Go with the Flow

Atlantic Canada Water and Wastewater Association Newsletter

An affiliate of the American Water Works Association and the Water Environment Federation

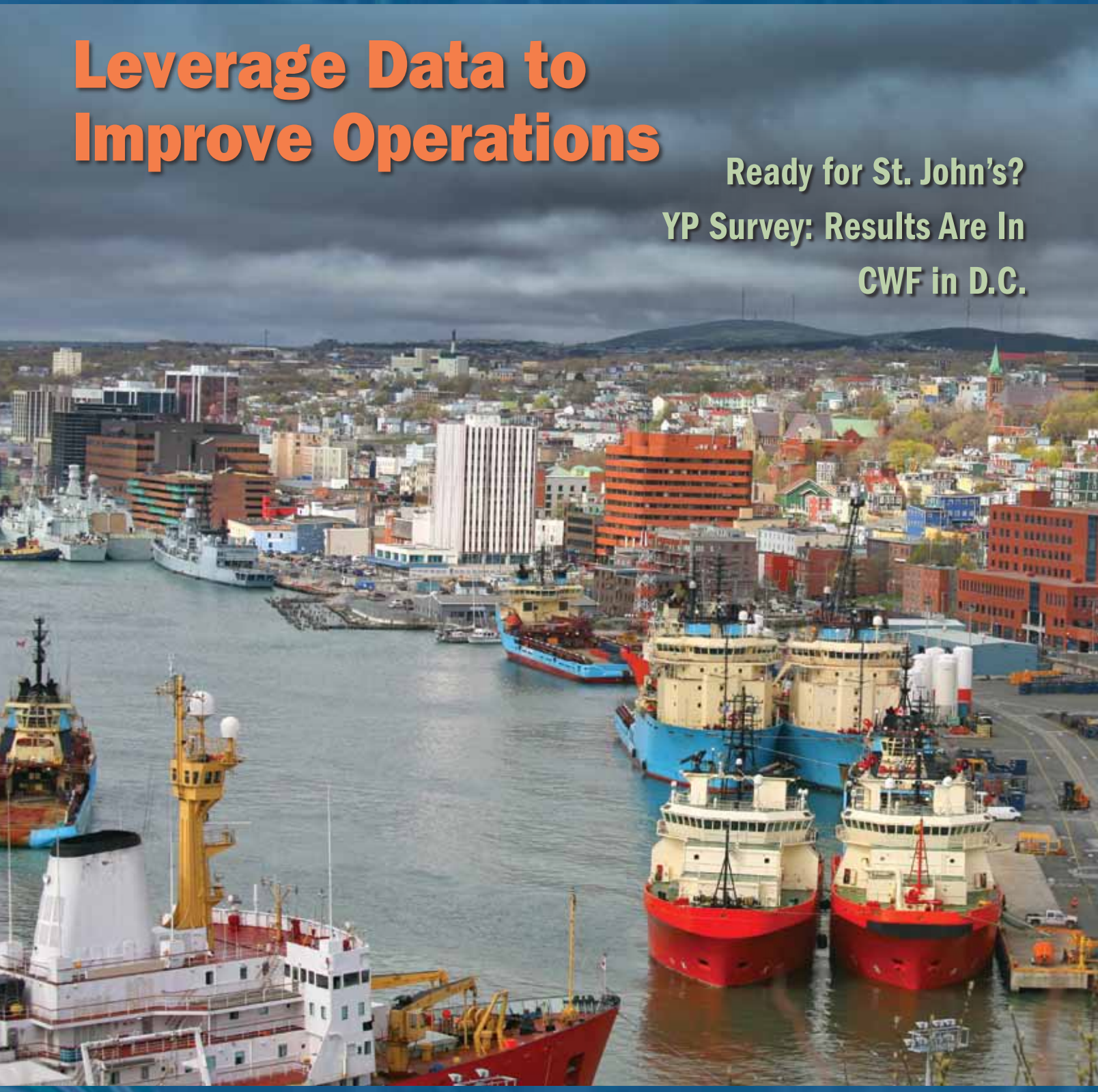
Fall 2011

Leverage Data to Improve Operations

Ready for St. John's?

YP Survey: Results Are In

CWF in D.C.



American Water Works Association | Water Environment Federation the water quality people

GENIVAR PROVIDES SUSTAINABLE INFRASTRUCTURE SOLUTIONS TO THE ATLANTIC COMMUNITY

GLOBAL SOLUTIONS IN PROFESSIONAL CONSULTING SERVICES

Municipal Infrastructure | Transportation | Industrial | Environment | Energy
Project Management | Land Surveying | Urban Planning

ATLANTIC OFFICE LOCATIONS

Nova Scotia Dartmouth | **New Brunswick** Moncton | Saint John | Fredericton
Prince Edward Island Summerside | Charlottetown

www.genivar.com

GENIVAR

An affiliate of the American Water Works Association and the Water Environment Federation

ATLANTIC CANADA WATER & WASTEWATER ASSOCIATION

American Water Works Association

Water Environment Federation
the water quality people®

Table of Contents

Atlantic Canada Water & Wastewater Association
PO Box 41002
Dartmouth, NS, B2Y 4P7
Phone: 902.434.6002
Fax: 902.435.7796
www.acwwa.ca
e-mail: acwwa@hfx.andara.com

GO WITH THE FLOW is published four times yearly by the Atlantic Canada Water and Wastewater Association, PO Box 41002, Dartmouth, NS, B2Y 4P7. Published in the USA.

On the cover:
You should receive this issue just as the ACWWA Annual Conference slides into North America's oldest city, St John's, NL. See you there!

Chair's Corner

It's Been a Wet But Busy Summer by Robert Gillis, P. Eng.

Welcome to another edition of *Go With the Flow*. I hope everyone enjoyed the past few weeks of summer; we finally had some sun versus the prior weeks of rain and cold temperatures. I am sure most municipalities exceeded their annual summer rainfall levels, which made it easy on the water treatment plants but pushed the wastewater plants harder than usual. It was great weather, if you were a duck.

This past couple of months have been very busy. Shawn Rowe with Dillon Consulting has been working tirelessly to improve our Operator Certification Course offering with material from the British Columbia Water & Wastewater Association. Shawn met with BCWWA and our instructors in July to discuss ways to improve the course and meet attendee expectations. Shawn also referenced student feedback from previous courses to ensure we don't make the same mistakes and we continue to offer operators the training they require. Thank you to Shawn and his committee.

Two years ago, the ACWWA refined their board structure. Over the last year, your directors and committee chairs have prepared and reviewed new terms of reference for each position to ensure they match our section's vision and goals. I would like to personally thank each board member and their respective committee chairs for their dedication and commitment in this project. Thank you.

This is the final edition prior to the upcoming Annual Conference in St. John's, NL, Oct. 2–4 at the Delta St. John's. That means all your travel plans should be made, hotel room booked and registration forms submitted. The conference chair, Debbie Smith, and her team have worked very hard putting an exceptional program together for you and your colleagues to enjoy. I hope to see you all there!

ACWWA Executive and Committee Officers

SECTION OFFICE

Clara Shea, ACWWA Administrator 902.434.6002
contact@acwwa.ca ..... F: 902.435.7796

BOARD

Chair
Robert Gillis, P. Eng 902.469.2806 x103
robert@aps.ns.ca ..... F: 902.463.3529

Past Chair
Ensor Nicholson, P.Eng 506.859.2667
ensor.nicholson@moncton.ca ..... F: 506.853.3543

First Vice Chair
Jamie Hannam, MBA, P.Eng 902.490.4804
jamie.hannam@halifaxwater.ca ..... F: 902.490.1584

Second Vice Chair
Brett Pugh, P.Eng ..... 902.421.7241 x 2270
brettp@cbcl.ca ..... F: 902.423.3938

Secretary-Treasurer
Willard D'Eon, MPH, P.Eng. 902.492.6753
willardd@cbcl.ca ..... F: 902.423.3938

WEF Delegate (2011–2012)
Gary Chew 902.895.2885
gary.chew@sansom.ca ..... F: 902.893.7584

AWWA Director (2011–2014)
Reid Campbell. 902.490.4877
reid.campbell@halifaxwater.ca ..... F: 902.490.4808

AWWA Director Elect (2014–2017) ..... Vacant

ABEA Representative Director (2008–2011)
Greg Eisnor 902.444.7350
geisnor@canadapipe.com ..... F: 902.444.7351

Gov't Relations Director (2009–2012)
Roland Richard, P. Eng 506.387.7977
rrichard@gmsc.nb.ca ..... F: 506.387.7389

Membership Involvement Director (2009–2012)
Scott Grasman, P.Tech 506.460.2038
scott.grasman@fredericton.ca ..... F: 506.460.2461

Education Director (2010–2013)
Shawn Rowe, EIT 902.450.4000 x5030
SRowe@dillon.ca ..... F: 902.450.2008

Membership Director (2010–2013)
John Eisnor, P.Eng 902.490.1930
johne@halifaxwater.ca ..... F: 902.490.1584

Communication Director (2008–2011)
Nicole Taylor, M.Eng, P.Eng 506.658.4455
nicole.taylor@stjohn.ca ..... F: 506.658.4740

Technical Director (2008–2011)
Margaret Walsh, PhD, P.Eng. 902.494.8430
mwalsh2@dal.ca ..... F: 902.494.3105

Tech. Papers/Scholarship ..... Margaret Walsh, PhD, P.Eng.

