NATIONAL ECONOMIC & LABOR IMPACTS OF THE WATER UTILITY SECTOR

TECHNICAL REPORT

Water Research Foundation℠
advancing the science of water

WERF
Water Environment Research Foundation
Collaboration. Innovation. Results.

Disclaimer:

This study was funded by the Water Research Foundation (WRF) and Water Environment Research Foundation (WERF). WRF and WERF assume no responsibility for the content of the research study reported in this publication or for the opinions or statements of fact expressed in the report. The mention of trade names for commercial products does not represent or imply the approval or endorsement of WRF or WERF. This report is presented solely for informational purposes.

Published September 2014

National Economic and Labor Impacts of the Water Utility Sector: Technical Report

Prepared by:

Alexander Quinn, Christine Safriet, Kevin Feeney, Vanessa Lauf

AECOM
300 California Street, Suite 400, San Francisco, CA 94104

Sponsored by:

Water Research Foundation
6666 West Quincy Avenue, Denver, CO 80235

Water Environment Research Foundation
635 Slaters Lane, Suite G-110, Alexandria, VA 22314

Project Technical Advisory Committee:

Radhika Fox, San Francisco Public Utilities Commission
Jerry Johnson, Washington Suburban Sanitary Commission
Mark Kim, District of Columbia Water and Sewer Authority
Karen Pallansch, Alexandria Renew Enterprises
Douglas Yoder, Miami Dade Water and Sewer Department

Published by:

Water Research Foundation℠
advancing the science of water

WERF
Water Environment Research Foundation
Collaboration. Innovation. Results.

Table of Contents

Acknowledgements vi

Executive Summary 1

1. Purpose & Context 3

2. Approach 6

3. Analysis & Findings 12

Bibliography 23

Appendix 27

Figures

Figure 1: Water and Wastewater Services 4
Figure 2: Map of Participating Utilities 8
Figure 3: Total Employment Contribution of Utilities in this Study 16
Figure 4: Water Sector Employment by Occupation at Utilities in this Study 19
Figure 5: Copy of Survey Questionnaire 29
Figure 6: National Factsheet 51

Tables

Table 1: Service Population of Participating Utilities by Region 7
Table 2: Utility Services Provided by Study Participants 7
Table 3: Participating Utilities 8
Table 4: Aggregate Utility Expenditure Projections by Year (in $ billions) 12
Table 5: Operating Expenditures for 2014 12
Table 6: Operating Expenditure Statistics for the Next Decade 13
Table 7: Allocation of Operating Expenditures 13
Table 8: Capital Expenditures for 2014 14
Table 9 : Capital Expenditures for the Next Decade 14
Table 10: Total Economic Impact of Surveyed Utilities 15
Table 11: Jobs per $1 Million of Spending in the Water Sector 16
Table 12: Jobs per $1 Million of Investment in the Water Sector Compared to Other Sectors 17
Table 13: Economic Impact of Operating Expenditures 17
Table 14: Economic Impact of Capital Plan Commitments 18
Table 15: Common & Mission Critical Occupations 19
Table 16: Entry-Level Educational Requirements, by Occupation, at Utilities in this Study 21
Table 17: Typical Wastewater Treatment Plant Operator Career Ladder 22
Table 18: IMPLAN Cost Coding of Operating Budgets 42
Table 19: IMPLAN Cost Coding Capital Plan Budgets 42
Table 20: Additional IMPLAN Activities for Capital Plan Analysis 43
Table 21: Definitions of Occupational Groups 45
Table 22: Utility Employment by Occupation 46
Table 23: Employment by Occupation, by Region 46
Table 24: Allocation of Capital Plan Commitments 47
Table 25: Regional Economic Impacts 48

Acronyms

ASCE	American Society of Civil Engineers
BLS	Bureau of Labor Statistics
CWA	Clean Water Act
EIA	Energy Information Administration
EPA	Environmental Protection Agency
GDP	Gross Domestic Product
MSA	Metropolitan Statistical Area
NPS	National Park Service
SDWA	Safe Drinking Water Act
U.S.	United States
USDOT	U.S. Department of Transportation
USGS	United States Geological Survey
WERF	Water Environment Research Foundation
WRF	Water Research Foundation

Acknowledgements

This research effort was undertaken in the spring and summer of 2014 by the AECOM Sustainable Economics team: Alexander Quinn, project director; Christine Safriet, project manager; Kevin Feeney, economic analyst; Vanessa Lauf, economic analyst; and Thia Buggia, graphic designer; with assistance from Christine Graziano and Lance Harris for technical review.

We would like thank the following entities for their invaluable assistance in the completion of the report.

- The directors and staff at the participating utilities who completed the questionnaire and responded to our numerous additional questions regarding their structure, operations, and budget projections.
- Our funder, the Water Research Foundation, with agency representative Jonathan Cuppett, project co-manager.
- Our funder, the Water Environment Research Foundation, with agency representative Theresa Connor, project co-manager.
- The members of our Technical Advisory Committee:

  - Radhika Fox, San Francisco Public Utilities Commission
  - Jerry Johnson, Washington Suburban Sanitary Commission
  - Mark Kim, District of Columbia Water and Sewer Authority
  - Karen Pallansch, Alexandria Renew Enterprises
  - Douglas Yoder, Miami Dade Water and Sewer Department

Executive Summary

OBJECTIVES

This study focuses on the economic impacts associated with water, wastewater, and stormwater service operations and capital investments. Funded by the Water Research Foundation (WRF) and the Water Environment Research Foundation (WERF), this study estimates how the planned operating and capital investments of 30 public water utilities contribute directly and indirectly to the economy and employment markets in their respective regions and to the nation over the next decade.

BACKGROUND

The following study analyzes the impacts of actual or planned expenditures of specific water utilities. While several local studies have quantified the employment impacts of individual water utilities, this analysis is the first to aggregate the national economic impact of 30 water utilities' planned operating and capital budgets. Prior national studies of the economic impact of water utilities have estimated the impact of hypothetical investments in water infrastructure according to how many jobs the water sector is estimated to create per million dollars of capital investment. None of these prior studies considered the impact of utility operations.

APPROACH

The term "water utilities" is used throughout this report to describe the 30 public utilities that participated in this study. The 30 participating water, wastewater, and stormwater utilities were surveyed regarding their current and projected operating budgets, capital plans, and labor requirements over the next ten years.

Responses were supplemented with information from an extensive literature review, and the economic impacts of the data were then analyzed using IMPLAN modeling software to determine the level of output, labor income, and jobs generated by utility investments.

This study examines investments by water utilities to understand the corresponding impacts to the national economy. It does not attempt to include an economic premium based on the essential nature of providing water and wastewater service, which supports most pillars of the economy (i.e., industry, agriculture, and public health). Nonetheless, as the primary purveyors of water, water and wastewater utilities provide an economic value that is greater than the sum of their operation and capital spending impacts.

RESULTS/CONCLUSIONS

The utilities in this study provide a broad range of services to their customers, including the provision of drinking water, wastewater collection and treatment, and/or stormwater collection and treatment. They operate in 25 distinct regions across the country and represent one-third of all large U.S. water utilities (those that provide water, wastewater, and/or stormwater service to more than 500,000 people).

Over the next decade, the 30 public utilities participating in this study plan to spend an aggregate total of $23 billion per year for operations and capital expenditures. These plans represent the utilities' ongoing commitment to provide safe, clean, and affordable services to their clients and to the public. Approximately 60 percent of projected spending is attributable to the ongoing operation of the utilities and 40 percent is for capital infrastructure

investments to maintain systems in a state of good repair. As these investments are re-spent by workers and suppliers, additional positive economic impacts are generated.

Combined, the utilities in this study support 289,000 permanent jobs and create $52 billion per year in economic activity. This results in a national economic contribution of $524 billion over the next decade. These utilities directly employ 36,500 workers and provide access to jobs that offer competitive pay and training opportunities.

On average, every $1 million in direct spending by these water utilities supports 16 jobs throughout all sectors of the economy. When compared to prior economic impact studies, investments by utilities in this study generate similar job impacts as compared to investments in clean energy, transportation, and health care. Further, investments by participating utilities generate more jobs per $1 million than income tax cuts for personal consumption or military spending (U.S. Department of Transportation 2013, Heintz et al. 2009 and Heintz et al. 2011).

APPLICATIONS/RECOMMENDATIONS

The findings of this study can be used to communicate the economic contributions of individual water utilities to their regional economies and the aggregate impact of the 30 water utilities to the nation. The findings also illustrate the impacts to potential employment and economic activity from additional investments in water, wastewater, and stormwater operations and infrastructure.

By funding capital improvements, the utilities in this study are making an $88 billion contribution to the nation's critical water infrastructure needs. While sizeable, this commitment represents only a modest portion of the nation's unfunded water infrastructure needs. The Environmental Protection Agency has estimated the nation's capital need over the next 20 years to be approximately $720 billion (EPA 2008; EPA 2013; adjusted to 2014 dollars). Up to two-thirds of water infrastructure capital investment needs through 2020 are estimated to remain unfunded (ASCE 2013). More than half of the utilities in this study report that current revenues do not cover the cost of their anticipated capital needs, including more than one-third that report a "large gap" between revenues and capital expenditure needs. The findings of this study can help highlight the positive economic benefits of funding the nation's water infrastructure needs.

PARTICIPANTS

The following utilities participated in this study:

Alexandria Renew Enterprises	Louisville Water Company
Boston Water & Sewer Commission	Metropolitan Sewer District of Greater Cincinnati
Camden County Municipal Utilities Authority	Metropolitan Water District of Southern California
City of Atlanta Department of Watershed Management	Metropolitan Water Reclamation District of Greater Chicago
City of Baltimore Water & Wastewater Utility	Miami-Dade Water and Sewer Department
City of Chicago Department of Water Management	Milwaukee Metropolitan Sewerage District
City of Houston - Combined Utility System	Northeast Ohio Regional Sewer District
City of Los Angeles Sanitation	NYC Department of Environmental Protection
City of Tulsa Water and Sewer Department	Orange County Water District
District of Columbia Water and Sewer Authority	Philadelphia Water Department
Denver Water	Pittsburgh Water & Sewer Authority
Hampton Roads Sanitation District	Sacramento Regional County Sanitation District
Kansas City Missouri Water Services Department	San Francisco Public Utilities Commission
Los Angeles Department of Water and Power	Sewerage and Water Board of New Orleans
Louisville and Jefferson County Metropolitan Sewer District	Southern Nevada Water Authority

1. Purpose & Context

1.1 PURPOSE OF THIS RESEARCH

It is widely accepted, and sometimes taken for granted, that water, wastewater, and stormwater utilities significantly contribute to public health, industry, and the environment. What is not as well understood is how these same utilities support the local and national economy by providing jobs, building reliable infrastructure, and supporting technological advancement with clean and reliable water systems.

This study contributes to the overall discussion of the value of water by focusing on the economic impacts associated with water, wastewater, and stormwater service operations and capital investments. Funded by the Water Research Foundation (WRF) and the Water Environment Research Foundation (WERF), this study estimates how the planned operating and capital investments of 30 large, public water utilities over the next decade contribute directly and indirectly to the economy and employment markets in their respective regions and to the nation overall.

The term "water utilities" is used throughout this report to describe the utilities that participated in this study. These utilities provide a broad range of services to their customers, including the provision of drinking water, wastewater collection and treatment, and/or stormwater collection and treatment.

The utilities surveyed for this study act as economic engines in their regions and to the nation as a whole. They directly employ thousands of workers and generate hundreds of millions of dollars in economic activity. Significant operational expenditures and capital investments boost the production of other industries across the nation. This study focuses on water utility spending to understand the corresponding impacts to the national economy.

1.2 ROLE OF WATER UTILITIES

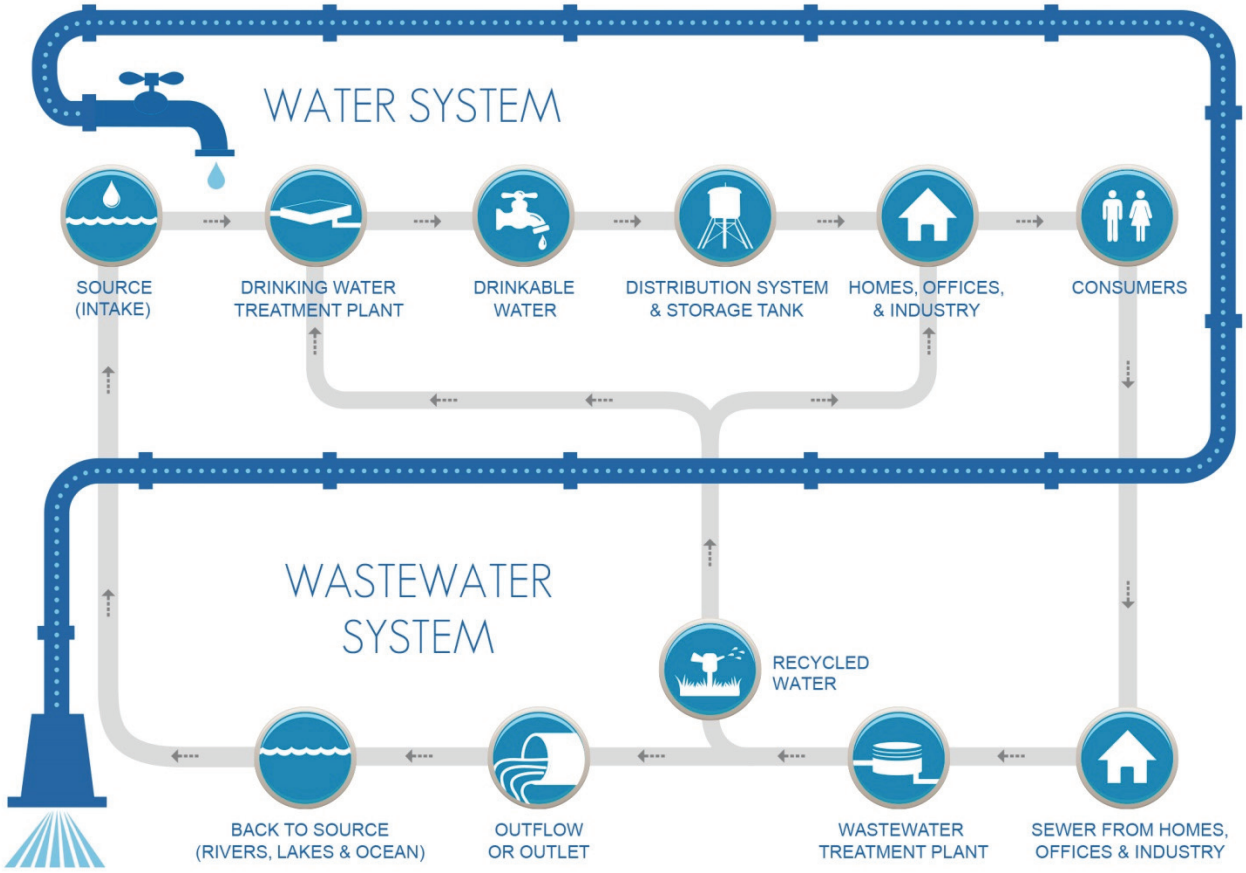
The role of water utilities can be divided into three major functions: protecting public health and safety; maintaining or improving the quality of surrounding water bodies and water sources, including resources recovery, and maintaining the economic vitality of the community through affordable rates and reliable service.

