epiccleantec

sales@epiccleantec.com
8425 Market St.
San Francisco, CA 94103
epiccleantec.com

WATER SOLUTIONS for the MODERN WORLD

Sustainable Onsite Water Reuse Solutions

Company and Technology Overview

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THERE IS NO SUCH THING AS WASTEWATER

ONLY WASTED WATER

Sustainable management of water and wastewater is one of the great challenges of our time. With 70% of the world's population expected to live in cities by 2050, up from 56% today, our aging infrastructure is being strained to the breaking point. Epic Cleantec is shifting the water industry toward a more decentralized, circular approach in which wastewater resources — water, nutrients, and energy — are recovered and reused. With our solutions, the "waste" in wastewater is converted into an endlessly renewable supply of valuable commodities, reducing costs and conserving resources.

CONTENT

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JOIN THE WATER REUSE REVOLUTION

Population growth, aging infrastructure, and water scarcity are putting increased pressure on municipal utilities, leading to annual water and sewer rate increases of 5-15% across major metropolitan markets. Building owners and developers are increasingly turning to water conservation solutions to mitigate the impact of these rising costs and to hedge against future utility rate increases.

For centuries, cities have largely relied on centralized water and wastewater management systems, with vast networks of underground pipes connecting to large treatment facilities. However, as urban density increases, those systems struggle to support new growth, hindering our ability to adapt to growing populations and address escalating water issues. Maintenance, expansion, and major upgrades of underground infrastructure, particularly in urban areas, are often prohibitively expensive.

By decentralizing wastewater management through onsite reuse systems, cities can support growth without overburdening existing infrastructure. By collecting wastewater at the building level and treating it for immediate reuse, we can transition from a traditional linear approach — where water is used once and then sent to the sewer — to a circular model that recovers, treats, and reuses water many times over.

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ABOUT
EPIC CLEANTEC

Epic Cleantec (“Epic”) is a full-service water technology company that deploys onsite water treatment and reuse systems into individual buildings or groups of buildings, converting wastewater (blackwater, greywater, stormwater, rainwater) into three sustainable outputs:

WATER
Recycled water for non-potable reuse

ENERGY
Recovered wastewater heat energy

SOIL
High-quality natural soil amendments

Epic’s water reuse solutions can capture up to 95% of a building’s wastewater for onsite treatment and reuse in non-potable applications such as toilet flushing, laundry, cooling towers, ornamental water features, and local irrigation. Epic’s solutions close the loop for urban water systems, reducing the load on existing centralized water infrastructure and adding resilience to the water grid.

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THE EPIC ONEWATER™ SYSTEM

Our fully customizable solutions collect building waste water and treat it onsite using an advanced multi-step process that includes membrane filtration, biological treatment, and robust disinfection. While the treated water (or effluent) is currently used for non-potable applications due to regulations, the water produced from our systems is so highly purified that it meets and often exceeds federal drinking water quality standards.

Our systems are designed for deployment at the building scale, where the cost of construction and standards for space efficiency are vastly different from municipal wastewater projects.

- **Small Footprint**
  Our system occupies the equivalent of a few parking spaces worth of square footage, excluding water storage tanks.

- **Robust Safety**
  Real-time monitoring and compliance with Article 12C, NSF 350, IAPMO IGC 324, as well as local and state public health regulations.

- **Energy Efficient**
  Our MBR-based systems mimic natural treatment processes without requiring additional polishing; incorporating wastewater heat recovery can also lower building energy demands at minimal added cost.

- **Reliable Partners**
  From permitting and design to ongoing operations and maintenance, we simplify the entire water reuse process to ensure successful projects for our clients.

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On the left is wastewater during the biological treatment process vs. the treated effluent water shown on the right.

SYSTEM OUTPUT 1

HIGHLY PURIFIED TREATED WATER

Onsite water reuse systems create a decentralized, circular approach where a building or community can become self-sufficient in its water use and management. This helps real estate owners reduce operational costs while saving water and creating a more sustainable and resilient building.

Our sustainable solutions can reuse up to 95% of a project's wastewater, saving owners thousands on utility and sewer fees annually.

Disinfected tertiary treated water, also known as reclaimed water or effluent, can be used in a variety of applications. The most common include:

- Toilet & urinal flushing
- Cooling tower makeup
- Irrigation (spray, drip or subsurface)
- Clothes washing
- Ornamental water features

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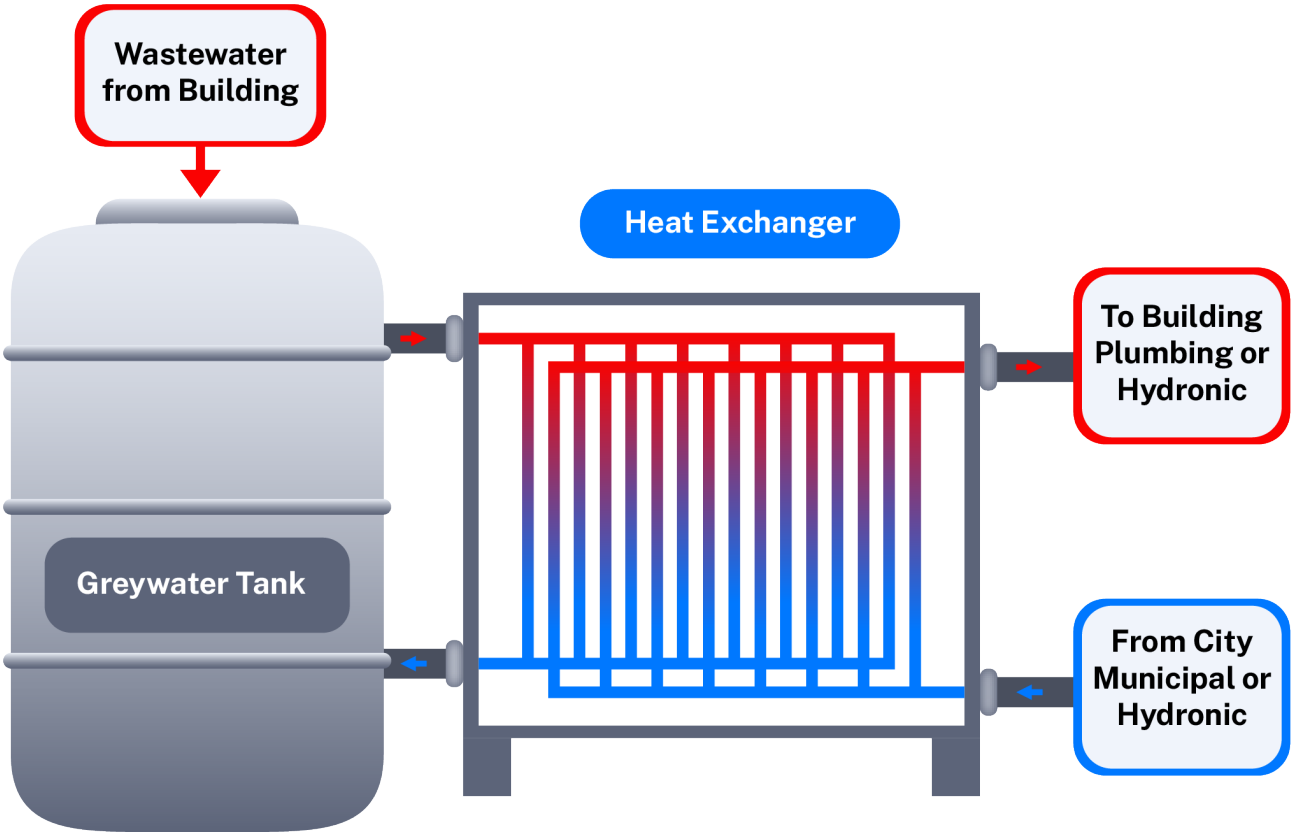

