POLICY-MAKING FOR HEALTHY, **RESILIENT WATER SYSTEMS** IN THE PUGET SOUND

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WWW.CASCADIAGBC.ORG

INTRODUCTION

Dear Water and Health Advocate,

These are exciting times in the building sector. Green builders and planners have helped to birth a new era of smarter, more efficient and healthier homes, workplaces, institutions and communities.

Water systems are central to this evolution. Designers are moving away from a one size fits all approach to more diversified, customized, integrated approaches to collecting, treating, reusing and releasing water. In response, Puget Sound permitting agencies are tasked with reviewing a growing number of projects featuring onsite systems like composting toilets, constructed wetlands, rainwater harvesting and greywater recycling systems. Appropriately applied, these technologies hold great promise for increasing the health and resiliency of our region's water systems. However, lack of information and regulatory support for these systems in many cases prohibit their use.

"Resiliency" describes the ability of an ecosystem to respond and adapt to changing conditions. In nature, this resilience comes from diversity of species types, scales, and responses. Diversity of water infrastructure will help our communities respond and adapt to changing conditions brought by climate change and population shifts. It will also help to weather more episodic challenges like earthquakes, flooding, and drought.

Of course, any new or upgraded water system must protect our families from waterborne pathogens and guarantee adequate water and sanitation for all residents. It also needs to be affordable. Done well, smaller scale systems meet all of these requirements and can significantly reduce the capital costs for financially strapped cities and counties.

The intent of this document is to provide local and regional policy makers and planners in the Puget Sound basin with recommendations for enhancing the health and resiliency of their water infrastructure through greater support of smaller, site-scale and distributed systems. We hope it will prove a useful tool for communities considering water system improvements.

Sincerely,

Jason F. McLennan, CEO

A CALL TO ACTION

In 2010 Cascadia launched a campaign to accelerate the adoption of best practices for designing, building and operating healthy and resilient water systems. The Water Call to Action campaign invites communities to re-imagine water and wastewater in a more holistic framework and consider the lifecycle impacts of systems when making capital investment decisions.

Cascadia Green Building Council (Cascadia) serves Oregon, Washington, British Columbia and Alaska, and includes members from as far away as Idaho and Montana. Our mission is to lead a transformation toward a built environment that is socially just, culturally rich and ecologically restorative. Services include education, research, thought leadership, and innovative tool development.

CASCADIA
GREEN BUILDING COUNCIL

INTRODUCTION

"The health of our waters is the principle measure of how we live on the land."

— LUNA LEOPOLD

BACKGROUND

Since the mid-20th century, urban water and waste systems have moved more and more towards centralized infrastructure to support growing populations. To an extent, centralized water infrastructure has served us very well. The advent of centralized water treatment has dramatically reduced exposure to water-born pathogens associated with contaminated water. Centralized water systems have also allowed communities and industries to exist and expand where they might not have been able to otherwise.

Large centralized systems, however, are expensive to build and maintain, require large amounts of energy for conveyance and treatment of water, and are not always the appropriate choice for every community. Re-evaluating the function and scale of our water systems allows us to explore approaches that are the right fit for meeting our residents' needs and protecting our natural environment.

Centralized infrastructure around the country, much of which was built 50-60 years ago, is now in need of extensive repairs or expansion. When planning for new or upgraded water infrastructure, local communities have the opportunity to choose systems at a variety of different scales that are adaptable and resilient.

Resilient Water Systems

- Enable conservation practices through education, water audits, and full-cost pricing of water
- Do not require potable water for every use
- Take into consideration the life-cycle impacts of water collection, conveyance, treatment and discharge back into the environment
- Recover water and nutrients from the wastewater stream
- Manage risks in light of long-term ecosystem health and population growth

PUGET SOUND WATER SYSTEMS

The Puget Sound basin is home to over 4.3 million residents. Water defines our region, which is heavily influenced by its proximity to the Pacific Ocean and surrounding mountain ranges. Precipitation, in the form of rain and snow, is filtered by forests and other vegetation into ground and surface waters from which Puget Sound communities source their water for drinking, agriculture and industry.

