The Changing Role of Reclaimed Water in Florida

60th Michigan On-Site Wastewater Conference

Presented by: **David Ammerman,** AECOM Water

January 2011

AECOM

First some definitions

- **"Domestic wastewater"** means wastewater derived principally from dwellings, business buildings, institutions, and the like.
- **"Effluent",** unless specifically stated otherwise, means water that is not reused after flowing out of any plant or other works used for the purpose of treating, stabilizing, or holding wastes.
- **"Disposal"** means the discharge of effluent to injection wells, effluent outfalls, subsurface drain systems, and other facilities utilized strictly for the release of effluents into the environment.
- **"Reuse"** means the deliberate application of reclaimed water, in compliance with Department and District rules, for a beneficial purpose.

Per Capita Rainfall Comparisons

Country or Region	**Annual Rainfall** (inches)	**Land Area** (sq. mi.)	**Pop** (millions)	**Per Capita Rainfall** (10^3 Gal/cap/yr)	**Per Capita Rainfall** (10^3 m^3/cap/yr)
Saudi Arabia	4.0	900,004	21.1	2,959	11.20
Arizona	13.1	113,642	5.1	5,043	19.09
U.S. Average	-	-	-	7,789	29.48
Potomac Watershed	~40.0	14,670	5.0	2,039	7.72
Singapore	86.6	267	4.4	91	0.35

Source: Thomas j. Grizzard, P.E. Ph.D, Virginia Tech

Note: Singapore calculations does not include Johor catchments

AECOM

Why we use reclaimed water

Effluent Disposal

Water Conservation

AECOM

Outline of this presentation

- A brief history of reuse in Florida
- The evolution of effluent to reclaimed water
- The price of success – regulatory attention
  - Water Management Districts
  - Florida Department of Environmental Protection
  - EPA
- What does it mean for Michigan?

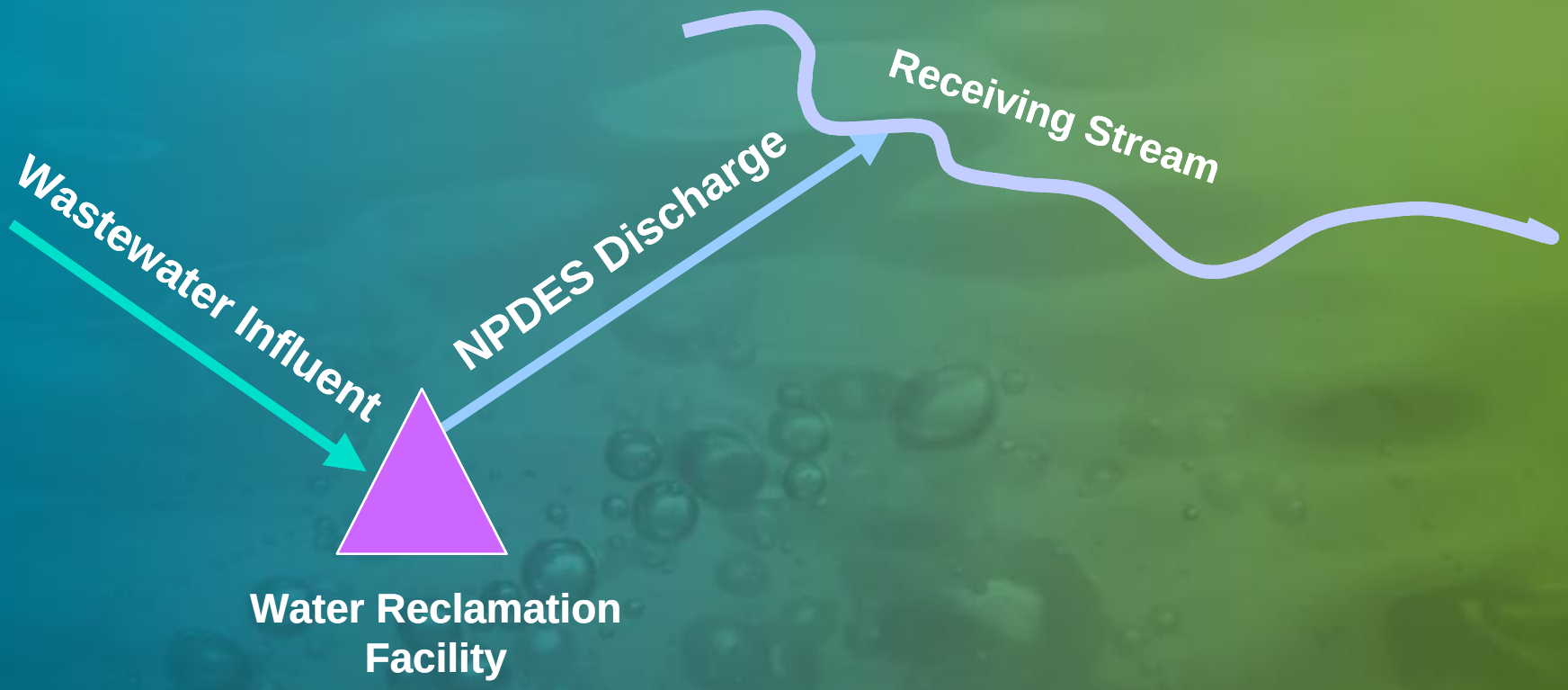
AECOM

Outline of this presentation

- A brief history of reuse in Florida
- The evolution of effluent to reclaimed water
- The price of success – regulatory attention
  - Water Management Districts
  - Florida Department of Environmental Protection
  - EPA
- What does it mean for Michigan?

AECOM

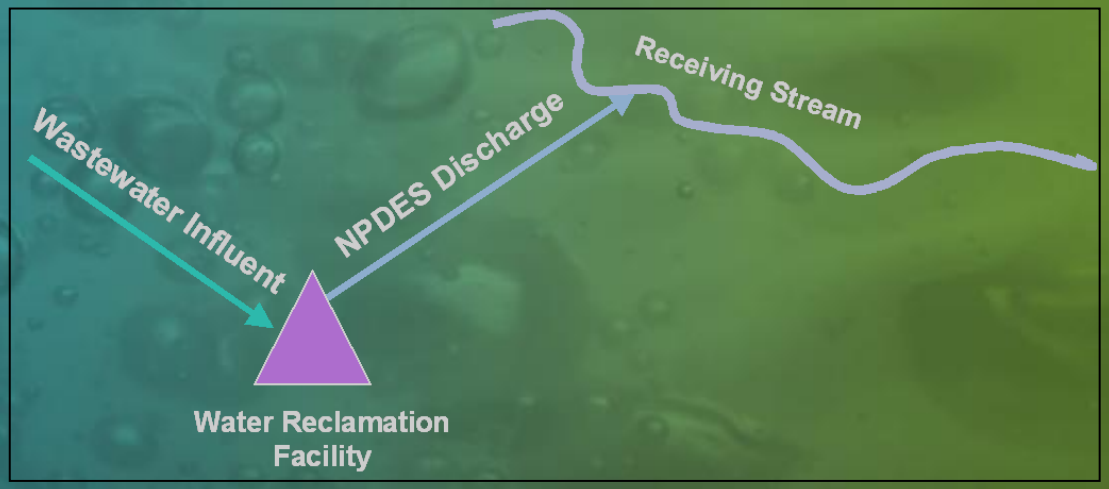
Traditional Treatment and Disposal Systems



