Maureen Duffy
T: 856-309-4546
maureen.duffy@amwater.com

Challenges in the Water Industry: Climate Change

Introduction

Climate change is greatly affecting weather patterns and the world's ecosystem and, in particular, posing serious challenges to the world's water supply. Causing poor water quality and scarcity and putting significant stress on our water infrastructure, climate change is having a profound effect on how communities can reliably access clean water.

For U.S. water providers, addressing the impact of climate change will require: finding solutions to maintain adequate levels of water supply to communities; ensuring high standards of water quality in the face of droughts or increased flooding; and balancing the need for infrastructure improvements while keeping this vital resource as affordable as possible. This paper outlines challenges that the water industry will face because of these predicted changes and the solutions sought to minimize these challenges.

Background – How Climate Change Affects Water Supply

Climate change generally refers to changes in average temperature, precipitation, and weather intensity. Climate experts agree that the main cause of global warming is the increasing levels of greenhouse gases in the atmosphere. While a certain level of greenhouse gases are essential to maintaining the temperature of the earth,[1] higher levels raise the earth's temperature causing climate change.

Global warming affects water sources in three general ways:

1. Changes in annual rainfall. As global temperatures rise, the frequency and intensity of precipitation changes. Some areas will see lower precipitation with an increased frequency of droughts while other areas will see higher precipitation with an increased frequency of floods. Variances in stream flow can also result from changes in the amount and rate of snow melting in mountain areas.
2. Sea levels rise. Global warming is contributing to the melting of the polar ice caps, resulting in a rise in sea levels.[2] When sea levels rise, saltwater can intrude into fresh water supplies making them unusable. It can also flood water infrastructure systems causing operational disruptions or rendering them inoperable.
3. Decreased raw water quality. Higher temperatures cause more algal blooms, which can introduce toxins, poor taste, and odor compounds into water sources. Likewise, higher

[1] Karl, Thomas R.; Kevin E. Trenberth (2003). "Modern Global Climate Change". *Science* 302 (5651): 1719-1723. doi:10.1126/science.1090228.
[2] Morgan, Wayne D. "Being Proactive on Climate Change: Tracking and Controlling Greenhouse Gas Emissions." West Virginia American Water.

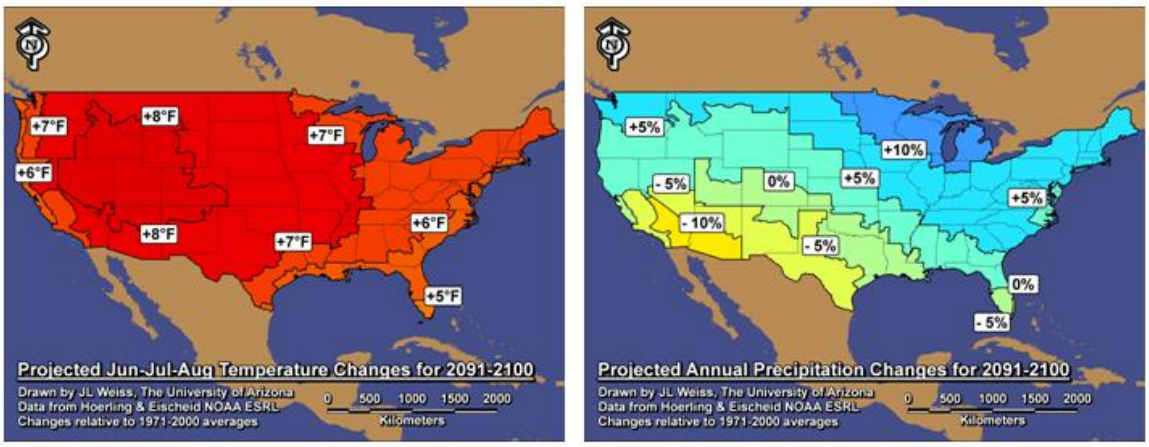
intensity rainfalls increase run-off rates from agricultural land resulting in higher levels of nutrients, pesticides, microbes, and debris in water sources. The poorer quality water results in a higher cost of water treatment. In some cases, floodwater can overflow well casings, contaminating well water sources.[3]

These changes can affect the nation's already compromised water infrastructure. Specifically, buried pipes become more prone to cracking as a result of greater soil movement due to flooding and droughts. This results in leaking pipes, which causes unnecessary water loss while compromising water quality.

