APPLICATION

LEADING UTILITY OF THE WORLD

APRIL 2019

Clean Water Services

Leading Our Region Through Innovation: A Message from the CEO

"Through innovation, we've saved hundreds of millions of ratepayer dollars, allowing us to keep our rates among the lowest in the region – and to attract a workforce of water entrepreneurs, always seeking new and cost-effective strategies to solve utility-inspired challenges."

All across our nation and throughout the world, water is valued as an asset, a source of life and a resource that brings communities together. Clean Water Services (CWS) recognizes the important role we play as a water resources utility leader and takes pride in protecting public health, important ecosystems, the environment and the people that live within our region. We have invested responsibly since our inception and today, Washington County's only river – the Tualatin River – is healthier than it has been in decades.

As our region grows and technology advances, we can no longer afford to view used water as waste to be disposed of but rather as a resource to be recovered. We embrace our role as leaders in a fully circular water economy. We recover resources such as clean water, fertilizer and energy. That is why we now refer to our treatment plants as water resource recovery facilities.

We are always working to create graceful solutions to our region's key water resources challenges, including water supply and security, variable weather patterns, increasing regulatory requirements, urban growth and aging infrastructure. In doing so, we have created innovative solutions that capture previously unutilized value, innovations that create new sources of energy and additional revenues for our utility, and innovations in wastewater treatment systems and the overall environmental sustainability of our region. These areas of outstanding innovation are captured here across three innovation areas, Business Development, Energy Efficiency and Wastewater Treatment & Environmental Impact.

Business Development: CWS has reinvented the utility mindset to bring value to our ratepayers by building workforce capacity, investing in lean approaches and serving as a technology incubator and accelerator for positive impact across our region, the nation and throughout the world.

Energy Efficiency: CWS combines the power of digester gas, cogeneration and solar energy to optimize the energy efficiency of wastewater treatment and resource recovery operations.

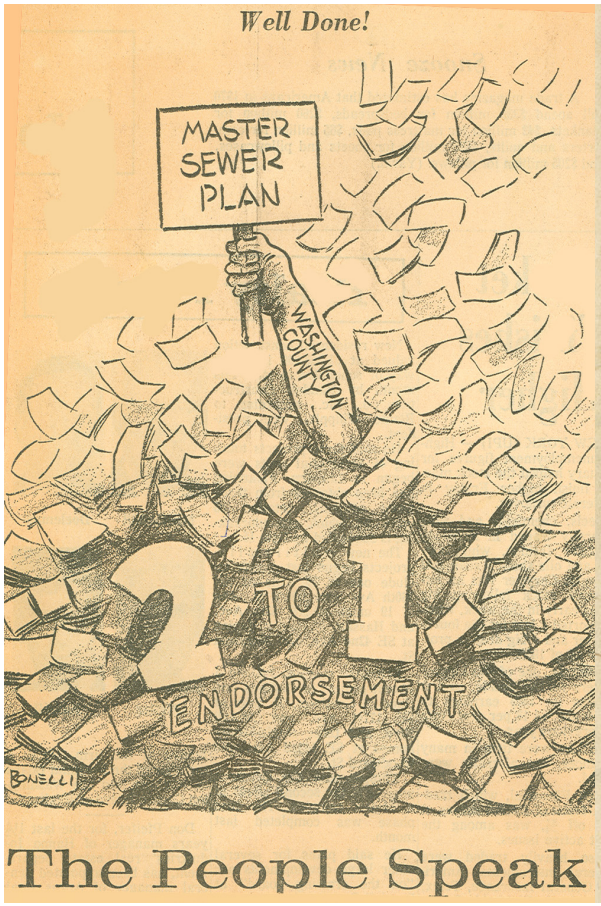
Wastewater Treatment & Environmental Impact: CWS is leading the way on nutrient recovery, direct potable reuse, smart technology applications and holistic solutions to solve grand challenges at the regional, national and global scale.

We are excited to present these three areas of innovation to the Leading Utilities of the World Advisory Board and look forward to sharing ideas, inspiring others to improve and driving performance across the sector.