AECOM

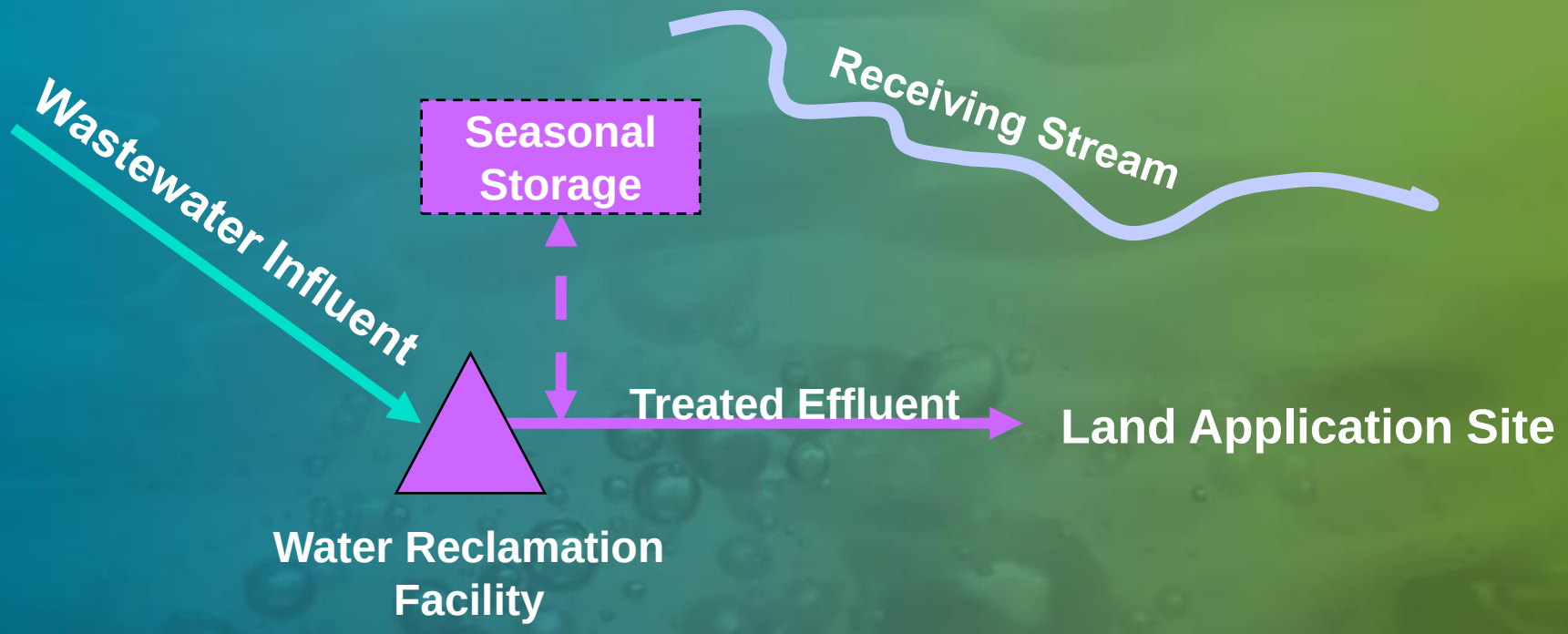
Why we have to change our ways:

- Streams and rivers experience very low flow conditions in the spring with a correspondingly low assimilative capacity
- Increased population necessitates expensive, possibly unattainable water quality for continued discharge
- Surface water quality linked to critical industries - tourism



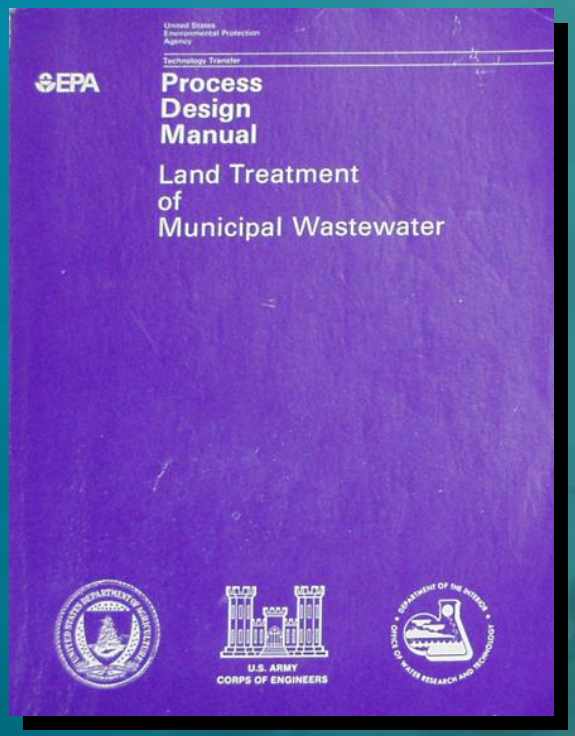
AECOM

A potential solution – stop discharging effluent



AECOM

Land Treatment was a recognized strategy for reducing nutrient loading to surface waters by the early 80's



1981

1984

AECOM

Example: Regulatory Suitability Criteria

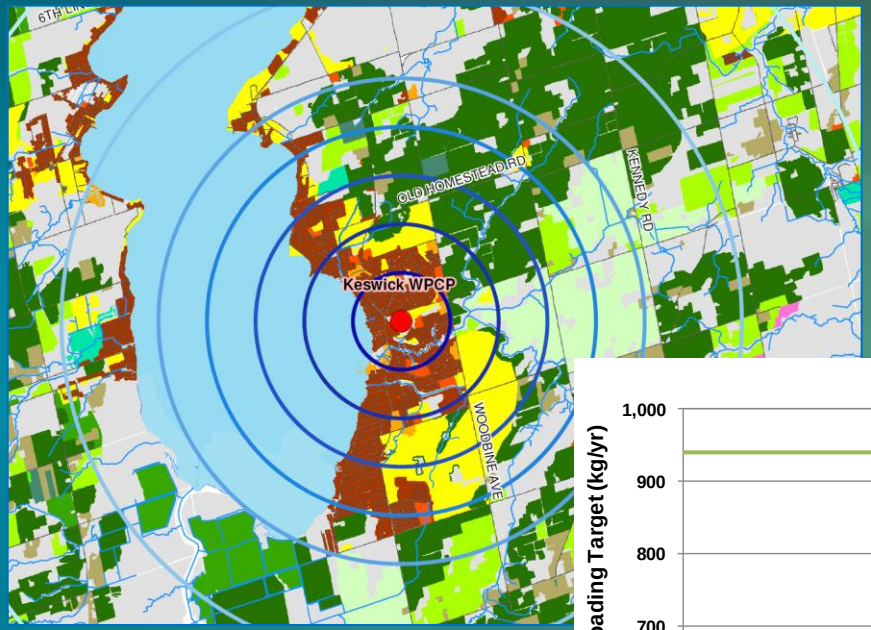
Criteria	Excellent	Good	Fair	Unsuitable
Area Topography - Slopes	< 2%	2 - 10%	10 - 15%	> 15%
Soil Permeability	Moderately High	Moderate	Moderately Low	Low/High
Groundwater Table Depth	>15	10 - 15	4 - 10	< 4
Nutrient Uptake	No limit	Nutrient limited - minor	Nutrient limited - moderate	Nutrient limited - major