SYSTEM OUTPUT 2

WASTEWATER HEAT RECOVERY

Epic's modular onsite wastewater reuse technology can be customized to include a wastewater heat recovery (WWHR) option. Our process uses double-walled heat exchangers that prevent any cross contamination between wastewater and the building water supply. In a typical apartment building, raw wastewater is stored at around 80° Fahrenheit.

The heat exchanger utilizes the heat from the tank and transfers it to the incoming municipal city water, which is typically between 55° and 65°. Raising the temperature of the incoming water supply even five degrees can create huge energy savings by lowering hot water energy demands.

Energy recovery solutions for the built environment

The significant benefit of wastewater heat recovery is evident in the fact that wastewater heat is present in almost all buildings, making wastewater a low-impact and "renewable" source of heat, in the sense that the wastewater heat is a byproduct of essential and normal building functions. This increases building resilience by creating a circular, self-sufficient resource loop.

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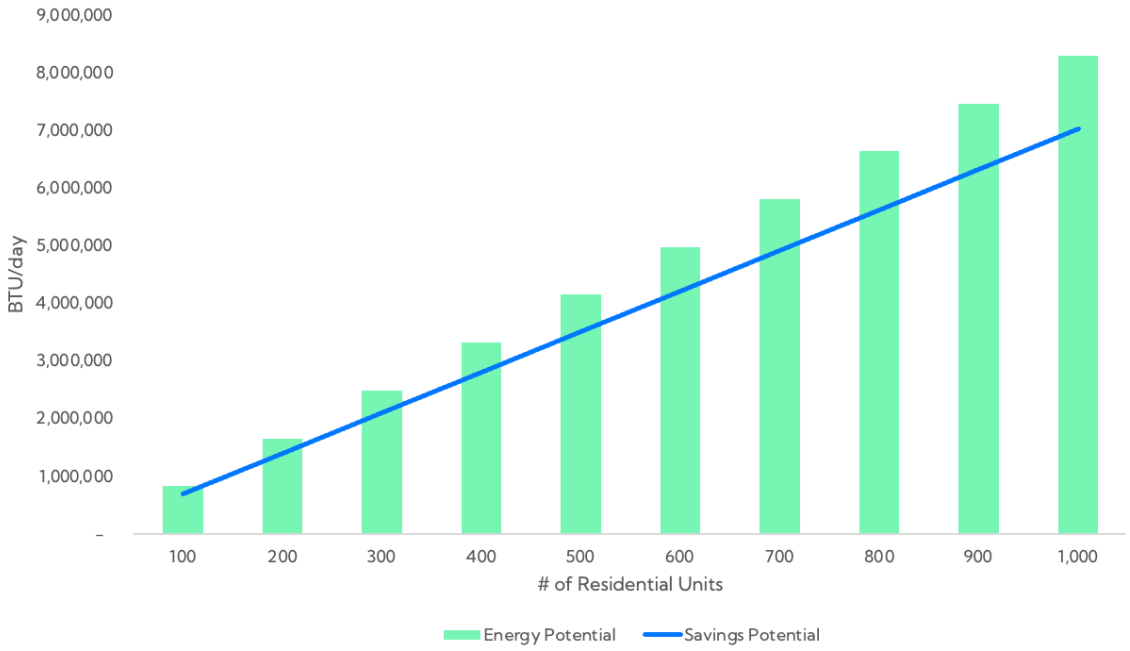
SYSTEM BENEFITS

WASTEWATER HEAT RECOVERY



- Extract up to 24 kW per 1,000 gallons of wastewater processed
- Integrated into Epic's OneWater™ system for a single control panel with SCADA monitoring and data access
- Fully automated, maximizing system uptime while reducing operational cost burden
- Skid-mounted system easily installed and incorporated into the building
- Reduce energy demand and contribute to decarbonization

ECONOMIC IMPACT

Wastewater is an important source of clean thermal energy with significant potential to improve energy efficiency and reduce GHG emissions. Residential and commercial buildings account for 75% of the total U.S. electricity consumption and 13.3% of that consumption goes toward heating water.

Higher temperatures and flows have greater heat recovery potential, translating to more utility savings. Building types that will see the biggest economic benefit are multifamily residential, hotels, student housing, sporting/event venues, and wineries.

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SYSTEM OUTPUT 3

NATURAL SOIL PRODUCTS

Wastewater is full of nutrient-rich organic matter that provides an endlessly renewable source of carbon and plant nutrition that can be used to beautify outdoor spaces, enrich gardens, and keep parks green. By up-cycling wastewater organics, we help divert them from landfills where they often emit harmful greenhouse gases like CO2 and methane into the atmosphere. When we turn these organics into powerful natural soil products, we are putting carbon back into the ground, where it belongs.

Taking the “waste” out of wastewater

Our soil products are a valuable source of both organic matter and other essential plant nutrients like nitrogen, phosphorus, and potassium. As a natural alternative to fossil fuel-intensive chemical fertilizers, our soil yields heartier plants and more robust root structures that sequester even more carbon in the ground.

With Epic, wastewater organics are processed and treated using a proprietary scientific process. Once tested and certified to be of exceptional quality, these soil products can be used as a fertilizer or soil amendment to improve soil health. We are creating a closed-loop system where wastewater organics can be beneficially used and reused for generations to come.

