INTEGRATED WATER MANAGEMENT

A Guide for City Leaders
June 2016

INTRODUCTION

Creating a healthy, livable, and equitable city must include a commitment to effective water management. Yet, most cities have a water system that is burdened by serious threats, from lack of funds for proactive maintenance to challenges in quality or supply, that are too great to solve with current management practices. Cities can instead create a more resilient water system by transitioning to a new framework: integrated water management. This approach to water management can help cities leverage limited resources more efficiently and better safeguard the important roles that water fills in residents' lives. Residents depend upon safe drinking water flowing reliably from their taps, and cities must safeguard this vital service to protect the health of their residents. Providing clean drinking water equitably to all, regardless of income level or location within the city, is essential to preserve public trust in government. Water is a necessary commodity, powering residents' lives and businesses. Safe and easy access to healthy, attractive, and recreational waterways greatly enhances livability and economic development; even without a body of water, cities can generate new economic opportunities through infrastructure investment and maintenance.

Moving toward this vision is more critical than ever. Climate change is altering the ways water moves through cities, bringing extremes – both drought and flooding will continue to worsen. Constituents take well-functioning water infrastructure for granted, yet city leaders may balk at the significant investment required to maintain or upgrade these systems. As a result, aging infrastructure leads to leaks, breaks, corrosion and other issues, causing service interruptions or even jeopardizing health (a major factor in the tragic mismanagement of Flint, MI's water system). Conservation – a necessary response to strained supply – also leads to reduced revenue for utilities, causing difficulties balancing the budget without overburdening residents who can least afford rate hikes.

Cities can transition to a more resilient water system by adopting an integrated water management framework. Integrated water management (IWM) refers to a set of principles, and the approaches that follow, that recognize all water is a resource. That core principle means that systems must manage all water as an asset, whatever form it's in when it first enters the city – rain, as one example, can be an invaluable resource rather than a nuisance, and should be treated as such. Cities must also reduce waste and capture all possible value, not only from water but from other resources in the process. Finally, these shifts also require that cities integrate management approaches wherever possible. Given that all water is a resource, it should not be managed in such discrete, disconnected flows. Beyond the question of water in different forms, water management must also be integrated into every other city decision, from land use to economic development planning. Integrated water management helps cities preserve water as an essential resource foundational to life.

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SUMMARY

City leaders need a new approach to maintain a safe, equitable water system as climate change worsens and budgets shrink.

Integrated water management (IWM) provides a framework that views all water within cities as a resource.

IWM focuses on water quality and supply while providing co-benefits like cost savings and economic development opportunities.

City leaders should implement IWM approaches within water utilities, across city departments, and at a watershed scale.

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THE CRITICAL ROLE OF POLITICAL LEADERS IN WATER MANAGEMENT

The core principle guiding an urban water system is often left unstated in more technical frameworks for water planning: residents depend on safe and reliable access to water, for everything from basic sustenance to operation of their businesses. Mayors and other political leaders can and must underscore the centrality of high-quality, reliable water management as a core tenet of a livable city. A city cannot thrive without a well-managed, resilient, and equitable water system that serves all residents.

> While we use the term "integrated water management," the term "One Water" is used to describe similar efforts to integrate and optimize urban water systems within the larger context of the city. The Water Environment & Reuse Foundation (formerly the Water Environment Research Foundation) developed the term, and defines it as an approach that "considers the urban water cycle as a single integrated system, in which all urban water flows are recognized as potential resources, and the interconnectedness of water supply, groundwater, stormwater and wastewater is optimized, and their combined impact on flooding, water quality, wetlands, watercourses, estuaries and coastal waters is recognized."[1]

The tragedy of poisoned water in Flint, MI reveals a jarring failure to meet this baseline requirement, but one that is sadly not unique, as many cities have a similar story. Over an estimated seven million people in the United States live in housing that has lead service lines, a major source of waterborne lead, and that is just one example of common water contaminants that threaten human health.[2] Over 800 cities still utilize combined sewer systems, which during heavy rains can overflow and discharge pollutants from stormwater runoff and raw sewage directly into local waterways, with serious risks to human and animal health for those exposed.[3] Elements of structural racism and classism have shaped which areas have access to the best water infrastructure, between cities and especially within them. For a city to be truly equitable, it must maintain a just and healthy water system accessible and affordable to all residents.