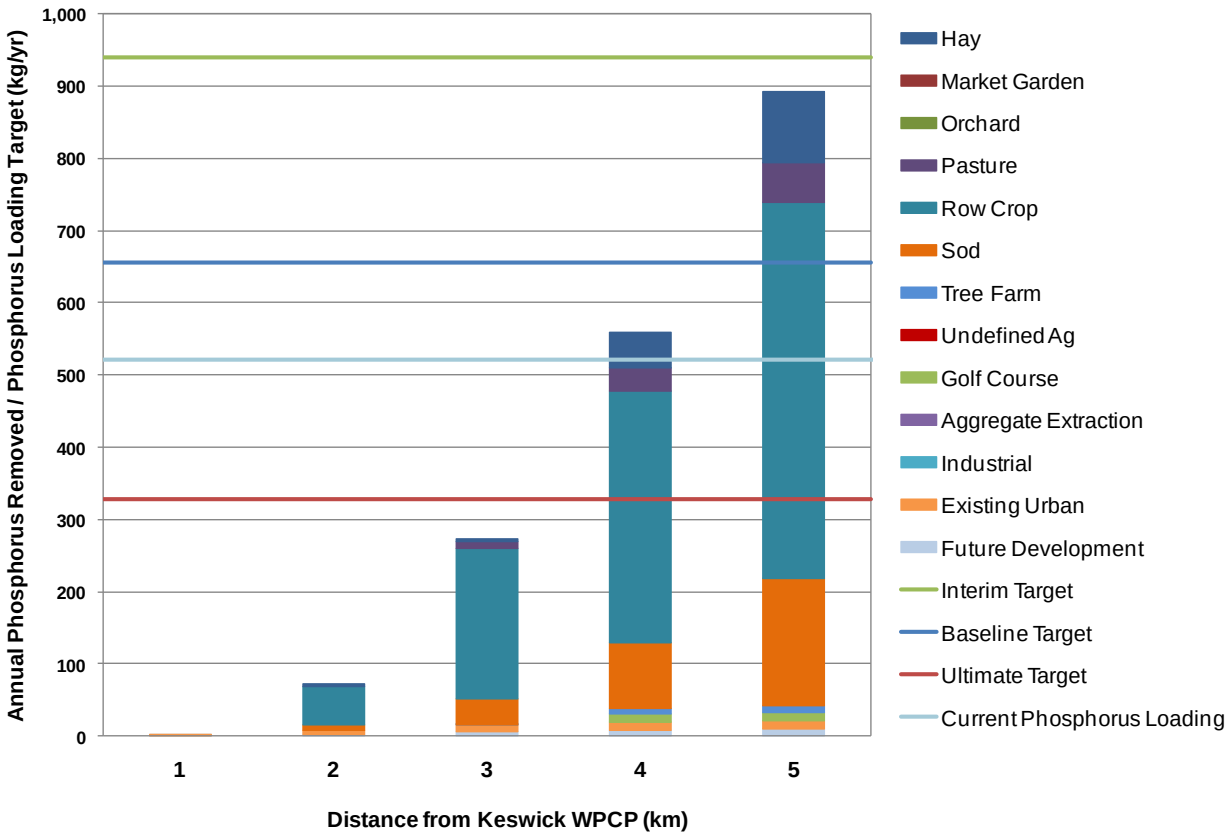
AECOM

Land Application

AECOM

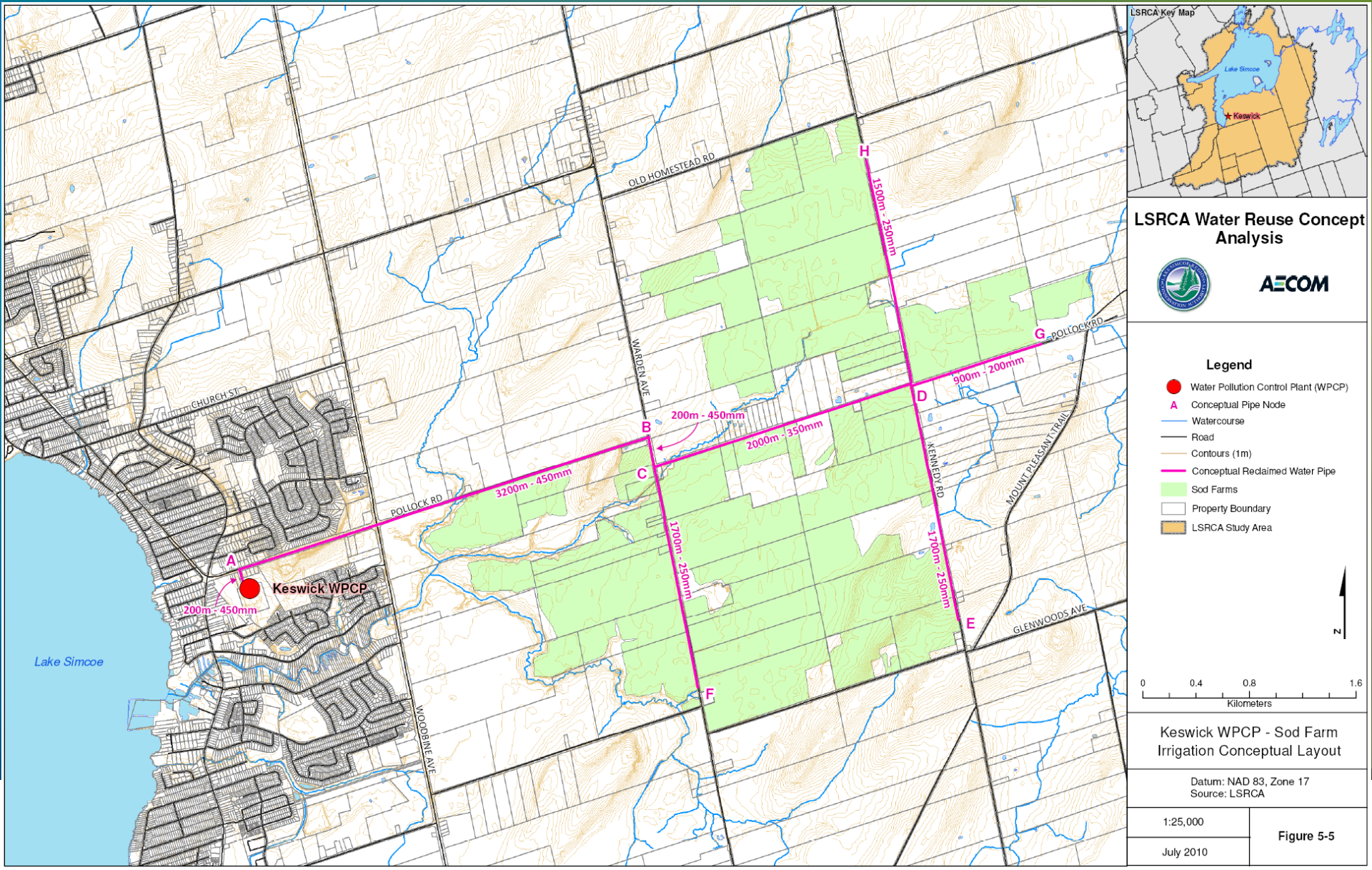
Lake Simcoe Project - Reuse/Land Application as an alternative to plant upgrades.



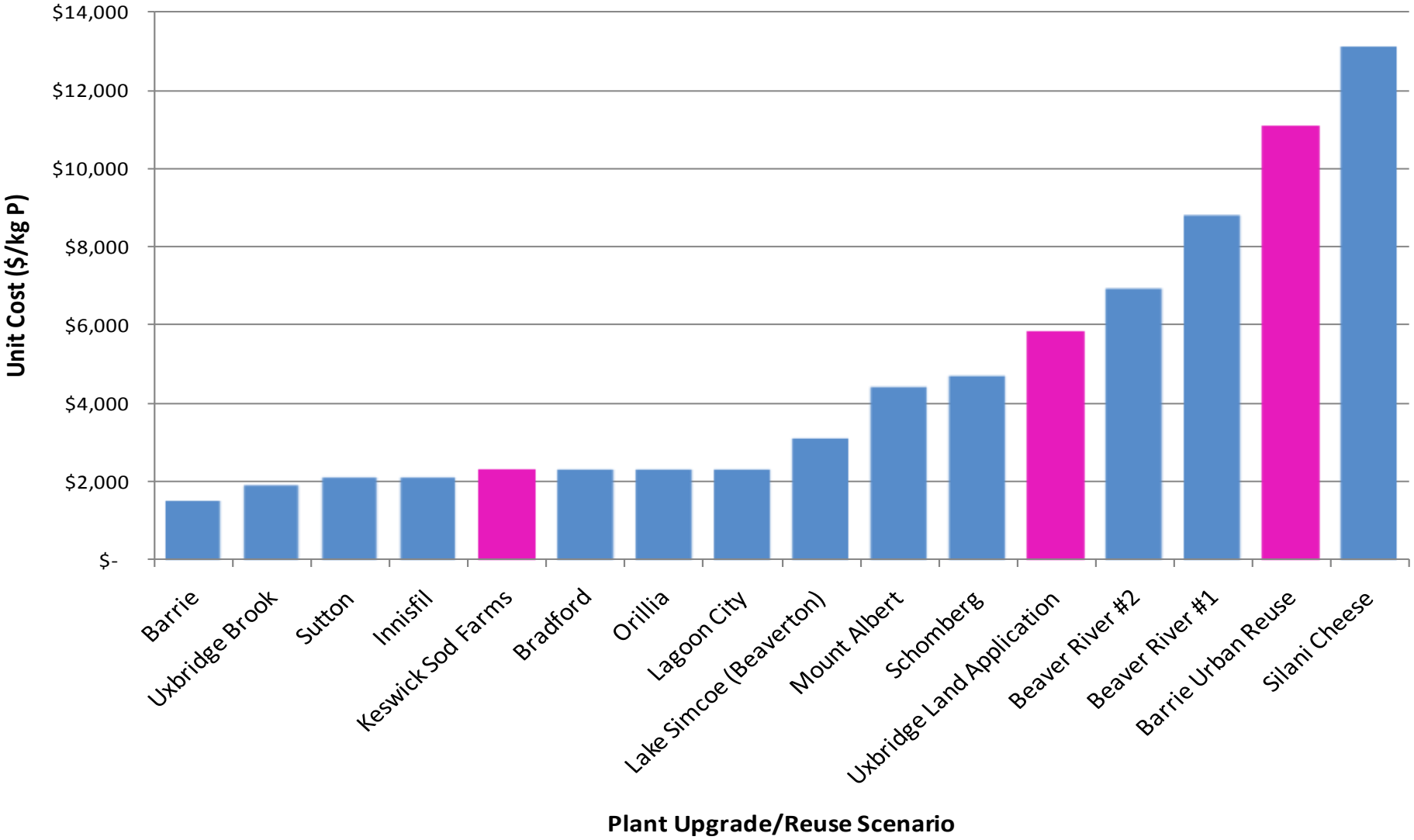


AECOM

Keswick – sod farm irrigation



Reuse Implementation Scenario



AECOM

Outline of this presentation

- A brief history of reuse in Florida
- The evolution of effluent to reclaimed water
- The price of success – regulatory attention
  - Water Management Districts
  - Florida Department of Environmental Protection
  - EPA
- What does it mean for Michigan?

