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REDUCING THE COSTS OF MUNICIPAL WATER INFRASTRUCTURE

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INTRODUCTION

According to the EPA, over the next 20 years, the United States faces hundreds of billions of dollars in water infrastructure liabilities.[1] Local governments across the country are grappling with the challenge of responding to ongoing water main breaks while simultaneously making the long-term investments that are necessary to sustain their systems going forward. These contradictory fiscal pressures are further exacerbated by the need for many of these localities to make expensive upgrades that separate combined sewer-storm water overflow systems to comply with the Clean Water Act. As governments and utilities engage this challenge, there is a significant need for creative cost-containment strategies that can make each dollar stretch further.

Unfortunately, even though the need for savings is growing ever greater, many decision-makers are bound by legacy statutes and rules that encourage or even require inefficient water infrastructure investments. However, by systematically introducing competitive infrastructure policies that are performance oriented and open to innovation—rather than narrowly tailored to the specifications of past practices—governments can mitigate their unfunded liabilities while continuing to deliver effective and reliable water services.

BRIEF HISTORICAL CONTEXT

As detailed in the American Water Works Association's report entitled "Dawn of the Replacement Era," drinking water infrastructure in the United States was largely built in tandem with a few major historical population booms, which were concentrated around 1890, the 1920s and the "Baby Boom" of the 1950s and '60s.[2] The earliest generation of water infrastructure was composed of thick-cast iron pipes with expected lifespans of 120 years. The 1920s boom buried pipes with lifespans of closer to 100 years, and the "Baby Boom" generation planted thinner pipes with expected average lifespans of approximately 75 years. Each of these surges in infrastructure spending occurred during historical population and economic booms that produced associated increases in spending capacity. Because of the long lifespans of water pipes, until now, no American generation has had to incur large scale simultaneous replacement costs. That has changed, however, as today's water utilities are at the beginning of what will quickly become the "new normal" for water distribution: continual replacement of water pipes as they reach end of life and fail, along with customary maintenance and emergency response.

A QUESTION OF PIPES

In order to adequately adjust to this new reality, it will be incumbent upon all levels of government to rigorously examine their procedures and make the changes necessary to reduce the cost of water infrastructure replacement. Unlike other infrastructure services such as transit, the primary cost driver in first-world water systems is not human labor but basic materials. According to the EPA, the pipes themselves comprise 60% of the cost of water needs.[3] Given this, reductions in pipe costs are likely to produce the greatest potential savings.

While a variety of materials can and traditionally have been used for water infrastructure, and many still have niche advantages in certain conditions, the current water pipe market predominantly uses either ductile iron or plastic pipes, such as PVC.[4] Discovered in 1948, ductile iron is the technological successor to the original cast iron pipes buried in the 19th and early 20th centuries. When intact, it is tremendously strong, and is lighter, cheaper and more flexible than its cast iron predecessor. That said, ductile iron is more expensive than competitor materials and is subject to corrosion. Plastic pipes, on the other hand, which came into wide service in the 1970s, are essentially corrosion-proof and are the lowest-priced common pipe material by a wide margin—30-70% cheaper than ductile iron.[5] Since their initial introduction, both materials have been subject to considerable refinement and improvement, but their core properties and respective trade-offs have remained broadly consistent.

Accordingly, when local water utilities plan the replacement of end-of-life water systems, they will generally have these two categories of materials from which to choose. And, that choice should depend entirely upon project-specific conditions and engineering judgment. As a number of observers have pointed out, however, local policymakers are often inhibited from accepting bids that use the full range of available technologies. For example, in their survey of water infrastructure rehabilitation challenges Ariamalar Selvakumar and Anthony N. Tafuri note that, "selected technologies and materials must be acceptable to the utility" and "some water utilities [...] wish to retain ductile iron for pipe replacement projects" merely as a matter of preference, which arbitrarily removes cost-effective plastic pipe replacement techniques from consideration.[6]

According to a 2013 U.S. Conference of Mayors report, such preferences are caused by a "habituation factor that renders certain practices in the procurement of goods and services wasteful by virtue of their fundamental, if hidden, flaws."[7] The determination to replace like with like is a risk-averse behavior that reduces the scope of work for writing a proposal and evaluating bids, but it does not necessarily produce the best public outcome. Indeed, Selvakumar and Tafuri also argue that: "Specifying a single technology in request for proposals may have a negative impact on the competitiveness of bids received for the use of that technology."[8] Accordingly, they argue, "a level playing field is created when bidders can propose one of several suitable technologies, so that a fair competition is created with similar performance characteristics specified for each."[9] However, as PHCP Pros reports, in some cities in Michigan, for example, "local ordinances and contracts restrict or prohibit the use of plastic piping to transfer water," which pre-emptively strikes the lowest cost material from consideration.[10] The American Water Works Association further notes that: "Some states preclude the use of alternate procurement methods that minimize infrastructure procurement costs."[11] And the U.S. Conference of Mayors describes the conventional decision-making process for water pipe replacement as merely "replac[ing] the pipe with roughly the same product regardless of price, and based on manufacturer's recommendations."[12]