Political leadership is also necessary to retain municipal control of water utilities, critical if a city wishes to fully integrate its water system management with other planning. On average, private utilities charge 14 percent more than municipal utilities.[4] Additionally, signing a contract with private utility operators may limit the city's rights to impose future legislation about water quality, sourcing, and other crucial elements of system management. Full-scale implementation of IWM is constrained in private water systems since so much of the approach requires responsive, collaborative planning.

Recognizing these complex issues, political leaders are uniquely poised to move cities toward integrated water management. Technical leaders, from utility managers to planning departments, provide essential services by focusing narrowly on their areas of expertise. Political leaders are tasked with the complementary role of taking a birds-eye view of the city, and are thus primed to look for opportunities to integrate and collaborate between often "siloed" departments and levels of government. Water systems are entwined with much more than just the resource, and integrated water management requires commitment from more than just utility leaders.

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INTEGRATED WATER MANAGEMENT IN PRACTICE

While IWM can seem both too audacious and too conceptual, cities around the country are showing what IWM can look like on the ground. IWM articulates a broad vision, but practices "the art of the doable" with the following core set of approaches.[5]

Protect and Restore Water Resources in the Environment

To reduce the treatment burden for drinking water, and to preserve water resources for their own sake, cities must adjust land use to preserve the natural areas surrounding bodies of water. Where feasible, cities should consider directly purchasing land, or working with regional partners, to create conservation easements; by preventing land development near waterways, cities can reduce pollutant loads upstream, saving the city money in treatment costs. Preserving vegetative cover in undeveloped land along waterways also encourages filtration of runoff while preventing erosion. Additionally, restoring natural areas within city bounds can enhance recreational opportunities.

Cities in both dry and wet climates understand the value of preserving natural land to protect water resources. New York, NY acquires "hydrologically sensitive" land through outright purchase or conservation easements, enabling the city to preserve natural areas undeveloped in order to protect water quality by reducing pollutants as well as supporting plants that filter out water contaminants.[6] The San Francisco Public Utilities Commission implemented a ten-year program from 2006 to 2015 to monitor, protect, and restore natural areas in the utility's service area, spanning across several watersheds.[7]

Conserve Water

Water conservation both ensures a sustainable long-term supply and reduces lost revenue for a city. Cities should first audit current systems to eliminate leaks and other sources of waste from municipal pipes, which not only waste a valuable resource but also cost cities money by losing water that could otherwise be charged to customers; an estimated 14 to 18 percent of municipal water is lost through leaks, inaccuracies in tracking, and unauthorized use.[8] The Birmingham, AL Water Works Board audited their water system to identify leaks and other issues causing nearly 3 billion gallons of lost water that cost the utility over $900,000 in 2011.[9] Technological innovations that better enable utilities to make sense of data collected can prove especially helpful for leak detection.

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Reducing usage is a second necessary step to conserve water. Many cities experiencing drought have instituted mandatory use restrictions, assessing fines to violators. A wider range of voluntary programs should also be adopted, from high-efficiency appliance rebates to training on water-wise irrigation. The Las Vegas, NV area utility has a particularly successful turf buy-back program to reduce the number of water-intensive lawns.[10] But it's not just dry cities striving to conserve via reductions in usage – Madison, WI has a high-efficiency toilet rebate program.[11]

As part of reducing drinking water usage, cities must also reevaluate many instances of current drinking water use – especially outdoor irrigation and industrial uses – that do not in fact require water treated up to potable standards, and can instead utilize rainwater, graywater (all water but that used for toilets from a building), or reclaimed water (wastewater effluent, treated either for non-potable use or more intensively for drinking water purposes). Austin, TX' City Code requires customers building near a "purple pipe" main, the term for pipes carrying water that has been treated to non-potable standards,[12] to use this reclaimed water for uses such as cooling and irrigation.[13]

Tucson, AZ

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Tucson, AZ.