Water For People Chair ..... Brett Pugh, P. Eng.

Volunteer Chair
Doug MacKinnon 902.895.2885
doug.mackinnon@sansom.ca ..... F: 902.893.7584

Newsletter Chair
Amy McHarg P.Eng 506.633.6650
amym@cbcl.ca ..... F: 506.633.6659

Education Chair
Mark Butler, P.Eng 506.633.5000
mbutler@dillon.ca ..... F: 506.633.5110

Cross Connection Control Chair
Fred Sawyer 506.658.6698
fred.sawyer@gnb.ca ..... F: 506.643.2853

Young Professionals Chair
Stephanie Gora, EIT 902.421.7241
stephanieg@cbcl.ca ..... F: 902.423.3938

Scholarships Chair
Jennie Rand, PhD, P. Eng 902.585.1519
jennie.rand@acadiau.ca ..... F: 902.585.1067

2011 St. John's Conference Chair
Deborah Smith, R.T 709.745.1870
dsmith@stjohns.ca ..... F: 709.745.0935

Website Chair
David Russell 506.658.4763
david.russell@saintjohn.ca ..... F: 506.658.4740

Operator Involvement Chair
Trent Brewer 506.460.2038
trent.brewer@fredericton.ca ..... F: 506.460.2301

Government Affairs Chair
Stefan Furey 902.424.4743
fureysm@gov.ns.ca ..... F: 902.424.0501

ATLANTIC CANADA WATER & WASTEWATER ASSOCIATION

WEF Delegate's Update

Where the 5s Society Came From by Gary Chew

Hello to all WEF members; here we are winding down towards St. John's, Oct. 2 to 4. Where did the summer (if we can call it that) go? It is going to be an exciting conference for WEF members in Atlantic Canada with the launch of the ACWWA 5s Society. We have never had a shoveller's society, and this will now give us a chance to grow the society with new members every year at the conference. Here is a bit of the history of the society for you, from the 5s Society, Ontario Chapter, website.

The Select of Sanitary Sludge Shovelers had its beginnings in the United States, but there is some dispute as to where and by whom it was founded. A commonly accepted thesis is that the original chapter of the Five S Society was formed in Arizona in October 1940, the idea being conceived by A.W. "Dusty" Miller and F. Carlyle Roberts, Jr. Other people strongly contend that it had its beginnings in the Commonwealth of Pennsylvania with the Ted Moses High Hat Award. Whatever its origins, independent chapters of the Society have since been formed in many of the American states, British Columbia, Quebec, Ontario, Alberta, Saskatchewan and Manitoba, the United Kingdom, Australia and New Zealand. In addition, there are Shovelers in Japan, Brazil and The Netherlands. The chapter in New Zealand is probably the youngest, having been inaugurated in May 1993. It will undoubtedly be of interest to Canadians to know that the former Governor General, the late Madame Sauve, was made an Honorary Member of the Florida Chapter when she spoke at the WPCF Conference in Miami in 1975. The Honourable Roger Simmons, M.P. for Burin-St. George's, was similarly honoured at the Conference in Los Vegas in 1980. The Society was formed to provide a means of recognizing those who have contributed freely of their time and talents to the growth, well being and success of their individual associations. Many of these hard workers do not become president of their association, or receive one of the coveted awards associated with water pollution control activities, and the Five S Society does provide a concrete method of expressing recognition and gratitude for their efforts. It is important to appreciate that one cannot "join" the Society, but that members are "selected" on the basis of merit. Tradition provides that the four senior members of a chapter present at a meeting of their association shall select three new chapter members who qualify by their activities.

Continued on Page 18

AWWA Director's Report

Some AWWA Changes, and Looking Forward to St. John's by Reid Campbell

This is my first opportunity to report to you as your representative on the AWWA Board of Directors. It is a tremendous privilege and honour for me to represent our section in this way. I look forward to serving our membership as your director and hope that I can meet the standard set by many previous directors who have represented Atlantic Canada before me. This also makes for a great opportunity for me to thank Bruce Buchanan, who has just concluded his term as director. Bruce did an excellent job in representing ACWWA and I want to thank him for so ably leading the way for me.

We are all looking forward to our Annual Conference in St. John's. Debbie Smith and her committee have been working hard and assembled a terrific program, so I trust you will make every effort to join us.

I will have the pleasure of hosting some important guests. AWWA Immediate Past-President Joe Mantua, who concluded a successful term as President at ACE11 in Washington, D.C., in June, is looking forward to sampling some Atlantic Canada hospitality and meeting as many of our members as possible. We are also very honoured to be hosting AWWA Executive Director David LaFrance. David was appointed as AWWA's Executive Director in May 2010, so we are very pleased that he has accepted an invitation from Atlantic Canada so early in his tenure.

I attended ACE11 in Washington, D.C., in June, which gave me the opportunity to attend board meetings as an observer.

The AWWA board dealt with some very important business at its June meetings: It approved the continuation of the Canadian Affairs Committee and determined that it will report to AWWA's Executive Committee. The future of CAC came in doubt when the Administrative and Policy

Continued on Page 19

YP Survey: The Results Are In

The results are in for the 2nd ACWWA Young Professionals Survey! The survey, which was conducted online using Survey Monkey, was designed to assess the state of the ACWWA YP Committee. Over 30 people, or half of the current mailing list, participated.

As shown in Figure 1, the Committee is mostly made up of people between the ages of 25 and 34, though there are a substantial number of members over 35. The results are not surprising, because the period between the ages of 25 and 34 is when most people start to establish themselves in their careers in the water and wastewater industry and thus when they are most likely to become active in the committee. Nonetheless, the fact that a large proportion of our members are over 30 years old suggests that many of them are reaching a point when they will no longer consider themselves young professionals. Efforts will have to be made to recruit younger people into the group if we are to remain vibrant.

Many YPs are reaching an age when they no longer consider themselves "young professionals."

Figure 2 summarizes the answers to the questions "Where do you live?" and "Where do you work?" The majority of the committee's members live and work in Nova Scotia, but New Brunswick

Figure 1.
Answers to: "How old are you (approximately)?"

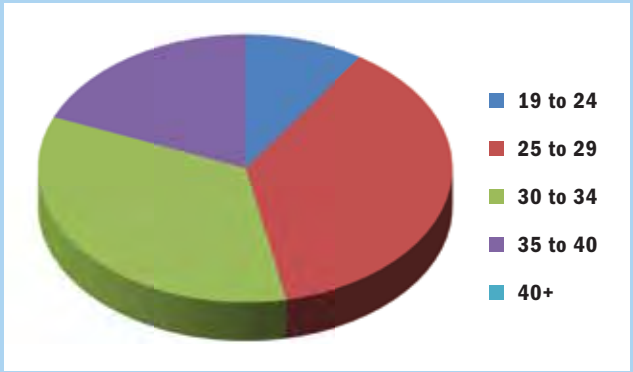


Figure 2.
Answers to: "Where do you live?" and "Where do you work?"

