BEFORE THE TENNESSEE REGULATORY AUTHORITY

In the Matter of the Application of)
TENNESSEE-AMERICAN WATER CO.) Docket 08-00039
Petition to Change and Increase Certain)
Rates for Water Service)

DIRECT TESTIMONY OF GLYNN L. STOFFEL.

ON BEHALF OF THE CITY OF CHATTANOOGA

July 17, 2008

Table of Contents

Introduction	1
Prior Experience	1
Subject and Purpose of Testimony	3
BAH Report	4
Summary	7

1 Introduction

- 2 Q. State your name, position, and business address.
- 3 A. My name is Glynn L. Stoffel. I am the Director of Utility Infrastructure Analysis for
- 4 the firm of Snavely King Majoros O'Connor & Bedell, Inc. ("Snavely King"),
- 5 located at 1111 14th Street, N.W., Suite 300, Washington, D.C. 20005.
- 6 Q. Describe Snavely King.
- 7 A. Snavely King is an economic consulting firm founded in 1970 to conduct
- 8 research on a consulting basis into the rates, revenues, costs and economic
- 9 performance of regulated firms and industries. We have a professional staff of
- 10 12 economists, accountants, engineers and cost analysts. Most of our work
- involves the development, preparation and presentation of expert witness
- testimony before Federal and state regulatory agencies. Over the course of our
- 13 37-year history, members of the firm have participated in more than 1,000
- 14 proceedings before almost all of the state commissions and all Federal
- 15 commissions that regulate utilities or transportation industries.
- 16 Q. Have you prepared a summary of your qualifications and experience?
- 17 A. Yes, Exhibit GLS-1 is a summary of my qualifications and experience. Exhibit
- 18 GLS-2 contains a tabulation of the courses I teach in utilities operation,
- maintenance management and safety
- 20 Q. For whom are you appearing in this proceeding?
- 21 A. I am appearing on behalf of the City of Chattanooga.
- 22 **Prior Experience**
- 23 Q. Do you have any specific experience in the public utility field?

1 A. Yes, I have over thirty years experience in the operation, maintenance, 2 management, consulting and training in the water and wastewater industry.

3 Q. Does your experience specifically include water utilities?

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A.

4 A. Yes, in addition to my consulting and training roles, I have extensive experience in the management of water utility infrastructure.

6 Q. Please describe your experience in the area of utilities benchmarking.

I have been actively involved in the use of benchmarks and performance metrics for over 20 years, as a manager, trainer and consultant. As a manager, I was fortunate to be part of a management team that, in less than five years, transformed a poorly functioning public utility into an organization that received national recognition for its excellence. One of the basic tools in that transition was the use of benchmarks as "dashboard" measurements in achieving organizational goals. Our basic management philosophy was, just as you would never drive your car with a curtain over your dashboard, a manager should never "drive" their operation without some type of gauge, or benchmark, to track their progress, both internally and externally. This is the management philosophy I have followed throughout my career. As a trainer, I have researched and developed training that stresses benchmarking as a key component to successful management. In my role with Snavely King, one of my duties is to benchmark the data obtained from various utilities to determine what level of best practices and potential efficiency they are attaining both internally and when compared to other utilities.

Subject and Purpose of Testimony

1

2 Q. What is the subject of your testimony?

I am addressing the validity of the benchmarking results comparing the 3 Α. 4 administrative charges and fees imposed on TAWC by its parent, American 5 Water Works Company ("AWC") to similar companies in the industry. particular, this testimony addresses Joe Van den Berg's report (the "BAH 6 7 Report") relating to the American Water Works Service Company ("AWWSC"). I 8 am to provide my opinion whether the benchmarking data provided in this report 9 is a valid indicator of comparative costs with other, similar water companies and 10 how useful that benchmarking data is for ratemaking purposes.

11 Q. What is the purpose of your testimony?

A. My testimony presents the results of my review and analysis of Mr. Van den
Berg's testimony and report, specifically Section 9, Relative Cost Performance. I

conclude that the benchmarking used in that section is not valid to the water and
wastewater industry. I also conclude that the Authority should not rely on the
benchmarks utilized by BAH as a basis to determine the necessity and
reasonableness of AWWSC's costs allocated and assigned to Tennessee

American Water Company ("TAWC").

19 Q. What did you do to prepare yourself to submit this testimony?

20 A. I read Mr. Van den Berg's testimony and studied his exhibits. I reviewed
21 responses to various data requests. I also researched the water and wastewater
22 industry to determine if benchmarks exist that are valid and would accurately

compare the cost performance of AAWSC to other utilities in the water and wastewater industry.

BAH Report

3

- Q. Please describe and summarize the BAH Report and the process BAH used
 to arrive at its conclusions.
- 6 The purpose of section 9 of the BAH Report is to compare AWWSC cost levels to Α. 7 those of similar companies. The process used is "benchmarking" which is a 8 commonly used method to determine a company's relative performance with 9 other, similar companies, or "peers." BAH chose to use a "peer" group consisting 10 of 20 electric utilities, apparently based upon the assumption that electric utilities 11 are appropriate peers to a water company. Seven benchmarks were developed 12 and, using data obtained from the electric utilities' 2006 FERC Form 60, 13 comparative metrics were established for each benchmark. Mr. Van den Berg 14 asserts that this "benchmarking" methodology establishes that AWWSC has a 15 below average cost in 5 of the 7 benchmark categories¹. He also asserts that 16 the methodology shows that AWWSC costs are equal to the average cost of the 17 peer group in one other category (Service Company O&M as percentage of 18 revenue) and above average in another (Service Company O&M expense 2005 19 to 2006 Change).
- Q. Why do you conclude that the benchmarking process used by BAH is not
 valid to the water and wastewater industry?

¹ Van den Berg Testimony, page 12

Overall, this analysis gives the impression that AWWSC is well below the average in costs with other service companies in the industry. The basic assumption in the analysis is that the activities of AWWSC are similar in nature to those performed by the service companies of the electric utilities chosen for the "peer" group.² The flaw in this analysis is that the utilities used to establish the benchmarks are not in the water and wastewater industry, but rather the energy industry.

BAH states that there is a limited amount of public water utility peer data available for cost performance comparison. However, there are many valid benchmarks established for use by the water and wastewater industry: The American Water Works Association (AWWA) has spent a great deal of effort and expense to develop the report, Benchmarking Performance Indicators for Water and Wastewater Utilities to obtain comparative data that are relevant to water utility companies. This report uses 22 benchmarks in five areas of operations to assist water and wastewater utilities in comparative analysis to improve performance. AWWA obtains data from 202 utilities throughout the United States and Canada to obtain data establishing the values in each of these benchmarks. Their initial survey was completed in 2005 using data from 2003-2004. The surveys are ongoing, and AWWA provides an annual report updating the information. A copy of the 2005 AWWA Benchmarking Report is submitted as an electronic file, marked GLS-3.

Α.

² Van den Berg Testimony, page 13

Another source of data is the Public Service Commission of Wisconsin.

They calculate benchmark data for about 600 water utilities and sanitary districts, based on figures within their annual reports. The purpose of these benchmarks is to establish a maximum, minimum and weighted average for expense, revenue and pumping statistics. Individual utilities can then compare their numbers to the statewide statistics. Information on these indicators is found on the Wisconsin PSC's website at http://psc.wi.gov/utilityinfo/water/newsinfo/Benchmark.htm. A copy of a spreadsheet reflecting the Wisconsin's 2007 water utility benchmarks is attached as Exhibit GLS-4.

On May 8, 2007, EPA and six major water and wastewater associations signed an agreement to work collaboratively in order to promote the effective utility management of water and wastewater utilities throughout the country. This agreement establishes a common management framework for utilities based on a series of attributes of effectively managed utilities, keys to management success, and example utility performance measures. The report of this agreement, with the existing performance measures, is contained in Exhibit GLS-5.

The reports marked as Exhibits GLS-3, GLS-4, and GLS-5 are reports of the types upon which I and others in the field of benchmarking and performance review regularly rely.

With this amount of established water and wastewater industry benchmarks available, using comparisons with the energy industry is unnecessary.

- Q. Does the use of electric company data for establishing benchmarks make adifference in the analysis?
 - A. Yes. As an example, the AWWA indicator *Customer Service Cost per Account* ³ appears similar to BAH's *Service Cost per Customer* ⁴. According to the AWWA report, the median customer service cost, obtained from a survey of sixty-one water utilities in the South, is \$38.20 per account ⁵. The BAH results state that the AWWSC cost for customer service is \$68⁶, approximately 78% higher than the AWWA cost. The BAH report also states that the average customer service cost of the electric company "peer" group is \$172 dollars, approximately 350% higher than the median cost of the water utility group. This large variance of costs between the electric utility sample used by BAH and AWWA's water utility company sample demonstrates that the electric utility sample is not a valid means to establish reasonable comparative costs for AWWSC.

Since valid water utility data was not used for comparison, the BAH study provides no proof that AWWSC's costs for this important service element are just and reasonable or are the result of prudent management decisions

<u>Summary</u>

- Q. Please summarize your testimony.
- A. There currently exist many established benchmarks in the water industry used to determine how well a utility is performing in comparison to its peers. In preparing their analysis, BAH chose to develop their own benchmarks and used them to

³ AWWA Benchmarking Report, Appendix A, page 225

⁴ Van den Berg Testimony, page 12

⁵ AWWA Benchmarking Report, page 109

⁶ BAH Report, Exhibit 9-1, page 8

compare AWWSC with companies in the electric industry. This is a questionable methodology when there are established benchmarks and performance indicators used in the water industry that would allow the comparison of AWWSC with actual water companies rather than electric companies.

A system of water and wastewater indicators has been a vision of many leaders in the industry for years, and a great deal of effort has been put forth to establish these measure for use in effectively managing the utility and controlling costs. It is my opinion that questions of validity arise when a company uses data gathered outside of the water industry, without referring to the water industry's already existing benchmarks, to justify costs for ratemaking purposes.

12 Q. Does this conclude your testimony?

13 A. Yes, it does.

IN THE TENNESSEE REGULATORY AUTHORITY. NASHVILLE, TENNESSEE

IN RE:)
)
PETITION OF TENNESSEE AMERICAN)
WATER COMPANY TO CHANGE AND)
INCREASE CERTAIN RATES AND) Docket No. 08-00039
CHARGES SO AS TO PERMIT IT TO EARN	1)
A FAIR AND ADEQUATE RATE OF)
RETURN ON ITS PROPERTY USED AND)
USEFUL IN FURNISHING WATER)
SERVICE TO ITS CUSTOMERS)

AFFIDAVIT OF Glynn Lee Stoffel

STATE OF Florida : COUNTY OF Bay :

BEFORE ME, the undersigned authority, duly commissioned and qualified in the State and County aforesaid, personally came and appeared Glym L. Stoffel being by me first duly sworn, who deposed and said as follows:

He is appearing as a witness on behalf of the City of Chattanooga before the Tennessee Regulatory Authority in the matter captioned above, and, if present before the Authority and duly sworn, his testimony would be as set forth in the transcript attached hereto, consisting of [8] pages.

Glyyn Lee Staffe | St

Sowrn to and subscribed before me this 17^Hday of July, 2008.

Notary Public

My Commission Expires: 5-/6-2010

THAOTHY W. DOWNS

Notary Public - State of Florida

Notary Public - State of Florida

Notary Public - State of Florida

Commission Explore May 16, 2010

Commission # DO 539739

Bonded By National Notary Assn.

GLS 1

Experience

Snavely King Majoros O'Connor & Lee, Inc., Washington D.C.

Director of Water Infrastructure Analyses (July 2007)

Mr. Stoffel assists professional and technical staff in the evaluation, safe operation, maintenance and management of water and wastewater utility systems. Mr. Stoffel is an experienced manager of both water distribution and wastewater collection systems, and as such has identified and implemented cutting edge performance indicator based evaluation systems by which to judge the efficiency and cost effectiveness of both utility operations and management.

Mr. Stoffel assists municipalities and public utility systems in the development of asset management programs, system vulnerability assessments, emergency response plans and system security programs. He also understand the financial constraints under which public utility systems operate, and has developed system optimization programs as alternatives to privatization.

In addition, Mr. Stoffel designs and delivers innovative training projects for managers, engineers and operators of water and wastewater utilities, and the many training events he has delivered over the last 15 years throughout the country have consistently earned the very highest student evaluation scores.

GLS Environmental Associates

President (2004-2007)

As an owner of a full service operations, maintenance and training consulting company, Mr. Stoffel served the water and wastewater utility sector. He has assisted Anne Arundel County (Md.), the District of Columbia and the cities of Springfield, Mass., Philadelphia, Pa., Easton, Md., as well as the Maryland Center for Environmental Training at the College of Southern Maryland

(La Plata, Md.) and the Delaware Technical Community College (Georgetown, Del.).

University of Florida, Gainesville, FL.

Training Associate (2006 to Present)

Mr. Stoffel develops and provides training in water and wastewater system operations, maintenance and management to industry professionals at the university's Center for Training, Research and Education for Environmental Occupations (TREEO).

Maryland Department of Public Works, Anne Arundel County

Utility Maintenance Superintendent (1994-2004)

Mr. Stoffel was responsible for managing, maintaining and upgrading the County's 1100 mile water distribution system.

Prior to 1994, Mr. Stoffel was the field manager of Anne Arundel County's Utility System Evaluation and Rehabilitation Division, where he was responsible for managing the activities required to establish asset management solutions for the county's water and wastewater infrastructure.

EDUCATION:

University of Baltimore, School of Business; 1991, B.S., cum laude, Management concentration

Anne Arundel Community College, 1986 -1988; Civil Engineering Technology Concentration

LICENSES and CERTIFICATES:

CET (Certified Environmental Trainer), CIT (Certified Instructional Technologist) National Environmental Training Association

State of Maryland Operator Certifications in both Wastewater Collection and Water Distribution

PROFESSIONAL AFFILIATIONS:

American Water Works Association Water Environment Federation National Environmental Safety and Health Training Association

GLS 2

Glynn L. Stoffel, CIT, CET

Affiliation: Snavely King Majoros O'Connor & Lee, Inc.

Education: University of Baltimore, School of Business, B.S. – Concentration in Management

Experience:

Mr. Stoffel currently designs and delivers innovative training projects in a variety of management and operations subjects related to the utility industry. The thousands of training hours he has delivered throughout the country have consistently earned the very highest student evaluation scores. In addition to his educational work, he has over twenty-five years experience in the operation and management of water and wastewater utility systems.

- Maryland Center for Environmental Training, La Plata, Md. (1991 to present)
- The Environmental Center, Delaware Technical and Community College, Georgetown, DE (1996 to present)
- University of Florida TREEO Center, Gainesville, FL. (2006 to present)

Mr. Stoffel serves as a Training Associate for these schools. He develops and provides training in utility system operations, maintenance and management to industry professionals.

• Department of Public Works, Anne Arundel County, Maryland - Utility Maintenance Superintendent (1994-2004)

Mr. Stoffel was manager of the Water Line Maintenance Division, responsible for managing and maintaining the county's 1,100 mile water distribution system.

Prior to 1994, Mr. Stoffel was Manager of field operations for Anne Arundel County's Utility System Evaluation and Rehabilitation Division, where he was responsible for managing the activities required to establish asset management solutions for the county's water and wastewater infrastructure.

Special Qualifications:

Mr. Stoffel is a Certified Environmental Safety and Health Trainer (CET) and a Certified Instructional Technologist (CIT), through the National Environmental, Safety and Health Training Association.

- 2007 Working with the Environmental Center at Delaware Technical and Community College, Mr. Stoffel developed a 12 part, 48 hour training program for water and wastewater utility inspectors to assist them in successfully passing the NICET (National Institute of Certification in Engineering Technologies) certification exam.
- **2005** Developed the on-line train-the-trainer program for the EPA sponsored TEAMS (Total Electronic Asset Management System) software distributed by the Maryland Center for Environmental Training. This program consisted of eight modules that assisted trainers in instructing personnel in the use of the TEAMS software.
- 2005 Assisted in the development of the wastewater collection infrastructure module for the TEAMS (Total Electronic Asset Management System) software prepared by the Maryland Center for Environmental Training under EPA sponsorship.
- **2004** Working with the Maryland Center for Environmental Training, Mr. Stoffel developed and delivered a seminar entitled *Emergency Response Planning for Small Utilities* to managers of utilities throughout Maryland and Delaware. This two-day seminar,

consisting of classroom instruction and tabletop simulations, instructed key personnel of water and wastewater utilities in techniques to enhance their emergency response capabilities.

2003 Working under an EPA Grant to the Maryland Center for Environmental Training, Mr. Stoffel developed a two-day train-the trainer seminar in drinking water system security techniques in compliance with the Bioterrorism Preparedness and Response Act of 2002 and delivered the seminar at locations throughout EPA Region 3.

Other courses Mr. Stoffel has developed and/or delivered include:

Category	Course Title	Course Length (hrs)
Management	Asset Management at the Operations Level	8
Management	Asset Management for Wastewater Utilities	8
Management	CMOM Compliance Techniques	8
Management	Knowledge Management and Retention for Managers	8
Management	Management of Wastewater Collection Systems	8
Management	Management of Water Distribution Systems	8
General	Introduction to Mechanical Maintenance	24
General	Introduction to Pump Hydraulics	8
General	Math for Water and Wastewater Operators	8
General	Operator Certification Preparation for Distribution &	0
General	Collection System Workers	8
General	Preparing for the State Operator Exam: Pumps and Pumping Systems	8
General	Preventative Maintenance and Lubrication	8
General	Pump Installation, Maintenance and Repair	8
General	Pumps and Pumping Systems	24
General	Reading Blueprints and Plans	8
General	Train the Trainer: Structured OJT Techniques	8
General	Train-the-Trainer: Training Environmental Trainers	24
Safety	Confined Space Safety	6
Safety	Construction Site Safety	6
Safety	Crane Safety	8
Safety	Excavation Equipment Safety	8
Safety	Excavation Safety	8
Safety	Hand and Power Tool Safety	6
Safety	Hoists and Rigging for Water and Wastewater Operators	6
Wastewater	Basics of Open Channel Flow Measurement	8
Wastewater	Collection System Troubleshooting	8
Wastewater	Introduction to Collection Systems	32
Wastewater	Lift Station Maintenance	8
Water	Distribution System Valves	8
Water	Field Disinfection of Water Mains	8
Water	Introduction to Cross Connection Control	8
		32
Water	Introduction to Distribution Systems Introduction to Water Hydroulies	
Water	Introduction to Water Hydraulics	8
Water	Unidirectional Distribution System Flushing	8

GLS 3

Performance Indicators
for Water and Wastewater
Utilities: Survey Data and
Analyses Report









Benchmarking Performance Indicators for Water and Wastewater Utilities: Survey Data and Analyses Report

The QualServe Benchmarking Program is a joint program of the American Water Works Association and the Water Environment Federation.

Angela K. Lafferty and William C. Lauer







Disclaimer

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BENCHMARKING

Performance Indicators for Water and Wastewater Utilities: Survey Data and Analyses Report



Contents

Acknowledgments, xv

- Introduction, 1
 - Performance Indicators Summary, 3
- 2 Survey Process and Report Organization, 7
- Guide to Using "Median Range" Charts, 13
- 4 Characterizing Participating Utilities, 19

Utility Service Type, 22

Utility Region, 23

Utility Size (Population Served), 23

Distribution of Services by Utility Participants, 25

Utility's Organizational Structure, 28

Utility Governance, 28

Performance Indicators, 43

- 1. Organizational Best Practices Index, 47
- 2. Employee Health and Safety Severity Rate, 54
- 3. Training Hours per Employee, 58
- 4. Customer Accounts per Employee (Water and Wastewater), MGD Water Delivered per Employee, and MGD Wastewater Processed per Employee, 61
- 5. Customer Service Complaints/Technical Quality Complaints, 73
- 6. Disruptions of Water Service, 79
- 7. Residential Cost of Water and/or Sewer Service, 93

- 8. Customer Service Cost per Account, 107
- 9. Billing Accuracy, 110
- 10. Debt Ratio, 115
- 11. System Renewal/Replacement Rate, 118
- 12. Return on Assets, 127
- 13. Drinking Water Compliance Rate, 133
- 14. Distribution System Water Loss, 136
- 15. Water Distribution System Integrity, 139
- 16. Operations and Maintenance Cost Ratios: Water, 142
- 17. Planned Maintenance Ratio: Water (Hours), 149
- 18. Sewer Overflow Rate, 157
- 19. Collection System Integrity: Wastewater, 160
- 20. Wastewater Treatment Effectiveness Rate, 163
- 21. Operations and Maintenance Cost Ratios: Wastewater, 166
- 22. Planned Maintenance Ratio: Wastewater, 173
- 6 Summary Tables of Performance Indicators by Type, Region, and Size, 179
- Performance Indicators Relational Analyses, 197

Appendix A, 207

List of Performance Indicators With Definitions and Calculations

Appendix B, 257

Definitions

Appendix C, 263

Additional Profile Summaries

Appendix D, 275

Confidence Ratings

Appendix E, 281

Conversion Table

About the Authors, 297

List of Figures

1–1	The QualServe Business Model for Water and Wastewater Utilities, 2
3–1	Percentile/Quartile Illustration, 14
3–2	Example Performance Indicator—Percentiles Indicated, 16
3–3	Example Performance Indicator—Utility Example, 17
4–1	Distribution of Utility Participation Across the United States, 20
4–2	Distribution of Service Type by Utility Participants, 22
4–3	Regional Distribution of Utility Participants, 24
4–4	Size Distribution of Utility Participants, 24
4–5	Distribution of Services Provided by All Utility Participants, 25
4–6	Distribution of Services Provided by Water-Only Utility Participants, 26
4–7	Distribution of Services Provided by Wastewater-Only Utility Participants, 26
4–8	Distribution of Services Provided by Combined Utility Participants, 27
4–9	Organizational Structure Distribution of Utility Participants, 27
4–10	Governance Distribution of Utility Participants, 28
5–1	Organizational Best Practices Index, 48
5–2	Employee Health and Safety Severity Rate, 55
5–3	Training Hours per Employee, 59
5–4	Customer Accounts per Employee (Water), 62
5–5	Customer Accounts per Employee (Wastewater), 64
5–6	MGD Water Delivered per Employee, 66
5–7	MGD Wastewater Processed per Employee, 68
5–8	Customer Complaints per 1,000 Customers, 75
5–9	Technical Quality Complaints per 1,000 Customers, 77
5–10	Disruption of Water Services per 1,000 Customers—Planned (<4 Hours), 80
5–11	Disruption of Water Service per 1,000 Customers—Planned (Between 4 and 12 Hours), 82
5–12	Disruption of Water Service per 1,000 Customers—Planned (>12 Hours), 84
5–13	Disruption of Water Service per 1.000 Customers—Unplanned (<4 hours), 86

5-14	Disruption of Water Service per 1,000 Customers—Unplanned	
	(Between 4 and 12 Hours), 88	

- 5-15 Disruption of Water Service per 1,000 Customers—Unplanned (>12 Hours), 90
- 5-16 Residential Cost of Water and/or Sewer Service—Monthly Residential Water Using 7,500 Gallons, 94
- 5-17 Residential Cost of Water and/or Sewer Service—Average Residential Water Bill Amount for 1 Month, 96
- 5-18 Residential Cost of Water and/or Sewer Service—Monthly Residential Sewer Using 7,500 Gallons, 98
- 5–19 Residential Cost of Water and/or Sewer Service—Average Residential Sewer Bill Amount for 1 Month, 100
- 5-20 Residential Cost of Water and/or Sewer Service—Multiservice, Monthly Bill Combined Service Using 7,500 Gallons, 102
- 5-21 Residential Cost of Water and/or Sewer Service—Multiservice, Average Residential Combined Bill for 1 Month, 104
- 5-22 Customer Service Cost per Account, 108
- 5-23 Billing Accuracy per 10,000 Bills, 111
- 5-24 Debt Ratio, 116
- System Renewal/Replacement Rate—Water Pipelines (Distribution), 119 5-25
- 5-26 System Rennewal/Replacement Rate—Water Treatment Facility and Pumping, 121
- 5-27 System Renewal/Replacement Rate—Wastewater Pipelines and Collection, 123
- 5-28 System Renewal/Replacement Rate—Wastewater Treatment Facility and Pumping, 125
- 5-29 Return on Assets, 128
- 5-30 Drinking Water Compliance Rate, 134
- 5-31 Distribution System Water Loss, 137
- 5-32 Water Distribution System Integrity, 140
- 5-33 O&M Cost per Account (Water), 143
- 5-34 O&M Cost per Million Gallons Distributed, 145
- 5-35 O&M Cost of Treatment per Million Gallons, 147
- 5-36 Planned Maintenance Ratio: Water (Hours), 150
- 5-37 Planned Maintenance Ratio: Water (Cost), 152
- 5-38 Sewer Overflow Rate, 158
- 5-39 Collection System Integrity: Wastewater, 161
- 5-40 Wastewater Treatment Effectiveness Rate, 164



- 5–41 O&M Cost per Account: Wastewater, 167
- 5–42 Planned Maintenance Ratio: Wastewater (Cost),169
- 5–43 Wastewater O&M Cost of Treatment per Million Gallons, 171
- 5–44 Planned Maintenance Ratio: Wastewater, 174
- 5–45 Planned Maintenance Ratio: Wastewater (Cost), 176
- 7–1 Relational Performance Indicator Comparison—Health and Safety Severity Rate Versus O&M Cost per Account, 199
- 7–2 Relational Performance Indicator Comparison—Health and Safety Severity Rate Versus O&M Cost per Account, 200
- 7–3 Water and Combined Services Utilities Comparison—Health and Safety Severity Rate or Customer Service Complaints per 1,000 Customers Versus Water Operations O&M Cost per Account, 201
- 7–4 Water and Combined Services Utilities Comparison—Disruptions of Service unplanned <4 hours) or Distribution System Water Loss Versus O&M Cost per Account, 202
- 7–5 Wastewater and Combined Services Utilities Comparison—Collection System Integrity Versus Wastewater O&M Cost per Account, 203
- 7–6 Water and Combined Services Utilities Comparison—Distribution System Water Loss or Water System Integrity Versus Water Pipeline Renewal/Replacement Rate, 204
- 7–7 Water and Combined Services Utilities Comparison—Customer Service Complaints per 1,000 Customers Versus O&M Cost per Account, 205
- 7–8 Wastewater and Combined Services Utilities Comparison—Wastewater Collection System Integrity Versus Wastewater Planned Maintenance Cost, 206



BENCHMARKING

Performance Indicators for Water and Wastewater Utilities: Survey Data and Analyses Report

List of Tables

4–1	Participant Summary—Service or Operation Type, 20
4–2	Participant Summary—Regional, 21
4–3	Participant Summary—Size (Population Served), 22
4–4	Utility Participation by Region and Type of Service, 29
4–5	Utility Participation by Size (Population Served), 36
5–1	Organizational Best Practice, 49
5–2	Employee Health and Safety Severity Rate, 56
5–3	Training Hours per Employee, 60
5–4	Customer Accounts per Employee (Water), 63
5–5	Customer Accounts per Employee (Wastewater), 65
5–6	MGD Water Delivered per Employee, 67
5–7	MGD Wastewater Processed per Employee, 69
5–8	Customer Complaints per 1,000 Customers, 76
5–9	Technical Quality Complaints per 1,000 Customers, 78
5-10	Disruption of Water Service per 1,000 Customers—Planned (<4 hours), 81
5-11	Disruption of Water Service per 1,000 Customers—Planned (Between 4 and 12 Hours), 83
5-12	Disruption of Water Service per 1,000 Customers—Planned (>12 Hours), 85
5–13	Disruption of Water Service per 1,000 Customers—Unplanned (<4 Hours), 87
5–14	Disruption of Water Service per 1,000 Customers—Unplanned (Between 4 and 12 Hours), 89
5–15	Disruption of Water Service per 1,000 Customers—Unplanned (>12 Hours), 91
5–16	Residential Cost of Water and/or Sewer Service—Monthly Residential Water Using 7,500 Gallons, 95
5–17	Residential Cost of Water and/or Sewer Service—Average Residential Water Bill Amount for 1 Month, 97

5-18	Residential Cost of Water and/or Sewer Service—Monthly Residential Sewer
0-10	Using 7,500 Gallons, 99
	Using 1,700 dunons, 77

- 5–19 Residential Cost of Water and/or Sewer Service—Average Residential Sewer Bill Amount for 1 Month, 101
- 5–20 Residential Cost of Water and/or Sewer Service—Multiservice, Monthly Bill Combined Service Using 7,500 Gallons, 103
- 5–21 Residential Cost of Water and/or Sewer Service—Multiservice, Average Residential Combined Bill for 1 Month, 105
- 5–22 Customer Service Cost per Account, 109
- 5–23 Billing Accuracy per 10,000 Bills, 112
- 5–24 Debt Ratio, 117
- 5–25 System Renewal/Replacement Rate—Water Pipelines (Distribution), 120
- 5–26 System Renewal/Replacement Rate—Water Treatment Facility and Pumping, 122
- 5–27 System Renewal/Replacement Rate—Wastewater Pipelines and Collections,124
- 5–28 System Renewal/Replacement Rate—Wastewater Treatment Facility and Pumping, 126
- 5–29 Return on Assets, 129
- 5–30 Drinking Water Compliance Rate, 135
- 5–31 Distribution System Water Loss ,138
- 5–32 Water Distribution System Integrity, 141
- 5-33 O&M Cost per Account (Water), 144
- 5-34 O&M Cost per Million Gallons Distributed, 146
- 5–35 O&M Cost of Treatment per Million Gallons, 148
- 5–36 Planned Maintenance Ratio: Water (Hours), 151
- 5–37 Planned Maintenance Ratios: Water (Cost), 153
- 5–38 Sewer Overflow Rate, 159
- 5–39 Collection System Integrity: Wastewater, 162
- 5–40 Wastewater Treatment Effectiveness Rate, 165
- 5–41 O&M Cost per Account: Wastewater, 168
- 5–42 O&M Cost per Million Gallons Processed: Wastewater, 170
- 5-43 Wastewater O&M Cost of Treatment per Million Gallons, 172

- 5–44 Planned Maintenance Ratio: Wastewater (Hours), 175
- 5-45 Planned Maintenance Ratio: Wastewater (Cost), 177
- Performance Indicators Summary by Utility Service Type (All, Water Only, Wastewater Only, Combined) 25th Percentile, Median, 75th Percentile, 180
- Performance Indicators Summary by Utility Region (US Region—Northeast, South, Midwest, West) 25th Percentile, Median, 75th Percentile, 185
- Performance Indicators Summary by Utility Size (Utility Size—Population Served) 25th Percentile, Median, 75th Percentile, 190
- C-1 Frequency Distribution Summary by Utility Service Type—Water Only, Wastewater Only, Combined, and Total, 264
- General Quantitative Background Information by Utility Service Type—
 Water Only, Wastewater Only, Combined, and Total Count, 25th Percentile,
 Median, 75th Percentile, 270
- D-1 Confidence Ratings by Utility Service Type—Water Only, Wastewater Only, Combined, and All Averages (i.e., Arithmetic Means), 276
- E-1 Conversion Factors, 282

BENCHMARKING

Performance Indicators for Water and Wastewater Utilities: Survey Data and Analyses Report



Acknowledgments

This project was dependent on active research and participation from numerous water and wastewater utilities. These utility participants deserve special recognition for the data they provided to support performance indicators. The participants will likely be principal users of the data system.

This report is based on performance indicators developed in *Selection and Definition of Performance Indicators for Water and Wastewater Utilities*, an Awwa Research Foundation (AwwaRF) and AWWA QualServe research report. Some modifications and updates have been made to the definitions and/or calculations since their inception. A detailed listing of the performance indicators is presented in appendix A.

The QualServe Benchmarking Utility Founding Members listed below deserve special recognition. These 45 utilities provided funding and input on the development of the Benchmarking program since its inception in 2000. Key deliverables produced during this period include 22 high-level performance indicators on which the Benchmarking Performance Indicators Survey is based, a code of conduct for data collection adopted from the American Productivity & Quality Center (APQC), and a protocol for performing benchmarking studies adopted from the AwwaRF report *Best Practices Study for Energy Management*.

The following 45 utilities were the QualServe Benchmarking Utility Founding Members:

Arlington (City of)

Beaufort-Jasper Water and Sewer Authority

Aquarion Water Company of Connecticut

Calgary Waterworks Division (City of)

Charleston CPW

Cleveland—Division of Water (City of)

Columbus Water Works

Delta Diablo Sanitation District

East Bay Municipal Utility District

Everett—Public Works Department (City of)

Fairfax County Office of Waste Management

Green Bay Water Utility

Hilton Head No. 1 Public Service District

Jacksonville Electric Authority (JEA)

Jordan Valley Water Conservancy District

Kissimmee, Department of Water Resources (City of)

Lansing Board of Water & Light

Long Beach Water Department

Los Angeles (City of), Bureau of Sanitation

Louisville Water Company

Louisville-Jefferson County Metropolitan

Sewer District

Martin County Environmental Services

Maui County Water Supply

Mesa (City of)

Moscow Water Department (City of)

Mount Pleasant Waterworks

Naperville Department of Public Utilities

(City of)

North Penn Water Authority

Olathe (City of)

Onondaga County Water Authority

(OCWA)

Ottawa (City of)

Phoenix Water Services Department

(City of)

Portland, Bureau of Water Works (City of)

Portland Water District

Riverside Public Utilities—Water Division

(City of)

Saint Paul Regional Water Services

Salt Lake City Water Department

San Antonio Water System

San Diego County Water Authority

Santa Clara Valley Water District

Sarasota County Environmental Services

Seattle Public Utilities

Tacoma Water

West Palm Beach Public Utilities (City of)

Winnipeg Water and Waste Department

(City of)

The QualServe Benchmarking Working Group members also deserve special recognition. These individuals volunteered time and effort in planning, preparing, reviewing, and revising to ensure creation of valuable information to aid utilities in improving their performance.

Members of the Benchmarking Working Group include:

Beth Bickerstaff, Columbus Water Works
Terry Brueck, EMA, Inc.
Chris Gardner, APQC
Scott Haskins, Seattle Public Utilities
Kurt Keeley, AWWA
Terry Murray, Beaufort Jasper
Water & Sewer Authority
Myron Olstein, Black & Veatch

Linda Paralez, Demarche Consulting

Group, Inc.

James Patterson, Columbus Water Works
Jennifer Paul, Aquarion Water Company
Janet Ryan, Regional Water Authority
Diann Shope, Seattle Water Utilities
Mike Sweeney, EMA, Inc.
David Visintainer, St. Louis Water
Division, (City of)
Steve Wright, APQC

Thanks also to Chris Gardner and Mike O'Kane from APQC. They developed the first Benchmarking Performance Indicators Survey and were instrumental in collecting and validating data for performing the initial data analyses for this project. Chris and Mike have been an invaluable resource with their reliable and boundless knowledge in benchmarking and performance measurement.

BENCHMARKING

Performance Indicators for Water and Wastewater Utilities: Survey Data and Analyses Report



Introduction

A system of performance indicators for water and wastewater utilities has been the vision of many utility leaders for years. In its 1995 charter for the utility quality service program (now QualServe), the American Water Works Association (AWWA) Board of Directors foresaw benchmarks as a key underpinning of the programs to help utilities improve performance. Since then, organizations around the world have implemented performance indicator systems. In January 2003 the launch of the QualServe Benchmarking Clearinghouse and its 65 members affirmed the importance of a system of performance indicators to help utilities in the United States and Canada with comparative analyses and building performance measurement systems for internal use. In 2004 the program, now called the QualServe Benchmarking Program, focused efforts on delivering the Performance Indicators Survey and presenting analyses on participating utility data.

This report assesses the performance of water and wastewater utilities using a set of identified and tested, high-level performance indicators. These indicators are designed to help participating utilities improve their operational efficiency and effectiveness. Participating utilities will use this information to determine where their performance resides within the industry peer group. High-level indicators were selected as the starting point for the system because they are more likely to be recognizable and applicable at large numbers of utilities. The QualServe Benchmarking Performance Indicators Survey was developed to provide utilities an opportunity to collect and track data from already identified and tested performance indicators. This report provides summary data and comparative analyses of the survey data.

This project report is based on what others have already researched, developed, and communicated. The intent of this approach to presenting performance data is to draw continuing support from other utilities that will both provide and use performance indicators data. The 22 performance indicators used in the survey are based on the Awwa Research Foundation (AwwaRF)/QualServe research report Selection and Definition of Performance Indicators for Water and Wastewater Utilities.

The QualServe business systems were chosen as an organizing framework to guide the design effort so the initial performance indicators database would be familiar to the many utilities participating in other elements of that program. The QualServe business model was used as the basic framework for organizing the performance indicators. The QualServe model characterizes the work of the typical water and wastewater utility around five business systems, each of which is comprised of four to seven business process categories. The performance indicators used in this report are categorized around these five business areas and are presented in Figure 1–1.

The design of an all-inclusive performance measurement system is not included in this project report. A narrower project scope was proposed as a start so participating utilities could gain understanding of the performance indicators definitions and calculations and so utilities will have opportunities to decide which indicators have the most meaning to them. The project scope will also aid those administering the measurement system so they can continue to learn how to build, finance, manage, and sustain an effective data and supported delivery system. With dedicated leadership and financing, a robust system can be constructed in the future. A more detailed indicator system can include the addition of lower-level indicators, and the development of a process benchmarking system. The QualServe Benchmarking program has already adopted a protocol for performing process benchmarking studies. The development of a process benchmarking system is anticipated once adequate participation is obtained to support such a system.



FIGURE 1–1 The QualServe Business Model for Water and Wastewater Utilities

This is the first published report of Benchmarking Performance Indicators Survey data. Two hundred and two utilities participated with data from 2003 and 2004. Two previous reports have been completed, but release of the summary data was exclusive to participating utilities. It is anticipated that this survey and report process will be offered on a routine schedule so utilities can prepare for data collection.

Each performance indicator is presented with Median Range chart(s) to illustrate the results from the data provided by participating utilities. The main content of this report is the presentation of summary and comparative analyses on each performance indicator. A comparison of utility results for each indicator using the various data categories can help to identify opportunities for operational performance improvements. Relationships between performance indicators can also reveal important insights when assessing utility performance. This report provides a mechanism to make these comparisons to aid those who wish to implement quality improvement processes.

The two years of data in the report allows some performance indicator comparisons between utilities and establishes a baseline for those utilities that participated. As more data is collected over a number of years, comparisons from year to year will be available and trends can be derived. Differences in attributes and drivers between individual utilities make comparison of utilities difficult, especially for international comparisons. One reliable indicator is the trend in performance indicators over time, so that the variables can be controlled and held somewhat constant. Long-term, consistent performance data therefore can be an important resource. Appendix A provides detailed descriptions of the performance indicators to aid in interpretation of the performance indicators, including definitions, calculations, data required, and background information.

Performance Indicators Summary

This report uses 22 key performance indicators that are categorized in five areas of water and wastewater utility operations: organizational development, customer relations, business operations, water operations, and wastewater operations. These indicators are listed below, accompanied by a short description.

Organizational Development

- 1. *Organizational Best Practices Index* is a self-assessment of the degree to which seven management practices are implemented by a utility:
 - a. Strategic planning
 - b. Long-term financial planning
 - c. Risk management planning
 - d. Optimized asset management
 - e. Performance measurement
 - f. Customer involvement
 - g. Continuous improvement

- 2. *Employee Health and Safety Severity Rate* measures lost workdays per employee per year. It is identical to that contained in Occupational Safety and Health Administration (OSHA) Form 300A and already recorded by US utilities.
- 3. *Training Hours Per Employee* measures a utility's investment in formal training for employees.
- 4. Customer Accounts per Employee, Million Gallons per Day (MGD) Water Delivered per Employee, and Million Gallons per Day Wastewater Processed per Employee are measures of employee efficiency. They account for contributions completed through contracts.

Customer Relations

- 5. *Customer Service Complaints* and *Technical Quality Complaints* per 1,000 customer accounts complement one another. The first are service associated; the second quantify complaints of technical quality.
- 6. *Disruptions of Water Service* quantifies the number of customers experiencing service disruptions as a ratio per 1,000 active customer accounts.
- 7. *Residential Cost of Water and/or Sewer Service* is a suite of six indicators, two of which apply at any water, wastewater, or joint water/wastewater utility.
 - a. Bill amount for monthly residential water service for a customer using 7,500 gallons per month.
 - b. Average residential water bill amount for 1 month of service.
 - c. Bill amount for monthly residential sewer service for a customer using 7,500 gallons of water per month.
 - d. Average residential sewer bill amount for 1 month of service.
 - e. For multiple service utilities that cannot provide individual costs, the total monthly bill amount for residential water and sewer service for a customer using 7,500 gallons of water per month.
 - f. For multiple service utilities that cannot provide individual costs, the average residential combined water and sewer bill amount for 1 month of service.
- 8. *Customer Service Cost Per Account* measures the cost to a utility of managing a single customer account for 1 year.
- 9. *Billing Accuracy* measures the number of error-driven bill adjustments per 10,000 bills issued during the reporting year.

Business Operations

- 10. Debt Ratio is a measure of utility indebtedness.
- 11. *System Renewal/Replacement Rate* measures the degree to which a utility is renewing or replacing its infrastructure. Rates are provided for water treatment, water distribution, wastewater collection, and wastewater treatment.
- 12. *Return on Assets* indicates the financial effectiveness of the utility. Investor-owned and enterprise fund utilities may see the greatest value to this indicator.

Water Operations

- 13. *Drinking Water Compliance Rate* tallies the percentage of days in the reporting year during which a utility was in full compliance with the maximum contaminant levels and treatment techniques mandated by the US National Primary Drinking Water Regulations.
- 14. *Distribution System Water Loss* measures the percentage of drinking water placed into distribution that does not find its way to customers or other authorized users.
- 15. *Water Distribution System Integrity* quantifies the condition of the water distribution system with the number of breaks and leaks requiring repair per 100 miles of distribution piping.
- 16. *Operations and Maintenance Cost Ratios* tally the cost of operations and maintenance and relate them on per-account and per-millions-of-gallons-produced bases.
- 17. *Planned Maintenance Ratio* measures how effectively utilities are investing in planned maintenance. Two proposed ratios make comparisons to cost and to hours invested in maintenance activities.

Wastewater Operations

- 18. *Sewer Overflow Rate* measures the condition of the sewerage collection system and the effectiveness of maintenance activities. It is expressed as the ratio of the number of overflows per 100 miles of collection piping.
- 19. *Collection System Integrity* measures the frequency of collection system failures per 100 miles of piping.
- 20. Wastewater Treatment Effectiveness Rate quantifies a utility's compliance with the effluent quality standards in effect at each of its wastewater treatment facilities.
- 21. *Operations and Maintenance Cost Ratios* tally the cost of operations and maintenance and relate them on per-account and per-millions-of-gallons-of-wastewater-processed bases.
- 22. *Planned Maintenance Ratio* measures how effectively utilities are investing in planned maintenance. Two proposed ratios make comparisons to cost and to hours invested in maintenance activities.

BENCHMARKING

Performance Indicators for Water and Wastewater Utilities: Survey Data and Analyses Report



Survey Process and Report Organization

Survey Process

Scope

The 2004 QualServe Benchmarking Performance Indicators Survey collected data from participating utilities to construct the 22 performance indicators. More than 300 individual data inputs were required to complete the survey. The same survey was conducted to a smaller group of utilities in 2003. The data collected from that earlier effort is included in the database used to produce this report. The Benchmarking Performance Indicators Survey was one of the most comprehensive ever conducted to obtain information about water and wastewater utility operation.

American Productivity and Quality Center

With corporate headquarters in Houston, Texas, the American Productivity & Quality Center (APQC) was contracted by the American Water Works Association (AWWA) as the primary developer of the survey instrument and was responsible for conducting the survey, collecting and validating the data, and producing preliminary data analysis results. APQC is an internationally recognized resource for process and performance improvement. The partnership with APQC ensured that the survey and analyses were conducted according to the highest standards and used internationally accepted methodology.

Founded in 1977, APQC is a member-based nonprofit serving approximately 500 organizations around the world in all sectors of business, education, and government. APQC's primary focus areas are

- benchmarking and best practices,
- knowledge management,
- metrics and measures,
- performance measurement, and
- professional development initiatives.

APQC works with its member organizations to identify best practices, discover effective methods of improvement, and broadly disseminate findings. APQC organized the first White House Conference on Productivity, spearheading the creation and design of the Malcolm Baldrige National Quality Award in 1987. In 1992, the evolution of best practices and benchmarking as tools for breakthrough improvement led APQC to form the International Benchmarking Clearinghouse, a comprehensive service designed to promote, facilitate, and improve the process of learning from best practices.

APQC involvement in the Benchmarking Performance Indicators Survey provides the credibility of the world's largest and most experienced benchmarking organization. The procedures used by APQC for survey design, data analysis, data confidentially, and code of conduct are the standards for the industry.

Methodology

AWWA and APQC worked together to offer the Benchmarking Performance Indicators Survey to all utilities in North America. Survey design was largely completed prior to the 2003 open data collection period. Some refinements to the data definitions and survey design were made prior to conducting the 2004 survey.

An Awwa Research Foundation funded project completed in 2002 created the key performance indicators and definitions that were used in the survey. The Benchmarking Clearinghouse (funded by Founding Members) contracted with the APQC to administer a pilot survey and produce a statistical report. The QualServe Benchmarking subcommittee evaluated the results of the pilot and approved the survey instrument.

Forty-five utilities responded to the 2003 survey. The results were compiled by APQC and distributed to the participating utilities. Feedback from the utilities and from the QualServe Benchmarking subcommittee led to some revisions to the definitions and some minor improvements to the survey instrument.

The 2004 Benchmarking Performance Indicators Survey open data collection period took place from May 2004 through July 2004. One hundred eighty-seven utilities participated in the 2004 survey; data from one utility was not used. Data validation was performed by APQC in August 2004 through October 2004. This involved e-mail inquiries to utilities regarding questionable data and, in some cases, telephone interviews. An individualized summary report was given to each participating utility in December 2004. Data from 16 utility participants from the 2003 survey (utilities that did not participate in the 2004 survey) were combined with the 2004 data. This combined database was used for the analyses included in this report.

Report Organization

The organization of this report is designed primarily to assist utilities that wish to compare their results with the participating utilities that submitted data. Participating utilities should also find this organization useful since they can refine their data comparison due to the additional utility classifications (compared to the report summary they received for submitting data) contained in this report. Consultants, manufacturers, and others can find the information they seek regarding the performance indicators and the results from the survey data.

The first three chapters of the report describe how the performance indicators were developed, the survey design process, the basic precepts of benchmarking and performance improvement, and how to read the summary data charts and interpret percentile statistics. Chapters 4 through 7 present the results of the data analysis for the performance indicators. The appendices include the performance indicator definitions, definitions of terms, additional profile summaries, confidence ratings for indicator data from utility estimates, and a conversion table for use by those wishing to convert results in other units of measure.

Below are brief discussions of contents of the data summary and analysis chapters (chapters 4–7).

Chapter 4—Characterizing Participating Utilities

Total participation includes 202 utilities that provided data from years 2003 and 2004. The majority of utility participants were from the United States and Canada. Two international utilities also submitted data. Data from Greece was excluded from the analysis because it was not consistent with the other data. To protect the identity of individual utility data and to ensure data validity, analyses with a population size under five are not included in this report. Performance indicator reporting shows quartile analysis only if there were five or more responses and median only if there were three or more.

Additional participant profile summaries—frequency distribution and general quantitative background information—are presented in appendix C. This profile information will help users understand the different utility attributes when assessing their utility in relation to others. The information will also aid those who use the performance indicators when looking for comparisons with utilities of similar size, location, service profile, and ownership.

Chapter 5—Performance Indicators

Throughout this report, performance indicators are presented using the following categories and analyses:

Utility Region (regions designated by the US Census Bureau)

- Northeast: CT, ME, MA, NH, RI, VT, NJ, PA, NY
- South: DE, DC, FL, GA, MD, NC, SC, VA, WV, AL, KY, MS, TN, AR, LA, OK, TX
- Midwest: IN, IL, MI, OH, WI, IA, KS, MN, MO, NE, ND, SD
- West: AZ, CO, ID, NM, MT, UT, NV, WY, AK, CA, HI, OR, WA

Utility Size (population served)

- >500,000
- **1**00,001–500,000
- **50,001–100,000**
- **1**0,000–50,000
- <10,000

Utility Service or Operation Type

- Water operations—represents those utilities designated as exclusively providing water services.
- Wastewater operations—represents those utilities designated as exclusively providing wastewater services.
- Combined operations—represents those utilities designated as providing both water and wastewater services.

All Participants

This category includes data submitted from all participating utilities. Canada and international utility data is included in this category.

For Water Only, participants were instructed to take the larger of the wholesale or retail. For Wastewater Only, participants were instructed to take the larger of the collection or treatment, retail or wholesale. For Combined, participants were instructed to take the larger of the water wholesale or retail, wastewater collection or treatment, retail or wholesale.

Quartile Ranking

The summary data is presented in quartile rankings. The top quartile reflects the 75th percentile, and the bottom quartile reflects the 25th percentile. Performance is explained in the summary of each performance indicator.

Median

The median is the 50th percentile value.

Miscellaneous

- A designation of "na" reflects data that were not available or applicable for that metric.
- Accuracy confidence ratings and frequency distribution data represent the arithmetic mean (average).
- Most metric definitions, calculations, and purpose statements originate from the QualServe Performance Indicators Report. A detailed summary of performance indicators is presented in appendix A.

Metric reporting shows quartiles only if there were five or more responses and median only if there were three or more responses.

Chapter 6—Summary Tables by Type, Region, and Size

The summary tables in chapter 6 present the 25th, median, and 75th percentiles of each performance indicator. These analyses provide further insights by breaking out each indicator by utility operation type, region, and size.

Chapter 7—Performance Indicators Relational Analyses

Relationships between performance indicators can reveal important insights when assessing utility performance. These relationships are useful when tracking the effect of changes in processes designed to improve efficiency. This chapter presents several samples of relational analyses between performance indicators and provides a guide for assessing additional relationships.

BENCHMARKING

Performance Indicators for Water and Wastewater Utilities: Survey Data and Analyses Report



Guide to Using "Median Range" Charts

For each performance indicator there is a chart illustrating the collective results from the data provided by participating utilities. This chart, labeled "Median Range Chart," depicts the data that is shown in the table that follows. Many alternatives for presenting this data were explored. This type of chart was chosen because of its simplicity and ease of use.

Although this presentation is not complicated, it provides a surprising depth of information. The following examples are provided to help you use these charts. After this short tutorial, you will be able to examine each performance indicator. By comparing your utility's results for each indicator with the various data categories, you will gain valuable insight regarding utility operations, which will in turn help you to identify opportunities for operational performance improvements.

What Is a Percentile?

Survey data of the type found in the Benchmarking Performance Indicators Survey database are commonly evaluated using percentiles. Here is an example to illustrate how percentiles are determined and how they can be used to evaluate a group of data values.

To obtain a percentile of a group of data values, first sort the data in order of value. If there are 100 data values, sort them from the lowest to the highest number. Then the 75th percentile is the 75th value in order.

In the example shown in Figure 3–1, 50 data values are listed in the first column to the left as they were received (unordered). In the second column (ordered data), the same data values have been sorted from lowest (0) to highest (35). The next column counts the values so that the percentiles can be easily identified. In this case, there are 50 values. The 50th percentile is the median and is the 25th value in this list (the number 10). The percentiles are shown in the fourth column.

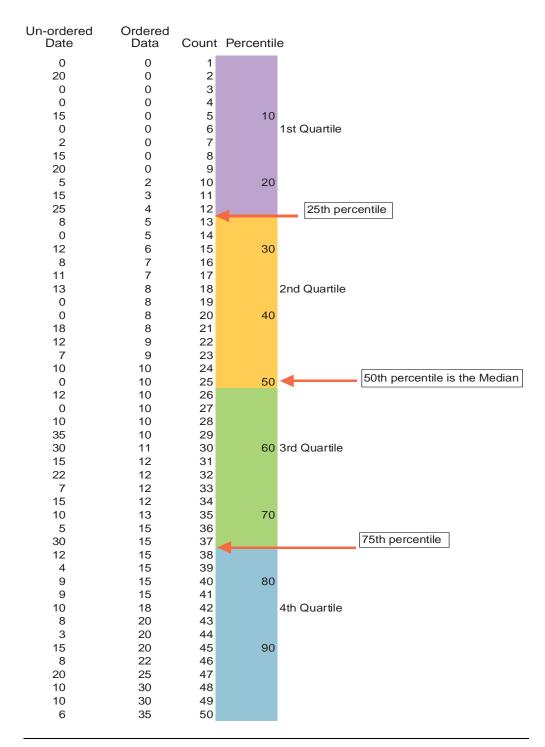


FIGURE 3-1 Percentile/Quartile Illustration

Quartiles and the "Median Range"

Another way of looking at this is that there are only 25% of the values *higher* than the 75th percentile value. For the 25th percentile value, there are only 25% of the values *lower* than that value. So, 50% of the values are between the 25th and 75th percentiles. The value association with the 50th percentile is the median (exactly 50% of the values are above and below this value).

You can see that dividing the data this way results in four groups of data.

- 1. Data below the 25th percentile
- 2. Data between the 25th and 50th percentiles
- 3. Data between the 50th and 75th percentiles
- 4. Data above the 75th percentile

Each of these groups is called a quartile (four quarters shown in Figure 3–1). Data in the middle two (#2 and #3) can be described as the "median range." The reason is that the median is the boundary between these two quartiles. Data in the median range includes 50% of all the values submitted for the performance indicator. This range is considered nominal or representative of the majority of the data.

Using the Median Range Chart

The following example (Figure 3–2) shows the median range of values for several data categories. The categories on the left show the data sorted by region, size, type of utility, and aggregate for all participants. The x axis shows the unit of measure described in the definition of the performance indicator. The bars illustrate the median range (the 2nd and 3rd quartiles). The ends of the bars on the left are the boundaries for the 25th percentile, and the ends of the bars on the right are the boundaries for the 75th percentile. The diamonds on each bar indicate the median value in the range.

75th Percentile 25th Percentile West South Midwest Northeast >500,000 100,001-500,000 50,001-100,000 10,000-50,000 Combined Wastewater Water All Participants 100 150 200 250 Units Median

Example Performance Indicator (Median Range, 25th-75th Percentile)

FIGURE 3–2 Example Performance Indicator—Percentiles Indicated

Comparing Individual Utility Data to Chart Ranges

A useful feature of this report is that utilities that have contributed data received their own values for each performance indicator. These values can be compared to the values from the other contributing utilities by using the tables or charts provided. There are several comparisons that may be useful. Here is an example of how to make the benchmark comparisons.

Example:

Utility Description

The utility is located in Indiana and provides both water and wastewater services to 125,000 customers. For this indicator, the utility received a value of 147 (Figure 3–3).

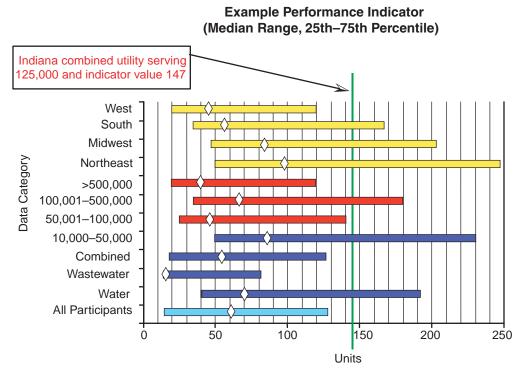


FIGURE 3-3 Example Performance Indicator—Utility Example

Comparison and Interpretation

By comparing the utility's value of 147 with "all participants" you can see that this is beyond the 75th percentile boundary (beyond the end of the "median range" bar). Assuming that a high value for this indicator is desirable, this utility may be one of the best performers when compared to the values for all participating utilities. The same interpretation could be attributed to the comparison with Combined Operations utilities. The utility's value is within the "median range" for like-size utilities (100,001–500,000 customers) and Midwest utilities. However, the value is well above the median in each category. In future years, this utility will want to maintain this level of performance or, perhaps, make operational improvements to increase this value even more.

As you can see, not only can a utility assess their relative performance, but these indicators can be used to measure the effect of future operational changes. Adoption of improved processes for delivering service and improving efficiency can lead to enhanced customer satisfaction and overall economy.

BENCHMARKING

Performance Indicators for Water and Wastewater Utilities: Survey Data and Analyses Report





Characterizing Participating Utilities

Analyses for 202 utilities is included in this report. Participants include water and wastewater utilities that submitted data in the Benchmarking Performance Indicators Survey from 2003 and 2004. A detailed list of reporting utilities is presented at the end of this chapter (Tables 4–4 and 4–5).

Figure 4–1 shows the distribution of utility participants across the United States. The location of each utility reinforces the fact that a disparity exists between utilities and their operating conditions. Differences in attributes such as type of operation, geographic location, size of operation, organizational structure (public, private, etc.), governing body, and organizational structure can all affect utility performance. Additional factors that can affect utility performance include regulatory regulations environment, political climate, availability of water, and weather conditions. An understanding of the attributes and drivers of water and wastewater utilities is critical to valid interpretation of performance indicator analyses. The information in this chapter will help you to understand the different attributes affecting the participating utilities. These differences should be taken into account when analyzing the reported performance indicators.

There are four utility participants from Canada (British Columbia and Manitoba) and one international utility (Cayman Islands). Data from the Canadian and international utility were not used in the profile summaries because the population size was too small to perform analyses. Refer to Tables 4–4 and 4–5 for information on these five utilities.

The tables and figures in this report have been categorized to differentiate between different types of operations, regions, and sizes. This is necessary, because utility performance can vary based on a utility's operations, region of operation, and size. Comparing utilities is meaningful only if the utility's relevant attributes are reported and their impact on performance is understood. Tables 4–1, 4–2, and 4–3 summarize utility participation by these three categories.:

- 1. Utility service or operation type
- 2. Utility region
- 3. Utility size

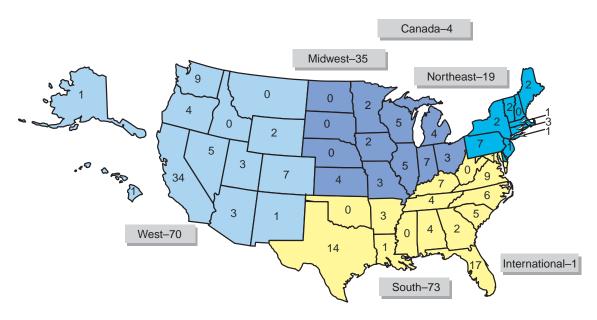


FIGURE 4-1 Distribution of Utility Participation Across the United States

NOTE: The number appearing within each state reflects the number of responding utilities.

TABLE 4-1 Participant Summary—Service or Operation Type

Service or Operation Type	Number of Utilities
Water only	70
Wastewater only	16
Combined	116
Total participants	202

TABLE 4-2 Participant Summary—Regional

Region	Number	Region	Number
1. Northeast		5. Canada	
Water	13	Water	1
Wastewater	2	Wastewater	0
Combined	4	Combined	3
Total	19	Total	4
2. Midwest		International	
Water	14	Water	0
Wastewater	3	Wastewater	0
Combined	18	Combined	1
Total	35	Total	1
3. South			
Water	16	Grand Total	202
Wastewater	4		
Combined	53		
Total	73		
4. West			
Water	26		
Wastewater	7		
Combined	37		
Total	70		

TABLE 4–3 Participant Summary—Size (Population Served)

Size (Population Served)	Number		Number
Size		Size	
<10,000		100,001-500,000	
Water	7	Water	26
Wastewater	1	Wastewater	6
Combined	8	Combined	39
Total	16	Total	71
10,000-50,000		>500,000	
Water	15	Water	15
Wastewater	2	Wastewater	5
Combined	29	Combined	20
Total	46	Total	40
50,001-100,000			
Water	7	Grand Total	202
Wastewater	2		
Combined	20		
Total	29		

Utility Service Type

Figure 4–2 shows the distribution by type of service or operations of the utility respondents. Combined utilities make up the largest group at 57%. Water-only utilities make up the second largest group at 35%, followed by wastewater-only utilities at 8%. Although the wastewater-only group is small, data from combined utilities contribute to reporting data on the wastewater performance indicators.

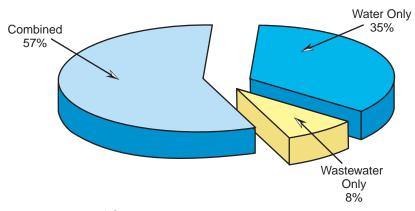


FIGURE 4-2 Distribution of Service Type by Utility Participants

Utility Region

Regional distribution of participating utility data are presented in Figure 4–3 and listed in Table 4–2. Regions are reported in the following categories (provided by the US Census):

- Region 1, Northeast States: CT, ME, MA, NH, RI, VT, NJ, PA, NY
- Region 2, Midwest States: IN, IL, MI, OH, WI, IA, KS, MN, MO, NE, ND, SD
- Region 3, South States: DE, DC, FL, GA, MD, NC, SC, VA, WV, AL, KY, MS, TN, AR, LA, OK, TX
- Region 4, West States: AZ, CO, ID, NM, MT, UT, NV, WY, AK, CA, HI, OR, WA
- Region 5, Canada
- International: Cayman Islands

Although the categories taken from the US Census Bureau are not broken down as much as some would like, these cuts do give a representation of how respondents were distributed across the United States, Canada, and internationally. As shown, the largest group of utility participants is from the South (37%) and West regions (35%), followed by the Midwest (17%) and Northeast (9%). Utility participation from Canada makes up 2% and international makes up <1%.

Utility Size (Population Served)

Economies of scale vary significantly across the utilities in North America and internationally. Population served is a key attribute in determining the difference in size of operations among the utility participants. For this report, the size of operation for participating utilities is categorized in five ranges:

- Less than 10,000
- **1**0,000–50,000
- **5**0,001–100,000
- **1**00,001–500,000
- Greater than 500,000

The distribution of size (population served) by utility participants is presented in Figure 4–4. The largest group makes up utilities serving a population of 100,001-500,000 (36%), followed by utilities serving a population of 10,000-50,000 (23%), and those utilities serving a population greater than 500,000 (20%). The smallest groups make up utilities serving a population of 50,001-100,000 (14%) and small utilities serving a population of less than 10,000 (7%).

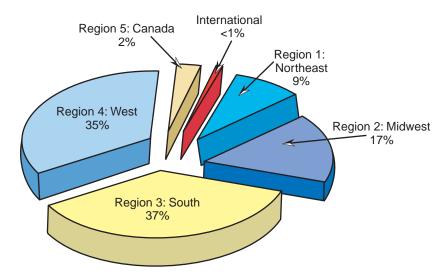


FIGURE 4-3 Regional Distribution of Utility Participants

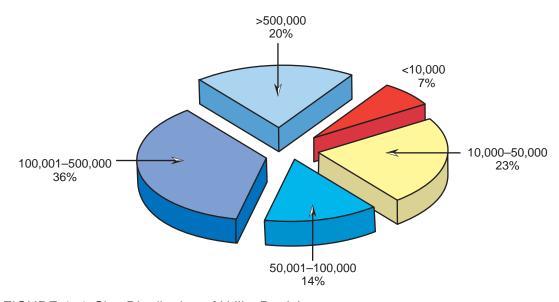


FIGURE 4–4 Size Distribution of Utility Participants

Distribution of Services by Utility Participants

Utility participants were asked what services their utility is responsible for providing. Figure 4–5 shows the distribution of services indicated by all utility respondents (water, wastewater, and combined). The figure shows that the majority of services provided all utilities are potable water distribution, wastewater treatment, wastewater collection (separated sewers), and potable water treatment and transmission. The distribution of services for water only, wastewater only, and combined utilities are shown in Figures 4–6, 4–7, and 4–8.

