ABOUT the quality of the water that's leaving their discharge pipes but also the content of the gases and odors that they emit into the surrounding air. With volumes of wastewater increasing and regulations becoming more stringent in many regions, operators of municipal sewage and industrial water treatment plants are seeking more effective and cost-efficient solutions.

For a growing number of treatment plant operators in the United States, Canada, China, South Africa, Mexico, Brazil and other countries, the air pollution control technology of choice is a biofiltration system pioneered by **Biorem Technologies** (Guelph, Ontario). Biorem's line of air pollution control systems reduces emissions of hydrogen sulfide, ammonia, total reduced sulfurs, volatile organic compounds and other hazardous and odorous emissions from wastewater treatment plants.

According to President Peter Bruijns, Biorem's technology offers advantages over older scrubbing technologies that can only treat certain contaminants, and it also outpaces other technologies in the newer biofiltration arena. "There are several other companies offering biofiltration that are very good in their space but don't provide a total solution," he said. "Some are terrific for hydrogen sulfide removal but not as good as ours at removing total reduced sulfurs."

All biofiltration systems use bacteria that consume air contaminants, according to Bruijns. But with Biorem's proprietary technology developed by the University of Waterloo in Ontario and European scientists, the company has engineered an inorganic media filtration system which he said performs better and lasts longer than the more commonly used organic media.

"The media is the base that bacteria grows on," said Bruijns. "With organic media, that base decomposes and deteriorates over time. In fact, performance starts to deteriorate from day one, and depending on constituents of the airstream, treatment plant operators have to replace it within a couple years. Our patented inorganic media system can last 10 or more years and handle almost the entire spectrum of air contaminants that are produced in wastewater treatment."

"Regulators across North America are becoming more educated about the limitations of the older technologies and they increasingly require the newer ones."

Central to its system's performance is the ability to manage bacteria in the filter media, said Bruijns. "You have to strike a very good balance between all the constituents and the environment: temperature, moisture, nutrients, the contaminants in the air stream, air velocities, pressure drop. The media is at the center of all that."

Biorem's technology has been available since 2000, but it has only been in the last three years that it has become widely accepted by wastewa-

ter treatment plant operators, according to Bruijns. "What has made the difference is data," he said. "Our biosorbents are now running at over 200 sites, which are providing owners and potential customers with data that shows our performance."

But even as it has established a ranking as a top performer, Bruijns said Biorem, like competing manufacturers, is under pressure to improve and streamline its systems. "Our customers are saying they need a product that will take up less space in their plant, and they need more consistently reliable performance," said Bruijns. "We're doing research to reduce the footprint of our odor removal systems per cubic foot per minute (CFM) of air treated."

About 70% of Biorem's business has been in the United States, with 20% in Canada and 10% in other countries, according to Bruijns. About 85% of applications to date have been for municipal wastewater treatment and the remainder applied to industrial effluents. "We just signed contracts for three projects in China, and we're bidding on three more," said Bruijns. "We have projects in South Africa now, several in the Middle East, and we've signed our first one in Brazil, at an industrial treatment plant. We've also done several smaller projects in Mexico."

Bruijns expects all these and other market regions to grow in demand for advanced biofiltration, with both municipal and industrial wastewater treatment plants seeking new technology. "Our pipeline looks very strong in all the categories," he said. "We're relating to the engineering firms far in advance of the time when projects come out to bid."

In the United States and Canada, increasingly stringent regulations—often driven by complaints about odors—are pushing wastewater treatment plant operators to upgrade their equipment.

“The regulators want reliable, consistent performance over time,” said Bruijns. “Organic media doesn’t provide that. It deteriorates rapidly, therefore the regulators are not impressed. Regulators across North America are becoming more educated about the limitations of the older technologies and they increasingly require the newer ones.”

In developing countries, the pressure to install the most effective odor and emissions controls is created more by market forces than regulation, according to Bruijns. “In China’s fast-growing cities, they can’t sell real estate next to a plant that’s giving off a lot of odors,” he said. “In South Africa, the market is also tied to real estate development. Same in Mexico and most developing countries.”

“We just signed contracts for three projects in China, and we’re bidding on three more.”

As its U.S. business has grown, Biorem has been under cost pressures due to the declining value of the U.S. dollar. To offset the currency disadvantage, it has begun purchasing more balance-of-system components such as tanks from U.S. firms. Bruijns anticipates following this approach in other regions as well. “As we sell more projects in South Africa, China and other countries, we’ll look at sourcing vendors for tanks in those countries,” said Bruijns.

