Water Research Foundation℠
advancing the science of water

Supported by:
nyserda
Energy. Innovation. Solutions.

# Changing Organizational Culture to Promote Sustainable Water Operations: A Guidebook for Water Utility Sustainability Champions

Subject Area: Infrastructure




# Changing Organizational Culture to Promote Sustainable Water Operations: A Guidebook for Water Utility Sustainability Champions

## About the Water Research Foundation

The Water Research Foundation is a member-supported, international, 501(c)3 nonprofit organization that sponsors research that enables water utilities, public health agencies, and other professionals to provide safe and affordable drinking water to consumers.

The Foundation's mission is to advance the science of water to improve the quality of life. To achieve this mission, the Foundation sponsors studies on all aspects of drinking water, including resources, treatment, and distribution. Nearly 1,000 water utilities, consulting firms, and manufacturers in North America and abroad contribute subscription payments to support the Foundation's work. Additional funding comes from collaborative partnerships with other national and international organizations and the U.S. federal government, allowing for resources to be leveraged, expertise to be shared, and broad-based knowledge to be developed and disseminated.

From its headquarters in Denver, Colorado, the Foundation's staff directs and supports the efforts of more than 800 volunteers who serve on the Board of Trustees and various committees. These volunteers represent many facets of the water industry, and contribute their expertise to select and monitor research studies that benefit the entire drinking water community.

Research results are disseminated through a number of channels, including reports, the Website, Webcasts, workshops, and periodicals.

The Foundation serves as a cooperative program providing subscribers the opportunity to pool their resources and build upon each others' expertise. By applying Foundation research findings, subscribers can save substantial costs and stay on the leading edge of drinking water science and technology. Since its inception, the Foundation has supplied the water community with more than $460 million in applied research value.

More information about the Foundation and how to become a subscriber is available at **www.WaterRF.org**.

# Changing Organizational Culture to Promote Sustainable Water Operations: A Guidebook for Water Utility Sustainability Champions

Prepared by:
**Charles Herrick**, **Joanna Pratt**, and **Holly Surbaugh**
Stratus Consulting Inc., 1920 L Street, NW, Washington, DC 20036
and
**Ben Grumbles**, **Lorraine Loken**, and **Kristen Abhold**
Clean Water America Alliance, 1816 Jefferson Place, NW, Washington, DC 20036

Jointly sponsored by:
**Water Research Foundation**
6666 West Quincy Avenue, Denver, CO 80235
and
**New York State Research and Development Authority**
17 Columbia Circle, Albany, NY 12203

Published by:

Water Research Foundation℠
advancing the science of water

## DISCLAIMER

This study was jointly funded by the Water Research Foundation (Foundation) and the New York State Energy Research and Development Authority (NYSERDA). The Foundation assumes no responsibility for the content of the research study reported in this publication or for the opinions or statements of fact expressed in the report. The mention of trade names for commercial products does not represent or imply the approval or endorsement of the Foundation. Neither NYSERDA nor any person acting on its behalf: (a) makes any warranty, express or implied, with respect to the use of any information, method, or process disclosed in this report or that such use may not infringe privately owned rights; or (b) assumes any liabilities with respect to the use of, or for damages resulting from the use of, any information, method, or process disclosed in this report. This report is presented solely for informational purposes.



ISBN 978-1-60573-191-9

Printed in the U.S.A.

# CONTENTS

# TABLES

# FIGURES

# FOREWORD

The Water Research Foundation (Foundation) is a nonprofit corporation dedicated to the development and implementation of scientifically sound research designed to help drinking water utilities respond to regulatory requirements and address high-priority concerns. The Foundation's research agenda is developed through a process of consultation with Foundation subscribers and other drinking water professionals. The Foundation's Board of Trustees and other professional volunteers help prioritize and select research projects for funding based upon current and future industry needs, applicability, and past work. The Foundation sponsors research projects through the Focus Area, Emerging Opportunities, and Tailored Collaboration programs, as well as various joint research efforts with organizations such as the U.S. Environmental Protection Agency and the U.S. Bureau of Reclamation.

This publication is a result of a research project fully funded or funded in part by Foundation subscribers. The Foundation's subscription program provides a cost-effective and collaborative method for funding research in the public interest. The research investment that underpins this report will intrinsically increase in value as the findings are applied in communities throughout the world. Foundation research projects are managed closely from their inception to the final report by the staff and a large cadre of volunteers who willingly contribute their time and expertise. The Foundation provides planning, management, and technical oversight and awards contracts to other institutions such as water utilities, universities, and engineering firms to conduct the research.

A broad spectrum of water supply issues is addressed by the Foundation's research agenda, including resources, treatment and operations, distribution and storage, water quality and analysis, toxicology, economics, and management. The ultimate purpose of the coordinated effort is to assist water suppliers to provide a reliable supply of safe and affordable drinking water to consumers. The true benefits of the Foundation's research are realized when the results are implemented at the utility level. The Foundation's staff and Board of Trustees are pleased to offer this publication as a contribution toward that end.

Denise L. Kruger
Chair, Board of Trustees
Water Research Foundation

Robert C. Renner, P.E.
Executive Director
Water Research Foundation

# ACKNOWLEDGMENTS

This report was funded by the Water Research Foundation (WaterRF) and the New York State Energy Research and Development Authority (NYSERDA). The WaterRF project manager was Jian Zhang and the Project Coordinator was Ginnie Harrington. The researchers extend their great appreciation to WaterRF, and especially to Jian and Ginnie, for their management, patience, and unflagging support and encouragement throughout this project. We also wish to thank Kathleen O'Connor of NYSERDA, who provided constant support and enthusiasm and thoughtful input to the project.

We also thank the project advisory committee (PAC), which provided guidance and constructive critique throughout the project:

| | |
|---|---|
| Michael Ambrose | East Bay Municipal Utility District |
| Glen Daigger | CH2M Hill |
| Brett Gracely | Colorado Springs Utilities |
| Adam Lovell | Water Services Association of Australia |
| Kathleen O'Connor | New York State Energy Research and Development Authority |
| Steve Whipp | United Utilities |

We also thank the participating utilities for their input on a series of surveys and for their feedback during the workshop and at other points during the research, analysis, and reporting stages of this project. Specifically, we would like to thank:

Albuquerque Bernalillo County Water Utility Authority
Alexandria Sanitation Authority
Austin Water Utility
Clean Water Services
Independence Water Pollution Control Department
JEA Water and Wastewater System
Jefferson County Public Service District
King County Wastewater Treatment Division
Metropolitan Sewer District of Greater Cincinnati
Metropolitan St. Louis Sewer District
Metropolitan Water Reclamation District of Greater Chicago
Milwaukee Metropolitan Sewerage District
The City of New York, Department of Environmental Protection
Narragansett Bay Commission
Philadelphia Water Department
Sanitation District No. 1
Seattle Public Utilities
Tualatin Valley Water District

Our thanks also go to the participants of our New York workshop for their valuable and insightful comments, suggestions, and recommendations.

We also wish to thank the many individuals who helped execute the technical tasks, especially Diane Callow and Erin Miles of Stratus Consulting and Christine Teter.

Finally, we wish to recognize our friend and colleague, John Cromwell, who passed away shortly after the start of this project. It was John's vision and passion that brought our team together and established the foundations for this report. We miss John greatly.

Charles Herrick, PhD (Principal Investigator)
Stratus Consulting Inc.
Washington, D.C.

# EXECUTIVE SUMMARY

The water sector is responsible for ensuring that clean, safe, and sufficient water is available to meet the needs of current customers and future generations. However, water utilities are confronting formidable challenges as they maintain, repair, and expand the water infrastructure system that supplies clean water to their customers, collects and treats wastewater, and manages stormwater. In addition to concerns related to the aging water infrastructure system, these challenges include pressures from population growth and related development, climate change, increasing energy costs, and a variety of environmental concerns. As these challenges converge, many water utilities have found that an integrated approach to water infrastructure and related utility operations, which focuses on sustainability, is needed.

Achieving sustainable water infrastructure and operations will require water utilities to engage in a process that is technically difficult, time consuming, and involves changing the existing mindset of many water utilities and water agency employees. It also requires changing mindsets at governmental (e.g., across city transportation, economic development, environmental protection, energy, and water departments), educational, and societal levels. In short, achieving sustainable water operations will require significant cultural change.

This document provides practical guidance, based on the experiences of "early adopter" water utilities on how drinking water, wastewater, and stormwater utilities can change their organizational cultures and influence the cultures of their customers and other stakeholders to embrace and support an ongoing program of sustainable water operations.

## OBJECTIVES

The overall goal of this project is to develop a framework to enable an organizational transformation toward implementing sustainable water infrastructure and operations. Specifically, the project objective is to develop clear, user-friendly guidance for sustainability champions at water utilities to support their implementation of sustainable water operations, by providing information to help them answer the following questions:

- How can they transform their organizations to ensure that sustainability is at the heart of their decision making?
- How can they change the mindsets of their leaders and staff to incorporate sustainability issues?

- How can they encourage culture change among other state and local agencies, stakeholders, customers, and educators?

## APPROACH

The Stratus Consulting research team conducted a three-part research approach to obtain information about whether and/or how "early adopters" of water sustainability have addressed the need for cultural change and organizational transformation. This approach entailed the following steps:

**Targeted literature review.** Stratus Consulting reviewed the professional literature in fields such as organizational change, social psychology, public administration and management studies to (1) identify factors that influence organizational transformation and (2) describe and understand cultural change as it relates to sustainability. The literature review also included a review of websites, articles, case studies, reports, and other documents developed by local, state, and federal agencies, water utilities, NGOs and other organizations that work on sustainability issues. These sources provided information on (3) concepts, technologies, and practices undertaken by water utilities and municipalities to support sustainable operations, and (4) organizational, communication, and education tools and actions that have been used to help encourage culture change and sustainability.

**Case studies.** Stratus Consulting conducted an in-depth set of surveys with 18 water utilities generally recognized as leaders in sustainable operations and/or infrastructure development. This process entailed:

- An initial telephone contact to establish the purpose and scope of the project.
- An internet questionnaire to learn why each utility has pursued sustainability initiatives, the type of sustainability activities implemented, and barriers to implementation.
- A telephone survey to capture in-depth information on how each utility achieved the cultural changes needed to implement sustainable operations. This included discussion of the organizational attributes of the utility that required transformation and the types of organizational, communication, and education actions and approaches the utility used to help achieve cultural transformation.

In addition, the Stratus Consulting research team conducted a focus group discussion with leading water utility communication and public relations experts to elicit ideas on ways to communicate about water sustainability and specific communication and education tools that are effective in terms of organizational transformation.

**Practitioner workshop.** Stratus Consulting synthesized findings from the literature review and case studies into a white paper that described cultural change and organizational factors that tend to either enable or constrain water utility efforts to achieve sustainable operations, and a set of tools that utilities can use to address organizational transformation. These findings were presented to, and critiqued by, academic experts and water sector professionals during a series of facilitated focus sessions at a two-day workshop held in New York City. As the final step in our

research approach, the Stratus Consulting team synthesized and assessed the findings from the workshop, case studies, and literature review to develop this guidance document.

## RESULTS/CONCLUSIONS

The adoption of sustainable water operations is a complex issue that requires, among other things, achieving an in-depth understanding of the need for water sustainability actions and outcomes, a multi-disciplinary approach to problem-solving, and multi-party solutions that cut across many currently "stove-piped" organizations (e.g., water utilities, municipal water departments, local departments of transportation, recreation, planning, and community and environmental organizations). Water utilities tend to be conservative organizations, and utility staff, management, and leadership are likely to share a mindset that is wary of enterprise-wide transformation. Consequently, successful achievement of sustainable water utility operations is likely to require many water utilities to transform their organizational culture.

The research conducted for this project provided key findings on the cultural characteristics of a sustainable utility. Findings from our literature review and case studies indicate that organizations that are successful in operating in a sustainable manner share the following traits:

- Acceptance that uncertainty is a "normal" aspect of operations.
- Realization that results cannot be predicted and that initiatives are "experimental."
- Disposition to accept flexible operating systems.
- Acceptance of the need for utility departments to integrate operations.
- Acknowledgement of the need to share information.
- Appreciation for the need to collaborate with outside partners.

In addition, our research uncovered 12 organizational attributes that can facilitate or constrain a utility's capacity to adopt these traits through a transformation of its culture. These organizational attributes form the backbone of the recommended framework for cultural change described in this guidance document. They include:

- Internal factors
    - Leadership style and issue inclination
    - Organizational structure
    - Learning mechanisms
    - Staff motivation
    - Management information system capacity
    - Technical capacity
    - Human resources practices
    - Budgetary and financial models and systems
    - Funding

- External factors
    - Stakeholder and customer receptivity
    - Policy and legal environment
    - Regulatory restrictions

## APPLICATIONS/RECOMMENDATIONS

This guidance document provides a framework for use by water utility employees who are committed to achieving a cultural transformation toward sustainable water operations. This framework entails the following steps:

- Get started by acknowledging the need for sustainable modes of operation, and creating a sustainability team of utility staff who embrace this need.

- Assess the utility's existing capacity for cultural change. As described above, we have identified 12 factors that can affect a utility's capacity for culture and organizational change. A self-audit matrix is provided that the sustainability team can use to assess the extent to which each factor is likely to facilitate or constrain change.

- Once the sustainability team understands what aspects of the utility are potentially constraining its ability to achieve sustainable water operations, the team can develop a strategy for change. This process involves several tasks, including (1) assess the utility's current portfolio of sustainability activities in light of its existing capacity for cultural change, (2) identify the specific attributes to target for change, and (3) select a set of organizational, communication, and educational tools, actions, and approaches to best address these attributes. This guidance document provides tools to accomplish all three tasks and presents examples of how two water utilities have addressed cultural constraints in order to effectively implement sustainability operations.

# CHAPTER 1. INTRODUCTION

## 1.1 PURPOSE OF THE GUIDE

The water sector faces numerous problems in ensuring that clean, safe, and sufficient water is available to meet the needs of current customers and future generations. Related to these issues, water utilities are confronting daunting challenges as they maintain and expand the infrastructure system that supplies clean water to their customers, collects and treats wastewater, and manages stormwater. While the specific problems vary regionally, they are exacerbated as pressures from population growth and related development increase, and new challenges such as climate change, increasing energy costs, environmental concerns, and aging water infrastructure arise. As all of these concerns converge, it is becoming clear to many water utilities that a new, integrated approach to water infrastructure and related utility operations, which focuses on sustainability, is needed to help ensure that the nation will be able to provide the quality and quantity of water demanded in the future.

Achieving sustainable water operations will require water utilities to engage in a process that is technically difficult, time consuming, and culturally challenging. Achieving sustainable water operations involves complex interactions between social and ecological systems. It will require, among other issues, achieving an in-depth understanding of the need for water sustainability interventions and outcomes, a multi-disciplinary approach to problem-solving, and multi-party solutions that cut across many currently "stove-piped" organizations. In short, sustainable water operations will require cultural change.

However, the current social science and management literature suggests that organizations are likely to seriously underestimate the difficulty associated with efforts to implement programs of fundamental and lasting change, and that their overall track record at success is very poor (Capra 2007). Water utilities tend to be conservative organizations. Utility staff, management, and leadership are inclined to share a mindset, or cultural predisposition, that is leery of broad-scaled, enterprise-wide transformation. Consequently, achievement of sustainable utility operations will likely require significant changes in this existing culture. This document provides guidance, based on the experiences of "early adopter" water utilities on how drinking water, wastewater, and stormwater utilities can change their cultures to embrace and support an ongoing program of sustainable water operations.

The guidance presented in this document is intended for use by water utility sustainability champions. Sustainability can be initiated by people at different levels of the utility organizational structure, or even those outside of the utility – anyone who is dedicated to

achieving sustainable operations. Thus, while sustainability champions are often the executive directors of a water utility, they can also be utility governing board members, mid-level utility staff who are passionate about the environment, or even external stakeholders committed to working with the water sector to become more sustainable.

## 1.2 SUSTAINABILITY AND WATER INFRASTRUCTURE SUSTAINABILITY

Over two decades ago, the Brundtland Commission challenged governments, public and private organizations, and citizens to act in a manner that meets the needs of the present in ways that are economically viable, environmentally sound, and socially equitable, while ensuring that future generations will have the resources to do the same. Put simply, sustainability is about meeting today's needs without reducing the prospects of future generations.

In terms of water sustainability, the term *sustainable water infrastructure* system has been defined in multiple ways. The Aspen Institute articulates the notion that water infrastructure sustainability includes the traditional, man-made water and wastewater infrastructure *plus* natural systems such as protection and restoration of watersheds, green infrastructure, low impact development, water reuse and reclamation, decentralized technologies, and water conservation and efficiency (Aspen Institute 2009).

The American Water Works Association's (AWWA) policy on sustainability advocates sustainability of drinking water utilities through the provision of an adequate and reliable water supply of desired quality – now and for future generations – in a manner that integrates economic growth, environmental protection, and social development. The AWWA policy supports sustainability activities that provide a "triple bottom line" of benefits, as shown in Table 1. These activities include a wide variety of environmental sustainability strategies, including:

- Water efficient technologies
- Industrial and residential energy/water conservation programs
- Leak detection and correction programs
- Construction of green infrastructure
- Reduced energy consumption across all facets of utility operations
- Development of recycled and reclaimed water systems that support the use of the lowest quality of water appropriate for the situation.

AWWA's definition also states that sustainable water utilities might adopt such financial actions as asset management practices and a full cost-of-service rate structure that allows for the generation of revenue to maintain and protect their infrastructure. Utilities can also work toward social sustainability, through engaging the local community in decision-making, implementing workforce development programs, and using water footprints to educate customers on the value of water.

Drawing on these definitions of sustainability, this guidance document adopts a broad perspective that focuses on a water utility's sustainable operations related to environmental and energy practices, and includes the following categories:

- Utility-wide sustainability planning
- Green infrastructure
- Land use
- Transportation
- Water conservation
- Water utility facility improvements
- Educational and outreach programs
- Other activities.

**Table 1. The Triple Bottom Line of Benefits of Water Sustainability Activities**

**Environmental Benefits**
- Improved water quality
- Improved air quality
- Improved groundwater recharge
- Energy savings
- Reduced greenhouse gas emissions
- Reduced heat stress
- Flood protection
- Reduced sewer overflow
- Water conservation
- Avoided/reduced ecosystem impacts

**Economic Benefits**
- Reduced grey infrastructure construction and maintenance costs
- Reduced waste disposal costs
- Increased revenues from recycled waste streams
- Increased economic development
- Increased jobs, including green jobs
- Increased land and property values

**Social Benefits**
- Enhanced community aesthetics
- Reduced environmental impacts on low-income or minority communities
- Increased education of the public about their role in stormwater management
- Enhanced work environment for water utility employees

Table 2 summarizes specific types of environmental- and energy-related sustainable activities that the utilities that participated in this study are undertaking or have already implemented.

## 1.3 CONTENTS OF THE GUIDE

### What is in the Guide?

This guide focuses on how to change water utility culture. It provides information to assist sustainability champions in understanding their utility's culture, identifying cultural attributes that need to change in order to become more sustainable, and assessing their capacity to make these changes.

The document also presents a framework for utilities to use to identify and select tools to help them change their cultural attributes, inculcate changes in utility staff outlooks, extend sustainability changes across utility and government agency silos, and encourage future generations of water managers to embrace sustainability.

The information presented in this guide is based on a three-part research approach involving (1) a targeted literature review, (2) case studies based on Internet and telephone surveys with 18 water utilities that are leaders in sustainability and related initiatives, and (3) an expert and practitioner workshop focused on the attributes for organizational change and communication and education approaches to achieve a sustainable organization. See Appendix A for a more detailed discussion of the research approach.

**Table 2. Examples of Sustainable Water Utility Infrastructure and Operations Practices**

**Green Infrastructure**
- Bioengineered stream bank stabilization
- Centralized infiltration and detention/slow release practices (i.e., collect runoff from several block area to centralized treatment area)
- Downspout connections
- Green roofs
- Green streets
- Permeable pavements
- Rain harvesting/rain gardens
- Tree planting and reforestation, urban forestry
- Urban agriculture
- Vegetated swales
- Wetlands construction

**Land Use**
- Flood control
- Land conservation

**Transportation**
- Carpooling
- On-site fueling
- Purchase fuel-efficient fleet
- Purchase electric/hybrid fleet vehicles

**Water Conservation**
- Advanced water conservation measures
- Municipal water conservation policies
- Utility water conservation policies
- Water reuse and reclamation (e.g., treated wastewater to recharge aquifer, treated wastewater for irrigation and industrial use, marketing reclaimed water)

**Other**
- Utility –wide sustainability plan development
- Biosolids management
- Decentralized systems
- Energy and environmental tracking
- Stormwater impervious fees

**Sustainable Water Facilities**
- Combined heat and power to produce heat and electricity
- Construction or retrofit of energy-efficient facilities (e.g., LEED© certification)
- Conversion of waste to energy (e.g., methane recovery, anaerobic digesters)
- Energy conservation practices (e.g., shutting off lights, use of power strips, timers on heating and cooling systems)
- Energy-efficient water pumps
- Green product procurement (lighting, paper goods, cleaning supplies, etc.)
- Green power purchases
- On-site renewable energy
- Recycling waste products
- Regular maintenance of heating/cooling and other systems
- Sustainable landscaping (including GI approaches)
- Thermal sewage heat pump (use of sewage as heat source or sink for heat pump technology to heat facilities)
- Water conservation (e.g., low-flow toilets, water use restrictions)

**Educational and Outreach Programs**
- Educational curricula on sustainability
- Employee training
- Guidance documentation on green infrastructure, sustainable facilities, etc.
- Incentive programs to encourage sustainability practices
- Outreach to customers about utility sustainability practices
- Outreach to regulators and policy makers

## What is Not in the Guide?

This guidance document does not attempt to provide an assessment of specific water infrastructure or operational activities or of sustainability planning approaches. For example, it does not provide a:

- Technology roadmap
- Comparative assessment of the effectiveness, efficiency, or return on investment of specific technologies or operational changes
- Process for developing a utility sustainability plan
- Risk assessment or risk assessment process
- Prioritization scheme for selection of sustainability technologies or processes
- Catalog of specifications for water infrastructure technologies.

Some excellent resources are available that address these topics. For example, on the issue of sustainability planning, EPA's *Planning for Sustainability: A Handbook for Water and Wastewater Utilities* provides guidance on how to enhance current planning processes by building in sustainability considerations. Also, numerous water utilities have executed sustainability plans that can be used as examples. A recent tool, the envision™ Sustainability Rating System, was developed by the Institute for Sustainable Infrastructure and the Zofnass Program for Sustainable Infrastructure at the Harvard University Graduate School of Design. It can be used to rate and prioritize infrastructure projects based on sustainability indicators over the course of a project's life cycle. These and other resources are listed in the *Selected Resources* at the end of this guide.

## Organizational Structure of the Guide

The remainder of this document is structured as a toolbox to help water utilities transform their internal culture and the mindsets of external stakeholders to support sustainable water infrastructure and operations. It includes the following chapters:

**Chapter 2** *Culture Change and the Water Utility Industry* – defines organizational culture and culture change, and compares the cultural characteristics of a "sustainable" water utility with those of a "typical" water utility.

**Chapter 3** *Attributes that Influence Organizational Culture Change* – describes 12 organizational attributes that can affect a utility's ability to change its culture, and explains how each of these factors might impact efforts to achieve sustainable operations.

**Chapter 4** *Water Utility Culture Change: Overview* – presents a framework for effectively working toward a water utility culture conducive to sustainable operations.

**Chapter 5** *Getting Started* – describes how a utility begins the process of becoming a sustainable organization.

**Chapter 6** *Assessing Capacity for Culture Change* – presents a self-audit matrix for guiding organizational transformation.

**Chapter 7** *Developing a Strategy for Culture Change* – presents a primer on how to change utility culture to embrace sustainability through identifying organizational attributes that can impact efforts to achieve cultural change and selecting tools and strategies that can help achieve cultural transformation.

**Chapter 8** *Water Utility Culture Change: Putting it all Together* – demonstrates how two water utilities have addressed cultural factors constraining their ability achieve sustainable operations.

In addition, sustainability champions can use the following set of *Tool Selection Matrices* to identify which organizational, communication, and education tool(s) can be used to transform the specific organizational attributes they have targeted for change (*Tool Selection Matrix 1*), and to select the most appropriate tools based on information about each tool and examples of how water utilities have used each tool (*Tool Selection Matrices 2- 4*):

**Tool Selection Matrix 1** *Tool Identification Instrument*
**Tool Selection Matrix 2** *Organizational Tools to Facilitate Utility Culture Change*
**Tool Selection Matrix 3** *Communication Tools to Facilitate Utility Culture Change*
**Tool Selection Matrix 4** *Education Tools to Facilitate Utility Culture Change*

Finally, Appendix A provides a description of our research approach, and Appendix B presents summaries of selected graduate programs in water resources and related topics that might be of interest to water utilities when developing a strategy for culture change.

# CHAPTER 2. CULTURE CHANGE AND THE WATER UTILITY INDUSTRY

## 2.1 ORGANIZATIONAL CULTURE

As explained in Chapter 1, adoption of sustainable water operations is a complex issue that is likely to require many utilities to transform their organizational culture. Table 3 presents a seminal definition of organizational culture, articulated by Edgar Schein more than two decades ago. Organizational culture is a set of shared beliefs, values, assumptions, experiences, and philosophies. An organization's culture can influence, for example, how it treats its employees, customers, and the wider community; how information flows through the organizational hierarchy; the way decisions are made; and its overall attitude toward environmental issues.

Achieving cultural change may involve a lengthy and challenging process. Organizations trying to implement sustainable development often find their conventional operations and culture fundamentally challenged (Brown 2005a, Brown 2005b, Siebenhumer and Arnold 2007). Some argue that a serious commitment to sustainability requires extensive redesign of organizations and their basic operating practices (Shrivastave and Hart 1995, Walker and Salt 2006).

This section demonstrates why it is difficult for utilities to change their organizational culture in order to achieve successful sustainable operations. Some cultural characteristics consistent with sustainable utility operations are discussed below, followed by description of a "typical" water utility culture.

**Table 3. A definition of organizational culture**

*Organizational culture* is a "pattern of basic assumptions that a given group has invented, discovered, or developed in learning to cope with its problems of external adaptation and internal integration, and that have worked well enough to be considered valid, and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems" (Schein 1984).

### 2.2.1 The Cultural Characteristics of a Sustainable Utility

Water utilities cannot just "bolt on" a new technology or approach to become sustainable. It is clear that utility cultures need to change to accommodate sustainable modes of operation. But what does this look like? Literature review and utility case studies (see Appendix A, Research Approach) suggest that utilities configured to operate in a sustainable manner need to adopt and embrace a set of predispositions that are not generally consistent with conventional views of water utility culture. These traits are outlined below.

1. **Recognition that utilities must adapt to uncertainty.** Issues that are motivating water utilities to develop sustainability programs include climate change, the evolution of regional economies, and other circumstances characterized by uncertainty. It will be essential for utilities to make significant changes to their operations in order to be able to take such ongoing uncertainty into account.

2. **Realization that results cannot be predicted with 100% accuracy.** Because of these unavoidable uncertainties, utility managers must understand the importance of making decisions without knowing the full consequences of their actions; they can predict but they cannot know the outcomes of their sustainability programs. It will be crucial for them to recognize that these programs are experimental, and that deficiencies or weaknesses must be identified and addressed.

3. **Disposition to accept flexible operating systems.** Due to their inability to predict relevant operational parameters, sustainable utilities must be careful to avoid reliance upon rigid, large-scale systems that make it difficult to "fail small."

4. **Awareness of the need for utility departments to collaborate.** The successful deployment of sustainability programs requires that the various operational sections of an organization cooperate in carrying out their activities, leaving behind the practice of operating unilaterally. Operational practices and viewpoints must be integrated across the utility, which is a departure from the standard culture of many utilities.

5. **Acknowledgment of the need to share information.** Information needs to be shared not only within the utility's various departments, but also with partner organizations. Such transparency will allow a utility to understand and address the changing circumstances related to their sustainability programs.

6. **Appreciation for the need to collaborate with outside partners.** The issues that necessitate the creation of sustainability programs cannot be fully addressed by any single organization; thus utilities must call upon partners and independent organizations to assist in their efforts to develop solutions.

### 2.2.2 The Cultural Characteristics of a "Typical" Water Utility

While water utilities do not share a singular, uniform mindset, our research suggests that many utilities are at least somewhat reluctant to embrace the characteristics described above. Instead, water utilities tend to be conservative organizations, characterized by strong inertia (Brown 2005a). As Lienert and others write, water utilities tend to be:

> …large, technical systems, where changes require much time because of the material longevity and strongly established institutional and professional expertise structures. Material and social infrastructure networks constitute a…system...which is extremely successful if its conditions remain stable…. (Lienert 2006).

Achievement of sustainable operations in the water sector thus poses a fundamental challenge: how do advocates of sustainability facilitate deep-seated and lasting change in an organizational

environment marked by conservatism and a strong bias for operational consistency? This guidance document provides a framework for change within the water industry and presents a kit of tools that utilities can use to implement change.

# CHAPTER 3. ATTRIBUTES THAT INFLUENCE ORGANIZATIONAL CULTURE CHANGE

An organization's capacity to change its culture can be affected by a large number of factors. This section describes key attributes, internal and external to a utility, that can affect a utility's ability to initiate and assimilate significant changes in its organizational culture.