Maintaining the health and resiliency of our waters bodies is critical—not only for ensuring fresh water for residents, but also for recreation and industries which rely on water as well as protection of the plentiful wildlife who also reside in the Puget Sound basin. Yet growing populations, greater urbanization, and variables such as changing weather patterns place our ecosystems at risk.

Impending investments in our region's water supply and wastewater infrastructure provide a singular opportunity to help address threats to our water systems. More than $6.5 billion will be spent in the Puget Sound area on wastewater projects alone over the next 20 years. By moving away from a big pipe, one-size-fits-all approach, Puget Sound communities have the opportunity to invest in more resilient and diversified systems. These systems will need to mitigate current threats and meet rising challenges associated with economic and environmental realities.

More than $6.5 billion will be spent in the Puget Sound area on wastewater projects alone over the next 20 years.

ECONOMIC ISSUES

Our current practices for managing water and wastewater necessitate large amounts of infrastructure, requiring significant investments to build, operate and maintain over time. Population growth places additional strain on older systems, with increased density demanding increased infrastructure in urban and suburban areas. Nationwide, the projected funding gap for wastewater infrastructure alone is estimated at $350 billion to $500 billion over the next 20 years.

ENVIRONMENTAL ISSUES

Many of our existing water systems have negatively affected the health and diversity of ecosystems in the Puget Sound basin. Leaking septic tanks, sewage treatment plant outfalls, and combined sewer overflows have contributed to eutrophication and other water quality issues. Upstream land use decisions have impacted instream flows and urban runoff is the leading source of pollution in the Sound. Groundwater contamination and depletion threaten the long-term availability of fresh water in some areas.

Environmental impacts are compounded by the inefficiency of current systems. Large amounts of energy are used to pressurize and convey water and wastewater to and from homes and businesses. In addition, aging and leaky pipes can lose up to 20% or more of the water passing through them according to the US Environmental Protection Agency.