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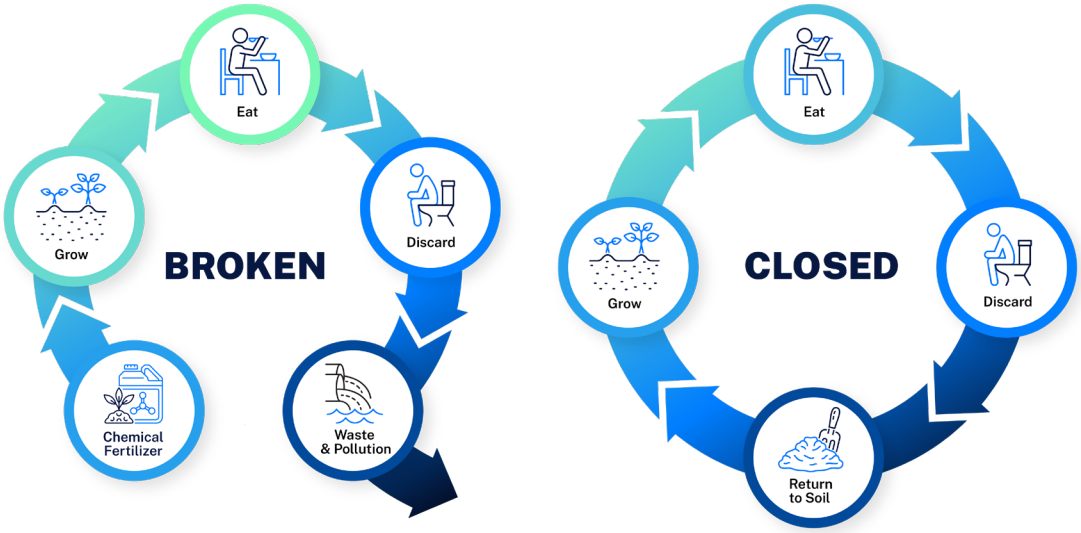
HOW IT WORKS

PROCESSING NATURAL SOIL AMENDMENTS



1. Removal of solids from blackwater
A pre-filtration step in our blackwater installations collects and removes wastewater organics, preparing the wastewater for the ultrafiltration and disinfection stages of our systems.

2. Collected for off-site processing
Wastewater organics are transported to Epic Soil Processing Hubs where they are converted into carbon-rich soil products using a proprietary oxidation process.

3. Returned as natural soil products
Upcycled organic soil products can be returned to the building site for beneficial reuse in landscaping projects or used locally in parks and natural spaces.

Before

After

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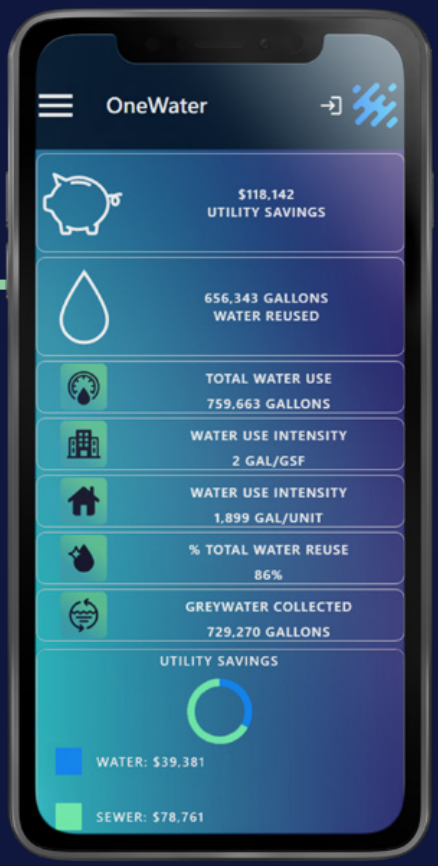
BUILT-IN ECO-INSIGHTS DASHBOARD

Our cloud-based technology can be accessed 24/7/365 and has built-in reporting dashboards. With remote monitoring capabilities, every critical function of the system operates automatically, saving time and limiting manual operator interaction.

- ✔ Fully automated reporting
- ✔ System health monitoring
- ✔ Real-time energy & water savings
- ✔ Built-in dashboard
- ✔ Reduced operational costs



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WHY MBR FOR BUILDINGS

Designers must consider several unique constraints when selecting technologies for onsite water reuse. While most municipal treatment systems utilize open-air ponds for treatment, building scale systems must prioritize designs that minimize footprint and eliminate odor and color to avoid impacting the building occupants. Membrane bioreactor (MBR) technology is the proven technology of choice due to the pairing of robust biological treatment with ultrafiltration membranes that maximize removal efficiency while saving on space required to implement a system. Epic uses an MBR-based treatment train for most building wastewater projects, with customization to each site's requirements.

The MBR-based treatment system process starts when untreated greywater or blackwater enters the system via an equalization tank, which serves as a buffer for flow fluctuations to maintain constant supply to the plant. The water is then pumped to an aerobic biological tank, where most of the treatment happens. Dissolved oxygen is added to the aerobic tank, allowing the microbes to reduce biochemical oxygen demand (BOD) and nutrients like phosphorus and nitrogen.

After 6-8 hours of retention in the biological tanks, the wastewater is then pumped through ultrafiltration membranes. The membranes produce filtered water that is then dosed with ultraviolet disinfection (UV) as well as chlorine disinfection to kill any pathogenic organisms present in the treated effluent. Membrane filtration coupled with UV and chlorine meets the log reduction requirements for safe discharge for reuse.

The Epic OneWater™ system uses best-in-class ultrafiltration membrane technology with a 0.04 µm pore size to maximize treatment and capture particulates and pathogens. In comparison, a single human hair ranges in diameter from 17 to 181 µm.