Based on a literature review and interviews with leading utilities, we have identified a set of 12 attributes that can influence a utility's ability to alter its identity, mission, or basic mode of operations. Outlined in Table 4, nine of these attributes are internal to the organization, while three are primarily external. Of the internal attributes, several involve individual staff and their capabilities, dispositions, and values, while others are primarily structural and/or procedural. Depending on a utility's current situation, a given attribute could either enable or constrain achievement of particular transformational objectives. It could also be the case that an attribute will have a mixed impact on transformational goals. Individuals seeking to facilitate organizational culture change must therefore assess the status of each attribute, determine whether it will enable or constrain transformational objectives, and, if necessary, identify interventions that will mitigate factors tending to interfere with transformational aspirations, in this case implementation of sustainable operations.

Each of the 12 attributes is described below. Information on how a utility can assess its capacity for change, based on these 12 attributes, is presented in Chapter 6, *Assessing Capacity for Culture Change*. Information on how to select specific attributes for change is provided in Chapter 7, *Developing a Strategy for Culture Change*. This chapter also introduces a host of organizational, communication, and education tools and interventions that utilities can use to mitigate the cultural attributes that they identify as constraints to achieving a sustainable mode of operations. Examples of how two utilities have accomplished cultural change within their own organizations are provided in Chapter 8, *Pulling it All Together*. Additional detail about each tool (including links to examples of how water utilities have used these tools) is provided in the *Tool Selection Guides*.

**Table 4. Organizational attributes and external factors that influence organizational culture change**

**INTERNAL**
- Leadership style and issue inclination
- Organizational structure
- Learning mechanisms
- Staff motivation
- Management information system capacity
- Technical capacity
- Human resources practices
- Budgetary and financial models and systems
- Funding

**EXTERNAL**
- Stakeholder and customer receptivity
- Policy and legal environment
- Regulatory restrictions

## 3.1 INTERNAL ATTRIBUTES

The nine organizational attributes described below are key factors relevant to a utility's internal operations.

### Leadership Style and Issue Inclination

Based on our literature review and interviews with leading utilities, it is clear that leadership is a key attribute for successful culture change. Most fundamentally, leaders must be aware that they are playing a "transformational" role, seeking to develop new modes of interaction and/or operation.

While it is not easy to predict the specific qualities that comprise an effective leader in terms of culture change in the context of water system sustainability, the literature suggests that the following attributes are important:

- *Ability to embrace a reflective, adaptive style of decision making.* Achievement of sustainable operations at the utility scale is not a simple, single-dimensional process. Water utilities have adopted sustainability programs to address combinations of thorny issues, such as climate change, combined sewage overflow, aging infrastructure, and rapidly shifting socio-economic conditions. As outlined in Section 2.2.1, *The Cultural Characteristics of a Sustainable Utility*, the uncertainty and complexity associated with these problems calls for an adaptive and flexible management approach, with leaders who are reflective and capable of action-oriented learning (Pahl-Wostl et al. 2007 and Marshal et al. 2011).

- *Ability to frame a narrative that tells a story about the importance of sustainable water operations and related organizational changes* in a way that resonates with internal and external stakeholders and compels them to accept and even embrace an uncertain process of change. Put differently, successful transitions toward sustainable operations can be constrained by lack of a clear, compelling message. This message must be repeated enough for people to "get it." One utility communication manager refers to this as a "mantra," a clear message repeated frequently.

- *A style that is comfortable with diffusion of authority across multiple actors and is participatory rather than directive.* Sustainability initiatives frequently involve formal and informal collaboration among water utility staff and between the utility and other state and local agencies and departments. Utility leaders interested in the achievement of sustainable operations must be willing to share significant authorities. Furthermore, effective implementation of culture change will require building a network of committed leaders and champions for change across all levels (top management, mid-management, staff) to embrace the transition and convince others to do likewise (Benn et al., 2006).

### Organizational Structure

The policies and rules that define an organization's overall administration, as well as the way it delegates responsibilities, comprise its structure. Organizational structure strongly influences

how an establishment is run, with regard to the extent of its information sharing and the way in which power is distributed. These structures vary according to how widely authority is distributed—i.e., whether power is concentrated in a distinct hierarchy or in a more decentralized arrangement.

Sustainability initiatives require close collaboration among utility departments and employees with different skill sets (e.g., engineering, management, maintenance, landscaping). Assigning activities only to individual departments can hinder the execution of innovative, cross-disciplinary, and valuable sustainability programs. Utilities that are accustomed to encouraging employees with diverse backgrounds to collaborate may be best prepared for implementing effective programs. (Brown 2005b, Denison *et al* 1996, Funfgeld 2010, Hunt and Auster 1990, Oxtoby *et al* 2005, Porter 1980, Senge, 1990, Shrivastave and Hart 1995, Wenger and Snyder 2000, Zheng *et al* 2010, and various utility interviews.)

**Learning Mechanisms**

A transformation toward sustainable operations can be constrained by staff deficits in analytical capacity and/or technical understanding. Organizations that can effectively train staff, develop and transmit new information, enhance problem-solving capabilities, and generally facilitate learning are more inclined to overcome knowledge-based barriers. (Funfgeld 2010, Siebenhuner and Arnold 2007, Vogel *et al* 2007, and various utility interviews.)

**Staff Motivation**

Organizational culture change can be influenced by the degree to which staff members (a) understand and (b) support any given rationale for change. The parlance, concepts, and values associated with sustainability may or may not resonate and/or animate the rank and file of a particular utility. Consequently, lack of support from utility staff can be a barrier to the implementation of sustainability-related programs. On the other hand, a cadre of passionate staff can spark leadership enthusiasm and enable development of a sustainability program. (Brown 2005a, Brown 2005b, Bryman et al 1996, Hartley et al 1997, Lienert et al 2006, Miles 2010, Siebenhuner and Arnold 2007, Wenger and Snyder 2000, Wilby and Vaughan 2010, and various utility interviews.)

**Management Information System Capacity**

Information technologies and computer networks have become the nerve systems of modern large-scale organizations. Such systems can multiply an organization's reach and capability, but also tend to channelize and delimit how things get done. Organizations can become captive to the structure and specifications of their information technologies and associated systems. For example, utility SCADA systems may be difficult to modify in order to accommodate new data streams associated with, for example, energy efficiency. Inflexible operating systems may act to reinforce a cultural reluctance to change; whereas flexible information platforms may make it easier for individuals to experiment with change. (Davenport 1997, Hammer 2007, Senge 1990, Welch 2010, Zheng et al 2010, and various utility interviews.)

### Technical Capacity

Organizations often hire staff with particular skill sets and/or disciplinary backgrounds. For example, water utilities tend to seek individuals with engineering backgrounds. Depending on the initiative, a sustainability program may need to involve expertise in landscape design, renewable energy applications, social marketing, or cutting edge financial analysis. In some cases, therefore, a utility might lack the internal technical capacity to pursue a robust portfolio of sustainability activities. Some sustainability activities, such as green infrastructure, are relatively new concepts and there is limited technical knowledge within utilities, as well as municipal agencies and even the general engineering and consulting community. As one utility representative expressed it, green technologies require cradle-to-grave analyses since their long-term impacts (e.g., maintenance requirements over time, ability to meet functionality requirements) are unclear. This type of analysis requires more or different tools, knowledge, resources, and time than some utilities might have at their disposal. (AAEE/BOKTF 2009, Brown 2005b, Denison et al 1996, Gouillart and Kelly 1995, Prahalad and Hamel 1990, Wirtenberg et al 2008, and various utility interviews.)

### Human Resources (HR) Practices

Achieving sustainability through changing a utility's culture requires not only technical change, but also attention to the "human element." It makes good sense for an organization's overall goals and objectives to be consistent with the goals and objectives that animate individual staff. Human resources tools such as job descriptions, performance agreements, benefit packages, and incentive structures can either support or detract from efforts to transform an organization. For example, efforts to encourage cross-unit collaboration can founder if individual incentive agreements are keyed to department-specific (as opposed to organization-wide) goals and targets. (Brown 2005a, Daily and Huang 2001, EPA 2005, Hammer 2007, Post and Altman 1991, Shrivastava and Hart 1995, Uren 2010, and various utility interviews.)

### Budgetary Templates and Financial Accounting Systems

Financial accounting systems can influence, even determine, the types of data and/or metrics that can be recorded and used in utility management, planning, and performance assessment activities, sometimes serving to channel initiatives toward a business-as-usual or status quo mode of activity. (EPA 2005, Marshall J and Toffel M 2005, Shrivastava and Hart 1995, and various utility interviews.)

### Funding

Organizational culture change to achieve a sustainable water infrastructure may require substantial upfront funding, or alternatively, imply near-term reductions in income or operating capital – either way, serving as a barrier to change. Our utility survey indicates that utility managers or leaders may fear risking their budgets on unproven processes, thus reinforcing the cultural status quo. Lack of funding or low perceived returns on investments has served to derail efforts to achieve sustainable operations. For example, water utilities are concerned about high capital costs associated with new, more sustainable wastewater treatment plants, combined heat

and power facilities, water reuse facilities, or green roofs. (EPA 2005, EPRI 2010, and various utility interviews.)

## 3.2 EXTERNAL ATTRIBUTES

External factors relate to the relationships that water utilities maintain with local, state, federal, and other public and private stakeholders. Three types of external factors that are critical to water sustainability operations are described below.

### Stakeholder and Customer Receptivity

Water utilities involved in sustainability initiatives frequently need to maintain a diversity of relationships with the public, customers, and other outside parties and entities, including local agencies involved in related activities such as parks and recreation, planning, street construction and maintenance, transportation, public health, and capital programs. External stakeholders and utility customers often hold considerable sway over how an organization operates. There is considerable variation among municipal and state agencies with respect to their overall focus on values such as environmental stewardship. Water utilities interviewed for this project frequently cited problems coordinating with other state and local departments as a barrier to implementing their water sustainability projects. On the other hand, some utilities gained momentum and support for their sustainability initiatives through strategic collaboration with customers and/or external entities (including environmental organizations, environmental justice groups, and some state and local agencies) that share their passion for environmental stewardship and/or social equity. Public attitudes concerning sustainability efforts may vary considerably. For example, a utility's customer base may focus unrelentingly on rate control, whereas environmental advocates may favor adoption of green programs even in the face of substantial cost increases.

### Policy and Legal Environment

Water utilities are frequently a subsidiary unit of a municipal government or other oversight body (e.g., special district). This means that the utility's ability to alter its basic mission or charter can either be constrained or enabled by policies in place at the municipal level. Moreover, organizational structures and operating practices can sometimes be fundamentally influenced by legal decisions, including court cases, consent decrees, and so on. As New York City Deputy Mayor of Operations, Stephen Goldsmith, once quipped "I have not yet had an innovative idea in any meeting that was legal" (Fund 2010).

### Regulatory Restrictions

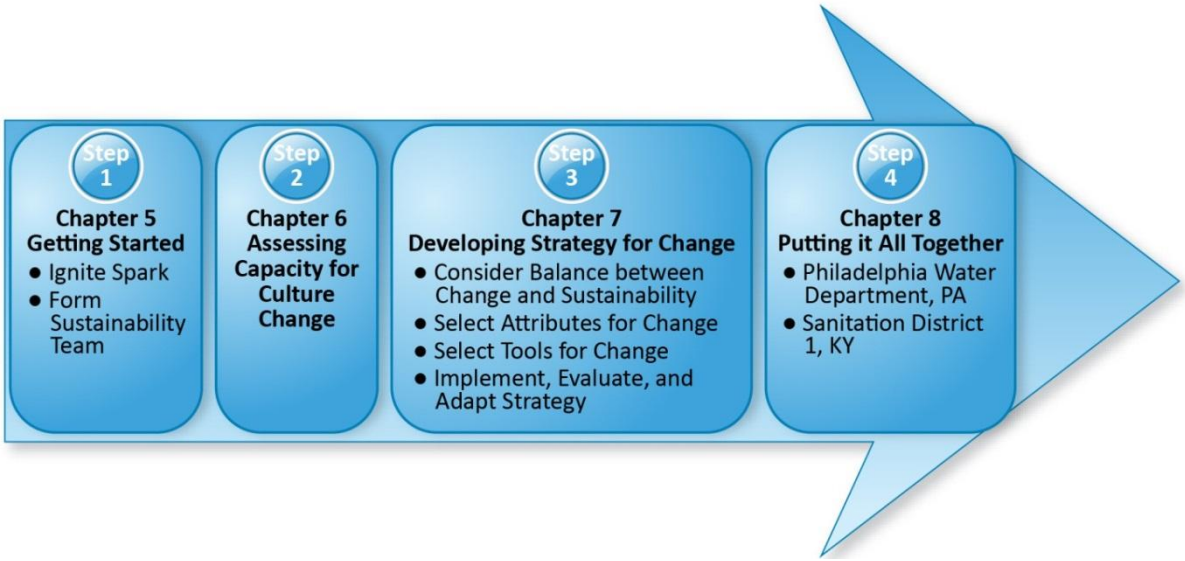
Water utilities interviewed for this project cite federal, state, and/or local regulations as a key barrier to sustainability initiatives. It is well-established that regulatory regimes can materially bound, direct, or influence pathways or options for organizational transformation. This is the case across multiple arenas including public health, worker safety, investment and fiduciary management, resource management, and environmental protection.

# CHAPTER 4. WATER UTILITY CULTURE CHANGE: OVERVIEW

A cultural transformation to support sustainable water utility operations cannot be approached in a disjointed manner. Just as total quality management in corporations demands attention to each stage of the design and production process, only an integrated approach can achieve an organizational "mindset" capable of supporting an ongoing program of sustainability (Shrivastava and Hart 1995). Nor is it reasonable to expect that transformations will occur quickly; indeed, utility interviews and literature review make it clear that cultural transformations can take several years, with some efforts lasting longer than a decade (Adler *et al* 2011, AMSA and AMWA 2005, Farrelly and Brown 2011, Mallak and Kurstedt 1996, Daily and Huang 2001). Consequently, utility champions for sustainability must have a long-term framework for addressing the sustainable activities that they wish to implement and how they intend to achieve the cultural transformation needed to initiate and maintain this sustainable mode of operation (Uren 2010).

Figure 1 presents a transformation framework geared toward organizational cultural change in the context of sustainable water utility operations. This framework presents a suggested approach, but is not intended to imply that all utilities must follow the same set of steps, or that each step of the process must occur in the specified order. In fact, we recognize that some readers of this guidance document may have already passed through some of the steps.

**Figure 1. Framework for Achieving a Cultural Transformation to Sustainable Water Utility Operations**



The key steps of this framework are summarized below and expanded upon in the remaining chapters of this guide:


**Step 1: Getting Started.** A meaningful sustainability program must be rooted in an organization's culture. Any effort to achieve lasting cultural change within a water utility must begin with some kind of a spark that ignites a desire to embrace sustainable modes of operation. Because people are the engine of cultural change, a critical early step in the process of implementing sustainable water operations is to create a transitional "Sustainability Team" and stipulate the roles and responsibilities of team members. Information on this step is provided in Chapter 5, *Getting Started*.


**Step 2 - Assessing the Organization's Capacity for Culture Change.** Chapter 3.0, *Attributes that Influence Culture Change* identified 12 factors that can affect a utility's capacity for change. Step 2 presents a self-audit matrix that the Sustainability Team can use to assess whether and how individual attributes are likely to facilitate or constrain organizational change. Detailed information on this step is provided in Chapter 6, *Assessing Capacity for Culture Change*.


**Step 3 – Developing a Strategy for Cultural Change.** This step describes how to develop a strategy for cultural change. First, the Sustainability Team should consider its contemplated portfolio of sustainability activities in light of its existing capacity for cultural change. Next, the Team designates the cultural attributes that it believes must be either accentuated or changed in order to support a meaningful program of sustainability and selects items for a tool box to best address these attributes for change. The cultural change tools are divided into three categories: organizational tools, communication tools, and educational tools. Once the Sustainability Team has identified the palette of tools, it is important to develop an implementation schedule, identify metrics to measure success, and periodically evaluate and revise (as needed) the program. Detailed information on this step is provided in Chapter 7, *Developing a Strategy for Culture Change*.


**Step 4 – Putting it All Together.** The process of cultural change is complex. While the strategy developed under Step 3 will enable the Sustainability Team to select from a wide range of approaches for achieving cultural change and sustainable water operations, it cannot provide a menu-driven answer on which tools to use or how to link tools as part of the overall strategy. Chapter 8, *Water Utility Culture Change: Putting it All Together* illustrates this step by showing how two water utilities – the Philadelphia Water Department (PWD) and Sanitation District No. 1 (SD1) – have addressed cultural constraints on their ability to implement sustainability operations.

# CHAPTER 5. GETTING STARTED


## 5.1 IGNITE THE SPARK

Any effort to achieve lasting cultural change within a water utility must begin with some kind of a spark that ignites a desire for a change toward sustainability. This might be an event or a focused and concerted act of leadership by a utility leader or a staff member who is a champion for change. Utility leaders interested in the inculcation of an organizational culture conducive to sustainable operations must articulate a story that compels internal and external stakeholders to let go of the status quo. It is likely that many of the readers of this guidance document are already engaged in this step.

## 5.2 FORM A SUSTAINABILITY TEAM

The champion(s) for change who want to stimulate a transformation toward utility sustainability cannot act alone. Thus, the next step in utility cultural change is to form a sustainability team that can help change organizational mindsets and champion the cause for sustainable operations.

Sustainability teams can take many forms, ranging from overarching and strategic to tactical and functional. But for the purpose of utility culture change, they are frequently structured as working groups and designed to overlay the silos of the existing organization. In fact, cross-functional teams are probably most able to plan, implement, and nurture cultural change within a water utility. As already mentioned, the issue of sustainability spans multiple issues and


functional departments across a utility. For example, just one type of sustainability activity – such as rooftop water collection – involves the skills of an engineer to size the roof, a soil scientist to determine appropriate plants for the soil and climate conditions, a facilities manager, someone familiar with irrigation equipment, a maintenance crew, and more. Sustainability Team members will need to have some or all of these diverse technical abilities, plus be capable of communicating with and educating their utility staff peers. Sustainability Team members can operate with part-time commitment and temporary assignments; they can also operate with relative autonomy and involve team assignments that are full-time and long-term. (Denison, Hart and Kahn 1996.)

# CHAPTER 6. ASSESSING CAPACITY FOR CULTURE CHANGE


Next, it is essential to assess the organization in terms of its capacity for change, as described under Chapter 3.0, *Attributes that Influence Culture Change*. This will help the Sustainability Team characterize the organizational, logistical, and technical capabilities required to implement and maintain a program of sustainable operations.

There is no pre-determined or one-size-fits-all configuration of attributes that will lead to a specified organizational end-state. The Sustainability Team should review and consider all of the attributes, determine which are potentially most salient to their situation, and devise an approach to guide an ongoing process of change.

To help the Sustainability Team assess their utility's capacity for change, this chapter presents a self-audit matrix that incorporates the 12 organizational attributes (see Table 5). Similar tools have been used in a wide range of circumstances to evaluate whether an organization has the requisite attributes, capabilities, and characteristics to initiate and sustain a major transformative initiative.

The self-audit matrix shown in Table 5 provides a three-part rubric that outlines whether a particular attribute is "likely to facilitate" cultural transformation (green), "likely to constrain" cultural change (red), or "indeterminate or mixed" with respect to its impact on envisioned changes in the organizational culture (yellow).


We recommend the following approach for using this self-audit matrix:

1. The Sustainability Team designates a self-audit group comprised of individuals who represent different sections of the organization (e.g., engineering, operations, environmental management, financial, public affairs).

2. The self-audit group members jointly review each attribute description and associated rubric, and make additions, deletions, and revisions if/as necessary to address or highlight utility-specific circumstances.

3. Each self-audit group member independently assesses all attributes and designates a score of green, yellow, or red for each attribute (e.g., by checking the appropriate box located at the bottom of each attribute description). Each member should take notes and document the basis for his or her score assignment.

4. Self-audit group members compare and discuss their scoring, and then develop a joint, consensus version of the matrix.

Chapter 7, *Developing a Strategy for Culture Change*, describes how to use the findings from this self-audit process to determine which cultural attributes to change and to identify the most appropriate tools to affect change.

| Table 5. Organizational culture change self-audit matrix | | | |
|---|---|---|---|
| **Attributes Internal to an Organization** | | | |
| **ATTRIBUTE** | Likely to facilitate | Indeterminate or mixed | Likely to constrain |
| **Leadership Style and Issue Inclination** | Overall, utility executive leaders and senior managers take a transformational role in running the utility, seeking to develop new modes of interaction and/or operation.<br><br>In general, the utility has a "directive" leadership approach, characterized by executive decision taking. This would be a strong enabling factor if the leader supported the sustainability initiative.<br><br>*Or*<br><br>In general, the utility has a "participatory" leadership approach, in which managers allow staff to deliberate and participate in decisions. This would be an enabling factor if there is staff level interest and support in the sustainability initiative. | Executive leaders and senior managers are neither champions nor detractors of a sustainability agenda. | Overall, utility executive leaders and senior managers take a transactional role in running the utility, seeking to focus on familiar problems and work within the context of the status quo.<br><br>In general, the utility has a "directive" leadership approach, characterized by executive decision taking. This would be a constraint if the leader was disinterested or hostile to a sustainability initiative.<br><br>*Or*<br><br>In general, the utility has a "participatory" leadership approach, in which managers allow staff to deliberate and participate in decisions. This might be a constraint if the leader is not committed and merely "staffs down" the initiative to a utility rank and file which itself lacks enthusiastic support. |
| **ATTRIBUTE** | Likely to facilitate | Indeterminate or mixed | Likely to constrain |
| **Organizational Structure** | The utility exhibits a clear tradition and legacy of cross-unit interaction. Such interaction has occurred without policy change or protracted executive focus. The utility has historical examples of significant change. The utility may already include environmental or sustainability-focused staff in "operations" units. Staff characterizes the organization as "open," "adaptive," or "flexible." | Cross-unit interaction has occurred, but may be dependent on external imposition or intensive executive focus. | The utility is characterized by rigid demarcations of activity that tend to restrict cross-unit activities that would support a sustainability initiative. Little or no history of significant organizational change. Environmental or sustainability focused staff are employed only in non-operational units. Staff members characterize the utility as "conservative." |

(continued)

| Table 5. Organizational culture change self-audit matrix (continued) | | | |
|---|---|---|---|
| **ATTRIBUTE** | Likely to facilitate | Indeterminate or mixed | Likely to constrain |
| **Learning Mechanisms** | The utility has experience addressing issues that require operational change, has used a wide variety of tools to familiarize and educate staff and managers regarding what to do and how to do it, including cross-disciplinary "bodies of knowledge" and information packages. | The utility has some experience supporting staff in learning to accommodate new, cross-unit initiatives. | The utility can best be characterized by operations that comport with long-standing protocols; few efforts can be cited that indicate efforts to use tools and information to familiarize staff with new modes of operation. |
| **ATTRIBUTE** | Likely to facilitate | Indeterminate or mixed | Likely to constrain |
| **Staff Motivation** | Staff is invested in sustainability as a value; and has requisite understanding to design and deliver a sustainability program. | Staff is generally aware of pressing environmental and social issues, broadly capable, but may not have focused on sustainability *per se*. Capabilities to address sustainability could be facilitated or marshaled. | Staff views sustainability as an unwanted distraction to their daily job; or staff does not have appropriate background to develop and undertake a sustainability agenda. |
| **ATTRIBUTE** | Likely to facilitate | Indeterminate or mixed | Likely to constrain |
| **Information Management System Capacity** | IT platforms and software can and have accommodated a wide variety of new initiatives; system is known to have supported cross-departmental initiatives in the past. | IT platforms and systems do not have technical or "business rule" limitations that could hamper cross-unit operation. | IT systems and staff operate as a conservative factor, making it difficult to allow use of new types of data, metrics, or reporting protocols. |
| **ATTRIBUTE** | Likely to facilitate | Indeterminate or mixed | Likely to constrain |
| **Technical Capacity** | Utility has internal or dedicated contractual access to technical disciplines necessary to address sustainability technologies or processes. Utility has a history of using cross-disciplinary teams to address issues. | Utility technical capabilities could, in theory, be re-focused on sustainability topics, but staff has not shown an inclination to do so. | Little or no apparent captive technical expertise in sustainability topics, technologies, or procedures. Utility has no history of forming or using cross-disciplinary teams to address issues. |

(continued)

| Table 5. Organizational culture change self-audit matrix (continued) | | | |
|---|---|---|---|
| **ATTRIBUTE** | Likely to facilitate | Indeterminate or mixed | Likely to constrain |
| **Human Resources Practices** | Sustainability (or other opportunities for innovation) is included and operationalized in HR materials in all units and at all levels. Clear, unambiguous performance metrics for sustainability related activities are included in all staff performance agreements, incentive arrangements, offer letters, and other HR documentation. | Sustainability is included and operationalized in some HR materials, perhaps concentrated within a few mission units. | Sustainability is not formalized in any employee relationship management documents or procedures. |
| **ATTRIBUTE** | Likely to facilitate | Indeterminate or mixed | Likely to constrain |
| **Budgetary and Financial Models and Systems** | Utility resource allocation and budgeting systems incorporate environmental and social criteria such as full cost accounting, lifecycle accounting, or triple bottom line analysis. | Standard accounting programs may be supplemented by offline consideration of social and environmental factors. | Utility budgeting and financial models are strictly focused on traditional metrics (e.g., ROI) and classical ledger accounting. |
| **ATTRIBUTE** | Likely to facilitate | Indeterminate or mixed | Likely to constrain |
| **Funding** | Overall, utility budget situation is strong. Utility and/or home municipality is well-funded for planned sustainability activities; sustainability program is a high priority, both within the utility and the community at large. Utility is ready to address potential financial risks from sustainability programs or projects. There are no obvious opponents of funding sustainability activities. | Overall, utility budget situation is challenging, but not dire. Current programs have adequate funding. Funding available for some sustainability activities, but programmatic funding not identified. Utility is relatively comfortable funding sustainability programs or projects. | Overall, utility budget situation is dire. Significant funding limitations threaten the viability of planned sustainability activities; current sustainability activities are threatened with discontinuation. Regardless of budget situation, utility fears risking its budget on new or unproven sustainability processes. |

(continued)

| Table 5. Organizational culture change self-audit matrix (continued) | | | |
|---|---|---|---|
| **Attributes External to an Organization** | | | |
| **ATTRIBUTE** | Likely to facilitate | Indeterminate or mixed | Likely to constrain |
| **Stakeholder and Customer Receptivity** | Strong community demand for sustainability and related values. Municipal leaders may be voted out if they fail to institute aggressive environmental and social equity programs. | Community exhibits support for sustainability efforts, but clearly values potentially countervailing factors such as cost, budgetary control, jobs, reliability. | Utility customers do not exhibit a strong focus on sustainability or related values. Environmental values may be viewed with suspicion. |
| **ATTRIBUTE** | Likely to facilitate | Indeterminate or mixed | Likely to constrain |
| **Policy and Legal Environment** | Municipality has already implemented covering resolutions or other policies that would impel or drive major sustainability initiatives. | Municipal policies are silent regarding factors that could either enable or constrain a utility-led effort to achieve sustainable infrastructure and operations. | No utility- or municipal-level policies or resolutions that would justify or cover utility-level initiatives to enhance sustainability. |
| **ATTRIBUTE** | Likely to facilitate | Indeterminate or mixed | Likely to constrain |
| **Regulatory Restrictions** | State or federal permitting and/or regulatory process is not anticipated to limit the utility's ability to pursue innovative solutions. Utility has a history of partnership and/or adaptive management with key regulatory agencies. | Some regulatory or permit provisions appear inconsistent with aspects of the utility's sustainability plan; however, oversight officials are anticipated to take a reasonable approach. | State or federal permits and/or regulatory provisions severely limit the utility's ability to adopt new and innovative approaches to sustainability issues. |

# CHAPTER 7. DEVELOPING A STRATEGY FOR CULTURE CHANGE


## 7.1 INTRODUCTION

The self-audit process described in Chapter 6 will enable the Sustainability Team to better understand their utility's current ability to initiate and assimilate significant change. At this point, the Sustainability Team must decide which attributes require attention and develop a strategy for intervention. Such a strategy need not be complex, but should at least address:

- The balance between the utility's ability to assimilate cultural change (e.g., tolerance for risk, resource limitations, regulatory restrictions) and its planned portfolio of sustainability activities
- Which cultural attributes require change, and whether some attributes are higher priority than others
- Tools or approaches that will be used to affect change in the designated attributes and a time frame for interventions
- An approach for implementing, evaluating, and adapting the strategy as needed, over time.

Each of these activities is described below.

## 7.2 CONSIDER THE BALANCE BETWEEN THE UTILITY'S ABILITY TO ASSIMILATE CULTURAL CHANGE AND ITS PLANNED PORTFOLIO OF SUSTAINABILITY ACTIVITIES

As described in Chapter 1, *Introduction* and illustrated in Table 1, *Examples of Sustainable Water Utility Operational Practices*, early adopter utilities are implementing a wide array of environmental- and energy-related sustainability activities. Specific activities vary by utility, and range from focusing on a single activity (e.g., implementing green infrastructure) to building a program of multiple sustainability actions across the utility's service programs. Some utilities have developed sustainability plans that delineate their water sustainability vision and goals, identify sustainability activities, and establish an approach for implementing their plan. Other utilities are not yet ready to develop a comprehensive sustainability plan. Table 6 briefly describes four water utility sustainability plans, and provides links to more detailed information about each plan and the water sustainability activities that water utilities are undertaking.


