Water Reuse Workshop

Proceedings Report

Prepared by Freshwater Society

July 2016

FOREWORD

Capitol Region Watershed District was proud to partner with Freshwater Society as a host for the May 2, 2016 Water Reuse Workshop.

In the last decade, there have been over 1,200 stormwater best management practices installed in Capitol Region Watershed District. Over 70% of those were green infrastructure practices but most noteworthy is that over 250 million gallons of stormwater is treated by these practices.

In the last many years there have been some unprecedented events around water, including:

- Clean Water Land and Legacy Act
- White Bear Lake water levels
- 500 Year flood in Duluth
- Groundwater Management Areas
- Buffer Initiative, parts 1 and 2!
- Flint, Michigan
- Governors Water Summit
- Water Action Week

These are exciting times to be working in the water sector. So why reuse? Water reuse is becoming the nexus between the traditional stormwater, surface water, watershed community and the groundwater and drinking water community. These groups have been in silos too long. We have had the luxury in Minnesota because of our abundance of largely separate surface water, drinking water and waste water.

Water reuse brings all of this together.

As the Met Council Stormwater Reuse Guide so aptly points out: Two water problems are emerging in urban areas, including the Twin Cities: excessive stormwater runoff is degrading our surface waters, and water treatment plants are undergoing costly expansions. These may seem to be unrelated problems, yet there is a common solution.

So what is water reuse? Reusing water for a second time, or more. When we think of water reuse the basic challenges are what is the source? And what is the use?

We hope the outcomes of the workshop and report can continue to improve the likelihood and success of water reuse in Minnesota. I say this because our grandchildren are counting on it!

Mark Doneux
District Administrator
Capitol Region Watershed District

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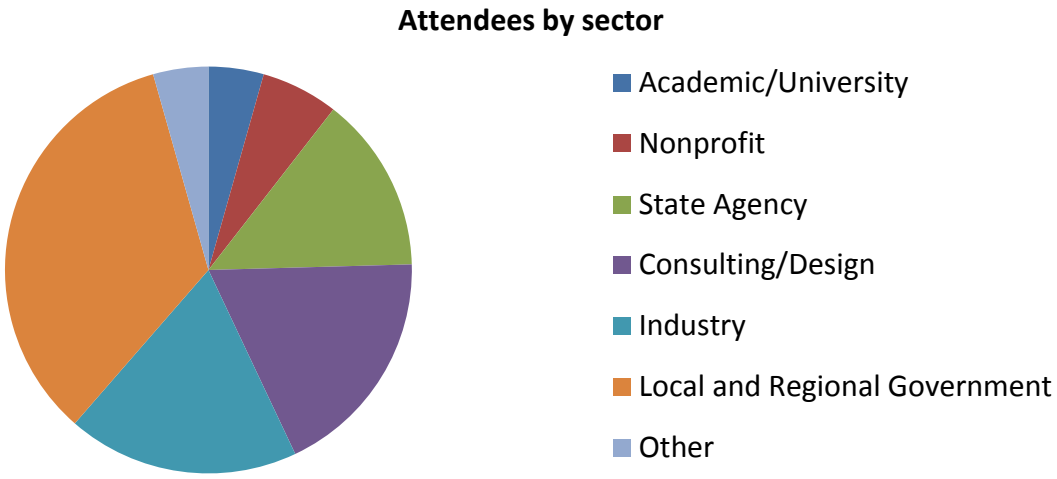
Cover photo: Water used for irrigation of CHS Field is treated rainwater collected from the adjacent roof. The picture was included in the presentation on CHS Field's water reuse system given by Wes Saunders-Pearce, Water Resources Coordinator for the City of Saint Paul.

PART 1: Workshop Summaries

Minnesotans require reliable water supplies for drinking, hygiene, irrigation, and many commercial and industrial uses. Yet despite our state's reputation for abundant waters, in some places water resources are being drained faster than they are being replenished. Reusing water is a promising strategy for helping us to meet current and future water demands and cope with the potential impacts of climate change. Reuse as a strategy for conserving and extending water supplies is gaining momentum across sectors. Nevertheless reuse projects still face multiple hurdles and it can be difficult to get them permitted and built.

Water reuse encompasses a variety of possible sources, as well as a wide range of possible end uses. Sources include rainwater (the "cleanest" source) to stormwater (encompassing a range of quality) to wastewater (the "dirtiest"). End uses include industrial cleaning, landscape irrigation and other non-potable outdoor uses, with potable water requiring the highest standard and assurance of purification. Expanding reuse in Minnesota is complicated by the number of factors that determine quality of water sources, the variable quality requirements for differing end uses, and the confusing overlap of jurisdictions among the agencies and local governments that oversee regulations and policies affecting water use projects.

Recognizing that Minnesota is behind other states in pursuing and building reuse projects, Freshwater Society and Capitol Region Watershed District hosted a Water Reuse Workshop on Monday May 2, 2016, at CHS Field in Saint Paul, Minnesota. More than 120 professionals from various sectors came together for a conversation to identify barriers to reuse, and solutions to overcoming them.



In the following section, summaries of speakers' presentations give an overview of the issues involved in reuse, the barriers projects and developers face, and strategies for overcoming those barriers. The pictures on each page were selected from the each speaker's presentation. A more detailed look at the projects presented as case studies begins on page 22.

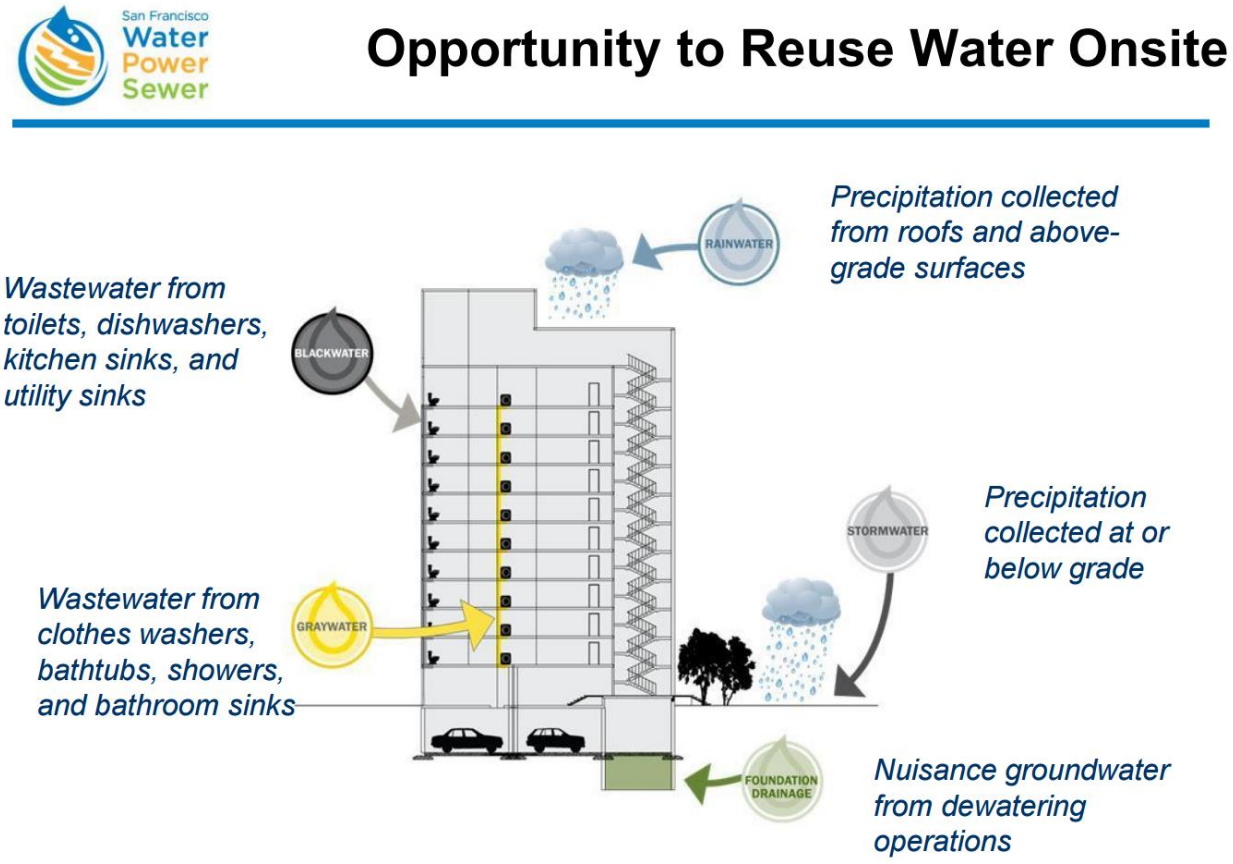
San Francisco's Non-Potable Water Program

