Innovative Wastewater Tech Pilots: A reuse case study

Michael Murphy - Director of Water Innovation

NEWEA Water Reuse Conference

Storrs, CT

August 10, 2018

MASSACHUSETTS CLEAN ENERGY CENTER®

Our Mission

Grow the state's clean energy industry while helping to meet the Commonwealth's clean energy, climate and economic development goals.

INVEST

Invest in programs that increase renewable energy adoption by residents, businesses and communities.

CONNECT

Connect employers, job seekers, students, communities and investors to the clean energy industry.

INNOVATE

Help to spur innovation through infrastructure, funding and technology development support.

How MassCEC Operates

FUNDING SOURCE

Massachusetts Utility Customers

5 Municipal Lighting Plant Customers

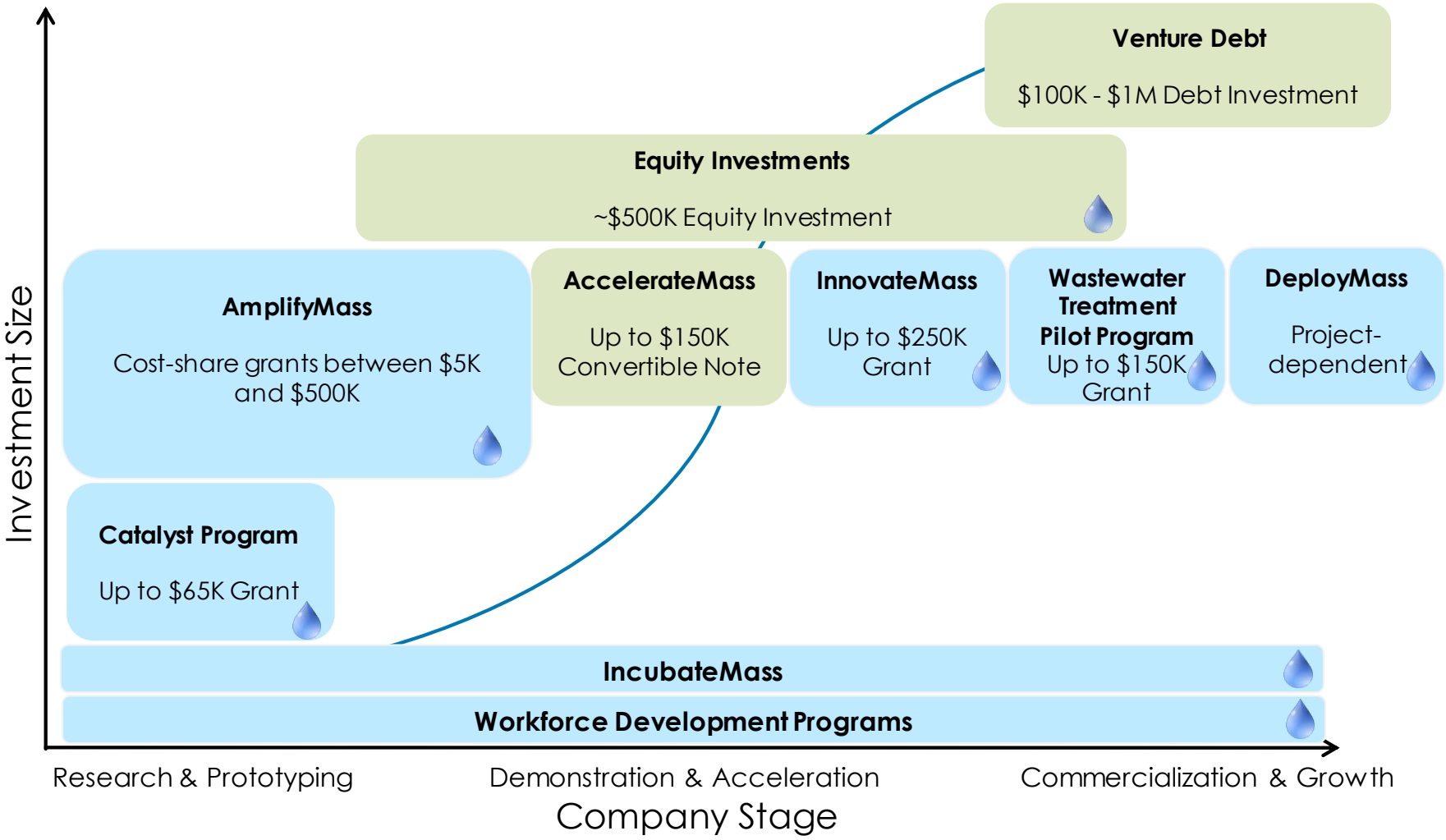
$22M annually

Collected via a surcharge equal to $.29/month for an average residential customer

CORE ACTIVITIES

- Renewable Energy Generation
- Investments
- Innovation & Industry Support
- Wind Technology Testing Center
- Marine Commerce Terminal

