February 28, 2019

Campus District Scale Wastewater Reclamation Systems Planned for 2020: WaterHub an Eco-Engineered Wastewater Treatment Plant

Bob Salvatelli

SUSTAINABLE WATER®
EXTENDING THE LIFE CYCLE OF WATER

INTERNATIONAL DISTRICT ENERGY ASSOCIATION
CampusEnergy2019

ECO-ENGINEERED REUSE SYSTEMS

RISK MITIGATION

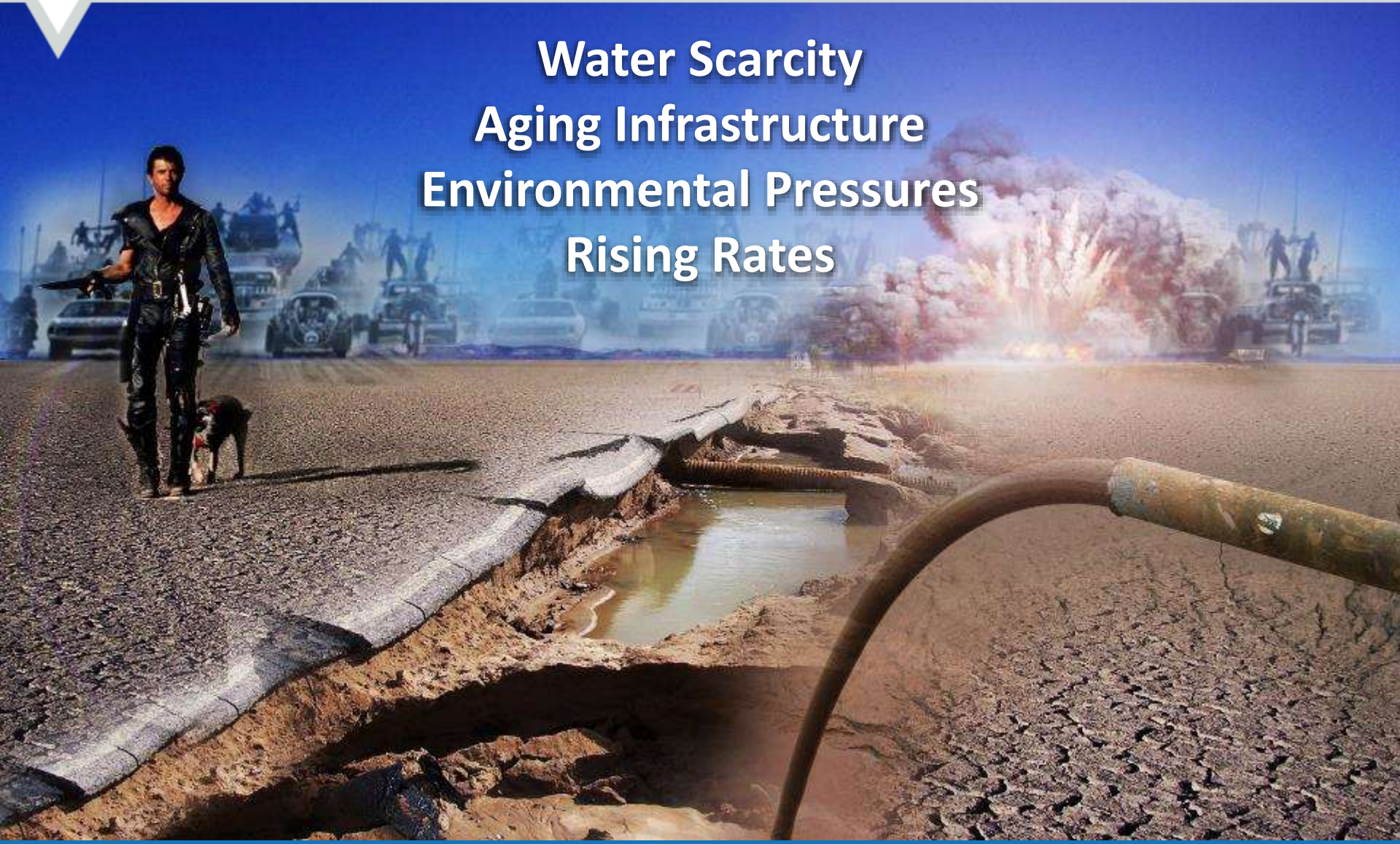
FINANCIAL SAVINGS

ENVIRONMENTAL RESPONSIBILITY

SOCIAL RESPONSIBILITY

Changing the Paradigm of Traditional Water Management

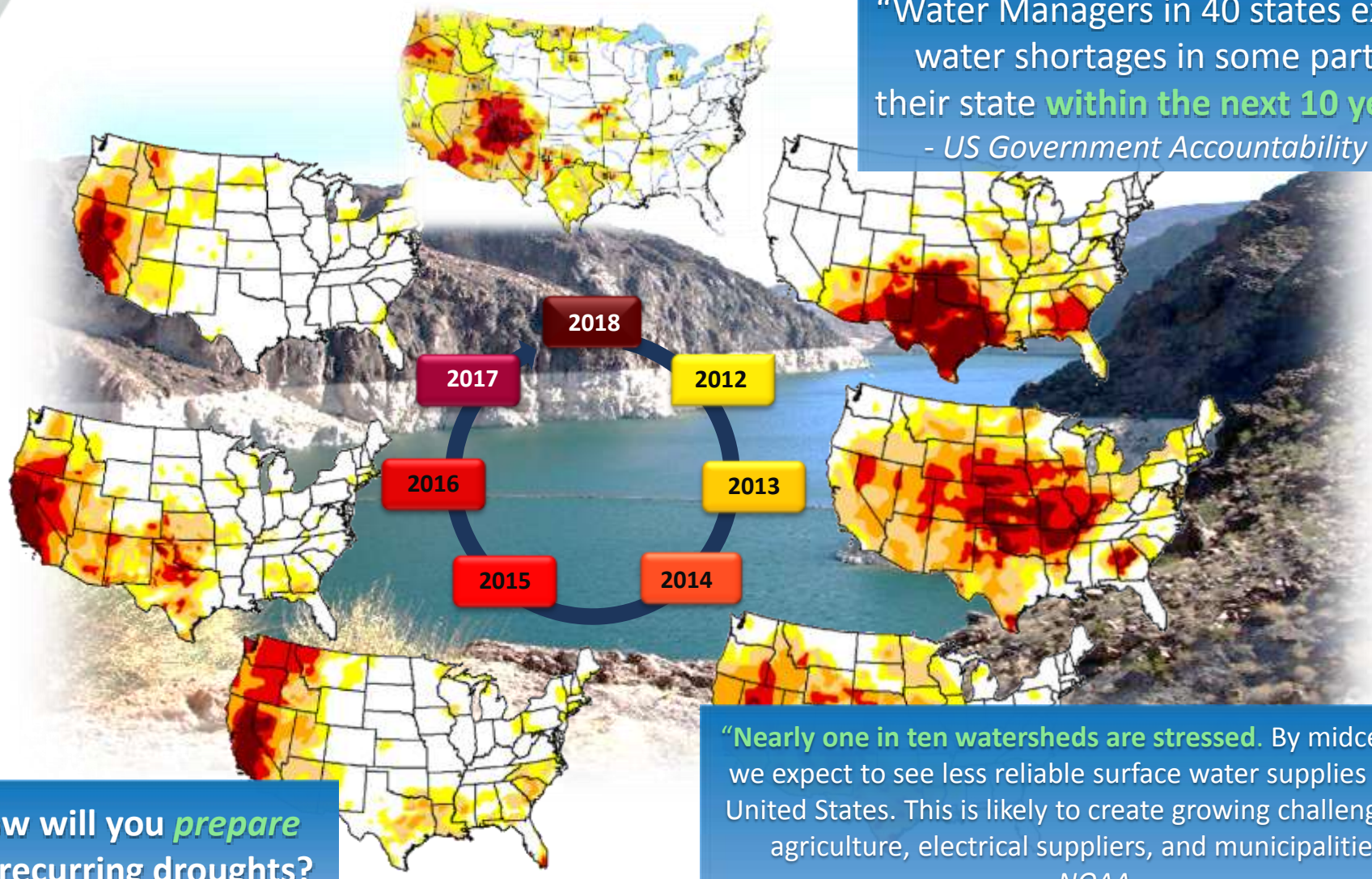
THE WATER APOCALYPSE



Together These Factors Will Completely Change Water Management

THE CYCLE OF DROUGHT

"Water Managers in 40 states expect water shortages in some part of their state **within the next 10 years.**"
- US Government Accountability Office



How will you *prepare* for recurring droughts?

"**Nearly one in ten watersheds are stressed.** By midcentury, we expect to see less reliable surface water supplies in the United States. This is likely to create growing challenges for agriculture, electrical suppliers, and municipalities."
- NOAA

National Water Challenges Demand Immediate Action

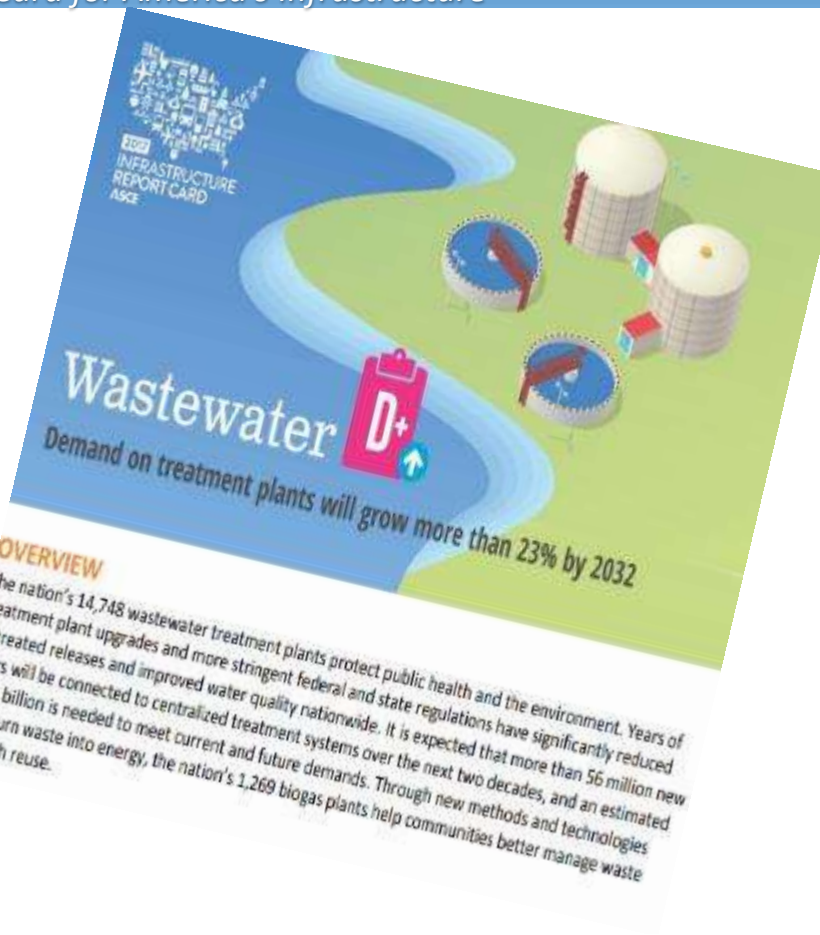
FIXING A FAILING SYSTEM

"Through strategic, sustained investment, bold leadership, thoughtful planning, and careful preparation for the needs of the future, America's infrastructure will be improved and restored."

