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Research Note

Bottling Troubled Waters

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Abstract: This reports discusses the vital role water and wastewater infrastructure plays in any society, and the relationship between public and private sectors in the role of managing water-related resources. The report examines how the two sectors relate to water, and the key roles of water and wastewater infrastructure, external threats, and management.

“Multinational companies now run water systems for 7 percent of the world’s population, and analysts say that figure could grow to 17 percent by 2015. Private water management is estimated to be a \$200 billion business, and the World Bank, which has encouraged governments to sell off their utilities to reduce public debt, projects it could be worth \$1 trillion by 2021. The potential for profits is staggering: in May 2000 Fortune magazine predicted that water is about to become ‘one of the world’s great business opportunities’, and that ‘it promises to be to the 21st century what oil was to the 20th.’” —John Louma, “Water Thieves,” *The Ecologist*, March 2004

The simple connection of two hydrogen atoms to one oxygen atom forms the chemical compound of the molecule known as water. Water covers approximately 71 percent of the surface of the earth, and is found in the air, the ground, and in every living thing. Comprising nearly 60 percent of the body mass of all living species, water is the basis for life. Water is not only the basis for life; it is the basis of civilization. And ensuring that clean water is easily and cheaply available to the population of any civilization is of vital importance to the state.

The U.S. Department of Homeland Security identifies Water and Wastewater Systems as one of the 17 critical infrastructures that support our country. In conjunction with private agencies, the U.S. government maintains over 150,000 public water systems across the country to provide safe and clean water to the population, and to remove wastewater and excess water from natural events. This report will focus on how the public and private sectors are dealing with the following challenges:

- Infrastructure – maintaining and developing water and wastewater systems that serve an exponentially growing population of 300 million
- External Threats – ensuring the safety of water and wastewater systems from contamination, bioterrorism, sabotage and natural events
- Management – the growing struggle between government control and the privatization of water resources, including water as a commodity (bottled water)

Infrastructure of Water and Wastewater Systems

Before the 1800s in the U.S., there was no real infrastructure of water and wastewater systems worth mentioning. Water inside the American home came from a well or was carried from a nearby river or lake. It was not until the mid-1800s that America saw its first comprehensive sewage system in Chicago.ⁱ The idea of water and wastewater systems began to catch on in U.S and spread to other major cities. According to the U.S. Census Bureau, the population in 1850 increased from 23 million to 76 million by 1900. And during this time is when most metropolises in the U.S. began to install water and wastewater systems, many of which were privatized operations. All of these systems used different materials, such as wood or lead, to create the water pipes leading to a complete lack of consistency between all the competing agencies.ⁱⁱ

The late 1800s and early 1900s also showed great advances in medicine. The greatest advance being in microbiology and the spread of communicable diseases. John Snow discovered in London that cholera was being passed through the water supply.ⁱⁱⁱ Robert Koch isolated the bacteria for tuberculosis and its possibility of spreading through the water supply.^{iv} Other medical research began to investigate the

detrimental effects of lead on human physiology. At the turn of the century now, the idea was introduced that lead pipes bringing in the water supply were responsible for the drop in infant mortality in places like New Hampshire.^v

Lead pipes may quite possibly be the greatest threat to the infrastructure of water systems in the U.S. Private institutions recognized that these pipes which were laid by at the turn of the century would propose an astronomical cost for replacing with safer materials. Rather than assume any risk of such a problem, and before government regulation, these water systems were transferred into the hands of government institutions.

It was not until the 1970's that the government passed the Safe Drinking Water Act.^{vi} By this point, the demand for water now answers to a population of over 200 million people. The infrastructure has been overloaded with such strain that government agencies cannot keep up with the cost of repairing the old systems in place and the demand to construct new systems for a population that reached 300 million in 2007.

External Threats to Water and Wastewater Systems

Perhaps the most damaging and debilitating threat to the water and wastewater systems of our country is the desecration of water quality. Clean, safe, and drinkable water is an inalienable right to all living species, which is threatened on all sides by the inequities of our civilization. External threats to our water supply are wide and varied. Contamination by pollution and careless dumping. Bioterrorism and sabotage of facilities. While most of these threats are imbued by human activity, there remain unpredictable natural events. Many civilizations throughout history have been lost due to all of these external threats. Whether the poisoning of wells and waterways as the agenda of military conquest, or awesome natural catastrophe, the imminent and debilitating threats to our water systems are external.

