INTERNATIONAL DISTRICT ENERGY ASSOCIATION

# Understanding our Water Footprint: De-risking Operations

Ed Kirk, Johns Hopkins University

JOHNS HOPKINS UNIVERSITY

Jonathan Lanciani, Sustainable Water

SUSTAINABLEWATER

# Water Apocalypse

Only 5-10% of “drinking” water produced will be used for consumption.

http://www.virginiaplaces.org/watersheds/drinkwater.html

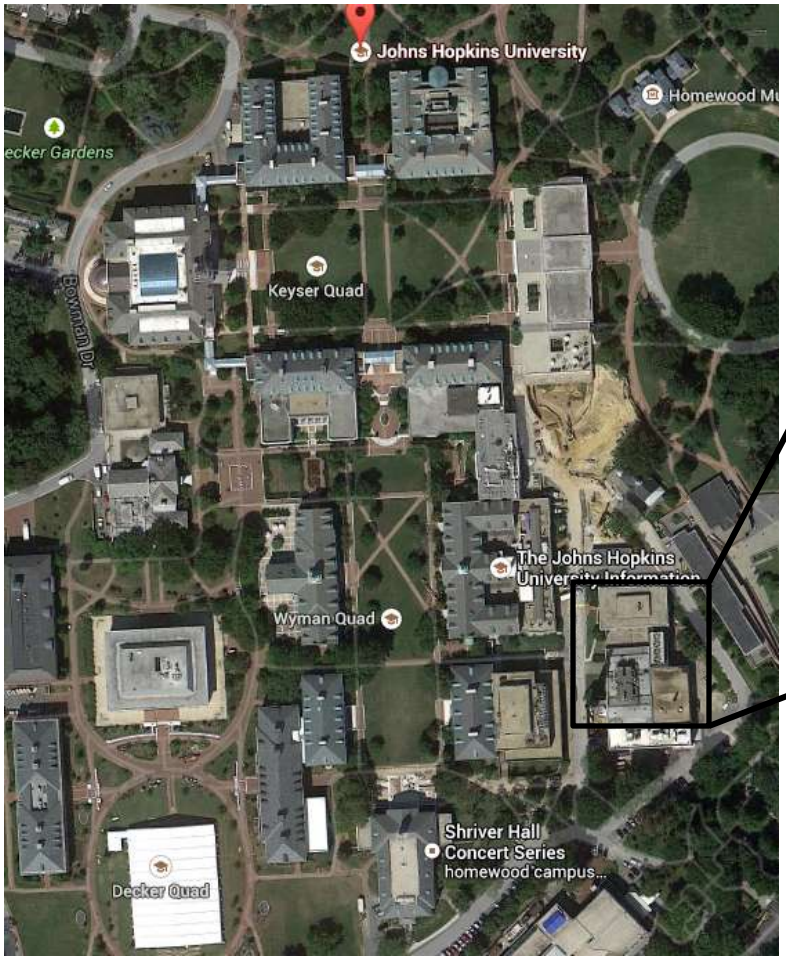
History of drought in region

Risks: Rates, Availability, Infrastructure, Environmental Pressure

# Water: The Lynchpin to JHU's Way of Life

Solutions for a Range of End Users

# Johns Hopkins University



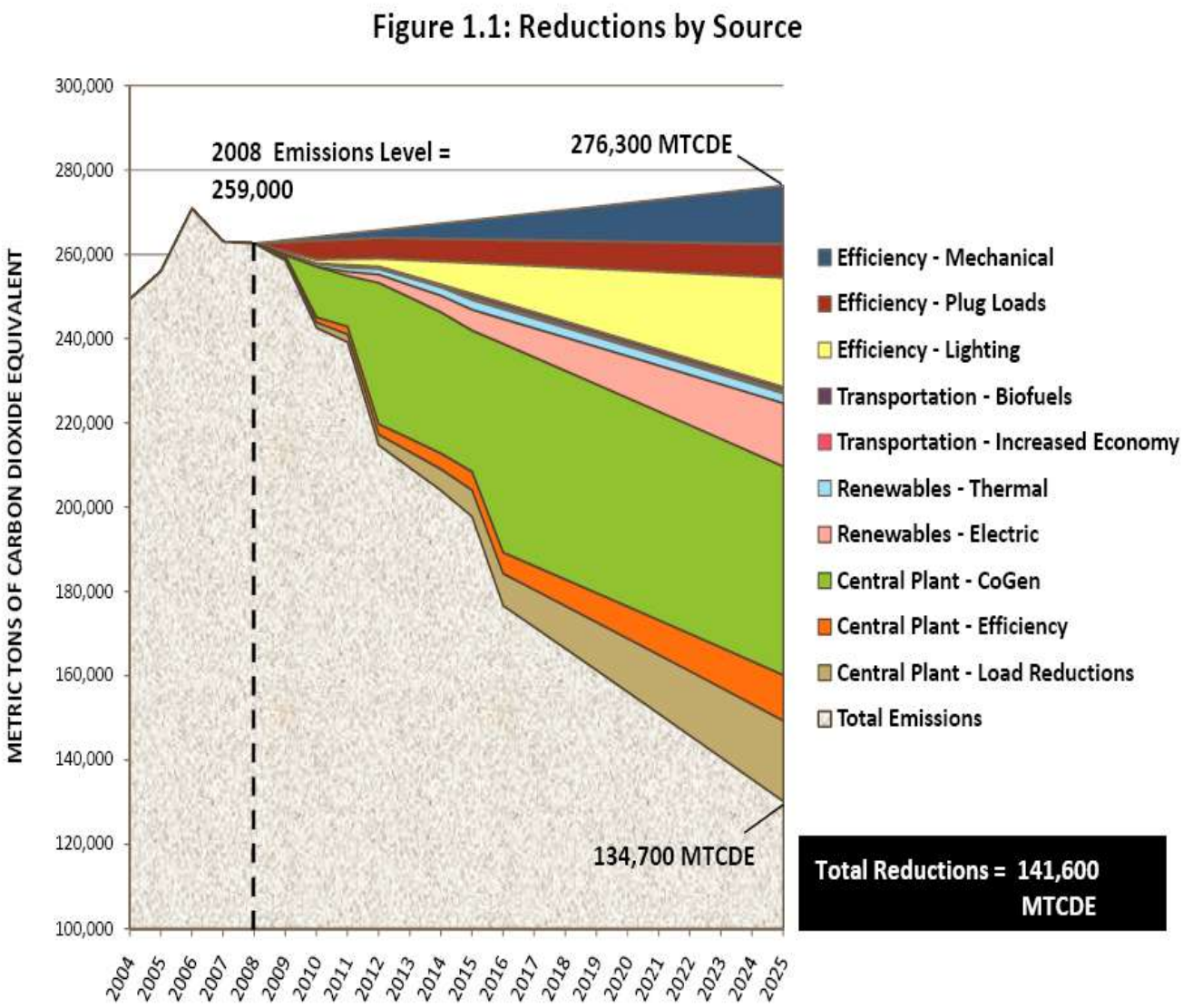


- Est. 1876
- 20 M GSF of Buildings
- 21 MW of CHP across 5 systems
- 50,000 tons of cooling and steam
- 320 M Gallons of water annually

Mission: Ensure JHU is sustainable and remains strong and vibrant

# 2009 JHU Task Force on Climate Change

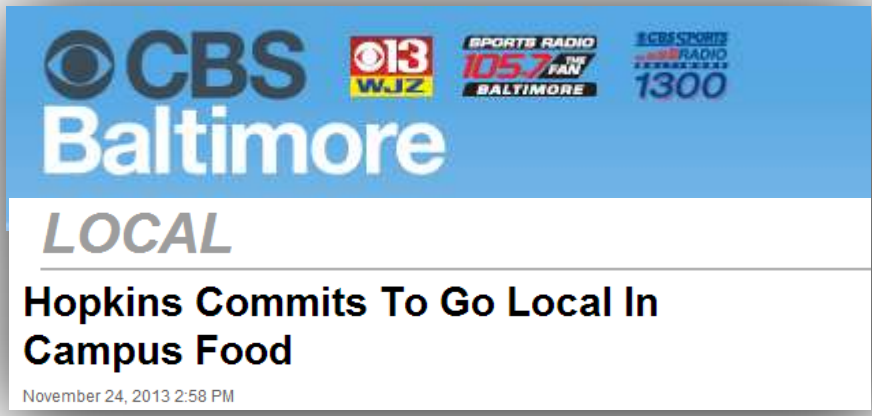
- From the Committee:
  - **Possible to reduce GHG by 141,600 MT CO2e**
  - **No one way to reach the goal.**
  - **Business as Usual growth rate: 0.3% annually.**
  - ***Result = 51% reduction in GHG by 2025.***



# JHU Sustainability Efforts

Since 2008:

- Reduced GHG Emissions by 23% while the campuses have grown by 9%
- Sustainable Purchasing initiatives