Paula Kehoe, Director of Water Resources, San Francisco Public Utilities Commission

Paula Kehoe is responsible for diversifying San Francisco's local water supply portfolio through the development and implementation of conservation, groundwater, and recycled water programs. Paula spearheaded landmark legislation allowing for collection, treatment, and use of alternate water sources for non-potable end uses in buildings and districts within San Francisco.

Summary of remarks:

San Francisco's PUC is focused on managing water and sewer infrastructure, filtering stormwater and wastewater, and supplying water to 2.6 million people.



San Francisco is spearheading efforts to promote onsite water reuse from various sources

San Francisco enacted a limited water reuse ordinance in 1991. Several more have followed, including the 2015 mandate that any new development greater than 250,000 square feet must utilize onsite reuse systems for all non-potable water. In addition, any irrigated landscape over 10,000 square feet must use recycled water. Reuse systems may utilize rainwater, stormwater, graywater, or wastewater sources. San Francisco's approach is both decentralized and centralized – with individual onsite water systems operating within a broader centralized infrastructure. Many challenges were encountered in the course of expanding water reuse including the questions

of: who sets water quality standards for onsite systems; who should issue permits and provide operational oversight; and how to move forward in the absence of state or national standards or guidelines.

San Francisco's successful expansion of water reuse is attributed to a number of factors:

- Over 50 percent of residential and almost 95 percent of commercial water usage doesn't require potable water
- Several significant successful project models, including the new PUC building that includes onsite treatment of rainwater, graywater, and blackwater have reduced potable water consumption in the building by 65 percent
- PUC has made significant investment in stakeholder outreach, in particular with developers and plumbers
- A change in California plumbing code that incorporated graywater and rainwater end uses and water quality standards, and provided construction requirements for reuse systems
- San Francisco Department of Health is acting as a regulator, developing water quality standards, issuing permits, and requiring ongoing reporting
- SFPUC provides technical assistance and financial assistance to projects
- There is recognition that citizens may be more supportive than we give them credit for, if told the facts about water supply, aging infrastructure, and costs
- SFPUC proactively planned for revenue adjustment through better projections, and better estimating demand to set rates

SFPUC has also taken the lead in instigating a national conversation regarding onsite water reuse systems including focus on how we handle these decentralized systems from a public agency perspective. There is a need for management and oversight programs, consistent water quality standards, and monitoring criteria. San Francisco planners developed a blueprint for onsite water reuse systems and a public health collaborative tasked with generating health risk-based recommendations for performance criteria and end use applications.

Water Reuse in Minnesota

Anita Anderson, Water Engineer, Minnesota Department of Health

Anita Anderson has 20 years of experience as a water supply engineer with the Minnesota Department of Health (MDH). Her primary area of expertise is surface water treatment, specializing in small systems. Currently she is also working on special projects to implement water reuse in Minnesota in a safe and sustainable way and to predict the vulnerability of groundwater-sourced drinking water to microbial pathogens. She holds a Master's in Environmental Engineering from University of Minnesota and is a registered professional engineer in Minnesota.

Summary of remarks:

Reuse is possible in Minnesota, but is not necessarily easy. The Minnesota Water Sustainability Framework calls for state agencies to plan for reuse. In this context, the Water Reuse Interagency Workgroup (WRIW) was formed to develop recommendations for best practices and policies for water reuse in Minnesota, with MDH acting as project sponsor and fiscal manager. The WRIW will explore both regulatory and non-regulatory approaches, and recommendations will be published in 2017. In developing its recommendations, the WRIW will undertake research to evaluate current regulations, practices, and barriers, as well as to determine acceptable health risks and performance standards.

Variations in treatment needs based on quality of the water source

Barriers to water reuse include: cost; lack of clarity about operations and maintenance; the need to update regulations and codes; lack of design standards; and contractor unfamiliarity.

Regarding regulation and code issues, there are multiple challenges:

- The current model in which water management is spread across multiple agencies is problematic because water reuse crosses over current agency silos/lines
- Current statutes were not written with water reuse in mind
- There is a lack of national regulations
- There is a lack of base federal funding
- Conflicting information and advice among available guidance documents leads to confusion and hesitancy
- There is a lack of public health and resource risk data
- Expertise is not always in the designated area of authority (e.g. graywater falls under the plumbing code not because of the content of the water but because of the method of conveyance)
- There are many competing priorities with regard to water, and relatively low demand for reuse

Three R's of Hugo's Stormwater Management Plan
Bryan Bear, City Administrator, City of Hugo

Bryan was appointed as the City Administrator for the City of Hugo, Minn. in November of 2011. Bryan came to the City of Hugo in 2004 and served as the city's Community Development Director for almost eight years. Prior to joining the City of Hugo, he worked for the City of Overland Park, Kansas as a Senior Planner in a large, rapidly growing suburb of Kansas City. Bryan holds a B.A. in Geography and Geology from Gustavus Adolphus College in St. Peter, Minn.

Summary of remarks:

Water reuse in Hugo has been driven by public awareness of groundwater issues, the White Bear Lake water level crisis, and the establishment of the North and East Metro Groundwater Management Area by the DNR. In response, the city council passed a "reduce, reuse, and replenish" policy directive. They also adopted an Integrated Water Management model, connecting the plans for the varying aspects of water to each other. This approach has allowed the city to plan to use stormwater as a source to offset the demand on groundwater.

The primary focus for reuse in Hugo has been residential irrigation as residences are the largest consumer of water in Hugo. However, site-by-site stormwater reuse projects were impractical, so a partnership with Oneka Ridge Golf Course was formed to manage a greater quantity of runoff. A pond on the golf course collects stormwater from the adjacent neighborhood, and then uses that water for irrigation. Stormwater presents a good reuse opportunity because management is also key to flood control and surface water quality.

