2016 State of the Water Industry Report

Established in 1881, the American Water Works Association is the largest nonprofit, scientific, and educational association dedicated to providing solutions to manage the world’s most important resource – water. With over 50,000 members and 5,000 volunteers, AWWA provides solutions to improve public health, protect the environment, strengthen the economy, and enhance our quality of life.

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EXECUTIVE SUMMARY

The American Water Works Association has been formally tracking issues and trends in the water industry since 2004 through the State of the Water Industry (SOTWI) study. The Association continues to conduct this annual survey in order to:

- Identify and track significant challenges facing the water industry
- Provide data and analysis to support water professionals as they develop and communicate strategies to address current and future issues
- Inform decision makers and the public of the challenges faced by the industry

In September 2015, emails were randomly sent to a general list of AWWA members and contacts inviting participation in the 2016 SOTWI study. The major findings summarized below were developed from the results of 1,468 completed surveys AWWA received during the survey period.

- The current health of the industry (i.e., soundness) as rated by all respondents was 4.5 on a scale of 1 to 7, the same score observed in 2015; this score has fallen into a range of 4.5 to 4.9 since the survey began in 2004
- Looking forward five years, the soundness of the water industry was expected to decline to 4.4 (also on a scale of 1 to 7), which is the same score observed in 2015; this score has fallen into a range of 4.4 to 5.0 since the survey’s inception
- The top five most important issues facing the water industry were identified as follows:
  1. Renewal & replacement (R&R) of aging water and wastewater infrastructure
  2. Financing for capital improvements
  3. Public understanding of the value of water systems and services
  4. Long-term water supply availability
  5. Public understanding of the value of water resources
- A note on gender: 77% of the 2016 SOTWI respondents were male, but the gender gap diminishes as age decreases; the greatest gender imbalance occurred for those 65 and older (only 3% women), but this imbalance decreased almost linearly as the age category decreased until parity is reached for those 25 years old and younger (i.e., 50% female/50% male ratio).
- 30% of utility personnel reported their utilities are currently struggling to cover the full cost of providing services, including R&R and expansion needs, through customer rates and fees, and this jumps to 38% when respondents considered the full cost of service in the future. Notably, 11% of respondents felt that their utilities were currently not at all able to cover the full cost of providing service.
- The most important issue in the area of infrastructure R&R was “establishing and following a financial policy for capital reinvestment,” with 42% of respondents rating this a critical issue. Other important R&R issues included prioritizing R&R needs, justifying R&R programs to ratepayers, and justifying R&R programs to oversight bodies such as boards and councils.
- 56% of respondents reported that their utilities’ access to capital was as good or better than at any time in the last five years, up from 53% in 2015 and 46% in 2014; only 10% reported that their utilities’ access to capital was “as bad or worse than at any time in the last five years”, down from 11% in 2015 and 17% in 2014.
- 38% of utility respondents reported declining total water sales while 31% of respondents reported their total water sales were flat or little changed in the last 10 years; similar results were observed on a per-account basis. Taken altogether, this means that a large majority of utilities could potentially face issues associated with low or declining water demand if these trends continue while the costs for water services increase.
When utility personnel were asked how their utilities are responding to cost recovery needs in the face of changing water sales and consumption patterns, the most reported response was shifting more of the cost recovery from consumption-based fees to fixed fees within the rate structure. Other commonly reported strategies included changes in growth-related fees and shifting the rate design to an increasing block-rate structure. Only 8% of the respondents indicated no changes were needed at their utilities.

Utility personnel were asked how six groups would perceive a potential rate increase in the upcoming year; public officials were expected to be the most positive at 21%, with the next closest group being business leaders at 12%. The most negative responses (~70% negative) were expected to come from residential customers.

When utility personnel were asked how prepared their utilities would be to meet their long-term water supply needs, 7% indicated their utilities will be challenged (i.e., not-at-all or only-slightly prepared), down from 11% in 2015.

A slight majority of utility personnel (51%) reported their utilities do not include any potential impacts from climate variability in their risk management or planning processes; 37% responded that planning at their utilities includes climate change effects while 12% indicated their utility is in the process of including climate change in their planning processes.

Of the options for water reuse, nonpotable reuse to augment irrigation was the most reported option with 20% of utility respondents indicating their utilities already have something implemented and another 18% responding theirs are considering it.

Both utility and non-utility personnel consider the water industry’s communication somewhat ineffective; communication with state/local regulators was the most effective of the groups that were rated, followed by federal regulators and public officials. The least effective communication was reported for youth, with approximately 50% responding that communication with young people was either poor or very poor.

The most important current regulatory concern of the water industry was chemical spills, followed by point source pollution and combined sewer overflows. The most important future regulatory concerns were pharmaceuticals and hormones, nonpoint source pollution, and security and preparedness (cyber, physical, and emergency response).

The 2016 SOTWI report provides the general directions in which the water industry is moving as well as specific guidance on the critical areas the industry feels need investment. AWWA provides a forum for innovation and leadership in the water industry by not only identifying and tracking important water issues, but by focusing the efforts and contributions of its dedicated members and volunteers to address the challenges identified in the SOTWI survey.
PART 1 – PURPOSE AND METHODOLOGY

Purpose
The American Water Works Association supports the water industry by providing solutions to effectively manage the world’s most important resource: water. AWWA first developed the State of the Water Industry (SOTWI) survey and report in 2004 to:

- Identify, explore, and track significant challenges facing the water industry
- Provide data and analysis to support water professionals as they develop and communicate strategies to address current issues
- Highlight and potentially mitigate problems on the water industry’s horizon

The annual SOTWI survey allows participants to serve as a voice for their colleagues and encourages necessary reflection on the water industry’s challenges and priorities. The water industry, which includes potable water, wastewater, stormwater, and reuse services, is foundational to modern society. The water industry typically provides excellent service, but it is often ignored until times of stress such as drought, water contamination, and rate disputes. Because these challenges can occur unexpectedly and with great variation, water professionals need a balanced understanding of today’s issues and tomorrow’s challenges so they can help communities respond effectively.

The STOWI survey provides an industry-wide self-assessment, gathering information to support the water community’s major tenets including safeguarding public health, supporting and strengthening communities, and protecting the environment; Figure 1 highlights these principles and how they are realized.

Figure 1. Basic Tenets of the Water Industry

Safeguard Public Health
- Safe drinking water
- Fire protection
- Water pollution control

Support and Strengthen Communities
- Adequate and reliable supplies
- Appropriate water quality
- Appropriate prices *(financial sustainability)*

Protect the Environment
- Adequate and reliable supplies
- Appropriate water quality
- Efficient use of supplies for minimum impacts *(environmental sustainability)*
Methodology

The SOTWI survey population includes all water professionals, i.e., those with a working understanding of the issues facing the entire water industry. The SOTWI survey classifies participants based on which of the following twenty categories best describes the type of organization for which they work:

- Drinking Water Utility
- Wastewater Utility
- Combined Water/Wastewater Utility (may include other services too)
- Water Wholesaler
- Reuse/Reclamation Utility
- Stormwater Utility
- Consulting Firm/Consultant
- Manufacturer of Products
- Manufacturer’s Representative
- Distributor
- Technical Services/Contractor
- Regulatory Authority/Regulator
- Non-utility Government (municipal, federal, etc.)
- University/Educational institution
- Laboratory
- Financial Industry (ratings agency, investor/fund rep., etc.)
- Law Firm/Attorney
- Nonprofit Organization
- Retired
- Other (please specify)

AWWA made deliberate efforts throughout the 2016 SOTWI study to anticipate and minimize errors due to coverage, sampling, nonresponse, and measurement. Coverage errors can result when members of the survey population have an unknown nonzero chance of being included in the sample. Sampling errors can result if data is collected from only a subset instead of all members of the sampling frame, which is the list from which a sample is to be drawn in order to represent the survey population. The 2016 SOTWI sample frame consisted of a general list of AWWA members and contacts. The survey primarily reflects water industry concerns in the United States, Canada, and Mexico.

A survey sample consists of all units of a population that are drawn from the sample frame for inclusion in the survey. In order to minimize coverage errors, the sample for the 2016 SOTWI Survey was distributed with the goal to provide uniform response from states and provinces. To avoid bias, AWWA membership was not considered in the survey distribution, meaning it was sent to members and nonmembers alike. This year was the first opportunity in which respondents had the option to take the survey in Spanish in addition to English; seven (7) Spanish-language completed responses were received.

From the sample frame, the survey invitation distribution included the following criteria:

1. All North American Utilities (water, wastewater, combined, etc.)
2. All North American Service Providers
3. All North American Partner Agencies & Institutions
4. All Canadian Individual Members
5. All Mexican Individual Members
6. All International Individual Members
7. US Individual Members as by State with the goal of producing uniform response rate by state population
On September 1, 2015, initial email invitations were delivered to approximately 74,000 randomly selected email addresses (excluding bounces), based on the criteria just described. On Sept. 25, 2015, a follow-up email was sent to this same group. After removing wholly incomplete responses (i.e., surveys submitted with no responses at all), the total number of 2016 SOTWI survey respondents was 1,467. See Appendix 1 for all of the 2016 SOTWI survey questions and Appendix 2 for a summary of the location specific response rates.

The data have not been weighted to reflect the demographic composition of any target population. Because the population size (i.e., water professionals in North America) is not well-defined and the amount of self-selection bias is unknown, no estimates of error have been calculated. For figures summarizing multiple survey responses, the number of respondents (n) as reported or shown in headings reflects the question that returned the lowest number of respondents of all the questions asked.

Figure 2 shows the total number of respondents based on their designated current career; all categories received responses. Approximately 52% of respondents (763) indicated they worked for a utility, while 48% (704) respondents were not directly employed by a utility. Utility workers consist of the following career categories: Drinking Water Utility, Wastewater Utility, Combined Water/Wastewater Utility, Water Wholesaler, Reuse/Reclamation Utility, and Stormwater Utility.

![Figure 2. Number of Respondents for the SOTWI Survey by Career Category (n = 1,467)](image-url)
The top 5 total responses by career type are as follows:

1. Combined Water/Wastewater Utility: 26% (381)
2. Drinking Water Utility: 22% (317)
3. Consultant/Consulting Firm: 20% (288)
4. Non-utility Government (municipal, federal, etc.): 5% (78)
5. Manufacturer of Products: 5% (65)

Figure 3 shows the age distribution of the 2016 SOTWI survey respondents. The largest response was from the age group 55–64 (34%) while the smallest was the age group Younger than 25 (2%). The age distribution of respondents was slightly skewed to those who have likely been water professionals for a longer period, thereby allowing more time to engage with AWWA and more likely to receive the SOTWI survey, but overall there was reasonable representation in all age range categories.

![Figure 3. Age Distribution of SOTWI Survey Respondents (n=1,139)](image)

Regarding gender, 77% of the 2016 SOTWI respondents were male and 23% were female. Interestingly, the gender gap diminishes as age decreases, a positive development demonstrating a growing gender equity in the water industry. The results presented in Figure 4 show that the greatest gender imbalance occurs for those 65 and older (only 3% women). This imbalance decreases almost linearly as the age category decreases until parity is reached for those 25 years old and younger (i.e., 50% female/50% male ratio).
While this overall trend is promising, dedicated resources are still needed to encourage female students to pursue career paths in science, technology, engineering and math (STEM), and similarly in areas such as finance and management. Likewise, the water industry needs to strive for better gender and racial equity to ensure that women and minorities are recruited, retained, and promoted in all positions.

Figure 5 shows the distribution of ethnicities of the 2016 SOTWI survey respondents. The largest response was from those who identified as white/non-Hispanic (87%). The next highest response came from those who identified themselves as having multiple ethnicities or others not identified.

Figure 6 shows the distribution of education levels of the 2016 SOTWI survey respondents. The largest response was from those who had completed a bachelor’s degree (38%). In general, the 2016 SOTWI sample was fairly well-educated, with 76% of respondents having a bachelor’s degree or higher levels of education.
Figure 5. Ethnicity of SOTWI Survey Respondents (n=1,136)

Figure 6. Education Levels of SOTWI Survey Respondents (n=1,109)
Figure 7 provides an overview of the number of water service connections or collection system connections served by the utility-career participants. Those responding for combined systems were instructed to use the larger between their systems’ water and wastewater connections. The population served by a water or wastewater system can be estimated by multiplying the number of connections by 3.5, i.e., there are approximately 3.5 people are served for each connection.

