Opportunities for Achieving Next Generation Water Infrastructure in CA, OR, and WA

JANUARY 2018
ILFI + RECODE + OEC
We are at a pivotal point with tremendous opportunity. Our nation’s water supply and wastewater infrastructure is well beyond its designed lifespan. In far too many communities, it is straining to meet current demand. This poses present-day impacts and serious future threats to our drinking water quality and the health of our communities and natural waterways. While performance lags, the cost to operate and maintain these systems increases. Even performing at their peak, most systems are not designed to remove the ever-increasing pollutants or recover the precious nitrogen and phosphorus nutrients in our wastewater.

We need to accelerate the adoption of the next generation water infrastructure that will protect and preserve our planet’s precious water resources for all species. While preparing for population growth, we still need to protect public health, meet climate resiliency needs, and fulfill global sustainability commitments. Components of this next generation water infrastructure exist now. Examples can be found in pioneering projects and communities around the nation and the world. In many cases, these systems use less water and energy, recycle water repeatedly, capture nutrients for beneficial use, and perform at a cost below conventional water treatment systems.

Operating at the intersection of public health and personal hygiene, water-related innovations often meet the most resistance to change. The relatively low cost consumers pay at the tap discourages investment in site or neighborhood scale water collection, reuse, and treatment infrastructure. In addition, non-profits and other organizations that share a common interest in “legalizing” sustainable water infrastructure often operate in isolation, making advocacy efforts less effective. To accelerate adoption of next generation water infrastructure, allied partners will need to make a concerted effort to learn from projects on the cutting edge, change perceptions among professionals and the public, and work collaboratively across disciplines to change the way we govern innovation. It is a not choice between centralized and decentralized systems. To maintain healthy, resilient, and safe communities into the future, we need to effectively integrate decentralized systems into existing centralized systems.

With support from the Rosin Fund of the Scherman Foundation, Recode, the International Living Future Institute (ILFI), and Oregon Environmental Council are working together with a broad base of stakeholders to identify barriers and create and test solution pathways. While the focus of this work is in California, Oregon, and Washington, the research, findings, and approach will have broader applicability.

**Building Bridges**

The development and scope of this project have been informed by our previous years of research in this field as well as the work of many others. ILFI’s work is summarized in part in the following reports, found at living-future.org/research/:

- **Making The Switch: Transitioning Toward Integrated Water Management in Puget Sound**
- **Policy Making for Healthy, Resilient Water Systems in the Puget Sound**

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• Clean Water, Healthy Sound: A Life Cycle Analysis of Alternative Wastewater Treatment Strategies in the Puget Sound Area

• Regulatory Pathways to Net Zero Water

• Toward Net Zero Water – Best Management Practices for Decentralized Sourcing and Treatment

• Achieving Water Independence in Buildings: Negotiating the Challenge of Water Reuse in Oregon

Examples of others’ work that has informed this project include:

The Center for Sustainable Infrastructure’s 2017 high-level report “A Northwest Vision for 2040 Water Infrastructure,” which outlines innovative financial and policy approaches for water utilities and their communities to create resilient next generation water infrastructure. The report’s focus is on how water utilities and our governments finance water supply, wastewater treatment, stormwater, and flood prevention infrastructure. They interviewed utility managers, technical experts, engineering consultants, design innovators, non-profit leaders, tribal officials, and equity advocates. Consistent with our early research findings, the report emphasizes that with the rapidly changing world of water treatment, distribution systems, and technology, we must focus on regulating performance rather than the process.

The San Francisco Public Utilities Commission (SFPUC) partnered with the US Water Alliance in 2016 to convene the National Blue Ribbon Commission for Onsite Non-Potable Water Systems. The National Blue Ribbon Commission is comprised of public health agencies and water utilities from nine states and the District of Columbia. Their mission is to advance best management practices that jurisdictions can use to support on-site non-potable water systems for buildings. The Commission has published their work in the recent publication entitled Risk Based Framework for the Development of Public Health Guidance for Decentralized Non-potable Water Systems.

Defining Our Shared Vision

Many terms can be used to describe the approach to and the goals of sustainably managing water and human waste at an appropriate scale within the built environment. Though the varied and diverse stakeholders within our industry may use different phrases, we believe these terms are united by a shared vision for clean and abundant water for healthy and resilient watersheds and communities.

To prioritize a healthy watershed framework, we consider how “next generation water” can lessen the impacts of the built environment on watersheds, both seasonally and over the long-term. The watershed’s flora and fauna, which provide numerous benefits for people, are adapted to its historic water balance. In next generation water towns and cities, water leaves the site to evaporate, infiltrate, or runoff in volumes and timing that closely match the historic water balance, while still providing for the needs of people and industry. Next generation water also includes nutrient cycling and food systems, which are regenerative building opportunities. All the water and nutrients are in a dynamic equilibrium at the micro- and macro-scales.