- American Society of Civil Engineers, *2017 Report Card for America's Infrastructure*

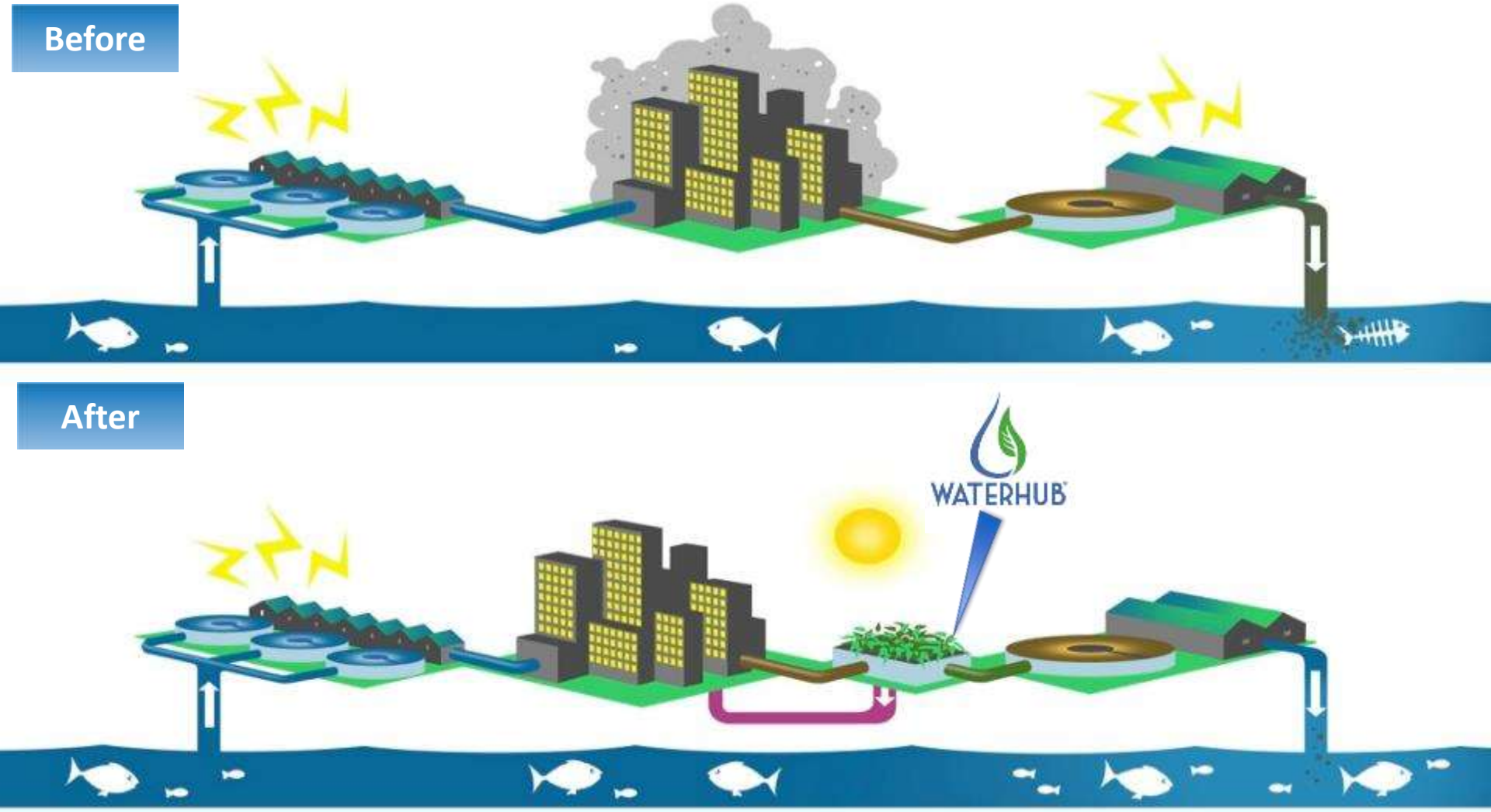
Suggested Solutions…

- Raise Awareness for the True Cost of Water
- Increase Costs for Water and Wastewater Services
- Develop and Harness New Technologies
- Increase Private Financing
- Implement Water Reuse & Expand Water Recycling



Resiliency Planning Must Include Water Reclamation and Reuse

A SUSTAINABLE WATER CYCLE…
DECENTRALIZED RECLAMATION AND REUSE



Risk Management | Cost Savings | Environmental Responsibility

FLEXIBILITY: INDEPENDENCE AND RESILIENCE

- Reduces freshwater withdrawal
- Additional On-Site Storage
- Zero Discharge: reduced contribution to CSOs and wastewater discharge to environment
- Minimum recovery time
- Protects Critical University Research
- Lower Life Cycle Costs
- Reliable & local water supply
- Expands Muni. Infrastructure Capacity

Multiple Benefits Allow for Cross Facility Collaboration

UNIQUE DEVELOPMENT APPROACH

Water Processing Agreement

Operating Lease | DBO Agreement | Performance Contract

ZERO
CAPITAL EXPENSE
AND
DEVELOPMENT RISK
TO THE END USER

Benefits

- No up-front capital
- Innovative technologies
- Leverages superior credit rating
- Lifecycle savings
- Long-term pricing stability
- No O&M responsibilities
- SW bears majority of risk

Flexible, Innovative Vehicle that Yields Guaranteed Savings

WATER PROCESSING AGREEMENT

Client Benefits

- Utility Plant Operational Resiliency (N+1 Water Supply)
- Campus Sustainability Initiative
- Guaranteed Savings over Business-as-Usual
- Hands-Off Operations

Developer Risk

- Proper System Engineering & Design
- Construction / Development Costs
- Facility Operational Cost
- Facility Maintenance Cost
- Production of Compliant Reclaimed Water
- Long-Term Upkeep of Plant

Client Responsibility

- Minimum Annual Purchase of Compliant Reclaimed Water (Demand Profile)
- Land Lease and Pipeline Easement
- 30 Year Operating Agreement

WPA: Designed To Align Objectives and Risks

FEASIBILITY STUDY SCOPE OF WORK

- Existing Conditions Assessment
  - Water Balance & Demands
  - Site & Infrastructure Review
  - Utility Water Audit / Review
  - Future Demand / Load Forecasts
  - Water Supply Resiliency Review
- Supplemental Field Investigation
  - Validate process / Cooling makeup
  - Wastewater Flow Monitoring
  - WW Characterization
- Establishing the Vision
  - Opportunities & Constraints
  - Campus Sustainability / Resiliency Goals
  - Developing a Basis of Design for Systems
- Concept Design
  - Site Plan
  - Conceptual Layout & Design
  - Water Supply Resiliency Assessment
  - Preliminary Constructability Review & Budget
  - Lifecycle Economics

Comprehensive Project Diligence Leading into Concept Design

CAMPUS WATER FOOTPRINT

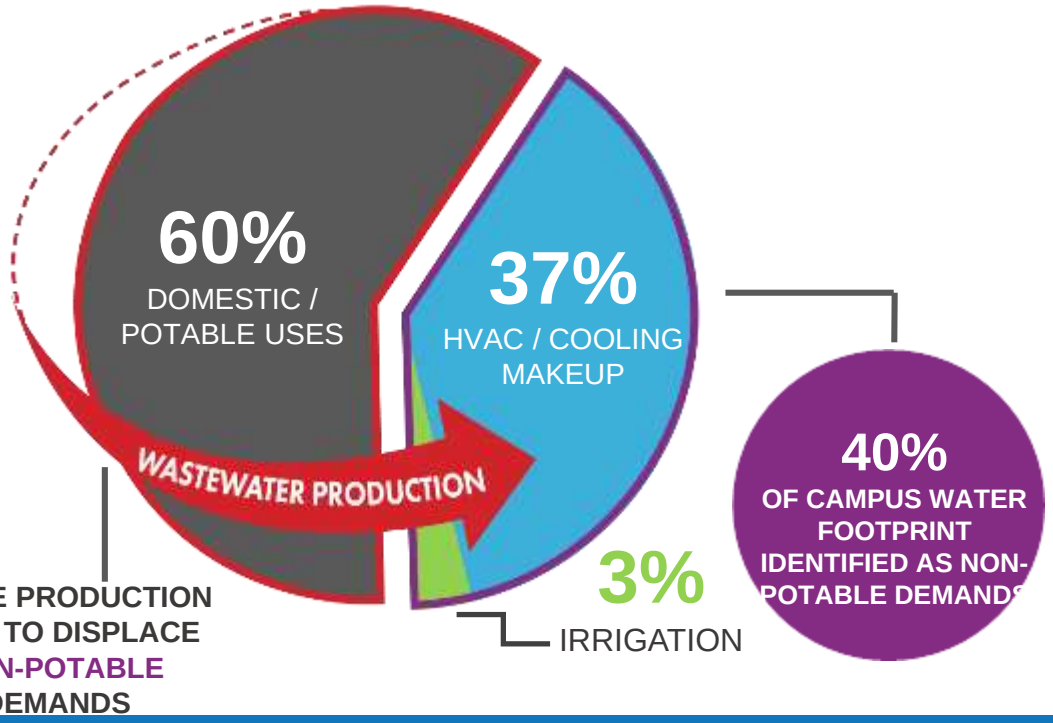
"We looked at where we currently use the most potable water in our facilities — *applications where we don't really need drinking-water quality water* — and it came down to our toilets, our steam plants and our chiller plants."

- Brent Zern, Assistant Director of Operational Compliance & Maintenance Programs, Emory University

EMORY UNIVERSITY

333 MILLION

GALLONS PER YEAR



40% Non Potable Demand Identified and Strategy Formulated

THE WATERHUB AT EMORY UNIVERSITY

OUTDOOR WETLANDS

INTERIOR HYDROPONICS

CLIENT TYPE:
College / University

LOCATION:
Atlanta, GA

PROJECT DESCRIPTION:
Campus-Scale Wastewater Reclamation & Reuse System

YEAR BUILT:
2015

GOALS / OUTCOMES:

- Up to 40% reduction in potable water footprint
- Up to 66% decrease in wastewater discharge

> "THIS IS A FIRST OF ITS KIND FACILITY IN NORTH AMERICA. IT EXEMPLIFIES HOW WE AS A SOCIETY CAN TAKE A MORE INTELLIGENT AND RESPONSIBLE PATH TO STEWARDSHIP OF NATURAL RESOURCES, FOR THE GOOD OF EACH OTHER."
>
> - JIM WAGNER, FORMER PRESIDENT OF EMORY UNIVERSITY

EMORY WATERHUB: SYSTEM OVERVIEW

HYDRAULIC CAPACITY:

400,000 Gallons Per Day (146 MGY)

TECHNOLOGIES APPLIED:

Primary Screen: Rotary Screen
Pretreatment: MBBR
Secondary: Hydroponic (SFFR)
Demo: Recip® Wetland System (5 KGPD)
Filtration: Disk Filter
Disinfection: UV & Chlorine

EFFLUENT QUALITY:

State of GA Reuse Regulations

BOD:	<5
Turbidity:	<3
TSS:	<5
TKN:	<5

BACKUP STORAGE:

50,000 Gallons

MOVING MEDIA

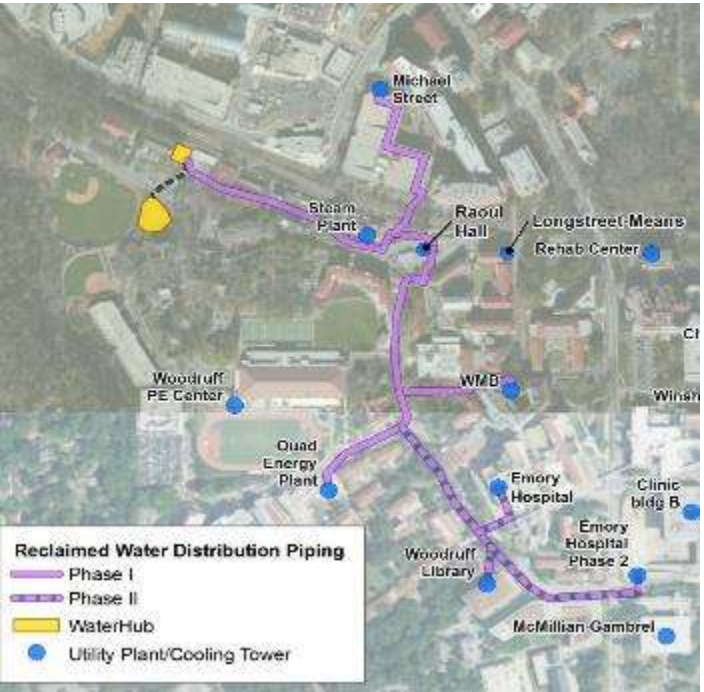
MOVING BED BIOREACTORS

IFAS / SFFR

SUBMERGED FIXED FILM

EMORY WATERHUB: DISTRICT-SCALE REUSE

NON-POTABLE WATER DISTRIBUTION & SYSTEM END USERS




STEAM PLANT


MICHAEL STREET CHILLER PLANT


QUAD ENERGY PLANT

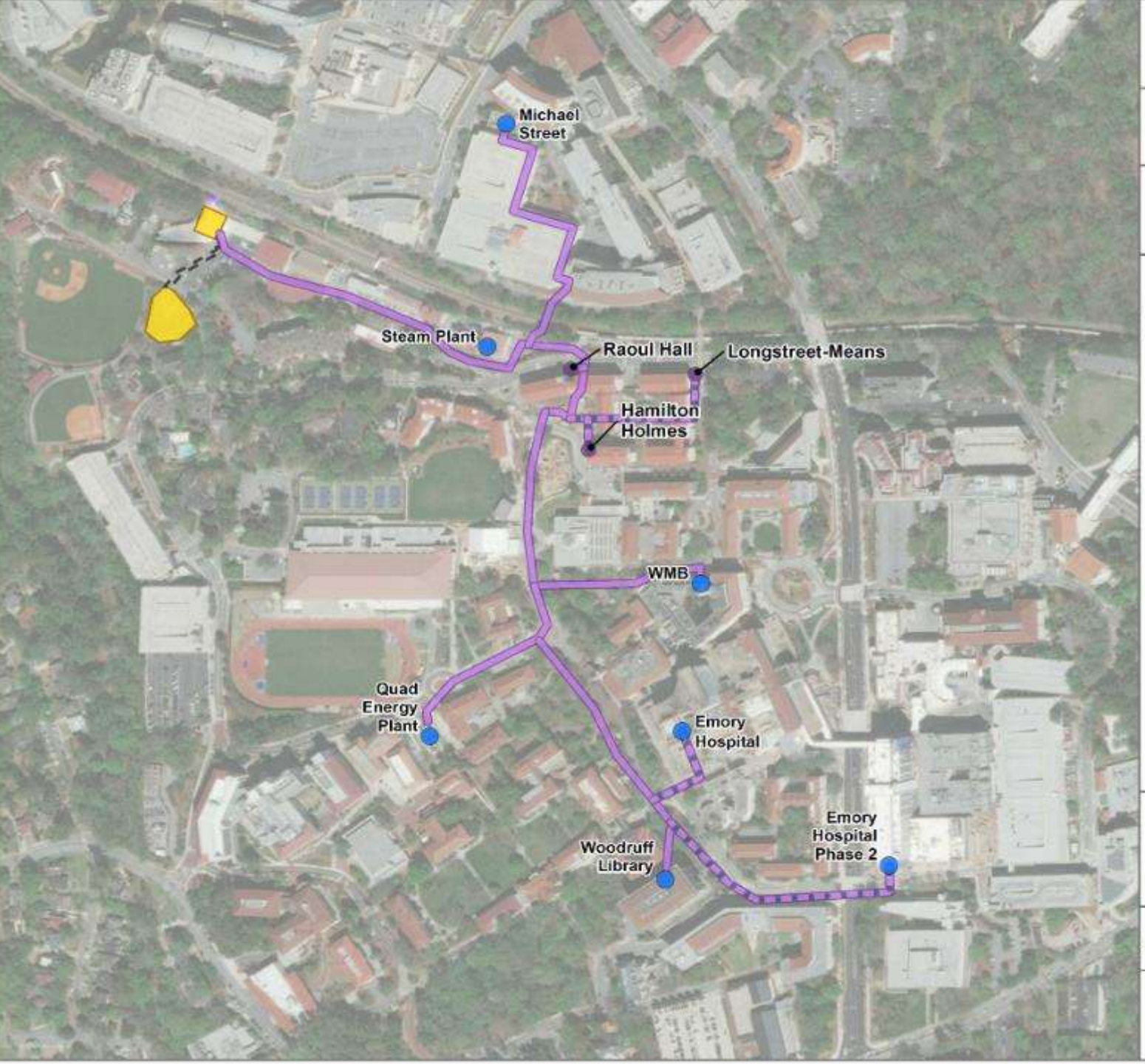
FOOTPRINT:
3,200 ft2 GlassHouse
1,600 ft2 Outdoor Landscaping

NON-POTABLE DISTRIBUTION:
4,400 linear feet (Purple Pipe)

REUSE DEMAND TYPES
Boiler Makeup
Cooling Tower Makeup
Toilet Flushing

SYSTEM END USERS:
Michael Street Chiller Plant
Steam Plant
WMB Chiller Plant
Quad Energy Plant
Raoul Hall (Dormitory)

FUTURE EXPANSION:
Emory Hospital Chiller Plant
Woodruff Library Chiller Plant



EMORY UNIVERSITY

Emory University

Atlanta, Georgia

Reclaimed Water Distribution

Reclaimed Water Distribution Piping

- Existing
- Future
- WaterHub
- Utility Plant/Cooling Tower
- Toilet Flushing

0 325 650 Feet

1:5,000

Notes

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

SUSTAINABLE WATER

Sustainable Water Consultants LLC
Glen Allen, VA

WATERHUB PROCESS DESIGN

How the WaterHub Works

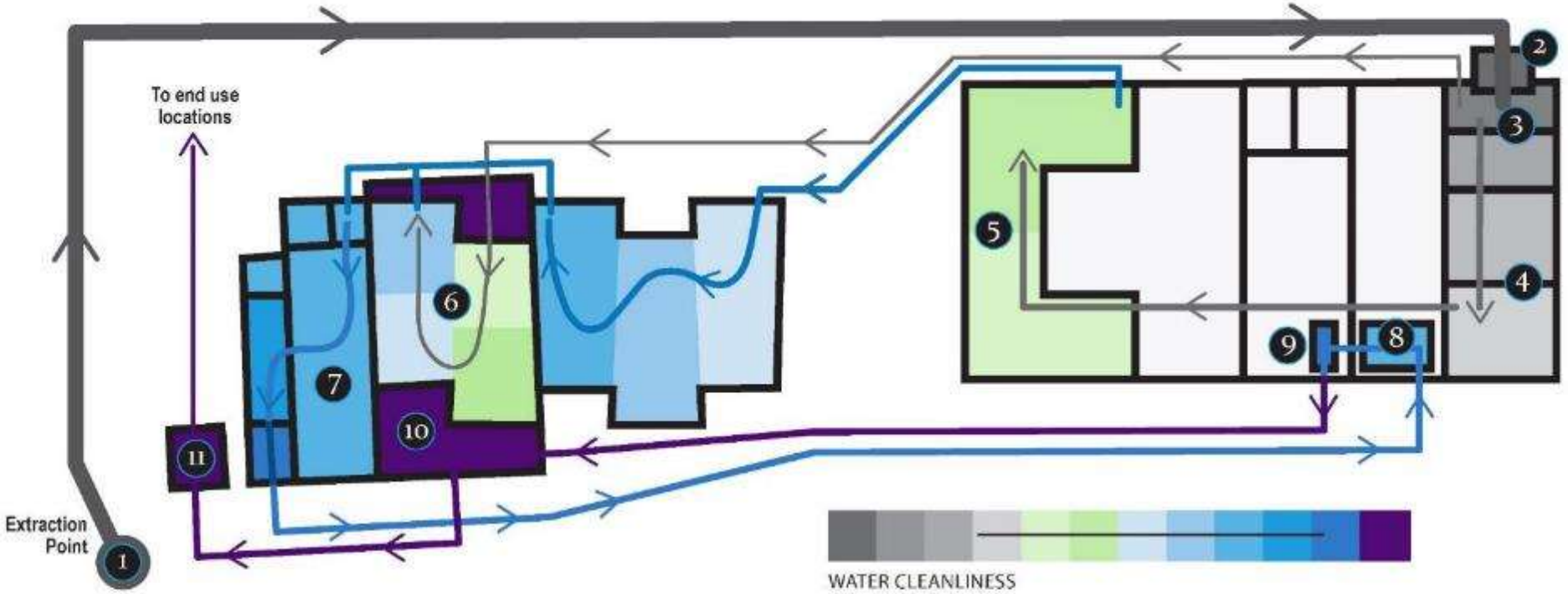
1 2 Extraction Point & Rotary Screen
Wastewater is diverted from the sewer system and sent through a screen to remove debris.

3 Anoxic Moving Bed Bioreactors
Wastewater enters a low-oxygen environment where microorganisms living on bio-impregnated plastic pellets (mid-density housing for microbes) begin to metabolize carbon and nitrogen.

4 Aerobic Moving Bed Bioreactors
Wastewater enters an oxygen containing environment with a different community of microbes that continue the treatment process. Diffusers add air bubbles to assist treatment. Odorous gasses are removed with charcoal filters.

5 Hydroponic Reactors
Water clarity increases as water is treated in tanks with suspended plant roots. Water is cleaned by microbes living on the plant roots and on the specially engineered bio fabric (high density housing for microbes) located below the plant roots.

6 Demonstration Reciprocating Wetlands
An alternate treatment system, this area demonstrates a highly energy efficient treatment process applicable for rural areas and developing countries. Screened wastewater is pumped to four 8' deep cells. Cells are alternately filled-and-drained 8 to 16 times a day. The system mimics the behavior of natural tidal wetland areas and uses gravel and plant roots to provide microbial habitat.



7 Clarifier Tank
In a still water tank, Phosphorus and any remaining solids are removed as the particles fall into the bottom.

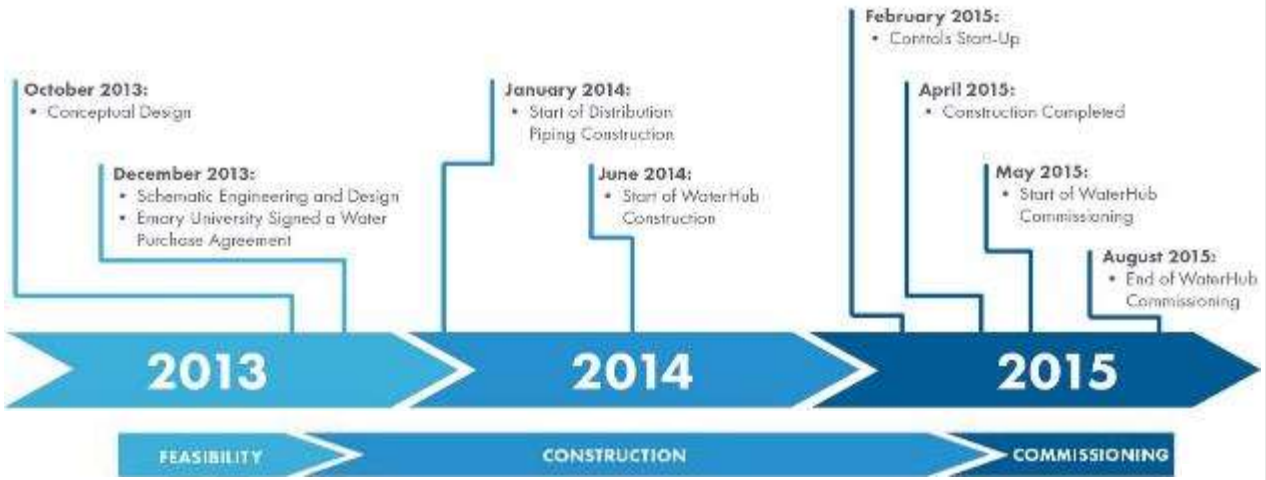
8 Disk Filter
Very clean water is sent through a felt filter to remove any remaining particulate material.

9 Ultraviolet Disinfection
Water is treated with ultraviolet light that provides extensive disinfection, producing water that complies with state and local health requirements.

10 50,000 Gallon Storage Tank
Fully treated water is stored underground as a reserve supply.

11 Campus Distribution
Water is distributed to the steam and chiller plants for use as process make-up water. In the future, water will be sent to residence halls for toilet flushing.