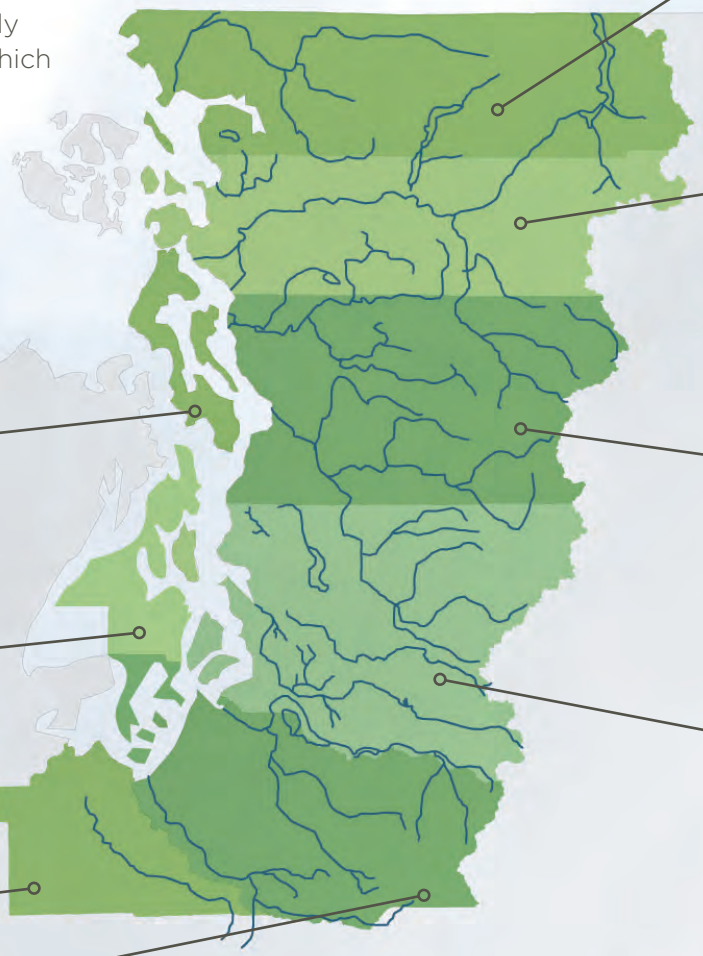
AGGRAVATING FACTORS

Compounding current economic and environmental challenges, local communities will need to address the health and resiliency of their water systems in the face of growing uncertainties. By 2030, the population of the Puget Sound area is expected to grow by over one million residents, placing greater strain on water infrastructure. Changes in climate patterns signal wetter winters and drier summers in the Pacific Northwest. As a result, stormwater management will become increasingly important during the wet season to prevent sewage overflows and flooding while water conservation will be critical during the region's dry summer months.

PUGET SOUND WATER SYSTEMS

In most areas of the region, large financial investments are needed for upgrading or expanding water and sewer infrastructure. While 70% of residents in the Puget Sound region are already served by public sewers, infrastructure investments are currently driven by the state's Growth Management Act (GMA) which requires local jurisdictions to provide sewer services for the projected 2030 population growth. Increasingly stringent federal water quality and discharge standards will also require existing infrastructure upgrades in order to reduce pollution.

Opportunities exist for those areas facing the largest financial burdens to consider infrastructure that is adaptive, resilient, and healthy for Puget Sound residents, businesses and wildlife.



WHATCOM
- 10 water districts
- 70% served by sewers
- $419M wastewater budget thru 2029
- Groundwater supply threatened by nitrate contamination

SKAGIT
- 7 water districts
- 67% served by sewers
- $64.5M wastewater budget thru 2021
- Exempt wells disrupting instream flows

SNOHOMISH
- 9 water districts
- 65% served by sewers
- $321.7M wastewater budget thru 2025
- Exempt wells disrupting instream flows

KING
- 34 water districts
- 94.6% served by sewers
- $4.9B wastewater budget thru 2030
- Increased water supply storage needed to accommodate growth

ISLAND
- 7 water districts
- 28% served by sewers
- $650K wastewater budget thru 2014
- Aquifers threatened by salt water intrusions

KITSAP
- 14 water districts
- 20% served by sewers
- $328.5M wastewater budget thru 2030
- Deep aquifers depleting faster than they are replenished

THURSTON
- 3 water districts
- 49% served by sewers
- $177M wastewater budget thru 2018
- Population growth expected to increase groundwater withdrawals

PIERCE
- 16 water districts
- 37% served by sewers
- $364.5M wastewater budget thru 2016
- Potential supply shortages due to climate change

All budgets are approximate based on county capital improvement plans.

WASHINGTON REGULATIONS

Water systems and their potential health and safety risks are regulated across multiple jurisdictions and agencies at the federal, state and local levels. Understanding how these agencies interact, and where gaps or conflicts exist, provides insight into how local Puget Sound communities can help influence policies and regulations in support of innovative water systems.

FEDERAL

The US Environmental Protection Agency (EPA) establishes standards for all public water supplies through the Safe Drinking Water Act while the Clean Water Act sets limits on wastewater discharges.

STATE

Washington State Department of Health (DOH) is responsible for enforcing federal standards related to drinking water and regulates all new public water supplies that serve more than one single-family residence. DOH has also established new standards for seasonal, greywater reuse as sub-surface irrigation, subject to adoption by local jurisdictions.

DOH has authority and approval for wastewater treatment systems with design flows between 3,500-100,000 gallons/day. Larger systems are permitted through the State's Department of Ecology. In addition, Ecology grants water rights for use of surface and ground waters for public supply and is in the process of defining new rules for reclaimed water.

The state-adopted 2009 Uniform Plumbing Code defines standards for water use inside buildings, including new provisions for greywater reuse.