A next generation water project is so responsive to the site conditions and stakeholders’ needs that it must be achieved by evaluating performance and results, instead of the blanket application of process or prescriptive approaches. When combined together in meaningful ways, water efficiency and watershed health strategies that support our goals include greywater and blackwater on-site treatment and reuse, rainwater harvesting, low impact development/green infrastructure, nutrient recovery, and innovations in agriculture such as dry land farming. Conserving water is also an important aspect of next generation water and includes approaches such as waterless urinals, composting toilets, urine diverting dry toilets, amended soils, and native plants. Systems and approaches can be optimized at various scales from the site to the neighborhood to the...
watershed depending on the project context and climate.

Within the Living Building Challenge, a green building philosophy and certification standard created and administered by ILFI, next generation water is addressed via the Net Positive Water Imperative. This Imperative asks projects to consider the full lifecycle of the project’s water, creating a human-made building that fits into that natural hydrology.

Under the imperative, project water use and release must work in harmony with the natural water flows of the site and its surroundings. One hundred percent of the project’s water needs must be supplied by captured precipitation or other natural water available on-site (if it can be fully replenished). Water captured and used on-site may be recycled and must be purified as needed without the use of chemicals. All stormwater and water discharge, including grey and black water, must be treated on-site and managed either through reuse, a closed loop system, infiltration, evaporation, and/or runoff matching pre-development conditions.4

You may see the terms Net Positive Water and next generation water used throughout this report. The intent is the same, though Net Positive Water refers specifically to a project’s ability to achieve Living Building Challenge certification.

Our Process

In early 2017, Recode and ILFI conducted over fifty targeted interviews with green building practitioners, regulators, manufacturers, non-profit leaders, and early adopters of next generation water approaches from across the country. We asked interviewees what water-related barriers or issues they encountered as they pursued ambitious water goals and innovative water strategies, including those in the Living Building Challenge. We also asked interviewees to share how they interacted with different agencies and their strategies and ideas for how to overcome the barriers they encountered on their permitting path.

ILFI and Recode staff then ranked the barriers we heard during these interviews on a scale of one to five based on the impact the ideas or barriers have on sustainability, social equity, replicability/transferability, return on investment, and timeline for change to occur. (Five represented the most impact and one the least.) Weighing the five different criteria for each barrier helped balance the impacts in order to identify the barriers that could be addressed in a three-year period and if addressed create the most positive change in the industry. This meant that sometimes ideas with a high impact for sustainability but that had a long timeline ranked lower overall on our list.

We presented this ranked list for feedback at the Water Summit at ILFI’s 2017 Living Future unConference.5 We combined presentations with active engagement amongst the more than 100 attendees. They reviewed our findings and re-ranked the barriers. Through this exercise barriers 3, 4, and 5 (see pages 7-10) were identified as the highest priorities.

For the remainder of the summit, participants worked in small groups on developing possible solution pathways to one of those three top ranked barriers. At the end, each group shared their ideas with the larger group.

ILFI and Recode staff incorporated the findings from the Summit into our work and a draft of this report, which was then peer reviewed by stakeholders and others in our network. Final comments were incorporated into this document.

Through these processes, this document represents a vetted and finalized version of the top ten barriers and possible solutions pathways.

What’s Next

Recode and ILFI will focus on implementing, testing, and reporting on three of the key solution pathways by the end of 2019.

We believe that good ideas, like seeds, need to be disseminated widely to ensure propagation. While Recode and ILFI will be focusing on three of these opportunities, our hope in sharing this list is that others will be inspired to work with us or take on different opportunities. Together, we can match passion and expertise with on-the-ground need to honor and protect our precious water for all species for generations.

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TOP TEN BARRIERS AND POSSIBLE SOLUTION PATHWAYS TO ACHIEVING NEXT GENERATION WATER INFRASTRUCTURE

The barriers and solution pathways documented here reflect the views of our interviewees and may not be equitable solutions in all cases. We encourage you to explore these recommendations with members of disinvested communities to develop strategies for incorporating greater equity and averting unintended consequences.

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<th>SOLUTION PATHWAY IDEA(S)</th>
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<tr>
<td>1</td>
<td>MAP HOTSPOTS</td>
<td>Map hotspots where decentralized water strategies could be useful for a specific locale due to pressing water infrastructure issues like sewer overflows or drought. Such a map would help municipalities and water utilities better communicate to owners and developers where and what kind of water technologies would help address local issues. Document and share the methodology to create a map of local hotspots.</td>
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<td>2</td>
<td>LIVING DATABASE</td>
<td>Create a database to share performance data on new and existing technologies. Draw data from existing Living Buildings achieving Net Positive Water to demonstrate the performance of all systems (conventional and next generation). This performance evaluation database will provide an effective, quantified approach to infrastructure planning.</td>
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3. **TRUE VALUE OF WATER**

Financial motivators for innovative water systems largely don’t exist, and don’t equitably distribute funds between the stakeholders.