EMORY WATERHUB: PROJECT EXECUTION



CONSTRUCTION:

CLIENT SERVICES OFFERED:

- Water Reuse Feasibility Study
- WaterHub Design-Build
- Owner-Operator (Current)

PROJECT DELIVERY METHOD:

Water Purchase Agreement:
Design-Build-Own-Operate (DBOO)

DESIGN-BUILD TEAM:

Developer: Sustainable Water
Engineer: McKim & Creed
Contractor: Reeves Young

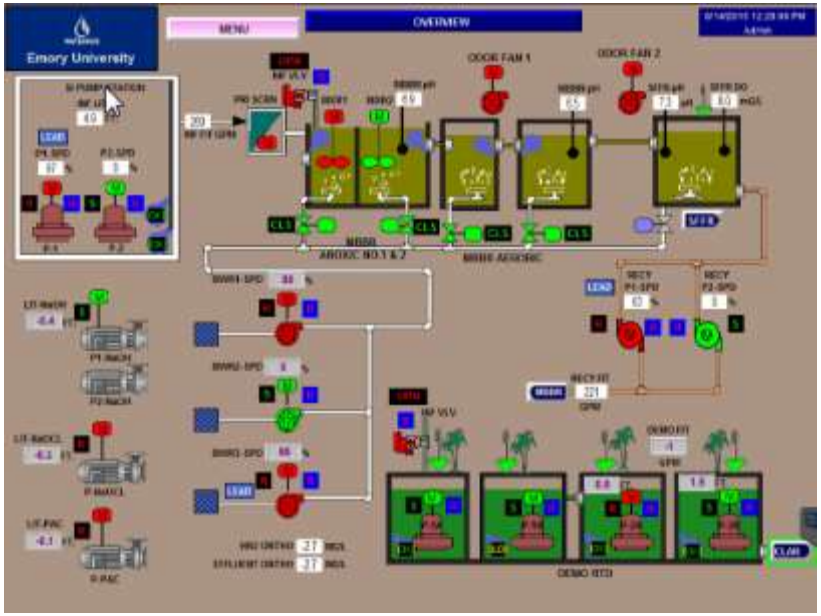
TIMELINE:

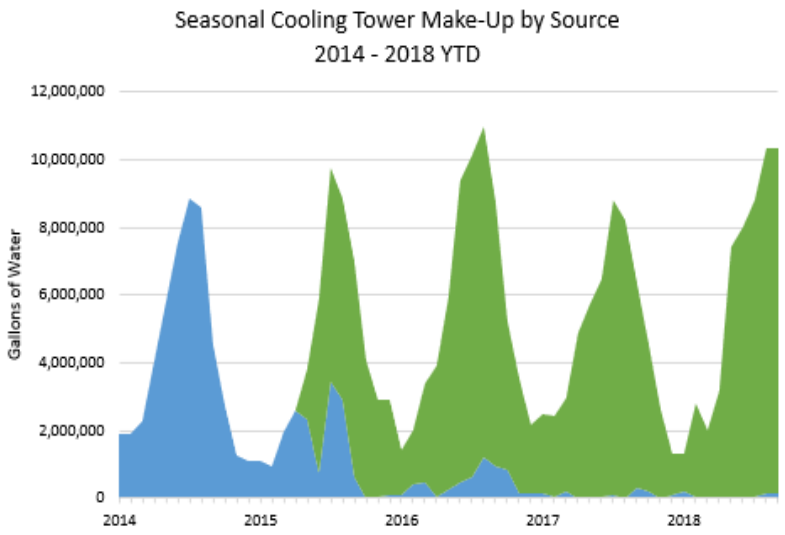
Feasibility: 3 Months (2013)
Engineering: 6 Months (2014)
Construction: 15 Months (2014 – 2015)
Commissioning: 3 Months (2015)

LESSONS LEARNED:

- Dedicate a Project Manager
- Know Your Waste Stream
- Prepare for Academic Engagement
- Prepare a Tour Strategy
- Communicate across all Campus Silos

EMORY WATERHUB: OPERATIONS





START-UP

May, 2015

HIGHLIGHTS:

- 1 full-time operator
- Highly automated & controlled treatment / distribution system
- Zero compliance Issues

RESULTS:

- 220 million gallons treated to-date
- Offset 95% of potable water use at 3 largest chiller operations
- Net energy reductions in campus water management

A LIVING, LEARNING LABORATORY


EMORY | news center

Fall courses offer fresh perspectives on high-profile issues

> "THE WATERHUB PROVIDES THE EXPERIENCE OF COLLECTING REAL DATA, INTERPRETING RESULTS AND WRITING REPORTS. FOR SOME STUDENTS, IT MAY HAVE BEEN THE FIRST HANDS-ON LAB EXPERIENCE THAT THEY'VE HAD."
>
> - CHRISTINE MOE, DIRECTOR OF THE CENTER FOR GLOBAL SAFE WATER, EMORY UNIVERSITY

EDUCATIONAL FEATURES:

Info / Educational Plaques & Signage
Classroom & Lab Space
Easy Access Water Quality Ports
Public Operations Monitors

NOTEWORTHY RESULTS:

- Over 4,500 tours held since May '15
- Used in graduate thesis studies
- Centerpiece of Student Docent Program
- Integrated into core coursework

RESEARCH & CURRICULUM:

- Used in the following fields:
  - Biology
  - Water, Sanitation & Hygiene (WASH)
  - Journalism
  - Chemistry
  - Law
- New Courses Introduced:
  - Water and Sanitation in Developing Countries
  - Research Methods in WASH

EMORY WATERHUB: RECOGNITION

AWARDS:

- 2015 PROJECT ACHIEVEMENT AWARD
- 2015 INNOVATIVE PROJECT OF THE YEAR AWARD
- 2015 LIQUID ASSETS AWARD
- 2015 SUPERIOR ENVIRONMENTAL PERFORMANCE AWARD
- 2015 INNOVATIVE DEAL OF THE YEAR AWARD
- 2016 ENGINEERING EXCELLENCE GRAND AWARD
- 2016 FULCRUM AWARD
- 2016 US WATER PRIZE
- 2016 EXCELLENCE IN LANDSCAPE ARCHITECTURE-GENERAL HONORABLE MENTION AWARD
- 2016 NATIONAL ENGINEERING EXCELLENCE GRAND AWARD
- 2016 EFFECTIVE & INNOVATIVE PRACTICES AWARD
- 2016 INNOVATION AWARD
- 2016 OUTSTANDING ACHIEVEMENT GAME CHANGER AWARD
- 2016 PROJECT EXCELLENCE AWARD

PUBLICATIONS:

Nearly 50 Articles Published

- District Energy
- Industrial WaterWorld,
- Civil Engineering News and more

AWARDS & ACCOLADES:

9 National Organizations

- Water Reuse Association, 2015
- US Water Alliance, 2016
- Society of College & University Planning, 2016
- American Society of Safety Engineers, 2016
- APPA, 2016
- National Association of College and University Business Officers, 2016
- Water Environment Federation, 2016
- IDEA Innovation Award, 2018
- The Association for the Advancement of Sustainability in Higher Education, (AASHE) Campus Sustainability Award, 2018

7 State & Regional Organizations

- Construction Management Association (South Region), 2015
- Metro Atlanta Chamber, 2015
- American Society of Safety Engineers of North Carolina, 2015
- Health and Environmental Conference and the Georgia Chapter of the American Society of Safety Engineers, 2015
- Urban Land Institute VA, 2015
- Southface, 2016
- Atlanta Better Buildings Challenge, 2016

PRELIMINARY ASSESSMENT

DATA REQUEST:

Water Use: 1 - 3 years of history if possible

- Total water inbound - by account, by month.
- Cooling and Chiller Plant Make-Up - by location, by month.
- Boiler Make-Up - by location, by month.
- Irrigation - by location, by month (only if readily available)
- Any Supplemental Sub-metering Data.

Economics: 1 - 3 years of history if possible

- Sample of recent water and sewer bills (include bills that demonstrate any evaporation credits as well).
- Historical Water billing.

PROCUREMENT PROCESS AT UT- AUSTIN

Texas Comptroller of Public Accounts
Glenn Hegar

DBOO - District-Scale Water Reclamation and Reuse Facility

Status: Closed **Solicitation ID:** 18UTL006

Response Due Date: 4/13/2018

Response Due Time: 2:00 PM

Agency Number: 721

Days Solicited: 21+ Days for Solicitation Notice

Solicitation Posting Date: 3/5/2018

Last Modified: 4/13/2018 2:00 pm

Solicitation Description: The University is seeking qualified teams indicating their interest and qualifications for the design, build, own and ope district-scale water reclamation and reuse system. This document provides preliminary project details to solicit information related to proposed system design and cost from qualified respondents. The full project details and specifications will be presented in a Request for Proposal (RFP), issued to prequalified Respondents only. A pre-submittal conference will be held at the time and location described below: March 19, 2018 at 2: The University of Texas at Austin Utilities and Energy Management Department 215 East 24th St, PPE Rm. 3.304 Austin, Texas 78712

Class/Item Code: 90822-Building Construction, Non-Residential (Office Bldg., Etc.)

Attachments

#	Name	Description
1	ESBD_File_125645_DB RFQ.pdf	DBOO - RFQ
2	ESBD_File_125645_Addendum#1.pdf	Addendum#1
3	ESBD_File_125645_Exhibit H-Bldg Construction Revised 09182017.docx	HUBH
4	ESBD_File_125645_Exhibit H-Professional Services 09042017 #2.docx	HUBh

REQUEST FOR QUALIFICATIONS FOR
DESIGN/BUILD/OWN/OPERATE

The University of Texas at Austin
District-Scale Water Reclamation and Reuse Facility
RFQ No.: *18UTL006*