Sincerely,

Diane Taniguchi-Dennis
Chief Executive Officer, Clean Water Services

CWS Background



Straddling the Tualatin River in 1958.

Who We Are

Everything we do at Clean Water Services aims to protect public health, while enhancing the natural environment of the Tualatin River Watershed. Combining science and nature, we work in partnership with others to safeguard the river's health and vitality, ensure the economic success of our region, and protect public health for more than 600,000 people in urban Washington County.

Working for the River Since 1970

In the late 1960s the Tualatin River's flow was so inadequate, you could stand across it. It was a crisis for public health, the economy and the environment. In 1970, Washington County voters went to the polls and resoundingly affirmed their commitment to clean water, public health and the environment with a two-to-one vote in favor of creating one of the region's first sewer utilities — then known as the Unified Sewerage Agency.

In the nearly half-century since that turning point, our core business has evolved. In 2001, we changed our name to Clean Water Services to better reflect our One Water approach. Over time, we have become industry leaders recognized for pioneering smart, practical solutions for the sustainability of the precious gift that is water. Today, we are public servants, working around the clock to protect public health and the natural environment. Together with our 12 member cities, we're working for the river.

Clean Water Services Today

Paddling the same section of the Tualatin River today.

Our River: 80 miles long, with a 712-square-mile watershed. Major tributaries include Dairy, Fanno, Gales and Rock creeks. Highly sensitive, and almost as flat and slow-moving as a lake in many places.

Our Ratepayers: 600,000+ people who live and work in the cities of Banks, Beaverton, Cornelius, Durham, Forest Grove, Gaston, Hillsboro, King City, North Plains, Sherwood, Tigard and Tualatin and the urban unincorporated Washington County. We also serve small portions of Clackamas and Multnomah counties that naturally fall within the watershed.

Our County: Clean Water Services is an Oregon Revised Statue (ORS) 451 county service district. CWS shares a Board and a close working relationship with Washington County but is a separately managed and financed utility.

Our Permit: In 2004, the EPA granted CWS the first fully integrated municipal National Pollutant Discharge Elimination System (NPDES) Watershed-Based Waste Discharge Permit. Five permits — for four wastewater treatment facilities and one urban stormwater management — are now combined into one permit for the Tualatin River Watershed.

Our Assets: Our 371 employees operate, maintain, support and manage the growth of four treatment facilities, 42 pump stations, approximately 850 miles of sanitary sewer line and 530 miles of storm sewer and many other assets. We manage about 24 percent of the water in Hagg Lake, 10 percent of the water in Barney Reservoir and more than 140 miles of riparian corridor.

Our Commitments: We are committed to the well-being of our watershed, people and businesses that thrive within it.

Key Strategic Outcomes

Organizational Excellence: CWS is a highly effective and transformative utility that maximizes the capabilities, talent and effectiveness of our employees to provide services and products that deliver on the values of the region we serve.

Integrated Water Resource Management and Resilient Watershed: CWS optimizes and integrates the management of water resources for the benefit of the public and the environment by creating resilient watersheds.

Innovation and Resource Recovery: CWS provides services and products that deliver practical and pragmatic water solutions for our region to recover resources and to optimize our operations through innovation that is shared globally.

Catalyzing Transformational Partnerships: CWS goes beyond organizational boundaries to create and sustain strategic partnerships in the region to accomplish more than any one organization can alone.

Contributing to the Region's Environmental & Economic Vitality: CWS' sound planning, investment and stewardship in regional assets is essential to Washington County's continued appeal as a place to invest, live, work and play.

Our Mission, Our Vision, Our Promise and Our Values

Our MISSION

We provide cost-effective services and environmentally sensitive management of water resources for the Tualatin River Watershed.

Our VISION

Enhance the environment and quality of life in the Tualatin River Watershed through visionary and collaborative management of water resources in partnership with others.

Our PROMISE

Beautiful clean water for today and tomorrow.