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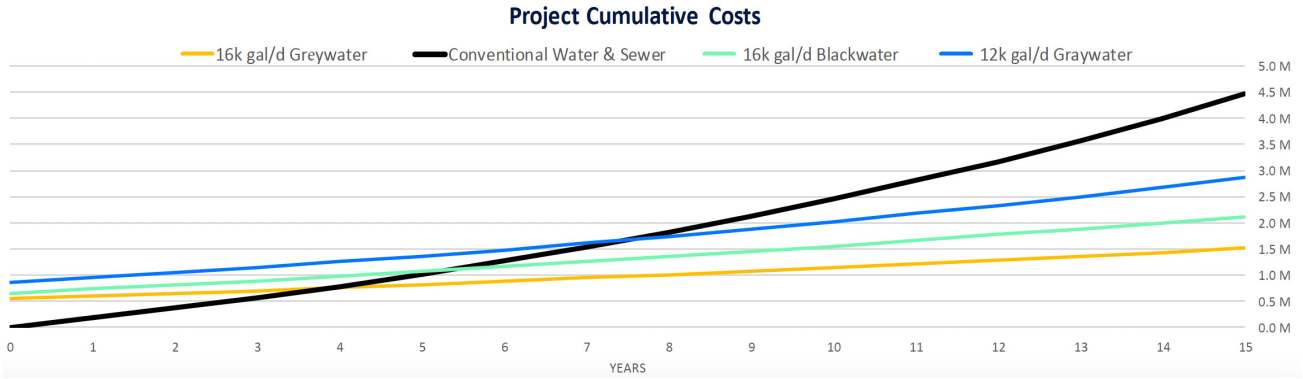
FINANCIAL BENEFITS

For many large buildings (>100,000 sq. ft), onsite water reuse can save hundreds of thousands of dollars annually. The exact amount depends on several factors including water volume, building size, location, property type, new construction vs. retrofit, and system type.

The biggest financial benefits when calculating water reuse ROI include the instant cost reduction in water and sewer utilities, reduced connection fees, insulation against rising water and sewer utility costs (which in many places are increasing by 5-10% a year), and energy savings through heat recovery.



The example graph above shows the projected cumulative costs for onsite reuse with blackwater vs. greywater vs. no reuse system for a project. Epic Cleantec provides this projection for all potential projects.

FINANCIAL BENEFITS

Reduced water and sewer bills, as well as related impact fees, save large building owners an average of 30-50% ($50,000-$1 million) per year on water and sewer-related expenses. Some examples include:

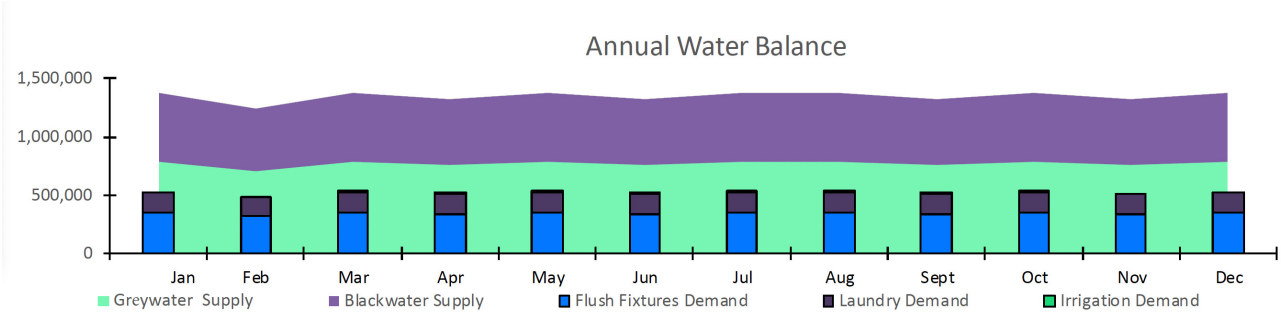
- **A 700,000 sq ft. commercial high-rise** in San Francisco can save hundreds of thousands of dollars on connection fees and around $160,000 per year with a blackwater reuse system

- **A 500-unit residential high-rise** in San Diego can save hundreds of thousands of dollars on connection fees and $200,000 per year recycling water for toilet flushing and laundry use

- **A 400-unit mixed-use high-rise** in Austin can save $150,000-$200,000 per year recycling water for toilet flushing, laundry use, and cooling towers

Heat recovery can boost water reuse savings as well. Epic systems can be customized to include a wastewater heat recovery (WWHR) option.

The WWHR system captures the energy from a building's wastewater and then uses it to preheat domestic hot water. This lowers the building's heating costs and energy use, contributing to decarbonization and sustainability energy targets.



The graph above shows an example water balance calculation performed by Epic Cleantec on all potential projects to determine water demands and usage for a given development.

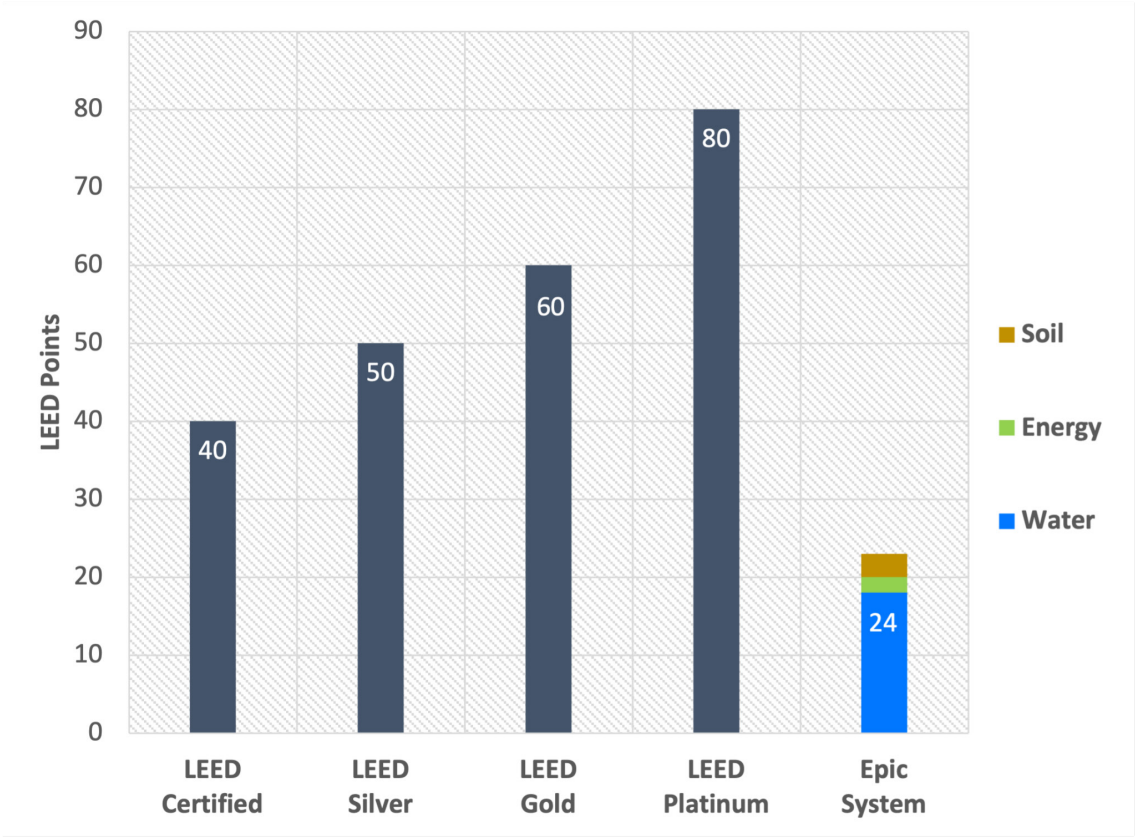
LEED POTENTIAL WITH FULL RESOURCE RECOVERY

Achieve sustainability goals in your projects through certifications like LEED, Living Building Challenge, and WELL. Epic's onsite wastewater reuse system has the potential to earn a project up to 18 LEED points, covering over 25% of points needed for a LEED Gold certification.