AECOM

Restricted Access Irrigation on Non-Food Crops

AECOM

WARNING
THIS AREA IS
IRRIGATED WITH
TREATED WASTEWATER
NOT FIT TO DRINK

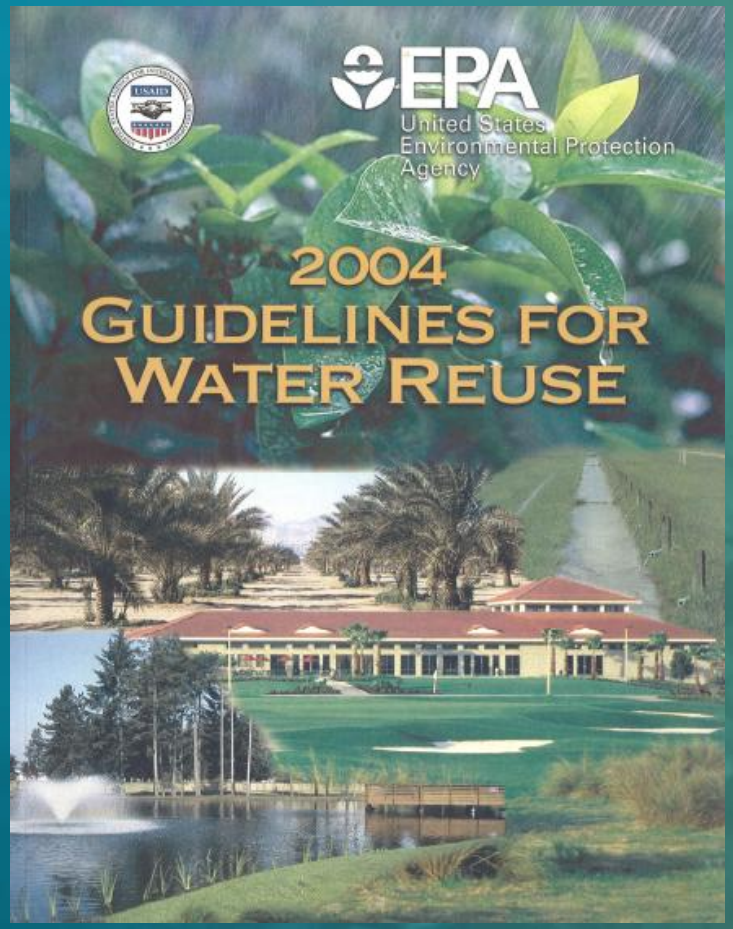
In the early 1900's Florida adopted Comprehensive Rules for Reclaimed Water

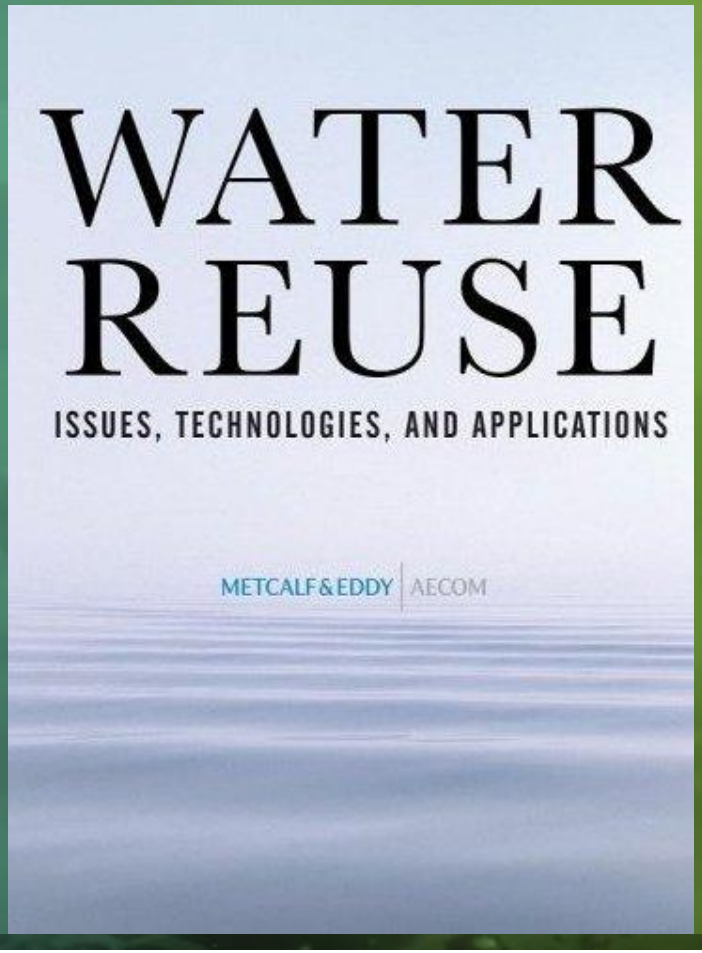
- Land application
- Agricultural irrigation
  - Non-food crops
  - Food crops
- Urban reuse
  - Landscape irrigation
  - Non-irrigation urban uses
- Industrial reuse
- Environmental, aesthetic & recreational uses
- Groundwater recharge
- Indirect/direct potable reuse

AECOM

The Benefits of Reuse

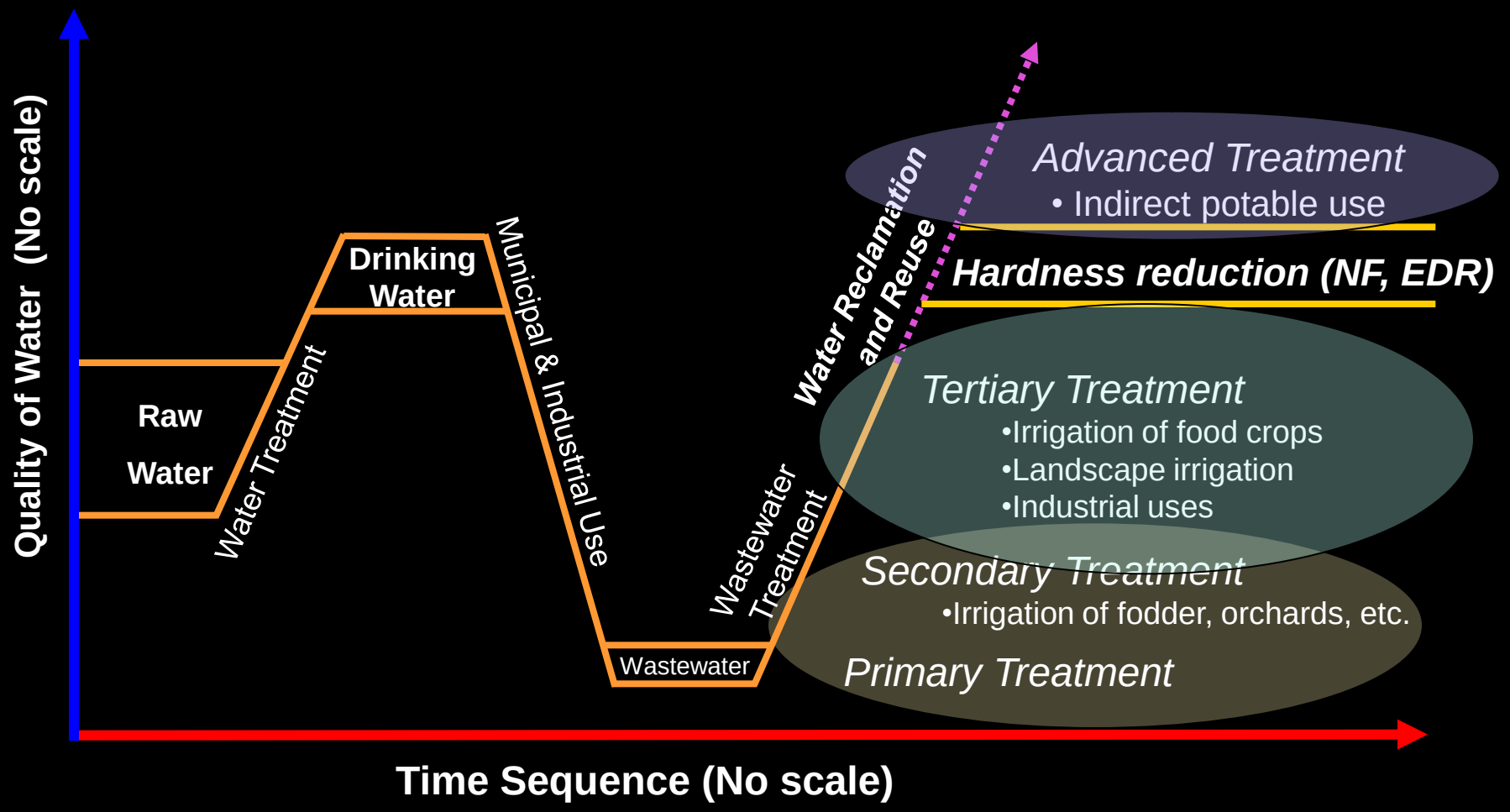
- Diversion of nutrients away from sensitive water bodies
- **Conservation of potable water**