LOCAL

Local health departments or districts enforce state regulations for smaller public water supply systems (less than 15 service connections or 25 people/day) and small on-site sewage systems (less than 3,500 gallons/day). Local health departments are also responsible for incorporating the State's new greywater rules into their programs, though many counties have limited resources with which to implement them. The local health official is able to approved indoor use of greywater for non-potable purposes through the administrative provisions of the Uniform Plumbing Code.

Local city and county land use codes require connection to existing water and wastewater infrastructure where available. Public utilities maintain rights for delivering fresh water and wastewater treatment within their service boundaries and establish fees for financing future infrastructure improvements.

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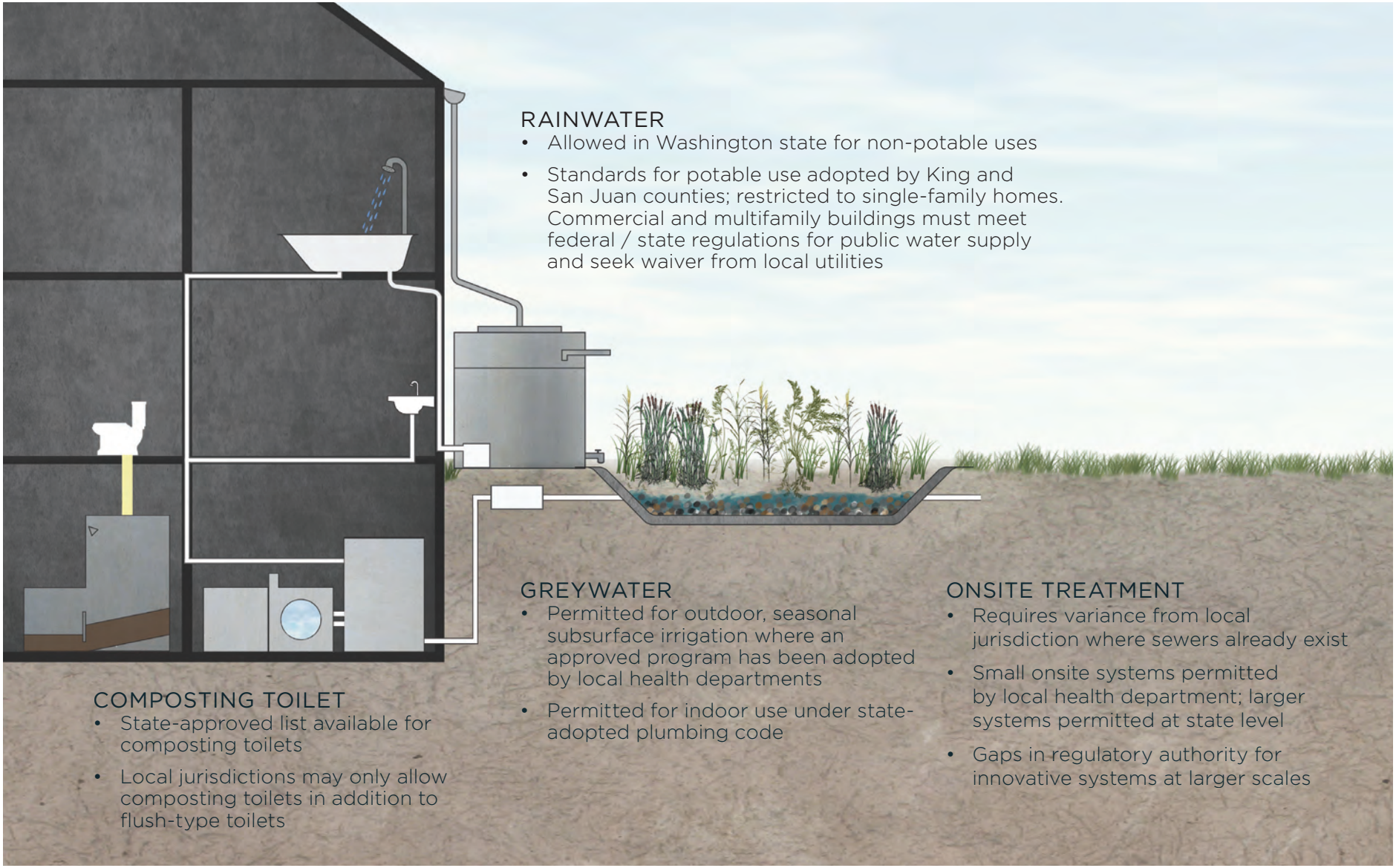
WASHINGTON REGULATIONS