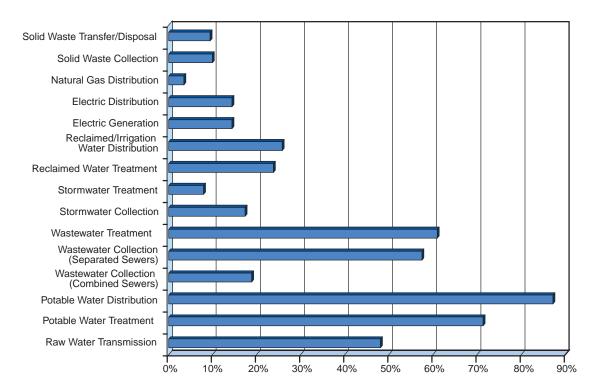


FIGURE 4-5 Distribution of Services Provided by All Utility Participants

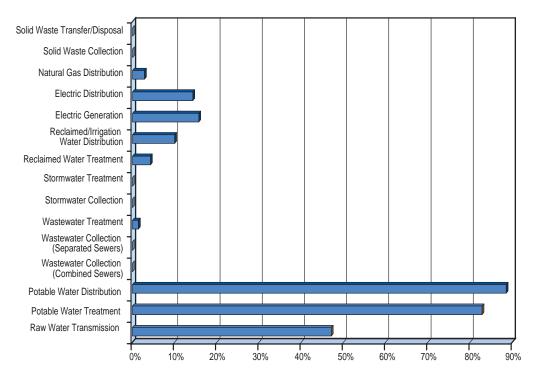


FIGURE 4-6 Distribution of Services Provided by Water-Only Utility Participants

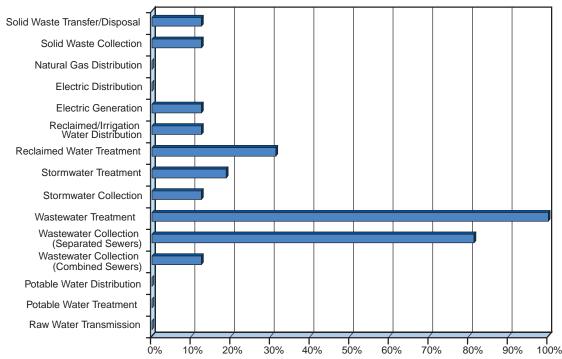


FIGURE 4-7 Distribution of Services Provided by Wastewater-Only Utility Participants

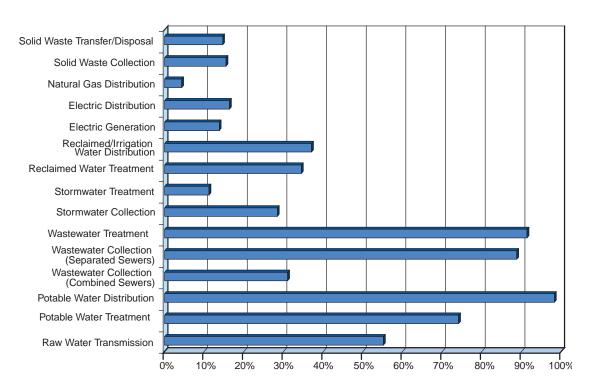


FIGURE 4-8 Distribution of Services Provided by Combined Utility Participants

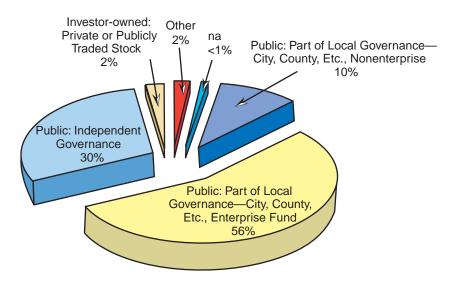


FIGURE 4–9 Organizational Structure Distribution of Utility Participants (na = not applicable)

Utility's Organizational Structure

The structure of utility organizations is divided into five categories:

- Public (part of local governance—city, county, etc., nonenterprise fund)
- Public (part of local governance—city, county, etc., enterprise fund)
- Public (independent governance)
- Investor-owned (private or publicly traded stock)
- Other

The distribution of participating utility's organizational structure is presented in Figure 4–9. Public utilities, in general, make up the largest group at 56% for public utilities that are part of local governance—city, county, etc., enterprise fund; 30% for public utilities that are under independent governance and 10% for public utilities that are part of local governance—city, county, etc., nonenterprise fund. Investor-owned utilities make up 2% of the participating utilities.

Utility Governance

In this report, a utility governance is categorized by

- Board of directors or commissioners
- City or county government
- Other

As shown in Figure 4–10, boards of directors or commissioners govern 55% of the organizations and city or county governments govern 43%.

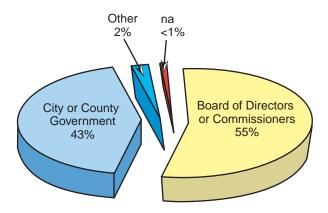


FIGURE 4–10 Governance Distribution of Utility Participants

TABLE 4-4 Utility Participation by Region and Type of Service

State	Utility	Region*	Type†	State	Utility	Region	Type
AK	Anchorage Water & Wastewater Utility	West	С	AL	Anniston Water Works and Sewer Board	South	С
AZ	Peoria, City of	West	С		Birmingham Water Works and Sewer Board	South	С
	Phoenix, City of	West	С		Mobile Area Water & Sewer System	South	С
	Tucson Water	West	W		Sheffield Utilities	South	С
CA	Alameda County Water District	West	W	AR	Beaver Water District	South	W
	Anaheim Public Utilities	West	W		Carroll–Boone Water District	South	W
	Azusa Light & Water	West	W		Little Rock Wastewater	South	WW
	City of Fresno	West	W	FL	Atlantic Beach, City of	South	С
	City of San Diego Metropolitan Water	West	WW		Broward Environmental Services	South	С
	Contra Costa Water District	West	W		Clearwater, City of	South	С
	Delta Diablo Sanitation District	West	WW		Cocoa, City of	South	С
	Dublin San Ramon Services District	West	С		EnvSBC Utilities	South	С
	East Bay Municipal Utility District	West	С		JEA Jacksonville	South	С
	Eastern MWD	West	С		Lakeland Water Utilities	South	С
	Elsinore Valley Municipal Water District	West	С		Miami–Dade Water and Sewer Department	South	С
	Fresno Wastewater Management Division	West	WW		Orlando Utilities Commission	South	W
	Indio Water Authority	West	W		Pinellas County Utilities	South	С

29

TABLE 4-4 Utility Participation by Region and Type of Service (continued)

State	Utility	Region*	Type [†]	State	Utility	Region	Type
	Lake Arrowhead Water and Wastewater	West	С		Sarasota ESBC Utilities	South	С
	Lompoc, City of	West	С		South Walton Utility Co., Inc.	South	С
	Los Angeles Bureau of Sanitation	West	WW		Tampa Bay Water	South	W
	Los Angeles County Waterworks Districts	West	W		Tampa Water Department	South	W
	Oceanside, City of	West	С		Titusville City of	South	С
	Olivenhain Municipal Water District	West	С		Toho Water Authority	South	С
	Otay Water District	West	С		West Palm Beach, City of	South	С
	Pasadena Water and Power	West	W	GA	Cobb County Water System	South	С
	Purissima Hills Water District	West	W		Columbus Water Works	South	С
	Rincon del Diablo MWD	West	W	KY	Butler Co. Water System	South	W
	Riverside, City of	West	С		Louisville Water Company	South	W
	San Diego Water Department	West	W		Northern Kentucky Water District	South	W
	San Francisco Public Utilities Commission	West	С		Owensboro Municipal Utilities	South	W
	San Jose Water Company	West	W		Paducah Water Works	South	W
	Santa Clara Valley Water District	West	W		Simpson Co. Water District	South	W
	Scotts Valley Water District	West	W		Warren Co. Water District	South	С
	South Tahoe Public Utility District	West	С	LA	New Orleans, S&WB of	South	С
	Sunnyvale, City of	West	С	MD	Washington Suburban Sanitary Comm.	South	С

TABLE 4-4 Utility Participation by Region and Type of Service (continued)

State	Utility	Region*	Type [†]	State	Utility	Region	Type
	Union Sanitary District	West	WW	NC	Charlotte–Mecklenburg Utilities	South	С
	Vallecitos Water District	West	С		Davidson Water, Inc.	South	W
	Yuba City, City of	West	С		Durham, City of	South	С
СО	Aurora, Colorado, City of	West	С		Fayetteville Public Works Commission	South	С
	Eagle River Water & Sanitation District	West	С		Greenville Utilities Comm.	South	С
	Fort Collins Utilities	West	С		Orange Water & Sewer Authority	South	С
	Pagosa Area Water and Sanitation District	West	С	SC	Beaufort–Jasper Water and Sewer Authority	South	С
	Town of Rangely	West	С		Charleston (SC) Comm. of Public Works	South	С
	Upper Eagle Regional Water Authority	West	W		Georgetown County Water & Sewer District	South	С
	Westminster, City of	West	С		Mount Pleasant Waterworks	South	С
HI	Honolulu, City and County of	West	WW		SJWD Water District	South	W
NM	Albuquerque Bernalillo County Water Utility Authority	West	С	TN	Athens Utilities Board	South	С
NV	Henderson, City of	West	С		Clarksville Gas & Water Department	South	С
	Las Vegas Valley Water District	West	W		Memphis Light, Gas and Water Division	South	W
	Moapa Valley Water District	West	W		Metro Water Services	South	С
	North Las Vegas, City of	West	С	TX	Arlington Water Utilities	South	С

31

TABLE 4-4 Utility Participation by Region and Type of Service (continued)

State	Utility	Region*	Type [†]	State	Utility	Region	Type
	Truckee Meadows Water Authority	West	W		Austin Water Utility	South	С
OR	Klamath Falls, City of	West	С		Carrollton, City of	South	С
	Salem, City of	West	С		College Station Utilities	South	С
	SW Lincoln County Water District	West	W		Denton, City of	South	С
	Tualatin Valley Water District	West	W		El Paso Water Utilities	South	С
UT	Central Utah Water Conservancy District	West	W		Fort Worth Water Department	South	С
	Jordan Valley Water Conservancy District	West	W		Garland, City of	South	С
	Salt Lake Public Utilities	West	С		Longview, City of	South	С
WA	Birch Bay Water & Sewer	West	С		Lower Colorado River Authority	South	С
	Bremerton, City of	West	С		New Braunfels Utilities	South	С
	Kent Public Works	West	С		Padre Dam Mun. Water District	South	С
	Richland, City of	West	W		San Antonio Water System	South	С
	Richland, City of	West	WW		Weatherford, City of	South	С
	Sammamish Plateau Water and Sewer District	West	С	VA	Appomattox River Water Authority	South	W
	Seattle Public Utilities	West	С		Chesterfield Utilities	South	С
	Snohomish County PUD	West	W		Fairfax County WMP	South	WW
	Vancouver, City of	West	W		Hampton Roads Sanitation District	South	WW
WY	Cheyenne Board of Public Utilities	West	С		Henrico County Dept. of Public Utilities	South	С

TABLE 4-4 Utility Participation by Region and Type of Service (continued)

State	Utility	Region*	Type†	State	Utility	Region	Type
	Laramie, City of	West	С		Hopewell Regional Wastewater Treatment Facility	South	WW
IA	Des Moines Water Works	Midwest	W		Newport News Waterworks	South	W
	Sioux City Water Plant	Midwest	W		Stafford Department of Utilities	South	С
IL	Central Lake County Joint Action Water Agency	Midwest	W		Washington County Service Authority	South	С
	Chicago, City Department of Water Management	Midwest	С	СТ	Aquarion Water Company of CT	Northeast	W
	Greater Peoria Sanitary District	Midwest	WW		Regional Water Authority	Northeast	W
	Naperville Department of Public Utilities, City of	Midwest	С	The Torrington Water Co.		Northeast	W
	Rock River Water Reclamation District	Midwest	WW	MA	White Water, Inc.	Northeast	W
IN	Bloomington Utilities	Midwest	С	ME	Bath Water District	Northeast	W
	City of South Bend	Midwest	С		Kennebec Water District	Northeast	W
	Elkhart Public Works	Midwest	С	NH	Concord, City of	Northeast	С
	Fort Wayne City Utilities	Midwest	С		Pennichuck Corporation	Northeast	W
	Marion Municipal Utilities	Midwest	С	NJ	Kearny Water Department	Northeast	W
	Michigan City Water Department	Midwest	W	NY	Erie County Water Authority	Northeast	W
	Mishawaka Utilities	Midwest	С	NY	Onondaga County Water Authority	Northeast	W
KS	Arkansas City	Midwest	С	PA	Buckingham Township	Northeast	С
	Olathe, City of	Midwest	С		Carmichaels–Cumberland Joint Sewer Authority	Northeast	WW



TABLE 4-4 Utility Participation by Region and Type of Service (continued)

State	Utility	Region*	Type†	State	Utility	Region	Туре
	Tecumseh Rural Water Dist. #8	Midwest	W		Cranberry Township	Northeast	С
	Wichita Water & Sewer	Midwest	С		DELCORA	Northeast	WW
MI	Benton Harbor–St. Joseph WWTP	Midwest	WW		Fox Chapel Authority	Northeast	W
	Coldwater Board of Public Utilities	Midwest	С		Lehigh County Authority	Northeast	С
	Lansing Board of Water & Light	Midwest	W		North Penn Water Authority	Northeast	W
	Zeeland Board of Public Works	Midwest	W	RI	Providence Water	Northeast	W
MN	Alexandria Board of Public Works	Midwest	W	ВС	Sun Peaks Utilities Co., Ltd.	Canada	С
	Grand Rapids Public Utilities Commission	Midwest	С		Greater Vancouver Regional District	Canada	С
МО	Utilities of Springfield, City of	Midwest	W		Capital Regional District		W
	Kansas City (MO) Water Services Department	Midwest	С	МВ	Winnipeg Water & Waste	Canada	С
	St. Louis, City of	Midwest	W		Cayman Islands Water Authority	International	С
ОН	Akron Public Utilities Bureau	Midwest	С		EYDAP SA (not included in aggregate data)	International	С
	Butler County DES	Midwest	С				
	Cleveland Division of Water	Midwest	W				
WI	Green Bay Water Utility	Midwest	W				
	La Crosse Water Utility	Midwest	W				
	Milwaukee Water Works	Midwest	W				
	Oak Creek Water & Sewer Utility	Midwest	С				

TABLE 4–4 Utility Participation by Region and Type of Service (continued)

State	Utility	Region*	Type [†]	State	Utility	Region	Туре
	River Falls Municipal Utility	Midwest	С				

NOTE: Utilities can use this table to sort and compare utility participants by state, region, and type and then by similar size categories.

*Region 1 = Northeast States: CT, ME, MA, NH, RI, VT, NJ, PA, NY

Region 2 = Midwest States: IN, IL, MI, OH, WI, IA, KS, MN, MO, NE, ND, SD

Region 3 = South States: DE, DC, FL, GA, MD, NC, SC, VA, WV, AL, KY, MS, TN, AR, LA, OK, TX

Region 4 = West States: AZ, CO, ID, NM, MT, UT, NV, WY, AK, CA, HI, OR, WA

Region 5 = Canada Provinces

 $^{\dagger}W$ = water only

WW = wastewater only

C = combined water and wastewater

HOME

TABLE 4–5 Utility Participation by Size (Population Served)

Size	Utility	State	Size	Utility	State
<10,000	Birch Bay Water & Sewer	WA	100,000-500,000	Broward Environmental Services	FL
<10,000	Buckingham Township	PA	100,000-500,000	Butler County DES	ОН
<10,000	Butler Co. Water System	KY	100,000-500,000	Capital Regional District	ВС
<10,000	Carmichaels-Cumberland Joint Sewer Authority	PA	100,000-500,000	Carrollton, City of	TX
<10,000	Cranberry Township	PA	100,000-500,000	Central Lake County Joint Action Water Agency	IL
<10,000	Grand Rapids Public Utilities Commission	MN	100,000-500,000	Central Utah Water Conservancy District	UT
<10,000	Lake Arrowhead Water and Wastewater	CA	100,000-500,000	Charleston (SC) Comm. of Public Works	SC
<10,000	Moapa Valley Water District	NV	100,000-500,000	Chesterfield Utilities	VA
<10,000	Purissima Hills Water District	CA	100,000-500,000	City of Fresno	CA
<10,000	Simpson Co. Water District	KY	100,000-500,000	City Utilities of Springfield	MO
<10,000	Sun Peaks Utilities Co., Ltd.	ВС	100,000-500,000	Clarksville Gas & Water Department	TN
<10,000	SW Lincoln County Water District	OR	100,000-500,000	Clearwater, City of	FL
<10,000	Tecumseh Rural Water Dist. #8	KS	100,000-500,000	Cocoa, City of	FL
<10,000	Town of Rangely	СО	100,000-500,000	Columbus Water Works	GA
<10,000	Zeeland Board of Public Works	MI	100,000-500,000	Contra Costa Water District	CA
10,000-50,000	Alexandria Board of Public Works	MN	100,000-500,000	Davidson Water, Inc.	NC
10,000-50,000	Arkansas City	KS	100,000-500,000	DELCORA	PA
10,000-50,000	Athens Utilities Board	TN	100,000-500,000	Des Moines Water Works	IA

TABLE 4-5 Utility Participation by Size (Population Served) (continued)

Size	Utility	State	Size	Utility	State
10,000-50,000	Atlantic Beach, City of	FL	100,000-500,000	Durham, City of	NC
10,000–50,000	Bath Water District	ME	100,000-500,000	Elsinore Valley Municipal Water District	CA
10,000-50,000	Bremerton, City of	WA	100,000-500,000	EnvSBC Utilities	FL
10,000-50,000	Carroll-Boone Water District	AR	100,000-500,000	Fayetteville Public Works Commission	NC
10,000-50,000	Cayman Islands Water Authority	*GC	100,000-500,000	Fort Collins Utilities	CO
10,000-50,000	City of South Bend	IN	100,000-500,000	Fort Wayne City Utilities	IN
10,000–50,000	Coldwater Board of Public Utilities	MI	100,000-500,000	Fresno Wastewater Management Division	CA
10,000-50,000	Concord, City of	NH	100,000-500,000	Garland, City of	TX
10,000-50,000	Fox Chapel Authority	PA	100,000-500,000	Greater Peoria Sanitary District	IL
10,000–50,000	Hopewell Regional Wastewater Treatment Facility	VA	100,000-500,000	Green Bay Water Utility	WI
10,000-50,000	Kearny Water Department	NJ	100,000-500,000	Henderson, City of	NV
10,000-50,000	Kennebec Water District	ME	100,000-500,000	Henrico County Dept. of Public Utilities	VA
10,000–50,000	Klamath Falls, City of	OR	100,000-500,000	Kansas City (MO) Water Services Department	МО
10,000-50,000	Laramie, City of	WY	100,000-500,000	Lakeland Water Utilities	FL
10,000-50,000	Lehigh County Authority	PA	100,000-500,000	Little Rock Wastewater	AR
10,000–50,000	Lower Colorado River Authority	TX	100,000-500,000	00 Los Angeles County Waterworks Districts	
10,000-50,000	Marion Municipal Utilities	IN	100,000-500,000	Mobile Area Water & Sewer System	AL

^{*}GC = Grand Cayman (International).

37

TABLE 4-5 Utility Participation by Size (Population Served) (continued)

Size	Utility	State	Size	Utility	State
10,000–50,000	Michigan City Water Department	IN	100,001–500,000	Naperville Department of Public Utilities, City of	IL
10,000-50,000	Mishawaka Utilities	IN	100,001-500,000	New Orleans, S&WB of	LA
10,000-50,000	Mount Pleasant Waterworks	SC	100,001–500,000	Newport News Waterworks	VA
10,000-50,000	New Braunfels Utilities	TX	100,001–500,000	North Las Vegas, City of	NV
10,000-50,000	North Penn Water Authority	PA	100,001-500,000	Northern Kentucky Water District	KY
10,000-50,000	Oak Creek Water & Sewer Utility	WI	100,001-500,000	Oceanside, City of	CA
10,000-50,000	Olivenhain Municipal Water District	CA	100,001–500,000	Onondaga County Water Authority	NY
10,000-50,000	Otay Water District	CA	100,001–500,000	Orlando Utilities Commission	FL
10,000-50,000	Padre Dam Mun. Water District	TX	100,001-500,000	Pasadena Water and Power	CA
10,000-50,000	Pagosa Area Water and Sanitation District	СО	100,001–500,000	Pennichuck Corporation	NH
10,000-50,000	Richland, City of	WA	100,001-500,000	Peoria, City of	AZ
10,000-50,000	Richland, City of	WA	100,001-500,000	Pinellas County Utilities	FL
10,000-50,000	Rincon del Diablo M.W.D.	CA	100,001-500,000	Regional Water Authority	CT
10,000-50,000	River Falls Municipal Utility	WI	100,001-500,000	Riverside, City of	CA
10,000-50,000	Sarasota ESBC Utilities	FL	100,001-500,000	Rock River Water Reclamation District	IL
10,000-50,000	Scotts Valley Water District	CA	100,001-500,000	Salem, City of	OR
10,000-50,000	Sheffield Utilities	AL	100,001-500,000	St. Louis, City of	МО
10,000-50,000	Snohomish County PUD	WA	100,001–500,000	Sunnyvale, City of	CA
10,000-50,000	South Walton Utility Co., Inc.	FL	100,001–500,000	Toho Water Authority	FL
10,000-50,000	The Torrington Water Co.	CT	100,001–500,000	Truckee Meadows Water Authority	NV

TABLE 4–5 Utility Participation by Size (Population Served) (continued)

Size	Utility	State	Size	Utility	State
10,000-50,000	Titusville City of	FL	100,001–500,000	Tualatin Valley Water District	OR
10,000-50,000	Upper Eagle Regional Water Authority	CO	100,001-500,000	Union Sanitary District	CA
10,000-50,000	Washington County Service Authority	VA	100,001–500,000	Vancouver, City of	WA
10,000-50,000	Weatherford, City of	TX	100,001-500,000	West Palm Beach, City of	FL
10,000-50,000	White Water, Inc.	MA	100,001-500,000	Westminster, City of	CO
10,000-50,000	Yuba City, City of	CA	100,001-500,000	Wichita Water & Sewer	KS
50,001–100,000	Anniston Water Works and Sewer Board	AL	>500,000	Aquarion Water Company of CT	CT
50,001-100,000	Benton Harbor–St. Joseph WWTP	MI	>500,000	Austin Water Utility	TX
50,001–100,000	Bloomington Utilities	IN	>500,000	Birmingham Water Works and Sewer Board	AL
50,001-100,000	Cheyenne Board of Public Utilities	WY	>500,000	Charlotte–Mecklenburg Utilities	NC
50,001–100,000	College Station Utilities	TX	>500,000	Chicago, City of Department of Water Management	IL
50,001-100,000	Delta Diablo Sanitation District	CA	>500,000	City of San Diego Metropolitan Water	CA
50,001–100,000	Denton, City of	TX	>500,000	Cleveland Division of Water	ОН
50,001-100,000	Dublin San Ramon Services District	CA	>500,000	Cobb County Water System	GA
50,001–100,000	Eagle River Water & Sanitation District	СО	>500,000	East Bay Municipal Utility District	CA
50,001-100,000	Elkhart Public Works	IN	>500,000	Eastern MWD	CA
50,001–100,000	Georgetown County Water & Sewer District	SC	>500,000	El Paso Water Utilities	TX

39

TABLE 4–5 Utility Participation by Size (Population Served) (continued)

Size	Utility	State	Size	Utility	State
50,001–100,000	Greenville Utilities Comm.	NC	>500,000	Erie County Water Authority	NY
50,001–100,000	Indio Water Authority	CA	>500,000	Fairfax County WMP	VA
50,001–100,000	Kent Public Works	WA	>500,000	Fort Worth Water Department	TX
50,001–100,000	La Crosse Water Utility	WI	>500,000	Greater Vancouver Regional District	ВС
50,001-100,000	Lansing Board of Water & Light	MI	>500,000	Hampton Roads Sanitation District	VA
50,001-100,000	Lompoc, City of	CA	>500,000	Honolulu, City and County of	HI
50,001-100,000	Longview, City of	TX	>500,000	JEA	FL
50,001–100,000	Olathe, City of	KS	>500,000	Jordan Valley Water Conservancy District	UT
50,001-100,000	Orange Water & Sewer Authority	NC	>500,000	Las Vegas Valley Water District	NV
50,001-100,000	Owensboro Municipal Utilities	KY	>500,000	Los Angeles Bureau of Sanitation	CA
50,001–100,000	Paducah Water Works	KY	>500,000	Louisville Water Company	KY
50,001–100,000	Sammamish Plateau Water and Sewer District	WA	>500,000	Memphis Light, Gas and Water Division	TN
50,001-100,000	Sioux City Water Plant	IA	>500,000	Metro Water Services	TN
50,001–100,000	SJWD Water District	SC	>500,000	Miami–Dade Water and Sewer Department	FL
50,001-100,000	South Tahoe Public Utility District	CA	>500,000	Milwaukee Water Works	WI
50,001-100,000	Stafford Department of Utilities	VA	>500,000	Phoenix, City of	AZ
50,001-100,000	Vallecitos Water District	CA	>500,000	Providence Water	RI
50,001–100,000	Warren Co. Water District	KY	>500,000	Salt Lake Public Utilities	UT
100,001-500,000	Akron Public Utilities Bureau	ОН	>500,000	San Antonio Water System	TX

TABLE 4-5 Utility Participation by Size (Population Served) (continued)

Size	Utility	State	Size	Utility	State
100,001–500,000	Alameda County Water District	CA	>500,000	San Diego Water Department	CA
100,001–500,000	Albuquerque Bernalillo County Water Utility Authority	NM	>500,000	San Francisco Public Utilities Commission	CA
100,001–500,000	Anaheim Public Utilities	CA	>500,000	San Jose Water Company	CA
100,001–500,000	Anchorage Water & Wastewater Utility	AK	>500,000	Santa Clara Valley Water District	CA
100,001–500,000	Appomattox River Water Authority	VA	>500,000	Seattle Public Utilities	WA
100,001–500,000	Arlington Water Utilities	TX	>500,000	Tampa Bay Water	FL
100,001–500,000	Aurora Colorado, City of	СО	>500,000	Tampa Water Department	FL
100,001–500,000	Azusa Light & Water	CA	>500,000	Tucson Water	AZ
100,001–500,000	Beaufort–Jasper Water and Sewer Authority	SC	>500,000	Washington Suburban Sanitary Commission	MD
100,001–500,000	Beaver Water District	AR	>500,000	Winnipeg Water & Waste	MB

NOTE: Utilities can use this table to sort and compare utility participants by state, region, and type and then by similar size categories.



BENCHMARKING

Performance Indicators for Water and Wastewater Utilities: Survey Data and Analyses Report



Performance Indicators

Data from the 202 utilities (as described in chapter 4) participating in the 2004 Benchmarking Performance Indicators Survey are represented in this report. This data is presented for the twenty-two performance indicators as described in chapter 1. Median range charts (discussed in chapter 3) are shown for each indicator and tabular statistical results (including percentiles) are provided for comparison with individual utility results and other user determined uses.

Several of the performance indicators have multiple parts. To some, these may stand on their own as performance indicators. If each of these are counted separately, the total number of indicators comes to more than 40 indicators that could apply to many joint water/wastewater utilities.

The indicators fall into three categories:

- Ratios, such as operation and maintenance costs per million gallons of water or wastewater processed,
- Absolute numbers, such as the monthly bill for a residential water or wastewater customer, and
- Practices employed, such as the Best Practices Index, where a self-assessment is used to quantify conformance to identified best (good) practices using a Likert scale (relative strength) of response.

In appendix A, each of the performance indicators is described in sufficient detail to understand the specific data needed to support that indicator. Definitions are provided for each indicator and the terms used to construct and calculate each indicator. These descriptions guide utility administrators to prepare their data collection and database systems so that they can participate in the next Benchmarking Performance Indicators Survey.

The data needed in direct support of each indicator is supplemented by utility profile information to help users contend with the effects of major explanatory factors and choose similar utilities for comparative analysis. There is discussion of profile information in chapter 4.



Performance Indicators

The performance indicators are categorized in five areas of water and wastewater utility operations and numbered sequentially.

Organizational Development

- 1. Organizational Best Practices Index
- 2. Employee Health and Safety Severity Rate
- 3. Training Hours per Employee
- 4. Customer Accounts per Employee (Water and Wastewater) Million Gallons per Day Water Delivered Per Employee Million Gallons per Day Wastewater Processed Per Employee

Customer Relations

- 5. Customer Service Complaints per 1,000 Customer Accounts Technical Quality Complaints per 1,000 Customer Accounts
- 6. Disruptions of Water Service
- 7. Residential Cost of Water and/or Sewer Service
- 8. Customer Service Cost per Account
- 9. Billing Accuracy

Business Operations

- 10. Debt Ratio
- 11. System Renewal/Replacement Rate
- 12. Return on Assets

Water Operations

- 13. Drinking Water Compliance Rate
- 14. Distribution System Water Loss
- 15. Water Distribution System Integrity
- 16. Operations and Maintenance Cost Ratios
- 17. Planned Maintenance Ratio

Wastewater Operations

- 18. Sewer Overflow Rate
- 19. Wastewater Collection System Integrity
- 20. Wastewater Treatment Effectiveness Rate
- 21. Operations and Maintenance Cost Ratios
- 22. Planned Maintenance Ratio

44



Organizational Development

BENCHMARKING

Performance Indicators for Water and Wastewater Utilities: Survey Data and Analyses Report

Description:

To summarize the utility's implementation of management programs or practices important to water and wastewater utilities.

The practices include the following:

- Strategic planning
- Long-term financial planning
- Risk management planning
- Optimized asset management
- Performance measurement
- Customer involvement
- Continuous improvement

Calculation:

Utilities use the following self-scoring system to identify the degree to which each of seven important practices is being developed:

- This activity is fully implemented at our utility (5 points).
- This activity is largely implemented, but there is room for improvement (4 points).
- This activity is implemented, but there is room for substantial improvement (3 points).
- This activity is implemented, but only occasionally or without uniformity (2 points).
- This activity is not practiced at our utility (1 point).

NOTE: With seven practices each scoring between 1 and 5, the aggregate score at each utility will range between 7 and 35.

Definitions:

The practices included in the index are

- Strategic planning
- Long-term financial planning
- Risk management planning
- Optimized asset management program
- Performance measurement system
- Customer involvement program
- Continuous improvement program

(Refer to Appendix A for detailed descriptions.)

Median Range Chart_

Organizational Best Practices Index (Median Range, 25th-75th Percentile)

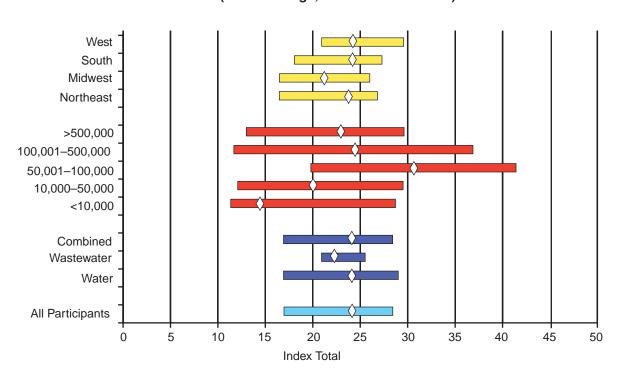


FIGURE 5-1 Organizational Best Practices Index

Tabular Results

TABLE 5-1 Organizational Best Practice

	25th Percentile	Median	75th Percentile	Sample Size
West	21	24	29.6	68
South	18.1	24	27.3	71
Midwest	16.5	21	26	35
Northeast	16.5	23.5	26.8	19
>500,000	13	22.9	29.6	39
100,001–500,000	11.7	24.7	36.9	71
50,001–100,000	19.8	30.2	41.4	28
10,000–50,000	12.1	20	29.6	45
<10,000	11.4	14.4	28.8	15
Combined	17	24	28.4	115
Wastewater	21	22	25.5	16
Water	17	24	29	70
All Participants	17	24	28.4	201

Organizational Best Practices Data per Each Index

Index	Participants	25th Percentile	Median	75th Percentile	Sample Size
Strategic Planning	All	3	4	4	197
Long-term Financial Planning	All	3	4	5	198
Risk Management Planning	All	3	4	4	198
Optimized Asset Management	All	2	3	3.4	198
Performance Measurement	All	2	3	4	197
Customer Involvement	All	2	3	4	195
Continuous Improvement	All	2	3	4	198

Organizational Best Practices Data per Each Index (continued)

Index	Туре	25th Percentile	Median	75th Percentile	Sample Size
Strategic Planning	Combined	3	4	4	112
	Wastewater	3.8	4	4	16
	Water	3	4	4	69
Long-term Financial Planning	Combined	3	4	5	113
	Wastewater	3.8	4	4.3	16
	Water	3	4	5	69
Risk Management Planning	Combined	3	4	4	113
	Wastewater	3	3	4	16
	Water	3	4	4	69
Optimized Asset Management	Combined	4	3	2	113
	Wastewater	3	3	3	16
	Water	4	3	2	69
Performance Measurement	Combined	2	3	4	113
	Wastewater	2.8	3	4	16
	Water	2	3	4	69
Customer Involvement	Combined	2	3	4	112
	Wastewater	2	2	3	16
	Water	2	3	4	68
Continuous Improvement	Combined	2	3	4	113
	Wastewater	3	3	3.3	16
	Water	2	3	4	69

Organizational Best Practices Data per Each Index

Index	Size	25th Percentile	Median	75th Percentile	Sample Size
Strategic Planning	>500,000	3	4	5	39
	100,001–500,000	3	4	4	71
	50,001–100,000	3.5	4	4	28
	10,000-50,000	3	4	4	45
	<10,000	2.8	4	4	15
Long-term Financial Planning	>500,000	4	4	5	39
	100,001–500,000	3	4	5	71
	50,001–100,000	3.5	4	4.5	28
	10,000-50,000	3	4	4	45

Organizational Best Practices Data per Each Index (continued)

Index	Size	25th Percentile	Median	75th Percentile	Sample Size
	<10,000	3	3.5	4	15
Risk Management Planning	>500,000	3	4	4	39
	100,001-500,000	3	4	4	71
	50,001-100,000	4	4	4	28
	10,000-50,000	3	3	4	45
	<10,000	2	3.5	4	15
Optimized Asset Management	>500,000	2	2	4	39
	100,001-500,000	2	3	3.4	71
	50,001-100,000	3	3	4	28
	10,000-50,000	2	2	3	45
	<10,000	1	2.5	4	15
Performance Measurement	>500,000	2	3	4	39
	100,001-500,000	2.8	3	4	71
	50,001-100,000	2	3	4	28
	10,000-50,000	2	2	3	45
	<10,000	1	3	3	15
Customer Involvement	>500,000	3	3.5	4	38
	100,001-500,000	2	3	4	70
	50,001-100,000	3	3	4	27
	10,000-50,000	2	3	4	45
	<10,000	2.8	3.5	4	15
Continuous Improvement	>500,000	3	3	4	39
	100,001-500,000	3	4	4	71
	50,001-100,000	2.5	3	4	28
	10,000-50,000	2	3	4	45
	<10,000	2	3	4	15

Organizational Best Practices Data per Each Index

Index	Region	25th Percentile	Median	75th Percentile	Sample Size
Strategic Planning	West	3	4	4	68
	South	3.1	4	4	71
	Midwest	2.5	3	4	35
	Northeast	3	4	4	19

Organizational Best Practices Data per Each Index (continued)

Index	Region	25th Percentile	Median	75th Percentile	Sample Size
Long-term Financial Planning	West	4	4	5	68
	South	3	4	5	71
	Midwest	3	4	4	35
	Northeast	3	4	4	19
Risk Management Planning	West	3	4	4	68
	South	3	4	4	71
	Midwest	3	3	4	35
	Northeast	2.5	4	4	19
Optimized Asset Management	West	2	3	4	68
	South	2	3	3	71
	Midwest	2	3	3	35
	Northeast	2	3	3	19
Performance Measurement	West	3	3	4	68
	South	2	3	4	71
	Midwest	2	3	4	35
	Northeast	2	3	4	19
Customer Involvement	West	3	3	4	67
	South	2	3	3.3	71
	Midwest	2	2	3	34
	Northeast	2	2.5	3.8	18
Continuous Improvement	West	3	3	4	68
	South	3	3	4	71
	Midwest	2	3	4	35
	Northeast	2	3	3.5	19

Performance Measure Interpretation:

Generally, higher values are desirable.

Practices are likely to be more formal and extensive in larger utilities. However, this indicator is applicable to all water and wastewater utilities, regardless of customer base, size, or ownership.

This indicator is particularly useful for identifying potential benchmarking partners, especially organizations that may have advanced knowledge and experience with applying these tools. Correlations with other indicators might show that performance in other areas is related to investments in improved management practices.

The degree of implementation of these programs is influenced by a variety of economic drivers or influences. If, for example, security programs are a priority, the development or maintenance of other programs may become less of a priority.

2. Employee Health and Safety Severity Rate

Description:

Quantifies the rate of employee days lost from work due to illness or injury.

Calculation:

employee health and safety rate =

200,000 (total workdays away from work) total hours worked by all employees

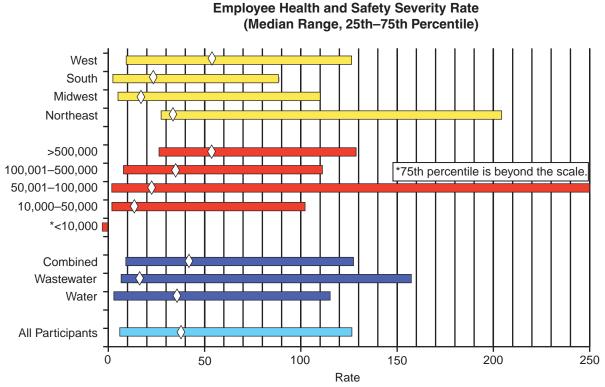
Definitions:

- *Total workdays away from work* are obtained directly from Occupational Safety and Health Administration* Form 300A (or state counterpart), *Summary of Work-Related Injuries and Illnesses*.
- *Total hours worked by all employees* is the sum of hours *actually worked* by full-time, part-time, temporary, and seasonal employees of the utility.

^{*} www.osha.gov includes a complete explanation of this indicator, including applicable definitions.

Employee Health and Safety Severity Rate

Median Range Chart_____



*Not applicable, insufficient sample size.

FIGURE 5-2 Employee Health and Safety Severity Rate

Employee Health and Safety Severity Rate

Tabular Results_____

TABLE 5-2 Employee Health and Safety Severity Rate

		25th Percentile	Median	75th Percentile	Sample Size
Region	West	9.9	54.5	126.9	58
	South	3.5	26.5	88.9	54
	Midwest	6	18.9	109.9	22
	Northeast	28.3	37.8	204.6	15
Size	>500,001	26.5	55.1	129.4	37
	100,000-500,000	8.4	36	111.3	60
	50,001–100,000	2.9	21.6	560	20
	10,000-50,000	2.5	13.1	102.4	33
	*<10,000	na	na	na	4
Type					
	Combined	9.6	43.6	126.9	94
	Wastewater	7.7	18.9	157	13
	Water	3.4	35.5	115.4	47
	All Participants	7	37.8	126.9	154

Employee Health and Safety Severity Rate

Performance Measure Interpretation:

Generally, lower values are desirable.

Excessive lost workdays affect productivity and can cost utilities in a number of ways. Health care, insurance premiums, and overtime can all be adversely impacted by lost work due to injury or health reasons. Safety and wellness programs have been proven to reduce this rate. However, the cost of these programs must be balanced with the benefits.

It is important for utilities to insist on accurate reporting. This can be a sensitive issue since there may be pressure to reduce the results for a utility.

There may be circumstances where a high value cannot be avoided. For example, an employee may contract a serious condition that necessitates considerable lost workdays.

Utilities that have health and safety severity rates higher than those shown for similar utilities (above the upper limit of the median range) may want to consider improvements in their safety and/or wellness programs. Monitoring this performance measure over time may indicate the effectiveness of these programs.

3. Training Hours per Employee

Description:

Measures the quantity of formal training that utility employees are actually completing. This indicator is expressed as the number of formal training hours per employee per year.

Calculation:

training hours per employee =

total of qualified formal training hours for all employees total FTEs worked by employees during the reporting period

Definitions:

- Qualified training hours include all hours spent at the event, from the opening session to the wrap-up, including all breaks that are part of the agenda. Travel time to and from the event, trainer time, and time invested in planning and conducting the training is not included.
- *Total full-time equivalents* (FTEs) is the sum of all compensated hours worked by all employees during the reporting period, divided by 2,080 hours per full-time employee per year.

Training Hours per Employee

Median Range Chart_____

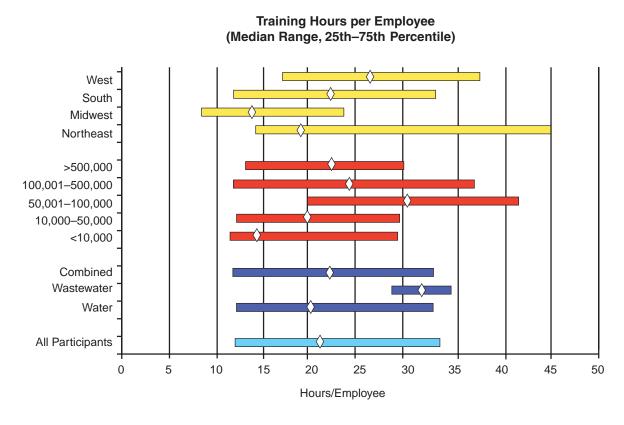


FIGURE 5-3 Training Hours per Employee

Training Hours per Employee

Tabular Results	5
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TABLE 5-3 Training Hours per Employee

		25th Percentile	Median	75th Percentile	Sample Size
Region	West	16.9	26.9	37.4	66
	South	11.7	22.6	32.8	66
	Midwest	8.4	13.5	23.2	31
	Northeast	14	18.9	44.8	16
Size					
	>500,000	13	22.9	29.6	37
	100,001-500,000	11.7	24.7	36.9	66
	50,001-100,000	19.8	30.2	41.4	25
	10,000-50,000	12.1	20	29.6	42
	<10,000	11.4	14.4	28.8	14
Type					
	Combined	11.8	22.7	32.6	109
	Wastewater	28.3	32	34.3	12
	Water	12.1	20.1	32.5	63
	All Participants	12	21.9	33.2	184

Performance Measure Interpretation:

Generally, higher values are desirable.

This measure is intended to reflect the organization's commitment to formal training as a means of improving employee knowledge and skills.

It does not address the effectiveness or efficiency of the training programs used by the utility. However, use of the indicator in comparative analysis will allow utilities to gauge whether their use of formal training is consistent with other utilities.

4. Customer Accounts per Employee (Water and Wastewater), MGD Water Delivered per Employee, and MGD Wastewater Processed per Employee

Description:

These indicators are intended to measure employee efficiency.

Calculation:

customer accounts per employee =

number of accounts number of full-time equivalents

MGD water delivered per employee =

average MGD delivered number of full-time equivalents

MGD wastewater processed per employee =

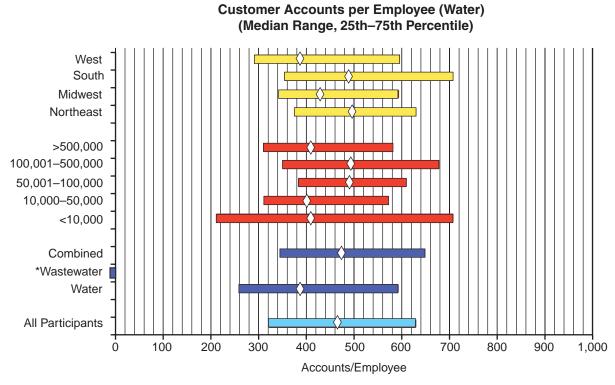
average MGD processed number of full-time equivalents

Note: Each equation can be run separately for water and wastewater utility data where data provided will support this process.

Definitions:

- *Active customer account* means all customer accounts that were billed for some or all of the reporting period. A single account may include service through more than one water *or* sewer service connection.
- Average daily volumes distributed are calculated by dividing the total volume of water distributed or wastewater processed during the reporting period by 365 days. Distributed water is the total volume of water entering the distribution system from all sources, including treatment facilities, individual wells, and purchased water connections.
- A *full-time equivalent (FTE)* is the allocation of employee time equal to 2,080 hours per year. Use of this term allows data to be normalized around a common measure. Part-time, temporary, and seasonal employees are converted to FTEs based on the total number of compensated hours. Employee time from contracts supporting utility operations and maintenance are applied in the same way. Employee time from engineering and construction of new facilities is not counted in these indicators.

Median Range Chart



*Not applicable, insufficient sample size.

FIGURE 5–4 Customer Accounts per Employee (Water)

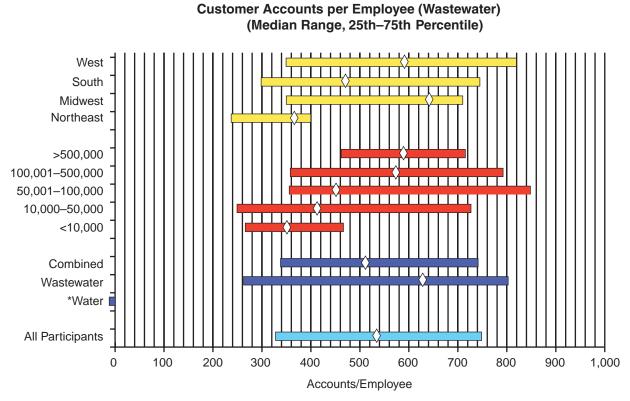
Tabular Results_____

TABLE 5-4 Customer Accounts per Employee (Water)

		25th Percentile	Median	75th Percentile	Sample Size
Region	West	292	385	595	61
	South	355	476	707	65
	Midwest	343	429	593	31
	Northeast	376	519	629	17
Size	>500,000	311	408	580	32
	100,001-500,000	351	498	677	63
	50,001-100,000	384	485	609	26
	10,000-50,000	312	404	571	43
	<10,000	212	395	707	14
Туре	Combined	346	469	648	113
	*Wastewater	na	na	na	14
	Water	260	386	592	65
	All Participants	322	467	629	178

^{*}na = not applicable, insufficient sample size.

Median Range Chart



*Not applicable, insufficient sample size.

FIGURE 5-5 Customer Accounts per Employee (Wastewater)

Tabular Results	

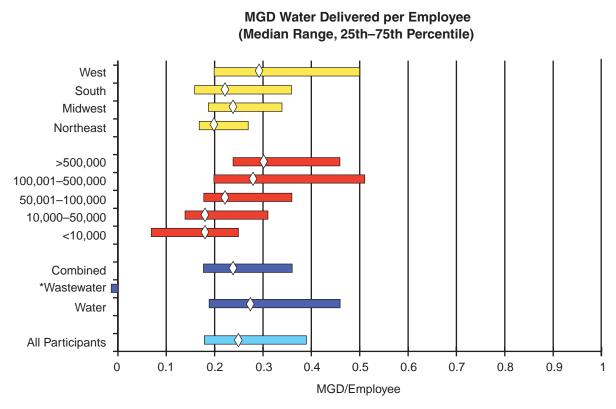
TABLE 5-5 Customer Accounts per Employee (Wastewater)

		25th Percentile	Median	75th Percentile	Sample Size
Region	West	350	592	824	41
	South	296	465	749	55
	Midwest	349	640	714	19
	Northeast	235	375	400	6
Size	>500,000	463	592	719	23
	100,001–500,000	356	567	797	43
	50,001–100,000	354	445	854	21
	10,000-50,000	248	407	730	29
	<10,000	263	374	465	8
Туре	Combined	339	514	745	109
	Wastewater	260	626	807	14
	*Water	na	na	na	0
	All Participants	328	532	749	123

^{*}na = not applicable, insufficient sample size.

MGD Water Delivered per Employee

Median Range Chart



*Not applicable, insufficient sample size.

FIGURE 5-6 MGD Water Delivered per Employee

MGD Water Delivered per Employee

Tabular Results_____

TABLE 5-6 MGD Water Delivered per Employee

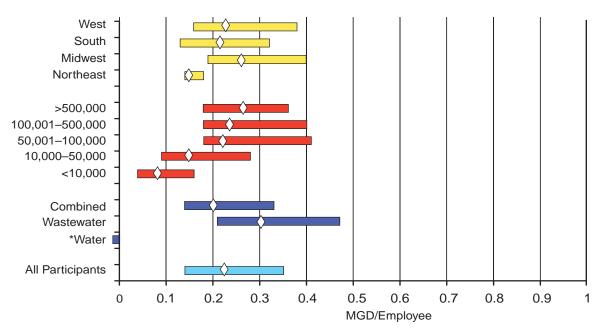
		25th Percentile	Median	75th Percentile	Sample Size
Region	West	0.20	0.29	0.50	61
	South	0.16	0.23	0.36	66
	Midwest	0.19	0.24	0.34	32
	Northeast	0.17	0.20	0.27	17
Size	>500,000	0.24	0.30	0.46	34
	100,001-500,000	0.20	0.28	0.51	64
	50,001-100,000	0.18	0.23	0.36	27
	10,000-50,000	0.14	0.19	0.31	42
	<10,000	0.07	0.19	0.25	14
Туре	Combined	0.18	0.24	0.36	114
	*Wastewater	na	na	na	0
	Water	0.19	0.28	0.46	67
	All Participants	0.18	0.25	0.39	181

^{*}na = not applicable, insufficient sample size.

MGD Wastewater Processed per Employee

Median Range Chart_

MGD Wastewater Processed per Employee (Median Range, 25th–75th Percentile)



*Not applicable, insufficient sample size.

FIGURE 5-7 MGD Wastewater Processed per Employee

MGD Wastewater Processed per Employee

Tabular Results		

TABLE 5-7 MGD Wastewater Processed per Employee

		25th Percentile	Median	75th Percentile	Sample Size
Region	West	0.16	0.23	0.38	41
	South	0.13	0.22	0.32	54
	Midwest	0.19	0.26	0.4	19
	Northeast	0.14	0.16	0.18	6
Size	>500,000	0.18	0.27	0.36	23
	100,001–500,000	0.18	0.24	0.4	42
	50,001-100,000	0.18	0.22	0.41	22
	10,000-50,000	0.09	0.15	0.28	29
	<10,000	0.04	0.09	0.16	8
Туре	Combined	0.14	0.2	0.33	109
	Wastewater	0.21	0.31	0.47	15
	*Water	na	na	na	0
	All Participants	0.14	0.22	0.35	124

^{*}na = not applicable, insufficient sample size.

Performance Measure Interpretation:

Generally, higher values are desirable.

These indicators measure employee efficiency. By expressing them in terms of both accounts and millions of gallons per day of water delivered or wastewater processed, the effects of customer class are diminished. Contracts for operations and maintenance can have significant effects if not captured. Utilities will need to account for operations and maintenance contract employees effectively.

BENCHMARKING

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Customer Relations

BENCHMARKING

Performance Indicators for Water and Wastewater Utilities: Survey Data and Analyses Report

5. Customer Service Complaints/Technical Quality Complaints

Description:

This indicator measures the complaint rates experienced by the utility, with individual quantification of those related to customer service and those related to core utility services. It is expressed as complaints per 1,000 customer accounts.

Calculation:

customer service complaint rate =

(1,000) number of customer service – associated complaints number of active customer accounts

technical quality complaint rate =

(1,000) number of technical quality – associated complaints number of active customer accounts

NOTE: Complaints are recorded as the number of complaints per 1,000 customers per reporting period. All complaints are recorded in one category or the other.

Definitions:

- *Active customer account* means all customer accounts of all classes that were billed for some or all of the reporting period. A single account may include service through more than one water or sewer service connection.
- A *complaint* is an expression of dissatisfaction conveyed to a utility employee acting in his/ her official capacity, whether or not action is taken to resolve it. Complaints may be communicated orally or in writing. To clarify, a complaint is a request for action, whereas an inquiry is a request for information.
- *Customer* refers to an individual service agreement for water or sewer service at a single property, regardless of size or billing category. An individual may own more than one property and be counted as a customer more than once. For example, an individual has three properties and each property has a meter. The utility would count this as three accounts.

Customer Service Complaints

- *Customer service complaints*, in the context of these indicators, refers to relationship factors such as personal appearance, courteousness, helpfulness, professionalism, responsiveness, adherence to traffic laws while driving a vehicle, and timeliness. Also refers to customer support services such as turn-on/turn-off, billing, rate setting, and communication. All utility employees should have assigned responsibility for good customer service, thereby helping the utility build a positive image within the community.
- *Technical qualities of service complaints* are directly related to core services of the utility. They include complaints associated with water quality, taste, odor, appearance and pressure, sewage backups and overflows, disruptions of water or sewer service, disruptions of traffic, and facilities upkeep.

Customer Service Complaints

Median Range Chart_____

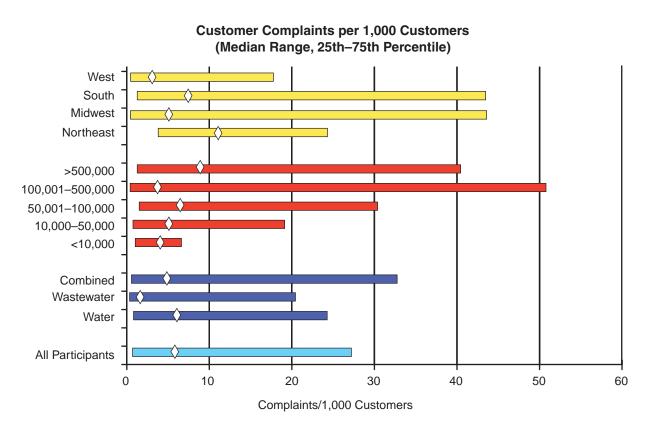


FIGURE 5-8 Customer Complaints per 1,000 Customers

Customer Service Complaints

TABLE 5-8 Customer Complaints per 1,000 Customers

		25th Percentile	Median	75th Percentile	Sample Size
Region	West	0.6	4	17.7	49
	South	0.5	7	43.7	53
	Midwest	1.3	5.4	43.6	29
	Northeast	3.9	10.5	24.3	17
Size	>500,000	1.2	9.6	40.5	26
	100,001–500,000	0.5	4.5	50.9	49
	50,001-100,000	1.6	8.4	30.4	23
	10,000-50,000	0.8	5.7	19.3	38
	<10,000	1.1	4.2	6.6	14
Туре	Combined	0.7	5.4	32.7	90
	Wastewater	0.3	1.7	20.5	8
	Water	1	5.9	24.3	53
	All Participants	0.7	5.7	27.3	151

Technical Quality Complaints

Median Range Chart_____

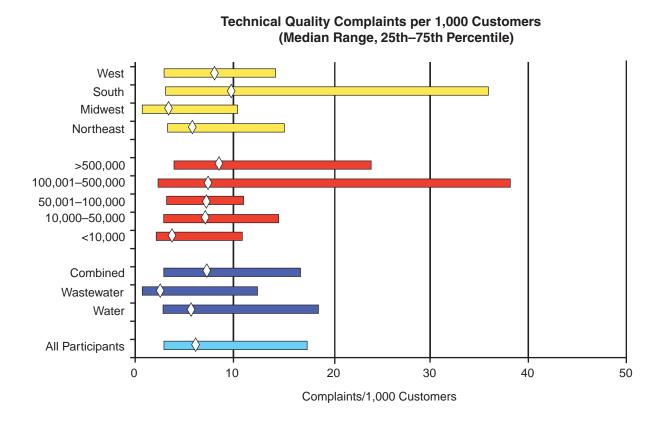


FIGURE 5-9 Technical Quality Complaints per 1,000 Customers

Technical Quality Complaints

Tabular Results	
Tubulul Results	

TABLE 5-9 Technical Quality Complaints per 1,000 Customers

		25th Percentile	Median	75th Percentile	Sample Size
Region	West	2.8	7.6	14.2	59
	South	3	9.8	35.9	56
	Midwest	1.1	3.9	10.5	30
	Northeast	3.4	6.2	15.9	17
Size	>500,000	3.9	9.1	24	29
	100,001-500,000	2.3	8.6	38.1	56
	50,001-100,000	3.1	6.9	10.9	25
	10,000-50,000	2.8	6.7	14.5	40
	<10,000	2.1	3.4	10.8	15
Туре	Combined	2.9	7.6	16.7	100
	Wastewater	0.7	2.7	12.3	9
	Water	2.8	6.1	18.5	56
	All Participants	2.8	7.2	17.4	165

Performance Measure Interpretation:

Generally, lower values are desirable.

The number of complaints is a good measure of customer service. This pair of indicators captures all complaints received by the utility, which are reported either as "service associated" or as "technical quality" complaints. Only those logged by the utility, whether acted on or not, count. The number of complaints is a good measure of customer service.

Technical quality complaints allow a utility to track complaints that are product related. For example, odor complaints are usually associated with wastewater treatment plants. Accordingly, there may be some correlation between the frequency of odor complaints and the number of wastewater treatment plants operated by a utility, or the number of properties or residential homes located nearby. Disruption of service would also generate a technical quality complaint. This area of performance will be considerably influenced by the size of the customer base in that any utility with a relatively small customer base but large networks is more likely to incur longer delays in reinstating service than utilities that serve more compact or larger urban areas. Therefore, some correlation between the ranking of agencies in this performance indicator and ranking achieved for connected properties served per mile of distribution pipes may be expected.

Disruptions of Water Service

Description:

This set of six indicators quantifies the number of water outages experienced by utility customers. Planned and unplanned disruptions of various durations (less than 4 hours, 4 to 12 hours, and more than 12 hours). Each is expressed as the number of customers experiencing disruptions per 1,000 customer accounts per year.

Calculation:

disruption rate =

(1,000) number of customers experiencing disruption number of active customer accounts

planned water service disruption rate =

(1,000) number of customers experiencing disruption number of active customer accounts

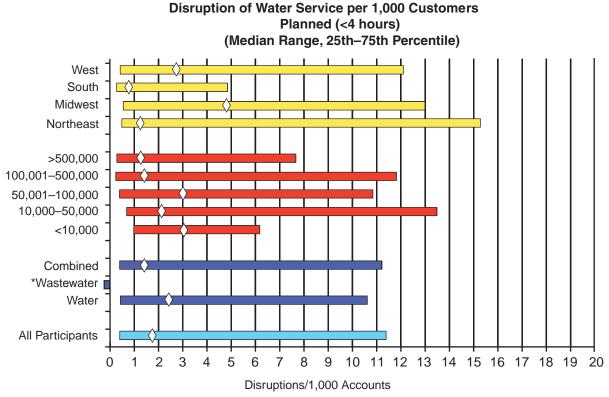
unplanned water service disruption rate =

(1,000) number of customers experiencing disruption number of active customer accounts

Definitions:

- *Active customer account* means all customer accounts that were billed for some or all of the reporting period. A single account may include service through more than one water service connection.
- Disruption of (water) service means any and all conditions within facilities or the distribution system under control of the utility whereby a customer loses full water service or has normal delivery pressure reduced below 20 pounds per square inch during a repair. Specific exclusions include complaints of low pressure that are unrelated to a system condition requiring repair work, repairs to service piping under control of the customer, and shutoffs for nonpayment of bills.
- *Planned disruptions* are those for which prior notice is given to all affected customers. Planned disruptions include new construction tie-ins and replacement of valves, hydrants, meters, and other appurtenances under nonemergency conditions.
- *Unplanned disruptions* include both those performed under emergency conditions for which prior customer notice is impossible or impractical *and* those that are otherwise planned for but for which prior notice was not given. Unplanned disruptions usually occur during emergency pumping facility failures, pipeline breaks, and newly discovered major leaks where there is potential for unsafe conditions or significant property damage.

Median Range Chart_



*Not applicable, insufficient sample size.

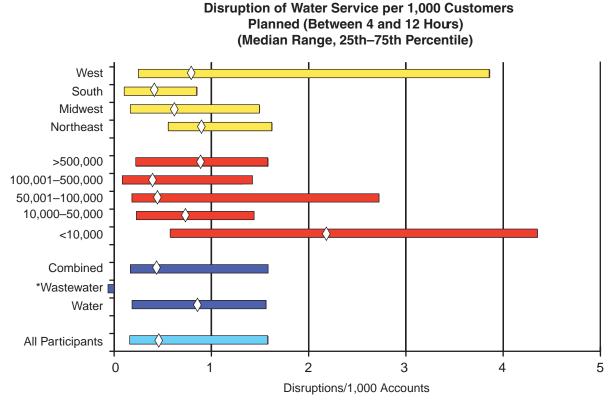
FIGURE 5–10 Disruption of Water Services per 1,000 Customers—Planned (<4 Hours)

TABLE 5-10 Disruption of Water Service per 1,000 Customers—Planned (<4 hours)

		25th Percentile	Median	75th Percentile	Sample Size
Region	West	0.5	2.8	12.1	52
	South	0.3	0.9	4.8	48
	Midwest	0.6	4.9	13.0	28
	Northeast	0.5	1.2	15.3	17
Size	>500,000	0.3	1.3	7.7	22
	100,001-500,000	0.3	1.4	11.8	50
	50,001-100,000	0.4	3.0	10.8	24
	10,000-50,000	0.7	2.1	13.5	39
	<10,000	1.0	3.0	6.2	12
Туре	Combined	0.4	1.3	11.2	91
	*Wastewater	na	na	na	0
	Water	0.5	2.4	10.6	55
	All Participants	0.4	1.9	11.4	146

^{*}na = not applicable, insufficient sample size.

Median Range Chart_



*Not applicable, insufficient sample size.

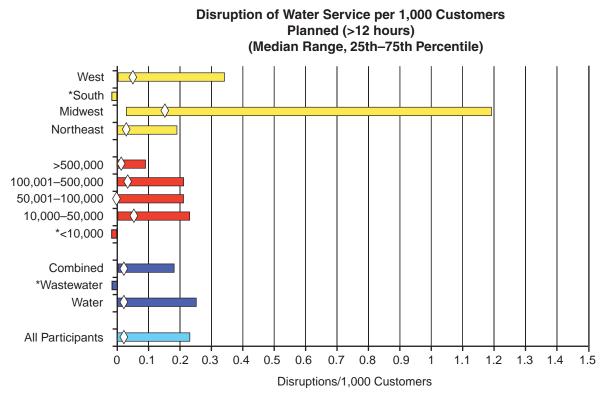
FIGURE 5–11 Disruption of Water Service per 1,000 Customers—Planned (Between 4 and 12 Hours)

TABLE 5–11 Disruption of Water Service per 1,000 Customers—Planned (Between 4 and 12 Hours)

		25th Percentile	Median	75th Percentile	Sample Size
Region	West	0.3	0.9	3.9	46
	South	0.1	0.4	0.9	41
	Midwest	0.2	0.8	1.5	23
	Northeast	0.6	0.9	1.6	13
Size	>500,000	0.2	0.9	1.6	22
	100,001-500,000	0.1	0.4	1.3	42
	50,001-100,000	0.2	0.5	2.7	22
	10,000-50,000	0.3	0.7	1.3	29
	<10,000	0.6	2.2	4.4	10
Туре	Combined	0.2	0.5	1.6	82
	*Wastewater	na	na	na	0
	Water	0.2	0.7	1.6	44
	All Participants	0.2	0.6	1.6	126

^{*}na = not applicable, insufficient sample size.

Median Range Chart_



*Not applicable, insufficient sample size.