![Figure 7. Summary of 2016 SOTWI respondents working for a utility by the number of service connections their utility serves (n= 678)](image)

The largest group of utility respondents served more than 150,000 connections (meaning service populations greater than ~500,000 people), while the smallest groups of respondents served between 100,001 to 150,000 connections. For this survey, small utilities are those that serve 3,000 or less connections (service populations of less than ~10,000 people). Eighty-nine percent of the utility personnel who responded worked for public utilities, while eleven percent worked for private/investor owned utilities.
PART 2 - STATE OF THE WATER INDUSTRY

Background

The results of the 2016 SOTWI survey are better understood against the backdrop of the broad “waterscape” in North America. Data presented in Figure 8 show the total populations of Canada, Mexico, and the United States continue to grow over time, where total population essentially includes all people regardless of legal status or citizenship (World Bank, 2016). Using the same data set from the World Bank, the five-year average annual percentage increase in total population (2010-2014) was 1.1% in Canada, 1.4% Mexico, and 0.8% in the United States. Based on this same data set, the percentage of the population that lives an urban setting is 81.6% in Canada, 79.0% Mexico, and 81.4% in the United States.

![Figure 8. Total Populations (in millions) in North America by Year (World Bank, 2016)](image)

As of 2013, the renewable internal freshwater resources per capita by country was 81,061 cubic meters/person in Canada (#7 rank), 3,305 cubic meters/person in Mexico (#115 rank), and 8,904 cubic meters/person in the United States (#61 rank) (World Bank, 2016). The renewable internal freshwater resources per capita of 211 countries ranged from Iceland (#1) at 525,073 cubic meters/person to Bahrain (#211) at 2.9 cubic meters/person.
In late 2014 the United States Geological Survey released its summary of water use in the United States through *Circular 1405: Estimated Use of Water in the United States in 2010* (USGS, 2014). Figure 9 shows the amount of water withdrawals across the U.S. from 1950 to 2010. It is interesting to note that water use in the United States in 2010 was 13% less than in 2005 and were at the lowest level since before 1970. Most of this decrease occurred because of lower fresh surface water withdrawals. Of the water withdrawals in 2010 (355 billion gallons/day of BGD), approximately 12% was used for public supply (42 BGD), 32% was used for irrigation (115 BGD), and 45% was used for thermoelectric power (161 BGD). Also from the USGS report, the average domestic per capita water use in 2010 was reported to be 88 gallons/day.

![Figure 9. Water Withdrawals in the United States 1950-2010, (USGS, 2014)](image)

**SIDEBAR – The “Water Industry”**  *Sector. Industry. Community. Profession.* These terms are commonly used interchangeably, but which is the most appropriate? From an economic perspective, “Sectors” are top-level descriptors that divide an economy into a broadly similar functions such as Finance & Insurance, Manufacturing, Construction, or Utilities. Within each economic sector there is further segmentation into “Industries”; for example, within the Utilities sector there are Electric Utilities, Gas Utilities, and Water Utilities. Professionals working in the Water Industry ensure the safe and reliable delivery of water, wastewater, reuse, and stormwater services; these water professionals form a community of leaders that generally shares the same values of safeguarding public health, supporting and strengthening communities, and protecting the environment as described in Figure 1.
State of the Water Industry

As has been done since the beginning of the SOTWI survey, the 2016 version asked participants for their opinion of the current and future health of the water industry through the following questions using a scale of 1 to 7 where 1 = “not at all sound” and 7 = “very sound”.

- In your opinion, what is the current overall state of the water industry?
- Looking forward, how sound will the overall water industry be five years from now?

Figure 10 shows the average scores as rated by all respondents to these two questions from 2004 to 2016. The current health of the industry was rated at 4.5 on a scale of 1 to 7, the same score observed in 2015; this score has fallen into the range of 4.5 to 4.9 since the survey began in 2004. Looking forward five years, the soundness of the water industry is expected to be 4.4 (also on a scale of 1 to 7), which is the same score observed in 2015; this score has fallen into a range of 4.4 to 5.0 since the survey’s inception.

Although the minimum error associated with these responses cannot be estimated, it is reasonable to report that there is little difference in the water industry health scores over the last several years, and likewise no dramatic changes since the inception of the SOTWI survey. The consistency of these scores suggests that the water industry is very resilient, perhaps because it mainly responds to community-specific needs. Water systems are somewhat isolated from larger “macro-crises” that can affect other sectors and industries, although as the SOTWI survey identifies subsequently, there are plenty of common challenges and larger issues that unite the whole of the industry (see Section 3).
Figures 11 and 12 show the soundness of the overall water industry as reported by those working in the United States and Canada, respectively. In terms of the current soundness of the water industry, the opinions of U.S. respondents was the same in 2016 as in 2015. In contrast, the opinions of Canadian respondents were slightly more pessimistic in 2016 with small decreases over last year for both the current and future states of the water industry. The United States also maintains its trend of a relatively pessimistic future outlook (in comparison to the overall sample) with an expected average soundness score of 4.4 in 2021 (down from 4.5 currently). In contrast, Canadian participants continued their somewhat more optimistic outlook for the future with an average soundness score of 4.6 for 2021 (up from 4.5 currently).

Figure 11. Health of the Water Industry – U.S. Respondents (rating scale: 1 to 7)
In addition to asking about the overall soundness of the water industry, the 2016 SOTWI survey also posed the following questions to better capture perspectives on regional soundness (focusing on the region in which respondents work most often), again using a scale of 1 to 7 where 1 = not at all sound and 7 = very sound:

- In your opinion, what is the current state of the water industry in the region where you work most often?
- Looking forward, how sound will the water industry be five years from now in the region where you work most often?

As shown in Table 1, the region-specific scores were higher than the general scores by the same groups in all cases. The reasons for this are not immediately apparent, but one explanation is that people likely have a better understanding of the water systems in the areas in which they work, and perhaps they are working to support these very same systems so their opinions are naturally biased. In contrast, the water-related news and information from outside of the region respondents’ focus on is typically only negative, leading to more negative perceptions regarding the overall industry.
Table 1. Overall and Regional Perceptions of the Water Industry Soundness for Total and Country-Specific Respondents (rating scale: 1 to 7); present (2016) and 5 years from now (2021)

<table>
<thead>
<tr>
<th>Sample</th>
<th>Overall 2016</th>
<th>Overall 2021</th>
<th>Regional 2016</th>
<th>Regional 2021</th>
<th>Counts</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Respondents</td>
<td>4.5</td>
<td>4.4</td>
<td>4.6</td>
<td>4.6</td>
<td>1,466</td>
</tr>
<tr>
<td>U.S. Respondents</td>
<td>4.5</td>
<td>4.4</td>
<td>4.6</td>
<td>4.6</td>
<td>1,234</td>
</tr>
<tr>
<td>Canadian Respondents</td>
<td>4.5</td>
<td>4.6</td>
<td>4.8</td>
<td>4.9</td>
<td>189</td>
</tr>
<tr>
<td>Mexican Respondents</td>
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<td>4.3</td>
<td>4.3</td>
<td>4.3</td>
<td>4</td>
</tr>
<tr>
<td>Other</td>
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<td>4.4</td>
<td>4.4</td>
<td>4.7</td>
<td>39</td>
</tr>
</tbody>
</table>

The average scores for the health of the water industry on a scale of 1 to 7 for the present year (2016) and five years from now (2021) are provided in Table 2 for each career category. The majority of respondent groups indicated they thought the health of the industry would be slightly worse in five years than it is now. Leaving aside potential statistical differences, the regional soundness scores for most groups were slightly higher than the corresponding overall scores, again most likely reflecting the negative information delivered on a broader scope from outside the region that respondents work in and understand best.

Table 2. Overall and Regional Soundness of the Water Industry by Respondent Career Category (scale: 1 to 7); present (2016) and 5 years from now (2021)

<table>
<thead>
<tr>
<th>Career Category</th>
<th>Overall 2016</th>
<th>Overall 2021</th>
<th>Regional 2016</th>
<th>Regional 2021</th>
<th>Counts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory</td>
<td>4.6</td>
<td>4.9</td>
<td>4.8</td>
<td>4.8</td>
<td>14</td>
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<td>Technical Services/Contractor</td>
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<td>Drinking Water Utility</td>
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<td>4.5</td>
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<td>4.8</td>
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<td>Water Wholesaler</td>
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<td>4.6</td>
<td>4.6</td>
<td>4.6</td>
<td>29</td>
</tr>
<tr>
<td>Regulatory Authority/Regulator</td>
<td>4.7</td>
<td>4.4</td>
<td>4.7</td>
<td>4.5</td>
<td>78</td>
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<tr>
<td>Retired</td>
<td>4.3</td>
<td>4.3</td>
<td>4.2</td>
<td>4.1</td>
<td>16</td>
</tr>
<tr>
<td>Combined Water/Wastewater Utility</td>
<td>4.5</td>
<td>4.4</td>
<td>4.8</td>
<td>4.8</td>
<td>382</td>
</tr>
<tr>
<td>Law Firm/Attorney</td>
<td>5.0</td>
<td>4.0</td>
<td>5.0</td>
<td>4.0</td>
<td>1</td>
</tr>
<tr>
<td>Non-utility Government</td>
<td>4.1</td>
<td>4.2</td>
<td>4.2</td>
<td>4.3</td>
<td>50</td>
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<tr>
<td>Wastewater Utility</td>
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<td>4.6</td>
<td>4.6</td>
<td>4.8</td>
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<tr>
<td>Distributor</td>
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<td>4.0</td>
<td>4.5</td>
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<td>Manufacturer’s Representative</td>
<td>4.4</td>
<td>4.3</td>
<td>4.4</td>
<td>4.4</td>
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<tr>
<td>University/Educational institution</td>
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<td>4.5</td>
<td>4.8</td>
<td>4.7</td>
<td>61</td>
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<tr>
<td>Nonprofit Organization</td>
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<td>4.4</td>
<td>4.5</td>
<td>4.5</td>
<td>31</td>
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<tr>
<td>Consulting Firm/Consultant</td>
<td>4.4</td>
<td>4.3</td>
<td>4.5</td>
<td>4.5</td>
<td>288</td>
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<tr>
<td>Reuse/Reclamation Utility</td>
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<td>4.0</td>
<td>4.0</td>
<td>4.2</td>
<td>5</td>
</tr>
<tr>
<td>Manufacturer of Products</td>
<td>4.3</td>
<td>4.3</td>
<td>4.3</td>
<td>4.6</td>
<td>65</td>
</tr>
<tr>
<td>Other (please specify)</td>
<td>3.9</td>
<td>4.0</td>
<td>3.9</td>
<td>4.2</td>
<td>37</td>
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<tr>
<td>Financial Industry</td>
<td>4.0</td>
<td>5.0</td>
<td>4.0</td>
<td>5.0</td>
<td>1</td>
</tr>
<tr>
<td>Stormwater Utility</td>
<td>3.0</td>
<td>2.0</td>
<td>1.0</td>
<td>2.0</td>
<td>1</td>
</tr>
<tr>
<td>Total Sample (all respondents)</td>
<td><strong>4.5</strong></td>
<td><strong>4.4</strong></td>
<td><strong>4.6</strong></td>
<td><strong>4.6</strong></td>
<td><strong>1,466</strong></td>
</tr>
</tbody>
</table>
Appendix 2 presents the average scores for the health of the water industry on a scale of 1 to 7 for the present year (2016) and five years from now (2021) based on the region where participants work most often.
Part 3 – Water Industry Challenges