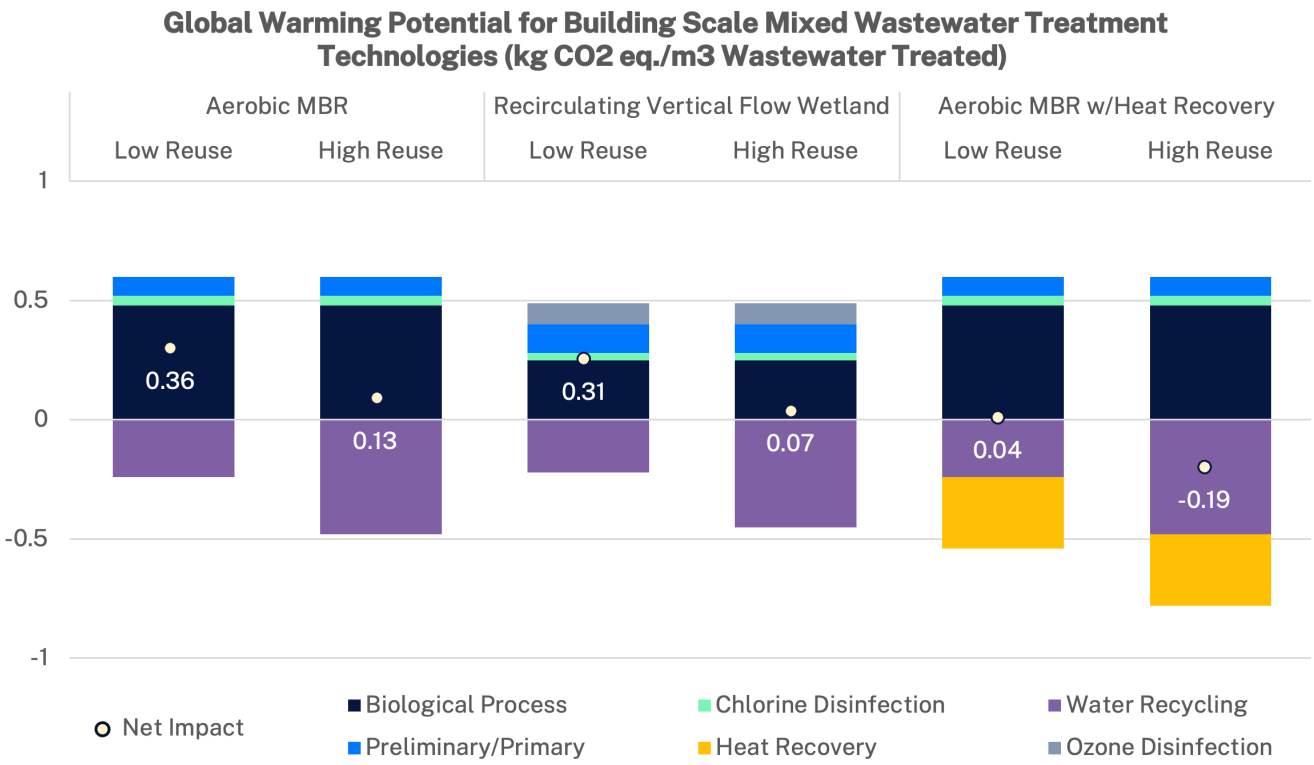
If the project also incorporates elements such as wastewater heat recovery and solids recovery, earned points can jump to 24.

Epic's distinct full resource recovery approach can secure LEED credits that surpass direct competitors in the following credit categories:

- Optimize energy performance
- Building life cycle impact reduction
- Innovation credit



ENERGY EFFICIENCY



MBR systems are misrepresented as being large energy wasters when compared to alternative treatment technologies, such as trickling filters and wetlands. A study by the U.S. Environmental Protection Agency proves that MBR systems actually have lower baseline energy use than typical wetland systems and have the additional benefit of becoming net energy producers when coupled with heat recovery[1]. For project sites like high-rise buildings, space comes at a large cost premium. Implementation of trickling filters and other similar systems is more costly due to the more substantial space requirements. Anaerobic systems are low energy users but cannot meet stringent water quality standards without added polishing steps downstream of digestion. Variable water quality is a common problem when implementing trickling filters, anaerobic digestion and wetlands, and subsequent polishing steps diminish or eliminate potential energy savings.

MBR systems consistently achieve water quality targets and can be designed to operate in an energy-conscious manner, especially where advanced controls are implemented to boost efficiency.

1. Morelli, B., S. Cashman, Xin Ma, J. Garland, D. Bless, AND M. Jahne. Life Cycle Assessment and Cost Analysis of Distributed Mixed Wastewater and Graywater Treatment for Water Recycling in the Context of an Urban Case Study. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-18/280, 2019.

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TECHNOLOGY LANDSCAPE

The treatment system configuration will depend on the regulatory landscape and the intended recycled water end uses. Disinfected tertiary recycled water offers the most flexibility for reuse.

The wastewater treatment process can be accomplished by a wide variety of system types. Though there are a multitude of options and combinations, some of the most common types used for achieving tertiary treatment standards include:

- Membrane bioreactor (MBR)
- Extended aeration / activated sludge
- Anaerobic digester
- Trickling & fixed film systems
- Wetlands

In areas where water is used for irrigation or other exposure to groundwater sources, nutrient removal is also critical to consider. Requirements will vary based on location.

For example, California has specific requirements for total nitrogen limits at certain flow and exposure thresholds. At the beginning of each project, Epic will evaluate the local and state regulatory landscape to ensure the system will have strict compliance.