Water utilities participating in this study provide three primary services to customers: water supply, wastewater treatment, and/or stormwater management. As suppliers, water utilities procure, treat, and distribute water to homes, businesses, industrial users, power plants, and other water users. When customers use water, they generate wastewater from domestic functions like cooking and washing, from commercial uses including landscaping and restrooms, and from industrial and manufacturing processes. As wastewater service providers, water utilities then collect, treat, and discharge used water back to the environment. Many utilities that provide wastewater services also collect, treat, and return stormwater back to the environment.

Each day in the United States, public water systems distribute approximately 44 billion gallons of water and collect and treat 32 billion gallons of wastewater (U.S. Geological Survey 2005; Environmental Protection Agency 2012). This is equivalent to the volume of water in the Mississippi River that flows through New Orleans in three hours (National Park Service 2014). It would take four months to fill the Great Salt Lake in Utah with the amount of drinking water distributed and wastewater collected daily across the country (Utah Geological Survey 2013).

To provide this scale of service, water utilities invest significant resources into planning, designing, constructing, operating, and maintaining water, wastewater, and stormwater systems. These investments ensure a safe and reliable water supply for customers and maintain public health, safety, and environmental quality in their communities. Investments by water utilities also result in significant and meaningful contributions to local and regional economies through the provision of jobs and the circulation of capital via business spending and labor income.

Figure 1: Water and Wastewater Services



Water Service and Infrastructure

Drinking water infrastructure has three primary components: water source infrastructure, distribution networks, and treatment facilities. Water sources can be any bodies of ground or surface water, such as aquifers, lakes, streams, rivers, and others. Several types of infrastructure are associated with water sources, including dams, reservoirs, manmade channel sections, weirs, and so on. Distribution networks include both aqueducts that convey water from water sources to purification plants, and water mains that deliver treated water from purification plants to homes, businesses, and other water users. Treatment facilities receive water, treat it such that it reaches an acceptable level of water quality, and produce drinking water for delivery. Water utilities are responsible for planning, designing, constructing, operating, and maintaining these infrastructure pieces.

Wastewater Service and Infrastructure

Wastewater infrastructure has two major components: collection systems and treatment plants. Collection systems funnel wastewater from homes, businesses, industrial buildings, and other operators, via sewer pipes, to a wastewater treatment or reclamation facility. At treatment plants, wastewater is treated by a variety of processes until it has achieved an acceptable water quality. Treated effluent is then released from the plant into a natural water system, or sold and used as recycled water.

Stormwater Service and Infrastructure

Stormwater infrastructure has two major components: storm drains or combined sewer collection and treatment systems, and green infrastructure. When it rains or after snow melts, water utilities may use storm drains to collect stormwater runoff from multiple street inlets and discharge water to a surface water body, such as a river, lake, or reservoir. In cities with older systems, stormwater is often handled by a combined sewer system which also performs wastewater treatment functions described in the preceding section. For these older systems, heavy rainfall can cause combined systems to discharge a mixture of stormwater and sewage without fully treating it. These overflows contain pollutants which pose serious threats to public health and water quality. To reduce incidents of overflows and flooding, water utilities invest in storage tanks to augment the capacity of collection systems to store stormwater until it can be treated, as well as green stormwater infrastructure, such as green roofs, constructed wetlands, and bioswales, to absorb stormwater runoff and filter pollutants using natural processes.

Affordability Imperative

Many water utilities, including those surveyed in this study, perform their functions – planning, designing, constructing, operating, and maintaining water and wastewater infrastructure – as a not-for-profit service.[1] Many utilities are departments of municipal governments, utility districts, or other public entities. Funding for these water utilities comes primarily from the revenues from water bills and wastewater fees.[2] Covering water utility costs for operations, maintenance, and capital efforts while maintaining affordable water and wastewater bills is a key challenge and responsibility of the utility. Given the essential nature of water and wastewater services to industry, agriculture, and residential life, affordability is a critical obligation for water utilities.

---

[1] Not all water utilities are public agencies, nor are all water utilities not-for-profit service providers.

[2] Some auxiliary funding comes from grants, bond funds, or other supplementary revenue sources. Revenue from these sources is relatively small, relative to utility costs and relative to the revenue from water bills and wastewater fees which are the primary source of funds.

2. Approach

2.1 STUDY PARTICIPANTS

Thirty utilities across the United States participated in the economic impact study, as listed in Table 3. These utilities provide water, wastewater, and/or stormwater services to their customers. For specific details on each of the participating utilities, refer to Appendix B.

The utilities in this study operate to serve 83 million people across the country, which accounts for more than 25 percent of the total U.S. population. These utilities represent approximately eight percent of the largest water utilities in the United States, and one-third of utilities that serve over 500,000 people.[3] The sample of utilities in this study provides a wide geographical representation, with six operating in the Midwest, five in the Northeast, eleven in the South, and eight in the West (Figure 2).[4]

Utilities in this study serve some of the most populated urban areas in the country, encompassing a combined service area of more than 18,000 square miles.[5] They operate in twenty-five different cities and Metropolitan Statistical Areas (MSAs) across the country, almost all of which have populations over one million.[6] Half of all large U.S. metropolitan areas are represented (U.S. Census Bureau-2, 2014).[7] Of the top 10 largest metropolitan areas in the United States, utilities from nine participated in this study.[8]

---

[3] Water utilities are agencies that manage public water systems. A public water system is a water supply system that provides drinking water through pipes or other constructed conveyances to at least 15 service connections, or serves an average of at least 25 people for at least 60 days per year. One type of public water system is a Community Water Systems (CWS), defined by the EPA as public water systems that supply water to the same population year-round. There are over 50,000 CWSs across the United States. CWSs are classified by the number of people they serve. Very large systems serve over 100,000 people. Of CWS' in the United States, only 400 are very large, and only 83 serve more than 500,000 people (EPA 2012, EPA 2002).

[4] Regional boundaries in this study correspond to Census Regions (U.S. Census Bureau-1 2014).

[5] To put this service area into context, the United States has 75,000 square miles of urban land area (U.S. Census 2010).

[6] The Tulsa, OK metropolitan area is the only MSA with a population below one million included in this study.

[7] (Office of Management and Budget 2013). MSAs are defined by the U.S. Office of Management and Budget as counties or county equivalents with at least one urbanized area of 50,000 or more population, plus adjacent territory that has a high degree of social and economic integration with the core, as measured by commuting ties. There are 381 defined MSAs in the United States.

[8] (US Census Bureau-2, 2014). The top 10 largest metro areas in the US are 1) New-York-Newark-Jersey City, NY-NJ-PA Metro Area, 2) Los Angeles-Long Beach-Anaheim, CA Metro Area, 3) Chicago-Naperville-Elgin, IL-IN-WI Metro Area, 4) Dallas-Fort Worth-Arlington, TX Metro Area, 5) Houston-The Woodlands-Sugar Land, TX Metro Area, 6) Philadelphia-Camden-Wilmington, PA-NJ-DE-MD Metro Area, 7) Washington-Arlington-Alexandria, DC-VA-MD-WV Metro Area, 8) Miami-Fort Lauderdale-West Palm Beach, FL Metro Area, 9) Atlanta-Sandy Springs-Roswell, GA Metro Area, and 10) Boston-Cambridge-Newton, MA-NH Metro Area. Utilities surveyed in this study operate in each except Dallas-Fort Worth-Arlington.

Table 1: Service Population of Participating Utilities by Region

Region	Total service population	Percent of Total Service Population in This Study	Total Regional Population	Share of Regional Population served
Midwest	19,100,000	23%	55,900,000	34%
Northeast	12,200,000	15%	67,500,000	18%
South	16,000,000	19%	118,400,000	14%
West	36,000,000	43%	74,300,000	48%
Total	83,000,000	100%	316,100,000	26%

Note: N = 30. Values may not total due to rounding.
Source: U.S. Census Bureau-2, 2014 for regional population estimates

On a daily basis, the utilities in this study distribute approximately seven billion gallons of water–16 percent of drinking water distributed by utility systems across the country—and collect and treat six billion gallons of wastewater–16 percent of wastewater treated by utility systems in the United States. (U.S. Geological Survey 2005; Environmental Protection Agency 2012). Many wastewater utilities included in this study also collect, treat, and return stormwater back to the environment.

In addition to water, wastewater, and stormwater management services, a number of the participating utilities provide additional services such electricity distribution and solid waste services that are not catalogued in this analysis. Table 2 summarizes the provision of water, wastewater, and stormwater services by the utilities in this study. All three services are well represented. Approximately half of participating utilities provide both water and wastewater services, while approximately 20 percent provide only water service and 30 percent provide only wastewater service. Forty percent of participating water utilities also provide stormwater service.

Table 2: Utility Services Provided by Study Participants

Region	Water Only	Water & Wastewater	Wastewater Only	Wastewater & Stormwater	Water, Wastewater, & Stormwater	Utilities
Midwest	0	0	1	3	2	6
Northeast	1	1	1	0	2	5
South	1	4	2	1	3	11
West	5	2	0	1	0	8
Total	7	7	4	5	7	30
Total (%)	23%	23%	13%	17%	23%	100%

N = 30. Stormwater service is only provided in combination with the provision of water and/or wastewater service.

Figure 2: Map of Participating Utilities

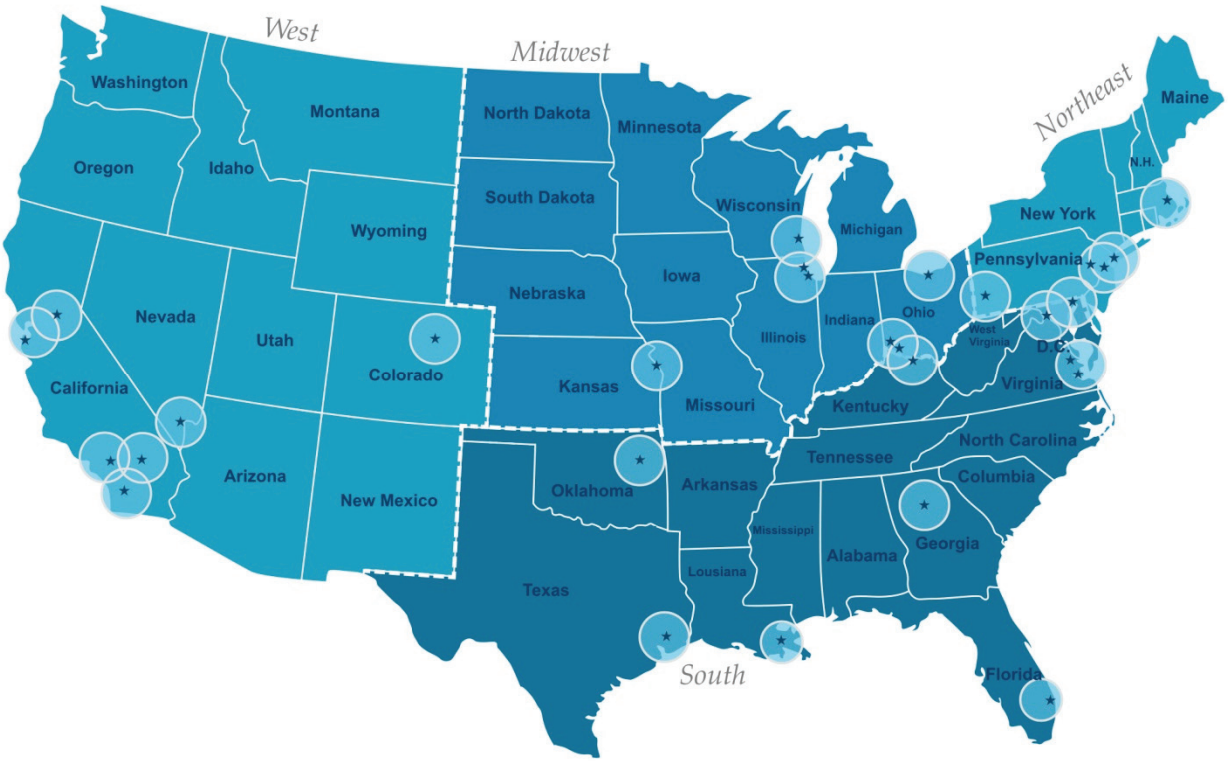


Table 3: Participating Utilities

Utility	Metropolitan Statistical Area	Region
Alexandria Renew Enterprises	Washington-Arlington-Alexandria, DC-VA-MD-WV	South
Boston Water & Sewer Commission	Boston-Cambridge-Newton, MA-NH	Northeast
Camden County Municipal Utilities Authority	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	Northeast
City of Atlanta Department of Watershed Management	Atlanta-Sandy Springs-Roswell, GA	South
City of Baltimore Water & Wastewater Utility	Baltimore-Columbia-Towson, MD	South
City of Chicago Department of Water Management	Chicago-Naperville-Elgin, IL-IN-WI	Midwest
City of Houston - Combined Utility System	Houston-The Woodlands-Sugar Land, TX	South
City of Los Angeles Sanitation	Los Angeles-Long Beach-Anaheim, CA	West
City of Tulsa Water and Sewer Department	Tulsa, OK	South
District of Columbia Water and Sewer Authority	Washington-Arlington-Alexandria, DC-VA-MD-WV	South
Denver Water	Denver-Aurora-Lakewood, CO	West
Hampton Roads Sanitation District	Virginia Beach-Norfolk-Newport News, VA-NC	South
Kansas City Missouri Water Services Department	Kansas City, MO-KS	Midwest
Los Angeles Department of Water and Power	Los Angeles-Long Beach-Anaheim, CA	West
Louisville and Jefferson County Metropolitan Sewer District	Louisville/Jefferson County, KY-IN	South
Louisville Water Company	Louisville/Jefferson County, KY-IN	South
Metropolitan Sewer District of Greater Cincinnati	Cincinnati, OH-KY-IN	Midwest

Utility	Metropolitan Statistical Area	Region
Metropolitan Water District of Southern California	Los Angeles-Long Beach-Anaheim, CA; San Diego-Carlsbad, CA; Riverside-San Bernardino-Ontario, CA	West
Metropolitan Water Reclamation District of Greater Chicago	Chicago-Naperville-Elgin, IL-IN-WI	Midwest
Miami-Dade Water and Sewer Department	Miami-Fort Lauderdale-West Palm Beach, FL	South
Milwaukee Metropolitan Sewerage District	Milwaukee-Waukesha-West Allis, WI	Midwest
Northeast Ohio Regional Sewer District	Cleveland-Elyria, OH	Midwest
NYC Department of Environmental Protection	New York-Newark-Jersey City, NY-NJ-PA	Northeast
Orange County Water District	Los Angeles-Long Beach-Anaheim, CA	West
Philadelphia Water Department	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	Northeast
Pittsburgh Water & Sewer Authority	Pittsburgh, PA	Northeast
Sacramento Regional County Sanitation District	Sacramento--Roseville--Arden-Arcade, CA	West
San Francisco Public Utilities Commission	San Francisco-Oakland-Hayward, CA	West
Sewerage and Water Board of New Orleans	New Orleans-Metairie, LA	South
Southern Nevada Water Authority	Las Vegas-Henderson-Paradise, NV	West

2.2 METHODOLOGY

The economic impact analysis of water and wastewater utilities covers a 10-year analysis period from 2014 until year-end 2023. The approach and methodology used to conduct the economic impact analysis is summarized by the following steps:

- A literature review of prior studies;
- Development and deployment of a questionnaire, issued to each of the participating utilities;
- IMPLAN analysis of economic impacts, informed by the survey data; and
- Analysis of workforce and labor data.