“Water is a major expense and an intensely variable one. Case studies would be helpful. Ultimately it would be good to demonstrate that water saving strategies should be a policy priority worth the extra expense up front.”

ERIK PATTISON, HOUSING DEVELOPER FOR ROSE COMMUNITY DEVELOPMENT

**SOLUTION PATHWAY IDEA(S)**

**a) Municipal/County Scale:** Clarify where decentralized approaches would help municipal water quality, quantity, resiliency, and other goals. Provide trainings and other technical support.

Create appropriate incentives to encourage adoption of next generation water and ease the pursuit of Net Positive Water via the following strategies:

• Replicate Seattle’s Living Building Challenge Pilot Program around the country
• Create a community of water that promotes a lifestyle around water culture and identity
• Offer a capital offset for developers, extra density, or area allowances

**b) Utility Providers:**

• Monetize the cost of water while providing every person/household with a subsistence/baseline volume of water for free
• Change metering approach
• Reduce water meter size for residential applications to reduce system development charges
• Meter wastewater so that sewer bills are based on discharge, not potable water use. Adjust the wastewater tap fee based on metering
• Provide non-potable water at slightly reduced fees
• Apply penalties if different forms of water aren’t separated
• Charge users based on quantities used

**c) Developers and Owners:**

• Create financial case studies for Net Positive Water precedents. How have other projects made the case, what has been the actual return on investment?
• Create grant programs to incentivize hardware investments. Include report on how other cities’ (such as San Francisco) grant programs have benefited their area.
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<td>3</td>
<td><strong>TRUE VALUE OF WATER (CONT.)</strong></td>
<td>Financial motivators for innovative water systems largely don’t exist, and don’t equitably distribute funds between the stakeholders.</td>
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<td>• EXISTING RESOURCE: The Urban Fabrick Collaborative is in the process of finalizing the “Design Professional’s Practice Guide to Integrating Onsite Water Use and Reuse.”</td>
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<td></td>
<td>e) <strong>Public/Private Partnerships for Research and Development (R&amp;D):</strong> Quantify and standardize costs for new technologies and systems to speed up innovation and demonstrate a regulatory path. Academic research institutions may be the best fit for this task.</td>
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<td></td>
<td>f) <strong>Building Appraisers:</strong> Educate them about the added value of on-site water systems so funding mechanisms support water reuse. Target seminars and talks to real estate lending and banking institutions.</td>
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“There’s a social justice aspect to water utilities having the same ongoing costs; those who can’t afford to upgrade to these new on-site systems are footing the bill for maintaining the municipal infrastructure. No city I know of has ever separated out these services they’re providing for users.”

COLLEEN MITCHELL, HERRERA ENVIRONMENTAL CONSULTANTS

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<td>4</td>
<td>REGULATORY PATHWAY</td>
<td>Some jurisdictions lack a management and regulatory structure for water provisioning and wastewater treatment at scales smaller than city scale but larger than single-family residential. When jurisdictional water “champions” leave, institutional knowledge is lost.</td>
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a) In partnership with regulatory officials, draft a reasonable management model and regulatory pathway for projects between single-family residential and municipal water works while maintaining reasonable costs per user.

- **UPCOMING RESOURCE:** San Francisco PUC and others are developing model regulations and local programs.

b) Draft an Ordinance Memorandum of Understanding that identifies and records responsibilities and who has what authority. Create a systems approach to coordinate central utilities and decentralized systems. Use lessons learned from the energy sector.

c) Provide “roadmaps” that explain the regulatory process for different thresholds (e.g. number of units or project size).

d) Support adoption of a performance code to replace or sit alongside the current prescriptive regulations.

e) Develop a monitoring metric scaled to the project size that is practical and cost-effective for buildings to implement such as a “Mini-scale Operator License” for daily/weekly activities of an on-site building technician with support from more highly trained individuals for monthly and more technical activities.

f) Make the case to jurisdictions that includes compelling value propositions related to resilience, health, combined sewer overflow, flood damage, and downstream waste cost.

g) Remove the “undue hardship” regulatory requirement and the “high performance” incentive during the permit process.

h) Provide staff with incentives to adopt regulations:

- Checklist tools

- Use a “safety valve” approach so small cities can send to state for review and approval (similar to the Underground Injection Control and 1200-C construction permits for stormwater)
5  PARADIGM SHIFT

We lack a larger vision for next generation water.