Hugo's Integrated Water Management Model

As new developments are proposed, stormwater reuse is being considered. Retrofits are also being pursued to connect irrigation systems of existing developments to these new stormwater supplies.

Barriers to reuse identified in Hugo:

- Small, site-by-site reuse projects are impractical and expensive
- The process for obtaining DNR appropriations permits is long and cumbersome
- People are concerned that pumping water out of the stormwater ponds will impact their aesthetic quality
- The best structure for managing and operating these systems is still being worked out
- Health and safety standards are not clear
- It is unclear how to pay for installation, maintenance and replacement
- Need for infiltration is at odds with stormwater reuse systems
  Conservation language (limits on water use) is not conducive to systems focused on removing stormwater from the landscape

Unpacking the Partnership Process for Rainwater Harvesting at CHS Field
Wes Saunders-Pearce, City of Saint Paul – CHS Field

Wes Saunders-Pearce is the Water Resource Coordinator for the City of Saint Paul. He joined Saint Paul in 2011 after practicing water resource management for over a decade mainly as a consultant. Wes works across departments to provide leadership for green infrastructure, water resource protection, and climate resiliency strategies. Wes received the 2014 Sustainable City Staff award for his collaboration and leadership in environmental stewardship. Wes holds a Master's degree in Water Resource Science from the University of Minnesota and an undergraduate degree in Environmental Studies from Macalester College in Saint Paul.

Summary of remarks:

CHS Field is an excellent model of a successful rainwater harvest and reuse system, collecting rainwater from the building's roof canopy and the adjacent Metropolitan Council transit facility and utilizing it for toilet flushing and field irrigation. In addition to its technical success, the project's development process offers a model of successful public/private collaboration among the various partners including Capitol Region Watershed District, Metropolitan council, Metro transit, St. Paul Saints, St. Paul Parks and Rec, and Ryan companies. These partners recognized the tremendous potential and value of the project due to the site's public visibility, with 400,000 annual visitors, and its geographical significance near the Mississippi River. In addition, this development was recognized as an opportunity to create "the greenest ballpark in America."

Rainwater is collected from the Metro Transit roof on the lower right for toilet flushing and irrigation at the stadium in the upper left.

Key lessons learned in project development:

- Get mechanical engineers involved early in planning
- Adjust as you go to account for demand and available supply: At first only the roof canopy was considered for rainwater capture, but that would only meet toilet-flushing needs, not irrigation; then capturing rainwater from entire four-acre building was considered; finally a hybrid approach: taking water from adjacent Met Transit building for closest toilet area, offsetting field irrigation demand by 20%
- Learn from others: The planning team toured the University of MN 17th Ave. dorm, which is a very different type of system, but helped the group think about the problem-solving process

Significant barriers:

- Originally there were no standards, but some exist now after the January 2016 plumbing code changes
- There was no defined process to guide developers and planners through planning and design
- Talking about the standards was very difficult, as there was little known about what was needed
- Arranging for the sharing of runoff between buildings was very complicated, taking months to figure out
- Initial operation and maintenance troubleshooting was difficult as no one had done this before

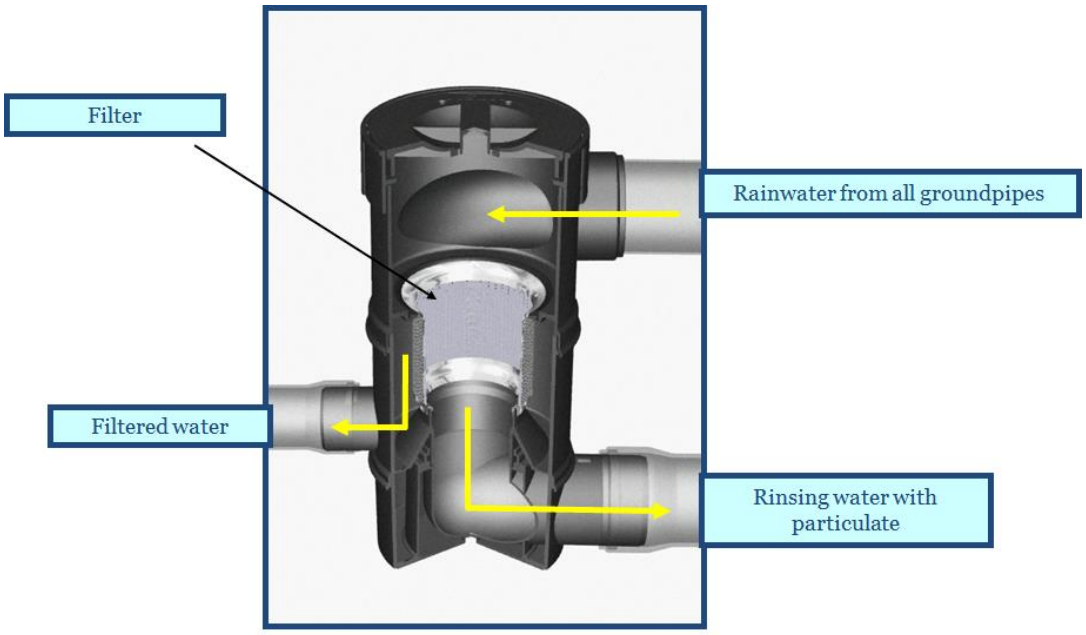
Project Planning and Implementation for Rainwater Harvesting Projects

Dave Stark, Stark Rainwater Harvesting

Dave Stark is the owner of Stark Rainwater Harvesting and is a regional representative and accredited professional of the American Rainwater Collection System Association. He works with commercial and residential teams and homeowners to design and install rainwater collection systems. He consults on integrated water cycle management and is involved in a variety of local water quality, hydrology, and restoration projects in the Lake Superior area.

Summary of remarks:

Stark Environmental specializes in rainwater harvesting and stormwater management, in recognition of the fact that less than 50% of individual American water usage requires purification. Activities such as toilet flushing, clothes washing, and garden or yard irrigation are ideal uses for rainwater.



Innovations such as this pre-tank treatment system can help make it easier to meet end-use quality requirements

Several key project planning steps for rainwater harvest installations have been identified:

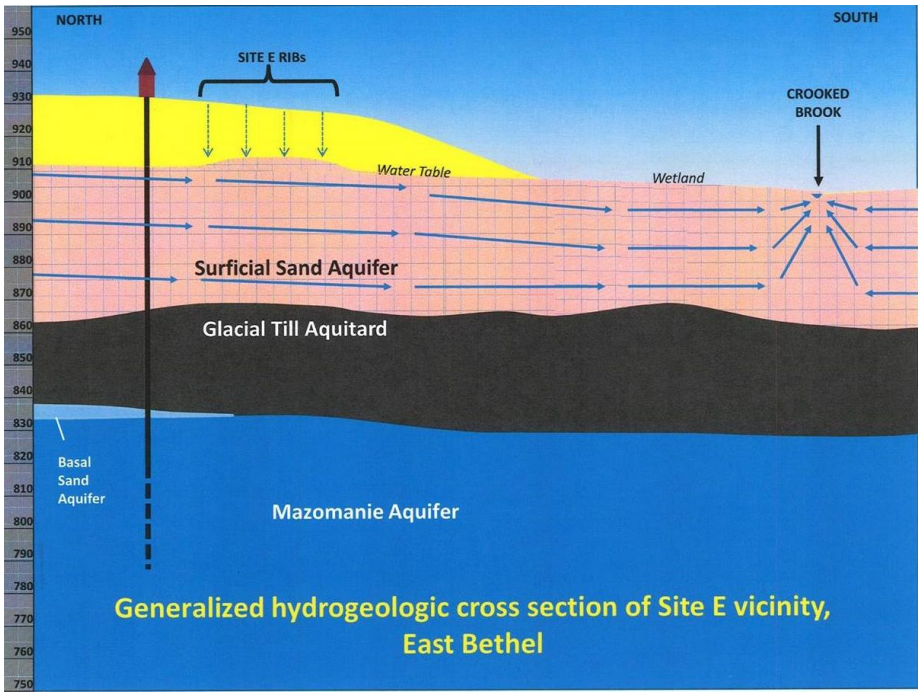
- Estimate the cost of systems before starting and identify operational needs. For example, pre-filtration before water enters tank can be challenging but can save significantly on tank-cleaning costs once system is operational. Pre-filtering makes it easier to meet end-use quality requirements
- Clarify demand and supply issues in order to understand whether balance can be achieved, and size your tank and system accordingly
- Implement conservation measures, including smart controls on irrigation, water sense fixtures
-