An ancillary benefit obtained by some Biorem clients is a reduction in greenhouse gases. “We’ve done a few municipal applications where we’ve taken out of service a thermal oxidizer, which is very energy intensive technology,” he said. With no significant external energy inputs, the Biorem systems achieved for these operators a 100% reduction in CO₂ emissions, said Bruijns. “One of our clients is saving about \$150,000 per year in natural gas costs.”

BioteQ Environmental Technologies Flexes its Operating Muscle, Expands Internationally

Company targets acid mine drainage and has other industries in its sights.

SEVENTY PERCENT OF THE WORLD’S MINING SITES HAVE A PROBLEM WITH ACID MINE DRAINAGE, making the potential market for BioteQ Environmental Technologies’ wastewater treatment and recovery technology substantial indeed. With a year of solid operating performance now under its belt, CEO Brad Marchant is feeling confident about his company’s ability to develop that potential.

In 2007, BioteQ plants in Canada and the U.S. operated at over 98% availability, an impressive performance for wastewater treatment systems. “Operations have really come into their own; we’re a really well tuned group,” said Marchant, adding that BioteQ is on track to commission a new plant every quarter. At this rate, the Vancouver-based company, which went public in 2000, expects to double revenues from \$5 million in 2007 to \$10 million in 2008.

BioteQ’s technology treats acid mine drainage and other metal-laden wastewater by sequentially removing metals and sulphate and producing saleable products—including copper, zinc, nickel, and cobalt—and clean water that can be discharged safely to the environment. Its three core technologies are the patented BioSulphide Process, which uses a biological process to produce biogenic sulphide reagent (as hydrogen sulfide) used to selectively recover metals dissolved in wastewater; the ChemSulphide Process, which uses a chemical sulphide reagent; and Sulf-IX, which uses ion-exchange resins to remove sulphate from water.

A Meeting of Economic and Environmental Drivers

Technologies traditionally used for metals recovery include reverse osmosis, ion exchange and cementation, “but they’re generally not economically or technically viable,” said Marchant. (For example, reverse osmosis has a tough

time handling wastewater heavily laden with iron.) As a result, relatively few mines in North America recover value from their wastestreams. However, when successful, recovery can re-jig the economics of environmental protection. The value of metals recovered from BioteQ systems ranges from \$1 million for a small plant to \$10 million for a larger operation, Marchant estimated, providing not only an income stream to pay for operations but also reducing environmental costs and liabilities.

“The economic driver is the recovery of metals; but there are a lot of underlying drivers for customers,” Marchant added. For example, BioteQ’s technology doesn’t produce a sludge byproduct, so there’s nothing left to store in perpetuity, eliminating long-term risks and bonding requirements—no small potatoes. Acid waste drainage, which occurs when water and oxygen react with exposed sulphide minerals in waste rock, picking up heavy metals in the process, continues to be produced long after a mine is closed. Mining companies are commonly required to put up substantial bonds to guarantee wastewater is treated long term. “If it costs \$2 million to treat wastewater annually, you’re looking at \$200 million in bonds, said Marchant. “We can lower or remove that banking requirement because we’re taking metals off the site.”

Happy in China

Two thousand and seven was also the year of international expansion for

BioteQ, which has projects in China, Chile and Australia, in addition to North America. In November 2007 BioteQ started commissioning a new plant at the Dexing mine (the first of six sites) in a joint venture with Jiangxi Copper Company Ltd., China's largest copper producer. For international projects BioteQ prefers to be part of a joint venture where BioteQ is the operator, and the partners share equally in capital and operating costs, as well as the metals recovered. The \$4.2 million plant will start by recovering some 1 million lbs of copper per annum with a maximum capacity to recover 4.4 million lbs.

In Marchant's view, large mining operations the world over face similar regulatory pressures. "The special needs of international clients are not technological or cultural; it's the construction that's different. It's really important to have a solid partner in China to make things go smoothly," he said. "Jiangxi Copper has proven to be an excellent partner.... We've learned a lot from them—it's been very instructive for both companies."