AECOM

Treatment for Appropriate Uses



AECOM

Florida also developed strategies for expanding the use of reclaimed water

1. Encourage metering and volume-based rate structures.
2. Implement viable funding programs.
3. Facilitate seasonal reclaimed water storage (including aquifer storage and recovery).
4. Encourage use of reclaimed water in lieu of other water sources in the agricultural irrigation, landscape irrigation, industrial/ commercial/ institutional, and indoor water use sectors.
5. Link reuse to regional water supply planning (including integrated water resource planning).
6. Develop integrated water education programs.

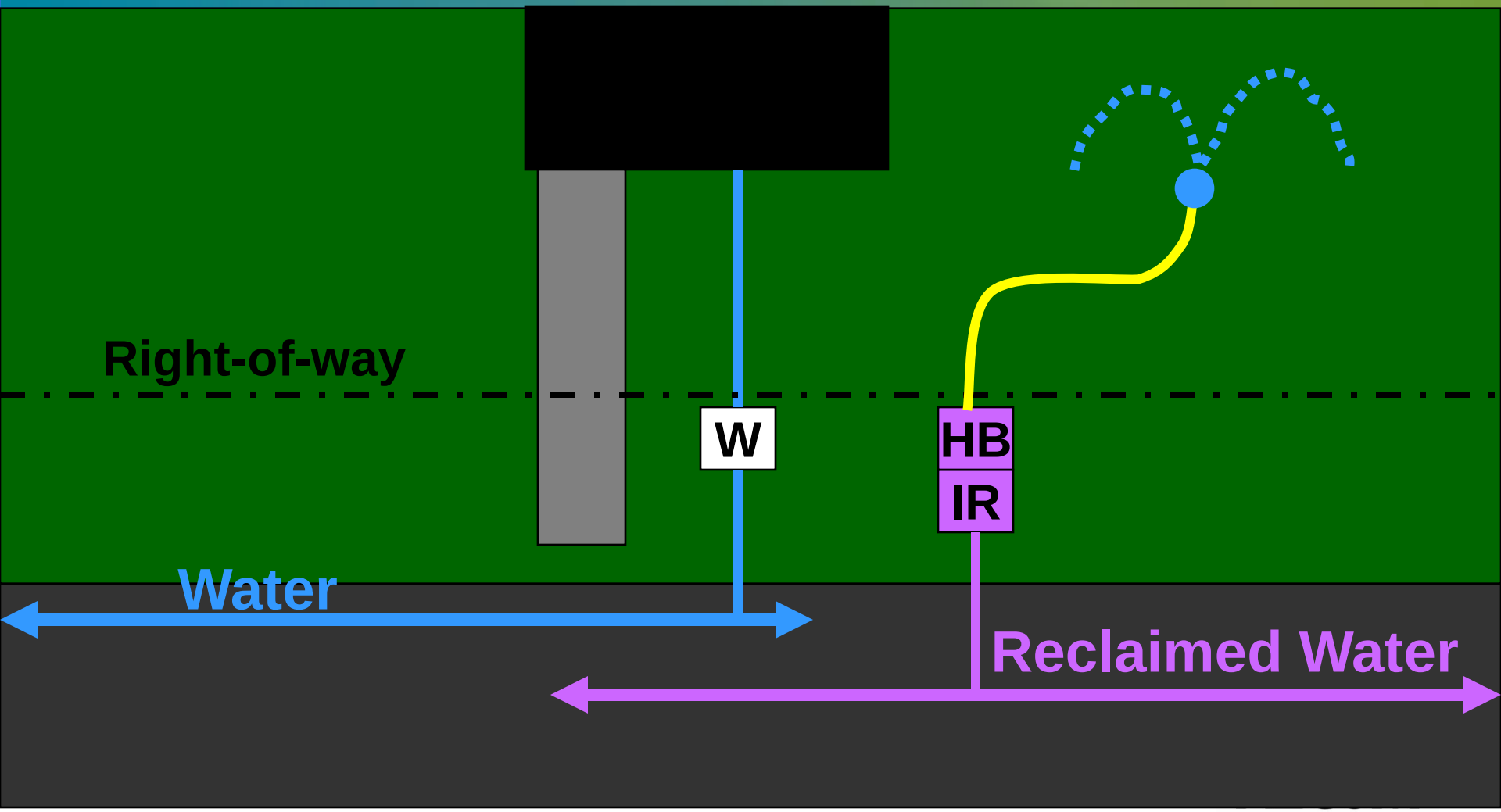
Reuse Strategies Continued

7. Encourage ground water recharge and indirect potable reuse.
8. Discourage effluent disposal.
9. Provide water use permitting incentives for utilities that implement reuse programs.
10. Encourage reuse in Southeast Florida.
11. Encourage use of supplemental water supplies.
12. Encourage efficient irrigation practices.
13. Encourage reuse system interconnects.
14. Enable redirecting of existing reuse systems to more desirable reuse options.
15. Use reclaimed water at government facilities.
16. Ensure continued safety of water reuse.

Agricultural Reuse

AECOM

Dual Distribution Systems: Residential Irrigation



WARNING
NEIGHBORHOOD
WATCH
AREA
IRRIGATION WITH
RECLAIMED WATER
DO NOT DRINK
AVISO... AGUA RECICLADA
SE PROHIBE BEBER

AECOM

Other Urban Uses of Reclaimed Water

Sewer cleaning, street sweeping, cooling water make-up and fire control

AECOM

Color Coded Pipes in a New Development

AECOM

Industrial Uses

- **Industrial cooling tower**
  - Secondary
  - addition treatment by Industry may be necessary
  - Blowdown
- **Boiler feed water**
  - High level treatment
  - Reverse osmosis (RO)
- **Other Industries**
  - Application-specific