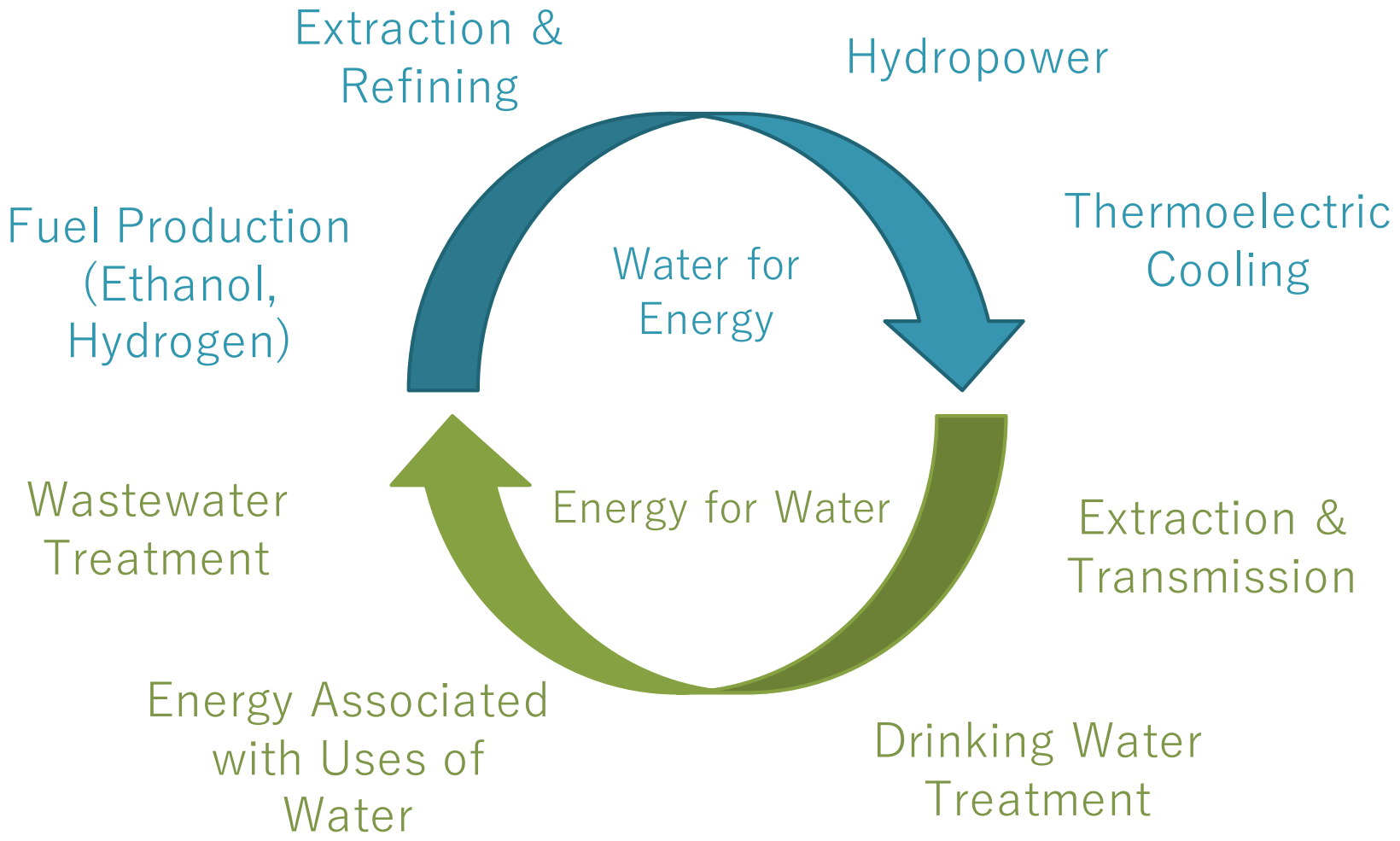
Technology Acceleration Programs



MASSACHUSETTS CLEAN ENERGY CENTER®

Investment | *Grant*

Water-Energy Nexus



Innovative Wastewater Treatment Technology Pilots

Authorization:

$600,000 in FY 2017; $800,000 in FY18; $800,000 in FY19

Purpose:

Provide grant funding for public wastewater districts and authorities to demonstrate innovative water technologies that increase energy efficiency.

Details:

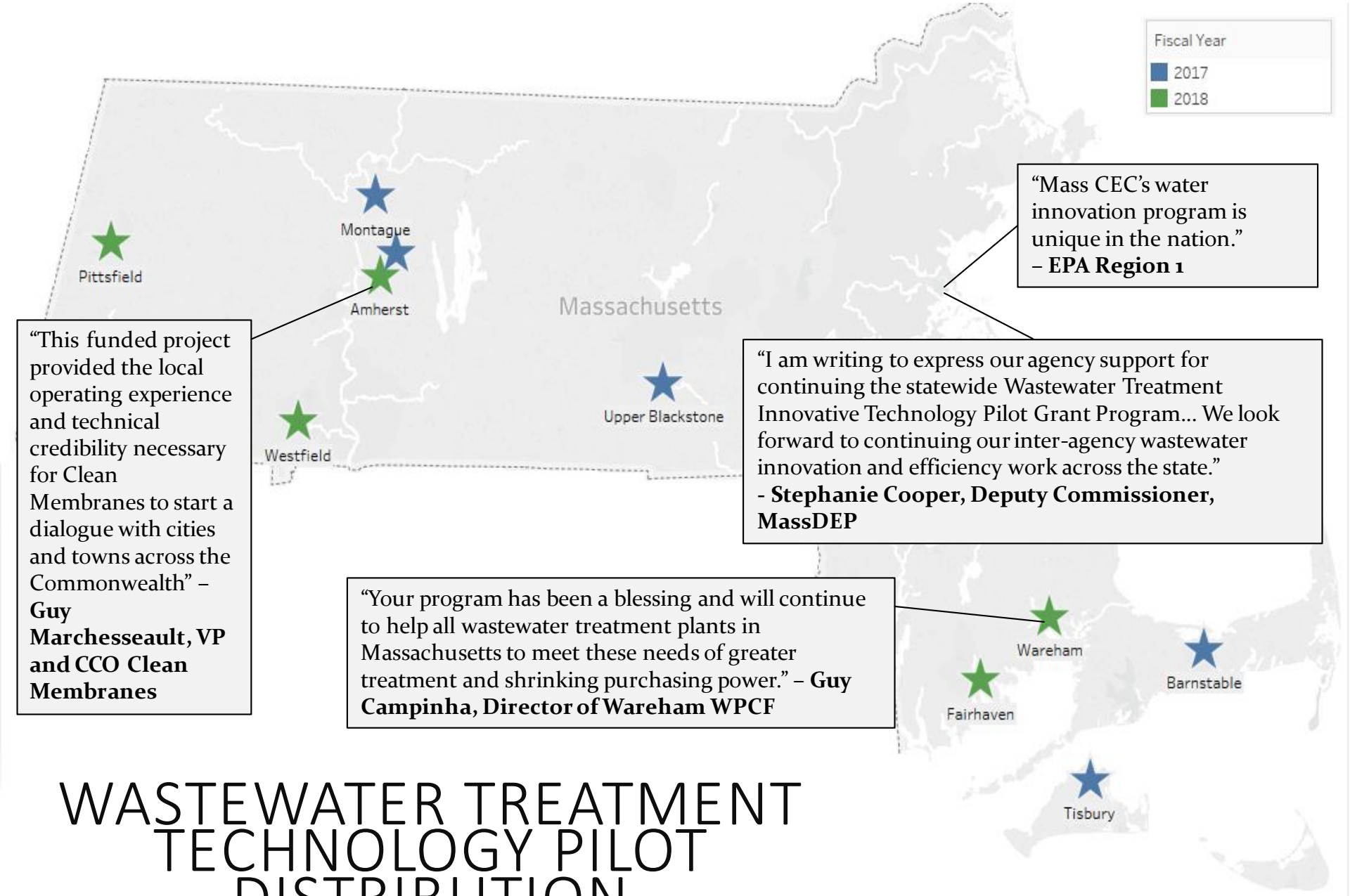
5-8 applicant teams (public wastewater district/authority + water technology provider) will each receive up to $150,000 in demonstration grants. Require 50% cost share