- LEED certification on 12 buildings
- Waste diversion increased more than 50%
- Already conserving and treating stormwater


CBS Baltimore

LOCAL

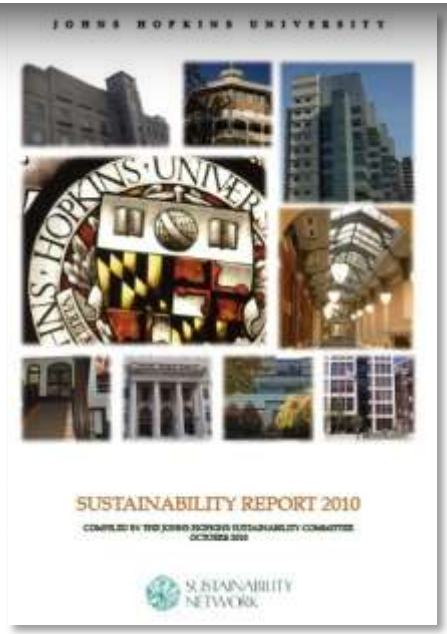
**Hopkins Commits To Go Local In Campus Food**

November 24, 2013 2:58 PM


**The Value of Sustainability Communications Strategies in Achieving Facilities Goals**

By David Bookhart and Ed Kirk

When sustainability efforts were gaining ground on ... sional staff's time. From both sustainability and facilities viewpoints, waste ... in concert with the plant operations staff to find ways of increasing building




But what about water?? Water use ROSE 9% in 2010

# What's Been Done…

## 3 Cogeneration Plants (18MW)

- Increases Plant EE & Reduces carbon footprint

## Trigeneration Plant (1.5MW)

- 85% better than grid electricity

## Small CHP (75KW Modules)

## Results:

- Displace High Carbon content grid electricity
- Capture & use waste heat

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# National Recognition

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Cogeneration & On-Site Power Production®

Magazine | Newsletter | Buyers Guid

HOME ▼ WORLD REGIONS ▼ COGEN/CHP ▼ ON-SITE POWER ▼ ON-SITE RENEWABLE

Home | More Cogeneration/CHP News | John Hopkins University takes on CHP as part of gre