RAINWATER

- Allowed in Washington state for non-potable uses
- Standards for potable use adopted by King and San Juan counties; restricted to single-family homes. Commercial and multifamily buildings must meet federal / state regulations for public water supply and seek waiver from local utilities

GREYWATER

- Permitted for outdoor, seasonal subsurface irrigation where an approved program has been adopted by local health departments
- Permitted for indoor use under state-adopted plumbing code

ONSITE TREATMENT

- Requires variance from local jurisdiction where sewers already exist
- Small onsite systems permitted by local health department; larger systems permitted at state level
- Gaps in regulatory authority for innovative systems at larger scales

COMPOSTING TOILET

- State-approved list available for composting toilets
- Local jurisdictions may only allow composting toilets in addition to flush-type toilets

INTEGRATED WATER SYSTEMS

The Puget Sound basin and its surrounding communities can benefit from a whole system, "integrated" approach to managing water that supports adaptability and innovation. Integrated water systems recognize the interconnected nature of water, stormwater and "waste" water management, evaluating solutions as well as cost and benefits of the entire system rather than in isolation.

Integrated approaches can be used to reduce the burden on existing systems and provide guidance for communities planning new infrastructure to serve their growing populations.

Integrated Water Systems:

- Augment existing resources through rainwater harvesting and water reuse
- Manage demand via high efficiency fixtures and other conservation strategies
- Treat water only as needed for its application
- Manage stormwater and wastewater discharge at a diversity of scales
- Recover resources from the waste stream
- Provide education to residents and businesses about how to use water wisely

A recent Cascadia study shows that decentralized wastewater treatment approaches, such as constructed wetlands, can reduce carbon emissions by over 40% compared to conventional practices.

The Omega Center for Sustainable Living in New York integrates wastewater treatment as an aesthetic amenity at their education center. The system uses plants, bacteria, algae, snails, and fungi to clean the water before using it to recharge the aquifer. *Photo courtesy of Farshid Assassi.*

RESILIENCY AT EVERY SCALE

SITE

The Bertschi School's Science Wing in Seattle, completed in 2011, is designed to operate as a net zero water building. The classroom includes a composting toilet and an interior greywater reuse system to eliminate the use of the public sewer. Greywater from the classroom sink and lavatory is routed to an interior vegetated wall where it is evapo-transpirated. Stormwater is managed onsite through captured precipitation and rain gardens designed into the landscape. Monitoring equipment allows the students to track and study the classroom's water use.

Photo courtesy of Benjamin Benschneider.

BLOCK

Common Ground, an 11-unit affordable housing development on Lopez Island, collects rainwater from each of the home's metal roofs and conveys it to a central, 38,000-gallon cistern located on the south end of the property. Rainwater is then filtered through sand and recirculated back to the homes providing water for washing machines, toilets, and exterior hose bibs. Meters located inside the homes help residents track the number of gallons of both potable water and rainwater they've used.

Photo courtesy of Mithun.

RESILIENCY AT EVERY SCALE

DISTRICT

Dockside Green is a mixed-use neighborhood development in Victoria, BC. When completed in 2015 it will encompass one million square feet of residential, commercial and light industrial buildings. Water-efficient fixtures and reuse of greywater reduce the development's municipal water needs by an estimated 65%. A district-scale packaged treatment plant treats 100% of wastewater generated within the development and produces reclaimed water for toilet flushing, irrigation, and water features. Excess reclaimed water is sold to neighboring industrial users. Biosolids recovered from the treatment process are used as a high value fertilizer.