To determine the issues currently facing the water industry, respondents were asked to rate the importance of several challenges on a scale of 1 (unimportant) to 5 (critically important). These issues, as ranked by 2016 SOTWI survey respondents, are shown in Table 4. In addition to the average scores, the percentage of respondents who scored the issue as critically important (i.e., 5 on the scale of 1 to 5) is also presented.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Category</th>
<th>Score</th>
<th>% Critical</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Renewal &amp; replacement of aging water and wastewater infrastructure</td>
<td>4.57</td>
<td>63%</td>
</tr>
<tr>
<td>2</td>
<td>Financing for capital improvements</td>
<td>4.51</td>
<td>61%</td>
</tr>
<tr>
<td>3</td>
<td>Public understanding of the value of water systems and services</td>
<td>4.42</td>
<td>56%</td>
</tr>
<tr>
<td>4</td>
<td>Long-term water supply availability</td>
<td>4.41</td>
<td>57%</td>
</tr>
<tr>
<td>5</td>
<td>Public understanding of the value of water resources</td>
<td>4.29</td>
<td>45%</td>
</tr>
<tr>
<td>6</td>
<td>Watershed/source water protection</td>
<td>4.26</td>
<td>47%</td>
</tr>
<tr>
<td>7</td>
<td>Public acceptance of future water and wastewater rate increases</td>
<td>4.09</td>
<td>36%</td>
</tr>
<tr>
<td>8</td>
<td>Water conservation/efficiency</td>
<td>4.08</td>
<td>41%</td>
</tr>
<tr>
<td>9</td>
<td>Cost recovery (pricing water to accurately reflect its true cost)</td>
<td>4.07</td>
<td>35%</td>
</tr>
<tr>
<td>10</td>
<td>Groundwater management and overuse</td>
<td>4.06</td>
<td>37%</td>
</tr>
<tr>
<td>11</td>
<td>Emergency preparedness</td>
<td>4.05</td>
<td>33%</td>
</tr>
<tr>
<td>12</td>
<td>Asset management</td>
<td>3.98</td>
<td>26%</td>
</tr>
<tr>
<td>13</td>
<td>Aging workforce/anticipated retirements</td>
<td>3.96</td>
<td>36%</td>
</tr>
<tr>
<td>14</td>
<td>Water loss control</td>
<td>3.95</td>
<td>27%</td>
</tr>
<tr>
<td>15</td>
<td>Drought or periodic water shortages</td>
<td>3.95</td>
<td>32%</td>
</tr>
<tr>
<td>16</td>
<td>Talent attraction and retention</td>
<td>3.94</td>
<td>27%</td>
</tr>
<tr>
<td>17</td>
<td>Energy use/efficiency and cost</td>
<td>3.91</td>
<td>24%</td>
</tr>
<tr>
<td>18</td>
<td>Data management</td>
<td>3.90</td>
<td>27%</td>
</tr>
<tr>
<td>19</td>
<td>Improving customer, constituent, and community relationships</td>
<td>3.88</td>
<td>27%</td>
</tr>
<tr>
<td>20</td>
<td>Compliance with current regulations</td>
<td>3.85</td>
<td>24%</td>
</tr>
<tr>
<td>21</td>
<td>Expanding water reuse/reclamation</td>
<td>3.83</td>
<td>33%</td>
</tr>
<tr>
<td>22</td>
<td>Water rights</td>
<td>3.80</td>
<td>29%</td>
</tr>
<tr>
<td>23</td>
<td>Certification and training</td>
<td>3.79</td>
<td>21%</td>
</tr>
<tr>
<td>24</td>
<td>Compliance with future regulations</td>
<td>3.79</td>
<td>20%</td>
</tr>
<tr>
<td>25</td>
<td>Cyber-security issues</td>
<td>3.65</td>
<td>21%</td>
</tr>
<tr>
<td>26</td>
<td>Climate risk and resiliency</td>
<td>3.57</td>
<td>20%</td>
</tr>
<tr>
<td>27</td>
<td>Physical security issues</td>
<td>3.54</td>
<td>15%</td>
</tr>
<tr>
<td>28</td>
<td>Water markets</td>
<td>3.35</td>
<td>12%</td>
</tr>
</tbody>
</table>

The most important issue to respondents in 2016, *renewal & replacement of aging water and wastewater infrastructure*, has consistently been the most important issue identified for several years (previously called the *state of water and sewer infrastructure*). A comparison of the top ten issues from the last three years is presented in Table 5. While the order of issues may change slightly, the most important issues are strikingly consistent year to year, aligning well with survey results prior to 2014 as well.
Table 5. Top 10 Issues Facing the Water Industry as Ranked by All Respondents, 2014-2016

<table>
<thead>
<tr>
<th>Rank</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>State of water and sewer infrastructure</td>
<td>Renewal &amp; replacement of aging water and wastewater infrastructure</td>
<td>Renewal &amp; replacement of aging water and wastewater infrastructure</td>
</tr>
<tr>
<td>2</td>
<td>Long-term water supply availability</td>
<td>Financing for capital improvements</td>
<td>Financing for capital improvements</td>
</tr>
<tr>
<td>3</td>
<td>Financing for capital improvements</td>
<td>Long-term water supply availability</td>
<td>Public understanding of the value of water systems and services</td>
</tr>
<tr>
<td>4</td>
<td>Public understanding of the value of water resources</td>
<td>Public understanding of the value of water systems and services</td>
<td>Long-term water supply availability</td>
</tr>
<tr>
<td>5</td>
<td>Public understanding of the value of water systems and services</td>
<td>Public understanding of the value of water resources</td>
<td>Public understanding of the value of water resources</td>
</tr>
<tr>
<td>6</td>
<td>Groundwater management and overuse</td>
<td>Watershed/source water protection</td>
<td>Watershed/source water protection</td>
</tr>
<tr>
<td>7</td>
<td>Watershed protection</td>
<td>Cost recovery (pricing water to accurately reflect its true cost)</td>
<td>Public acceptance of future water and wastewater rate increases</td>
</tr>
<tr>
<td>8</td>
<td>Drought or periodic water shortages</td>
<td>Emergency preparedness</td>
<td>Water conservation/efficiency</td>
</tr>
<tr>
<td>9</td>
<td>Emergency preparedness</td>
<td>Water conservation/efficiency</td>
<td>Cost recovery (pricing water to accurately reflect its true cost)</td>
</tr>
<tr>
<td>10</td>
<td>Cost recovery</td>
<td>Compliance with future regulations</td>
<td>Groundwater management and overuse</td>
</tr>
</tbody>
</table>

Grouping together utility workers (those in the career categories of drinking water utility, wastewater utility, combined water/wastewater utility, water wholesaler, reuse/reclamation utility, or stormwater utility) and non-utility workers (everyone else not directly employed by a utility), Table 6 shows the most important issues impacting these two groups. These lists are very similar, and the first six issues are the same for both groups. Two issues identified by utility personnel that were not as highly ranked by non-utility personnel were (#7) emergency preparedness and (#10) aging workforce/anticipated retirements. Likewise, the two issues identified by non-utility personnel that were not as highly ranked by utility personnel were (#7) water conservation/efficiency and (#10) groundwater management and overuse.
Table 6. Issues Facing the Water Industry in 2016 as Ranked by Utility and Non-utility Respondents, respectively (differences in topics highlighted)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Utility Employees (n=718)</th>
<th>Non-Utility Employees (n=664)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Renewal &amp; replacement of aging water and wastewater infrastructure</td>
<td>Renewal &amp; replacement of aging water and wastewater infrastructure</td>
</tr>
<tr>
<td>2</td>
<td>Financing for capital improvements</td>
<td>Financing for capital improvements</td>
</tr>
<tr>
<td>3</td>
<td>Public understanding of the value of water systems and services</td>
<td>Public understanding of the value of water systems and services</td>
</tr>
<tr>
<td>4</td>
<td>Long-term water supply availability</td>
<td>Long-term water supply availability</td>
</tr>
<tr>
<td>5</td>
<td>Watershed/source water protection</td>
<td>Public understanding of the value of water resources</td>
</tr>
<tr>
<td>6</td>
<td>Public understanding of the value of water resources</td>
<td>Watershed/source water protection</td>
</tr>
<tr>
<td>7</td>
<td>Emergency preparedness</td>
<td>Water conservation/efficiency</td>
</tr>
<tr>
<td>8</td>
<td>Public acceptance of future water and wastewater rate increases</td>
<td>Groundwater management and overuse</td>
</tr>
<tr>
<td>9</td>
<td>Cost recovery (pricing water to accurately reflect its true cost)</td>
<td>Public acceptance of future water and wastewater rate increases</td>
</tr>
<tr>
<td>10</td>
<td>Aging workforce/anticipated retirements</td>
<td>Cost recovery (pricing water to accurately reflect its true cost)</td>
</tr>
</tbody>
</table>

System Stewardship

In general, the water industry plans, builds, operates, maintains, and replaces the typically large and expensive assets that provide water services including potable water, wastewater, stormwater, and reuse. Overall system stewardship is a primary duty of each community, but implementation and ultimate responsibility resides with service providers (i.e., utilities) and the groups charged with their oversight. If overall water resource management is included under the umbrella of system stewardship, which is reasonable from the perspective of resource planning, all of the top issues identified in the 2016 SOTWI survey pertain to system stewardship, that is, how water and wastewater systems are operated, maintained, and replaced.

Viewing system stewardship from the more traditional view of asset and financial management, specific issues identified regularly through the SOTWI surveys include renewing and replacing aging infrastructure, financing for capital improvements, and cost recovery (i.e., pricing water to accurately reflect its true cost). These issues continue to be important because many water and wastewater systems built and financed by previous generations are approaching or have exceeded their useful lives and are now facing renewal or replacement (R&R). Water system R&R can be challenging even for well-performing utilities because of capital funding restraints and/or limited public support for these efforts (AWWA, 2012).
**Full-cost Pricing**

AWWA holds that the public can best be provided water services by self-sustaining enterprises that are adequately financed with rates and charges based on sound accounting, engineering, financial, and economic principles. Revenues from service charges, user rates, and capital charges (e.g., impact fees and system development charges) should be sufficient to enable utilities to provide for the full cost of service including:

- Annual operation and maintenance expenses
- Capital costs (e.g., debt service and other capital outlays)
- Adequate working capital and required reserves

Full-cost pricing, i.e., charging rates and fees that reflect the full cost of providing water and/or wastewater services, should include renewal and replacement costs for treatment, storage, distribution, and collection systems. Some utilities have previously kept their rates low by minimizing or ignoring these costs, but as the useful lives of their systems draw to a close, current managers and the communities they serve are forced to address these costs, sometimes through painful and unexpected rate increases. Issues related to equity and affordability must be considered as rates are adjusted, and each system has its own unique rate-setting challenges based on current conditions as well as recent developments and long-term history.

Full-cost pricing is in many ways a utility-specific issue defined by the specific community a utility services, so to explore the issue at this level, utility personnel were asked “Is your utility currently able to cover the full cost of providing service(s), including infrastructure renewal & replacement and expansion needs, through customer rates and fees?” They were also asked “Given your utility’s future infrastructure needs for renewal & replacement and expansion, do you think your utility will be able to meet the full cost of providing service(s) through customer rates and fees?” Responses are provided in Figure 13.

Although the numbers are marginally better in 2016, the results shown in Figure 13 are still not encouraging. Combining those who are not at all able and those that are slightly able, 29% of utilities are currently struggling to implement full-cost pricing, down from 30% in 2015. In addition, 35% of respondents think they will struggle to cover the full cost of service in the future, down from 38% in 2015.

Of the results in Figure 13, the most notable is that 11% of respondents felt that their utilities were currently not at all able to cover the full cost of providing service; unfortunately, this is up from 9% in 2015. On the other hand, the percentage of respondents that felt their utilities were currently fully able to cover the cost of providing service through rates and fees was 21% in 2016, up from 17% in 2015. Utility personnel are perhaps still expecting challenges ahead, though, as the percentage of respondents who felt that their utilities would be fully able to cover the future cost of providing service was only 15%, although that was up from 12% in 2015. As is typically the case, the SOTWI survey found a wide range of responses reflecting the variation in perceived ability to meet current and future funding requirements.
Specific to infrastructure renewal and replacement, the 2016 SOTWI Survey asked all participants to rate the importance of specific R&R challenges currently facing the water industry on a scale of 1 to 5. As shown in Table 7, the most important issue was “establishing and following a financial policy for capital reinvestment,” with 42% of respondents rating this issue as critical (i.e., 5 out of 5); this was also the most important issue identified in the 2015 SOTWI Survey.