During the utility survey portion of our project research, we became aware of cases in which utilities initially pursued an extensive portfolio of sustainability-related projects and activities, for example, investing simultaneously in green infrastructure, renewable energy projects, electric vehicle fleets, permeable pavements, and a range of water conservation initiatives. In some cases, plans to achieve sustainable operations were delayed or otherwise thwarted by staff and/or stakeholder recalcitrance to embrace new modes of operation.

It is critically important for a utility to consider its contemplated portfolio of operational and technological sustainability changes in light of its existing capacity for cultural change. In particular, the Sustainability Team should attempt to forge a balance between the utility's ability to assimilate cultural change and the extent of its planned portfolio of sustainability activities. Consideration of this balance should be an iterative process, subject to evaluation and reconsideration over time.

Figure 2 illustrates how sustainability champions can approach the balance between the utility's cultural capacity for change and extent of its sustainability portfolio. The horizontal axis of the figure portrays the utility's capacity for cultural change, as determined

**Table 6. Sample Utility, Municipal, and State Sustainability Plans**

**Albuquerque Bernalillo County's Water Resources Management Strategy** is focused on conservation and sustainability. This 69 page document summarizes 13 policies, 60 specific recommendations, five projects, and explicit linkage to an asset management program. http://www.abcwua.org/pdfs/WRMS_Update_101207.pdf

**City of Philadelphia's Greenworks Philadelphia** is a municipal sustainability plan developed by the Mayor's Office of Sustainability. It sets 15 sustainability targets in the areas of energy, environment, equity, economy, and engagement. One of the targets – manage stormwater to meet federal standards – includes two stormwater management initiatives and eight green infrastructure initiatives. Water sustainability initiatives also crosscut other target areas. http://www.phila.gov/green/greenworks/PDFs/GreenworksPlan002.pdf

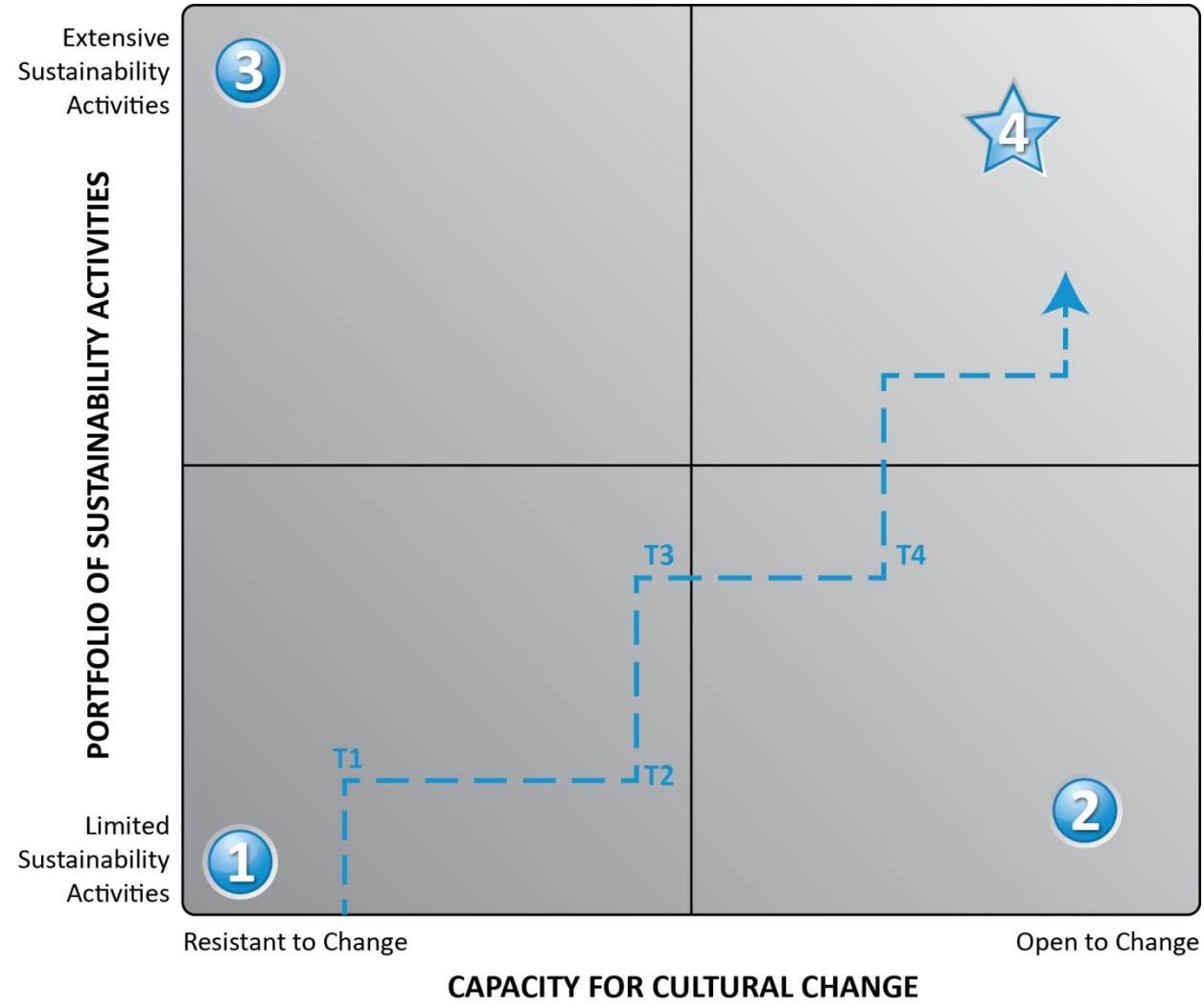
The **Oregon Water Resources Department** developed a 17-page Sustainability Plan with the vision of assuring that sufficient and sustainable water supplies are available to meet current and future needs. This document includes sustainability actions in four broad categories: 1) Facilities and Operations, 2) Resource Management, 3) Education and Outreach, and 4) Regulatory Streamlining. For each action, the plan describes the goal it addresses, how it links to sustainability, specific annual targets, and agency partners. http://www.oregon.gov/OWRD/LAW/docs/OWRD_Sustainability_Plan.pdf

The **Minnesota Water Sustainability Framework** is a long-term strategy to protect and enhance the state's water resources. While conducted at the state level, it illustrates a comprehensive approach to sustainability planning. This 146-page document lays out ten key issues that must be addressed to achieve sustainable water use, 23 strategies to meet these issues, and multiple recommendations for specific activities to meet these challenges. http://wrc.umn.edu/prod/groups/cfans/@pub/@cfans/@wrc/documents/asset/cfans_asset_292471.pdf

through the audit exercise outlined in Chapter 6. The left end of the horizontal axis depicts a conservative organization, marked mostly by red and yellow attributes. On the other hand, the right end of the horizontal axis indicates an organization comfortable with change and experienced in dealing with new and perhaps uncertain contingencies. A utility with many green attributes would be located near the right side of the horizontal axis. The vertical axis indicates the extent of the sustainability activities being contemplated. On the lower end of the axis one would find a utility planning only a limited portfolio of simple activities, perhaps installation of a few small PV panels on a remote facility and installation of rain barrels on a utility office building. The upper end of the axis would be occupied by a utility planning to aggressively implement a diverse array of sustainability activities, perhaps including technologies and/or processes that are not fully proven in an operational setting.

As shown in Figure 2 (see numbers 1-4), the quadrants delineated in the figure represent four ways that a utility might balance its organizational cultural capabilities against contemplated changes in sustainability activity. The dotted line portrays a series of points in time within this construct. At the point in time T1, the utility has recognized that its culture is strongly conservative and that some of its organizational attributes would act to constrain sustainability initiatives. Because of this, it has chosen to concentrate on cultural reforms while investing initially only in a limited set of sustainability activities. At point T2, the same utility has worked successfully to alter key aspects of its culture; attributes that before would have strongly limited sustainability initiatives are now believed to be neutral or even slightly enabling. The utility is now ready to pursue a wider and more diverse palette of sustainability projects. Points T3 and T4 are meant to illustrate a continuation of this effort to jointly assess a utility's cultural capacity against its contemplated agenda of sustainability activity, to ultimately arrive at a point where aggressive sustainability goals are in alignment with cultural attributes.

**Figure 2. Iterative Process for Balancing Capacity for Cultural Change vs. Portfolio of Sustainable Activities**




**Key to Quadrant Descriptions**

***1. Reasonable match:*** conservative utility lacks ability to pursue and assimilate operational change, and has a limited sustainability portfolio that does not challenge business-as-usual operations or existing infrastructure.

***2. Utility capable of more***: dynamic organization could assimilate deep and extensive sustainability changes, but instead is pursuing a limited sustainability agenda.

***3. Sustainability goals apt to be frustrated***: poorly conceived match between a utility culture resistant to change and plans for sustainability that are aggressive, extensive, and very likely to challenge existing operations.

***4. Aggressive sustainability goals matched to dynamic organization capable of transformational cultural change:*** many cultural attributes "score" green, suggesting high capacity to facilitate aggressive changes in sustainability infrastructure and operations.

## 7.3 SELECT ATTRIBUTES FOR CHANGE

It is not essential for all attributes to be green before attempting a particular transformation. What is more likely is that an audit will identify a mix of green, yellow, and red attributes. Attributes characterized as green should be viewed as strongly aligned with the envisioned cultural change; green areas might be relied upon as fulcrum points for change, or as primary sources of transformational motivation. Utilities may discern the need to improve or remediate yellow attributes before embarking upon a particular sustainability agenda. Organizational attributes characterized as red should be viewed as a barrier to cultural transformation. It may be that red attributes are subject to aggressive intervention – either understood by the utility as an ongoing source of organizational tension and perhaps buffered by corresponding green attributes, or viewed as enough of a barrier to compel modification of envisioned efforts to achieve enterprise-scale sustainability.

It is important for utilities to select the cultural attributes they want to target for change in a thoughtful manner, with the goal of achieving a meaningful and effective transformation. However, there is no one-size-fits-all approach for accomplishing this – each utility is different in terms of its goals and objectives, staffing, required time frame, experience with sustainability activities and technologies, and other characteristics that could influence its approach. This section suggests two contrasting approaches for designating cultural attributes for change.

As an informal approach, the Sustainability Team might decide to review the attributes that they have designated as "yellow" or "red" and make an informed decision on which one(s) to address. This could involve reviewing the "yellow" and "red" attributes through consideration of questions such as the following:

- Which attributes, if targeted, are most likely to facilitate efforts to achieve meaningful change?
- Which attributes, if ignored, are most likely to impede or constrain efforts to achieve meaningful change?
- Which attributes are likely to be impossible to change?
- Should change in some attributes precede interventions in other areas?

A more formal approach could involve developing a weighted, multi-attribute matrix to provide a structured method for selecting attributes for change, modeled on the following steps:

- Identify criteria for selecting attributes. While each utility will develop criteria most appropriate to its needs, these criteria could include:
  - Time required to accomplish the change
  - The level of the utility staff's knowledge, ability, mindsets, or values with regard to sustainability programs related to the attribute
  - Anticipated impact of the change
  - Existence of successful examples of other utilities making a similar change.

- Assess the "yellow" and "red" attributes and delete any that are not feasible to change based on the selected criteria.

- Review the remaining attributes based on the identified criteria, and assign each attribute a rating of 1 (e.g., for a negative characteristic) to 5 (e.g., for a positive characteristic). For example, if the time required to change an attribute is expected to be prohibitively long, it might be assigned a rating of 1, while an attribute that could be changed quickly would receive a rating of 5.

- Prioritize each criterion according to how important it is to the utility. For example, if it is most important to select attributes that can be accomplished quickly, this criterion would be assigned a rating of 1.0, while if it is less important to select attributes that can be implemented quickly, the criterion might be assigned a rating of 0.5.

- Calculate the ranking score for each attribute by multiplying the "attribute rating" times the "priority rating" and summing these figures for each attribute.

- Review the findings and develop conclusions on which attributes to designate for change.

Table 7 provides an example of how to construct a weighted, multi-attribute matrix for designating attributes for change. This example assumes that utility leadership is a "yellow" attribute, meaning that executive leaders are neither champions nor detractors of a sustainability agenda. It further assumes that the Sustainability Team believes that it will not take a long time to get utility leaders on board with sustainability goals (i.e., a rating of "4"), that the Team and possibly other utility staff have a good understanding of how to influence leadership attitudes regarding sustainability (i.e., a rating of "4"), that the impact on the sustainability program of gaining leadership support will be very positive (i.e., a rating of "5"), and that the Team is aware of other utilities that have successfully changed their leaders' views on sustainability (i.e., a rating of "5"). In terms of prioritization, the Sustainability Team has rated "time to accomplish" and "impact of change" as the highest priority criteria (rating of 1), followed by staff knowledge and ability (rating of 0.5), and existence of examples of successful utilities (rating of 0.3).

**Table 7. Sample Matrix to Compare Attributes for Culture Change**

| Attribute | Attribute "Color" | Time to Accomplish | Staff Knowledge, Ability, Values | Impact of Change | Successful Examples | Ranking Score |
|---|---|---|---|---|---|---|
| Leadership | Yellow | 4 x 1 = 4 | 4 x 0.5 = 2 | 5 x 1 = 5 | 5 x 0.3 = 1.5 | 12.5 |
| Organizational Structure | Yellow | 3 x 1 = 3 | 3 x 0.5 = 1.5 | 4 x 1 = 4 | 5 x 0.3 = 1.5 | 10.0 |
| HR Practices | Red | 2 x 1 = 2 | 2 x 0.5 = 0.5 | 4 x 1 = 4 | 2 x 0.3 = 0.6 | 7.1 |

Based on this analysis, the Sustainability Team might decide initially to address cultural change through interventions focused on leadership and organizational structure. The team might further decide to address human resources practices later on, once the culture of sustainability begins to take hold.

## 7.4 SELECT TOOLS TO ADDRESS DESIGNATED ATTRIBUTES FOR CHANGE

A key part of the culture change strategy is to identify and select tools, including instruments and more qualitative processes, actions, and interventions, that can be used to alter cultural attributes that constrain the utility's ability to implement and maintain a meaningful program of sustainable options. It is important to remember that a combination of different tools can be used to address a particular attribute, and individual tools can address multiple attributes. An effective tool box will draw upon three types of tools:

- *Organizational tools.* Organizational tools or other organizational actions and interventions can enhance the utility's capacity for change. A utility can select from a diverse array of tools to help it achieve the organizational transformation necessary to facilitate and support a particular agenda of operational change within the utility or to coordinate policy, regulatory, or legal issues with external stakeholders. Specific tools include, for example, development of executive sustainability policies, conducting executive coaching, HR incentives aligned with sustainability goals, use of triple bottom line analysis and life-cycle costing, and working with other organizations to craft ordinances that support sustainability. Table 8 presents a list of organizational tools that utilities can employ when addressing each attribute.

- *Communication tools.* All of the utilities we spoke with confirmed that cultural change cannot occur in the absence of a thorough and focused communication effort, both within the utility and with external stakeholders (e.g., municipality and state agencies, nonprofits, educators, the public). Communication tools comprise an essential element of the utility's tool box to help advance cultural change and sustainability goals. A meaningful cultural transformation requires a shared comprehension and understanding of the reasons behind a utility's efforts to achieve sustainable options. Utilities interviewed for this project have devised, adapted, and used a broad array of communications tools to spread messages of sustainability. Table 9 provides a list of communication vehicles used by utilities interviewed for this study.

- *Educational tools.* Education is an integral part of any transformational process, but is especially necessary in the context of sustainable water operations. Development of a new organizational mindset will likely require un-learning some policies and individual behaviors and learning others. This can be established, in part, through a training regime for utility staff and managers as well as other relevant municipal staff, managers, and executive leaders. An educational program can also involve development of curriculum on water sustainability for those outside the utility or municipal structure, including elementary and middle school programs and high school and college curricula. Utilities interviewed for this project have devised, adapted, and used a broad array of educational tools to spread messages of sustainability. Deconstruction of programs employed by leading utilities interviewed for this study suggests that it may also be effective to configure educational programs to differentiate between *formal* education (e.g., elementary school, high school, college, and graduate school programs), *informal* education (e.g., community events, classes sponsored by local organizations), and *continuing education and training* (e.g., staff training, operator certification, classes

sponsored by associations and universities). Table 10 provides a list of education methods used by utilities interviewed for this study.

**Table 8. Organizational Tools and Methods Used by Water Utilities in Support of Sustainable Operations**

**INTERNAL TOOLS**

**Revise sustainability policies and plans**
- Enact board or executive sustainability policies
- Integrate sustainability initiatives with long-range/comprehensive planning process

**Enhance leadership**
- Executive coaching
- External pressure
- Replace managers and/or executive leaders

**Revise HR structures and incentives**
- Align reward and incentive structures to match desired behaviors and targets
- Establish cross-organizational performance objectives
- Develop new or revised position descriptions
- Recruit new staff
- **Revise performance agreements**

**Revise financial and accounting systems and policies**
- Dedicated budget line
- Extramural funding
- Innovative financial instruments
- Train for and adopt life-cycle and/or full cost accounting models
- Train for and use Triple Bottom Line (TBL) accounting systems

**Revise business practices and policies**
- Conduct corporate reporting
- Seek rate increases
- Sustainability-focused fees
- Reorganize utility
- Work with contractors or consultants

**Revise social and cultural policies**
- Allow and/or encourage space and time for networking
- Cross-departmental units or teams, executive committees, staff working groups

**Improve IT systems**
- New and expanded platforms
- Revise IT system business rules

**EXTERNAL TOOLS**

**Coordinate policy, regulatory, legal issues**
- Craft supporting ordinances
- Facilitate enactment of overarching sustainability policies
- Ongoing negotiation

**Table 9. Communication Tools and Methods Used by Water Utilities in Support of Sustainable Operations**

## INTERNAL TOOLS

**Engage staff in sustainability**
- Assign staff roles in sustainability decision-making or implementation
- Organize facilitated venues to imagine new ways of doing business
- Commit utility staff time to the role of internal communications
- Identify staff who have or will become champions for sustainability

**Communicate directly with staff**
- Early and frequent one-on-one/face-to-face communication
- Hold staff focus groups
- Articles in corporate newsletters

**Encourage inter-staff communication**
- Encourage participation in social networking forums
- Use change agents, internal networks, communities of practice
- Hold employee meetings and brown bag lunches

**Communicate directly with leadership**
- Leader persuasion

**Other**
- Establish communication guidance and tools

## EXTERNAL TOOLS

**Meetings with stakeholders**
- In-person town hall meetings
- Meetings with affected community members
- Regular roundtable meetings with community stakeholder groups
- Meetings with industry and commercial stakeholder groups

**Community or customer surveys**
**Electronic vehicles**
**Dedicated website**
- Mobile applications
- Social media
- E-newsletters
- Online chats with utility staff or leaders

**Marketing and print media**
- Branding mechanisms
- Ads in public places
- News copy and press releases
- Bill stuffers

**Community programs**
- Sustainable product giveaways
- Community service projects
- Community events
- Community alerts and advisories (e.g., on flooding or CSO events)
- Unconventional media (art projects, poetry, music)
- Recognize stakeholder contributions to sustainability

**Reporting**
- Sustainability reports
- Guidance documents

**Partner with stakeholders**
- Advisory panels
- Partner with other agencies
- Partner with regional councils and other utilities
- Partner with stakeholders/outside community
- Joint ventures with outside organizations and businesses

**Table 10. Educational Tools and Methods Used by Water Utilities in Support of Campaigns to Achieve Sustainable Operations**

## INTERNAL TOOLS

### Provide information on sustainability

- Develop disciplinary and interdisciplinary clearing houses and/or bodies of knowledge
- Guidance documents for utility staff and managers

### Training and continuing education

- Utility staff and supervisor training and certification
- Information products for internal training and education
- Training on social media and other types of electronic communication tools
- Encourage employees to enroll in classes at local universities or through on-line courses
- Partner with other utilities to provide training
- Partner with local universities

### Informal education opportunities

- Tours of utility facilities
- Implement sustainability examples on utility grounds

## EXTERNAL TOOLS

### Primary and secondary school programs

- Curriculum on water sustainability and related water issues
- Science fairs
- Presentations to schools, recreation centers, and other organizations
- Utility internships for high school students

### College and graduate school programs

- Curriculum on water resources management
- Speakers on specific water sustainability topics
- Utility internships for college students

### Community education (for community groups, students, and other organizations)

- Provide utility tours and field trips
- Sponsor contests
- Distribute sustainability newsletters
- Develop information products for training and education (flyers, videos, brochures)
- Provide training workshops and speakers

### Guidance documents

- For teachers (e.g., hands-on activities for school projects)
- For utility collaborators (e.g., on green infrastructure techniques)

### Partner with stakeholders

- Local agencies whose goals align with water sustainability (e.g., transportation, parks and recreation, finance departments)
- Other utilities, NGOs, and other organizations in the region

When selecting the "right" organizational, communication, and education strategies, utilities should consider the following issues:

- *Attribute(s) being targeted*. As described above, the Sustainability Team will identify attributes for change, and then select tools to target each of these attributes.

- *Target audience*. When selecting organizational, communication, and education tools, it is important to differentiate between internal audiences (i.e., water utility managers and staff) and external audiences (e.g., state and local environmental agencies, nonprofit organizations, associations, educators, students, and the public). In this context, it is critical to understand differences among target audiences, especially within the utility customer base. Table 11 provides a list of key types of internal and external target audiences. After the tools have been selected, they can be shaped to target one or more of these specific target audiences, as appropriate.

- *Phase of cultural change*. Culture change usually occurs slowly and varies in its timing and intensity. The phases of culture change refer to the distinct but overlapping stages involved in changing a utility's and its stakeholders' knowledge and attitudes about sustainability. Each of these phases, described below, may require different organizational, communication, and/or education strategies:

  - *Raising awareness* of sustainability benefits, issues, policies, and programs,
  - *Developing a more in-depth understanding* of these sustainability issues, policies, and programs,
  - *Achieving a change in attitude* about the need for water sustainability interventions and outcomes, and
  - *Engaging in ongoing dialogue and*

**Table 11. Internal and External Sustainability Target Audiences**

**INTERNAL AUDIENCES**

Water Utility
- Board of Directors/Commissioners
- Director
- Management staff
- Other Staff

**EXTERNAL AUDIENCES**

Customers
- Residential
- Business
- Institutional

State and Local Agency Leaders and Staff
- Transportation
- Environment
- Energy
- Sustainability
- Water, wastewater, stormwater
- Housing
- Other

Local Businesses

Nonprofit Organizations
- Local nonprofit organizations
- State nonprofit organizations
- National organizations

Civic and Religious Organizations
- Neighborhood associations
- Churches and temples

Developers and Builders

Students
- Elementary School
- Middle School
- High School
- College
- Graduate School
- Technical School

Teachers
- Elementary School
- Middle School
- High School
- College
- Graduate School
- Technical School

Other Stakeholders

*continuing education* about water sustainability in order to anchor this new cultural approach in the outlook of current and future generations.

The *Tool Selection Matrices* at the end of this chapter are intended to help the Sustainability Team select the appropriate tools for addressing each designated attribute. Team members can use the tool box as follows:

- Use *Tool Selection Matrix 1: Tool Identification Instrument* to identify the organizational, communication, and education tools that are appropriate for changing each designated attribute. The tool selection instrument also indicates if the tool is appropriate for internal vs. external audiences, and whether it is most appropriate for raising awareness vs. subsequent stages of culture change.

- Once the Sustainability Team has identified potential tools for change, it can refer to the following guides to learn more about each tool, including a description of each tool; issues and observations about when and how to use it, barriers to use, and other challenges; and examples of how early adopter utilities have successfully used the tool (including links to relevant websites and other electronic products).

    - Tool Selection Matrix 2: Organizational Tools to Facilitate Utility Culture Change
    - Tool Selection Matrix 3: Communication Tools to Facilitate Utility Culture Change
    - Tool Selection Matrix 4: Education Tools to Facilitate Utility Culture Change

## 7.5 IMPLEMENT, EVALUATE, AND ADAPT SUSTAINABILITY TRANSFORMATION STRATEGY

This section provides a description of the process for establishing a time line for implementing a strategy of sustainable transformation, evaluating the strategy over time, and making revisions, as needed.

### 7.5.1 Establish Implementation Schedule

As described in Section 7.2, *Consider the Balance between the Utility's Ability to Assimilate Cultural Change and its Planned Portfolio of Sustainability Activities*, and demonstrated in Figure 2, organizational transformation will probably not occur "all at once" but is likely to evolve over time. The time frame required to implement an effective sustainability transformation strategy will depend on multiple factors, including where the utility is along the axes of cultural capacity for change and the extent and intensity of existing sustainability activities, the utility's goals and objectives, unanticipated hurdles encountered along the way, and other factors. As shown in Figure 2, a cultural transformation toward sustainable operations could pass through several phases, beginning with a small number of disjointed projects, and moving through an iterative process where the utility addresses designated attributes for change in order to enable implementation of multiple sustainability activities, with an ultimate goal of supporting an integrated and extensive portfolio of sustainability-related activities. While it probably is not reasonable to stipulate a precise time frame during which this process will occur, outlining a general time frame is a fundamental aspect of strategy creation (AMA 2007). The

utility can develop a "PERT" or Gantt-type chart or other time line that indicates the anticipated sequence of key culture change activities. The utility should review this chart periodically and iteratively (i.e., at each point in time that the utility anticipates it is time to compare cultural change results with sustainability implementation results).

### 7.5.2 Establish Measures of Success, Evaluate and Revise Program

As with any new program, it is essential to track and evaluate the strategy for change in order to identify strengths and weaknesses, determine if goals are being met, and assess overall program execution. Utilities can establish criteria to measure their success in achieving designated attributes for change and for the overall effectiveness of cultural transformation. For example, measures of success could include the following outputs and outcomes:

- Did the utility implement each of the organizational, communication, and/or educational tools that it selected to address each attribute designated for change? For example, if the utility decided to improve its HR structure, did it develop a process to align reward and incentive structures to match transformational behaviors, recruit new staff with the required expertise, revise performance agreements, and communicate these new HR practices to employees? Did the utility meet its projected time frame for accomplishing these changes?

- Has the number of utility staff members who support sustainability increased?

- Has the number of sustainability activities implemented on the utility campus increased?

- Has the utility's total portfolio of sustainability activities increased?

Because the implementation of a culture change strategy is an iterative process that should be implemented in conjunction with a sustainability program, utilities should periodically assess the status of their culture change strategy and compare it with sustainability program implementation, as established in their time schedule. Evaluation methods can be as simple as tracking whether actions and outputs are accomplished completely and on time, to holding staff meetings to discuss program status, to conducting formal staff surveys to establish the impact of the culture change strategy on beliefs and behaviors.

The utility should adjust the components of its sustainability transformation plan based on findings from these periodic evaluations, with changes made over time as the utility moves toward becoming more sustainable. It is also important to periodically report on program results to utility leaders and staff.

# CHAPTER 8. WATER UTILITY CULTURE CHANGE: PUTTING IT ALL TOGETHER


The previous chapters of this guidance explain the need for utilities to change their organizational culture in order to initiate and maintain sustainable operations. They provide a tool box for water utilities to use to assess their capacity for cultural change, select cultural attributes for intervention, identify tools for use in cultural transformation, and then evaluate and revise their strategy for cultural change.

As previously discussed, this process is complex, iterative, and adaptive. In addition, each water utility has a unique set of water sustainability concerns; organizational values, behaviors, and attitudes; external stakeholders; and policy, regulatory, and legal issues. While the tool box provides a variety of approaches for achieving sustainable water operations, it cannot provide a menu-driven answer on which tools to use or how to link tools as part of an overall strategy.

This chapter illustrates how two of the water utilities interviewed for this study – the Philadelphia Water Department (PWD) and Sanitation District No. 1 (SD1) – have accomplished cultural change within their operations to facilitate sustainable operations. As described below, these two utilities have faced different challenges and used different approaches to meet these challenges to achieve more sustainable water operations. These two stories provide useful illustrations of how water utilities can work to change their cultures to incorporate sustainable water operations.

## 8.1 PHILADELPHIA WATER DEPARTMENT (PWD), PENNSYLVANIA

Table 12 presents a summary of the process PWD has pursued in becoming a leader in urban sustainability. Water sustainability projects undertaken by PWD are numerous, and include sustainability planning, a comprehensive green infrastructure program, greening of utility facilities, adoption of a triple bottom line approach for assessing gray and green water infrastructure options, and considerable education and outreach to utility staff and external stakeholders.

PWD has been pursuing a transformation toward sustainability for over a decade, and describes this process as a story of changing from the "inside out." As shown in the table, a key attribute that helped spark PWD's journey was leadership. The current PWD Water Commissioner started at a lower-level position, becoming a champion for water sustainability. Because the top leadership operated in a hands-off manner, he was able to cultivate a group of staff members (referred to as "passionistas") who were highly enthusiastic about water sustainability (focusing

on green infrastructure) and worked together to address challenges to implementing green infrastructure and achieving measurable improvements to the region's waterways. PWD has struggled to counter several cultural attributes that were hindering its ability to affect change, including organizational rigidity and functional stove piping, initial lack of staff support, and misaligned HR policies. In terms of internal organizational structure, PWD reorganized to integrate three separate programs (combined sewer overflow, source water protection, and stormwater management) that are tied together by land use and watershed management issues. Initial lack of staff support was addressed through internal advocacy by the staff "passionistas" and recruitment of external champions. Although it has not been possible to change the HR systems that impede managers' abilities to hire staff with a diverse set of skills needed to fit into their teams, PWD has been able to hire full-time consultants to support new initiatives.