The following sub-sections describe the process in more detail.

Literature Review

In developing the overall approach for the economic impact analysis, the research team reviewed prior studies of water utilities' economic impacts. Of the 20 studies reviewed in detail, three quantify national economic impacts, while the remaining studies assess regional impacts or describe labor opportunities within the water sector in more qualitative terms. Like the present analysis, a majority of studies with a quantitative component use the economic modeling software, IMPLAN, to estimate indirect and induced economic impacts of water utility expenditures.

Prior national studies provide a rule of-thumb for how many jobs the water sector creates per million dollars of capital investment rather than estimate actual or planned economic impacts of specific water utilities. None of the studies considered the impact of utility operations. According to these studies, the water sector supports between nine and 22 direct, indirect and induced jobs per million dollars in capital spending (adjusted to constant 2014 dollars for comparison purposes). Of the three prior studies, the study that apportioned capital expenditures to different industries based on historical project data provided by water utility contactors yielded a significantly higher estimate of employment per million dollars than the two studies which applied a single multiplier to the

total projected infrastructure investment. This study, by PA Consulting Group (2009), estimated 19 to 25 jobs per million dollars compared to 10 to 13 jobs estimated by Heintz et al. (2009) and Gordon et al. (2011).[9]

Regional studies rely on a similar approach to the PA Consulting Group study to estimate economic impacts of water-related capital and/or operating expenditures of a single utility based on the utility's actual or planned expenditure patterns. The studies assign different multipliers to a variety of expenditure types (such as chemicals or construction materials) within the economic model to arrive at a locally specific economic impact. Regional studies of this type have estimated that water utilities create between five and 13 jobs per million dollars in capital and operating expenditures within the defined study area – or roughly half the average employment impact estimated by the national studies above.

This analysis is the first to aggregate the national economic impact of 30 major water utilities' planned operating and capital budgets. The resulting estimate reflects utilities' actual spending patterns, though the approach is not as granular as some regional studies, such as Austrian et al. (2010) and Burns and Flaming (2011), which are based on highly disaggregated budget data, each for a single water utility or single region.

Other studies have assessed the labor impacts of water and wastewater utilities in more qualitative terms. Gordon 2011 and GSP Consulting 2010, for example, rely on Bureau of Labor Statistics (BLS) data and stakeholder interviews to identify the most common water sector occupations, their wage structure, and education requirements. Labor analyses have identified "career ladders" within the water sector, or occupations with low barriers to entry and high potential for advancement, as well as "mission critical" occupations, or occupations that pose an operational risk if they are not filled (Davis 2009; Brueck et al. 2010). This analysis draws on direct survey data from utilities concerning their occupations, training offerings, and replacement needs, adding to the conclusions of prior labor analyses that the water sector provides a range of employment opportunities that are accessible at the entry-level to those with a high-school diploma, with advanced roles requiring additional training and education.

Questionnaire Development & Deployment

A questionnaire was developed and deployed to gather information to support the economic analysis. The same questionnaire form was sent to each of the 30 participating utilities. The questionnaire form was divided into four distinct sections for data collection:

- **General utility information**: The first section requested information about the utility's service offerings, departmental expenditure types, scope, scale, and funding priorities. This data was requested to help provide an introductory narrative and a context for the analysis.
- **Operations**: The second section asked about operations, including current and projected operating budgets, and departmental expenditures. This data was requested to support the economic analysis, in order to estimate direct, indirect, and induced economic impacts.
- **Capital Planning**: The third section asked about capital planning, including projected capital plan budgets and fund distribution among design, planning, and construction phases. This data was requested to support the economic analysis, in order to estimate direct, indirect, and induced economic impacts.
- **Labor Information**: The fourth and final section asked for labor information. Specific questions were asked about the size, composition, and wages of the utility's workforce. Optional questions were asked about labor programs, including training initiatives and local hire targets. This data was requested to support the labor component of the economic analysis, including qualitative analysis about advancement opportunities within the agency compared to the overall employment market.

---

[9] Employment densities adjusted for inflation and expressed in real 2014 dollars.

All 30 utilities completed the questionnaire. More information about the questionnaire development and deployment process, as well as a copy of the questionnaire, is provided in Appendix A.

IMPLAN Methodology

After establishing estimates of the labor, capital, and purchasing commitments of the 30 surveyed utilities, the research team calculated the indirect and induced economic contributions for each of the respective regions and for the nation overall. The research team relied on the economic modeling software, IMPLAN, to estimate the direct, indirect, and induced effects of water utilities' capital and operating spending. IMPLAN analyzes economic relationships between industries, households, and government institutions to estimate the employment and output impacts caused by an expected change in economic activity. This study considers water utilities' contribution to the employment and output of their suppliers (indirect effects) as well as the employment and output associated with spending by employees of water utilities and their suppliers (induced effects).[10]

Water utilities reported their existing and projected capital and operating expenditures across a broad set of expenditure categories. For operating costs, utilities reported the split between imported water, internal labor, debt service, contracts, other water-related service operations, as well as all other non-water related service operations, such as taxes and fees. For capital budgets, utilities distributed expenditures between external construction contracts, external engineering and design contracts, program management, major equipment and other capital expenses (such as internal engineering and design forces).

Each of these cost categories was coded as a specific IMPLAN activity to be inputted into the modeling software. IMPLAN activities define a broad economic change: a change in labor income, industry or institutional spending, or industry sales. The list of the IMPLAN activities assigned to each cost category is provided in Appendix C .

The direct, indirect, and induced impacts of the surveyed utilities' activities were modeled in the IMPLAN software for every study year. Per standard IMPLAN calculation protocol, impacts reported by the software were combined with additional direct impacts calculated outside of IMPLAN to determine the aggregate economic contribution of the surveyed utilities. Key modifications to direct impacts included:

- For operating impacts, the total direct effects were determined to be equal to the utility's output.
- For operating impacts, direct output excluded debt payments and other non-water related payments (such as taxes and fees) to avoid double-counting capital plan impacts.
- For capital impacts, total direct effects were determined to be the output of utility contractors and/or internal construction and engineering forces.

All economic impacts are presented in constant 2014 dollars (adjusted for inflation).

[10] Note that this study does not consider the induced economic impacts of ratepayer fees paid by households nor does it estimate the indirect contribution of affordable and reliable water to industries, households, and local commercial establishments. Rather, the economic impact analysis focuses on the direct economic investments made by the 30 surveyed utilities and how those investments resonate through the economy.

3. Analysis & Findings

3.1 OPERATING & CAPITAL PLAN BUDGETS

Overview

Over the next decade, the utilities in this study plan to spend an aggregate total of $23 billion per year for operations and capital expenditures. These plans represent the utilities' ongoing commitment to provide safe, clean, and affordable services to their clients and to the public. Approximately 60 percent of projected spending is attributable to the ongoing operation of the utilities and 40 percent is for capital infrastructure investments to maintain systems in a state of good repair.

Table 4: Aggregate Utility Expenditure Projections by Year (in $ billions)

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total
Operations	$12.4	$12.9	$13.2	$13.7	$14.2	$14.6	$15.2	$15.8	$16.4	$17.1	$145.5
Capital Plan	$10.0	$8.9	$9.6	$9.8	$9.2	$9.2	$8.6	$8.2	$7.3	$7.3	$88.1
Total	$22.40	$21.80	$22.80	$23.50	$23.40	$23.80	$23.80	$24.00	$23.70	$24.40	$233.6

N = 30. Projections are expressed in nominal dollars. Values may not total due to rounding.

Operating Expenditures

The operating and maintenance budgets of the surveyed water utilities fund their ongoing efforts to provide safe, clean, and affordable water and wastewater services to their clients. In 2014 alone, the aggregate operating expenditures reported across surveyed utilities total $12.4 billion, with the average operating budget per surveyed utility in 2014 being more than $400 million.

Table 5: Operating Expenditures for 2014

Region	Aggregate Expenditures in 2014	Average Expenditure per Utility
Midwest	$2,297,000,000	$383,000,000
Northeast	$2,754,000,000	$551,000,000
South	$3,382,000,000	$307,000,000
West	$3,966,000,000	$496,000,000
Total	$12,399,000,000	$413,000,000

N = 30 utilities. As reported by surveyed utilities, in nominal dollars.

Operating and maintenance costs escalate over time. The reported escalation rate for utility operating costs averages 3.5 percent per year for the next decade, a reflection of increasing maintenance needs and higher costs of commodities such as energy and chemicals, combined with inflation. Over this period, surveyed utilities are projected to spend a total of $146 billion dollars to provide water and wastewater services to their customers.

The average operating expenditure per surveyed utility is projected to be $485 million per year. Table 6 summarizes the operating budget projections for the analysis period by region.

Table 6: Operating Expenditure Statistics for the Next Decade

Region	Aggregate Operating Expenditures (10 years)	Average Annual Expenditure per Utility
Midwest	$28,364,000,000	$473,000,000
Northeast	$32,108,000,000	$642,000,000
South	$40,551,000,000	$369,000,000
West	$44,475,000,000	$556,000,000
Total	$145,498,000,000	$485,000,000

Note: N = 30 utilities. As reported by surveyed utilities, in nominal dollars.

The distribution of operating expenses is categorized into six broad classifications, as shown in Table 7:

- Imported water purchases;
- Labor costs (utility staff salaries and benefits);
- Debt payments;
- External contracts;
- Other water-related service operations; and
- All other non-water operations.

Table 7: Allocation of Operating Expenditures

Region	Utility Labor	Contracts	Debt Payments	Imported Water	Other Service Operations	Non-Water Operations
Midwest	26%	46%	25%	0%	3%	0%
Northeast	37%	17%	13%	7%	18%	7%
South	29%	26%	29%	1%	16%	0%
West	25%	16%	21%	25%	13%	1%
Total	29%	24%	22%	10%	13%	2%

N = 30 utilities.

On an aggregate basis, utilities spend 29 percent of their operating budgets on staff and labor costs. Contracts with external companies, consultants, construction contractors or other agencies constitute, on average, another 24 percent of operating expenditures. Approximately 22 percent of operating costs are used to service water utility debt. Buying imported water accounts for an average of 10 percent of the operating expenditures. Other water-related service operations account for 13 percent of expenditures. The remaining two percent of operating budgets are used for all other non-water operations.

The most notable regional variation is in the West, which expends a quarter of its operating funds on imported water. This is not surprising, given the concentration of population centers in semi-arid locations such as Los Angeles, San Diego, Phoenix, etc. The Midwest, Northeast, and South regions all spend less than 10 percent of their operating budgets on water imports. In the Midwest, almost half of the operating expenses are work contracts with external partners. In the West, Northeast, and South, contracts constitute less than a quarter of the operating expenses.

Capital Plan Expenditures

Capital expenditures are intended to fund the planning and construction of utility infrastructure necessary for our future. Over the next decade, participating utilities will be: replacing aging infrastructure, improving local water quality, expanding services to accommodate increased demand, building system resiliency in the face of rising natural risks, and responding to an assortment of other needs that are driving investments in water infrastructure

throughout the nation. In 2014 alone, surveyed utilities have committed to spend $10.0 billion on capital plan investments (Table 8).

Table 8: Capital Expenditures for 2014

Region	Aggregate Expenditures in FY14	Average Expenditure per Utility
Midwest	$1,729,000,000	$288,000,000
Northeast	$3,358,000,000	$672,000,000
South	$2,860,000,000	$260,000,000
West	$2,102,000,000	$263,000,000
Total	$10,049,000,000	$335,000,000

N = 30 Utilities. As reported by surveyed utilities, in nominal dollars.

An aggregate total of $88 billion dollars has been committed towards capital plan expenditures by the surveyed water utilities over the next decade. Annually, the aggregate capital plan commitment for the surveyed utilities is projected to range from $7 to $10 billion per year. Reported capital plan commitments are relatively constant over time, changing by less than 10 percent from year to year over the study period. Table 9 summarizes the capital budget projections for the analysis period by region.

Table 9 : Capital Expenditures for the Next Decade

Region	Aggregate Capital Spending (10 years)	Average Annual Expenditure per Utility
Midwest	$15,968,000,000	$266,100,000
Northeast	$16,460,000,000	$329,200,000
South	$27,967,000,000	$254,200,000
West	$27,744,000,000	$346,800,000
Total	$88,140,000,000	$293,800,000

N = 30 Utilities. As reported by surveyed utilities, in nominal dollars.

By funding these capital improvements, the utilities in this study are making an $88 billion contribution to the nation's critical water infrastructure needs. While sizeable, this commitment represents only a modest portion of the nation's unfunded water infrastructure needs. The Environmental Protection Agency has estimated the nation's capital need over the next 20 years to be approximately $720 billion in total: 56 percent ($400 billion) for drinking water infrastructure and 44% ($320 billion) for wastewater infrastructure (EPA 2008; EPA 2013; adjusted to 2014 dollars). A study by the American Society of Civil Engineers (ASCE) estimates that across the nation, up to two-thirds of water infrastructure needs through 2020 remain unfunded (ASCE 2013). More than half of the utilities surveyed for this study (17 of 30) report that current revenues do not cover the cost of their anticipated capital needs, including more than one-third (11 of 30) who report a "large gap" between revenues and capital expenditure needs.