There is a logical progression apparent in the ranking shown Table 7 that a utility could follow as it tackles these issues, beginning with comprehensive planning and management. The next several challenges focus on communication (as justification); these are ongoing issue for the water industry, which, like other industries that must respond to a wide array of stakeholders, needs to be able to capture and convey system-specific needs. After communication come the challenges of implementing and funding a utility’s R&R programs.

The challenge of “defining appropriate levels of service” was ranked eighth in importance, but only 17% thought the issue was critical. The challenge of “addressing declining water sales” was ranked twelfth in importance, but 21% thought the issue was critical. Interestingly, over a quarter of respondents thought that the issue of “obtaining R&R funding via Federal, State, or Territorial grants” was critical, and that grants were the highest rated approach to obtaining R&R funding compared to bonds, loans, public-private partnerships, or taxation, where these are listed in diminishing order in Table 7.
Table 7. Renewal and Replacement (R&R) Challenges as ranked by SOTWI respondents (n = 1,261)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Category</th>
<th>Score (1-5)</th>
<th>% Ranked Critically Important</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Establishing and following a financial policy for capital reinvestment</td>
<td>4.27</td>
<td>42%</td>
</tr>
<tr>
<td>2</td>
<td>Prioritizing R&amp;R needs</td>
<td>4.24</td>
<td>40%</td>
</tr>
<tr>
<td>3</td>
<td>Justifying R&amp;R programs to ratepayers</td>
<td>4.23</td>
<td>42%</td>
</tr>
<tr>
<td>4</td>
<td>Justifying R&amp;R programs to oversight bodies (board, council, etc.)</td>
<td>4.21</td>
<td>41%</td>
</tr>
<tr>
<td>5</td>
<td>Establishing and maintaining specific R&amp;R reserves</td>
<td>4.16</td>
<td>35%</td>
</tr>
<tr>
<td>6</td>
<td>Coordinating R&amp;R with other activities (e.g., road repair, redevelopment, etc.)</td>
<td>4.06</td>
<td>34%</td>
</tr>
<tr>
<td>7</td>
<td>Developing/implementing asset management programs</td>
<td>3.96</td>
<td>27%</td>
</tr>
<tr>
<td>8</td>
<td>Defining appropriate levels of service</td>
<td>3.75</td>
<td>17%</td>
</tr>
<tr>
<td>9</td>
<td>Obtaining R&amp;R funding via Federal, State, or Territorial grants</td>
<td>3.72</td>
<td>26%</td>
</tr>
<tr>
<td>10</td>
<td>Obtaining R&amp;R funding via bonds</td>
<td>3.69</td>
<td>18%</td>
</tr>
<tr>
<td>11</td>
<td>Obtaining R&amp;R funding via Federal, State, or Territorial loans</td>
<td>3.64</td>
<td>20%</td>
</tr>
<tr>
<td>12</td>
<td>Addressing declining water sales</td>
<td>3.60</td>
<td>21%</td>
</tr>
<tr>
<td>13</td>
<td>Obtaining R&amp;R funding involving public-private partnerships</td>
<td>3.37</td>
<td>14%</td>
</tr>
<tr>
<td>14</td>
<td>Pay-as-you-go R&amp;R funding</td>
<td>3.35</td>
<td>14%</td>
</tr>
<tr>
<td>15</td>
<td>Obtaining R&amp;R funding by taxation (e.g., property taxes)</td>
<td>3.05</td>
<td>10%</td>
</tr>
</tbody>
</table>

Access to Capital

To begin to understand the current financing environment for the water industry, utility personnel were asked “If you can make an assessment, how would you rate your utility’s current access to capital for financing infrastructure renewal/replacement projects?” As shown in Figure 14, 56% of respondents reported that their utility’s access to capital was as good or better than at any time in the last five years, up from 53% in 2015 and 46% in 2014. Only 10% reported that their utility’s access to capital was “as bad or worse than at any time in the last five years”, down from 11% in 2015 and 17% in 2014. Combining these results with a likely slow increase in interest rates (at least in the U.S.), the capital markets for financing water infrastructure renewal and replacement projects can be described as good and trending positively in comparison to previous years.
Figure 14. Responses (as % of total) from utility personnel regarding their opinion of their utilities’ access to capital (n = 574)

Changing Water Demands
As was intended with the introduction of more efficient appliances and broader water conservation education, the demand for residential and industrial water (i.e., public supplies) in the United States is decreasing. Refer again to Figure 9, which shows the withdrawal of public water supplies has been relatively constant going back to 1975 while the population steadily grew over this same period (USGS, 2014). Public water supply, which made up only 12% of the total water used in the United States actually declined 5% from 2005 to 2010 or from to 44.3 billion gallons per day (BGD) in 2005 to 42.0 BGD in 2010.

In terms of trends, water for public supply in the United States has remained in a range of 35 to 45 BGD since 1985 even as the population has increased by approximately 70 million people over the same period. Based on the USGS data (USGS, 2014), the average per capita use for public water supply had been approximately 150 gallons/person/day since 1985 but decreased to 134 gallons/person/day in 2010, a 9% decrease over the 2005 level. If these observations are extended to represent all of North America, then taken together they support the premise that the public’s use of water has become more efficient over time.

Although more efficient use of water is a major goal of the industry, in areas where customer growth is slow or nonexistent, declining water use left unaddressed can decrease operating revenue and impact how costs are recovered through rates and charges. In some cases, utilities must explain to customers that their rates must go up even as their community uses the same or less amounts of water. This situation clearly demonstrates the need for ongoing and effective communication between utilities, their customers, and their broader community so that everyone understands how their water quality and supply depends on their system’s regular operation, maintenance, and infrastructure renewal and replacement.
In order to explore this issue, utility staff members were asked a series of questions about their utilities’ trends in water sales. Results regarding trends in total water sales as shown in Figure 15 reveal that 38% of utility respondents reported declining total water sales (either a >10 year or <10 year trend) while 31% of respondents reported their total water sales were flat or little changed in the last 10 years; these levels were 43% and 29%, respectively, in 2015. Taken together, this means that approximately three-quarters of utilities could face issues associated with low or declining water demand if it is assumed that the costs of water services have increased over this same period. In 2016, 26% of utility personnel reported their utility saw an increasing trend in total water sales (either a >10 year or <10 year trend), which is up from 23% in 2015.

![Figure 15](image)

**Figure 15. Responses (as % of total) from utility personnel regarding their opinion of their utilities’ trends in total water sales (n = 472)**

Results from utilities regarding their trends in per account water sales are shown in Figure 16. Even more dramatic than the results for total water sales, 49% of utility respondents reported their utility was experiencing declining per account water sales (either a >10 year or <10 year trend), while 31% of respondents reported flat or little change in per account water sales; these levels were 47% and 33%, respectively, in 2015. Taken together, this means that approximately 80% of utility respondents must potentially address issues associated with low or declining water demand, at least on a per account basis. Only 15% of utilities reported increasing per account water sales (either a >10 year or <10 year trend), which is up slightly from 14% in 2015.
Figure 16. Responses (as % of total) from utility personnel regarding their opinion of their utilities’ trends in per account water sales (n = 545)

Cost Recovery

As mentioned previously, declining water sales can impact a utility’s approach to cost recovery (the #9 overall issue, see Table 4). Cost recovery refers to pricing water and wastewater services to accurately reflect their true costs and then obtaining these from customers. To understand this more, utility staff members were asked how their utilities are responding to their cost recovery needs in the face of changing water sales and consumption patterns; results are shown in Table 8. For this question, utilities could respond to multiple approaches.

Ranking the cost recovery options, the most used option was to shift more of the cost recovery from consumption-based fees to fixed fees within the rate structure. The next most popular option was to change growth-related fees, i.e., system development charges, impact fees, or capacity charges. Other popular options were to shift the rate design to an increasing block-rate structure and to increase financial reserves. Only 8% of the total responses indicated no changes were needed.
Table 8. Responses (as % of total) from utility personnel regarding how their utilities are responding to cost recovery needs (n = 691 total responses); note - utilities could respond to multiple options

<table>
<thead>
<tr>
<th>Rank (based on # responses)</th>
<th>Category</th>
<th>% Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Shifting more of the cost recovery from consumption-based fees to fixed fees within the rate structure</td>
<td>24%</td>
</tr>
<tr>
<td>2</td>
<td>Changes in growth-related fees (i.e., system development charges, impact fees, or capacity charges)</td>
<td>19%</td>
</tr>
<tr>
<td>3</td>
<td>Shifting rate design to increasing block-rate structure</td>
<td>14%</td>
</tr>
<tr>
<td>4</td>
<td>Increasing financial reserves</td>
<td>14%</td>
</tr>
<tr>
<td>5</td>
<td>Implementing rate stabilization reserves</td>
<td>9%</td>
</tr>
<tr>
<td>6</td>
<td>No changes needed</td>
<td>8%</td>
</tr>
<tr>
<td>7</td>
<td>Revenue diversification</td>
<td>6%</td>
</tr>
<tr>
<td>8</td>
<td>Incorporating seasonal rates</td>
<td>4%</td>
</tr>
<tr>
<td>9</td>
<td>Shifting rate design to decreasing block-rate structure</td>
<td>1%</td>
</tr>
</tbody>
</table>

Public/Private Partnerships (P3s)

As water and wastewater utilities deal with system stewardship issues, some are beginning to consider alternative management approaches including public-private partnerships (P3s). Figure 17 shows the results from utility employees regarding whether their utilities are considering or implementing a P3. Approximately one quarter (24%) of respondents indicated that their utility was considering, planning to use, or already involved in a public-private partnership; this figure was up from 20% in 2015.

Figure 17. Responses (as % of total) from utility personnel regarding if their utilities are considering public-private partnerships (P3s) (n = 519)
Rate Increases

Faced with increasing capital needs and potential funding shortfalls, many utilities must increase the rates they charge for water services in the immediate future. To understand how rate increases would be perceived, utility personnel were asked, "If your utility was to consider a rate increase in the coming year, how do you think it would be received by following groups?" The groups presented were the general public, residential customers, nonresidential customers (industrial/commercial/institutional), public officials, business leaders, and the media. Response options were very negatively, negatively, indifferently, positively, and very positively. Figure 18 summarizes the responses from 2016 SOTWI survey respondents. The results in Figure 18 are not unexpected; only 1% of any of the six groups would be expected to view a rate increase as very positively. Public officials would be expected to be the most positive at 21%, with the next closest group being business leaders at 12%. The most negative responses (~70% negative) would be expected to come from residential customers (14% very negative and 55% negative). Again, “public acceptance of future water and wastewater rate increases” was identified in Table 4 as the seventh most important challenge facing the water industry in 2016.
Affordability

As water utilities consider changes to their rates and fees, it is important they keep in mind low-income consumers who may find themselves choosing between paying their water bills or buying food or paying rent. A first step in assessing a utility’s need for a low-income program is to gather information about the community and begin a dialogue with community organizations and agencies that work with low-income people (AWWA, 2014). Through this information-gathering process, a utility manager can develop a deeper understanding of the community’s needs and identify ways to help address some of these needs.

In order to understand the extent of assistance programs, the 2016 SOTWI survey asked utility personnel if their utility offers an affordability program to assist low-income customers pay their water and/or wastewater bills; responses are presented in Figure 19. Approximately two-thirds of respondents indicated their utilities do not provide bill assistance to low-income customers.

![Figure 19. Responses from utility employees regarding whether their utility offers an affordability program to assist low-income customers pay water and/or wastewater bills (n = 446)](image)

Asset Management

Utilities are increasingly adopting asset management to manage their infrastructure more effectively and affordably. Many funding agencies incentivize or require components of asset management because they understand that applying advanced asset management principles can provide a degree of confidence that the investment will be properly managed over time (AWWA, 2016). Implementing the concepts of asset management means making more informed decisions to sustain the desired level of customer service in the most efficient and effective way possible.
To explore the status of asset management, utility workers were asked the following questions:

- Does your utility have a dedicated asset management manager and/or a group of asset management focused staff?
- Has your utility realized a benefit from its asset management program and/or efforts?