Initial regional water quality efforts were also hampered by jurisdictional mismatches over relevant water quality stressors that spanned multiple city departments. This issue began to be addressed in 2007, when incoming Mayor, Michael Nutter, made sustainability one of his priorities and implemented a city-wide, multi-year plan to reduce energy consumption, utilize renewable energy, reduce GHG emissions, divert solid waste from landfills, manage stormwater, increase urban tree coverage, reduce vehicle miles traveled, and increase the number of green jobs. PWD is also involved in developing full-cost accounting, asset management, and Triple Bottom Line decision protocols.

## 8.2 SANITATION DISTRICT NO. 1 (SD1), KENTUCKY

Table 13 presents a profile of SD1, which provides sewer and stormwater management services to parts of Northern Kentucky. The utility faces multiple challenges, including aging infrastructure, population growth, and the high cost of, and the need for, continued and sustained economic development. SD1's water sustainability projects focus on green infrastructure, flood control, greening of utility facilities, and a comprehensive set of education and outreach activities.

As shown in the table, organizational attributes that have helped enable SD1's transition toward sustainable operations include supportive SD1 leadership and an organizational structure that engages staff participation through a bottom-up approach. Attributes that have tended to obstruct progress toward sustainable operations are externally-focused, and include regulatory and legal restrictions. SD1 is currently a party to a consent decree with the U.S. EPA and the Kentucky Division of Water designed to meet Clean Water Act requirements by addressing CSOs and Sanitary Sewer Overflows (SSOs). To best address these obstacles, SD1 has developed a holistic, adaptive watershed management approach to more efficiently and cost-effectively reduce overflows and improve water quality. SD1's watershed-based approach focuses on water quality by identifying characteristics of individual watersheds and putting water quality impairment caused by CSOs and SSOs in context with other sources of pollution, such as stormwater runoff.

The watershed-based approach in SD1's Consent Decree allows for the consideration of alternative control strategies such as green infrastructure and watershed controls to more cost-effectively reduce CSO volume and improve water quality. Utilizing a watershed approach also allows SD1 to prioritize and direct funds to projects that provide the greatest benefits.

SD1 has used a variety of tools to demonstrate the anticipated benefits and outcomes of its approach, including policy advocacy through a variety of national associations and organizations (e.g., Clean Water America Alliance, National Association of Clean Water Agencies, and the Wet Weather Partnership). An example of successful advocacy efforts includes the passage of House Bill 504, which requires the Kentucky Division of Water to consider the cost of infrastructure improvement projects and the maximization of environmental benefits when negotiating improvement plans with local communities.

Additionally, to communicate benefits of such an approach, SD1 has developed very strong educational and outreach initiatives aimed at community leaders and officials, educators, students and Northern Kentucky residents. Through these initiatives, SD1 is conveying information about the impacts of stormwater runoff; water quality concerns; and the environmental, economic and social benefits of a watershed-based approach.

## Table 12. Philadelphia Water Department (PWD), PA

### ABOUT UTILITY

**LOCATION:**
Philadelphia, PA

**UTILITY TYPE:**
Drinking Water and Wastewater

**URL:**
http://www.phila.gov/water
http://www.phillywatersheds.org/

**NUMBER OF SUSTAINABILITY PROJECTS IN SURVEY:** 5

**TYPES OF SUSTAINABILITY ACTIVITIES:**

**Green Infrastructure**
- Green roofs
- Permeable pavements
- Rain harvesting/rain gardens
- Downspout connection
- Vegetated swales
- Trees and urban forestry

**Drinking Water and Wastewater**
- Treatment
- Best available technology

**Water Utility Facilities**
- Green product purchasing/procurement
- Onsite renewable energy (e.g., wind, solar)
- Construct new, energy-efficient facilities
- Sustainable landscaping
- Water conservation (e.g., low-flow toilets, water user guidelines/restrictions

**Educational and outreach**
- Educational curricula on sustainability
- Incentive for sustainability practices
- Outreach to customers

**Other**
- Decentralized systems
- Energy and environment tracking (carbon footprinting, GHG inventory, GHG reporting)

### PWD BACKGROUND

The Office of Watersheds (OOW) is a unit of the Philadelphia Water Department's Planning and Engineering Division. OOW was formed in January 1999 through reorganization of the Philadelphia Water Department (PWD), by integrating three historically separated programs: Combined Sewer Overflow, Stormwater Management, and Source Water Protection. The OOW is working to achieve viable and measureable improvements to the region's waterways by implementing planning and management strategies that foster good science, public involvement, and fiscal responsibility. The OOW's goal is to meet regulatory requirements while enhancing the health and aesthetics of Philadelphia's environment. In 2007, incoming Mayor, Michael Nutter, made sustainability one of his priorities. Under Nutter's leadership, the city has adopted an aggressive multi-year "Greenworks" plan to reduce energy consumption, utilize renewable energy, reduce GHG emissions, divert solid waste from landfills, manage stormwater, increase urban tree coverage, reduce municipal vehicle miles traveled, and increase the number of green jobs.

### SELECTION OF KEY SUSTAINABILITY ACTIVITIES

**Sustainability Planning**
The City of Philadelphia has developed a sustainability plan that lays out specific targets for energy, environment, equity, and economy. This plan includes targets for stormwater management and related issues such as lowering city government energy consumption, use of alternative energy, and increasing tree coverage.
http://www.phila.gov/green/greenworks.

**Green Stormwater Infrastructure: Green City, Clean Waters**
"Green City, Clean Waters" is the Combined Sewer Overflow Long-Term Control Plan Update for the City of Philadelphia. The plan primarily utilizes green stormwater infrastructure to incrementally reduce flows into the City's combined sewer system, thus reducing overflows and achieving compliance with the Clean Water Act. Green stormwater infrastructure is partnered with stream corridor restoration and preservation and with wet weather treatment plant upgrades. This approach was determined to provide maximum return in environmental, economic, and social benefits. On June 1, 2011, the Philadelphia Department of Environmental Protection and the Philadelphia Water Department signed an agreement that will allow PWD to officially implement its Green City, Clean Waters plan.
http://www.phillywatersheds.org/what_were_doing/documents_and_data/cso_long_term_control_plan

**Solar Power: SE Solar Project and "Glass of Sunshine"**
The SE Solar project involves the installation of 250 kilowatts-peak (kWp) of solar power, which will provide 300,000 kWh of electricity annually toward the power used by the Southeast Water Pollution Control Plant. A grant from the U.S. Department of Energy paid for about one-half of the capital cost of the project.

PWD hopes to undertake the Glass of Sunshine project during the next calendar year. The utility will issue an RFP for the development of a solar power purchase agreement (PPA). This will be a long-term agreement to buy power from a company producing electricity. The partner company will build the solar energy facility on the utility's site and will continue to maintain and operate the machinery. PWD plans to construct the solar facility on top of its water storage basins, so it will not require development of open land.

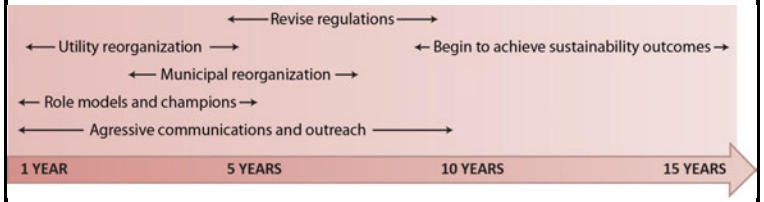
**NE Cogeneration**
This is the development of a combined heat and power unit that will burn cleaned, compressed digester gas (62.5% methane) to produce both heat and electricity. About half the gas is used to heat water for the plant, with the other half being flared. The utility plans to use all the digester gas to provide both heat and electricity in the future.

**Sewage Heat Pump Demonstration Project: SE NovaThermal**
This project will use sewage, rather than air, as a heat source or sink for heat pump technology. This is a demonstration project to show the efficacy of the equipment and the ability of this approach to reduce energy use.

### ORGANIZATIONAL CAPACITY ASSESSMENT AND TOOL SELECTION

| Organizational Factors that *Constrain* Transition Toward Sustainable Operations | Tools Used to Mitigate Organizational Constraints |
|---|---|
| **Organizational Structure (~ 2002)** Incumbent structure tended to deflate efforts to integrate roles and activity. | • Reorganization that combined regulatory affairs, land-use issues, and watershed management. |
| **Staff Motivation** While not vehemently opposed to sustainability efforts, incumbent staff were described as "overly comfortable" in their jobs. | • Formation of a group of staff role models or champions called the "Passionistas."<br>• Partners recruited to be external champions. |
| **HR Systems and Procedures** Antiquated process delayed onboarding of staff to support new initiatives. | • Consultants hired who brought technical prowess and enthusiasm. |

| Organizational Factors that *Enable* Transition Toward Sustainable Operations | How Enabling Factors Support or Drive Transformational Efforts |
|---|---|
| **Leadership Issue Inclination** PWD's Water Commissioner is a tireless and visionary advocate for water program sustainability, starting at lower leadership roles and working his way to PWD Executive Director and now Commissioner. | • Leadership willing to stretch organizational and procedural bounds. |
| **Policy and Legal Environment (~ 2008)** Municipal reorganization has brought together formerly separate functions (water, parks, and recreation, transportation), helping to spur innovations. | • Cross functional initiatives have become easier to undertake, fund, and manage. |




**Sustainable Transition Timeline**

## Table 13. Sanitation District No. 1, KY

### ABOUT UTILITY

**LOCATION:**
Ft. Wight, Kentucky

**UTILITY TYPE:**
Wastewater

**URL:**
www.sd1.org

**NUMBER OF SUSTAINABILITY PROJECTS IN SURVEY:** 8

**TYPES OF SUSTAINABILITY ACTIVITIES:**

**Green Infrastructure**
- Green roofs
- Permeable pavements
- Rain harvesting/rain gardens
- Downspout connection
- Vegetated swales
- Trees and urban forestry
- Land use
- Flood control

**Water Utility Facilities**
- Energy efficient water pumps
- Sustainable landscaping
- Water conservation (e.g., low-flow toilets, water use guidelines/restrictions

**Educational and outreach**
- Educational curricula on sustainability
- Incentive for sustainability practices
- Outreach to customers

**Other**
- Decentralized systems

### SD1 BACKGROUND

Sanitation District No. 1 of Northern Kentucky (SD1) has been in existence for over 60 years and provides sewer services for Boone, Kenton, and Campbell counties. SD1 also oversees stormwater management for the Northern Kentucky region. SD1's service area is challenged by extreme wet weather flows in both its combined and separated sewer systems, impacting water quality in the region. SD1 is currently operating under a twenty year consent decree with U.S. EPA Region IV. Suburban growth is another challenge with respect to sewer service and nonpoint source water quality. Given these challenges, SD1 is demonstrating sustainability technologies such as water conservation, decentralized wastewater systems, low impact development (LID) approaches, resource recovery, and installation of high-efficiency pumping systems.

Although progressing, SD1 faces challenges due to lack of a local champion and regulatory limitations, especially pertaining to sanitary sewer overflows. Due mostly to the need to address regulatory mandates, SD1 has been forced to implement significant rate increases (15-20%) every year for the past six years, a development that has resulted in significant tension with fiscally conservative local political leadership.

### SELECTION OF KEY SUSTAINABILITY ACTIVITIES

**Interactive Environmental Education Center: Public Service Park (PSP)**
When SD1 expanded its headquarter facilities in 2003, it incorporated an outdoor environmental education center into the site design. The Public Service Park (PSP) offers interactive learning through structured field trips and tours that illustrate best management practices for protecting waterways for future generations. SD1 trains teachers and parents to be the tour guides and to lead students through ten scientific stations that include hands-on activities such as comparing the ability of a vegetated roof vs. a conventional roof to reduce runoff; pouring water on the parking lot to observe what happens to water on porous vs. regular pavements; and using test tubes to separate oil from water.

**Elementary Educational Programming: Stormwater Curriculum**
SDI worked with a team of teachers to develop a stormwater curriculum tailored to fourth and fifth grade students in local schools. The program provides educators with all materials needed to teach a five-lesson unit. The utility also offers to teach the first day session. The program targets this particular age group as the best for learning behaviors to carry into adulthood. The hands-on exercises are designed to promote students' conversations with parents, which results in the message reaching adults as well as students. Additional programs exist to keep teachers involved, and participating schools earn a 25% credit towards their stormwater fees. This project also involves partnership with other organizations. For example, Wal-Mart provides funding for the participating schools, and SD1 cooperates with the public transportation system to offer schools an optional field trip to a stormwater facility for a tour that emphasizes the eco-benefits of both stormwater management and environmentally friendly mass transit.

**Middle School Outreach Program: Waterific Science Fair**
SD1 partners with local environmental groups and other utilities to stage a hands-on science fair for middle school students devoted to water conservation topics. Held at either SD1's main office or in its Public Service Park, each partner prepares and presents a 20-minute lesson about water. Students interact with the organizations at their individual stations and booths, learning how conservation and land preservation improve the quality of life in the community.

**College Course: Protecting Water Resources**
SD1 partnered with Northern Kentucky University to launch a 200-level lecture and lab course about stormwater management. This general studies course teaches students about water quality issues from a national level down to a local level. In addition, students learn about existing regulations and are encouraged to engage in the community to help protect water quality.

**Constructing Wetlands: Banklick Creek Regional Wetlands**
This project involves construction of wetlands to improve water quality in Banklick Creek during dry weather conditions.

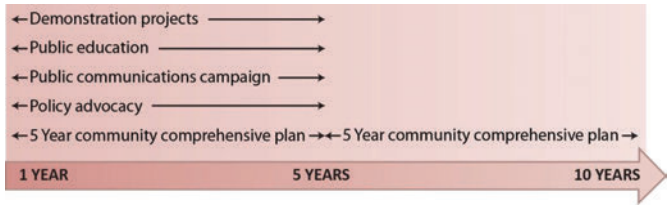
**Terraced Reforestation of Interstate Right-of-Ways**
This project involves construction of green infrastructure in interstate right-of-way spaces, using bioretention and reforestation approaches.

**Stormwater Detention Basins: KYTC Basin Retrofit and St. Elizabeth Detention Basin Retrofit**
The KYTC basin retrofit involves a green infrastructure retrofit of a stormwater detention basin, primarily located on the Kentucky Transportation Cabinet (KYTC) right-of-way. In another project, SD1 constructed a bioretention retrofit of an existing stormwater detention basin located in a combined sewer area.

**Rainwater Harvesting: Prisoner's Lake**
This is a rainwater harvesting and reuse project located on a city-owned park/golf course. It represents a joint project between SD1 and the City of Covington.

### ORGANIZATIONAL CAPACITY ASSESSMENT AND TOOL SELECTION

| Organizational Factors that *Constrain* Transition Toward Sustainable Operations | Tools Used to Mitigate Organizational Constraints |
|---|---|
| **Regulatory Restrictions**<br>Regulatory requirements for dealing with wet weather issues are restrictive and inflexible. | • Ongoing regulatory negotiation.<br>• Policy advocacy through national associations.<br>• Policy advocacy for state-level supporting mandates. Worked to get state legislature to adopt House Bill 504, which requires the Kentucky Division of Water to consider the costs of infrastructure improvement projects and the maximization of environmental benefits when negotiating and implementing improvement plans with local communities and U.S. EPA Region 4. |
| **Policy and Legal Environment**<br>Local political leadership is focused on budget cutting and fiscal conservancy. | • Extensive program of public education to build understanding and support for sustainable operations and to build a future generation of leaders on water issues.<br>• Community and business partnerships help support education efforts.<br>• Extensive program of community outreach. |
| **Organizational Factors that *Enable* Transition Toward Sustainable Operations** | **How Enabling Factors Support or Drive Transformational Efforts** |
| **Leadership Issue Inclination**<br>SDI leadership is providing a supportive role in gaining outside support for GI programs. | • Staff participation and support for education and outreach initiatives. |
| **Organizational Structure**<br>Utility structure enables bottom-up, people-oriented activity. Strong support at all levels for innovative programs. | • SD1 leaders and staff obtained regional community government support for green infrastructure. |




**Sustainable Transition Timeline**

## 8.3 PARTING THOUGHTS

This guidance document is intended to help utilities assess the challenge of implementing sustainable water operations in a new way. We start with the recognition that achieving sustainability requires a change in the culture of water utilities and also in the cultures of other local agencies, utility customers, and utility stakeholders. Cultural change cannot occur quickly, typically involving a lengthy and difficult process. This understanding provides the foundation for an approach that requires water utilities to balance two key issues over time – their capacity for cultural change and their desired water sustainability portfolio. This can be accomplished by the following series of steps, outlined in the preceding chapters:

- Form a sustainability team
- Assess the utility's capacity for culture change
- Review the utility's contemplated portfolio of sustainability activities in light of its existing capacity for cultural change
- Designate the cultural attributes that must be changed in order to support a meaningful water sustainability program
- Identify and select organizational, communication, and education tools that can best address these attributes for change
- Develop an implementation schedule for change that takes into account, in an iterative fashion, the process of reviewing the utility's capacity for cultural change vs. its desired portfolio of sustainability activities. And finally, identify metrics to measure success, and periodically evaluate and revise (as needed) the program.

This approach will help water utility sustainability champions use their understanding of their capacities for culture change to achieve water sustainability operations within their utility and ultimately, through their interactions with external stakeholders and collaborators, across the water industry and to future generations of water managers.

# Tool Selection Matrix 1: Tool Identification Instrument

| ID NUMBER | INTERNAL OR EXTERNAL | INITIAL PHASE OF CHANGE | TOOL | ATTRIBUTE | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Leadership Style and Issue Inclination | Organizational Structure | Learning Mechanisms | Staff Motivation | Information Management System Capacity | Technical Capacity | Human Resources Practices | Budgetary and Financial Models and Systems | Funding | Stakeholder and Customer Receptivity | Policy and Legal Environment | Regulatory Restrictions |
| **ORGANIZATIONAL TOOLS** | | | | | | | | | | | | | | | |
| | Internal | | **Revise sustainability policies and plans** | | | | | | | | | | | | |
| 1 | Internal | | Board or executive sustainability policies | | Yes | | Yes | | | | | | | | |
| 2 | Internal | | Fit sustainability initiatives into long-range/comprehensive planning process | | | | | | | | | Yes | | | |
| | Internal | | **Enhance leadership** | | | | | | | | | | | | |
| 3 | Internal | Yes | Executive coaching | Yes | | | Yes | | | | | | | | |
| 4 | Internal | Yes | External pressure | Yes | | | | | | | | | | | |
| 5 | Internal | | Replace managers and/or executive leaders | Yes | Yes | | | | | | | | | | |
| | Internal | | **Revise HR structures and incentives** | | | | | | | | | | | | |
| 6 | Internal | | Align reward and incentive structures to match transformational behaviors and targets | | Yes | | Yes | | | Yes | | | | | |
| 7 | Internal | | Cross-organizational performance objectives | | Yes | | Yes | | | | | | | | |
| 8 | Internal | | Develop new or revised position descriptions | | Yes | | Yes | | Yes | Yes | | | | | |
| 9 | Internal | | Recruit and augment new staff | | | | | | Yes | Yes | | | | | |
| 10 | Internal | | Revise performance agreements | | Yes | | Yes | | | Yes | | | | | |
| | Internal | | **Revise financial and accounting systems and policies** | | | | | | | | | | | | |
| 11 | Internal | | Dedicated budget line | | Yes | | | | | | | Yes | | | |
| 12 | Internal | | Extramural funding | | | | | | | | | Yes | | | |
| 13 | Internal | | Innovative financial instruments | | | | | | | | | Yes | | | |
| 14 | Internal | Yes | Train for and adopt life-cycle and/or full cost accounting models | | | | | | | | Yes | | | | |
| 15 | Internal | Yes | Train for and use Triple Bottom Line (TBL) accounting systems | | | | | | | | Yes | | | | |
| | Internal | | **Revise Business Practices and Policies** | | | | | | | | | | | | |
| 16 | Internal | | Conduct corporate reporting | | Yes | Yes | | | | | | | | | |
| 17 | Internal | | Seek rate increases | | | | | | | | | Yes | | | |
| 18 | Internal | | Sustainability-focused fees | | | | | | | | | Yes | | | |
| 19 | Internal | | Reorganize utility | | Yes | | | | | | | | | | |
| 20 | Internal | | Work with contractors or consultants | | Yes | | | | Yes | | | | | | |

| ID NUMBER | INTERNAL OR EXTERNAL | INITIAL PHASE OF CHANGE | TOOL | ATTRIBUTE | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Leadership Style and Issue Inclination | Organizational Structure | Learning Mechanisms | Staff Motivation | Information Management System Capacity | Technical Capacity | Human Resources Practices | Budgetary and Financial Models and Systems | Funding | Stakeholder and Customer Receptivity | Policy and Legal Environment | Regulatory Restrictions |
| | Internal | | **Revise social and cultural policies** | | | | | | | | | | | | |
| 21 | Internal | Yes | Allow and/or encourage space and time for networking | | Yes | | Yes | | | | | | | | |
| 22 | Internal | Yes | Cross-departmental units or teams, executive committees, staff working groups | | Yes | | Yes | | | | | | | | |
| | Internal | | **Improve IT systems** | | | | | | | | | | | | |
| 23 | Internal | | New and expanded platforms | | | | | Yes | | | | | | | |
| 24 | Internal | | Revise IT system business rules | | | | | Yes | | | | | | | |
| | External | | **Coordinate policy, regulatory, legal issues** | | | | | | | | | | | | |
| 25 | External | | Craft supporting ordinances | | | | | | | | | | | Yes | |
| 26 | External | | Facilitate enactment of overarching sustainability policies | | | | | | | | | | | Yes | |
| 27 | External | | Ongoing negotiation | | | | | | | | | | | | Yes |
| **COMMUNICATION TOOLS** | | | | | | | | | | | | | | | |
| | Internal | | **Engage staff in sustainability** | | | | | | | | | | | | |
| 28 | Internal | Yes | Assign staff roles in sustainability decision-making or implementation | | Yes | Yes | Yes | | | | | | | | |
| 29 | Internal | | Organize facilitated venues to imagine new ways of doing business | | Yes | | Yes | | Yes | | | | | | |
| 30 | Internal | Yes | Commit utility staff time to the role of internal communications | | Yes | | Yes | | Yes | | | | | | |
| 31 | Internal | | Identify staff who have or will become champions for sustainability | | | | Yes | | | | | | | | |
| 32 | Internal | | Implement sustainability examples on utility grounds | | | Yes | Yes | | | | | | | | |
| 33 | Internal | | Develop communication and technical guidance and tools | | | Yes | Yes | | Yes | | | | | | |
| | Internal | | **Communicate directly with staff** | | | | | | | | | | | | |
| 34 | Internal | Yes | Early and frequent one-on-one or face-to-face communication | | | | Yes | | Yes | | | | | | |
| 35 | Internal | Yes | Hold staff focus groups | | | | Yes | | Yes | | | | | | |
| 36 | Internal | Yes | Publish articles in corporate newsletters | | | Yes | Yes | | Yes | | | | | | |
| | Internal | | **Encourage inter-staff communications** | | | | | | | | | | | | |
| 37 | Internal | Yes | Encourage participation in social networking forums and communities of practice | | | Yes | Yes | | | | | | | | |
| 38 | Internal | Yes | Hold employee meetings and brown bag lunches | | Yes | | Yes | | Yes | | | | | | |
| | Internal | | **Leadership communication** | | | | | | | | | | | | |
| 39 | Internal | Yes | Persuade leadership | Yes | | | Yes | | | | | | | | |
| 40 | Internal | Yes | Persuasion by leadership | Yes | | | Yes | | | | | | | | |

| ID NUMBER | INTERNAL OR EXTERNAL | INITIAL PHASE OF CHANGE | TOOL | ATTRIBUTE | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Leadership Style and Issue Inclination | Organizational Structure | Learning Mechanisms | Staff Motivation | Information Management System Capacity | Technical Capacity | Human Resources Practices | Budgetary and Financial Models and Systems | Funding | Stakeholder and Customer Receptivity | Policy and Legal Environment | Regulatory Restrictions |
| | **External** | | **Stakeholder meetings** | | | | | | | | | | Yes | | |
| 41 | **External** | Yes | In-person town hall meetings | | | | | | | | | | Yes | | |
| 42 | **External** | Yes | Meetings with affected community members | | | | | | | | | | Yes | | |
| 43 | **External** | Yes | Regular roundtable meetings with community stakeholder groups | | | | | | | | | | Yes | | |
| 44 | **External** | Yes | Meetings with industry and commercial stakeholder groups | | | | | | | | | | Yes | | |
| 45 | **External** | Yes | **Community or customer surveys** | | | | | | | | | | Yes | | |
| | **External** | | **Electronic vehicles** | | | | | | | | | | | | |
| 46 | **External** | Yes | Dedicated website | | | | | | | | | | Yes | | |
| 47 | **External** | | Mobile applications for cell phones, iPads, etc. | | | | | | | | | | Yes | | |
| 48 | **External** | | Social media | | | | | | | | | | Yes | | |
| 49 | **External** | | E-newsletters | | | | | | | | | | Yes | | |
| 50 | **External** | | Online chats with utility staff or leaders | | | | | | | | | | Yes | | |
| | **External** | | **Print media and marketing** | | | | | | | | | | Yes | | |
| 51 | **External** | | Branding mechanisms | | | | | | | | | | Yes | | |
| 52 | **External** | Yes | Ads in public spaces | | | | | | | | | | Yes | | |
| 53 | **External** | Yes | News copy and press releases | | | | | | | | | | Yes | | |
| 54 | **External** | Yes | Bill stuffers | | | | | | | | | | Yes | | |
| | **External** | | **Community programs** | | | | | | | | | | Yes | | |
| 55 | **External** | | Sustainable product giveaways | | | | | | | | | | Yes | | |
| 56 | **External** | | Community service projects | | | | | | | | | | Yes | | |
| 57 | **External** | Yes | Community events | | | | | | | | | | Yes | | |
| 58 | **External** | Yes | Community alerts and advisories | | | | | | | | | | Yes | | |
| 59 | **External** | Yes | Unconventional media (arts projects, poetry, music) | | | | | | | | | | Yes | | |
| 60 | **External** | | Recognize stakeholder contributions to sustainability | | | | | | | | | | Yes | | |
| | **External** | | **Reporting** | | | | | | | | | | | | |
| 61 | **External** | | Publish sustainability reports | | | | | | | | | | Yes | | |
| 62 | **External** | | Assess stakeholder communication | | | | | | | | | | Yes | | |
| | **External** | | **Partnerships** | | | | | | | | | | | | |
| 63 | **External** | | Appoint an external community advisory board or panel | | Yes | Yes | | | | | | Yes | Yes | | |
| 64 | **External** | | Partner with other local and state agencies and departments | | Yes | Yes | | | Yes | | | Yes | Yes | | |
| 65 | **External** | | Partner with regional councils and other utilities | | Yes | Yes | | | Yes | | | Yes | Yes | | |
| 66 | **External** | | Partner with stakeholders, the outside community, and businesses | | Yes | Yes | | | Yes | | | Yes | Yes | | |

| ID NUMBER | INTERNAL OR EXTERNAL | INITIAL PHASE OF CHANGE | TOOL | ATTRIBUTE | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Leadership Style and Issue Inclination | Organizational Structure | Learning Mechanisms | Staff Motivation | Information Management System Capacity | Technical Capacity | Human Resources Practices | Budgetary and Financial Models and Systems | Funding | Stakeholder and Customer Receptivity | Policy and Legal Environment | Regulatory Restrictions |
| **EDUCATIONAL TOOLS** | | | | | | | | | | | | | | | |
| | Internal | | **Provide information on sustainability** | | | | | | | | | | | | |
| 67 | Internal | Yes | Develop disciplinary and interdisciplinary clearinghouses and/or bodies of knowledge | | | Yes | | | Yes | | | | | | |
| 68 | Internal | Yes | Guidance documents for utility staff and managers | | Yes | Yes | | Yes | Yes | | | | | | |
| | Internal | | **Training and continuing education** | | | | | | | | | | | | |
| 69 | Internal | Yes | Utility staff and supervisor training and certification | | | Yes | Yes | | Yes | | | | | | |
| 70 | Internal | Yes | Information products for internal training and education | | | Yes | Yes | | Yes | | | | | | |
| 71 | Internal | | Training on social media and other types of electronic communication tools. | | | Yes | Yes | Yes | Yes | | | | | | |
| 72 | Internal | | Encourage employees to enroll in classes at local universities or through on-line courses | | | Yes | Yes | | Yes | | | | | | |
| 73 | Internal | | Partner with other utilities to provide training to utility staff | | Yes | Yes | | | Yes | | | | | | |
| 74 | Internal | | Partner with local universities to provide classes and training | | Yes | Yes | | | Yes | | | | | | |
| | Internal | | **Informal education opportunities** | | | | | | | | | | | | |
| 75 | Internal | Yes | Tours of utility facilities | | | Yes | Yes | | Yes | | | | | | |
| | **External** | | **Primary and secondary school programs** | | | | | | | | | | | | |
| 76 | **External** | | Curriculum on water sustainability and related water issues | | | | | | | | | | Yes | | |
| 77 | **External** | Yes | Presentations to schools, recreation centers, and other community organizations | | | | | | | | | | Yes | | |
| 78 | **External** | Yes | Science fairs | | | | | | | | | | Yes | | |
| 79 | **External** | | Utility internships for high school students | | | | | | | | | | Yes | | |
| | **External** | | **College and graduate school programs** | | | | | | | | | | | | |
| 80 | **External** | | Curriculum on water resources management | | | | | | | | | | Yes | | |
| 81 | **External** | | Utility internships for college students | | | | | | | | | | Yes | | |
| | **External** | | **Community education (for community groups, students, and other organizations)** | | | | | | | | | | | | |
| 82 | **External** | Yes | Provide tours and field trips to utility facilities | | | | | | | | | | Yes | | |
| 83 | **External** | | Provide speakers on specific water sustainability topics | | | | | | | | | | Yes | | |
| 84 | **External** | | Sponsor contests | | | | | | | | | | Yes | | |
| 85 | **External** | | Distribute sustainability newsletters and other information products. | | | | | | | | | | Yes | | |
| 86 | **External** | | Provide training workshops on water sustainability issues | | | | | | | | | | Yes | | |
| 87 | **External** | Yes | Hold brown bag lunches with legislative aides | | | | | | | | | | Yes | | |

| ID NUMBER | INTERNAL OR EXTERNAL | INITIAL PHASE OF CHANGE | TOOL | ATTRIBUTE | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Leadership Style and Issue Inclination | Organizational Structure | Learning Mechanisms | Staff Motivation | Information Management System Capacity | Technical Capacity | Human Resources Practices | Budgetary and Financial Models and Systems | Funding | Stakeholder and Customer Receptivity | Policy and Legal Environment | Regulatory Restrictions |
| | **External** | | **Guidance documents** | | | | | | | | | | | | |
| 88 | **External** | | For homeowners | | | | | | | | | | Yes | | |
| 89 | **External** | | For teachers | | | | | | | | | | Yes | | |
| 90 | **External** | | For utility collaborators | | | | | | | | | | Yes | | |
| | **External** | | **Partner with stakeholders** | | | | | | | | | | | | |
| 91 | **External** | | Local agencies and departments | | | | | | Yes | | | Yes | Yes | | |
| 92 | **External** | | Other utilities, NGOs, and organizations in the region | | | | | | Yes | | | Yes | Yes | | |