Our VALUES

- Technical Excellence & Innovation
- Public Health & The Environment
- Efficient Decision-Making
- Scientific Information
- Visionary Leadership
- Employee Team
- Public Awareness
- Team-Based Work Environment
- Financially Sound Management
- Performance Management
- Long Range, Comprehensive, Basin-Wide Systems Approach

Business Development

$300 million

Ratepayer dollars saved over the past two decades

CWS has reinvented the utility mindset to bring value to our ratepayers by building workforce capacity, investing in lean approaches and serving as a technology incubator and accelerator for positive impact across our region, the nation and throughout the world.

CWS is an innovative organization composed of talented staff from many different disciplines, all dedicated to serving the needs of the watershed and our community. Working collaboratively across the organization and at the watershed scale, our water entrepreneurs have reinvented the utility mindset in pursuit of public service. This approach has saved more than $300 million in ratepayer dollars over the past two decades, savings that have been passed on to our community in the form of predictable rate increases and to our workforce through CWS' Goal Share program.

CWS pioneered integrated water resources management, receiving the Environmental Protection Agency's first fully integrated National Pollutant Discharge Elimination System permit in 2004. This monumental achievement of shifting the focus on water quality from pipes, pumps and plants to a more holistic watershed-based approach marked a significant change in state and federal policy. Today, five permits — four wastewater treatment facilities and one urban stormwater management program — are combined into one permit that represents an integrated approach to achieving holistic watershed management for the Tualatin River Watershed.

Recognizing that this groundbreaking approach to meeting regulatory requirements and watershed goals would require focused resources and expertise, CWS embarked upon organizational changes, forming the Watershed Management Department in 2002 and the Regulatory Affairs Department in 2007. These groups provide technical support and leadership in many areas, including water supply, stream enhancement, flow restoration, ecosystem data management, water quality research and data analysis, compliance and monitoring, and the development of state and federal regulations.

CWS worked with Ostara Nutrient Recovery Technologies to commercialize our patented waste activated sludge stripping to recover internal phosphorus (WASSTRIP®) process, which promotes efficient and effective biological phosphorus recovery. In doing so, CWS installed North America's first commercial nutrient recovery facility at our Durham treatment facility and three years later a second facility at our Rock Creek treatment facility. These facilities enhance the treatment process by removing phosphorus and ammonia from recycle flows, which would otherwise have to be retreated in the mainstream wastewater flow. The recovered nutrients are converted into a premium, slow-release and environmentally-friendly commercial fertilizer product called Crystal Green®.

The Clean Water Institute (CWI), founded by CWS in 2010, was established to advance watershed restoration and resource recovery through innovative strategies to promote scientific discoveries, education and environmental protection activities that benefit the watershed throughout the country and the world. Some of the initiatives include commercialization of the WASSTRIP® process; commercialization of CWI's Clean Water Grow® product; and regional, national and international knowledge transfer.

Clean Water Grow® (GROW) is a powerful, tangible, personal way of telling the resource recovery story. Created in 2012, the slow-release fertilizer contains Crystal Green® recovered from our watershed's used water. The result is a high-performing retail product that benefits the environment, improves operation and maintenance of the resource recovery process and provides the community with a thriving plant food for their gardens. Today, GROW is sold on Amazon.com and at 200 local and regional U.S. stores, including Fred Meyer (Kroger Co.), ACE Hardware, True Value chains and a variety of locally owned independent businesses.

There are currently 10 resource recovery facilities worldwide that are using the CWI patented WASSTRIP process. CWI receives equipment and fertilizer royalties from the installation and use of this technology in Madison, Wisconsin; Gwinnett, Georgia; Opequon, Virginia; St. Cloud, Minnesota; and Chicago, Illinios; Calgary, Alberta, in Canada; Amersfoot, Utrecht, in the Netherlands; and Jarocin, Poland.