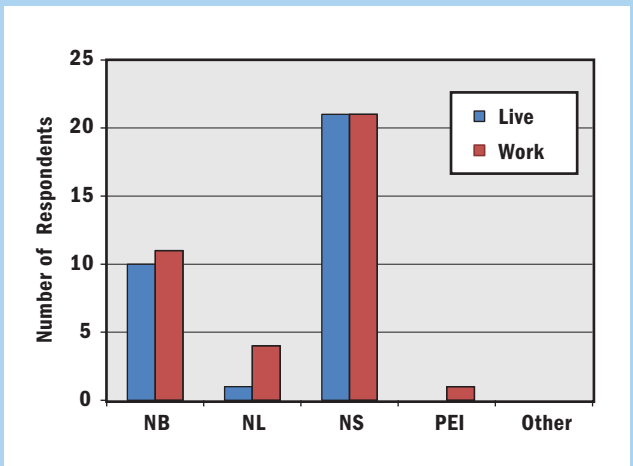


Figure 3.
Answers to: "Which category best describes your current position?"

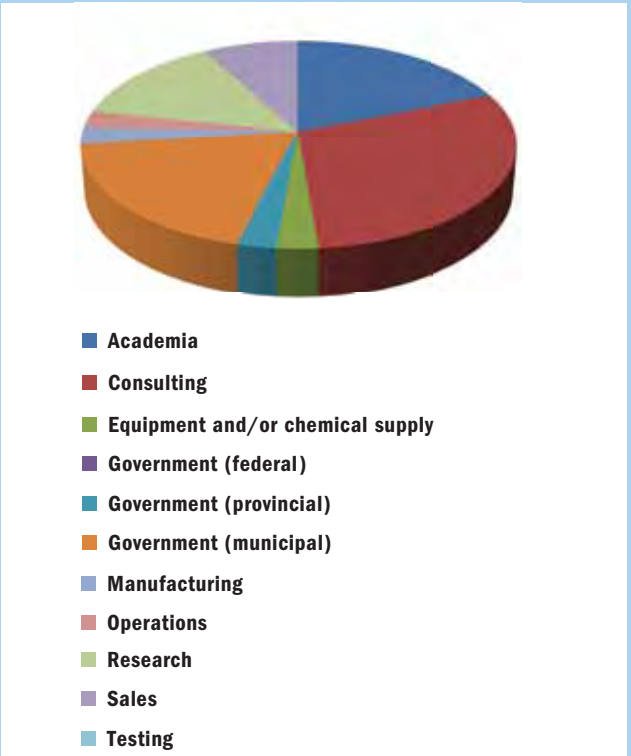
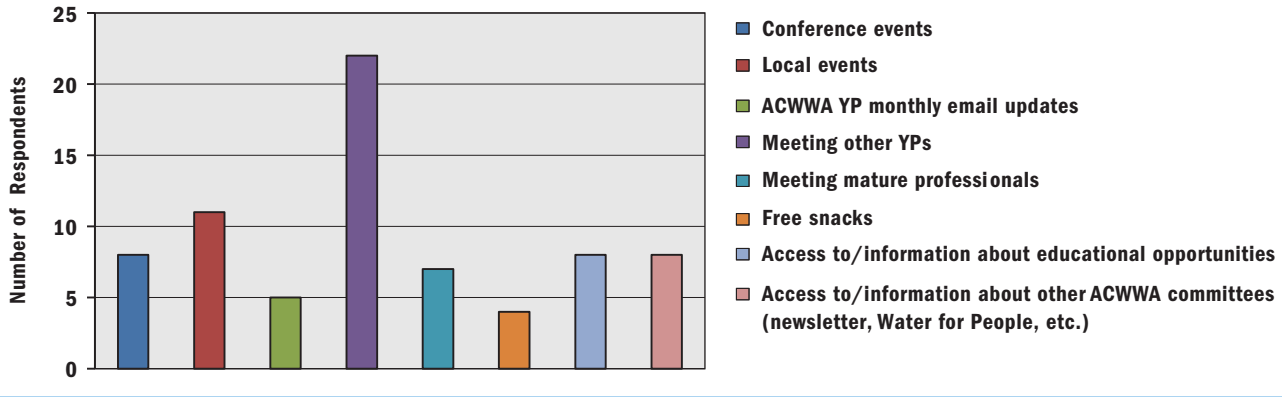


Figure 4.

Answers to: "What is the best thing about being part of the ACWWA YP Committee?"



is beginning to catch up. This highlights the efforts of Barb Crawford and Greg McCann, who have organized a number of YP events in Saint John and Fredericton. Future expansion efforts will likely focus on Moncton, NB; Charlottetown, PEI; and St. John's, NL.

The committee includes people from many different parts of the industry, including academia, government, consulting and equipment and chemical supply. Figure 3 shows that the majority are clustered in consulting, academia and municipal government. This finding suggests that the committee should do more to reach out to other groups in the water and wastewater industry, including federal and provincial government employees and operators.

Respondents were also asked to indicate how they had heard about the committee. The majority (45 percent) said that they had been recruited by their local representative, while 29 percent heard of the committee through a friend or co-worker. These results show that word of mouth is the most effective recruitment tool for the committee. Another 32 percent of respondents learned of the group through the annual ACWWA conference, which has traditionally been an excellent opportunity for YPs to meet and exchange ideas.

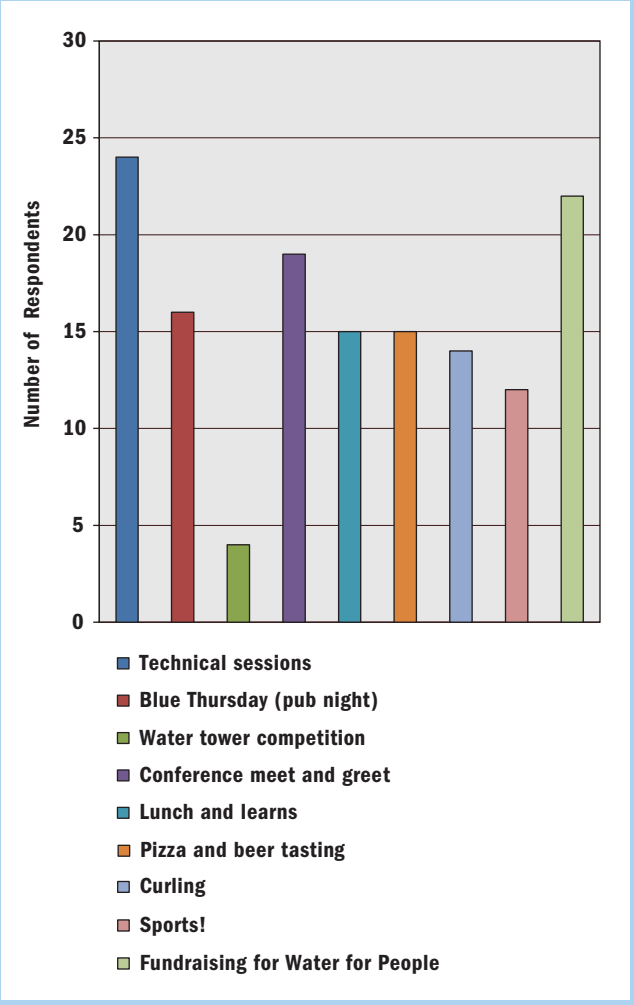
Figure 4 shows the answers received to the question: "What's the best part of being a member of the ACWWA YP Committee?" Almost all respondents indicated that they enjoyed meeting other YPs. Local and conference events were also popular.

Finally, respondents were asked to choose what types of events they would be most likely to attend. There appears to be a significant demand for technical sessions and more fundraising activities for Water For People. Blue Thursday and the annual YP conference event were also popular choices.

The results of the survey will be used to set goals and choose events for the coming year. Thanks to everyone who participated, and don't forget to sign up for the YP event at the ACWWA conference in St. John's, NL, this October!

Figure 5.

Answers to: "What activities are you most likely to attend in the future?"



Canada's First YP Summit Heads to Vancouver

by Stephanie Gora, MASc, EIT, CBCL Limited

This past spring I was asked to represent the ACWWA at the first Canadian Young Professionals Summit, which took place on May 19 in Vancouver, BC. The summit was a great opportunity to get together with young professionals from across the country to share ideas and develop new events and initiatives.

The day began with some wise words from mature professionals Cordell Samuels (Municipality of Durham) and Mike Nolan (Kerr Wood Leidel and Associates Ltd.). Next, Joyce Chang (CH2M HILL) discussed the application of sustainable design concepts to wastewater treatment processes. After her presentation, representatives from the various AWWA and WEF chapters in Canada provided snapshots of the structure and operation of their local young professionals committees. It was interesting to learn of the vast network of water and wastewater young professionals and student groups in Ontario, and of the educational and social initiatives implemented by other chapters.