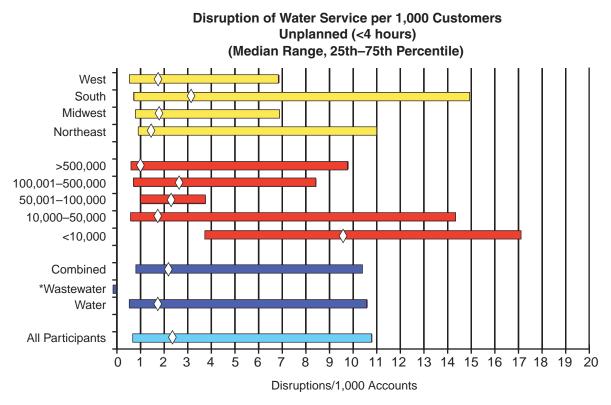
FIGURE 5–12 Disruption of Water Service per 1,000 Customers—Planned (>12 Hours)

TABLE 5-12 Disruption of Water Service per 1,000 Customers— Planned (>12 Hours)

		25th Percentile	Median	75th Percentile	Sample Size
Region	West	0	0.05	0.34	33
	South	0	0	0.01	18
	Midwest	0.03	0.17	1.19	10
	Northeast	0	0.02	0.19	9
Size	>500,000	0	0.01	0.09	18
	100,001-500,000	0	0.03	0.21	24
	50,001-100,000	0	0	0.21	12
	10,000-50,000	0	0.05	0.23	14
	*<10,000	na	na	na	2
Type	Combined	0	0.02	0.18	48
	*Wastewater	na	na	na	0
	Water	0	0.02	0.25	23
	All Participants	0	0.02	0.23	71

^{*}na = not applicable, insufficient sample size.

Median Range Chart_



*Not applicable, insufficient sample size.

FIGURE 5–13 Disruption of Water Service per 1,000 Customers—Unplanned (<4 hours)

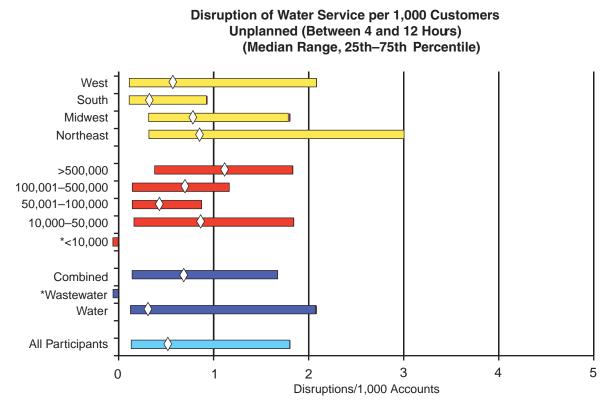
Tabular Results	
rabaiai nesaits	

TABLE 5-13 Disruption of Water Service per 1,000 Customers—Unplanned (<4 Hours)

		25th Percentile	Median	75th Percentile	Sample Size
Region	West	0.6	1.9	6.9	53
	South	0.7	3.1	14.9	43
	Midwest	0.8	2.0	6.9	28
	Northeast	0.9	1.5	11.0	14
Size	>500,00	0.6	1.1	9.8	22
	100,001-500,000	0.7	2.7	8.4	47
	50,001-100,000	1.0	2.3	3.7	24
	10,000-50,000	0.6	1.8	14.3	37
	<10,000	3.7	9.9	17.1	9
Туре	Combined	0.8	2.4	10.4	86
	*Wastewater	na	na	na	0
	Water	0.6	1.9	10.6	53
	All Participants	0.7	2.3	10.8	139

^{*}na = not applicable, insufficient sample size.

Median Range Chart_



*Not applicable, insufficient sample size.

FIGURE 5–14 Disruption of Water Service per 1,000 Customers—Unplanned (Between 4 and 12 Hours)

TABLE 5–14 Disruption of Water Service per 1,000 Customers—Unplanned (Between 4 and 12 Hours)

		25th Percentile	Median	75th Percentile	Sample Size
Region	West	0.1	0.7	2.1	47
	South	0.1	0.4	0.9	40
	Midwest	0.3	0.8	1.8	24
	Northeast	0.3	0.8	3.0	14
Size	>500,000	0.4	1.2	1.8	20
	100,001–500,000	0.2	0.7	1.2	43
	50,001-100,000	0.1	0.4	0.9	23
	10,000-50,000	0.2	0.8	1.8	33
	*<10,000	na	na	na	7
Туре	Combined	0.2	0.7	1.7	83
	*Wastewater	na	na	na	0
	Water	0.1	0.4	2.1	43
	All Participants	0.1	0.6	1.8	126

^{*}na = not applicable, insufficient sample size.

Median Range Chart_

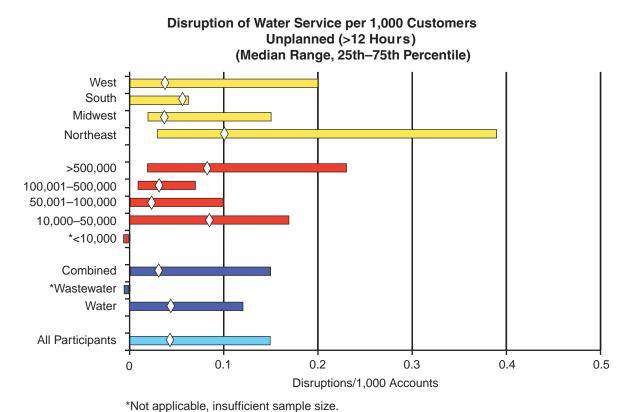


FIGURE 5–15 Disruption of Water Service per 1,000 Customers—Unplanned (>12 Hours)

TABLE 5-15 Disruption of Water Service per 1,000 Customers—Unplanned (>12 Hours)

		25th Percentile	Median	75th Percentile	Sample Size
Region	West	0	0.03	0.2	52
	South	0	0.04	0.06	28
	Midwest	0.02	0.03	0.15	9
	Northeast	0.03	0.1	0.39	10
Size	>500,000	0.02	0.07	0.23	18
	100,001-500,000	0.01	0.03	0.07	31
	50,001-100,000	0	0.02	0.1	14
	10,000-50,000	0	0.07	0.17	17
	*<10,000	na	na	na	0
Туре	Combined	0	0.03	0.15	54
	*Wastewater	na	na	na	0
	Water	0	0.04	0.12	26
	All Participants	0	0.04	0.15	80

^{*}na = not applicable, insufficient sample size.

Disruptions of Water Service

Performance Measure Interpretation:

Generally, lower values are desirable.

Customers have come to expect full water service all of the time. Maintenance and repair work that results in water outages or substantially reduced water pressure disrupts customer plans, brings complaints, and diminishes goodwill toward the utility. This group of indicators measures the number and duration of water service disruptions. It does not address inconveniences resulting from access limitations around construction and repair work sites.

Large numbers and proportions of unplanned service disruptions likely reflect on distribution system inadequacies. Outages of long durations may be indicative of poor repair practices. Therefore, this indicator is calculated separately for planned and unplanned disruptions of three different durations. For each of these six categories, the rate is expressed as the number of customers experiencing disruptions per 1,000 active customer accounts.

This area of performance will be considerably influenced by the size of the customer base in that any utility with a relatively small customer base but large networks is more likely to incur longer delays in reinstating service than utilities that serve more compact or larger urban areas. Therefore, some correlation between the ranking of agencies in this performance indicator and ranking achieved for connected properties served per mile of distribution pipes may be expected.

Description:

These indicators allow utilities to compare the residential cost of water and sewer service based on both a defined quantity of water use and the average residential bill amounts for these services.

Calculation:

This indicator has several parts. A utility reports the individual costs in items 1–4, if possible, deferring to items 5 and 6 only if it cannot.

- 1. Bill amount for monthly residential water service for a customer using 7,500 gallons per month.
- 2. Average residential water bill amount for 1 month of service.
- 3. Bill amount for monthly residential sewer service for a customer using 7,500 gallons of water per month.
- 4. Average residential sewer bill amount for 1 month of service.
- 5. For multiple service utilities that cannot provide individual costs, the total monthly bill amount for residential water and sewer service for a customer using 7,500 gallons of water per month.
- 6. For multiple service utilities that cannot provide individual costs, the average residential combined water and sewer bill amount for 1 month of service.

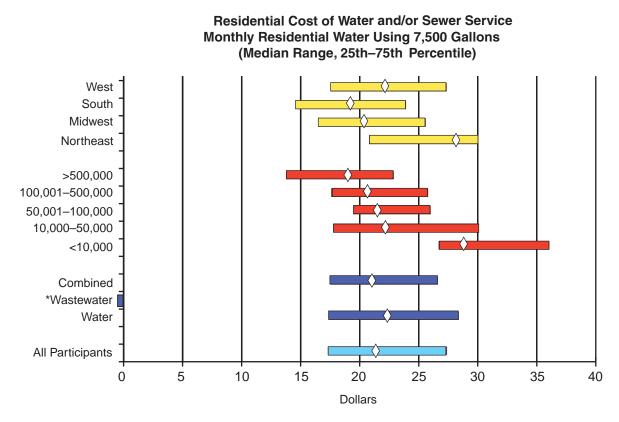
The utility should calculate the bill amount for a typical residential customer served water through a $3/4 \times 5/8$ -inch meter. Include the fee for 7,500 gallons of water or the fee for sewer service consistent with that volume of water use. Also add any surcharges and taxes in effect during the reporting period. If billing is quarterly, calculate what the fee would be for 22,500 gallons of water and divide by 3. If there is more than one rate zone, calculate the weighted average of charges for all zones.

NOTE: Include any additional costs added to the bill for basic service that may include other taxes and fees required to be paid by the residential customer to retain basic service.

Definitions:

- *Bill* means the periodic statement of charges (volumetric, surcharges, and taxes) for water and/or sewer services, which are calculated based on known volumes of water delivered or wastewater collected.
- *Flat fee* means a set fee charged to a water or sewer customer regardless of the amount of water used or wastewater collected during the billing period. If there are surcharges or ad valorem taxes assessed to flat-fee customers, they are considered part of the flat fee.

Median Range Chart



*Not applicable, insufficient sample size.

FIGURE 5–16 Residential Cost of Water and/or Sewer Service—Monthly Residential Water Using 7,500 Gallons

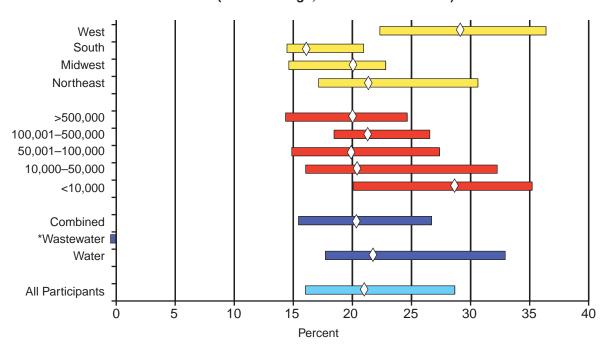
TABLE 5–16 Residential Cost of Water and/or Sewer Service—Monthly Residential Water Using 7,500 Gallons

		25th Percentile	Median	75th Percentile	Sample Size
Region	West	17.6	22.1	27.3	61
	South	16.6	20.7	25.6	64
	Midwest	14.7	19.0	23.9	30
	Northeast	20.9	27.8	30.0	16
Size	>500,000	13.8	19.3	22.8	32
	100,001-500,000	17.6	20.5	25.7	62
	50,001-100,000	19.5	21.4	26.0	26
	10,000-50,000	17.8	23.4	30.1	41
	<10,000	26.8	28.9	36.0	13
Type	Combined	17.6	21.6	26.6	113
	*Wastewater	na	na	na	1
	Water	17.4	22.2	28.3	60
	All Participants	17.4	21.9	27.4	174

^{*}na = not applicable, insufficient sample size.

Median Range Chart_

Residential Cost of Water and/or Sewer Service Average Residential Water Bill Amount for 1 Month (Median Range, 25th–75th Percentile)



*Not applicable, insufficient sample size.

FIGURE 5–17 Residential Cost of Water and/or Sewer Service—Average Residential Water Bill Amount for 1 Month

TABLE 5-17 Residential Cost of Water and/or Sewer Service—Average Residential Water Bill Amount for 1Month

		25th Percentile	Median	75th Percentile	Sample Size
Region	West	22.5	29.3	36.4	61
	South	14.7	20.0	22.8	64
	Midwest	14.6	17.7	20.9	30
	Northeast	17.3	22.4	30.6	16
Size	>500,000	14.5	20.0	24.6	32
	100,001-500,000	18.5	22.5	26.5	62
	50,001–100,000	14.9	20.0	27.4	26
	10,000-50,000	16.1	21.1	32.2	41
	<10,000	20.1	28.8	35.2	14
Туре	Combined	15.5	21.1	26.7	114
	*Wastewater	na	na	na	14
	Water	17.8	23.6	32.9	60
	All Participants	16.1	21.5	28.7	175

^{*}na = not applicable, insufficient sample size.

Median Range Chart

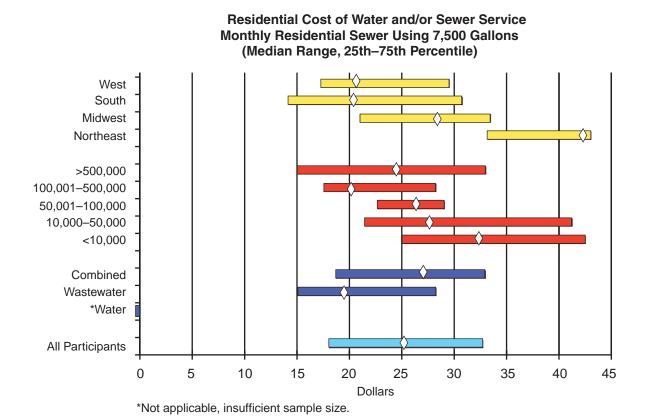


FIGURE 5–18 Residential Cost of Water and/or Sewer Service—Monthly Residential Sewer Using 7,500 Gallons

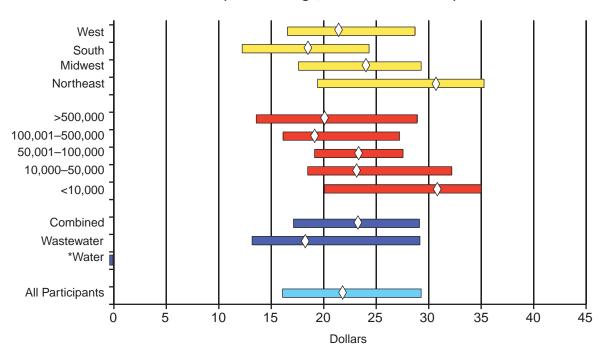
TABLE 5–18 Residential Cost of Water and/or Sewer Service—Monthly Residential Sewer Using 7,500 Gallons

		25th Percentile	Median	75th Percentile	Sample Size
Region	West	17.4	21.0	29.5	43
	South	21.0	27.4	33.5	58
	Midwest	14.3	20.3	30.8	24
	Northeast	33.2	42.5	43.0	7
Size	>500,000	15.1	24.7	33.0	25
	100,001-500,000	17.7	20.7	28.3	47
	50,001-100,000	22.8	27.0	29.1	23
	10,000-50,000	21.5	31.3	41.3	30
	<10,000	25.1	33.6	42.5	8
Туре	Combined	18.8	26.8	33.0	110
	Wastewater	15.2	19.8	28.3	14
	*Water	na	na	na	9
	All Participants	18.1	25.7	32.7	133

^{*}na = not applicable, insufficient sample size.

Median Range Chart_

Residential Cost of Water and/or Sewer Service Average Residential Sewer Bill Amount for 1 Month (Median Range, 25th–75th Percentile)



*Not applicable, insufficient sample size.

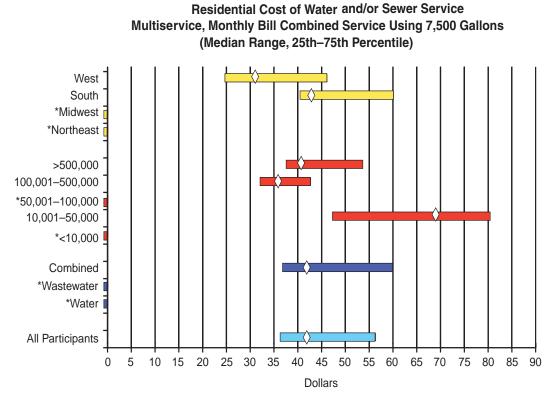
FIGURE 5–19 Residential Cost of Water and/or Sewer Service—Average Residential Sewer Bill Amount for 1 Month

TABLE 5–19 Residential Cost of Water and/or Sewer Service—Average Residential Sewer Bill Amount for 1 Month

		25th Percentile	Median	75th Percentile	Sample Size
Region	West	16.6	21.1	28.7	42
	South	17.7	24.3	29.3	57
	Midwest	12.3	18.5	24.3	24
	Northeast	19.5	30.9	35.2	7
Size	>500,000	13.6	20.0	28.9	24
	100,001-500,000	16.2	18.8	26.9	47
	50,001-100,000	19.2	24.5	27.5	22
	10,000-50,000	18.5	24.3	32.2	31
	<10,000	20.1	30.9	35.0	9
Туре	Combined	17.2	23.1	29.1	111
	Wastewater	13.2	17.9	29.1	14
	*Water	na	na	na	8
	All Participants	16.1	22.0	29.3	133

^{*}na = not applicable, insufficient sample size.

Median Range Chart_



*Not applicable, insufficient sample size.

FIGURE 5–20 Residential Cost of Water and/or Sewer Service—Multiservice, Monthly Bill Combined Service Using 7,500 Gallons

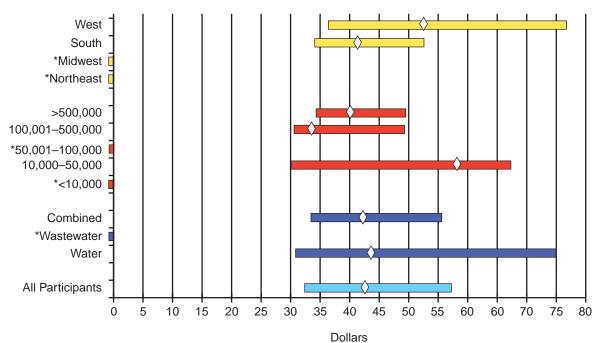
TABLE 5–20 Residential Cost of Water and/or Sewer Service—Multiservice, Monthly Bill Combined Service Using 7,500 Gallons

		25th Percentile	Median	75th Percentile	Sample Size
Region	West	24.8	31.3	46.1	6
	South	40.6	43.8	60.1	22
	*Midwest	na	na	na	3
	*Northeast	na	na	na	0
Size	>500,000	37.7	41.0	53.5	8
	100,001-500,000	32.2	36.4	42.6	12
	*50,001–100,000	na	na	na	3
	10,000-50,000	47.4	69.6	80.3	6
	<10,000	na	na	na	2
Туре	Combined	37.0	42.7	59.9	27
	*Wastewater	na	na	na	0
	*Water	na	na	na	4
	All Participants	36.4	42.7	56.3	31

^{*}na = not applicable, insufficient sample size.

Median Range Chart_____

Residential Cost of Water and/or Sewer Service Multiservice, Average Residential Combined Bill for 1 Month (Median Range, 25th–75th Percentile)



*Not applicable, insufficient sample size.

FIGURE 5–21 Residential Cost of Water and/or Sewer Service—Multiservice, Average Residential Combined Bill for 1 Month

Tabular Results_____

TABLE 5–21 Residential Cost of Water and/or Sewer Service—Multiservice, Average Residential Combined Bill for 1 Month

		25th Percentile	Median	75th Percentile	Sample Size
Region	West	36.4	53.1	76.0	6
	South	34.2	41.3	52.4	22
	*Midwest	na	na	na	3
	*Northeast	na	na	na	1
Size	>500,000	34.3	40.1	49.6	8
	100,001-500,000	30.7	34.3	49.2	12
	*50,001–100,000	na	na	na	3
	10,000-50,000	30.2	57.4	67.2	7
	*<10,000	na	na	na	4
Туре	Combined	33.3	43.4	55.6	29
	*Wastewater	na	na	na	0
	Water	30.9	44.2	75.0	5
	All Participants	32.3	43.3	57.0	34

^{*}na = not applicable, insufficient sample size.

Performance Measure Interpretation:

Generally, lower values are desirable.

This indicator may be particularly useful to utilities with artificially low rates and needs for significant capital improvements.

Because each utility is unique, this indicator is quite complex. In some places, rates may be artificially low to reflect well on elected officials. In others, rates may be artificially high in order for elected officials to achieve nonutility objectives such as annexations or general fund contributions. In others, investor-owned utilities may have rates controlled by public utility commissions. There are also physical differences in the age and condition of facilities; raw water quality;

wastewater discharge requirements; mix of service to residential, commercial, and wholesale customers; etc.

It is important to note that in many cases bulk water or wastewater charges are beyond the control of the retailer, while they are still a significant component of operating costs for a retail utility. Furthermore, where operating costs for a retail utility do not include depreciation, the charges from a wholesale utility may include a component to cover the capital costs of the wholesale business. Generally, it can be expected that overall operating costs for wholesale utilities would be at a lower end of the range.

8. Customer Service Cost per Account

Description:

This indicator measures the amount of resources a utility applies to its customer service program.

Calculation:

customer service cost per active account =

total customer service cost number of active accounts

Definitions:

- Customer service costs include all direct salaries, employee benefits, and direct costs, including contracts, that are associated with providing the following services to customers, plus a proportional share of total utility indirect costs:
 - Activation of new accounts
 - Meter reads, maintenance, and repair or replacement
 - Preparation and delivery of bills
 - Receipt and processing of payments
 - Records maintenance
 - Collection of delinquent accounts
 - Processing of bankruptcies
 - Provision of turn-on/turn-off services
 - Receipt, investigation, and resolution of complaints
 - Preparation and provision of outreach and educational materials, including the Consumer Confidence Report
 - Specifically excluded are all costs associated with maintaining service pipelines and customer plumbing on the customer side of the meter if present or service property line if no meter is present.
- Active customer account means all customer accounts that were billed for some or all of the reporting period. A single account may include service through more than one water or sewer service connection.

Customer Service Cost per Account

Median Range Chart_

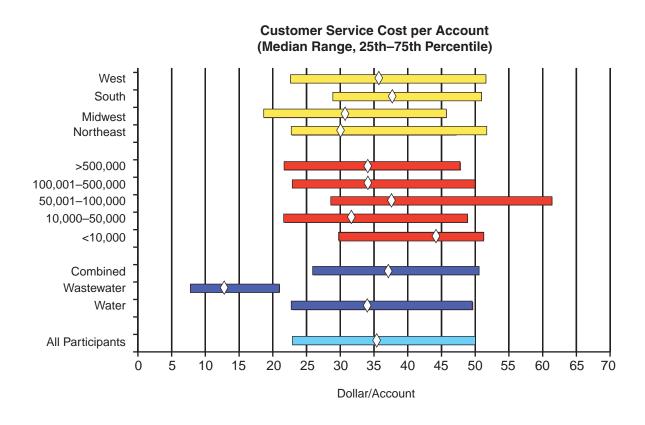


FIGURE 5-22 Customer Service Cost per Account

Customer Service Cost per Account

Tabular Results

TABLE 5-22 Customer Service Cost per Account

		25th Percentile	Median	75th Percentile	Sample Size
Region	West	22.7	35.9	51.5	62
	South	29.0	38.2	50.9	61
	Midwest	18.8	32.7	45.7	31
	Northeast	22.9	31.0	47.2	18
Size	>500,000	21.8	34.7	47.8	33
	100,001-500,000	23.0	34.7	49.9	64
	50,001-100,000	28.7	37.1	61.4	25
	10,000-50,000	21.9	32.8	48.8	41
	<10,000	29.8	44.9	51.2	13
Туре	Combined	26.2	37.1	50.5	107
	Wastewater	8.0	13.9	20.9	11
	Water	23.0	34.8	49.6	58
	All Participants	23.1	35.2	49.9	176

Performance Measure Interpretation:

Generally, lower values are desirable.

The indicator is expressed as the cost of managing a single customer account for 1 year. When viewed alone, it quantifies resource efficiency. Viewing in conjunction with other indicators can help clarify. For example, a utility with high numbers of complaints and low customer service costs might be sacrificing effectiveness and yet appear as efficient. That information can help to identify opportunities for improvement.

9. Billing Accuracy

Description:

This indicator measures the effectiveness of water and/or wastewater utility billing practices. The calculation shows the number of error-driven billing adjustments per 10,000 bills generated during the year.

Calculation:

billing accuracy =

(10,000) (number of error-driven billing adjustments during reporting period) number of bills generated during reporting period

Definitions:

- *Bill* means the periodic statement of charges (volumetric, surcharges, and taxes) for water and/or wastewater services. Charges are calculated based on known volumes of water delivered or wastewater collected during a specific period of time.
- Error-driven billing adjustment is an adjustment to a customer's charges resulting from an error on the original bill actually sent to the customer, regardless of cause and including all such discoveries made by utility staff, the customer, or a third party. Errors include all those under control of the utility, such as meter reads (whether by utility staff or the customer), data entry, and calculations or computer programming. Bills re-issued for estimated bills should NOT be included as a billing error.

Billing Accuracy

Median Range Chart

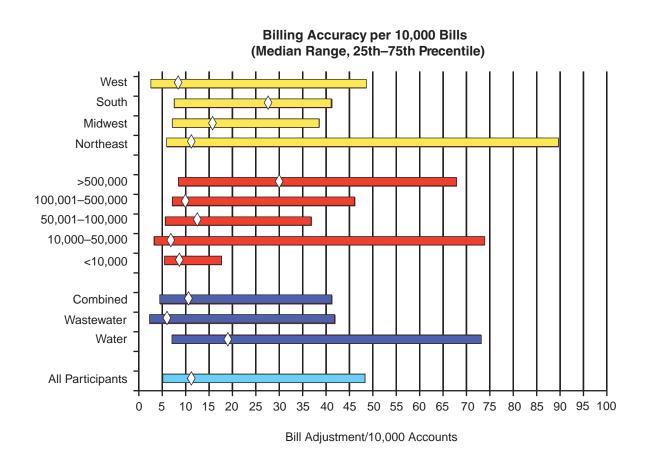


FIGURE 5-23 Billing Accuracy per 10,000 Bills

Billing Accuracy

Tabular Results

TABLE 5-23 Billing Accuracy per 10,000 Bills

	25th Percentile	Median	75th Percentile	Sample Size
West	2.7	9.3	48.5	55
South	7.2	15.7	38.5	57
Midwest	7.6	28.5	41.2	29
Northeast	6.1	12.3	89.6	18
>500,000	8.6	30.0	67.8	28
100,001–500,000	7.2	10.6	46.1	57
50,001-100,000	5.7	13.8	36.8	24
10,000-50,000	3.3	7.7	73.8	40
<10,000	5.6	9.1	17.6	13
Combined	4.6	10.3	41.2	100
Wastewater	2.4	7.3	41.9	10
Water	7.2	19.4	73.0	52
All Participants	5.3	12.1	48.3	162

Performance Measure Interpretation:

Generally, lower values are desirable.

Utility effectiveness is rarely in the minds of customers, unless they have a problem with service or billing. This indicator helps a utility measure how effective its billing practices are relative to others.

Explanatory factors are minimized so this indicator can be very meaningful. Accuracy will be very high for most utilities (which is good), so the measure is standardized around 10,000 billings.



Business Operations

BENCHMARKING

Performance Indicators for Water and Wastewater Utilities: Survey Data and Analyses Report

10. Debt Ratio

Description:

This indicator quantifies the utility's level of indebtedness.

Calculation:

 $debt ratio = \frac{total liabilities}{total assets}$

Definitions:

- *Total liabilities* are all obligations of the utility under law or equity. (They are categorized as such on the utility's financial statement. In essence, they are the total amount of dollars owed to others. Liabilities are defined and designated by the Governmental Accounting Standards Board [GASB] or the Financial Accounting Standards Board [FASB] [as applicable to each utility]. They include outstanding bonds, outstanding long-term debt, outstanding short-term debt, payments owed to others, accounts payable, and deposits collected from customers.)
- *Total assets* are all resources of the utility, both tangible and intangible. (They are categorized as such on the utility's financial statement. They include the total value of properties and claims against others that are owned by the utility as expressed at original cost. Assets are defined and designated by the GASB or the FASB [as applicable to each utility]. They include accounts receivable, cash, inventories, service delivery facilities [less depreciation], cost of easements, cost of water rights, and all other items of value owned by the utility.)

Debt Ratio

Median Range Chart_

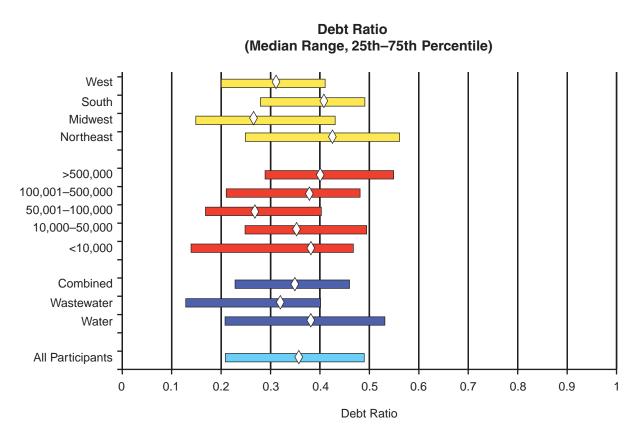


FIGURE 5-24 Debt Ratio

Debt Ratio

Tabular Results	

TABLE 5-24 Debt Ratio

		25th Percentile	Median	75th Percentile	Sample Size
Region	West	0.2	0.3	0.4	65
	South	0.3	0.4	0.5	69
	Midwest	0.2	0.3	0.4	34
	Northeast	0.3	0.4	0.6	18
Size	>500,000	0.3	0.4	0.6	40
	100,001-500,000	0.2	0.4	0.5	68
	50,001-100,000	0.2	0.3	0.4	28
	10,000-50,000	0.3	0.4	0.5	41
	<10,000	0.1	0.4	0.5	14
Туре	Combined	0.2	0.4	0.5	111
	Wastewater	0.1	0.3	0.4	15
	Water	0.2	0.4	0.5	65
	All Participants	0.2	0.4	0.5	0

Performance Measure Interpretation:

Generally, lower values are desirable.

Generally, the higher the calculated debt ratio, the more dependent the utility is on debt financing. Many utilities use this indicator as an internal measure of performance. Debt equity ratio is an important measure for many businesses, because a high debt burden brings larger costs for interest and capital repayments.

11. System Renewal/Replacement Rate

Description:

This indicator quantifies the rate at which the utility is meeting its individual need for infrastructure renewal or replacement.

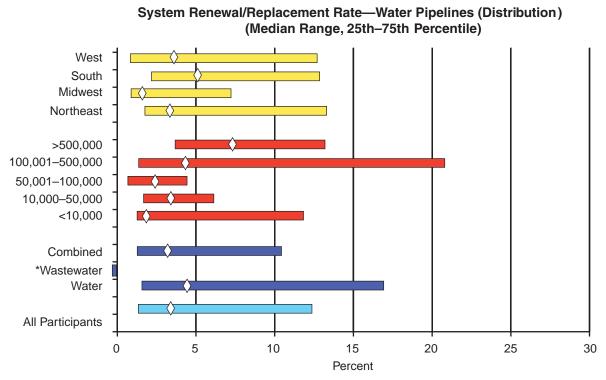
Calculation:

renewal rate (%) = 100 (total actual expenditures or total amount of funds reserved for renewal and replacement for each asset class)/total present worth for renewal and replacement needs for each asset group

Definitions:

- Asset class in the context of this indicator means one of the following classes for a water or wastewater utility:
 - Water treatment facilities include all assets associated with treating source water to make it ready for distribution. They include those assets associated with disposal of solids accumulated during treatment.
 - Water distribution system includes all piping, valves, hydrants, pump stations, storage facilities, service taps and meters, and other appurtenances conveying treated water to customers.
 - Water miscellaneous assets include surface water and groundwater resources, source water storage facilities, office buildings, maintenance facilities, laboratories not associated with treatment process control, and land acquired to protect water resources.
 - Wastewater collection assets include all piping, access holes, clean-outs, pumping facilities, and force mains used to convey wastewater to a central location for treatment.
 - Wastewater treatment facilities include all assets at each facility used to treat wastewater, treat and dispose of solids, and protect air quality.
 - Wastewater miscellaneous assets include office buildings, maintenance facilities, and laboratories not associated with process control.

Median Range Chart_



*Not applicable, insufficient sample size.

FIGURE 5–25 System Renewal/Replacement Rate—Water Pipelines (Distribution)

Tabular Results	
I abaiai Acsaics	

TABLE 5-25 System Renewal/Replacement Rate—Water Pipelines (Distribution)

		25th Percentile	Median	75th Percentile	Sample Size
Region	West	0.9	3.9	12.7	51
	South	2.2	5.0	12.8	47
	Midwest	0.9	1.9	7.2	25
	Northeast	1.8	3.8	13.3	16
Size	>500,000	3.7	7.2	13.2	26
	100,001-500,000	1.4	4.8	20.8	51
	50,001-100,000	0.7	2.8	4.4	20
	10,000-50,000	1.7	3.3	6.1	35
	<10,000	1.3	1.9	11.8	11
Туре	Combined	1.3	3.2	10.4	89
	*Wastewater	na	na	na	0
	Water	1.6	4.8	16.9	54
	All Participants	1.4	3.8	12.2	143

^{*}na = not applicable, insufficient sample size.

Median Range Chart_____

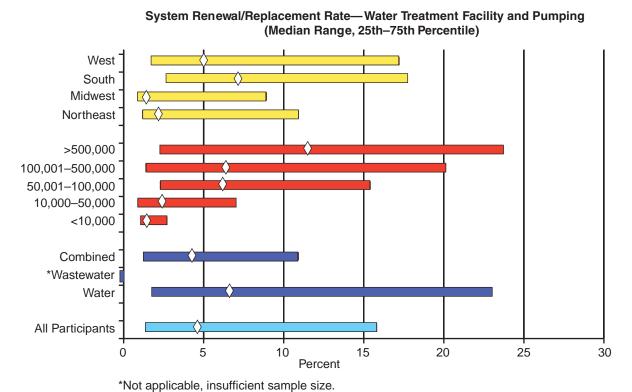


FIGURE 5-26 System Rennewal/Replacement Rate—Water Treatment Facility and Pumping

Tabular Results_____

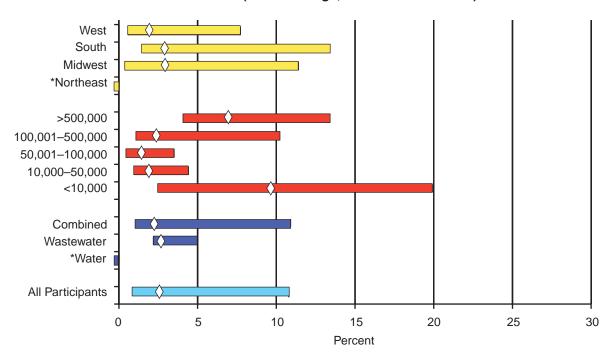
TABLE 5-26 System Renewal/Replacement Rate—Water Treatment Facility and Pumping

		25th Percentile	Median	75th Percentile	Sample Size
Region	West	1.8	5.0	17.2	43
	South	2.7	7.3	17.7	44
	Midwest	0.9	1.8	8.9	24
	Northeast	1.2	2.2	10.9	14
Size	>500,000	2.3	11.7	23.7	25
	100,001-500,000	1.4	6.8	20.1	45
	50,001-100,000	2.3	6.3	15.4	19
	10,000-50,000	0.9	2.6	7.0	33
	<10,000	1.1	1.4	2.7	7
Туре	Combined	1.3	4.8	10.9	81
	*Wastewater	na	na	na	0
	Water	1.8	6.5	23.0	48
	All Participants	1.4	4.9	15.8	129

^{*}na = not applicable, insufficient sample size.

Median Range Charts_____

System Renewal/Replacement Rate—Wastewater Pipelines and Collection (Median Range, 25th–75th Percentile)



*Not applicable, insufficient sample size.

FIGURE 5-27 System Renewal/Replacement Rate—Wastewater Pipelines and Collection

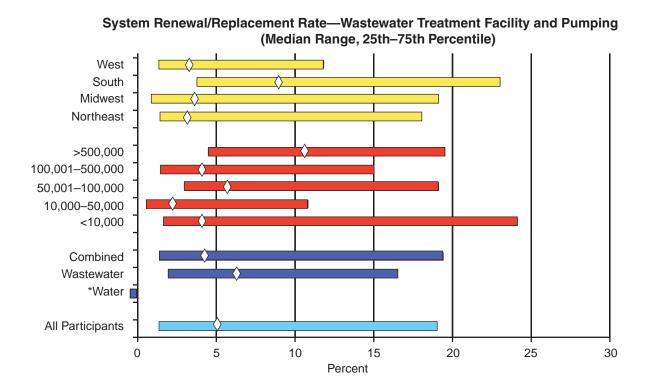
Tabular Results_____

TABLE 5-27 System Renewal/Replacement Rate—Wastewater Pipelines and Collections

		25th Percentile	Median	75th Percentile	Sample Size
Region	West	0.6	2.1	7.7	32
	South	1.5	3.8	13.4	35
	Midwest	0.4	3.0	11.4	18
	*Northeast	na	na	na	4
Size	>500,000	4.1	7.3	13.4	16
	100,001-500,000	1.1	2.4	10.2	31
	50,001-100,000	0.5	1.4	3.5	16
	10,000-50,000	1.0	2.0	4.4	22
	<10,000	2.5	9.7	19.9	7
Туре	Combined	0.6	2.4	10.9	83
	Wastewater	2.2	2.6	4.9	9
	*Water	na	na	na	0
	All Participants	0.9	2.5	10.8	92

^{*}na = not applicable, insufficient sample size.

Median Range Chart_



*Not applicable, insufficient sample size.

FIGURE 5–28 System Renewal/Replacement Rate—Wastewater Treatment Facility and Pumping

Tabular Results

TABLE 5-28 System Renewal/Replacement Rate—Wastewater Treatment Facility and Pumping

		25th Percentile	Median	75th Percentile	Sample Size
Region	West	1.4	3.1	11.8	27
	South	3.8	9.4	23.0	35
	Midwest	0.9	3.7	19.1	17
	Northeast	1.5	3.1	18.0	5
Size	>500,000	4.5	10.5	19.5	14
	100,001-500,000	1.5	4.4	15.0	27
	50,001-100,000	3.0	5.7	19.1	17
	10,000-50,000	0.6	2.1	10.8	21
	<10,000	1.7	4.2	24.1	7
Туре	Combined	1.4	4.7	19.4	76
	Wastewater	2.0	6.1	16.5	10
	*Water	na	na	na	0
	All Participants	1.4	5.0	19.0	86

^{*}na = not applicable, insufficient sample size.

Performance Measure Interpretation:

Generally, higher values are desirable.

This indicator measures the degree to which a water or wastewater utility is replacing its infrastructure for each of two asset groups: distribution system and treatment for water utilities and collection system treatment for wastewater utilities. Combined water/wastewater utilities are asked to provide data for all four categories.

12. Return on Assets

Description:

This indicator measures the financial effectiveness of the utility.

Calculation:

return on assets = $\frac{\text{net income}}{\text{total assets}}$

Definitions:

- *Net income* is titled as such on the utility's financial statement and is defined and designated by the Governmental Accounting Standards Board (GASB) or the Financial Accounting Standards Board (FASB), as applicable to each specific utility.
- Total assets are all resources of the utility, both tangible and intangible. (They are categorized as such on the utility's financial statement. They include the total value of properties and claims against others that are owned by the utility as expressed at original cost. Assets are defined and designated by the GASB or the FASB [as applicable to each specific utility]. They include accounts receivable, cash, inventories, service delivery facilities [less depreciation], cost of easements, cost of water rights, and all other items of value owned by the utility.)

Return on Assets

Median Range Chart_

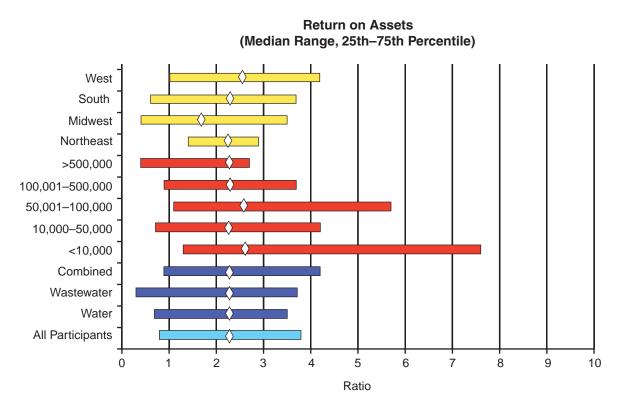


FIGURE 5-29 Return on Assets

Return on Assets

Tabular Results	
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TABLE 5-29 Return on Assets

	25th Percentile	Median	75th Percentile	Sample Size
West	1.0	2.6	4.2	61
South	0.6	2.2	3.7	69
Midwest	0.4	1.7	3.5	33
Northeast	1.4	2.1	2.9	18
>500,000	0.4	2.2	2.7	38
100,001–500,000	0.9	2.2	3.7	67
50,001–100,000	1.1	2.6	5.7	27
10,000–50,000	0.7	2.2	4.2	39
<10,000	1.3	2.7	7.6	13
Combined	0.9	2.2	4.2	107
Wastewater	0.3	2.2	3.7	13
Water	0.7	2.2	3.5	64
All Participants	0.8	2.2	3.8	184

Performance Measure Interpretation:

Generally, higher values are desirable.

All utilities are interested in their financial health. Investor-owned and enterprise-fund utilities are particularly sensitive to this indicator, seeking higher ratios where possible. Some publicly owned utilities operating within a larger budget may find this indicator valuable when justifying organizational improvements. Others may see little immediate value to this indicator.

BENCHMARKING

Performance Indicators for Water and Wastewater Utilities: Survey Data and Analyses Report



Water Operations

BENCHMARKING

Performance Indicators for Water and Wastewater Utilities: Survey Data and Analyses Report

13. Drinking Water Compliance Rate

Description:

This indicator quantifies the percentage of time each year that a water utility meets all health-related drinking water requirements of the US National Primary Drinking Water Regulations.

Calculation:

drinking water compliance rate (%) =

(100) (number of days in full compliance)
365 days

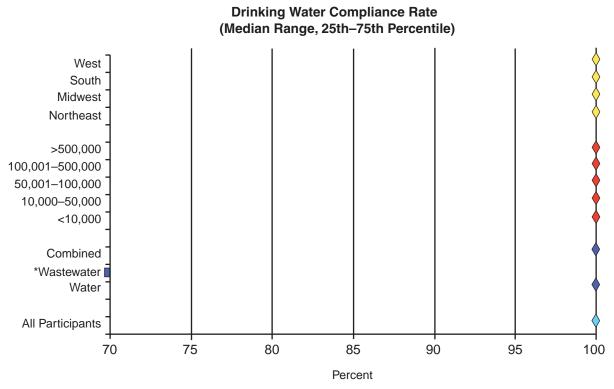
Definitions:

- Regulated contaminants and treatment technique requirements are contained in 40 CFR Part 141 (National Primary Drinking Water Regulations).
- *Noncompliance* refers to violation of an applicable primary maximum contaminant level or a treatment technique requirement.

Note: The US Environmental Protection Agency Web site www.epa.gov includes a complete explanation of this indicator, including applicable definitions.

Drinking Water Compliance Rate

Median Range Chart



*Not applicable, insufficient sample size.

FIGURE 5-30 Drinking Water Compliance Rate

Drinking Water Compliance Rate

Tabular Results	
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TABLE 5-30 Drinking Water Compliance Rate

Region		25th Percentile	Median	75th Percentile	Sample Size
	West	100	100	100	61
	South	100	100	100	68
	Midwest	100	100	100	32
	Northeast	100	100	100	17
Size	>500,000	100	100	100	34
	100,001-500,000	100	100	100	65
	50,001-100,000	100	100	100	27
	10,000-50,000	100	100	100	43
	<10,000	100	100	100	14
Туре	Combined	100	100	100	113
	*Wastewater	na	na	na	0
	Water	100	100	100	70
	All Participants	100	100	100	183

^{*}na = not applicable, insufficient sample size.

Performance Measure Interpretation:

Higher values are desirable.

A compliance rate of 100% is the goal of every utility. Most utilities that responded to the Benchmarking Performance Indicators Survey indicated 100% compliance with all health-related US National Primary Drinking Water Regulations (only 22 of the 183 utilities that responded to this question reported a value less than 100%). Therefore, there are no differences to evaluate for any of the data subcategories. Although 100% compliance is important, there is no way this indicator can be used to track improvement because all reporting utilities provided this number. This indicator therefore is a demographic that further defines the utilities that responded to this survey.

14. Distribution System Water Loss

Description:

This indicator is a measure of the percentage of produced water that fails to reach customers and cannot otherwise be accounted for through authorized usage.

Calculation:

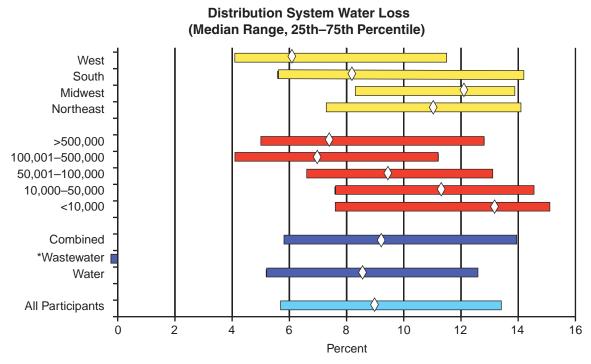
distribution water loss (%) = 100 [volume distributed – (volume billed + volume unbilled but authorized)/volume distributed]

Definitions:

- Water losses are those water volumes that do not find their way to authorized uses while under the utility's control. Water losses consist of real losses and apparent losses. The former are true losses of water from the utility's system, up to the point of customer metering. Apparent losses consist of unauthorized use and inaccuracies associated with metering. Water losses occur throughout the water system, from source water intakes, transmission pipelines, treatment facilities, distribution pipelines, and storage facilities. (For this indicator the focus is on losses from the points of distribution through the points of customer service meters.)
- *Distributed water* is the total volume of water entering the distribution system from all sources, including treatment facilities, well fields, individual wells, and purchased water connections.
- *Volume billed* is the total for all customer classes.
- Volume unbilled but authorized are the metered or estimated volume totals for all unbilled but authorized uses (e.g., flushing fire hydrants to maintain water quality, washing storage facilities, or pipeline construction and rehabilitation activities).

Distribution System Water Loss

Median Range Chart_



*Not applicable, insufficient sample size.

FIGURE 5-31 Distribution System Water Loss

Distribution System Water Loss

Tabular Results

TABLE 5-31 Distribution System Water Loss

Region		25th Percentile	Median	75th Percentile	Sample Size
	West	4.1	6.2	11.5	32
	South	5.6	8.3	14.2	48
	Midwest	8.3	12.6	13.9	22
	Northeast	7.3	11	14.1	15
Size	>500,000	5	7.6	12.8	20
	100,001-500,000	4.1	7	11.2	44
	50,001-100,000	6.6	9.6	13.1	17
	10,000-50,000	7.6	11.7	14.6	31
	<10,000	7.6	13.7	15.2	7
Туре	Combined	5.8	9.3	14	78
	*Wastewater	na	na	na	0
	Water	5.2	8.4	12.6	43
	All Participants	5.7	9.1	13.4	121

^{*}na = not applicable, insufficient sample size.

Performance Measure Interpretation:

Generally, higher values are not desirable.

Water loss can adversely impact revenue and water use efficiency. Utilities located where there are water shortages are focused on reducing this performance indicator. Water used (but not billed) for authorized purposes is not considered water loss. Examples of this type of water use include flushing programs designed to maintain water quality, water used to clean water storage facilities, and water used during new pipeline construction. There is probably no way to completely eliminate all water loss, but most utilities strive to minimize this value.

15. Water Distribution System Integrity

Description:

This indicator is a measure of the condition of the water distribution system, expressed as the total annual number of leaks and pipeline breaks per 100 miles of distribution piping.

Calculation:

water distribution system integrity rate =

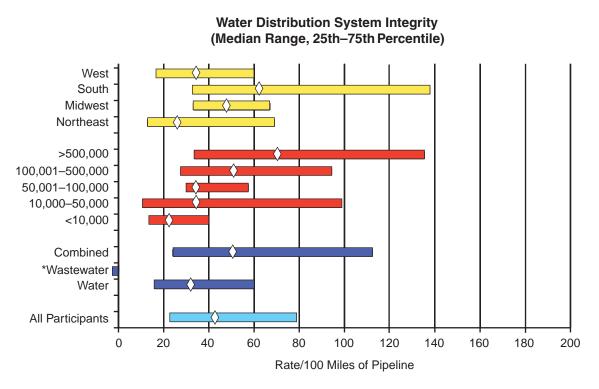
100 (annual total number of leaks + annual total number of breaks)
total miles of distribution piping

Definitions:

- *Distribution piping* includes all pipes, valves, hydrants, and other appurtenances conveying treated water between treatment facilities and the final point of utility control over customer service connections. Customer service piping downstream of that point is not part of the distribution system.
- A *leak* is an opening in a distribution pipeline, valve, hydrant, appurtenance, or service connection that is continuously losing water. The rate of leakage may be stable or progressive. This excludes any break, leak, or failure directly caused by the action of a person authorized by the utility.
- A *break* is physical damage to a pipe, valve, hydrant, or other appurtenance that results in an abrupt loss of water. This includes any break, leak, or failure directly caused by the action of a utility employee or contractor.

Water Distribution System Integrity

Median Range Chart



*Not applicable, insufficient sample size.

FIGURE 5–32 Water Distribution System Integrity

Water Distribution System Integrity

Tabular Results	
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TABLE 5–32 Water Distribution System Integrity

		25th Percentile	Median	75th Percentile	Sample Size
Region	West	16.9	36.4	59.6	52
	South	32.9	63.6	137.7	53
	Midwest	33.2	47.3	66.9	28
	Northeast	13	29.2	68.9	15
Size	>500,000	33.8	70.5	135.3	30
	100,001-500,000	27.7	52.1	94.2	51
	50,001-100,000	30.2	37.8	57.3	25
	10,000-50,000	10.9	35.4	98.6	35
	<10,000	13.7	21.4	39.5	11
Type	Combined	24.1	50.8	112.3	99
	*Wastewater	na	na	na	0
	Water	16.2	36.7	60	53
	All Participants	22.9	43.6	78.7	153

^{*}na = not applicable, insufficient sample size.

Performance Measure Interpretation:

Generally, higher values are not desirable.

Excessive leaks and breaks result in increased costs due to an increased number of emergency repairs. Utilities use operational and maintenance (O&M) procedures designed to reduce the value of this indicator. The cost of these (O&M) programs must be balanced against the cost of emergency repairs and the consequences of water supply interruptions. Comparing the value of this indicator with other utilities can provide information on the rate that many utilities may find acceptable.

16. Operations and Maintenance Cost Ratios: Water

Description:

This indicator includes three measures to quantify utility costs related to operations and maintenance (O&M). Two ratios use total utility O&M costs while the third ratio focuses only on the cost of water treatment.

Calculation:

O&M cost per account = total O&M costs (less

depreciation)/total number of active customer accounts

O&M cost per million gallons distributed = total O&M costs (less

depreciation)/volume (in million gallons) distributed during the

reporting period

direct cost of treatment per million gallons distributed = total O&M costs directly

attributable to water treatment/ total volume (in million gallons) distributed during the reporting

period

Definitions:

- *Active customer account* refers to all customer accounts of all classes that were active for some or all of the reporting period. A single account may include service through more than one water service connection.
- *Total volume distributed* refers to the total volume of water processed by the utility during the reporting period. It is reported in millions of gallons.
- *Total O&M costs directly attributable to water treatment* is the total costs for salaries, direct benefits, and direct O&M costs associated with treatment. It includes pumping costs only within treatment facilities, not those associated with delivery of water to treatment facilities.

Operations and Maintenance Cost Ratios: Water

Median Range Chart_____

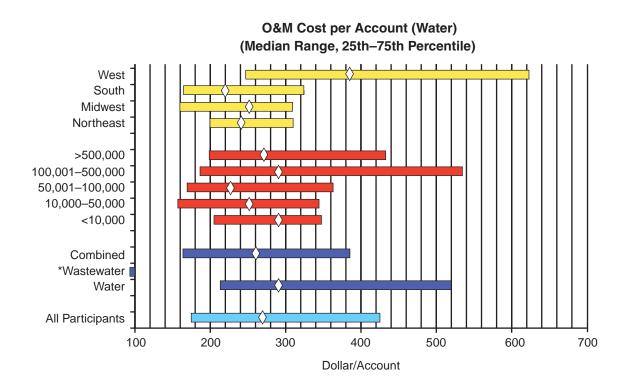


FIGURE 5-33 O&M Cost per Account (Water)

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Operations and Maintenance Cost Ratios: Water

Tabular Results

TABLE 5–33 O&M Cost per Account (Water)

		25th Percentile	Median	75th Percentile	Sample Size
Region	West	244	387	621	57
	South	163	220	323	63
	Midwest	158	257	308	27
	Northeast	198	240	308	16
Size	>500,000	198	274	431	30
	100,001-500,000	184	290	532	60
	50,001-100,000	168	224	362	23
	10,000-50,000	156	247	343	41
	<10,000	203	290	345	14
Туре	Combined	162	256	383	105
	*Wastewater	na	na	na	0
	Water	212	290	517	66
	All Participants	173	272	422	171

^{*}na = not applicable, insufficient sample size.

Performance Measure Interpretation:

Generally, higher values are not desirable.

Higher O&M costs per customer account may indicate inefficient procedures or may be the result of aging infrastructure. However, this may not always be the case. Higher costs per account may be the desired outcome to improve customer satisfaction or to make up for deferred maintenance practices. Comparing the value of this indicator with other utilities can provide information regarding the status of current accepted practices.

Median Range Chart_____

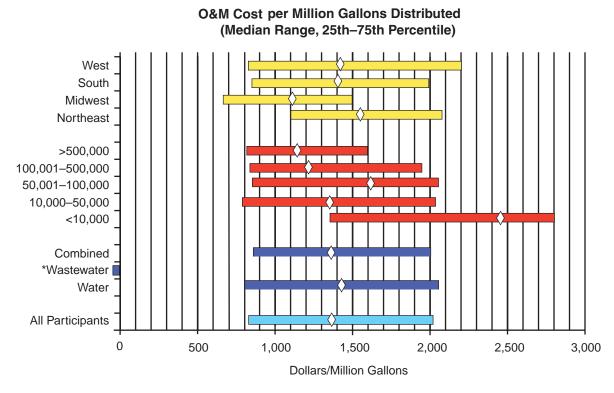


FIGURE 5-34 O&M Cost per Million Gallons Distributed

Tabular Results	
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TABLE 5-34 O&M Cost per Million Gallons Distributed

		25th Percentile	Median	75th Percentile	Sample Size
Region	West	860	1441	2239	56
	South	869	1417	2023	64
	Midwest	692	1102	1537	28
	Northeast	1126	1559	2110	16
Size	>500,000	840	1239	1635	32
	100,001–500,000	862	1308	1989	60
	50,001-100,000	883	1531	2088	24
	10,000-50,000	812	1324	2072	40
	<10,000	1376	2488	2828	14
Туре	Combined	884	1388	2025	105
	*Wastewater	na	na	na	0
	Water	849	1428	2081	66
	All Participants	860	1399	2053	171

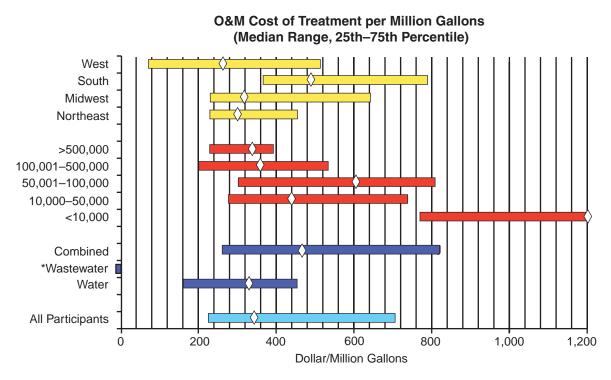
^{*}na = not applicable, insufficient sample size.

Performance Measure Interpretation:

Generally, higher values are not desirable.

Higher O&M costs per million gallons distributed may indicate inefficient procedures or may be the result of aging infrastructure. However, this may not always be the case. Higher costs per million gallons distributed may be the desired outcome to improve customer satisfaction or to make up for deferred maintenance practices. Comparing the value of this indicator with other utilities can provide information regarding the status of current accepted practices.

Median Range Chart_



*Not applicable, insufficient sample size.

FIGURE 5-35 O&M Cost of Treatment per Million Gallons

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VIEW

Tabular Results			

TABLE 5–35 O&M Cost of Treatment per Million Gallons

		25th Percentile	Median	75th Percentile	Sample Size
Region	West	85	310	517	46
	South	363	518	794	54
	Midwest	244	377	647	28
	Northeast	242	317	458	13
Size	>500,000	240	334	398	26
	100,001-500,000	212	369	539	57
	50,001-100,000	315	602	816	20
	10,000-50,000	288	486	747	33
	<10,000	784	1,604	2,420	9
Туре	Combined	275	466	826	105
	*Wastewater	na	na	na	0
	Water	174	336	447	66
	All Participants	238	385	713	171

^{*}na = not applicable, insufficient sample size.

Performance Measure Interpretation:

Generally, higher values are not desirable.

Higher O&M costs directly attributable to water treatment per million gallons distributed may indicate high staffing levels or increased maintenance due to aging equipment and facilities. However, this may not always be the case. Higher costs may be unavoidable due to the use of more expensive treatment processes. Comparing the value of this indicator with other utilities can provide information regarding the status of current accepted practices.

VIEW

17. Planned Maintenance Ratio: Water (Hours)

Description:

This indicator is a measure of the investment in planned maintenance.

Calculation:

planned maintenance ratio (hours) = $100 \times \text{hours of planned maintenance}$ (hours of planned + hours of corrective maintenance)

planned maintenance ratio (cost) = $100 \times \text{cost of planned maintenance}$ (cost of planned + cost of corrective maintenance)

Definitions:

- *Planned maintenance* is all maintenance (annual) undertaken in advance of an asset failure. Planned maintenance may be predictive or preventive.
- *Corrective maintenance* is all maintenance (annual) undertaken after an asset failure.

Planned Maintenance Ratio: Water (Hours)

Median Range Chart

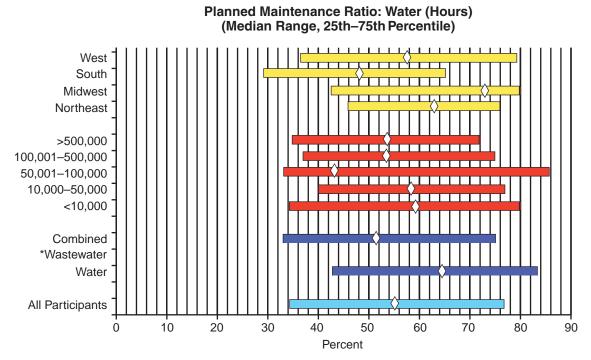


FIGURE 5–36 Planned Maintenance Ratio: Water (Hours)

Planned Maintenance Ratio: Water (Hours)

TABLE 5–36 Planned Maintenance Ratio: Water (Hours)

		25th Percentile	Median	75th Percentile	Sample Size
Region	West	37.9	57.6	79.2	50
	South	29.3	48	65	51
	Midwest	42.5	72.7	80	26
	Northeast	46	63.6	76.1	13
Size	>500,000	35	53.5	72	23
	100,001-500,000	37.2	53.2	75	55
	50,001-100,000	33.3	43.1	85.7	21
	10,000-50,000	40	58.2	76.5	34
	<10,000	34.2	59.1	80	12
Туре	Combined	33.3	51.6	75	92
	*Wastewater	na	na	na	0
	Water	42.9	64.3	83.4	52
	All Participants	34.4	55.3	76.8	144

^{*}na = not applicable, insufficient sample size.

Performance Measure Interpretation:

Generally, higher values are desirable.

Many utilities want to increase their percentage of planned maintenance activities and reduce their percentage of corrective maintenance activities. A higher ratio may indicate a reduction in emergency maintenance resulting from system malfunctions (e.g., pipeline breaks or pump failures). However, spending more time on planned maintenance without a corresponding reduction in corrective maintenance is a negative indicator.

Planned Maintenance Ratio: Water (Cost)

Median Range Chart

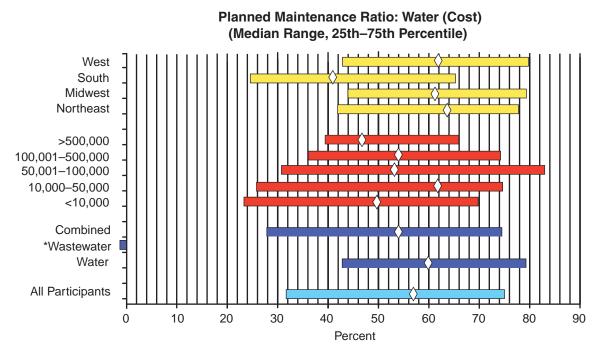


FIGURE 5-37 Planned Maintenance Ratio: Water (Cost)

Planned Maintenance Ratio: Water (Cost)

Tabular Results			

TABLE 5-37 Planned Maintenance Ratios: Water (Cost)

		25th Percentile	Median	75th Percentile	Sample Size
Region	West	43.6	63.5	80	45
	South	25	43.4	65.1	46
	Midwest	44.6	63.4	79.4	23
	Northeast	42.2	65.3	78.5	12
Size	>500,000	40	48.5	66.3	21
	100,001-500,000	36.8	57.5	74.9	49
	50,001-100,000	31.4	55.4	83.7	18
	10,000-50,000	26.4	62.5	75	33
	<10,000	24.1	48.1	70.2	10
Туре	Combined	28.7	54.3	74.7	92
	*Wastewater	na	na	na	0
	Water	43.6	60.0	79.6	52
	All Participants	32.4	56	75	144

^{*}na = not applicable, insufficient sample size.

Performance Measure Interpretation:

Generally, higher values are desirable.

Many utilities want to increase their percentage of planned maintenance activities and reduce their percentage of corrective maintenance activities. A higher ratio may indicate a reduction in emergency maintenance resulting from system malfunctions (e.g., pipeline breaks or pump failures). However, spending more on planned maintenance without a corresponding reduction in corrective maintenance is a negative indicator.

BENCHMARKING

Performance Indicators for Water and Wastewater Utilities: Survey Data and Analyses Report



Wastewater Operations

BENCHMARKING

Performance Indicators for Water and Wastewater Utilities: Survey Data and Analyses Report

18. Sewer Overflow Rate

Description:

This indicator is a measure of the collection system piping condition and the effectiveness of routine maintenance.

Calculation:

sewer overflow rate = $100 \times \text{total number of sewer overflows during the reporting}$ period/total miles of pipe in the sewage collection system

Definitions:

- An *overflow* refers to a discharge from a sewer through an access hole, clean-out, pumping facility, customer floor drain, or the drain in a fixture, if that discharge is related to limitations or problems with collection or treatment system components under control of the utility. Overflows caused by limitations or problems within customer-controlled piping and facilities are specifically excluded from this definition. A single limitation or problem can result in multiple overflows.
- A *dry weather sewer overflow* is an overflow from a combined sanitary/storm sewer that is experienced when weather conditions are such that the portion of the flow attributed to stormwater is negligible.
- The *collection system* is comprised of all gravity sewerage piping, access holes, pressure sewers, and lift stations under control of the utility from the point of customer's property lines to the treatment facility or the point of interception by another wastewater utility. Portions of the collection system may convey both sanitary sewage and stormwater.