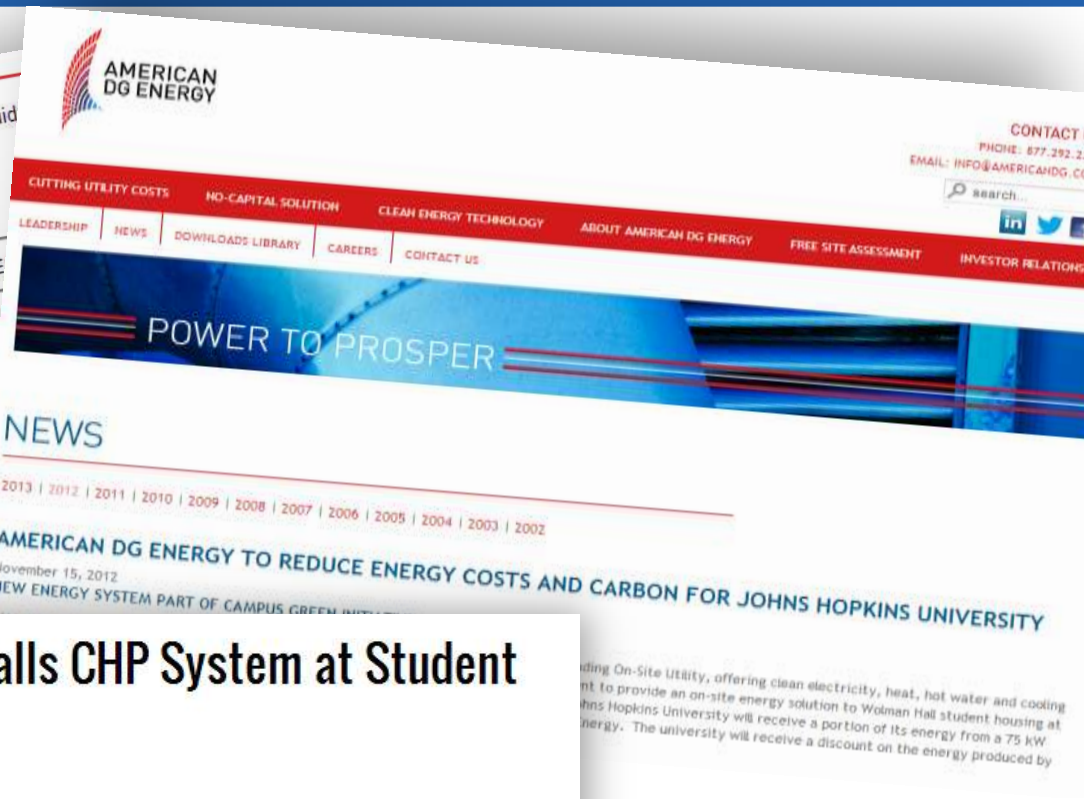
John Hopkins University takes on C of green initiative

15/11/2012
By Diarmaid Williams
International Digital Editor

The John Hopkins University in Baltimore on-site power expertise to facilitate the W

Under the terms from a 75 kW co American DG E system and rec

American DG


AMERICAN DG ENERGY

CUTTING UTILITY COSTS | NO-CAPITAL SOLUTION | CLEAN ENERGY TECHNOLOGY | ABOUT AMERICAN DG ENERGY | FREE SITE ASSESSMENT | INVESTOR RELATIONS

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POWER TO PROSPER

NEWS

2013 | 2012 | 2011 | 2010 | 2009 | 2008 | 2007 | 2006 | 2005 | 2004 | 2003 | 2002

AMERICAN DG ENERGY TO REDUCE ENERGY COSTS AND CARBON FOR JOHNS HOPKINS UNIVERSITY

November 15, 2012

NEW ENERGY SYSTEM PART OF CAMPUS GREEN

ding On-Site Utility, offering clean electricity, heat, hot water and cooling nt to provide an on-site energy solution to Wolman Hall student housing at hns Hopkins University will receive a portion of its energy from a 75 kW nergy. The university will receive a discount on the energy produced by

## Johns Hopkins Installs CHP System at Student Housing Building

November 21, 2012 by Linda Hardesty

JOHNS HOPKINS UNIVERSITY

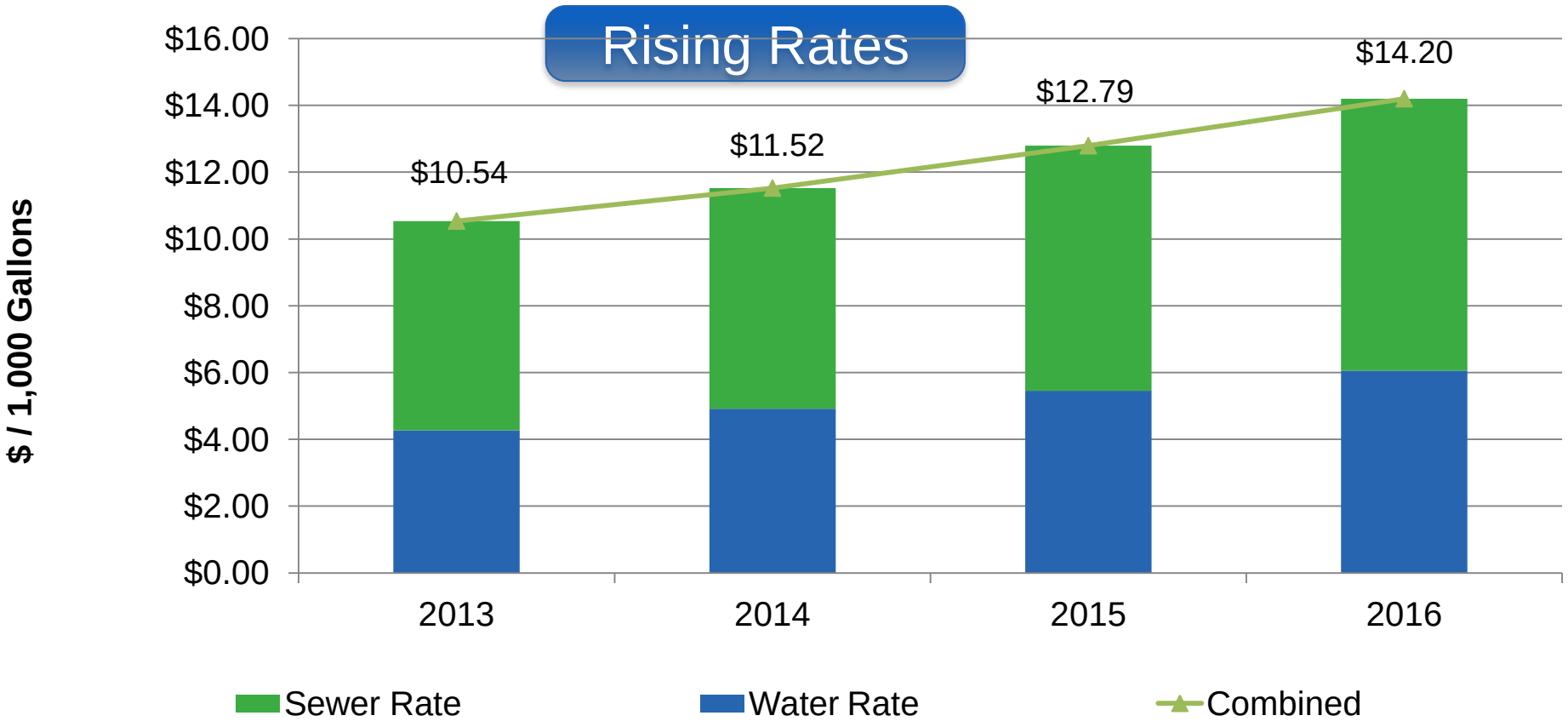
American DG Energy will provide on-site energy to Wolman Hall student housing at The Johns Hopkins University in Baltimore, Md.