Project Planning and Implementation for Wastewater Reuse Projects
Deborah Manning, Principal Engineer, Metropolitan Council

Deborah Manning is a Principal Engineer with Metropolitan Council's Environmental Services, with a Bachelor's and Master's in Civil and Environmental Engineering from Virginia Tech. Throughout her career, she has worked with water and wastewater utilities to meet upcoming regulatory, system expansion, and level of service requirements. She is a proud member of the Select Society of Sanitary Sludge Shovelers.

Summary of remarks:

Water reuse is increasing in Minnesota, and across North America. The Metropolitan Council is in a unique position to lead through working with partners to develop regional water plans, conducting feasibility studies, providing grants, and offering guidance such as that included in the Master Water Supply Plan and the Stormwater Reuse guidelines.



Interaction between surface and groundwater is an important consideration for water reuse.

The Metropolitan Council is also motivated to lead by example and has implemented water reuse in some of their own plants. For example, they have developed the East Bethel water reclamation facility. This is a small plant but treats to a quality level that surpasses permit requirements, in order to protect local groundwater quality.

Barriers:

- Cost—wastewater reuse costs significantly exceed typical revenues collected in the Twin Cities where water rates are around $1-$5 per 1,000 gallons, while the cost of wastewater reuse would come to more like $5-$10 per 1,000 gallons
- The benefit of groundwater protection needs to be quantified in order to get a true cost comparison
- Wastewater treatment plants aren't designed to remove total dissolved solids, sodium, and chloride

The Purified Water System

Paul Helgeson, Sustainability Manager, GNP Company

Paul Helgeson joined GNP Company as its Sustainability Manager in 2010. At that time he represented the fourth generation in the family-owned chicken business, which is best known for its Gold'n Plump brand of fresh poultry products. He helped to define an environmental mission for the organization "to focus on lessening the impacts across the entire supply chain, making positive change in the areas we directly control while proactively expanding our influence in the areas we don't." Under his leadership, GNP Company participated in the World Resources Institute GHG Product Road Test to help set a worldwide standard for measuring a products life-cycle-impact on the environment. He also led an effort in which the company partnered with the Carbon Trust to measure, report and reduce the carbon impact of the company's Just BARE® branded retail products. He also initiated the publishing of the company's "Farm to Fork Report", which outlines the company's goals and values related to the 4 P's of sustainability which he helped develop: People, Planet, Poultry and Progress. Helgeson has a Bachelor's degree in Business Administration from the University of Denver. He earned his Masters of Business Administration from the University of Minnesota's Carlson School of Business Management.

Summary of remarks:

GNP is a values-based, nationally competitive company, which has implemented reuse through a "purified water system" (PWS) at its Cold Spring processing facility. The facility uses approximately 1.2 million gallons of water daily, and treats and reuses 25% of that in non-food-contact areas including irrigation, compressor cooling, and truck washing.

Due to the scale of the facility, investments in water reuse and sustainability were made, and many benefits from reuse implementation were identified, including: supporting Governor Dayton's water protection goals; helping GNP to meet their climate protection goals; creating an operational model for the agriculture industry and other private industries. GNP feels that their efforts have helped to highlight an important area of opportunity for Minnesota—engaging the agricultural industry in water protection goals and opportunities.

GNP's state of the art water treatment system

Barriers:

- GNP is a food producer, not a water utility or technology company; this is not a core part of the business, so it can be challenging to prioritize if the process is difficult
- There are a number of competing demands for time and money
- Customers haven't placed a high value on environmental sustainability

PART 2: Workshop Outcomes

Over the course of the day, attendees were asked to identify and prioritize the barriers to reuse they encountered in their work. Their responses pertained predominantly to rainwater and wastewater sources. The top five barriers for each of these sources, as identified by the attendees, were:

Rainwater	1. Cost is high, and potable water is inexpensive
	2. Lack of state or national policies/guidelines for oversight and management of decentralized non-potable water systems
	3. Lack of water quality/performance standards for decentralized water systems
	4. Water appropriations permits and reporting processes are discouraging
	5. Not enough public health or risk data
Wastewater	1. Cost is high, and potable water is inexpensive
	2. Treatment requirements are not in line with use
	3. High chlorides in treated wastewaters is a challenge for industrial reuse
	4. Lack of state or national policies/guidelines for oversight and management of decentralized non-potable water systems
	5. Lack of water quality data on alternate water sources

These barriers became the focus for an interactive work session at the end of the day, in which participants were invited to discuss in small groups what strategies were needed to get past the identified barrier, and who should be at the table as we do this work.

Attendees identified that the most significant barriers to reuse are matters of policy more than of technology or perception. It is fitting, then, that the strategies offered for moving past those barriers are also largely focused on addressing policy and regulations. While the problems are clearly complex, common threads exist across strategies that delineate categories of both reuse-related challenges and the necessary action steps that must be taken to advance reuse in Minnesota. We identified the following categories:

- **Fill in knowledge gaps**: While the science and technology involved in designing, operating, and monitoring water reuse projects are largely known, there remain some things we need to understand better.
- **Update and streamline regulation**: There is a need for clear standards that reflect the nuances of reuse and are set at an appropriate scale of governance, and a need to advocate for ordinances and codes that ensure those standards are met.
- **Compel action**: There is a need for clearer information on the benefit and need for reuse to share with decision makers, developers, planners, and the community so as to generate greater public will to expand reuse in Minnesota.

This final section of these proceedings explores each of these action categories in greater detail, using case studies to illustrate needs and opportunities.[1]

[1] Freshwater Society will be publishing a report on how to make more efficient use of existing water supply in Minnesota later this year, containing a chapter on water reuse that will continue the exploration of this topic.

Getting started: appreciate the nuances

Both speakers and participants clearly emphasized that before barriers can be addressed in order to advance water reuse, it is necessary to understand and clarify the many nuances that exist related to end use, source, and jurisdictional oversight. Within each of these areas, there is a balance that must be struck between risk and risk management. Source treatment approaches and the water quality standard for the end use are based on risk. In determining approaches, we must ask "what is the potential for adverse human health impact, given the intended use?" What pathogens may be present in the source water? What is the likelihood that people could come into contact with those pathogens? How can regulation and policy appropriately protect environmental and human health given what is known about source and use? Our ability to clarify and promote appreciation of these nuances is fundamental to encouraging reuse as a strategy that makes best use of existing supplies.