\$8-Million Plant in Chile

BioteQ's technology can be used alone or piggyback on existing treatment systems such as a lime plant to treat acid drainage or reverse osmosis for sulfate removal. The technology it most often supplants for sulfate removal is reverse osmosis. In February 2008 BioteQ signed an agreement with Molibdenos y Metales SA (MolyMet) for a Sulf-IX plant to replace a reverse osmosis process at a refinery near Santiago, Chile for a capital cost of US\$8 million to produce clean water and saleable gypsum. Estimated net savings are \$US10 per cubic meter of water treated compared to the existing plant, derived from direct operating cost savings and net savings from the sale of product.

BioteQ's future footprint will be North America, Chile and China, said

Marchant—all prime mining regions. (The high cost of construction makes Australia a less attractive prospect for the time being.) In the future he expects approximately half of company revenues to be generated outside Canada, the United States and Mexico.

In North America the company prefers either a build-own-operate model or a joint venture in which it remains the operator. In all cases it seeks a three-year payback scenario, with compensation coming from straight fees for turnkey outsourced treatment services or revenues from metals recovery—or a combination of the two. Customers in North America include Phelps Dodge, Xstrata, Freeport McMoRan, Vale-Inco, Columbia Metals, EPCOR and US EPA. "We're pretty flexible; we look at the customers' needs and what they provide... Each site is like a fingerprint; they look similar, but they're all different," said Marchant.

BioteQ has funded construction costs ranging from \$2 to \$10 million, drawing on cash flow and monies raised from equity markets. In 2007 it invested \$11 million in new plants, with another \$6 million anticipated this year. In the future the company will likely use some form of debt facility for more costly projects, such as greenfield sites which could run as high as \$25 million.

In recently reported 2007 financial results, BioteQ reported a net loss, but with more plants coming on line it expects to be profitable in 2008. BioteQ, whose executives all hailed from the mining business, will seek strategic partners to expand into new areas, such as pulp and paper and municipal wastewater. Expansion will be led by its "branchout" Sulf-IX technology.

"With four operating plants, five sites under construction and three in the design engineering stage, "We're a growing company with a solid balance sheet, and we grow with our technology," Marchant concluded." §

Mergers & Acquisitions:

Canadian Companies Participate in Consolidation of a Fragmented Market

THE COMPELLING NEED TO RENOVATE MUNICIPAL WATER AND WASTEWATER INFRASTRUCTURE, combined with the new requirements of fast-growing economies worldwide, not to mention water scarcity issues and increasing regulation, have boosted interest in the water and wastewater segment to an all-time high among both strategic and private equity investors.

This interest has led to consolidation on the vendor side of the business and contributed to rapid changes of ownership of large assets in North America. Ironically, despite investors' eagerness not to miss the boat on water opportunities, there is a disconnect between dollars and infrastructure needs, according to Steve Maxwell, managing director of TechKNOWLEDGEy Strategic Group (Boulder, Colorado) and editor of *The Environmental Benchmark and Strategist*. "They don't connect well because it's a municipal marketplace," he said. Rather than utilities, the preferred investment targets have been technology firms in membranes, UV treatment and purification. As a result, many of the viable candidates have already been acquired, contributing to a slowing of M&A deals in the water and wastewater segment in 2006-7, at least compared to the frenzy of activity earlier in the decade, he noted.

Valuations are also cooling the pace somewhat. "Prices have been up to ridiculous levels as a result of the frenzy," said Maxwell, "There's still a lot of activity, but at a smaller level" compared to the big deals of prior years. So while transactions have