3.2 ECONOMIC IMPACTS

All economic impacts are expressed in constant 2014 dollars (adjusted for inflation).

Total Impact

Through their operating and capital expenditures, the surveyed utilities will generate $52 billion in annual economic output across the United States, supporting 289,000 jobs per year. In other words, over the next decade, surveyed utilities will contribute a total of $524 billion in economic output to the national economy.

Water, wastewater, and stormwater utilities will contribute $524 billion to the economy over the next decade, supporting 289,000 permanent jobs.

Output refers to the market value of goods and services produced directly by the utilities in this study and indirectly by their expenditures and employee wages. In other words, the utilities' initial expenditures for materials, services, and labor (their *direct effects*) are transferred to other businesses and their employees. These businesses and their employees then engage in additional spending for materials and services (their *indirect and induced effects)*. The original utility expenditures thereby ripple across their local economies and positively impact the overall economic health and vitality of individual regions and the nation as a whole.

Jobs refer to employment that will be provided by the utilities (their *direct effects*) and within other industries that are supported by utility expenditures and employee wages (their *indirect and induced effects*).

The surveyed utilities will generate direct impacts of $17.9 billion in annual economic output and support jobs for approximately 86,600 employees.[11] Indirect and induced operating impacts amount to approximately $34.5 billion in annual economic output and support 201,900 jobs per year.

Table 10: Total Economic Impact of Surveyed Utilities

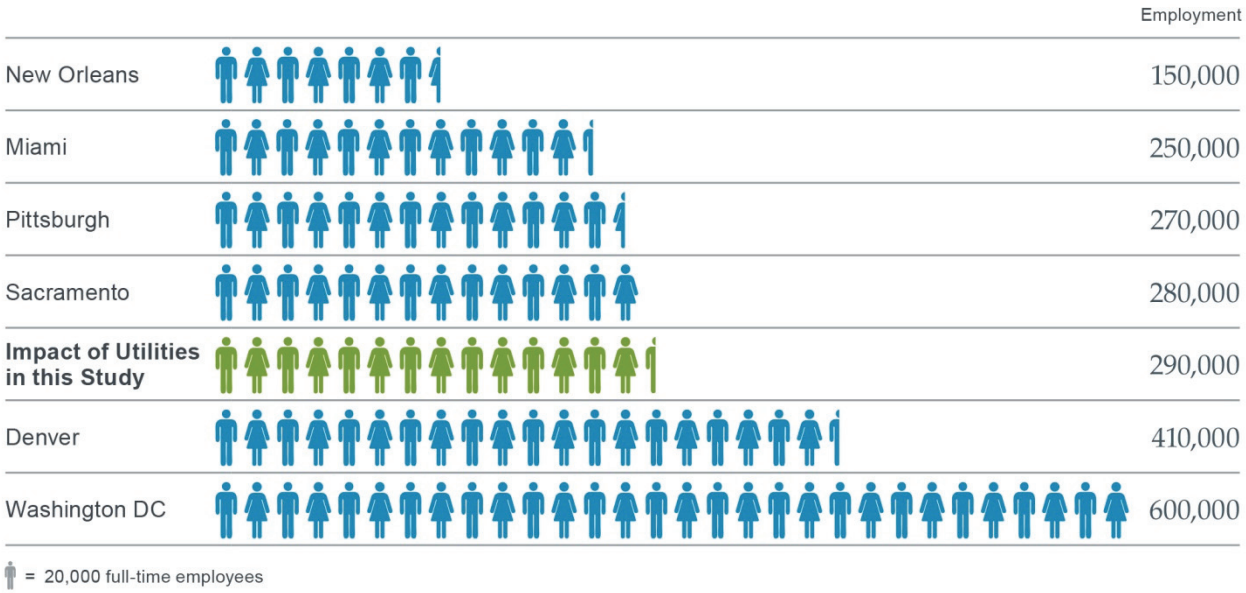
	Employment	Labor Income	Output
Aggregate Impact over 10 years	2.89 million job-years	$188.6 billion	$524.1 billion
Annual Impacts	288,500 jobs	$18.9 billion/year	$52.4 billion/year
Subtotal: Direct effect	86,600 jobs	$7.1 billion/year	$17.9 billion/year
Subtotal: Indirect effect	88,500 jobs	$5.9 billion/year	$16.7 billion/year
Subtotal: Induced effect	113.500 jobs	$5.8 billion/year	$17.7 billion/year

N = 30. Impacts are expressed in constant 2014 dollars. Values may not total due to rounding. Labor income includes benefits and payroll taxes.

To put this level of economic activity into context, the total annual employment impact of the utilities in this study exceeds the total workforce of many American cities, including the cities of New Orleans (150,000), Miami (250,000 employees), Pittsburgh (270,000 employees), and Sacramento (280,000 employees), (U.S. Census Bureau 2013). The combined economic contribution exceeds the gross regional product of metropolitan regions such as Chattanooga, Tennessee; Springfield, Massachusetts; Huntsville, Alabama; and Santa Barbara, California (Bureau of Economic Analysis 2013).

[11] Direct impacts include engineering, design and construction contractors that directly supply goods and services to utilities' capital projects.

Figure 3: Total Employment Contribution of Utilities in this Study Compared to Total Employment of U.S. Cites



On average, every $1 million in direct spending by surveyed water and wastewater utilities supports 16 jobs across all sectors of the economy. Note that this estimate excludes taxes, fees, and debt service from direct spending, which may differ from previous economic impact studies. As illustrated in the table below, the labor intensity of spending by surveyed utilities falls within the range of prior economic studies of the water sector.

Table 11: Jobs per $1 Million of Spending in the Water Sector

	AECOM	Gordon 2011	PA Consulting 2009 (Low)	PA Consulting 2009 (High)	Heintz 2009
Expenditure Type	Operating & Capital	Capital	Capital	Capital	Capital
Jobs per $1 million	16	10	19	25	15
Study Year	2014	2011	2009	2009	2009

All values expressed in constant 2014 dollars, adjusted to 2014 using IMPLAN inflation factors. Jobs per $1 million = total jobs divided by direct output. Sources: Gordon et al. 2011, PA Consulting 2009, Heintz 2009

When compared to prior economic impact studies of other sectors, investments by utilities in this study generate similar job impacts as compared to investments in clean energy, transportation, and health care. Further, investments by participating utilities generate more jobs per $1 million than investments in military spending, personal income tax cuts, or retail spending on general merchandise (U.S. Department of Transportation 2013, Heintz et al. 2009 and Heintz et al. 2011).

Table 12: Jobs per $1 Million of Investment in the Water Sector Compared to Other Sectors

Investment	Jobs per $1 million	Expenditure type	Source
Water, Wastewater, & Stormwater	16	Capital and operating	AECOM 2014
Transportation	13 – 20	Capital	Heintz et al. 2009 & 2011, USDOT 2013
Clean Energy	13 – 16	Capital	Heintz et al. 2009 and 2011
Healthcare	16	Operating	Heintz et al. 2011
Personal income tax cuts	14	Personal spending	Heintz et al. 2011
Retail spending on general merchandise	13	Personal spending	AECOM 2014
Military spending	11	Capital and operating	Heintz et al. 2011

All values expressed in constant 2014 dollars, adjusted to 2014 using IMPLAN inflation factors.

Operating Impacts

The projected operating expenditures of the surveyed utilities in this study will generate $29.9 billion in annual economic outputs to the nation and will sustain 157,400 jobs per year over the next decade. This represents an aggregate value of $299.4 billion over ten years.

Operations will generate $299 billion in economic activity over the next 10 years and support 157,400 jobs.

Over the next decade, operating expenditures at the surveyed utilities will generate direct impacts of $9.9 billion in annual output and support jobs for 36,600 utility employees. Indirect operating impacts amount to nearly $9.9 billion in economic output per year and support an additional 55,500 jobs. Induced operating impacts support another $10.2 billion in economic output per year and sustain 65,200 jobs.

In addition to Water and Sewer, other industries most impacted by utilities' operating expenditures, in order of employment contribution, include: Maintenance and Repair Construction of Nonresidential Structures; Food Services and Drinking Places: Accounting and Payroll Services; Real Estate Establishments: and Architectural, Engineering, and Related Services.[12]

Table 13: Economic Impact of Operating Expenditures

	Employment	Labor Income	Output
Aggregate Total over 10 years	1.57 million job years	$108.6 billion	$299.4 billion
Annual Total	157,400 jobs	$10.9 billion/year	$29.9 billion/year
Subtotal: Direct effect	36,600 jobs	$3.8 billion/year	$9.9 billion/year
Subtotal: Indirect effect	55,500 jobs	$3.7 billion/year	$9.9 billion/year
Subtotal: Induced effect	65,200 jobs	$3.3 billion/year	$10.2 billion/year

N = 30. Impacts are expressed in constant 2014 dollars. Values may not total due to rounding.

[12] IMPLAN 2013 industry sector categories.

Capital Plan Impacts

The projected capital plan investments of the surveyed utilities in this study will generate $22.5 billion in annual economic outputs to the nation and will sustain 131,100 jobs per year for the next decade. Altogether, this represents an aggregate value of $224.7 billion over ten years.

Capital plan investments will generate $225 billion in economic activity over the next 10 years and support 131,100 jobs.

As with operating budget impacts, capital plan budget impacts can be broken down into direct, indirect and induced impacts. Over the next decade, surveyed utilities' capital plan expenditures will generate direct impacts of $8.1 billion in annual output and support jobs for 49,900 utility employees. Indirect impacts add another $6.9 billion in annual output and 33,000 jobs. Induced impacts support another $7.5 billion in economic output and sustain 48,200 jobs per year.

Table 14: Economic Impact of Capital Plan Commitments

	Employment	Labor Income	Output
Aggregate Total over 10 years	1.31 million job years	$79.9 billion	$224.7 billion
Annual Total	131,100 jobs	$8.0 billion/year	$22.5 billion/year
Subtotal: Direct effect	49,900 jobs	$3.3 billion/year	$8.1 billion/year
Subtotal: Indirect effect	33,000 jobs	$2.2 billion/year	$6.9 billion/year
Subtotal: Induced effect	48,200 jobs	$2.5 billion/year	$7.5 billion/year

N = 30. Impacts are expressed in constant 2014 dollars. Values may not total due to rounding.

3.3 LABOR IMPACTS

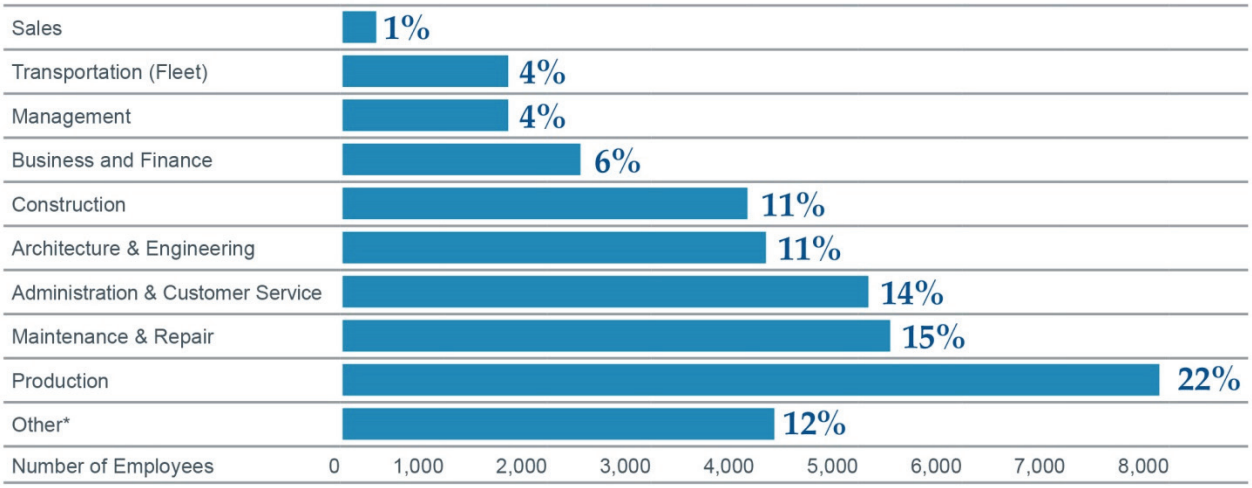
Overview

Water utilities provide residents in our communities with access to stable, high-quality jobs with competitive wages and benefits. Utilities in this study anticipate significant replacement hiring needs over the next decade, with nearly a third of their existing workforce currently eligible for retirement. In order to help satisfy this pending demand, utilities are actively engaged in workforce development activities, laying a path for the next generation of employees to access careers in the water sector that will operate and maintain our critical water systems. These positions are not only in engineering, but represent a full spectrum of occupation needs from business management to administration and customer service.

Occupational Structure of the Water Sector

The surveyed utilities directly employ 36,500 full-time workers in high-quality, stable jobs with competitive wages and benefits. At least seventy percent of employees are concentrated in the production, maintenance, administrative, engineering, and construction occupations, according to surveyed utilities. As described below, employment in the water sector requires specialized skills and is rewarded with competitive pay. In six of eight occupational categories, average salaries at surveyed utilities exceed national averages.

Figure 4: Water Sector Employment by Occupation at Utilities in this Study



N = 30. 26 utilities reported detailed occupational data. "Other" includes uncategorized data as well as the employment figures for utilities that did not provide detailed information regarding their employment distribution.

Prior workforce studies of the water sector have identified "mission critical positions," or occupations that pose a serious risk to operations if they are not filled (Davis 2009; Brueck et al. 2010). These studies, combined with information reported by BLS regarding occupations that are common to the water sector, help provide detail on the specific occupations that water sector employees hold. The table below lists common job titles of water sector employees by occupational group and highlights those jobs identified as mission critical. Most mission critical occupations are concentrated in the production, maintenance, administrative, engineering, and construction occupational groups. A detailed description of the full range of occupations encompassed by each of these occupational groups can be found in Appendix D.

Table 15: Common & Mission Critical Occupations

Occupational Group	Common Occupations – Water Sector
Production Occupations	Water and wastewater treatment plant and system operators ♦ First line supervisors of production workers ♦ Machinists ♦
Installation, maintenance, and repair occupations	Maintenance and repair workers, general ♦ Industrial machinery installation, repair, and maintenance workers ♦ Electronic Maintenance Technicians ♦ First line supervisors of mechanics and maintenance workers ♦
Customer Service and Administrative occupations	Customer service representatives ♦ Meter readers, utilities Office clerks, general Secretaries and administrative assistants, except legal, medical, and executive
Architecture and Engineering occupations	Engineering technicians, except drafters ♦ Environmental engineers ♦ Civil engineers

Occupational Group	Common Occupations – Water Sector
Construction and extraction occupations	Electricians ♦ Pipelayers, plumbers and steamfitters ♦ Construction Laborers
Business and Financial Operations occupations	Accountants and auditors Business operations specialists, all other
Management occupations	General and operations managers ♦ Financial managers Industrial production managers

♦ = identified as "mission critical" in prior studies
Source: BLS-2 2013, McTigue and Mansfield 2013, Snow and Mutschleer 2012, SFPUC 2012, GSP Consulting 2010, Brueck et al. 2010, Davis 2009, and Manning et al. 2008.