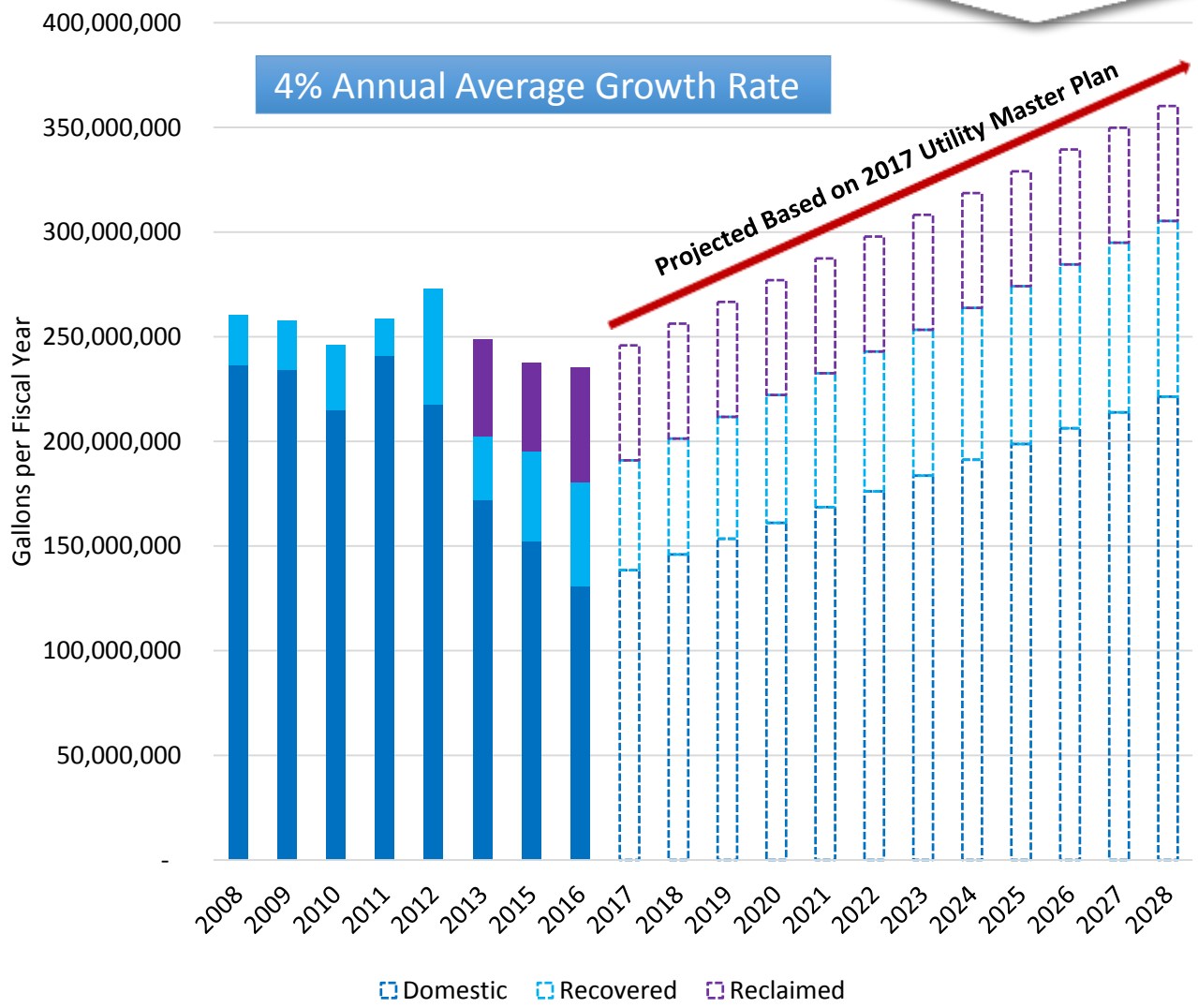
RFQ SUBMITTAL DUE DATE: *Apr. 13, 2018*

RFQ ISSUE DATE: *March 5, 2018*

Clear And Concise Request to Market for Third Party Developer

PROJECTED CHILLING STATION M/U BY SOURCE

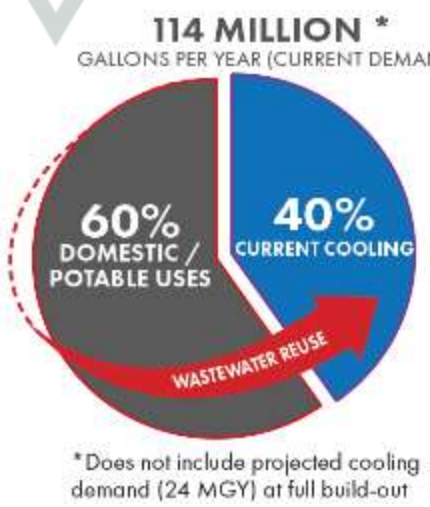
PROJECTED CHILLING STATION M/U BY SOURCE

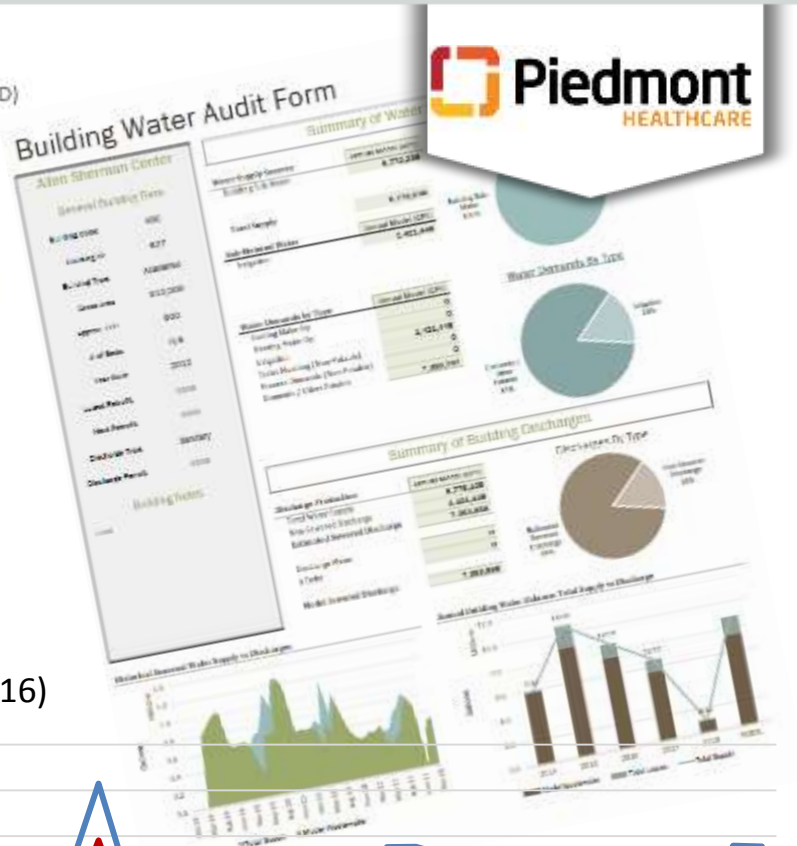


Projected Chilling Station Demands

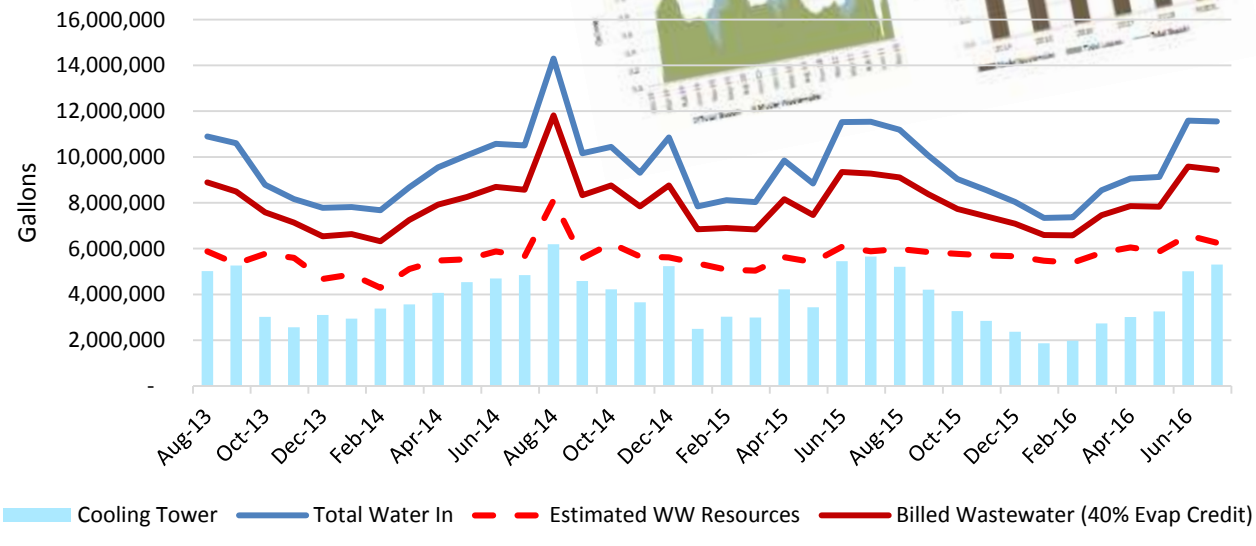
- **Based on 2017 Utility Plan**
  (does not include Weaver PP)
- **2016 Demand**
  - 31,328 Peak Tons
  - 235 MGY cooling m/u
    - Domestic: 131 MGY
    - Recovered: 49 MGY
    - Reclaimed: 55 MGY
- **2028 Cooling Projections**
  - 53% Increase
  - 47, 675 peak tons
  - 360 MGY cooling m/u
    - Domestic: 221 MGY
    - Recovered: 84 MGY
    - Reclaimed: 55 MGY

BUILDING WATER AUDIT / CAMPUS WATER BALANCE





Historical Water Use Trends, Piedmont Hospital (2013 – 2016)



TASKS:

- Building Water Audit Process
- Update campus water balance
  - Water use by Type
  - Non-potable demand volumes
- Model seasonal non-potable demands at targeted reclaimed water users (Power Plant Cooling Towers, Boilers)
- Evaluate future makeup demands / loads
- Update campus-contributed wastewater flow model
- **Verify the need for additional flow measurement at end use / process locations**

SUPPLEMENTAL FIELD INVESTIGATION

WASTEWATER CHARACTERIZATION STUDY

FLOW MONITORING STUDIES

TASKS:

- Review all 3rd party flow & water quality testing
- Administer supplemental field investigations where needed
  - Wastewater flow monitoring
  - End-use flow validation
  - Wastewater characterization
- Develop field testing reports summarizing results

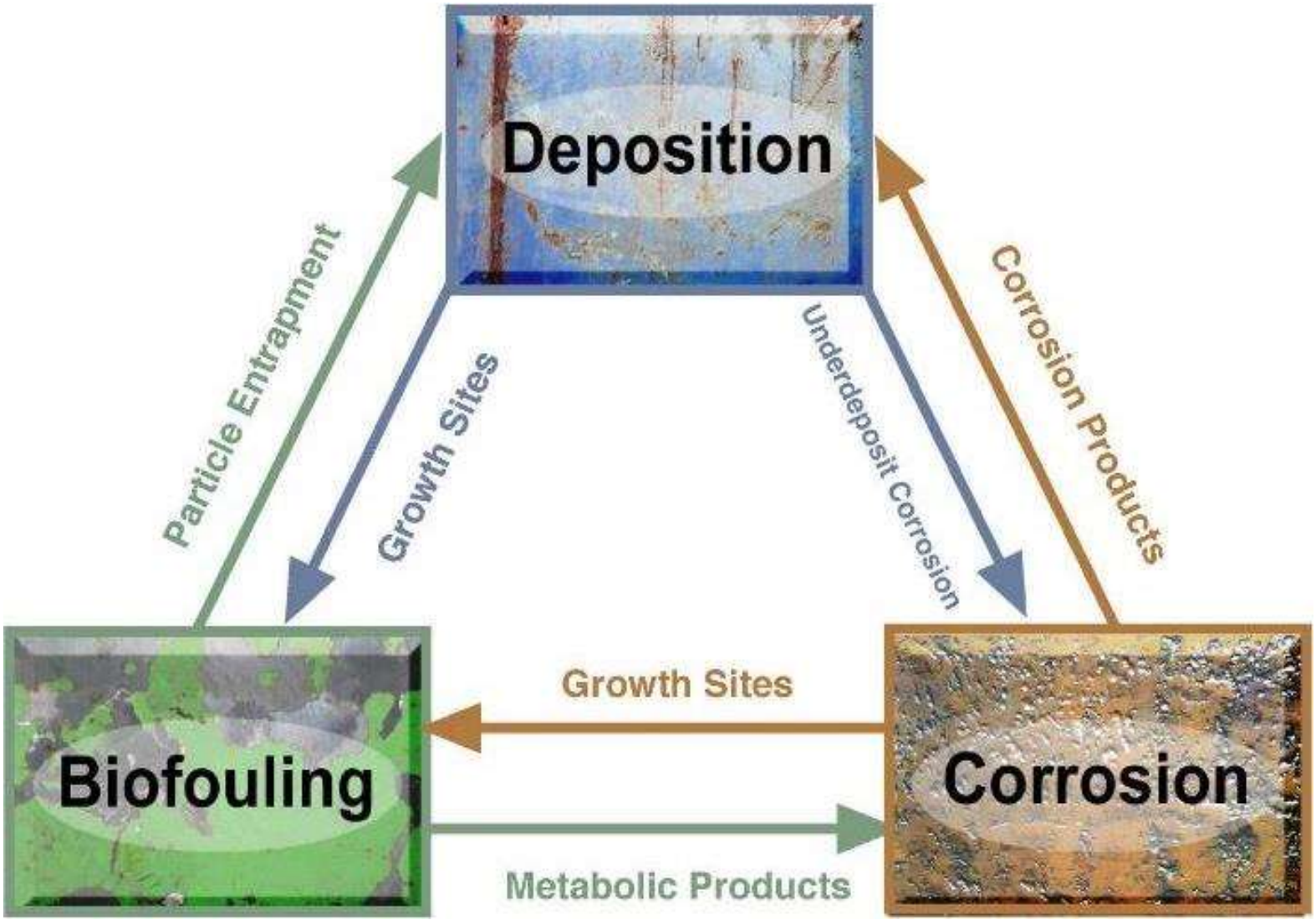
FLOW MONITORING

- Seasonal variations in flow
- Diurnal patterns
- Reuse potential

WASTEWATER CHARACTERIZATION

- Variability
- Treatability
- Contaminants of Concern
- Informs basis of design

UNDERSTANDING WATER ISSUES



Interdependent Results Require Systemic Solutions

UTILITY WATER AUDIT

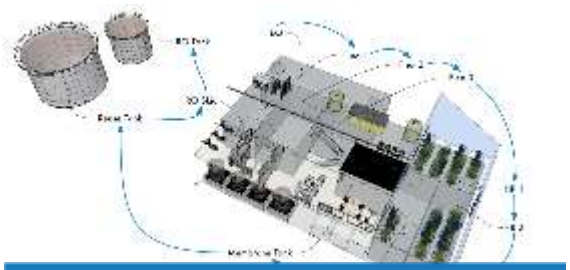
Equipment Inventory

Equipment Conditions

Operational Protocols

Treatment Program Admin

Reclaimed Water Modeling

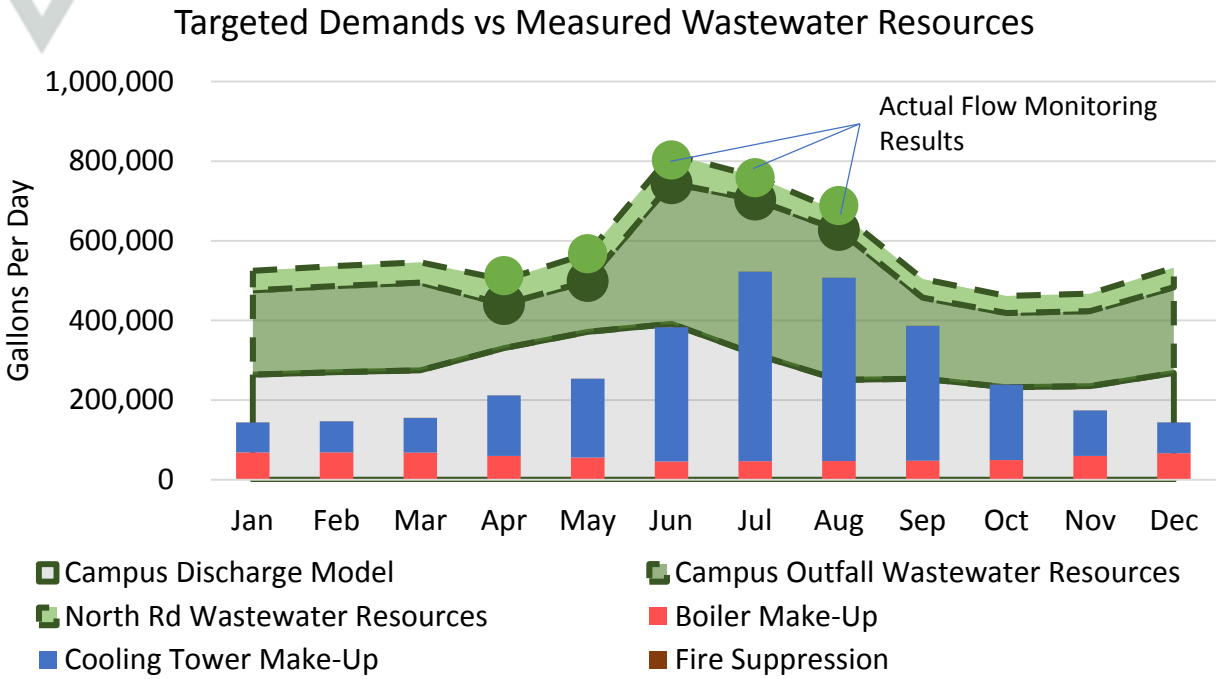


Treatment Process Design

TASKS:

- Catalogue existing utility / process water equipment at targeted reclaimed water end use locations
- Assess process water equipment conditions (w/ Azure Water)
  - Corrosion Rates
  - Non-destructive testing
  - Inspection reports
- Review chemical treatment program administration / maintenance
  - Operator logs
  - Disinfection / Inhibition Program
- Validate operating loads and water demands / diurnal profiles
- Review district energy expansion / modification plans & assess future operating loads
- Establish baseline water quality characteristics

SYSTEM DESIGN BASIS



Parameter	Unit	Influent	Effluent	Standard
BOD	mg/l	183.87	< 10	Class A
TSS	mg/l	151.71	< 5	Class A
pH	S.U.	7.22	6.5 - 8.5	Class A
Turbidity	NTU	72.44	< 2	Class A
Total Nitrogen	mg/l	36.0	< 10	Class A
Fecal Coliform	Col/100ml	--	Non-detect	Class A
Conductivity Tower	uhms	1,000	< 250	End Use
Conductivity Boiler	uhms	730 - 1,100	< 50	End Use

FIELD INVESTIGATION:

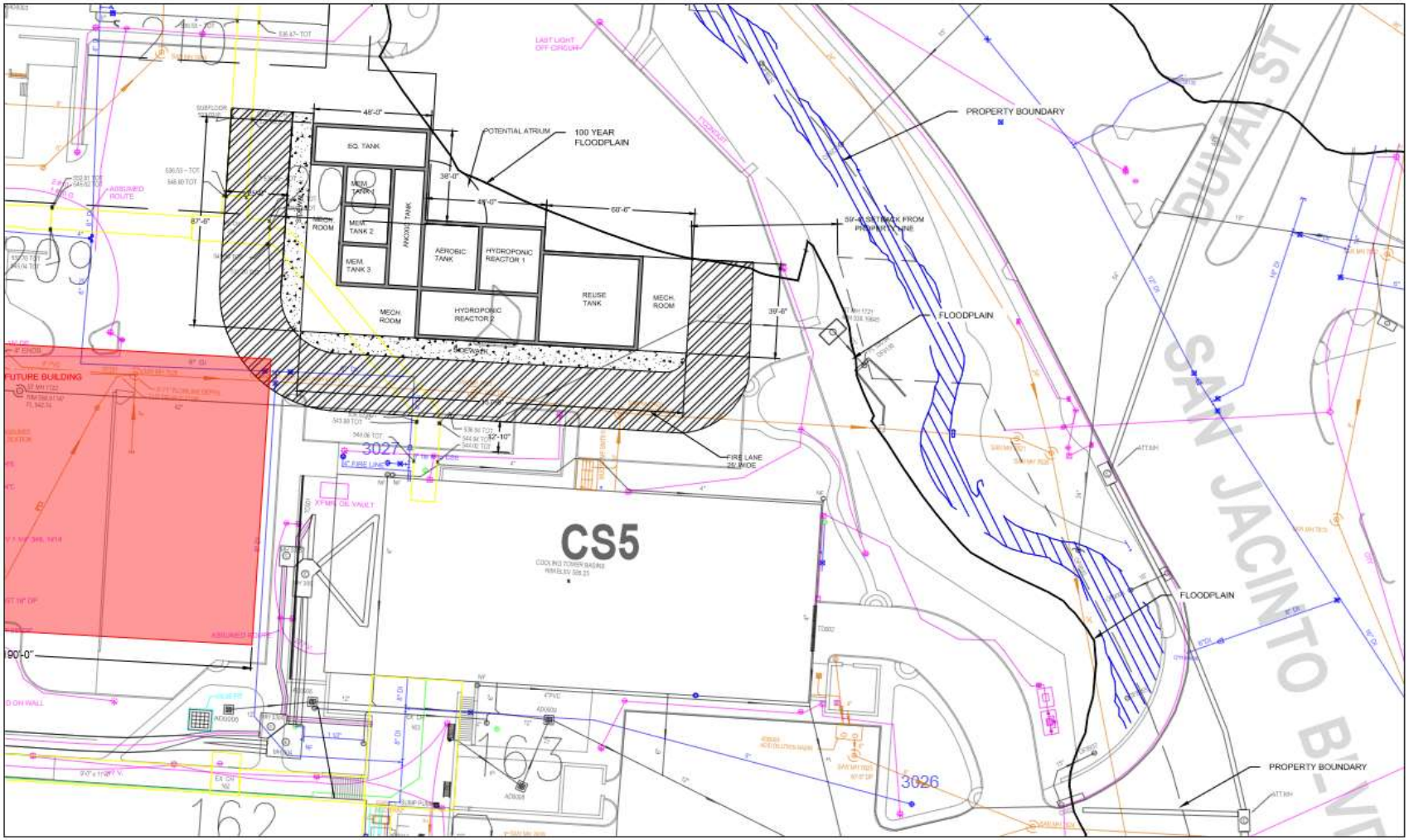
- 7 Days of Composite Sampling
- 120 Days of Flow monitoring
- Ongoing to provide highest quality dataset

- Campus Outfall:
  - Avg Flow - 575k GPD
  - Est Annual – 190 MGY
- North Rd Outfall Avg:
  - Avg Flow - 56k GPD
  - Est Annual – 20 MGY

EFFLUENT DESIGN:

- State Class A Standard
- Additional End Use Standards

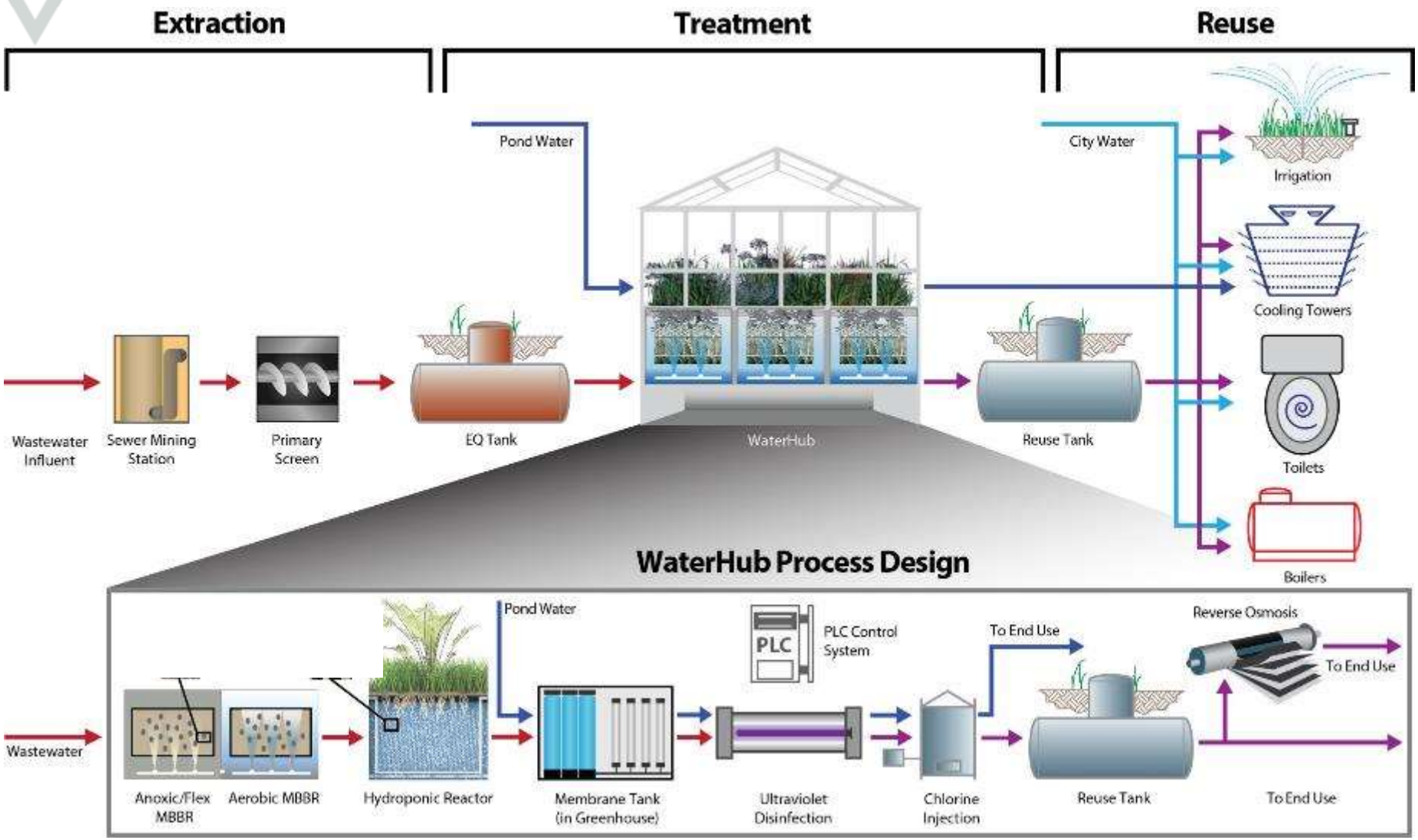
UT SITE EXERCISE



Project: District Scale Water Reclamation & Reuse Facility		Title/Description: Potential Building Layout- Existing Conditions Site Area A	
Client: University of Texas - Austin	Location: Austin, TX	Initial:	Revision:
		01/16/19	-

FLINTCO | BURNS & MCDONNELL | SUSTAINABLE WATER

CUSTOMIZED WATERHUB PROCESS DESIGNS



Customized for Each Unique Siting Requirements

SYSTEM DESIGN COLLABORATION

CREATING A VISION FOR WATER MANAGEMENT

TASKS:

- Establish water management goals specific to reuse & conceptual design
- Explore siting options for system components
  - WW Extraction
  - RW Distribution
  - Facility Siting
- Facilitate conceptual design charrettes
  - Academic Faculty
  - Office of University Architect
  - Energy Services
  - Engineering
  - Sustainability Office
- Review campus construction / design standards
- Begin preliminary SWOT (Strengths, Weakness, Opportunity and Threats)Analysis on siting options
- Begin evaluating various technology / process solutions

UPCOMING PROJECTS

PMUSA MANUFACTURING CENTER

HYDRAULIC CAPACITY:
650,000 Gallons Per Day (235 MGY)

FOOTPRINT:
6,400 ft^2 including GlassHouse Building

TECHNOLOGIES APPLIED:
Primary Screen
Pretreatment: Aerobic / Anoxic Reactors
Secondary: Hydroponic (SFFR)
Filtration: Membrane & Side-Stream RO
Disinfection: UV & Chlorine