Recognize differences in end use

In a typical community water supply system, there is a single delivery (pipe) infrastructure and all water is treated to potable (drinking water) standards before entering the system. In other words, the water used to water lawns, flush toilets, and wash laundry all gets cleaned to the same level as water for drinking, and is delivered through the same pipes regardless of how it is used. However, treatment does not need to be equal across all uses.

At this time, with guidance from the Minnesota Pollution Control Agency, the Minnesota Department of Health has identified three levels of minimum treatment standards for reuse of wastewater:

TREATMENT FOR END USE: ONEKA RIDGE AND GNP

Oneka Ridge Golf Course irrigates the golf course using a stormwater pond that manages runoff from 915 acres of land. Golf course irrigation has less potential for human contact. With lower risk for the public, there are less treatment requirements.

GNP Company's reuse treatment facility treats effluent for use in everything from washing vehicles to irrigation around the property. They are piloting treatment to drinking water quality for use in food-contact areas.

These vastly different end uses demonstrate the need for different standards.

As new standards are set, ensuring that the standards reflect the nuances in end use will be key for ensuring projects are cost-effective.

Minimum Treatment	Types of Reuse
Disinfected Tertiary Secondary, filtration, disinfection	Edible food crops Irrigation of golf courses, etc. Toilet flushing Decorative fountains Cooling towers
Disinfected Secondary 23 Secondary, disinfection	Roadway landscaping Nursery stock Cleaning roads Industrial boiler feed
Disinfected Secondary 200 Secondary, disinfection	Fodder, fiber and seed crops Non-food bearing trees

However, while there is variety in treatment standards, their application in projects is not always in line with the end use. This causes friction through extra cost and delay—barriers identified at multiple points throughout the workshop.

Recognize differences in source

Similarly, different water sources contain different contaminants, and a one-size-fits-all approach to treatment is not appropriate. Contaminants of concern differ between rainwater, graywater, stormwater, and wastewater. Treatment standards also need to take into consideration the reuse water source.

Clarify differences in jurisdiction

Jurisdictional oversight of reuse projects in Minnesota is complex. While it is understood that there is and should be oversight of reuse projects, *who* is regulating for *what* and where there is overlap remains confusing at the start of projects, especially in communities new to reuse or implementing a new type of reuse. While agencies may see clear distinctions and understand their own role, the picture is less clear for those not involved in the regulation of reuse. This can lead to surprise, confusion, and frustration.

Generally in Minnesota, state agency involvement falls along the following lines:

- **Department of Health**: drinking water protection and when there is potential for human contact
- **Department of Labor and Industry**: when a project involves any amount of indoor plumbing or plumbing connections to outdoor facilities
- **Department of Natural Resources**: aquatic habitat protection, and the management of water quantity (including groundwater and surface water) through appropriation permitting
- **Minnesota Pollution Control Agency**: treatment and discharge of stormwater and wastewater

However, while these appear to be neat and clear jurisdictional divisions on paper, the clarity is lost in practice—especially for those attempting to navigate the regulatory system to get projects permitted and built. A combination of nuances leads to this lack of clarity. The factors that contribute to this complexity include:

- There are multiple water sources that can be used in reuse, and each source has a range of potential contaminants that may be involved
- There are multiple possible end uses with a range of purification requirements depending on type of use and potential for human contact
- Each component of the reuse system may involve different regulatory agencies

WATER SOURCE TREATMENT: CHS FIELD AND WASTEWATER TREATMENT PLANTS

CHS Field collects rainwater from the roof for use in irrigation and toilet flushing. Though rainwater is among the cleanest of reuse sources, it still contains many contaminants.

The requirements for the treatment of rainwater pale in comparison to those needed at wastewater treatment plants such as those managed by the Metropolitan Council. Treatment plants need to remove everything from human waste to chemicals and pharmaceuticals.

While the treatment needs are greater, the volume that can be treated is also greater and consistently available, making wastewater reuse an important option for augmenting drinking water supplies.

- Multiple agencies are tasked with managing sometimes-overlapping aspects of project planning, approval, implementation, and oversight
- There is no clearly defined process for getting a project permitted and built

The Water Reuse Interagency Working Group[2] has drafted information to help clarify and convey jurisdictional involvement in water reuse projects. We have adapted and expanded upon this information, and included it on the following page.

Ultimately, the conversation around nuances in water reuse centers on the need to understand and manage risk, while recognizing that not all water needs to be treated to drinking-water quality. Striking the balance between these would allow for water quality standards based on end use and more cost-effective and resource-efficient treatment of different sources, all while protecting public health.

REGULATING WATER: STARK RAINWATER HARVESTING

Nuances in end use affect the jurisdictions and codes involved.

Indoor use and combined systems are regulated by plumbing, health, and stormwater code. Outdoor use systems only apply stormwater code.

Further nuance enters into the picture when source is considered. These and other nuances are illustrated in the chart on the following page.

Establishing a defined process to permit and build reuse systems would remove a layer of uncertainty, increasing the confidence municipalities, planners, and developers feel in knowing that their efforts are in compliance with various codes and requirements, and that their projects are safe for their communities.

[2] The workgroup is comprised of representatives from Minnesota Departments of Agriculture, Health, Labor and Industry, and Natural Resources, Pollution Control Agency, Metropolitan Council, Plumbing Board, University of Minnesota Water Resources Center, and Board of Water and Soil Resources. The University of Minnesota will collect and analyze field data to support Minnesota-specific, cold-weather climate health risk assessment.

Nuances in the regulation of water reuse

The information below has been adapted with permission from a draft document of the Water Reuse Interagency Workgroup.