Photo courtesy of Perkins+Will Canada.

CITY / REGION

The LOTT Clean Water Alliance is a regional wastewater utility in south Puget Sound serving the areas of Lacy, Olympia, Tumwater and Thurston County. In 2006, the Budd Inlet Treatment Plant began producing Class A reclaimed water which is used by several customers in downtown Olympia for irrigation and by LOTT's facilities for toilet flushing, irrigation and water features. Reclaimed water from a satellite site is conveyed to constructed wetland ponds and groundwater recharge basins which provide a public park-like setting and offers walking trails and interpretive kiosks for educating residents about the benefits of water conservation and reuse.

Photo courtesy of Washington State Department of Transportation.

POLICY-MAKING RECOMMENDATIONS

RAISE AWARENESS

ESTABLISH A SHARED VISION OF HOW YOUR WATER SYSTEM WILL SERVE PEOPLE AND THE PLANET

Local communities need safe drinking water, responsible wastewater treatment, and effective stormwater management over the long-term. Regulatory agencies and the public are demanding environmental protections at increasing levels of stringency. Raise awareness about the viability of your community's water systems in light of climate change, growing population, and aging infrastructure.

1.1 Identify and convene key stakeholders in local water systems. Engage key stakeholders in discussion around the risks and opportunities associated with possible water system alternatives at varying scales. Key stakeholders may include present and future system users, environmental and business interests, community groups, public health agencies, utilities, plumbers, builders, and system designers (engineers, architects, landscape architects, public artists).

1.2 Define shared goals and objectives that move your community toward a resilient water future. Clarify your community's desires for a resilient water future. Take a high level view of your community's water systems from a watershed perspective and develop a statement that reflects your community's vision for a resilient water future. Think holistically about the health of your local water supply, eco-system, economy, and culture. Discuss how much freshwater your local community should use and consider the impacts of that water use on the local environment. Rethink the quality and quantity of water that can be returned to your local eco-systems.

CREATE A BASELINE

STUDY YOUR CURRENT WATER SYSTEMS TO GLEAN INSIGHTS INTO YOUR WATER SYSTEM'S FUTURE

Prior to any investment in water infrastructure, assess the existing system. This assessment should include a clear picture of current assets and their resiliency, as well as system efficiencies achievable via conservation and other demand management strategies.

2.1 Map the water assets in your community. Evaluate the condition of existing infrastructure assets, understanding the likelihood and consequence of asset failure. Assess the resiliency of your current water system and identify its limitations in respect to climate change, natural disaster, increasing demand, and infrastructure upgrades.

Sample Goals and Objectives

- Reduce demand through use of water efficient fixtures and practices, rainwater harvesting and reuse of greywater.
- Minimize wastewater discharges by treating it to standards suitable for reuse.
- Conserve resources by treating water only as needed for its intended use.
- Preserve the natural hydrological regime of catchments and waterways.
- Maintain public safety, provide community amenities, and reduce economic burden through appropriately scaled, low impact water infrastructure.

POLICY-MAKING RECOMMENDATIONS

2.2 Identify the points in your planning calendar when the topics of water, wastewater management and water infrastructure are addressed. A number of planning and permitting processes provide opportunities to address water infrastructure and related systems such as water quality permitting, comprehensive planning, subarea planning, and the capital improvement planning and budgeting process.

2.3 Examine relevant regulatory frameworks, best practices and case studies for opportunities and examples of integrated water management systems at various scales. Seek out resources that highlight innovation and provide lessons learned, cost/benefit analysis and management considerations. See the *Research and Additional Resources* section at this end of this document for recommendations.

DEVELOP CREATIVE SOLUTIONS

USE BACKCASTING TO DEVELOP STRATEGIES THAT ALIGN WITH YOUR COMMUNITY'S VISION

Beginning with the end in mind, define steps that move toward the shared vision of sustainability, ensuring that each action provides a platform for further improvement.