“Decentralized water reuse and centralized water infrastructure practitioners need to start thinking collaboratively at a watershed scale. We need to discover the optimal scale and integration for both decentralized and centralized water reuse while recognizing that it will likely differ from watershed to watershed throughout the state.”

DEBBIE FRANCO, CALIFORNIA GOVERNOR’S OFFICE OF PLANNING AND RESEARCH

SOLUTION PATHWAY IDEA(S)

a) Create high-level (possibly state-level) goals to support and catalyze local initiatives. For example, “Five per cent of all urban water is generated from on-site reuse.”

b) Re-value the true cost of water to quantify the cost impact that development projects have on downstream pollution and upstream treatment.

c) Encourage larger paradigm shifts across all agencies (e.g. US Water Alliance; ‘One Water’ movement) grounded in watershed health and sustainability. Shift from waste management to resource management attitude and approach. Clarify the comparative long-term public health risk of on-site treatment compared to municipal treatment.

d) Develop regional alliances. Share local-level successes.

e) Provide incremental goals to achieve paradigm shift, breaking up the steps for local jurisdictions. Rank and prioritize code changes.

f) Increase public awareness regarding the consequences of maintaining the status quo as it relates to water use (e.g. an ad campaign exposing the dangers of water resource depletion showing examples of other countries or communities who have failed to address the issues and the result of inaction). Match a small dose of fear and big dose of hope to an action that’s do-able.
We lack a national standard for treatment and reuse of non-potable water adopted by all states.

**CONFLICTING CODES**
Jurisdictions inconsistently interpret existing rules due to a lack of consistent regulations for different types of water and nutrient reuse (blackwater, greywater, rainwater, stormwater, compost, etc.).

**OUTREACH**
The public lacks confidence in water and wastewater treatment systems and possesses overarching misconceptions around health and sanitation.

**SOLUTION PATHWAY IDEA(S)**

_a) A national standard and framework for reuse of non-potable water adopted by all states._

- **EXISTING RESOURCE:** In 2017, the National Blue Ribbon Commission to Accelerate the Adoption of Onsite Water Reuse created recommended guidelines for non-potable water reuse for health departments and actionable recommendations for consideration by the US EPA. They also foster state-level peer exchange and learning among water utilities and state public health agencies that are working to establish standards and practices for on-site water reuse.

_b) Develop a task force to track federal government actions and organize “resistance” efforts and “support” efforts by the community as appropriate and timely. Progress must continue at the state and county level if and when the federal government stalls._

_a) Work with regulators to create state specific roadmaps to next generation water with links to additional resources to help agencies explain how current regulations work and save projects time and frustration. Draw from the experience of project teams currently pursuing the Net Positive Water Imperative._

_b) Create and normalize terms for different types of water across jurisdictions (plumbing, environmental health, etc.).

_c) Create consistent permit pathways for water collection, treatment, and reuse projects at all scales._

_a) Share ways to combat the public health concerns related to water and nutrient reuse systems. For example, a guide and webinar on how to address the most common concerns about composting toilets._

- **UPCOMING RESOURCE:** Blue Ribbon Commission Non-potable Reuse’s health guidelines can serve as a resource in addressing public health concerns.
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<td>OUTREACH (CONT.)</td>
<td>The public lacks confidence in water and wastewater treatment systems and possesses overarching misconceptions around health and sanitation.</td>
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|      |         | • EXISTING RESOURCE: Marketing Non-potable Recycled Water: A Guidebook for Successful Public Outreach & Customer Marketing by the Water Reuse Foundation.⁷  
 |      |         | b) Glorify the process of water reuse as “Purified Water” and make the concept sound more attractive to the general public. |
| 9    | JURISDICTIONAL AUTHORITY | Agencies lack the organizational capacity for program management. |
|      |         | If jurisdictions lack the financial resources, staff or other internal components to effectively adopt new building codes for health, safety or sustainability, then they need to have the ability to adopt or delegate their authority (e.g. to the state or federal government) to a method that allows change to occur. |
| 10   | TECHNOLOGY | Technology and industry need further development. |
|      |         | a) We need more NSF certified products.  
 |      |         | b) Performance standards are needed to allow alternative treatment trains.  
 |      |         | c) Develop an expert practitioner database so that project teams and building owners can easily source out and hire water consultants to help solve design challenges within their region.  
 |      |         | d) Support the development of off-the-shelf solutions that have been tested and approved by brand name manufacturers to reduce risk at all scales, similar to buying an off-the-shelf water delivery system such as a faucet, toilet, shower head, dehumidifier, coffee maker, water dispensing refrigerator, etc. These product examples all pose potential health risks to those using them, yet there is very little concern among the public due to a high level of trust in the products and manufacturers supporting them. |

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Thank you to our amazing interviewees and reviewers who generously shared their ideas and experiences with us. Your insights were and continue to be invaluable!

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