As a large desert city, Tucson, AZ has prioritized policies that promote conservation and help the city secure a resilient water supply into the future. Tucson has been strategizing about its long-term water future since overdrawing its groundwater supply in the 1970s, prompting conservation measures that have expanded in the decades since.[14] Tucson's paradigm shift toward conservation has achieved dramatic results. The City has succeeded in reducing per-capita water consumption by a third compared to late 1970s levels.[15]

Several policies have strengthened conservation efforts and integrated water planning into other city functions. The City passed a xeriscaping (low-water landscaping) requirement by ordinance in 1991, limiting grass or other water-intensive uses to a small portion of the landscape on commercial and multi-family sites.[16] A 2008 ordinance requires all new construction to include plumbing suitable for "graywater" installations, which allow household water to be reused for certain applications before being conveyed away to the city treatment system.[17] Tucson also created a green streets policy that requires installation of green infrastructure to manage stormwater as part of every transportation department upgrade or new construction of a street.[18]

Tucson also established several financial levers to incentivize conservation. Utility rates for residential customers are tiered, such that higher users pay more for that additional water to discourage wasteful home uses.[19] The City created a rainwater harvesting rebate program for single-family homes and small commercial sites[20] as well as a single-family home graywater installation rebate program.[21]

While Tucson's work within its own utility service area demonstrates an integrated approach, the City's work and leadership from the Mayor to coordinate regionally further demonstrates its commitment to long-term, sustainable, and collaborative use of limited supplies. Tucson has led among cities in the region to coordinate planning that enables neighboring cities, including Phoenix, to utilize the City's water infrastructure to transport and bank water allocated from the Colorado River.[22] As Mayor Jonathan Rothschild describes, "by developing innovative policies and water sharing agreements, Tucson contributes to multi-state efforts to slow declining levels in Lake Mead and to ensure secure flows of river water to communities that depend on it."[23] This successful effort to coordinate across jurisdictions and even states to manage water supply proves that an integrated, collaborative approach to water management can help cities preserve a sustainable supply long-term.

Rain is a Resource

Traditional stormwater management approaches squander rain's potential to serve as an asset by funneling away water in large pipes, either directly to a water body in separate sewer systems (dumping pollutants in street run-off straight into waterways while sending water away downstream) or into a combined sewer system (risking sewer overflows into local waterways and increasing wastewater treatment loads). Instead, cities should capture rain where it falls, either via direct capture into cisterns or by groundwater recharge via infiltration. In addition to enhancing supply, this also reduces localized flooding risks.

On a systemic level, cities should reevaluate their land use practices to reduce impervious surface cover. At the site level, a set of tools called "green infrastructure" (in contrast to the "gray" infrastructure – traditional concrete and pipes) reduce impermeability and often also capture rain for reuse. There are a host of green infrastructure interventions, from tools to filter water, such as rain gardens in street bump-outs or green roofs, to those that capture rain for reuse, like cisterns. Cities should install green infrastructure wherever feasible.