Contamination of our water systems is bestowed on us in a variety of insidious methods. Pollution caused by human activity has affected the quality of our freshwater resources to the point that more than half are too contaminated to sustain aquatic life.^{vii} Industrial dumping in water resources is most likely the main culprit in this pollution. Avoiding the cost and time it takes to properly dispose of chemical waste, corporations often dump this in the water supply. The amount of waste produced and dumped each year far exceeds any possibility of a homeostatic natural recovery. While the ecosystem can sustain a certain amount of pollution and recover, the amount of chemicals dumped far exceeds what the ecosystem can handle.

Pollution in the water does not always result from direct dumping. A significant portion of the pollution is collected from runoff water as it moves through the environment. Running down streets and hills, rainwater collects all of the pollutants and contaminants along the way. Even if the water is not collected by runoff, chemical pollutants saturate into the ground and eventually reach the ground water supply.^{viii} Most of these chemicals and pollutants are the direct result of oil from the automotive industry. Automobiles, busses, boats, and airplanes are the culprit in disseminating oil-based pollutions into the air and on the ground – all of which end up in the water system. Treating this water is a complex process that is expensive and does not always work. The *New York Times* reports that only 91 contaminants are

regulated in drinking water – which is 0.0015 percent of the identifiable contaminants found in the water.^{ix}

Another major contaminant in the water supply is the increasing amount of drugs found from the pharmaceutical industry. The prevalent use and administration of drugs such as amoxicillin, doxycycline, acetaminophen, and fluoxetine are now regularly found in our water supply.^x Since they are reaching measurable amounts, there is no precedent for determining their effect. Up here in the Pacific Northwest, the local addiction to coffee has caused unprecedented amounts of caffeine in the water.^{xi} While caffeine may seem to be a relatively harmless substance to humans, in the marine world it can cause significant stress.

While most of the contamination discussed so far is unintentional, special consideration must be given to intentional contamination – more specifically, bioterrorism. Bioterrorism is the intentional poisoning of a water supply using a biological agent such as bacteria, virus, or other toxins. These biological agents are released in the water supply with the intention of causing illness or death. While these agents are often already found in the water supply, bioterrorism seeks to unnaturally add these agents. Well poisoning has long been a military technique to deliver a debilitating blow to the enemy. Bioterrorism is usually thought to be part of an external campaign, but nonetheless there are domestic enemies who would seek this method first. Poisoning the water of a city or a large arena seems to be the prime targets of foreign terrorists. However, there are a handful of U.S. citizens who would use bioterrorism to curb illegal immigration. California has long fought domestic terrorists who leave poisoned water supplies for illegal immigrants under the guise of compassionate aid.^{xii} This method often backfires when random hikers or children find the water and drink it.

Lastly, and probably the most devastating external threat to the water and wastewater threats, is natural events. Any naturally occurring phenomenon can have a debilitating and devastating effect on the water supply. Large magnitude earthquakes can completely disrupt the flow of water. Earthquakes can alter the flow of a river, which would either completely wipe a population out or deprive an area of its water supply. Any water system that uses outdated, or even modern, technology can be obliterated and rendered useless. In addition to altering the water system itself, an earthquake can cause the devastation of a chemical or nuclear plant causing all of contained contaminants to enter the water supply. And what does not immediately enter the water supply, eventually enters the groundwater supply.

Flooding can be equally damaging. As climate change takes its toll on the environment, excessive rain and flooding are becoming a more common occurrence and not just a threat. Flooding can overflow storm drains causing backup in the wastewater system. Now instead of the wastewater flowing to its destination, it simply spreads everywhere – including raw sewage. Flooding also picks up a large amount of debris including chemical contaminants that now float freely in the water supply and eventually seep into the groundwater.

Drought inevitably takes its toll too. When an area becomes impoverished of water, painstaking efforts are sought to reroute water back to the area. Southern California has long fought this problem with the aqueduct – which has been a long and heated political debate. Drought causes massive crop loss and without rerouting water supply, there is little chance of recovery. Rerouting water supply is often a major

political debate between public sectors and private sectors because of the fiscal cost in rerouting and the environmental damage caused in the area from where the water was routed. Who owns the water?