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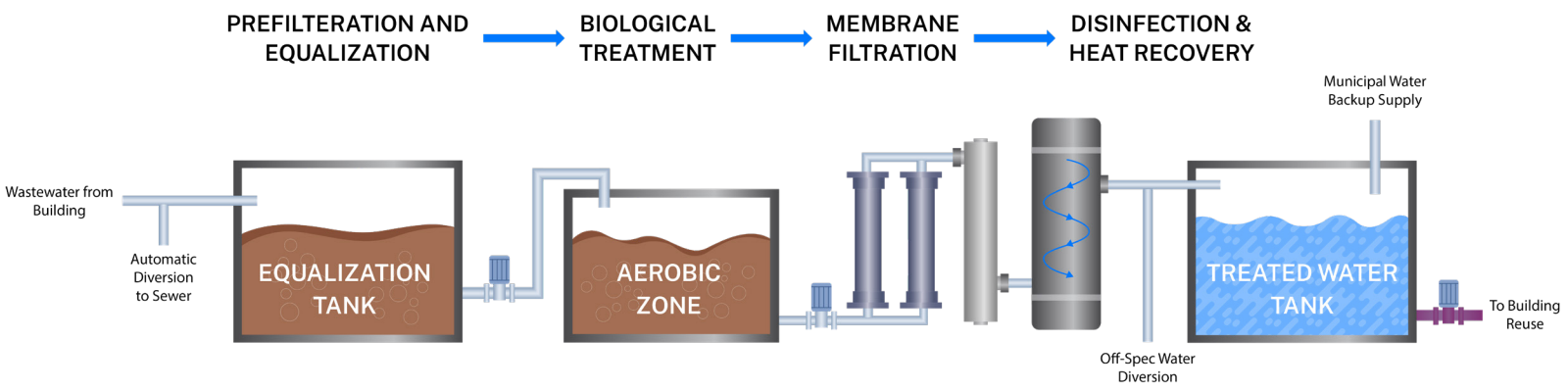

HOW IT WORKS

TREATMENT PROCESS

1. Prefiltration and Equalization
The first step is a prefiltering process, as wastewater collected from toilets, showers, sinks, washing machines, and other wastewater sources contains debris and organic solids that need to be removed prior to any treatment step.

The filtered water is then sent to an equalization holding tank, which serves to buffer out flow peaks, thereby allowing optimization of system sizing.

2. Biological Treatment
The raw water undergoes advanced biological treatment for removal of contaminants, impurities, and organics, known as Biological Oxygen Demand, or BOD.

3. Membrane Filtration
Epic utilizes membrane bioreactor (MBR) filtration, which is a rigorous biological treatment process combined with an ultrafiltration membrane (membranes with a nominal pore diameter of 0.04 microns) to capture particles and organisms.

Dissolved oxygen is added to the biology tanks and the microbiology reduces the BOD and nutrients like phosphorus and nitrogen.

4. Disinfection and Heat Recovery
Before pumping for reuse in the building, water undergoes multiple steps of disinfection via ultraviolet light and chlorine, which render the water safe for reuse in non-potable applications.

If heat recovery is included, the system will capture energy from wastewater and use it to pre-heat incoming municipal supply, resulting in lower heating costs for the building.

Nutrient Removal

In locations where nutrient removal is required, our system is custom-tailored to achieve regulatory requirements. For nitrogen removal, an anoxic zone is created to support anaerobic biological treatment. The system is automated for the proper amount of recycle flow and mixing to maximize nutrient removal while balancing energy consumption and odor considerations. The biological treatment system consumes nitrogen and phosphorus in removing the biochemical oxygen demand; additional steps can be implemented where stringent total phosphorus limits are in place.

Disinfection

Disinfection is a critical step for protection of public health. Although the membranes in an MBR process remove many pathogens, some can pass through the physical barrier. As such, our approach involves at least two disinfection steps to protect the reuse network and end users.

Ultraviolet disinfection (UV) plus chlorine contact/residual allows for efficient treatment and provides residual disinfectant to protect the distribution system. There are additional options including onsite generated ozone or Granular Activated Carbon (GAC), which can be utilized for enhanced color removal if needed. Typically, UV and chlorination are more than sufficient in most building wastewater systems for disinfection.

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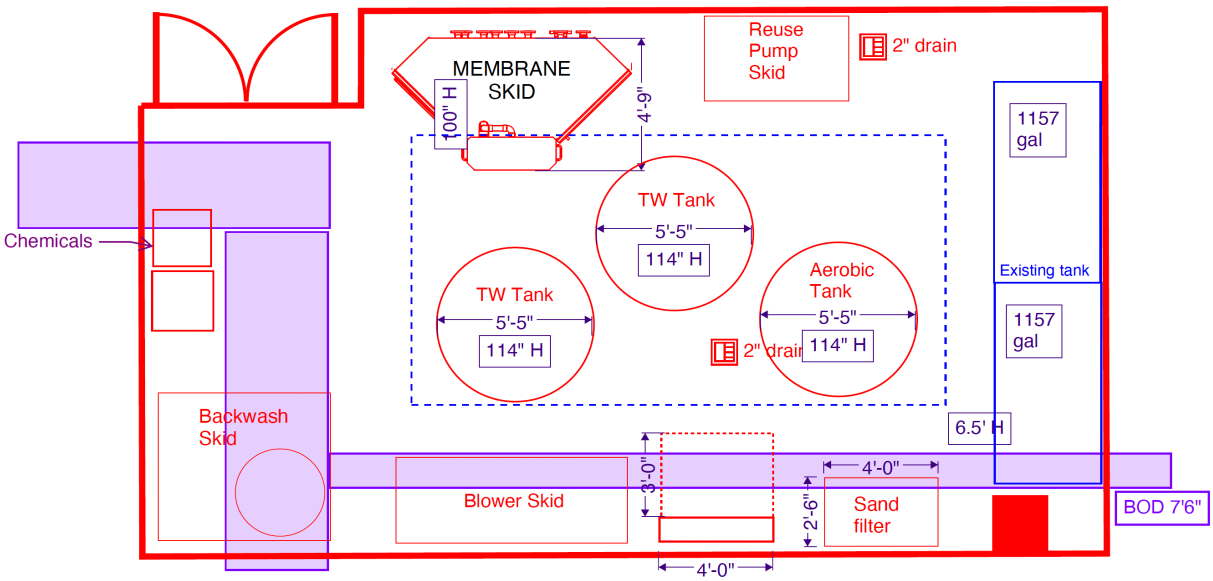