After the presentations, we were invited on a tour of the newly constructed Seymour-Capilano water treatment plant. The WTP includes alum coagulation, direct filtration and disinfection with UV and chlorine. It incorporates numerous sustainable design features, including rain water capture, residuals recycling and LEED building concepts.

The summit included a visit to the new Seymour-Capilano WTP in Vancouver.

The first Canadian YP Summit was informative and well-executed. I learned quite a bit about the administration of YP groups across the country as well as sustainable design for water and wastewater treatment processes. I would like to thank the ACWWA for allowing me to serve as their representative in Vancouver and look forward to introducing what I learned there into our local ACWWA YP Committee.

ACE11 Canadian Water Forum a Hit

by Bruce Buchanan, Chair, Canadian Affairs Committee

Each year, the Canadian Affairs Committee organizes a function for Canadians attending the AWWA Annual Conference and Exposition. The objective of the Canadian Water Forum is to meet old friends, make new ones and reminisce about the events of the last year over a few refreshments.

This year the venue for the CWF was the Canadian Embassy in Washington, D.C. This beautiful facility, situated close to the US Capital Building, was a short walk from the hotel for the Canadian delegates. More than 350 people managed to take in the very popular event with others being turned away at the door due to the capacity of the room.

Because of this popularity, the Canadian Affairs Committee has managed over the years to realize a profit, which has been donated to the Canadian Water For People organization. The money goes towards funding projects that provide safe drinking water in underdeveloped countries. This year was no exception, and over $3,000 will be donated.

The Canadian Affairs Committee thanks the staff of the embassy for allowing us to host the event there, and for making it such an enjoyable evening. During my conversation with Deborah Lyons, Deputy Canadian Ambassador, we realized we had grown up in within 15 km of each other, on the Miramichi River in New Brunswick. It really can be a small world sometimes.

Thank you all for attending and making it success. Hope to see you in Dallas in 2012!

Deputy Ambassador Deborah Lyons and Bruce Buchanan

This feature is an excerpt from *Opflow*, published February 2011 by American Water Works Association (www.awwa.org). Reprinted by permission.

Bill Serjeantson, Scott McKinney, and Rod van Buskirk are with Westin Engineering (www.we-inc.com), Rancho Cordova, Calif.

State-of-the-art systems that monitor and automate operations can help utilities tap into an extensive data source to improve operations. So why is access to quality operations data such a struggle?

BY BILL SERJEANTSON, SCOTT McKINNEY, AND ROD VAN BUSKIRK

LEVERAGE OPERATIONS DATA AND IMPROVE UTILITY PERFORMANCE

ACCESSING QUALITY OPERATIONS data hasn't always been a user-friendly process. Data collection was often unreliable, and integration required costly customization. The end result was that supporting and maintaining operational data was time consuming, and direct access to the data was limited to supervisory control and data acquisition (SCADA) or information technology (IT) staff.

Fortunately there's a light at the end of the data tunnel. A variety of data management and access tools are now available from SCADA vendors, as well as those who specialize in operations data management. These commercial, off-the-shelf solutions have shifted the focus from solution development to product selection, system design and management, and configuration.

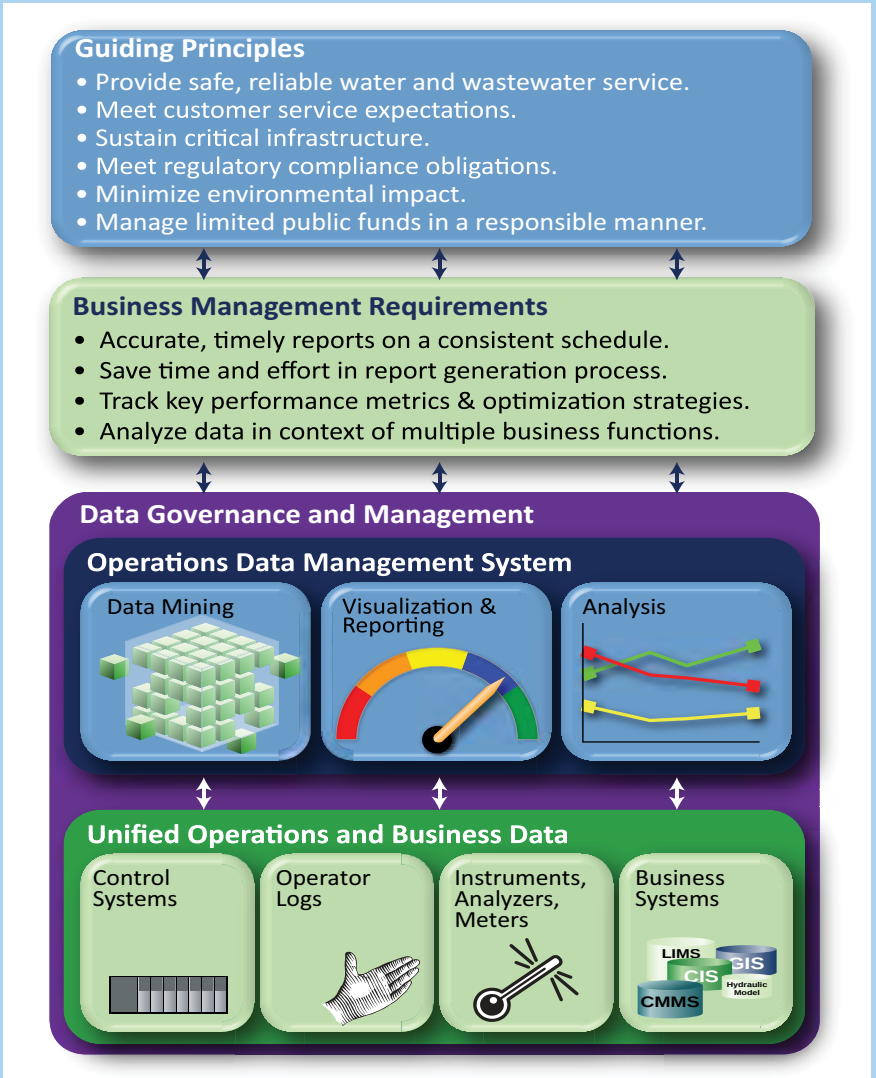
The foundation of an operations data management system (ODMS) is data capture and a time-series database that provides a uniform view of a utility's operations data, regardless the source. Time-series databases are commonly called historians and may be custom-built, supplied by a utility's human–machine interface vendor, or developed by an independent ODMS solution provider. Each option has its relative strengths and weaknesses; there isn't a universal solution for all utilities.

PHOTOGRAPH: JIM HAVEY, HAVEY PRODUCTIONS (TOP)

An ODMS can help managers view and report on operations data in the context of other business measures to guide capital decisions or reduce operating costs; operators can see near-real-time results of a process change; and compliance staff can produce reports in a fraction of the time required to assemble them by hand.

ODMS Benefits

An ODMS provides a wide range of operational data, allowing users to manage fundamental utility strategies and improve performance.



LAYING THE FOUNDATION

A database's usefulness is a function of the level of data accessibility by users. For many utilities, the value of operations data is severely diminished because access is limited to a small number of technicians with advanced programming skills. Data's value is increased by maximizing the number of users who can query, present, and analyze the data using graphically driven tools.

At its highest level of maturity, an ODMS culminates in an enterprise-integrated database supported by effective governance to ensure continuity and integrity. The greatest value is achieved when an ODMS enables the timely, electronic exchange of data among operations and business systems to support effective operations and business decisions. With the help of an ODMS, managers can view and report on operations data in the context of other business measures to guide capital decisions or reduce operating costs; operators can see near-real-time results of a process change; and compliance staff can produce reports in a fraction of the time required to assemble them by hand.

To be successful, an ODMS solution needs

- clearly defined operational performance measures designed to drive improvement.
- the system itself, including data capture and integration, dashboards, reports, etc.
- an enterprise integrated database.
- effective data governance and management policies.