In 2018, CWI was awarded a contract to provide holistic watershed management services to several business partners and cities across China. CWI provided conceptual planning, design, plan review and training to many government and private partners throughout the region, including Shandong Province, Zhejiang Province, Hubei Province, Tianjin, Beijing and Shanghai. These services integrated grey, green and natural treatment systems to solve anthropogenic challenges. CWI also hosted representatives from Shenzhen Bestsum Environmental Technology, Dongze Water Management, Chengxin Universal Energy Conservation and Environmental Protection Technology — in collaboration with officials from the Washington County's Sister City, Yichang — sharing knowledge and novel approaches to stormwater management, resource recovery and watershed planning.

CWS is an innovative organization composed of talented staff from many different disciplines, all dedicated to serving the needs of the watershed and our community. Working collaboratively across the organization and at the watershed scale, our water entrepreneurs have reinvented the utility mindset in pursuit of public service.

Energy Efficiency

40%

Annual energy demand produced at Rock Creek and Durham facilities through cogeneration and solar power generation to offset energy consumption

CWS combines the power of digester gas, cogeneration and solar energy to optimize energy generation of wastewater treatment and resource recovery operations.

CWS is recognized as a leader in delivering innovative and cost-effective services that leave a lasting impression on the region. Through optimizations in energy generation, we use the power of digester gas for cogeneration of electricity and hot water for process and space heating, and solar energy to generate nearly 19,000 MWh of electricity annually. This allows CWS to provide additional services to our community, maintain reliable and predictable rates, practice responsible environmental stewardship and continue to develop and expand local, national and international partnerships.

CWS' energy optimization program takes into consideration opportunities for energy conservation, energy production and energy costs savings and applies these opportunities where our energy demand is the greatest — our two advanced wastewater treatment facilities. Combined, Durham and Rock Creek consume 90 percent of our 57,000 MWh annual treatment facility demand. Offsetting this demand has been one of CWS' key strategic objectives for more than 30 years with our Rock Creek and Durham facilities producing 40 percent of their annual energy demand through cogeneration and solar power generation.

Cogeneration began at our Rock Creek facility in 1988 with the installation of a 0.5-MW Superior reciprocating rich burn engine that operates on untreated digester gas. This systems capacity was doubled in 1992 with the installation of a second 0.5-MW engine and has been in continuous operation ever since. Today, the 1.0-MW cogeneration system is fueled by two 1.3 million gallon and three 0.67 million gallon anaerobic digesters that produce more than 6,300,000 m^3 of biogas annually. The Rock Creek facility has a 62.5kW fixed-angle photovoltaic array mounted to the superstructure of the facility. In 2018, Rock Creek's energy efficiency program generated 6,639,000 kWh and saved an estimated $400,000 in operating expenses.

Investments in cogeneration began in 1993 at our Durham facility. This cogeneration system was similar to the initial design at Rock Creek and included the installation of one 0.5-MW Superior reciprocating rich burn engine. Since then, Washington County's population has grown by more than 60 percent. With that growth came increased biogas production. This growth, coupled with new regulatory requirements for air emissions and the desire to maximize the ratio of biogas generated to energy production, led to the exploration of opportunities to upgrade our cogeneration system. In 2016, CWS engaged the Energy Trust of Oregon and the Oregon Department of Energy to contribute to $16.8 million in upgrades to the existing cogeneration system. CWS received a $3 million grant from the Energy Trust and a $2.8 million tax credit (net value) from the Oregon Department of Energy.

Durham operates a 1.7-MW cogeneration system fueled by 6,700,000 m^3 of anaerobic digestion derived biogas. The anaerobic digesters are fed indigenous sludge generated by the treatment processes and more than 6.7 million gallons of fats, oils and grease (FOG) collected from Washington County restaurants and commercial food processors. Addition of the FOG increases biogas production by approximately 50 percent. Prior to being fed to the 850-kW engines, the biogas is treated to remove hydrogen sulfide particulates, siloxane and moisture. The Durham facility has a 403-kW fixed-angle photovoltaic field-array that is optimized to the azimuth angle, which produced 465,000 kWh of renewable clean energy in 2018. Combining cogeneration with renewable energy reduces operating expenses by $1,000,000 and collects around $360,000 per year in tipping fees — a significant business development contribution.