These questions were also asked in parallel in 2015 through a project supported by AWWA’s Technical & Educational Council (AWWA, 2016) entitled *Establishing the Level of Progress in Utility Asset Management (TEC Project)*. Table 9 presents the results from both the 2016 SOWTI Survey and the 2015 TEC Study for responses to the number and type of asset management staff at utilities. Respondents that did not know their utility’s position were removed from these samples. In both cases, the highest number of responses was that respondents’ organizations had adequate staff for asset management but did not have a dedicated asset management coordinator and/or group of asset management focused staff. Both surveys show that approximately two-thirds of utilities do not have staff specifically focused on asset management. In general, the results to the two studies align well with one another, but it should be noted that the TEC Study was sent to utility employees whose work focuses specifically on asset management or similar activities, so that data set may paint a more accurate picture.

**Table 9. Responses from utility employees regarding whether their utilities have dedicated asset management managers and/or a group of asset management focused staff**

<table>
<thead>
<tr>
<th>Category</th>
<th>% Response SOTWI Survey</th>
<th>% Response TEC Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>No, the organization has adequate staff for asset management but does not have a dedicated asset management coordinator and/or group of asset management focused staff</td>
<td>29%</td>
<td>33%</td>
</tr>
<tr>
<td>The organization has a full time asset management coordinator and additional staff support</td>
<td>20%</td>
<td>15%</td>
</tr>
<tr>
<td>The organization recognizes the need for an asset coordinator and/or focused staff, but has not yet created the position(s)</td>
<td>18%</td>
<td>26%</td>
</tr>
<tr>
<td>No, the organization does not see the need for dedicated asset management staff</td>
<td>17%</td>
<td>12%</td>
</tr>
<tr>
<td>The organization has a part time asset management coordinator</td>
<td>8%</td>
<td>8%</td>
</tr>
<tr>
<td>The organization has a full time asset management coordinator but no other staff</td>
<td>8%</td>
<td>6%</td>
</tr>
</tbody>
</table>

Table 10 presents the results from both the 2016 SOWTI Survey and the 2015 TEC Study as to whether respondents’ utilities have realized benefits from their asset management programs and/or efforts. Respondents that did not know their utility’s position were removed from these samples. In both cases, the highest number of responses was that the respondents’ organizations have benefited although these benefits were not well documented. Both studies also showed that approximately half of the respondents had achieved some benefit through asset management. As with Table 9, the results to the two studies align well with one another, but again it should be noted that the TEC Study was sent to utility employees whose work specifically focuses on asset management or similar activities which may paint a more accurate picture.
Table 10. Responses from utility employees regarding whether their utilities have realized benefits from asset management programs and/or efforts
(SOTWI Survey n = 458; TEC Study n = 510)

<table>
<thead>
<tr>
<th>Category</th>
<th>% Response SOTWI Survey</th>
<th>% Response TEC Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes, benefits have been achieved, although they are not well documented</td>
<td>28%</td>
<td>36%</td>
</tr>
<tr>
<td>Not yet, but the future benefits are expected (asset reliability, improved service levels, and/or future cost avoidance)</td>
<td>23%</td>
<td>23%</td>
</tr>
<tr>
<td>Yes, benefits have been achieved and they are well documented</td>
<td>16%</td>
<td>11%</td>
</tr>
<tr>
<td>There are no asset management efforts underway as of yet</td>
<td>14%</td>
<td>21%</td>
</tr>
<tr>
<td>No, asset management efforts are active but have not produced any tangible benefits</td>
<td>13%</td>
<td>5%</td>
</tr>
<tr>
<td>Yes, benefits have been achieved and they are well documented. Costs and benefits of the asset management program/efforts are quantified such that a return on investment can be calculated</td>
<td>5%</td>
<td>3%</td>
</tr>
</tbody>
</table>

System Stewardship Summary
In the end, decision-makers charged with managing water and wastewater systems along with other community leaders and ultimately customers must face the challenges of optimizing water and wastewater infrastructure investments, balancing system upgrades to maintain service life goals and meet regulatory requirements, and trying to anticipate new technologies and forthcoming regulations. All of this requires significant planning and coordination from across the utility. It is important to remember that many systems were designed for past water quality and supply conditions, and these system will need to meet changing demands while anticipating greater uncertainty. Because of the long-term nature of the necessary investments, utilities need to maintain a forward-looking and holistic approach to system stewardship.
Water Resource Management

Respondents rated highly several issues related to water resources management in the 2016 SOTWI survey in Table 4, including long-term water supply availability (#4 most important issue), watershed/source water protection (#6 most important issue), water conservation/efficiency (#8 most important issue), groundwater management and overuse (#10 most important issue), and drought or periodic water shortages (#15 most important issue). The following sections explore these areas in greater detail.

Long-Term Water Supply Availability

The main challenge of water resource management, namely long-term water supply availability, can result from full allocation, and in some cases over-allocation, of local and/or regional water resources. Communities need to establish how much water they have, how much water they need, and how they will meet any future gaps based on current and future supplies. Some areas are reaching the limits of their current supply options and are seeking additional water through conservation, desalination, and reuse. In addition, some water-limited areas may also be susceptible to further water stress from climate change and increasing populations.

To understand the issue of long-term water supply availability, utility personnel were asked the question “How prepared do you think your utility will be to meet its long-term water supply needs?” The summary presented in Figure 20 shows that 7% of utility personnel indicated their utility will be challenged to meet anticipated long-term water supply needs (i.e., not-at-all or only-slightly prepared), down from 11% in 2015. In addition, 58% of respondents indicated that their utilities are very or fully prepared, up from 57% in 2015. Only 1% of respondents indicated their utilities were not at all prepared to meet their long-term water supply needs.

Figure 20. Responses from utility employees regarding their opinion of how prepared their utility is to meet long-term water supply needs (n = 526)
Drought & Water Shortages

Shifting from long-term to near-term water supply, water systems are dramatically affected by shortages resulting from drought, the severity of which will likely be influenced by climate change moving forward. Following a series of the hottest global years ever observed, many regions in North America may again face drought conditions in 2016, which is likely why “drought or periodic water shortages” was the #15 most important issue identified by the 2016 SOTWI survey.

To gauge the extent of water shortages, utility personnel were asked how many years in the last decade their utilities had implemented voluntary or mandatory water restrictions. The responses summarized in Figure 21 reveal that the majority of respondents’ utilities have had either 0 or 1 period of voluntary restrictions (64% together), and either 0 or 1 period of mandatory restrictions (74% together). 16% of utility personnel indicated their utilities had 5 or more years of voluntary restrictions and 12% had 5 or more years of mandatory restrictions.

![Figure 21. Responses from utility employees regarding how many years in the last decade their utilities implemented either voluntary or mandatory water restrictions (n = 452)](image)

To understand the state of water shortage preparedness, staff members were asked “Does your utility have a drought management or water shortage contingency plan?” The responses summarized in Figure 22 reveal that 92% of utility respondents indicated their utility had such a plan or that one was in development, up from 80% in 2015. Only 8% of respondents reported their utility did not have a drought management or water shortage contingency plan, down from 20% in 2015.
As communities evaluate their water shortage preparedness, it is also an opportunity to gain an overall better understanding of regional water supply sustainability and potential relationships with other large water users. In addition to reliability during water shortages, utilities and the communities they serve can also evaluate and/or determine their policies and practices for water conservation and alternative water supplies such as desalination of brackish groundwater or seawater, nonpotable reuse, potable reuse, and stormwater capture and reuse – these issues are explored in the following sections.

**Water Conservation**

A common perception of water conservation is that it only entails restricting or curtailing customer use as a temporary response to drought. Although water restrictions can be a useful short-term drought management tool, most utility-sponsored water conservation programs emphasize lasting long-term improvements in water use efficiency while maintaining quality of life standards. Water conservation, very simply, is doing more with less, not doing without (AWWA, 2006).

In order to understand the status of conservation planning at water utilities, staff members were asked if their utilities have water conservation programs. The responses summarized in Figure 23 show that the majority of respondents’ utilities have a water conservation program (68%), with an additional 4% reporting their utilities’ plans are in development. Surprisingly, 28% of respondents reported their utility did not have a water conservation program, up from 20% of responding utilities in 2015.
Desalination

In addition to water conservation, another non-traditional source of water supply is seawater or brackish groundwater. Utility participants were asked if their utilities were considering desalination of either brackish groundwater or seawater to augment existing drinking water supplies. Of the 337 responses, 11% responded that their utility is considering some sort of desalination project while 5% responded that their utility currently already has something implemented.

Groundwater Management

Groundwater management and overuse was identified as the tenth most important issue in the 2016 SOTWI survey (see Table 4). Due to potentially diminishing levels of recharge, more use of groundwater in response to drought and surface water shortages, and varying regulatory requirements for groundwater use, groundwater management issues are expected to become even more significant in the immediate future.

To understand which aspects are the most important, all participants of the 2016 SOTWI survey were asked to rate the importance of several groundwater management issues on a scale of 1 (unimportant) to 5 (critically important). The results shown in Table 9 reveal that, of the options presented, declining water levels were the greatest concern, with 41% of respondents considering this a critical water supply issue. The next most important issue, watershed/groundwater protection, speaks to concerns with maintaining water quality. The remaining groundwater management issues presented in Table 9 revolve around the policies and practices that impact groundwater supplies.
Table 9. Groundwater Management Challenges as ranked by respondents of the 2015 SOTWI Survey (n = 1,382)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Category</th>
<th>Score</th>
<th>% Ranked Critically Important</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Declining groundwater levels</td>
<td>4.09</td>
<td>41%</td>
</tr>
<tr>
<td>2</td>
<td>Watershed/groundwater protection</td>
<td>4.01</td>
<td>34%</td>
</tr>
<tr>
<td>3</td>
<td>Groundwater regulations</td>
<td>3.82</td>
<td>26%</td>
</tr>
<tr>
<td>4</td>
<td>Agricultural use of groundwater</td>
<td>3.79</td>
<td>27%</td>
</tr>
<tr>
<td>5</td>
<td>Monitoring and reporting groundwater withdrawals</td>
<td>3.75</td>
<td>23%</td>
</tr>
<tr>
<td>6</td>
<td>Restrictions on groundwater pumping</td>
<td>3.72</td>
<td>24%</td>
</tr>
<tr>
<td>7</td>
<td>Oil and gas activities</td>
<td>3.63</td>
<td>28%</td>
</tr>
<tr>
<td>8</td>
<td>Reclaimed water for groundwater recharge</td>
<td>3.55</td>
<td>17%</td>
</tr>
<tr>
<td>9</td>
<td>Groundwater pricing</td>
<td>3.35</td>
<td>11%</td>
</tr>
</tbody>
</table>

Climate Change
For the water industry, potential outcomes of climate change include increasing temperatures/increasing evaporation rates, changing precipitation patterns (frequency, duration, and intensity), changing patterns of extreme weather events, and rising sea levels. Taken separately or in combination, these phenomena can result in the following challenges for the water industry:

- Degraded water quality and subsequent treatment challenges
- Reduced snowpack and groundwater recharge
- Stormwater management challenges
- Coastal flooding from increased sea level and/or storm surges
- Saltwater intrusion into coastal aquifers
- Increased frequency, duration, and extent of floods, droughts, and wildfires
- Loss of wetlands and coastal ecosystems
- Increased risk to infrastructure (at surface and underground)

To better understand the cascading consequences of potential climate change outcomes, water managers need an expanded information base and reliable models. They must make informed decisions under uncertain conditions to reduce vulnerabilities. The development of contingency and energy management plans can address a wide range of climate scenarios, and such comprehensive planning efforts can lead to recommendations on water supply scenarios and related pricing strategies (WUCA, 2010). However, managers also need better approaches that incorporate downscaled global climate model results into regional and local water utility planning.

Through the STOWI survey, utility personnel were asked “Does your utility include potential impacts from climate variability in your risk management or planning processes?” The majority of utility personnel (51%) responded that their utilities do not include potential impacts from climate variability in their risk management or planning processes while 37% responded that planning at their utilities includes climate change effects. The remaining 12% of respondents indicated their utility is in the process of including climate change in their planning processes. Viewed another way, almost half of utility personnel responding to the 2016 SOTWI survey indicated their utility was including potential climate change effects in their planning or risk management activities.
Water Reuse

Water supplies in some regions are strained, and systems in these areas are looking to meet the demands of new development, shortages from droughts, or ecological imperatives. The options for utilities and their communities to consider on the demand-side of the water balance equation include increased conservation efforts, restrictions, and improving water loss control. On the supply side, the use of reclaimed water can significantly reduce the demands placed on more conventional water supplies.