EFFLUENT QUALITY:
State of VA Reuse Regulations

BOD:	<5
Turbidity:	<2
TSS:	<2

BACKUP STORAGE:
160,000 Gallons

PMUSA AERIAL VIEW

WATERHUB GOALS

- Conserve community water resources
- Provide leadership in water sustainability
- 40% reduction of consumed water
- 55% wastewater discharge reduction
- Relieve strain on local municipal infrastructure
- Insulate operational viability & supply chain

WATERHUB

JOHNS HOPKINS CONCEPTUAL DESIGN

Compact Design for Tight Urban Campus Environments

YALE UNIVERSITY

LOCATION:
New Haven, CT

PROJECT:
Domestic Wastewater Reclamation & Reuse (WaterHub)

HYDRAULIC CAPACITY:
450,000 – 650,000 Gallons Per Day (164 – 237 MGY)

END USES:
Boiler Makeup, Cooling Tower Makeup

SERVICES PROVIDED:
Advanced Feasibility Study
Concept Design Report

TECHNOLOGIES APPLIED:
Moving Bed Bio-Reactors
Hydroponic with Submerged Fixed-Film
Membrane Bio-Reactors

ESTIMATED PROJECT OUTCOMES:
Up to 100% decrease in potable water use at Power Plant
Up to 40% decrease in wastewater outfall

JOHN DAY

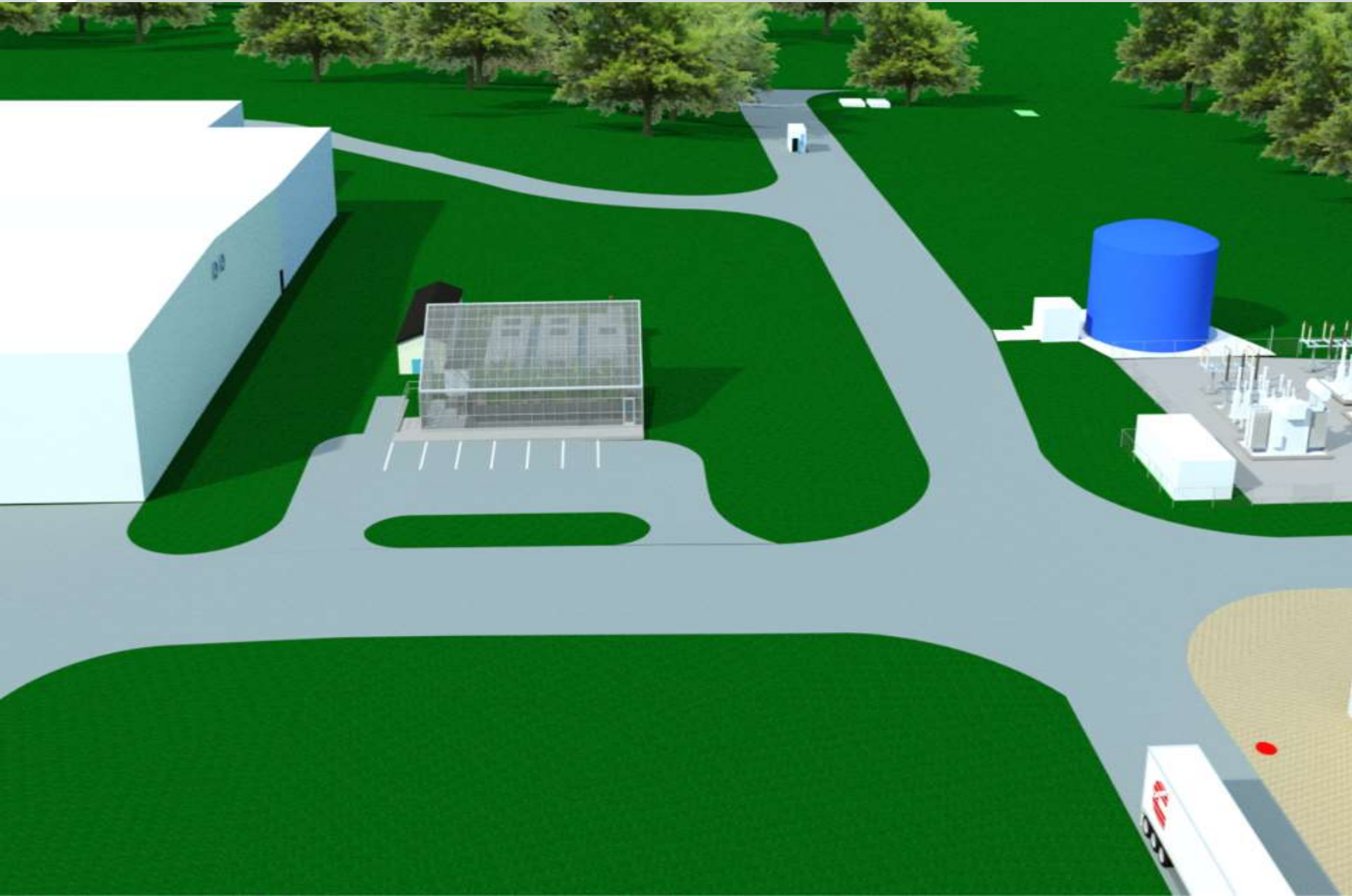
CITY OF JOHN DAY

Eco-Engineered Wastewater Reclamation & Reuse

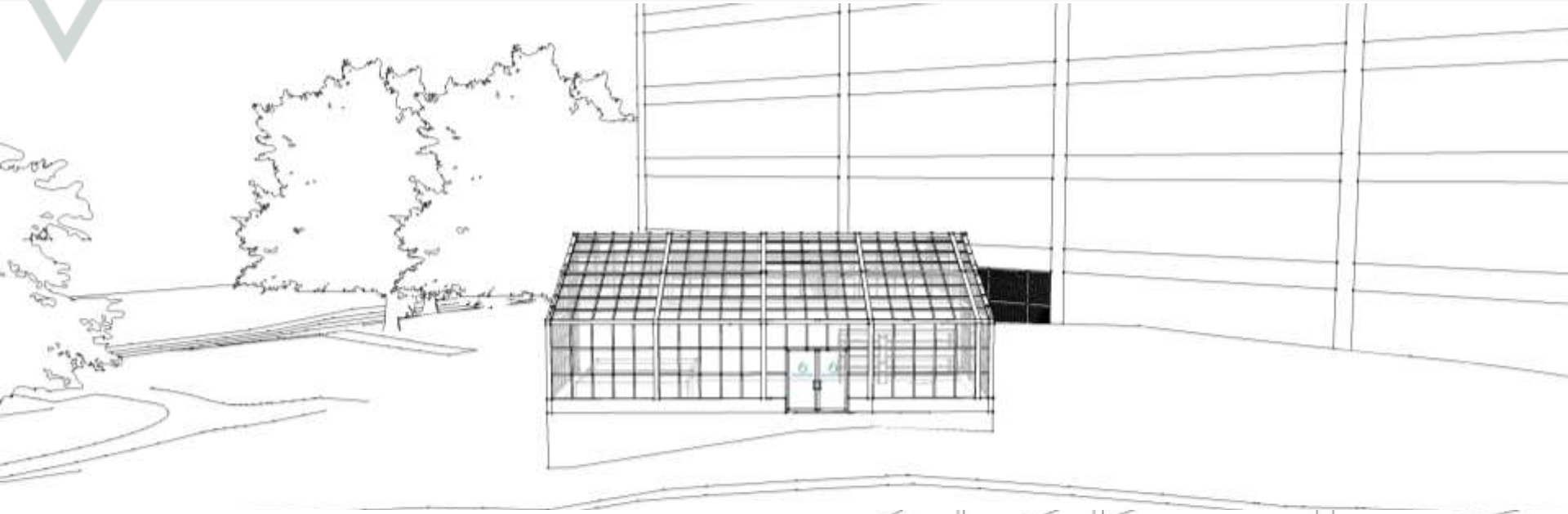
SUSTAINABLEWATER

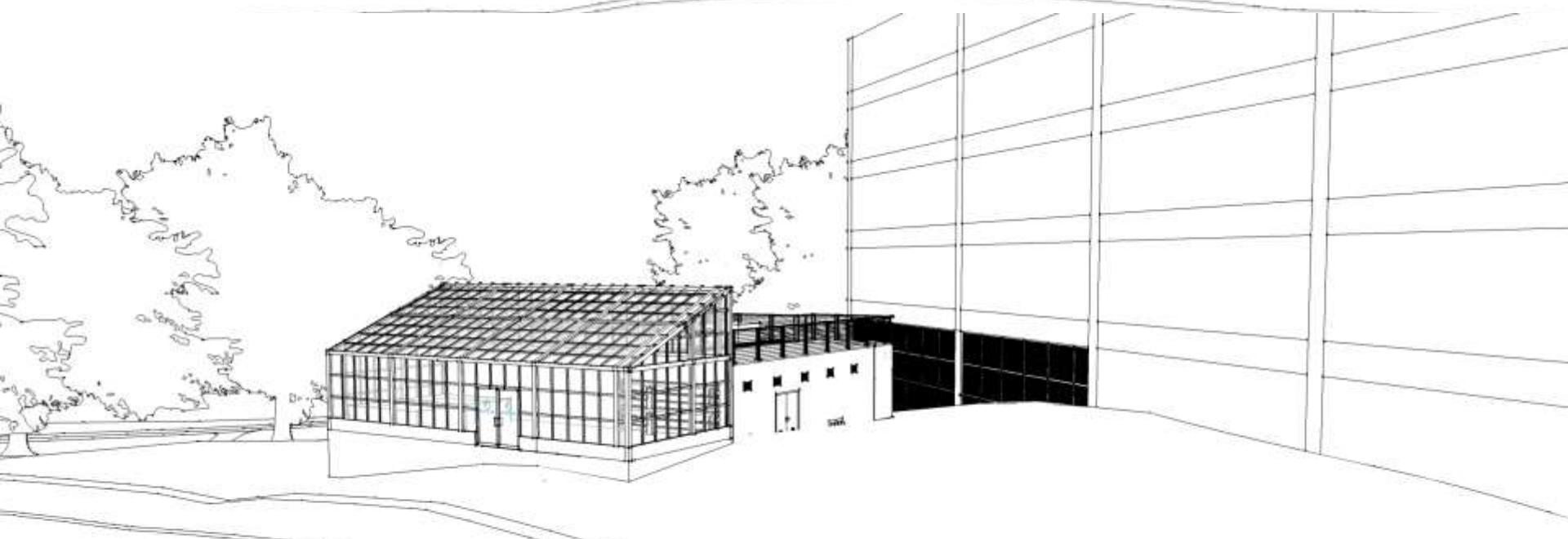
- Long-Term Community Water Supply Resiliency
- Improved Environmental Impact
- Anchor Development for John Day River Plan