Under the terms of the agreement, Johns Hopkins will receive a portion of its energy from a 75 kW combined heat and power system (CHP), which will be owned and operated by American DG Energy. The university will receive a discount on the energy produced by the CHP system and reduce its carbon footprint.

Setting Standards for Efficiency and Reliability

# Risks to Water

## Rising Rates




## Maryland's Aging Infrastructure

$13 billion Infrastructure Investment Needs Through 2030

Baltimore: Rates set to rise 11% over next 2 years

# Risk Mitigation

## Campus water objectives:

- Redundant Water Supply
  - Drought
  - Municipal infrastructure failures
- Additional On-Site Storage
- Flexibility & Resilience
- Independence
- Availability in the event of failure
- Minimum recovery time
- Insulation from rising water costs




N+1: Reliable and Safe Alternatives to Potable Water

# Solution: Reuse Water

## A logical extension to conservation efforts

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### Operational

- De-risks operations with an alternative water source
- Protects against mandatory conservation programs

### Cost Savings

- Discounted water rates
- Reduced potable water intake
- Reduced sewer fees

### Environmental & Social

- Decreases diversion of water from ecosystems
- Decreases wastewater discharge
- Net energy efficiency gains
- Reclaimed water shows no danger to public health

**Eliminate Risks, Save Money and Increase Sustainability**

# Centralized vs. Decentralized Reuse



Water Treatment Facility

**~10+ miles**

End User

Wastewater

Reclaimed Water

The Embodied Energy of Water

Impractical for Baltimore, MD

# Overview

## Utility Water Assessment

- Equipment inventory
- Water quality needs
- Program admin.
- Reclaimed water modeling

## Water Footprint Assessment & Economic Validation

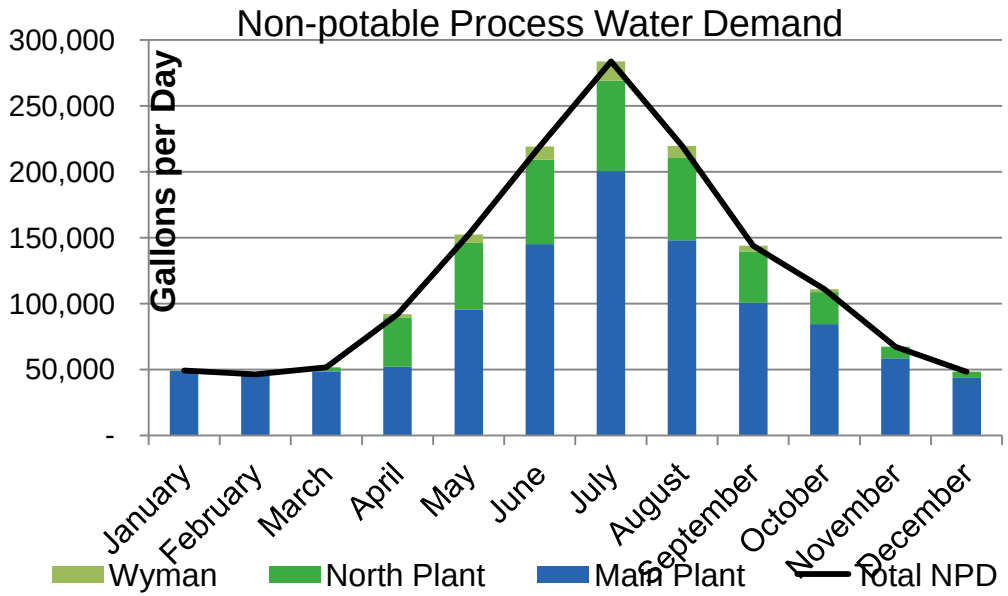
- Water balance & use
- WW flow projections
- Non-potable demand
- Economic assessment