Generally higher treatment required than irrigation

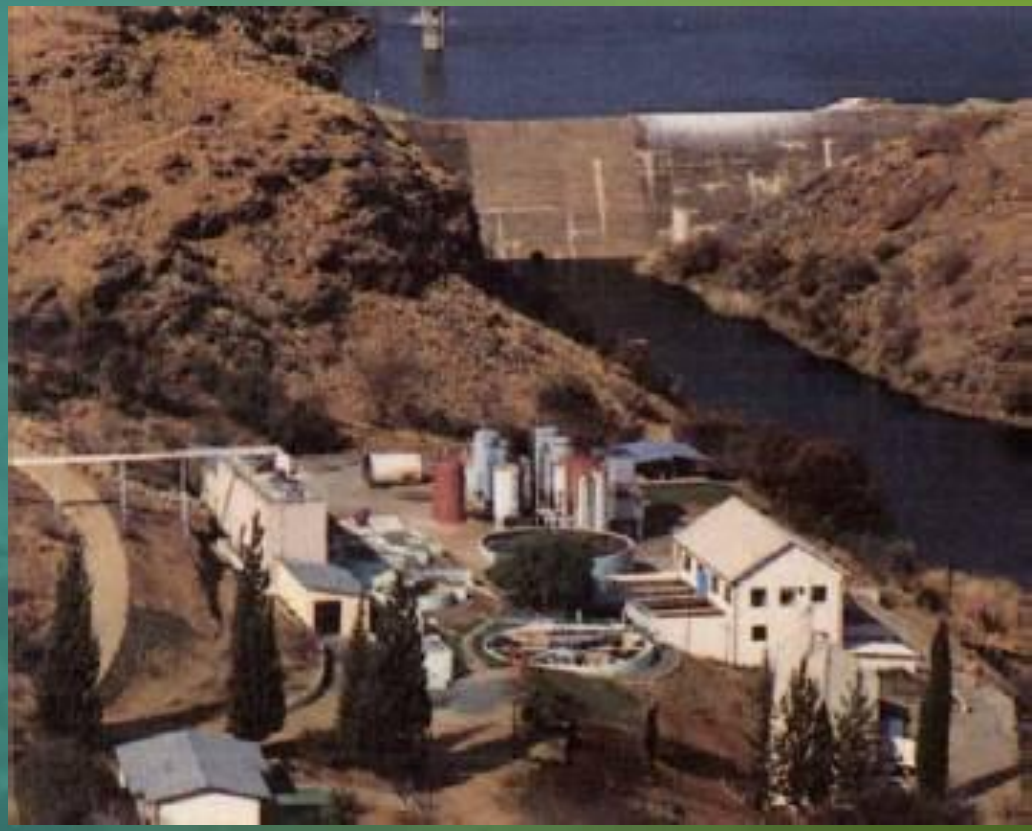
Uses of Reclaimed Water - Aesthetic Uses

AECOM

Ground Water Recharge for Non-potable Reuse

Namibia: Direct Potable Reuse

- 12,000 m^3/day
- Dissolved air floatation
- Sedimentation
- Rapid sand filtration
- Ozonation
- Activated carbon
- Chlorine residual
- 1:3.5 blend with dam water



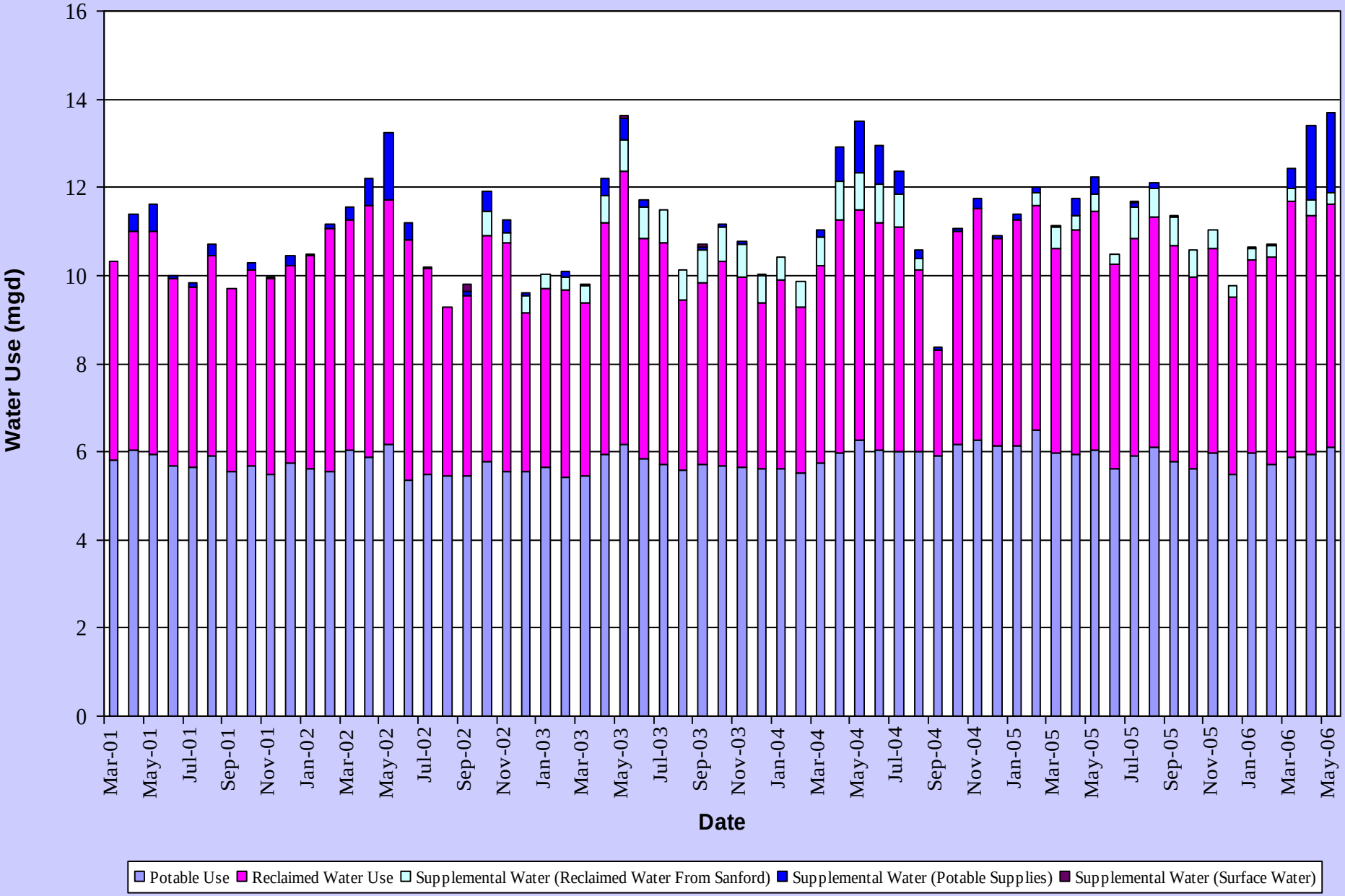
AECOM

Singapore's "New Water" Program Drivers

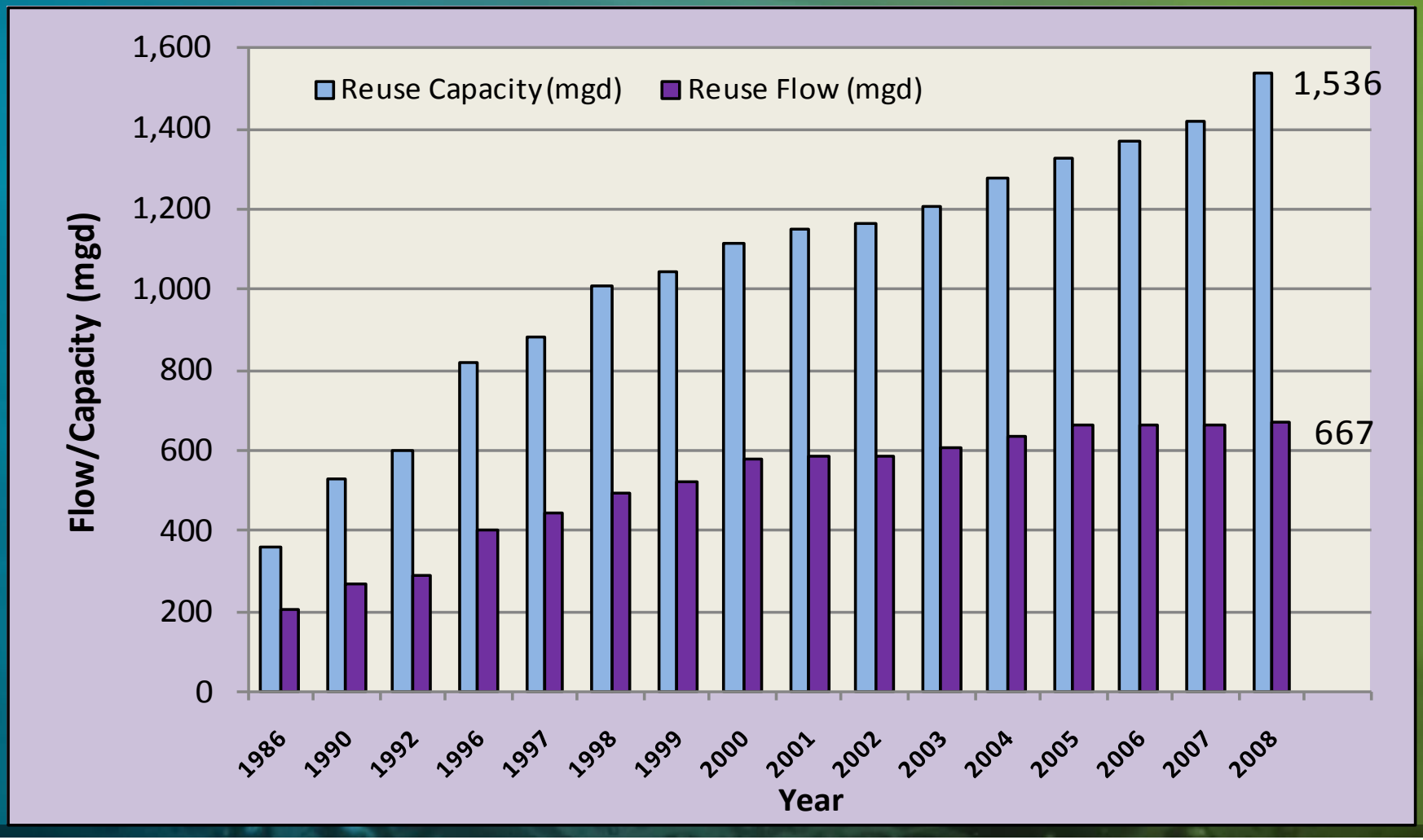
- 73.4 m**3**/day produced by 3 plants
- 44 m**3**/day used for blending with desalinated drinking water supply for indirect potable reuse
- Remaining New Water used for :
  - Wafer fabrication plants
  - Other non-potable uses by industry
- Total potable water demand = 1060 m**3**/day