Sewer Overflow Rate

Median Range Chart_

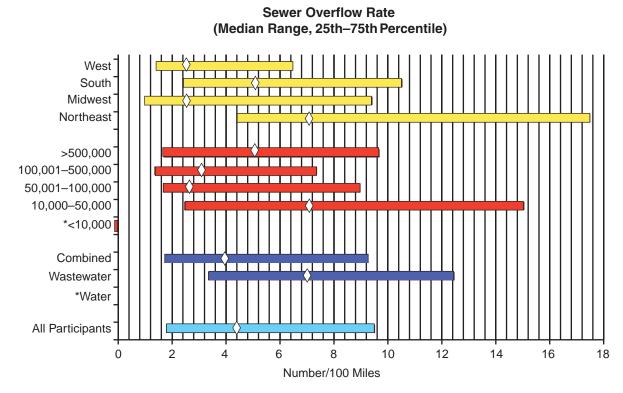


FIGURE 5-38 Sewer Overflow Rate

Sewer Overflow Rate

Tabular Results	
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TABLE 5-38 Sewer Overflow Rate

		25th Percentile	Median	75th Percentile	Sample Size
Region	West	1.44	2.74	6.46	39
	South	2.45	5.66	10.52	48
	Midwest	1	2.76	9.41	16
	Northeast	4.43	7.61	17.48	5
Size	>500,000	1.71	5.47	9.67	23
	100,001-500,000	1.36	3.5	7.35	41
	50,001-100,000	1.68	2.26	8.96	19
	10,000-50,000	2.47	7.29	15.04	23
	*<10,000	na	na	na	4
Туре	Combined	1.75	4	9.25	95
	Wastewater	3.36	7.61	12.45	15
	*Water	na	na	na	0
	All Participants	1.8	4.3	9.5	110

^{*}na = not applicable, insufficient sample size.

Performance Measure Interpretation:

Generally, lower values are desirable.

An overflow is an uncontrolled release, and utilities strive to reduce this number. This ratio does not include any weighting that would account for the severity of the overflow. All overflows are considered equal.

Collection System Integrity: Wastewater

Description:

A measure of the condition of the sewage collection system.

Calculation:

collection system integrity failure rate

 $= 100 \times \text{total number of collection system}$ failures during the year/total miles of collection system piping

Definitions:

- The collection system is comprised of all gravity sewerage piping, access holes, pressure sewers, and lift stations under control of the utility from the point of customers' property lines to the treatment facility or the point of interception by another wastewater utility. Portions of the collection system may convey both sanitary sewage and stormwater.
- A *collection system failure* is a loss of capacity that results from a flow restriction in gravity or pressurized sewer systems. Flow restrictions may be caused by deposition of foreign materials; structural failure of pipes, appurtenances, or access holes; deterioration of collection system materials; and root intrusion. Low spots in gravity sewers (sometimes called "swags") are considered failures if there is potential for deposition and diminished sewer capacity. If left unattended, collection system failures can result in cave-ins, backups, or overflows. Maintenance activities such as sewer cleaning, rodding, root removal, and minor repairs to minimize infiltration or inflow are not collection system failures. Electrical and mechanical lift station failures unrelated to flow restriction, electrical power outages at lift stations, and failures that occur on customer properties are not considered failures for the purpose of this indicator. Excluded is any failure directly caused by the action of a person authorized by the utility, such as failure caused by incidental damage during construction/repair or an incorrectly marked location.

Collection System Integrity: Wastewater

Median Range Chart_

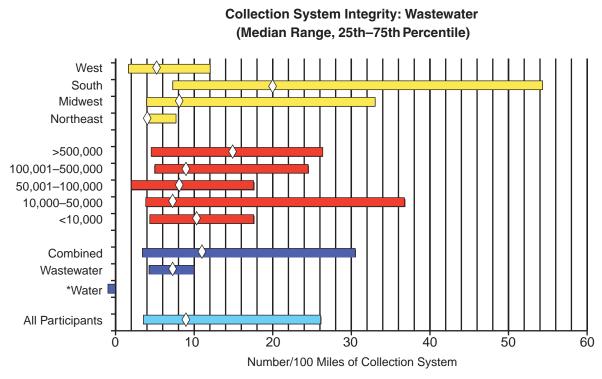


FIGURE 5-39 Collection System Integrity: Wastewater

Collection System Integrity: Wastewater

Tabular Results_____

TABLE 5-39 Collection System Integrity: Wastewater

		25th Percentile	Median	75th Percentile	Sample Size
Region	West	1.7	5.6	12	36
	South	7.3	20	54.3	49
	Midwest	4	8.2	33	18
	Northeast	4.4	4.4	7.6	5
Size	>500,000	4.6	15.8	26.3	22
	100,001-500,000	5	9.3	24.5	40
	50,001–100,000	2.1	8	17.6	19
	10,000-50,000	3.9	7.2	36.8	23
	<10,000	4.4	10.5	17.6	5
Туре	Combined	3.5	11.1	30.5	96
	Wastewater	4.3	7.6	10	13
	*Water	na	na	na	0
	All Participants	3.6	9.4	26.1	109

^{*}na = not applicable, insufficient sample size.

Performance Measure Interpretation:

Generally, lower values are desirable.

Most wastewater systems seek to minimize the annual number of collection system failures.

20. Wastewater Treatment Effectiveness Rate

Description:

This indicator is a measure that quantifies compliance with the effluent quality standards in effect at each treatment facility.

Calculation:

wastewater treatment effectiveness rate =

100 (365 – total number of standard noncompliance days)

365

Definitions:

- An *operating/discharge permit* is a permit that is issued through the National Pollutant Discharge Elimination System or its equivalent delegated state program.
- A *standard noncompliance day* is any day during which the wastewater utility, through actual monitoring, determines that it has not met one or more of its permitted effluent quality standards at an individual treatment facility.



Wastewater Treatment Effectiveness Rate

Median Range Chart_

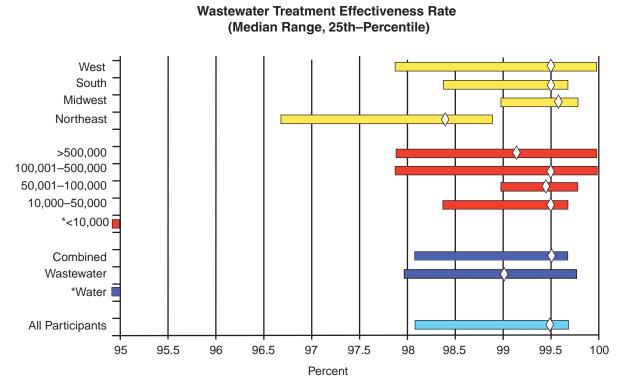


FIGURE 5-40 Wastewater Treatment Effectiveness Rate

Wastewater Treatment Effectiveness Rate

Tabular Results	
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TABLE 5-40 Wastewater Treatment Effectiveness Rate

		25th Percentile	Median	75th Percentile	Sample Size
Region	West	97.9	99.5	100	27
	South	98.4	99.5	99.7	32
	Midwest	99	99.7	99.8	12
	Northeast	96.7	98.4	98.9	5
Size	>500,000	98.4	99.2	100	17
	100,001-500,000	98.1	99.5	99.7	30
	50,001–100,000	96.4	99.5	99.7	13
	10,000-50,000	98.9	99.5	99.7	14
	*<10,000	na	na	na	4
Туре	Combined	98.1	99.5	99.7	66
	Wastewater	98	99	99.8	12
	*Water	na	na	na	0
	All Participants	98.1	99.5	99.7	78

^{*}na = not applicable, insufficient sample size.

Performance Measure Interpretation:

Generally, higher values are desirable.

Ideally, the percentage of days in a year that the treatment facility satisfies all discharge permit requirements should be 100%. A number lower than this indicates that a violation occurred during the year.



Description:

There are three measures to quantify utility costs related to operations and maintenance (O&M). Two of the ratios use total utility O&M costs, and the third ratio focuses only on the cost of wastewater treatment.

Calculation:

O&M cost per account = total O&M costs (less depreciation)/total number of active customer accounts

O&M cost per million gallons processed = total O&M costs (less depreciation)/volume

(in million gallons) processed during the

reporting period

direct cost of treatment per million gallons = total O&M costs directly attributable to

processed

 total O&M costs directly attributable to wastewater treatment/total volume (in million gallons) processed during the

reporting period

Definitions:

- *Active customer accounts* includes all customer accounts of all classes that were billed for some or all of the reporting period. A single account may include service through more than one sewer service connection.
- *Total volume processed* refers to the total volume of wastewater processed by the utility during the reporting period. It is reported in millions of gallons.
- Total O&M costs directly attributable to wastewater treatment are the total costs for salaries, direct benefits, and direct O&M costs associated with treatment. They include pumping costs only within treatment facilities, not those associated with delivery of wastewater to treatment facilities or those associated with discharge of treated solids or liquids leaving wastewater treatment facilities. Costs of solids treatment are included.

Median Range Chart_____

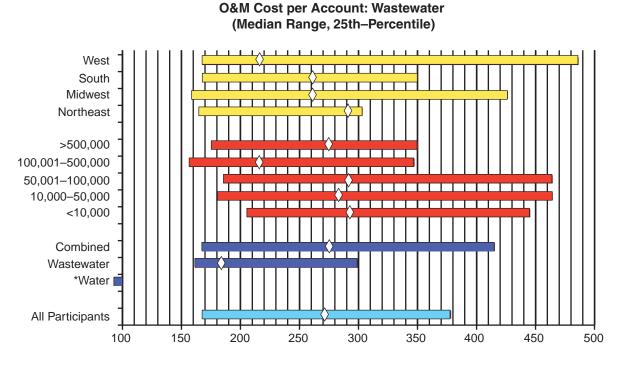


FIGURE 5-41 O&M Cost per Account: Wastewater



Tabular Results_____

TABLE 5-41 O&M Cost per Account: Wastewater

		25th Percentile	Median	75th Percentile	Sample Size
Region	West	168	239	486	40
	South	168	267	350	53
	Midwest	159	266	426	18
	Northeast	165	282	303	6
Size	>500,000	176	275	350	22
	100,001-500,000	157	232	347	41
	50,001-100,000	186	283	464	20
	10,000-50,000	181	274	464	29
	<10,000	206	298	445	8
Туре	Combined	168	274	415	105
	Wastewater	162	186	299	16
	*Water	na	na	na	0
	All Participants	168	272	378	121

^{*}na = not applicable, insufficient sample size



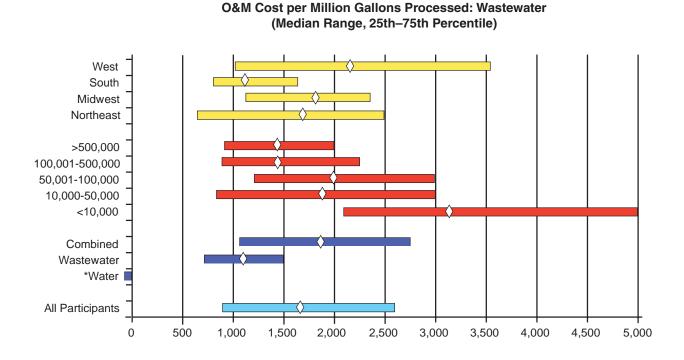


FIGURE 5-42 Planned Maintenance Ratio: Wastewater (Cost)

Tabular Results_____

TABLE 5–42 O8M Cost per Million Gallons Processed: Wastewater

		25th Percentile	Median	75th Percentile	Sample Size
Region	West	1051	2095	3668	39
	South	853	1200	1672	19
	Midwest	1165	1824	2384	52
	Northeast	692	1588	2554	6
Size	>500,001	950	1457	2037	23
	100,001-500,000	925	1472	2284	40
	50,001-100,000	1258	2001	3003	20
	10,000-50,000	883	1856	2994	29
	<10,000	2136	3096	5648	8
Туре	Combined	1119	1887	2781	105
	Wastewater	706	1053	1523	16
	*Water	na	na	na	0
	All Participants	930	1719	2621	121

^{*}na = not applicable, insufficient sample size

Median Range Chart_____

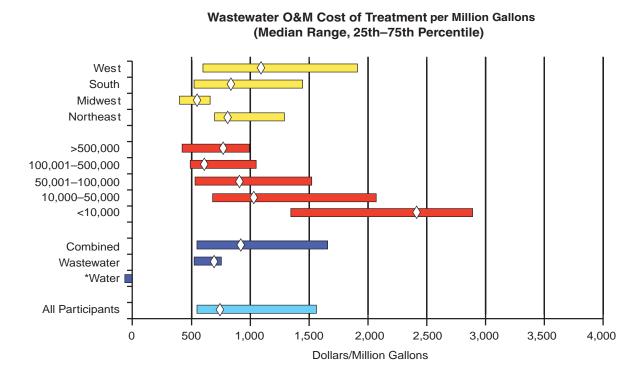


FIGURE 5–43 Wastewater O&M Cost of Treatment per Million Gallons



Tabular Results	

TABLE 5-43 Wastewater O&M Cost of Treatment per Million Gallons

		25th Percentile	Median	75th Percentile	Sample Size
Region	West	627	1014	1942	35
	South	540	838	1478	47
	Midwest	430	546	697	19
	Northeast	732	754	1324	6
Size	>500,001	454	720	1036	22
	100,001-500,000	500	631	1005	37
	50,001–100,000	561	925	1552	18
	10,001–50,000	717	1033	2118	26
	<10,000	1383	2450	2919	8
Туре	Combined Services	511	893	1689	105
	Wastewater Only	501	715	783	16
	*Water Only	na	na	na	0
	All Participants	508	759	1513	121

^{*}na = not applicable, insufficient sample size

Performance Measure Interpretation:

Generally, lower values are desirable.

Higher O&M costs per customer account may indicate inefficient procedures or may be the result of aging infrastructure. However, this may not always be the case. Higher costs per account may be the desired outcome to improve customer satisfaction or to make up for deferred maintenance practices. Comparing the value of this indicator with other utilities can provide information regarding the status of current accepted practices.

Description:

This indicator is a measure of the investment in planned maintenance.

Calculation:

```
planned maintenance ratio (hours) = \frac{100 \times \text{hours of planned maintenance}}{\text{(hours of planned maintenance + hours of corrective maintenance)}}
planned maintenance ratio (cost) = \frac{100 \times \text{cost of planned maintenance}}{\text{(cost of planned maintenance + cost of corrective maintenance)}}
```

Definitions:

- *Planned maintenance* is all maintenance (annual) undertaken in advance of an asset failure. Planned maintenance may be predictive or preventive.
- *Corrective maintenance* is all maintenance (annual) undertaken after an asset failure.

Median Range Chart

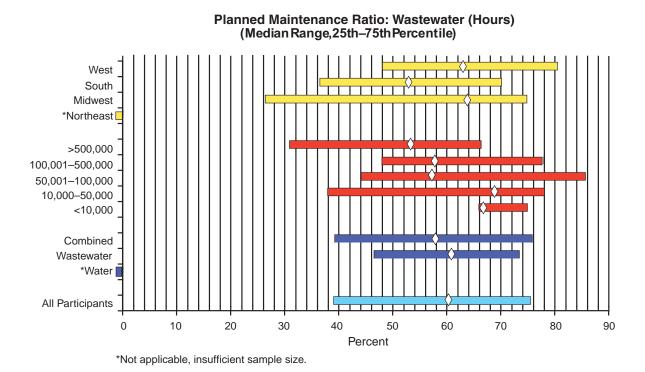


FIGURE 5-44 Planned Maintenance Ratio: Wastewater (Hours)

Tabular Results_____

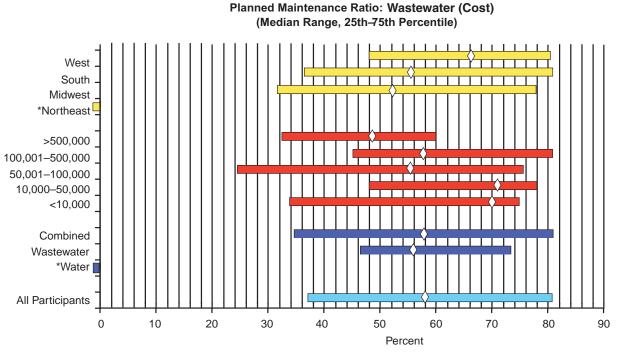
TABLE 5-44 Planned Maintenance Ratio: Wastewater (Hours)

		25th Percentile	Median	75th Percentile	Sample Size	
Region	West	48.3	63.7	80.6	37	
	South	36.6	52.8	70.1	36	
	Midwest	26.5	64.2	75	18	
	*Northeast	na	na	na	4	
Size	>500,000	30.9	52.8	66.3	19	
	100,001-500,000	48.3	58	78	33	
	50,001-100,000	44.1	57.7	85.6	17	
	10,000-50,000	38.3	69.8	77.8	22	
	<10,000	66	67.6	75	7	
Туре	Combined	39.3	58.1	75.8	86	
	Wastewater	46.7	61.8	73.5	12	
	*Water	na	na	na	0	
	All Participants	39.3	60.3	75.7	98	

^{*}na = not applicable, insufficient sample size.



Median Range Chart



*Not applicable, insufficient sample size.

FIGURE 5-45 Planned Maintenance Ratio: Wastewater (Cost)

Tabular Results	
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TABLE 5-45 Planned Maintenance Ratio: Wastewater (Cost)

		25th Percentile	Median	75th Percentile	Sample Size
Region	West	47.2	66.6	77.7	33
	South	36	55.9	81.2	36
	Midwest	32.9	55.7	77.5	16
	*Northeast	na	na	na	4
Size	>500,000	30.7	47.2	60	17
	100,001–500,000	45.5	58	81.2	32
	50,001-100,000	25	56.4	76.5	17
	10,000-50,000	50	74.9	88.5	20
	<10,000	34.5	74.4	75	5
Туре	Combined	36	58.1	81.2	86
	Wastewater	43.7	57.6	73.5	12
	*Water	na	na	na	0
	All Participants	36	58	80.4	98

^{*}na = not applicable, insufficient sample size.

Performance Measures Interpretation:

Generally, higher values are desirable.

Many utilities want to increase their percentage of planned maintenance activities (time and cost) and reduce their percentage of corrective maintenance activities. A higher ratio may indicate a reduction in emergency maintenance resulting from system malfunctions (e.g., pipeline breaks or pump failures). However, spending more on planned maintenance without a corresponding reduction in corrective maintenance is a negative indicator.



BENCHMARKING

Performance Indicators for Water and Wastewater Utilities: Survey Data and Analyses Report



Summary Tables of Performance Indicators by Type, Region, and Size

TABLE 6–1 Performance Indicators Summary by Utility Service Type (All, Water Only, Wastewater Only, Combined) 25th Percentile, Median, 75th Percentile

	All Participants		,	Water Onl	y	Was	tewater (Only	Com	bined Serv	vices	
	25th	Median	75th	25th	Median	75th	25th	Median	75th	25th	Median	75th
Organizational Develo	pment											
Organizational best practices index	17.0	24.0	28.4	17.0	24.0	29.0	21.0	22.0	25.5	17.0	24.0	28.4
Employee health and safety severity rate	7.0	37.8	126.9	3.4	35.5	115.4	7.7	18.9	157.0	9.6	43.6	126.9
Training hours per employee	12.0	21.9	33.2	12.1	20.1	32.5	28.3	32.0	34.3	11.8	22.7	32.6
Customer accounts per employee (water)	322	467	629	260	386	592	na*	na	na	346	469	648
Customer accounts per employee (wastewater)	328	532	749	na	na	na	260	626	807	339	514	745
Water delivered per employee (MGD)	0.18	0.25	0.39	0.19	0.28	0.46	na	na	na	0.18	0.24	0.36
Wastewater processed per employee (MGD)	0.14	0.22	0.35	na	na	na	0.21	0.31	0.47	0.14	0.20	0.33
Customer Relations												
Customer service complaints per 1,000 customers	0.7	5.7	27.3	1.0	5.9	24.3	0.3	1.7	20.5	0.7	5.4	32.7
Technical quality complaints per 1,000 customers	2.8	7.2	17.4	2.8	6.1	18.5	0.7	2.7	12.3	2.9	7.6	16.7

Table continued next page

TABLE 6–1 Performance Indicators Summary by Utility Service Type (All, Water Only, Wastewater Only, Combined) 25th Percentile, Median, 75th Percentile *(continued)*

		-	-						-	-		
	All	Participa	nts		Water Onl	y	Was	tewater (Only	Com	bined Ser	vices
	25th	Median	75th	25th	Median	75th	25th	Median	75th	25th	Median	75th
Disruptions of water serv	vice rate											
Planned (<4 hours)	0.42	1.89	11.36	0.45	2.40	10.59	na	na	na	0.42	1.28	11.21
Planned (4–12 hours)	0.17	0.56	1.58	0.19	0.74	1.56	na	na	na	0.17	0.50	1.58
Planned (>12 hours)	0.0	0.02	0.23	0.00	0.02	0.25	na	na	na	0.00	0.02	0.18
Unplanned (<4 hours)	0.70	2.25	10.79	0.56	1.94	10.59	na	na	na	0.82	2.35	10.35
Unplanned (4–12 hours)	0.14	0.58	1.80	0.14	0.35	2.08	na	na	na	0.15	0.67	1.67
Unplanned (>12 hours)	0.0	0.04	0.15	0.00	0.04	0.12	na	na	na	0.00	0.03	0.15
Residential cost of water	and/or se	wer service	2									
Monthly residential water (7,500 gal/mo)	\$17.36	\$21.90	\$27.35	\$17.41	\$22.23	\$28.34	na	na	na	\$17.59	\$21.55	\$26.56
Average residential monthly water bill	\$16.10	\$21.52	\$28.65	\$17.75	\$23.63	\$32.90	na	na	na	\$15.47	\$21.07	\$26.67
Monthly residential sewer (7,500 gal/mo)	\$18.11	\$25.73	\$32.72	na	na	na	\$15.15	\$19.76	\$28.26	\$18.76	\$26.80	\$32.97
Average residential monthly wastewater bill	\$16.13	\$22.00	\$29.25	na	na	na	\$13.24	\$17.85	\$29.09	\$17.19	\$23.09	\$29.08
Multiservice, monthly combined bill (7,500 gal/mo)	\$36.39	\$42.68	\$56.29	na	na	na	na	na	na	\$36.96	\$42.68	\$59.89

181

TABLE 6–1 Performance Indicators Summary by Utility Service Type (All, Water Only, Wastewater Only, Combined) 25th Percentile, Median, 75th Percentile (continued)

	All	Participa	nts		Water Onl	y	Was	tewater (Only	Com	bined Ser	vices
	25th	Median	75th	25th	Median	75th	25th	Median	75th	25th	Median	75th
Multiservice, average residential combined monthly bill	\$32.31	\$43.26	\$56.95	\$30.94	\$44.17	\$75.00	na	na	na	\$33.33	\$42.35	\$55.60
Customer service cost per account	\$23.05	\$35.22	\$49.90	\$22.98	\$34.75	\$49.61	\$7.95	\$13.85	\$20.94	\$26.15	\$37.11	\$50.54
Billing accuracy	5.3	12.1	48.3	7.2	19.4	73.0	2.4	7.3	41.9	4.6	10.3	41.2
Business Operations								l				
Debt ratio	0.21	0.36	0.49	0.21	0.39	0.53	0.13	0.31	0.40	0.23	0.36	0.46
System renewal/replace	ment rate							I.				
Water pipeline	1.4%	3.8%	12.2%	1.6%	4.8%	16.9%	na	na	na	1.3%	3.2%	10.4%
Water treatment facility and pipeline	1.4%	4.9%	15.8%	1.8%	6.5%	23.0%	na	na	na	1.3%	4.8%	10.9%
Wastewater pipelines and collections	0.9%	2.5%	10.8%	na	na	na	2.2%	2.6%	4.9%	0.6%	2.4%	10.9%
Wastewater treatment facility and pumping	1.4%	5.0%	19.0%	na	na	na	2.0%	6.1%	16.5%	1.4%	4.7%	19.4%
Return on assets	0.8%	2.2%	3.8%	0.7%	2.2%	3.5%	0.3%	2.2%	3.7%	0.9%	2.2%	4.2%
Water Operations								l.				
Drinking water compliance rate	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	na	na	na	100.0%	100.0%	100.0%
Distribution system water loss	5.7%	9.1%	13.4%	5.2%	8.4%	12.6%	na	na	na	5.8%	9.5%	14.0%
Water distribution system integrity	22.9%	43.6%	78.7%	16.2%	36.7%	60.0%	na	na	na	24.1%	50.8%	112.3%



TABLE 6–1 Performance Indicators Summary by Utility Service Type (All, Water Only, Wastewater Only, Combined) 25th Percentile, Median, 75th Percentile *(continued)*

	Al	l Participa	ants		Water On	ly	Was	tewater (Only	Com	bined Sei	vices
	25th	Median	75th	25th	Median	75th	25th	Median	75th	25th	Median	75th
Operations and mainten	ance cost	ratios										
O&M cost per account	\$173	\$272	\$422	\$212	\$290	\$517	na	na	na	\$162	\$256	\$383
O&M cost per million gallons processed	\$860	\$1,399	\$2,053	\$849	\$1,428	\$2,081	na	na	na	\$884	\$1,388	\$2,025
Direct cost of treatment per million gallons	\$238	\$385	\$713	\$174	\$336	\$447	na	na	na	\$275	\$466	\$826
Planned maintenance ra	tios	1	1		1	u.		•			1	•
Ratio (hours)	34.4%	55.3%	76.8%	42.9%	64.3%	83.4%	na	na	na	33.3%	51.6%	75.0%
Ratio (cost)	32.4%	56.0%	75.0%	43.6%	60.0%	79.6%	na	na	na	28.7%	54.3%	74.7%
Wastewater Operation	ns	-			-	1			•			
Sewer overflow rate	1.8%	4.3%	9.5%	na	na	na	3.36%	7.61%	12.45%	1.75%	4.00%	9.25%
Collection system integrity	3.6%	9.4%	26.1%	na	na	na	4.3%	7.6%	10.0%	3.5%	11.1%	30.5%
Wastewater treatment effectiveness rate	98.1%	99.5%	99.7%	na	na	na	98.0%	99.0%	99.8%	98.1%	99.5%	99.7%
Operations and mainten	ance cost	ratios	1		1	u.		•			1	•
O&M cost per account	\$168	\$272	\$378	na	na	na	\$162	\$186	\$299	\$168	\$274	\$415
O&M cost per million gallons processed	\$930	\$1,719	\$2,621	na	na	na	\$706	\$1,053	\$1,523	\$1,119	\$1,887	\$2,781

TABLE 6–1 Performance Indicators Summary by Utility Service Type (All, Water Only, Wastewater Only, Combined) 25th Percentile, Median, 75th Percentile (continued)

	Al	l Participa	ants		Water Onl	Y	Was	tewater (Only	Com	bined Ser	vices
	25th	Median	75th	25th	Median	75th	25th	Median	75th	25th	Median	75th
Direct cost of treatment per million gallons	\$508	\$759	\$1,513	na	na	na	\$501	\$715	\$783	\$511	\$893	\$1,689
Planned maintenance	ratios											
Ratio (hours)	39.3%	60.3%	75.7%	na	na	na	46.7%	61.8%	73.5%	39.3%	58.1%	75.8%
Ratio (cost)	36.0%	58.0%	80.4%	na	na	na	43.7%	57.6%	73.5%	36.0%	58.1%	81.2%

^{*}na = not available.

TABLE 6–2 Performance Indicators Summary by Utility Region (US Region—Northeast, South, Midwest, West) 25th Percentile, Median, 75th Percentile

		Northeas	t		Midwest			South			West	
	25th	Median	75th	25th	Median	75th	25th	Median	75th	25th	Median	75th
Organizational Devel	opment											
Organizational best practices index	16.5	23.5	26.8	16.5	21.0	26.0	18.1	24.0	27.3	21.0	24.0	29.6
Employee health and safety severity rate	28.3	37.8	204.6	6.0	18.9	109.9	3.5	26.5	88.9	9.9	54.5	126.9
Training hours per employee	14.0	18.9	44.8	8.4	13.5	23.2	11.7	22.6	32.8	16.9	26.9	37.4
Customer accounts per employee (water)	376	519	629	343	429	593	355	476	707	292	385	595
Customer accounts per employee (wastewater)	235	375	400	349	640	714	296	465	749	350	592	824
Water delivered per employee (MGD)	0.17	0.20	0.27	0.19	0.24	0.34	0.16	0.23	0.36	0.20	0.29	0.50
Wastewater processed per employee (MGD)	0.14	0.16	0.18	0.19	0.26	0.40	0.13	0.22	0.32	0.16	0.23	0.38
Customer Relations		1						•			•	
Customer service complaints per 1,000 customers	3.9	10.5	24.3	1.3	5.4	43.6	0.5	7.0	43.7	0.6	4.0	17.7
Technical quality complaints per 1,000 customers	3.4	6.2	15.9	1.1	3.9	10.5	3.0	9.8	35.9	2.8	7.6	14.2

TABLE 6–2 Performance Indicators Summary by Utility Region (US Region—Northeast, South, Midwest, West) 25th Percentile, Median, 75th Percentile *(continued)*

		Northeas	t		Midwest			South			West	
	25th	Median	75th	25th	Median	75th	25th	Median	75th	25th	Median	75th
Disruptions of water s	ervice rate	e										
Planned (< 4 hours)	0.51	1.21	15.25	0.56	4.88	12.96	0.30	0.90	4.83	0.45	2.75	12.07
Planned (4–12 hours)	0.56	0.94	1.62	0.17	0.76	1.49	0.11	0.37	0.85	0.26	0.87	3.86
Planned (>12 hours)	0.00	0.02	0.19	0.03	0.17	1.19	0.00	0.00	0.01	0.00	0.05	0.34
Unplanned (<4 hours)	0.94	1.46	10.99	0.81	1.98	6.86	0.72	3.08	14.87	0.56	1.90	6.85
Unplanned (4–12 hours)	0.28	0.84	3.00	0.32	0.79	1.80	0.12	0.37	0.93	0.12	0.67	2.08
Unplanned (>12 hours)	0.03	0.10	0.39	0.02	0.03	0.15	0.00	0.04	0.06	0.00	0.03	0.20
Residential cost of water	er and/or s	sewer serv	ice									
Monthly residential water (7,500 gal/ mo)	\$20.86	\$27.79	\$30.01	\$14.66	\$19.04	\$23.88	\$16.55	\$20.70	\$25.55	\$17.60	\$22.06	\$27.32
Average residential monthly water bill	\$17.31	\$22.35	\$30.59	\$14.63	\$17.65	\$20.92	\$14.69	\$20.00	\$22.80	\$22.46	\$29.30	\$36.36
Monthly residential sewer (7,500 gal/mo)	\$33.24	\$42.47	\$43.03	\$14.28	\$20.33	\$30.77	\$21.04	\$27.39	\$33.46	\$17.36	\$20.96	\$29.52
Average residential monthly wastewater bill	\$19.51	\$30.85	\$35.22	\$12.34	\$18.49	\$24.27	\$17.67	\$24.30	\$29.25	\$16.59	\$21.08	\$28.68

TABLE 6–2 Performance Indicators Summary by Utility Region (US Region—Northeast, South, Midwest, West) 25th Percentile, Median, 75th Percentile *(continued)*

		Northeas	t		Midwest			South			West	
	25th	Median	75th	25th	Median	75th	25th	Median	75th	25th	Median	75th
Multiservice, monthly combined bill (7,500 gal/mo)	na*	na	na	na	na	na	\$40.64	\$43.84	\$60.07	\$24.77	\$31.27	\$46.09
Multiservice, average residential combined monthly bill	na	na	na	na	na	na	\$34.20	\$41.33	\$52.42	\$36.41	\$53.10	\$75.96
Customer service cost per account	\$22.92	\$30.99	\$47.16	\$18.80	\$32.65	\$45.68	\$28.99	\$38.23	\$50.91	\$22.72	\$35.87	\$51.53
Billing accuracy	6.1	12.3	89.6	7.6	28.5	41.2	7.2	15.7	38.5	2.7	9.3	48.5
Business Operations					l						1	
Debt ratio	0.25	0.43	0.56	0.15	0.26	0.43	0.28	0.41	0.49	0.20	0.32	0.41
System renewal/repla	cement ra	te										
Water pipeline	1.8%	3.8%	13.3%	0.9%	1.9%	7.2%	2.2%	5.0%	12.8%	0.9%	3.9%	12.7%
Water treatment facility and pipeline	1.2%	2.2%	10.9%	0.9%	1.8%	8.9%	2.7%	7.3%	17.7%	1.8%	5.0%	17.2%
Wastewater pipelines and collections	na	na	na	0.4%	3.0%	11.4%	1.5%	3.8%	13.4%	0.6%	2.1%	7.7%
Wastewater treatment facility and pumping	1.5%	3.1%	18.0%	0.9%	3.7%	19.1%	3.8%	9.4%	23.0%	1.4%	3.1%	11.8%
Return on assets	1.4%	2.1%	2.9%	0.4%	1.7%	3.5%	0.6%	2.2%	3.7%	1.0%	2.6%	4.2%

TABLE 6–2 Performance Indicators Summary by Utility Region (US Region—Northeast, South, Midwest, West) 25th Percentile, Median, 75th Percentile *(continued)*

		Northeas	t		Midwest			South			West		
	25th	Median	75th	25th	Median	75th	25th	Median	75th	25th	Median	75th	
Water Operations													
Drinking water compliance rate	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	
Distribution system water loss	7.3%	11.0%	14.1%	8.3%	12.6%	13.9%	5.6%	8.3%	14.2%	4.1%	6.2%	11.5%	
Water distribution system integrity	13.0	29.2	68.9	33.2	47.3	66.9	32.9	63.6	137.7	16.9	36.4	59.6	
Operations and maintenance cost ratios													
O&M cost per account	\$198	\$240	\$308	\$158	\$257	\$308	\$163	\$220	\$323	\$244	\$387	\$621	
O&M cost per million gallons processed	\$1,126	\$1,559	\$2,110	\$692	\$1,102	\$1,537	\$869	\$1,417	\$2,023	\$860	\$1,441	\$2,239	
Direct cost of treatment per million gallons	\$242	\$317	\$458	\$244	\$377	\$647	\$363	\$518	\$794	\$85	\$310	\$517	
Planned maintenance	ratios								•				
Ratio (hours)	46.0%	63.6%	76.1%	42.5%	72.7%	80.0%	29.3%	48.0%	65.0%	37.9%	57.6%	79.2%	
Ratio (cost)	42.2%	65.3%	78.5%	44.6%	63.4%	79.4%	25.0%	43.4%	65.1%	43.6%	63.5%	80.0%	
Wastewater Operation	ons												
Sewer overflow rate	4.43	7.61	17.48	1.00	2.76	9.41	2.45	5.66	10.52	1.44	2.74	6.46	
Collection system integrity	4.4	4.4	7.6	4.0	8.2	33.0	7.3	20.0	54.3	1.7	5.6	12.0	

TABLE 6–2 Performance Indicators Summary by Utility Region (US Region—Northeast, South, Midwest, West) 25th Percentile, Median, 75th Percentile *(continued)*

		Northeas	t		Midwest			South			West	
	25th	Median	75th	25th	Median	75th	25th	Median	75th	25th	Median	75th
Wastewater treatment effectiveness rate	96.7%	98.4%	98.9%	99.0%	99.7%	99.8%	98.4%	99.5%	99.7%	97.9%	99.5%	100.0%
Operations and maint	enance co	ost ratios										
O&M cost per account	\$165	\$282	\$303	\$159	\$266	\$426	\$168	\$267	\$350	\$168	\$239	\$486
O&M cost per million gallons processed	\$692	\$1,588	\$2,554	\$1,165	\$1,824	\$2,384	\$853	\$1,200	\$1,672	\$1,051	\$2,095	\$3,668
Direct cost of treatment per million gallons	\$732	\$754	\$1,324	\$430	\$546	\$697	\$540	\$838	\$1,478	\$627	\$1,014	\$1,942
Planned maintenance	ratios											
Ratio (hours)	na	na	na	26.5%	64.2%	75.0%	36.6%	52.8%	70.1%	48.3%	63.7%	80.6%
Ratio (cost)	na	na	na	32.9%	55.7%	77.5%	36.0%	55.9%	81.2%	47.2%	66.6%	77.7%

^{*}na = not available.

TABLE 6–3 Performance Indicators Summary by Utility Size (Utility Size—Population Served) 25th Percentile, Median, 75th Percentile

		<10,000		10),000–50,	000	50	,001–100,	000	100),001–500	,000		>500,000)
	25th	Median	75th	25th	Median	75th	25th	Median	75th	25th	Median	75th	25th	Median	75th
Organizationa	l Devel	opment													
Organizational best practices index	11.4	14.4	28.8	12.1	20.0	29.6	19.8	30.2	41.4	11.7	24.7	36.9	13.0	22.9	29.6
Employee health and safety severity rate	na*	na	na	2.5	13.1	102.4	2.9	21.6	560.0	8.4	36.0	111.3	26.5	55.1	129.4
Training hours per employee	11.4	14.4	28.8	12.1	20.0	29.6	19.8	30.2	41.4	11.7	24.7	36.9	13.1	22.9	29.6
Customer accounts per employee (water)	212	395	707	312	404	571	384	485	609	351	498	677	311	408	580
Customer accounts per employee (wastewater)	263	374	465	248	407	730	354	445	854	356	567	797	463	592	719
Water delivered per employee (MGD)	0.07	0.19	0.25	0.14	0.19	0.31	0.18	0.23	0.36	0.20	0.28	0.51	0.24	0.30	0.46
Wastewater processed per employee (MGD)	0.04	0.09	0.16	0.09	0.15	0.28	0.18	0.22	0.41	0.18	0.24	0.4	0.18	0.27	0.36

TABLE 6–3 Performance Indicators Summary by Utility Size (Utility Size—Population Served) 25th Percentile, Median, 75th Percentile *(continued)*

		<10,000		10	,000–50,0	000	50	,001–100,	000	100	,001–500	,000		>500,000)
	25th	Median	75th	25th	Median	75th	25th	Median	75th	25th	Median	75th	25th	Median	75th
Customer Rela	tions														
Customer service complaints per 1,000 customers	1.1	4.2	6.6	0.8	5.7	19.3	1.6	8.4	30.4	0.5	4.5	50.9	1.2	9.6	40.5
Technical quality complaints per 1,000 customers	2.1	3.4	10.8	2.8	6.7	14.5	3.1	6.9	10.9	2.3	8.6	38.1	3.9	9.1	24.0
Disruptions of w	ater ser	vice rate													
Planned (<4 hours)	1.00	3.04	6.16	0.71	2.07	13.48	0.41	3.00	10.83	0.25	1.41	11.80	0.31	1.34	7.65
Planned (4–12 hours)	0.59	2.22	4.35	0.26	0.72	1.33	0.19	0.48	2.72	0.09	0.40	1.32	0.23	0.92	1.58
Planned (>12 hours)	na	na	na	0.00	0.05	0.23	0.00	0.00	0.21	0.00	0.03	0.21	0.00	0.01	0.09
Unplanned (<4 hours)	3.74	9.87	17.08	0.63	1.78	14.32	1.03	2.25	3.73	0.74	2.73	8.41	0.62	1.11	9.78
Unplanned (4–12 hours)	na	na	na	0.2	0.8	1.8	0.1	0.4	0.9	0.2	0.7	1.2	0.4	1.2	1.8
Unplanned (>12 hours)	na	na	na	0.00	0.07	0.17	0.00	0.02	0.10	0.01	0.03	0.07	0.02	0.07	0.23

TABLE 6–3 Performance Indicators Summary by Utility Size (Utility Size—Population Served) 25th Percentile, Median, 75th Percentile (continued)

		<10,000		10	,000–50,0	000	50	,001–100,	.000	100	,001–500	,000		>500,000)
	25th	Median	75th	25th	Median	75th	25th	Median	75th	25th	Median	75th	25th	Median	75th
Residential cos	t of wate	er and/or	sewer se	rvice											
Monthly residential water (7,500 gal/mo)	\$26.75	\$28.94	\$36.01	\$17.81	\$23.36	\$30.05	\$19.52	\$21.39	\$25.96	\$17.64	\$20.54	\$25.74	\$13.82	\$19.30	\$22.84
Average residential monthly water bill	\$20.13	\$28.82	\$35.20	\$16.08	\$21.07	\$32.22	\$14.92	\$19.98	\$27.35	\$18.49	\$22.52	\$26.51	\$14.47	\$20.01	\$24.62
Monthly residential sewer (7,500 gal/mo)	\$25.13	\$33.55	\$42.50	\$21.53	\$31.25	\$41.25	\$22.76	\$27.00	\$29.05	\$17.67	\$20.70	\$28.25	\$15.13	\$24.70	\$33.00
Average residential monthly wastewater bill	\$20.12	\$30.85	\$35.00	\$18.52	\$24.26	\$32.17	\$19.18	\$24.50	\$27.53	\$16.15	\$18.78	\$26.92	\$13.62	\$19.97	\$28.90
Multiservice, monthly combined bill (7,500 gal/mo)	na	na	na	\$47.43	\$69.64	\$80.33	na	na	na	\$32.21	\$36.39	\$42.61	\$37.66	\$40.99	\$53.54
Multiservice, average residential combined monthly bill	na	na	na	\$30.22	\$57.40	\$67.19	na	na	na	\$30.68	\$34.32	\$49.16	\$34.28	\$40.12	\$49.59

	<10,000			10,000–50,000			50,001–100,000			100,001–500,000			>500,000		
	25th	Median	75th	25th	Median	75th	25th	Median	75th	25th	Median	75th	25th	Median	75th
Customer service cost per account	\$29.79	\$44.93	\$51.24	\$21.85	\$32.77	\$48.84	\$28.71	\$37.11	\$61.36	\$22.97	\$34.73	\$49.94	\$21.78	\$34.72	\$47.78
Billing accuracy	5.6	9.1	17.6	3.3	7.7	73.8	5.7	13.8	36.8	7.2	10.6	46.1	8.6	30.0	67.8
Business Oper	Business Operations														
Debt ratio	0.14	0.39	0.47	0.25	0.35	0.49	0.17	0.28	0.40	0.21	0.38	0.48	0.29	0.40	0.55
System renewa	System renewal/replacement rate														
Water pipeline	1.3%	1.9%	11.80%	1.7%	3.3%	6.10%	0.7%	2.8%	4.40%	1.4%	4.8%	20.80%	3.7%	7.2%	13.20%
Water treatment facility and pipeline	1.1%	1.4%	2.70%	0.9%	2.6%	7.00%	2.3%	6.3%	15.40%	1.4%	6.8%	20.10%	2.3%	11.7%	23.70%
Wastewater pipelines and collections	2.5%	9.7%	19.90%	1.0%	2.0%	4.40%	0.5%	1.4%	3.50%	1.1%	2.4%	10.20%	4.1%	7.3%	13.40%
Wastewater treatment facility and pumping	1.7%	4.2%	24.10%	0.6%	2.1%	10.80%	3.0%	5.7%	19.10%	1.5%	4.4%	15.00%	4.5%	10.5%	19.50%
Return on assets	1.3%	2.7%	7.60%	0.7%	2.2%	4.20%	1.1%	2.6%	5.70%	0.9%	2.2%	3.70%	0.4%	2.2%	2.70%
Water Operation	Water Operations														
Drinking water compliance rate	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

193

TABLE 6–3 Performance Indicators Summary by Utility Size (Utility Size—Population Served) 25th Percentile, Median, 75th Percentile (continued)

	<10,000			10,000–50,000			50,001–100,000			100,001–500,000			>500,000		
	25th	Median	75th	25th	Median	75th	25th	Median	75th	25th	Median	75th	25th	Median	75th
Distribution system water loss	7.6%	13.7%	15.2%	7.6%	11.7%	14.6%	6.6%	9.6%	13.1%	4.1%	7.0%	11.2%	5.0%	7.6%	12.8%
Water distribution system integrity	13.7	21.4	39.5	10.9	35.4	98.6	30.2	37.8	57.3	27.7	52.1	94.2	33.8	70.5	135.3
Operations and	l mainte	nance co	ost ratios												
O&M cost per account	\$203	\$290	\$345	\$156	\$247	\$343	\$168	\$224	\$362	\$184	\$290	\$532	\$198	\$274	\$431
O&M cost per million gallons processed	\$1,376	\$2,488	\$2,828	\$812	\$1,324	\$2,072	\$883	\$1,531	\$2,088	\$862	\$1,308	\$1,989	\$840	\$1,239	\$1,635
Direct cost of treatment per million gallons	\$784	\$1,604	\$2,420	\$288	\$486	\$747	\$315	\$602	\$816	\$212	\$369	\$539	\$240	\$334	\$398
Planned maint	enance i	ratios	•								•				
Ratio (hours)	34.2%	59.1%	80.00%	40.0%	58.2%	76.50%	33.3%	43.1%	85.70%	37.2%	53.2%	75.00%	35.0%	53.5%	72.00%
Ratio (cost)	24.1%	48.1%	70.20%	26.4%	62.5%	75.00%	31.4%	55.4%	83.70%	36.8%	57.5%	74.90%	40.0%	48.5%	66.30%
Wastewater O	peratio	ns	ı					,			1				
Sewer overflow rate	na	na	na	2.47	7.29	15.04	1.68	2.26	8.96	1.36	3.50	7.35	1.71	5.47	9.67

TABLE 6–3 Performance Indicators Summary by Utility Size (Utility Size—Population Served) 25th Percentile, Median, 75th Percentile (continued)

		<10,000			10,000–50,000			50,001–100,000			100,001–500,000			>500,000		
	25th	Median	75th	25th	Median	75th	25th	Median	75th	25th	Median	75th	25th	Median	75th	
Collection system integrity	4.4	10.5	17.6	3.9	7.2	36.8	2.1	8.0	17.6	5.0	9.3	24.5	4.6	15.8	26.3	
Wastewater treatment effectiveness rate	na	na	na	98.9%	99.5%	99.7%	96.4%	99.5%	99.7%	98.1%	99.5%	99.7%	98.4%	99.2%	100%	
Operations and	Operations and maintenance cost ratios															
O&M cost per account	\$206	\$298	\$445	\$181	\$274	\$464	\$186	\$283	\$464	\$157	\$232	\$347	\$176	\$275	\$350	
O&M cost per million gallons processed	\$2,136	\$3,096	\$5,648	\$883	\$1,856	\$2,994	\$1,258	\$2,001	\$3,003	\$925	\$1,472	\$2,284	\$950	\$1,457	\$2,037	
Direct cost of treatment per million gallons	\$1,383	\$2,450	\$2,919	\$717	\$1,033	\$2,118	\$561	\$925	\$1,552	\$500	\$631	\$1,005	\$454	\$720	\$1,036	
Planned maint	enance i	atios			•									•		
Ratio (hours)	66.0%	67.6%	75.00%	38.3%	69.8%	77.80%	44.1%	57.7%	85.60%	48.3%	58.0%	78.00%	30.9%	52.8%	66.30%	
Ratio (cost)	34.5%	74.4%	75.00%	50.0%	74.9%	88.50%	25.0%	56.4%	76.50%	45.5%	58.0%	81.20%	30.7%	47.2%	60.00%	

^{*}na = not available.

BENCHMARKING

Performance Indicators for Water and Wastewater Utilities: Survey Data and Analyses Report



Performance Indicators Relational Analyses

Relationships between performance indicators can reveal important information that can be used when assessing utility performance. These relationships are useful when tracking the effect of changes in processes designed to improve efficiency.

It is important to recognize any possible adverse consequences when seeking to improve or change the value of a performance indicator. Some indicators reflect a level of service while others are related to productivity or efficiency. The relationships described here represent the most important possibilities. You may wish to insert your values into these charts to see where you are and track your performance following any process changes. You may also construct your own relationship charts by placing the appropriate values for the median, 25th, and 75th percentiles on the axes for the performance indicators you choose. Then you can put your results on the chart to see how your utility is performing.

Using the Performance Indicator Relationship Charts

Figures 7–1 and 7–2, two performance indicator relationship charts, are included to illustrate how to assess your performance for two indicators simultaneously and to track changes due to modified operational processes. The basic chart is a square with a level-of-service performance indicator plotted on the left and a productivity (or efficiency) indicator plotted on the bottom. The 25th, median, and 75th percentile values for each indicator are shown next to the appropriate grid tick (Note that these are not to scale.). The values should be in the order from



lower performance to higher performance (or poorer to better). To do this, the performance indicator value may need to be given from higher value to lower value. For each relationship the highest performers are in the upper right (pink) of the chart and the lowest performers are in the lower left (blue-green) area. The central (yellow) section represents the median range for both indicators (the majority of the utilities will fall in this area).

These charts are used to compare two performance indicators. It is possible to compare three or more indicators using other charting techniques (spider webs, for example). However, for most utilities it is more useful to limit this type of assessment to only two indicators. The example charts use the values obtained from an analysis of the data submitted from all participants. Utilities may want to construct charts that use values from similar size utilities or utilities that provide similar services (e.g., wastewater only). For these assessments, utilities should construct their own charts by substituting the appropriate values for the ones presented here.

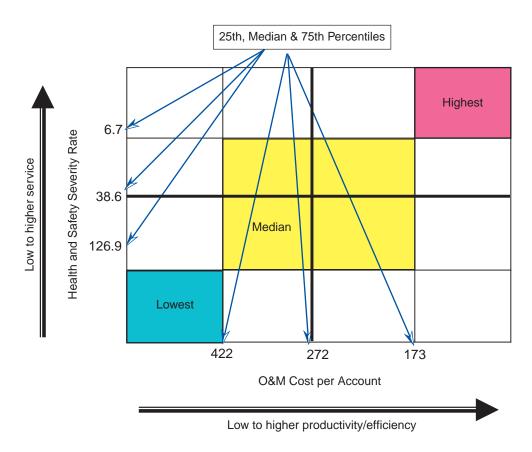


FIGURE 7–1 Relational Performance Indicator Comparison—Health and Safety Severity Rate Versus O&M Cost per Account

In Figure 7–1 the values listed next to the 25th and 75th percentile grid lines for the Health and Safety Severity Rate axis are in reverse order. A higher level of service (better value) is indicated by a lower value for the indicator. Therefore, it is necessary to list the values from high to low rather than low to high. The values for the Operations and Maintenance (O&M) Cost per Account (Water) indicator are also listed from high to low, because a lower value is considered desirable (Some utilities may interpret this indicator so that the opposite is true. In that case, the values can be reversed.)

The point of this relationship is that it may be easy to reduce the O&M Cost per Account. But it is important to maintain or even reduce the Health and Safety Severity Rate at the same time. A reduction in cost may result in the need to reduce training or education, and this could affect the Health and Safety Severity Rate. The very highest performing utilities have learned how to reduce both indicators at the same time.

The next step in using the relationship chart is to plot your data. You can use the following three examples:

	Health and Safety Severity Rate	O&M Cost/Account
Utility A	2.4	92
Utility B	99.2	283
Utility C	29.7	432

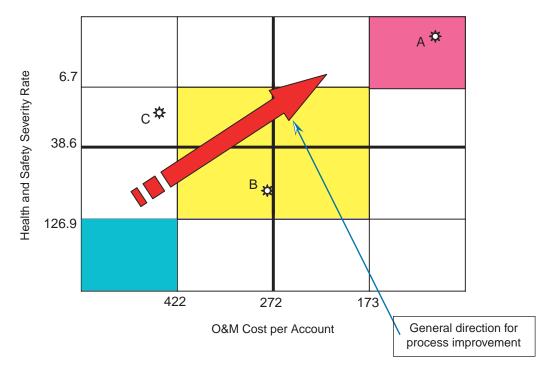


FIGURE 7–2 Relational Performance Indicator Comparison—Health and Safety Severity Rate Versus O&M Cost per Account

Figure 7–2 shows that Utility A is a very high performer; it may be a utility that should be used as a process benchmark for these indicators. Utility B is located in the median, yellow, range for both indicators. Utility C has its O&M Cost per Account outside the 25th percentile for this indicator, but the value for the Health and Safety Severity Rate is above the median. For both Utilities B and C, process changes that move their value toward the pink area are desirable. Neither utility, however, is in the blue-green area where they may want to consider major changes in these programs.

Performance Indicator Relationship Charts

The following figures illustrate relationships that may be useful when evaluating utility performance for various performance indicators. As described earlier, each chart includes the 25th, median, and 75th percentile boundaries from an analysis of the data provided by all participating utilities.

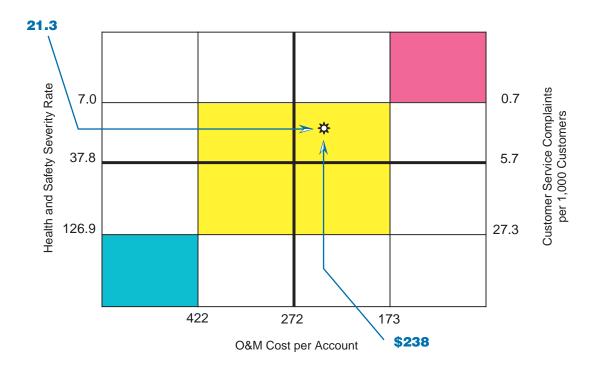


FIGURE 7–3 Water and Combined Services Utilities Comparison—Health and Safety Severity Rate or Customer Service Complaints per 1,000 Customers Versus Water Operations O&M Cost per Account

Values from a combined utility are shown in Figure 7–3. This utility had a Health and Safety Severity Rate of 21.3 and an O&M Cost per Account of \$238. Notice how these values are plotted on the chart—each indicator is plotted from high to low on the axes. The result is within the median range for both indicators and above the median value for both indicators. This indicates that this utility is in good position with regard to these indicators and is performing well. It is possible to further reduce the O&M Cost per Account without increasing the Health and Safety Severity Rate.

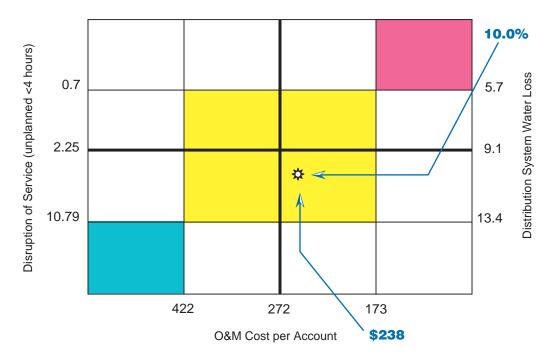


FIGURE 7–4 Water and Combined Services Utilities Comparison—Disruptions of Service (unplanned <4 hours) or Distribution System Water Loss Versus O&M Cost per Account

Figure 7–4 shows the indicator values for a utility that has a Distribution System Water Loss of 10.0% and an O&M Cost per Account of \$238. Again, the position of the relationship is within the median range for both indicators. Reducing the O&M Cost per Account will move the value toward the area of best performance (pink) as long as the Distribution System Water Loss is not increased.

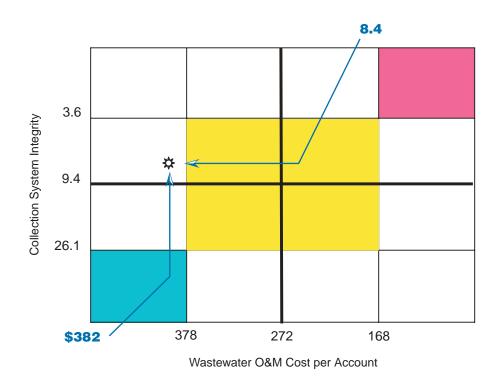


FIGURE 7–5 Wastewater and Combined Services Utilities Comparison—Collection System Integrity Versus Wastewater O&M Cost per Account

The values for Collection System Integrity and Wastewater O&M Cost per Account are shown in Figure 7–5. The result is outside the median range for the cost indicator. This utility may make improvements by reducing the value of this indicator, but the utility must maintain or reduce the Collection System Integrity value as well.



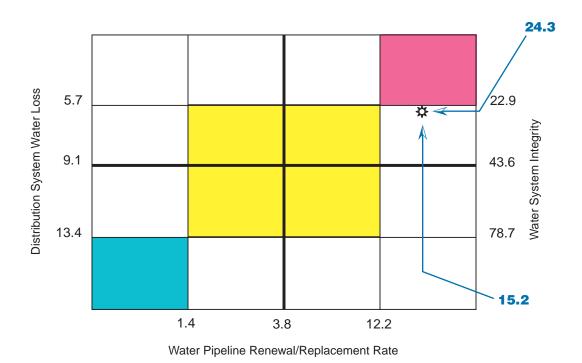


FIGURE 7–6 Water and Combined Services Utilities Comparison—Distribution System Water Loss or Water System Integrity Versus Water Pipeline Renewal/Replacement Rate

The indicator values for Water System Integrity and Water Pipeline Renewal/Replacement Rate are shown in Figure 7–6 for a combined utility. The example is very near the area (pink) where the very best performers are located. This utility is performing very well for these indicators. Further improvement may be difficult.

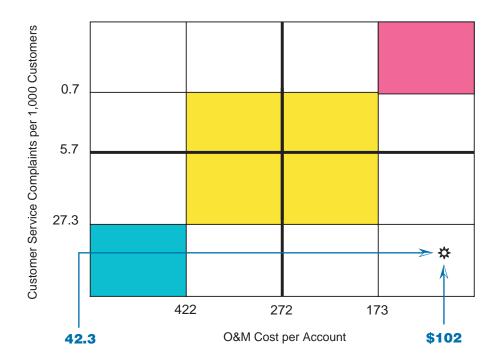


FIGURE 7–7 Water and Combined Services Utilities Comparison—Customer Service Complaints per 1,000 Customers Versus O&M Cost per Account

The values for indicators for O&M Cost per Account and Customer Service Complaints per 1,000 Customers indicators are shown in Figure 7–7. In this example, the O&M Cost per Account is very low. However, this may be affecting the number of customer service complaints. The utility may want to investigate if the level of maintenance is affecting customer complaints. It may be necessary to increase this indicator to reduce the complaint value.



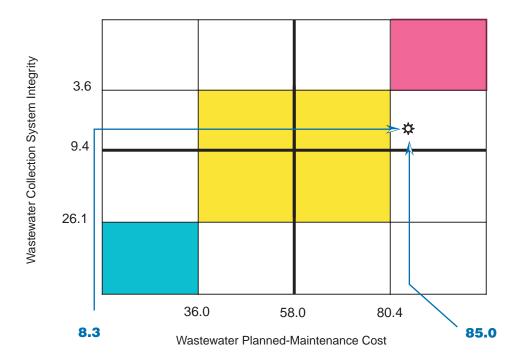


FIGURE 7–8 Wastewater and Combined Services Utilities Comparison—Wastewater Collection System Integrity Versus Wastewater Planned Maintenance Cost

This chart showing Wastewater Planned Maintenance Cost Ratio (Figure 7–8) can be interpreted in two ways. A higher value may be desirable for some utilities if the value indicates that a higher percentage of costs are being spent on planned activities. Other utilities may view this as undesirable because they are seeking to reduce all costs. Figure 7–8 indicates a Wastewater Collection System Integrity value of 8.3 and a Planned Maintenance Cost Ratio of 85%. The result of this relationship shows that this utility is a high performer. Decreasing the System Integrity value while keeping the Cost Ratio constant will move the result to the area of highest performing utilities.



A

Appendix A List of Performance Indicators

With Definitions and Calculations

Descriptions and calculations of each performance indicator are included in this summary. Each indicator is presented in the following format:

Title: Gives the name of the indicator. Some titles may need to be reconsidered as evaluations are completed.

Purpose: Describes the intent of the performance indicator.

Discussion: Gives a basic description of each indicator.

Mathematical Expression and Measurement Tips: Shows how the indicator is calculated and adds comments where needed to clarify potential ambiguities.

Data Needed to Support the Calculation: Describes the specific information that a utility will need to provide in order for the indicator to be calculated.



Definitions: Describes each key word or term where common understandings are essential to providing comparable data. Within each definition, certain words may be *italicized*, indicating that they too have a specific definition of secondary importance.

Applicability: Describes the utility settings where the indicator is likely to apply.

Additional Guidance: Offers guidance, where needed, for those preparing the data collection survey.

QualServe Business System: See Figure 1–1 in the Introduction for a depiction of the QualServe business systems and the business process categories. The QualServe business systems are the five major areas of focus for a combined water and wastewater utility, as represented by each box. The business process categories are the subcategories of each business system. There are 26 business process categories in the QualServe business model. Each recommended performance indicator is fitted into that model.

QualServe Business Process Category: See *QualServe Business System* above. Each recommended indicator is fitted into the appropriate QualServe business process category or categories.

Utility Business Architecture Category: Shows how the recommended indicator is classified in the utility business architecture (UBA) described first by EMA Services, Inc., in *The Utility Business Architecture: Designing for Change*, an Awwa Research Foundation project completed in 1997. The UBA is built around the core and support processes a water or wastewater utility implements to deliver complete service to customers.

Balanced Scorecard Measure Type: Describes how the recommended indicator would fit into the four generic categories of measures comprising the basic Kaplan and Norton balanced scorecard.

GASB Indicator Type: Shows how each indicator would fit within the Governmental Accounting Standards Board (GASB) performance measurement framework. Because performance indicators are performance measures used for external comparisons, the usage has been extended.

Organizational Best Practices Index

Purpose:

To summarize a utility's implementation of management programs important to water and wastewater utilities.

Discussion:

This indicator summarizes the status of implementation of good management practices at a utility. It is particularly useful for identifying potential benchmarking partners, especially organizations that may have advanced knowledge and experience with applying these tools. Correlations with other indicators might show that performance in other areas is related to investments in improved management practices.

Utilities will use a self-scoring system, identical to that used for the QualServe self-assessment program, to identify the degree to which each of seven important practices are being implemented by utility staff. Scores will be available individually for each of the seven areas, plus the aggregate, or index score.

The practices included in the index are as follows:

1. Strategic Planning

Good strategic planning practice will include

- Vision, mission, and organizational values statements;
- Consideration of the internal and external factors that will or may impact the utility;
- An assessment of the utility's strengths and opportunities for improvement for the next 3 to 10 years;
- Analysis and selection of strategies in the areas of water and wastewater system management, customer service, finance, human resources management, and business process improvement;
- Short- and long-term action plans, including allocation of resources directed at achieving the goals and strategies the utility has adopted; and
- A process for strategic plan development and annual review/updates that facilitate input from customers, employees, and other *stakeholders*.

2. Long-Term Financial Planning

This planning process looks 5 to 25 years into the future and matches resources to achievement of strategic goals such as

- Funding of operations and maintenance costs,
- Funding of the capital improvement plan, taking into account the effects of capital improvements on operations and maintenance costs,
- Funding of the optimized asset management plan for all asset classes, and
- Development of rate alternatives and recommended projected rates over the life of the plan.



3. Risk Management Planning

This planning process is used for identifying the potential risks to the utility within the context of its strategic plan and for developing plans to mitigate physical and financial loss. Examples of planning elements are

- Disaster readiness planning;
- *Security program* for resources, facilities, and service delivery systems;
- *Health and safety programs* for employees and the general public;
- Public liability exposure;
- Emergency operating planning;
- Hazardous material contingency planning; and
- Insurance procurement (or alternative self-insurance policies), including property and casualty insurance, health and worker's compensation insurance, and liability insurance.

4. Performance Measurement System

An effective performance measurement system will

- Be multidimensional, utilizing appropriate measures for internal and external stakeholders, supporting both routine work and special projects, and offering integrated measurement systems responsive to the needs of line *employees*, management, and executives;
- Have a process for establishing targets, usually in conjunction with the budgeting process, that reflect broad internal, external, financial, and improvement goals in strategic and operating plans;
- Provide measures focused on quality, efficiency, and effectiveness; and
- Include a routine monitoring and reporting process.

Tools such as the utility business process framework, the Kaplan and Norton balanced scorecard, and the Governmental Accounting Standards Board (GASB) performance measurement framework offer useful outlines for organizing a measurement system.

5. Optimized Asset Management Program

An asset management program ensures the best decisions at all levels of the asset's life cycle to optimize performance, reduce risk, and minimize cost. Effective asset management programs will include

- An inventory of infrastructure assets;
- A condition assessment for all asset classes;
- Replacement cycles for each asset class;
- Assessments of the financial impacts of both maintenance and replacement of assets;
- Life-cycle costing in support of major asset decisions;

- Integrated use of data from multiple sources, such as geographical information and maintenance management systems to support decisions; and
- Communications with elected officials, customers, and the general public.