THE VALUE OF DATA

The information stored within an ODMS describes the effect of events and operating strategies on a utility's primary mission, as well as past and current asset performance. An ODMS can help

- streamline creation and distribution of regulatory compliance and production reports.
- analyze incidents to determine cause and effect for establishing corrective actions.
- calibrate hydraulic models used for emergency response, capital planning, what-if analysis, and optimization of energy, chemicals, water loss, water conservation, and water quality.
- trend equipment performance to support condition-based, predictive maintenance and asset renewal.
- record metering data to support bulk water delivery invoicing.
- monitor and track performance that supports operators' decisions.

IMPLEMENTATION CHALLENGES

Utilities face two universal challenges when building and maintaining an ODMS: data quality and data accessibility. Utility staff members must be confident their operations data are accurate, complete, and timely. But even the best-quality data

The greatest value is achieved when an ODMS enables the timely, electronic exchange of data among operations and business systems to support effective operations and business decisions.

have minimal value if staff members can't access the data when needed.

Data Access. The most common data access and visualization requirements are handled by a suite of business intelligence tools that support ad-hoc queries, dashboards, and scheduled reporting. More sophisticated business intelligence tools also include features for statistical analysis and enterprise integration.

Routine, scheduled reports (e.g., regulatory compliance and performance monitoring) often incorporate numerous calculations and condition-based data processing, such as totaling flow only when a pump is turned on. An ODMS typically includes report scheduling, a data processing scripting language, and a graphical forms generator for data presentation.

A user-friendly interface and unrestricted access is particularly important when analyzing an unplanned event or creating an incident report. Ad-hoc query tools allow quick, unformatted access to data, allowing casual data users to mine, visualize, and analyze data through a graphical, menu-driven interface. Drop-down menus and fill-in-the-blank fields expedite the process of building and executing a query. Data can also be analyzed with vendor-supplied tools or exported to third-party tools such as spreadsheets.

A key feature of an ODMS is its ability to present information about key performance indicators (KPIs) in a visual dashboard. Dashboards monitor near real-time information, enabling managers to see and quantify the results of a decision. Dashboards can display KPIs through data reports, graphical dials, trends, and charts. The most effective dashboards dynamically update summary KPIs that provide a visual alert when a KPI strays from its target range or trends off goal.

Data Quality. Data quality starts with getting the "right data to the right place at the right time." Completing a metadata analysis before ODMS implementation is an important first step to meeting this goal. Metadata determines which data are important to capture and how the data should be captured to ensure relevance to users. Instead of capturing all available data, utilities must consider that most SCADA historians base license fees on the number of data tags. In addition, increasing the rate and amount of data that's captured and stored reduces the performance of flat-file databases used by typical SCADA historians.

Manual data entry presents the greatest opportunity for introducing data quality problems into an ODMS. However, automating all data collection can be cost prohibitive. The quality of manual data collection can be improved by

- reducing transposition errors (provide staff with hand-held data entry computers).
- eliminating delays associated with remote data collection (enable wireless communication between hand-held devices and base servers).
- correcting data at the point of entry (code data validation into electronic forms).

Other data quality issues—data holes and inaccurate data—can be introduced by equipment failures or system maintenance. Data holes represent missing data. A common source of data holes is failure of network communications (especially to remote facilities) that isolates a data source from the ODMS data collector. Other data holes are caused by system component failures or when components are taken offline for maintenance. Design strategies to mitigate data holes include storing and forwarding data captured at remote facilities or redundancy at points of consolidation, such as SCADA servers or critical programmable logic controllers. System design is the best time to analyze system failure modes and determine which strategies should be implemented.

DATA GOVERNANCE

Getting full value from enterprise integration requires cooperation between corporate IT and SCADA groups to address security, data access, and data integration

Report Generation

Logic and format can be structured so reports are presented with a consistent look and repeatable conclusions.

WATER TREATMENT PLANT OPERATIONS REPORT

1-Aug-10 thru 31-Aug-10

Plant Production	Raw Inflow	Dutard	East Pipeline	Total Production	Utility Water	Recovered Water	Underflow Sludge
Total MG	776	14.6	718	732	1010.1	30.0	1.3
Average MGD	25.0	0.5	23.2	23.6	32.58	0.97	0.04
Total Acre Feet	2381	44.4	2203	2247	3099.8	92.1	4.1

NOTE: RAW BIFLOW includes recovered water; TOTAL PRODUCTION is amount of treated water leaving the plant.

Plant Performance	Raw	Settled	Ozonated	Comb Filter	Clearwell	Finished	Disinfection CT Ratio
Average NTU	4.97	1.11		0.04		0.03	
Average pH	8.04	8.88	7.27	7.56	7.71	7.71	Minimum
Average Temp	22.9	23.0	23.6	23.3		23.0	4.4

Filter Performance	Filter 1	Filter 2	Filter 3	Filter 4	Filter 5	Filter 6	Maximum
Avg. gpm/ft2	3.7	3.7	3.7	4.0	3.6	3.7	11.6
Avg. Filter Run - Hrs	46	60	60	50	60	60	Average
Avg. UFRV gal/ft2	10,328	13,232	13,470	11,886	13,013	13,336	7.4

Total Filters Washed	76
Average Filter Run-Hrs	56
Backwash Total MG	14.4
Backwash Avg. MG	0.192
East Pipeline Flows	MG
Mabury	70
Alum Rock	154
Hostetter	344
Milpitas	118
Intertie	0

Chemicals	Gallons Used	Bulk lbs Used	Avg. Dose mg/L
Aluminum Sulfate	21,866	239,038	16.1
Anionic Polymer	35,560	587	86.6
Aqueous Ammonia	2,625	20,263	0.49
Ca Thiosulfate - Cl2	0	0	0.00
Ca Thiosulfate - O3	0	0	
Cationic Polymer	1,814	15,739	0.48
Ferric Chloride	0	0	
Hydrogen Peroxide	0	0	
Liquid Oxygen	4,514	47,670	0.47
Nonionic Polymer **	172	1,494	0.23
PAC (Carbon)	0	0	
Permanganate		0	
Phosphoric Acid	1,706	0	0.98
Sodium Hydroxide	4,582	59,546	4.51
Sodium Hypochlorite	19,224	192,990	3.76
Sulfuric Acid	0	0	

Belt Press Operation	
Operating Hours	92
Sludge Processed MG	0.812

**Nonionic Polymer Use	Avg. mg/L
Flocculation Aid	0.17
Filter Aid	0.06

Ozone Production Summary

associated with moving data from real-time operational systems to the business network. Maintaining a secure control system means an organization must maintain a version of the operations database in a demilitarized zone where it can be accessed by business users. When elements of the ODMS reside on the corporate IT and SCADA network infrastructures, however, the question of database ownership arises. System continuity and integrity depend on establishing clearly defined roles and responsibilities for database management and maintenance, as well as policies and procedures for data validation, database backup, or adding new data points.

Users must have confidence in their operations data for regulatory compliance reports, invoices to wholesale customers, and event analysis. Yet many common operating conditions—equipment failure, maintenance, or instrument calibration—can cause inaccurate or missing data. A clearly defined data validation process establishes who's responsible, what data require validation, and business rules for discovery and resolution. Automated reports, soft sensors based on neural networks, or programmatic business rules can be used to find, annotate, and summarize missing or suspect data.

The Holy Grail for an ODMS is achieving a "single version of the truth." This doesn't necessarily mean the data are the most accurate, but rather the system reports only one version of the data.

ODMS SOLUTIONS AND DEVELOPMENT

There's no one ODMS solution that's right for every utility. Standard SCADA historians are often based on a flat-file database. The database is a single file (or sequential files) in which data are appended upon the data's capture. Although this approach makes efficient use of disk space and provides high-speed data capture, search capabilities are relatively slow compared with a multidimensional, relational database. Hybrid solutions leverage the strengths of both technologies, which combine efficient data storage and high-speed data capture capabilities of a flat-file database with high-speed indexing and querying capabilities of a relational database system.

The best solution for your utility depends on data access and delivery requirements, SCADA and business system standards, available internal and external technical support, system size, and budget. A structured approach to solution development ensures that an ODMS meets your expectations. Without it, user confidence erodes as system problems and deficiencies are discovered. When a utility takes system development short-cuts, Murphy's law takes over. For example:

- After a catastrophic hard-drive failure, it was discovered that database backup procedures weren't properly configured.
- Data for pH and turbidity weren't captured because the deadband was set too high. This issue was only identified when the annual regulatory compliance report was being produced.
- An operator accidentally overwrote critical values because database security wasn't properly configured.