Selected Canadian Water & Wastewater Acquisitions, 2006-3/2008

ACQUIROR	TARGET	TARGET BUSINESS	DATE
GLV Inc. (Montreal, QC)	AJM Envmtl Services Pty Ltd (Sydney, Australia)	Integrated treatment/reuse for food ind	2008
Exterran Holdings Inc (Houston, TX)	GLR Solutions Ltd (Calgary, AB)	Water treatment products for energy ind	2008
ENPAR Technologies Inc (Guelph, ON)	BioSource Inc (Worcester, MA)	IP for ENPAR's DesEL products	2008
Stantec (Edmonton, AB)	R.D.Zande (Columbus OH)	Consulting & Engineering	2008
Stantec (Edmonton, AB)	Fuller, Mossbarger, Scott & May (Lexington, KY)	Consulting & Engineering	2008
TORR Canada Inc (Montreal, QC)	Pure Group AS (Norway)	Purification technology	2007
H2O Innovation Inc (Quebec City, QC)	Sigma Environmental Solutions (Calgary, AB)	Water solutions for oil/mining inds	2007
Schlumberger Water Svcs (Waterloo, ON)	Water Management Consultants (Denver, CO)	Water management consultancy, mining	2007
BioteQ Envmtl Technologies (Vancouver, BC)	Dennerik Engineering (Burnaby, BC)	Engineering/fabrication services	2007
Jacques Whitford (Dartmouth, NS)	NA Wetland Engineering (White Bear Lake, MN)	Engineered wetland treatment systems	2007
Jacques Whitford (Dartmouth, NS)	EcoCheck Inc. (White Bear Lake, MN)	Water/ww systems management	2007
FLSmith (Denmark)	Process Group of GL&V Inc. (Montreal, QC)	Chemical and ore processing	2007
Corix Group of Companies (Vancouver, BC)	Edward S. Walsh Company (California)	Water/wastewater & storm products.	2007
Aecom Technology Corp (Los Angeles, CA)	Gartner Lee Ltd (Markham, ON)	Environmental C&E firm	2007
Aecom Technology Corp (Los Angeles, CA)	KMK Consultants Ltd (Brampton, ON)	C&E specialist in water/wastewater	2007
Ontario Teachers' Pension Plan	Empresa de Svcs Sanitarios del Bio Bio (Chile)	Water supply, distribution & wastewater	2007
Ontario Teachers' Pension Plan	Aguas Nuevo Sur Maule, SA (Chile)	Water supply, distribution & wastewater	2007
Ontario Teachers' Pension Plan	Esval (Chile)	Public water and wastewater company	2007
GLV Inc (Montreal, QC)	CDS Technologies Ltd (COPA-Australia/UK)	Wastewater solutions, membranes	2006
GLV Inc (Montreal, QC)	Enviroquip	W/ww treatment equipment for munis	2006
GE Water & Process Tech (Trevose, PA)	ZENON Environmental Inc (Oakville, ON)	Membranes	2006
Aqua-Pure Ventures (Calgary, AB)	Fountain Quail Water Management (Texas)	Oilfield services	2006
Seair Inc. (Edmonton, AB)	SeaAir Septic from Terroza Expediting	Remote sewage treatment systems	2006
CAI Capital Management (Toronto, ON)	Terasen Water & Utility Services (Vancouver, BC)	Water/wastewater utility services	2006
Precision Drilling Trust (Alberta)	Terra Water Group Ltd (Alberta)	WW treatment for remote locations	2006
CCS Income Trust (Calgary, AB)	ARKLA Disposal Services Inc. (Louisiana)	Operates ind WW plant in Louisiana	2006
Osprey/Canada Pension Plan Invstmt Board	AWG Plc (Cambridgeshire, UK)	UK water utility Anglian	2006
H2O Innovation Inc (Quebec City, QC)	Membrane Systems Corp	Membrane filtration technology	2006

Sources: Derived from Canwest Digital Media, a Division of Canwest Publishing Inc.(Toronto); Industry Canada; and Environmental Business International (San Diego). Although EBI has made every effort to be accurate, accuracy is not guaranteed; errors or omissions are unintentional. Some deals may not be final.

been fewer, "There are still lots and lots of players out there; demand fundamentals are the story for the long term, and there's a good deal of consolidation yet to go," he concluded.

Consolidation in the water industry has led to successful Canadian companies being absorbed by global gi-

ants. In 2004, **Trojan Technologies**, a manufacturer and marketer of UV systems water and wastewater treatment, was acquired by **Danaher Corporation** through its wholly-owned subsidiary, Helen Nova Scotia ULC.

In 2006, **Zenon Environmental Inc.** of Ontario was purchased

by **GE Water & Process** for a dizzying \$689 million for a \$238 million revenue company. Zenon, a membrane manufacturer and leader in hollow fiber membrane bioreactors, has become the backbone of GE's water treatment and desalination business.

General Electric is one of several

diversified industrial conglomerates that since 2001 have taken over the torch from the privatized European utilities that entered the U.S. market in the 1990s, hoping to duplicate their water and wastewater privatization strategies in North America. Disappointed that privatization did not proceed as envisioned, they sold off to the likes of GE, Danaher, Siemens and 3M, companies expected to dominate the water industry in the next five to 10 years. Financial investors were not left out of the equation: Participants included MacQuairie and RWE/Thames; HIG Capital and Severn Trent Labs; Blackstone, Apollo, Goldman Sachs and Suez-Nalco; and Osprey, a private consortium including the Canada Pension Plan Investment Board, and Anglian Water.