6. Customer Involvement Program

This is a formal program for relating with customers in a way that assures they participate effectively in the utility management process. Examples of good practices include

- Offering *educational programs* and materials and assessing their effectiveness;
- Providing customers with a list of *subject matter experts* to answer their questions;
- Conducting customer satisfaction surveys and responding to what is learned;
- Soliciting input on projects and programs under consideration, in planning, or under construction;
- Identifying and confirming *customer priorities* both in terms of topic and breadth and degree of concern; and
- Resolving *customer issues* and complaints.

7. Continuous Improvement Program

An organizational continuous improvement program will help utility employees at all levels examine their practices with the goal of identifying and implementing improvements to service quality, effectiveness, and efficiency. A large number of systems and programs are available to water and wastewater utilities. Good practice would include examining the following and participating in the appropriate suite of systems that are aligned with utility goals:

- *ISO 9000* series;
- ISO 14001;
- Other environmental management systems;
- Work process documentation programs;
- Self-assessments, peer reviews, and benchmarking such as those offered through QualServe;
- National Biosolids Partnership;
- The *Partnership for Safe Water;* and
- The Malcolm Baldrige National Quality Award Program or similar state-run programs.

The recommended scoring system is as follows:

- This activity is fully implemented at our utility (5 points)
- This activity is largely implemented, but there is room for improvement (4 points)
- This activity is implemented, but there is room for substantial improvement (3 points)
- This activity is implemented, but only occasionally or without uniformity (2 points)
- This activity is not practiced at our utility (1 point)

With seven practices each scoring between 1 and 5, the aggregate score at each utility will range between 7 and 35.





Mathematical Expression and Measurement Tips:

Each of the seven components to this indicator will be assigned a level of conformance of between 1 and 5 by utility staff. The index will equal the sum of the seven component "scores."

This type of self-assessment is necessarily subjective. A single respondent will have only limited knowledge to make a selection. A team comprised of executive, managerial, and line employees can provide a deeper and broader collective view and is likely to offer a truer assessment, provided that good group processes are used to solicit and discuss information before seeking consensus on a response that all can support.

Data Needed to Support the Calculation:

Utility self-assigned levels of conformance to each of the seven index components.

Definitions:

As included in the discussion above.

Applicability:

This indicator is applicable to all water and wastewater utilities, regardless of customer base, size, or ownership. Practices are likely to be more formal and extensive in larger utilities.

Additional Guidance:

Utilities reporting high levels of conformance with the components of this indicator should anticipate inquiries from others looking for study partners.

Survey designers should consider asking for the source of information provided by the utility: cross-functional team, subject matter expert, or individual (identified by job title).

QualServe Business System: Organizational Development **QualServe Business Process Category:** Leadership and Organization

Leadership and Organization
Continuous Improvement

Customer Strategy and Satisfaction

Strategic Planning

Financial and Fiscal Management

Utility Business Architecture Category: Understand Markets and Customers

Develop Business Plans

Provide Legal Services and Risk

Management

Measure and Improve Performance

Balanced Scorecard Measure Type: Learning and Growth

Internal Process

GASB Indicator Type: Service Effort

Employee Health and Safety Severity Rate

Purpose:

To quantify the rate of employee days lost from work due to illness or injury.

Discussion:

The Occupational Safety and Health Administration (OSHA) has established accident and illness recording and reporting requirements that affect most organizations. Some states have been delegated authority from OSHA to operate their own, similar systems. The OSHA standard is recommended because it has broad applicability and most utilities are already recording the needed data.

The OSHA lost-days indicator measures the rate of days lost due to illness or injury per 100 employee-years of work. It was selected as a good indicator for water and wastewater utilities because it summarizes a very useful set of data that is readily available at most utilities.

Detailed information about all of the OSHA indicators is found at www.osha.gov. Forms and tools to assist with understanding the indicator, applicable definitions, and the record-keeping process are available on-line. That information is not repeated here.

Mathematical Expression and Measurement Tips:

Utilities should refer to OSHA Form 300A, *Summary of Work-Related Injuries and Illnesses*, for the appropriate reporting period to determine the total number of days away from work in the equation below.

employee health and safety severity rate =

200,000 (total days away from work) total hours worked by all employees

Where:

- 200,000 is the number of hours actually worked by 100 typical full-time employees in 1 year
- The severity rate is expressed in lost workdays per 100 employees per year

Data Needed to Support the Calculation:

- *Total workdays away from work* are obtained directly from OSHA Form 300A (or state counterpart) *Summary of Work-Related Injuries and Illnesses*.
- *Total hours worked by all employees* is the sum of hours actually worked by full-time, part-time, temporary, and seasonal employees of the utility.





Definitions:

Visit www.osha.gov for a complete explanation of this indicator, including applicable definitions.

Applicability:

This indicator is applicable to all water and wastewater utilities, regardless of customer base, size, or ownership. Utilities in Canada may need assistance with expanded guidance if their questions are not answered by a visit to the OSHA Web site.

Additional Guidance:

- The Bureau of Labor Statistics performs surveys of occupational injuries and illnesses by industry, employer size, etc., and publishes some data at www.bls.gov. Utilities may find this information of value for comparisons to other industries.
- Utilities will report total full-time equivalents for other indicators such as *Training Hours per Employee*. OSHA requirements are specific, including overtime hours and excluding nonwork hours due to vacations, holidays, sick leave, and other absences. When data is reported for this indicator, system managers should note that there is a difference.

QualServe Business System: Organizational Development

QualServe Business Process Category: Health and Safety Management

Utility Business Architecture Category: Manage and Develop Human Resources

Balanced Scorecard Measure Type: Internal Process

GASB Indicator Type: Service Accomplishment

Training Hours per Employee

Purpose:

To measure the quantity of formal training utility employees are actually completing. This indicator is expressed as the number of formal training hours per employee per year.

Discussion:

This measure is intended to reflect the organization's commitment to formal training as a means of improving employee knowledge and skills. It also does not address the effectiveness or efficiency of the training programs used by the utility.

Use of the indicator in comparative analysis will allow utilities to gauge whether their use of formal training is consistent with other utilities.

Mathematical Expression and Measurement Tips:

training hours per employee =

total qualified formal training hours for all employees total full-time equivalents worked by employees during the reported period

Data Needed to Support the Calculation:

- Sum of all qualified formal training hours completed by all employees
- The total number of full-time equivalents (FTEs) worked by employees

Definitions:

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- *Apprenticeship program* means a formal program designed to prepare an individual for journeyman status in any of several job categories.
- *Employees* are all full-time, part-time, temporary, and seasonal employees of the utility. Contractors are not included.
- *Formal training* meets at least one of the following descriptions:
 - A professionally developed program or session with a fixed agenda that is offered on or off site during compensated working hours of the employee
 - The classroom and study portions of a formal apprenticeship program completed during working hours
 - A compensated training or related educational program, including an apprenticeship program, completed by an employee during nonwork hours

For the purposes of this definition, training is not limited to events where continuing education credits are awarded. Formal training includes technical training, certification training, apprenticeship training, employee skills and development training, professional seminars, attendance at professional conferences, and college classes. It does not include onthe-job training (OJT).

- A *full-time equivalent (FTE)* is the allocation of employee time equal to 2,080 hours per year. Use of this term allows data to be normalized around a common measure. Parttime, temporary, and seasonal employees are converted to FTEs based on the total number of compensated hours. Employee time from contracts supporting utility operations and maintenance is applied in the same way.
- Qualified training hours include all hours spent at the event, from the opening session to the wrapup, including all breaks that are part of the agenda. Travel time to and from the event, trainer time, and time invested in planning and conducting the training is not included.
- *Total full-time equivalents* is the sum of all compensated hours worked by all employees during the reporting period, divided by 2,080 hours per full-time employee per year.

Applicability:

This indicator is applicable to all water and wastewater utilities, regardless of customer base, size, or ownership.

QualServe Business System:Organizational DevelopmentQualServe Business Process Category:Human Resources Management

Utility Business Architecture Category: Manage and Develop Human Resources

Balanced Scorecard Measure Type: Learning and Growth

GASB Indicator Type: Service Efforts

Customer Accounts per Employee (Water and Wastewater), MGD Water Delivered per Employee, and MGD Wastewater Processed per Employee

Purpose:

To measure employee efficiency.

Discussion:

These indicators measure employee efficiency. By expressing them in terms of both accounts and millions of gallons (MGD) per day of water delivered or wastewater processed, the effects of customer class are diminished.

The effects of contracts for operations and maintenance (O&M) can have significant effects if not captured. Utilities will need to account for O&M contract employees effectively.

At multiple-service utilities, care will need to be taken with apportioning employee time to water or wastewater service. Budgets will help with making these counts for line employees, and added care will be needed with apportioning support employee time. Once this has been done for the first survey, it will be relatively easy to review and update that information for future years. If a utility cannot provide good data separately, it should be allowed to provide a single set of data for both water and wastewater services.

Utilities that receive support from larger organizations will need to work with those managers to estimate employee time applied to utility work. This may be most complex in the city setting where centralized services for human resources, fleet management, purchasing, engineering, and the like are applied to both water and wastewater work. It will be necessary to capture these numbers separately for the two.

Mathematical Expression and Measurement Tips:

customer accounts per employee =

number of accounts number of full-time equivalents

MGD water delivered per employee =

average MGD delivered number of full-time equivalents

MGD wastewater processed per employee =

average MGD processed number of full-time equivalents

Each equation can be run separately for water and wastewater utility data where data provided will support that.

Data Needed to Support the Calculation:

- Number of active water accounts
- Number of active wastewater accounts
- Average daily volume of water distributed (in million gallons per day)
- Average daily volume of wastewater processed (in million gallons per day)
- Number of full-time equivalents (FTEs) supporting water service
- Number of FTEs supporting wastewater service

Definitions:

- Active customer account means all customer accounts that were billed for some or all of the reporting period. A single account may include service through more than one water or wastewater service connection.
- Average daily volumes distributed are calculated by dividing the total volume of water distributed or wastewater processed during the reporting period by 365. Distributed water is the total volume of water entering the distribution system from all sources, including treatment facilities, individual wells, and purchased water connections.
- A *full-time equivalent (FTE)* is the allocation of employee time equal to 2,080 hours per year. Use of this term allows data to be normalized around a common measure. Parttime, temporary, and seasonal employees are converted to FTEs based on the total number of compensated hours. Employee time from contracts supporting utility operations and maintenance is applied in the same way. Employee time from engineering and construction of new facilities is not counted in these indicators.

Applicability:

This indicator is applicable to all water and wastewater utilities, regardless of customer base, size, or ownership. Comparisons will be most valid among utilities of similar size and with similar numbers of customers in various customer classes.

QualServe Business System:Organizational DevelopmentQualServe Business Process Category:Human Resources Management

Utility Business Architecture Category: Develop and Manage Human Resources

Balanced Scorecard Measure Type: Internal Process

GASB Indicator Type: Relating Efforts and Accomplishments

Customer Service Complaints and Technical Quality Complaints

Purpose:

To measure the complaint rates experienced by the utility, with individual quantification of those related to customer service and those related to core utility services. It is expressed as complaints per 1,000 customer accounts.

Discussion:

This pair of indicators captures all complaints received by the utility, which are reported either as "service associated" or as "technical quality" complaints. Only those logged by the utility, whether acted on or not, count. Frivolous complaints and those unrelated to utility business are not considered.

The number of complaints is a good measure of customer service. The two categories suggested here allow a utility to track those that are people related and those that are product related. Utility staff engaged in customer service may want to track measures for additional subcategories as a way to quantify the causes of such complaints.

Mathematical Expression and Measurement Tips:

customer service complaint rate =

(1,000) (number customer service–associated complaints) number of active customer accounts

technical quality complaint rate =

(1,000) (number technical quality–associated omplaints) number of active customer accounts

Both types of complaints are recorded as the number of complaints per 1,000 customers per reporting period. All complaints are recorded in one category or the other.

Data Needed to Support the Calculation:

- Number of active customer accounts during the reporting period
- Number of customer service—associated complaints received by the utility during the reporting period
- Number of technical quality—associated complaints received by the utility during the reporting period

Definitions:

■ *Active customer account* means all customer accounts of all classes that were billed for some or all of the reporting period. A single account may include service through more than one water or wastewater service connection.



- A *complaint* is an expression of dissatisfaction conveyed to a utility employee acting in his/her official capacity, whether or not action is taken to resolve it. Complaints may be communicated orally or in writing. To clarify, a complaint is a request for action, whereas an inquiry is a request for information.
- *Customer* refers to an individual service agreement for water or wastewater service at a single property, regardless of size or billing category. An individual may own more than one property and be counted as a customer more than once. For example, an individual has three properties and each property has a meter. This utility would count this as three accounts.
- Customer service complaints, in the context of these indicators, refers to relationship factors such as personal appearance, courteousness, helpfulness, professionalism, responsiveness, adherence to traffic laws while driving a vehicle, and timeliness. It also refers to customer support services such as turn-on/turn-off, billing, rate setting, and communication. All utility employees should have assigned responsibility for good customer service, thereby helping the utility build a positive image within the community.
- *Technical qualities of service complaints* are directly related to core services of the utility. They include complaints associated with water quality, taste, odor, appearance, pressure, sewage backups and overflows, disruptions of water or wastewater service, disruptions of traffic, and facilities upkeep.

Applicability:

These indicators apply at all water and wastewater utilities serving retail customers. Wholesalers will find value primarily in data for technical quality complaints.

QualServe Business System: Customer Relations

QualServe Business Process Category: Customer Strategy and Satisfaction

Customer Service

Utility Business Architecture Category: Customer Service

Balanced Scorecard Measure Type: Customer

GASB Indicator Type: Service Accomplishments

Disruptions of Water Service

Purpose:

To quantify the numbers of water outages experienced by utility customers. Each indicator is expressed as the number of customers experiencing disruptions per 1,000 customer accounts per year.

Discussion:

Customers have come to expect full water service all of the time. Maintenance and repair work that result in water outages or substantially reduced water pressure disrupt customer plans, bring complaints, and diminish goodwill toward the utility. This family of indicators measures the numbers and durations of water service disruptions. It does not address inconveniences resulting from access limitations around construction and repair work sites.

Six separate indicators are supported: planned and unplanned service disruptions for durations of less than 4 hours, between 4 and 12 hours, and more than 12 hours. Large numbers and proportions of unplanned service disruptions likely reflect on distribution system inadequacies. Outages of long durations may be indicative of poor repair practices.

The indicator is calculated separately for planned and unplanned disruptions of three different durations. For each of these six categories, the rate is expressed as the number of customers experiencing disruptions per 1,000 active customer accounts.

Mathematical Expression and Measurement Tips:

disruption rate =

(1,000)(number of customer accounts experiencing disruption)

number of active customer accounts

planned water service disruption rate =

(1,000)(number of customer accounts experiencing disruption)
number of active customer accounts

unplanned water service disruption rate =

(1,000)(number of customer accounts experiencing disruption number of active customer accounts

Data Needed to Support the Calculation:

- The number of both planned and unplanned service disruptions during the reporting period, broken down by durations of less than 4 hours, between 4 and 12 hours, and greater than 12 hours (six individual numbers are to be provided)
- The total number of active customer accounts during the reporting period



Definitions:

- *Active customer account* means all customer accounts that were billed for some or all of the reporting period. A single account may include service through more than one water service connection.
- Disruption of (water) service means any and all conditions within facilities or the distribution system under control of the utility whereby a customer loses full water service or has normal delivery pressure reduced below 20 pounds per square inch during a repair. Specific exclusions include complaints of low pressure that are unrelated to a system condition requiring repair work; repairs to service piping under control of the customer; and shutoffs for nonpayment of bills.
- *Planned disruptions* are those where prior notice is given to all affected customers. Planned disruptions include new construction tie-ins and replacements of valves, hydrants, meters, and other appurtenances under nonemergency conditions.
- *Unplanned disruptions* include both those performed under emergency conditions where prior customer notice is impossible or impractical *and* those that are otherwise planned for but for which prior notice was not given. Unplanned disruptions usually occur during emergency pumping facility failures, pipeline breaks, and newly discovered major leaks where there is potential for unsafe conditions or significant property damage.

Applicability:

These indicators are applicable to all water utilities, regardless of customer base, size, or ownership. The durations for disruptions may not be consistent with that in use by individual utilities during the early years of the performance indicator system. Utilities should be encouraged to adopt these time intervals as standards.

Additional Guidance:

Where service disruptions are felt by customers of utilities that are wholesale customers of the utility, the total number of affected customers should be reported, even if those customers do not have service agreements with the wholesaling utility.

These indicators are useful for comparative analyses among utilities. Utilities are encouraged to collect additional data for internal measures. Tracking disruptions impacting different customer classes has merit. If record-keeping allows, maintaining records of disruptions felt by individual customers also has merit.

QualServe Business System:Customer RelationsQualServe Business Process Category:Customer ServiceUtility Business Architecture Category:Customer Service

Balanced Scorecard Measure Type: Customer

GASB Indicator Type: Service Accomplishments

Residential Cost of Water and/or Sewer Service

Purpose:

To allow utilities to compare the residential cost of water and sewer service based on both a defined quantity of water use and the average residential bill amounts for those services.

Discussion:

This indicator has several parts. A utility reports the individual costs in items 1–4, if possible, deferring to options 5 and 6 only if it cannot.

- 1. Bill amount for monthly residential water service for a customer using 7,500 gallons per month
- 2. Average residential water bill amount for one month of service
- 3. Bill amount for monthly residential wastewater service for a customer using 7,500 gallons of water per month
- 4. Average residential wastewater bill amount for one month of service
- 5. For multiple service utilities that cannot provide individual costs, the total monthly bill amount for residential water and wastewater service for a customer using 7,500 gallons of water per month
- 6. For multiple service utilities that cannot provide individual costs, the average residential combined water and wastewater bill amount for one month of service

NOTE: Include any additional costs added to the bill for basic service that may include other taxes and fees required to be paid by the residential customer to retain basic service.

Although this indicator seems simple, it is really quite complex because of the uniqueness of each utility. In some places, rates may be artificially low to reflect well on elected officials. In others, rates may be artificially high so elected officials can achieve nonutility objectives, such as annexations or general fund contributions. In still others, investor-owned utilities may have rates controlled by public utility commissions. And then there are the physical differences: age and condition of facilities; raw water quality; wastewater discharge requirements; mix of service to residential, commercial, and wholesale customers, and others.

The utility should calculate the bill amount for a typical residential customer served water through a $^{3}/_{4} \times ^{5}/_{8}$ -inch meter. Include the fee for 7,500 gallons of water or the fee for wastewater service consistent with that volume of water use. Also, add any surcharges and taxes in effect during the reporting period. If billing is quarterly, calculate what the fee would be for 22,500 gallons of water and divide by 3. If there is more than one rate zone, calculate the weighted average of charges for all zones.

Mathematical Expression and Measurement Tips:

No calculation required beyond those required of the utility when preparing their submittal(s).

Data Needed to Support the Calculation:

No calculation required beyond those required of the utility when preparing their submittal(s).

Definitions:

Bill means the periodic statement of charges (volumetric, surcharges, and taxes) for water and/or wastewater services, which are calculated based on known volumes of water delivered or wastewater collected.

Flat fee means a set fee charged to a water or wastewater customer regardless of the amount of water used, or wastewater collected, during the billing period. If there are surcharges or ad valorem taxes assessed to flat-fee customers, they are considered part of the flat fee.

Applicability:

This indicator is applicable to all water and wastewater utilities, regardless of customer base, size, or ownership.

Additional Guidance:

This indicator may be particularly useful to utilities with artificially low rates and significant capital improvement needs.

QualServe Business System: Customer Relations

QualServe Business Process Category: Customer Accounts Management

Utility Business Architecture Category: Customer Service

Set Rates, Sell Service, and Conservation

Balanced Scorecard Measure Type: Customer

GASB Indicator Type: Service Accomplishments

Customer Service Cost per Account

Purpose:

To measure the amount of resources a utility applies to its customer service program.

Discussion:

The indicator is expressed as the cost of managing a single customer account for 1 year. When viewed alone, it quantifies resource efficiency. Viewing in conjunction with other indicators gives the respondent more information about utility operational performance. For example, a utility with high numbers of complaints and low customer service costs might be sacrificing effectiveness and yet appear efficient. That information can help to identify opportunities for improvement.

Mathematical Expression and Measurement Tips:

Customer service cost per active account =

total customer service costs number of active accounts

Data Needed to Support the Calculation:

- Total customer service costs for the reporting period
- Number of active customer accounts

Definitions:

- *Customer service costs* are all direct salaries, employee benefits, and direct costs, including contracts that are associated with providing the following services to customers, plus a proportional share of total utility indirect costs:
 - Activation of new accounts
 - Meter reads, maintenance, and repair or replacement
 - Preparation and delivery of bills
 - Receipt and processing of payments
 - Records maintenance
 - Collection of delinquent accounts
 - Processing of bankruptcies
 - Provision of turn-on/turn-off services
 - Receipt, investigation, and resolution of complaints
 - Preparation and provision of outreach and educational materials, including the Consumer Confidence Report



Specifically excluded are all costs associated with maintaining service pipelines and customer plumbing on the customer side of the meter if present or service property line if no meter is present.

■ *Active customer account* means all customer accounts that were billed for some or all of the reporting period. A single account may include service through more than one water *or* wastewater service connection.

Applicability:

This indicator is applicable to all water and wastewater utilities, regardless of customer base, size, or ownership.

Additional Guidance:

- If water and wastewater services are billed together, there are options for requesting and presenting the data supporting this indicator:
 - The preferred option is to separate accountings for costs associated with each service and provide separate tallies of active customer accounts for each service.
 - An acceptable alternative is to provide aggregate costs for both services and provide separate counts of active customer accounts for water and wastewater services represented by those costs.
 - A third alternative is to report single numbers for total costs and active customer accounts.
- When preparing surveys, similar consideration should be given to utilities that employ single billings for multiple services such as water, wastewater, solid waste, electricity, and natural gas services.
- It is uncertain whether utilities will have data in sufficient detail to make this indicator meaningful. During pilot testing of the survey and database, and perhaps for early surveys, respondents should be asked to qualify their data using a fixed set of measures, such as
 - This data is accurate and would withstand an audit.
 - The data reported is an estimate and we have a high degree of confidence in it.
 - The data reported is a guesstimate.

QualServe Business System: Customer Relations

QualServe Business Process Category: Customer Accounts Management

Continuous Improvement

Utility Business Architecture Category: Customer Service

Measure and Improve Performance

Balanced Scorecard Measure Type: Financial

GASB Indicator Type: Relating Efforts and Accomplishments

Billing Accuracy

Purpose:

To measure the effectiveness of water and/or wastewater utility billing practices. The calculation shows the number of error-driven billing adjustments per 10,000 bills generated during the year.

Discussion:

Customers rarely think about their utility, unless they have a problem with service or billing. This indicator helps a utility measure how effective its billing practices are relative to others.

Because explanatory factors are minimized, this indicator can be very meaningful. Accuracy will be very high for most utilities (which is good). Consequently, it is recommended that the measure be standardized at around 10,000 billings.

Mathematical Expression and Measurement Tips:

billing accuracy =

(1,000)(number of error-driven billing adjustments during reporting period) number of bills generated during the reporting period

Data Needed to Support the Calculation:

- For the number of bills generated during the reporting period, multiple-service utilities that send a single bill for water and wastewater service will count each such bill as two bills for the purposes of this indicator.
- For the number of error-driven billing adjustments made during the reporting period, multiple-service utilities that send a single bill for water and wastewater service will count each billing adjustment once unless both water and wastewater billings are adjusted, in which case two billing adjustments are counted.

Definitions:

Bill means the periodic statement of charges (volumetric, surcharges, and taxes) for water and/or wastewater services, which are calculated based on known volumes of water delivered or wastewater collected during a specific period of time.

Error-driven billing adjustment is an adjustment to a customer's charges resulting from an error on the original bill actually sent to the customer, regardless of cause and including all such discoveries made by utility staff, the customer, or a third party. Errors include all those under control of the utility such as meter reads (whether by utility staff or the customer), data entry, and calculations or computer programming. Bills re-issued for estimated bills should not be included as a billing error.



Applicability:

This indicator is applicable to all water and wastewater utilities, regardless of customer base, size, or ownership. As with many of the recommended indicators, smaller utilities should expect larger annual swings because their basis for measurement is small.

Additional Guidance:

This indicator actually calculates billing inaccuracy. During review of the final draft report, all but one reviewer favored this approach. An alternate approach for consideration during the pilot period is shown in the following equation. It results in the number of accurate billings per 10,000 issued by the utility.

billing accuracy =

(1,000)(number of bills generated–number of error-driven adjustments during reporting period) number of bills generated during the reporting period

QualServe Business System: Customer Relations

QualServe Business Process Category: Customer Accounts Management

Utility Business Architecture Category: Customer Service

Balanced Scorecard Measure Type: Customer

GASB Indicator Type: Service Accomplishment

Debt Ratio

Purpose:

To quantify the utility's level of indebtedness.

Discussion:

The higher the calculated debt ratio, the more dependent the utility is on debt financing. Many utilities use this indicator as an internal measure of performance. Data is readily available from the utility's audited financial statements that are generated at the end of each fiscal year.

Mathematical Expression and Measurement Tips:

$$debt ratio = \frac{total \ liabilities}{total \ assets}$$

Data Needed to Support the Calculation:

- Total liabilities
- **■** Total assets

Definitions:

Total liabilities are all obligations of the utility under law or equity. They are categorized as such on the utility's financial statement. In essence, they are the total amount of dollars owed to others. Liabilities are defined and designated by the Governmental Accounting Standards Board (GASB) or the Financial Accounting Standards Board (FASB) as applicable to each specific utility. They include outstanding bonds, outstanding long-term debt, outstanding short-term debt, payments owed to others, accounts payable, and deposits collected from customers.

Total assets are all resources of the utility, both tangible and intangible. They are categorized as such on the utility's financial statement. They include the total value of properties and claims against others that are owned by the utility as expressed at original cost. Assets are defined and designated by the GASB or the FASB, as applicable to each specific utility. They include accounts receivable, cash, inventories, service delivery facilities (less depreciation), cost of easements, cost of water rights, and all other items of value owned by the utility.

Applicability:

This indicator is applicable to all water and wastewater utilities, regardless of customer base, size, or ownership. However, utilities that do not maintain independent financial statements, such as departments of city government and multiservice utilities that do not maintain costs for each service, may have difficulty providing accurate data.

Additional Guidance:

During pilot tests of the survey and database, evaluate whether utilities are providing audited or estimated data to help decide whether data reported in actual surveys should be qualified.

QualServe Business System:Business Operations

QualServe Business Process Category:Finance and Fiscal PlanningUtility Business Architecture Category:Manage Finance and Accounting

Balanced Scorecard Measure Type: Financial

GASB Indicator Type: Relating Efforts and Accomplishments

System Renewal/Replacement Rate

Purpose:

To quantify the rate at which the utility is meeting its individual need for infrastructure renewal or replacement.

Discussion:

This indicator measures the degree to which a water or wastewater utility is replacing its infrastructure based on target lives for each of two asset groups: (1) distribution system and treatment for water utilities and (2) collection system treatment for wastewater utilities. Joint water and wastewater utilities will be asked to provide data for all four categories.

- 1. Water pipeline/distribution
- 2. Water treatment facility and pumping
- 3. Wastewater pipelines and collection
- 4. Wastewater treatment facility and pumping

As asset management systems become more prominent at public utilities as a result of Governmental Accounting and Standards Board (GASB) Statement 34, many public utilities are joining long-standing practices at investor-owned utilities by establishing target lives for these asset groups. Utilities that have not done this should use the following default values for these indicators:

- Water distribution system components—50 years
- Wastewater collection system components—100 years
- Wastewater or water treatment facilities—50 years

Not all utility assets are captured by this indicator. Miscellaneous categories are established for both water and wastewater utilities, but anticipated differences limit the value of that data for comparative analysis. As a performance indicator system is implemented and refined, this decision can be reconsidered.

Mathematical Expression and Measurement Tips:

renewal rate (%) = 100 (total actual expenditures or total amount of funds reserved for renewal and replacement for each asset group)/total present worth for renewal and replacement needs for each asset group

Utilities will need to collect important data and perform several calculations to provide good data for these indicators. However, once those actions are completed, it will be relatively easy for utilities to update that information each year. The following concessions have been made to make these calculations as simple as possible, consistent with the needs of meaningful indicators:

- 1. Inventory and separate assets into appropriate asset groups as noted in the discussion, with a separate group for miscellaneous assets that will not be used in the calculations.
- 2. Use known current renewal and replacement costs for each asset or use historic values and update them using the *Engineering News-Record* Construction Cost Index (CCI). For example, the replacement cost for a treatment facility constructed in 1990 would be calculated by multiplying the 1990 cost by the CCI for the reporting year divided by the CCI for 1990. For water and wastewater pipelines where complete cost information is absent, it is permissible to simplify calculations by ignoring the effects of relatively low-cost water valves and hydrants and wastewater access holes and clean-outs. Major installations such as pumping stations and water storage facilities would be included.
- 3. Establish asset lives for each asset group or use the defaults values in the discussion. Where a utility calculates its own asset lives and where asset groups have subcategories with different lives, a weighted average should be calculated.
- 4. Calculate the target level for the annual investment in renewal and replacement for each asset group by dividing the total asset group renewal/replacement cost by the asset group life.
- 5. Because total actual expenditures may be difficult to aggregate accurately, utilities could be offered two ways of calculating their renewal/replacement rate: with actual expenditures or by providing the funding amount reserved for renewal/replacement in each asset group during the reporting year. Utilities should be asked to designate the method used for their calculation and that method should be reported in the database.

Data Needed to Support the Calculation:

- Total present worth of renewal and replacement needs for each asset class
- Weighted average lives for each asset class
- Total actual expenditures or total amount of funds reserved for renewal and replacement for each asset class during the reporting period
- Indication of whether total actual expenditures or total of funds reserved was provided on the survey

Definitions:

- Asset class in the context of this indicator means one of the following classes for a water or wastewater utility:
 - Water treatment facilities include all assets associated with treating source water to make it ready for distribution. They include those assets associated with disposal of solids accumulated during treatment.
 - Water distribution system includes all piping, valves, hydrants, pump stations, storage facilities, service taps and meters, and other appurtenances conveying treated water to customers.

- Water miscellaneous assets include surface and groundwater resources, source water storage facilities, office buildings, maintenance facilities, laboratories not associated with treatment process control, and land acquired to protect water resources.
- Wastewater collection assets include all piping, access holes, clean-outs, pumping facilities, and force mains used to convey wastewater to a central location for treatment.
- Wastewater treatment facilities include all assets at each facility used to treat wastewater, treat and dispose of solids, and protect air quality.
- Wastewater miscellaneous assets include office buildings, maintenance facilities, and laboratories not associated with process control.

Applicability:

These indicators apply to all water and wastewater utilities regardless of ownership, size, or customer base. Utilities report data for all asset categories important to their operations.

QualServe Business System: Business Operations

QualServe Business Process Category: Capital Improvement Planning

Plant and Property Management

Utility Business Architecture Category: Construct Facilities and Infrastructure

Manage Real Estate and Facilities

Internal Process Balanced Scorecard Measure Type:

Service Efforts **GASB** Indicator Type:



Return on Assets

Purpose:

To measure the financial effectiveness of the utility.

Discussion:

All utilities are interested in their financial health. Investor-owned and enterprise-fund utilities are particularly sensitive to this indicator, seeking higher ratios where possible. Some publicly owned utilities operating within a larger budget may find value for this indicator when justifying organizational improvements. Others may see little immediate value for this indicator.

Mathematical Expression and Measurement Tips:

return on assets = $\frac{\text{net income}}{\text{total assets}}$

Data Needed to Support the Calculation:

- Net income
- **■** Total assets

Definitions:

Net income is titled as such on the utility's financial statement and is defined and designated by the Governmental Accounting Standards Board (GASB) or the Financial Accounting Standards Board (FASB), as applicable to each specific utility.

Total assets are the entire resources of the utility, both tangible and intangible. They are categorized as such on the utility's financial statement. They include the total value of properties and claims against others that are owned by the utility as expressed at original cost. Assets are defined and designated by the GASB or the FASB, as applicable to each specific utility. They include accounts receivable, cash, inventories, service delivery facilities (less depreciation), cost of easements, cost of water rights, and all other items of value owned by the utility.

Applicability:

This indicator is applicable to all water and wastewater utilities, regardless of customer base, size, or ownership. However, utilities that do not maintain financial statements, such as departments of city government and multiservice utilities, may have difficulty providing accurate data.

Additional Guidance:

During pilot tests of the survey and database, evaluate whether utilities are providing audited or estimated data to help decide whether data reported in actual surveys should be qualified.

■ During pilot tests of the survey and database, evaluate whether utilities see value for this indicator.

QualServe Business System:Business Operations

QualServe Business Process Category: Financial and Fiscal Planning

Strategic Planning

Utility Business Architecture Category: Manage Finance and Accounting

Develop Business Plans

Balanced Scorecard Measure Type: Financial

GASB Indicator Type: Efforts and Accomplishments



Drinking Water Compliance Rate

Purpose:

To quantify the percentage of time each year that a water utility meets all of the health-related drinking water standards in the US National Primary Drinking Water Regulations.

Discussion:

The drinking water compliance rate is similar to the wastewater treatment effectiveness rate. It indicates the percent of time that a drinking water utility is in full compliance with all of the water quality contaminants and treatment techniques mandated for public water systems in the United States. It does not take into account additional parameters regulated by individual states, nor does it include violations of monitoring requirements. A utility measures its compliance relative only to those primary maximum contaminant levels and treatment techniques that apply to its operations.

The drinking water compliance rate uses simple tests of "in compliance" and "not in compliance." Thus, a utility that detects a contaminant at the maximum contaminant level (MCL) receives credit for being in compliance the same as if that contaminant had been present below the MCL or had not been detected.

The drinking water compliance rate does not take into account secondary MCLs. These are recommended, nonmandatory drinking water quality parameters in the United States. These parameters, which are associated with the aesthetic quality of drinking water, are covered through another recommended performance indicator, the technical quality of service complaints.

As an internal performance measure, the drinking water compliance rate allows a utility to gauge its compliance with health-related drinking water quality parameters. Anything less than 100 indicates at least one excursion beyond the MCL, for at least one primary drinking water quality standard or treatment technique, for at least 1 day. The indicator does not identify the excursion(s).

As a performance indicator for comparative analysis, the drinking water compliance rate allows a utility to gauge its compliance with health-related drinking water parameters relative to other water utilities reporting data into the comparative analysis system. Since most if not all of this information is readily available through Consumer Confidence Reports published by utilities in the United States, it is recommended that data be attributed.

The categories of potential drinking water contaminants listed below are included in the calculation:

- Microbiologicals
- **■** Turbidity
- Disinfectant residuals in the distribution system
- Trihalomethanes and haloacetic acids
- Inorganic chemicals

- Organic chemicals
- Treatment techniques

To calculate the compliance rate, a utility simply notes and tallies all days during which it was in full compliance with applicable primary MCLs and treatment techniques throughout its system. The compliance rate is calculated as shown below and defines the percentage of the year that the utility was in compliance with all federally mandated, health-related drinking water quality parameters.

Mathematical Expression and Measurement Tips:

drinking water compliance rate (%) = $\frac{(100)(\text{number of days in full compliance})}{365 \text{ days}}$

Data Needed to Support the Calculation:

Number of calendar days during which the utility was in full compliance with all drinking water quality and treatment technique requirements contained in the National Primary Drinking Water Regulations

Definitions:

Definitions of regulated contaminants and treatment techniques are contained in 40 CFR Part 141 (the National Primary Drinking Water Regulations).

Noncompliance refers to exceedance of an applicable primary MCL or less than full compliance with an applicable treatment technique.

Applicability:

This indicator is applicable to all public water systems regardless of ownership, size, or customer base.

Additional Guidance:

Only utilities that have completed all required monitoring during the reporting period should provide data for this indicator.

Since the calculation of days in full compliance can be cumbersome, data surveys should include a tabulation form that includes all drinking water quality primary contaminant and treatment technique requirements. This will assist utility staff with compiling accurate data.

After much consideration and debate among the study team and workshop participants, this indicator is recommended as a substitute for the elusive "water quality index" originally proposed but set aside due to complexity. Conceptually, the "water quality index" received strong support from workshop participants and peer reviewers. Development of such an indicator seems warranted and may require a dedicated project. In the short term, the drinking water compliance rate is recommended as a companion to the wastewater treatment effectiveness rate for pilot testing and, if shown to be of value, for inclusion in the suite of performance indicators.

QualServe Business System: Water Operations

QualServe Business Process Category: Water Quality Management

Water Treatment

Distribution Operations and

Maintenance

Utility Business Architecture Category: Manage Compliance and Emergency

Response

Water Treatment Water Distribution

Balanced Scorecard Measure Type: Internal Process

GASB Indicator Type: Service Accomplishments

Distribution System Water Loss

Purpose:

To quantify the percentage of produced water that fails to reach customers and cannot otherwise be accounted for through authorized usage.

Discussion:

Distribution system water loss is the difference between the volume of water distributed for use by all customer classes and the volume of water actually consumed by authorized users. There are many factors contributing to distribution system water loss. The major ones are leakage, metering inaccuracies, and unauthorized consumption. Among these, only leakage is a true loss of water. Metering inaccuracies affect the utility's capability for measuring true loss, but such inaccuracies can lead to both overstatements and understatements of the true loss. Unauthorized consumptions diminish revenues and should be dealt with, but they are not real losses of water.

A distribution system without losses is an unrealistic goal. There is a loss rate that each utility considers as acceptable based on its own circumstances. Because water losses impact revenues, it is important that a utility have practices in place to understand the specific causes of losses in its system. The utility will then be able to make good decisions regarding operations, maintenance, and pipeline replacements. This is particularly important in areas of water shortage and especially during drought conditions when the utility may be asking its customers to curtail use. Public knowledge of losses within the system makes it difficult for a utility to instill a need for conservation.

Tracking water losses helps utility managers understand the condition of distribution system infrastructure and the effects of its operation, maintenance, and replacement practices. Increasing rates of water loss and high loss rates are both reasons to examine current and planned practices.

This indicator provides opportunity for a utility manager to compare the distribution system water loss against that in the distribution systems of other utilities. Utilities with high loss rates may find value in identifying practices in place and contributing to more favorable loss rates at other utilities.

Utilities that are fully and accurately metered will have little difficulty providing data for this indicator. Others will have varying degrees of difficulty and may find that this indicator is beyond their current capacity to measure reliably. In itself, that realization may be reason to examine and improve practices.



Mathematical Expression and Measurement Tips:

distribution water loss (% of distribution) = 100 [volume of water distributed – (volume of water billed + volume of unbilled authorized water)]/volume of water distributed

Data Needed to Support the Calculation:

- Total volume of water distributed for customer use
- Total volume of water billed to customers
- Total volume of unbilled authorized water to customers

Definitions:

- *Volume of water distributed* is the total volume of water entering the distribution system from all sources, including treatment facilities, well fields, individual wells, and purchased water connections.
- *Volume of water billed to customers* is the total volume of water billed to all classes of registered customers, the water supplier, and others.
- *Volume of unbilled authorized water* is the total volume of water used for authorized purposes but is not billed. Examples of unbilled authorized uses include fire fighting and training, municipal uses such as flushing mains and sewers, street cleaning, watering of municipal properties, public fountains, construction, tank drainage, storage tank overflows, and frost protection. Most utilities may need to use estimates to compile this number.
- Water losses are those water volumes that do not find their way to authorized uses while under control of the utility. Water losses consist of real losses and apparent losses. The former are true losses of water from the utility's system, up to the point of customer metering. Apparent losses consist of unauthorized use and inaccuracies associated with metering. Water losses occur throughout the water system, from source water intakes, transmission pipelines, treatment facilities, distribution pipelines and storage facilities. (For this indicator, the focus is on losses from the points of distribution through the points of customer service meters.)

Applicability:

This indicator is applicable to all water utilities, regardless of customer base, size, or ownership.

QualServe Business System: Water Operations

QualServe Business Process Category: Distribution Operations

and Maintenance

Utility Business Architecture Category: Water Distribution **Balanced Scorecard Measure Type:** Internal Process

GASB Indicator Type: Service Accomplishments

Water Distribution System Integrity

Purpose:

To quantify the condition of the water distribution system, expressed as the total annual number of leaks and pipeline breaks per 100 miles of distribution piping.

Discussion:

For a water utility, distribution system integrity has importance for health, customer service, operations, and asset management reasons. This indicator quantifies the total number of water distribution system breaks and leaks requiring repair per 100 miles of piping. Low-frequency ratings are desirable.

Mathematical Expression and Measurement Tips:

```
integrity rate = \frac{100 \text{ (total number of leaks + total number of breaks)}}{\text{total miles of distribution piping}}
```

By definition, leaks and breaks are distinctly different events. If an event requires repair, it fits one category or the other.

Data Needed to Support the Calculation:

- Total miles of distribution piping
- Total number of leaks during the reporting period
- Total number of pipeline breaks experienced during the reporting period

Definitions:

Distribution piping includes all pipes, valves, hydrants, and other appurtenances conveying treated water between treatment facilities and the final point of utility control over customer service connections. Customer service piping downstream of that point is not part of the distribution system.

Leak means an opening in a distribution pipeline, valve, hydrant, appurtenance, or service connection that is continuously losing water. The rate of leakage may be stable or progressive.

Break means physical damage to a pipe, valve, hydrant, or other appurtenance that results in an abrupt loss of water.

Applicability:

This indicator is applicable to all water utilities, regardless of customer base, size, or ownership. Smaller utilities are likely to have frequency rates that vary significantly with each reporting period due largely to the small quantities of distribution piping.

Additional Guidance:

Utilities should consider supplementing this indicator with other internal measures, which can be useful for trend analysis and when sharing benchmarking studies with other utilities. The types of data to consider tracking for each leak or break include

- Leak or break characteristics such as pinhole corrosion, pipe split, joint leak, contractor damage, circumferential break, etc.
- Pipe material, diameter, and age
- Pipeline depth

QualServe Business System: Water Operations

QualServe Business Process Category: Distribution Operations and

Maintenance

Utility Business Architecture Category: Water Distribution **Balanced Scorecard Measure Type:** Internal Process

GASB Indicator Type: Service Accomplishment

Operations and Maintenance Cost Ratios: Water and Wastewater

Purpose:

To quantify all utility costs related to operations and maintenance (O&M), with breakouts of those costs related to water or wastewater treatment, as related to volumes processed and the number of active customers. Three indicators each are proposed for water and wastewater utilities.

These are O&M cost per account, O&M cost per million gallons processed, and direct cost of treatment per million gallons.

Discussion:

These related indicators tally the cost of O&M per account and per million gallons of water or wastewater processed. Additional subsets are possible for utilities maintaining detailed cost accounting systems. It is likely that many utilities already maintain data associated with direct costs of water or wastewater treatment, in which case those two subsets are recommended for immediate implementation. Data for appropriate major operations such as water resource acquisition and maintenance, water distribution, wastewater collection, and watershed management can be added as the indicator system grows.

For utilities following Governmental Accounting Standards Board (GASB) or Financial Accounting Standards Board (FASB) practices, the required total O&M cost information can be found on the audited financial statement. Use of the GASB and FASB definitions where possible will help to ensure compatibility among utilities.

Depreciation is excluded from total O&M costs to help normalize responses and to take into account the fact that some utilities do not depreciate assets, or are just now beginning to depreciate assets, and may not have an accurate assessment of total assets.

Obviously, single-service utilities will keep data on only water or wastewater operations. Utilities that provide more than a single service may maintain only aggregate data. However, it is recommended that surveys for information to support these indicators request separate submittals for water and wastewater service. This will allow all water and wastewater utilities to compare data and identify study partners.

Utility customer profiles can provide useful explanatory information for this indicator, especially if there are numerous large commercial/industrial and/or wholesale customers. It is recommended that surveys ask for information on volumes of service attributed to these three customer sectors: residential, commercial/industrial, and wholesale.

The indicators become even more useful where utility accounting practices allow apportioning total O&M costs among residential, commercial, and wholesale customers. Utilities should be asked for these additional breakdowns if they are available and if implementation resources allow.

Mathematical Expressions and Measurement Tips:

O&M cost per account =

total O&M costs (less depreciation)
total number of active customer accounts

O&M cost per million gallons distributed =

total O&M costs (less depreciation) total volume processed during the reporting period (in million gallons)

direct cost of treatment per million gallons distributed =

total direct O&M costs for water and/or wastewater treatment total volume processed during the reporting period (in million gallons)

Data Needed to Support the Calculation:

- *Total operations and maintenance costs* (less depreciation) are compiled in accordance with GASB and FASB statements of accounting practices. Specific guidance can be developed and included with data surveys.
- *Total number of active accounts* is the total of customer accounts
- *Total volume processed* in million gallons
- *Total direct O²M costs* for water and/or wastewater treatment (including all supporting functions)

Definitions:

- *Active customer account* means all customer accounts that were billed for some or all of the reporting period. A single account may include service through more than one water service connection.
- *Total volume processed (in million gallons)* refers to the total volume of water and/or wastewater distributed by the utility during the reporting period. It is reported in millions of gallons.
- *Total direct O&M costs* for water and/or wastewater treatment (including all supporting functions) is the total costs for salaries, direct benefits, and direct O&M costs associated with treatment. It includes pumping costs only within treatment facilities, not those associated with delivery of water or wastewater to treatment facilities nor those associated with discharge of treated solids or liquids leaving wastewater treatment facilities. Costs of solids treatment are included.

Applicability:

This indicator applies at all water and wastewater utilities. Those with financial records that do not follow FASB or GASB practices may find it more complex to provide accurate information for O&M costs. It may be useful to ask respondents to indicate whether their accounting practices adhere to FASB, GASB, or neither and whether the utility's financial records have been audited.

Additional Guidance:

Added flexibility for comparison will be gained if multiple-service utilities can report separate data for water and wastewater operations and if all utilities can break out costs of serving residential, commercial/industrial, and wholesale customers.

Depreciation has been purposefully eliminated from the calculation of this indicator to preserve the focus on current costs of O&M activities.

QualServe Business System: Water Operations

Wastewater Operations

QualServe Business Process Category: Water Resources Management

Water Treatment O&M
Water Distribution O&M
Water Quality Management
Wastewater Collection O&M
Wastewater Treatment O&M

Biosolids Management Watershed Management

Permitting Air and Water Quality

Utility Business Architecture Category: Protect Water Sources

Produce Water
Treat Water
Transmit Water
Distribute Water
Collect Wastewater
Collect Stormwater
Treat Wastewater
Dispose of Solids

Monitor Sewer Use

Balanced Scorecard Measure Type: Financial

GASB Indicator Type: Relating Efforts and Accomplishments



Planned Maintenance Ratios: Water and Wastewater

Purpose:

To allow comparison of how effectively utilities are investing in planned maintenance.

Discussion:

Planned maintenance includes preventive and predictive maintenance. Preventive maintenance is performed according to a predetermined schedule rather than in response to failure. Predictive maintenance is initiated when secondary monitoring signals from activities such as vibration and oil analysis indicate that maintenance is due. All other maintenance is categorized as corrective (i.e., maintenance resulting from an asset that is no longer providing reliable service such as a breakdown, blockage, or leakage). At some utilities corrective maintenance may be known as reactive maintenance.

Planned maintenance is preferable for assets for which the cost of repairs is high relative to the cost of planned maintenance. The avoided cost includes both the cost of repair and the cost consequences of the service disruption, with the latter including an allowance for customer costs. Assets are often defined as critical based on the cost consequences of service disruption.

Not all maintenance should be planned. In the case of noncritical assets for which the cost of planned maintenance is expected to be higher than the cost consequences of failure, total reliance on corrective maintenance may be good business practice. On a utility-wide basis, corrective maintenance might be appropriate up to 30% of the time.

There are alternatives to how this indicator might be calculated. Costs may be preferable because their use would encourage utilities to make business decisions based on total cost. However, the reliability of costs is uncertain. It is likely that there is more variability to utility tracking of cost than to utility tracking of hours. Unfortunately, not all utilities track hours. Thus, it is recommended that ratios be calculated on whichever data sets the utility can provide.

Mathematical Expression and Measurement Tips:

planned maintenance ratio in percent (hours) =

(100) hours of planned maintenance
hours of planned maintenance + corrective maintenance

planned maintenance ratio in percent (cost) =

(100) cost of planned maintenance

cost of planned maintenance + corrective maintenance

Utilities should be asked to provide both sets of data in early surveys so a decision can be made on which data are most readily available. Once that is established, it might be possible to delete one of these indicators from the system.

Data Needed to Support the Calculation:

- Total hours of planned maintenance undertaken by the utility and contractors working on behalf of the utility during the reporting period
- Total hours of corrective maintenance undertaken by the utility and contractors working on behalf of the utility during the reporting period
- Total cost of planned maintenance during the reporting period, including costs of contracts for planned maintenance
- Total cost of corrective maintenance undertaken by the utility, including costs of contracts for corrective maintenance

Definitions:

Planned maintenance is all maintenance undertaken in advance of asset failure. Planned maintenance may be *predictive* or *preventive*. Total hours should include employee hours such as sick time and overtime.

Corrective maintenance is all maintenance undertaken after asset failure. Total hours should include employee hours such as sick time and overtime.

Applicability:

This indicator is applicable to all water and wastewater utilities, regardless of customer base, size, or ownership.

Users of this data should be cautioned that there are a variety of maintenance management systems in use at utilities. Many utilities have more than one system. Each system may be configured differently relative to how maintenance activities are classified and how work hours are recorded. Thus, the reliability of reported data is likely to vary.

Additional Guidance:

- Hours charged to maintenance work include all time charged to maintenance work orders for travel, obtaining tools and parts, and for completing the work. Do not include time spent in training, meetings, or similar activities not directly related to a maintenance work order. Use similar limitations for cost data.
- For joint water/wastewater utilities, usefulness will increase if data are provided separately for water and wastewater maintenance.

ENLARGE

QualServe Business System: Water Operations

Wastewater Operations

Business Operations

QualServe Business Process Category: Water Resources Management

Water Treatment O&M
Water Distribution O&M
Wastewater Collection O&M
Wastewater Treatment O&M

Biosolids Management

Plant and Property Management

Utility Business Architecture Category: Protect Water Sources

Produce Water
Transmit Water
Treat Water
Distribute Water
Collect Wastewater
Collect Stormwater
Treat Wastewater
Dispose of Solids

Provide Vehicles and Equipment Manage Real Estate and Facilities

Balanced Scorecard Measure Type: Internal Process

GASB Indicator Type: Relating Efforts and Accomplishments

Sewer Overflow Rate

Purpose:

To provide a measure of collection system piping condition and the effectiveness of routine maintenance by quantifying the number of sewer overflows per 100 miles of collection piping.

Discussion:

Overflows are good indicators of collection system condition and the effectiveness of maintenance activities. For comparison among utilities, this indicator measures the total number of such events and expresses the rate as the ratio of the number of overflow events per 100 miles of sanitary and combined collection system piping. Record keeping at a utility will likely go beyond this and categorize such events by location; cause; pipeline size, age, material, and gradient; and other parameters of importance to the utility. The latter additional information is useful for planning maintenance, renewal, and replacement work.

This indicator is intended to measure overflows created by conditions within collection system components under control of the utility. Generally, these will include overflows from sanitary sewers and dry weather overflows from combined sanitary/storm sewers, with the following limitations, which are deemed outside control of the utility:

- General flooding that results in overflows in an otherwise separate sanitary sewer;
- Conditions within facilities for which a customer is responsible, including building plumbing or service sewer deterioration, failure, and flow restrictions; and
- Wet weather conditions, such as precipitation, snowmelt, and natural flooding, when they are clearly the cause of overflows in combined sewers.

A single collection system problem can result in multiple overflows, and each of those overflows should be included in the count for this indicator.

Mathematical Expression and Measurement Tips:

sewer overflow rate =

100 (total number of sewer overflows during the reporting period) total miles of pipe in sewage collection system

Data Needed to Support the Calculation:

- Total number of sewer overflows during the reporting period
- Total miles of pipe in the utility's collection system



Definitions:

An *overflow* refers to a discharge from a sewer through an access hole, clean-out, pumping facility, customer floor drain, or the drain in a fixture, if that discharge is related to limitations or problems with collection or treatment system components under control of the utility. Overflows caused by limitations or problems within customer-controlled piping and facilities are specifically excluded from this definition. A single limitation or problem can result in multiple overflows.

A *dry weather sewer overflow* is an overflow from a combined sanitary/storm sewer experienced during weather conditions where the portion of flow attributed to stormwater is negligible.

The *collection system* is comprised of all gravity sewerage piping, access holes, pressure sewers, and lift stations under control of the utility from the point of customer property lines to the treatment facility or point of interception by another wastewater utility. Portions of the collection system may convey both sanitary sewage and stormwater.

Applicability:

This indicator applies at all wastewater utilities, regardless of size or customer base.

Additional Guidance:

The US Environmental Protection Agency is developing regulations for storm sewer overflows. The status of those regulations should be reviewed prior to collecting data for this indicator to determine whether definitions are consistent with those regulations.

QualServe Business System: Wastewater Operations

QualServe Business Process Category: Collection O&M

Utility Business Architecture Category: Collect Wastewater

Collect Stormwater

Balanced Scorecard Measure Type: Internal Process

GASB Indicator Type: Service Accomplishment

Collection System Integrity: Wastewater

Purpose:

To provide a measure of the condition of a sewage collection system. The indicator expresses the number of collection system failures each year per 100 miles of collection system piping.

Discussion:

The indicator measures the frequency of collection system failures per 100 miles of collection piping. When tracked over time, a utility can compare its failure rate to those at other utilities and it can evaluate whether its own rate is decreasing, stable, or increasing. When data is maintained by the utility to characterize failures according to pipe type and age, type of failure, and cost of repairs, better decisions regarding routine maintenance and replacement/renewals can be made.

Mathematical Expression and Measurement Tips:

failure rate =

100 (total number of collection system failures during the reporting period) total miles of collection system piping

Data Needed to Support the Calculation:

- Total number of collection system failures experienced during the reporting period
- Total miles of collection system pipeline

Definitions:

Collection system means all gravity sewerage piping, access holes, pressure sewers, and lift stations under control of the utility from the point of customer property lines to the treatment facility or point of interception by another wastewater utility. Portions of the collection system may convey both sanitary sewage and stormwater.

A *collection system failure* means a loss of capacity resulting from a flow restriction in gravity or pressurized wastewater systems. Flow restrictions may be caused by deposition of foreign materials; structural failures of pipes, appurtenances, or access holes; deterioration of collection system materials; and root intrusion. Low spots in gravity sewers (sometimes called swags) are failures if there is potential for deposition and diminished sewer capacity. If left unattended, collection system failures can result in cave-ins, backups, or overflows. Maintenance activities such as sewer cleaning, rotting, root removal, and minor repairs to minimize infiltration or inflow are not collection system failures. Electrical and mechanical lift station failures unrelated to flow restrictions, electrical power outages at lift stations, and failures that occur on customer properties are not counted as failures for the purpose of this indicator.

Exclude any failure directly caused by the action of a person authorized by the utility such as failure caused by incidental damage during construction/repair or incorrectly marked location.

Applicability:

This indicator applies to all wastewater utilities regardless of size or customer base.

Additional Guidance:

It is uncertain whether wastewater utilities currently maintain data that will support this indicator. When the actual data collection and reporting system is pilot tested, utilities should be polled as to the availability of this data.

QualServe Business System: Wastewater Operations

QualServe Business Process Category:Collection O&MUtility Business Architecture Category:Collect Wastewater

Collect Stormwater

Balanced Scorecard Measure Type: Internal Process

GASB Indicator Type: Service Accomplishments

Wastewater Treatment Effectiveness Rate

Purpose:

To quantify a utility's compliance with the effluent quality standards in effect at each of its wastewater treatment facilities. The indicator is expressed as the percent of time each year that an individual wastewater treatment facility is in full compliance with applicable effluent quality requirements.

Discussion:

The wastewater treatment effectiveness rate (WWTER) is expressed as the percentage of days during which the utility meets or exceeds all of the effluent quality standards in effect at a facility.

The indicator allows a utility to compare its treatment effectiveness rate for each facility with those achieved at its other facilities and with those at other utilities. It also can track its individual facility performances over time. Caution should be exercised when using this data because individual permits and effluent limit regulations are likely to contain varying requirements based on local conditions and they can change over time.

For utilities with multiple treatment facilities, separate WWTERs are calculated. Utilities base their calculations on requirements in operating/discharge permits if possible. Utilities without permits, such as those in Canada, base their calculations on the effluent quality regulations in effect at their utility.

Mathematical Expression and Measurement Tips:

WWTER =

100 (365 – total number of standard noncompliance days)

365

The total number of standard noncompliance days (SNDs) is the sum of all noncompliance days relative to all operating/discharge permits issued to the utility for an individual facility. Violation of daily requirements count as 1 SND, those for weekly requirements count as 7 SNDs, those for monthly requirements count as 30 SNDs, and those for quarterly requirements count as 90 SNDs. If in violation of more than a single effluent quality standard at the same treatment facility on the same day, only a single SND is counted.

Data Needed to Support the Calculation:

- Number of operating/discharge permits issued to the utility
- Total number of standard noncompliance days at each facility



Definitions:

An *operating/discharge permit* is one issued through the National Pollutant Discharge Elimination System or its equivalent delegated state program.

A *standard noncompliance* day is any day during which the wastewater utility, through actual monitoring, determines that it has not met one or more of its permitted effluent quality standards at an individual treatment facility.

Applicability:

This indicator applies directly at all wastewater utilities operating under discharge permit limitations. Wastewater utilities without discharge permits are invited to provide data consistent with effluent quality limitations in effect in their area. Data submitted by such utilities will be recognizable because they will report "0" permits.

Additional Guidance:

A sample is offered to demonstrate how this indicator is to be calculated.

The Anytown Wastewater Department has been issued separate permits for its two treatment facilities. During the course of the annual reporting period, it aggregates the following data:

	Plant 1	Plant 2
Number of violations of daily effluent limitations	5 1	2 3
Number of violations of weekly effluent limitations	2 2	1 3
Number of violations of monthly effluent limitations	1	1
Number of violations of quarterly effluent limitations	1	0
Total SNDs (see notes and calculations below)	129	31

NOTES:

- 1. Three of these daily violations occurred during periods when there were also weekly or quarterly violations.
- 2. One of these violations occurred during a period when there was also a quarterly violation.
- 3. One of these daily violations, and the weekly violation, occurred during the period of the monthly violation.

WWTER (plant 1) =

$$\frac{100[(365) - (2 \times 1) - (1 \times 7) - (1 \times 30) - (1 \times 90)]}{365} = 65\%$$

WWTER (plant 2) =

$$\frac{100[(365) - (1 \times 1) - (1 \times 30)]}{365} = 92\%$$

WWTER (Anytown) =

$$\frac{65\% + 92\%}{2} = 79\%$$

QualServe Business System: Wastewater Operations

QualServe Business Process Category: Wastewater Treatment O&M

Permitting Air and Water Quality

Utility Business Architecture Category: Treat Wastewater

Manage Compliance and Emergency

Response

Balanced Scorecard Measure Type: Internal Process

GASB Indicator Type: Service Accomplishment

BENCHMARKING

Performance Indicators for Water and Wastewater Utilities: Survey Data and Analyses Report



В

Appendix B Definitions

Active customer account: All customer accounts that were billed for some or all of the reporting period. A single account may include service through more than one water service connection.

Active wastewater account: All customer accounts that were billed for some or all of the reporting period. A single account may include service through more than one wastewater service.

Active water account: All customer accounts that were billed for some or all of the reporting period. A single account may include service through more than one water service.

Asset: As defined and designated by the Governmental Accounting Standards Board (GASB) or the Financial Accounting Standards Board (FASB) (as applicable to each specific utility). Assets include accounts receivable, cash, inventories, service delivery facilities (less depreciation), cost of easements, cost of water rights, and all other items of value owned by the utility. Total assets are the entire resources of the utility, both tangible and intangible. They are categorized as such on the utility's financial statement. They include the total value of properties and claims against others that are owned by the utility as expressed at original cost.

Average daily use/demand (measured in million gallons per day): The estimated average daily use or demand on a system.



Average daily volume of wastewater processed (measured in million gallons per day): Calculated by dividing the total volume of wastewater processed during the reporting period by 365.

Average daily volume of water distributed (measured in million gallons per day): Calculated by dividing the total volume of water distributed during the reporting period by 365. Distributed water is the total volume of water entering the distribution system from all sources, including treatment facilities, well fields, individual wells, and purchased water connections.

Bill: The periodic statement of charges (volumetric, surcharges, and taxes) for water and/or sewer services. Calculated based on known volumes of water delivered or wastewater collected during a specific period of time.

Billed water: The total volume of water billed to all classes of registered customers, the water supplier, and others.

Break: Physical damage to a pipe, valve, hydrant, or other appurtenance that results in an abrupt loss of water. Any break, leak, or failure directly caused by the action of a utility staff person is excluded.

Complaint: Number of customer service associated complaints received by the utility during the reporting period. A complaint is an expression of dissatisfaction conveyed to a utility employee acting in his/her official capacity. Complaints may be communicated orally or in writing. To clarify, a complaint is a request for action whereas an inquiry is a request for information.

Contaminant: Any physical, chemical, biological, or radiological substance or matter in water.

Customer: An individual service agreement for water or sewer service at a single property, regardless of size or billing category. An individual may own more than one property and be counted as a customer more than once. For example, an individual with three properties, each of which has a meter, would be counted as three accounts by the utility.

Customer service: In the context of these indicators, relationship factors such as personal appearance, courteousness, helpfulness, professionalism, responsiveness, adherence to traffic laws while driving a vehicle, and timeliness. Also includes customer support services such as turn-on/turn-off, billing, rate setting, and communication. All utility employees should have assigned responsibility for good customer service, thereby helping the utility build a positive image within the community.

Customer service costs: All direct salaries, employee benefits, and direct costs, including contracts that are associated with providing the following services to customers, plus a proportional share of total utility indirect costs:

- Activation of new accounts (including meter and service installation costs)
- Meter reads, maintenance, and repair or replacement
- Preparation and delivery of bills
- Receipt and processing of payments
- Records maintenance
- Collection of delinquent accounts
- Processing of bankruptcies
- Provision of turn-on/turn-off services
- Receipt, investigation, and resolution of complaints
- Preparation and provision of outreach and educational materials, including the Consumer Confidence Report

Specifically excluded are all costs associated with maintaining service pipelines and customer plumbing on the customer side of the meter, if present, or service property line, if no meter is present.

Distributed water: The total volume of water entering the distribution system from all sources, including treatment facilities, well fields, individual wells, and purchased water connections.

Distribution piping: All pipes, valves, hydrants, and other appurtenances that convey treated water between treatment facilities and the final point of utility control over customer service connections. Customer service piping downstream of that point is not part of the distribution system.

Drinking Water Contaminant Candidate List (DWCCL): A list issued by the US Environmental Protection Agency of contaminants known or anticipated to occur in public water systems and that may require regulation under the Safe Drinking Water Act (Section 1412(b)(1).

Error-driven billing adjustment: An adjustment to a customer's charges resulting from an error on the original bill actually sent to the customer, regardless of cause and including all such discoveries made by utility staff, the customer, or a third party. Errors include all those under control of the utility such as meter reads (whether by utility staff or the customer), data entry, and calculations or computer programming. Bills re-issued for estimated bills should not be included as a billing error.

Formal training: Technical training, certification training, apprenticeship training, employee skills and development training, professional seminars, attendance at professional conferences, and college classes. It does not include on-the-job training.

Formal training hours: Sum of all qualified formal training hours completed by all employees. Employees include all full-time, part-time, temporary, and seasonal employees of the utility. Contractors are not included. Formal training meets at least one of the following descriptions:

- A professionally developed program or session with a fixed agenda that is offered on or off site during compensated working hours of the employee.
- The classroom and study portions of a formal apprenticeship program completed during working hours.
- A compensated training or related educational program, including an apprenticeship program, completed by an employee during nonwork hours.