The United States is already seeing changes in the frequency of severe weather conditions, such as droughts, floods, and hurricanes, which have adverse impacts on the nation's water supply. On a month-by-month basis, 2012 was characterized by large areas of dry and, earlier in the year, large areas of wet weather. Eight months had ten percent or more of the country experiencing very dry (at the tenth percentile of the historical record or drier) precipitation anomalies, with five months having more than a fifth (20 percent) of the country very dry.[4]

By the end of 2012, three drought epicenters remained — Hawaii, the Southeast, and one large area of drought stretching from the southern California coast across the West and Great Plains to the Midwest, with the worst drought conditions focused on the Plains states.[5]

While the effects of climate change are being felt today, trends are likely continue if we do not adjust our approach. The next century's predicted temperature and precipitation changes offer a telling look into our water resource future.



In the next century, temperatures for the June July months could rise by as much as 8 degrees Fahrenheit in some parts of the United States. Likewise, forecasts show states in the Northeast and Midwest with a precipitation increase of five to ten percent in the next century. The Southeast and West could see a decrease in precipitation levels by five to ten percent.

Given these challenges, it is essential to identify practical solutions today to help mitigate the impact of climate change on our future water supply.

Finding Solutions

[3] AWWA Research Foundation and University Corporation for Atmospheric Research.
[4] State of the Climate Drought Annual 2012 NOAA National Climate Data Center: http://www.ncdc.noaa.gov/sotc/drought/
[5] State of the Climate Drought Annual 2012 NOAA National Climate Data Center: http://www.ncdc.noaa.gov/sotc/drought/

The water industry is exploring ways to maintain high water quality while conserving existing sources. The following section looks at ways in which the water industry can help ensure that the public continues to receive an adequate supply of high quality drinking water.

Conserving What Exists

One of the most basic ways to offset the effects of climate change on the nation's water supply is to continue to conserve water and develop new water conservation strategies. Water industry experts have already invested much time and research into this area. Among the most basic, but fundamental, solutions:

- **Improved Leak Detection & Repair -** The American Society of Civil Engineers reports that an average of six billion gallons of potable water is lost per day in the U.S. through leaky pipes. This not only wastes water as a resource, it also wastes the energy used to pump and treat the leaked water. Acoustic leak detection systems locate pipe leaks by the sounds they emit. Recent developments allow acoustic leak detection to be incorporated into automated meter reading (AMR) systems, noting day-to-day acoustic patterns to determine potential leak locations.[6] In 2007, American Water utilized this method to identify and repair leaks in a small, 5,000 customer system, which will save the system about 64 million gallons of water and $120,000 per year. Advanced meter reading technologies allow utilities to notify customers of sudden changes in consumption that could indicate leaks on the customer's property. This allows a utility-customer partnership that promotes the wise use of water.

- **Investment in Infrastructure -** The country's water infrastructure is aging with many pipes approaching or past the end of their useful life. It is estimated that water utilities spend approximately $10.4 billion annually on infrastructure improvements.[7] However, even more investment is needed, as the average pipe age is still increasing. Additional funds are necessary to adequately maintain, repair and replace the nation's aging and defective network of pipes.

Reducing Consumption

While water conservation must be a part of the response in protecting water supply, so must reduced consumption. The following list contains some ways to achieve this:

- **Education and Awareness -** Water use education will help Americans understand their role in reducing daily water use. Reports find that the average American's domestic water use of 135 gallons per capita per day is 3-4 times that of the average German (39 g/c/d) or British citizen (40 g/c/d).[8] Many are not aware of the simple actions they can take to positively impact the water supply, but there are a number of methods consumers and small businesses can undertake to conserve water. A complete list can be found on either on American Water's website: http://www.amwater.com/coaw/Customer-Service/Wise-Water-Use/ or through the EPA's website: http://www.epa.gov/watersense/.