CASE STUDIES

REAL-WORLD ODMSs BENEFIT WATER UTILITIES

To better understand how an operations data management system (ODMS) can benefit a water utility, consider the impact such a system has made in two water utilities in recent years.

SANTA CLARA VALLEY WATER DISTRICT

In November 2010, Santa Clara Valley Water District, San Jose, Calif., finished implementing an ODMS. The goal was to deploy a system to improve decision making related to water quality, billing, regulatory compliance, and operations. The project identified data access and reporting needs of operations, engineering, information management, and utility management, as well as requirements for data organization, technical architecture, administration, and support. The project included formal system selection, configuration, and training.

Johanna Castro, the district's senior engineer who managed the project, immediately recognized the value of the tool. "For those of us who are already tapping into the ODMS, it has been extremely useful," says Castro.

Having access to a reliable data source simplifies the effort required to identify trends and troubleshoot ongoing process issues. According to Castro, the district's planning group uses the historian to validate hydraulic models, and laboratory staff use the historian to help troubleshoot unusual analytical results or determine where to collect samples.

The system also reduces Castro's reliance on staff at remote facilities to collect and report on data.

"Operational facilities are remote from my office," relates Castro. "The ODMS lets me follow events in real time, in different treatment plants, all at the same time."

The district's commitment to continuous improvement means Santa Clara needs to face the ongoing challenge of collecting and validating operational data. "Defining and implementing a sustainable data validation procedure will be one of our greatest challenges," relates Castro.

In addition to being automated and operator-friendly, the system must be manageable. According to Castro, the district needs to figure out which of the millions of data points are reasonable to gather and validate. Moreover, the ability to gather data with finer granularity means the district may need to change its way of

Users must have confidence in their operations data for regulatory compliance reports, invoices to wholesale customers, and event analysis.

Applying a structured approach to an ODMS project ensures that all aspects of the solution are addressed, the utility's business needs are met, the utility gains value from its investment, and the solution helps the utility meet its performance goals.

AN ENTERPRISE PERSPECTIVE

Utilities gain significant advantages from having the ability to view operational information in the context of overall utility management. For example, calculating the total cost of water requires data from the control, maintenance management, and finance systems. Attaining this level of sophistication requires integrating business processes, applications, and data across functional units. Historically, the business case hasn't justified the cost of such integration. Challenges related to system ownership, governance, and security have further limited integration of SCADA and business systems. Now, however, the expense is relatively low and the potential value higher than ever.

Given the technical advances and recent emphasis on operational improvement as a source of operating budget, integration of SCADA data with business systems can now be business as usual.

Because an ODMS database can deliver information through the control system firewall without compromising security, operational data can be easily integrated with business systems. With proper integration, ODMS data can be used to initiate events such as creating a work order, tracking and trending conditions in the context of process changes, and helping utilities achieve performance objectives.

An ODMS provides a significant opportunity to attain enterprisewide intelligence and improve performance. As part of an enterprise–business systems integration strategy, an ODMS can enhance many aspects of operations.

- Organizational roles and responsibilities are more effectively defined when processes and applications aren't separate, isolated, and departmental.
- Critical business processes that depend on operational data can be streamlined and automated (e.g., performance management, customer service, asset/maintenance management, facilities engineering, and design).
- Utilities can cross-reference information from various departments, facilities, and processes to illuminate macro trends and correlations.
- Decision processes at all levels—strategic, tactical, operational, and real-time—can be integrated to ensure they're based on consistent, reliable information delivered in a standard way.

Whether producing regulatory reports, planning capital projects, or validating billing, utilities need easily accessible data they can trust. An ODMS can relieve problems associated with data access, organizational effort, and accuracy, as well as help utilities tap into an extensive data source to improve overall performance—water quality, regulatory and operations reporting, billing, asset management, process optimization, and capital planning.

thinking. The district must grapple with these and other issues as it continues to transition from diverse methods of data collection and reporting to using its ODMS as a single source of operational information.

DUFFIN CREEK WATER POLLUTION CONTROL PLANT

Duffin Creek Water Pollution Control Plant is jointly owned by the regional municipalities of York and Durham in Ontario, Canada. In 2006, plant management commissioned a historian to improve data access, reliability, and consistency. The system provides Cordell Samuels, the facility's superintendent, with near-real-time access to operational data for business and operational decisions.

"Whenever I return to my desk, I can quickly look at the key performance indicators I'm interested in and get up-to-date information about plant operations," says Samuels. "I have good, reliable information whenever I need it."

The system has also significantly reduced the effort required to prepare and produce reports. "In the old days I had a person doing calculations by hand," explains Samuels. "Our system saves a [full-time equivalent] per year."

The tool has fundamentally changed reliability and reliance on data for decision making. In the past, according to Samuels, the plant had different people using different data sets, or even the same data set, and arriving at different answers. Now calculations occur in the same manner every time and draw from the same data set. "Because the system captures data directly from plant instruments, people have a lot more confidence in what we're doing," says Samuels.

This confidence has changed how management meetings occur. "We used to print 20–30 copies of five to 10 sheets," explains Samuels. "Now I use live reports. We just pull up the screen and look at a standard set of reports that let us compare and predict status for conditions such as flow or sludge use."

Samuels and his staff use the data for two primary uses: regulatory reports and billing. Because the plant is owned by two separate municipalities, billing accuracy is essential. "If you need accurate, reliable data quickly, there's no other way," says Samuels.

In the Bookstores

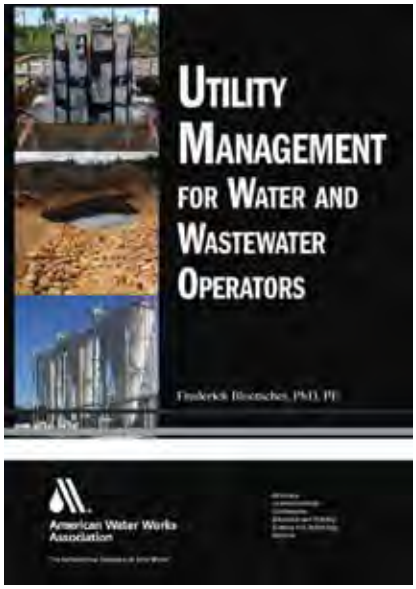
Book Excerpt: Utility Management for Water and Wastewater Operators

AWWA recently published *Utility Management for Water and Wastewater Operators*, authored by Fred Bloetscher, PhD, PE. Following is an excerpt from the book's introductory chapter.

The provision of safe drinking water and removal and treatment of wastewater in an environmentally safe manner is a public trust issue—the public trusts the utility system's ability to deliver in both cases. The expectation of water systems in the United States and Canada is that they will operate 24 hours per day, uninterrupted, and provide safe, clean water in sufficient quantities for potable purposes. Wastewater systems function to remove wastes with similar efficiency, 24 hours per day without interruption. The expectation is also that provision of water and sewer services should be inexpensive, and in many cases, the cost of water plus sewer is less than cable television.

When these expectations are not met, the public will rally to call for the removal of those perceived to be responsible. Rarely does the public understand what is required to meet these expectations, which is a credit to the effectiveness to which these systems have been designed and operated for well over 100 years. But it also is a detriment when trying to make the public and local elected officials understand the need to invest in upgrades, replacements, or maintenance of these complex systems to ensure expectations are met.

Making sure that the utility system operates continuously is of vital importance to ensure economic stability in the community. Communities with well-developed water and sewer systems tend to be more successful with development in general than those that may be limited by insufficient water and sewer supplies or treatment technologies.



Water and wastewater infrastructure is extensive and investments in the system are usually large. As a result, the investment to construct many water and sewer utilities, and to provide ongoing operations, is often made by municipal governments or local authorities in the United States and Canada. However, by their very nature (e.g., buried pipes and protected facilities that are out of the public view), water and sewer utility operations are often not in the forefront of the minds of elected officials or local government management and finance personnel. Water and wastewater are viewed as basic services, which are not as "glamorous" as more visible municipal services, such as industrial parks, community revitalization areas, public buildings, landscaping, parks, or recreational areas.

The technical nature of water and wastewater systems also hinders understanding by the public and/or local government officials. The lack of obvious problems or critical failures may lead local officials to believe that the water and sewer infrastructure is fine as is. Unfortunately, evidence gathered on the condition of infrastructure nationally tends to dictate otherwise, exposing local officials and staff to potentially significant risk and public relations problems.