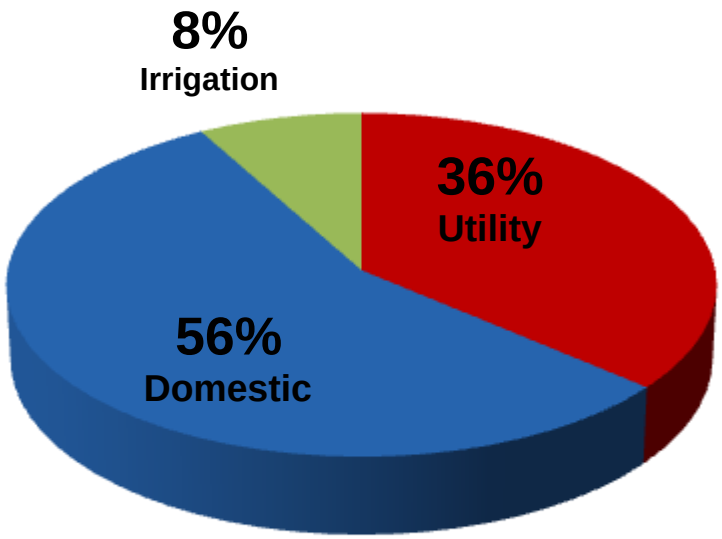
## Site & Infrastructure Assessment

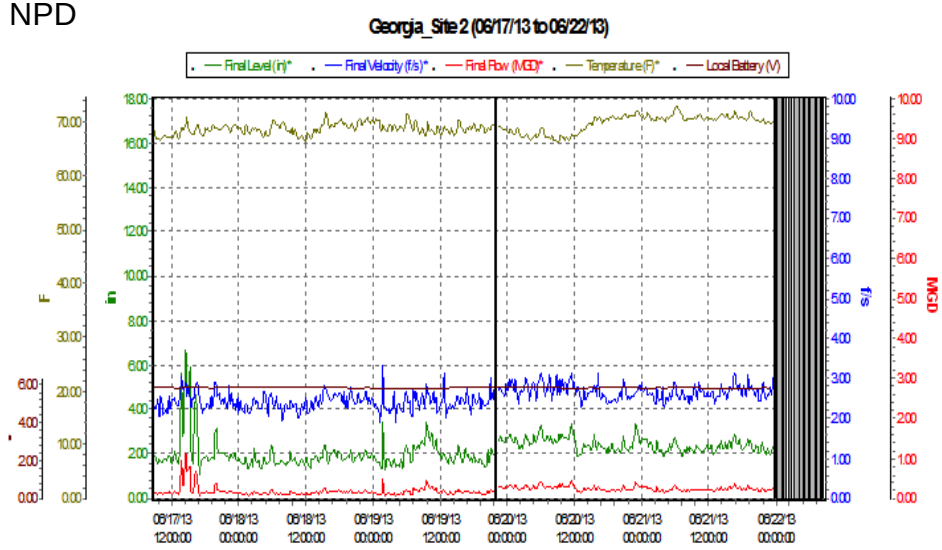
- Infrastructure review
- Prelim. siting & design
- Regulatory review
- Lifecycle Savings

## Validating Impact & Developing a Plan

# Utility & Sewer Data



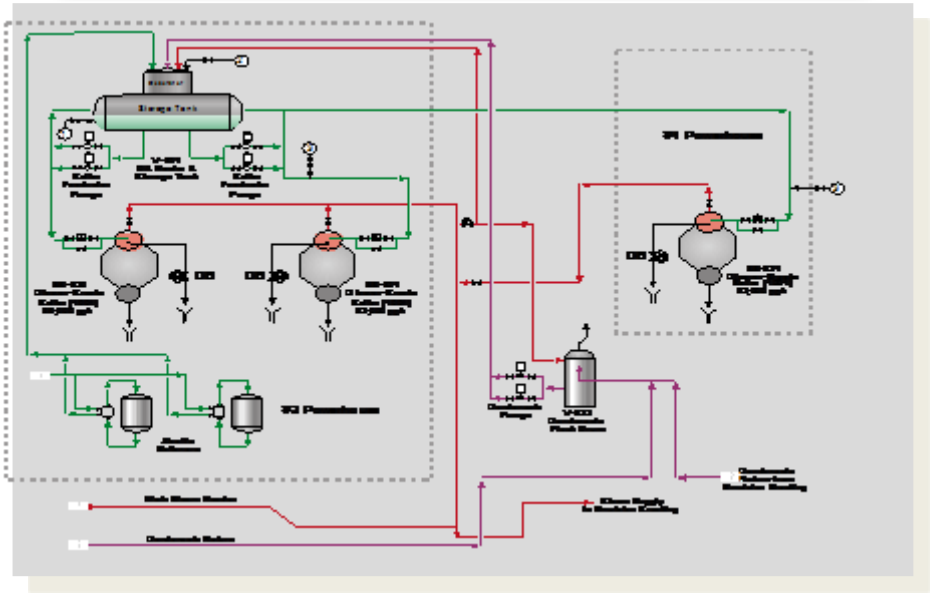

Predictable Demand

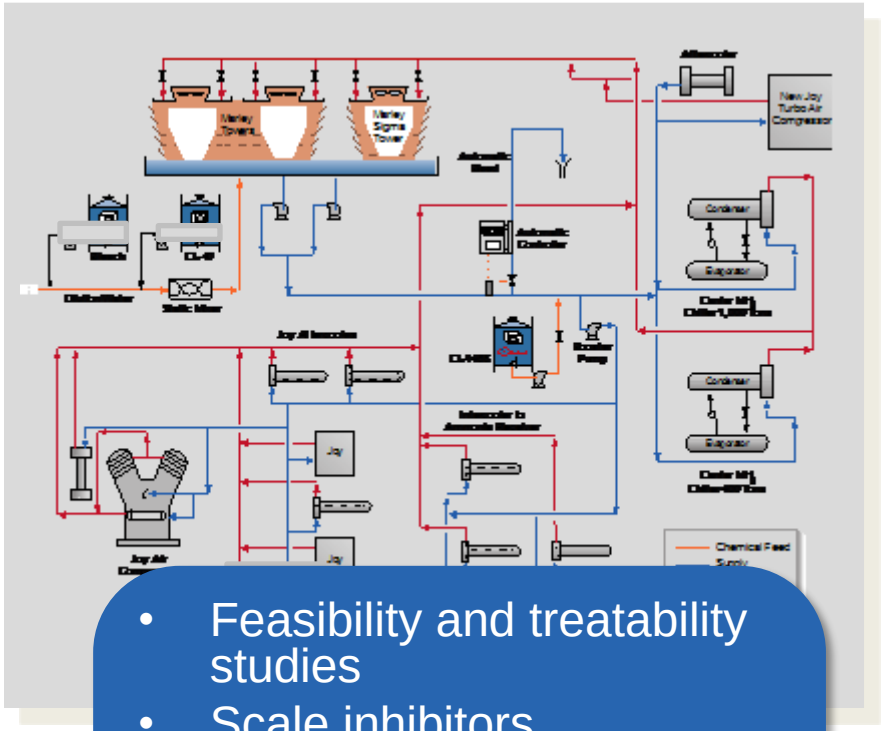
# Some Independent Power Producers Currently Using Reclaimed Water