Replacing an Aging Workforce

According to the Bureau of Labor Statistics, the median water sector employee is 48 years old—six years senior to the national median employee age of 42. Meanwhile, the typical water and wastewater employee retires at age 56 (BLS-3 2013; Brueck et al. 2010). Due to a number of circumstances, including the pending retirement of the Baby Boomer-generation, surveyed utilities are anticipating unprecedented replacement needs over the next decade. Sixty percent report that they actively track the aging of their workforce, and 40 percent currently have a succession plan in place.

Among participating utilities that provided an estimate of retirement eligibility, twenty percent of employees are currently eligible for regular retirement, while another 10 percent of employees are eligible for early retirement. Thus, extrapolating to the larger population, nearly a third of the total workforce at water, wastewater, and stormwater utilities may be eligible for some form of retirement benefit.[13] This finding correlates to a recent study by the Water Research Foundation, which projects that 37 percent of water utility workers and 31 percent of wastewater utility workers will retire over the next decade (Brueck et al. 2010). Replacement needs within the water sector over the next decade exceed the 23 percent nationwide replacement need of the total workforce (BLS-2 2012). If this projection is realized, as many as 12,400 jobs will be vacated over the next decade at the utilities participating in this study,[14] not including workers contracted to the utilities by outside firms, who represent an additional replacement opportunity.

Training and Hiring the Next Generation

The water sector offers challenging and rewarding employment to workers with a range of educational and training backgrounds. With as many as 12,400 anticipated job openings[15] over the next decade, many of the utilities in this study are engaged in training and professional development initiatives to support successful career entry and advancement of the next generation of workers.

As shown in Table 16, a majority of career paths offered by surveyed utilities can be accessed with a high school degree or equivalent. However, the majority of entry-level workers will require additional education or training to advance their careers at water, wastewater, and stormwater utilities. As an example, entry-level wastewater

[13] Figures are a weighted average of the 14 water and wastewater utilities that were able to estimate retirement eligibility. These utilities reported on the retirement eligibility of 14,500 of the 36,500 workers employed by all 30 water and wastewater utilities.

[14] Assumes a 34% replacement rate (the average of water and wastewater) (Brueck et al. 2010).

[15] Calculation based on previous two footnotes.

treatment plant operators can access an apprenticeship with a high school diploma by demonstrating basic aptitudes in math, English and mechanical and electrical principles (see Table 17). To advance, operators must acquire additional professional and academic skills, as well as professional certification, through college-level coursework and on-the-job training.

At least half of surveyed utilities provide regular on-the-job skills training, and an equal number participate in workforce training programs to ensure that new workers are properly prepared for employment opportunities. At one-third of the utilities in this study (10 of 30), local and/or disadvantaged residents receive priority for filling vacancies through local hiring programs. Two-thirds of utilities (21 of 30) also emphasize the hiring of external contractors that are locally owned businesses, women-owned businesses, minority-owned businesses, or other businesses owned by other defined groups.

Table 16: Entry-Level Educational Requirements, by Occupation, at Utilities in this Study

Occupational Group	Typical Educational Requirement for Entry-Level Position at Surveyed Utilities	Comparison to BLS National Standard
Production	High School diploma	On par
Maintenance and Repair	High School diploma	On par
Administrative Support	High School diploma	On par
Architecture and Engineering	2- or 4-year degree	Lower / on-par
Construction	High school diploma	On par
Business and Finance	Bachelor's degree	On par
Management	Bachelor's degree	On par
Transportation	High school diploma	On par
Sales	High school diploma	On par

Source: AECOM survey 2014 and BLS 2012. N = 26 utilities. "On par" = the same or equivalent educational requirement.

Table 17: Typical Wastewater Treatment Plant Operator Career Ladder

Job Characteristics	Entry Level	Mid-Level	Executive
Job Titles	Pre-apprentice/ apprentice	Wastewater treatment plant operator Sanitary engineer	Stationary engineer plant chief Sewage treatment plant superintendent Division manager
Education Requirement	High School diploma	+ Relevant college-level coursework	+ Associate's degree including 15 semester units of science courses
Technical Aptitudes	Math, English, Mechanical and Electrical	+ Basic Biology and Chemistry	+ Administration
Professional Aptitudes	Basic soft skills such as dependability and effective communication	+ Knowledge of plant processes and procedures	+ Ability to plan and direct plant activities, supervise staff, and liaise with other departments
Experience	0 years +	4 years +, offset with additional education	6 years +, offset with additional education
Professional Certification	None, or Grade I	Grade II	Grade IV or V
BLS National Wage Estimate	$26,000 - $34,000	$34,000 - $68,000	$68,000 - $90,000

Source: Davis 2009 , BLS-2 2013, and AECOM 2014. Requirements listed above are additive. In other words, all entry-level aptitudes also apply to senior positions. Entry-level wages are assumed to earn between the 10th and 25th percentile operator wages, mid-level operators are assumed to earn between the 25th to 90th percentile and executive-level staff wages are assumed to represent the 75th to 90th percentile of production supervisor earnings. Professional Certification is earned through a combination of professional experience and educational training.

SUPPORTING PROSPERITY

Water, wastewater, and stormwater utilities are generating new economic opportunities in our communities by their commitments to constructing, operating, and maintaining safe and reliable water systems. Utility employment represents a full spectrum of rewarding careers, and utilities are making sure the next generation of workers receives the necessary training and education to access quality career pathways.

This study has shown that the opportunities generated by water utilities extend to the industries that supply goods and services to support their activities, from construction and engineering services to chemical manufacturing. Altogether, investments by the water utilities in this study support 289,000 jobs in many different sectors of the economy.

This study estimates the economic contributions resulting from the operating and capital expenditures of water, wastewater, and stormwater utilities. Considering the essential nature of these utilities to public health, business, and the environment, the findings of this study represent only a portion of the water sector's total economic value in our national economy.

Bibliography

Works Cited

AECOM. 2014. National Economic and Labor Impacts of the Water Utility Sector. Water Research Foundation and Water Environment Research Foundation.

ASCE. 2013. Failure to Act: The Impact of Current Infrastructure Investment on America's Economic Future.

Austrian, Z., Clouse, C., and I. Lendel. 2010. Northeast Ohio Regional Sewer District: Economic Impact of Operating and Capital Expenditures, 2012-2016. Center for Economic Development.

Bureau of Economic Analysis. 2012. Industry Economic Accounts. Quoted in National Association of Manufacturers. Facts About Manufacturing in the United States [Online]. Available at: <http://www.nam.org/Statistics-And-Data/Facts-About-Manufacturing/Landing.aspx>. [cited June 23, 2014]

Bureau of Economic Analysis. 2013. GDP by Metropolitan Area, Advance 2012, and Revised 2001–2011. Available at: http://www.bea.gov/newsreleases/regional/gdp_metro/gdp_metro_newsrelease.htm

BLS. 2013. Industry-occupation matrix data, by industry. Table 1.9. Available at: <http://www.bls.gov/emp/ep_table_109.htm> [accessed June 20, 2014]

BLS-2. 2013. Metropolitan and Nonmetropolitan Area Occupational Employment and Wage Estimates. Available at: http://www.bls.gov/oes/2013/may/oessrcma.htm [Accessed June 2014]

BLS-3. 2013. Employed Persons by Detailed Industry and Age. Available at: <www.bls.gov/cps/industry_age.xls> [accessed July 29, 2014]

BLS. 2012. Education and training assignments by detailed occupation. Available at: <http://www.bls.gov/emp/ep_table_112.htm> [Accessed June 2014]

BLS-2. 2012. Replacement needs projected, 2012-2022. Available at: < http://www.bls.gov/emp/ep_table_110.htm> [accessed July 29, 2014]

BLS. 2010. Standard Occupational Classifications. Available at: < http://www.bls.gov/soc/> [accessed August 18, 2014]

Brueck, T., M. Isbell, D. O'Berry, and P. Brink. 2010. Water Sector Workforce Sustainability Initiative. WRF and American Water Works Association Available at: http://www.waterrf.org/PublicReportLibrary/4206.pdf [cited July 29, 2014]

Burns, P., and D. Flaming. 2011. Water Use Efficiency and Jobs. Economic Roundtable.

Davis, C. 2009. Water and Wastewater Occupations - Bay Region. Center of Excellence -California Community Colleges.

Department of the Interior. 2013. National Park Service Fiscal Year 2013 Budget Justifications.

EPA. 2002. Community Water System Survey 2000. DIANE Publishing.

EPA. 2008. Clean Watershed Needs Survey 2008. Report to Congress.

EPA. 2012. Public Drinking Water Systems: Facts and Figures [Online]. Available at: <http://water.epa.gov/infrastructure/drinkingwater/pws/factoids.cfm>. [cited June 23, 2014]

EPA. 2013. Drinking Water Infrastructure Needs Survey and Assessment: Fifth Report to Congress.

EPA. 2014. Water Use Today [Online]. Available at: <http://www.epa.gov/watersense/our_water/water_use_today.html>. [cited June 23, 2014]

Gordon, E., et al. 2011. Water Works: Rebuilding Infrastructure, Creating Jobs, Greening the Environment. Green For All.

GSP Consulting and Ecolibrium Group. 2010. Capturing the Storm: Profits, Jobs, and Training in Philadelphia's Stormwater Industry. Business United for Conservation Industry Partnership.

Heintz, J., Polin, R., and H. Garrett-Peltier. 2009. How Infrastructure Investments Support the U.S. Economy: Employment, Productivity and Growth. Political Economy Research Institute. University of Massachusetts-Amherst.

Heintz, J., Polin, R., and H. Garrett-Peltier. 2011. The U.S. Employment Effects of Military and Domestic Spending Priorities. Political Economy Research Institute. University of Massachusetts-Amherst.

IMPLAN Group. 2013. IMPLAN System (data and software), 16740 Birkdale Commons Pkwy, Suite 206, Huntersville, NC 28078. www.implan.com

Kenny, J.F., Barber, N.L., Hutson, S.S., Linsey, K.S., Lovelace, J.K., and M.A. Maupin. 2009. Estimated use of water in the United States in 2005. U.S. Geological Survey Circular 1344.

Manning, A., Brueck, T., Isbell, M., and P. Brink. 2008. Workforce Planning for Water Utilities - Successful Recruiting, Training, and Retraining of Operators and Engineers.

McTigue, N., and R. Mansfield. Competency Model Development and Application to Meet Water Utility Workforce Needs. 2013. Water Research Foundation.

National Park Service. 2014. Mississippi River Facts [Online]. Available at: <http://www.nps.gov/miss/riverfacts.htm>. [cited June 23, 2014]

Office of Management and Budget. 2013. Revised Delineations of Metropolitan Statistical Areas, Micropolitan Statistical Areas, and Combined Statistical Areas, and Guidance on Uses of the Delineations of These Areas. OMB Bulletin No. 13-01. Washington CD: OMB.

PA Consulting Group. 2009. Sudden Impact: An Assessment of Short-Term Economic Impacts of Water and Wastewater Construction Projects in the U.S. Clean Water Council.

Peter G. Peterson Foundation. 2014. The U.S. spends more on defense than the net eight countries combined [Online]. Available at : <http://pgpf.org/Chart-Archive/0053_defense-comparison>. [cited June 23, 2014]

Snow, M. and D. Mutschleer. 2012. Promoting Entry to Career Pathways in the Drinking Water and Wastewater Sector. Lowell Center for Sustainable Production University of Massachusetts Lowell and the Massachusetts Workforce Alliance.

SFPUC 2012. Five Year Strategic Plan for Workforce Reliability in Operations. San Francisco Public Utilities Commission.

U.S. Census Bureau-1. 2014. Census Regions and Divisions of the United States [Online]. Available at: <https://www.census.gov/geo/maps-data/maps/pdfs/reference/us_regdiv.pdf>. [cited May 28, 2014]

U.S. Census Bureau-2. 2014. Annual Estimates of the Resident Population: April 1, 2010 to July 1, 2013. U.S. Census Bureau, Population Division.

U.S. Census Bureau. 2013. LODES Data. Longitudinal-Employer Household Dynamics Program. <http://lehd.ces.census.gov/applications/help/onthemap.html> [accessed August 8, 2014]

U.S. Census Bureau. 2012. American Community Survey: DP03: Selected Economic Characteristics (1-year estimates).

U.S. Census Bureau 2010. Land Area in Square Miles by Urban and Rural and Size of Place: 2000 and 2010.

U.S. Department of Transportation (USDOT). 2013. Employment Impacts of Highway Infrastructure Investment. Available at: < http://www.fhwa.dot.gov/policy/otps/pubs/impacts/> [cited July 31, 2014]

USGS. 2005. Total Water Use in the United States, 2005 [Online]. Available at: <http://water.usgs.gov/edu/wateruse-total.html>. [cited June 23, 2014]

Utah Geological Survey. Great Salt Lake [Online]. 2013. Available at: <http://geology.utah.gov/online_html/pi/pi-39/pi39pg04.htm>. [cited June 23, 2014]

Van Riper, Tom. 2008. America's Most Lucrative Sports Arena [Online]. Available at: <http://www.forbes.com/2008/08/11/sports-stadiums-biz-sports-cx_tvr_0811stadiums.html>. [cited June 30, 2014]

Works Consulted

Berkman, M., Sunding, D., and M. Tran. 2011. Employment Impacts for Proposed Bay Delta Water Conveyance Tunnel. Delta Habitat Conservation and Conveyance Program.

Berkman, M., Sunding, D., and M. Tran. 2013. Technical Memorandum on Recommended Methodology for Estimating Employment Impacts of Water Related Infrastructure Projects. Berkeley Economic Consulting.

Clouse, C., et al. 2013. Northeast. Ohio Regional Sewer District: Job Opportunity Analysis, 2013-2036. Center for Economic Development, Maxine Goodman Levin College of Urban Affairs Cleveland State University.

Energy Information Administration. 2013. Electric Sales, Revenue, and Average Price: T3 [Online]. Available at: <http://www.eia.gov/electricity/sales_revenue_price/>. [Accessed June 23, 2014]

EIA-2. 2013. Monthly Generation Data by State, Producer Sector and Energy Source; Months Through December 2013. EIA-923 Report.

Morrison, Brian. 2013. The Importance of Water to the U.S. Economy. Synthesis Report, Contract No. EP-W-10-002. Washington, DC: U.S.EPA.