Reclaimed water properly treated to appropriate standards may serve as a sustainable supplement to a utility’s water supply portfolio. Depending on the levels of treatment and safeguards to protect public health, reclaimed water can be used for nonpotable uses such as irrigation or industrial purposes, for indirect potable uses such as replenishing drinking water sources, to maintain aquifer levels or increase stream flow, and potentially for direct potable reuse.

In order to better understand the current status of water reuse in North America, utility staff members were asked if their utilities are considering any forms of reuse (see Sidebar for definitions); the specific questions were as follows:

- Is your utility considering nonpotable reuse to augment existing irrigation water supplies?
- Is your utility considering indirect potable reuse to augment existing drinking water supplies?
- Is your utility considering direct potable reuse to augment existing drinking water supplies?

Figure 24 shows that the majority of utility personnel responded that their utilities are not considering any form of reuse. Of these reuse options, nonpotable reuse to augment irrigation was the most popular option with 20% of utility respondents reporting their utility already has something implemented, 18% responded their utility was considering it; 4% responded that a nonpotable project was in development at their utility but not yet implemented.

Figure 24 also shows that 6% of utility respondents reported their utility already had an indirect potable system in place while another 12% are reportedly considering it; 5% responded that an indirect potable project was in development at their utility but not yet implemented. Approximately 1% of utility respondents reported their utility already had a direct potable system in place while another 12% are reportedly considering it; 4% responded that a direct potable project was in development at their utility but not yet implemented.

In addition to domestic wastewater reclamation, several utilities have explored capturing, treating, and reusing stormwater specifically to augment potable water supplies. Figure 25 shows that of the 530 responses collected through the 2016 SOTWI survey, 8% responded that their utilities are considering a stormwater reuse project while approximately 2% responded that their utilities already have something implemented and another approximately 2% responded that their utilities currently have something in development.
Figure 24. Responses from utility employees regarding if their utilities are considering nonpotable reuse, indirect potable reuse, or direct potable reuse to augment existing water supplies (n = 528)

Figure 25. Responses from utility employees regarding if their utilities are considering collecting stormwater to augment existing water supplies (n = 530)
Communication

Results of the 2016 SOTWI survey highlight the industry’s concern over communicating with stakeholders, in particular regarding the public’s understanding of their water systems and resources (the #3 and #5 most important issues in Table 4, respectively). In addition, the need for communities to invest in their water systems, and ultimately for their customers to pay for these investments, is captured in the #7 most important issue, namely, public acceptance of future water and wastewater rate increases.

Effectively communicating infrastructure and water supply challenges to customers and key decision makers is vital, and the water industry has tried collectively to inform the public of the value of water services and resources for decades. However, local efforts to communicate with community stakeholders are key, so while tools and common messaging are important, it is the local connections that ultimately determine the success of any awareness campaign.

To explore the perceptions of communication with various groups, the 2016 SOTWI survey asked all study participants to rate the understanding of the following groups on a scale of 1 (very poor) to 5 (very good):

- General public
- Residential customers
- Nonresidential customers (industrial/commercial/institutional)
- Public officials
- Media

The specific questions asked were:

1. For non-utility personnel: How would you rate the effectiveness of the water industry’s communication or outreach to the following groups?
2. For utility personnel: How would you rate the effectiveness of your utility’s communication or outreach to the following groups?

The results presented in Figure 26 show that non-utility personnel do not rate highly the effectiveness of the water industry’s communication with any of the groups identified. Non-utility respondents felt that communication with state/local regulators was the most effective of the groups rated with 52% relaying that communication with state/local regulators was either good (36%) or very good (16%). Communications with federal regulators were second in terms effectiveness, followed by public officials. The least effective communication was reported for youth, with 50% responding communication with youth was either poor or very poor. Communication with the media and the general public was also felt to be relatively ineffective in comparison to other groups.

The results presented in Figure 27 show that utility personnel also do not highly rate the effectiveness of their utilities’ communication with any of the groups identified; these local observations are very similar to the general observations summarized in Figure 26. Utility respondents felt that communication with state/local regulators was the most effective of the groups rated, with 51% relaying communication with these regulators was either good (38%) or very good (13%). Communications with federal regulators were second in terms effectiveness, followed by public officials. As with non-utility personnel, utility workers felt the least effective communication was with youth, with 55% responding communication with youth was either poor or very poor. Communication with the media and the general public was also felt to be relatively ineffective in comparison to other groups.
Figure 26. Non-utility worker perceptions of the effectiveness of the water industry’s communication or outreach to various groups (n=702)

Figure 27. Utility worker perceptions of their utilities’ effectiveness at communication or outreach to various groups (n=658)
None of these results or short-term trends in communication are positive for the water industry, which needs public support in order to effectively manage its systems and resources. Utility leaders often face a difficult challenge as they explain their systems’ needs, the associated costs, and the way these costs are balanced equitably through rate structures and financing plans. If the groups identified in Figures 26 and 27 are unaware of the value of water systems and the cost of maintaining them, public officials may be less willing to support necessary investments – and associated rate increases – for fear of losing constituent support.

**Regulations**

The importance of current and future regulatory compliance were not as highly rated in the 2016 SOTWI survey as in past years. Referring to Table 4, compliance with current regulations was rated #20 in importance (rated #12 in 2015) and compliance with future regulations was rated #24 in the current survey (rated #10 in 2015). The reasons regulatory compliance was not as highly rated this year are not readily apparent, but those utilities that are out of compliance or expect to be in the future will need to address all necessary changes to ongoing and future planning, treatment, and monitoring – all of which can result in increased O&M costs and capital needs.

All survey participants were asked about their levels of concern regarding the water industry’s ability to comply with current regulations, and their responses are summarized in Table 10. Scores are on a scale of 1 (not at all concerned) to 5 (extremely concerned). Current regulations regarding chemical spills, point source pollution, and combined sewer overflows were the top three areas of concern identified through both the 2016 and 2015 SOTWI surveys. It will be interesting to observe how important lead and copper regulations are considered following a high profile lead event in Flint, Mich. that came to prominence in late 2015.

**Table 10. Current Regulatory Concerns of the Water Industry (n = 1,245)**

<table>
<thead>
<tr>
<th>Rank</th>
<th>Current Regulatory Concern</th>
<th>Score</th>
<th>% Ranked Extremely Concerned</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chemical spills</td>
<td>3.25</td>
<td>16%</td>
</tr>
<tr>
<td>2</td>
<td>Point source pollution</td>
<td>3.22</td>
<td>13%</td>
</tr>
<tr>
<td>3</td>
<td>Combined sewer overflows</td>
<td>3.17</td>
<td>13%</td>
</tr>
<tr>
<td>4</td>
<td>Disinfection Byproducts</td>
<td>3.08</td>
<td>10%</td>
</tr>
<tr>
<td>5</td>
<td>Perfluorinated compounds such as PFOA and PFOS</td>
<td>2.80</td>
<td>5%</td>
</tr>
<tr>
<td>6</td>
<td>Arsenic</td>
<td>2.70</td>
<td>7%</td>
</tr>
<tr>
<td>7</td>
<td>Radionuclides</td>
<td>2.69</td>
<td>6%</td>
</tr>
<tr>
<td>8</td>
<td>Lead and copper</td>
<td>2.49</td>
<td>5%</td>
</tr>
</tbody>
</table>

In addition, all survey participants were asked about their concern over compliance with potential future regulations, and their responses are summarized in Table 11. Scores are on a scale of 1 (not at all concerned) to 5 (extremely concerned). As in 2015, the 2016 SOTWI survey results show the most concern over future regulation of pharmaceuticals and hormones, nonpoint source pollution, and security and preparedness.
<table>
<thead>
<tr>
<th>Rank</th>
<th>Future Regulatory Concern</th>
<th>Score</th>
<th>% Ranked Extremely Concerned</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pharmaceuticals and Hormones</td>
<td>3.48</td>
<td>19%</td>
</tr>
<tr>
<td>2</td>
<td>Nonpoint source pollution</td>
<td>3.23</td>
<td>13%</td>
</tr>
<tr>
<td>3</td>
<td>Security and Preparedness (cyber, physical, and emergency response)</td>
<td>3.19</td>
<td>13%</td>
</tr>
<tr>
<td>4</td>
<td>Disinfection Byproducts</td>
<td>3.14</td>
<td>11%</td>
</tr>
<tr>
<td>5</td>
<td>Unknown chemical or hydrocarbon spills</td>
<td>3.13</td>
<td>12%</td>
</tr>
<tr>
<td>6</td>
<td>Point source pollution</td>
<td>3.10</td>
<td>11%</td>
</tr>
<tr>
<td>7</td>
<td>Cyanotoxins</td>
<td>3.06</td>
<td>11%</td>
</tr>
<tr>
<td>8</td>
<td>Perfluorinated Compounds such as PFOA and PFOS</td>
<td>3.05</td>
<td>9%</td>
</tr>
<tr>
<td>9</td>
<td>Combined sewer overflows</td>
<td>3.04</td>
<td>12%</td>
</tr>
<tr>
<td>10</td>
<td>Chemical storage tanks</td>
<td>2.96</td>
<td>10%</td>
</tr>
<tr>
<td>11</td>
<td>Chloramines</td>
<td>2.94</td>
<td>8%</td>
</tr>
<tr>
<td>12</td>
<td>Naegleria fowleri</td>
<td>2.92</td>
<td>8%</td>
</tr>
<tr>
<td>13</td>
<td>Volatile Organic Compounds (VOCs)</td>
<td>2.92</td>
<td>7%</td>
</tr>
<tr>
<td>14</td>
<td>Hexavalent Chromium</td>
<td>2.89</td>
<td>8%</td>
</tr>
<tr>
<td>15</td>
<td>Legionella</td>
<td>2.88</td>
<td>8%</td>
</tr>
<tr>
<td>16</td>
<td>Perchlorate</td>
<td>2.80</td>
<td>6%</td>
</tr>
<tr>
<td>17</td>
<td>Arsenic</td>
<td>2.77</td>
<td>8%</td>
</tr>
<tr>
<td>18</td>
<td>NDMA and other nitrosamines</td>
<td>2.75</td>
<td>5%</td>
</tr>
<tr>
<td>19</td>
<td>Manganese</td>
<td>2.68</td>
<td>6%</td>
</tr>
<tr>
<td>20</td>
<td>Radionuclides</td>
<td>2.68</td>
<td>6%</td>
</tr>
<tr>
<td>21</td>
<td>Lead and Copper</td>
<td>2.66</td>
<td>7%</td>
</tr>
<tr>
<td>22</td>
<td>Chlorate</td>
<td>2.63</td>
<td>4%</td>
</tr>
<tr>
<td>23</td>
<td>Selenium</td>
<td>2.63</td>
<td>5%</td>
</tr>
<tr>
<td>24</td>
<td>Vanadium</td>
<td>2.59</td>
<td>5%</td>
</tr>
<tr>
<td>25</td>
<td>Molybdenum</td>
<td>2.57</td>
<td>5%</td>
</tr>
<tr>
<td>26</td>
<td>Fluoride</td>
<td>2.57</td>
<td>7%</td>
</tr>
<tr>
<td>27</td>
<td>Strontium</td>
<td>2.52</td>
<td>4%</td>
</tr>
</tbody>
</table>
Workforce Issues

Workforce issues continue to concern the water industry, with talent attraction and retention rated as the #16 most important issue (up from #17 in 2015), aging workforce/anticipated retirements rated as the #13 most important issue (up from #20 in 2015), and certification and training as the #23 most important issue (down from #22 in 2015). The water industry seems to continuously face difficulty in recruiting, training, and retaining skilled employees, especially for small systems. Likewise, a large number of water industry employees are nearing or are currently eligible for retirement; this group represents a significant amount of institutional knowledge that could be lost without proper succession planning and process documentation.