As a result, management of the utility has many responsibilities. There are seven major areas that management must focus on:

1) Operational Planning
   - Maintenance
   - Equipment
   - Resources
2) Administrative
   - Staffing
   - Performance monitoring
   - Data acquisition
3) Project Planning
   - Scheduling
   - Contracting
   - Project management (PM) oversight
   - Public impacts
4) Financial
   - Revenue generation
   - Expenses
   - Capital
5) Emergency Planning
6) Organizational Planning
   - Staffing
   - Succession
   - Knowledge retention
7) Communications Planning
   - Internal vs. external
   - Medium
   - Strategies for media relations

The line personnel, those whose jobs affect the delivery of water and sewer services, are the operations group, including

water treatment, water distribution, sewer collection, and wastewater treatment. They are the front line for utility service delivery. Department or division managers supervise the basic system operations, while line supervisors direct field staff. Running close behind is utility engineering, which ensures that water and sewer services can be provided by the utility. Ancillary activities, those that exist solely to support the delivery of water and sewer services, include finance, budget, human resources, and puchasing, although often the staff for these support activities do not understand that their role is ancillary to utility delivery. For a utility to operate effectively, management of each of these areas must be addressed with the appropriate staff, policies, equipment, and materials.

The structure of the utility usually involves a governing body or board of directors. The governing board is tasked with ensuring that the appropriate policies are in place to provide fairness to all customers. The less political the board, the more it can focus on long-term goals and service reliability. Most local officials want to develop water and sanitary sewage systems that will meet the water and sewerage needs of the areas served by the utility, yet ensure that existing and future utility systems are constructed, operated, and managed at a reasonable or fair cost to the users (without outside subsidies), and to develop a system that is compatible with the area's future growth. Meeting this objective involves understanding the utility's operating environment, performing planning activities, and making financial decisions that will provide appropriate funding to achieve the utility's needs.

Executive managment reports to this board. Management's task is to ensure that the appropriate tools and resources, including personnel, are available to effectively provide service. It usually benefits the utility if the management staff possesses relevant expertise, education, and technical skills, such as engineering. Legal services should also be available to the management staff; many of today's issues are both technical and legal in nature. Permits are a typical example. Personnel with technical skills to demonstrate permit compliance and provide training are important and should report directly to management. The functions to ensure adequate personnel (human resources), finances (budget and accounting), and materials (purchasing) as divisions should report directly to management and should be held accountable to provide the assets and tools necessary to operate the utility system.

Figure 1-1 in the book shows one example of how a utility might be organized, but there are endless variations. As a result, there is no "one way" to provide service, meet the utility goals, or establish fees, and, except for implementation of impact fees or operations that consistently violate regulations, there are many appropriate ways to provide services or establish fees. The proof is that in the United States, for the most part, publicly owned water and sewer systems comply with all regulations on a consistent basis, but the backlog of infrastructure needs means that longer-term compliance may be an issue.

One objective of this book is to outline each of the areas on the organization chart while providing utility and local officials, both technical and nontechnical, with a basic understanding of what water and sewer systems consist of; what is required for proper operations, management, supervision, maintenance, and infrastructure investment needs; and

appropriate fiscal standards. The guidelines used herein are principles that have been shown to be effective and understandable to the public, an important issue for elected and municipal management officials. To this end, there are four objectives for this document.

The first objective is to provide the reader with a basic understanding of the environment in which the utility operates. To accomplish this objective, a basic introduction to those components of a treatment facility that are necessary to treat water to appropriate standards, distribute the finished, potable water to customers, and then retrieve the water for treatment after usage in the wastewater system is included. Much of the utility's costs are derived from the construction or maintenance of piping and treatment facilities. Ongoing upgrades are necessary to meet changing regulations affecting the water and wastewater industries. Because both public health and the health of the ecosystem are involved, the number of regulations with which utilities must comply is significant. Because utilities are often point sources for pollution, they have been, and remain, obvious targets for regulatory action. Understanding how to meet regulatory challenges and the focus of regulatory agencies is therefore imperative. Capital improvements and ongoing operations are intertwined with the ability of a utility to meet regulatory requirements. After the events of September 11, 2001, meeting security needs also requires ongoing maintenance and monitoring of the utility system, often without direct public knowledge.

The second objective concerns the development, maintenance, and expansion of the utility system, from current day-to-day operations to long-range planning. Governing boards, whether local elected officials or appointed district board members, and the management staff must balance the needs and goals of the utility to meet the expectations of the public (i.e., to provide safe drinking water in sufficient quantities, and remove and treat wastewater so that it creates no adverse health effects). Because public perception of water quality and the quality of operations is often very different from reality, efforts are needed to preserve the public trust in the utility system's ability to deliver adequate supplies of safe drinking water. The bottled water and home faucet filter industries depend on negative public perception of local utilities to sell expensive home treatment units to residents in markets where perfectly safe potable water supplies are present at a small fraction of the cost.

Implicit in the operations and maintenance of the utility is the need to understand employees, including hiring, training, supervision, and matching skill sets with organizational needs. Because many utility managers come from the ranks of engineers or front-line operators, management and supervision are often areas where they receive training. *Management* encompasses not only managing people, but equipment, assets, finances and budgets, and ultimately infrastructure, which incorporates parts of all other aspects. The future loss of operators and engineers with experience in the utility industry as a result of retirement has been identified by AWWA and other entities as a serious concern for the industry.

Having a "vision" of the utility in the future is helpful. Visioning can only be developed by a public planning process that reaches some community consensus. Long-range planning is needed because current customers are not the only ones making demands for water – developers will also ask for water and wastewater guarantees, and adjacent communities may want to participate in bulk agreements to acquire water and/or wastewater service from the utility. The financial impacts of these added demands must be evaluated carefully. Regulatory and customer-driven demands may stretch limited available funds, requiring prioritization or reallocation of project monies.

The third objective is to provide enough background for interested parties to understand the proper financial basis for utility operations. This includes an outline of how enterprise funds work and why, policies to encourage self-sufficiency and effective operations, and development of appropriate fees. Unlike the general funds of most local governments, water and sewer utilities should rely almost exclusively on user fees. Fees can be developed to encourage growth, conservation, or other local objectives. Impact fees are an issue in many states. Significant litigation has occurred in states such as Florida which form the basis in case law for imposition of impact fees throughout the nation. Impact fees are designed to have growth pay for itself, as opposed to forcing existing residents to pay for growth. While this is an important goal, there are cases where balancing the needs of the local economy and the costs to current residents must be weighed. If large capital projects are anticipated, borrowing funds will be required. Bonds, loans, and grants are available to most municipal systems. Grants are severely limited (usually to small, economically depressed areas). Borrowing will require securing a payback, so policies that provide the lender with confidence are important for securing favorable borrowing rates.

The final goal of this document is the introduction of a series of emerging issues for water and wastewater systems. Other issues, such as pathogens in water, the presence of pharmaceutically active substances (the next frontier for regulations), and watershed protection are also discussed. These emerging issues are all technical in nature, however, and this book is not intended to provide detailed technical discussions.

The appendixes include examples of policies and ordinances that may provide some guidance to other municipal utility systems. Several papers published by the author on emerging issues are also included for those who want more detail.

Take your operator certification exam with confidence.

Published by AWWA, 2011, softcover, 400 pp
ISBN 978-1-58321-852-5
$59 AWWA members, $89 nonmembers
No. 20517-6E

NEWLY REVISED!

Water Operator Certification Study Guide, sixth edition

John Giorgi

Now, the best water operator certification study guide just got even better! The new sixth edition of AWWA's finest operator training book, ***Water Operator Certification Study Guide***, has more sample questions and answers than ever—1,390—so you can really hit those problem areas.

Questions are similar in format and content to those on actual exams. You'll take your exam confidently ... and pass the first time!

Inside the sixth edition:

- 1,390 sample questions and answers—more than twice as many as in the previous edition. Questions are organized by grade level so you can study exactly what you need.
- 154 sample math questions—tackle those tough math questions with confidence. Includes more formulas and tables for quick reference, too.
- 871 water treatment questions: monitoring, chemicals, coagulation and flocculation, clarification and sedimentation, filtration, regulations, equipment, safety, source water quality, and more.
- 365 water distribution questions: system components; monitoring and adjusting disinfection; lab analysis; equipment installation, operation, and maintenance; and security, safety, and more.
- Questions follow the new need-to-know requirements established by the Association of Boards of Certification, the developer of US water operator certification tests. Questions are based on AWWA's latest edition of Principles and Practices of Water Supply Operations textbooks and current federal drinking water regulations.