CUMMINS ROCKY MOUNT ENGINE PLANT



WIN MED PRELIMINARY SITE INTEGRATION

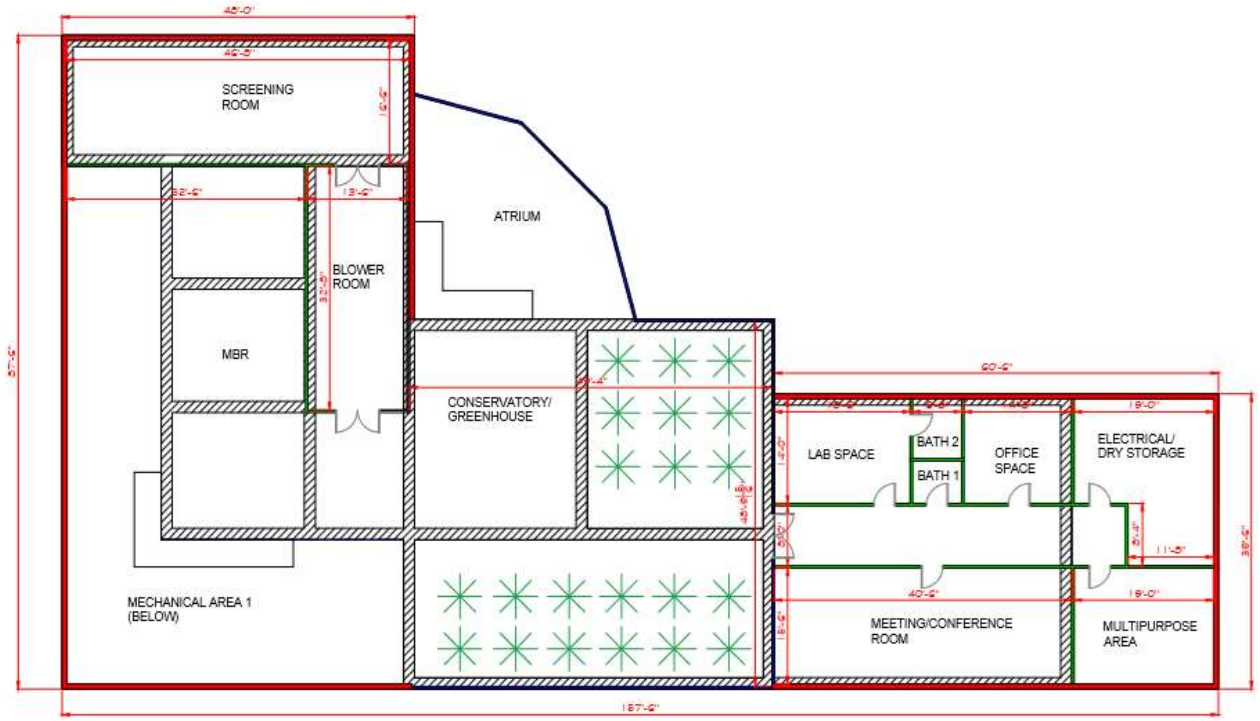




UT AUSTIN- SITE A

LEGEND

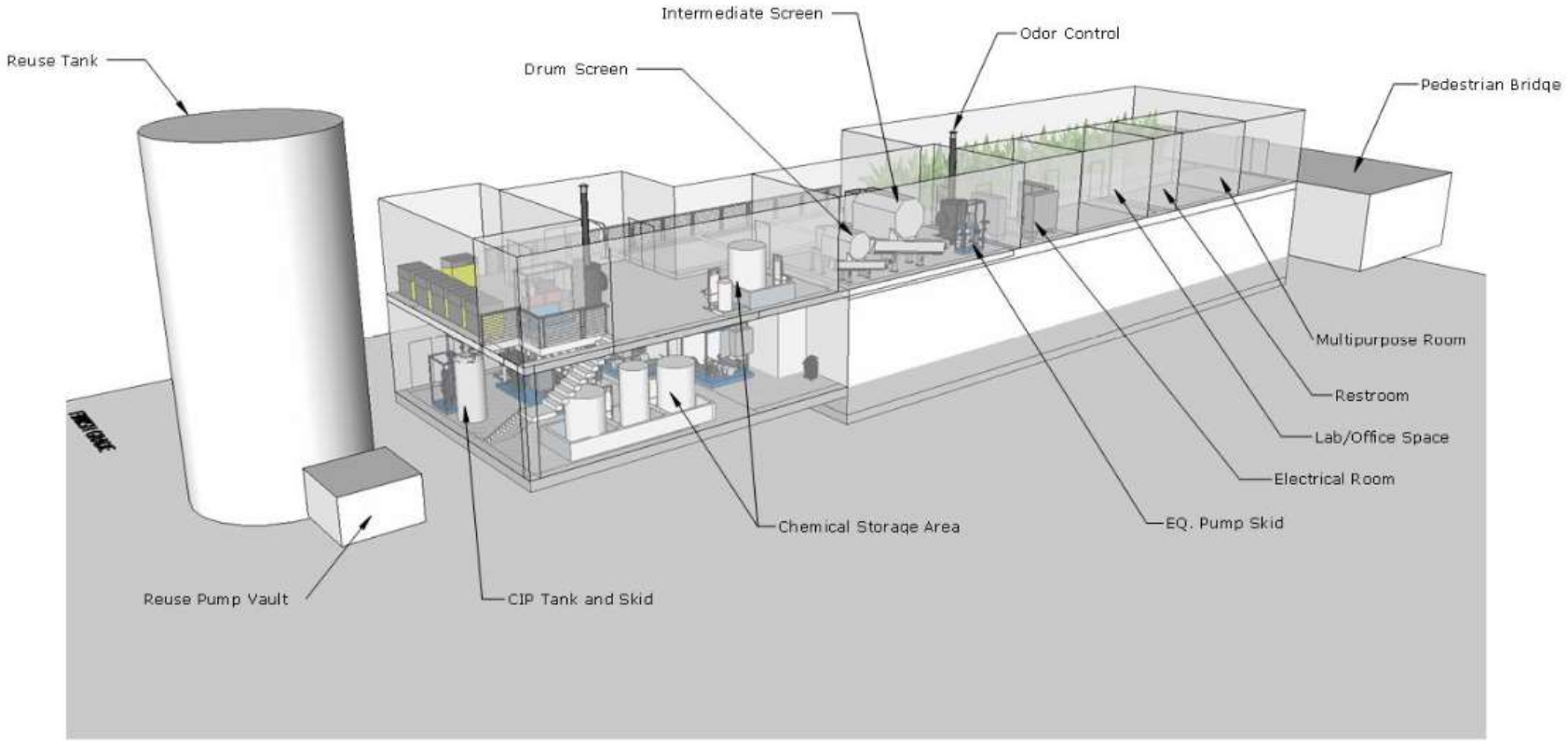
- GLASS CURTAIN WALL
- INTERIOR WALLS
- EXTERIOR WALLS



SITE A - FLOORPLAN (UPPER LEVEL)

Project:	Title/Description:			
District Scale Water Reclamation & Reuse Facility	Site A Floorplan - Upper Level	THE UNIVERSITY OF TEXAS	FLINTCO	BURNS MCDONNELL

UT AUSTIN- SITE B

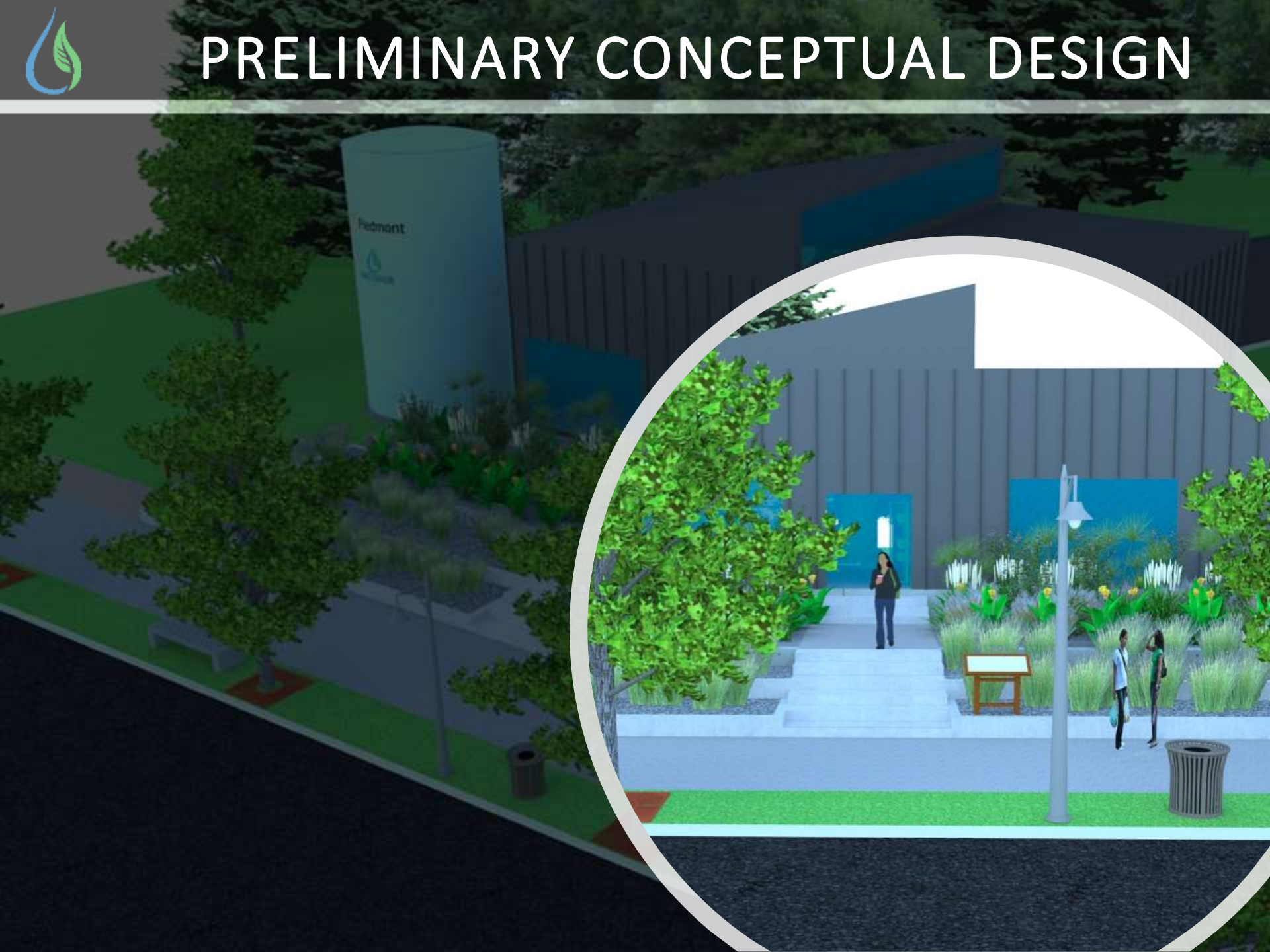


roject: WaterHub® Reclamation System and Ancillary Improvements	Title/Description: Building Layout - Site B2 Iso View	THE UNIVERSITY OF TEXAS AT AUSTIN	FLINTCO BURNS McDONNELL
ient: University of Texas Austin	Location: Austin, TX	Initial:	Revision:

PRELIMINARY CONCEPTUAL DESIGN

PROPOSED STREETSCAPE DESIGN

PRELIMINARY CONCEPTUAL DESIGN



AUSTIN WATER RENDERING

AUSTIN WATER RENDERING

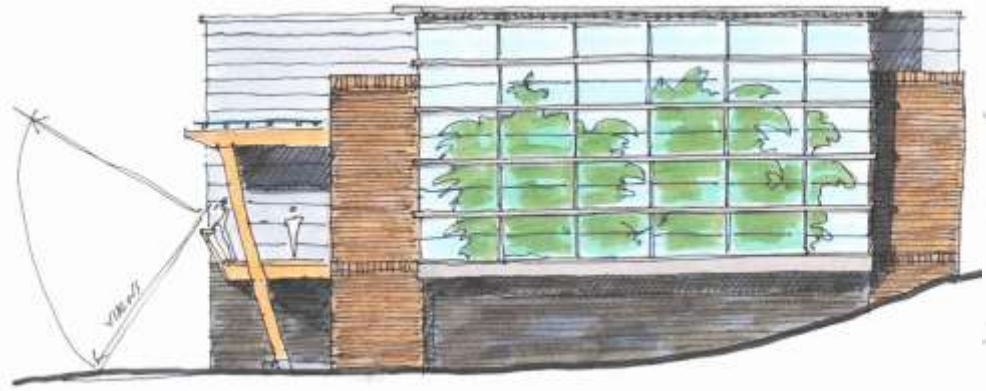
AUSTIN WATER RENDERING

Flad Architects

SUSTAINABLE WATER®
EXTENDING THE LIFE CYCLE OF WATER

McKIM&CREED

McADAMS



DUKE

DUKE

Bridge and canopy

Curtainwall and metal panel

3-Brick academic blend

2-Brick blend base (or black diamond only)

FLOOR PLAN

LESSONS-LEARNED: GENERAL

- Don’t Under Estimate Public Interest…
  - Tours, Program Space, Community Outreach
  - 4,500 Tours at Emory University
- Facility Design Aesthetics
  - Public access areas from Front to Back of House
  - Pedestrian circulation through system
  - Fully enclosed mechanical areas & better operator access
- Data Collection & Field Investigations
  - Never “too much” operational, sampling & flow data
  - Strong data collection investigations in preliminary engineering, save time and money down the road

LESSONS-LEARNED: PROCESS

- Pre-Fabrication
  - Hydraulic “Sweet-spots” to more or less prefabrication
  - Skids, Tanks, Operator Rooms
- Process Resiliency…
  - Equipment Redundancy (Primary screening, Influent Pumps, UV, etc.
  - Dual Process Trains
  - You can’t optimize what isn’t measured
  - WQ Sensors starting in influent wet-well
- Maintenance
  - Removal & Maintenance of Influent Pumps from Wet Well
  - Ability to Pump Backwards from Screen or EQ to flush influent lines
  - Membrane / Filter Access, Location of Hoists
- Turn-Down
  - Contingency planning for turn-down scenarios

SUSTAINABLE WATER®

EXTENDING THE LIFECYCLE OF WATER

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