AECOM

Water Use in Altamonte Springs by Use/Source



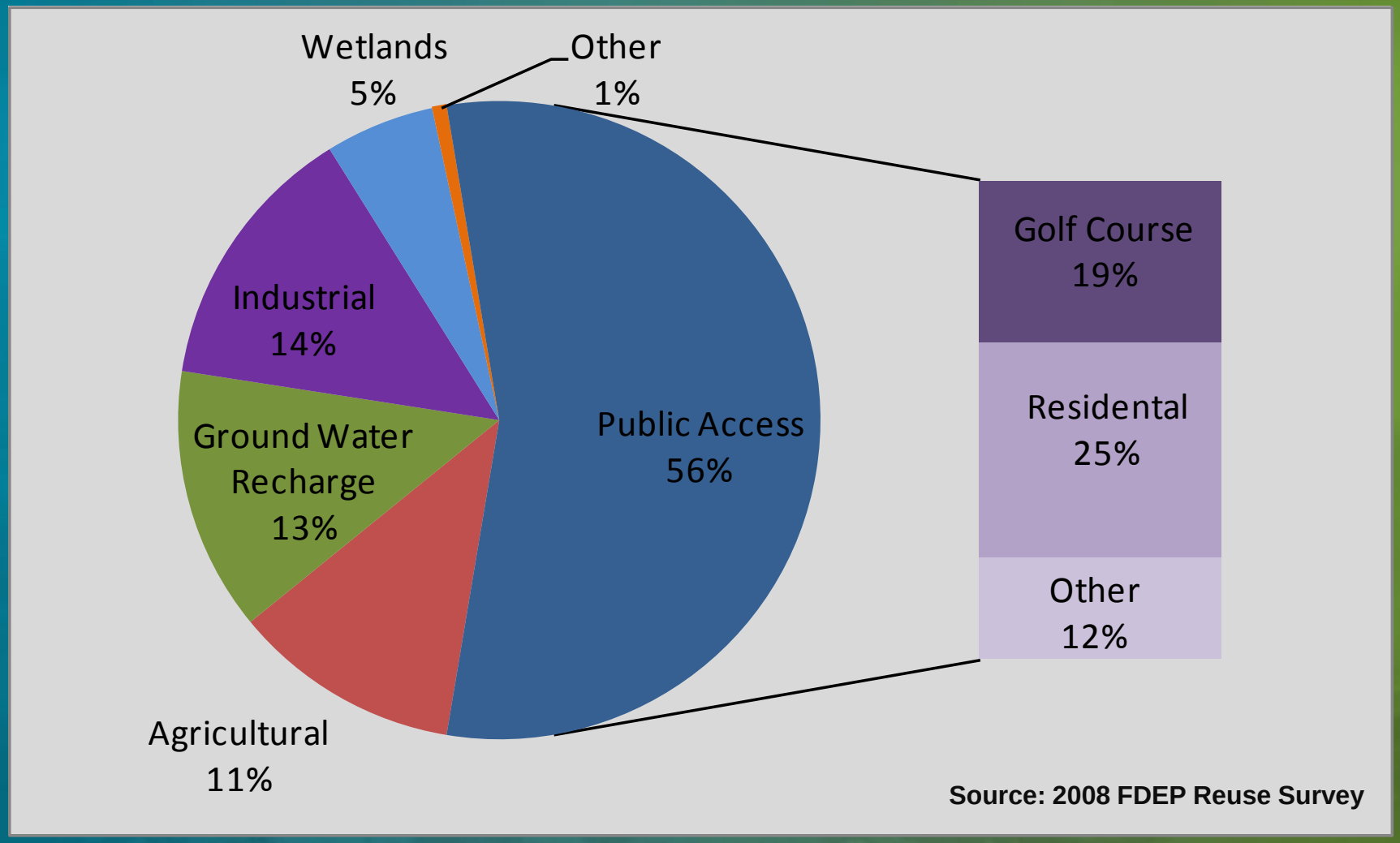
The growth of reclaimed water capacity use in Florida



Source: 2008 FDEP Reuse Survey

AECOM

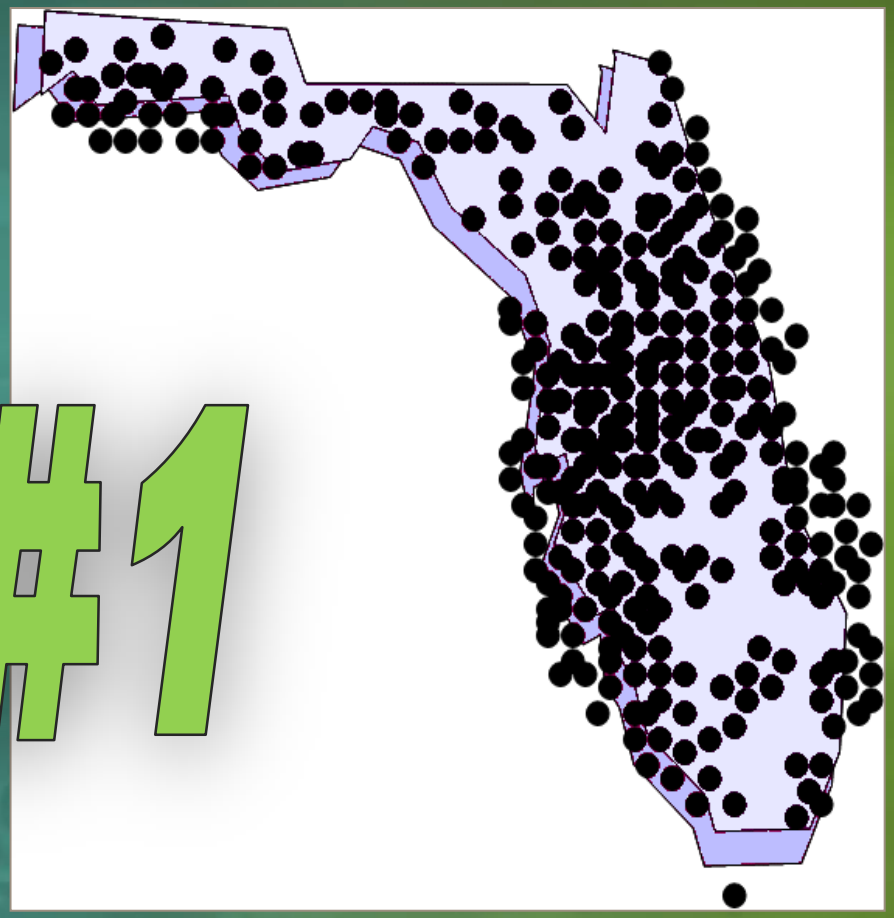
Breakdown of public access reuse



AECOM

National Leader in Reuse

We're #1



In 2007, 663 million gallons per day were reused in Florida rather than being disposed. This equates to nearly half of all WWTP flow.