Full-time equivalent (FTE): The allocation of employee time equal to 2,080 hours per year. Use of this term allows data to be normalized around a common measure. Part-time, temporary, and seasonal employees are converted to FTEs based on the total number of compensated hours.

Industrial/commercial customer account: The total number of industrial/commercial customer accounts that are billed for all or some of the reporting period. Includes hotels/motels, schools, restaurants, Laundromats, car washes, office buildings, hospital/medical office, food stores, auto shops, cooling and heating facilities, industrial processing plants, washing facilities, and businesses for which water is an ingredient.

Leak: An opening in a distribution pipeline, valve, hydrant, appurtenance, or service connection that is continuously losing water. The rate of leakage may be stable or progressive. Any break, leak, or failure directly caused by the action of a person authorized by the utility are excluded.

Liability: As defined and designated by the Governmental Accounting Standards Board (GASB) or the Financial Accounting Standards Board (FASB) (as applicable to each specific utility), liabilities include outstanding bonds, outstanding long-term debt, outstanding short-term debt, payments owed to others, accounts payable, and deposits collected from customers. Total liabilities are the entire obligations of the utility under law or equity. They are categorized as such on the utility's financial statement. In essence, they are the total amount of dollars owed to others.

Meter read: Periodic noting or reading of a meter register that reflects the customer's water usage. This is done by measuring the passage of water through the meter.

Net income: Total revenue minus total expenses; what's left of the monies received after all debts have been paid; the bottom line.

Noncompliance: Exceedance of an applicable primary maximum contaminant level or less than full compliance with an applicable treatment technique.

Number of active customer accounts during the reporting period: All customer accounts of all classes that were billed for some or all of the reporting period. A single account may include service through more than one water or sewer service connection.

Planned service disruption (or service interruption): A disruption for which prior notice is given to all affected customers. Planned disruptions include new construction tie-ins and replacements of valves, hydrants, meters, and other appurtenances under nonemergency conditions.

Residential customer account: The total number of single-family and multifamily customer accounts that are active for all or some of the reporting period.

Retail population served: The total number of people and/or users of the service that includes residential, commercial, institutional, and industrial customers. It does not include wholesalers.

Service disruption (or interruption): Any and all conditions within facilities or the distribution system under control of the utility whereby a customer loses full water service or has normal delivery pressure reduced below 20 pounds per square inch during a repair. Specific exclusions include complaints of low pressure that are unrelated to a system condition requiring repair work, repairs to service piping under control of the customer, and shutoffs for nonpayment of bills.

System capacity (measured in million gallons per day): The maximum amount of water and/or wastewater a system can treat, store, or collect in a day.

Technical quality complaint: Complaints directly related to core services of the utility. They include complaints associated with water quality, taste, odor, appearance, and pressure, sewage backups and overflows, disruptions of water or sewer service, disruptions of traffic, and facilities upkeep.

Treatment technique (TT) requirement: A requirement of the National Primary Drinking Water Regulations that specifies, for a particular contaminant, one or more specific treatment techniques that lead to a reduction in the level of the contaminant sufficient to achieve compliance with the requirements of 40 Code of Federal Regulations Part 141.

Unbilled water: The total volume of water that is used for authorized purposes but is not billed. Includes water used for fire fighting and training, municipal uses such as flushing of

mains and sewers, street cleaning, watering of municipal properties, public fountains, construction, tank drainage, storage tank overflows, and frost protection. Utilities may need to use estimates to compile this number.

Unplanned service disruption (or interruption): Disruptions that occur under emergency conditions for which prior customer notice is impossible or impractical and disruptions that are otherwise planned for but for which prior notice was not given. Unplanned disruptions usually occur during emergency pumping facility failures, pipeline breaks, and newly discovered major leaks where there is potential for unsafe conditions or significant property damage.

Wholesale customer account: The service sold to a customer at one or more major points of delivery for resale within the wholesale customer's service area.

Wholesale population served: The total number of people served by all wholesale accounts.



Appendix C Additional Profile Summaries

The following two summaries, Frequency Distribution Summary and General Quantitative Background Information, present the responses to utility profile questions from the Benchmarking Performance Indicators Survey. This profile information will help users understand the different utility attributes when assessing where their utility stands relative to others. The information will aid users of the performance indicators when looking for comparisons with utilities of similar size, climate, service profile, and ownership.

TABLE C-1 Frequency Distribution Summary by Utility Service Type—Water Only, Wastewater Only, Combined, and Total

					Тур	e			
		Wate	er Only	Wastev	vater Only	Con	nbined	T	otal
	What is your corporate structure?	Count	Percent	Count	Percent	Count	Percent	Count	Percent
	Public (part of local governance, nonenterprise)	11	15.7%	1	6.3%	8	6.9%	20	9.9%
	Public (part of local governance, enterprise fund)	25	35.7%	7	43.8%	80	69.0%	112	55.4%
	Public (independent governance)	26	37.1%	8	50.0%	25	21.6%	59	29.2%
	Investor-owned (private or publicly traded stock)	5	7.1%	0	0.0%	0	0.0%	5	2.5%
	Other	2	2.9%	0	0.0%	3	2.6%	5	2.5%
	na*	1	1.4%	0	0.0%	0	0.0%	1	0.5%
Total		70	100.0%	16	100.0%	116	100.0%	202	100.0

		Туре													
		Wate	er Only	Wastew	ater Only	Con	nbined	Total							
What is	your utility's form of governance?	Count	Percent	Count	Percent	Count	Percent	Count	Percent						
	Board	1	5.3%	0	0.0%	0	0.0%	1	1.0%						
	Government	18	94.7%	7	30.4%	62	100.0%	87	83.7%						
	Other	0	0.0%	0	0.0%	0	0.0%	0	0.0%						
	na	0	0.0%	16	69.6%	0	0.0%	16	15.4%						
Total	ıl		100.0%	23	100.0%	62	100.0%	104	100.0%						

TABLE C-1 Frequency Distribution Summary by Utility Service Type—Water Only, Wastewater Only, Combined, and Total *(continued)*

				Туј	pe				
What utility memberships does your	Wate	r Only	Wastew	ater Only	Com	bined	Total		
organization maintain?	Count	Percent	Count	Percent	Count	Percent	Count	Percent	
American Water Works Association	66	94.3%	8	50.0%	109	94.0%	183	90.6%	
Awwa Research Foundation	40	57.1%	2	12.5%	54	46.6%	96	47.5%	
Water Environment Foundation	12	17.1%	15	93.8%	84	72.4%	111	55.0%	
Association of Metropolitan Sewerage Agencies	1	1.4%	12	75.0%	43	37.1%	56	27.7%	
Association of Metropolitan Water Agencies	28	40.0%	1	6.3%	38	32.8%	67	33.2%	
National Association of Water Companies	6	8.6%	0	0.0%	4	3.4%	10	5.0%	
Water Environment Research Foundation	4	5.7%	9	56.3%	38	32.8%	51	25.2%	

		Туре												
Does vo	our utility have	Water	Only	Wastew	ater Only	Com	bined	Total						
	uthority?	Count	Percent	Count	Percent	Count	Percent	Count	Percent					
	Yes	19	27.1%	3	18.8%	26	22.4%	48	23.8%					
	No	50	71.4%	13	81.3%	89	76.7%	152	75.2%					
	na	1	1.4%	0	0.0%	1	0.9%	2	1.0%					
Total		70	100.0%	16	100.0%	116	100.0%	202	100.0%					

TABLE C-1 Frequency Distribution Summary by Utility Service Type—Water Only, Wastewater Only, Combined, and Total *(continued)*

		Туре											
		Wate	r Only	Wastewa	ater Only	Com	bined	Total					
Is your util	Is your utility contract operated		Percent	Count	Percent	Count	Percent	Count	Percent				
	Yes	6	8.6%	0	0.0%	0	0.0%	6	3.0%				
	No	63	90.0%	16	100.0%	114	98.3%	193	95.5%				
	na	1	1.4%	0	0.0%	2	1.7%	3	1.5%				
Total		70 100.0%		16	100.0%	116	100.0%	202	100.0%				

		Туре												
		Wate	r Only	Wastewa	ter Only	Comb	ined	Total						
Does you	r utility have fee-setting authority?	Count	Percent	Count	Percent	Count	Percent	Count	Percent					
	Yes	58	82.9%	13	81.3%	91	78.4%	162	80.2%					
	No	11	15.7%	3	18.8%	23	19.8%	37	18.3%					
	na	1	1.4%	0	0.0%	2	1.7%	3	1.5%					
Total		70	100.0%	16	100.0%	116	100.0%	202	100.0%					

TABLE C-1 Frequency Distribution Summary by Utility Service Type—Water Only, Wastewater Only, Combined, and Total *(continued)*

				Ту	pe			
	Wate	r Only	Wastew	ater Only	Com	bined	To	tal
What services are provided by your utility?	Count	Percent	Count	Percent	Count	Percent	Count	Percent
Raw water transmission	33	47.1%	0	0.0%	64	55.2%	97	48.0%
Potable water treatment and transmission	58	82.9%	0	0.0%	86	74.1%	144	71.3%
Potable water distribution	62	88.6%	0	0.0%	114	98.3%	176	87.1%
Wastewater collection (combined sewers)	0	0.0%	2	12.5%	36	31.0%	38	18.8%
Wastewater collection (separated sewers)	0	0.0%	13	81.3%	103	88.8%	116	57.4%
Wastewater treatment	1	1.4%	16	100.0%	106	91.4%	123	60.9%
Stormwater collection	0	0.0%	2	12.5%	33	28.4%	35	17.3%
Stormwater treatment	0	0.0%	3	18.8%	13	11.2%	16	7.9%
Reclaimed water treatment	3	4.3%	5	31.3%	40	34.5%	48	23.8%
Reclaimed/irrigation water distribution	7	10.0%	2	12.5%	43	37.1%	52	25.7%
Electric generation	11	15.7%	2	12.5%	16	13.8%	29	14.4%
Electric distribution	10	14.3%	0	0.0%	19	16.4%	29	14.4%
Natural gas distribution	2	2.9%	0	0.0%	5	4.3%	7	3.5%
Solid waste collection	0	0.0%	2	12.5%	18	15.5%	20	9.9%
Solid waste transfer/disposal	0	0.0%	2	12.5%	17	14.7%	19	9.4%

TABLE C-1 Frequency Distribution Summary by Utility Service Type—Water Only, Wastewater Only, Combined, and Total *(continued)*

	icate your utility's interest in participating				Ту	pe			
	netrics and process benchmarking with other utilities to establish industry-	Wate	er Only	Wastew	ater Only	Com	bined	Total	
	ormance indicators.	Count	Percent	Count	Percent	Count	Percent	Count	Percent
	High	51	72.9%	14	87.5%	88	75.9%	153	75.7%
	Medium	19	27.1%	2	12.5%	26	22.4%	47	23.3%
	Low	0	0.0%	0	0.0%	1	0.9%	1	0.5%
	na	0	0.0%	0	0.0%	1	0.9%	1	0.5%
Total	otal		100.0%	16	100.0%	116	100.0%	202	100.0%

TABLE C-1 Frequency Distribution Summary by Utility Service Type—Water Only, Wastewater Only, Combined, and Total *(continued)*

				Тур	e			
Please indicate whether total actual expenditures or total funds reserved was provided on the	Wate	er Only	Wastewa	ater Only	Com	bined	Т	otal
survey.	Count	Percent	Count	Percent	Count	Percent	Count	Percent
Water pipeline								
Total actual expenditures	41	58.6%	6	37.5%	66	56.9%	113	55.9%
Total funds reserved	19	27.1%	0	0.0%	34	29.3%	53	26.2%
na	10	14.3%	10	62.5%	16	13.8%	36	17.8%
Water treatment facility and pumping								
Total actual expenditures	42	60.0%	6	37.5%	64	55.2%	112	55.4%
Total funds reserved	15	21.4%	0	0.0%	33	28.4%	48	23.8%
na	13	18.6%	10	62.5%	19	16.4%	42	20.8%
Wastewater pipelines and collection								
Total actual expenditures	30	42.9%	10	62.5%	59	50.9%	99	49.0%
Total funds reserved	2	2.9%	4	25.0%	35	30.2%	41	20.3%
na	38	54.3%	2	12.5%	22	19.0%	62	30.7%
Wastewater treatment facility and pumping								
Total actual expenditures	30	42.9%	9	56.3%	61	52.6%	100	49.5%
Total funds reserved	3	4.3%	6	37.5%	34	29.3%	43	21.3%
na	37	52.9%	1	6.3%	21	18.1%	59	29.2%

*na = not available.

TABLE C–2 General Quantitative Background Information by Utility Service Type—Water Only, Wastewater Only, Combined, and Total Count, 25th Percentile, Median, 75th Percentile

							Statist	ics									
			Vater Oi Percenti			Wastewater Only Percentiles				Combined Percentiles				P	Total Percentile	es	
Question	Count	25th	50th	75th	Count	25th	50th	75th	Count	25th	50th	75th	Total Count	25th	50th	75th	
Wholesale Population—Number of Citizens—Potable Water Service	43	2,633	35,000	167,000	na*	na	na	na	56	4,060	15,877	51,629	99	3,293	22,749	101,68	
Retail Population— Number of Utilities Providing Electric Generation Services— Potable Water Service	62	28,750	95,731	346,142	na	na	na	na	110	42,375	100,706	249,722	172	40,463	100,706	294,57	
Residential—Number of Customer Accounts—Potable Water Service	65	4,949	23,818	72,900	na	na	na	na	112	12,519	28,300	77,600	177	9,335	26,024	76,425	
Commercial/ Industrial—Number of Customer Accounts—Potable Water Service	64	341	2,153	7,728	na	na	na	na	110	1,201	2,779	5,914	174	879	2,589	6,638	
Wholesale—Number of Customer Accounts—Potable Water Service	36	2	4	8	na	na	na	na	68	2	3	9	104	2	3	8	
Total Capacity (MGD)—Potable Water Service	68	18	56	165	na	na	na	na	112	15	34	110	180	15	44	142	
Average Daily Flow (MGD)—Potable Water Service	68	6	24	70	na	na	na	na	114	6	19	48	182	6	21	60	

TABLE C-2 General Quantitative Background Information by Utility Service Type—Water Only, Wastewater Only, Combined, and Total Count, 25th Percentile, Median, 75th Percentile (continued)

							Statis	tics									
			r Only entiles		,		ater Onl	ly	Combined Percentiles					Total Percentiles			
Question	Count	25	50	75	Count	25	50	75	Count	25	50	75	Count	25	50	75	
Wholesale Population—Number of Citizens— Wastewater Collection	na	na	na	na	6	31,625	74,690	399,845	30	2,850	25,252	114,394	36	1,375	25,250	105,49	
Retail Population— Number of Utilities Providing Electric Generation Services— Wastewater Collection	na	na	na	na	13	46,702	200,000	680,000	102	27,870	80,540	217,937	115	27,940	88,909	232,30	
Residential—Number of Customer Accounts— Wastewater Collection	na	na	na	na	13	15,000	66,000	130,327	102	8,982	22,327	63,981	115	6,733	20,500	66,000	
Commercial/ Industrial—Number of Customer Accounts— Wastewater Collection	na	na	na	na	13	2,060	5,385	7,127	97	710	1,742	4,570	110	716	2,070	5,368	
Wholesale—Number of Customer Accounts— Wastewater Collection	na	na	na	na	7	9	11	22	33	1	2	21	40	2	4	21	
Total Capacity (MGD)—Wastewater Collection	na	na	na	na	12	70	105	206	88	10	23	73	100	10	27	98	
Average Daily Flow (MGD)—Wastewater Collection	na	na	na	na	10	30	71	138	90	4	12	34	100	4	13	40	
Wholesale Population—Number of Citizens— Wastewater Treatment	na	na	na	na	7	37,750	57,140	299,690	42	1,896	11,600	59,275	49	1,505	12,100	68,000	

TABLE C-2 General Quantitative Background Information by Utility Service Type—Water Only, Wastewater Only, Combined, and Total Count, 25th Percentile, Median, 75th Percentile *(continued)*

							Stat	istics								
		Water Perce					ater Onl	Y			bined entiles				otal entiles	
Question	Count	25	50	75	Count	25	50	75	Count	25	50	75	Count	25	50	75
Retail Population— Number of Utilities Providing Electric Generation Services— Wastewater Treatment	na	na	na	na	15	93,351	200,000	581,953	97	20,190	74,900	181,027	112	25,224	88,412	225,083
Residential— Number of Customer Accounts— Wastewater Treatment	na	na	na	na	16	22,101	62,732	152,745	92	7,804	21,693	56,654	108	6,696	20,805	61,650
Commercial/ Industrial— Number of Customer Accounts— Wastewater Treatment	na	na	na	na	16	1,698	4,552	9,095	91	565	1,575	4,212	107	613	1,742	4,758
Wholesale— Number of Customer Accounts— Wastewater Treatment	na	na	na	na	7	37,750	57,140	299,690	49	1	2	9	56	1	2	11
Total Capacity (MGD)— Wastewater Treatment	na	na	na	na	16	33	70	169	101	6	18	56	117	7	21	61
Average Daily Flow (MGD)— Wastewater Treatment	na	na	na	na	15	18	33	128	98	4	11	34	113	4	13	37



TABLE C-2 General Quantitative Background Information by Utility Service Type—Water Only, Wastewater Only, Combined, and Total Count, 25th Percentile, Median, 75th Percentile (continued)

							Stat	istics								
		Water Perce			Wastewater Only Combined Percentiles Percentiles				Total Percentiles							
Question	Count	25	50	75	Count	25	50	75	Count	25	50	75	Count	25	50	75
What percent of your utility's future capital improvement programs will be financed with debt?	58	25.0%	50.0%	73.8%	15	50.0%	62.4%	80.0%	105	31.5%	51.5%	80.0%	178	30.0%	50.0%	77.3%
What is your utility's typical time horizon for capital improvement programs in years?	68	5	5	10	16	5	5	10	114	5	5	10	198	5	5	10
What percent of your employees are represented by labor bargaining units?	46	51.0%	67.0%	85.9%	12	61.5%	82.5%	99.3%	66	60.0%	78.0%	86.5%	124	60.0%	75.0%	89.0%

^{*}na = not available.



BENCHMARKING

Performance Indicators for Water and Wastewater Utilities: Survey Data and Analyses Report



Appendix D Confidence Ratings

For each question on the Benchmarking Performance Indicators Survey, respondents were asked to rate their confidence in the accuracy of each response on a scale of 1 to 7 (1 = very low confidence, 7 = complete confidence). The following table presents the aggregate data of the confidence ratings for Water Only, Wastewater Only, Combined, and All Operations. The aggregate represents the averages (i.e., arithmetic means).



TABLE D-1 Confidence Ratings by Utility Service Type—Water Only, Wastewater Only, Combined, and All Averages (i.e., Arithmetic Means)

Survey Question	Water	Wastewater	Combined	All
What percent of your utility's future capital improvement programs will be financed with debt?	5.1	5.2	5.6	5.4
What is your utility's typical time horizon for capital improvement programs in years?	6.4	6.5	6.5	6.5
What percent of your employees are represented by labor bargaining units?	6.9	6.9	6.7	6.8
What year did your utility first provide water service?	6.8	na*	6.4	6.5
What year did your utility first provide wastewater service?	7.0	6.7	6.3	6.4
What is your utility's current corporate bond rating?	6.8	6.8	6.8	6.8
Total workdays away from work.	6.6	6.6	6.4	6.5
Total hours worked by all employees.	6.5	6.1	6.2	6.3
Qualified formal training hours completed by all employees.	5.4	5.0	5.1	5.2
Number of full-time equivalents (FTEs) worked by employees.	6.5	6.6	6.2	6.4
Number of active water accounts.	6.7	na	6.7	6.7
Number of active wastewater accounts.	7.0	6.9	6.6	6.7
Average daily volume of water distributed (in million gallons per day).	6.7	na	6.7	6.7
Average daily volume of wastewater distributed (in million gallons per day).	7.0	6.9	6.6	6.7
FTEs supporting water service (include support).	6.4	na	6.0	6.2

TABLE D-1 Confidence Ratings by Utility Service Type—Water Only, Wastewater Only, Combined, and All Averages (i.e., Arithmetic Means) *(continued)*

Survey Question	Water	Wastewater	Combined	All
FTEs supporting wastewater service (include support).	7.0	6.9	6.1	6.3
Number of active customer accounts.	6.7	6.8	6.5	6.6
Customer service associated complaints.	4.7	4.6	4.4	4.5
Technical quality of service complaints.	5.3	5.9	5.1	5.2
Planned water service disruptions (less than 4 hours).	5.3	na	5.2	5.2
Planned water service disruptions (between 4 and 12 hours).	5.6	na	5.2	5.3
Planned water service disruptions (greater than 12 hours).	6.0	na	5.6	5.8
Unplanned water service disruptions (less than 4 hours).	5.5	na	5.1	5.3
Unplanned water service disruptions (between 4 and 12 hours).	5.6	na	5.2	5.4
Unplanned water service disruptions (greater than 12 hours).	6.0	na	5.6	5.8
Active customer accounts.	6.7	na	6.8	6.7
Monthly residential water using 7,500 gallons per month.	6.8	na	6.8	6.8
Average residential water bill amount for one month of service.	6.4	na	6.5	6.5
Monthly residential sewer using 7,500 gallons per month.	6.7	6.9	6.8	6.8
Average residential sewer bill amount for one month of service.	6.7	6.9	6.6	6.6
Multiservice, monthly bill—combination service using 7,500 gallons per month.	6.9	na	6.7	6.8

277

TABLE D-1 Confidence Ratings by Utility Service Type—Water Only, Wastewater Only, Combined, and All Averages (i.e., Arithmetic Means) *(continued)*

Survey Question	Water	Wastewater	Combined	All
Multiservice, average residential combination bill for one month of service.	6.9	na	6.4	6.6
Customer service costs (include all supporting functions).	5.6	6.0	5.8	5.8
Number of active customer accounts.	6.6	6.9	6.6	6.6
Bills generated during the reporting period.	6.3	6.5	6.3	6.3
Number of error-driven billing adjustments.	5.5	5.9	5.5	5.5
Total liabilities.	6.6	6.6	6.6	6.6
Total assets.	6.6	6.5	6.5	6.5
Total present worth of renewal and replacement needs.	5.4	na	5.4	5.4
Weighted average life (average).	5.9	5.7	5.7	5.7
Water pipeline.	5.6	na	5.7	5.7
Water treatment facility and pumping.	5.4	na	5.7	5.6
Wastewater pipelines and collection.	6.3	5.8	5.7	5.7
Wastewater treatment facility and pumping.	6.3	5.6	5.6	5.7
Expenditures or funds reserved for renewal/replacement.	6.5	5.7	6.1	6.1
Water pipeline.	6.0	na	6.1	6.0
Water treatment facility and pumping.	5.9	na	6.0	6.0

TABLE D-1 Confidence Ratings by Utility Service Type—Water Only, Wastewater Only, Combined, and All Averages (i.e., Arithmetic Means) *(continued)*

Survey Question	Water	Wastewater	Combined	All
Wastewater pipelines and collection.	7.0	5.6	6.1	6.1
Wastewater treatment facility and pumping.	7.0	5.8	6.1	6.1
Net income.	6.7	6.8	6.5	6.6
Total assets.	6.7	6.8	6.6	6.6
Calendar days when the utility was in full compliance.	6.9	na	6.9	6.9
Total volume of water distributed for customer use.	na	na	na	na
Total volume of water billed to customers.	6.4	na	6.1	6.2
Total miles of distribution piping.	6.4	na	6.1	6.2
Total number of leaks during the reporting period.	5.9	na	5.6	5.8
Total number of pipeline breaks experienced.	6.1	na	5.9	6.0
Operations and maintenance costs (less depreciation).	6.5	6.8	6.3	6.4
Total number of active accounts.	6.7	6.9	6.7	6.7
Total volume processed in million gallons.	6.7	6.6	6.7	6.7
Direct operations and maintenance costs for water.	5.9	6.3	6.1	6.0
Hours of planned maintenance.	4.5	4.8	4.7	4.7
Hours of corrective maintenance.	4.6	4.8	4.7	4.7

TABLE D-1 Confidence Ratings by Utility Service Type—Water Only, Wastewater Only, Combined, and All Averages (i.e., Arithmetic Means) *(continued)*

Survey Question	Water	Wastewater	Combined	All
Cost of planned maintenance.	4.4	4.9	4.7	4.6
Cost of corrective maintenance.	4.4	5.1	4.7	4.6
Number of sewer overflows.	na	6.0	6.4	6.4
Total miles of pipe in the utility's collection system.	7.0	6.3	6.1	6.2
Number of collection system failures.	7.0	5.5	5.8	5.8
Total miles of collection system pipeline.	7.0	6.3	6.1	6.2
Operating/discharge permits issued to the utility.	7.0	6.9	6.9	6.9
Standard noncompliance days at each facility.	7.0	6.5	6.8	6.7

^{*}na = not available.



TABLE E-1 Conversion Factors

Conve	ersions		Procedure		Approximations
From	То	Multiply number of	by	To get number of	(Actual answer will be within 25% of approximate answer.)
acres	hectares (ha)	acres	0.4047	ha	1 acre ≈ 0.4 ha
acres	square feet (ft ²)	acres	43,560	ft ²	1 acre $\approx 40,000 \text{ ft}^2$
acres	square kilometers (km²)	acres	0.004047	km ²	1 acre ≈ 0.004 km ²
acres	square meters (m ²)	acres	4,047	m ²	1 acre ≈ 4,000 m ²
acres	square miles (mi ²)	acres	0.001563	mi ²	1 acre ≈ 0.0015 mi ²
acres	square yards (yd²)	acres	4,840	yd ²	1 acre ≈ 5,000 yd ²
acre-feet (acre-ft)	cubic feet (ft ³)	acre-ft	43,560	ft ³	1 acre-ft $\approx 40,000 \text{ ft}^3$
acre-feet (acre-ft)	cubic meters (m ³)	acre-ft	1,233	m ³	1 acre-ft ≈ 1,000 m ³
acre-feet (acre-ft)	gallons (gal)	acre-ft	325,851	gal	1 acre-ft ≈ 300,000 gal
centimeters (cm)	feet (ft)	cm	0.03281	ft	1 cm ≈ 0.03 ft
centimeters (cm)	inches (in.)	cm	0.3937	in.	1 cm ≈ 0.4 in.
centimeters (cm)	meters (m)	cm	0.01	m	_
centimeters (cm)	millimeters (mm)	cm	10	mm	_
centimeters per second (cm/s)	meters per minute (m/min)	cm/s	0.6	m/min	_
cubic centimeters (cm ³)	cubic feet (ft ³)	cm ³	0.00003531	ft ³	$1 \text{ cm}^3 \approx 0.00004 \text{ ft}^3$
cubic centimeters (cm ³)	cubic inches (in. ³)	cm ³	0.06102	in. ³	$1 \text{ cm}^3 \approx 0.06 \text{ in.}^3$
cubic centimeters (cm ³)	cubic meters (m ³)	cm ³	0.000001	m ³	_
cubic centimeters (cm ³)	cubic yards (yd³)	cm ³	0.000001308	yd ³	$1 \text{ cm}^3 \approx 0.0000015 \text{ yd}^3$
cubic centimeters (cm ³)	gallons (gal)	cm ³	0.0002642	gal	$1 \text{ cm}^3 \approx 0.0003 \text{ gal}$
cubic centimeters (cm ³)	liters (L)	cm ³	0.001	L	_

TABLE E-1 Conversion Factors (continued)

Conv	ersions		Procedure		Approximations
From	То	Multiply number of	by	To get number of	(Actual answer will be within 25% of approximate answer.)
cubic feet (ft ³)	acre-feet (acre-ft)	ft ³	0.00002296	acre-ft	$1 \text{ ft}^3 \approx 0.00002 \text{ acre-ft}$
cubic feet (ft ³)	cubic centimeters (cm ³)	ft ³	28,320	cm ³	$1 \text{ ft}^3 \approx 30$
cubic feet (ft ³)	cubic inches (in. ³)	ft ³	1,728	in. ³	$1 \text{ ft}^3 \approx 1,500 \text{ in.}^3$
cubic feet (ft ³)	cubic meters (m ³)	ft ³	0.02832	m^3	$1 \text{ ft}^3 \approx 0.03 \text{ m}^3$
cubic feet (ft ³)	cubic yards (yd³)	ft ³	0.03704	yd ³	$1 \text{ ft}^3 \approx 0.04 \text{ yd}^3$
cubic feet (ft ³)	gallons (gal)	ft ³	7.481	gal	$1 \text{ ft}^3 \approx 7 \text{ gal}$
cubic feet (ft ³)	kiloliters (kL)	ft ³	0.02832	kL	$1 \text{ ft}^3 \approx 0.03 \text{ kL}$
cubic feet (ft ³)	liters (L)	ft ³	28.32	L	$1 \text{ ft}^3 \approx 30 \text{ L}$
cubic feet (ft ³)	pounds (lb) of water	ft ³	62.4	lb of water	1 ft ³ \approx 60 lb of water
cubic feet per second (ft ³ /s)	cubic meters per second (m ³ /s)	ft ³ /s	0.02832	m ³ /s	$1 \text{ ft}^3/\text{s} \approx 0.03 \text{ m}^3/\text{s}$
cubic feet per second (ft ³ /s)	million gallons per day (mgd)	ft ³ /s	0.6463	mgd	$1 \text{ ft}^3/\text{s} \approx 0.6 \text{ mgd}$
cubic feet per second (ft ³ /s)	gallons per minute (gpm)	ft ³ /s	448.8	gpm	$1 \text{ ft}^3/\text{s} = 400 \text{ gpm}$
cubic feet per minute (ft³/min)	gallons per second (gps)	ft ³ /min	0.1247	gps	$1 \text{ ft}^3/\text{min} = 0.1 \text{ gps}$
cubic feet per minute (ft³/min)	liters per second (L/s)	ft ³ /min	0.4720	L/s	$1 \text{ ft}^{13}/\text{min} = 0.5 \text{ L/s}$
cubic inches (in. ³)	cubic centimeters (cm ³)	in. ³	16.39	cm ³	$1 \text{ in.}^3 = 15 \text{ cm}^3$
cubic inches (in. ³)	cubic feet (ft ³)	in. ³	0.0005787	ft ³	$1 \text{ in.}^3 = 0.0006 \text{ ft}^3$
cubic inches (in. ³)	cubic meters (m ³)	in. ³	0.00001639	m^3	$1 \text{ in.}^3 = 0.00015 \text{ m}^3$
cubic inches (in. ³)	cubic millimeters (mm ³)	in. ³	16,390	mm ³	$1 \text{ in.}^3 = 15,000 \text{ mm}^3$
cubic inches (in. ³)	cubic yards (yd³)	in. ³	0.00002143	yd ³	$1 \text{ in.}^3 = 0.00002 \text{ yd}^3$
cubic inches (in. ³)	gallons (gal)	in. ³	0.004329	gal	$1 \text{ in.}^3 = 0.004 \text{ gal}$

283

TABLE E-1 Conversion Factors (continued)

Conv	ersions		Procedure		Approximations
From	То	Multiply number of	by	To get number of	(Actual answer will be within 25% of approximate answer.)
cubic inches (in. ³)	liters (L)	in. ³	0.01639	L	$1 \text{ in.}^3 = 0.015 \text{ L}$
cubic meters (m ³)	acre-feet (acre-ft)	m ³	0.0008107	acre-ft	$1 \text{ m}^3 = 0.0008 \text{ acre-ft}$
cubic meters (m ³)	cubic centimeters (cm ³)	m ³	1,000,000	cm ³	_
cubic meters (m ³)	cubic feet (ft ³)	m^3	35.31	ft ³	$1 \text{ m}^3 = 40 \text{ ft}^3$
cubic meters (m ³)	cubic inches (in. ³)	m ³	61,020	in. ³	$1 \text{ m}^3 = 60,000 \text{ in.}^3$
cubic meters (m ³)	cubic yards (yd³)	m ³	1.308	yd ³	$1 \text{ m}^3 = 1.5 \text{ yd}^3$
cubic meters (m ³)	gallons (gal)	m ³	264.2	gal	$1 \text{ m}^3 = 300 \text{ gal}$
cubic meters (m ³)	kiloliters (kL)	m ³	1.0	kL	_
cubic meters (m ³)	liters (L)	m ³	1,000	L	_
cubic meters per day (m ³ /d)	gallons per day (gpd)	m³/d	264.2	gpd	$1 \text{ m}^3/\text{d} = 300 \text{ gpd}$
cubic meters per second (m ³ /s)	cubic feet per second (ft ³ /s)	m³/s	35.31	ft ³ /s	$1 \text{ m}^3/\text{s} = 40 \text{ ft}^3/\text{s}$
cubic millimeters (mm ³)	cubic inches (in. ³)	mm ³	0.00006102	in. ³	$1 \text{ mm}^3 = 0.00006 \text{ in.}^3$
cubic yards (yd³)	cubic centimeters (cm ³)	yd ³	764,600	cm ³	$1 \text{ yd}^3 \approx 800,000 \text{ cm}^3$
cubic yards (yd³)	cubic feet (ft ³)	yd ³	27	ft ³	$1 \text{ yd}^3 \approx 30 \text{ ft}^3$
cubic yards (yd³)	cubic inches (in. ³)	yd ³	46,660	in. ³	$1 \text{ yd}^3 \approx 50,000 \text{ in.}^3$
cubic yards (yd³)	cubic meters (m ³)	yd ³	0.7646	m ³	$1 \text{ yd}^3 \approx 0.8 \text{ m}^3$
cubic yards (yd³)	gallons (gal)	yd ³	202.0	gal	1 yd ³ ≈ 200 gal
cubic yards (yd³)	liters (L)	yd ³	764.6	L	$1 \text{ yd}^3 \approx 800 \text{ L}$
feet (ft)	centimeters (cm)	ft	30.48	cm	1 ft ≈ 30 cm
feet (ft)	inches (in.)	ft	12	in.	_

TABLE E-1 Conversion Factors (continued)

Con	versions		Procedure		Approximations
From	То	Multiply number of	by	To get number of	(Actual answer will be within 25% of approximate answer.)
feet (ft)	kilometers (km)	ft	0.0003048	km	1 ft ≈ 0.0003 km
feet (ft)	meters (m)	ft	0.3048	m	1 ft ≈ 0.3 m
feet (ft)	miles (mi)	ft	0.0001894	mi	1 ft ≈ 0.0002 mi
feet (ft)	millimeters (mm)	ft	304.8	mm	1 ft ≈ 300 mm
feet (ft)	yards (yd)	ft	0.3333	yd	1 ft ≈ 0.3 yd
feet (ft) of hydraulic head	kilopascals (kPa)	ft of head	2.989	kPa	1 ft of head ≈ 3 kPa
feet (ft) of hydraulic head	meters (m) of hydraulic head	ft of head	0.3048	m of head	1 ft of head ≈ 0.3 m of head
feet (ft) of hydraulic head	pascals (Pa)	ft of head	2,989	Pa	1 ft of head ≈ 3,000 Pa
feet (ft) of water	inches of mercury (in. Hg)	ft of water	0.8826	in. Hg	1 ft of water ≈ 0.9 in. Hg
feet (ft) of water	pounds per square foot (lb/ft ²)	ft of water	62.4	lb/ft ²	1 ft of water $\approx 60 \text{ lb/ft}^2$
feet (ft) of water	pounds per square inch gauge (psig)	ft of water	0.4332	psig	1 ft of water ≈ 0.4 psig
feet per hour (ft/h)	meters per second (m/s)	ft/h	0.00008467	m/s	1 ft/h ≈ 0.00008 m/s
feet per minute (ft/min)	feet per second (ft/s)	ft/min	0.01667	ft/s	1 ft/min ≈ 0.015 ft/s
feet per minute (ft/min)	kilometers per hour (km/h)	ft/min	0.01829	km/h	1 ft/min ≈ 0.02 km/h
feet per minute (ft/min)	meters per minute (m/min)	ft/min	0.3048	m/min	1 ft/min ≈ 0.3 m/min
feet per minute (ft/min)	meters per second (m/s)	ft/min	0.005080	m/s	1 ft/min ≈ 0.005 m/s
feet per minute (ft/min)	miles per hour (mph)	ft/min	0.01136	mph	1 ft/min ≈ 0.01 mph
feet per second (ft/s)	feet per minute (ft/min)	ft/s	60	ft/min	_
feet per second (ft/s)	kilometers per hour (km/h)	ft/s	1.097	km/h	$1 \text{ ft/s} \approx 1 \text{ km/h}$

285

TABLE E-1 Conversion Factors (continued)

Con	versions		Procedure		Approximations
From	То	Multiply number of	by	To get number of	(Actual answer will be within 25% of approximate answer.)
feet per second (ft/s)	meters per minute (m/min)	ft/s	18.29	m/min	1 ft/s ≈ 20 m/min
feet per second (ft/s)	meters per second (m/s)	ft/s	0.3048	m/s	1 ft/s ≈ 0.3 m/s
feet per second (ft/s)	miles per hour (mph)	ft/s	0.6818	mph	1 ft/s ≈ 0.7 mph
foot-pounds per minute (ft-lb/min)	horsepower (hp)	ft-lb/min	0.00003030	hp	1 ft-lb/min ≈ 0.00003 hp
foot-pounds per minute (ft-lb/min)	kilowatts (kW)	ft-lb/min	0.00002260	kW	1 ft-lb/min ≈ 0.00002 kW
foot-pounds per minute (ft-lb/min)	watts (W)	ft-lb/min	0.02260	W	1 ft-lb/min ≈ 0.02 W
gallons (gal)	acre-feet (acre-ft)	gal	0.000003069	acre-ft	1 gal ≈ 0.000003 acre-ft
gallons (gal)	cubic centimeters (cm ³)	gal	3,785	cm ³	1 gal ≈ 4000 cm ³
gallons (gal)	cubic feet (ft ³)	gal	0.1337	ft ³	$1 \text{ gal} \approx 0.15 \text{ ft}^3$
gallons (gal)	cubic inches (in. ³)	gal	231.0	in. ³	1 gal ≈ 200 in. ³
gallons (gal)	cubic meters (m ³)	gal	0.003785	m^3	$1 \text{ gal} \approx 0.004 \text{ m}^3$
gallons (gal)	cubic yards (yd³)	gal	0.004951	yd ³	$1 \text{ gal} \approx 0.005 \text{ yd}^3$
gallons (gal)	kiloliters (kL)	gal	0.003785	kL	1 gal ≈ 0.004 kL
gallons (gal)	liters (L)	gal	3.785	L	1 gal ≈ 4 L
gallons (gal)	pounds (lb) of water	gal	8.34	lb of water	1 gal ≈ 8 lb of water
gallons (gal)	quarts (qt)	gal	4	qt	
gallons per capita per day (gpcd)	liters per capita per day (L/d per capita)	gpcd	3.785	L/d per capita	1 gpcd ≈ 4 L/d per capita

TABLE E-1 Conversion Factors (continued)

Conversions		Procedure			Approximations
From	То	Multiply number of	by	To get number of	(Actual answer will be within 25% of approximate answer.)
gallons per day (gpd)	cubic meters per day (m ³ /d)	gpd	0.003785	m ³ /d	$1 \text{ gpd} \approx 0.004 \text{ m}^3/\text{d}$
gallons per day (gpd)	liters per day (L/d)	gpd	3.785	L/d	1 gpd ≈ 4 L/d
gallons per day per foot (gpd/ft)	square meters per day (m²/d)	gpd/ft	0.01242	m²/d	$1 \text{ gpd/ft} \approx 0.01 \text{ m}^2/\text{d}$
gallons per day per foot (gpd/ft)	square millimeters per second (mm²/s)	gpd/ft	0.1437	mm ² /s	$1 \text{ gpd/ft} \approx 0.15 \text{ mm}^2/\text{s}$
gallons per day per square foot (gpd/ft²)	millimeters per second (mm/s)	gpd/ft ²	0.0004716	mm/s	$1 \text{ gpd/ft}^2 \approx 0.0005 \text{ mm/s}$
gallons per hour (gph)	liters per second (L/s)	gph	0.001052	L/s	1 gph ≈ 0.001 L/s
gallons per minute (gpm)	cubic feet per second (ft ³ /s)	gpm	0.002228	ft ³ /s	$1 \text{ gpm} \approx 0.0002 \text{ ft}^3/\text{s}$
gallons per minute (gpm)	liters per second (L/s)	gpm	0.06309	L/s	1 gpm ≈ 0.06 L/s
gallons per minute per square foot (gpm/ft ²)	millimeters per second (mm/s)	gpm/ft ²	0.6790	mm/s	$1 \text{ gpm/ft}^2 \approx 0.7 \text{ mm/s}$
gallons per second (gps)	cubic feet per minute (ft ³ /min)	gps	8.021	ft ³ /min	$1 \text{ gpm} \approx 8 \text{ ft}^3/\text{min}$
gallons per second (gps)	liters per minute (L/min)	gps	227.1	L/min	1 gps ≈ 200 L/min
grains (gr)	grams (g)	gr	0.06480	g	1 gr ≈ 0.06 g
grains (gr)	pounds (lb)	gr	0.0001428	lb	1 gr ≈ 0.00015 lb
grams (g)	grains (gr)	g	15.43	gr	1 g ≈ 15 gr
grams (g)	kilograms (kg)	g	0.001	kg	_
grams (g)	milligrams (mg)	g	1,000	mg	_
grams (g)	ounces (oz), avoirdupois	g	0.03527	OZ	1 g ≈ 0.04 oz

287

TABLE E-1 Conversion Factors (continued)

Conversions		Procedure			Approximations
From	То	Multiply number of	by	To get number of	(Actual answer will be within 25% of approximate answer.)
grams (g)	pounds (lb)	g	0.002205	lb	1 g ≈ 0.002 lb
hectares (ha)	acres	ha	2.471	acres	1 ha ≈ 2 acres
hectares (ha)	square meters (m ²)	ha	10,000	m ²	_
hectares (ha)	square miles (mi ²)	ha	0.003861	mi ²	1 ha ≈ 0.004 mi ²
horsepower (hp)	foot-pounds per minute (ft-lb/min)	hp	33,000	ft-lb/min	1 hp ≈ 30,000 ft-lb/min
horsepower (hp)	kilowatts (kW)	hp	0.7457	kW	1 hp ≈ 0.7 kW
horsepower (hp)	watts (W)	hp	745.7	W	1 hp ≈ 700 W
inches (in.)	centimeters (cm)	in.	2.540	cm	1 in. ≈ 3 cm
inches (in.)	feet (ft)	in.	0.08333	ft	1 in. ≈ 0.08 ft
inches (in.)	meters (m)	in.	0.02540	m	1 in. ≈ 0.03 m
inches (in.)	millimeters (mm)	in.	25.40	mm	1 in. ≈ 30 mm
inches (in.)	yards (yd)	in.	0.02778	yd	1 in. ≈ 0.03 yd
inches of mercury (in. Hg)	feet (ft) of water	in. Hg	1.133	ft of water	1 in. Hg ≈ 1 ft of water
inches of mercury (in. Hg)	inches (in.) of water	in. Hg	13.60	in. of water	1 in. Hg ≈ 15 in. of water
inches of mercury (in. Hg)	pounds per square foot (lb/ft ²)	in. Hg	70.73	lb/ft ²	1 in. Hg \approx 70 lb/ft ³
inches of mercury (in. Hg)	pounds per square inch (psi)	in. Hg	0.4912	psi	1 in. Hg ≈ 0.5 psi
inches per minute (in./min)	millimeters per second (mm/s)	in./min	0.4233	mm/s	1 in./min ≈ 0.4 mm/s
inches (in.) of water	inches of mercury (in. Hg)	in. of water	0.07355	in. Hg	1 in. of water ≈ 0.07 in. Hg

TABLE E-1 Conversion Factors (continued)

Conversions			Procedure	Approximations	
From	То	Multiply number of	by	To get number of	(Actual answer will be within 25% of approximate answer.)
inches (in.) of water	pounds per square foot (lb/ft ²)	in. of water	5.198	lb/ft ²	1 in. of water ≈ 5 lb/ft ²
inches (in.) of water	pounds per square inch gauge (psig)	in. of water	0.03610	psig	l in. of water ≈ 0.04 psig
kilograms (kg)	grams (g)	kg	1,000	g	_
kilograms (kg)	pounds (lb)	kg	2.205	lb	1 kg ≈ 2 lb
kiloliters (kL)	cubic feet (ft ³)	kL	35.31	ft ³	$1 \text{ kL} \approx 40 \text{ ft}^3$
kiloliters (kL)	cubic meters (m ³)	kL	1.0	m ³	_
kiloliters (kL)	gallons (gal)	kL	264.2	gal	1 kL ≈ 300 gal
kiloliters (kL)	liters (L)	kL	1,000	L	_
kilometers (km)	feet (ft)	km	3,281	ft	1 km ≈ 3,000 ft
kilometers (km)	meters (m)	km	1,000	m	_
kilometers (km)	miles (mi)	km	0.6214	mi	1 km ≈ 0.6 mi
kilometers (km)	yards (yd)	km	1,094	yd	1 km ≈ 1,000 yd
kilometers per hour (km/h)	feet per minute (ft/min)	km/h	54.68	ft/min	1 km/h ≈ 50 ft/min
kilometers per hour (km/h)	feet per second (ft/s)	km/h	0.9113	ft/s	1 km/h ≈ 1 ft/s
kilometers per hour (km/h)	meters per minute (m/min)	km/h	16.67	m/min	1 km/h ≈ 15 m/min
kilometers per hour (km/h)	meters per second (m/s)	km/h	0.2778	m/s	1 km/h ≈ 0.3 m/s
kilometers per hour (km/h)	miles per hour (mph)	km/h	0.6214	mph	1 km/h ≈ 0.6 mph
kilopascals (kPa)	feet (ft) of hydraulic head	kPa	0.3346	ft of head	1 kPa ≈ 0.3 ft of head

TABLE E-1 Conversion Factors (continued)

Conversions			Procedure	Approximations	
From	То	Multiply number of	by	To get number of	(Actual answer will be within 25% of approximate answer.)
kilowatts (kW)	foot-pounds per minute (ft-lb/min)	kW	44,250	ft-lb/min	1 kW ≈ 40,000 ft-lb/min
kilowatts (kW)	horsepower (hp)	kW	1.341	hp	1 kW ≈ 1.5 hp
kilowatts (kW)	watts (W)	kW	1,000	W	_
liters (L)	cubic centimeters (cm ³)	L	1,000	cm ³	_
liters (L)	cubic feet (ft ³)	L	0.03531	ft ³	$1 L \approx 0.04 \text{ ft}^3$
liters (L)	cubic inches (in. ³)	L	61.03	in. ³	1 L ≈ 60 in. ³
liters (L)	cubic meters (m ³)	L	0.001	m ³	_
liters (L)	cubic yards (yd³)	L	0.001308	yd ³	$1 L \approx 0.0015 \text{ yd}^3$
liters (L)	gallons (gal)	L	0.2642	gal	1 L ≈ 0.3 gal
liters (L)	kiloliters (kL)	L	0.001	kL	_
liters (L)	milliliters (mL)	L	1,000	mL	_
liters (L)	ounces (oz), fluid)	L	33.81	oz (fluid)	1 L ≈ 30 oz (fluid)
liters (L)	quarts (qt), fluid	L	1.057	qt (fluid)	1 L≈1 qt (fluid)
liters per capita per day (L/d per capita)	gallons per capita per day (gpcd)	L/d per capita	0.2642	gpcd	1 L/d per capita ≈ 0.3 gpcd
liters per day (L/d)	gallons per day (gpd)	L/d	0.2642	gpd	1 L/d ≈ 0.3 gpd
liters per minute (L/min)	gallons per second (gps)	L/min	0.004403	gps	1 L/min ≈ 0.004 gps
liters per second (L/s)	cubic feet per minute (ft ³ /min)	L/s	2.119	ft ³ /min	$1 \text{ L/s} \approx 2 \text{ ft}^3/\text{min}$
liters per second (L/s)	gallons per hour (gph)	L/s	951.0	gph	1 L/s ≈ 1000 gph

TABLE E-1 Conversion Factors (continued)

Conversions			Procedure	Approximations	
From	То	Multiply number of	by	To get number of	(Actual answer will be within 25% of approximate answer.)
liters per second (L/s)	gallons per minute (gpm)	L/s	15.85	gpm	1 L/s ≈ 15 gpm
megaliters per day (ML/d)	million gallons per day (mgd)	ML/d	0.2642	mgd	1 ML/d ≈ 0.3 mgd
meters (m)	centimeters (cm)	m	100	cm	_
meters (m)	feet (ft)	m	3.281	ft	1 m ≈ 3 ft
meters (m)	inches (in.)	m	39.37	in.	1 m ≈ 40 in.
meters (m)	kilometers (km)	m	0.001	km	_
meters (m)	miles (mi)	m	0.0006214	mi	1 m ≈ 0.0006 mi
meters (m)	millimeters (mm)	m	1,000	mm	_
meters (m)	yards (yd)	m	1.094	yd	1 m ≈ 1 yd
meters (m) of hydraulic head	feet (ft) of hydraulic head	m of head	3.281	ft of head	1 m of head ≈ 3 ft of head
meters (m) of hydraulic head	pounds per square inch gauge (psig)	m of head	1.422	psig	1 m of head ≈ 1.5 psig
meters per minute (m/min)	centimeters per second (cm/s)	m/min	1.667	cm/s	1 m/min ≈ 1.5 cm/s
meters per minute (m/min)	feet per minute (ft/min)	m/min	3.281	ft/min	1 m/min ≈ 3 ft/min
meters per minute (m/min)	feet per second (ft/s)	m/min	0.05468	ft/s	1 m/min ≈ 0.05 ft/s
meters per minute (m/min)	kilometers per hour (km/h)	m/min	0.06	km/h	_
meters per minute (m/min)	miles per hour (mph)	m/min	0.03728	mph	1 m/min ≈ 0.04 mph
meters per second (m/s)	feet per hour (ft/h)	m/s	11,810	ft/h	1 m/s ≈ 10,000 ft/h
meters per second (m/s)	feet per minute (ft/min)	m/s	196.8	ft/min	1 m/s ≈ 200 ft/min
meters per second (m/s)	feet per second (ft/s)	m/s	3.281	ft/s	1 m/s ≈ 3 ft/s

291

TABLE E-1 Conversion Factors (continued)

Conversions			Procedure	Approximations	
From	То	Multiply number of	by	To get number of	(Actual answer will be within 25% of approximate answer.)
meters per second (m/s)	kilometers per hour (km/h)	m/s	3.6	km/h	1 m/s ≈ 4 km/h
meters per second (m/s)	miles per hour (mph)	m/s	2.237	mph	1 m/s ≈ 2 mph
miles (mi)	feet (ft)	mi	5,280	ft	1 mi ≈ 5,000 ft
miles (mi)	kilometers (km)	mi	1.609	km	1 mi ≈ 1.5 km
miles (mi)	meters (m)	mi	1,609	m	1 mi ≈ 1,500 m
miles (mi)	yards (yd)	mi	1,760	yd	1 mi ≈ 2,000 yd
miles per hour (mph)	feet per minute (ft/min)	mph	88	ft/min	1 mph ≈ 90 ft/min
miles per hour (mph)	feet per second (ft/s)	mph	1.467	ft/s	1 mph ≈ 1.5 ft/s
miles per hour (mph)	kilometers per hour (km/h)	mph	1.609	km/h	1 mph ≈ 1.5 km/h
miles per hour (mph)	meters per minute (m/min)	mph	26.82	m/min	1 mph ≈ 30 m/min
miles per hour (mph)	meters per second (m/s)	mph	0.4470	m/s	1 mph ≈ 0.4 m/s
milligrams (mg)	grams (g)	mg	0.001	g	_
milliliters (mL)	liters (L)	mL	0.001	L	_
millimeters (mm)	centimeters (cm)	mm	0.1	cm	_
millimeters (mm)	feet (ft)	mm	0.003281	ft	1 mm ≈ 0.003 ft
millimeters (mm)	inches (in.)	mm	0.03937	in.	1 mm ≈ 0.04 in.
millimeters (mm)	meters (m)	mm	0.001	m	_
millimeters (mm)	yards (yd)	mm	0.001094	yd	1 mm ≈ 0.001 yd
millimeters per second (mm/s)	gallons per day per square foot (gpd/ft²)	mm/s	2,121	gpd/ft ²	$1 \text{ mm/s} \approx 2,000 \text{ gpd/ft}^2$

TABLE E-1 Conversion Factors (continued)

Conversions			Procedure	Approximations	
From	То	Multiply number of	by	To get number of	(Actual answer will be within 25% of approximate answer.)
millimeters per second (mm/s)	gallons per minute per square foot (gpm/ft²)	mm/s	1.473	gpm/ft ²	$1 \text{ mm/s} \approx 1.5 \text{ gpm/ft}^2$
millimeters per second (mm/s)	inches per minute (in./min)	mm/s	2.362	in./min	1 mm/s ≈ 2 in./min
million gallons per day (mgd)	cubic feet per second (ft ³ /s)	mgd	1.547	ft ³ /s	$1 \text{ mgd} \approx 1.5 \text{ ft}^3/\text{s}$
million gallons per day (mgd)	megaliters per day (ML/d)	mgd	3.785	ML/d	1 mgd ≈ 4 ML/d
ounces (oz), avoirdupois	grams (g)	OZ	28.35	g	1 oz ≈ 30 g
ounces (oz), avoirdupois	pounds (lb)	OZ	0.0625	lb	1 oz ≈ 0.06 lb
ounces (oz), fluid	liters (L)	OZ	0.02957	L	1 oz ≈ 0.03 L
pascals (Pa)	feet (ft) of hydraulic head	Pa	0.0003346	ft of head	1 Pa ≈ 0.0003 ft of head
pascals (Pa)	pounds per square inch (psi)	Pa	0.0001450	psi	1 Pa ≈ 0.00015 psi
pounds (lb)	grains (gr)	lb	7,000	gr	
pounds (lb)	grams (g)	lb	453.6	g	1 lb ≈ 500 g
pounds (lb)	kilograms (kg)	lb	0.4536	kg	1 lb ≈ 0.5 kg
pounds (lb)	ounces (oz), avoirdupois	lb	16	OZ	_
pounds (lb) of water	cubic feet (ft ³)	lb of water	0.01603	ft ³	1 lb of water $\approx 0.015 \text{ ft}^3$
pounds (lb) of water	gallons (gal)	lb of water	0.1199	gal	1 lb of water ≈ 0.1 gal
pounds per square foot (lb/ft ²)	feet (ft) of water	lb/ft ²	0.01603	ft of water	$1 \text{ lb/ft}^2 \approx 0.015 \text{ ft of water}$
pounds per square foot (lb/ft ²)	inches of mercury (in. Hg)	lb/ft ²	0.01414	in. Hg	1 lb/ft ² \approx 0.015 in. Hg
pounds per square foot (lb/ft²)	inches (in.) of water	lb/ft ²	0.1924	in. of water	1 lb/ft ² ≈ 0.2 in. of water

TABLE E-1 Conversion Factors (continued)

Conversions			Procedure	Approximations	
From	То	Multiply number of	by	To get number of	(Actual answer will be within 25% of approximate answer.)
pounds per square inch gauge (psig)	feet (ft) of water	psig	2.31	ft of water	1 psig ≈ 2 ft of water
pounds per square inch (psi)	inches of mercury (in. Hg)	psi	2.036	in. Hg	1 psi ≈ 2 in. Hg
pounds per square inch gauge (psig)	inches (in.) of water	psig	27.70	in. of water	1 psig ≈ 30 in. of water
pounds per square inch gauge (psig)	meters (m) of hydraulic head	psig	0.7034	m of head	1 psig ≈ 0.7 m of head
pounds per square inch (psi)	pascals (Pa)	psi	6,895	Pa	1 psi ≈ 7,000 Pa
quarts (qt)	gallons (gal)	qt	0.25	gal	_
quarts (qt)	liters (L)	qt	0.9464	L	1 qt ≈ 0.9 L
square centimeters (cm ²)	square inches (in. ²)	cm ²	0.1550	in. ²	$1 \text{ cm}^2 \approx 0.15 \text{ in.}^2$
square centimeters (cm ²)	square millimeters (mm ²)	cm ²	100	mm ²	_
square feet (ft ²)	acres	ft ²	0.00002296	acres	$1 \text{ ft}^2 \approx 0.00002 \text{ acre}$
square feet (ft ²)	square inches (in. ²)	ft ²	144	in. ²	$1 \text{ ft}^2 \approx 150 \text{ in.}^2$
square feet (ft ²)	square meters (m ²)	ft ²	0.09290	m ²	$1 \text{ ft}^2 \approx 0.09 \text{ m}^2$
square feet (ft ²)	square millimeters (mm ²)	ft ²	92,900	mm ²	$1 \text{ ft}^2 \approx 90,000 \text{ mm}^2$
square feet (ft ²)	square yards (yd²)	ft ²	0.1111	yd ²	$1 \text{ ft}^2 \approx 0.1 \text{ yd}^2$
square inches (in. ²)	square centimeters (cm ²)	in. ²	6.452	cm ²	$1 \text{ in.}^2 \approx 6 \text{ cm}^2$
square inches (in. ²)	square feet (ft ²)	in. ²	0.006944	ft ²	$1 \text{ in.}^2 \approx 0.007 \text{ ft}^2$
square inches (in. ²)	square meters (m ²)	in. ²	0.0006452	m ²	$1 \text{ in.}^2 \approx 0.0006 \text{ m}^2$
square inches (in. ²)	square millimeters (mm ²)	in. ²	645.2	mm ²	$1 \text{ in.}^2 \approx 600 \text{ mm}^2$

TABLE E-1 Conversion Factors (continued)

Conversions			Procedure	Approximations	
From	То	Multiply number of	by	To get number of	(Actual answer will be within 25% of approximate answer.)
square inches (in. ²)	square yards (yd ²)	in. ²	0.0007716	yd ²	$1 \text{ in.}^2 \approx 0.0008 \text{ yd}^2$
square kilometers (km ²)	acres	km ²	247.1	acres	1 km ² ≈ 200 acres
square kilometers (km ²)	square miles (mi ²)	km ²	0.3861	mi ²	$1 \text{ km}^2 \approx 0.4 \text{ mi}^2$
square meters (m ²)	acres	m ²	0.0002471	acres	$1 \text{ m}^2 \approx 0.0002 \text{ acre}$
square meters (m ²)	hectares (ha)	m ²	0.0001	ha	_
square meters (m ²)	square feet (ft ²)	m ²	10.76	ft ²	$1 \text{ m}^2 \approx 10 \text{ ft}^2$
square meters (m ²)	square inches (in. ²)	m ²	1,550	in. ²	$1 \text{ m}^2 \approx 1,500 \text{ in.}^2$
square meters (m ²)	square miles (mi ²)	m ²	0.0000003861	mi ²	$1 \text{ m}^2 \approx 0.0000004 \text{ mi}^2$
square meters (m ²)	square yards (yd ²)	m ²	1.196	yd ²	$1 \text{ m}^2 \approx 1 \text{ yd}^2$
square meters per day (m ² /d)	gallons per day per foot (gpd/ft)	m²/d	80.53	gpd/ft	$1 \text{ m}^2/\text{d} \approx 80 \text{ gpd/ft}$
square miles (mi ²)	acres	mi ²	640	acres	1 mi ² ≈ 600 acres
square miles (mi ²)	hectares (ha)	mi ²	259.0	ha	1 mi ² ≈ 300 ha
square miles (mi ²)	square kilometers (km²)	mi ²	2.590	km ²	$1 \text{ mi}^2 \approx 3 \text{ km}^2$
square miles (mi ²)	square meters (m ²)	mi ²	2,590,000	m ²	$1 \text{ mi}^2 \approx 3,000,000 \text{ m}^2$
square millimeters (mm ²)	square centimeters (cm ²)	mm ²	0.01	cm ²	_
square millimeters (mm ²)	square feet (ft ²)	mm ²	0.00001076	ft ²	$1 \text{ mm}^2 \approx 0.00001 \text{ ft}^2$
square millimeters (mm ²)	square inches (in. ²)	mm ²	0.001550	in. ²	$1 \text{ mm}^2 \approx 0.0015 \text{ in.}^2$
square millimeters per second (mm²/s)	gallons per day per foot (gpd/ft)	mm ² /s	6.958	gpd/ft	$1 \text{ mm}^2/\text{s} \approx 7 \text{ gpd/ft}$

295

TABLE E-1 Conversion Factors (continued)

Conversions			Procedure	Approximations	
From	То	Multiply number of	by	To get number of	(Actual answer will be within 25% of approximate answer.)
square yards (yd ²)	acres	yd ²	0.0002066	acres	$1 \text{ yd}^2 \approx 0.0002 \text{ acre}$
square yards (yd ²)	square feet (ft ²)	yd ²	9	ft ²	_
square yards (yd ²)	square inches (in. ²)	yd ²	1,296	in. ²	$1 \text{ yd}^2 \approx 1,500 \text{ in.}^2$
square yards (yd ²)	square meters (m ²)	yd ²	0.8361	m^2	$1 \text{ yd}^2 \approx 0.8 \text{ m}^2$
watts (W)	foot-pounds per minute (ft-lb/min)	W	44.25	ft-lb/min	1 W ≈ 40 ft-lb/min
watts (W)	horsepower (hp)	W	0.001341	hp	1 W ≈ 0.0015 hp
watts (W)	kilowatts (kW)	W	0.001	kW	_
yards (yd)	feet (ft)	yd	3	ft	_
yards (yd)	inches (in.)	yd	36	in.	1 yd ≈ 40 in.
yards (yd)	kilometers (km)	yd	0.0009144	km	1 yd ≈ 0.0009 km
yards (yd)	meters (m)	yd	0.9144	m	1 yd ≈ 0.9 m
yards (yd)	miles (mi)	yd	0.0005681	mi	1 yd ≈ 0.0006 mi
yards (yd)	millimeters (mm)	yd	914.4	mm	1 yd ≈ 900 mm

About the Authors

Angela K. Lafferty is the benchmarking project manager for the American Water Works Association. In this role Ms. Lafferty has lead the development of the program and has served as associate principal investigator in the Performance Indicators research project that identified the measures that were used in the Survey and whose data is represented in this publication.

Ms. Lafferty has more than 8 years of experience in quality improvement programs. QualServe, accreditation, and International Organization for Standardization (ISO) processes are a specialty.

William C. Lauer has more than 30 years of experience in drinking water quality and treatment process technology. He is a nationally recognized authority on drinking water quality, treatment methods, distribution system issues, and utility management.

Mr. Lauer has been program manager for the *Partnership for Safe Water* treatment plant optimization program since 1996. This program is a benchmarking effort to improve treatment plant performance. Mr. Lauer was also manager of utility quality programs for AWWA during the period that the benchmarking performance indicators were developed.

Mr. Lauer is a noted author and has published more than 70 articles and books, and conducted training programs on a wide variety of technical subjects. His work in statistical data analysis is represented in several of these publications.