		Roles of Regulators at Different Points of a Reuse System				
		Source	**Capture/Storage**	**Treatment**	**Distribution**	**End Use**
Sources of Reuse Water	**Rainwater**	***Not explicitly regulated***	**DLI** regulates the drainage or collection from roofs and catchment systems.	**MDH** has broad authority over drinking water quality and public health in evaluating the safety of reuse systems. **DLI** has water quality treatment requirements for rainwater.	**DLI** regulates use within buildings and drainage systems. **DNR** regulates if volumes collected/used >10,000 gallons per day or one million gallons per year (some residential exceptions).	**MDH** regulates injection wells, has controls on infiltration in vulnerable DWSMAs, ERAs, and some WHPAs. **DLI** requires backflow preventers to prevent cross-contamination with potable water sources.
	Graywater	**DLI** administers plumbing code, which governs the design and installation of graywater systems as well as plumbing licensing requirements; all graywater systems require a variance. **County or City** issues permits for volumes < 10,000 gal/day.	**MPCA** regulates disposal of graywater as a component of wastewater, including specific technical requirements for septic tanks, pumps, dispersal in trenches, seepage beds, mounds, at-grade systems. **DLI** mandates that public sewer and water be used if available, requiring a variance for graywater projects.	***Lack of standardized treatment, though DLI can set treatment requirements through variance.***	**MDH** requires graywater disposal to be certain distances from wells. **DLI** requires graywater and backup systems to be separated through plumbing code for piping, make-up water, backflow provisions, cross connections, testing requirements, and setbacks.	**MDH** is involved only if the end use is potable, as drinking water standards would apply. **DLI** would require a variance for uses in buildings. **MPCA** regulates discharge to surface waters and land discharge (including irrigation), issues guidance on reuse.
	Stormwater	***Not explicitly regulated***	**MPCA** provides guidance in capture and storage of stormwater in the Stormwater Manual.	**MDH** is evaluating for the safety of common stormwater reuse installations.	**DLI** regulates use within buildings (and has broad authority to regulate stormwater conveyance systems, but does not regulate irrigation systems unless combined with indoor use. **DNR** regulates if volumes collected/used >10,000 gallons per day or one million gallons per year (some residential exceptions).	**MDH** regulates injection wells and infiltration in vulnerable DWSMAs, ERAs, and certain WHPAs. **DLI** requires backflow preventers and compliance with MDH well code to prevent cross-contamination. Stormwater use within buildings requires a variance. **MPCA** issues permits for stormwater discharge and infiltration.
	Wastewater	**MPCA** regulates municipal and industrial sources of wastewater. **County or City** issues permits for volumes < 10,000 gal/day. **DLI** would require a variance for all wastewater systems.	**MPCA** regulates the disposal of wastewater including specific technical requirements for septic tanks, pumps and dispersal in trenches, seepage beds, mounds, or at-grade systems. **DLI** mandates that public sewer and water be used if available, requiring a variance for wastewater projects.	***Lack of standardized treatment, though DLI can set treatment requirements through variance.***	**MDH** requires wastewater disposal to be certain distances from wells. **MPCA** regulates municipal and industrial disposal to surface waters, subsurface, and land. **Metropolitan Council** permits any discharge to the metro system (many large cities/sanitary districts also have this authority). **DLI** regulates wastewater piping within buildings and property lines.	**MPCA** regulates discharge to surface waters and land discharge (including irrigation), issues guidance on reuse. **MDH** applies drinking water standards to potable end uses; a variance would be needed for aquifer injection. **DLI** requires a variance for use in buildings, and upholds MPCA design requirements. **USEPA** involved in aquifer injection.

DLI Department of Labor and Industry (or local plumbing authority)
DNR Department of Natural Resources
DWSMA Drinking Water Supply Management Area
ERA Emergency Response Area
MDH Minnesota Department of Health
MPCA Minnesota Pollution Control Agency
WHPA Well Head Protection Area

ACTIONS NEEDED TO ADVANCE WATER REUSE

Fill in the gaps

While we know a great deal about the quality of sources, and the treatment required for different end uses, there are gaps in knowledge and practice identified during the workshop that need to be addressed. Ultimately, there are three principal knowledge gap categories: quantifying and managing the potential human health risks associated with different water sources; expanding our understanding of tradeoffs between water reuse and environmental impacts; and clarifying the true cost of water and how financial incentives affect reuse.

Quantify and manage risk

We lack a thorough understanding of the possible risks to human health related to different water sources and the range of end uses. In general, there are three categories of end uses: outdoor non-potable, indoor non-potable, and indoor potable. Human contact MIGHT occur with any of these, but typically, outdoor non-potable water uses involve lower risk. Nonetheless, the potential risks for all end uses must be quantified and managed appropriately, and treatment standards developed and applied accordingly.

Understand tradeoffs

Water use doesn't occur in a vacuum. Water used in one area or for one purpose means less for other areas or purposes, with ripples of impact on the ecosystems and the users who depend on that water. It is essential that we explore reuse from an integrated or "one water" perspective. For example, research is needed on whether more rainwater and stormwater reuse will decrease the amount of water soaking into the ground, further depleting aquifers. Or how might the use of chlorides in treated wastewater add to chloride pollution in surface and groundwater, and what alternatives are there? For wastewater reuse, how will reductions in treated discharge impact the quality and quantity of water supply for downstream users?

Clarify true water costs

By far, the most frequently named barrier to reuse by workshop attendees was the current low cost of potable water, creating no incentive for exploration or implementation of reuse practices.

When potable water is as cheap as it is in Minnesota communities, not only is there not enough money to pay for infrastructure upgrades to fix leaks and increase efficiency, the low price also serves as a disincentive for water reuse projects. Developers and property owners, cognizant of the need to meet their bottom lines, will not likely rush to pay anything additional for water reuse projects, especially when faced with significant barriers, and without any mandates for inclusion of reuse or incentives to reward their efforts.

It is essential that we accurately quantify the true cost of water. We must ask, "what is the best way to cover that cost?" How do we encourage more reuse to take place given the cost of those projects? Several areas need to be explored:

- The effectiveness of disincentives, such as increased water fees to motivate consumers to conserve water
- The effectiveness of incentives in promoting reuse systems in new development, redevelopment, and retrofits
- The opportunity to align reuse projects with other water-related goals to provide for mutual benefits and reduced cost

By reviewing pricing structures, incentives, and mandates in other communities where these questions have already been addressed, Minnesota could identify what makes the most sense here, and begin to change the nature of the game.

Update and streamline regulation

There is a need for clear standards that reflect the nuances of reuse and are set at an appropriate level of governance. Another of the most significant barriers for both wastewater and rainwater reuse was the lack of national, state and local standards for design and process. This lack of standards leads to a series of issues:

- Uncertainty about what is possible or even required
- Lack of guidance for design or process
- Lack of basic consistency in regulation across local jurisdictions
- Treatment regulations that are not in line with end use
- Continuation of status quo for permitting and building of reuse projects
- Resistance from local jurisdictions not comfortable taking on projects without standards in place

WATER REUSE POLICY

San Francisco has been a leader in policies that promote reuse. A limited water reuse ordinance passed in 1991. San Francisco faced many of the same challenges Minnesota faces today, from uncertainty around who sets standards to questions around oversight and authority.

Their success stems from the concrete actions they took to clarify standards, investigate appropriate roles for the different agencies, identify funding strategies, and clear the way for both centralized and decentralized opportunities. San Francisco's pressures for water conservation, combined with the recognition that more than 50% of residential and almost 95% of commercial water usage was not for uses requiring water treated to a drinking water quality, provided incentive to pursue reuse sooner than Minnesota did.

Most speakers identified two drivers of reuse: concerns over sustainability of water supply, and future population growth. The changing climate, shrinking aquifers, and growing populations create a new set of planning and design constraints within which planners, decision makers, and developers are operating. Water reuse has been identified nationally as an important strategy for addressing this new reality. However, challenges will remain as long as standards—and the codes and ordinances based on them—do not reflect this new context.

The challenge here is in setting standards at the appropriate level of government, and under the appropriate authority. National water reuse standards related to public health are currently being developed through a national research group led by Paula Kehoe (of the San Francisco Public Utilities Commission) and the National Water Research Institute. Likewise, national precedent often exists where policy does not, providing some guidance on what is possible and required. However, aside from a base set of regulations, the local nature of climate, water supply, and population demand leaves most regulation to the states. And while there is a need for

flexibility in standards even at the level of individual municipalities, the majority of regulation again will be at the scale of the state in order to ensure consistency and adequate authority and resources for review and enforcement.

Most regulations are set at state agencies already, but the regulatory authority doesn't always match the area of expertise. For instance, indoor non-potable use is currently regulated by the Department of Labor and Industry through the plumbing code. Even though there is high chance of human contact through toilet flushing, clothes washing, and other non-potable uses, there is no current regulation from the Department of Health. Updates to current standards and development of new standards need to consider the nuances in source, use, and jurisdiction.