# Tool Selection Matrix 2:
# Organizational Tools to Facilitate Utility Culture Change

| ID#/Tool | Cultural Change Attributes | Description | Observations and Examples |
|---|---|---|---|
| **Revise Sustainability Policies and Plans** | | | |
| 1. Board or executive sustainability policies | Organizational structure<br><br>Staff motivation | The current utility structure may reinforce attitudes, perspectives, or functional purviews that are inconsistent with a transformative agenda. Establishment and vigorous enactment of an executive policy focused on sustainable operations can help to breech silos and provide organization-wide impetus for a new way of doing business. | Requires ongoing executive and management investment in the issue, otherwise policies risk becoming "dead letters." |
| 2. Fit sustainability initiatives into long-range or comprehensive planning process | Lack of funding | Various sustainability initiatives may be easier to undertake if combined with priorities outlined in community or municipal comprehensive plans or similar "omnibus" planning vehicles. | The Metropolitan Sewer District of Greater Cincinnati has integrated its sustainability program with a watershed planning effort developed to address long-term Combined Sewer Overflow issues. http://projectgroundwork.org/sustainability/index.html<br><br>Similarly, Sanitation District No. 1 of northern Kentucky is addressing sustainability under a series of 5 year adaptive watershed plans, integrated with a broader community comprehensive planning process. |
| **Enhance leadership** | | | |
| 3. Executive coaching | Leadership style<br><br>Staff motivation | Many corporate leaders work closely with executive coaches to seek advice, critique, and support for a variety of personal or organizational objectives. Individuals with executive-level experience can be retained to work with utility leaders in a non-adversarial manner and help them understand, accept, and embrace new modes of doing business. | Coaching efforts may be best focused on tactical, rather than strategic, issues. |
| 4. External pressure | Leadership style | Utility leaders are subject to a variety of pressures from the broader community. Sustainability champions can rally influential citizens, community organizations, and business leaders to help chart a new direction for reluctant leadership. | Several utilities interviewed for this study reported working with external partners as a means to help sway internal perspectives and priorities. There are obvious risks associated with utility staff working with "outside" groups to advocate or direct internal issues. |

| ID#/Tool | Cultural Change Attributes | Description | Observations and Examples |
|---|---|---|---|
| 5. Replace managers and/or executive leaders | Leadership style<br><br>Organizational structure | Achievement of sustainable water utility operations may require fundamental change in comparison to a given utility's established ways of doing business, making it difficult or even impossible for incumbent leaders to adapt and make a successful transition. | Several utilities in our survey mention challenges associated with recalcitrant leadership. Sustainability champions may be able to work with boards or other oversight officials to replace leaders incapable or disinclined to embrace a new mode of operation.<br><br>Unless driven strictly by natural attrition, replacement of career staff may involve HR or union difficulties.<br><br>There are risks associated with efforts to "engineer" changes in executive leadership. |
| **Revise HR structures and incentives** | | | |
| 6. Align reward and incentive structures to match transformational behaviors and targets | Organizational structure<br><br>Staff motivation<br><br>HR Practices | Compensation schemes, performance agreements, bonus structures, incentive awards, and employee rewards should be tied to and align with (or at least not be inconsistent with) utility-wide sustainability objectives. This may include creation of new recognition devices for behavior consistent with transformational objectives. | May require extensive interaction or negotiation with unions or parent municipality.<br><br>In order to undergird development of a culture of workplace safety and security, JEA Water Systems of Jacksonville, Florida, undertook a significant revision to its personnel and human resources practices and policies. For example, JEA implemented safety-related performance awards as part of its annual employee evaluation, eliminated "risk pay," developed new positions, changed existing position descriptions, and initiated a system of reprimands for staff who fail to follow safe workplace procedures.<br><br>Similarly, Tualatin Valley Water District issues awards to employees "caught in the act" of doing sustainable practices; and the Narragansett Bay Commission eliminated longevity pay and switched to a "pay to performance" system to support organizational transformation. |
| 7. Cross-organizational performance objectives | Organizational structure<br><br>Staff motivation | Individual performance agreements can include objectives and metrics shared by all staff employed by the utility. This can help to assure that managers and staff do not adopt a narrow outlook informed merely by the operational imperatives of a single department or functional area. | Changes to organizational performance objectives may need to be couched in terms of ongoing strategic planning or related activities. |

| ID#/Tool | Cultural Change Attributes | Description | Observations and Examples |
|---|---|---|---|
| 8. Develop new or revised position descriptions | Organizational structure<br><br>Staff motivation<br><br>Technical capacity<br><br>HR Practices | Position descriptions are the legal basis for an individual's job with the utility. They describe what is expected from an employee, and stipulate what types of tasks they should (and should not) undertake. Position descriptions should be evaluated to assure that they address utility-specific sustainability objectives, or lacking that, to assure that they are not inconsistent with objectives. It may be necessary develop entirely new position descriptions. | Changes to position descriptions may be subject to union review and/or approval.<br><br>Changes in position duties may entail termination of staff who fail to meet new operational requirements (e.g., certifications). |
| 9. Recruit and augment staff | Technical capacity<br><br>HR Practices | As sustainability plans take shape, it may become clear that the utility will need to augment its existing staff skills through new hires. Sustainability champions my need to recruit new staff with relevant background, training, and skill-sets. | Many of the utilities in our survey list technical capacity as a barrier. Several utilities spoke of using natural staff attrition as a window of opportunity to bring in staff with appropriate skills and outlooks. In other utilities, new job requirements and/or certifications resulted in staff turn-over and led to a more qualified workforce, better capable of implementing sustainability activities. |
| 10. Revise performance agreements | Organizational structure<br><br>Staff motivation<br><br>HR Practices | Performance agreements spell out how staff will be evaluated in the execution of their duties. Performance agreements can be written to address sustainability objectives, providing direct incentive for individual staff to contribute to achievement of enterprise-level goals. | The Tualatin Valley Water District instituted a series of sustainability-related employee benefits, including making achievement of sustainability-related objectives subject to annual employee performance reviews, and requiring all new staff to complete sustainability training. |
| **Revise financial and accounting systems and policies** | | | |
| 11. Dedicated budget line | Organizational structure<br><br>Lack of funding | Sustainability projects and initiatives can "get lost" among organizational silos because they lack independent authority and resources. Establishment of a dedicated budget line can help solidify a sustainability initiative and provide its champions with an equal footing in their relationships with peers. | May require consideration and approval at the board or council level.<br><br>May be difficult to implement during periods of fiscal austerity.<br><br>To support its conservation program, the Austin (TX) Water Utility established a $900,000 budget for dedicated communication activities. |

| ID#/Tool | Cultural Change Attributes | Description | Observations and Examples |
|---|---|---|---|
| 12. Extramural funding | Lack of funding | Sustainability champions in some utilities have found it necessary to write proposals to foundations, state and federal agencies, and other entities to obtain funding for new programs. | Utility may lose flexibility or independence of operation.<br>Utility may have legal restrictions on budgetary discretion.<br>Grants (and other extramural funds) may be restricted in use or applicability.<br>Several utilities report using Clean Water Act Section 319 grants to address sustainability issues. Sanitation District No.1 has used grants from the Department of Energy and the American Recovery and Reinvestment Act to fund sustainability improvements. |
| 13. Innovative financial instruments | Lack of funding | Some utilities have experimented with innovative financial tools, such as Investment Tax Credits for projects undertaken by a third-party taxable entity, Business Energy Tax Credits for LEED-certified buildings, and Power Purchase Agreements for solar installations. | The Tualatin Valley Water District has been able to enhance funding for some sustainability initiatives through use of an Oregon State business energy tax credit. |
| 14. Train for and adopt life-cycle and/or full cost accounting models | Budgetary templates and financial accounting systems | A broader basis of accounting may help to influence decision-making with regard to sustainability activities. The current paradigm for water infrastructure decision-making relies heavily on capital and recurring (e.g., operations and maintenance) costs as primary inputs to cost-benefit analyses. Life-cycle costing covers a long-term period (e.g., 50-100 years) believed to span the entire "life-cycle" of a project or investment. Life-cycle costing methods and models may include only "direct" cost factors, or may be configured to address foreseeable "indirect" costs and impacts associated with an investment, including externalities. | Although well-configured to address sustainability investments, non-conventional accounting models may confuse or alienate utility or municipal staff steeped in tradition models of financial management.<br>The Alexandria (VA) Sanitation Authority has utilized elements of life-cycle accounting in the context of sustainability financing. |

| ID#/Tool | Cultural Change Attributes | Description | Observations and Examples |
|---|---|---|---|
| 15. Train for and use triple bottom line accounting systems | Budgetary templates and financial accounting systems | The term "triple bottom line" (TBL) is used to refer to three key attributes associated with sustainable systems – environmental performance, economic benefits, and social equity. At its core, a decision framework that incorporates TBL consists of a formalized process for consideration of the environmental, economic, and social equity implications of a project or investment. In some cases these attributes are operationalized, quantified, and considered in a standard cost-benefit framework; in other cases, they are characterized in a qualitative or narrative format and considered as a supplement to conventional costs and benefits. | Although well-configured to address sustainability investments, non-conventional accounting models may confuse or even alienate utility staff steeped in tradition models of financial management.<br><br>Albuquerque Bernalillo County Water Utility Authority used TBL analysis to demonstrate the multiple environmental, social, and sustainability benefits of its San Juan-Chama project, and to obtain community support, gain political buy-in, and justify rate increases.<br><br>The Metropolitan Sewer District of Greater Cincinnati, Tualatin Valley Water District, and the San Francisco Public Utilities Commission have all developed or adapted TBL matrices for use in integrating social, community, and environmental benefits in their design and implementation decisions. |
| **Revise Business Practices and Policies** | | | |
| 16. Conduct corporate reporting | Organizational structure<br><br>Learning mechanisms | It is difficult for staff in large, functionally diversified organizations to maintain high levels of awareness regarding activities outside their purview. Establishment of a regular, organization-wide report (hardcopy, web-based, or both) dealing with sustainability activities and achievements can help to educate and remind staff that they share responsibility for an enterprise-wide initiative. It can also help them see how their role and function meshes with that of colleagues working in other facilities and/or departments. | This tool can support, but not drive change.<br><br>An ongoing reporting activity will require resources and time for report compilation and dissemination activities, and perhaps need dedicated staff.<br><br>Clean Water Services (Hillsboro, OR) publishes a weekly internal newsletter dealing with its transition toward sustainable operations. |
| 17. Seek rate increases | Lack of funding | Prevailing community values may support a rate increase to cover sustainability projects. Several utilities interviewed for this project were able to secure rate increases to support transformative efforts, including conservation and sustainability. | The City Council of Austin, Texas approved a rate increase and a $900,000 expenditure focused on media outreach dealing with conservation-related issues. This high level of sustained outreach is credited for helping to shift community values pertaining to water use. Interestingly, the surge in public interest has fostered associated changes in the utility's internal culture, helping to change prevalent staff perceptions about the utility's role. |

| ID#/Tool | Cultural Change Attributes | Description | Observations and Examples |
|---|---|---|---|
| 18. Sustainability-focused fees | Lack of funding | Some water systems have instituted fee structures to support specific sustainability initiatives. | The process of establishing a dedicated fee structure can be time intensive and politically risky.<br><br>The Metropolitan St. Louis Sewer District initiated a fee based on customer impervious areas to help finance a "green" storm water management effort. However, the enacted fee was subject to litigation and determined to be a tax. An appeal is pending.<br><br>The Austin (TX) Water utility is working with the Austin City Council to develop model language for a sustainability fee. |
| 19. Reorganize utility | Organizational structure | It may be that the current utility structure is fundamentally inconsistent with establishment of sustainable operations. In such a case, it may be necessary to merge departments, eliminate a group, or establish a new department or bureau.<br><br>The current utility structure may reinforce attitudes, perspectives, or functional purviews that are inconsistent with a transformative agenda. Strategic reorganization may be a good step in changing utility staff mindsets concerning a sustainable mode of operation. | While reorganization may be a "radical" solution, it may be a necessary step if a water system seeks to make sustainability a pillar of its operations.<br><br>Strategic reorganization may be a good first step in changing utility staff mindsets concerning a sustainable mode of operation. Most of the utilities interviewed for this study reported some level of reorganization, including the Alexandria (VA) Sanitation Authority, Philadelphia Water Department, and JEA (formerly known as Jacksonville Electric Authority).<br><br>To mitigate problems associated with organizational inflexibility, Clean Water Services (Hillsboro, OR) formed an aligned non-profit organization to provide financial flexibility to work with private sector technology development firms. |
| 20. Work with contractors or consultants | Organizational structure<br><br>Technical capacity | Sustainability initiatives can be jump-started by commissioning the services of specialized contractors, capable of immediately filling deficits in technical experience or understanding. | Useful as program jump-start, less viable as a long-term solution.<br><br>Could be costly, perhaps even prohibitively expensive.<br><br>Several utilities interviewed for this study (Independence Missouri Water Pollution Control, Philadelphia Water Department, and the Narragansett Bay Commission) report use of consultants to augment staff technical deficits in sustainability-related matters. |
| **Revise Social and Cultural Policies** | | | |
| 21. Allow and/or encourage space and time for networking | Organizational structure<br><br>Staff motivation | Sustainability initiatives may gain momentum if addressed through self-elected, self-motivated communications networks. Such networking can be supported through active encouragement and flexibility from management. | Absent central coordination and direction, networking activities may lead in unplanned directions. |

| ID#/Tool | Cultural Change Attributes | Description | Observations and Examples |
|---|---|---|---|
| 22. Cross-departmental units or teams, executive committees, staff working groups | Organizational structure<br><br>Staff motivation | Designation and empowerment of cross-departmental bodies can help to spur cooperation, resource sharing, and interaction. Committees and working groups should be charged to produce specific outcomes, such as a cross-departmental plan, performance objectives, or demonstration projects. In this case, it is not the output of a working group that is most important, but the interactive process that serves to "acculturate" staff and managers to the possibility of news ways of doing business. | Without clear empowerment and authority from executive leadership, such arrangements risk marginalization.<br><br>Team-generated enthusiasm can dissipate if supporting infrastructure, training, and processes are not provided.<br><br>Successful utilization of cross-departmental teams was reported by Alexandria (VA) Sanitation Authority and the Metropolitan St. Louis Sewer District. |
| **Improve IT Systems** | | | |
| 23. New and Expanded Platforms | Information management system capacity | Drawing on the model of Environmental Management Systems (EMS), some organizations have developed useful and effective Sustainability Management Systems (SES). Indeed, in some cases, development of the SES has even served as the focal point for an entire transformation initiative. | The Metropolitan St. Louis Sewer District is in the process of a district-wide re-tooling of their IT system to better support a transformative asset management initiative. |
| 24. Revise IT system business rules | Information management system capacity | IT systems are typically structured around specific rules of operation, including object definition, process steps, and stipulated use-cases. These rules can be reviewed and revised to better accommodate factors relevant to sustainability. | JEA believes that sustainability will be facilitated through a comprehensive program of asset management. The utility's emphasis on asset management has necessitated changes in IT systems operations to better accommodate asset-specific data streams. |

| ID#/Tool | Cultural Change Attributes | Description | Observations and Examples |
|---|---|---|---|
| **Coordinate Policy, Regulatory, Legal Issues** | | | |
| 25. Craft supporting policies, ordinances, or legal instruments | Policy and Legal Environment | Utility staff can work with municipal colleagues and/or council staff to draft measures to support particular sustainability activities. | In order to assure adequate interaction with other municipal government units, the Metropolitan Sewer District of Greater Cincinnati (MSDGC) worked with the Ohio State Legislature to develop enabling legislation in support of interagency cost-sharing and other collaborative mechanisms.<br><br>MSDGC also developed memoranda of understanding with other agencies to enable development and maintenance of green infrastructure, elimination of impervious surfaces, and enactment of best management practices on various non-utility properties.<br><br>Water Pollution Control of Independence, Missouri worked with the city to develop and implement an ordinance to protect and maintain stream-side riparian corridors. Creating buffer zones by means of setback restrictions, the intent of this ordinance is to protect the water quality of watercourses, reservoirs, and lakes; reduce impacts to aquatic ecosystems; and provide for environmentally sound use of land resources. |
| 26. Facilitate enactment of overarching sustainability policies | Policy and Legal Environment | Utility staff can work with municipalities or oversight commissions to draft policies that mandate sustainable operations. Such an omnibus instrument may enable the utility to pursue a wide variety of diverse sustainability projects. | The Milwaukee Metro Sewerage District is developing a region-wide policy to serve as a framework for implementing green infrastructure investments, linked to the utility's 2035 vision goals, see http://www.h2ocapture.com/en/GI%20Plan.aspx.<br><br>As another example, the Metropolitan Sewer District of Greater Cincinnati is working to build sustainability into its overall strategic planning process. |
| 27. Ongoing negotiation | Regulatory Restrictions | In many cases, there is no magic bullet for alleviating issues associated with regulatory pressure. The answer involves patient ongoing negotiation, possibly working through partners to help broker arrangements between the utility and an intransigent regulatory body. | Milwaukee Metropolitan Sewerage District efforts to develop a watershed-focused, long-term planning process (under the rubric of sustainability) were a challenge because different pollutant sources often were subject to different local regulatory requirements.<br><br>Sanitation District No. 1 struggled with restrictive and inflexible regulatory requirements for wet weather issues. |

# Tool Selection Matrix 3: Communication Tools to Facilitate Utility Culture Change

| ID#/Tool | Cultural Change Attributes | Description | Issues and Observations | Examples and Links |
|---|---|---|---|---|
| **INTERNAL** | | | | |
| **Engage staff in sustainability** | | | | |
| 28. Assign staff roles in sustainability decision-making or implementation | Organizational structure<br><br>Learning Mechanisms<br><br>Staff Motivation | In most cases of organizational transformation, it is effective for utility managers to identify teams to help design and implement new programs. | Providing staff with leadership roles increases their sense of inclusion and their motivation to be a part of the change.<br><br>Can require considerable planning time. | When the Alexandria Sanitation Authority made the transformation from a fully manual to a fully automated system, the utility integrated staff into different design teams. These employees had a role in the project and then held monthly meetings to share information. They'd attend workshops, meet with their colleagues, share information, and provide input on design. The utility selected champions as well as staff who might be resistant to the change. |
| 29. Organize facilitated venues to imagine new ways of doing business | Organizational structure<br><br>Staff motivation<br><br>Technical capacity | Use of neutral, outside facilitators can help staff think outside the box and imagine new ways of doing business. | A facilitated process could be time-consuming and expensive.<br><br>Management must think carefully about the process and establish reasonable expectations; for example, staff must understand how recommendations from the facilitated process will be addressed. | Many of the utilities we spoke with mentioned the need for culture change as a prerequisite for achievement of lasting sustainability. As an illustration, the Metropolitan St. Louis Sewer District (MSLSD) is in the midst of a cultural transformation with regard to storm water management. When this transformation first began, there was significant internal and external resistance to changing time-honored standards, practices, and roles. MSLSD has used a range of tools to address this issue, including use of outside facilitators to conduct charrette exercises. |
| 30. Commit utility staff time to the role of internal communications | Organizational structure<br><br>Staff motivation<br><br>Technical capacity | This can be accomplished formally by dedicating a utility staff position to internal communications with staff, or more informally by designating existing staff to take on the role of communications liaison. | Helps ensure continual and thoughtful communication among utility employees by someone with enthusiasm and relevant expertise. As one utility expressed it, we are "never done trying to communicate."<br><br>Can be expensive if a new position is created. | When transforming their utility to evaluate and improve productivity, King County added a full-time position devoted to internal communication.<br><br>The Philadelphia Water Department (PWD) is using internal newsletters, videos, social media, and strategic planning to better communicate with utility employees. |

| ID#/Tool | Cultural Change Attributes | Description | Issues and Observations | Examples and Links |
|---|---|---|---|---|
| 31. Identify utility staff who have or will likely become champions for sustainability | Staff motivation | This strategy is both an important communication tool and implementation approach. Influential staff can serve as sustainability role models or champions, helping colleagues to learn and adopt new frames of reference. Champions are vocal leaders who can encourage other utility employees to participate in sustainability actions. | Helps gain support from inside the utility.<br><br>May require time-consuming coordination with management and executive leadership to ensure consistent messaging.<br><br>Efforts can be diffused if not echoed by managerial and executive exhortation.<br><br>Using the enthusiasm of staff role models and champions can help spark change.<br><br>Executive empowerment can buoy this approach. | Philadelphia Water Department was able to cultivate "passionistas" within the Department, who are staff who are passionate about green infrastructure and tenacious in working for its implementation.<br><br>The Metropolitan St. Louis Sewer District (MSLSD) is in the midst of a cultural transformation with regard to storm water management. There is staff recalcitrance to abandon time-honored standards, practices, and roles. MSLSD has used a range of tools to address this issue, including recognition and empowerment of sustainability champions. |
| 32. Implement sustainability examples on utility grounds (e.g., rain garden, green roof, recycling, and water reuse barrels) | Staff motivation<br><br>Learning mechanisms | Utilities lead by example through implementing water sustainability demonstration projects on utility grounds. | Captures staff interest in water sustainability projects.<br><br>Can increase employee pride in their utility.<br><br>By demonstrating the results of water sustainability activities, utilities can help staff understand program goals and values and gain their support.<br><br>Could be expensive and time-consuming, depending on the project. | When implementing its water reclamation program, some Austin Water employees expressed reservations about using "dirty" water. The utility installed a five-gallon jug "watering station" in the building and labeled it with the phrase "give your plants a treat – it contains nutrients plant love." Their staff have asked for additional watering stations in other utility buildings.<br><br>Philadelphia Water Department conducts demonstration programs (e.g., permeable pavement, green roof) to show the feasibility and benefits of these actions and gain support both within and outside the Department.<br><br>Tualatin Water Valley District established an extensive recycling program. Employees can bring items to work that they are unable to easily recycle from home. The utility absorbs the cost of recycling these materials. The program increases employee awareness of sustainability in every part of their lives, thus helping to create a change in mindset at the grassroots level. |

| ID#/Tool | Cultural Change Attributes | Description | Issues and Observations | Examples and Links |
|---|---|---|---|---|
| 33. Develop technical communication guidance documents and tools | Staff motivation<br><br>Learning mechanisms<br><br>Technical capacity | Staff may lack knowledge to understand and accept various sustainability initiatives. Guidance documents can enhance understanding and bolster support. | Development of guidance materials may be time-consuming. | The Tualatin Water Valley District has produced many successful guidance materials, including a book (The Green Utility: A Practical Guide to Sustainability) and a DVD focused on sustainability. |
| **Communicate Directly with Staff** | | | | |
| 34. Early and frequent one-on-one/face-to-face communication | Staff motivation<br><br>Technical capacity | Utility managers can meet with staff to discuss water sustainability changes, explain the benefits, and ask for input and ideas on sustainability issues. | Including staff in the sustainability process via one-on-one interactions helps increase their sense of inclusion, builds trust, and expands motivation.<br><br>Can be time-consuming. | When implementing new aspects of its water conservation program, Austin Water's Executive Team met with employees one-on-one to answer questions and explain how the program is in the community's interest and the long-term interest of the utility. |
| 35. Hold staff focus groups | Staff motivation<br><br>Technical capacity | Utilities can initiate two-way communication with employees through facilitated focus groups where management and staff can share information. | Focus group discussions can help build trust and expand motivation. | Philadelphia Water Department held focus groups with internal teams and departments to communicate the utility's goals, enable expression of concerns, and ensure everyone is on the same page. The ultimate goal is for all employees to see themselves as "ambassadors" for their programs. To further this concept, PWD cross-functional task forces will be developed as a component of the strategic planning process. |
| 36. Publish articles in corporate newsletters | Learning mechanisms<br><br>Staff motivation<br>Technical capacity | Utilities that publish regular newsletters can include articles and information about sustainability programs and activities. | Can be a cost-effective way to reach utility staff, especially about specific sustainability concerns. | The Public Service Commission of Wisconsin publishes an electronic newsletter, Water Currents, intended for water utility staff, state and local government officials, consultants, and others. It provides information on news and events related to water conservation and efficiency in Wisconsin. http://psc.wi.gov/utilityinfo/water/newsletter/index.htm<br><br>Clean Water Services publishes a weekly internal newsletter dealing with its transition toward sustainable operations. |

| ID#/Tool | Cultural Change Attributes | Description | Issues and Observations | Examples and Links |
|---|---|---|---|---|
| **Encourage inter-staff communication** | | | | |
| 37. Encourage participation in social networking forums and communities of practice | Learning mechanisms<br><br>Staff motivation | Develop and/or participate in social networking and communities of practice for relevant professional topics. For example, design and maintenance challenges associated with rain gardens or how sustainability initiatives can enhance traditional utility operations. | Studies of organizational change indicate that transformations are sometimes facilitated by individuals or groups within an organization who are either highly motivated to achieve a particular outcome or empowered to explore a particular issue area. The "voice" of such individuals and groups can be greatly enhanced by use of social networking technologies. | Clean Water Services (CWS) presentation, "Is Social Media Right for You?" provides guidance on how to choose the most appropriate social media tools.<br>http://www.pncwa.org/assets/Committees/PubEd/2011Workshop/ely%20teragli.pdf<br><br>Sources such as the *Green Infrastructure Wiki* can provide examples of the use of social networking and forums.<br>http://www.greeninfrastructurewiki.com/ |
| 38. Hold employee meetings and brown bag lunches | Organizational structure<br><br>Staff motivation<br><br>Technical capacity | Staff meetings and informal brown bag lunches provide a way for utilities to share information with employees and encourage cross-departmental communications. | Provides a forum for staff to share information about their projects, cutting across utility "silos."<br><br>Enables staff to express concerns and share both problems and successes.<br><br>Enables utility management to explain sustainability program goals, objectives, and results.<br>Can be time-consuming. | Tualatin Valley Water District holds regular all-employee meetings, which frequently relate to sustainability issues.<br><br>DC Water holds brown bag lunches for employees so they can learn about the work and projects that staff in other parts of the agency are conducting.<br><br>CWS has undertaken a diverse and far-reaching program to assure staff support for its sustainability program. "In-reach" activities include frequent brown bag lunches where staff members explain their jobs to colleagues. |
| **Leadership Communication** | | | | |
| 39. Persuade leadership | Leadership style and issues<br><br>Staff motivation | Utility leaders tend to well educated, rational managers, subject to appeals based on reason and sound argumentation. In some cases, leaders may adopt significant changes in outlook and orientation based on ongoing discussion and persuasion. The ability to articulate and quantify the benefits of changes is often helpful in persuading leaders to change their outlook. | Going "against authority" can be difficult and even risky. | Several utilities interviewed for this study established sustainability programs from the "bottom up," dealing with early skepticism from leadership. |