Pajl, M.J., DeBoer, D., Taylor, G., and D. Adamson. 2009. Economic Impact of South Dakota's Regional Water Systems. Regional Water System Research Consortium.

Stratus Consulting Inc. 2013 Economic Impacts of Alternative Combined Sewer Overflow Control Strategies: Evaluation of Green and Grey Infrastructure Approaches for the DC Clean Rivers Project. District of Columbia Water and Sewer Authority.

U.S. Department of Agriculture. 2014. U.S.D.A. Agricultural Projections to 2023. Long-term Projections Report OCE-2014-1: 97. Prepared by Interagency Agricultural Projections Committee for the Office of the Chief Economist, World Agricultural Outlook Board.

World Bank. 2014. GDP (current U.S.$) [Online]. Available at: <http://data.worldbank.org/indicator/NY.GDP.MKTP.CD>. [cited June 23, 2014]

Appendix

Appendix A

UTILITY SURVEY: DEVELOPMENT, DEPLOYMENT, AND QUESTIONNAIRE

Appendix D outlines in more detail the process for developing and deploying the survey issued to each of the 30 participating water utilities. . The data from this survey informs the economic and workforce analysis. A copy of the survey questions is also included in this appendix.

Survey Development

Survey questions were developed to support the economic analysis as well as provide contextual information for each utility. Questions were reviewed internally and refined for application to water, wastewater, and stormwater utilities. The client team and the project advisory committee then reviewed the draft survey questions and provided feedback and comments. Comments from the client and advisory parties were incorporated to prepare the finalized survey questions. The finalized survey questions were formatted into a macro-enabled survey form for deployment.

Survey Deployment

WRF and WERF representatives developed a list of potential participants, and then contacted each of the potential utilities to confirm their willingness to participate in the economic study. WRF and WERF briefed utility representatives on the participation expectations and advised them of the forthcoming survey. The survey was emailed with an explanatory cover letter to each of the 30 participating utilities. The cover letter provided information on free, optional webinars to help clarify the survey format and purpose, provide instructions for filling out and submitting the survey, and answer any questions utilities might have about the survey. Utilities were also provided with the contact information for two survey administrators, who would be available to answer questions about the survey over telephone or email.

Upon completion, surveys were submitted via email to the survey administrators who confirmed receipt, verified survey responses, and performed any follow-up with individual utilities as necessary to clarify responses in preparation for running the economic analysis.

Questionnaire

A copy of the questionnaire form used for the utility survey is included on the following pages.

Figure 5: Copy of Survey Questionnaire

Survey Questionnaire

Economic and Labor Impact Analysis of Water and Wastewater Utilities

Pages: 1 2 3 4

Required Field | Optional Field | Not Applicable | URL Hyperlink

GENERAL UTILITY INFORMATION

This section of the survey will ask questions regarding the utility's purpose, organizational structure, and size and scale of operations. The responses will be used to categorize the economic impacts of the utility and provide comparisons across the region and the nation.

1.1

Utility Name	
Respondent name	
Title	
Department	
Email	
Phone	

1.2

When does your fiscal year begin/end?	

1.3

What is your organization type?	

1.4

List all services your utility provides	
Please explain "Other"	

1.5 For water services:

What is your average daily flow? (gal/day)	
What is your average daily flow capacity? (gal/day)	
What is your water treatment plant capacity? (gal/day)	

1.6 For wastewater services:

What is your average daily flow? (gal/day)	
What is your average daily flow capacity? (gal/day)	
What is your wastewater treatment plant capacity? (gal/day)	

1.7 Regarding wastewater:

How much wastewater is conveyed to a regional wastewater treatment facility? (gal/day)	

1.8 For stormwater services:

What is your design storm? [Ex.: 10-year storm]	
What is your established level of service?	

1.9

What is the utility's total estimated service population (include both retail and wholesale service population)?	

Provide additional comments or clarifications in the text box below:

1.10 What is the geographic extent of your service area (in square miles, for your service population)?

	Retail	Wholesale
Water Service		
Wastewater Service		
Stormwater Service		

1.11 What was your utility's annual revenue in the last fiscal year?

Total Revenue		$ -
Water Service Revenue		
Wastewater Service Revenue		
Stormwater Service Revenue		
Pass-Through Revenues		
	Describe "Other"	
Other		
Other		
Other		

1.12 Do revenues generated under the utility's current rate structure fully cover the cost of providing 1) operating services and 2) necessary long-term capital improvements?

	Operating Service	Long Term Capital Improvements
Water		
Wastewater		
Stormwater		

OPERATIONS

This section of the survey will ask questions regarding the utility's annual operating budget, both for the current year as well as for the future. In addition, the survey asks questions regarding the allocation of operating funds into various categories. The responses will be used in the calculation of the utility's economic impact using IMPLAN, the economic modelling software used for this effort.

2.1 What is your total annual operating (non-capital) budget for your current fiscal year?

Service	Operating Budget
Water	
Wastewater	
Stormwater	
Other Services	
Total Operating Budget for Utility	

2.2 Please distribute your annual **operating** budget into the following categories (column total should equal 100%):

Categories		% Annual Operating Budget		
		Water	Wastewater	Stormwater
Imported water				
Labor (Utility staff only)				
Debt Payments				
Contracts (including chemicals, labor, etc.)				
Other water-related service operations				
	Describe "Other"			
All other non-water-related service operations (e.g., solid waste enterprises, power enterprises, etc.)				
Total		***0%***	***0%***	***0%***

Note: This distribution will be applied to the operating budget projections in the next question. If you have concerns regarding the applicability of this method, please contact us using the help button at the top of this page, and comment briefly on your concerns:

2.3 Please provide operating budget projections for the next 10 years, if available. If not available, check here

Fiscal Year	Operating Budget ($)		
	Water	Wastewater	Stormwater
2014			
2015			
2016			
2017			
2018			
2019			
2020			
2021			
2022			
2023			

Please enter the estimated annual escalation rate for operating costs for each applicable water operation. Budget projections will be automatically calculated based on this rate.

	Water	Wastewater	Stormwater
Escalation Factor (%)			
Fiscal Year			
2014	$ -	$ -	$ -
2015	$ -	$ -	$ -
2016	$ -	$ -	$ -
2017	$ -	$ -	$ -
2018	$ -	$ -	$ -
2019	$ -	$ -	$ -
2020	$ -	$ -	$ -
2021	$ -	$ -	$ -
2022	$ -	$ -	$ -
2023	$ -	$ -	$ -

2.4	Is there any significant portion of the operational spending described above (question 2.3) that will occur outside of your metropolitan area? view map	
2.5	What is your annual escalation factor for labor/staffing costs?	

Note: This will be applied to the projected annual changes in wage rates & benefits. The escalation factor can be the same or different from the overall operating budget escalation factor.

Provide additional comments or clarifications in the text box below:

CAPITAL PLAN

This section of the survey will ask questions regarding the utility's capital plan, both for the current year as well as for the future. In addition, the survey asks questions regarding the allocation of capital funds into various categories. The responses will be used in the calculation of the economic impact using IMPLAN.

3.1 Please rank the following Capital Plan goals from most important (1) to least important (6).

Goal		Rank (Each can only be used once; or Not applicable/Not A Factor)
Regulatory compliance (to conform with regulatory standards)		
Safety and reliability (upgrades to existing assets that may be deteriorating; increases to system capacity to accommodate existing or projected future population growth or demand, etc.)		
Cost containment		
Customer expectations		
Critical/emergency resiliency (Improve system resiliency against flooding, drought, sea level rise, seismic activity, other catastrophic event)		
Other: Fill in here		

3.2

Is the utility under a consent decree?	

3.3 Please provide a breakdown of capital spending each year for the duration of the Capital Plan using the following template. These estimates should be exclusive of the operating budget projections described in question 2.3; in other words, there should be no double-counting of funds.

Fiscal Year	Total Budget	Program Management	Engineering, Design, and Planning Studies	Construction	Major Equipment	Land / Building / Right-of-Way Acquisition	Other* (Define here)
	($)	(internal spending)	(external spending)	(external spending)	(external spending)	(external spending)	
2014							
2015							
2016							
2017							
2018							
2019							
2020							
2021							
2022							
2023							
2024							

Note: Internal spending represents spending that will be captured by the utility, such as for labor to provide program management. External spending represents spending to private firms, other agencies, and external suppliers that are not part of the utility.

3.4

Is there any significant portion of the capital spending described above that will occur outside of your metropolitan area? view map	

EMPLOYMENT

This section of the survey will ask questions regarding the utility's staffing and employment. In addition, the survey asks questions regarding training, workforce development, and local hiring requirements. The responses will be used in the analysis of the utility's labor impacts to the region and across the nation.

4.1 How many staff do you currently employ:

Type of Staff	Number of Staff
Full-time	
Part-time	
Total	***0***

4.2 Please provide a breakdown of Utility staff, using the following template:

Employee Category	Example Occupations	Number of Full time Staff	Number of Part-Time Staff	Total Direct Employee Pay[1]	Avg Hourly Wage or Avg. Annual Salary[2]	Minimum Education Requirement for Entry Level Position
		#	#	$	$/year	text entry
Production occupations	51-8031: Water and Wastewater Plant and System Operators					
Installation, maintenance, and repair occupations	49-9071: Maintenance and Repair Workers, General 49-9040: Industrial machinery installation, repair, and maintenance					
Construction and extraction occupations	47-2152: Pipelayers, plumbers, pipefitters, and steamfitters 47-2061: Construction laborers					
Architecture and Engineering occupations	17-2000: Engineers 17-3000: Drafters, engineering, and mapping technicians					
Transportation and material moving occupations	53-3030: Driver/sales workers and truck drivers 53-7060: Laborers and material movers					
Office and Administrative Support occupations	43-5041: Meter readers, utilities 43-6000: Secretaries and administrative assistants 43-3000: Financial clerks					
Management occupations	11-1000: Top Executives 11-1021: General and Operations Managers					
Business and Financial Operations occupations	13-1020: Buyers and purchasing agents 13-2011: Accountants and auditors 13-1071: Human resources specialists					
Sales and related occupations	41-4012: Sales representatives, wholesale and manufacturing					

Note:
(1) Direct Employee Pay: Utility TOTAL (only hourly/ annual wages, no overhead/ fringe/benefits)
(2) Avg Hourly Wage or Avg. Annual Salary (no overhead/ fringe/benefits/etc)

4.3 Please provide information on participation in any employee/professional development trainings in the last fiscal year, using the template below:

Category		Value
Number of Utility Participants (employees)		
Utility Training Budget ($ per employee or total)		
Total Staff Hours Spent in Training (hours)		

4.4 Does the utility participate in a workforce development or apprenticeship program?	
4.5 Does the utility have a local hiring preference for full-time staff? (Broadly defined, local hiring is a goal or requirement to hire employee who live near the place of work.)	
4.6 Does the utility have targets for contractors as a percent of all contracts awarded, such as for the following or similar types of enterprises: DBE/MBE/WBE/SBE/LBE/etc.? See definitions	
4.7 Does the utility track the aging/retiring of its workforce?	

5.0 **Confirmation of Use :** I confirm that I am authorized to share the information provided herein with AECOM's project team for use in a national economic and labor impact analysis and public report, and that the information is the best available at the time of the survey.

Appendix B

OVERVIEW OF SURVEYED UTILITIES

Alexandria Renew Enterprises

Alexandria Renew Enterprises, also known as AlexRenew, is a water district in the City of Alexandria, Virginia and part of Fairfax County. AlexRenew provides wastewater services to 320,000 people via its wastewater reclamation facility operations. The AlexRenew plant, situated on a 35-acre site in Old Town Alexandria, processes an average of 35 million gallons of wastewater each day.

City of Atlanta Department of Watershed Management

The City of Atlanta Department of Watershed Management (DWM) provides water and wastewater services to almost 720,000 people in the City of Atlanta. On average, DWM provides 91.5 million gallons per day of water service and 110 million gallons per day of wastewater service. Although the City has traditionally managed its drinking water and wastewater services separately, DWM considers these functions both related to overall water quality and management of water resources and has combined these functions under a single municipal department (of watershed management).

City of Baltimore Water and Wastewater Utility

Baltimore's Department of Public Works houses the City of Baltimore Water and Wastewater Utility, which serves 1.8 million people in the Baltimore metropolitan area. Managing three reservoirs, three filtration plants, over twenty pumping stations and water towers, the City of Baltimore Water and Wastewater Utility supplies an average of 225 million gallons of drinking water each day. In terms of wastewater services, the City of Baltimore Water and Wastewater Utility operates two wastewater treatment plants that collect and treat an average daily wastewater flow of 194 million gallons.

Boston Water & Sewer Commission

The Boston Water & Sewer Commission (BWSC) owns, operates, and maintains the water and wastewater infrastructure in the City of Boston, providing water and wastewater services for over 600,000 people. BWSC supplies an average of 55 million gallons of water each day from two reservoirs in central and western Massachusetts. BWSC treats an average of 96 gallons of wastewater each day at the treatment plant in Boston Harbor.

Camden County Municipal Utilities Authority

The Camden County Municipal Utilities Authority (CCMUA) provides wastewater services to over half a million people in the 37 municipalities within Camden County. Via the operations of its two wastewater treatment plants, CCMUA treats an average of 58 million gallons of wastewater each day.

District of Columbia Water and Sewer Authority

Within its 725 square mile service area, the District of Columbia Water and Sewer Authority (DC Water) provides water and wastewater services to 2.2 million people. DC Water purchases and distributes drinking water from the Potomac River at an average daily volume of 100 million gallons. DC Water treats an average of 280 million gallons of wastewater each day in its Blue Plains wastewater treatment plant.

Denver Water

Denver Water supplies water to the City of Denver and the surrounding suburbs in its 255 square mile service area. Denver Water is a municipal department and the oldest water utility in the state of Colorado. Denver Water supplies an average of 165 million gallons per day of drinking water via its 3,000 miles of pipelines

Hampton Roads Sanitation District

Hampton Roads Sanitation District (HRSD) collects and treats wastewater from 17 counties and cities in Virginia. Across its 3100 square mile service area, HRSD serves 1.6 million people. With nine major plants and four smaller plants, HRSD treats an average of 158 million gallons of wastewater per day

City of Houston Combined Utility System

The City of Houston Combined Utility System is a division of the Houston Public Works and Engineering Department, with two branches of service: drinking water and wastewater. The drinking water services branch supplies an average of 446 million gallons each day. The wastewater services branch treats an average of 209 million gallons each day. Approximately 4.4 million people are served by the City of Houston Combined Utility System across a 625 square mile service area.