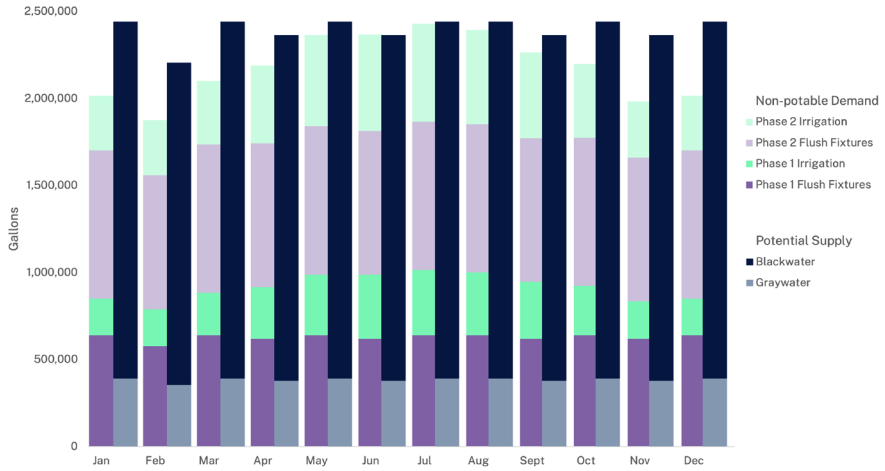
BUILDING INTEGRATION CONSIDERATIONS

With extensive experience in the built environment, the Epic team understands the challenges and opportunities presented when installing treatment systems in buildings. As square footage generally comes at a premium cost, each system is designed to maximize space efficiency. For some buildings, this means fitting into an area with low head space, and for others, it means making use of odd spaces that may otherwise be underutilized.

Epic works closely with the project team to ensure the treatment system will integrate seamlessly with MEP, structural, and architectural design. During early design, Epic provides a Design Integration Memo to inform the design team of integration recommendations and requirements in the early stages of their designs, and coordinates with the team in later design phases to ensure all disciplines' requirements are met. Epic provides guidance and coordination on the following:

- Plumbing including required drainage and water connections
- Tank and waterproofing recommendations
- Ventilation requirements and odor control recommendations
- Fire protection requirements and recommendations
- Electrical and low voltage requirements
- Lighting requirements
- Structural requirements
- Logistics considerations for equipment maintenance and solids removal (where applicable)

PROJECT IMPLEMENTATION



Epic works together with owners and project teams throughout each stage of design. Initially, Epic's water balance models verify available wastewater sources and recycled water end uses. The selection of wastewater source depends on the building type, regulations, and climate. Identifying available water sources and potential end uses is critical to project success, allowing Epic to match the treatment system to the intended use, resulting in the most efficient solution possible. The treatment train is then custom-engineered for the site to meet regulatory needs while addressing energy and space-savings goals.

Site-specific needs are also considered during design. This includes items such as multiple barriers for disinfection redundancy, diversion capability, storage, nutrient removal for groundwater protection, salt loading management for horticultural longevity, and enhanced TDS and color removal.

To simplify the project delivery process, Epic Cleantec helps project stakeholders navigate the complex regulatory landscape by handling all permitting discussions and submittals. Epic also provides guidance on applicable grants and incentives that support onsite reuse implementation.

Epic is actively involved with helping to shape the regulatory landscape for onsite reuse and has extensive experience working with regulators to demonstrate system compliance and safety.

Each system is designed to meet stringent water quality standards including national standards such as NSF 350 and Title-22. Projects under local requirements, such as San Francisco's Article 12C and Austin's GoPurple program, are designed to meet specific standard with guaranteed compliance.

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SIMPLE INSTALLATION

Epic understands that it is critical to deliver a complete, factory-tested system to the site for seamless installation. Commonly referred to as “plug and play,” the major system components are provided in a skid-mounted or containerized form factor, allowing the system to be fully constructed and tested off-site.

The form factor significantly reduces installation cost and complexity, resulting in a rapidly deployable solution that can be installed and operational in a matter of weeks. To assist in project deployment, Epic offers onsite construction oversight, commissioning, and startup services.

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OPERATIONS AND MAINTENANCE

Epic's end-to-end service platform was created to provide owners with a holistic solution to their water conservation and utility savings goals. Operations and asset management are critical to long-term success, which is why we have a team of licensed operators who provide ongoing support for everything from system inspections and process adjustments to regulatory requirements like water quality sampling.

Epic's secure data management platform offers 24/7 remote access to system data, with multiple layers of treatment oversight to ensure water quality stays within specified limits. With remote monitoring capabilities, our systems require minimal onsite operation. Daily tasks are typically limited to a brief walk-through by the owner's facilities team to observe any obvious issues like leaks or unfamiliar sounds. More in-depth assessments are scheduled weekly or monthly, depending on the complexity of each project, to address operational items such as preventative maintenance, water quality sampling, process diagnostics and adjustment, clean-in-place cycles, and inventory planning.

Our robust service platform allows us to take full accountability for the performance of each project, from design and construction to system startup, commissioning, and operation.

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GREYWATER CASE STUDY

Fifteen Fifty is a 40-story apartment building that is home to the first permitted and approved onsite greywater reuse operation in San Francisco's city history. The 550-unit residential tower also includes 40,000 square feet of retail space and a 12,000 square foot park.

Operated and maintained by Epic, the onsite water reuse system has the capacity to recycle 7,500 gallons of greywater per day, over 2.5 million gallons per year, and will save Related California more than $90,000 annually on utility costs over the next 10 years.

LOCATION
San Francisco, CA

SIZE
760,000 square feet

UNITS
550 apartments

COLLECTION SOURCES
Rainwater, greywater

SYSTEM CAPACITY
7,500 gal/day

END USES
Toilet flushing, irrigation

RELATED

SOM

Southland

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GREYWATER CASE STUDY

Kuilei Place is a planned 43-story luxury residential project in Honolulu, HI that will utilize Epic's OneWater™ system to reduce the project's total water demand by nearly 24%. The system will recycle up to 30,000 gallons of greywater per day and reuse it for toilet flushing in its 1,005 units and irrigation of its lush 1,100,000 square foot property.

The system will treat 8.5 million gallons of water per year collected from the building's showers, sinks, baths, and washing machines, saving around $133,000 annually in utility costs.

Epic Cleantec is overseeing the design, permitting, and implementation of the greywater system. This collaboration ensures seamless integration and adherence to the highest standards of efficiency and sustainability.