| ID#/Tool | Cultural Change Attributes | Description | Issues and Observations | Examples and Links |
|---|---|---|---|---|
| 40. Persuasion by leadership | Leadership style and issues<br><br>Staff motivation | It is important that utility and municipal leaders "animate" sustainability policies or other transformational initiatives using their "bully pulpit" to exhort, educate, and excite staff and managers about sustainability and new modes of operation. This role should be frequent and ongoing, with utility executives acting as "evangelists" of sustainable infrastructure and operations. | | |
| **EXTERNAL** | | | | |
| **Stakeholder Meetings** | | | | |
| 41. In-person town hall meetings | Stakeholder and customer receptivity | Utility managers, executives, or experts address stakeholder or customer groups in public venues to provide information, answer questions, and promote face-to-face interaction. | Quality face-to-face interaction directly with constituency.<br><br>Helps impart messages and build trust.<br><br>Time-consuming to arrange.<br><br>Difficult to schedule for utility leaders. | |
| 42. Meetings with affected community members | Stakeholder and customer receptivity | Meetings focused on individuals and groups who are affected by the utility's sustainability programs and projects (e.g., a green streets project) can help stakeholders understand the program benefits, how they will be affected, and the actions they can take to help achieve sustainability (e.g., maintain stormwater detention basins in their neighborhood). | Quality face-to-face interaction helps to impart messages, build trust, and encourage participation.<br><br>People might not want to attend a meeting.<br><br>Can be time consuming.<br><br>Interaction can be difficult to control.<br><br>Utility must have the "right kind" of participants (e.g., patient, articulate, knowledgeable). | Independence Missouri Water Pollution Control (WPC) conducts a regional stormwater program. WPC is replanting retention basins that are typically in residential neighborhoods with native vegetation. WPC held public meetings at their offices and on-site to explain the reason for converting to native plants and how they are maintained. Public meetings were followed by one-on-one conversations (through telephone calls, emails, and on-site meetings). |

| ID#/Tool | Cultural Change Attributes | Description | Issues and Observations | Examples and Links |
|---|---|---|---|---|
| 43. Regular roundtable meetings with community stakeholder groups | Stakeholder and customer receptivity | Utilities can establish their role as "thought leaders" on water sustainability and encourage stakeholder engagement by holding series of small-group community meetings with community leaders and stakeholder groups. | Quality face-to-face interaction helps impart messages and build trust.<br><br>Time-consuming to arrange.<br><br>People might not want to attend a meeting.<br><br>Difficult to schedule for utility leaders. | Austin Water will establish a quarterly meeting (such as "Breakfast on the Water" or "Water Cooler Roundtable") with rotating topics related to water conservation and speakers targeting different stakeholder groups to ensure consistent stakeholder engagement.<br>http://www.ci.austin.tx.us/water/conservation/downloads/140planfinal.pdf |
| 44. Meetings with industry and commercial stakeholder groups | Stakeholder and customer receptivity | Stakeholder groups can play a role in ensuring effective sustainability programs and projects. For example, meeting with representatives of the local the Home Builders' Association can help impart the importance of incorporating water sustainability (e.g., water conservation, green infrastructure) in new housing developments. | Quality face-to-face interaction helps to impart messages, build trust, and encourage participation in water sustainability activities.<br><br>Can be time consuming.<br><br>Interaction can be difficult to control. | Austin Water attends regularly scheduled meetings of stakeholder groups such as the Apartment Association and Home Builder's Association to communicate water conservation messages, keep these groups informed of upcoming conservation efforts, and solicit feedback.<br>http://www.ci.austin.tx.us/water/conservation/downloads/140planfinal.pdf |
| 45. Community or customer surveys | Stakeholder and customer receptivity | Telephone, mail, or internet surveys can be conducted to gauge public awareness, understanding, or acceptance of specific topics or proposals. | Enables utilities to better understand customer values, preferences, and issues.<br><br>Enables utilities to track if their key messages are taking root with customers.<br><br>Internet surveys can be relatively inexpensive to design and implement.<br><br>Does not promote two-way interaction.<br><br>Telephone or mail surveys can be time-consuming and expensive to design, implement, and maintain through time. | Clean Water Services conducts surveys of its customers and uses the results to determine if its messages are influencing customer awareness. |
| **Electronic Vehicles** | | | | |
| 46. Dedicated website | Stakeholder and customer receptivity | A well-established and widely utilized communications and interaction tool, websites can | Websites are a standard and expected mode of information dissemination. | Milwaukee MMSD has a website dedicated to capturing stormwater runoff. It includes a discussion forum on stormwater capture. |

| ID#/Tool | Cultural Change Attributes | Description | Issues and Observations | Examples and Links |
|---|---|---|---|---|
| | | prominently display information about sustainability, "how to" information, data and reports, and tools for gauging sustainability levels (e.g., a water use calculator to encourage water conservation). | They can target a range of stakeholder groups.<br><br>They can be used as vehicles to disseminate reports or large quantities of data.<br><br>Websites do not foster two-way communication, unless augmented by a blog or other social media tools.<br><br>Websites require upkeep – a dedicated site must be kept up-to-date or the utility will risk sending an unintended message that the initiative is moribund. | http://www.h2ocapture.com/<br><br>Philadelphia Water Department established its own Office of Watersheds website to communicate about watershed issues, what the Department is doing to address these issues, and how its work affects the residents of Philadelphia. http://www.phillywatersheds.org/<br><br>MSLSD's website includes an Education and Outreach section that provides information on best practices, green infrastructure, and its stormwater management plan. (http://www.stlmsd.com/educationoutreach)<br><br>United Utilities in the U.K has a website with pages dedicated to sustainability, climate change and other environmental issues. It includes a way for users to calculate their carbon footprint from water consumption. http://corporateresponsibility2011.unitedutilities.com/carbonfootprint.aspx |
| 47. Mobile applications for cell phones, iPads, etc. | Stakeholder and customer receptivity | Utilities can develop mobile apps for use on smart phones. These apps can mirror their existing website or provide specific services related to water sustainability. | Reaches younger audiences.<br><br>Provides a fast, relatively easy, and free approach for sharing information.<br><br>Relatively new web application, requires careful planning on how to best address audience needs. | DC Water provides a free mobile app for its TapIt program. The app has a GPS locator that shows the closest places to fill your water bottle based on your current location. http://www.tapitwater.com/blog/2011/06/tapit-launches-water-refill-network-in-washington-dc.html |
| 48. Social media | Stakeholder and customer receptivity | Twitter, Facebook, or blogs can be used to make customers aware of issues and support an ongoing thread or conversation concerning an issue or topic. Social media tools can also be used as a proxy for a more formal survey when utility sustainability champions want to "run an idea | Social media tools can provide a fast, relatively easy, and free approach for sharing news and ideas with stakeholders.<br><br>Reaches younger audiences.<br><br>Active social media campaigns can become time-consuming to keep organized. (Utilities can use social media editorial | Austin Water Utility has an Austin Water Twitter page. (http://twitter.com/#!/austinwater)<br><br>Philadelphia Water Department has an active Facebook page, Twitter account, and blog. http://phillywatersheds.org/blog<br><br>The Water Education Foundation uses its Facebook page to provide information on facility |

| ID#/Tool | Cultural Change Attributes | Description | Issues and Observations | Examples and Links |
|---|---|---|---|---|
| | | up the flagpole." | calendars to help develop a coherent social media strategy and keep track of social media actions.)<br><br>Does not reach all audiences. | tours, short interviews with utility staff, and photos of the facilities. It posts news items on Twitter. http://www.facebook.com/pages/Water-Education-Foundation/97190152647?ref=share<br><br>Clean Water Services presentation, "Is Social Media Right for You?" provides guidance on how to choose the most appropriate social media tools. http://www.pncwa.org/assets/Committees/PubEd/2011Workshop/ely%20teragli.pdf<br><br>The U.S. Centers for Disease Control (CDC) established a presence on two virtual worlds – Second Life (for all ages) and Whyville (expressly for "tweens"). Virtual worlds are online environments where users can create a virtual persona (i.e., avatar) and interact with others in the virtual environment. They can be used to creatively disseminate information and encourage active participation and learning. http://blog.social-marketing.com/2006/11/cdcs-second-life.html http://www.cdc.gov/SocialMedia/Tools/guidelines/pdf/virtualworld.pdf<br><br>Other sources, such as *Green Infrastructure Wiki* can provide examples of the use of social media and related tools. http://www.greeninfrastructurewiki.com/ |
| 49. E-newsletters | Stakeholder and customer receptivity | Newsletters with information about sustainability programs and activities, community events, and facility tours can be posted on the utility website and also sent electronically to subscribers. | Can be a cost-effective way to target stakeholders who are interested in the topic of sustainability (and ask to receive the newsletter).<br><br>The distribution list for an email newsletter can expand quickly and require culling.<br><br>Email newsletters are helpful for one-way communication, but not for the exchange | Clean Water Services provides an electronic newsletter that customers can receive by email or view on the utility's website. http://www.cleanwaterservices.org/Newsletter/ |

| ID#/Tool | Cultural Change Attributes | Description | Issues and Observations | Examples and Links |
|---|---|---|---|---|
| | | | of information and ideas. | |
| 50. Online chats with utility staff or leaders | Stakeholder and customer receptivity | Using a medium such as SharePoint, utility sustainability champions can meet with large numbers of stakeholders to address specified topics. | Can provide an inexpensive way to share information and answer questions about water sustainability.<br><br>Stakeholders might not be aware of the existence of online chats or know where or how to join a chat. | DC Water holds online chats between its General Manager and members of the community. |
| **Print media and marketing** | | | | |
| 51. Branding mechanisms | Stakeholder and customer receptivity | Program titles, logos, or catch-phrases can be disseminated via print ads, water bottles or other tchotchkes, or even musical jingles | Effective for raising and maintaining awareness of programs, topics of simple themes.<br><br>Does little to foster customer input or two-way interaction; cannot be used to communicate complex topics. | Austin Water's water conservation program centered around a jingle about water conservation ("Let's have a conversation about water conservation") written and performed by the band, Asleep at the Wheel.<br><br>DC Water distributes free water bottles with the "TapIt" logo as part of its water refill network campaign to encourage people to fill up their water bottles with tap water, rather than purchasing bottled water. http://www.tapitwater.com/blog/2011/06/tapit-launches-water-refill-network-in-washington-dc.html |
| 52. Ads in public spaces | Stakeholder and customer receptivity | A sustainability program or specific project can be "advertised" using public media, such as signs on buses or in subway stations. | Relatively inexpensive way to raise awareness of clearly articulated issues, simple facts, or programs.<br><br>Space limitations will accommodate only very brief messages, limiting this vehicle as a means for teaching or enhancing understanding of complex topics. | Austin Water posts print ads and ads on buses to alert consumers to mandatory watering restrictions. |
| 53. News copy and press releases | Stakeholder and customer receptivity | News outlets, such as local radio stations, TV stations, and newspapers, often welcome submittals about local events, issues, or stories. | Media coverage is often free.<br><br>A regular media presence helps ensure consistent and appropriate branding for a water sustainability program.<br><br>Requires strong public relations skills to develop media contacts and content. | Austin Water is able to obtain free media about mandatory watering restrictions (e.g., through interviews about why it is important to reduce watering and how water conservation is tied to climate change). |

| ID#/Tool | Cultural Change Attributes | Description | Issues and Observations | Examples and Links |
|---|---|---|---|---|
| | | | Media reporters might not completely understand water issues and/or might focus on what they think is a good "story" rather than providing all the facts.<br><br>Media might lose interest concerning a long-term transitional effort.<br>Media may sensationalize failures. | |
| 54. Bill stuffers | Stakeholder and customer receptivity | Bill stuffers or other existing vehicles can be used to disseminate short "update" notices. Water utilities frequently insert letters or short notices in monthly billing packages, allowing topical communication efforts to piggy-back on an existing process. | Use of existing outreach and dissemination mechanisms will help to hold down costs.<br><br>Sustainability communications are guaranteed a regular "audience" of rate payers due to the necessity of opening the billing package.<br><br>Could require administrative and time burden on utility staff to author or compile monthly update features. May compete with other utility outreach priorities. | Austin Water's utility bills provide comparative information about water use, including graphs of individual water use history. Bills will soon include text comparing an individual's use with the residential average both by ZIP code and citywide to enable customers to compare their usage with that of their neighbors.<br>http://www.ci.austin.tx.us/water/conservation/downloads/140planfinal.pdf |
| **Community Programs** | | | | |
| 55. Sustainable product giveaways or sales | Stakeholder and customer receptivity | Sustainable infrastructure activities frequently involve disbursed or customer site components, such as rain barrels, low-flow appliances, swales, or permeable pavements. These products can provide a focus for communications and outreach. For example, one utility sponsored a rain barrel painting contest, helping to publicize the program and increase awareness. Customer site components also provide an opportunity for utilities to interact with customers. | Programs such as these seem very popular. The individual "ownership" of the free or purchased product seems to convey a sense of allegiance to the program and its planned outcomes.<br><br>The administrative effort and cost associated with such a program can be significant.<br><br>Requires sustained outreach and interaction. | MWRD of Greater Chicago Rain Barrel Program provides rain barrels at cost. The utility also provides information on where to place rain barrels and how to install and maintain them.<br>http://www.mwrd.org/irj/portal/anonymous/rainbarrel<br><br>Milwaukee MMSD sponsors a rain garden grant program. Government agencies, businesses, and homeowners can apply to purchase native plants for their rain gardens at reduced prices. In addition, all grant recipients receive a bag of Milorganite Garden Care, and five grantees are chosen at random to receive a $20 gift certificate.<br><br>SD1 offers rain barrels for sale and information |

| ID#/Tool | Cultural Change Attributes | Description | Issues and Observations | Examples and Links |
|---|---|---|---|---|
| | | | | about installation and use through their website. http://www.sd1.org/ProjectsandPrograms/RainBarrelProgram.aspx |
| 56. Community service projects | Stakeholder and customer receptivity | Utilities can coordinate or sponsor a wide range of community service projects. Investments in green infrastructure are consistent with the goals of many community organizations. For example, construction of a rain garden or swale may advance the goals of a community garden club or conservation society.<br><br>Storm drain marking programs are another way utilities have brought attention to stormwater runoff concerns through community service projects. | Helps to achieve sustainability objectives.<br><br>Helps to create a constituency for utility efforts to adopt sustainable operations.<br><br>Sponsorship of community projects may be prohibitively expensive.<br><br>Partnering with community groups may constrain a utility's ability to designate and control outcomes.<br><br>May augment sustainability education efforts. | SD1's Storm Drain Marking Program provides storm drain marking kits to students and service organizations. These groups place this water pollution message on drains in their community. http://www.sd1.org/ProjectsandPrograms/StormDrainMarking.aspx<br><br>Washington Suburban Sanitary Commission offers an annual Volunteer of the Year award. The WSSC also coordinates with the local school system to recruit student volunteers for sustainability projects, since all students are required to conduct voluntary community service work.<br><br>Another way to sponsor community service is to work with youth groups, such as the Girl Scouts. The U.S. Environmental Agency has developed the Water Drop Patch Project to inspire Girl Scouts to learn about water quality and take action in their communities to protect and restore local water resources, including their local rivers, lakes, streams, wetlands and ground water (http://water.epa.gov/learn/resources/esms/patch/upload/May_1_WDPP.pdf). Water utilities have developed similar programs. For example, the San Diego County Water Authority's Water Patch Program focuses on water conservation. |

| ID#/Tool | Cultural Change Attributes | Description | Issues and Observations | Examples and Links |
|---|---|---|---|---|
| 57. Community events | Stakeholder and customer receptivity | Utilities can work with partners such as civic associations, city and state agencies, and environmental organizations, to sponsor a community event. Events can focus on topics other than water quality (e.g., a hike, run, or fishing event) and still be successful in communicating about the utility's water-related goals. | Helps to achieve sustainability objectives.<br><br>Helps to create a constituency for utility efforts to adopt sustainable operations.<br><br>Requires time to organize and run the event. | The Philadelphia Water Department partnered with the Darby-Cobbs Watershed Partnership, Philadelphia Parks & Recreation, Pennsylvania Environmental Council, the Fairmount Park Conservancy, and GLH Concepts to sponsor the First Annual 5k Run/Walk to support the revitalization of Cobbs Creek Park. The ultimate goal is to spread the word about the creek's water quality and improving the watershed.<br><br>Clean Water Services worked with local non-profit organizations to sponsor a community tree-planting event as part of a green infrastructure project. |
| 58. Community alerts and advisories | Stakeholder and customer receptivity | Alerts and advisories regarding flooding, CSO, and other water-related emergency events provide a public service to citizens. They can also be used to advise residents on what to do if a sewer overflow occurs on their property and educate the public about potential health hazards and water quality impacts associated with sewer overflows. | Provide a window of opportunity to help raise awareness about stormwater and drinking water issues among members of the public and other stakeholders.<br><br>Might not reach all affected stakeholders. | SD1 has launched a program to notify Northern Kentucky residents by email when existing or predicted weather conditions could potentially cause sewer overflows. http://www.sd1.org/ProjectsandPrograms/WetWeatherOverflowPublicNotificationProgram.aspx<br><br>The Philadelphia Water Department's Office of Watersheds website provides a CSOcast, which alerts the public of possible combined sewer overflows from Philadelphia's combined sewer system outfalls. Its Philly RiverCast provides a daily forecast of Schuylkill River water quality to tell residents when it's safe for recreational activities involving contact with the water. http://phillywatersheds.org/what_were_doing/documents_and_data/live_data/csocast<br><br>http://phillywatersheds.org/what_were_doing/documents_and_data/live_data/rivercast |
| 59. Unconventional media (arts projects, poetry, music) | Stakeholder and customer receptivity | Some leading utilities have been able to promote sustainability initiatives through unconventional media such as art projects, poetry, and music. | Using art, music or other less conventional media to communicate about sustainability will grab the attention of stakeholders in a positive and enticing way. | Austin Water Utility asked the band, Asleep at the Wheel, to write and perform a jingle about water conservation. |

| ID#/Tool | Cultural Change Attributes | Description | Issues and Observations | Examples and Links |
|---|---|---|---|---|
| 60. Recognize local stakeholder contributions to sustainability | Stakeholder and customer receptivity | Utilities can develop water sustainability certification programs and challenges to encourage different audiences (e.g., local businesses, individual citizens, and other stakeholder groups) to implement sustainable practices. | Recognizing stakeholder contributions to water sustainability can increase stakeholder engagement, build trust, and convey a sense of allegiance to the program and its planned outcomes. | Austin Water is creating a WaterWise Partner program that will recognize customers who have made comprehensive water efficiency upgrades in their facilities or have incorporated efficiency measures into the design of new properties. Initial focus is on developing a car wash certification program as a voluntary approach to achieving water savings. http://www.ci.austin.tx.us/water/conservation/downloads/140planfinal.pdf<br><br>Milwaukee MMSD has instituted a "Soak it Up" challenge with the goal of capturing 500 million gallons of rain with green infrastructure during any storm in the region. Citizens are encouraged to plant rain gardens, install rain barrels, and implement other measures. They use a green infrastructure benefits calculator to estimate their contribution to the goal and enter their information into a "Soak It Up" Calculator, which shows the percentage of MMSD's goal that has been reached. http://www.h2ocapture.com/ |
| **Reporting** | | | | |
| 61. Publish sustainability program reports | Stakeholder and customer receptivity | Many utilities interviewed for this project have produced and published reports that describe their sustainability programs, including anticipated benefits, rationale for action, goals and metrics, and accomplishments. Such reports often highlight partnership initiatives, educational efforts, and examples of successful projects. | Sustainability program reports provide more detailed and quantitative information than many other communication approaches.<br><br>Development of a quality report requires significant time and expense on the part of multiple utility staff and might involve external professionals in communications and document publication.<br><br>It will likely be necessary to publish periodic or annual updates. | Cincinnati MSD issued a sustainability report in 2010 called "Redefining the Future." The report presents the utility's baseline performance in 2009 and goals for the future. It describes MSD's sustainability activities and presents sustainability indicators to measure performance compared to long-term targets. http://projectgroundwork.org/sustainability/index.html |
| 62. Assess stakeholder communication | Stakeholder and customer receptivity | Utilities can develop tools to guide and assess stakeholder communication. For example, | A utility's communication plan can be quite complex, involving multiple stakeholders and communication tools. A stakeholder | Austin Water Utility's Austin Water 140 GPCD Conservation Plan includes an education and outreach plan that uses a |

| ID#/Tool | Cultural Change Attributes | Description | Issues and Observations | Examples and Links |
|---|---|---|---|---|
| | | some utilities develop a stakeholder matrix or similar tool to help ensure their key audiences are being reached and have opportunities to provide feedback. It can be used to help assess the success of stakeholder communications, and guide use of future communication strategies. | matrix and related engagement plan can help utilities ensure that their communication plan targets key stakeholders and identifies the most appropriate ways to engage them. | stakeholder matrix to guide communications with stakeholders. http://www.ci.austin.tx.us/water/conservation/downloads/140planfinal.pdf |
| **Partnerships** | | | | |
| 63. Appoint an external community advisory board or panel | Organizational structure<br>Learning mechanisms<br>Lack of funding<br>Stakeholder and customer receptivity | External advisory boards can help cut across utility, local, and state silos to help guide water infrastructure sustainability programs. | A well-selected panel of influential community members can provide guidance and critical perspective, add credibility to utility-generated initiatives, and serve as an external champion for utility activities.<br><br>Administration of an advisory panel can be relatively time-consuming.<br><br>While an independent panel can provide support for the utility, it could also become a source of criticism. | Cincinnati Metropolitan Sewer District's Project Groundwork Advisory Committee assists in developing integrated wet weather reduction strategies and projects that link the utility's efforts to other community goals, such as community revitalization and economic recovery. Committee members represent more than 30 local, state, and federal government agencies, environmental advocacy groups, academia, and business. |
| 64. Partner with other local and state agencies and departments | Organizational structure<br>Learning mechanisms<br>Technical capacity<br>Lack of funding<br>Stakeholder and customer receptivity | Water sector sustainability projects often involve collaboration with other branches of municipal government, non-profit organizations, and state and local resource management agencies.<br><br>Many city agencies have goals that are in alignment with water infrastructure sustainability goals, including community development, city planning, and transportation departments. | Partnering with other local agencies cuts across agency silos.<br><br>Building partnerships with these agencies can help all parties leverage funds and enhance their programs and projects. In some cases, utilities have been able to transfer services, develop cost-sharing arrangements, or undertake fee-for-service activities with other entities to help support sustainability projects.<br><br>Partnerships have the potential to cultivate external champions for utility sustainability initiatives. | Metropolitan Sewer District of Greater Cincinnati (MSDGC) has signed a memorandum of understanding with the Parks Department, in which the Parks Department agrees to help maintain green infrastructure projects and the utility provides funding to the Parks Department. |

| ID#/Tool | Cultural Change Attributes | Description | Issues and Observations | Examples and Links |
|---|---|---|---|---|
| 65. Partner with regional councils and other utilities | Organizational structure<br><br>Learning mechanisms<br><br>Technical capacity<br><br>Lack of funding<br><br>Stakeholder and customer receptivity | Regional councils are organizations with state and locally-defined boundaries that deliver a variety of federal, state and local programs, and provide regional planning for the area they represent. They promote regional cooperation and can help in developing innovative solutions to common issues. | Can play key role in communicating with stakeholders.<br><br>May provide resource for small utilities that lack communication departments.<br><br>Partnerships have the potential to cultivate external champions for utility sustainability initiatives. | When developing a stream setback ordinance, Independence Missouri Water Pollution Control (WPC) partnered with the MidAmerica Regional Council (MARC). MARC provided expertise, coordinated with stakeholders, conducted communication and outreach, and worked with local and state governments. |
| 66. Partner with stakeholders, the outside community, and businesses | Organizational structure<br><br>Learning mechanisms<br><br>Technical capacity<br><br>Lack of funding<br><br>Stakeholder and customer receptivity | Other organizations may be much better suited to address a community's sustainability objectives than a water utility. It may be more efficient for the utility to partner with another organization than it is to change its internal structure. In some cases, utilities have been able to develop cost-sharing arrangements with other entities to undertake sustainability projects. | Provides opportunities to share ideas and expertise.<br><br>Enables identification of sustainability champions.<br><br>Encourages collaborative approaches to outreach and training, as well as developing consistent messaging.<br><br>May provide opportunities to pool resources.<br><br>Utility may lose flexibility or autonomy of operation.<br><br>May exceed legal authorities.<br><br>Works best if utility can offer funding.<br><br>Not a "quick fix," part of a long-term strategy to change culture and utility staff mindsets. | Philadelphia Water Department develops strong partnerships with stakeholders and the outside community to help build champions for their GreenWorks plan. Support for the program comes both from within and the outside.<br><br>The Tualatin Valley Water District is a member of the Natural Step Network, which serves U.S.-based business, governmental, and educational organizations interested in using The Natural Step (TNS) framework for sustainability. Tualatin networks with organizations at local, state, and Pacific Northwest levels to communicate about sustainability and share information. http://www.thenaturalstep.org/<br><br>Tualatin is a leading member of Partners for a Sustainable Washington County Community. This partnership was formed to help coordinate sustainability efforts across Washington County. It focuses on community outreach, sustainability training, and collaborative projects. http://www.pswcc.org/<br><br>Tualatin is also a member of a regional water providers' consortium. The consortium was |

| ID#/Tool | Cultural Change Attributes | Description | Issues and Observations | Examples and Links |
|---|---|---|---|---|
| | | | External partners often share a utility's objectives for social and environmental outcomes. Partners may bring strong capabilities, talents, resources, and credibility that a utility lacks. | initially established to work on water supply planning, but moved on to water conservation issues. The member utilities sometimes pool their resources through the consortium to conduct media actions, marketing, and consistent messaging.<br><br>Clean Water Services has developed the Stakeholder Engagement Process (STEP) to obtain input on complex or controversial projects and policy decisions.<br><br>In the European Union, thirteen partners from six European countries are joining forces to develop the "Knowledge Bridge." The purpose is to promote and to improve the implementation of the European Water Framework Directive (WFD). The long-term mission is the establishment of sustainable water management throughout Europe. The Knowledge Bridge website provides links to online training for the adoption and implementation of the EU's Water Framework Directive and a place to enable the exchange of expertise and experiences. http://www.wfd-training.net/cms/bridge/app?service=external/index&sp=2022&sp=2064 |