Traditional stormwater management approaches squander rain's potential to serve as an asset…

Green infrastructure has co-benefits beyond water quality and supply, including neighborhood beautification and creating installation and maintenance jobs.[24] While many cities that have a combined sewer system in at least part of their service area have been leading in the use of green infrastructure, there are benefits for even separate sewer systems. Philadelphia, PA's Green City, Clean Waters is a model program that implements green infrastructure systematically throughout the city, using green infrastructure in many city projects from new street construction to playgrounds at local school districts.[25] The smaller mixed-system city of Lancaster, PA found that green infrastructure provided an estimated $2.8 million in benefits annually while avoiding over $600,000 in wastewater treatment costs.[26] In drought-stricken Los Angeles, CA, Mayor Eric Garcetti has advocated for green infrastructure and other tools to increase the volume of stormwater captured from current levels (just under 9 billion gallons) to 50 billion gallons by 2035.[27]

No More "Waste" Water

With water supplies getting ever scarcer, cities cannot afford to deem any water flow as "waste." Instead, cities should optimize their water reclamation process to keep as much water recirculating within city limits in a usable form, rather than sending it all downstream. While reducing wasted water, cities can also optimize processes to reduce wasted energy and maximize value from water treatment by-products (by creating fertilizer from biosolids, for example).

As a primary step in waste reduction, cities should strive to reclaim waste water to bolster supply. As mentioned, "purple pipes" (reclaimed water used for non-potable purposes) should be used in cities to conserve drinking water. Better still, highly treated waste water effluent should be used for drinking water, though only a few cities have started using this approach. More cities are using indirect potable reuse, also known as groundwater recharge. The Orange County (CA) Water District, working in partnership with the Sanitation District, now has one of the world's largest groundwater recharge system, pumping treated wastewater out to percolation basins where the water recharges the aquifer.[28]

Plan for Climate Resilience

Water systems will be particularly vulnerable to the effects of climate change, both through deepening droughts and the increasing intensity of rainstorms. To ensure a well-functioning, safe water system for the future, cities must act now to increase their resilience.

Cities should plan for and work to mitigate expected climate change impacts in all infrastructure projects and management approaches. Modeling is a critical first step to understand the likely effects of changing weather patterns in order to alter design standards. Seattle Public Utilities has conducted long-term modeling and planning to mitigate projected effects of climate change on infrastructure, from sea level rise to frequent deluges.[29] Every city, even those in drought, will have to take into account increasing intensity of storms that will strain current stormwater systems, and should work to enhance stormwater capture to reduce volumes flowing through the system. Additionally, long-term planning for drought (even in areas currently at normal levels) will ensure that supply can meet increasing demand as temperatures rise. The small city of Las Vegas, NM has had success in strengthening its own conservation programs like leak detection measures

as well as cultivating partnerships with the county emergency response team and a state-wide collaboration between water systems, allowing the city to borrow a tanker from its larger neighbor Albuquerque in case of emergency.[30]

TRANSFORMING APPROACHES: THE "HOW" OF IWM

Integrate

Starting at the utility level, cities should consider merging the management of all water flows (drinking, waste, storm and surface) into a single utility for best use of scarce funds and to enable more alignment in planning. Such integration can encourage the use of IWM approaches, from planning for drinking water reuse in waste water management decisions, to ensuring that stormwater is managed more effectively as an asset. Altoona, IA merged its drinking water and waste water utilities in 2011, a measure that saved costs and added a storm water utility.[31] Integrated utilities can also thrive in larger service areas – DC Water handles drinking water and waste water, and works in close coordination with the DC Department of Energy and Environment to manage stormwater in a way that protects local surface waters.[32]

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Within the city, leaders should strive to integrate planning between departments to encourage a "big picture" approach that plans for water wherever it is found, not just limiting proactive planning to drinking water or waste water flows. Consider a culture shift to prioritize regular meetings between water managers and land use planners: this shift alone might improve water quality (it's harder to site a gas station near a well when in regular conversations about water) and supply (thinking about water could also lead to tighter efficiency standards in city code). There are structural, informal, and policy levers that cities should use to drive integration in water management.