Management of Water and Wastewater Systems

As talked about earlier in this report, the management of the water and wastewater systems has had an uneven balance between the public and private sector. Now that we are faced with the imperative dilemma of upgrading the infrastructure, while protecting against contamination, bioterrorism, and natural phenomenon, and recognizing that we live in an exponentially increasing population. The question emerges: who should be in charge of it? Public institutions have failed us due to poor management. Private institutions have bailed out on us when the going got tough. As a critical infrastructure, the problem must be addressed now.

As it is, a public service, our water and wastewater systems are failing us. They are understaffed and underfunded, forced to work with yesterday's technology. The continued management of water as a public resource means little progress and our problems will get bigger. Lost in political debate, corporations will continue to contaminate the water with an underfunded government institution trying to fight back. However, public management of the water ensures the most efficient management. Keeping water as a public utility ensures that corporations will not gouge the price and effectively kill off those who cannot afford to be a consumer. Public agencies can work with other public agencies to ensure the safety of the methods in practice.

Privatizing the water systems seems to be a step in the wrong direction. Private industries answer to investors and must continue to turn a profit – usually at the expense of the consumer. While we know this to be true, profiting off the most essential resource to sustain life seems to ensure natural selection – at the expense of the poor who cannot afford it. Privatizing water has the advantage of ensuring (perceived) better management, void of political backlash. Also, with a steady stream of increased profit there would be room for research and technology to enter the scene and strive for efficiency.

The question becomes, do we pay for our water in private profits or public taxes? Neither seems to be a favorable answer. Water systems currently owned by private sectors have risen to the challenge by selling bottled water. Ounce for ounce, bottled water is worth more than gasoline.^{xiii} Public institutions do not have the option of selling off excess water for profit. There is a shaky balance now, neither of which really seems to benefit the public. Working together on this solution seems to be the optimal answer. However, such an agreement would imply an endorsement of a particular institution. Causing unfair competition would probably lead to lawsuits that would completely strangle everyone and everything involved instead of progressing toward an answer.

Conclusion

The inception of water and wastewater systems in the U.S. has had an extraordinary history and prevalence. Shared water systems began to develop as the result of urbanization. Recognizing the demand for a supply private institutions began to take control of water systems as did public institutions. Who should be providing the service has always been a question. Regardless, water and wastewater systems are a critical infrastructure to our nation and need to be protected as vital elements of the state.

The current state of the infrastructure of the 150,000 water and wastewater systems in the nation lacks fluidity. Our current systems are based on technology that developed at the end of the 1800s. Since then, our population has more than tripled and the areas we service have grown just as much. Serving this demand is a daunting task that requires an overhaul of not just the infrastructure's physical components, but also its management.

Protecting the water and wastewater systems from external threats is vital to our safety. Water is the target of contamination from outside sources. Chemical contaminants are regularly dumped in our water system and infect not only the water supply, but also the ground itself. The other major source of contamination is runoff water that collects oil from the street and pesticides from our yards. Bioterrorism is also a major concern to the well being of our water systems. There are those that would poison our wells and rivers with agents of destruction that cause illness and death. All of these factors are compounded by the imminent threat of natural phenomenon. Earthquakes, flood, and drought all equally have the potential to devastate our water systems. Protecting against these external threats is astronomical, in terms of management and cost.

The final challenge to our water system is management. The argument between water systems being a public or private institution has been prevalent since the inception of water systems. Public institutions are often underfunded and mismanaged by government resources. Although they seek to provide service to all, this widespread action is costly and inefficient. Private institutions proffer glamorous ideas of efficiency, technology, and profit – but at whose expense. Private institutions also have the options of selling off water resources for a profit. This could easily lead to the destruction of a natural resource. The argument may forever ebb and tide.

Forging an alliance between the public and private sectors to protect our critical infrastructure resource seems to be like mixing oil and water. Infrastructure, external threats, and management of the water and wastewater systems need to come together in a manner that satisfies the public. Privatization of water may seem like a good answer in the short run, but it also transfers the power out of the people's hands. Ideally, the two institutions will work together, but paying taxes and profits on the lifeblood of life seems inane. Ensuring that water is available to everyone without destroying our environment is on the hands of government. The technology to do this will emanate from the private sector. The real work is piecing these two together – just as the old pipes used to build the initial infrastructure. Eventually we must make it work together, and it will flow like the river.

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