Wastewater Treatment Pilot Program FY 2017 Projects

	Municipality	Technology Partner	Project Details	Project Status
1	Amherst	Clean Membranes	Water reuse to irrigate UMass Amherst's athletic fields.	Project complete
2	Upper Blackstone	Clearas	Resource recovery to produce algae for wastewater treatment.	Project complete
3	Montague	The Water Planet Company	Solids destruction via anaerobic digestion.	Pilot on hold per DEP request
4	Tisbury	CES Clean Water LLC	Removal of nitrogen from residential Title 5 septic systems.	In process
5	Barnstable	Geomatrix, LLC	Removal of nitrogen and selected contaminants from residential Title 5 septic systems.	In process

Wastewater Treatment Pilot Program FY 2018 Projects

	Municipality	Technology Partner	Project Details	Project Status
1	Amherst	Nanostone	Ceramic ultrafiltration for potential reuse on UMass Amherst campus	In Process
2	Pittsfield	MICROrganic	Microbial Fuel Cell technology, an energy efficient replacement for traditional wastewater aeration	In Process
3	Wareham	Water Warriors	Microbubble aeration and biomedia filtration to reduce energy for aeration	In Process
4	Westfield	Hach; Woodard & Curran	Ammonia-based aeration control (ABAC) for energy savings and nutrient removal	Will Begin Sept 2018
5	Fairhaven	WesTech; Microvi Biotech; Stantech	Carbon diversion technology and biocatalytic carbon and nitrogen removal for energy and cost savings	Will begin Nov 2018



"Mass CEC's water innovation program is unique in the nation." **– EPA Region 1**

"This funded project provided the local operating experience and technical credibility necessary for Clean Membranes to start a dialogue with cities and towns across the Commonwealth" – **Guy Marchesseault, VP and CCO Clean Membranes**

"I am writing to express our agency support for continuing the statewide Wastewater Treatment Innovative Technology Pilot Grant Program… We look forward to continuing our inter-agency wastewater innovation and efficiency work across the state." **- Stephanie Cooper, Deputy Commissioner, MassDEP**

"Your program has been a blessing and will continue to help all wastewater treatment plants in Massachusetts to meet these needs of greater treatment and shrinking purchasing power." **– Guy Campinha, Director of Wareham WPCF**

WASTEWATER TREATMENT TECHNOLOGY PILOT DISTRIBUTION

Amherst secondary wastewater reuse pilot

Goal: Water reuse for surface irrigation.

Objectives: 1) Cost-effectively treat municipal water effluent to irrigate athletic fields, and 2) collect data on operating costs

Pilot Duration: 4.5 Months

Results: Class A reuse standards met. 4.5m gallons of water treated. Module meets the effluent limits for the six parameters (pH, BOD5, TSS, turbidity, fecal coliform, and total nitrogen)

Guy Marchesseault, VP and CCO, Clean Membranes, Inc.

Amherst Wastewater Treatment Plant and Clean Membranes Pilot Site

Project Team

TOA

- Guilford Mooring
- Kimberly Bergeron
- Duane Klimczyk
- Amy Rusiecki

CM

- Guy Marchesseault
- Michael Grossman
- Duong Thuy Ha
- Katrina Puffer

UMass

- David Reckhow
- Patrick Wittbold
- Celina Dozier
- Ray Jackson
- David Schoen
- Benjamin McDaniel
- John Tobiason
- Additional grad & undergrad students