Leaders should initiate integration as a shift in city government culture by convening all utilities and departments that work on water. Mayors and other city leaders are well within their authority to request these kind of internal meetings, and can use these gatherings as a launching point to explore concrete changes to better integrate water management. While a city might start by convening at minimum land use and transportation stakeholders along with water managers, there are very few departments that do not interact with water in some way (at least via rain). Los Angeles, CA's One Water LA 2040 Plan details the outcomes of meetings between all relevant city departments and other government districts within the city limits, from the airport to the zoo, to align their own water management with the larger water planning goals.[33]

Cities should implement policy changes for the most lasting and wide-reaching integration of water management into other planning. Many cities, from Philadelphia, PA[34] to North Saint Paul, MN,[35] have adopted green streets policies that weave green infrastructure and related stormwater mitigation planning into every street renovation or construction project. Updating these guidelines also presents an opportunity to improving biking and pedestrian infrastructure standards, further enhancing livability. Cities have considerable untapped potential to expand required integration of water planning with planning for other outcomes, like inclusive economic development (particularly job creation for local residents via infrastructure investment, or renewed investment along surface waters), land use planning that promotes density, and more. Austin, TX stands out as one of a few cities with policy that formalizes integration between water planning and land use review processes.[36]

Onondaga County, NY

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Syracuse, NY

Onondaga County, NY (with its central city of Syracuse) has applied many elements of the integrated approach in its Save the Rain campaign, utilizing green infrastructure to reduce graywater needs. The County struggled with water quality issues for many decades, with combined sewer overflows from inadequate municipal stormwater management becoming a growing crisis.[38] Rather than build another water treatment plant, the County instead devised a plan to work with partners and utilize green infrastructure to reduce the volume of stormwater moving through the combined sewer system. In 2009, the County became the first in the nation to have green infrastructure included in its federal consent order.[39] From 2010 to 2014, Save the Rain completed 169 green infrastructure projects, resulting in 108 million fewer gallons of stormwater and sewer overflow entering local waterways annually.[40] The program has met the requirement to capture and treat 95 percent of stormwater several years ahead of schedule.[41]

Save the Rain has been so successful in part because of the integration of water management into other city projects, aligning resources to improve water quality while spurring renewed investment. In the Connective Corridor project, the City and County partnered with Syracuse University to win grants that enabled a complete overhaul of the streets, implementing not only revamped stormwater management but also improved bike lanes, public art installations, and other amenities.[42] Recognizing rain as a resource, a core project at Syracuse's War Memorial Arena uses a large cistern to capture, filter, and then use stormwater to form the ice surface for the local hockey team.[43] Beyond these key publicly funded projects, Save the Rain Coordinator Tom Rhoads credits an increase in water quality with renewed private investment along the lake.[44] Each of these water-driven investments provides opportunities to create high quality jobs; two programs to train local residents in green infrastructure construction and maintenance have been created by other agencies.[45]

The success in Syracuse demonstrates the power for water management not only to make best use of financial resources, but also to build more livable neighborhoods. Save the Rain's tree planting drive with partners at the Parks Department engaged 5,000 local residents, including over one thousand who volunteered with the effort to plant and care for trees as a stormwater filtration tool.[46] Additionally, the Vacant Lot Program turns lots into green infrastructure installations that also function as usable public space while reducing blight.[47]

Lessons from Save the Rain's success can be applied in any city. Partnerships, both with other governments or departments as well as non-profit or private partners, provide essential access to funding, technical expertise, and allow projects to realize multiple co-benefits in addition to water management goals. A culture change is necessary to change what each department considers part of its purview – both a water utility and a streets department have to consider how their work can support the other goal. As Tom Rhoads puts it, with an integrated approach, "you're actually changing what every department looks at from their perspective."[48]

Realize Co-Benefits

The co-benefits of efficient and sustainable water management through IWM offer city leaders appealing ways to bolster other parts of their agenda while providing real benefits to residents that would not emerge from traditional approaches. Utilizing a "triple bottom line" analysis – one that considers not just economic, but also social and environmental outcomes – underscores the benefits inherent to an integrated approach.