LOCATION
Honolulu, HI

SIZE
1,100,000 square feet

UNITS
1,005 apartments

COLLECTION SOURCES
Greywater

SYSTEM CAPACITY
30,000 gal/day

END USES
Toilet flushing, irrigation

KOBAYASHI GROUP

DESIGN PARTNERS INCORPORATED

Commercial Plumbing Inc.
AN EMPLOYEE OWNED COMPANY

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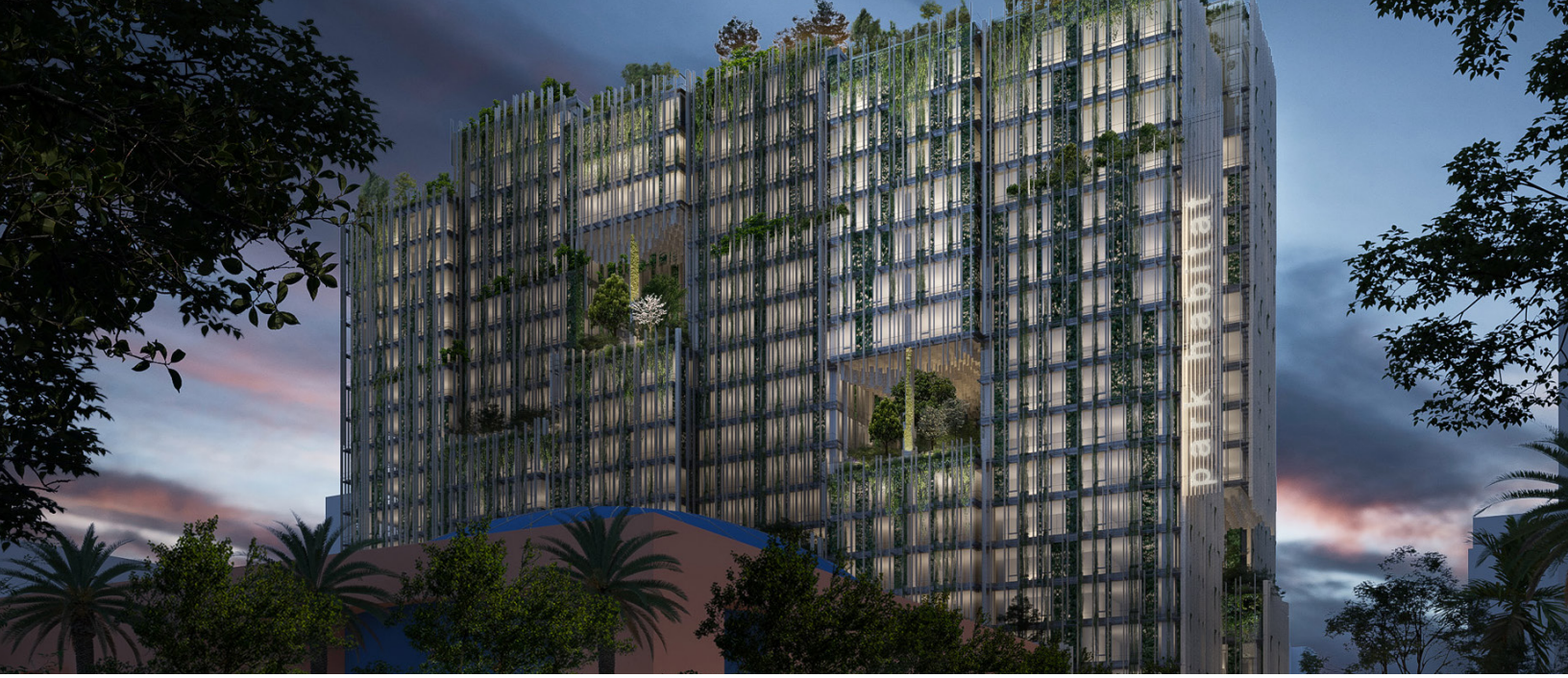

BLACKWATER CASE STUDY

Park Habitat is a proposed 20-story, 1.3 million square foot office space, retail shopping center and museum in San Jose with lush vegetation and verdant landscaping throughout the project.

A massive living, green wall coupled with horizontal landscaping features will be irrigated using highly purified recycled water with Epic's award-winning OneWater™ approach. Additionally, Epic will collect and upcycle the building's organic wastewater solids, converting them into high-quality soil amendments for beneficial reuse in the buildings landscape program and in local green spaces.

With Epic's blackwater treatment and reuse system, Park Habitat will reuse nearly 11 million gallons of water per year, saving over $150,000 in ongoing water and sewer utility fees.

LOCATION
San Jose, CA

SIZE
1,300,000 square feet

COLLECTION SOURCES
Blackwater

SYSTEM CAPACITY
30,000 gal/day

END USES
Toilet flushing, irrigation, soil amendments

westbank

KENGO KUMA & ASSOCIATES
隈研吾建築都市設計事務所

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BLACKWATER CASE STUDY

The Campus at Horton is a 1,000,000 square foot redevelopment project located in San Diego, CA that will reinvent a formerly abandoned mall into a lively community complex with beautiful office spaces, life science facilities, retail outlets, and dining establishments.

The project will reuse roughly 55% of its water by deploying Epic's OneWater™ system to capture and treat 24,000 GPD of wastewater for treatment and reuse in cooling tower makeup and flushing throughout the campus. The blackwater system will recycle over 7.5 million gallons per year, saving over $170,000 per year in water and sewer fees.

Epic Cleantec is overseeing the design, permitting, and startup commissioning for this innovative project.

LOCATION
San Diego, CA

SIZE
1,000,000 square feet

COLLECTION SOURCES
Blackwater

SYSTEM CAPACITY
24,000 gal/day

END USES
Toilet flushing, cooling towers

STOCKDALE CAPITAL PARTNERS

Introba rdc.

atelier ten

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CREATING
SOLUTIONS

Born out of initial work with the Bill and Melinda Gates Foundation's Reinvent the Toilet Challenge, Epic Cleantec is spearheading an onsite water reuse revolution. Trusted by leading players in real estate throughout North America, we leverage our multidisciplinary expertise in water and wastewater engineering, building science, public policy, and marketing to create systems that transform how we manage our water resources.

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SUMMARY

CONCLUSION

Understanding a building's water and wastewater consumption and available reuse options enables the implementation of optimal solutions to meet site goals. By tapping into the resources inherent in their wastewater streams, owners and developers can reduce costs, capture energy, expand housing or production capacity, hedge against mandatory water curtailments, and manage long-term utility cost escalation risk. Sustainable design through the treatment and reuse of wastewater enhances the site and community by minimizing the "waste" in wastewater while creating new project opportunities.

Get in touch with Epic Cleantec to discuss how onsite water reuse technology can benefit your next project.

>> REQUEST FREE PROJECT ASSESSMENT

epiccleantec.com

sales@epiccleantec.com