American Water Works Association

The Authoritative Resource on Safe Water®

Order at www.awwa.org/store/studyguide or call AWWA Customer Service, 1.800.926.7337 or 303.794.7711

WEF Delegate's Update

Continued from Page 3

However, most chapters have developed their own rules, regulations and methods of operation in this regard, although all honour the original purpose and intent of the society. A cardinal rule is that the initiation, induction and integration ceremonies must be conducted by a sludge shoveler. There are no dues for membership in the society, nor are there any officers except the "Influent Integrator", who is designated by the neutral "pH 7", who is elected, or should be elected, by a vote of the Shovelers present at a meeting of the association, and serves until his successor has been elected and installed. His duties are to record and report selections, present official certificates of elevation, bestow badges, and generally keep chapter members advised concerning activities of the society. He can of course delegate any or all of these duties as he may see fit. The only privilege accorded to members of the society is that of cleaning up before, during and after all meetings of the association. The official badge of the society is a shovel worn extending from the left breast pocket. However, for obvious reasons, this is only used at official initiation ceremonies. The "Gold Shovel Emblem" is worn as a lapel pin, tie clasp or for some other utilitarian or decorative purpose. It must always be worn or displayed to indicate a member in good standing; the penalty for being found without the shovel by another Shoveler is to provide all present with a refreshment of their choice. Each member is provided with a membership certificate signed by the Influent Integrator as pH 7 and by twelve other Shovelers for the remaining concentrations from pH 1 to pH 13. While the wording on the certificates may vary from chapter to chapter, it normally indicates that selection to membership is in recognition of "outstanding service above and beyond the call of duty" to the association. Membership bestows the accolade of elevation, "On the official shovel to the highest ridge of the sludge bed with the title of select sanitary sludge shoveler and all the honour, atmosphere, perquisites and dignity appertaining thereto." There are certain signs and a password associated with the Society which are normally demonstrated at the installation and integration of new members. These are described briefly below. The Grip of the Society is made by curling the fingers of the right hand as if around the handle of a shovel.The Grand Hailing Sign is made by raising the Grip head high, thumb on the left, and lowering smartly, thereby symbolizing the close relationship between the water and sewage with which the associations are so intimately concerned and interested. The Password is given while performing the Grand Hailing Sign, and is derived from the first letters of the Society's name. It is pronounced "Sh-h-h-h". The Signal of Distress is a sweeping motion made with both hands as if shovelling. The chosen station of a Select Sanitary Sludge Shoveler is at the opposite end of the meeting from the President of the Association.

We will also be awarding one of our WEF members with the Bedell award. The Shovelers Society and the Bedell will be given out on Tuesday morning at the awards breakfast. I also encourage everyone to give a good Atlantic Canada welcome to Betty Jordan, our visiting WEF guest for the conference.

Beyond that, all is well. WEF is going very well in Atlantic Canada with almost 30 new members coming into ACWWA this year. A big congrats to Clara Shea for her recruiting skills. We are becoming a much stronger association with all this growth.

That's it for this issue; see you in St John's.

AWWA Director's Report

Continued from Page 3

Council, to which CAC reported, was sunset under a program and service review. Bruce Buchanan chaired an ad hoc committee, appointed by the AWWA board, to determine the fate of CAC, along with the fates of the Membership and Section Services committees. CAC is an important committee in that it ensures that Canadian voices are heard within the complex structure of AWWA. Bruce's committee made a compelling case to the AWWA board, and it was a tremendous accomplishment to ensure CAC's continuation.

As the United States economy continues to struggle, AWWA is facing some difficult challenges. Membership has declined from approximately 56,000 members a few years ago to just over 50,000 today. This results in downward trends in AWWA's three main revenue sources: membership dues, publications and conferences. The AWWA staff and board have responded; operating costs have been reduced by $4 million and staff has been reduced by 10 percent. Clear strategies are in place to focus on membership and ensure that valued programs continue.

Despite these actions, the board faced some difficult decisions to ensure AWWA can continue to operate sustainably in this tougher environment. The board approved AWWA's first dues increase in three years. Individual memberships will see an increase of $5 per year. Dues increases for utilities will range from $0 for the smaller utilities to $526 for the largest. Service providers will see increases from $0 for the smallest to $622 for the largest.

The board also made the difficult decision to make some changes to the Life Member designation. Currently, Life Members receive all of the benefits of individual members, dues free. Members become Life Members automatically upon 30 years of membership. AWWA has over 5,700 Life Members. Demographically, Life Members are the fastest-growing category of membership—such that, left unchanged, 30 percent of AWWA's membership will be Life Members in 10 years! The financial implications of this are enormous, and without changes, the Life Member program would become unsustainable.

Subject to approval of some changes to AWWA's governing documents, the following changes will take effect January 1, 2012. Starting in 2012, designation as a Life Member will be granted to individuals who have been members for 30 years and who have reached the age of 65. Those designated as Life Members prior to January 2012 will retain their Life Member status. Starting in January 2012, all Life Members will be charged an annual membership fee of $85; however, retired Life Members will have the option of paying the retired member fee of $44 (or $32 without the subscription to *Journal AWWA*). AWWA will also be introducing a recognition program for members with 30 years of membership. Clearly, this decision will not be received favourably by all members. However, it was simply not possible to continue the existing program and both the board and AWWA staff struggled long and hard to arrive at a package that will continue to recognize long-standing members and meet the financial realities facing the Association.

I am sure there will be questions relating to these changes. If you have questions, please call or email me. For those attending St. John's, I will be happy to speak to you in person, as I am sure will be David LaFrance or Joe Mantua.

I look forward to seeing you in St. John's!

Certification Corner

Excerpted from the April 2010 issue of *Opflow*, published by AWWA. Reprinted by permission. For more information and references, visit www.awwa.org.

WATER

1. **Hard water scale is usually caused by**
   a. calcium bicarbonate.
   b. calcium carbonate.
   c. magnesium bicarbonate.
   d. magnesium carbonate.

2. **Which of the following is an example of a weighting agent?**
   a. Polyelectrolytes
   b. Bentonite clay
   c. Calcium carbonate
   d. Sodium bicarbonate

3. **Coagulation is a chemical and physical reaction that converts**
   a. settleable solids into nonsettleable solids.
   b. nonsettleable solids into settleable solids.
   c. dissolved solids into settleable solids.
   d. dissolved solids into a precipitate.

4. **The minimum detention time in a conventional detention basin is**
   a. 2 hr.
   b. 4 hr.
   c. 6 hr.
   d. 8 hr.

5. **What's the most common filtration rate for slow sand filters?**
   a. 0.02 gpm/ft^2
   b. 0.05 gpm/ft^2
   c. 0.1 gpm/ft^2
   d. 0.5 gpm/ft^2

ANSWERS

Water: 1. b, 2. b, 3. b, 4. b, 5. b
Wastewater: 1. a, 2. a, 3. d, 4. b

WASTEWATER

1. **Which type of organisms are most likely associated with poor treatment or young biomass?**
   a. Amoebas
   b. Free-swimming ciliates
   c. Rotifers
   d. Stalked ciliates

2. **The most common flow-measuring device for wastewater is a**
   a. Parshall flume.
   b. magnetic flowmeter.
   c. weir.
   d. Venturi meter.

3. **In secondary aerobic treatment, living organisms partially stabilize organic matter by the process of**
   a. putrefaction.
   b. fermentation.
   c. hydrolysis.
   d. oxidation.

4. **Which of the following would most likely control foaming?**
   a. Increase the detention time
   b. Water sprays
   c. Increase the dissolved oxygen
   d. Increase solids wasting

The Metropolitan Water District of Southern California, AWWA utility member since 1944.

Think water. Think AWWA.

When it comes to water, no one has you covered like the American Water Works Association. From treatment to distribution to regulations to training, we're the water community's go-to source for information, education, and involvement. When you think water, think AWWA.

American Water Works Association

The Authoritative Resource on Safe Water®

130 Years of Safe Water AWWA 1881–2011

www.awwa.org