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Financially, IWM should trim budgets by seeking to remove inefficiencies in spending and by seeking more collaborative sources of funding. Some typical IWM interventions, such as green infrastructure, avoid water treatment costs or eliminate the need for costly infrastructure expansion by reducing volumes moving through the system compared to solely using "gray" infrastructure. Connecting water outcomes to other city issues like transit or economic development can also expand the pool of funding available.

Socially, IWM strives to manage water in ways that most benefit residents while protecting the resources. IWM cities must work to ensure equitable access to water, addressing this public health imperative. IWM can also spur investment in water infrastructure, which generates jobs for local residents, and should especially be targeted to marginalized residents. Cities should invest in waterway restoration as part of protecting their water supply, but this can also spur redevelopment along the shoreline or enhance recreational public spaces.

Environmentally, IWM also prioritizes good stewardship of natural lands and waters in the region, preserving these resources for their own sake as well as for the outcomes regarding water quality. The efficiencies built in, particularly reductions in the amount of energy required by reducing volumes in the system, reduce emissions that accelerate climate change. Up to 80 percent of a typical drinking water utility and 25-40 percent of a wastewater utility budget is applied toward energy use,[37] so energy efficiency and onsite energy generation in water systems can also generate a large cost savings.

Collaborate Across Political Boundaries

Collaboration to manage water in an integrated manner across jurisdictions ensures better use of constrained funding and staff capacity. Water does not respect political boundaries, instead existing within natural boundaries of the watershed; so too should water management transcend these political distinctions. While challenging, finding ways to work with other local and regional governments and stakeholders is an essential element of IWM.

Collaborating across political boundaries to align with the actual watershed boundaries helps rally stakeholders around shared goals for water supply and quality. After years of conflict over water use, Yakima, WA was a key player in negotiations within the Yakima River Basin to create an integrated water management plan that respected the needs of fisheries, farms, municipal users, and other stakeholders in the region.[49] The Milwaukee Metropolitan Sewerage District, Milwaukee, WI, coordinates across six watersheds to serve the city and twenty-seven other municipalities while working with other regional partners to prevent combined sewer overflows, which includes a tunnel system that captures all but about two percent of stormwater along with extensive use of partnership-based green infrastructure projects.[50]

Collaboration with partners outside of city government can also enhance the technical capacity and other resources available to utility and political leaders. In Cincinnati, OH, the utility worked with other government stakeholders (the county and EPA) but also nearby universities to improve data collection about green

infrastructure installations, working at a watershed scale to prevent combined sewer overflows while saving an estimated $200 million in public funds.[51]

Collaboration can also engage residents in water management efforts. Clean Water Services, a utility based in Hillsborough, OR, convened over thirty partners from the county to conservation non-profits to plant over two million trees and shrubs in a single year for the Tree for All project.[52] Such engagement efforts can raise critical awareness of and support for IWM approaches while expanding capacity with volunteers.

CREATIVE FUNDING

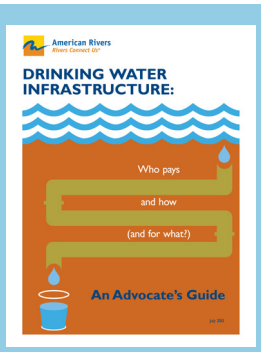
Financing water infrastructure can be a complex and expensive proposition, but the core principles of IWM and its cultural shifts to encourage collaboration can lead to new, creative funding supplements that can help keep costs manageable for the city and for ratepayers. As demonstrated in examples throughout this brief, IWM approaches encourage alignment of water with other city projects in ways that can bolster available funding. A few additional tools can expand the pool of water funding for cities.

At the utility level, IWM promotes efficiency and creative reuse of resources, which can result in significant cost savings or even revenue generation. Oakland, CA's East Bay Municipal Utility District has the first water treatment facility to become a net producer of energy by procuring food scraps to power twelve biodigesters.[53] This innovative strategy to divert organic waste and generate energy also brings in about $500,000 in annual sales.[54] On a smaller scale, Sheboygan, WI upgraded its aging wastewater treatment infrastructure to invest in a micro-turbine system that burns biogas produced by the plant's digesters, resulting in 20 percent less energy used compared to pre-installation baselines (and energy cost savings just over $5,000 annually).[55] Several utilities, including DC Water,[56] are using purified biosolids extracted in the water reclamation process to produce and sell fertilizer.