Consultants

- Paul Lambert
- John McArdle
- Thomas Cadoudal
- Olivier Léon

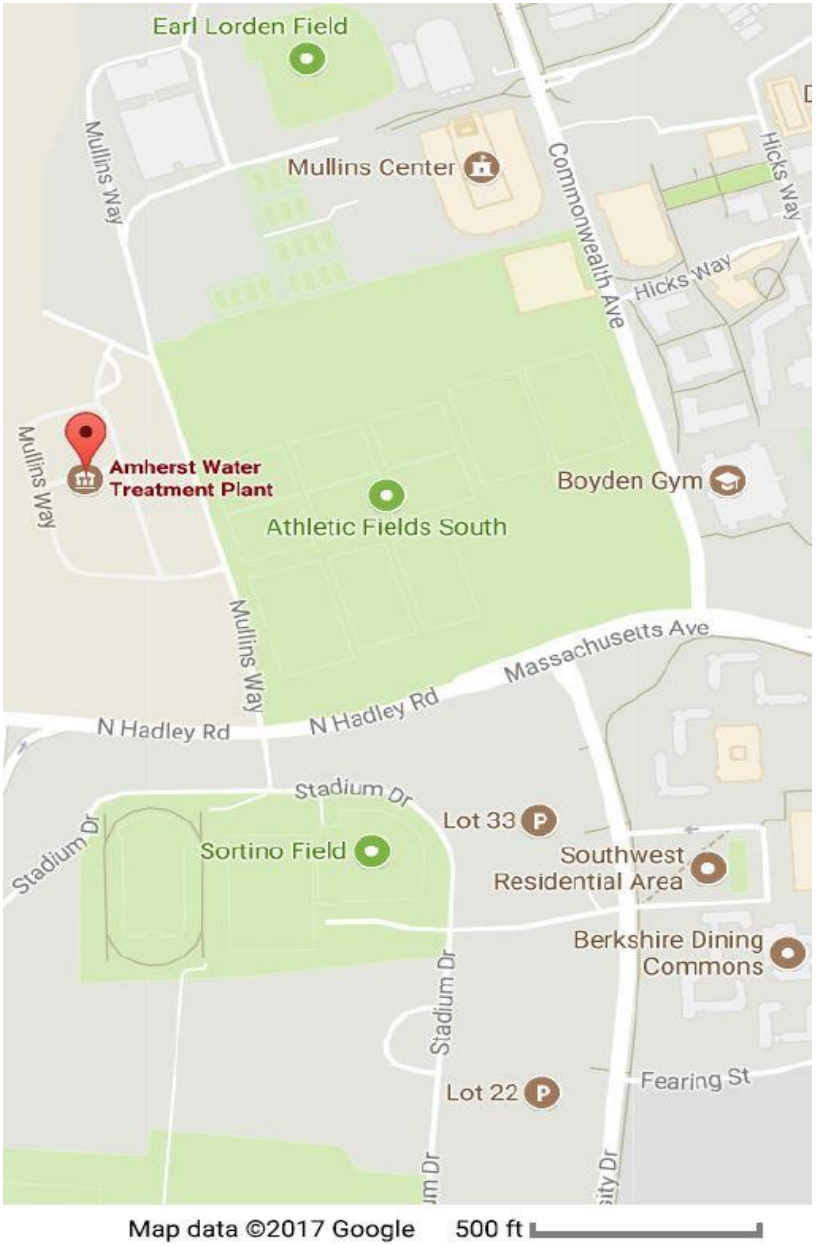
MassCEC

- Michael Murphy
- Katie Dobbins

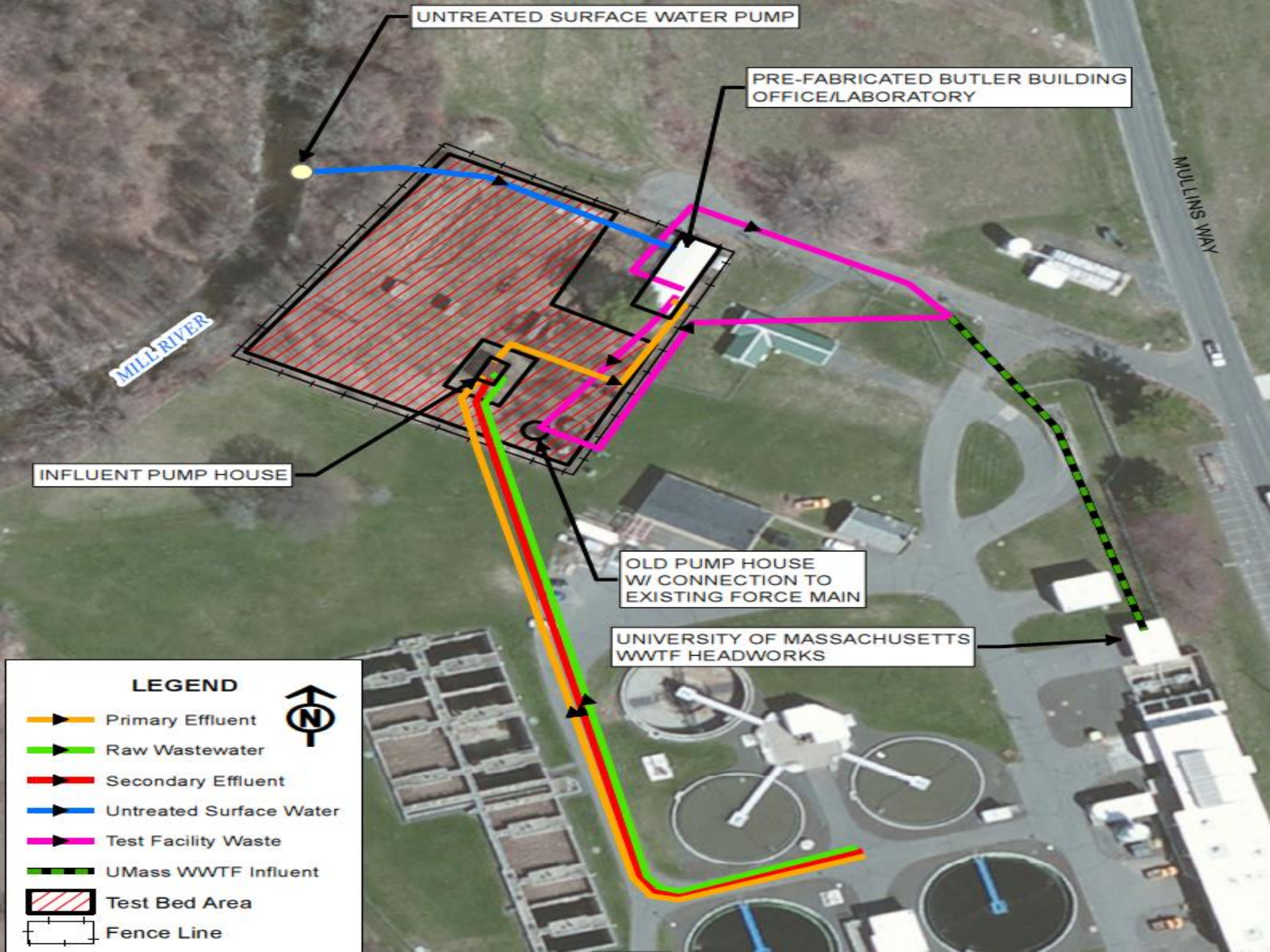
Key Potential Benefits

- Energy efficiency for already established water reuse programs (e.g. cooling towers)