All 2016 SOTWI participants were asked “Overall, how prepared do you think the water sector is to address issues related to talent attraction and retention in the next five years?”, and their responses are summarized in Figure 28. Only 1% of 2016 SOTWI respondents indicated that the water industry was fully prepared to address issues related to talent attraction and retention in the next five years, the same percentage in 2014 and 2015. The challenge of talent attraction and retention is highlighted by the 12% or respondents who thought the industry is not at all prepared (compared to 14% in 2014) and the 32% who thought it was only slightly prepared (compared to 40% in 2014); although the trend is moving in a positive direction, there remains plenty yet to do. In summary, 44% of respondents have a negative perception of the water industry’s preparation for talent attraction and retention, which is an improvement over the 54% who responded that way in 2015.

Figure 28. Responses from all SOTWI survey participants regarding how prepared they thought the water sector is to address issues related to talent attraction and retention in the next five years (n =1,275)
All 2016 SOTWI participants were asked “Overall, how prepared do you think the water sector is to cope with any expected retirements in the next five years?” The summary of responses provided in Figure 29 reveals that just 1% of respondents indicated that the water industry was fully prepared to cope with any expected retirements in the next five years while 12% thought the industry not at all prepared and 38% thought it was only slightly prepared. In summary, 50% of respondents have a negative perception of the water industry’s preparation for retirement (slightly or not at all prepared), which is a large increase over the 42% who responded this way in 2015.

![Figure 29. Responses from all SOWTI survey participants regarding how prepared they thought the water sector is to cope with any expected retirements in the next five years (n =1,274)](image)

Finally, all 2016 SOTWI participants were asked “Overall, how prepared do you think the water sector is to address issues related to certification and training in the next five years?” Responses are provided in Figure 30. The majority of respondents (85%) indicated that the water industry was at least moderately prepared to address issues related to certification and training in the next five years, which is up from 82% who responded this way in 2015. Roughly 14% of respondents have a negative perception of the water industry’s preparation for certification and training (slightly or not at all prepared), which is a large improvement over this level reported in 2015 (21%).
Figure 30. Responses from all SOWTI survey participants regarding how prepared they thought the water sector is to address issues related to certification and training in the next five years (n = 1,274)

Other Issues

Big Data

As we progress further into the era of “big data” or the internet of things, water and wastewater utilities have the ability to collect and analyze large quantities of information about their systems and customers. Utility staff members were asked about their utilities’ “big data” strategies, and a summary of the results is provided in Figure 31. The majority of respondents indicated their utility does not have a big data strategy (54%). However, the other 46% are in various stages of exploration, implementation, or operation. Of the groups reporting their utility has a big data strategy, 22% reported that it was well communicated to them, 16% reported it was poorly communicated, and 9% reported it had not been communicated at all.

In order to understand where big data strategies and associated data mining were taking root, utility staff members were asked the following questions. Results are shown in Figure 32:

- Is your utility using data mining techniques to better understand its customers?
- Is your utility using data mining techniques to better understand its water and/or wastewater system?
Figure 31. Responses from utility employees regarding if their utility has a big data strategy (n = 407)

Figure 32. Responses from utility employees regarding how their utility is using data mining (n = 390)
As Figure 32 shows that more utilities appear to be using their big data strategies/data mining techniques to better understand their water and/or wastewater system (32%) in comparison to those using data mining techniques to better understand their customers (22%); these are almost the same results observed in 2015. With regards to utilities with a big data strategy in development, an almost equal percentage of respondents reported their utilities would be developing data mining techniques to better understand their water and/or wastewater system (10%) as those who plan to use data mining techniques to better understand their customers (12%).

Large-Scale Phenomena

In order to understand the potential impacts of several large-scale phenomena on the water industry, all SOTWI participants were asked to rank a list of macro-issues using the following scale:

1. Significant negative impact
2. Slight negative impact
3. No impact at all
4. Slight positive impact
5. Significant positive impact

Table 15 provides a ranking of the large-scale phenomena provided to participants and a differential, which is the average score minus 3. A score of 3 is the median potential score reflecting no impact, while a positive differential indicates a positive impact and a negative differential indicates a negative impact. These results show that water industry professionals think housing markets and business/industrial activities will have a slight positive impact on the industry. On the other hand, political instability, terrorism, and pollution are expected to have the greatest negative impacts.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Category</th>
<th>Score (median = 3)</th>
<th>Differential*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Housing Markets</td>
<td>3.07</td>
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</tr>
<tr>
<td>2</td>
<td>Business/Industrial Activities</td>
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<td>Bond Markets</td>
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<td>4</td>
<td>Urbanization</td>
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<td>5</td>
<td>Population Growth</td>
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<td>6</td>
<td>Stock Markets</td>
<td>2.72</td>
<td>-0.28</td>
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<td>7</td>
<td>Unemployment</td>
<td>2.71</td>
<td>-0.29</td>
</tr>
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<td>8</td>
<td>Agriculture</td>
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<td>-0.43</td>
</tr>
<tr>
<td>9</td>
<td>Energy Costs</td>
<td>2.54</td>
<td>-0.46</td>
</tr>
<tr>
<td>10</td>
<td>Social Instability</td>
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<td>11</td>
<td>Inflation</td>
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<td>War</td>
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<td>Chemical Costs</td>
<td>2.33</td>
<td>-0.67</td>
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<td>16</td>
<td>Terrorism</td>
<td>2.28</td>
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<tr>
<td>17</td>
<td>Pollution</td>
<td>2.13</td>
<td>-0.87</td>
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</table>

* A positive differential means a positive impact, a differential of 0 means no impact, and a negative differential means a negative impact.
PART 4 – CONCLUSIONS

Water is a vital component for all societies and access to safe and sufficient drinking-water is a primary characteristic that distinguishes developed from undeveloped countries. For over a century, North America’s water industry, which includes potable water, wastewater, reuse, and stormwater, has increased its technical, managerial, and financial proficiency while improving public health and environmental protection. While some systems still struggle to meet the expectation of continuous safe drinking water and clean water discharges, the majority of utilities in North America are dealing with issues of system and resource stewardship along with effectively communicating the wide-range of needs in these two areas.

The overall successes of water professionals should continue to be a source of pride and inspiration; however, the current State of the Water Industry survey highlights several important challenges including the costs of system stewardship, water resource development and protection, and effective stakeholder communication. In addition to facing these mostly long-term problems, shorter-term water shortages related to drought and localized source water protection issues such as chemical spills continue to plague watersheds across North America, and the impacts that these events will ultimately have on awareness of water issues could be significant. As communities recognize their limited and precious supplies, water will become ever more important in shaping our communities as they adapt and grow.

It is difficult to specifically account for the relatively stagnant perceptions of the industry’s soundness as identified in this report, but water leaders should take these trends as a call to action. As they address today’s important issues and prepare to tackle those on the horizon, water industry professionals should promote their successes and transfer newly created knowledge to their peers to reinforce an atmosphere of continuous improvement. On the path toward financial sustainability, water providers should strive to implement fair rates and fees that reflect the total cost of water services including infrastructure renewal and replacement. Regarding environmental sustainability, the water industry continues to minimize its footprint through the efficient use of supplies and resources. Indeed, it is an ongoing commitment to these values that unites the water community as a vital component of modern society in developed nations.

AWWA’s annual State of the Water Industry Report is intended to serve as a foundation for action and further discovery. Water professionals need to continue to meet society’s expectations for safe and clean water by developing and implementing solutions that solve ongoing and new challenges. The quality of water service in Canada and the United States remains consistently high; comprehensive data on Mexican systems is hard to find. The larger message that is repeated consistently throughout this report is that as communities we must address our water infrastructure and resource management challenges or else the reliability and resiliency of our water systems, the health of our environment, the prosperity of our economy, and the safety of our water will be increasingly at risk.

The continued credibility of the water profession requires open and ongoing communication that establishes relationships and creates a framework for understanding, trust, and cooperation. AWWA will continue to serve as a bridge organization, uniting the worlds of science and research, policy, and practice to address the issues identified in this report. With over 50,000 members and more than 3,000 volunteers, AWWA is the community for water professionals to create and exchange knowledge to solve the challenges before us.

If you participated in the 2016 State of the Water Industry survey, the Association thanks you, and if you wish to participate in the 2017 survey scheduled to occur in September, 2016, please make sure your contact information is current or create an AWWA login at www.awwa.org.
REFERENCES


AWWA, 2016. 2015 Establishing the Level of Progress in Utility Asset Management, a survey conducted by the AWWA Asset Management Committee (AMC) and funded by the AWWA Technical & Educational Council


APPENDIX 1 – 2016 State of the Water Industry Survey

AWWA annually surveys water professionals to gauge their perceptions of the industry and to identify and track significant trends. This survey should take 10 to 20 minutes to complete. Individual responses are held strictly confidential. Thanks in advance for your contribution to this collective effort and for supporting AWWA's mission to provide solutions to effectively manage the world's most important resource.

If you would prefer to take this survey in Spanish, please follow this link. If you would prefer to take this survey in English, please follow this link.

Q: *In which one of the following states or territories do you work most often (grouped by country: Canada, U.S., Mexico)? If outside of North America please enter the country in the space provided.

Outside of North America - please specify:

Q: *Which one of the following best describes the type of organization you work for?
1. Drinking Water Utility
2. Wastewater Utility
3. Combined Water/Wastewater Utility (may include other services too)
4. Water Wholesaler
5. Reuse/Reclamation Utility
6. Stormwater Utility
7. Consulting Firm/Consultant
8. Manufacturer of Products
9. Manufacturer's Representative
10. Distributor
11. Technical Services/Contractor
12. Regulatory Authority/Regulator
13. Non-utility Government (municipal, federal, etc.)
14. University/Educational institution
15. Laboratory
16. Financial Industry (ratings agency, investor/fund rep., etc.)
17. Law Firm/Attorney
18. Nonprofit Organization
19. Retired
20. Other (please specify)

Q: In your opinion, what is the current overall state of the water industry?
1 = Not at all sound  2  3  4  5  6  7 = Very sound

Q: Looking forward, how sound will the overall water industry be five years from now?
1 = Not at all sound  2  3  4  5  6  7 = Very sound

Q: In your opinion, what is the current state of the water industry in the region where you work most often?
1 = Not at all sound  2  3  4  5  6  7 = Very sound

Q: Looking forward, how sound will the water industry be five years from now in the region where you work most often?
1 = Not at all sound  2  3  4  5  6  7 = Very sound
Q: Please rate the importance of the following industry challenges on a scale of 1 (unimportant) to 5 (critically important). [page 1 of 3]

1 = Unimportant 2 = Slightly important 3 = Important 4 = Very important 5 = Critical  No opinion/don’t know

PAGE 1
1. Financing for capital improvements
2. Improving customer, constituent, and community relationships
3. Expanding water reuse/reclamation
4. Aging workforce/anticipated retirements
5. Public understanding of the value of water systems and services
6. Watershed/source water protection
7. Data management
8. Water conservation/efficiency
9. Water rights
10. Water markets

PAGE 2
1. Long-term water supply availability
2. Public understanding of the value of water resources
3. Groundwater management and overuse
4. Energy use/efficiency and cost
5. Renewal & replacement of aging water and wastewater infrastructure
6. Emergency preparedness
7. Asset management
8. Climate risk and resiliency
9. Water loss control

PAGE 3
1. Drought or periodic water shortages
2. Talent attraction and retention
3. Certification and training
4. Public acceptance of future water and wastewater rate increases
5. Governing board acceptance of future water and wastewater rate increases
6. Cost recovery (pricing water to accurately reflect the cost of service)
7. Compliance with current regulations
8. Compliance with future regulations
9. Physical security issues
10. Cyber-security issues

Any others rating at least “very important” but not listed (please specify):

Q: How would you rate the effectiveness of the water industry’s communication or outreach to the following groups?  
1 = Very poor 2 = Poor 3 = Average 4 = Good 5 = Very good  Don’t know

General Public
Residential customers
Nonresidential customers (industrial/commercial/institutional)
Public officials
Federal Regulators
State/Local Regulators
Business leaders
Media
Youth

What do you think the water sector could do to improve the overall understanding of the value of water systems, services, and resources? <open ended>
Q: Infrastructure renewal and replacement (R&R) encompasses several issues; how would you rate the importance of the following areas with regards to the challenge of renewing or replacing aging water and wastewater infrastructure? [page 1 of 2]

1 = Unimportant 2 = Slightly important 3 = Important 4 = Very important 5 = Critical  Don’t know

Justifying R&R programs to oversight bodies (board, council, etc.)
Justifying R&R programs to ratepayers
Obtaining R&R funding via bonds
Obtaining R&R funding involving public-private partnerships
Obtaining R&R funding via Federal, State, or Territorial loans
Obtaining R&R funding via Federal, State, or Territorial grants
Obtaining R&R funding by taxation (e.g., property taxes)
Pay-as-you-go R&R funding

Establishing and following a financial policy for capital reinvestment
Establishing and maintaining specific R&R reserves
Addressing declining water sales
Developing/implementing asset management programs
Defining appropriate levels of service
Prioritizing R&R needs
Coordinating R&R with other activities (e.g., road repair, redevelopment, etc.)