Kansas City Missouri Water Services Department

The Kansas City Missouri Water Services Department is a municipal department that provides water and wastewater services to a service area of 320 square miles and a service population of 460,000 people. The 2,800 miles of water pipes supply an average of 102 gallons of drinking water each day. The Kansas City Missouri Water Services Department operates six wastewater treatment plants, treating an average of 89 million gallons of wastewater each day.

Los Angeles Department of Water and Power

The Los Angeles Department of Water and Power (LADWP) is a department of the municipal government. LADWP provides water to a service population of 3.9 million people, with almost 680,000 active water connections. LADWP's 7,225 miles of water mains pipe an average of 499 million gallons of water each day throughout its 465 square mile service area.

City of Los Angeles Bureau of Sanitation

Wastewater services in the City of Los Angeles and surrounding communities are provided by the City of Los Angeles Bureau of Sanitation – a department of the municipal government. The City of Los Angeles Bureau of Sanitation treats a daily average of 371 million gallons of wastewater from its service population of four million.

Louisville and Jefferson County Metropolitan Sewer District

The Louisville and Jefferson County Metropolitan Sewer District (MSD) provides wastewater services to the Louisville metropolitan region. MSD operates and maintains more than 3,200 miles of sewer lines, six regional treatment plants, and 14 smaller treatment plants. MSD treats an average of 145 million gallons of wastewater each day. MSD serves approximately 751,000 people in a 339 square mile service area.

Southern Nevada Water Authority

Southern Nevada Water Authority (SNWA) is a cooperative, not-for-profit agency. SNWA provides water to almost two million people in the Las Vegas Valley. SNWA distributes an average of 360 million gallons per day of drinking water.

Metropolitan Sewer District of Greater Cincinnati

The Metropolitan Sewer District of Greater Cincinnati (MSDGC) serves the wastewater collection and treatment needs of residents and businesses in Hamilton County, Ohio (a 290 square mile service area). MSDGC serves 855,000 people by treating an average of 201 million gallons of wastewater per day.

Louisville Water Company

The Louisville Water Company (LWC) has been supplying water to the Louisville metropolitan area for over 150 years. LWC supplies water to 850,000 people across a 620 square mile service area in the Louisville metropolitan region, at an average daily volume of 116 million gallons.

Metropolitan Water Reclamation District of Greater Chicago

Metropolitan Water Reclamation District of Greater Chicago (MWRDGC) operates seven treatment plants to provide wastewater services to the Greater Chicago area. MWRDGC serves over 10 million people in the City of Chicago and 125 surrounding suburbs, with a total service area of 954 square miles. On average, MWRDGC treats 1.4 billion gallons of wastewater each day.

Miami-Dade Water and Sewer Department

Miami-Dade Water and Sewer Department provides water and wastewater services to 2.3 million people in 400 square miles of Miami-Dade County. Miami-Dade Water and Sewer Department is a department of the county government. Miami-Dade Water and Sewer Department draws its water from groundwater aquifers. Values for the average daily water supplied by Miami-Dade Water and Sewer Department and the average daily wastewater flow treated are unavailable.

Milwaukee Metropolitan Sewerage District

Milwaukee Metropolitan Sewerage District (MMSD) operates two wastewater treatment plants to provide wastewater services to 1.1 million people in the Greater Milwaukee Area. MMSD service covers 411 square miles, including portions of six distinct watersheds. On average, MMSD treats 130 million gallons of wastewater each day, the treated effluent of which is discharged into Lake Michigan.

Metropolitan Water District of Southern California

The Metropolitan Water District of Southern California (MWDSC) is a consortium of 29 cities and districts that provides drinking water to over 18 million people in parts of Los Angeles, Orange, San Diego, Riverside, San Bernardino, and Ventura counties. MWDSC delivers an average of 1.8 billion gallons of water each day across its 5,180 square mile land area.

Northeast Ohio Regional Sewer District

Northeast Ohio Regional Sewer District (NORSD) is responsible for wastewater services in the 381 square miles of the greater Cleveland metropolitan area. Collecting and treating an average of 236 million gallons of wastewater each day, NORSD serves almost one million people. NORSD operates three wastewater treatment plants.

Sewerage and Water Board of New Orleans

The Sewerage and Water Board of New Orleans (S&WB) is a special district designated to provide water and wastewater services to New Orleans. S&WB has a service area of 86 square miles and a service population of nearly 380,000 people. S&WB supplies an average of 143 million gallons of drinking water to its customers each day. Average daily volumes of wastewater flow are unavailable.

NYC Department of Environmental Protection

The New York City Department of Environmental Protection (NYC DEP) is a department of the municipal government responsible for providing drinking water to, and collecting and treating wastewater from, New York City. NYC DEP delivers an average of one billion gallons of drinking water each day to its service population of 8.4 million people in its 300 square mile service area from large upstate reservoirs. NYC DEP treats an average 1.3 billion gallons of wastewater each day, protecting the quality of New York Harbor.

Orange County Water District

Orange County Water District (OCWD) is a special district, with rights to water in the Santa Ana River, and a mandate to manage the vast groundwater basin under north and central Orange County. OCWD uses water from the Santa Ana River and groundwater sources to supply drinking water to 2.4 million people in a 358 square mile service area. The average daily amount of water supplied by OCWD is over 285 million gallons.

Philadelphia Water Department

Philadelphia Water Department (PWD) is the municipal department responsible for water and wastewater services to 230 square miles of the Greater Philadelphia area. PWD's three water treatment plants supply an average of 238 million gallons of drinking water per day. PWD treats an average of 394 million gallons of wastewater per day. Over 2.3 million people benefit from the water and wastewater services of PWD.

Pittsburgh Water & Sewer Authority

Pittsburgh Water & Sewer Authority (PWSA) draws water from the Allegheny River to supply the City of Pittsburgh with nearly 65 million gallons of drinking water each day. PWSA also collects wastewater from the city via 1,200 miles of sewers for treatment. PWSA serves 350,000 customers in the City of Pittsburgh across 36 square miles.

Sacramento Regional County Sanitation District

Sacramento Regional County Sanitation District, or RegionalSan, operates the Sacramento Regional Wastewater Treatment Plant that serves nearly 1.5 million people in the Sacramento region. RegionalSan has a service area of 375 square miles and treats an average of 119 million gallons of wastewater each day. RegionalSan supplies a small volume of non-drinking water for irrigation and other uses, as a byproduct of its wastewater treatment facilities. Nonetheless, RegionalSan is not considered to offer water services, since no drinking water is supplied to customers.

San Francisco Public Utilities Commission

San Francisco Public Utilities Commission (SFPUC) provides water and wastewater services to the City and County of San Francisco, and wholesale water to three additional counties in the San Francisco Bay Area. SFPUC service area spans 468 square miles and provides service to 2.6 million people. On average 220 million gallons of drinking water are supplied by SFPUC each day. 75 million gallons of wastewater are treated on average each day.

City of Tulsa Water and Sewer Department

Water and wastewater services are provided to the nearly 573,000 residents of the City of Tulsa by the Water and Sewer Department of the municipal government. City of Tulsa Water and Sewer Department (TWSD) supplies 98 million gallons of drinking water and treats 54 million gallons of wastewater each day, on average.

City of Chicago Department of Water Management

City of Chicago Department of Water Management (CDWM) is responsible for delivering, on average, 757 million gallons of drinking water each day to nearly 5.4 million people. CDWM is also responsible for collecting wastewater from almost 600 square miles of the Greater Chicago area and delivering it to the Metropolitan Water Reclamation District of Greater Chicago for treatment. (While MWRDGC undertakes the treatment of wastewater, CDWM manages the collection and conveyance network, including sewer mains, pumping stations, valves, and other structures.)

Appendix C

IMPLAN METHODOLOGY

IMPLAN Overview

This study examines how water utilities' capital plan and operating expenditures contribute to the employment and output of their suppliers (indirect effects) as well as the output and employment associated with spending by employees of water utilities and their suppliers (induced effects). This study does not consider the induced economic impacts of ratepayer fees paid by households.

This study relies on the desktop economic modeling software, IMPLAN, to estimate the direct, indirect, and induced effects of water utilities' capital plan and operating spending. IMPLAN analyzes economic relationships between industries, households, and government institutions to estimate the employment and output impacts caused by an expected change in economic activity. IMPLAN's understanding of the economic linkages among industries is based on national input-output data. For purposes of simplicity, IMPLAN assumes production functions (or the goods and services required to produce an additional unit of output) do not change by geography or scale. The model uses data on the percentage of inputs available and local household spending behavior specific to the study area to estimate regional effects, but does not allow for import substitution that may occur over time as a result of higher costs, supply constraints, or competition from other regions.

Preparing the IMPLAN Model

IMPLAN-based impact analysis first requires the definition of a change in economic activity (be it compensation, or the purchase of a commodity) before multipliers can be applied to estimate subsequent rounds of impacts. As the first step in the economic impact analysis, water utilities' operations and capital plan expenditures were coded as IMPLAN activities that can be input into the modeling software.

Coding Expenditures: Operating Budgets

Surveyed utilities were asked to provide 10-year projected operating budgets by water-related service department: water, wastewater, and stormwater. Where 10-year projections were not available, utilities provided an escalation factor to apply to the current year budget. Utilities also reported, for the current year only, the split in operating costs between imported water, internal labor, debt service, contracts, other water-related service operations, and all other non-water related service operations, such as taxes and fees. These distributions were reported for water, wastewater and stormwater departments.

Future operating costs were projected by category for each department by multiplying the total projected department budget by the department's current year percentage split in operating costs. Utilities also had the option of submitting detailed annual projections if they determined this simplified approach would not accurately capture the distribution of their expenditures in future years.

Expenditures were totaled across departments to derive an aggregate annual operating budget for each major cost category. Cost categories were then coded according to IMPLAN activities and events. IMPLAN activities define a broad economic change: a change in labor income, industry or institutional spending, or industry sales. IMPLAN events provide additional details on the economic change: the type and value of compensation, spending, or sales. For operating costs, activities were either defined as a labor income change or an industry spending pattern, which is an activity used to encapsulate a series of commodity purchases. IMPLAN's predefined spending pattern for the water sector was used to simulate how contracts and other operating costs would be spent. Utility expenditures toward imported water were excluded from local analyses. For the national analysis, a custom industry spending pattern was created, with all spending going toward water commodity purchases. The following table summarizes IMPLAN activities and events assigned to operating costs.

Table 18: IMPLAN Cost Coding of Operating Budgets

Operating Cost Category	IMPLAN Activity	IMPLAN Event
Labor	Labor Income Change	Employee Compensation
Contracts Other Water Related Service Operations	Industry Spending Pattern – 33 Water, Sewage and Other Treatment and Delivery Systems	Imported Spending Pattern
Imported Water* (excluded in MSA analysis)	Industry Spending Pattern (Custom)	100% of spending to Water, Sewage and Other Treatment and Delivery Systems sector (3033)
Debt Service	Excluded from IMPLAN analysis	NA
Non-Goods Expenses (Taxes and Fees)	Excluded	NA

Coding Expenditures: Capital Plan

Utilities provided a 10-year capital plan budget by year for the following expenditure categories: External Construction, Program Management, External Engineering and Design, Equipment, Other, and Land Acquisition. As with operating costs, capital plan expenditure categories were then coded according to IMPLAN activities. External construction and engineering were classified as commodity changes. Major equipment was classified as a custom industry spending pattern based on the nonresidential construction sector's spending on heavy manufactured goods. Program management was classified as an institutional spending pattern based on the imported spending pattern of state or local government. The following table summarizes the IMPLAN activities and events assigned to capital plan costs.

Table 19: IMPLAN Cost Coding Capital Plan Budgets

Capital Category	IMPLAN Activity	IMPLAN Event
Construction (External)	Commodity Change	3036 – Other Newly Constructed Nonresidential Structures
Engineering and Planning (External) Project Management (External)	Commodity Change	3369 – Architecture, Engineering and Related Services
Major Equipment	Custom Institutional Spending Pattern	Based on Sector 36 (Nonresidential Construction) Institutional Spending Pattern for industrial machinery *only*
Program Management Other Internal Spending (Permitting, Other Materials)	Institutional Spending Pattern	State / Local Government (Non-education)
Land Acquisition	*Excluded*	*Excluded*

Several surveyed utilities reported internal engineering or construction forces in their capital plan budget. Internal construction and/or engineering costs were apportioned between labor and materials according to the share of industry spending reported by IMPLAN that goes to materials and the proportion that goes to labor income. It was assumed that all internal construction costs are captured by these categories and that other forms of value added (proprietor income or corporate profit) are equal to zero. Internal construction and engineering costs were then designated in IMPLAN as a labor income change and as an industry spending pattern of the construction and/or engineering sector.

Table 20: Additional IMPLAN Activities for Capital Plan Analysis

Capital Category	IMPLAN Activity	IMPLAN Event
Internal Construction (Labor)	Labor Income Change	Employee Compensation
Internal Construction (Materials)	Industry Spending Pattern – Sector 36, Other Newly Constructed Nonresidential Structures	Imported Spending Pattern
Internal Engineering (Labor)	Labor Income Change	Employee Compensation
Internal Engineering (Materials)	Industry Spending Pattern – Sector 369, Architecture, Engineering and Related Services	Imported Spending Pattern

IMPLAN Modeling

Creating Activities

Activities were created for every study year by combining the relevant cost categories that compose the activity. Institutional spending patterns that include only materials were normalized to one so that 100 percent of the value assigned to the activity was distributed according to pre-established industry spending coefficients. Each activity was labeled in IMPLAN with the year, the budget type (Operating or Capital), and the Activity Type. The local purchase percentage for all events was set to the Social Accounts Matrix (SAM) Model value.[16] The SAM model value estimates the share of a commodity that will be supplied locally based on existing trade flows.

Scenarios

Two scenarios were built in the software: Capital Impact and Operating Impact. The Capital Impact Scenario totaled direct, indirect, and induced effects for the Capital Budget. The Operating Scenario does the same for the Operating budget.

Post-Modeling: Recalculating Direct Effects

Direct effects were defined as the utility's output (for operating impacts) and the output of utility contractors and/or internal construction and engineering forces (for capital plan impacts). For operating impacts, output was assumed to equal direct utility costs (other forms of value added besides employment compensation were excluded).

Depending on the type of activity, the IMPLAN model does not always reflect the direct effect, or the change in economic activity being studied. For example, the labor income change activity in IMPLAN only reports induced effects. Direct employment and earnings must be added outside of IMPLAN to reflect the direct output, earnings, and employment impact associated with agency staff. Similarly, industry spending patterns do not reflect the first round of spending by the agency itself; only indirect output impacts are reported. In order to reflect all direct effects defined above, IMPLAN results were combined with agency-reported data outside the model.

[16] For the local analysis, activities may be adjusted downward prior to importing to IMPLAN. Utilities were asked if a significant portion of capital plan or operating spending occurs outside the MSA. If that is the case, all activity values will be reduced by the percentage of total spending that is assumed to occur outside the MSA.