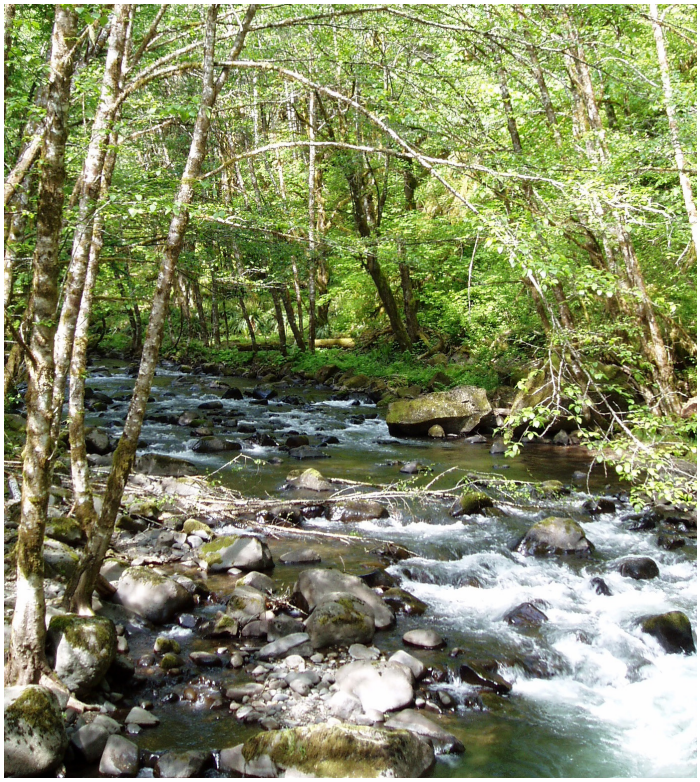
CWS' solar power generation project is made possible through a power purchase agreement business model with Tesla Energy, a national provider of clean energy systems. The agreement reduces risk and exposure for CWS, allowing Tesla to utilize CWS' property in exchange for purchasing wholesale electricity. Tesla owns and operates the solar power plants at Rock Creek and Durham, which contributes to CWS meeting our renewable energy initiative and Oregon State Clean Energy goals.

CWS uses a series of practices, activities and approaches to empower our workforce to identify opportunities for improving energy efficiency through the CWS Energy Teams — Mega-Hurtz and the Kill-O-Watts . These teams host biannual "Energy Treasure Hunts" where Energy Trust of Oregon subject matter experts are invited to tour the facilities with our staff — generating new ideas, sharing best practices and exploring new technology options. By setting clear goals and developing measures and metrics for success, our workforce is able to undertake annual projects that aspire to improve energy efficiency.

In 2017, energy efficiency projects at Rock Creek and Durham facilities saved more than $165,000 — reducing energy consumption by 2,800 MWh annually. Projects include the installation of three variable frequency drives on the secondary and tertiary blower systems and the decommissioning of a digester sludge tank mixer at Durham, and the implementation of timing controls to operate mixers in aeration basins and operational improvements to the secondary clarifier spray systems at Rock Creek.

CWS' energy efficiency optimization program takes into consideration opportunities for energy conservation, energy production and energy costs savings and applies these opportunities where our energy demand is the greatest — our two advanced wastewater treatment facilities.

Wastewater Treatment and Environmental Impact



$150 million

Savings in avoided costs associated with installation of mechanical chillers after Tree for All partners restored more than 140 river and tributary miles

CWS is leading the way on nutrient recovery, direct potable reuse, smart technology applications and holistic solutions to solve grand challenges at the regional, national and global scale.

CWS employees are working around the clock to clean on average 70 million gallons a day of used water from Washington County homes and businesses to among the highest standards in the nation. Our four treatment facilities received awards for near perfect compliance in the last fiscal year, meeting thousands of discharge requirements — with our Rock Creek and Forest Grove treatment facilities achieving perfect compliance for 14 and 16 consecutive years, respectively. In doing so, CWS removed 156,000 pounds of total nitrogen and 33,200 pounds of total phosphorus from the Tualatin River Watershed — a portion of which is recycled back into the environment through our regional biosolids program, made available nationally through Crystal Green and our patented Ostara Nutrient Recovery technology and regionally in the form of CWS' sustainable slow-release fertilizer, GROW®.