Water Reuse is Prevalent Amongst IPPs

# Utility Assessment

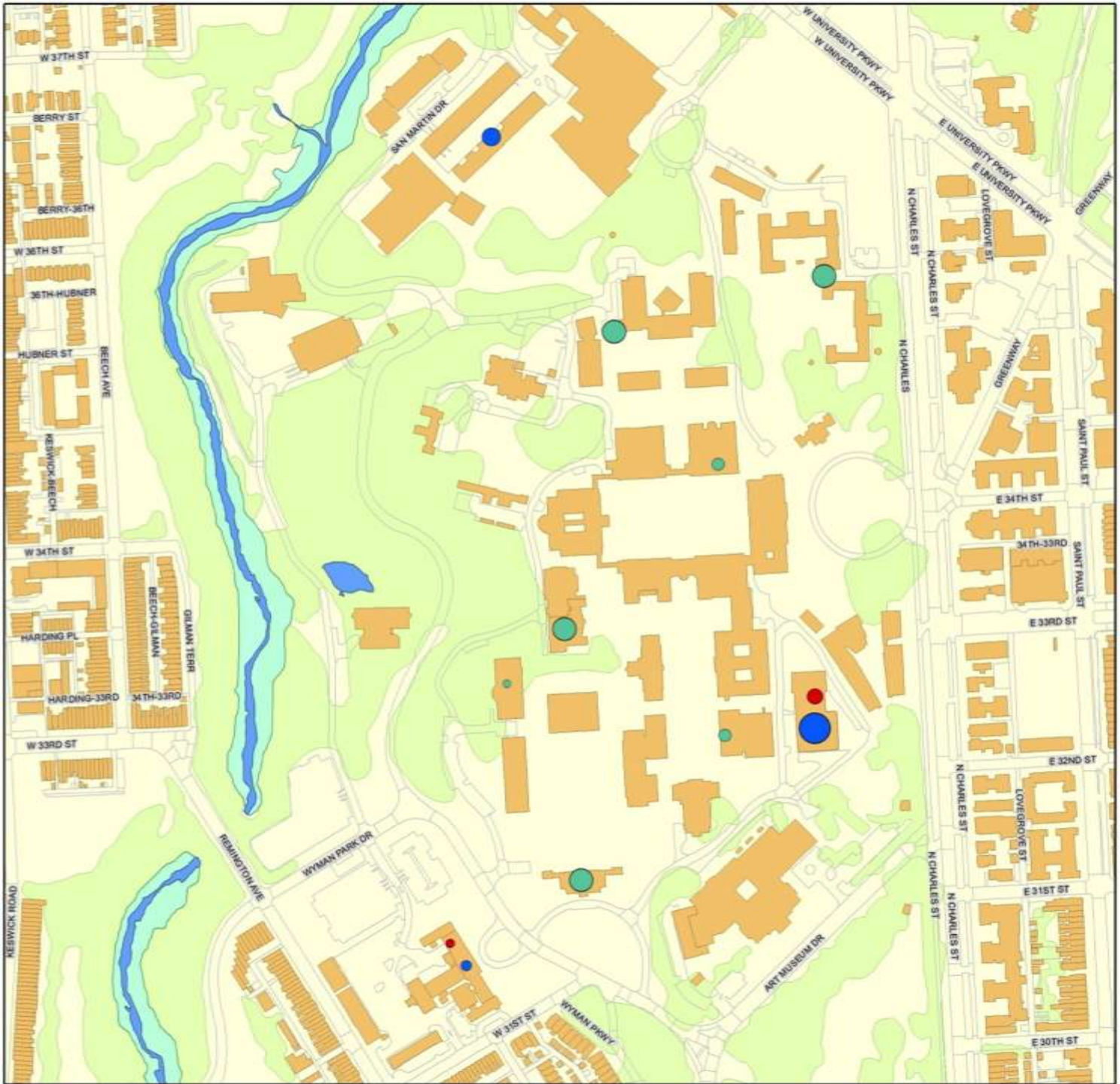
- Biological studies
- Corrosion studies
- Automation
- Treatability studies
- Equipment Integrity





- Feasibility and treatability studies
- Scale inhibitors
- Sludge dispersants
- Treatment specifications
- Purity studies
- Corrosion studies
- Fuel conservation studies

Superior Program Oversight: Unparalleled Collaboration

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**Johns Hopkins University**
**City of Baltimore, Maryland**

# Non-Potable Demand Locations

**Cooling Tower Makeup - GPD**
- 4,600
- 4,601 - 35,700
- 35,701 - 71,600

**Boiler Makeup - GPD**
- 150
- 151 - 15,000

**Irrigation - GPD**
- 605
- 606 - 2,646
- 2,647 - 4,507

Lakes & Rivers
Floodplain
Vegetated Area

0 300 600 ft

*Scale* 1:10,328

Coordinate System: NAD 1983 StatePlane Maryland FIPS 1900 Feet

**Notes**

UTILITY FEATURES PORTRAYED ON THIS MAP MAY NOT BE SURVEY VERIFIED.