Adding Direct Effects for Operations

Labor Income: Direct labor income was calculated by combining annual labor costs of the utilities. The GDP deflator used by IMPLAN was applied to annual values to reflect total labor income in 2014 dollars – the same way IMPLAN reports labor income.

Employment: Employment was derived by taking projected labor income by year and dividing by the projected ratio of annual labor income per job. This ratio was determined by dividing total current loaded labor costs by current employees, and escalating the outcome by the agency's reported labor cost escalation factor.

Output: Direct output was defined in this analysis as the total operating budget, net debt service, taxes, and fees. The annual operating budget was de-escalated by the industry deflator used by IMPLAN for Sector 33 to reflect total output over the period in 2014 dollars.

Value added: Direct value added was reported as the equivalent of total labor income. Profits were excluded from the analysis as the economic change modeled is based on agency expenditures, not revenue.

Direct Effects for Capital Spending

Labor Income: Direct labor income was calculated as the sum of direct labor income impacts estimated in the IMPLAN model *plus* the labor income assigned to internal construction and engineering forces.

Employment: Direct employment was calculated as the sum of direct employment impacts estimated by the IMPLAN model *plus* the estimated employment of internal construction and engineering forces. The estimate of internal construction and engineering employment was derived by taking projected labor income by year and dividing by the projected ratio of construction and/or engineering labor income per job. This ratio was determined by dividing total current loaded labor costs for current construction and engineering employees, and escalating the outcome by the agency's reported labor cost escalation factor.

Output: Direct output was defined as the total capital plan budget, net debt service, taxes, and fees. The direct effect is the sum of direct output reported by IMPLAN *plus* direct spending on internal construction and engineering, deflated according to IMPLAN deflators. Internal construction and engineering spending was deflated according to the IMPLAN deflators for the nonresidential construction and engineering sectors, respectively, and labor income was deflated according to IMPLAN's GDP deflator.

Calculating Total Impacts

Direct effects were combined with indirect and induced effects reported by IMPLAN to arrive at the total economic contribution of water agency operating and capital plan budgets. All impacts were reported in real 2014 dollars. Impacts of both Capital and Operating scenarios were divided by 10 to arrive at an average annual impact to be used for illustrative purposes.

Appendix D

OCCUPATIONAL DEFINITIONS AND LABOR STATISTICS FROM SURVEYED UTILITIES

Table 21: Definitions of Occupational Groups

Occupational Group	Occupational Sub-groups	Example Occupations
Production	Power and System Operators	• 51-8031: Water and Wastewater Plant and Treatment Operators
Maintenance and Repair	Electrical Equipment Repairers and Installers Other Maintenance and Repair Occupations	• 49-9071: Maintenance and Repair Workers, General • 49-9040: Industrial machinery installation, repair, and maintenance
Administration and Customer Service	Financial Clerks Information and Record Clerks	• 43-5041: Mater readers, utilities • 43-4050: Customer service representatives • 43-3000: Financial clerks
Architecture and Engineering	Architects Engineers Drafters	• 17-2000: Engineers • 17-3000: Drafters, engineering and mapping technicians
Construction	Trades Workers	• 47-2152: Pipelayers, plumbers, pipefitters and steamfitters • 47-2061: Construction laborers
Business and Finance	Operations Specialists Financial Specialists	• 13-1020: Buyers and purchasing agents • 13-2011: Accountants and auditors • 13-1071: Human resources specialists
Management	Top Executives Operations Managers	• 11-1000: Top Executives • 11-1021: General and Operations Managers
Transportation	Motor Vehicle Operators Material Moving Workers	• 53-3030: Driver/sales workers and truck drivers • 53-7060: Laborers and material movers
Sales	Sales Representatives	• 41-4012: Sales representatives, wholesale and manufacturing

Source: BLS 2010.

Table 22: Utility Employment by Occupation

Occupation	BLS Reference Code	Number of Employees	Share of Total Employment	Utility Salary
Production	51-0000	7,900	22%	$62,600
Maintenance and Repair	49-0000	5,300	15%	$59,900
Administrative Support	43-0000	5,100	14%	$51,900
Architecture and Engineering	17-0000	4,100	11%	$85,100
Construction	47-0000	3,900	11%	$69,200
Business and Finance	13-0000	2,300	6%	$76,600
Management	11-0000	1,600	5%	$113,800
Transportation	53-0000	1,600	4%	$53,400
Sales	41-0000	400	1%	$49,700
Total Categorized Employment	n/a	4,200	89%	
Left uncategorized by agency	n/a	32,300	11%	
Total Agency Employment		36,500	100%	$67,300

N = 30. 26 utilities reported detailed occupational data. BLS Reference Code refers to BLS Standardized Occupation Code as reported in BLS-2 2013. The category: "Left uncategorized by agency" includes the employment of surveyed utilities that did not respond to this question. "Share of total employment" includes employment left uncategorized by utilities. Share of categorized employment includes the distribution of occupations actually categorized by responding utilities. Reported utility salaries are calculated averages per occupation of all reported data from surveyed utilities.

Table 23: Employment by Occupation, by Region

Occupation	Production	Maintenance	Office/Admin	Arch/Eng	Construction	Business	Management	Transportation	Sales	Occupations not categorized	Total Employees
Midwest	16%	11%	12%	8%	17%	3%	5%	7%	0%	21%	6,200
Northeast	28%	16%	21%	14%	11%	3%	5%	1%	0%	3%	8,000
South	29%	12%	13%	6%	8%	7%	5%	6%	3%	11%	12,500
West	11%	20%	12%	18%	10%	10%	4%	3%	0%	13%	9,800
Total	22%	15%	14%	11%	11%	6%	5%	4%	1%	11%	36,500

N = 30 utilities. 26 utilities provided occupational data for more than 50 percent of their workforce. Remaining utilities are included in the "Uncategorized" column.

Appendix E

CAPITAL SPENDING BY SURVEYED UTILITIES

Capital spending falls into the following broad categories:

- Program management, which represents utility staff time and materials to manage, supervise, and coordinate capital projects;
- Engineering, design, and planning studies, commissioned by the utility to be performed by external organizations;
- Construction;
- Major equipment purchased by the utility to be owned and operated by the utility;
- Land, building, or right-of-way acquisition;
- Other expenditures.

The distribution of capital plan projections is outlined in Table 24. Across the surveyed utilities, nearly three-quarters of capital plan spending (72 percent) is allocated to construction purposes. Ten percent of capital plan commitments are projected to be spent on engineering, design, and planning studies. Program management, major equipment purchases, and other expenses each represent approximately six percent of the capital plan commitments. The remainder is budgeted for capital plan expenditures related to the acquisition of land, buildings, or rights-of-way.

Table 24: Allocation of Capital Plan Commitments

Region	Program Management	Engineering	Construction	Major Equipment	Land Acquisition	Other
Midwest	4%	13%	69%	10%	2%	2%
Northeast	5%	5%	85%	4%	1%	1%
South	3%	12%	78%	6%	1%	1%
West	9%	9%	59%	5%	0%	18%
Total	6%	10%	72%	6%	1%	6%

N = 30 utilities.

Appendix F

ECONOMIC IMPACTS BY MSA

Table 25: Regional Economic Impacts

		Economic Output ($ over 10 years)				Employment (annual jobs for ten years)			
Utility	Region	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Alexandria Renew Enterprises	South	$450 million	$190 million	$190 million	$830 million	200	100	100	400
Boston Water & Sewer Commission	Northeast	$3.3 billion	$560 million	$580 million	$4.4 billion	700	300	400	1,400
Camden County Municipal Utilities Authority	Northeast	$380 million	$270 million	$220 million	$880 million	100	200	200	500
City of Atlanta Department of Watershed Management	South	$4.6 billion	$3.5 billion	$2.4 billion	$10.5 billion	1,900	2,300	1,800	5,900
City of Baltimore Water & Wastewater Utility	South	$6.7 billion	$2.9 billion	$3.0 billion	$12.6 billion	3,600	1,800	2,200	7,600
City of Chicago Department of Water Management	Midwest	$12.1 billion	$10.2 billion	$6.9 billion	$29.2 billion	4,200	5,600	4,600	14,400
City of Houston - Combined Utility System	South	$8.1 billion	$4.7 billion	$3.6 billion	$16.3 billion	3,800	2,500	2,500	8,800
City of Los Angeles Sanitation	West	$5.0 billion	$2.7 billion	$2.7 billion	$10.3 billion	3,000	1,400	1,000	6,200
City of Tulsa Water and Sewer Department	South	$2.4 billion	$1.1 billion	$890 million	$4.4 billion	1,100	700	700	2,500
District of Columbia Water and Sewer Authority	South	$7.1 billion	$3.6 billion	$2.4 billion	$13.1 billion	3,300	2,100	1,700	7,100
Denver Water	West	$3.0 billion	$1.2 billion	$1.6 billion	$5.7 billion	1,700	800	1,200	3,600

Hampton Roads Sanitation District	South	$2.6 billion	$1.1 billion	$1.0 billion	$470 million	1,500	700	800	3,000
Kansas City Missouri Water Services Department	Midwest	$4.0 billion	$2.6 billion	$2.2 billion	$8.7 billion	2,200	1,700	1,700	5,500
Los Angeles Department of Water and Power	West	$15.9 billion	$5.0 billion	$4.3 billion	$24.1 billion	4,900	2,800	2,800	10,500
Louisville and Jefferson County Metropolitan Sewer District	South	$1.8 billion	$700 million	$1.0 billion	$3.4 billion	1,000	500	800	2,300
Louisville Water Company	South	$1.3 billion	$590 million	$720 million	$2.7 billion	1,000	500	500	2,000
Metropolitan Sewer District of Greater Cincinnati	Midwest	$2.9 billion	$1.5 billion	$1.4 billion	$5.8 billion	1,700	1,100	1,100	3,900
Metropolitan Water District of Southern California	West	$12.2 billion	$6.8 billion	$5.8 billion	$24.7 billion	3,500	4,000	3,900	11,300
Metropolitan Water Reclamation District of Greater Chicago	Midwest	$5.9 billion	$2.9 billion	$3.8 billion	$12.6 billion	3,300	1,500	2,500	7,400
Miami-Dade Water and Sewer Department	South	$12.5 billion	$6.3 billion	$6.1 billion	$24.9 billion	7,600	4,200	4,600	16,500
Milwaukee Metropolitan Sewerage District	Midwest	$2.7 billion	$1.5 billion	$1.3 billion	$5.4 billion	1,400	1,000	1,000	3,300
Northeast Ohio Regional Sewer District	Midwest	$3.5 billion	$1.1 billion	$1.4 billion	$6.0 billion	2,200	700	1,100	4,000
NYC Department of Environmental Protection	Northeast	$25.2 billion	$10.2 billion	$10.9 billion	$46.3 billion	10,900	5,500	6,900	23,200
Orange County Water District	West	$1.5 billion	$980 million	$710 million	$3.2 billion	500	600	500	1,500
Philadelphia Water Department	Northeast	$8.5 billion	$5.0 billion	$5.0 billion	$18.5 billion	3,300	2,800	3,400	9,600

Pittsburgh Water & Sewer Authority	Northeast	$820 million	$710 million	$430 million	$2.0 billion	400	400	400	1,200
Sacramento Regional County Sanitation District	West	$2.9 billion	$1.1 billion	$1.2 billion	$5.2 billion	1,400	800	800	3,000
San Francisco Public Utilities Commission	West	$9.7 billion	$4.5 billion	$3.8 billion	$18.0 billion	4,700	2,300	2,300	9,300
Sewerage and Water Board of New Orleans	South	$4.0 billion	$2.0 billion	$1.7 billion	$7.7 billion	2,400	1,300	1,300	5,100
Southern Nevada Water Authority	West	$1.3 billion	$760 million	$5.1 billion	$2.5 billion	300	500	400	1,200

Impacts reported in constant 2014 dollars.

Appendix G

NATIONAL FACTSHEET

Figure 6: National Factsheet

Water Research Foundation — advancing the science of water

WERF — Water Environment Research Foundation. Collaboration. Innovation. Results.

Economic Impact of **Public Water, Wastewater, and Stormwater Utilities** across the United States

Economic Impact = 289,000 jobs and $524 billion over ten years

The 30 utilities in this study were surveyed regarding their operating and capital plan investments for the next decade. They represent one-third of all large U.S. water utilities, directly employing 36,500 workers. Their combined economic contribution totals $524 billion over the next decade, supporting 289,000 jobs per year across the country.

Jobs

87,000
Direct
+
202,000
Indirect & Induced
=
289,000
Total Jobs Created

Economic Output

$179B
Direct
+
$345B
Indirect & Induced
=
$524B
Total Economic Output

Participating utilities provide water, wastewater, and stormwater services to 83 million people over a combined service area of 18,300 square miles.

Services Provided: Water, Wastewater & Stormwater

Service Population: 83 Million (25% of the U.S. Population)

Service Area: 18,300 Square Miles (Less than 1% of the U.S.)

Flow & Capacity:

	Average Daily Flow		Treatment Plant Capacity
	Flow	Capacity	
Water	6,500 mgd	11,100 mgd	11,300 mgd
Wastewater	5,700 mgd	8,400 mgd	11,000 mgd

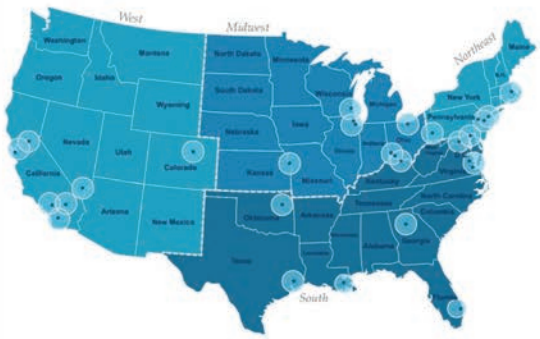
mgd = millions of gallons per day

Economic Impact of Operating & Capital Expenditures

	Aggregate Impact (Over 10 Years)	Annual Impact (Per Year)
Employment	**2.9 million job-years**	**289,000 jobs**
Operations	1.6 million job-years	157,000 jobs
Capital	1.3 million job-years	131,000 jobs
Economic Output	**$524 billion**	**$52 billion**
Operations	$299 billion	$30 billion
Capital	$225 billion	$22 billion

Impacts are expressed in real 2014 dollars, values may not total due to rounding.

30 Participating Utilities



Published August 2014

Water Research Foundation℠
advancing the science of water

WERF
Water Environment Research Foundation
Collaboration. Innovation. Results.

AECOM

FSC
Printed on 100% recycled / 100% post-consumer waste, FSC-certified paper.