- **Tariff Structures -** One way to reduce consumption is through the introduction of water conservation tariff structures. Water tariffs, also known as water rates, affect the amount that consumers pay for the water they use. Water conservation rates encourage conservation by charging increasingly higher rates for increased water consumption. Another way to limit water use is through implementing voluntary or mandatory restrictions governing non-potable use, such as lawn irrigation.

- **Product Labeling -** The EPA is leading this effort to reduce unnecessary water consumption with its WaterSense® program. The objectives of the program are to encourage efficient use of water resources, preserve them for future generations, and reduce water and wastewater

[6] Morgan, Wayne D. 2006. JAWWA 98(2): 33-35.
[7] Yardley, William. "Gaping Reminders of Aging and Crumbling Pipes." 08 Feb. 2007 *The New York Times*.
[8] Reed, Hal. American Water

infrastructure costs. American Water joined the program to promote water efficiency through the use of WaterSense® labeled products.

Developing Alternative Supplies

Climate change will result in some areas of the country receiving less water in the future. These areas will need to find new water supplies when conservation alone cannot bring supply and demand into balance. Two rapidly developing solutions for alternative supply include:

- **Desalination** - As 97 percent of the earth's water is seawater, desalination provides a viable solution to the problem of water scarcity. Indeed, more than 50 percent of the U.S. population lives in coastal areas within 50 miles of seawater, creating vast opportunities to use the ocean as a source for drinking water. This is especially important as access to new sources of fresh water continue to decrease. Recent developments have made seawater and brackish water desalination more energy efficient, making desalination an increasingly sustainable and cost-effective solution for supplying drinking water. Desalination research and development must continue in order to make the technology even more efficient.

- **Water Reuse -** Wastewater that has been treated to near drinking water standards can be used for non-potable uses such as irrigation, industrial processes, toilet flushing, and replenishing of ground water (referred to as ground water recharge). This decreases the pressure on the finite supply of fresh water. The effective management of wastewater drastically reduces operating costs and greenhouse gas emissions, which can help ease climate change pressures.[9]

Minimizing Water Utility Greenhouse Gas Emissions (GHGe)

While global warming poses a business challenge to water utilities, utilities also contribute to the global warming problem through their energy use. The technology used for advanced water treatment processes is energy intensive, meaning treatment plants contribute to greenhouse gas emissions, creating an unfortunate link between improved water quality and climate change. Likewise, the increased use of advanced water treatment processes will only increase the energy intensity of potable water systems (kWh/gal).

As the accumulation of greenhouse gases leads to global warming, water utilities must continue to assess their own contributions and track greenhouse gas emissions to find ways to reduce their impact on the environment. There are a number of strategies for doing so, including undertaking regular energy audits to determine how they can become more efficient.