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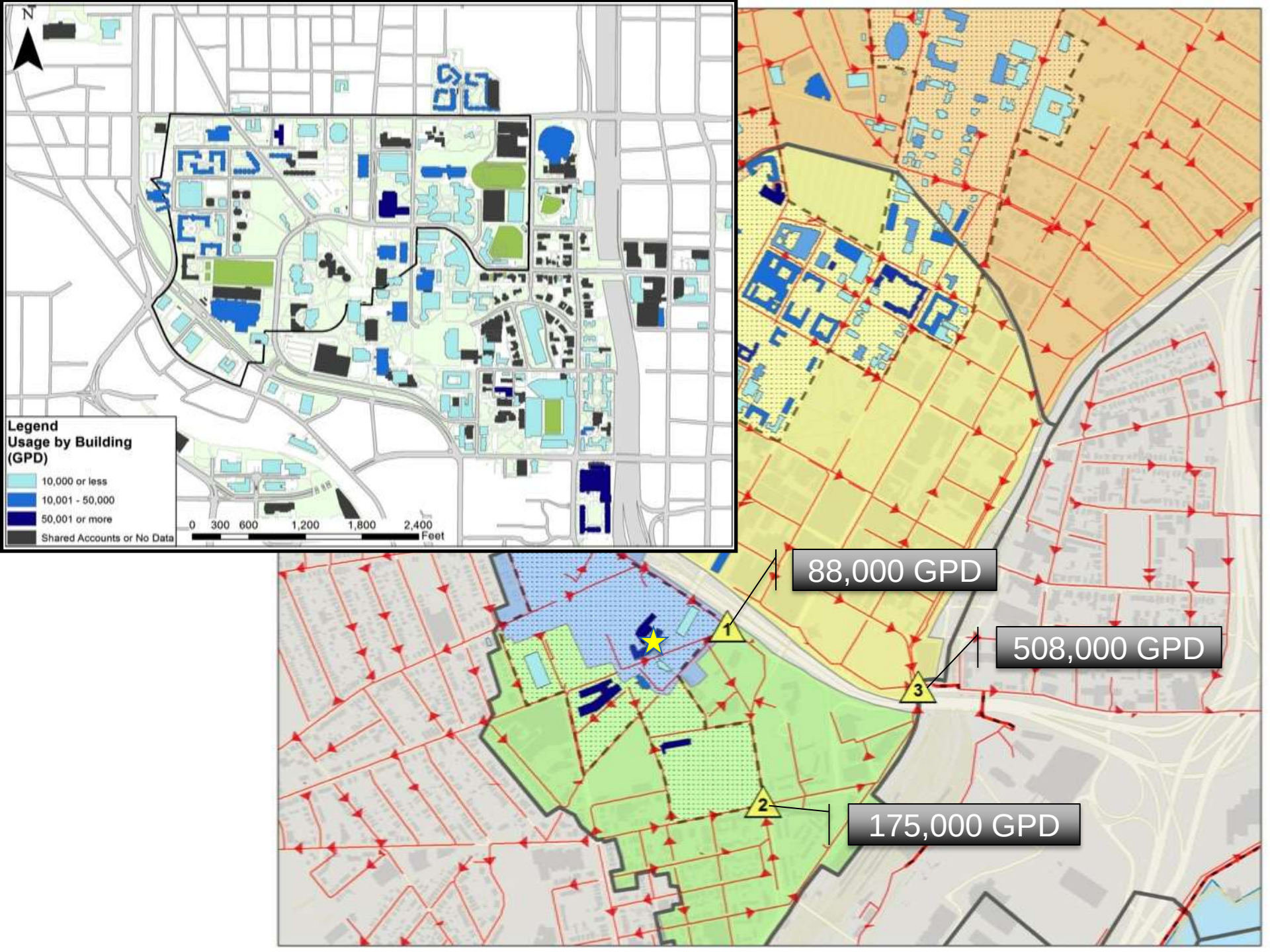
Sustainable Water Consultants LLC, Glen Allen, VA


N
Legend
Usage by Building
(GPD)
10,000 or less
10,001 - 50,000
50,001 or more
Shared Accounts or No Data
0 300 600 1,200 1,800 2,400
Feet
88,000 GPD
508,000 GPD
175,000 GPD
1
2
3

# Water Purchase Agreement

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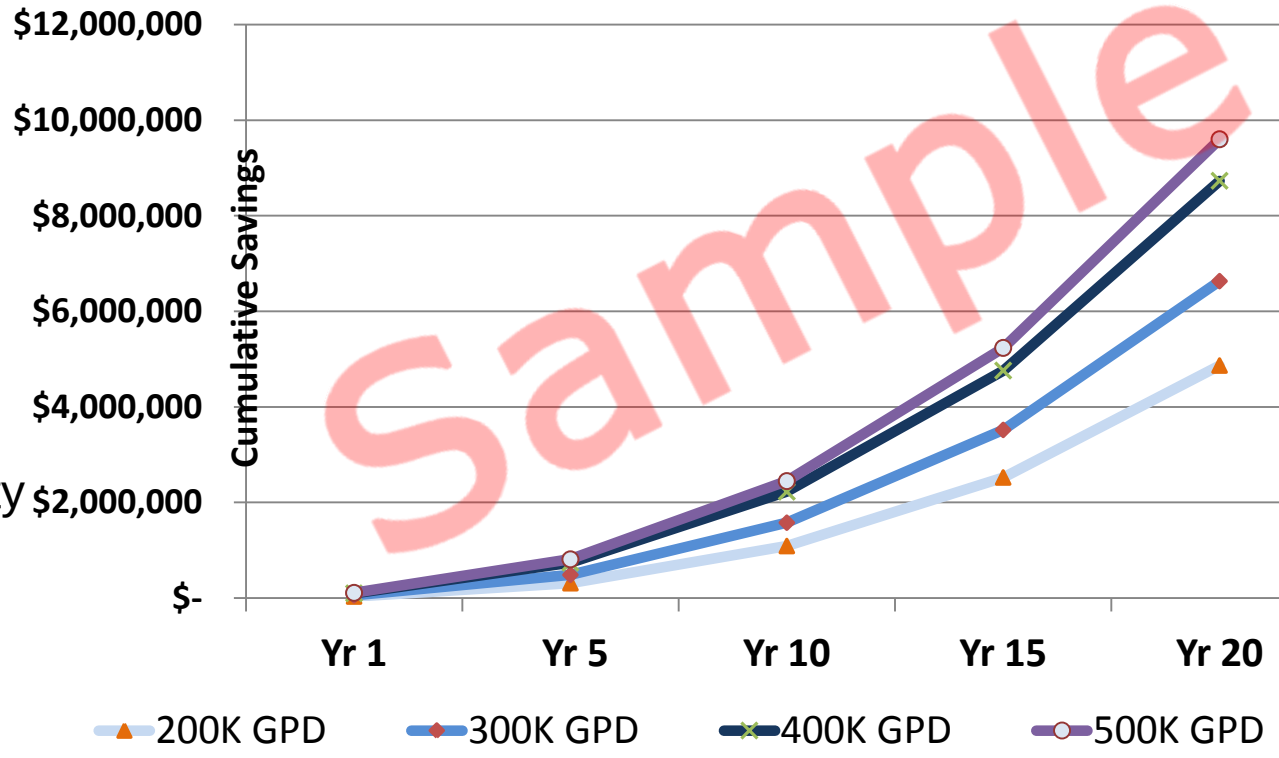
**Flexible project financing arrangements utilizing:**
~ Performance Contracts ~ Operating Leases ~ Design-Build Agreements