CWS has Oregon's largest water reuse program. In 2018, CWS provided on average 230,000 gallons of clean water per day to irrigate school grounds, wetlands, golf courses and sports fields generating more than $40,000 in revenue annually. Our regional water reuse partners include Durham Park, Cook Park in Tigard, Durham Elementary School, King City Civic Association golf course, Summerfield Civic Association golf course, Tigard High School and Tualatin Country Club.

CWS is leading the way in educating our region, the nation and the world on direct potable reuse through our Pure Water Brew Program. Pure Water Brew is the world's most sustainable beer made from 100 percent pure recycled water. CWS and the Oregon Brew Crew held the first Pure Water Brew competition in 2014. Media coverage generated more than 500 television, radio, print and electronic stories — sparking a conversation and challenging the taboo of direct potable reuse. Today, more than 35 brewing companies, homebrew clubs, pubs, tap houses and brewhouses have

participated in Oregon, California, Wisconsin, Colorado, Florida and Arizona. CWS is building on this momentum and taking the conversation to the road with the CWS' Pure Water Wagon — a mobile showcase of water purification technology that is changing how people think about the water they drink.

CWS uses IoT sensors, controls and machine learning to provide optimal services to our region, including wastewater operations, fertilizer recovery, watershed management, and smart stormwater and sanitary sewer systems. CWS collaborates with universities from across the country to develop elegant solutions to today's most pressing environmental challenges. For example, CWS is one of the region's first utilities to integrate real-time weather forecasts and real-time sensor data to actively control the overall systems performance and optimize the flow and treatment of stormwater runoff. This approach allows CWS to do more with less — increasing watershed resiliency, providing additional storage and treatment capacity, reducing the region's flooding risk and improving the quality of water resources. CWS has also pioneered remote sensing technologies including Light Detection and Ranging (LIDAR) and Unmanned Aircraft Systems (UAS) to leverage advanced data analytics and high resolution imagery analysis to monitor watershed on a large scale. CWS serves as a technology incubator, moving ideas from proof of concept to commercialization.

In 2017, CWS began operating a 95-acre natural treatment system (NTS), repurposing three old sewage lagoons into a series of NTS wetlands for improving water quality and protecting valuable ecosystems. NTS utilizes a diverse palette of native plants — sculpted precisely to move more that 5 million gallons of water every day to cool and naturalize the water while absorbing nutrients in harmony with the soil and air. This holistic approach to water resources management resulted in a savings of $16.8 million in avoided expansion costs to our Rock Creek Advanced Wastewater Treatment Facility.

CWS recognizes the need to develop holistic solutions to grand challenges such as urbanization, climate change, agricultural vibrancy and ecological diversity. Tackling these challenges head on requires a shift in the traditional way of thinking — moving away from transactional partnerships and aligning our mission, vision and values with other organizations to act on an unprecedented scale. Our Tree for All program leverages transformational partnerships and new sources of funding to realize the nations' largest and most successful landscape conservation program. Tree for All is a community-based, systems approach to ensure a heathy and resilient environment for humans and wildlife, now and for future generations. This initiative helps CWS lower its thermal TMDL loads to meet regulatory compliance, assists in fish recovery and has saved an estimated $150 million in avoided costs associated with the installation of mechanical chillers. Since 2005, Tree for All partners have restored more than 140 river and tributary miles across 25,000 acres of Oregon's Tualatin River Watershed, building the capacity of the region's workforce through job creation and entrepreneurship.

CWS is leading the way in educating our region, the nation and the world on direct potable reuse through our Pure Water Brew Program. Pure Water Brew is the world's most sustainable beer made from 100 percent pure recycled water.

APPLICATION

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