Finally, as updates and changes to regulations are made, it is important that a common regulatory language is used across jurisdictions to describe who regulates what, what is actually regulated, and what standards are used. This will remove yet another level of complexity and ambiguity that is not only unnecessary for effective regulation of reuse, but in fact hinders the development of reuse projects.

Compel action

Workshop participants highlighted the need for education around the specifics of water reuse and the opportunities it provides. Even after regulation has been streamlined, incentives reviewed, and common language adopted, getting planners, policy-makers, and developers to incorporate reuse will still take intentional efforts.

Perhaps the most significant need here is to promote and facilitate consideration of reuse earlier in project planning. Currently, adding reuse to a project typically is just that—an addition. As climate change, population growth, and shrinking groundwater supply create new design constraints, planners and policy-makers need to consider policies which encourage water reuse, and incentivize developers to make water reuse a key part of projects through early incorporation in the development process. Communities also need to be willing to advocate for reuse in projects, and ask for those policies that will encourage reuse. Everyone has a role to play in increasing the number and scale of reuse projects in the state.

These steps require that actors at all levels know about water reuse. While there are clear roles each of us could play, efforts in those roles will not be effective without education around what is possible, what is required, and why reuse is needed. There are many resources available to engineers, project managers, and water supply technicians, but there is little information available nationally (and nothing locally) for the layperson. Following the other recommendations from this report, the final step is communicating all of this information in clear, concise language, made readily and appropriately available to the public.

WHAT HAPPENS NEXT

This proceedings report has covered the information presented and collected at the Water Reuse Workshop held in Saint Paul on May 2, 2016. It is intended as an overview of what is currently possible, what is not, and what needs to happen in Minnesota to make water reuse a more available and feasible solution.

We stand at a pivotal time for advancing water reuse in the state of Minnesota. There is a heightened awareness of the need for water reuse to help meet our water needs in the near-term future context —a context of a changing climate, growing population, and shrinking aquifers. Addressing the barriers to water reuse will largely require policy and regulatory changes, and these changes must be rooted in a fundamental acknowledgement of the highly varied quality of sources and treatment requirements for different end uses.

Strategies to address barriers have been included throughout, and are summarized below:

- **Fill in gaps in knowledge**:
    - Understand how reuse impacts other water bodies and those depending on them
    - Quantify the true cost of water, and how to pay for it
    - Review the effectiveness of financial incentives and disincentives on promoting reuse
- **Update and streamline regulation**:
    - Clarify treatment standards relative to varied sources and end uses
    - Ensure that authority matches the area of expertise
    - Remove redundancies in oversight to streamline the process
    - Establish a common regulatory and messaging language across agencies
- **Compel action**:
    - Create educational information that actively engages non-technical and non-regulatory audiences
    - Encourage local policy-makers to update codes and ordinances to reflect nuance-informed standards, clearing regulatory hurdles at the city and county levels
    - Encourage developers to consider water reuse in the early stages of project planning
    - Establish a defined process for designing, permitting, and installing reuse systems

Freshwater Society is pleased that the state agencies have come together to form the Water Reuse Interagency Workgroup with the goals of developing consistent messaging across agencies and gathering information needed to build an efficient and understandable regulatory and implementation framework that addresses public health protection and ecosystem benefits. This is an important first step and a critical vehicle for addressing many of the recommendations that came out of the Water Reuse Workshop.

Freshwater Society will actively pursue a policy agenda informed by the barriers and strategies included in this proceedings report in the coming years. We will also continue to work with our partners to provide guidance and support to move ahead on other strategies that don't require policy change. It is our hope that this report will expedite that process, and allow reuse projects to become more feasible in Minnesota.

PART 3: Workshop Case Studies

City of Hugo

Location: Hugo, Minn.
Project Owner: City of Hugo
Project Partners: Rice Creek Watershed District (RCWD)

Project description: The project consists of a large stormwater pond that was excavated along the 18th tee and fairway that collects stormwater runoff from 915 acres of land. From there it is pumped and used by Oneka Ridge Golf Course for irrigation instead of groundwater. Excess water beyond that needed for irrigation is sent to an infiltration system in the southwest corner of the golf course. RCWD expects that this project will reduce the golf course's dependency on groundwater for irrigation by 40-50% and remove up to 75 pounds of phosphorus from runoff to Bald Eagle Lake annually.

Project cost: $689,000

Funding: $497,100 Clean Water Fund grant from Minnesota's Clean Water, Land and Legacy Amendment; $113,700 in matching funds were provided by the RCWD, City of Hugo, and Oneka Ridge Golf Course.

Primary reasons for pursuing this project: Managing Groundwater Supply, White Bear Lake lawsuit, "Reduce, Reuse, Replenish" policy directive, flood control and water quality, improved water quality in Bald Eagle Lake, population growth, conservation goals (17% reduction in water use).

What barriers were encountered in the development and/or installation of this project? Uncertainty around health and safety standards, uncertainty around upfront and long-term funding and maintenance, slow regulatory process, cost ineffectiveness of small projects, best management practices still evolving, public attitudes regarding stormwater ponds, infiltration and reuse at odds, uncertainty around future use of golf course land and easements, effect of project on water levels downstream.

Strategies: focus on simple end use (irrigation) and on larger, less complex multi-family residential projects.

What was necessary for success? Large area from which the stormwater is collected, stormwater reuse is part of a larger integrated water management plan, private landowner willing to participate in project, public funding sources.

Who is managing the long-term maintenance? The Golf Course handles day-to-day maintenance and operation. City of Hugo and RCWD are responsible for replacement of pumps and maintenance of stormwater pond.

What are the backup plans for the system? The Clean Water Fund grant requires operation and maintenance for 25 years. If irrigation of the course from this source ceases for any reason, such as a change in land use, there is a backup infiltration system that can accept runoff from the pond.

CHS field

Location: Saint Paul, Minn.
Project Owner: Saint Paul Saints
Project Partners: *Public:* Capitol Region Watershed District, Metropolitan Council, Metro Transit, and City of Saint Paul Parks and Recreation. *Private:* Saint Paul Saints, Ryan Companies, Schadegg Mechanical, Solution Blue Inc., and Rainwater Management Solutions.

Project description: CHS Field is the first major sports venue to meet B3 and MN SB 2030, and has met the equivalent of LEED Silver. Rainwater from the roof of the Metro Transit Operation and Maintenance Facility for the Green Line LRT (about 3/4 acre) is collected in a 27,000 gallon cistern for use in ballpark irrigation and toilet flushing, saving up to 450,000 gallons of water and $1,600 each year. In addition, virtually all stormwater runoff is treated through sand filters, tree trenches, or rain gardens to remove pollutants.

Project cost: $487,000 for all sustainable stormwater elements including rainwater harvesting system. The rainwater system treatment, controls and storage unit were approximately 20% of the total project cost for sustainable stormwater elements.

Primary reasons for pursuing this project: Sports facilities can be large consumers of water and this project helped identify and showcase innovation for sustainability and water conservation. It was important for this project to reflect the city and community commitment (Greater Lowertown Master Plan, Comprehensive Plan Water Chapter) to water quality and exceed minimum requirements. Another reason was to raise awareness about water resource protection, and capitalize on proximity to the Mississippi River as well as the tremendous expected attendance (more than 180 events and 400,000 visitors annually).