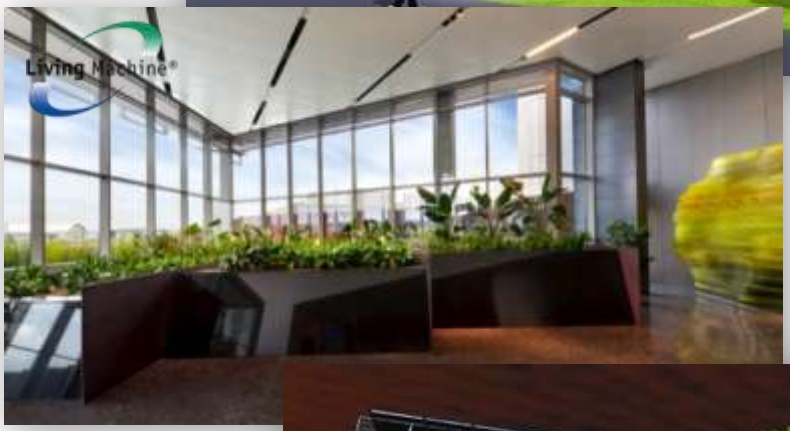
## Benefits

- No up-front capital
- Innovative Technologies
- Leverages superior credit rating
- Immediate, Guaranteed Savings
- Long Term Pricing Stability
- No O&M Responsibilities
- SW bares majority of risk



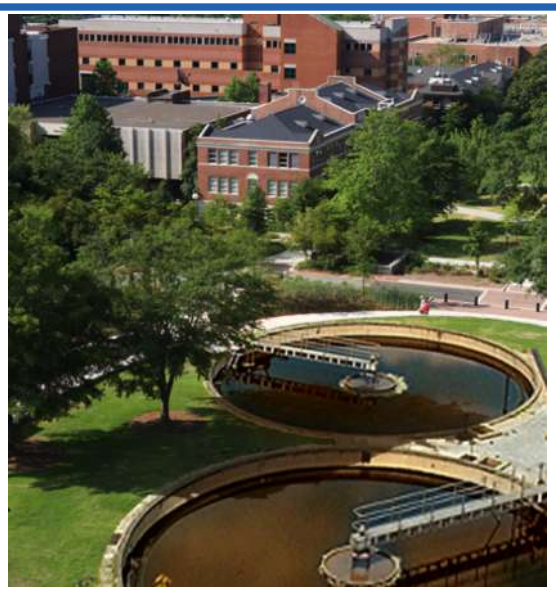

**Water is Principal to Facility Operations**

# The WaterHub™


Student Engagement: Functional, but also a Living, Learning Classroom

# Water Reuse in Urban Spaces



VS.

| | Tidal Wetlands | Hydroponic and Textile | Moving Bed Bioreactor (MBBR) | Membrane Bioreactor (MBR) | Conventional Activated Sludge |
|---|---|---|---|---|---|
| Capital Expense | 🟢 | 🟢 | 🟢 | 🔴 | 🟡 |
| Operating Expense | 🟢 | 🟢 | 🟡 | 🔴 | 🟡 |
| Energy Efficiency | 🟢 | 🟡 | 🟡 | 🔴 | 🟡 |
| Effluent Quality | 🟢 | 🟢 | 🟢 | 🟢 | 🔴 |
| Footprint | 🟡 | 🟢 | 🟢 | 🟡 | 🔴 |
| Aesthetics | 🟢 | 🟢 | 🟡 | 🔴 | 🔴 |

Decentralization Creates New Dynamics: Safety, Aesthetics & Footprint

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# Complex, Adaptive Ecosystems

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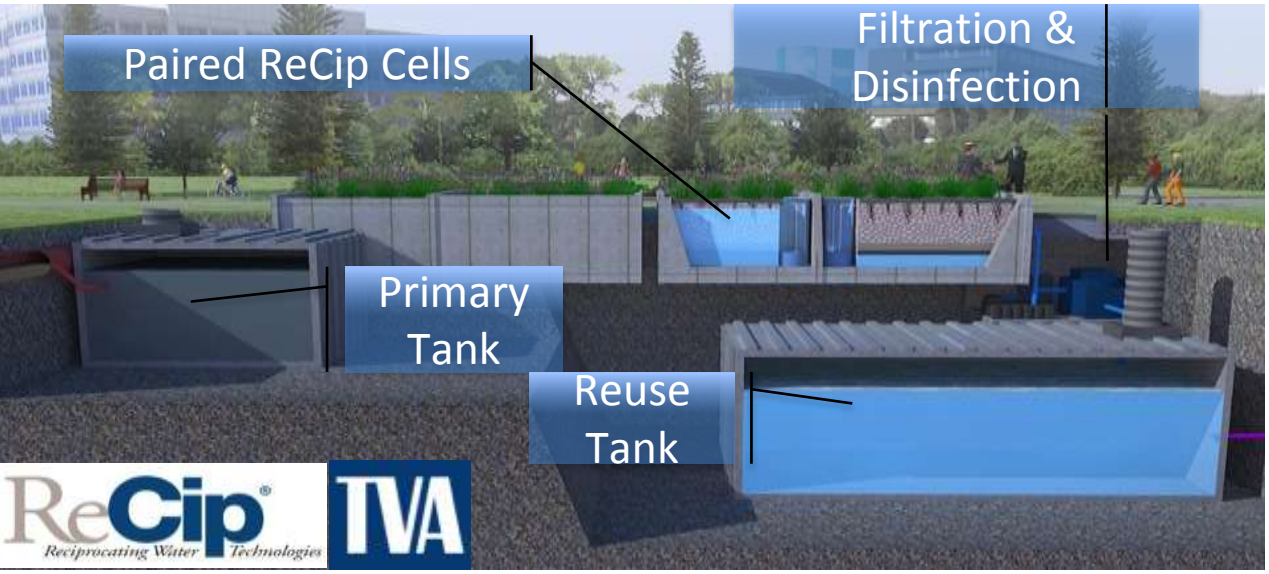
Increased Biodiversity, Reduced Energy Requirements

# Adaptive Ecological Solutions




SUSTAINABLE WATER
EXTENDING THE LIFE CYCLE OF WATER

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# QUESTIONS?

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