Canadian Companies Participate in Consolidation

Canadian companies have also been in the purchasing seat. In April 2007, **Groupe Laperrière & Verreault Inc.** (GL&V) sold its Process Group to **FLSmidth** of Denmark and spun off to shareholders its other two groups, Water Treatment and Pulp and Paper, into a new corporation, **GLV Inc.** The predecessor company GL&V had been rolling up water acquisitions since 2000, building a portfolio of technologies that includes submerged membrane moving bed bioreactors, submerged aerated filters, and technology for screening high volume intakes of seawater and river water for the power and desalination markets.

Acquisitions included the U.S. company **Environmental Equipment & Systems Inc.**; **EIMCO**; **Jones & Attwood Ltd.** and **Brackett Green Ltd.** of the U.K.; assets of the Paper Chemical Systems Unit of **Metso Paper Inc.** of Finland; **Enviroquip Inc.** of Texas; and **COPA** in the U.K. and Australia. In March 2008, GLV expanded into technology for the food

and beverage production and processing industry by purchasing **AJM Environmental PTY Ltd.** (Sydney, Australia), an industrial wastewater treatment company, for \$16.2 million.

“Demand fundamentals are the story for the long term, and there’s a good deal of consolidation yet to go.”

“Given the compelling need for more efficient water management practices worldwide, water recycling and re-use constitute a foremost field of expertise,” said Richard Verreault, GLV’s president and chief operating officer. “The AJM acquisition is consistent with our long-term objective of positioning GLV as a global leader in comprehensive technological solutions for wastewater management, focusing on a number of high-potential niche markets and territories.”

Smaller Canadian water companies have also made technology acquisitions. For example, publicly traded **TORR Canada Inc.** (Montreal), a company dedicated to the extraction of hydrocarbons from upstream oil- and gas-produced water, acquired **Pure Group AS**, a Norwegian developer of oil, gas and water purification technologies. Pure Group generated approximately \$26.2 million in revenues in 2006; the 2007 deal was valued at \$43.8 million.

Service Firms Globalize

On the services side of the business, consulting & engineering (C&E) firms have been expanding geographically. In December 2007, **Stantec Inc.**, the 54-year-old, publicly traded global engineering design firm, signed letters of intent to acquire two water-oriented environmental C&E firms in the U.S. Midwest. **R.D. Zande and Fuller, Mossbarger, Scott & May Engineers** had revenues of US\$29 million and US\$36

million, respectively, adding more than 600 employees, strengthening Stantec in the Great Lakes Region, and creating new markets in Kentucky and Tennessee. Stantec, an Edmonton-based engineering and design firm, has about 7,500 employees working from more than 100 locations in North America.

Also in 2007, **Schlumberger Water Services** acquired **Water Management Consultants** of Denver, Colorado, a water quality consultancy with about 200 staff at nine offices in North America, South America, the U.K. and Australia. Schlumberger said the company would also add strength to its services to the global mining industry.

Another deal last year involved Canadian environmental sciences and engineering firm **Jacques Whitford** (Dartmouth, Nova Scotia), which acquired U.S.-based **North American Wetland Engineering LLC**, an innovator in wetlands technology, and its related infrastructure management services company **EcoCheck Inc.** “Not only are we expanding our core services by incorporating their cutting-edge technology in engineered wetlands, but we are also furthering our commitment to sustainable initiatives and the environment,” said Bob Youden, chief executive officer of Jacques Whitford.

On the utilities side, investors have ventured outside Canada for opportunity. Mississauga-based **Algonquin Power Income Fund**, which invests in renewable power generation and sustainable infrastructure assets across North America, now owns 17 water distribution and wastewater facilities in the the United States serving 61,000 customers.

In 2007, **The Ontario Teachers’ Pension Plan** completed its purchase of interests in **Empresa de Servicios Sanitarios del Bio-Bio S.A.** (ESSBIO) and **Agua Nuevo Sur Maule, S.A.** (ANSM), two water utilities represent-

Survey: Continued from page 4

lations by 61%; and local/municipal regulations by 59%. (See table.) Liability and safety also rated high as market drivers, with drinking water safety/liability deemed a crucial/very important market driver by 47% of respondents. Liability associated with pollution was rated crucial/very important by 45% of respondents.