Political leaders can work with utilities to help other local government stakeholders see the benefits of IWM to secure additional funding or in-kind resources such as property. In Fort Worth, TX, the school district agreed to perform long-term maintenance of a stormwater detention basin created at an elementary school, a project that overall cost about half as much as a proposed conveyance system while adding city-funded recreational enhancements on the site.[57]

Cities should also investigate state and federal opportunities to access financing. The EPA's new Water Infrastructure and Resiliency Finance Center offers technical assistance to cities and their utilities in assessing the best financing options.[58]

For a thorough primer on municipal water infrastructure financing, including questions of utility rates and affordability, see American Rivers' report "Drinking Water Infrastructure: Who Pays and How (And For What?)." According to the brief, over 90 percent of water infrastructure is funded by either municipal bonds or, for smaller cities, State Revolving Funds administered by the EPA. An IWM approach offers complementary avenues to generate funding by amplifying co-benefits and recognizing the value added beyond water to engage diverse partners.



CONCLUSION

While cities are currently facing enormous challenges to their water infrastructure, integrated water management offers solutions to most efficiently manage water while advancing other city priorities. Viewing all water as a resource encourages conservation and novel forms of reuse to bolster limited supply and protection of water quality in all urban water flows. Reducing waste and capturing all possible value drives innovations in more efficient use of natural resources, along with creative collaboration that magnifies the availability and impact of funding. The core challenge and opportunity to integrate management approaches for water with other goals can lead to cities that not only have more sustainable, well-maintained, and financially viable water systems, but are also more livable, equitable, and resilient places on the whole.

GETTING STARTED

1. Meet with utility leaders to assess current water management practices in the city and to understand the major issues regarding quality, supply, and affordability. Develop a vision for water that addresses these challenges.

2. Identify opportunities for water management to align with other city priorities, such as economic development, multi-modal transportation, dense land use patterns, and more. Convene stakeholders within city government to consider more formal alignments.

3. Develop policies that integrate water planning into other city functions and projects consistently.

4. Establish formal collaborations within the city (between departments and utilities) and the region (with other cities, county government, and any federal stakeholders in the area).

5. Seek funding in partnership with other stakeholders to improve water infrastructure as part of other city projects.

RESOURCES

» The City Upstream and Down: How Integrated Water Management Can Help Cities Thrive (American Rivers 2016). This report provides insight from expert city leaders nationwide on how elected officials and utility leaders can best collaborate to implement IWM in cities.

» Pathways to One Water (Water Environment Research Foundation 2015). This brief provides numerous examples of cities transforming how water is managed, breaking down water management integration through a multi-strategy approach.

» The Value of Green Infrastructure (Center for Neighborhood Technology & American Rivers 2010). A comprehensive overview of various green infrastructure tools and their multiple co-benefits, with metrics to quantify benefits by technical and financial standards.

» Drinking Water Infrastructure: Who Pays and How (And For What?) (American Rivers 2013). A primer on financing drinking water infrastructure as well as critical insight about how to balance conservation, the need for revenue, and affordability for ratepayers.

» Integrated Urban Water Management for Planners (Water Research Foundation & American Planning Association 2014). Written from a land use planning perspective, this brief offers a different take on the potential synergy and benefits of integration for water management.

ENDNOTES

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About us

The Mayors Innovation Project is a learning network among American mayors committed to "high road" policy and governance: shared prosperity, environmental sustainability, and efficient democratic government. We are a project of COWS (Center on Wisconsin Strategy). This work is generously supported by the Pisces Foundation and Surdna Foundation. We can be contacted at:

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