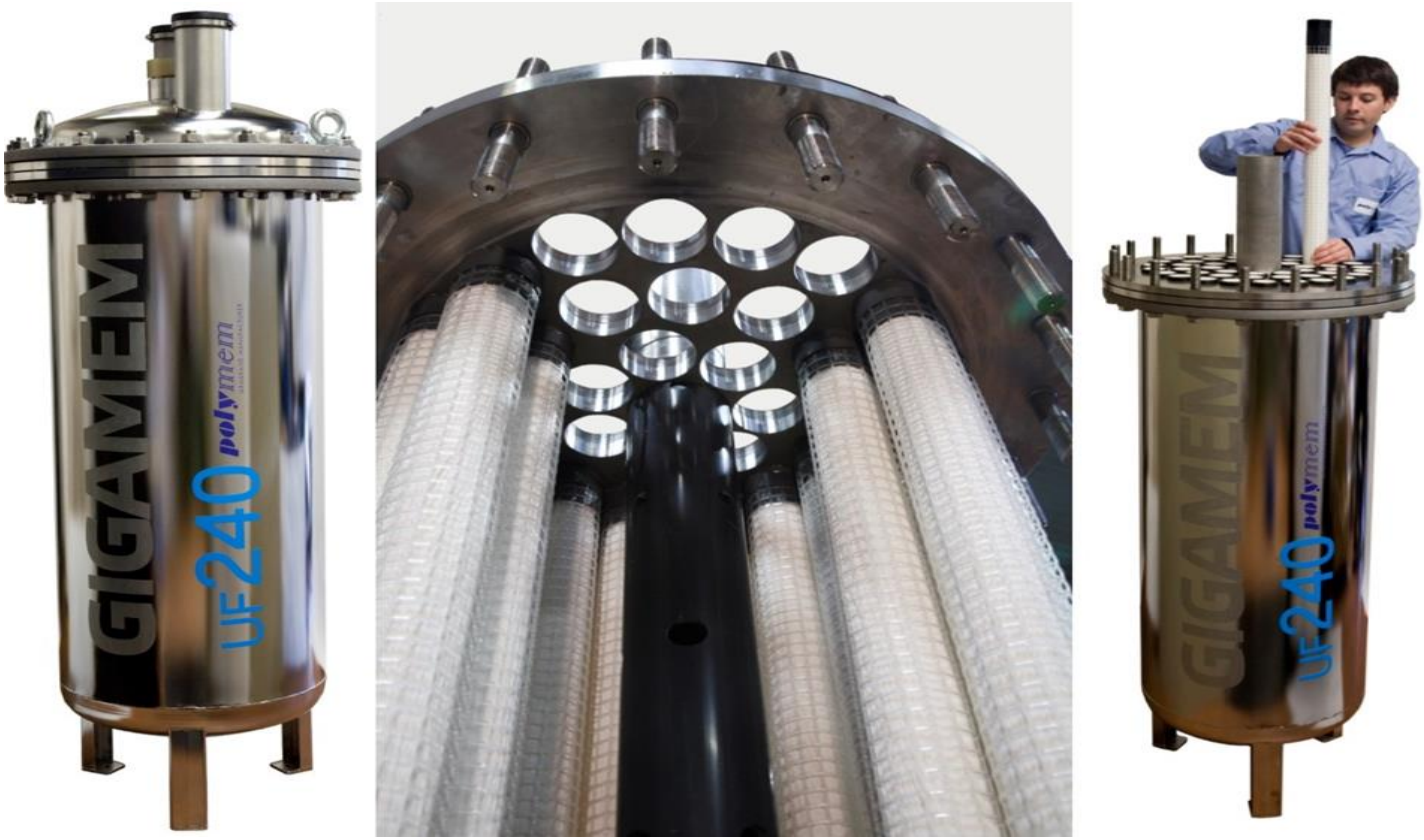
- Generating Class A recycled water suitable for additional reuse applications (e.g. irrigation


Earl Lorden Field
Mullins Way
Mullins Center
Commonwealth Ave
Hicks Way
Hicks Way
Mullins Way
Amherst Water Treatment Plant
Athletic Fields South
Boyden Gym
Mullins Way
Massachusetts Ave
N Hadley Rd
N Hadley Rd
Stadium Dr
Stadium Dr
Lot 33
Sortino Field
Southwest Residential Area
Berkshire Dining Commons
Stadium Dr
Lot 22
Fearing St
Map data ©2017 Google
500 ft


Northern
Construction Services
UMass Pilot Building
and Field Site
Google
Imagery ©2017 Google, Map data ©2017 Google
50 ft


UNTREATED SURFACE WATER PUMP
PRE-FABRICATED BUTLER BUILDING
OFFICE/LABORATORY
MULLINS WAY
MILL RIVER
INFLUENT PUMP HOUSE
OLD PUMP HOUSE
W/ CONNECTION TO
EXISTING FORCE MAIN
UNIVERSITY OF MASSACHUSETTS
WWTF HEADWORKS
LEGEND
N
Primary Effluent
Raw Wastewater
Secondary Effluent
Untreated Surface Water
Test Facility Waste
UMass WWTF Influent
Test Bed Area
Fence Line