3.1 Host a water system design charrette with local and regional experts that considers integrated solutions to water management. Engage stakeholders from multi-disciplinary backgrounds to inspire creative problem solving. Avoid censoring solutions based on what is deemed "possible" under current code or practice and consider strategies at multiple density scales.

3.2 Outline the risks and opportunities associated with each strategy. Evaluate lifecycle costs and environmental impacts of potential strategies. Determine health risk exposure associated with various options and develop a framework for managing risks.

3.3 Decide on priorities. Choose actions that move the community's water systems toward resiliency fastest, while optimizing flexibility as well as maximizing social, ecological and economic returns. Review priorities with local and regional experts and reconvene stakeholders to participate in the decision-making process.

IMPLEMENT AND MONITOR SUCCESS

ESTABLISH POLICIES AND PROGRAMS THAT ARE EVALUATED AND UPDATED OVER TIME

4.1 Implement policies and programs that support your community's priorities. Consider pilot programs that demonstrate integrated water systems at multiple scales. Pursue local, state, and federal funding to affect the increased costs involved with the planning and implementation of new programs. Amend codes and regulations to encourage, rather than prevent, new technologies and systems that demonstrate innovation and adaptability.

4.2 Monitor and evaluate. Policies and programs that support resilient water systems should be dynamic and adapt over time. Require regular benchmarking and evaluation to determine if policies and programs are continuing to support your community's vision as expected. Use evaluation methods that provide meaningful feedback on your community's success and help inform future policy updates.

RESOURCES

CASCADIA RESEARCH

Clean Water, Healthy Sound: A Life Cycle Analysis of Alternative Wastewater Treatment Strategies in the Puget Sound Area. DRAFT July 2011.
This in-progress study utilizes Life Cycle Assessment (LCA) to analyze the relative environmental impacts associated with conventional, centralized treatment systems against four alternative, smaller-scale decentralized approaches. Link

Regulatory Pathways to Net Zero Water: Guidance for Innovative Water Projects in Seattle. February 2011.
This report describes obstacles within current codes, identifies possible alternative pathways for approvals, and provides guidance to Seattle-area design teams pursuing net zero water goals. Link

Toward Net Zero Water: Best Management Practices for Decentralized Sourcing and Treatment. March 2011.
This report provides an overview of best practices and technologies for decentralized and distributed water systems. Link

Cascadia Advocacy

Sustainable Water Campaign
www.cascadiagbc.org/action/water

ADDITIONAL RESEARCH

Distributed Water Infrastructure for Sustainable Communities: A Guide for Decision-Makers. WERF, 2009.
Report analyzes 20 case studies of distributed approaches and describes how to use the accompanying excel-based decision-making modeling tool. Link

Institutional Challenges and Opportunities: Decentralized and Integrated Water Resource Infrastructure. Valerie Nelson, 2008.
Report discusses how a more sustainable water infrastructure will be accomplished when decentralized technologies are integrated into water management practices. Link

Sustainable Water Resources Management, Vol. 3, Case Studies on New Water Paradigm. Electric Power Research Institute, 2010.
This report discusses the foundation and requirements for sustainable water infrastructure at the community and watershed scales. Link

The Soft Path for Water in a Nutshell. Oliver M. Brandes and K. Ferguson, 2004.
An overview of the paradigm shift towards innovative approaches to water sustainability in Canada. Link

When to Consider Distributed Systems in an Urban and Suburban Context. WERF, 2009.
Provides assistance to planners, utility managers, engineers, developers, regulators, and other decision-makers on using decentralized approaches in urban and suburban settings. Link

ORGANIZATIONS

Cascadia Green Building Council
www.cascadiagbc.org

Decentralized Water Resources Collaborative
www.decentralizedwater.org

People for Puget Sound
www.pugetsound.org

Puget Sound Partnership
www.psp.wa.gov

US Environmental Protection Agency
www.epa.gov

WA Department of Health
www.doh.wa.gov/ehp/dw/

WA Department of Ecology
www.ecy.wa.gov

Water Environmental Research Foundation
www.werf.org

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