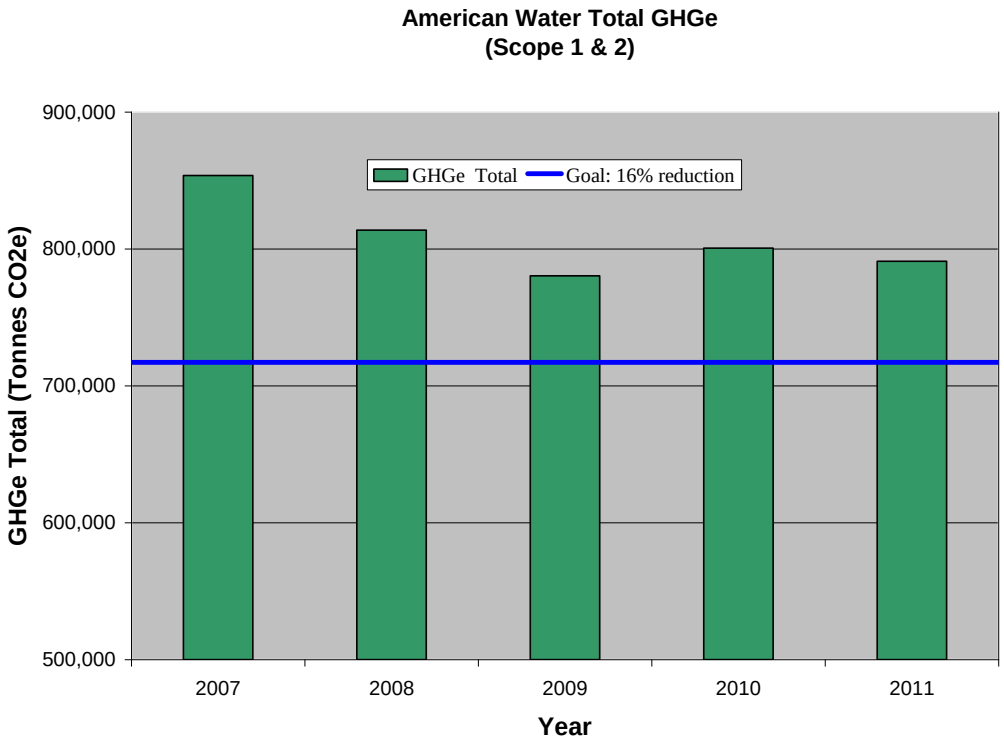
The federal government responded to this challenge in 2002 by creating the Climate Leaders program within the EPA. Climate Leaders was an industry-government partnership that worked with companies to develop comprehensive climate change strategies. Partner companies committed to reducing their impact on the global environment by completing a corporate-wide inventory of their greenhouse gas emissions based on an audited and approved GHGe Inventory Management Plan, setting aggressive reduction goals, and annually reporting their progress to the EPA.

American Water joined the Climate Leaders program in 2007 and reported annual GHGe from 2007 - 2010. In 2010, the EPA announced it was phasing out the Climate Leaders program in September of 2011 and they encouraged all Climate Leaders Partners to transition their annual GHGe reporting to a state or non-governmental program.

[9] American Water has significant experience in developing water reuse systems. More information can be found in an American Water white paper, entitled: "Innovations in the Water Industry: Going Green" (http://files.shareholder.com/downloads/AMERPR/440567917x0x188151/C3B8E9E0-4923-41F3-9239-39BE0343AAEE/Challenges%20In%20The%20Water%20Industry%20Going%20Green041608.pdf)

American Water transitioned to the Carbon Disclosure Project (CDP) in 2011 and reported our annual GHGe through the CDP in 2011 and 2012. The transition was relatively simple since both programs use the "Greenhouse Gas Protocol" from the World Resources Institute, the most widely used international accounting tool for governments and businesses to understand, quantify, and manage GHGe.

American Water has completed five years of greenhouse gas emissions accounting. The data in the graph below show our greenhouse gas emissions have decreased 7.4 percent from 2007 to 2011. This reduction is a result of our successful efforts to lower our non-revenue water and increase water conservation. We expect our greenhouse gas emissions to continue to decline over the next six years with additional improvements in non-revenue water, increased water conservation, and improvements in pump efficiency.



Conclusion – Working Together

Global climate change will not only have widespread implications for water utilities, but also for communities and business around the world. An important step in addressing the challenges of climate change is identifying ways to limit greenhouse gas emissions and educate people about these measures. American Water is dedicated to doing both. While the water utility industry must demonstrate leadership here, it cannot succeed alone. A unified effort between government, businesses, and consumers is needed to implement near-term solutions and develop broad strategies to address the adverse impacts of global warming on the water industry and the global water supply. Policy changes, funding for infrastructure, development of alternative water supplies, and public education will all be necessary in order to make significant progress. As the issues are vast, actions must be undertaken by the both public and private sectors in order to effectively meet and address the challenges of climate change that lie ahead.