High-Capacity Membrane Module




GIGAMEM
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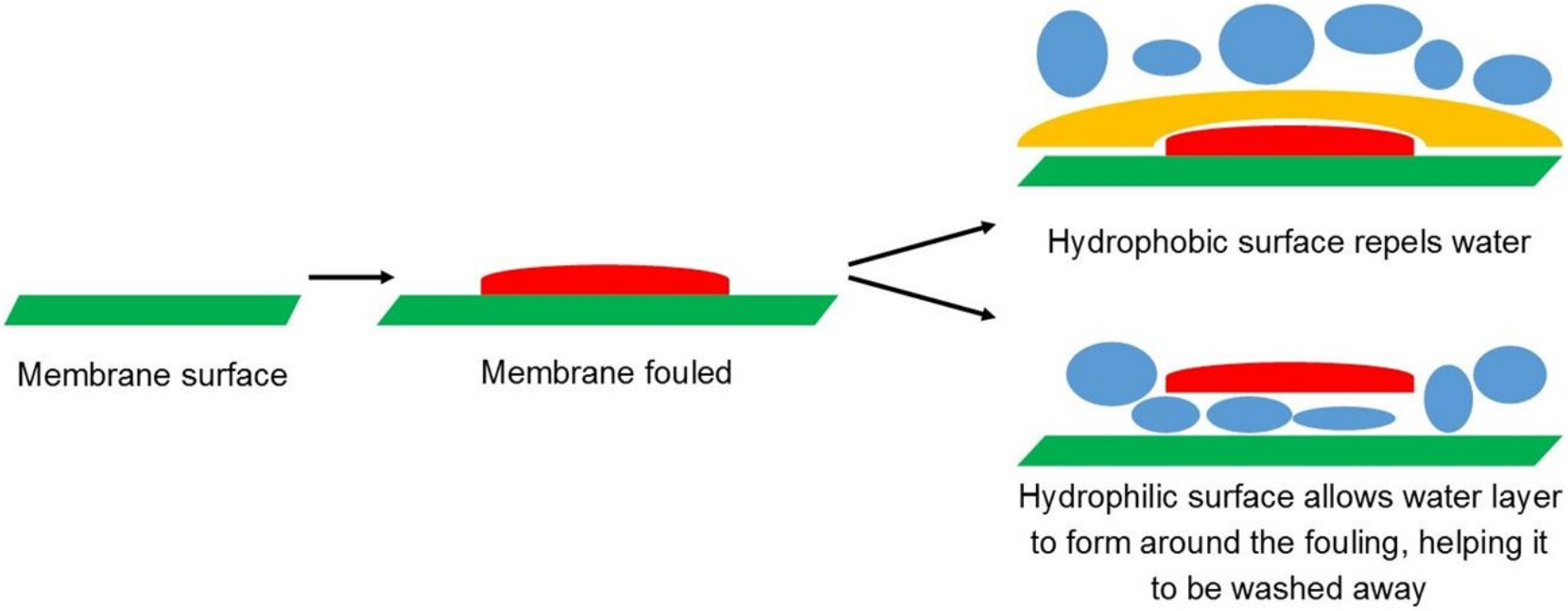
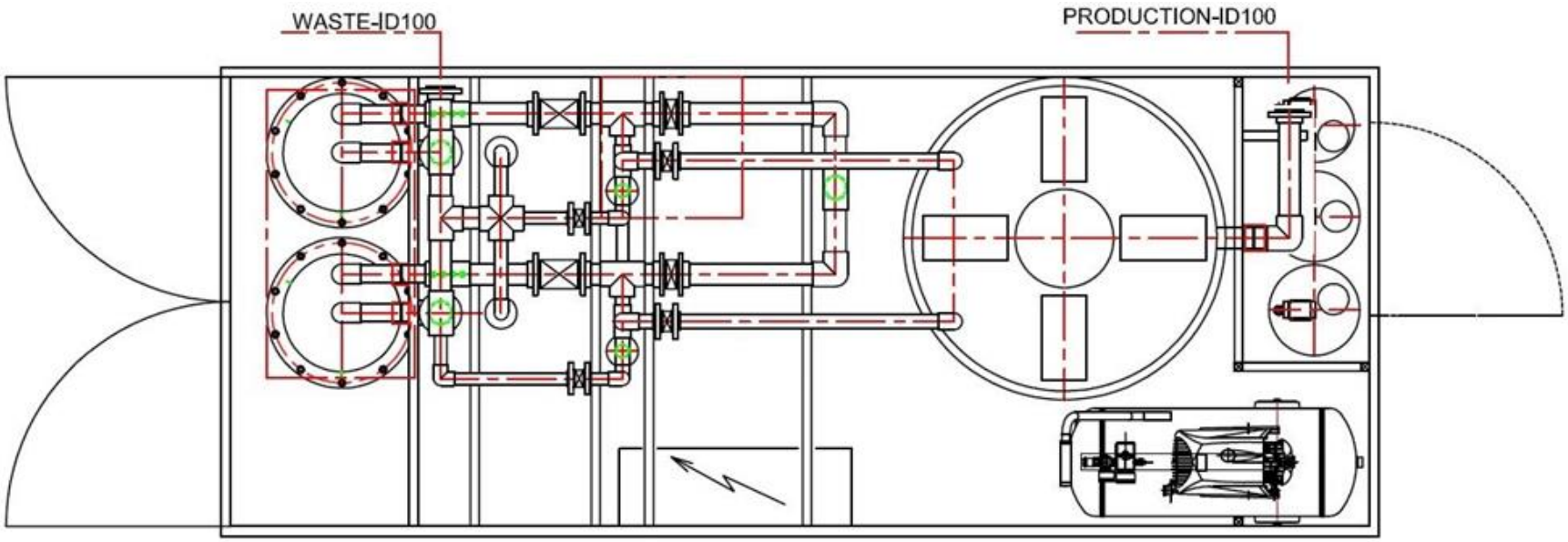
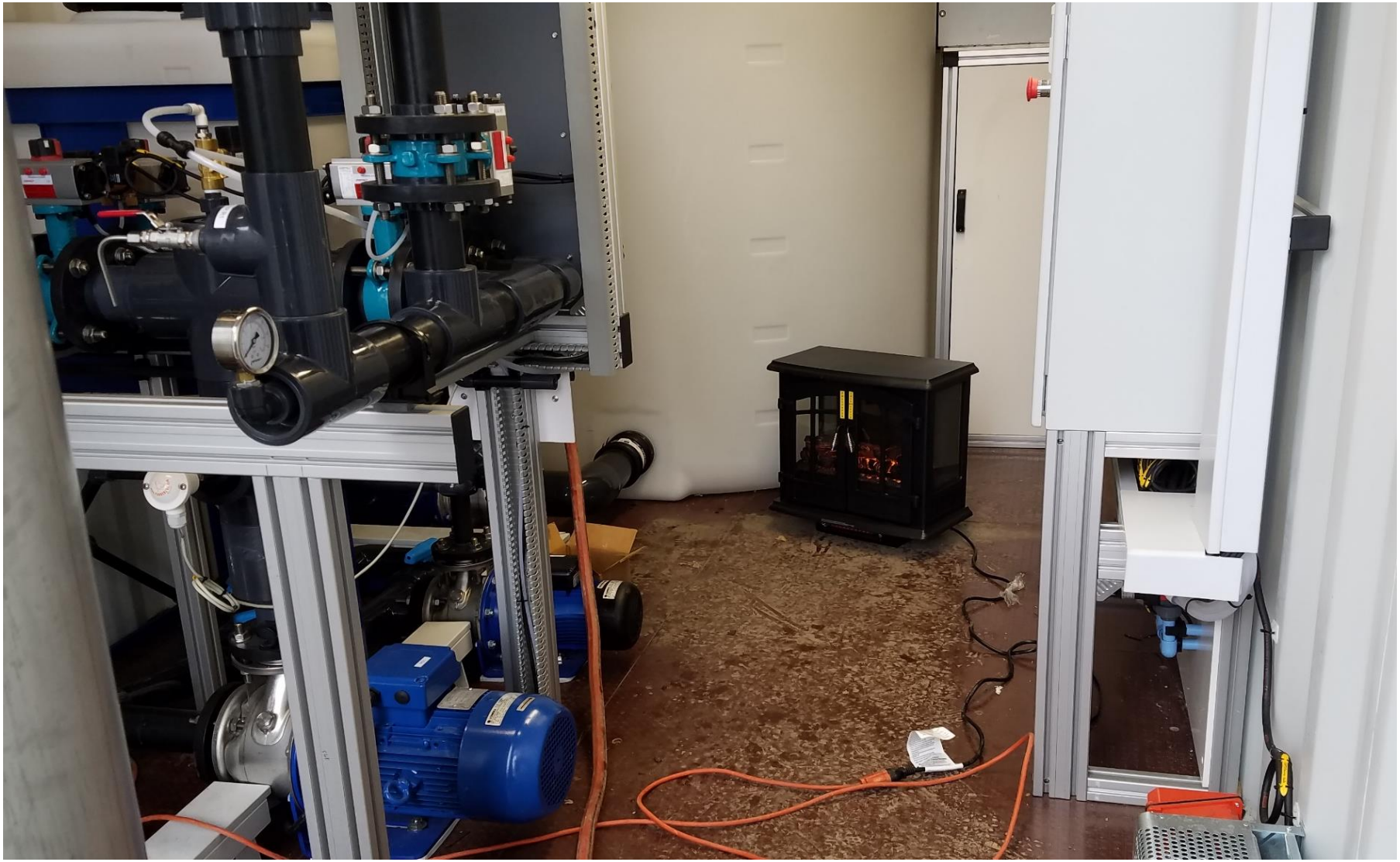
Membrane Surface Properties