# Tool Selection Matrix 4: Education Tools to Facilitate Utility Culture Change

| ID#/Tool | Culture Change Attributes | Description | Issues and Observations | Examples and Links |
|---|---|---|---|---|
| **INTERNAL** | | | | |
| **Provide Information on Sustainability** | | | | |
| 67. Develop disciplinary and interdisciplinary clearinghouses and/or bodies of knowledge | Learning mechanisms<br>Technical capacity | Sustainability is an inherently technical and multi-disciplinary construct. Development of an easy-to-use web clearinghouse or similar disciplinary and/or interdisciplinary resource can help staff gain familiarity with new topics, processes, and management methods. | Utilities poised to help staff learn and address knowledge deficits will likely experience a faster and smoother transition.<br>Requires a significant investment in development, compilation, and maintenance of needed technical materials.<br>Key supporting element in a comprehensive effort.<br>May work best if planned and conducted with or through a specialist partner. | The Philadelphia Water Department (PWD), Office of Watersheds developed a web-based library of watershed-related information, the Watershed Information Center, as a technical resource for PWD staff and regional stakeholders. http://phillywatersheds.org/ |
| 68. Guidance documents and materials for utility staff and managers | Organizational structure<br>Learning mechanisms<br>Technical capacity | Utilities develop guidance topics on key sustainability issues (such as how to construct sustainable facilities or green infrastructure approaches) to provide consistent information and training. If a sustainability program is strongly focused on a particular technology or mode of operation, it may make sense for the utility to draft or commission specific guidance materials. | Enables consistent approach to the sustainability topic covered in the guidance.<br>Provides training to utility staff and managers.<br>Time-consuming to develop.<br>Requires internal or commissioned expertise.<br>May require third-party peer review or alignment with standards/codes | The Metropolitan Water Reclamation District of Greater Chicago has developed Sustainable Facilities Guidelines to provide internal design guidance, based on LEED© for all buildings constructed by the utility.<br>Clean Water Services' Low Impact Development Approaches Handbook was developed to promote and encourage Low Impact Development (LID) approaches to protect natural resources. It is intended as a reference document for use by Clean Water Services staff and for other public agencies within the Tualatin Basin who make or influence development decisions. It will be updated as codes and policies change and new techniques and best practices emerge. http://www.cleanwaterservices.org/PermitCenter/NewsAndResources/LIDAHandbook.aspx |
| | | | | |

| ID#/Tool | Culture Change Attributes | Description | Issues and Observations | Examples and Links |
|---|---|---|---|---|
| **Training and Continuing Education** | | | | |
| 69. Utility staff and supervisor training and certification | Learning mechanisms<br><br>Staff motivation<br><br>Technical capacity | Becoming a sustainable utility requires investing in human assets. Many utilities have extensive experience developing training programs that provide state and utility certification on specific topics. Alternatively, utilities can provide incentives for their staff to attend training programs offered by other organizations.<br><br>Many utilities that have undergone a planned, successful transformation report a strong emphasis on training. To paraphrase one utility manager, "investment in capital assets must be accompanied by relevant investment in human assets." | Utilities that have a strong training infrastructure and program are well-positioned to address sustainability-related knowledge deficits. This can be approached in two ways: (1) a sustainability-focused training regime can be created as a new, dedicated initiative; or (2) sustainability-related topics and/or skill-sets can be integrated with a utility's existing professional development training program.<br><br>Even so, it should be noted that sustainability demands an unusually broad range of topics and technical competencies.<br><br>Provides incentive for staff to excel (e.g., staff could be promoted based on their skills and certification levels).<br><br>Time spent by employees on training might cut into normal activities.<br><br>Ongoing training programs can be expensive. | Albuquerque Bernalillo County Water Utility Authority runs the Water Authority University. The intent is to train staff and managers, typically by bringing in other staff to present information on the work that they do. Topics covered include asset management, triple bottom line analysis, and risk assessment. Sustainability topics have not yet been offered.<br><br>Clean Water Services' College of Clean Water engages specialists who educate and train managers and staff from Clean Water Services and other local, public entities in special topic areas. Topics range from highly technical courses (including sustainability) to project management (including communication and outreach) and safety practices.<br><br>http://www.cleanwaterservices.org/CollegeOfCleanWater/<br><br>Organizations such as the American Council of Engineering Companies (ACEC) sometimes offer courses and conferences on water sustainability topics. http://www.acec.org/education/eventDetails.cfm?eventID=1281<br><br>The American Society of Civil Engineers (ASCE) (http://www.asce.org/knowledgeandlearning/) is now offering an on-line course on The Fundamentals of Sustainable Engineering. https://secure.asce.org/ASCEWebSite/EStore/ProductSearchResult.aspx?ProdId=18112<br><br>The Washington Stormwater Center provides stormwater management tools, training, and certifications for municipalities, stormwater permittees, and businesses for use in their efforts to control stormwater and protect water quality. http://www.wastormwatercenter.org/home |
| 70. Information products for internal training and education | Learning mechanisms<br><br>Staff motivation | Utilities can develop flyers, videos, newsletters, brochures, articles and other materials to alert employees to new sustainability | Provides a relatively fast and easy way to provide education and guidance to utility employees about sustainability issues. | Albuquerque Bernalillo County Water Utility Authority develops employee newsletter articles, flyers, and posters about its asset management and other new programs.<br><br>The Tualatin Valley Water District developed a DVD and |

| ID#/Tool | Culture Change Attributes | Description | Issues and Observations | Examples and Links |
|---|---|---|---|---|
| | Technical capacity | initiatives, explain technical sustainability issues, and provide other types of continuing education and guidance to staff and managers. | Staff might not the find time or have the inclination to read the materials. | booklet, *Taking the Next Step: Tualatin Valley Water District's Journey toward Sustainability,* about its sustainability program, which they use for new employee training. http://www.tvwd.org/media/17617/sustainability_video_handbook.pdf<br><br>CWS has undertaken a diverse and far-reaching program to assure staff support for its sustainability program. "In-reach" activities include a weekly newsletter devoted to sustainability initiatives and conducting field trips to enable staff to visit with colleagues in other facilities. As a manager puts it, "this results in less stone-throwing because people now understand each other's roles." |
| 71. Training on social media and other types of electronic communication tools | Learning mechanisms<br><br>Staff motivation<br><br>Management information system capacity<br><br>Technical capacity | Utility staff may need to learn more about how to effectively use social media tools in communicating with their stakeholders, especially the 20- and 30-year-olds. | Provides information on when and how to use social media tools.<br><br>Courses can be expensive. | EUCI provides continuing education and training for electric industries. However, it sometimes provides social media training that might also be useful to water utilities. http://www.euci.com/index.php<br><br>The CDC's Social Media Tools, Guidelines, and Best Practices website is another source of information on how to conduct a social media campaign. http://www.cdc.gov/SocialMedia/Tools/guidelines/ |
| 72. Encourage employees to enroll in classes at local universities or on-line classes | Learning mechanisms<br><br>Staff motivation<br><br>Technical capacity | Culture change requires more than an incidental training effort. It may require an entire curriculum and include a wide range of topics, disciplines, methods, and skill sets. | Helps utility staff understand sustainability issues.<br><br>Helps build employee morale and participation in utility.<br><br>Classes can be expensive.<br><br>Sustainability demands an unusually broad range of topics and technical competencies.<br><br>Nearly all leading-edge utilities report significant effort and investment in an aligned regimen of training. | Several of the participating utilities encourage staff to take classes from local universities or through on-line programs. For example, Jefferson County Public Service District noted that the University of Southern California offers an on-line program for an M.S. in Environmental Engineering that covers topics on water and wastewater. http://gapp.usc.edu/graduate-programs/masters/civil-environmental-engineering/environmental-engineering<br><br>Appendix B provides examples of engineering, business management, and policy graduate programs and certificate programs on water resources management and related topics. These programs were selected for their emphasis on sustainability, working with water utilities and on local issues, and/or an interdisciplinary approach. |

| ID#/Tool | Culture Change Attributes | Description | Issues and Observations | Examples and Links |
|---|---|---|---|---|
| 73. Partner with other utilities to provide training programs to utility staff | Organizational structure<br><br>Learning mechanisms<br><br>Technical capacity | Utilities in the same geographic area can partner with each other to hire internal or external teachers and provide training on a variety of utility operations and topics. | Helps utility staff understand sustainability issues.<br><br>Helps build employee morale and participation in utility programs. | The Prince William County Service Authority coordinates a training program open to other local utilities. While classes do not currently include sustainability issues, this model illustrates a cost-effective way to provide training to utility staff. |
| 74. Partner with local universities to provide classes and training | Organizational structure<br><br>Learning mechanisms<br><br>Technical capacity | Local schools can be a good source of information and expertise on sustainability. | Source of technical expertise for utilities when developing new programs or new skill sets. | The University of West Virginia and Shepard University provided valuable support to Jefferson County Public Service District in starting up its GIS program. |
| **Informal Education Opportunities** | | | | |
| 75. Tours of utility facilities | Learning mechanisms<br><br>Staff motivation<br><br>Technical capacity | Utilities facilitate tours of their wastewater treatment plant, drinking water facility, GI projects, and other utility operations for utility employees. | Helps utility staff understand sustainability issues, especially if this is not an area they work on.<br><br>Helps build employee morale and spur participation in utility programs. | Clean Water Services offers half-day tours of their wastewater facilities that enable staff to visit with colleagues in other facilities. They keep track of the percentage of employees who want to participate and conduct follow-up surveys. As a CWS manager puts it, “this results in less stone-throwing because people now understand each other’s roles.” |
| **EXTERNAL** | | | | |
| **Primary and secondary school water sustainability curriculum** | | | | |
| 76. Curriculum on water sustainability and related water issues | Stakeholder and customer receptivity | Many water utilities offer water-related programs to elementary schools. As evidenced by the success of the national anti-smoking campaign, which had a strong school education component, this can be a highly effective way to effect culture change. | Many utilities have experienced significant success through programs aimed at K-12 education. These programs clearly promote awareness of water sustainability issues at an early age.<br><br>Because schools must now follow standardized curriculum, it is important to ensure that programs meet local educational standards and/or count as teacher training. | Austin Water’s Water in our World course for 5th graders includes a teacher's book, student books (in English and Spanish), videos about local water resources, and supplies for projects and experiments. Teachers using the Water in Our World course are offered a stipend to attend a required one-time teacher training session. http://www.austintexas.gov/department/water-our-world<br><br>Cincinnati MSDGC helps sponsor a comprehensive, year-round, interdisciplinary, environmental education program for middle school and high school students. http://www.msdgc.org/downloads/wetweather/greenreport/Files/Green_Report_Exhibit_S.pdf<br><br>St. Louis MSD has a teacher packet and student workbook, |

| ID#/Tool | Culture Change Attributes | Description | Issues and Observations | Examples and Links |
|---|---|---|---|---|
| | | | | Clean Water Education, for grades 4–6. It is a highly interactive curriculum that covers the water cycle, watersheds and stormwater runoff, nonpoint source pollution, and best management practices.<br><br>Teacher Guide:<br>http://www.stlmsd.com/portal/pls/portal/!PORTAL.wwpob_page.show?_docname=352439.PDF<br><br>Student Workbook:<br>http://www.stlmsd.com/portal/pls/portal/!PORTAL.wwpob_page.show?_docname=352440.PDF<br><br>The Narragansett Bay Commission has developed the Woon Watershed Explorers (WWE) program, a free, hands-on environmental education program for students and teachers about the health of their local watersheds. The curriculum includes monthly in-class lessons, two water quality testing field trips, and an environmental education symposium. The curriculum meets state and federal education standards.<br>http://www.narrabay.com/Education/watershed_explorers.aspx<br><br>SD1 has developed a stormwater elementary education program for 5th grade students. The curriculum includes five one-hour lessons, including topics such as point/nonpoint source pollution, watershed management, wetlands, and Best Management Practices (BMPs). It has been incorporated into nearly every fourth-grade classroom in Northern Kentucky.<br>http://www.sd1.org/ProjectsandPrograms/StormWaterEducation.aspx<br><br>Clean Water Services' River Rangers Program teaches elementary students about stormwater pollution prevention.<br>http://www.cleanwaterservices.org/Residents/JoinTheCycle/InYourCommunity/RiverRangers.aspx<br><br>The Southern Nevada Water Authority has developed an educational website, H2O University, which has information for grade levels K-2, 3-5, and 6-12, as well as resources for teachers and parents and a library of water facts.<br>http://www.h2ouniversity.org/html/ |

| ID#/Tool | Culture Change Attributes | Description | Issues and Observations | Examples and Links |
|---|---|---|---|---|
| | | | | The Massachusetts Water Resources Authority's School Program website provides school educational guides that contain hands-on activities for a range of topics and grade levels. These materials are supported by free teacher workshops. http://www.mwra.state.ma.us/02org/html/sti.htm<br><br>The Water Education Foundation offers a variety of programs to teach students about water. Students in grades K-12 learn about the history, geography and science of water, and the difficult decisions surrounding this complex issue. All Foundation classroom materials are consistent with the standards of the California State Frameworks for Science and History/Social Science and are designed to correlate with grade-level teaching requirements. http://www.watereducation.org/doc.asp?id=873<br><br>United Utilities in the U.K. has developed (in conjunction with teachers and the community) a range of education resources, ranging from the water cycle to climate change. Intended for teachers and students within the British educational system, these materials are also relevant to water education in the U.S. http://www.unitedutilities.com/education.aspx |
| 77. Presentations to schools, recreation centers, and other community organizations | Stakeholder and customer receptivity | Many utilities provide presentations on water quality, stormwater, and other issues to elementary and secondary schools, as well as to other community groups. These presentations can be developed to meet an individual school's need, such as describing stormwater management to a school that is located next to an on-going green infrastructure project. | Promotes awareness of water sustainability issues at an early age.<br><br>Targets audiences that are directly affected by water sustainability issues.<br><br>Can be time-consuming.<br><br>May conflict with other staff roles. | Austin Water's "Dowser Dan" visits classrooms to give a musical program about wasting water. http://austintexas.gov/department/dowser-dan-school-assembly-program<br><br>SD1 provides presentations to students and residents of the Northern Kentucky community on environmental stewardship and protecting water resources. The utility uses an interactive Enviroscape (model of a town) to show students how human behavior can impact waterways. SD1 sends its clean water mascot to schools to teach about the impacts of human behavior on fish and wildlife habitats. http://www.sd1.org/Education/Mascot_Visits.aspx<br><br>Philadelphia Water Department conducts targeted education to schools, recreation centers, and other stakeholders. PWD has developed a curriculum for schools and another for their Interpretive Center. It conducts sessions when a green infrastructure project, such as a green street, is being built near |

| ID#/Tool | Culture Change Attributes | Description | Issues and Observations | Examples and Links |
|---|---|---|---|---|
| | | | | a school or center in order to explain and demonstrate the project. |
| 78. Science fairs | Stakeholder and customer receptivity | Some utilities offer science fairs – often at the 5th grade level. In some cases this involves judging at a school science fair. In other cases, utilities have set up demonstration booths on different water issues and provide students with the opportunity to talk with utility employees about water sustainability issues. | Students are "future customers" – science fair participation promotes awareness of water sustainability issues at an early age.<br><br>Can be time-consuming. | Austin Water sponsors a science fair event that includes 20 booths on water conservation and other water-related topics.<br><br>SD1 partners with local environmental groups and utilities to stage a hands-on science fair, Waterific, devoted to water conservation topics for middle school students. Each partner presents a lesson about water and operates a booth devoted to their topic. This program and other SD1 environmental education programs are supported through a partnership with a local Walmart.<br><br>The Narragansett Bay Commission conducts a special competition at the Rhode Island State Science Fair. They select students whose clean water projects show excellence in scientific inquiry. Winners receive U.S. Savings Bonds and special recognition at an NBC Board of Commissioners meeting. http://www.narrabay.com/Education/ForStudents/JuniorHigh.aspx<br><br>United Utilities (U.K.) sponsors the Big Bang Fair, a national fair that celebrates young people's achievements in science and engineering. United Utilities sponsors this event in order to encourage the future input and innovation of young people in helping to solve some of the world's biggest challenges - dealing with climate change, developing carbon-neutral fuels and providing safe, clean water sources for all. http://www.thebigbangfair.co.uk/home.cfm |
| 79. Utility internships for high school students | Stakeholder and customer receptivity | Local high school students can learn about utility sustainability efforts through formal internships. | Educates the next generation of water resource managers about the issue of water sustainability. | Metropolitan Sewer District of Greater Cincinnati's Student Intern Academy is a paid summer internship program for high school juniors and seniors. MSD professionals lead students in projects and provide hands-on experience. http://www.msdgc.org/downloads/about_msd/career/student_intern_academy/msd_student_intern_application_2013.pdf |

| ID#/Tool | Culture Change Attributes | Description | Issues and Observations | Examples and Links |
|---|---|---|---|---|
| **College and Graduate School Programs** | | | | |
| 80. Curriculum on water resources management | Stakeholder and customer receptivity | Utility staff can share their knowledge of water sustainability issues by offering to speak at local colleges and university classrooms. | Educates the next generation of water resource managers about the issue of water sustainability.<br><br>Utility staff report enjoying this role.<br><br>Can be time-consuming. | A Milwaukee MMSD employee has developed a relationship with the School of Architecture and Urban Planning at the University of Wisconsin, Milwaukee, where she gives classroom presentations on GI, sustainability, and planning.<br><br>SD1 partnered with Northern Kentucky University to launch a very successful 200-level lecture and lab course on stormwater management. (http://www.sd1.org/NewsArticle.aspx?id=42)<br><br>The Water Education Foundation has developed a college curriculum that is aimed at a social science class studying management of natural resources or a science class studying the interaction of humans and the environment. (http://www.watereducation.org/doc.asp?id=873)<br><br>*Interdisciplinary Environmental Education on the Nation's Campuses: Elements of Field identity and Curriculum* Design, published by the National Council for Science and the Environment, provides a useful resource for identifying local colleges and universities that might be particularly interested in working with local utilities to speak in the classroom or develop an interdisciplinary water resources course. http://ncseonline.org/interdisciplinary-environmental-education-nations-campuses<br><br>Another useful resource, developed by EPA's Minority and Academic Institutions Initiative, is *Green Careers Curriculum Manual: Improving Access to Green Careers through Environmental Science and Engineering Programs at Historically Black Colleges and Universities.* http://www.epa.gov/osbp/mai_gccm.htm<br><br>Appendix B provides examples of graduate engineering, policy, and business management programs that utilities can work with to help shape water resources management curriculum. The programs in Appendix B were selected for their emphasis on sustainability, working with water utilities, and/or interdisciplinary approach. |
| 81. Utility internships for | Stakeholder and customer receptivity | Utilities can collaborate with local colleges and universities | Educates the next generation of water resource managers about the | Cincinnati MSD operates a co-op internship program that gives college students temporary positions at MSD to help them learn |

| ID#/Tool | Culture Change Attributes | Description | Issues and Observations | Examples and Links |
|---|---|---|---|---|
| college students | | to design internship programs for students interested in water resource management. | issue of water sustainability. | about the types of positions available to students who pursue careers in water resource management. Students who participated in the high school internship program sometimes apply for the college internship. |
| **Community education (for community groups, students, and other organizations)** | | | | |
| 82. Provide tours and field trips to utility facilities | Stakeholder and customer receptivity | Utilities sponsor tours of their water and wastewater treatment facilities and GI projects. | Helps community members and other stakeholders understand how the utility works, the challenges it faces, and their own role in water sustainability. | SD1 constructed an outdoor environmental education center – Public Service Park – that offers interactive learning on Best Management Practices (BMPs). The Journey of a Drop of Water field trip at the park won the National Association for Clean Water Agency 2005 National Environmental Achievement Award. http://www.sd1.org/Education/Field_Trips_and_Tours.aspx<br><br>The Narragansett Bay Commission provides tours of its wastewater treatment facilities for fourth-graders and above. Students learn how the dirty water from their homes gets cleaned and returned to Narragansett Bay and why clean water is important. www.narrabay.com/en/Education/ForStudents/Elementary.aspx |
| 83. Provide speakers on specific water sustainability topics | Stakeholder and customer receptivity | Some utilities offer a speakers bureau that provides utility staff to talk to schools, community organizations, businesses, and other stakeholders about water and sustainability issues. | Can be time-consuming.<br><br>Requires coordination and logistical planning with external parties. | Austin Water offers presentations on water conservation techniques and available programs to a variety of interest groups. It sponsors a Water Conservation Speakers Bureau, from which stakeholder and community groups can request speakers on topics of interest. http://www.austintexas.gov/department/speakers-bureau<br><br>MSLSD offers a speakers bureau that sends utility staff to community meetings to present short presentations or brief informal discussions on programs and projects that impact the neighborhood. http://www.stlmsd.com/educationoutreachloads/140planfinal.pdf |
| 84. Sponsor contests | Stakeholder and customer receptivity | Utilities can raise awareness about water sustainability issues by sponsoring contests for students, community groups, and other audiences. | Can target students and other audiences.<br><br>Raises awareness of sustainability issues. | The Narragansett Bay Commission sponsors an annual poster contest for elementary students in grades K-6. The theme focuses on the importance of clean water. One winning artist in each grade level receives a $100 U.S. Savings Bond. Winning entries are featured on the NBC calendar, which is distributed to all elementary schools in the NBC service area and to all elected officials. The winning posters are also exhibited at a |

| ID#/Tool | Culture Change Attributes | Description | Issues and Observations | Examples and Links |
|---|---|---|---|---|
| | | | | local art gallery. http://www.narrabay.com/Education/ForStudents/Elementary.aspx<br><br>SD1 sponsors an environmental award program for students, teachers, and scouts who have gone above and beyond to protect Northern Kentucky's water resources and the environment. Cash prizes are awarded. http://www.sd1.org/ProjectsandPrograms/ProtectingtheEnvironmentAward.aspx<br><br>The U.S. Environmental Protection Agency has developed the Water Drop Patch Project to inspire Girl Scouts to learn about water quality and take action in their communities to protect and restore local water resources, including their local rivers, lakes, streams, wetlands, and ground water (http://water.epa.gov/learn/resources/esms/patch/upload/May_1_WDPP.pdf). Water utilities have developed similar programs. For example, the San Diego County Water Authority's Water Patch Program focuses on water conservation.<br><br>http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=7&cts=1331765258654&ved=0CEgQFjAG&url=http%3A%2F%2Fwww.sdcwa.org%2Fsites%2Fdefault%2Ffiles%2Ffiles%2Foutreach-education%2FGirlScouts.pdf&ei=VSBhT7v9IoWD0QGp4OHRBw&usg=AFQjCNFIXcYbzvivecOQ2ekTdIjIt7A4Mw |
| 85. Distribute sustainability newsletters and other information products | Stakeholder and customer receptivity | Utilities can help educate local students by developing sustainability newsletters and distributing them at schools, on websites, at community events, and/or through an electronic email system.<br><br>Utilities can also develop flyers, videos, newsletter articles and other materials to provide education about water sustainability measures for citizens and other | Promotes awareness of water sustainability issues.<br><br>Can target different audiences. | Narragansett Bay Commission publishes a bi-weekly newsletter for kids, which covers environmental issues. http://www.narrabay.com/Education/ForStudents/~/media/Files/PR%20Documents/Woony%20News/AugustSeptemberWoonyNews.ashx<br><br>Clean Water Services provides The Clean Water Connection, an e-newsletter, on its website. http://www.cleanwaterservices.org/AboutUs/News/Newsletters/2012/CleanWaterConnectionMarch2012.htm |

| ID#/Tool | Culture Change Attributes | Description | Issues and Observations | Examples and Links |
|---|---|---|---|---|
| | | stakeholders. | | |
| 86. Provide training workshops on water sustainability activities | Stakeholder and customer receptivity | Utilities can use approaches (such as training seminars that provide continuing education credits and web-based training videos) to offer stakeholders relevant information on water sustainability. | Helps stakeholders and members of the public understand water sustainability issues, including benefits and challenges, and their own role in water sustainability.<br><br>Some utilities have partnered with community or regional colleges to design multi-topic, multi-discipline degree or certificate programs. Operational examples do not include sustainability per se, but illustrate the point that transformational objectives can be enabled by utility-sponsored educational programs. | Austin Water offers seminars to area licensed professional irrigators in order to provide continuing education credits toward license renewal, and it conducts homeowner trainings with information on scheduling irrigation systems, available water conservation programs, and the mandatory watering schedule.<br>http://www.ci.austin.tx.us/water/conservation/downloads/140planfinal.pdf |
| 87. Hold brown bag lunches with legislative aides | Stakeholder and customer receptivity | This provides an opportunity to talk about issues of interest to legislators and advocate for sustainability. | Helps educate the next generation of decision makers on water issues. | The Water Education Foundation has helped utilities plan for such sessions. |
| **Guidance Documents** | | | | |
| 88. Guidance documents for homeowners | Stakeholder and customer receptivity | Controlling stormwater runoff and other water sustainability concerns requires participation from citizens as well as utilities and municipal agencies. Utilities can encourage citizens to play a role in water sustainability by providing guidance documents that describe water issues and present actions that citizens can take to make a difference. | Helps homeowners understand the benefits of water sustainability programs and the role of water utilities.<br><br>Introduces homeowners to roles they can take to improve water sustainability. | St. Louis MSD has developed a Clean Water Management Plan guidebook for homeowners and parents of students who participate in the school program on clean water. The motto of this guidance is "Only rain to the storm drain."<br>http://www.stlmsd.com/portal/pls/portal/!PORTAL.wwpob_page.show?_docname=352438.PDF<br><br>The Philadelphia Water Department has developed a Homeowners Guide to Stormwater Management.<br>http://phillywatersheds.org/doc/Homeowners_guide_to_stormwater_management.pdf |
| 89. Guidance documents for | Stakeholder and customer receptivity | School teachers can use guidance to help develop hands-on activities to help | Educates the next generation of water resource managers about the | Philadelphia Water Department partnered with the Schuylkill Action Network and the Partnership for the Delaware Estuary — A National Estuary Program to develop a Guide to |

| ID#/Tool | Culture Change Attributes | Description | Issues and Observations | Examples and Links |
|---|---|---|---|---|
| teachers | | control stormwater runoff on school grounds. | issue of water sustainability.<br><br>Helps students understand the benefits of water sustainability programs and the role of water utilities.<br><br>Introduces students to roles they can take to improve water sustainability. | Stormwater Management on School Campuses. The Guide provides steps and actions for improving stormwater management on campuses and in the surrounding community. http://www.phillywatersheds.org/sites/default/files/CampusStormwaterGuide.pdf |
| 90. Guidance documents for the utility's collaborators | Stakeholder and customer receptivity | Guidance documents can be prepared to help utility collaborators (e.g., developers, municipal government departments) in their efforts to implement sustainable water operations. In many cases, guidance prepared for internal utility use can be shared with collaborators and stakeholders. | Enhances coordination among the utility, the municipalities it serves, developers, and other collaborators. | Metropolitan St. Louis' Sewer District (MSD) routinely coordinates with about 60 municipalities within metropolitan St. Louis. Its "Stormwater Best Management Practices Post-Construction Recommendations" guidance document is distributed to their collaborators to help streamline the green learning process by providing information on how to implement the LID design process. MSD has also developed a five-page site design guidance. http://www.stlmsd.com/portal/pls/portal/!PORTAL.wwpob_page.show?_docname=384405.PDF |
| **Partner with Stakeholders** | | | | |
| 91. Partner with other local agencies and departments | Technical capacity<br><br>Lack of funding<br><br>Stakeholder and customer receptivity | Coordinating with other city agencies and departments whose goals align with water sustainability goals (e.g., transportation, parks and recreation, finance departments) helps expand awareness of water sustainability across city silos and enables joint implementation of sustainability programs and projects that are often highly visible to the utility's stakeholders. | Partnering with other departments and organizations may result in more cost-effective solutions to stormwater management.<br><br>Water utilities can partner with other agencies and departments for a wide variety of purposes, including on community education events. | Austin Water recently partnered with the City of Austin's Watershed Protection Department to develop an ordinance requiring commercial development to redirect stormwater to landscaping. Also partnered on the Grow Green program to develop design templates that align with Austin Water's landscape conversion incentive. http://austintexas.gov/department/grow-green |

| ID#/Tool | Culture Change Attributes | Description | Issues and Observations | Examples and Links |
|---|---|---|---|---|
| 92. Partner with other utilities, NGOs, and organizations in the region. | Technical capacity<br>Lack of funding<br>Stakeholder and customer receptivity | Utilities can partner with other organizations to share information (e.g., through regional conferences or other events) about water sustainability and increase understanding of water sustainability trends. | Leverages expertise and skills from a range of organizations.<br>Cuts across agency and subject-area silos to emphasize the contributions of multiple actors in implementing water sustainability.<br>More cost-effective when multiple organizations share financial and other responsibilities of hosting an event. | Austin Water worked with the Austin Area Research Foundation, the Texas Water Foundation, LCRA (a Texas conservation and reclamation district that provides water, energy, and community services), the Sierra Club, and local utilities to sponsor the first water conservation symposium in Central Texas. The conference provided elected officials, executive-level government staff, and utility staff with an enhanced understanding of the need for water conservation and associated resources.<br>http://www.hillcountryalliance.org/HCA/WaterConservation |

# APPENDIX A: RESEARCH APPROACH

The research underlying this guidance document included three basic steps: (1) targeted literature review, (2) reflexive case studies with water utilities recognized as leaders in sustainability or related initiatives, and (3) an expert and practitioner workshop with focused review of attributes found to influence organizational transformation in the water sector and organizational, communication, and education approaches that can be used to address these attributes. Each of these research steps is described below.

## LITERATURE REVIEW

The literature review was targeted to address four areas of focus: (1) factors that influence organizational transformation, (2) cultural change as it pertains specifically to sustainability (in water utilities and analog organizations); (3) concepts, technologies, and practices that support sustainable operations at the level of the utility or municipality, and (4) organizational, communication, and education tools and approaches to help spur cultural change. Literature reviewed for the first two focus areas included fields such as organizational change, social psychology, public administration, management studies, and professional water system management. For the second two focus areas, the literature search included a general Internet search with a focus on articles and reports published by water research organizations, the U.S. Environmental Protection Agency (EPA) and other federal agencies, water utilities, state and local agencies, and other organizations and NGOs that work on sustainability issues.

## CASE STUDIES

Case studies were synthesized from information captured through a three-phase, in-depth survey process with 18 U.S. water utilities generally viewed as progressive, well-managed, and accomplished with respect to sustainable operations and/or infrastructure development. Utilities were selected based on a non-random, snowballing process informed through existing expert/practitioner networks. Development of the case information included (1) initial telephone contact to establish the purpose and scope of the project; (2) completion of an internet questionnaire focusing on why sustainability initiatives were pursued (e.g., challenges and benefits), specific sustainability activities undertaken, and barriers to implementation; and (3) an in-depth telephone survey focused on utility cultural change necessary to implement sustainable operations, including explicit articulation of factors that enabled or constrained organizational transformation. The telephone survey also included discussion of the types of organizational, communication, and education approaches the utilities have found to be effective in achieving sustainable operations.

Telephone interviews were semi-structured and thematically focused, lasting approximately one hour. Interview subjects were provided with guidelines, but were encouraged to speak freely and focus on areas of particular salience to their experience. In many cases, additional conversations were conducted to clarify issues or elicit further information. Inputs gathered through this process were analyzed using a "replication logic" approach, through which themes and topics that emerged from the first case interviews were compared to the second, and the outcomes synthesized though this comparison were considered in light of the third case, and so on. Interactions with utilities typically included multiple staff, representing different functional areas and different levels of hierarchy and responsibility. The interview process was supplemented through review of utility archival materials including sustainability plans, policies, procedures, and web domain content.

To augment these interviews, a focus group of eight leading water utility communications and public relations specialists was organized. During this facilitated forum, ideas on ways to communicate about water sustainability were elicited, and reaction was sought about communication and education tools and approaches believed to be effective in the context of organizational transformation.