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THE PUBLIC SERVICE COMMISSION OF WISCONSIN

Water Utility Benchmarks

Statewide Statistical Benchmarks, 2007

	Number of			
Description of Benchmark	<u>Utilities</u>	<u>Minimum</u>	<u>Maximum</u>	<u>Average</u>
Operating Revenues, Metered Sales of Water				
Residential per customer				
Class AB	81	90.33	514.26	190.47
Class C	142	92.14	370.11	195.32
Class D	336	41.66	646.05	203.92
Residential per thousand gallons of water sold				
Class AB	81	1.59	13.87	3.05
Class C	142	1.41	9.05	3.72
Class D	336	0.96	36.87	4.48
Commercial per customer				
Class AB	81	229.84	1,787.79	765.78
Class C	142	60.88	2,392.22	560.45
Class D	327	56.33	3,263.46	484.15
Commercial per thousand gallons of water sold				
Class AB	81	1.09	10.84	2.18
Class C	142	1.14	9.79	2.7
Class D	327	0.59	41.02	2.98
Industrial per customer				
Class AB	77	283.32	120,227.00	7,122.71

Class C	115	103	85,046.29	4,645.20
Class D	196	60	197,672.00	2,662.14
Industrial per thousand gallons of water sold				
Class AB	77	0.5	10.41	1.42
Class C	115	0.32	12.88	1.52
Class D	196	0.28	37.4	1.38
Public authorities per customer				
Class AB	81	476.16	25,559.00	2,219.45
Class C	142	177.55	8,705.00	1,097.98
Class D	313	49.75	52,160.33	696.42
Public authorities per thousand gallons of water so	old			
Class AB	81	0.98	11.95	1.72
Class C	142	0.27	14.74	2.37
Class D	313	0.76	1,373.00	3.09
Total Operating Revenues Per Full-Time Equivalen	t Employee			
Class AB	81	143,051.13	1,017,745.81	264,313.66
Class C	142	43,432.00	2,516,130.00	292,170.31
Class D	326	10,470.25	2,541,840.00	180,939.93
Transmission and Distribution Expenses for Class Al	3 and C Utilities			
Per \$1,000 of utility plant				
Class AB	81	10.63	94.35	43.19
Class C	142	1.93	227.59	27.7
Per \$1,000 of revenues				
Class AB	81	44.9	305.07	152.2
Class C	142	10.21	797.95	111.68

Per milion gallons of water sold				
Class AB	81	131.81	2,669.55	419.47
Class C	142	79.21	3,780.96	459.98
Per customer				
Class AB	81	17.67	152.02	61.33
Class C	142	5.93	302.88	46.69
Customer Accounts Expenses for Classes AB and C Utili	ities			
Per \$1,000 of revenues				
Class AB	81	6.15	112.69	21.43
Class C	140	0.4	141.92	29.09
Per milion gallons of water sold				
Class AB	81	23.75	444.86	59.06
Class C	140	0.57	793.26	119.67
Per customer				
Class AB	81	3.98	34.49	8.63
Class C	140	0.46	49.62	12.2
Sales Expenses for Classes AB and C Utilities				
Per \$1,000 of revenues				
Class AB	11	0.02	11.52	2.29
Per milion gallons of water sold				
Class AB	11	0.08	39.68	8.53
Per customer				

Class AB	11	0.01	5.5	0.95
Administrative and General Expenses for Classes AB and	<u>C Utilities</u>			
Per \$1,000 of revenues				
Class AB	81	33.32	364.52	139.57
Class C	142	50.36	564.44	168.01
Per milion gallons of water sold				
Class AB	81	144.41	3,932.11	384.68
Class C	142	83.51	3,884.89	691.95
Per customer				
Class AB	81	21.92	292.66	56.24
Class C	142	21.22	466.38	70.24
Total Operating and Maintenance Expenses				
Per \$1,000 of utility plant				
Class AB	81	41.66	450.82	94.59
Class C	142	22.74	397.06	83.92
Class D	338	23.86	18,034.55	81.22
Per \$1,000 of revenues				
Class AB	81	350.19	1,029.46	560.35
Class C	142	271.39	1,426.48	502.27
Class D	339	207.29	3,389.56	539.27
Per milion gallons of water sold				
Class AB	81	644.45	8,857.73	1,544.41
Class C	142	507.07	6,759.15	2,068.63
Class D	339	510.72	36,234.49	2,803.33

Per customer				
Class AB	81	111.64	629.36	225.8
Class C	142	100.92	1,566.91	209.97
Class D	339	79.13	2,456.73	225.08
Other Operating ExpensesDepreciation				
Per \$1,000 of utility plant				
Class AB	81	16.99	35.72	23.42
Class C	142	6.67	42.31	24.46
Class D	338	2.22	99.29	23.89
Per \$1,000 of operating revenues				
Class AB	81	44.59	217.55	138.73
Class C	142	38.83	721.66	146.4
Class D	338	1.73	3,659.01	158.6
Per milion gallons of water sold				
Class AB	81	137.07	4,223.72	382.36
Class C	142	116.23	3,220.04	602.95
Class D	338	13.41	30,930.68	824.48
Per customer				
Class AB	81	17.1	191.65	55.9
Class C	142	13.53	844.24	61.2
Class D	338	0.57	704.13	66.2
Other Operating ExpensesAmortization				
Per \$1,000 of utility plant				
Class AB	6	0.84	9.4	2.57

Class C	5	0.07	15.38	2.33
Class D	21	0.01	15.17	4.99
Per \$1,000 of operating revenues				
Class AB	6	7.49	61.72	19.24
Class C	5	0.38	67.25	10.69
Class D	21	0.08	135.35	32.39
Per milion gallons of water sold				
Class AB	6	19.76	159.24	65.03
Class C	5	1.62	187.86	39.86
Class D	21	0.7	1,105.84	241.96
Per customer				
Class AB	6	3.64	18.3	9.09
Class C	5	0.13	23.01	3.97
Class D	21	0.04	60.79	16.67
Taxes for a Municipally-Owned Water Utility				
Per \$1,000 of utility plant				
Class AB	79	9.04	47.79	21.57
Class C	133	3.92	85.93	25.03
Class D	285	-0.83	1,919.85	22.56
Per \$1,000 of operating revenues				
Class AB	79	53.2	257.6	128.75
Class C	133	34.08	647	149.95
Class D	285	-5.91	462.11	149.89
Per milion gallons of water sold				
Class AB	79	154.83	3,421.89	352.07

Class C	133	107.68	2,445.80	615.15
Class D	285	-24.67	12,332.97	763.3
Per customer				
Class AB	79	22.19	155.27	51.91
Class C	133	12.34	756.89	63.72
Class D	285	-1.13	767.37	62.16
Taxes for a Sanitary District				
Per \$1,000 of utility plant				
Class AB	2	1.92	2.76	2.25
Class C	9	0.8	5.48	2.72
Class D	49	0.12	149.45	2.08
Per \$1,000 of operating revenues				
Class AB	2	6.3	9.36	7.58
Class C	9	3.23	31.64	15.91
Class D	50	0.59	90.5	13.65
Per milion gallons of water sold				
Class AB	2	35.49	39.58	37.49
Class C	9	12.83	222.5	70.91
Class D	50	2.84	765.02	85.85
Per customer				
Class AB	2	2.94	2.97	2.95
Class C	9	0.85	17.63	5.09
Class D	50	0.19	15.04	6.02

Total Operating Expenses

Per \$1,000 of utility plant				
Class AB	81	76.87	473.1	139.77
Class C	142	49.23	452.11	132.4
Class D	338	46.17	18,230.18	125.97
Per \$1,000 of revenues				
Class AB	81	629.47	1,153.78	828.01
Class C	142	504.81	2,708.07	792.35
Class D	339	337.6	7,139.06	836.14
Per milion gallons of water sold				
Class AB	81	936.34	16,503.33	2,282.11
Class C	142	824.43	9,727.35	3,263.37
Class D	339	673.98	60,348.64	4,346.61
Per customer				
Class AB	81	193.4	748.84	333.65
Class C	142	150.06	3,168.04	331.24
Class D	339	106.9	3,729.40	348.99
Per full-time equivalent employee				
Class AB	81	121,015.79	832,982.63	218,853.36
Class C	142	36,308.50	2,054,400.00	231,501.88
Class D	326	9,765.00	2,370,670.00	151,119.56
verage Cost of Additions and Retirements for Ma	ass Property Plant Acc	<u>ounts</u>		
Transmission and distribution mains, average co	st per foot for addition	S		
Class AB	76	22.81	306.13	78.55
Class C	107	5.71	2,041.37	61.78
Class D	123	0.58	114,856.00	44.98
			•	

Transmission and distribution mains, average cost per f	oot for retirement	:S		
Class AB	71	1.09	162	7.87
Class C	73	0.63	67.47	10.83
Class D	52	0.76	49.6	9.24
Services, average cost per unit of additions				
Class AB	76	20.2	21,883.33	987.43
Class C	112	18	54,682.50	713.79
Class D	154	25	120,000.00	1,560.74
Services, average cost per unti for retirements				
Class AB	66	0.6	19,535.00	116.24
Class C	73	12.73	3,026.00	166.26
Class D	55	20	1,025.00	116.97
Meters, average cost per unit for additions				
Class AB	79	26.65	7,168.00	259.88
Class C	136	34.73	38,053.00	243.72
Class D	221	4	13,194.25	189.9
Meters, average cost per unit for retirements				
Class AB	74	10	1,221.33	121.27
Class C	115	4.04	2,579.09	82.78
Class D	200	3.39	767	71.46
Hydrants, average cost per unit for additions				
Class AB	76	721.6	26,135.43	4,211.01
Class C	107	767.57	12,909.00	3,388.08
Class D	146	107	28,810.00	3,724.08
Hydrants, average cost per unit for retirements				
Class AB	68	75	8,583.09	692.79

Class C	78	70	2,969.00	644.95
Class D	74	70	2,400.00	688.52
Pumping Statistics				
Total Kilowatt hours of electricity used per mi	llion gallons pumped			
Class AB	81	3.03	4,848.71	1,723.04
Class C	139	321.04	6,442.86	2,006.51
Class D	319	3.19	12,188.03	2,073.58
Percent of water pumped into distribtion mai	ns which is unaccounted fo	or		
Class AB	81	-10.00%	30.00%	11.00%
Class C	142	-22.00%	37.00%	10.00%
Class D	331	-11.00%	65.00%	12.00%
Financial Ratios				
Debt to equity ratio, defined as long-term deb	ot and notes payable divide	ed by municipal equ	uity	
Class AB	76	3.00%	352.00%	44.00%
Class C	135	1.00%	423.00%	34.00%
Class D	232	-310.00%	585.00%	49.00%
Rate of return of net investment rate base (N	IRB) in percent			
Class AB	81	-5.78%	10.21%	4.22%
Class C	142	-25.49%	24.19%	5.03%
Class D	328	-125.14%	93.38%	3.57%
Water Production Expenses for Class AB Utilities	es With Own Source of Gre	ound Water		
Source of Supply Expenses				
Per \$1,000 of utility plant	40	3.11	7,777.71	227.31
Per \$1,000 of revenues	40	1.21	633.99	81.31

Per million gallons of water sold	40	4.55	4,464.26	230.99
Per customer	40	0.5	407.22	29.85
Pumping Expenses				
Per \$1,000 of utility plant	54	40.55	463.64	171.22
Per \$1,000 of revenues	54	25.68	200.01	104.29
Per million gallons of water sold	54	108.26	826.27	303.7
Per customer	54	15.18	82.85	37.87
Water Treatment Expenses				
Per \$1,000 of utility plant	54	21.03	6,008.63	124.47
Per \$1,000 of revenues	54	3.46	234.45	42.46
Per million gallons of water sold	54	17.18	1,087.15	123.66
Per customer	54	2.22	90.29	15.42

Water Production Expenses for Class AB Utilities With Own Source of surface Water from Lakes Michigen and Superior

Source of Supply Expenses				
Per \$1,000 of utility plant	7	0.32	111.81	2.89
Per \$1,000 of revenues	7	0.87	10.05	4.22
Per million gallons of water sold	7	2.31	51.01	9.68
Per customer	7	0.43	6.04	1.93
Pumping Expenses				
Per \$1,000 of utility plant	11	88.82	459.79	191.53
Per \$1,000 of revenues	11	33.87	131.13	86.73
Per million gallons of water sold	11	137.35	746.38	185.96
Per customer	11	11.5	75.75	36.94
Water Treatment Expenses				
Per \$1,000 of utility plant	11	35.86	391.86	79.37

Per \$1,000 of revenues	11	76.39	260.32	141.73
Per million gallons of water sold	11	146.91	1,320.91	303.9
Per customer	11	27.48	88.88	60.37
Water Production Expenses for Class AB Utilities Wi	ith Own Source of Sur	face Water from	<u>Lake Winnebago</u>	
Source of Supply Expenses				
Per \$1,000 of utility plant	3	7.36	200.12	31.51
Per \$1,000 of revenues	3	1	11.57	3.12
Per million gallons of water sold	3	6.16	50.91	17.88
Per customer	3	0.67	7.92	2.08
Pumping Expenses				
Per \$1,000 of utility plant	4	135.92	339.45	180.7
Per \$1,000 of revenues	4	39.81	70.6	54.77
Per million gallons of water sold	4	224.37	341.28	313.22
Per customer	4	26.59	48.32	32.68
Water Treatment Expenses				
Per \$1,000 of utility plant	4	42.14	275.97	89.55
Per \$1,000 of revenues	4	125.47	298.58	209.75
Per million gallons of water sold	4	713.86	1,639.45	1,199.56
Per customer	4	58.97	204.35	125.15
Water Production Expenses for Class AB Utilities Wi	ith Purchased Water			
Source of Supply Expenses				
Per \$1,000 of utility plant	7	743.8	16,820.03	2,081.09
Per \$1,000 of revenues	9	202.85	857.92	387.21
Per million gallons of water sold	9	694.22	4,834.55	1,508.44
Per customer	9	79.81	404.33	145.13

Pumping Expenses				
Per \$1,000 of utility plant	7	15.81	231.06	126.49
Per \$1,000 of revenues	7	3.78	71.25	44.02
Per milion gallons of water sold	7	12.43	417.57	173.57
Per customer	7	1.49	28.03	16.4
Water Treatment Expenses				
Per \$1,000 of utility plant	4	63.06	1,620.48	292.2
Per \$1,000 of revenues	5	0.6	9.53	4.34
Per million gallons of water sold	5	2.36	55.09	17.88
Per customer	5	0.25	3.76	1.66
Water Production Expenses for Class C Utilities With C	Own Source of Ground	d Water		
Source of Supply Expenses				
Per \$1,000 of utility plant	95	0.31	3,066.23	95.22
Per \$1,000 of revenues	95	0.05	590.1	46.39
Per million gallons of water sold	95	0.2	4,183.03	197.81
Per customer	95	0.02	378.39	19.35
Pumping Expenses				
Per \$1,000 of utility plant	135	3.1	780.26	117.18
Per \$1,000 of revenues	135	4.82	445.91	87.67
Per million gallons of water sold	135	50.83	1,947.03	357.03
Per customer	135	2.15	393.54	35.91
Water Treatment Expenses				
Per \$1,000 of utility plant	130	5.47	307,000.00	111.42
Per \$1,000 of revenues	133	2.2	506.88	51.4
Per million gallons of water sold	133	9.37	2,017.34	210.16
Per customer	133	0.76	592.98	21.16

Water Production Expenses for Class C Utilities With Purchased water

Source of Supply Expenses				
Per \$1,000 of utility plant	4	800.17	6,213.80	2,982.36
Per \$1,000 of revenues	5	163.21	540.81	408.62
Per million gallons of water sold	5	826.06	2,117.97	1,805.04
Per customer	5	81.37	312.5	222.88
Pumping Expenses				
Per \$1,000 of utility plant	3	40.81	204.28	54.97
Per \$1,000 of revenues	3	22.97	40.63	35.18
Per million gallons of water sold	3	99.25	216.38	165.22
Per customer	3	14.05	35.79	21.99
Water Treatment Expenses				
Per \$1,000 of utility plant	1	580.79	580.79	580.79
Per \$1,000 of revenues	1	1.45	1.45	1.45
Per million gallons of water sold	1	6.25	6.25	6.25
Per customer	1	0.73	0.73	0.73
Class D Operating and Maintenance Expenses				
Plant Operation and Maintenance Expenses				
Per \$1,000 of utility plant	338	11.54	9,626.55	51.8
Per \$1,000 of revenues	339	80.82	1,735.85	343.89
Per million gallons of water sold	339	319.44	27,607.23	1,787.69
Per customer	339	26.06	1,838.20	143.53
General Operating Expenses				
Per \$1,000 of utility plant	338	4.43	8,408.00	29.43
Per \$1,000 of revenues	339	46.55	1,653.71	195.37

Per million gallons of water sold	339	114.19	13,979.29	1,015.63
Per customer	339	15.28	700.67	81.55

GLS 5

A Final Report Submitted by the Effective Utility Management Steering Committee to the Collaborating Organizations:

American Public Works Association
American Water Works Association
Association of Metropolitan Water Agencies
National Association of Clean Water Agencies
National Association of Water Companies
U.S. Environmental Protection Agency
Water Environment Federation

Findings and Recommendations for a Water Utility Sector Management Strategy
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Table of Contents

Execu	utive Summary	ES-1
I.	Introduction	1
II.	Challenges Faced by Water Utilities and Barriers to Implementing Management	
	Improvement Efforts	3
III.	Ten Attributes of Effectively-Managed Water Sector Utilities	6
IV.	Water Utility Measures	11
V.	Water Utility Management Resources	16
VI.	Supporting Strategy Elements	22
VII.	Next Steps for the Sector Strategy	24
VIII.	Conclusion	26

Appendices (provided separately)

Appendix A: May 2, 2006 Statement of Intent

Appendix B: Focus Group Participants

Appendix C: Focus Group Agenda

Appendix D: Example Utility Measures

Appendix E: Example Resources

Appendix F: Steering Committee Members and Collaborating Organization

Representatives

Findings and Recommendations for a Water Utility Sector Management Strategy
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Executive Summary

On May 2, 2006, the Effective Utility Management Collaborating Organizations—The Association of Metropolitan Water Agencies; the American Public Works Association; the American Water Works Association; the National Association of Clean Water Agencies; the National Association of Water Companies; the United States Environmental Protection Agency; and the Water Environment Federation—(referred to as the Collaborating Organizations) entered into a Statement of Intent¹ to "formalize a collaborative effort among the signatory organizations in order to promote effective utility management." The Statement of Intent included a commitment to produce "a joint strategy to identify, encourage, and recognize excellence in water and wastewater utility management."

The seven organizations formed and chartered the Effective Utility Management Steering Committee (Steering Committee) to advise them on a future, joint water utility sector management strategy that would be applicable to water, wastewater, and combined water/wastewater utilities across the country. The Steering Committee, composed of sixteen managers from water sector utilities across the country, was asked to prepare a synthesis of findings and recommendations on a future water sector strategy. The Steering Committee deliberated for nine months, met in person twice, and received targeted input from two focus groups. This report presents the Steering Committee's findings and recommendations to the Collaborating Organizations.

The Committee found that water sector utilities across the country face common challenges, such as rising costs and workforce complexities, and that utilities need to focus attention on these areas to deliver quality products and services and sustain community support. The Committee also explored the barriers that can inhibit improved utility management. These challenges and barriers provide insight into where a sector strategy should focus to be effective and how the Collaborating Organizations will want to structure their promotion of effective utility management to help utilities successfully make improvements. Within this context, the Committee identified the following findings and recommendations for a future sector strategy.

Ten Attributes of Effectively-Managed Water Sector Utilities

The Committee identified "Ten Attributes of Effectively-Managed Water Sector Utilities" (Attributes) that provide a succinct indication of where effectively-managed utilities focus and what they strive to achieve. The Attributes can be viewed as a continuum of, or a set of building blocks for, management improvement opportunities. The Attributes are listed below and explained more fully in the main body of the report.

¹ See Appendix A or http://www.epa.gov/water/infrastructure/utility-mgmt-joint-statement.pdf.

Ten Attributes of Effectively Managed Utilities

- Product Quality
- Customer Satisfaction
- Employee and Leadership Development
- Operational Optimization
- Financial Viability

- Infrastructure Stability
- Operational Resiliency
- Community Sustainability
- Water Resource Adequacy
- Stakeholder Understanding and Support

Keys to Management Success

As a complement to the Attributes, the Steering Committee also identified the following "Keys to Management Success" as consistently utilized management approaches and systems that have been shown to foster utility management success and provide an important framework for using the Attributes and example measures described later:

- 1. Leadership (key throughout the management improvement cycle);
- 2. Strategic business planning;
- 3. Organizational approaches (e.g., participatory culture, change management processes);
- 4. Measurement; and
- 5. Continual improvement management framework (i.e., "plan, do, check, act").

The Steering Committee recommends:

- That the water utility sector adopt and utilize the "Ten Attributes of Effectively-Managed Utilities" as a basis for promoting improved management within the sector; and
- That the Collaborating Organizations explicitly reference the "Keys to Management Success" in efforts to promote the Attributes and enable effective management within the sector.

Water Utility Measures

The Steering Committee strongly affirms the view that measurement is critical to effective utility management. It has identified measurement as one of the Keys to Management Success for achieving or making progress toward the Ten Attributes of Effectively Managed Utilities, and has spent a substantial amount of time conceptualizing, researching, and discussing utility measures as part of its sector strategy recommendations.

The Committee identified a set of high-level example water utility measures and considered how to convey these examples and its findings on measurement more broadly to the Collaborating Organizations. The Committee believes that utilities should measure, and that the identified example measures are a good place to start when considering where to focus measurement efforts. The example measures are not, however, equivalent to a utility measurement program: they are high-level, illustrative examples and are not presented with enough information for "off the shelf" use.

The Steering Committee identified the following recommendations.

- Include a set of example utility measures that are related to the Attributes in the sector strategy. The example measures could be based on, or could be the same as, those identified by the Committee. In either case, it is important that example measures be accompanied by a preamble that includes the types of caveats and considerations identified in this report.
- Circulate a set of example measures to a broader sector audience as soon as possible.
- Initiate a longer-term effort to establish a program supporting a cohesive set of targeted, generally applicable, individual water sector utility measures. The purpose of this program would be to provide individual utilities with a robust measurement system for gauging and improving their internal operational and managerial practices and for communicating with external audiences such as utility boards, rate payers, and community leaders.

Water Utility Management Resources

The Steering Committee believes that water utilities are interested in tools that can support management progress, and that many utilities would benefit from a "helping hand" that can guide them to useful resources that address their management needs, particularly in the context of the Attributes. The Committee explored ideas on what developing a utility management "resource toolbox" could involve. Committee members identified resources that could be used as a starting point for a resource toolbox, and considered several options for toolbox scope, structure, and format. The Committee recognizes that there is currently no budget or coordinated plan for creating a resource toolbox, and that the ability to implement a toolbox will be critically dependent on available resources.

Within this context, the Steering Committee recommends:

- That, to effectively support utilities' ability to make progress toward achieving the Attributes, the Collaborating Organizations pursue the creation of a resource toolbox that is clearly linked to the Attributes;
- That the toolbox, even if in an interim form, be made available to a wider audience as soon as it is possible to do so;
- That the toolbox allow for resource cross-referencing and categorization (e.g., management tools cross referenced by Attribute, Key to Management Success, media type, file format, etc.) with, if possible, some form of interactive functionality; and
- That the Collaborating Organizations consider the Committee's other findings and observations on resources—such as including a targeted set of resources in the toolbox, making the toolbox easily accessible, and using peer-reviewed resources whenever possible.

Supporting Strategy Elements

The Steering Committee also explored a set of "supporting strategy elements" designed to create incentives for and reduce barriers to adopting management practices that would lead to Attribute-

related improvements. The Attributes, Keys to Management Success, resource toolbox, and example measures are designed to inform and enable management change, while the supporting strategy elements focus on providing additional motivation for change.

The Committee recommends that the Collaborating Organizations develop plans to enact as many of the following supporting strategy elements as possible:

- Explicit advocacy for the sector strategy, in particular by the Collaborating Organizations;
- Community education and outreach to raise awareness around the value water sector utilities
 provide, the critical challenges and needs water sector utilities face, and the benefits of
 enhanced utility management practices;
- Recognition to acknowledge commitment to progress and management excellence, which could be achieved in many ways, perhaps by explicitly aligning existing Collaborating Organization recognition efforts with the Attributes, initiating a "sector challenge" that lists utilities that commit to taking (any) actions to improve their management in at least one Attribute area, drawing on existing concepts of peer review programs, and/or combining recognition with the availability of volunteer peer experts that can help utilities evaluate current performance and identify opportunities for improvement; and
- <u>Financial incentives</u> or related opportunities for agencies using the Attributes to more clearly
 demonstrate "effective management" and, as a result, generate a favorable response from
 the sources of financial resources such as private capital markets, rate setting organizations,
 and rate payers.

Next Steps for the Sector Strategy

The Committee identified the following recommendations around transforming this report into a sector strategy that utilities can start to benefit from.

The Committee recommends that the Collaborating Organizations:

- Roll out the sector strategy to the water industry as soon as possible;
- Prepare a brief, stand-alone primer with water sector utility managers as its intended audience;
- Continue the collaboration among the Collaborating Organizations; and
- Employ a continual improvement approach to the strategy's implementation over time.

The Steering Committee recognizes that several steps need to be taken between the submittal of this report and the launching of the sector strategy, such as gaining the formal support of each Collaborating Organization for the content of this report.

The Steering Committee thanks the Collaborating Organizations for the opportunity to participate in this ground-breaking effort. The Committee hopes and believes that these findings and recommendations will be valuable to the Collaborating Organizations and to the sector in general.

I. Introduction

This report presents the findings and recommendations of the Effective Utility Management Steering Committee to the Effective Utility Management Collaborating Organizations—Association of Metropolitan Water Agencies (AMWA); American Public Works Association (APWA); American Water Works Association (AWWA); National Association of Clean Water Agencies (NACWA); National Association of Water Companies (NAWC); United States Environmental Protection Agency (EPA); and Water Environment Federation (WEF)—referred to as the Collaborating Organizations. As described below, the findings and recommendations in this report are to be used by the Collaborating Organizations to develop a water utility sector management strategy.

Background

In July 2005, the EPA Office of Water convened a group of water and wastewater utility managers to discuss effective management practices within the sector. Outcomes of this meeting included a draft list of "Attributes of a Sustainably-Managed Utility" and a set of "critical success factors" for effective utility management. Following this meeting, EPA and the Associations met to discuss possible ways to collaborate in order to promote more effective utility management.

As a result of those discussions, on May 2, 2006, AMWA, APWA, AWWA, EPA, NACWA, NAWC, and WEF entered into a Statement of Intent² to "formalize a collaborative effort among the signatory organizations in order to promote effective utility management." The Statement of Intent included a commitment to produce "a joint strategy to identify, encourage, and recognize excellence in water and wastewater utility management."

As part of the ongoing utility management collaborative effort launched by the Statement of Intent, the Collaborating Organizations chartered an Effective Utility Management Steering Committee (Steering Committee). The Steering Committee, composed of sixteen water and wastewater utility managers from across the country who were nominated by the Collaborating Organizations, was charged with identifying findings and recommendations related to the advancement of effective management of water and wastewater utilities that would be used by the Collaborating Organizations to support the development of a future joint water sector strategy aimed at supporting water, wastewater, and combined water/wastewater utilities.

According to its charge, the Committee's final findings and recommendations were to include:

- A refined list of existing key attributes of effectively-managed utilities and related critical success factors (in this report, the critical success factors are called "Keys to Management Success");
- Exploration of existing utility management resources (linked to the Attributes) and options for presentation of these resources;

March 30, 2007

² See Appendix A or http://www.epa.gov/water/infrastructure/utility-mgmt-joint-statement.pdf.

- An evaluation of a set of potential measures of success for utilities to gauge progress; and
- An examination of barriers to more widespread implementation of utility improvement efforts, as well as incentives and a path forward that could help lead to greater adoption of these efforts.

To achieve this charge, the Steering Committee held several conference calls, two in-person meetings (one in Washington, D.C. on July 6-7, 2006, and one in Seattle on November 9-10, 2006), and communicated extensively via e-mail and ad-hoc telephone calls. During the summer and fall of 2006, two subgroups of the Steering Committee held separate calls to explore ideas on a resources toolbox and example utility measures. Additionally, two focus groups were convened in late September, one in Las Vegas, Nevada, and one in Elmhurst, Illinois, to discuss effective utility management and provide feedback to the Steering Committee's findings to date. (Appendices B and C provide a list of focus group participants and the focus groups' agenda.) Through a contract with the Water Environment Foundation funded by a cooperative agreement with U.S. EPA, Ross & Associates Environmental Consulting, Ltd. supported and facilitated the Committee's work.

Report Approach and Organization

This report reflects nine months of deliberation by the Steering Committee and delivers the Committee's findings and recommendations to the Collaborating Organizations. The report is divided into eight sections, listed below. Following the Introduction, Section II explores the challenges faced by water utilities today and the barriers that keep some utilities from engaging in management improvement efforts. The sector strategy recommendations have been developed with these challenges and barriers in mind and are intended to help utilities to overcome these obstacles. Section III, Ten Attributes of Effectively Managed Water Sector Utilities, presents the Committee's findings and recommendations regarding the Attributes. The Attributes define what utilities should aspire to achieve over time. Section IV, Water Utility Management Resources, explores ways to approach presenting management resources that can help utilities translate aspirational goals into action. Section V, Water Utility Measures, includes ideas on how utilities could think about measuring their progress. These three sections—Attributes, Resources, and Measures—form the primary components of the Committee's findings and recommendations, in direct response to the Committee's charge as outlined in the May 2 Statement of Intent. Committee added Section VI, Supporting Strategy Elements, to begin investigating the kinds of opportunities and mechanisms that would create incentives for utilities to engage in management improvement work. Finally, Section VII explores ideas for the future of the collaboration.

March 30, 2007

II. Challenges Faced by Water Utilities and Barriers to Implementing Management Improvement Efforts

A key aspect of the Committee's deliberations involved exploring the context in which the Collaborating Organizations' efforts to promote more effective utility management will take place. These deliberations took the form of exploring key challenges faced by the water sector and the barriers utilities experience when attempting to implement management improvements. The focus groups were designed to make a significant contribution to the Committee's understanding of challenges and barriers, and a substantial portion of the focus group meetings were devoted to these topics. The Committee spent a portion of its November meeting reviewing Focus Group results and adding its own perspectives to these findings.

A critical aspect of exploring and discussing challenges was to ensure that efforts to develop a sector strategy for improved management would be well grounded in the sector's most pressing needs and that individual components of the strategy would be highly relevant to the challenges utilities are facing on a day-to-day basis. The Committee viewed understanding barriers as an important aspect of identifying the incentives needed to motivate utilities to push forward with management improvement efforts. The Committee wanted its findings and recommendations to promote incentives that address the key constraints utility managers experience as they consider and implement management improvements.

Water Sector Utility Challenges

The Steering Committee, through input from the focus groups and its own deliberations, found that water utilities across the country face common challenges. These challenges represent some of the most pressing issues faced by utility managers today and were consistently identified as areas where utilities need to focus attention and make improvements to produce quality products and services and sustain community support. These key challenges include the following:

- Rising materials costs (concrete, steel, chemicals, fuel, etc.) that are significantly affecting
 ongoing operational expenses and, more importantly, capital expenses associated with new
 and replacement infrastructure projects;
- Aging infrastructure in need of more intensive asset management attention and in need of intensive repair and replacement efforts;
- Regulatory challenges including substantial new capacity and treatment requirements in the
 context of water quality standards and combined and sanitary sewer overflows, compounded
 by a sense that regulators and the sector have been unable, in many areas, to establish a
 workable set of sequenced priorities that communities can effectively fund and implement;
- Ensuring adequate long-term water supply (particularly in high-growth and arid areas);
- Identifying and meeting security and emergency/hazard preparedness needs;

- <u>Cuts in federal funding</u>, in the form of cuts to the State Revolving Loan Fund (SRF) and uncertainty of future federal funding;
- Rate structures under stress from a combination of federal funding cuts, new regulatory requirements, and infrastructure asset maintenance, repair, and replacement needs; and
- Workforce complexities, including a significant number of pending retirements, compounded by difficulties recruiting and retaining qualified staff in the context of more competitive labor markets.

These challenges provided an important lens through which the Steering Committee members and focus group participants could evaluate the appropriateness and relevance of the Attributes. Both Committee members and focus group participants found the Attributes well aligned with these challenges. For example, there are Attributes addressing operational efficiency (speaking to rising materials costs), asset management (speaking to infrastructure repair and replacement needs), workforce and leadership development (speaking to workforce planning needs), and operational risk management (speaking to all hazards preparedness needs). The Steering Committee further believes that the Attributes, together with the Keys to Management Success, the resource toolbox, and example measures of success, will provide a set of sector strategy tools that can help utilities address these challenges.

Barriers to Implementing Management Improvement Efforts

The Steering Committee members and focus group participants also explored and discussed what factors can limit management improvement efforts. These barriers provide insight into how the Collaborating Organizations will need to promote effective utility management efforts to help utilities move beyond barriers and successfully enact improvements.

One consistent theme emerged during discussions of barriers—the difficulty of generating and sustaining the support of a governing body and the general community for enhanced management efforts. Discussions consistently indicated that utility managers struggle to establish the value of their services to communities and the need for enhanced management efforts if service quality and reliability are to be maintained in the long term. Several dynamics within communities underlie this difficulty including the long-term nature of utility management decisions and benefits as compared to the potentially more short-term decision horizon of elected officials. Additional factors include turnover of elected and other community leaders requiring constant re-education efforts, and the "hidden infrastructure" aspect of the water sector utility business which causes residents to undervalue the service provided. Discussion indicated that these dynamics place significant political leadership and strategy demands on utility executives who may have limited knowledge of the strategies needed or available for working effectively in these contexts.

In addition to this overarching sense of difficulty faced by utility managers, other barriers included:

 Cultural resistance to change (the "if it ain't broke why fix it" mentality experienced in many organizations);

- Difficulty sorting through and establishing the relevance and potential benefits of management improvement options (described by some as a sense of initiative overload);
- Difficulty establishing appropriate performance expectations and associated performance measurement approaches; and
- Difficulty identifying how and where to get started in a manageable way on what can appear from the outside to be a complex, time consuming, and generally overwhelming undertaking.

The Steering Committee has kept a focus on these potential barriers as it has worked to produce its findings and recommendations. This focus has influenced its efforts to produce the refined set of Attributes and associated Keys to Management Success, the findings and recommendations on a resource toolbox and utility measures, and, in particular, the identification of the supporting strategy elements that are intended to provide incentives for enacting change.

III. Ten Attributes of Effectively-Managed Water Sector Utilities

The Steering Committee developed the Ten Attributes of Effectively Managed Water Sector Utilities during discussions and review of current utility management practices among water and wastewater utility executives, water sector associations, and EPA. The May 2 Statement of Intent specifically indicates that outreach to utilities during the collaboration will, in part, focus on "key attributes of effectively managed utilities."

The Attributes recommended below emerged from analysis of current utility management practices, discussion among Committee members regarding what they view as promising developments in utility management efforts, and input from the focus groups. When asked to independently define "effective utility management," focus group participants' observations overlapped substantially with the Committee's initial list of Attributes. The utility management challenges identified by focus group participants also tracked closely with the Attributes, indicating their strong relevance to pressing water sector concerns. Overall, focus group participants indicated a high degree of comfort with the concept of using outcome-oriented attributes as a basis for promoting effective utility management, and were comfortable with the draft version of the Attributes that they reviewed.

Findings

The Steering Committee identified ten Attributes, summarized in Figure 1, that cover a range of desired utility outcomes in the areas of operations, infrastructure, customer satisfaction, community welfare, natural resource stewardship, and financial performance. The Attributes provide a succinct indication of where effectively-managed utilities focus and what they strive to achieve. They can best be viewed as a continuum of, or a set of building blocks for, management improvement opportunities. Individual utilities will need to tailor the timing, sequence, and degree to which they address each Attribute to their management and community needs and circumstances.

The Committee deliberately has not presented the Attributes in a particular order; utility managers can decide their relevance and relative importance depending on individual utility circumstances. For those utilities with a strong need for guidance on where to start, implementation experience suggests the Product Quality and Customer Satisfaction Attributes—as critical, basic aspects of utility operation—are strong candidates for initial attention. Even as all utilities will need to approach improved management one step at a time, utility managers involved in the development of the Attributes believe increasingly excellent, overall utility management will emerge when utilities address more, and eventually all, of the Attributes.

Figure 1: Ten Attributes of Effectively Managed Utilities

Product Quality	Infrastructure Stability
Customer Satisfaction	 Operational Resiliency
Employee and Leadership Development	Community SustainabilityWater Resource Adequacy
Operational OptimizationFinancial Viability	 Stakeholder Understanding and Support

An articulation of each Attribute follows.

- Product Quality: Produces potable water, treated effluent, and process residuals in full
 compliance with regulatory and reliability requirements and consistent with customer, public
 health, and ecological needs.
- Customer Satisfaction: Provides reliable, responsive, and affordable services in line with explicit, customer-accepted service levels. Receives timely customer feedback to maintain responsiveness to customer needs and emergencies.
- Employee and Leadership Development: Recruits and retains a workforce that is competent, motivated, adaptive, and safe-working. Establishes a participatory, collaborative organization dedicated to continual learning and improvement. Ensures employee institutional knowledge is retained and improved upon over time. Provides a focus on and emphasizes opportunities for professional and leadership development and strives to create an integrated and well-coordinated senior leadership team.
- Operational Optimization: Ensures ongoing, timely, cost-effective, reliable, and sustainable performance improvements in all facets of its operations. Minimizes resource use, loss, and impacts from day-to-day operations. Maintains awareness of information and operational technology developments to anticipate and support timely adoption of improvements.
- Financial Viability: Understands the full life-cycle cost of the utility and establishes and
 maintains an effective balance between long-term debt, asset values, operations and
 maintenance expenditures, and operating revenues. Establishes predictable rates—
 consistent with community expectations and acceptability—adequate to recover costs,
 provide for reserves, maintain support from bond rating agencies, and plan and invest for
 future needs.
- Infrastructure Stability: Understands the condition of and costs associated with critical infrastructure assets. Maintains and enhances the condition of all assets over the long-term at the lowest possible life-cycle cost and acceptable risk consistent with customer, community, and regulator-supported service levels, and consistent with anticipated growth and system reliability goals. Assures asset repair, rehabilitation, and replacement efforts are coordinated within the community to minimize disruptions and other negative consequences.
- Operational Resiliency: Ensures utility leadership and staff work together to anticipate and avoid problems. Proactively identifies, assesses, establishes tolerance levels for, and

effectively manages a full range of business risks (including legal, regulatory, financial, environmental, safety, security, and natural disaster-related) in a proactive way consistent with industry trends and system reliability goals.

- Community Sustainability: Is explicitly cognizant of and attentive to the impacts its decisions have on current and long-term future community and watershed health and welfare. Manages operations, infrastructure, and investments to protect, restore, and enhance the natural environment; efficiently use water and energy resources; promote economic vitality; and engender overall community improvement. Explicitly considers a variety of pollution prevention, watershed, and source water protection approaches as part of an overall strategy to maintain and enhance ecological and community sustainability.
- Water Resource Adequacy: Ensures water availability consistent with current and future
 customer needs through long-term resource supply and demand analysis, conservation, and
 public education. Explicitly considers its role in water availability and manages operations to
 provide for long-term aguifer and surface water sustainability and replenishment.
- Stakeholder Understanding and Support: Engenders understanding and support from oversight bodies, community and watershed interests, and regulatory bodies for service levels, rate structures, operating budgets, capital improvement programs, and risk management decisions. Actively involves stakeholders in the decisions that will affect them.

Keys to Management Success

The Steering Committee further identified the following "Keys to Management Success" that, based on an exploration of and experience with utility management efforts, reflect several, consistently utilized, management approaches and systems that can foster utility management success.

1. Leadership

A consistent theme throughout Committee discussions and focus group observations was the critical role leadership plays in effective utility management, particularly in the context of driving and inspiring change within an organization. In this context, the term "leaders" refers both to individuals who can be effective champions for improvement, and to leadership teams that provide resilient, day-to-day management continuity and direction. Effective leadership ensures the utility's direction is understood, embraced, and followed on an ongoing basis throughout the management cycle. It further reflects a commitment to organizational excellence, leading by example to establish and reinforce an organizational culture that embraces change and strives for continual improvement.

2. Strategic Business Planning

Strategic business planning emerges as an important tool for helping utilities strike an effective balance among, and drive integration and cohesion across, the Attributes. Strategic business planning involves taking a long-term view of utility goals and operations and establishing, in that context, an explicit vision and mission that drive and guide utility objectives, measurement efforts, investments, and operations.

3. Organizational Approaches

Utility managers have identified a variety of organizational approaches as part of overall effective utility management and critical to the success of management improvement efforts. These include:

- Establishing a "participatory organizational culture" that actively seeks to engage employees
 in improvement efforts (e.g., establishing management improvement, employee
 empowerment, and cross-functional teams);
- Deploying an explicit change management process that anticipates and plans for change and encourages staff and managers to embrace rather than resist change; and
- Utilizing implementation strategies that seek early, step-wise victories that help utilities get started and remain motivated.

4. Measurement

A focus and emphasis on measurement emerges as critical to management improvement efforts associated with the Attributes and as the backbone of successful continual improvement management and strategic business planning. As one participant succinctly put it, "you can't improve what you don't measure." Committee members (and focus group participants) indicated that successful measurement efforts tend to share certain commonalities:

- They are viewed as a continuum starting with basic internal tracking, and moving on, as needed and appropriate, to more sophisticated base-lining and trend analysis, development of key performance indicators, and inclusion of externally-oriented measures speaking to community sustainability interests;
- They are driven by and focused on answering questions critical to effective internal management and external stakeholder needs (e.g., questions utility boards need answered to comfortably support large capital investments); and
- They are supported by a well-defined decision framework assuring results are evaluated, communicated, and responded to in a timely manner.

Even as Committee members embraced measurement as a critical part of effective utility management, they emphasized that measurement can be complicated, needs to be approached carefully, and presents several challenges. Deciding where to start and how much to measure can be difficult, especially when the benefits of measurement and appropriate performance levels may be uncertain. Measures can also be taken out of context and used to make baseless comparisons; measurement must therefore be approached, structured, and used with care.

5. Continual Improvement Management Framework

A continual improvement management framework, most frequently implemented through a complete, start-to-finish management system, plays a central role in effective utility management and is viewed as a critical management strategy to make progress in the context of the Attributes.

Continual improvement management includes:

Conducting an honest and comprehensive self-assessment;

- Establishing explicit performance objectives and targets;
- Defining related operational requirements, practices, and procedures;
- Establishing supporting roles and responsibilities;
- Implementing measurement activities including regular evaluation through, for example, operational and procedural audits; and
- Responding to evaluations through the use of an explicit change management process.

This "plan, do, check, act" continual improvement framework is often further supported by gap analysis, benchmarking, and best practice review to understand improvement opportunities and establish explicit service levels, guide investment and operational decisions, form the basis for ongoing measurement, and provide the ability to communicate clearly with customers and key stakeholders.

Recommendations

- 1. The Steering Committee recommends that the water utility sector adopt and utilize the "Ten Attributes of Effectively-Managed Utilities" as a basis for promoting improved management within the sector.
- 2. The Steering Committee recommends that the Collaborating Organizations explicitly call out and reference the "Keys to Management Success" in efforts to promote the Attributes and enable more effective utility management within the sector.

IV. Water Utility Measures

Water utility performance measurement has long been a part of efforts to improve utility management. The May 2 Statement of Intent recognized this role by explicitly highlighting measurement as a component of the Collaboration's work. The Statement includes an objective to "improve utility performance through the utility-specific application of effective management tools, performance measurement, and other techniques and systems" and further specifies that the Collaboration is expected to involve outreach to utilities on "potential measures of success for utilities to gauge progress." This assertion of the importance of measurement supports and complements multiple efforts over the past several years, including the 2005 Managing for Excellence analysis³ and the draft AwwARF Triple Bottom Line Reporting report.

The Steering Committee spent a substantial amount of time conceptualizing, researching, and discussing utility measures. The Committee discussed measurement at length during both of its in-person meetings; formed a Measures Subgroup, which held separate conference calls to identify example measures and an approach to presenting those measures; and spent a substantial amount of additional time researching and considering the example measures and related information discussed below. In addition, both focus groups discussed the role of measurement in effective utility management, and their input is consistent with the Steering Committee's findings and recommendations.

Findings

The Steering Committee strongly affirms the view that measurement is critical to effective utility management. It has identified measurement as one of the Keys to Management Success for achieving or making progress toward the Ten Attributes of Effectively Managed Utilities.

The Steering Committee is using the term "measurement" generally to refer to a combination of stand-alone units of measure (e.g., number of X), measurement indicators (e.g., yes/no questions or facts that are not necessarily numerical), and related performance measures. The discussion on measurement in this report and the example measures identified by the Steering Committee in Appendix D are intentionally not articulated as objectives, targets, or benchmarks. That is, they do not specify what result or improvement the utility should be aiming for or how a utility would use any example measure to compare itself to other utilities or some kind of sector norm. The Steering Committee wants to be clear, however, that identifying and gauging progress toward targets and benchmarking against previous utility performance and against the performance of similar utilities can be very helpful management exercises.

March 30, 2007

³ EPA Office of Wastewater Management, as prepared by Ross & Associates Environmental Consulting, Ltd., and Industrial Economics, Inc. *Managing for Excellence: Analysis of Water and Wastewater Utility Management Systems*. August 2005.

⁴ AwwaRF, as prepared by Steven Kenway and Shiroma Maheepala. *Triple Bottom Line Reporting of Sustainable Water Utility Performance*. September 2006 [Draft].

→ Utilities should measure.

Utilities need to measure their performance and progress to identify areas for improvement, make informed management decisions, improve operations, and communicate effectively with key stakeholders and the public. Benefits of measurement include:

- Helping to explain and justify decisions, expenditures, and rate increases;
- Helping to achieve long term strategic organizational goals;
- Explaining progress and making effective presentations to Boards, Councils, and regulatory agencies;
- Identifying the warning signs of compliance problems;
- Tracking the absolute numbers needed to gauge a utility's status regarding both specific issues (e.g., legal requirements) and more broad issues (e.g., regarding sustainability);
- Determining needs in new areas (e.g., watershed level work);
- Identifying and assessing group-based (e.g., multiple-utility) problems;
- Comparing a utility's performance against previous periods;
- · Setting future goals;
- Promoting continuous improvement; and
- Benchmarking performance against similar utilities to better understand utility strengths and weaknesses and opportunities for utility practice improvement (done carefully to avoid "apples and oranges" comparisons).

→ The example measures identified by the Steering Committee are a good place to start.

The example measures identified in Appendix D are not designed to be a utility measurement program. They are, however, a strong starting point for utilities to consider how they could approach measurement in support of the Attributes. The Steering Committee is therefore recommending (below) that they be used as the basis for a set of example measures that would be included in the Sector Strategy. The measures should be contextualized, however, as a diverse group of *preliminary* example measures that do not apply to all utilities. Some of the example measures focus on emerging issues that relatively few utilities are in a position to measure; others are more fundamental to water utility operations. Utilities will want to determine for themselves whether these examples apply or are of interest based on, for example, specific service-level requirements, improvement efforts, and stakeholder interests, and keep in mind that these example measures have not been fully "road tested" or validated by the Collaborating Organizations.

→ The example measures identified by the Steering Committee are <u>not equivalent to a</u> <u>measurement program</u>. They were not generated with the objective of gauging the progress of the water/wastewater industry. They are high-level, illustrative examples and are not presented with enough information for "off the shelf" use.

The example measures identified by the Steering Committee are intended to provide a starting point for utilities to consider the kinds of measures that could be used to track status and progress against the Attributes. The example measures are not ready or intended for "off the shelf" use. Most of them have been generalized and are missing the detail and technical information that would be needed to implement them successfully. Instead, they are being offered as triggers or "think pieces" about where and how utilities could measure in these areas. (For approximately 20 measures, readers are given reference information for additional measurement specifics that will enable use of these measures. This information is included only in those instances where the measures are part of a formal, publicly-available measurement program.)

The example measures in Appendix D are not intended for comparative (cross-utility) purposes. Rather, they are intended for utilities to use for their own management purposes. In some instances, utilities may choose to use measures to report to the public, regulators, or other interested parties; or to explore benchmarking using comparative measures (e.g., their rates relative to the rates of similar utilities) to help gauge and improve management of their own utility. However, this kind of comparison could be taken out of context and used to compare "apples to oranges." For this reason, the Steering Committee urges caution when using measures for cross-utility purposes. A few measures in the example list, notably those that are QualServe Benchmarks, have been specifically designed to allow for meaningful "apples to apples" cross-utility comparisons. However, explanatory information and utility specific information is usually required to make appropriate and useful comparisons.

→ The example measures do not reflect a comprehensive set of utility measures.

There are hundreds of measures in addition to the example measures identified by the Steering Committee that utilities use to manage themselves effectively. Several organizations have identified utility measurement systems that outline approaches to water utility performance measurement and include coordinated sets of measures. The example measures identified by the Steering Committee through the Effective Utility Management Collaboration simply reflect a subset of measures across the Attributes spectrum.

→ More measurement is not necessarily better measurement: start where you are and progress over time.

Every utility starts measuring performance somewhere. It is important that utilities start with an appropriate set of measures tailored to their needs. The number of example measures included here is not intended to suggest that utilities need to measure everything to manage effectively. Similarly, some of the example measures are more advanced and may be appropriate for future consideration. It is important to not be paralyzed by the universe of measurement opportunities, and to just start with a few measures in core areas.

Utilities do not need to measure everything to improve their own management performance. In fact, measurement efforts that take on too much too quickly can be crushed by their own weight. It is therefore important to be systematic about undertaking new measurement projects. It is also important, however, to not wait for the perfect measurement system before just starting

somewhere. Measurement will always evolve, and along with the rest of utility management efforts, a "continual improvement" perspective on measurement is realistic.

→ Utility measurement is complicated and needs to be done carefully to be useful.

Performance measurement, while useful for management purposes, does present a number of challenges. For example, deciding what and how many things to measure to get started with performance measurement is difficult, especially when it is not clear what the benefits are and what the appropriate level of performance should be (e.g., what does "good" or "excellent" performance look like?). In addition, as stated earlier, performance measures can easily be taken out of context or used to compare "apples to oranges." It is important to develop meaningful measures that can be used to make real improvements and to communicate accurate information to those who will interpret the information correctly. This can be a challenging and time consuming exercise, but it is also important to "not let the perfect be the enemy of the good," and simply get started.

→ Utility measurement is constantly evolving, and any "ideal" set of measures will also dynamically evolve.

The world of utility measurement, both outside of and within the U.S., is quickly evolving and will continue to be the topic of significant attention for years to come. The example measures identified by the Steering Committee should be viewed in this light—as an informed set of examples that would likely change as new information and insights are available.

Recommendations

- 1. The sector strategy should include a set of example utility measures that are related to the Attributes, based on those provided in Appendix D. The example measures could be based on, or could be the same as, those provided in Appendix D.
- 2. The example measures should be accompanied by a preamble that includes caveats and considerations that communicate the findings outlined above.
- 3. If possible, the sector strategy should include updates of the example measures in line with the "continual improvement" framework.
- 4. The Steering Committee recommends circulating a set of example measures to a broader sector audience as soon as possible, recognizing at the same time that additional tuning, validating, and "road testing" of the example measures with utilities over time would be desirable.
- 5. The Steering Committee also recommends that, in parallel to making the example measures available to the sector, the Collaborating Organizations initiate a longer-term effort to establish a program supporting a cohesive set of targeted, generally applicable, individual water sector utility measures. The purpose of this program would be to provide individual utilities with a robust measurement system for gauging and improving their internal

operational and managerial practices and for communicating with external audiences such as utility boards, rate payers, and community leaders. The program would fill an important gap between the Committee's identification of measurement as a "key to management success" and the "starting place" nature of the example measures compiled for this report. The Committee believes individual utilities could benefit from access to a strong, validated, cohesive system of strategy-related measures, thereby providing some structure and focus to individual experimentation and avoiding "reinventing the wheel" one utility at a time. The compiled example measures may or may not serve as a starting point for this measurement system—existing measurement efforts and other measurement resources will likely be valuable contributors to such an undertaking.

Steering Committee members also discussed the concept of leveraging the development of the individual utility measures program to support utility-to-utility benchmarking and sector-wide practice and performance assessment. Members expressed a range of opinions relating to the challenges and opportunities associated with moving in this direction, reflecting, in part, different past experiences with similar efforts. This mix of opinions left the Committee with insufficient common ground to formulate a recommendation on this topic.

V. Water Utility Management Resources

The May 2 Statement of Intent identifies several key topic areas in which outreach to utilities is anticipated to occur, including "existing utility management resources."

Approach

The Steering Committee discussed how to approach this task at its first meeting in July 2006 and decided to form a Resources Subgroup to explore toolbox options, including identification of example resources that could be used in a future toolbox, and exploration of different toolbox formats, scopes, and management approaches. The Resources Subgroup, comprised of four volunteer Steering Committee members and three Collaborating Organization staff members, held two conference calls and conducted research and exchanged ideas via e-mail. In addition, all Steering Committee members and Collaborating Organization staff representatives were asked to submit nominations for their "top five" most useful utility management resources. These nominated resources, plus a few additional resources discussed at the November 2006 Steering Committee meeting, form the list of management resources provided in Appendix E, which is discussed in more detail below.

To be clear, the Steering Committee was not tasked with *creating* a resource toolbox. It was tasked with creating ideas and recommendations on the content and structure of a resource toolbox, and as part of this task, the Committee decided to identify a "starting point" set of useful management resources. This set of resources, and the accompanying conceptual matrix that links these resources to the Attributes and Keys to Management Success, would need to be updated and completed if the Collaborating Organizations decide to use them. The following options describe how a resource management toolbox could be developed and made available to interested utilities. There is currently no formal plan or funding to create the toolbox, therefore, these are hypothetical options.

Findings

The Steering Committee believes that utilities are interested in tools that can support management progress and that many utilities would benefit from a "helping hand" that can guide them to useful resources that address their management needs, particularly in the context of the Attributes. There are hundreds of resources available, and a resource "toolbox," linked to the Attributes and the other components of the sector strategy, would help to bridge the gap between the challenges and barriers faced by utilities and the actions they can take to improve their utility's management and performance.

The Steering Committee's more specific findings on the development of a resource toolbox are divided into three categories: (1) general toolbox findings; (2) findings regarding toolbox content; and (3) findings regarding toolbox structure, format, and management.

General Toolbox Findings

The Steering Committee believed that the toolbox would benefit from the following.

- Including a targeted set of resources that are linked to, or are related to, the Attributes and the Keys to Management Success.
- Providing the capability for toolbox users to search resources based on different filters or categories to prevent users from being overwhelmed and to help them navigate easily to the resources they need. These categories could be:
 - Attribute:
 - Keys to Management Success;
 - Resources related to only one Attribute or topic area versus resources related to more than one Attribute or topic area;
 - Resource media type/file format (e.g., videos versus publications);
 - Utility type and size;
 - Resource title:
 - Resource author:
 - Key word; and
 - Date listed (assuming the resources would be updated over time).
- Making the resource toolbox—and, if possible, the resources themselves—quickly and easily accessible (e.g., PDF downloads from the web).
- Utilizing peer-reviewed resources whenever available.
- Enabling a continual improvement approach for the toolbox, including making adjustments based on (regularly) receiving feedback on the resources.

During the process of identifying the "starting point" resources in Appendix E, Committee members also observed that, based on their own experience, many of the most useful management resources are not specific to water utilities or even related to water, but rather are either general management resources, or resources developed for other sectors.

Findings Regarding Toolbox Content

The Steering Committee identified what they believe is a strong starting point in the form of a list of example resources for use in the toolbox. Committee members have found these resources useful in their own management practices, and this is the type of information that could be the foundation of the toolbox. In addition, the Steering Committee recognizes that a description of the Attributes and Keys to Management Success as well as some background on the sector strategy are also important toolbox foundational elements.

The Committee identified several additions to these foundational elements for possible inclusion in the toolbox:

- Case studies or examples of how the resources have been used by utilities;
- Actual resources, not just references to the resources (e.g., documents that are free, publicly available, and accessible/downloadable directly from the toolbox);
- Links to the example utility measures described in this report;

- Inclusion of or links to a compendium of additional resources available from the Collaborating Organizations⁵: and
- The logos of the Collaborating Organizations to make clear that this is an effort by all of the Organizations.

Findings on Toolbox Structure, Format, and Management

The Steering Committee also explored general toolbox structure, format, and management approaches. The Committee's findings in these areas are included below, divided by the general categories of toolbox structure and format identified in discussions. Note that these options are neither mutually exclusive nor exhaustive—they simply explore some of the general options available.

→ Written Document (e.g., PDF/MS Word file)

The toolbox could be made available as a hard copy document. In this case, organizing the resources by title, Attribute, Keys to Management Success, and/or another organizing framework may be preferable to other organizational constructs, such as listing resources by author as shown in the Committee's list of resources.

Advantages: These include the ease of completion and feasibility. Distribution would be easy, as the toolbox could be handed out at meetings, posted on websites as a PDF document for download, and otherwise made available without a lot of additional toolbox "construction."

There is also the option for the toolbox to be provided electronically in a format that would allow users to link or jump from one part of the document to another (e.g., from one Attribute to another without reading through all of the resources for each Attribute) if "hyperlink" functions like the one available in Microsoft Word or Adobe Acrobat files were used (for example, <u>click here</u> to return to the top of this section). This type of linking would still not be as user friendly as the more interactive options made available by creating a toolbox website (these are explored more below).

Disadvantages: This option would not enable the toolbox to be tailored to users' interests as would be, for instance, a different kind of interactive toolbox that would provide tailored information based on a user's specific characteristics (e.g., size of utility) and needs. As a static document, the toolbox could contain outdated information and the user would not know this. Depending on how the resources were organized, the toolbox could be quite cumbersome. For example, organizing the toolbox by Attribute would require those resources that apply to multiple Attributes (as many of the listed resources do) to be listed multiple times, making the toolbox both long and duplicative. (Note that this additional length could be avoided if the resources were only listed in detail once—perhaps by title—and readers would use a cross-reference table like the conceptual example provided in Appendix E to identify which resources apply to which Attributes, Keys to Management Success, etc.). Another drawback of this option would be that users would not immediately be able to "jump" or link to more information on the resource, or be able to

March 30, 2007

⁵ The Collaborating Organizations were asked to approximate the number of resources they may each want to include if this were to be pursued. Estimates ranged from 5 to 40 resources per association.

download or purchase the resource immediately, though written information about how to do so could be provided.

For an electronic option in PDF form, any changes made to the document would require creating a new PDF file, and all of the links would have to be recreated for each update. This would take a substantial amount of time if an extensive linking system were put in place or if the document were frequently updated.

→ Toolbox on Compact Disk (CD)

The toolbox could be made available electronically on a CD, which would allow users to see a structured hierarchy of topics (like a Table of Contents) and then to pick and choose which information to access based on interest, need, etc. This would function like browsing a set of electronic file folders on a desktop computer. This option, like the written document/flat file option, could take advantage of document hyperlink functions so that users could jump from one section to another, or easily return to the beginning of the toolbox.

Advantages: This option would be fairly quick and easy to create and distribute (e.g., handed out at conferences, sent by mail), and it would have some interactivity available for users. In addition, CDs can store fairly large amounts of data, which is advantageous for people with slower internet connections or for files which are too big to send by email. Finally, electronic files on a CD could be used to "jump" directly to the web to download/purchase items.

Disadvantages: These are the same as those described for the written document/hard copy toolbox, except that electronic files on a CD could be used to jump directly to the web to download/purchase items. In addition, there is a physical waste factor associated with CDs, as CDs can't be updated, only replaced.

→ Basic Website/Web-Enabled Toolbox

The toolbox could be available on a relatively basic website. Users could jump/link to resources by Attribute, Key to Management Success, media type (e.g., video or book), author, and/or any other organizing constructs chosen. Users could follow links directly to other websites where they could download or purchase the resource. It is also possible that some resources could be available for free download from the toolbox website itself.

Advantages: This option would allow more user interactivity, and, in general, a toolbox that is more tailored to users' interests because users could be provided with links to navigate the site based on their profile. This option would allow users to more quickly and easily access the resources themselves, by linking to the source of the resource (e.g., organization where the resource is available to purchase) or perhaps directly to the resource itself. Assuming the website would be updated periodically, it would be fairly easy to update the toolbox to add new resources, include new sector strategy-related components (e.g., information on Attribute-related performance measures), or to update information on resource availability. This option would also not require a tremendous amount of work. Assuming that all decisions on website content and general approach have been made, and that there would not be automated interactions between this site and other websites, the initial website design would require perhaps 20-30 web

designer/database developer hours to develop the design and back-end database and to create the site; relative to more extensive website options, this is a small investment. Finally, this option could easily (and logically) be tied into a general sector strategy website that introduces the Attributes.

Disadvantages: This option would require more up-front investment than the document/flat file or CD options. In addition, if the site were updated periodically, links to resources could cease to work, as links are likely to change over time. This option may therefore best be pursued if ongoing or routine website maintenance were possible. Also, this option would not provide as many interactive options as would a more extensive and sophisticated website, though it could be designed to allow expansion to such a site in the future if desired.

→ More Extensive Website Options

There are a variety of options for building a more extensive website with more sophisticated and interactive functions, such as the following:

- An (optional) interactive survey to allow resources to be screened based on information about the user's utility type, size, needs, and interest areas;
- A mechanism for allowing users to suggest or submit resources;
- A mechanism for tracking feedback on resources; and
- Possibly, the option of linking more "seamlessly" to Collaborating Organization websites in order to view more information and purchase resources without leaving the original website. (Note, however, that this particular option is likely to be technically very complicated and costly to implement.)

Several Steering Committee members noted that having a more interactive website, tailored to each user's interests and needs, would be desirable, but at the same time acknowledged that pursuing this kind of site may be prohibitively expensive and difficult to maintain.

Advantages: Although the Steering Committee did not explore the scope and functions of more complicated website options in detail, it is clear that this kind of site *could* be very user-friendly, providing both more information and more user-tailored information. It could make accessing the resources easier, and could even result in some kind of personalized portfolio of resources for each utility that decides to take advantage of this kind of tool. It could also greatly improve the toolbox's "continual improvement" ability by allowing for feedback on resources, suggestions for additional resources, etc.

Disadvantages: These more complicated website options would require substantially more upfront website design work and database/website programming, would require more ongoing maintenance, and in general, might cost substantially more than the other options, though the actual cost would depend on the specific scope and functions selected.

Recommendations

The Steering Committee recognizes that there is currently no budget or coordinated plan for creating the toolbox, and that the ability to implement the toolbox will be critically dependent on the resources available to the Collaborating Organizations to do so. With this as context, the Steering Committee identified the following recommendations.

- 1. To effectively support promoting the Ten Attributes, the Collaborating Organizations should pursue the creation of a resource toolbox with, in particular, clear linkage to the Attributes.
- 2. The toolbox, even if in an interim form, should be made available to a wider audience as soon as is feasible.
- Toolbox design should allow for resource cross-referencing and categorization, perhaps by Attribute, Keys to Management Success, resource media type/file format, utility type, and author.
- 4. As possible, some form of interactivity between the user and the toolbox itself should be pursued to allow some tailoring of toolbox information based on user interests and to make acquisition of resources as easy as possible. In this context, the Committee believes the Collaborating Organizations should seriously consider a searchable CD or basic website format as a means to organize and deliver the information.
- 5. The other findings—such as including a targeted set of resources, making the toolbox easily accessible, using peer-reviewed resources whenever possible, allowing for toolbox improvements over time, observations regarding content, and the pros and cons of the different options for toolbox structure—should be considered as the Collaborating Organizations make their decisions on how to proceed on the toolbox.

VI. Supporting Strategy Elements

As part of their deliberations, Committee members explored a set of "supporting strategy elements" designed to create incentives for and reduce barriers to adopting management practices consistent with the Attributes. In this context, Committee members recognize that utility managers will need to be both motivated and enabled to make management change. The Attributes, the resource toolbox, and example measures are all designed to enable management change, while the supporting strategy elements lean into providing additional motivation for change.

Findings

As described earlier in this report, the Steering Committee members, with additional input from the focus groups, identified several key barriers that act to constrain utilities' ability to adopt more effective management approaches, as well as potential incentives to motivate and enable utilities to enact management improvements. The Steering Committee used the results of these discussions to identify the following set of sector strategy components that would complement and support the Attributes, the Keys to Management Success, resource toolbox, and example utility measures.