CLEAN
MEMBRANES

Modularized Membrane System





Water Quality Analysis Methodology

Parameter	Laboratory	Analytical Methods
pH	UMass Amherst	Thermo Scientific Orion Star A329 portable pH/ISE/Conductivity/RDO/DO meter
BOD_5	Microbac	Wet-Chem W/SW 5210B-2001
TSS	TOA	USGS method 1-3765-85
Turbidity	On-line turbidimeter	Continuous recording turbidimeters ▪ Hach Lange SC200 Turbidimeter (influent) ▪ Swan AMI Turbiwell Turbidimeter (effluent)
Fecal coliform	Microbac	SM9222D-1997
Total nitrogen	TOA	Sum of $N\text{-}NO_3^-$ (nitrate), $N\text{-}NO_2^-$ (nitrite), and TKN (Total Kjeldahl Nitrogen): ▪ $N\text{-}NO_3^-$ (Hach DR3900 method 10206 Dimethylphenol TNT835) ▪ $N\text{-}NO_2^-$ (Hach DR3900 method 10207 Diazotization TNT839/TNT840) ▪ TKN (Hach DR3900 method 10242 S-tkn TNT880)

Water Quality Results

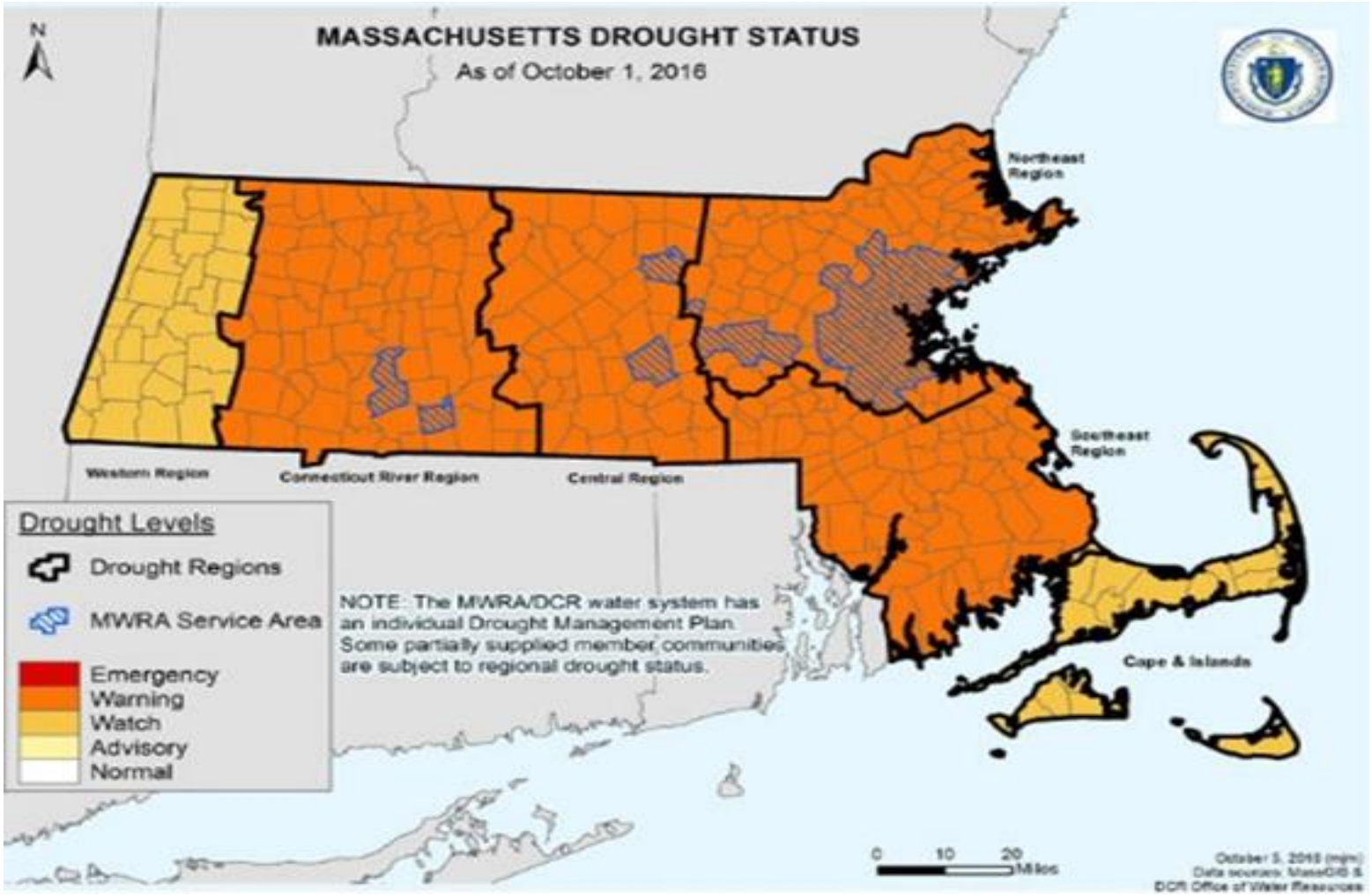
Parameters	Class A Reclaimed Water Effluent limits, 314 CMR 20.17	Pilot Effluent
pH	6.5-8.5	6.79-6.96
BOD_5	<10 mg/L	<2 mg/L (**BDL[1]**)
TSS	<5 mg/L	0-0.2 mg/L
Turbidity	Average of <2 NTU within a 24-hour period Not >5 NTU more than 5% of the time within a 24-hour period Not >10 NTU at any time	0.039-0.141 NTU (average of a 24-hour period) No results >5 NTU
Fecal coliform	Median of no detectable fecal coliform/100 ml over continuous seven-day sampling periods Not to exceed 14/100 mL in any one sample	<1 CFU/100 mL (**BDL[1] in all samples**)
TN	<10 mg/L	5.463-6.416 mg/L