Any others rating at least “very important” but not listed (please specify):

Q: Overall, how prepared do you think the water sector is to address issues related to certification and training in the next five years?
1=Not at all prepared 2 = Slightly prepared  3 = Moderately prepared  4 Very prepared  5=Fully prepared  No opinion/don’t know

Q: Overall, how prepared do you think the water sector is to cope with any expected retirements in the next five years?
1=Not at all prepared 2 = Slightly prepared  3 = Moderately prepared  4 Very prepared  5=Fully prepared  No opinion/don’t know

Q: Overall, how prepared do you think the water sector is to address issues related to talent attraction and retention in the next five years?
1=Not at all prepared 2 = Slightly prepared  3 = Moderately prepared  4 Very prepared  5=Fully prepared  No opinion/don’t know

Q: How concerned are you over the ability of the water sector to comply with current regulations in the following areas?
1 = Not at all concerned, 2 = Slightly concerned,3 = Moderately concerned, 4 = Very concerned, 5 = Extremely concerned
Don’t know
1. Lead and copper
2. Perfluorinated compounds such as PFOA and PFOS
3. Arsenic
4. Disinfection Byproducts
5. Radionuclides
6. Combined sewer overflows
7. Point source pollution
8. Chemical spills

Any others rating at least “very concerned” but not listed (please specify):
Q: How concerned are you about future water sector regulations in the following areas? [page 1 of 3]
1 = Not at all concerned, 2 = Slightly concerned, 3 = Moderately concerned, 4 = Very concerned, 5 = Extremely concerned  
No opinion/don’t know

Lead and Copper
Perchlorate
Hexavalent Chromium
Chloramines
Fluoride
Pharmaceuticals and Hormones
Perfluorinated Compounds such as PFOA and PFOS
Arsenic
Naegleria fowleri

Disinfection Byproducts
Volatile Organic Compounds (VOCs)
Security and Preparedness (cyber, physical, and emergency response)
Radionuclides
Vanadium
Molybdenum
Selenium
Manganese
Cyanotoxins

Strontium
Chlorate
NDMA and other nitrosamines
Combined sewer overflows
Legionella
Point source pollution
Nonpoint source pollution
Chemical storage tanks
Unknown chemical or hydrocarbon spills

Any others rating at least “very concerned” but not listed (please specify):

Q: What impact (positive or negative) do you think the following large-scale phenomena will have on the overall water industry in 2016? [page 1 of 2]
Significant negative impact, (2) Slight negative impact, (3) No impact at all (4) Slight positive impact, (5) Significant positive impact
Don’t know

Unemployment
Housing Markets
Stock Markets
Bond Markets
Business/Industrial Activities
Energy Costs
Agriculture
Political Instability
Social Instability

Inflation
Population Growth
Terrorism
War
Pollution
Wealth Inequality
Urbanization
Chemical Costs
Labor Costs

Any others with significant impact but not listed (please specify):
Identifying Information

Q: What is your age?
   Younger than 25
   25-34
   35-44
   45-54
   55-64
   65 and older
   Prefer not to answer

Q: What is your gender?
   Male
   Female

Q: What is the highest level of education you completed?
   Did Not Complete High School
   High School/GED
   Some College
   Associate’s Degree
   Bachelor’s Degree
   Master’s Degree
   Advanced Graduate work or Ph.D.

Q: Which race/ethnicity best describes you? (Please choose only one.)
   American Indian or Alaskan Native
   Asian / Pacific Islander
   Black/Non-Hispanic
   Hispanic or Latino
   White/Non-Hispanic
   Multiple ethnicity/Other

End for non-utility career groups; the following questions were provided to the submitters based upon their answers to “Which one of the following best describes the type of organization you work for?”
The following questions refer specifically to the utility you work for.

Q: Is the utility you work for publicly or privately owned?  
1 = Publicly owned    2 = Privately/investor owned

Q: Please select your utility’s number of connections (drinking water OR collection system). If your utility provides both water and wastewater services, use the service with the greater number of connections (drinking water OR collection system)

The number of connections can be estimated by (population served)/3.5. If possible, please include an estimate of the number of connections in areas receiving wholesale water service in this count.

0 to 3,000  
3,001 to 10,000  
10,001 to 25,000  
25,001 to 50,000  
50,001 to 100,000  
100,001 to 150,000  
Over 150,000

Q: Is your utility currently able to cover the full cost of providing service(s), including infrastructure renewal & replacement and expansion needs, through customer rates and fees?  
1=Not at all able  2 = Slightly able  
3 = Moderately able  4 = Very able  5=Fully able  No opinion/don’t know

Q: Given your utility’s future infrastructure needs for renewal & replacement and expansion, do you think your utility will be able to meet the full cost of providing service(s) through customer rates and fees?  
1=Not at all able  2 = Slightly able  3 = Moderately able  4 = Very able  5=Fully able  No opinion/don’t know

Q: Which of the following best describes any trend in your utility’s total water sales?  
Not applicable  
>10 year trend of declining total water sales  
<10 year trend of declining total water sales  
Flat or little change in total water sales  
<10 year trend of increasing total water sales  
>10 year trend of increasing total water sales  
No specific trend  
Don’t know

Q: Which of the following best describes your utility’s trend in per account water sales?  
Not applicable  
>10 year trend of declining per account water sales  
<10 year trend of declining per account water sales  
Flat or little change in per account water sales  
<10 year trend of increasing per account water sales  
>10 year trend of increasing per account water sales  
No specific trend  
Don’t know
Q: How is your utility responding to its cost recovery needs in the face of changing water sales/consumption patterns? (choose all that apply)
Not applicable
No changes needed
Shifting more of the cost recovery from consumption-based fees to fixed fees within the rate structure
Shifting rate design to increasing block-rate structure
Shifting rate design to decreasing block-rate structure
Incorporating seasonal rates
Changes in growth-related fees (i.e., system development charges, impact fees, or capacity charges)
Revenue diversification
Increasing financial reserves
Implementing rate stabilization reserves
Don't know
Other (please specify)

Q: Is your utility considering or currently involved in a public-private partnership (P3)?
Not considering a P3 at this time
Considering a P3 but not committed
Planning to use a P3
Already involved in a P3
Don’t know

Q: Has your utility realized a benefit from its asset management program and/or efforts?
There are no asset management efforts underway as of yet
No, asset management efforts are active but have not produced any tangible benefits
Not yet, but the future benefits are expected (asset reliability, improved service levels, and/or future cost avoidance)
Yes, benefits have been achieved, although they are not well documented
Yes, benefits have been achieved and they are well documented
Yes, benefits have been achieved and they are well documented. Costs and benefits of the asset management program/efforts are quantified such that a return on investment can be calculated
I don’t know.

Q: Does your utility have a dedicated asset management manager and/or a group of asset management focused staff?
No, the organization has adequate staff for asset management but does not have a dedicated asset management coordinator and/or group of asset management focused staff
No, the organization does not see the need for dedicated asset management staff
The organization recognizes the need for an asset coordinator and/or focused staff, but has not yet created the position(s)
The organization has a part time asset management coordinator
The organization has a full time asset management coordinator but no other staff
The organization has a full time asset management coordinator and additional staff support
I don’t know.

Q: How would you rate the effectiveness of your utility’s communication or outreach to the following groups?
1 = Very poor/none 2 = Poor 3 = Average 4 = Good 5 = Very good  Don’t know
General Public
Residential customers
Nonresidential customers (industrial/commercial/institutional)
Public officials
Federal Regulators
State/Local Regulators
Business leaders
Media
Youth
Q: If your utility was to consider a rate increase in the coming year, how do you think it would be received by following groups?
1 = Very negatively 2 = Negatively 3 = Indifferently 4 = Positively 5 = Very Positively
General Public
Residential customers
Nonresidential customers (industrial/commercial/institutional)
Public officials
Business leaders
Media

Q: Does your utility offer an affordability program to assist low-income customers pay their water and/or wastewater bills?
Yes
No
In development but not implemented
Don’t know

Q: If you can make an assessment, how would you rate your utility’s current access to financial capital?
Worse than any time in the past 5 years
As bad as any time in the past 5 years
Similar to most of the past 5 years
As good as any time in the past 5 years
Better than any time in the past 5 years
Can’t assess/don’t know

Q: Does your utility include potential impacts from climate variability in your risk management or planning processes?
Yes
No
In development but not implemented
Don’t know

Q: How prepared do you think your utility will be to meet its long-term water supply needs?
Not at all prepared
Slightly prepared
Moderately prepared
Very prepared
Fully prepared
Don’t know
Not applicable

Q: Does your utility have a water conservation program?
Yes
No
In development but not implemented
Don’t know
Not applicable

Q: Does your utility have a drought management or water shortage contingency plan?
Yes
No
In development but not implemented
Don’t know
Not applicable

Q: How many years in the last decade has your utility implemented voluntary water restrictions? Change years to 5+
Drop down: 0, 1 year, 2-4 years, >5 years
Q: How many years in the last decade has your utility implemented mandatory water restrictions? Drop down: 0, 1 year, 2-4 years, >5 years

Q: Is your utility considering desalination of either brackish groundwater or seawater to augment existing drinking water supplies? Not applicable Yes No In development but not implemented Already implemented Not possible (no brackish groundwater or seawater options) Don’t know

Q: Is your utility considering nonpotable reuse to augment existing irrigation or industrial water supplies? Not applicable Yes No In development but not implemented Already implemented Don’t know

Q: Is your utility considering indirect potable reuse to augment existing drinking water supplies? Not applicable Yes No In development but not implemented Already implemented Don’t know

Q: Is your utility considering direct potable reuse to augment existing drinking water supplies? Not applicable Yes No In development but not implemented Already implemented Don’t know

Q: Is your utility considering urban stormwater recovery for nonpotable or potable reuse? Not applicable Yes No In development but not implemented Already implemented Don’t know

Q: Water and wastewater utilities have the ability to collect and analyze large quantities of information about their systems and customers. Which of the following best describes your utility’s “big data” strategy? We have a big data strategy and it has been well communicated to me. We have a big data strategy but it has been poorly communicated to me. My utility has a big data strategy, but it has not been communicated to me. My utility does not have a big data strategy. I don’t know whether or not my utility has a big data strategy

Q: Is your utility using data mining techniques to better understand its customers? Yes No In development but not implemented Don’t know
Q: Is your utility using data mining techniques to better understand its water and/or wastewater system?
Yes
No
In development but not implemented
Don’t know

Thank you for participating in the 2016 State of the Water Industry Survey. Your answers will be submitted to AWWA by clicking the submit button below. To see past results go to awwa.org and search for State of the Water Industry.

Results and analysis will be available online in Spring of 2016, as well as in the June 2016 edition of the Journal - American Water Works Association and at presentations at ACE16 (June 19-22, 2016 in Chicago, IL).
APPENDIX 2 – 2016 Health of the Industry Responses by Location

Below are the responses by states and territories to the questions below regarding the overall and regional health of the water industry using a scale of 1 to 7 where 1 = “not at all sound” and 7 = “very sound” for the present year (2016) and five years from now (2021):

- In your opinion, what is the current overall state of the water industry?
- Looking forward, how sound will the overall water industry be five years from now?
- In your opinion, what is the current state of the water industry in the region where you work most often?
- Looking forward, how sound will the water industry be five years from now in the region where you work most often?

### United States

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<th>Location</th>
<th>Overall 2016</th>
<th>Overall 2021</th>
<th>Regional 2016</th>
<th>Regional 2021</th>
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