→ Explicit Advocacy

First and foremost, Committee members believe that promotion of the Ten Attributes, to be successful, must be led by the Collaborating Organizations. Committee members view the Organizations as an important and credible source of information for and leadership to the water utility sector. Explicit and focused advocacy of the Attributes, and perhaps other sector strategy components, by the Organizations could take a variety of forms, including inclusion in key note addresses made by executive directors and other representatives; ongoing coverage in newsletters and other literature; acknowledgement on organization websites; inclusion in the programs of annual and other meetings sponsored by the Collaborating Organizations; and development of specific workshops/trainings devoted to promotion and adoption of the Attributes.

→ Community Education and Outreach

Committee members and focus group participants consistently identified generating and maintaining support from governing bodies and the broader community as a key utility management challenge and a barrier to pressing forward with utility management improvements. In this context, Committee members believe education programs that raise awareness of the value water sector utilities provide, the critical challenges and needs they face, and the benefits of enhanced utility management practices will play a critical role in creating an atmosphere in which utility managers can succeed. The Committee envisioned both general education efforts undertaken on behalf of the sector that target community leaders (e.g., city mayors, city councils, utility board members, etc.), and more targeted education efforts that individual utilities could use to raise awareness and garner support within their local communities.

→ Recognition

Acknowledging excellence through awards and other programs has been a means for Collaborating Organizations and others to encourage water utility sector change and improvement. Committee members see a continuing role for such efforts and believe that, at minimum, an opportunity exists to more explicitly align current Collaborating Organization recognition efforts with the Attributes. This would entail reviewing the selection criteria for current recognition efforts and aligning or adjusting them to be reflective of the Attributes. In addition to leveraging existing efforts, Committee members believe that recognition could be broader and simpler than awards programs. For instance, one idea for increased recognition would be acknowledging through a "sector challenge" a list of utilities that commit to taking (any) actions to improve their management in at least one Attribute area. Recognition could also draw on existing concepts of peer review programs, combining recognition with the availability of volunteer peer experts that can assist utilities to evaluate current performance and identify opportunities for improvement.

→ Financial Incentives

There may be opportunities for agencies using the Attributes to more clearly demonstrate "effective management" and, as a result, generate a favorable response from the sources of financial resources such as private capital markets, rate setting organizations, and rate payers.

Recommendation

1. Develop plans to enact supporting strategy elements as possible.

The Steering Committee recognizes that these supporting strategy elements could require the investment of a significant amount of time and resources to implement, and that there are currently no funds set aside for these purposes. At the same time, Committee members believe that, although the Attributes, the Keys to Management Success, resource toolbox, and example measures can provide a basis to enable water sector utility management improvement, on their own they likely lack the ability to motivate timely change. The supporting strategy elements are designed to help provide the motivating force for change and, as such, should be given serious consideration by the Collaborating Organizations.

VII. Next Steps for the Sector Strategy

Findings

Feedback to the Steering Committee has affirmed that a water utility sector management strategy is timely and very important, and that the primary elements of the sector strategy outlined in this report (Attributes, Keys to Management Success, resources, and measures) will help water utilities to make improvements and take a step toward the "next generation" of water utilities in this country. The following recommendations are intended to support the work of the Collaborating Organizations in transforming this report into the strategy that utilities can start to benefit from. In addition to these recommendations, the Steering Committee recognizes that several steps need to be taken between the submittal of this report and the launching of the sector strategy, such as gaining the formal support of each Collaborating Organization for the content of this report.

Recommendations

1. Roll out the sector strategy as soon as possible.

The Steering Committee encourages the Collaborating Organizations to develop and roll out the sector strategy as soon as possible. This can be achieved one strategy element at a time, presumably starting with the Attributes, which have received the most attention and agreement to date, and which the Steering Committee believes are ready for a wider audience.

2. Launch the sector strategy with a short, stand-alone document geared to the sector.

The Steering Committee recommends that, as part of the process of launching the sector strategy, the Collaborating Organizations prepare within the next several months a brief, standalone primer with water sector utility managers as its intended audience. The primer would be based in the content of this report (Attributes, Keys to Management Success, example measures, and resources), be short enough to read quickly, and yet provide enough information to act as an initial guidepost for engaging in utility management improvement efforts. The primer would focus on the Ten Attributes of Effective Utility Management and the associated Keys to Management Success, and could include one or a few of the example measures for each Attribute included in Appendix D of this report. (Alternatively, the document could refer to relevant utility measures that have been developed as part of separate utility measurement programs.) The document could also include reference to utility management resources, perhaps through a selection of the examples explored through the Steering Committee's work, a discussion of how utilities could access similar resources, or, at a minimum, information on the plans to date for how the Collaborating Organizations will support a resource toolbox in the future.

3. Continue the collaboration among the Collaborating Organizations.

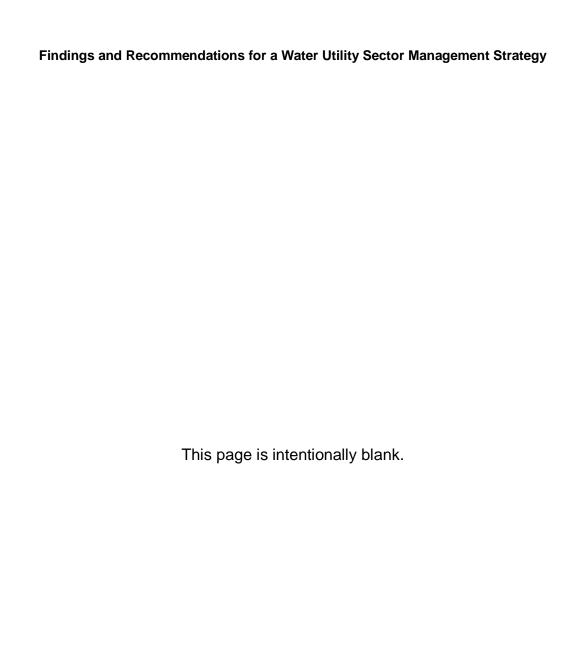
The Steering Committee recommends that collaboration continue in some manner. In particular, to further the future of the collaboration, the Steering Committee recommends that the Collaborating Organizations continue to work together on the strategy's development, implementation, and rollout. The Steering Committee wants to acknowledge the importance of this positive working relationship among the Collaborating Organizations and encourage a furthering of such efforts in the future. In addition, several Steering Committee members and focus group participants have indicated they see value in the continuation of a member steering committee in some form to help support and guide sector strategy development, implementation, and advocacy. In this context, the Steering Committee recommends that the Collaborating Organizations consider forming a new committee drawn at least in part from current committee membership to provide input to the Collaborating Organizations and help promote adoption of the key elements of the sector strategy.

4. Employ a continual improvement approach to the strategy's implementation over time.

Similar to the previous recommendation, the Steering Committee recommends that the sector strategy itself be reflected upon and improved/updated periodically. The water utility sector will continue to advance over time, and as information becomes available and additional feedback is sought and provided, the sector strategy will be strengthened by employing a "continual improvement" approach. Doing so will necessarily involve gaining feedback on the sector strategy from water utilities. It would also ideally involve identifying the sector's status—how the sector is doing relative to the strategy, particularly the Attributes—and whether the sector strategy has played a role in the sector's progress (or lack thereof) over time. The Committee hopes that the Collaborating Organizations will identify ideas on how to achieve this recommendation, and the Committee members are happy to provide additional thought in this regard to the extent that doing so would be useful.

VIII. Conclusion

The Steering Committee would like to thank the Collaborating Organizations for the opportunity to participate in this ground-breaking effort. The Committee hopes that the findings and recommendations in this report will be valuable both to the Collaborating Organizations and to the sector on the whole. Although it is understood that the Collaborating Organizations will need time to reflect upon these findings and recommendations and to translate them into the sector strategy itself, we hope and expect that this will take place in a timely manner to help move the sector in the right direction. We look forward to staying engaged as the sector takes this step toward moving ahead in a coordinated manner toward realizing the next generation of water utilities in this country.



Appendix A: May 2, 2006 Statement of Intent

Appendix B: Focus Group Participants

Appendix C: Focus Group Agenda

Appendix D: Example Utility Measures

Appendix E: Example Resources

Appendix F: Steering Committee Members and

Collaborating Organization

Representatives

Findings and Recommendations for a Water Utility Sector Management Strategy				
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Appendix A: Statement of Intent















May 2, 2006

Effective Water Sector Utility Management

Statement of Intent

U.S. Environmental Protection Agency (EPA) Association of Metropolitan Water Agencies (AMWA) American Public Works Association (APWA) American Water Works Association (AWWA) National Association of Clean Water Agencies (NACWA) National Association of Water Companies (NAWC) Water Environment Federation (WEF)

Introduction: This Statement of Intent is entered into and between the U.S. Environmental Protection Agency (EPA) and the following organizations: Association of Metropolitan Water Agencies (AMWA), American Public Works Association (APWA), American Water Works Association (AWWA), National Association of Clean Water Agencies (NACWA), National Association of Water Companies (NAWC), and the Water Environment Federation (WEF). These organizations are referred to herein as the Signatory Organizations.

Background: Recent events have highlighted the fundamental importance of sustaining our Nation's water and wastewater infrastructure. Effective utility management is key to achieving this goal. Effective management can help utilities enhance the stewardship of their infrastructure, improve performance in critical areas, and respond to other challenges. Addressing the Nation's water and wastewater infrastructure also calls for ongoing collaboration between government, industry, elected officials, and other stakeholders. The Signatory Organizations have a history of collaborating to promote effective utility management and desire to formalize these efforts.

Purpose: The purpose of this Statement is to formalize a collaborative effort among the signatory organizations in order to promote effective utility management. The Statement is intended to describe and facilitate cooperation, collaboration, coordination, and effective communication among the signatory organizations.

March 30, 2007 Appendix A-1

Objectives: The objectives of this Statement are to:

- o Affirm the belief by the Signatory Organizations in the value of sound and effective utility management;
- o Strengthen partnerships among the Signatory Organizations and water and wastewater utilities;
- o Establish a framework for working together to advance understanding of the principles and practices of effective utility management, and to encourage and promote their wider application;
- o Improve utility performance through the utility-specific application of effective management tools, performance measurement and other techniques and systems; and
- o Enhance utility decision making through public awareness and customer confidence.

Outreach to Utilities: Outreach to utilities is expected to occur throughout this collaboration on the following topics:

- o key attributes of effectively managed utilities;
- o existing utility management resources;
- o resource gaps, barriers, and opportunities to encourage more utilities to manage effectively; and
- o potential measures of success for utilities to gauge progress.

Recognition: The Signatory Organizations intend to develop a joint strategy to identify, encourage, and recognize excellence in water and wastewater utility management.

Communication: The Signatory Organizations intend to communicate widely about this Statement with their constituencies and encourage them to focus increased attention on utility management systems and programs.

Note: All actions that EPA may take in furtherance of this statement are subject to the availability of appropriated funds and the parties to this agreement will not submit a claim to EPA for compensation solely on the basis of this agreement. In signing this statement, none of the organizations listed above, including EPA, are obligating funds nor making any commitment to provide funding to any organization or individuals in the future. Further, EPA cannot endorse the sale or purchase of products or services developed by the participating organizations. This Statement does not create any right or benefit, substantive or procedural, enforceable by law or in equity against the other Signatory organizations or EPA, their officers or employees, or any other person. This Statement does not apply to any person outside of the other Signatory Organizations and EPA.

March 30, 2007 Appendix A–2

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Assistant Administrator for Water
U.S. Environmental Protection Agency

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Executive Director

Water Environment Federation

PETER COOK Executive Director

National Association of Water Companies

Appendix B: Focus Group Participants

Las Vegas Focus Group

Name	Title	Organization
Costanzo, Nick	Assistant General Manager	El Paso Water Utilities
Friess, Philip	Departmental Engineer	County Sanitation Districts of Los Angeles
Gans, Jim	Senior Vice President of Operations	Las Vegas Convention and Visitor's Authority
Graham, Guy	Wastewater Services Manager	City of Gresham
Hardy, W. Brent	Citizen	
Janis, Wayne	Assistant Director	Phoenix Water Services
Johnson, Peggy Maze	Executive Director	Citizen Alert
Offret, Dan M.	Executive Assistant to the President	Pima Community College
Pantuso, Joseph	Environmental Affairs Specialist	Southern Nevada Homebuilders Association
Porter, Dennis	Utility Services Director	City of Henderson
Steirer, Marsi	Deputy Director	City of San Diego Water Department
Stratton, Mark	General Manager	Metro Water District
Williams, Myrna	President of the Board	Clark County Commissioner
Facilitators:		
Greenwood, Rob	Partner	Ross & Associates Environmental Consulting, Ltd.
Williams, Anna	Associate	Ross & Associates Environmental Consulting, Ltd.

March 30, 2007 Appendix B–1

Elmhurst Focus Group

Name	Title	Organization
Clavel, Robert	Engineer-Manager	Wheaton Sanitary District
Gardner, Mike	Water and Wastewater Systems Manager	Bowling Green Municipal Utilities
Garelli, Brett	Assistant Chief Engineer	Metropolitan Water Reclamation District of Greater Chicago
Larson, Roger	Deputy Watershed Management Bureau Director	Wisconsin Department of Natural Resources
Marshall, Raymond	Deputy Director	Narragansett Bay Commission
McCracken, Stephen	Director of Watershed Management	The Conservation Foundation
Poole, Allan	Director	Department of Public Utilities, City of Naperville
Schellpfeffer, Jon	Chief Engineer and Director	Madison Metropolitan Sewerage District
West, Mary	Environmental Services Coordinator	Missouri Public Utility Alliance
Facilitators:		
Greenwood, Rob	Partner	Ross & Associates Environmental Consulting, Ltd.
Williams, Anna	Associate	Ross & Associates Environmental Consulting, Ltd.
Observers:		
Horne, Jim		U.S. Environmental Protection Agency, Office of Water
O'Neill, Eileen	Chief Technical Officer	Water Environment Federation

March 30, 2007 Appendix B–2

Appendix C: Focus Group Agenda

[Note: The agendas for the two focus groups were the same except for the date and location.]

Effective Water Utility Management Focus Group

September 26, 2006 | 11:00 AM – 4:00 PM Mead Conference Room – Las Vegas Valley Water District 1001 S. Valley View Blvd., Las Vegas, NV 89153

Please arrive no later than 10:45 AM

11:00 AM—Welcome and Introduction

11:15 AM—Background and Working Lunch

What are the key challenges water sector utility managers face?

12:00 PM—Defining "Effective Utility Management"

- What do you think of when you hear the term effective utility management?
- What accomplishments or actions signal to you that a water sector utility is effectively managed?

1:30 PM—Barriers to and Incentives for Effective Utility Management

- What do you view as the primary factors that motivate utilities to invest in improving their management efforts?
- What holds utilities back from undertaking improvement to their management efforts?
- What are the ways the water sector can overcome these barriers to improving management?

2:30 PM—Measuring Utility Performance

- What has your experience been with performance measurement at your utility?
- Are you using, or are you aware of other utilities using, what you consider practical and useful measures of utility performance?
- If there are measures you would like to be using, but don't, what has held you back from developing these measures?

3:15 PM—Synthesis and Wrap Up

4:00 PM—Adjourn

March 30, 2007 Appendix C–1

Appendix D: Example Utility Measures

1. Product Quality: Example Measures

Produces potable water, treated effluent, and process residuals in full compliance with regulatory and reliability requirements and consistent with customer, public health, and ecological needs.

Example Measures

Drinking Water Utility Measures

- 1) <u>Pressure adequacy</u>: Percent of customers with less than XX psi of pressure at the meter during normal operations.
- 2) <u>Drinking water supply outages</u>: Percent of retail customers experiencing water outages for one or more events totaling more than X hours/year.
- 3) <u>Drinking water system reliability</u>: Number of customer hours out of service per year divided by the total number of customer hours in that year.
- 4) <u>Drinking water system reliability</u>: Number of main breaks per mile of pipe per year.
- 5) <u>Water quality complaints</u>: Percent of customers that complain about water quality.
- 6) Turbidity: Monthly turbidity average (NTU) of filtered water.
- 7) Fire hydrant condition: Number of inoperable or leaking hydrants per 1,000 hydrants.
- 8) Fire hydrant flow: Percent of hydrants where flow available achieves required flow.
- 9) <u>Drinking water compliance rate</u>: Number of days in full compliance (times 100) divided by 365 days.¹

Wastewater Utility Measures

- 10) <u>Sewer overflows</u>: Number of sewer overflows per 1,000 miles of pipe per year. Note: Utilities may wish to break this down into wet-weather and dry-weather overflows. Some overflows are allowable—the absolute number of overflows should be considered in this context.
- 11) <u>Number of environmental violations</u>: Number of documented regulatory violations (common utility measure). Note: This could include measures of the number of significant non-compliance violations (SNC) under the Clean Water Act and/or other violations.
- 12) <u>Problem responsiveness</u>: Percent of sewer system problems (backups, voids, lid off, ponding) responded to within a target period of time. Note: Problem responsiveness in this context also relates to operational optimization. It could also relate to customer service;

March 30, 2007 Appendix D–1

¹ QualServe benchmark

however, in these instances, maintaining "product quality" involves identifying and addressing problems *before* the customer is aware that problems exist.

- 13) <u>Wastewater treatment effectiveness rate (compliance with effluent quality standards)</u>: Total number of standard non-compliance days (sum of all non-compliance days relative to all operating/discharge permits issues to the utility for an individual facility).²
- 14) <u>Compliance monitoring measures (day-to-day operational)</u>: e.g., number of days permit parameters are maintained consistent with NPDES permit limit per year.

2. Customer Satisfaction: Example Measures

Provides reliable, responsive, and affordable services in line with explicit, customer-accepted service levels. Receives timely customer feedback to maintain responsiveness to customer needs and emergencies.

Considerations regarding measurement of customer satisfaction are as follows.

- Regardless of how done, it is important to measure customer satisfaction consistently (e.g., once every six months or once a year) to understand changes over time.
- People who call into utilities represent a small fraction of the total customer base; therefore, it is important to measure customer satisfaction beyond incoming calls. There are more and less intensive ways to gauge broad customer satisfaction, e.g., using the invoice process to gather information, holding focus groups, conducting statisticallysignificant telephone surveys, etc.

Example Measures

Basic Measures

- 1) Number of customer complaints: e.g., number of customer complaint calls in daily reports. The number of customer calls (in general, not specific to customer complaint calls) is sometimes used as a customer satisfaction measure; but it alone is not necessarily associated with customer satisfaction. Calls may be placed for routine purposes such as turning on meters/service, or because customers lost their bills. For this reason, this example measure specifies the number of customer complaint calls. Other categories of incoming calls could also be used to track those that are related specifically to customer satisfaction.³
- 2) <u>Customer service complaint rate</u>: Percent of customer service complaints divided by number of active customer accounts.⁴
- 3) <u>Customer service cost per account</u>: Total customer service costs divided by number of active accounts.⁵

March 30, 2007 Appendix D–2

² QualServe benchmark

³ Common measure, also a QualServe benchmark

⁴ QualServe benchmark

⁵ QualServe benchmark

Responsiveness Measures

- 4) <u>Responsiveness/rapidity of response</u>: Percent of calls received and answered within a target timeframe.
- 5) Responsiveness: Number of customer calls dropped or abandoned.
- 6) Responsiveness/first call resolution: Number of customer calls resolved in one contact divided by total number of calls received. Note: this measure tracks the identity of the caller to ensure that the same customer is not calling back with the same problem.
- Customer work order response time: Percent of customer work order requests completed within established service standards.

Comprehensive Customer Satisfaction Measures

8) Overall customer satisfaction: Percent of customers rating overall job as "good" or "excellent" (through a customer service survey).

3. Employee and Leadership Development: Example Measures

Recruits and retains a workforce that is competent, motivated, adaptive, and safe-working. Establishes a participatory, collaborative organization dedicated to continual learning and improvement. Ensures employee institutional knowledge is retained and improved upon over time. Provides a focus on and emphasizes opportunities for professional and leadership development and strives to create an integrated and well-coordinated senior leadership team.

Note: Safety measures are under the "Operational Resiliency" Attribute.

Example Measures

Human Resources Management

- 1) <u>Turnover</u>: Annual percentage of total and voluntary turnover.
- Overtime: Total number of O&M overtime hours worked divided by total number of O&M hours.
- 3) Workforce succession planning: Does the utility have a current long-term workforce succession plan that accounts for projected retirements and other vacancies in each skill and management area (Yes/No)?
- 4) Professional development: Percent of employees that have employee development plans.
- 5) Professional development: Percent of employees eligible for certification that have attained it.
- 6) <u>Professional development</u>: Does the utility have a leadership development program that includes leadership training and other leadership-building opportunities (Yes/No)?

March 30, 2007 Appendix D-3

7) <u>Employee satisfaction survey</u>: Does the utility conduct an employee satisfaction survey (Yes/No)? **OR** Union grievances: Number of union grievances filed.

Productivity

8) Labor productivity: Staff per 1,000 water/sewer/water and sewer population served.

4. Operational Optimization: Example Measures

Ensures ongoing, timely, cost-effective, reliable, and sustainable performance improvements in all facets of its operations. Minimizes resource use, loss, and impacts from day-to-day operations. Maintains awareness of information and operational technology developments to anticipate and support timely adoption of improvements.

Example Measures

- 1) <u>Cost per million gallons produced / treated</u>: O&M expenses (e.g., chemical, power, and/or total cost) per million gallons produced and delivered.
- 2) <u>Distribution system water loss</u>: Percent of produced water that fails to reach customers and cannot otherwise be accounted for through authorized usage.⁶ This is equivalent to: Non revenue water: Difference between water supplied and water sold (i.e. volume of water "lost") expressed as a percentage of net water supplied.⁷
- 3) <u>Sewer system effectiveness</u>: Percent of customers experiencing backups in any year caused by the utility's sewer system.
- 4) <u>Finished water efficiency rate (for surface water plants)</u>: Finished water as a percent of raw water.
- 5) Efficiency ratio: O&M expenditures relative to revenue.
- 6) <u>Planned maintenance ratio</u>: Planned maintenance ratio in percent (hours): hours of planned maintenance (times 100) divided by hours of planned and corrective maintenance.⁸
- 7) <u>Direct energy use</u>: Total amount of energy used (including renewable energy) per 1,000 customers.⁹
- 8) <u>Material waste</u>: Percentage of materials used that are wastes (processed or unprocessed) from sources external to the utility.¹⁰

¹⁰ Adapted from GRI 2002

March 30, 2007 Appendix D-4

⁶ QualServe benchmark

⁷ The International Benchmarking Network for Water and Sanitation Utilities (IBNET) indicator definition

⁸ QualServe benchmark

⁹ Adapted from GRI 2002, Water U.K. 2005, and Australian VicWater 2003 measures as reprinted in Kenway and Maheepala, *Triple Bottom Line Reporting of Sustainable Water Utility Performance*, p. 112 (draft)

5. Financial Viability: Example Measures

Understands the full life-cycle cost of the utility and establishes and maintains an effective balance between long-term debt, asset values, operations and maintenance expenditures, and operating revenues. Establishes predictable rates—consistent with community expectations and acceptability—adequate to recover costs, provide for reserves, maintain support from bond rating agencies, and plan and invest for future needs.

Example Measures

Basic Measures

- 1) <u>Rates</u>: Average monthly bill relative to similar utilities (common measure). Note: Some utilities may wish to compare against a national average; others may choose to measure against utilities in nearby areas. In addition, it is important to note that rates are a function of many factors and simple comparisons of different utilities' rates may be misleading.
- 2) Water use per customer: Meter sales per customer account.
- 3) Revenues to expenditures: Ratio of revenue to expenditure.
- 4) Return on assets: Net income divided by total assets. 11
- 5) Return on equity: Annual return as a percentage of shareholder equity.

Liabilities and Debt

- 6) Debt ratio 1: Total liabilities divided by total assets. 12
- 7) <u>Debt ratio 2</u>: Percent of debt greater than 180 days/total revenue.

Projections Versus Actual

- 8) Operating revenue versus plan: Operating revenue for the period/planned revenue for the period
- 9) Operating expenditures versus planned expenditures: Percent of O&M expenditures for current year versus planned O&M in the 10-year finance plan.

Cost Recovery

- 10) Full cost recovery: Economic water and wastewater real rates of return.
- 11) Rate adequacy: Rate revenue relative to long term infrastructure replacement cost.

March 30, 2007 Appendix D-5

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¹¹ QualServe benchmark

¹² QualServe benchmark

6. Infrastructure Stability: Example Measures

Understands the condition of and costs associated with critical infrastructure assets. Maintains and enhances the condition of all assets over the long-term at the lowest possible life-cycle cost and acceptable risk consistent with customer, community, and regulator-supported service levels, and consistent with anticipated growth and system reliability goals. Assures asset repair, rehabilitation, and replacement efforts are coordinated within the community to minimize disruptions and other negative consequences.

Example Measures

Asset Condition

- 1) Asset condition: Percent of assets for which a condition assessment has been conducted.
- 2) Sewer cleaning: Percent of sewers cleaned each year.
- Sewer inspections: Linear feet of sewer lines televised each year divided by total linear feet of sewer lines.
- 4) Manholes inspected: Percent of manholes inspected per year.
- 5) <u>Water distribution system integrity</u>: Total annual number of leaks and pipeline breaks per 100 miles of distribution piping.¹³
- 6) <u>Collection system integrity</u>: Number of collection system failures per 100 miles of collection system piping per year.¹⁴
- 7) Planned maintenance ratio: Percent per hours and percent per cost. 15

Asset Management Planning and Implementation

- 8) <u>Comprehensive planning</u>: Does the utility have a long-term comprehensive plan that addresses future asset needs (Yes/No)?
- 9) Asset renewal/replacement rate: Total actual expenditures (or total amount of funds reserved for renewal and replacement for each asset group) divided by the total present worth for renewal and replacement for each asset group. ¹⁶ Note: this is a system of measures that requires breaking down assets into classes (e.g., water treatment facilities, water distribution system, wastewater collection assets, wastewater treatment facilities, wastewater miscellaneous assets) and having data with which to support the calculations (e.g., total present worth of renewal and replacement needs for each asset class).
- 10) <u>Capital reinvestment</u>: Five-year running average of capital reinvestment relative to replacement value.

¹³ QualServe benchmark

¹⁴ QualServe benchmark

¹⁵ QualServe benchmark

¹⁶ QualServe benchmark

11) Capital investment progress: Percent of capital investment projects started and completed on time and on budget (according to a capital improvement plan).

7. Operational Resiliency: Example Measures

Ensures utility leadership and staff work together to anticipate and avoid problems. Proactively identifies, assesses, establishes tolerance levels for, and effectively manages a full range of business risks (including legal, regulatory, financial, environmental, safety, security, and natural disaster-related) in a proactive way consistent with industry trends and system reliability goals.

Example Measures

Risk Management

- 1) Risk identification: Has the utility identified organizational risks (Yes/No)?¹⁷
- 2) Risk management planning: Does the utility have a risk management plan in place, and is this plan fully integrated into the utility (e.g., is there a high level of awareness of the risk management policies and procedures amongst the staff?) (Yes/No)?¹⁸

Safety

- 3) <u>Injury frequency rate</u>: Total accident incident rate per year.
- 4) Vehicle accident rate: Number of vehicle accidents per one million miles.
- 5) Lost time: Lost time due to accidents per 1,000 field labor hours.
- 6) Safety training: Average hours of safety-related training per employee per vear. 19
- 7) Compliance with health regulations and standards: Number and type of non-compliance incidences with public health regulations and standards.²⁰
- 8) Community notification: Does your utility provide timely notification to the public about spills, sewage discharges, and other water quality problems that make it unsafe for the public to swim, recreate or consume fish from local waters (Yes/No)?²¹

¹⁷ Adapted from Kenway and Maheepala, *Triple Bottom Line Reporting of Sustainable Water* Utility Performance, p. 109 (draft)

Adapted from Kenway and Maheepala, Triple Bottom Line Reporting of Sustainable Water Utility Performance, p. 109 (draft)

¹⁹ NAWC Water Utility Benchmark Survey

²⁰ GRI 2002, Water U.K. 2005, VicWater 2003, and related QualServe benchmark, as repeated in Kenway and Maheepala, Triple Bottom Line Reporting of Sustainable Water Utility Performance, p. 113 (draft)
²¹ Philadelphia Water Department, 2005, *The Smart Watershed Program Benchmarking Tool*

All-Hazards Preparedness

- High security risk assets: Percent of assets determined to be a high security risk by vulnerability assessment.
- 10) <u>All-hazards preparedness</u>: State of revisions to protocols/procedures for incorporating continuity of operations into internal utility design and construction standards for new facilities/infrastructure and major maintenance projects.
- 11) Does the utility have a current All-Hazards Disaster Readiness Response plan?
- 12) Has the utility conducted a Hazard Identification and Vulnerability Analysis?
- 13) Is the utility trained according to NIMS and ICS requirements?
- 14) Have key customers and partners in emergency management been identified and are plans coordinated and reviewed?
- 15) Has the utility typed its equipment for Mutual Aid/requesting purposes?

8. Community Sustainability: Example Measures

Is explicitly cognizant of and attentive to the impacts its decisions have on current and long-term future community and watershed health and welfare. Manages operations, infrastructure, and investments to protect, restore, and enhance the natural environment; efficiently use water and energy resources; promote economic vitality; and engender overall community improvement. Explicitly considers a variety of pollution prevention, watershed, and source water protection approaches as part of an overall strategy to maintain and enhance ecological and community sustainability.

Example Measures

- 1) Community perception of utility: Does the utility seek out the views of customers, stakeholders, shareholders, and the community about its strengths, abilities, objectives, and/or strategies (Yes/No)?²²
- 2) <u>Community perception of utility</u>: (Based on customer survey or other public information gathering effort.) Percentage of the community that believes that the utility's priorities reflect the community's priorities.
- 3) Watershed-based long-term infrastructure planning: Does the utility integrate alternative, watershed-based approaches to potentially reduce future infrastructure costs (e.g., centralized management of decentralized systems, smart growth strategies, source water protection programs, low-impact development, etc.) (Yes/No)?
- 4) <u>Water affordability</u>: Percent of households for whom water and sewerage service bills represent more than an affordable level of the average household income.

March 30, 2007 Appendix D-8

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²² From Kenway and Maheepala, *Triple Bottom Line Reporting of Sustainable Water Utility Performance*, p. 106 (draft)

- 5) Organizational best practices index: Summary measure on implementation of management programs important to water and wastewater utilities, including strategic planning, long-term financial planning, risk management planning, performance measurement system, optimized asset management program, customer involvement program, and continuous improvement.²³
- 6) <u>Triple bottom line commitment</u>: Does the utility include social, economic, and environmental goal areas as part of its strategic plan (Yes/No)?²⁴
- 7) <u>Triple bottom line progress assessment</u>: Does the utility employ performance measures that cover economic, social, and environmental outcomes (Yes/No)?²⁵
- 8) <u>Total water use</u>: Combination of following items: amount of water extracted by source per customer; water supplied by customer type per customer; wastewater collected per customer; recycled water per customer.²⁶
- 9) <u>Water conservation and efficiency</u>: Does the utility have a water conservation program (e.g., covering leakage detection, demand management, urban design, appliance efficiency, etc.) in place (Yes/No)?²⁷
- 10) Watershed management planning: Does the utility have watershed management programs in place (and do these include measurable objectives and targets) (Yes/No)?²⁸
- 11) <u>Investment in watershed management</u>: Does the utility have a long-term capital budget that extends beyond the current budget year to provide dedicated funding for watershed management (e.g., protection and restoration) projects (Yes/No)?²⁹
- 12) <u>Green building/infrastructure:</u> Has the utility promoted "green building" and related water conservation strategies, both for its own assets/buildings and in terms of promoting these throughout the larger community (e.g., working with local planning departments and developers on options for new construction) (Yes/No)?

9. Water Resource Adequacy: Example Measures

Ensures water availability consistent with current and future customer needs through long-term resource supply and demand analysis, conservation, and public education. Explicitly considers its role in water availability and manages operations to provide for long-term aquifer and surface water sustainability and replenishment.

From Kenway and Maheepala, *Triple Bottom Line Reporting of Sustainable Water Utility Performance*, p. 106 (draft)

March 30, 2007 Appendix D–9

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²³ QualServe benchmark

²⁵ From Kenway and Maheepala, *Triple Bottom Line Reporting of Sustainable Water Utility Performance*, p. 106 (draft)

 ²⁶ GRI 2002, Water U.K. 2005, and Australian VicWater 2003, and adapted from Kenway and Maheepala, *Triple Bottom Line Reporting of Sustainable Water Utility Performance*, p. 116 (draft)
 ²⁷ From Kenway and Maheepala, *Triple Bottom Line Reporting of Sustainable Water Utility Performance*, p. 107 (draft)

From Kenway and Maheepala, *Triple Bottom Line Reporting of Sustainable Water Utility Performance*, p. 109 (draft)

²⁹ Adapted from Philadelphia Water Department, 2005, *The Smart Watershed Program Benchmarking Tool*

Example Measures

Short-term Supply Adequacy

- 1) <u>Anticipated supply versus anticipated demand</u>: Is anticipated supply sufficient for anticipated demand (Yes/No)?
- Accuracy of demand projections: Actual water demand as a percent of projected water demand.
- 3) Reduced use from recycling: Amount of potable water demand reduced through recycling.
- 4) Water losses: Percent of unaccounted water of net water (production).
- 5) <u>Drought management</u>: Has the utility adopted a drought management plan (Yes/No)?
- 6) Per capita water consumption: Per capita water consumption per year.

Long-term Supply Adequacy

- 7) <u>Long-term supply plan</u>: Does the utility have a long-term water supply plan that accounts for anticipated (and unanticipated) population/demand changes (Yes/No)?
- 8) <u>Long-term demand</u>: Does the utility know the current and projected future population and water demand for current and future service areas (Yes/No)?
- 9) <u>Long-term supply availability</u>: Does the utility know the number of years for which existing supply sources are adequate (Yes/No)?
- 10) <u>Long-term demand-management plan</u>: Does the utility have a demand management/demand reduction plan (Yes/No)?
- 11) <u>Long-term supply management</u>: Does the utility predict and manage for long-term water supply? For example, does it predict supply adequacy based on predictions (e.g., using average past reservoir elevation data, year-to-date reservoir elevation data, and future normal, wet, dry, and very dry scenarios) (Yes/No)?
- 12) <u>Supply policy/commitment</u>: Does the utility have policies in place that require that, prior to committing to new service areas, it must have adequate dry year supply, or require additional supply be provided (Yes/No)? Alternatively, does the utility have a strong commitment to denying service commitments unless a reliable drought year supply, with reasonable drought use restrictions, is available to meet the commitment (Yes/No)?

10. Stakeholder Understanding and Support: Example Measures

Engenders understanding and support from oversight bodies, community and watershed interests, and regulatory bodies for service levels, rate structures, operating budgets, capital improvement programs, and risk management decisions. Actively involves stakeholders in the decisions that will affect them.

Example Measures

- 1) <u>Stakeholder opinion</u>: Based on feedback from likely stakeholder groups; e.g., governance board/council, residential customers, commercial/industrial clients, developers, city/county, regional partners, legislature, regulators, public/community/special interest.
- 2) <u>Stakeholder opinion</u>: Does the utility have a citizen advisory panel or other method to provide stakeholder input into the utility's decision making, priority setting, etc. (Yes/No)?
- 3) <u>Government relations survey</u>: Does the utility conduct a written survey to mayor and other key legislative officials (Yes/No)?
- 4) Community outreach and education: Number of public education presentations per year.
- 5) <u>Community contribution</u>: Number of volunteer hours in the community per employee (or per 100 employees, or per XX non-volunteer hours?) per year.
- 6) <u>Stakeholder outreach and education</u>: Does the utility consult regularly with stakeholders (Yes/No)?
- 7) Community contribution: Does the utility approach its business in a manner that provides tangible benefits to the community (e.g., by conducting neighborhood improvements) (Yes/No)?
- 8) <u>Transparency to stakeholders</u>: Is the information on the utility's strategies and performance complete (coverall all aspects of the utility), adequately disclosed, transparent, and readily available to customers, stakeholders, and (where applicable) shareholders (Yes/No)?³⁰
- Community outreach and education: Does the utility have a program to educate the community about the value of water, water services, and water conservation (Yes/No)?³¹

March 30, 2007 Appendix D-11

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³⁰ From Kenway and Maheepala, *Triple Bottom Line Reporting of Sustainable Water Utility Performance*, p. 106 (draft)

³¹ From Kenway and Maheepala, *Triple Bottom Line Reporting of Sustainable Water Utility Performance*, p. 107 (draft)

Appendix E: Example Resources

Part I: Example Resource Crosswalk

This example crosswalk shows the relationship between the resources identified by the Resources Subgroup and the Attributes of Effectively-Managed Water Sector utilities. For more information on authorship and availability of each resource, see the next section ("Example Resources").

In addition, six non-Attribute columns have been added to this example crosswalk: One column for each of the five Keys to Management Success (Continual Improvement Management Framework, Strategic Business Planning, Measurement, Leadership, and Organizational Approaches), and one column for case studies, which describe how a particular utility benefited from using a particular resource.

Please note that the Attribute and Key assignments for some resources are based on a general description of the resource and would need to be confirmed if a crosswalk like this were to be finalized and used.

#	Resource	Product Quality	Customer Satisfaction	Employee and Leadership Development	Operational Optimization	Financial Viability	Infrastructure Stability	Operational Resiliency	Community Sustainability	Water Resource Adequacy	Stakeholder Understanding and Support	Continual Improvement	Strategic Business Planning	Measurement	Leadership	Organizational Approaches	Case Study
1	American Management Association Seminars			Х											Х		
2	AMWA Annual Meeting	Χ	Х	Х	Χ	Χ	Х	Х	Х	Х	Х						
3	Building the Water Utility Brand		Χ						Χ		Χ						
4	The Changing Workforce - Crisis and Opportunity			Х												Х	
5	Evaluating Privatization II					Χ											
6	Public vs. Private: Comparing the Costs					Χ											
7	The Changing Workforce - Seizing the Opportunity			Х												Х	1
8	Public Works Management Practices Manual				Χ			Х									
9	Performance Measurement in Public Works				Χ			Χ			Χ			Χ			
10	Public Works Performance Management				Χ			Х			Χ			Χ			

#	Resource	Product Quality	Customer Satisfaction	Employee and Leadership Development	Operational Optimization	Financial Viability	Infrastructure Stability	Operational Resiliency	Community Sustainability	Water Resource Adequacy	Stakeholder Understanding and Support	Continual Improvement	Strategic Business Planning	Measurement	Leadership	Organizational Approaches	Case Study
11	Everything You Need to Know to be a Public Works Director			Χ	Χ			Χ			Χ				Χ		
12	Financing Stormwater Utilities					Χ				Х							
13	Avoiding Rate Shock		Х			Χ					Х						
14	AWWA Manuals	Х	Х	Х	Χ		Χ	Χ	Х	Χ	Х						
15	The Evolving Water Utility: Pathways to Higher Performance	Х	Χ		Χ		Χ	Χ	Χ		Х						
16	Thinking Outside the Bill		Х	Х		Χ			Х						Χ		
17	Water Infrastructure at a Turning Point						Χ										
18	AWWA WaterWiser website				Χ				Х		Х						
19	Water and Wastewater Leadership Center	Х	Х	Х		Χ					Х				Χ		
20	Partnership for Safe Water	Х	Х		Χ												
21	AWWA/QualServe Program	Х	Х	Х	Χ	Х	Х	Х		Х	Х	Χ		Χ			
22	AWWA/WEF Joint Management Conference	Х	Х	Х	Χ	Χ	Χ	Χ	Х	Χ	Х				Χ		
23	Workforce Planning for Successful Organization Change			Х	Χ											Х	
24	Triple Bottom Line Reporting				Χ	Χ			Х					Χ			
25	Leadership, Motivation, and Change in the Competitive Utility Environment			Х	Χ										Χ		Χ
26	Launching CMOM Using an EMS	Х	Х		Χ				Χ	Χ							Х
27	Laying the Foundation	Х	Х		Χ				Х	Х							Х
28	City of Fort Worth Six Sigma Page				Χ	Χ											
29	Charleston Commissioners of Public Works Conducting a Two-Front War	Х		Х	Χ				Х			Χ					Х
30	Managing the Water and Wastewater Utility			Х	Χ	Χ	Χ								Χ		
31	East Bay Municipal Utility District Strategic Plan	Х	Х	Х	Χ	Χ	Χ	Χ	Χ	Χ	Х		Х				
32	Asset Management: A Handbook for Small Water Systems		Х		Χ		Х										
33	Setting Small Drinking Water System Rates for a Sustainable Future					Χ	Χ										
34	Using Smart Growth Techniques as Stormwater Best Management Practices	Х			Χ				Х								
35	National Biosolids Partnership - EMS Program	Х	Х								Χ						
36	Achieving Environmental Excellence	Х		Х	Χ			Χ	Х		Х						
37	Reducing Cost and Optimizing Performance	Х		Х	Χ			Χ	Χ		Х						
38	Capacity, Management, Operations, and Maintenance	Х	Х		Χ				Χ	Χ							
39	Getting to Yes: Negotiating Agreement Without Giving In			Х	Χ	-									Χ		
40	Governmental Accounting, Auditing, and Financial Reporting 2005					Χ						·					

#	Resource	Product Quality	Customer Satisfaction	Employee and Leadership Development	Operational Optimization	Financial Viability	Infrastructure Stability	Operational Resiliency	Community Sustainability	Water Resource Adequacy	Stakeholder Understanding and Support	Continual Improvement	Strategic Business Planning	Measurement	Leadership	Organizational Approaches	Case Study
41	Generally Accepted Accounting Principles (GAAP)				Χ	X	Х	Χ	Χ		Х						
42	Primal Leadership: Learning to Lead with Emotional Intelligence			Х											Χ		
43	Hunter Water Australia - Asset Management				Χ		Х										
44	ICMA Center for Performance Measurement		Х		Χ									Χ			
45	ISO 9000 Series	Χ	Х														
46	ISO 14001	Х	Х		Χ				Χ	Χ							
47	Draft ISO 24510	Х	Х		Χ			Х	Χ								
48	Draft ISO 24511	Х	Х		Χ		Х	Х	Χ								
49	Draft ISO 24512	Χ	Х		Χ		Х	Х	Χ	Χ							
50	Alignment: Using the Balanced Scorecard to Create Corporate Synergies	Χ	Х	Х		Χ											
51	The Balanced Scorecard: Translating Strategy into Action	Χ	Х	Х		Χ						Χ	Х	Χ			
52	The Strategy-Focused Organization	Χ	Х	Х		Χ											
53	Leading Change			Х	Χ										Χ	Х	
54	Watershed Impact Assessment Guidance for Municipal Managers				Χ		Х		Χ								
55	International Infrastructure Management Manual				Χ		Х										
56	NARUC Chart of Accounts				Χ	Χ	Х	Х	Χ		Х						
57	NAWC Benchmarking Surveys	Х	Х	Х	Χ	Χ	Х	Χ	Х	Χ	Х						
58	Managing Public Infrastructure Assets to Minimize Cost and Maximize Performance				Χ		Х										
59	Charleston CPW Water Distribution Operation	Χ	Х		Χ				Χ	Χ							Х
60	The Six Sigma Way Team Fieldbook																
61	Crucial Conversations: Tools for Talking when Stakes are High			Х							Х				Χ		
62	Peter F. Drucker Foundation for Nonprofit Management / Leader to Leader Institute			Χ	Χ										Χ		
63	The Triple Bottom Line				Χ	Χ			Х								
64	The Fifth Discipline Fieldbook				Χ							Χ				Χ	
65	SA 8000			Х													
66	UVA Senior Executive Institute			Χ	Χ										Χ		
67	WaterISAC Information Sharing and Analysis Center							Х									
68	Water Services Association of Australia		Х		Χ		Χ										
69	Asset Management for Water and Wastewater Utilities						Х										
70	Water is Life, and Infrastructure Makes it Happen		Х			Χ	Х				Χ						

#	Resource	Product Quality	Customer Satisfaction	Employee and Leadership Development	Operational Optimization	Financial Viability	Infrastructure Stability	Operational Resiliency	Community Sustainability	Water Resource Adequacy	Stakeholder Understanding and Support		Strategic Business Planning	Measurement	Leadership	Organizational Approaches	Case Study
71	Continual Improvement in Utility Management	Х	Х		Χ			Х	Х								
72	Sustainable Infrastructure Management Program Learning Environment (SIMPLE)						Χ										
	TOTAL	28	30	29	47	23	23	21	28	13	22	4	2	6	13	5	5

Part II: Example Resources

Included in the draft list of example resource are the top five/most useful resources identified by Steering Committee Members and Collaborating Organization Representatives. This list would need further refinement for a final toolbox.

The final set of resources in a formal toolbox could be organized by Attribute (or other organizing construct), rather than alphabetically by author as they appear below. Please refer to the example crosswalk to see a conceptual exploration of the relationships between the Attributes and the example resources in the list below.

Most useful resources identified to date (in alphabetical order)

1. AMA. American Management Association (AMA) Seminars.

http://www.amanet.org/seminars/index.cfm

Attributes: employee and leadership development

- AWMA. AMWA Annual Meeting. http://www.amwa.net/ [Note: Speakers' PowerPoint presentations are posted on the Members Only area of the AMWA website]
 Attributes: product quality, customer satisfaction, employee and leadership development, operational optimization, financial viability, infrastructure stability, operational resiliency, community sustainability, water resource adequacy, stakeholder understanding and support
- 3. AMWA. 2006. Building the Water Utility Brand.

http://www.amwa.net/features/competitiveness/

Attributes: customer satisfaction, community sustainability, stakeholder understanding and support

4. AMWA and AMSA (NACWA). 2004. **The Changing Workforce...Crisis and Opportunity**. http://www.amwa.net/features/competitiveness/

Attributes: employee and leadership development

5. AMWA and AMSA (NACWA). 2002. Evaluating Privatization II.

http://www.amwa.net/features/competitiveness/

Attributes: financial viability

6. AMWA and AMSA (NACWA). 2003. Public vs. Private: Comparing the Costs.

http://www.amwa.net/features/competitiveness/

Attributes: financial viability

AMWA and NACWA. 2006. The Changing Workforce...Seizing the Opportunity.

http://www.amwa.net/features/competitiveness/

Attributes: employee and leadership development

8. APWA 2004. Public Works Management Practices Manual, 5th Edition.

http://www.apwa.net/bookstore/detail.asp?PC=PB.APWM

Attributes: operational optimization, operational resiliency

9. APWA 1999. Performance Measurement in Public Works.

http://www.apwa.net/bookstore/detail.asp?PC=PB.ANUT

Attributes: operational optimization, operational resiliency, stakeholder understanding and support

10. APWA 1999. Public Works Performance Management.

http://www.apwa.net/bookstore/detail.asp?PC=PB.APER

Attributes: operational optimization, operational resiliency, stakeholder understanding and support

11. APWA 2004. Everything You Need to Know to be a Public Works Director.

http://www.apwa.net/bookstore/detail.asp?PC=PB.A420

Attributes: operational optimization, operational resiliency, stakeholder understanding and support

12. APWA 2003. Financing Stormwater Utilities.

http://www.apwa.net/bookstore/detail.asp?PC=PB.AFSF

Attributes: financial viability, water resource adequacy

13. AWWA. 2004. Avoiding Rate Shock: Making the Case for Water Rates.

http://www.awwa.org/bookstore/product.cfm?id=20570

Attributes: customer satisfaction, financial viability, stakeholder understanding and support

14. AWWA. AWWA Manuals of Water Supply Practices, Standards, and Benchmarks.

www.awwa.org

Attributes: product quality, customer satisfaction, operational optimization, infrastructure stability, operational resiliency, employee and leadership development, community sustainability, water resource adequacy, stakeholder understanding and support

15. AWWA. 2003. Nancy Zelig, editor. The Evolving Water Utility: Pathways to Higher

Performance. http://www.awwa.org/bookstore/product.cfm?id=20519

Attributes: product quality, customer satisfaction, operational optimization, operational resiliency, community sustainability, stakeholder understanding and support, infrastructure stability

16. AWWA. 2005. Thinking Outside the Bill: A Utility Manager's Guide to Assisting Low-Income Water Customers. http://www.awwa.org/bookstore/product.cfm?id=20594

Attributes: customer satisfaction, financial viability, community sustainability

17. AWWA. 2006. Water Infrastructure at a Turning Point: The Road to Sustainable Asset

Management. http://www.awwa.org/bookstore/product.cfm?id=20615

Attributes: infrastructure stability

18. AWWA. WaterWiser website. www.waterwiser.org

Attributes: operational optimization, community sustainability, stakeholder understanding and support

19. AWWA, AMWA, NACWA, and WEF. Water and Wastewater Leadership Institute.

www.nacwa.org/meetings/leader

Attributes: product quality, customer satisfaction, employee and leadership development, financial viability, stakeholder understanding and support

- 20. AWWA and EPA. **Partnership for Safe Water**. http://www.awwa.org/science/partnership/ Attributes: product quality, customer satisfaction, operational optimization
- 21. AWWA and WEF. **AWWA/QualServe Self Assessment, Peer Review, and Benchmarking Program**. <u>www.awwa.org/science/qualserve/</u>

Attributes: product quality, customer satisfaction, employee and leadership development, operational optimization, financial viability, infrastructure stability, operational resiliency, water resource adequacy, stakeholder understanding and support

22. AWWA and WEF. **AWWA/WEF Joint Management Conference**.

http://www.awwa.org/conferences/jmc/

Attributes: product quality, customer satisfaction, employee and leadership development, operational optimization, financial viability, infrastructure stability, operational resiliency, community sustainability, water resource adequacy, stakeholder understanding and support

- 23. AwwaRF. 2003. Workforce Planning for Successful Organization Change (AwwaRF Report 90965F). http://www.iwapublishing.com/template.cfm?name=isbn1843398710 Attributes: employee and leadership development, operational optimization
- 24. AwwaRF, as prepared by Steven Kenway and Shiroma Maheepala. Triple Bottom Line Reporting of Sustainable Water Utility Performance. September 2006 [Draft] Attributes: operational optimization, financial viability, community sustainability
- 25. Bickerstaff, Rick. Leadership, Motivation, and Change in the Competitive Utility Environment. [case study]
 Attributes: employee and leadership development, operational optimization
- 26. Bickerstaff, Rick, and John Cook. **Launching CMOM using an EMS**. [case study]
 Attributes: product quality, customer satisfaction, operational optimization, community sustainability, water resource adequacy
- 27. Bickerstaff, Rick, Adrian Williams, and John Cook. 2003. Laying the Foundation: An Environmental Management System is a Great First Step in Launching a CMOM Program. From Water Environment and Technology. [case study]
 Attributes: product quality, customer satisfaction, operational optimization, community sustainability, water resource adequacy
- 28. City of Fort Wayne. **Six Sigma website**.

 http://www.cityoffortwayne.org/index.php?option=com_content&task=view&id=454&Itemid=5

 91 [case study]

 Attributes: operational optimization, financial viability
- Cook, John, and Myron Olstein. Charleston Commissioners of Public Works Conducting a Two-Front War to Achieve Continual Improvement. [case study]
 Attributes: product quality, employee and leadership development, operational optimization, community sustainability
- Dolan, Roger. 2004. Managing the Water and Wastewater Utility. http://www.e-wef.org/timssnet/static/UM/P12103.htm
 Attributes: operational optimization, financial viability, infrastructure stability

- 31. East Bay Municipal Utility District. 2006. **EBMUD Strategic Plan**.

 http://www.ebmud.com/about_ebmud/overview/strategic_plan/ebmud_strategic_plan.pdf

 Attributes: product quality, customer satisfaction, employee and leadership development, operational optimization, financial viability, infrastructure stability, operational resiliency, community sustainability, water resource adequacy, stakeholder understanding and support
- 32. EPA. Asset Management: A Handbook for Small Water Systems 2003.

 http://www.epa.gov/safewater/smallsys/pdfs/guide-smallsystems-asset-mgmnt.pdf

 Attributes: infrastructure stability, operational optimization, customer satisfaction
- 33. EPA. 2006. **Setting Small Drinking Water System Rates for a Sustainable Future**. http://www.epa.gov/safewater/smallsys/pdfs/guide-smallsystems-final ratesetting guide.pdf Attributes: financial viability, infrastructure stability
- 34. EPA. 2005. Using Smart Growth Techniques as Stormwater Best Management Practices. http://www.epa.gov/smartgrowth/pdf/sg stormwater BMP.pdf

 Attributes: operational optimization, product quality, community sustainability
- 35. EPA, NACWA, and WEF. **National Biosolids Partnership EMS Program**. www.biosolids.org.

Attributes: product quality, customer satisfaction, stakeholder understanding and support

36. EPA and the Global Environment and Technology Foundation. 2004. Achieving Environmental Excellence: An Environmental Management Systems (EMS) Handbook for Wastewater Utilities. www.peercenter.net

Attributes: operational optimization, operational resiliency, community sustainability, employee and leadership development, product quality, stakeholder understanding and support

37. EPA and the Global Environment Technology Foundation. 2006. Reducing Costs and Optimizing Performance: An Environmental Management Systems (EMS) Handbook for Wastewater Utilities. www.peercenter.net

Attributes: operational optimization, operational resiliency, community sustainability, employee and leadership development, product quality, stakeholder understanding and support

38. EPA Regions. Capacity, Management, Operations, and Maintenance (CMOM). www.epa.gov.

Attributes: product quality, operational optimization, community sustainability, water resource adequacy, customer satisfaction

39. Fisher, Roger, William L. Ury, and Bruce Patton (editor). **1991. Getting to Yes: Negotiating Agreement Without Giving In (2nd edition)**. http://www.amazon.com/Getting-Yes-Negotiating-Agreement-Without/dp/0140157352/sr=1-1/qid=1161127268/ref=pd bbs 1/102-2170278-4848903?ie=UTF8&s=books

Attributes: operational optimization

 Gauthier, Stephen J. Governmental Accounting, Auditing, and Financial Reporting 2005. http://www.amazon.com/Governmental-Accounting-Auditing-Financial-Reporting/dp/0891252754

Attributes: financial viability

41. Generally Accepted Accounting Principles (GAAP).

Attributes: financial viability, operational optimization, infrastructure stability, operational resiliency, community sustainability, stakeholder understanding and support

42. Goleman, Daniel, Richard E. Boyatzis, and Annie McKee. 2002. **Primal Leadership:**Learning to Lead with Emotional Intelligence. http://www.amazon.com/Primal-Leadership-Learning-Emotional-Intelligence/dp/1591391849

Attributes: employee and leadership development

43. Hunter Water Australia. Asset Management.

http://www.hwa.com.au/recentprojects.asp?id=345

Attributes: operational optimization, infrastructure stability.

44. International City/County Management Association. **ICMA Center for Performance Measurement.**

http://www1.icma.org/main/bc.asp?bcid=107&hsid=1&ssid1=50&ssid2=220&ssid3=297&t=0
Attributes: customer satisfaction, operational optimization

45. International Organization for Standardization. **ISO 9000 Series: Quality Management**. www.iso.org.

Attributes: product quality, customer satisfaction

46. International Organization for Standardization. **ISO 14001: Environmental Management**. www.iso.org

Attributes: product quality, operational optimization, community sustainability, water resource adequacy, customer satisfaction

47. International Organization for Standardization. **Draft International Standard ISO/DIS 24510:**Service activities related to drinking water and wastewater – Guidelines for the improvement and for the assessment of the service to users. Final version expected in 2007. www.iso.org.

Attributes: product quality, customer service, operational optimization, operational resiliency, community sustainability

48. International Organization for Standardization. **Draft International Standard ISO/DIS 24511: Service activities related to drinking water and wastewater – Guidelines for the management of wastewater utilities and for the assessment of wastewater services.**Final version expected in 2007. www.iso.org.

Attributes: product quality, customer service, operational optimization, infrastructure stability, operational resiliency, community sustainability

49. International Organization for Standardization. **Draft International Standard ISO/DIS 24512:**Service activities related to drinking water and wastewater – Guidelines for the management of drinking water utilities and for the assessment of drinking water services. Final version expected in 2007. www.iso.org.

Attributes: product quality, customer satisfaction, operational optimization, infrastructure resiliency, operational resiliency, community sustainability, water resource adequacy

 Kaplan, Robert S. and David P. Norton. 2006. Alignment: Using the Balanced Scorecard to Create Corporate Synergies. http://www.amazon.com/Alignment-Balanced-Scorecard-Corporate-Synergies/dp/1591396905/sr=8-1/qid=1161814232/ref=sr-1-1/102-7413398-1706530?ie=UTF8&s=books

Attributes: customer satisfaction, financial viability, employee and leadership development, product quality

51. Kaplan, Robert S. and David P. Norton. 1996. **The Balanced Scorecard: Translating Strategy into Action**. http://www.amazon.com/Balanced-Scorecard-Translating-Strategy-Action/dp/0875846513/sr=1-1/qid=1161814319/ref=sr_1_1/102-7413398-1706530?ie=UTF8&s=books

Attributes: customer satisfaction, financial viability, employee and leadership development, product quality

52. Kaplan, Robert S. and David P. Norton. 2000. **The Strategy-Focused Organization: How Balanced Scorecard Companies Thrive in the New Business Environment**. http://www.amazon.com/Strategy-Focused-Organization-Scorecard-Companies-

http://www.amazon.com/Strategy-Focused-Organization-Scorecard-Companies-Environment/dp/1578512506/sr=1-1/qid=1161814346/ref=sr 1 1/102-7413398-1706530?ie=UTF8&s=books

Attributes: customer satisfaction, financial viability, employee and leadership development, product quality

53. Kotter, John P. 1996. **Leading Change**. http://www.amazon.com/Leading-Change-John-P-Kotter/dp/0875847471/sr=1-1/qid=1161814375/ref=sr 1 1/102-7413398-1706530?ie=UTF8&s=books

Attributes: employee and leadership development, operational optimization

54. Low Impact Development Center. 2005. **Watershed Impact Assessment Guidance for Municipal Managers**. <u>www.lowimpactdevelopment.org</u>.

Attributes: community sustainability, infrastructure stability, operational optimization

55. National Asset Management Steering Group (New Zealand). 2006. **International Infrastructure Management Manual**.

http://www.nams.org.nz/International%20Infrastructure%20Management%20Manual Attributes: operational optimization, infrastructure stability

56. National Association of Regulatory Utility Commissioners (NARUC). **NARUC Chart of Accounts**. <u>www.naruc.org</u>

Attributes: financial viability, operational optimization, infrastructure stability, operational resiliency, community sustainability, stakeholder understanding and support

57. National Association of Water Companies (NAWC). **NAWC Benchmarking Surveys**. www.nawc.org

Attributes: product quality, customer satisfaction, operational optimization, financial viability, infrastructure stability, operational resiliency, employee motivation and commitment, water resource adequacy, community sustainability, stakeholder understanding and support

58. National Association of Clean Water Agencies (NACWA) in cooperation with AMWA, AWWA, and WEF. Managing Public Infrastructure Assets to Minimize Cost and Maximize Performance. http://www.nacwa.org/pubs/index.cfm#management Attributes: infrastructure stability, operational optimization

 Oberoi, Kanwal, and Rick Bickerstaff. Charleston CPW Water Distribution Operation: First Public Utility to Acquire ISO 14001 Certification. [case study]

Attributes: product quality, customer satisfaction, operational optimization, community sustainability, water resource adequacy

- 60. Pande, Peter S., Robert P. Neuman, and Roland R. Cavanagh. 2002. The Six Sigma Way Team Fieldbook: An Implementation Guide for Process Improvement Teams. http://doi.contentdirections.com/mr/mgh.jsp?doi=10.1036/0071373144
 Attributes: operational optimization, financial viability
- 61. Patterson, Kerry, Joseph Grenny, Ron McMillan, and Al Switzler. 2002. Crucial Conversations: Tools for Talking when Stakes are High. http://www.amazon.com/Crucial-Conversations-Tools-Talking-Stakes/dp/0071401946
 Attributes: employee and leadership development, stakeholder understanding and support
- 62. Peter F. Drucker Foundation for Nonprofit Management / Leader to Leader Institute.

 http://www.pfdf.org/about/index.html

 Attributes: employee and leadership development, operational optimization
- 63. Savitz, Andrew W and Karl Weber. 2006. The Triple Bottom Line: How Today's Best-Run Companies are Achieving Economic, Social and Environmental Success and How You Can Too. http://www.amazon.com/Triple-Bottom-Line-Companies-Environmental/dp/0787979074/sr=8-1/qid=1161815464/ref=pd bbs sr 1/102-7413398-1706530?ie=UTF8&s=books

 Attributes: financial viability, community sustainability, operational optimization
- 64. Senge, Peter M., Art Kleiner, Charlotte Roberts, Rick Ross, and Bryan Smith. 1994. **The Fifth Discipline Fieldbook: Strategies and Tools for Building a Learning Organization**. http://www.amazon.com/Fifth-Discipline-Fieldbook-Peter-Senge/dp/0385472560
 Attributes: operational optimization
- 65. Social Accountability International. **Social Accountability 8000 Standard**. http://www.sa-intl.org/index.cfm?fuseaction=Page.viewPage&pageId=473
 Attributes: employee and leadership development
- 66. **UVA Senior Executive Institute**. http://www.coopercenter.org/leadership/SEI/ Attributes: operational optimization
- 67. **WaterISAC Information Sharing and Analysis Center**. http://www.waterisac.org/ Attributes: operational resiliency
- 68. Water Services Association of Australia (WSAA) process benchmarking, asset management, civil maintenance, customer services. http://www.wsaa.asn.au/
 Attributes: customer satisfaction, infrastructure stability, operational optimization
- 69. WEF. Asset Management for Water and Wastewater Utilities: Manageable, Incremental Steps to Life-Cycle Asset Management. www.wef.org/conferencesTraining/
 Attribute: infrastructure stability
- WEF administered broad alliance. Water is Life, and Infrastructure Makes it Happen. www.waterislife.net
 - Attributes: customer satisfaction, financial viability, infrastructure stability, stakeholder understanding and support
- 71. WEF, NACWA, and EPA. Continual Improvement in Utility Management: A Framework for Integration. 2004. www.wef.org, www.nacwa.org, www.peercenter.net
 Attributes: product quality, operational optimization, customer satisfaction, operational resiliency, community sustainability

72. Water Environment Research Foundation (WERF). **Sustainable Infrastructure Management Program Learning Environment (SIMPLE)**. www.werf.us/products/tools.cfm.
Free to WERF subscribers.

Attributes: infrastructure stability

Appendix F: Steering Committee Members and Collaborating Organization Representatives

Steering Committee Members

David Brosman, El Paso Water Utilities Public Service Board

John Cook, Advanced Data Mining International, formerly of Charleston Water System[†]

Stephen Densberger, Pennichuck Water Service Co.

JC Goldman, Jr., United Water*

Dan Hartman, City of Golden Public Works*

Scott Haskins, Seattle Public Utilities*

Mary Lappin, Kansas City Water Services Department

Ed McCormick, East Bay Municipal Utility District[†]

Patricia Mulroy, Las Vegas Valley Water District

Howard Neukrug, Philadelphia Water

Dave Rager, Greater Cincinnati Water Works

Brian Ramaley, Newport News Waterworks

Joseph Superneau, Springfield Water and Sewer Commission[†]

Diane Taniguchi-Dennis, City of Albany Dept of Public Works[†]

Billy Turner, Columbus Water Works*

John Young, Jr., American Water*

Collaborating Organization Representatives

Julia Anastasio, American Public Works Association

Peter Cook, National Association of Water Companies

Jim Ginley, American Water Works Association*†

Chris Hornback, National Association of Clean Water Agencies*

Jim Horne, US EPA, Office of Water*

Eileen O'Neill, Water Environment Federation[†]

Carolyn Peterson, Association of Metropolitan Water Agencies*

^{*} Participated in the Measures Subgroup

[†] Participated in the Resources Subgroup