[1]Below detection limit

Pilot System Energy Cost Projection

Frequency	Energy Usage (kWh)	Energy Cost ($)	Demand Cost ($)	Total Costs ($)
Daily	6	$0.66	-	-
Weekly	42	$4.62	-	-
Monthly	183	$20.11	$4.50	$24.61
Annual	2,193	$241.27	$54.05	$295.32

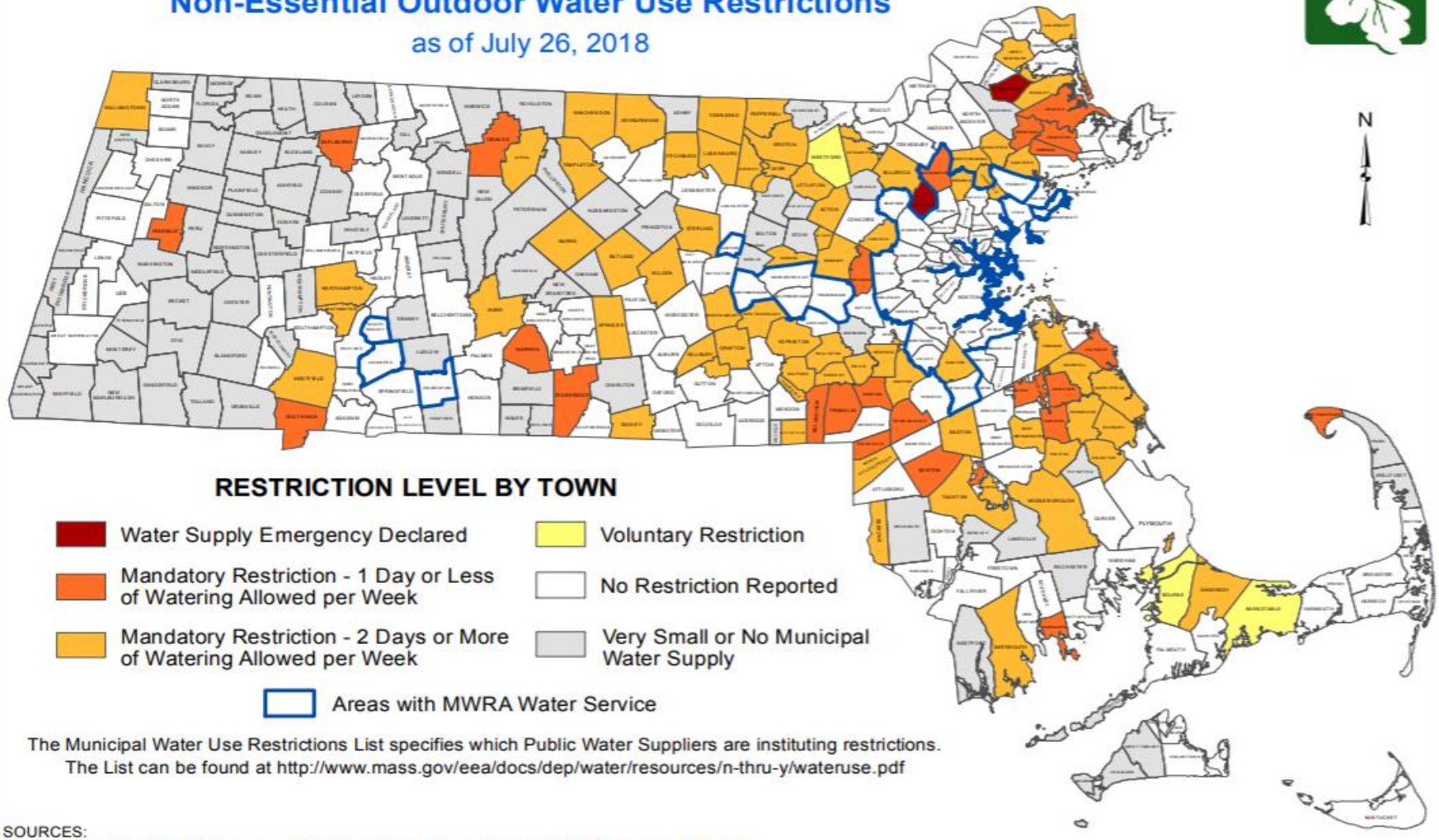
Implications and Path Forward



CURRENT MUNICIPAL WATER USE RESTRICTIONS

Non-Essential Outdoor Water Use Restrictions

as of July 26, 2018



RESTRICTION LEVEL BY TOWN

- Water Supply Emergency Declared
- Mandatory Restriction - 1 Day or Less of Watering Allowed per Week
- Mandatory Restriction - 2 Days or More of Watering Allowed per Week
- Voluntary Restriction
- No Restriction Reported
- Very Small or No Municipal Water Supply
- Areas with MWRA Water Service

The Municipal Water Use Restrictions List specifies which Public Water Suppliers are instituting restrictions. The List can be found at http://www.mass.gov/eea/docs/dep/water/resources/n-thru-y/wateruse.pdf

SOURCES:
MassDEP Bureau of Water Resources, Water Management Program; MassDEP GIS Program; MassGIS.
Restriction Level data provided by municipal Public Water Suppliers or by MassDEP internet search.
For more information contact MassDEP Water Management Program at 617-654-6591.
NOTE: Sub-town water supply service areas are approximate.

MassDEP GIS Program
7/26/2018

Amherst Reuse Pilot

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Questions and Discussion

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