Given the new pressures placed on water infrastructure budgets by the advent of the "replacement era," however, habit is insufficient justification for major public works decision making. In light of this, performance-based procurement would encourage competition and further innovation in water infrastructure because it can be appropriately designed to suit the specific needs of each project and it takes into account the full life cycle costs of each proposal.[13] To accept bids from rival materials encourages each industry to increase long-term quality while decreasing cost. Further, as the state of the material sciences advances, it also encourages potential new market entrants. In cases where local corrosive soils drive up the long-term maintenance costs of ferrous pipe materials, such performance-based procurement would allow local municipal water departments to choose PVC pipes, rather than relegating them arbitrarily to more expensive iron ones. Performance-based standards would also account for pressure and environmental conditions that are best addressed by ductile iron in the long-term, even given the higher short-term cost involved.

GREEN INFRASTRUCTURE AND STORM WATER

Performance-based standards do not have to be limited to a choice between which pipe materials are put into the ground, however. At least on the storm water side of the infrastructure equation, cities increasingly have the option to decide whether to bury pipes at all.

Equal to or even greater than the outstanding cost of replacing their drinking water infrastructure is the cost many cities face to separate Combined Sewer Overflow (CSO) systems to comply with the federal Clean Water Act. CSOs bring storm water and sewer together into one pipe that is then sent to a water treatment plant. During severe surges, however, the combined storm water and sewer can overwhelm the treatment plant's capacity. When that happens, raw sewage is diverted directly into local streams and rivers. The EPA enforces the Clean Water Act's objections to this practice through binding consent agreements with cities across the country in which local governments commit to separating their systems for the protection of their local water. While this is certainly beneficial work, it can also be tremendously expensive, and storm water and sewer rates often increase many-fold over just a few years in order to fund the work.

As cities undertake these separations, though, they are also beginning to reach an initial critical mass of experience in a radically different form of storm water infrastructure: green technology. Composed of things like bioswales, retention ponds, pervious pavers and rain gardens, casual observers could easily mistake green infrastructure[14] as an urban fad that caters to citizens who prioritize organic surroundings over synthetic ones—even as they desire to live in cities. It could also be mistaken as purely an environmentalist effort, cleaning the air and water while hopefully cooling the climate. However, it can also be a powerful tool in the municipal toolbox for containing infrastructure costs because it preemptively reduces the amount of water that enters the traditional storm water system. In some circumstances, it can even pre-empt the need for extending the system to new development.

According to the EPA, "green infrastructure mimics natural systems by absorbing storm water back into the ground (infiltration), using trees and other natural vegetation to convert it to water vapor (evapotranspiration) and using rain barrels or cisterns to capture and reuse storm water."[15] The most important implication for local governments is that such actions intercept storm water before it ever enters the expensive-to-maintain "gray infrastructure" of municipal water and sewer systems.

In fact, a 2007 EPA green infrastructure study found that, "in the vast majority of cases, significant savings were realized [...] due to reduced costs for site grading and preparation, storm water infrastructure, site paving, and landscaping. Total capital cost savings ranged from 15 to 80 percent."[16] Philadelphia, for instance, estimates that under its new storm water regulations, most one-inch storms will be managed on-site instead of sending 25 billion gallons a year into its combined sewer overflow. It is estimated that this will save the city $170 million.[17]

Green infrastructure implementation is not always smooth, however, and experience suggests that the government is most likely to thwart its own efforts. An EPA report notes that many cities first need to overhaul a variety of local ordinances in order to allow these alternatives to be built: "Local policies, such as landscaping and parking requirements or street design criteria [...] land development regulations, building codes, permitting processes and more" need to be coordinated around the new methods of storm water abatement, and city agencies need to work together on municipal projects.[18] Private sector adoption of new practices, on the other hand, is easily encouraged by the enactment of specific storm water fees that can be discounted based on the extent of storm water abatement a property achieves. A simple user fee is another method-neutral water policy, wherein a property either pays for the use of public storm water services, or it finds another way to achieve the same end.

CONCLUSION

As the United States transitions into the "replacement era" of water infrastructure, local governments are at risk of severe fiscal stress if they fail to successfully adapt to new investment conditions. Procurement policies designed around familiar materials and methods risk leaving too little margin for error as successive generations of pipes reach the end of their lifespans and federal clean water regulations continue to demand compliance. In the best case scenario, municipal water managers will need to think creatively and execute their plans efficiently to stave off both municipal bankruptcy and ratepayer revolt.

By adopting performance-based procurement standards, local governments can become flexible enough to adopt new methods and materials as their circumstances demand. If, on the other hand, they persist in following 20th century habits while expecting better results, they will be significantly disappointed.

ABOUT THE AUTHOR

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ENDNOTES

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