## PRACTITIONER WORKSHOP

Findings synthesized through the literature review and case study process were consolidated into a white paper that described cultural change and organizational factors that tend to either enable or constrain water utility efforts to achieve sustainable operations, and a set of tools that utilities can use to address organizational transformation. These findings were presented and critiqued by academic experts and water sector professionals during a series of facilitated focus sessions at a two-day workshop held in New York City. The workshop participants included a variety of utility professionals, municipal officials, experts in the arenas of sustainability and organizational change, and specialists in communications and education. Several PAC members and sponsors also attended the conference. Table A.1 provides a list of the workshop participants.

| Table A.1. Workshop Participants | |
|---|---|
| **Name** | **Organization** |
| Michael Apgar* | Sanitation District No. 1 |
| Caswell Holloway* (Keynote Speaker) | NYC Department of Environmental Protection |
| Jay Hoskins* | Metropolitan St. Louis Sewer District |
| Alexander Keating | Penn Institute for Urban Research |
| James Kilduff | Rensselaer Polytechnic Institute |
| Linda Macpherson | New Water ReSources |
| Kathleen O'Connor | New York State Energy Research and Development Authority |
| Dan Pedersen* | Austin Water |
| John Phillips* | King County Department of Natural Resources and Parks |
| Carter Strickland* | NYC Department of Environmental Protection |
| Karen Sands* | Milwaukee Metropolitan Sewerage District |
| Kaniz Siddiqui* | Metropolitan Sewer District of Greater Cincinnati |
| Rita Schmidt Sudman | Water Education Foundation |
| Diane Taniguchi-Dennis* | Clean Water Services |
| Michael Toffel | Harvard Business School |
| Steve Whipp | United Utilities (UK) |
| Jian Zhang | Water Research Foundation |
| *Participants are also members of participating utilities for this study. | |

# APPENDIX B: SELECTED ENGINEERING, POLICY, AND BUSINESS MANAGEMENT GRADUATE PROGRAMS IN WATER RESOURCES AND RELATED TOPICS

| Institution | Field | Program | Degrees Offered | Curriculum Description/Website |
|---|---|---|---|---|
| Antioch University New England | Business | Organization and Management | MBA | This "Green MBA" program focuses on sustainability. The curriculum is designed around Triple Bottom Line theory and emphasizes balancing a company's financial health, environmental sustainability, quality of work life, ethical practices, and corporate social responsibility. Courses include "Introduction to Sustainability," "Earth Systems in Organizations," "Ecological Economics," "Supply Chain and Green IT Operations," and "Leadership, Entrepreneurship and Leading Change."<br>http://www.antiochne.edu/om/mba |
| Duquesne University | Business | Donahue School of Business | MBA | TBL is the foundation of the curriculum. Sustainability is built into all classes, and many classes focus on sustainability, including a two-semester seminar called "Leading Change in Sustainable Enterprises."<br>http://mba.sustainability.duq.edu |
| Presidio Graduate School | Business | N/A | MBA, MPA, Executive Education Certificate (all in Sustainable Management) | The school's focus is on sustainable management. It integrates a framework of sustainability into every course and across the entire program—including social innovation, integrated bottom-line accounting, sustainable marketing and ecological economics.<br>http://www.presidioedu.org |
| University of North Carolina-Chapel Hill | Business | Kenan-Flagler Business School | MBA | The MBA program offers a concentration in "Sustainable Enterprise." It cooperates with the school's Center for Sustainable Enterprise (http://www.kenan-flagler.unc.edu/cse/index.cfm).<br>http://www.kenan-flagler.unc.edu/cse/mba-sustainable-enterprise-concentration.cfm |
| University of Wisconsin | Business | Wisconsin School of Business | MBA with certificate in Business, Environment and Social Responsibility | The graduate certificate program provides students with the knowledge and skills to analyze and leverage the interrelations between a business and its natural and social environment.<br>http://www.bus.wisc.edu/certificates/graduate/sustainability |

| Institution | Field | Program | Degrees Offered | Curriculum Description/Website |
|---|---|---|---|---|
| Illinois Institute of Technology | Business, Law, Science | Stuart School of Business | MS in Environmental Management and Sustainability, MBA with concentration in Sustainable Enterprise | The Environmental Management and Sustainability curriculum emphasizes options for pollution prevention and waste minimization that improve economic efficiency, global competitiveness, and corporate financial performance while meeting broad societal goals, including an emphasis on the importance of sustainability at the global and enterprise levels.<br><br>http://www.stuart.iit.edu/graduateprograms/ms/environmentalmanagement |
| University of Michigan | Business, Natural Resources | Erb Institute for Global Sustainable Enterprise (Ross School of Business and School of Natural Resources and Environment) | MBA/MS Dual Degree in Global Sustainable Enterprise | The vision of the program is that graduates will draw upon their interdisciplinary training to inspire, develop and implement innovative and practicable methods for cultivating a sustainable future.<br><br>http://erb.umich.edu/education-programs/mbams |
| The New School | Business, Policy | Milano New School for Management and Urban Policy | MS in Environmental Policy and Sustainability Management; also offers a post-Masters certificate in "Sustainability Strategies" | The M.S. in Environmental Policy and Sustainability Management is an interdisciplinary professional master's program that prepares graduates to play valuable roles as planners, managers, policy analysts, and consultants in defining environmental policy and giving support to institutions that seek to enhance their sustainability performance. It is designed to provide a broad understanding of the importance of ecological, financial, and social sustainability to organizational success. The program core focuses on mastering the relevant natural sciences, targeted financial analytics, public policy, climate change issues, and an array of perspectives on organizational, environmental, and social ecology.<br><br>http://www.newschool.edu/public-engagement/ms-organizational-change-management/ |
| The New School | Business, Policy | Milano New School for Management and Urban Policy | MS in Organizational Change Management | The curriculum is designed for students who are already engaged in change-related professional roles, transitioning into organizational change management or consulting from another field, and managers who see the effective implementation of change as critical to their professional success. Coursework focuses on leadership development and coaching; building teams and project groups; working effectively with clients; restructuring and realigning work processes; managing diversity and difference; and articulating vision, structure, and culture.<br><br>http://www.newschool.edu/public-engagement/ms-organizational-change-management/ |

| Institution | Field | Program | Degrees Offered | Curriculum Description/Website |
|---|---|---|---|---|
| George Mason University | Engineering | Department of Civil, Environmental, and Infrastructure Engineering | Water resources engineering (certificate) | George Mason University offers a Water Resources Engineering Graduate Certificate, which consists of 15 credits (5 courses) in Engineering, Methods, Policy, and Practice. Available courses include one called "Sustainable Development."<br>http://catalog.gmu.edu/preview_program.php?catoid=15&poid=6234&returnto=1031 |
| Marquette University | Engineering | Department of Civil and Environmental Engineering | Environmental/Water Resources Engineering (MS, PhD), Graduate certificate programs in Water and Wastewater Treatment Processes and Water Resources Engineering | Marquette offers several graduate programs in water resources engineering, and have a generally strong emphasis on sustainability (http://www.marquette.edu/sustainability/academics.shtml).<br>http://www.marquette.edu/engineering/civil_environmental/grad.shtml |
| University of Washington | Engineering | Department of Civil and Environmental Engineering | Hydrology, water resources and environmental fluid mechanics (MS, MSCE, MSE, PhD) | Intended to complement traditional engineering methods, this program takes a comprehensive and interdisciplinary approach to solving water and environmental problems. Students learn a range of analytic techniques and gain a broad understanding of the societal context of decision-making. Students have opportunities to work directly with agencies, industries, and stakeholders on water resources problems.<br>http://www.ce.washington.edu/research/water/index.html |
| Villanova University | Engineering | Program in Water Resources and Environmental Engineering | Master of Science in Water Resources and Environmental Engineering (MSWREE) | This program coordinates with the Villanova Urban Stormwater Partnership (http://www3.villanova.edu/VUSP/).<br>http://www.villanova.edu/engineering/departments/civil/graduate/masters/waterresourcesenviron/ |
| Tufts University | Engineering, Policy, Law, Health | Tufts Institute of the Environment | Interdisciplinary Graduate Certificate in Water: Systems, Science, and Society. Can be earned with a Masters or PhD in various fields. | The curriculum has four core areas: Water Resources Science and Technology; Biological Aspects of Water, Health, and Nutrition; Water Planning and Policy; and Economic and Systems Analysis. Sustainability is specifically addressed in classes offered in the Policy and Economics areas.<br>http://www.tufts.edu/water/index.html |
| Oregon State University | Engineering, Science, Policy, and Management | Water Resources Graduate Program | MS, PhD in Water Resources Engineering, Water Resources Science, or Water Resources Policy and Management | One of OSU's goals is to train water professionals with a rich roster of faculty and courses. The curriculum offers coursework that covers engineering approaches, watershed processes, and water resources management and policy.<br>http://oregonstate.edu/gradwater/ |

| Institution | Field | Program | Degrees Offered | Curriculum Description/Website |
|---|---|---|---|---|
| Duke University | Natural Resources | Nicholas School of the Environment | Water and air resources (Master of Environmental Management) | Coursework includes an interdisciplinary range of classes in science, economics, policy, law, and sustainability.<br>http://www.nicholas.duke.edu/people/students/advising/curriculum-course-planning-sheets/war.pdf/view |
| University of Arizona | Natural Resources | Department of Soil, Water and Environmental Science | MS, PhD in Soil, Water, and Environmental Science (some areas of specialization involve water resources). May concurrently pursue Certificate in Water Policy. | The University of Arizona's Graduate Certificate in Water Policy is an interdisciplinary program intended for both working professionals pursuing the Certificate only and UA graduate students concurrently enrolled in a graduate degree program.<br>http://gcwp.arizona.edu/ |
| State University of New York College of Environmental Science and Forestry | Natural Resources, Policy | Division of Environmental Science | Water and wetland resource studies (MPS, MS, PhD) | The water and wetland resources area of study develops an understanding of technical, social and institutional aspects of water resources management, mitigation, and restoration. Students study both scientific and social (e.g., planning, regulation, law and institutions and management of water and wetland resources) subject areas.<br>http://www.esf.edu/environmentalscience/graduate/areas.htm |
| Columbia University | School of Continuing Education | Sustainability Management | Master of Science in Sustainability Management | Columbia has developed this program to address the need to formally train and educate sustainability practitioners, including lawyers, engineers, marketers, communications professionals, policymakers and scientists.<br>http://ce.columbia.edu/Sustainability-Management/About-the-Program |
| Rutgers, The State University of New Jersey, New Brunswick | Science | Department of Environmental Sciences | Offers MS and PhD programs in Environmental Sciences; within those programs, areas of concentration include water and wastewater treatment and water resources | The Rutgers Environmental Sciences program is linked to the Rutgers Cooperative Extension Water Resources Program, which focuses on issues that are important to New Jersey, including stormwater management and water resources for sustainable communities (http://water.rutgers.edu/).<br>http://envsci.rutgers.edu/programs/envsci_grad.shtml |

| Institution | Field | Program | Degrees Offered | Curriculum Description/Website |
|---|---|---|---|---|
| Texas A&M University, College of Geosciences | Science | Water Management and Hydrologic Science Interdisciplinary Graduate Program | Master of Water Management (Non-Thesis), Master of Science, PhD | This program was designed to integrate diverse disciplines in water management and hydrologic science with the goal of educating the next generation of water managers and scientists. The curriculum addresses the following research areas: climate variability/change, economics of water, stormwater management, water management/policy analysis, water resources planning, and others.<br>http://geosciences.tamu.edu/academics/degrees |
| University of Nevada, Las Vegas | Science | Program in Water Resources Management | MS | An interdisciplinary course of study leading to a Master of Science degree, this is a technically and scientifically based program that blends the physical aspects of the hydrologic sciences with policy and management issues. Students take classes and conduct research with faculty in the Colleges of: Sciences, Business, Urban Affairs, Engineering, and Liberal Arts, plus the Boyd School of Law and the Desert Research Institute.<br>http://www.unlv.edu/sciences/wrm/ |
| University of Wisconsin-Madison, The Nelson Institute for Environmental Studies | Science | Water Resources Management Program | MS | Interdisciplinary program where students can design their own areas of specialty. Courses must be selected from at least the following categories: natural science and technology, water resources institutions and public decision-making processes, and analytical and design tools in water resources.<br>http://www.nelson.wisc.edu/graduate_degrees/wrm/ |
| University of Florida | Science, Engineering, Policy | Hydrologic Sciences Academic Cluster | MS, PhD | The Academic Cluster for graduate studies in Hydrologic Sciences is an interdisciplinary teaching program designed to broaden the skills of science and engineering students who are interested in all aspects of water (occurrence and quantity, distribution, circulation, quality, and management/policy).<br>http://hydrology.ufl.edu |
| University of New Mexico | Science, Policy | Program in Water Resources | Master in Water Resources (MWR) | The MRW program is designed to encourage a multidisciplinary approach to learning. Students enter the program from a wide variety of undergraduate programs, and take classes and conduct research with faculty in the Colleges of Sciences, Business, Urban Affairs, and Engineering.<br>http://www.unm.edu/~wrp/ |

| Institution | Field | Program | Degrees Offered | Curriculum Description/Website |
|---|---|---|---|---|
| University of Idaho | Science, Policy, Engineering | Waters of the West Program | MS, PhD | Students can earn interdisciplinary master's and doctoral degrees in water resources in one of three emphases: engineering & science; science & management; or law, management & policy. Students can also earn a concurrent law and water resources degree (JD/M.S. or JD/PhD).<br>http://www.water.uidaho.edu/ |
| Pratt Institute | Urban Planning | School of Architecture, Programs for Sustainable Planning & Development | MS in Environmental Systems Management | Program focuses on participatory planning and sustainable development and stresses an interdisciplinary approach. Classes include: Environmental Law, Planning for Sustainable Communities, The Science of Sustainability, Environmental Economics, Solid Waste, Water Quality & Energy Policy, Environmental Impact Assessment, Sustainable Business Studio, Sustainable Community Planning, Green Development, and Sustainability Indicators.<br>http://www.pratt.edu/academics/degrees/graduate/urban_environmental_systems_management_ms/ |

# REFERENCES


AAEE (American Academy of Environmental Engineers). 2009. Environmental Engineering Body of Knowledge. Prepared by The Environmental Engineering Body of Knowledge Task Force.

AMA (American Management Association). 2007. *Creating a Sustainable Future: A Global Study of Current Trends and Possibilities 2007-2017.* New York: American Management Association.

AMSA and AMWA. 2005. Thinking, getting, staying competitive: A public sector handbook. Washington, DC: Association of Metropolitan Sewerage Agencies.

Aspen Institute. 2009. *Sustainable Water Systems: Step One - Redefining the Nation's Infrastructure Challenge.* Washington, DC: The Aspen Institute.

Benn, Suzanne, Dexter Dunphy and Andrew Griffiths. 2006. Enabling change for corporate sustainability: An integrated perspective. *Australasian Journal of Environmental Management*. Volume 13: 156-165.

Brown, R. 2005a. Impediments to integrated urban stormwater management: The need for institutional reform. *Environmental Management*. 10.1007/s00267-004-0217-4.

Brown R. 2005b. Local Institutional Development and Organizational Change for Advancing Sustainable Urban Water Futures. Keynote Address in Proceedings of the International Conference on Water Sensitive Urban design: Cities as Catchments, 21-25 November 2004, Adelaide, Australia.

Bryman, A., D. Gillingwater, and I. McGuinness. 1996. Leadership and organizational transformation. *International Journal of Public Administration*, 19(6):849-872.

BusinessDictionary.com. Available: http://www.businessdictionary.com/definition/organizational-culture.html#ixzz1mZ6urS9D. Accessed: 2/16/2012

Daily, Bonnie and Su-chun Huang. 2001. Achieving sustainability through attention to human resource factors in environmental management. *International Journal of Operations & Production Management*. 21(12): 1539-1552.

Davenport, Thomas. 1997. Information Ecology. New York: Oxford University Press

Denison, D., S. Hart, and J. Kahn. 1996. Chimneys to cross-functional teams: Developing and validating a diagnostic model. *The Academy of Management Journal*, 39(4):1005-1023.

Electric Power Research Institute. 2010. *Sustainable Water Resources Management*, Vol. 1, Executive Summary and Vol. 3: Case Studies on New Water Paradigm. Palo Alto, CA: Electric Power Research Institute.

Farrelly M and Brown R. 2011. Rethinking urban water management: Experimentation as a way forward? Global Environmental Change. 21(2011): 721-732.

Fund, J. 2010. Disruptive questions for New York: Interview with Stephen Goldsmith. *The Wall Street Journal*. Saturday/Sunday, July 31 – August 1, 2010. Page A9.

Funfgeld, H. 2010. Institutional challenges to climate risk management in cities. *Current Opinion in Environmental Sustainability*, 2:156-160.

Goldsmith, S. 2010. *The Power of Social Innovation.* San Francisco, CA: John Wiley and Sons.

Gouillart, F., and J. Kelly. 1995. *Transforming the Organization.* New York: McGraw-Hill.

Hammer, M. 2007. The process audit. *Harvard Business Review*. April.

Hartley, J., J. Benington, and P. Binns. 1997. Researching the roles of internal-change agents in the management of organization change. *British Journal of Management*, 8(1):61-73.

Henriques, I., and N. Roome. 1994. *A case study of Ontario Hydro: A strategy for sustainable energy development and use.* Ontario: York University.

Hunt, C., and E. Auster. 1990. Proactive environmental management: Avoiding the toxic trap. *Sloan Management Review*. 31:7-18.

Lienert, J., J. Monstadt, and B. Truffer. 2006. Future scenarios for a sustainable water sector: A case study from Switzerland. *Environmental Science and Technology*, 40(2): 436-442.

Mallak, Larry and Harold Kurstedt. 1996. Understanding and using empowerment to change organizational culture. *Industrial Management*. Nov-Dec.

Miles, R. 2010 Accelerating corporate transformations. *Harvard Business Review*. January-February:69-75.

NRC (National Research Council). 1997. *Enhancing Organizational Performance.* Washington, DC: National Academy Press.

Oxtoby, B., T. McGuinness, and R. Morgan. 2002. Developing organizational change capability. *European Management Journal*, 20(3):310-320.

Pahl-Wostl, C., M. Craps, A. Dewulf, E. Mostert, D. Tabara, and T. Taillieu. 2007. Social learning and water resources management. *Ecology and Society*. 12(2).

Peterson, R. 1997. A directive leadership style in group decision making can be both virtue and vice: Evidence from elite and experimental groups. *Journal of Personality and Social Psychology*, 72(5):1107-1121.

Porter, M. 1980. *Competitive Strategy*. New York: The Free Press.

Post, J., and B. Altman. 1991. Corporate environmentalism: The challenge of organizational learning. Paper presented at *Academy of Management*: Miami Beach, FL.

Prahalad, M., and G. Hamel. 1990. The core competence of the corporation. *Harvard Business Review*. May-June:79-91.

Schein, E. 1984. Coming to a new awareness of organizational culture. *Sloan Management Review*, 25(2):3-16.

Senge, P. 1990. *The Fifth Discipline: The Art and Practice of the Learning Organization*. New York: Doubleday.

Shrivastava, P., and S. Hart. 1995. Creating sustainable corporations. *Business Strategy and the Environment*. 4:154-165.

Siebenhuner, B., and M. Arnold. 2007. Organizational learning to manage sustainable development. *Business Strategy and the Environment*, 16:339-353.

Uren, S. 2010. Seven tips for creating a sustainable business model. *Environmental Leader*, November 8, 2010.

U.S. Environmental Protection Agency. 2005. Summary: Meeting with Utility Leaders on Sustainable Management. Washington, DC, July 27-28, 2005.

Vogel, C., S. Moser, R. Kasperson, and G. Dabelko. 2007. Linking vulnerability, adaptation, and resilience science to practice: Pathways, players, and partnerships. *Global Environmental Change*, 17:349-364.

Walker, B., and D. Salt. 2006. *Resilience Thinking*. Washington, DC: Island Press.

Wenger, E., and W. Snyder. 2000. Communities of practice: The organizational frontier. *Harvard Business Review*, January-February: 139-145.

Wilby, Robert and Kit Vaughan. 2010. Hallmarks of organizations that are adapting to climate change. *Water and Environment Journal*. Doi:10.111/j. 1747-6593.2010.00220.x.

Wirtenberg, J., W. Russell, and D. Lipsky. 2008. *The Sustainable Enterprise Fieldbook.* New York: Greenleaf Publishing (in association with the American Management Association).

Zheng, W., B. Yang, and G. Mclean. 2010. Linking organizational culture, structure, strategy, and organizational effectiveness: Mediating role of knowledge management. *Journal of Business Research*, 63(7):763-771.

# SELECTED RESOURCES

The following resources provide useful information on sustainability planning, implementation, technologies and approaches, and related topics.


Adams, J. 2003. Successful change: Paying attention to the intangibles. OD Practitioner, 35(4):3-7.

Albuquerque Bernalillo County Water Utility Authority, 2007**.** *Water Resources Management Strategy.*

Alder P, Heckscher C, and Prusak L. 2011. Building a collaborate enterprise. *Harvard Business Review*. July-August: 95-101.

American Rivers. 2009. Natural Security: How Sustainable Water Strategies are Preparing Communities for a Changing Climate. Washington, DC. http://www.americanrivers.org/our-work/global-warming-and-rivers/infrastructure/natural-security.html.

Austin Water Utility (AWU). 2009. Water Conservation in Austin: An Overview and Update for CMO and Council. June. http://www.ci.austin.tx.us/water/downloads/waterconservationreport.pdf.

Awwa Research Foundation. 2005. Customer Acceptance of Water Main Structural Reliability.

Bate, T., K. Sands, and K. Shafer. 2008. *Building a Sustainable Region, One Drop at a Time.* Washington, DC: Water Environment Federation.

Centers for Disease Control and Prevention, Office of the Associate Director for Communication. 2010. The Health Communicator's Social Media Toolkit. August 6.

City of Philadelphia, Mayor's Office of Sustainability. 2009. *Greenworks Philadelphia*. http://www.phila.gov/green/greenworks/.

Clements T, D'Amato V, and Taylor T. 2010. Integrating water infrastructure for sustainable, resilient communities. WEFTEC 2010: Washington, DC: Water Environment Federation.

Douglas M. 1986. How Institutions Think. London: Routledge & Kegan Paul.

Farrelly M and Brown R. 2011. Rethinking urban water management: Experimentation as a way forward? *Global Environmental Change*. 21(2011): 721-732.

Institute for Sustainable Infrastructure and Zofnass Program for Sustainable Infrastructure at the Harvard University Graduate School of Design. 2012. envision™ Sustainability Rating System. Available: http://www.sustainableinfrastructure.org/rating/index.cfm. Accessed: June 16, 2012.

Hughes, T. 1987. The evolution of large technical systems. In *The Social Construction of Large Technological Systems*. Edited by W. Bijker, T. Hughes, and T. Pinch. Cambridge, MA: MIT Press.

Jones Christensen L, Peirce E, Hartman L, Hoffman W, and Carrier J. 2007. Ethics, CSR, and sustainability Education in the Financial Times top 50 global business schools: Baseline data and future research directions. *Journal of Business Ethics*. 73: 347-368.

Judge W and Elenkov D. 2005. Organizational capacity for change [OCC] and environmental performance: An empirical assessment of Bulgarian firms. *Journal of Business Research*. 58: 893-901.

Marshall J, Coleman G, and Reason P. 2011. *Leadership for Sustainability: An Action Research Approach*. Sheffield, UK: Greenleaf Publishing Ltd.

Marshall J and Toffel M. 2005. Framing the elusive concept of sustainability: A sustainability hierarchy. *Environmental Science & Technology*. 39(3): 673-682.

Moore J. 2005(a). Barriers and pathways to creating sustainability education programs: Policy, rhetoric and reality. *Environmental Education Research*. 11(5): 537-555.

Moore J. 2005(b). Is higher education ready for transformative learning: A question explored in the study of sustainability. *Journal of Transformative Education*. 3(1): 76-91.

Moser, S. and Dilling, L. 2007. Creating a Climate for Change: Communicating Climate Change and Facilitating Social Change. Cambridge, U.K., Cambridge University Press.

Nelson, V. 2008. Public Education and Outreach Strategies in Decentralized Wastewater Management. Coalition for Alternative Wastewater Treatment.

Parsons, T. 1951. The Social System. Glencoe IL: The Free Press.

Philadelphia Water Department. 2009. *Green City Clean Waters: The City of Philadelphia's Program for Combined Sewer Overflow Control, A Long Term Control Plan Update*. September 1. http://www.phillywatersheds.org/what_were_doing/documents_and_data/cso_long_term_control_plan.

San Francisco Public Utilities Commission. 2011. Strategic Sustainability Performance on Goals and Objectives FY 2010/11. November. http://www.sfwater.org/index.aspx?page=166

San Francisco Public Utilities Commission. 2011. Strategic Sustainability Plan. March. http://www.sfwater.org/index.aspx?page=354

Schon D. 1983. *The Reflective Practitioner: How Professionals Think in Action*. New York: Basic Books, Inc.

Southern D, McMeekin, A, and Evans, D. 2011. *International Review of Behaviour Change Initiatives: Climate Change Behaviours Research Programme.* Scottish Government Social Research.

Spence A. and Pidgeon, N. 2009. Psychology, Climate Change & Sustainable Behaviour. *Environment: Science and Policy for Sustainable Development.* November-December.

Stratus Consulting. 2009. A Triple Bottom Line Assessment of Traditional and Green Infrastructure Options for Controlling CSO Events in Philadephia's Watersheds. Prepared for City of Philadelphia Water Department. August. http://www.michigan.gov/documents/dnr/TBL.AssessmentGreenVsTraditionalStormwaterMgt_293337_7.pdf

Sterman J. 2001. System dynamics modeling: Tools for leading in a complex world. *California Management Review*. 43(4): 8-25.

Tualatin Valley Water District, 2006. *Tualatin Valley Water District Sustainability Plan*. http://www.tvwd.org/about-us/practicing-sustainability.aspx.

Tualatin Valley Water District, 2006. Taking the Next Step: Tualatin Valley Water District's Journey toward Sustainability.

U.S. Environmental Protection Agency. 2012. Climate Resilience Evaluation and Awareness Tool (CREAT). Available: http://water.epa.gov/infrastructure/watersecurity/climate/creat.cfm. Accessed: June 16, 2012.

U.S. Environmental Protection Agency. 2008. *Ensuring a Sustainable Future: An Energy Management Guidebook for Wastewater and Water Utilities.* Office of Wastewater Management. http://www.epa.gov/region1/eco/energy/pdfs/guidebook_si_energymanagement.pdf.

U.S. Environmental Protection Agency. 2010. *Green Infrastructure Case Studies: Municipal Policies for Managing Stormwater with Green Infrastructure*. Office of Wetlands, Oceans and Watersheds. Washington, DC. August. http://www.epa.gov/owow/NPS/lid/gi_case_studies_2010.pdf.

U.S. Environmental Protection Agency. 2012. *Green Careers Curriculum Manual: Improving Access to Green Careers through Environmental Science and Engineering Programs at Historically Black Colleges and Universities.* A project of the U.S. EPA's Minority and Academic Institutions Initiative. January. http://www.epa.gov/osbp/mai_gccm.htm

U.S. Environmental Protection Agency. 2012. *Planning for Sustainability: A Handbook for Water and Wastewater Utilities.* Washington, DC. February. EPA-832-R-12-001. http://water.epa.gov/infrastructure/sustain/upload/EPA-s-Planning-for-Sustainability-Handbook.pdf.

U.S. Environmental Protection Agency. 2012. EPA's Clean Water and Drinking Water Infrastructure Sustainability Policy. Available: http://water.epa.gov/infrastructure/sustain/Clean-Water-and-Drinking-Water-Infrastructure-Sustainability-Policy.cfm. Accessed: June 16, 2012.

Vincent, Shirley. 2010. *Interdisciplinary Environmental Education on the Nation's Campuses: Elements of Field Identity and Curriculum Design.* National Council for Science and the Environment. June.

Walker B and Salt D. 2006 *Resilience Thinking*. Washington, DC: Island Press.

Water Corporation. 2008. Water Forever: Sustainability Assessment. http://www.watercorporation.com.au/~/media/Files/About%20us/Our%20strategies/Water-forever-50-year-plan.

Water Environment Federation. Proceedings of the Water Environment Federation, Sustainability 2008. http://www.ingentaconnect.com/content/wef/wefproc/2008/00002008/00000006

Water Sustainability Committee or the British Columbia Water & Waste Association. 2004 Water Sustainability Action Plan for British Columbia: Framework for Building Partnerships. February.

Welch C. 2010. *The Green Utility*. Denver, CO: American Water Works Association.

Wirtenberg J, Russell W, and Lipsky D. 2008. The Sustainable Enterprise Fieldbook. New York: Greenleaf Publishing (in association with the American Management Association).

Yale Project on Climate Change and George Mason University Center for Climate Change Communication. 2010. Global Warming's Six Americas. January.

Young O, King L, and Schroeder H. 2008. *Institutions and Environmental Change: Principal Findings, Applications, and Research Frontiers*. Cambridge, MA: The MIT Press.

# ABBREVIATIONS

| | |
|---|---|
| AMA | American Management Association |
| AMSA | Association of Metropolitan Sewerage Agencies |
| AMWA | Association of Metropolitan Water Agencies |
| AWWA | American Water Works Association |
| CSO | Combined Sewer Overflow |
| EPA | United States Environmental Protection Agency |
| GHG | Greenhouse Gas |
| GI | Green Infrastructure |
| HR | Human Resources |
| IT | Information Technology |
| LEED | Leadership in Energy and Environmental Design |
| NGO | Non-Governmental Organization |
| PERT | Program Evaluation and Review Technique |
| POU/POE | Point of use/point of entry |
| PWD | Philadelphia Water Department |
| ROI | Return on Investment |
| SCADA | Supervisory Control and Data Acquisition |
| SD1 | Sanitation District No. 1 |
| SSO | Sanitary Sewer Overflow |
| TBL | Triple Bottom Line |
| WCED | World Commission on Environment and Development |