What barriers were encountered in the development and/or installation of this project? Lack of end use standards, no defined review process, multiple jurisdictions involved, operations and management unknowns (cost, municipal oversight), water economics, sharing runoff between buildings, and creating meaningful visibility for the system.

Strategies: Design process facilitated by outside reuse expert, multiple design and funding partners, meaningful education and visibility, managing rainwater across properties.

What was necessary for success? Obtaining non-project funds to add rainwater harvesting to the project scope. Also necessary was local code officials willing to consider being the “first” to review, and an operator willing to take on, a rainwater harvesting system proposed for indoor use.

Who is managing the long-term maintenance? The Saint Paul Saints is responsible for managing and maintaining all of the sustainable stormwater elements including the rainwater harvesting system.

What are the backup plans for the system? The rainwater harvesting system has automatic valves to supply domestic water to the irrigation system and toilets when the rainwater harvesting system is off-line.

GNP Company

Location: Cold Spring, Minn.

Project Owner: GNP Company

Project Partners: Ecolab

Project description: GNP treats effluent to nonpotable standards to be used in many areas of the facility, from vehicle washing to irrigation. This treated water makes up approximately one third of the total water use of the facility (113 million gallons in 2014), and can be reused five times, thus reducing environmental impacts by up to 80%. A system treating to potable standards is in a pilot phase now to be used across the facility, including in the first rinse of chickens.

Primary reasons for pursuing this project:

Population growth, groundwater demands, surface water quality, facility water demand, alternative supply in a geologically challenging area

What barriers were encountered in the development and/or installation of this project?

Not a core part of the business—competing demands for time and money, not a high demand from customers for environmentally sustainable practices, public perception

Strategies:

Internalize control of water quality for nonpotable use (potable use being explored now through a pilot project)

Storm Water Runoff and Filter Backwater (A Project of Workshop Sponsor, WSB)

Location: St. Anthony, Minn.
Project Owner: City of St. Anthony
Project Partners: WSB, City of St. Anthony, Hennepin County, St. Anthony - New Brighton School District, Mississippi Watershed Management Organization, Rice Creek Watershed District

Project description: The St. Anthony Village water reuse facility is a half million gallon reservoir located under a stormwater pond. Water stored in the reservoir is recycled to irrigate a 20-acre city hall campus and municipal park site. WSB was retained by the City of St. Anthony Village to complete the design, plans, and specifications for this first of its kind innovative project. In addition, WSB was responsible for construction management, surveying, and construction observation services. The reuse facility provides a multitude of environmental benefits that substantially protect and improve water resources of the region. The project captures and reuses two primary sources of water that were previously discharged to surface waters. The first source is storm water runoff from 13.5 acres of county road, city streets, and the city hall site that is collected by storm sewer and drained into the storage reservoir. The second source of water is filter backwash water, which is a waste byproduct of the City's water treatment process. Approximately 75,000 gallons of water are used weekly to clean the excess iron and manganese from the filters. Using this system reduces the City's irrigation costs, substantially reduces the need to use groundwater resources, and eliminates the previous six million gallons of potable water needed for watering.

Project cost: $1.5 million

Funding: The Mississippi Watershed Management Organization and Rice Creek Watershed District provided funding for the project ($1.2 million and $50,000 respectively) due to the exceptional water quality improvements that the project offered through innovative design.

Local Water Pricing: $3.10 per 1,000 gal

Primary reasons for pursuing this project: The school district and Hennepin County were in need of stormwater management to meet watershed district requirements. The City was interested in an alternative to discharging backwash to the sanitary sewer system.

What barriers were encountered in the development and/or installation of this project? The system is difficult to optimize: determining ideal operations and providing additional training for system operation have been a challenge. Prior to construction, staff assessed the risk of stormwater coming in contact with contaminants of concern (e.g. pet waste, contaminated runoff) and found low risk.

Who is managing the long-term maintenance? City of St. Anthony

What are the backup plans for the system? Augmented by potable (minimal), backwash can discharge to sanitary sewer.

City of Eagan Water Reuse Feasibility Study (A Project of Workshop Sponsor, Barr Engineering)

Location: Eagan, Minn.
Project Owner: Metropolitan Council, City of Eagan
Project Partners: Barr Engineering, City of Eagan, Metropolitan Council, CH2M Hill, private businesses (water users), University of Minnesota (capstone project)

Project description: Feasibility study on the use of dewatering water from Metropolitan Council's Seneca wastewater treatment plant for non-potable uses in the City of Eagan, including irrigation

Project cost: TBD

Funding: TBD

Local Water Pricing: $1.58 per 1,000 gal

Primary reasons for pursuing this project: Reduce the need for the City peak water supply infrastructure and to reduce the use of groundwater supplied to the water system

What challenges are expected to be encountered in the development and/or installation of this project? The main challenge is finding funding to offset the costs of a new reuse system versus the cheaper cost of using potable water system for non-potable use. The proposed reuse system is expensive due to the need to install an additional treatment system and a new separate distribution system. Some potential uses for the reuse water are not allowed by current regulations, like using the treated water for aquifer recharge. The system also should be designed to be adaptable to expand for future demands that may come online.

What is necessary for success?
The project will need to have a clear outline of benefits and costs, and should be considered from a triple bottom line approach. Envision™ and life cycle analysis can demonstrate value. The strong partnerships and early advocates have helped this project move forward so far.

Who is managing the long-term maintenance? TBD

What are the backup plans for the system? The backup water supply to the system will either be potable water or a groundwater well.

THANK YOU

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Thank you to the more than 100 professionals who participated in the workshop. Your comments and questions for the speakers, your prioritizing of barriers, and your feedback in the hands-on work at the end of the day provided the input necessary to identify our most significant challenges and possible next steps.

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RECENT PUBLICATIONS FROM THE FRESHWATER SOCIETY

Freshwater Society regularly publishes information on water, conservation and threats to water quality and sustainability. Recently released publications include:

The Water Underground: Reframing the local groundwater picture is targeted at public water supply managers – the public works directors, council members, and mayors of those municipalities operating water supply systems. This report — the first in a series of three planned for 2016-17 — tackles head on which portions of the state and metropolitan area currently have long-term water supply issues. This eliminates a major flaw of previous reports; namely, most cities hear about declining groundwater levels and assume it doesn't apply to them.

Protecting Groundwater-sourced Drinking Water: An assessment of the needs and barriers faced by local water management professionals is a study done by Freshwater Society for the Minnesota Department of Health that looks at how state-level agencies can best match resources with local needs in order to accelerate the adoption and implementation of groundwater and drinking water protections.

Advice from the Field: Preparing for county level buffer work focuses on how local governments can prepare themselves for tackling the buffer challenge. The report consolidates discussions we had with 32 Soil and Water Conservation Districts in late 2015. We asked Districts what success would look like two years down the road, and, what their biggest concerns were at this time. The conversations helped operations with different capacities know what to do and explored ways for districts to pool efforts with each other, or their county. As we say in the report, "this is different work."

A full listing of publications is available at **freshwater.org**. Later in 2016, Freshwater will publish a report on how to expand water supply in Minnesota which will contain a chapter on water reuse continuing the exploration of this topic.

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