Green Drivers: Of the three green-oriented drivers of business opportunity listed, 33% of respondents gave a crucial/very important rating to reuse/recycling, 20% to corporate social responsibility/image, and 17% to climate change. Not too surprisingly, 49% of respondents deemed climate change issues not very important or meaningless and approximately one third felt the same about corporate responsibility and reuse/recycling.

Customer Trends: Asked to rate customers by growth prospects over the next 2-3 years, 61% of respondents said municipal wastewater treatment

plants represented the highest/very important growth prospect for their company, followed by 57% who said municipal water utilities. The next top-rated customers for growth prospects were oil and gas (44%), private water utilities (36%) and food (35%).

Business Issues: Interestingly, although Canadian water companies consider federal funding to be the most crucial issue, in general companies regard private ownership and private management as increasingly important. Private funding is also seen as crucial/very important by 40% of survey respondents.

In terms of system scale, worth noting is that more than twice the respondents cited Small-Scale Point-of-Use Systems as crucial to the water market's future compared to traditional Large-Scale Centralized Systems. Rated almost as high were Mid-Scale Point-of-Entry Systems, indicating the breadth of opportunity for systems and technology providers in the global water market. §

M&A: Continued from page 23

ing 20% of regulated water and wastewater services in Chile. Ontario Teachers' acquired 50.8% of ESSBIO for \$356.5 million and 100% of ANSM, a privately held company, for an undisclosed amount. Also in 2007, Ontario Teachers' agreed to acquire up to 100% of Esval S.A., a public water and wastewater company and Chile's third largest water operator, serving approximately 16% of the country's regulated water market. Ontario Teachers' agreed to acquire the 48.92% interest in Esval held by Consorcio Financiero and other shareholders for \$384 million. §

EnviroTower: Continued from page 16

sion reductions that its systems achieve with energy savings. "Addressing climate change is increasingly an issue for property management companies," said Cornforth, "and many of their clients set specific goals to reduce energy consumption and carbon emissions. We can definitely help them move toward achieving those goals." §

Importance of Market Drivers in the Canadian Water Industry

Market Driver	Crucial	Very Important	Important	Not Very Important	Meaningless	No Opinion
Provincial/State Water Quality Regulations	23.6%	43.6%	18.2%	9.1%	3.6%	1.8%
Federal/National Water Quality Regulations	18.5%	42.6%	16.7%	16.7%	3.7%	1.9%
Local/Municipal Water Quality Regulations	17.9%	41.1%	25.0%	7.1%	5.4%	3.6%
Drinking Water Safety/Liability	9.4%	37.7%	20.8%	18.9%	7.5%	5.7%
Liability Associated with Pollution & Discharge	11.3%	34.0%	32.1%	17.0%	3.8%	1.9%
Government Funding Programs	23.2%	21.4%	28.6%	14.3%	7.1%	5.4%
Demand for Water Reuse/Recycling	10.9%	21.8%	34.5%	29.1%	1.8%	1.8%
Water Scarcity	11.3%	20.8%	32.1%	22.6%	7.5%	5.7%
Economic Growth Rates	3.8%	26.4%	49.1%	15.1%	0.0%	5.7%
Water Resource Planning	5.6%	22.2%	27.8%	25.9%	7.4%	11.1%
Pace of Development & Construction	1.9%	24.5%	35.8%	30.2%	1.9%	5.7%
Development Bank Funding Programs	7.5%	17.0%	20.8%	26.4%	22.6%	5.7%
Demand for High-Purity Water by Industry	7.7%	15.4%	34.6%	25.0%	13.5%	3.8%
Corporate Social Responsibility/Image	3.6%	16.4%	36.4%	36.4%	5.5%	1.8%
Rising Price of Wholesale/Retail Water	3.8%	15.1%	24.5%	35.8%	15.1%	5.7%
Climate Change	5.7%	11.3%	28.3%	28.3%	20.8%	5.7%
High Price of Oil	1.9%	13.5%	23.1%	34.6%	21.2%	5.8%

Source: Canadian water survey conducted by EBI Inc. on behalf of Industry Canada in March 2008. Market drivers are ranked by the sum of 'crucial' and 'very important'. Respondents were encouraged to respond only to drivers they felt qualified to rate. Actual survey question was: Please rate the importance of market drivers to creating business opportunities for your company in water and wastewater.