Source: *Shanin Speas-Frost, FDEP*

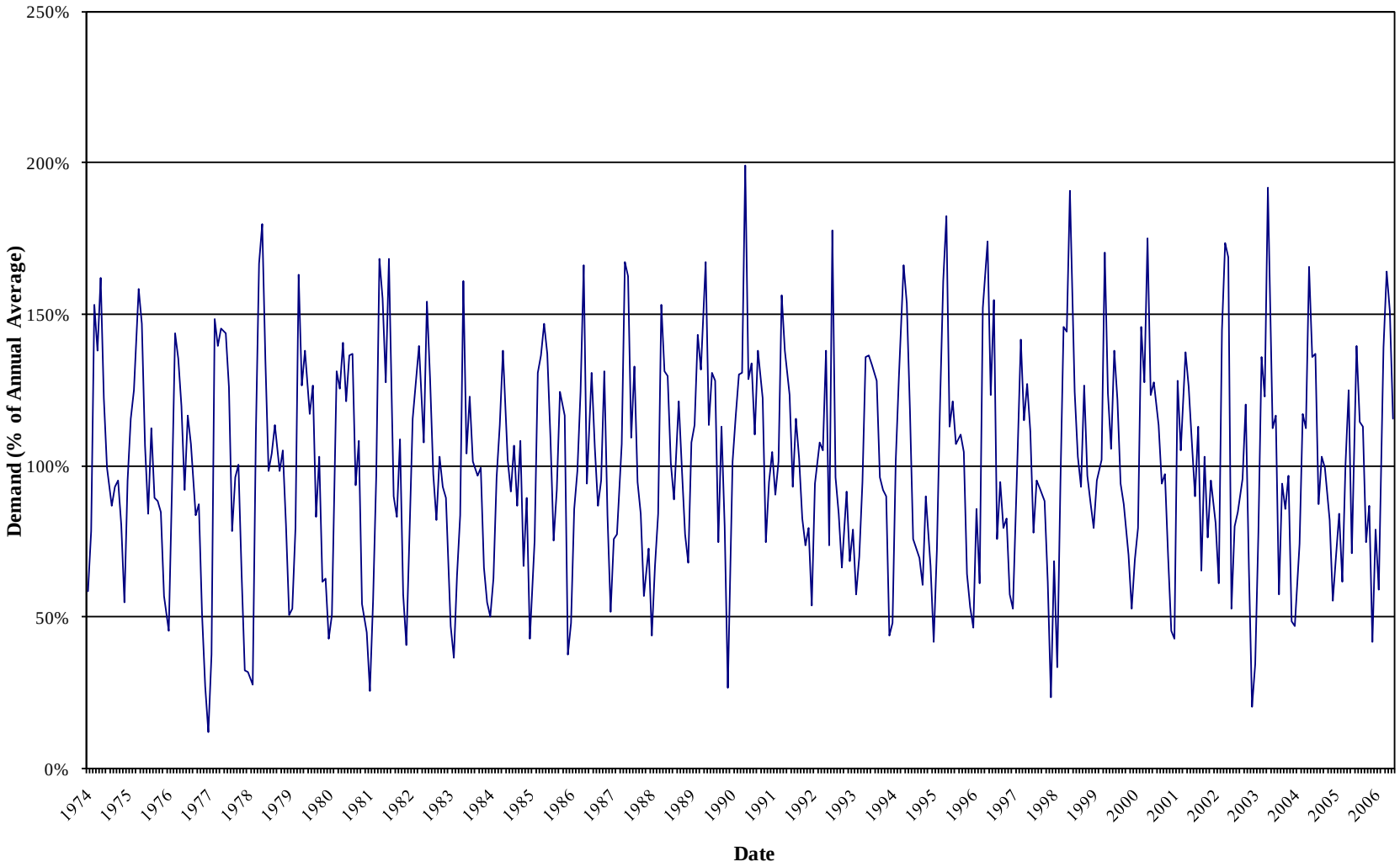
AECOM

Outline of this presentation

- A brief history of reuse in Florida
- The evolution of effluent to reclaimed water
- The price of success – regulatory attention
  - Water Management Districts
  - Florida Department of Environmental Protection
  - EPA
- What does it mean for Michigan?

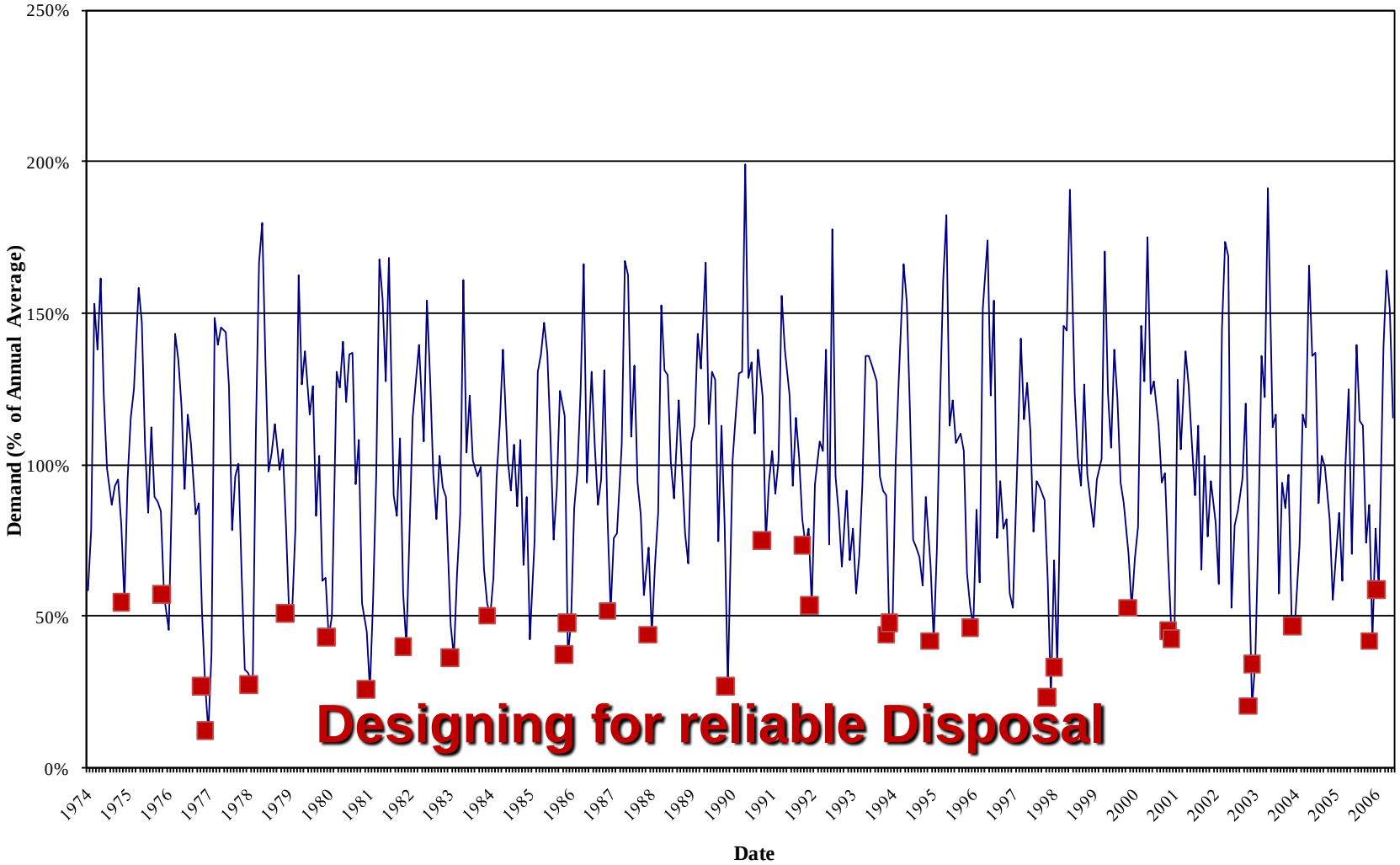
AECOM

Typical Irrigation Demand Pattern



AECOM

Typical Irrigation Demand Pattern



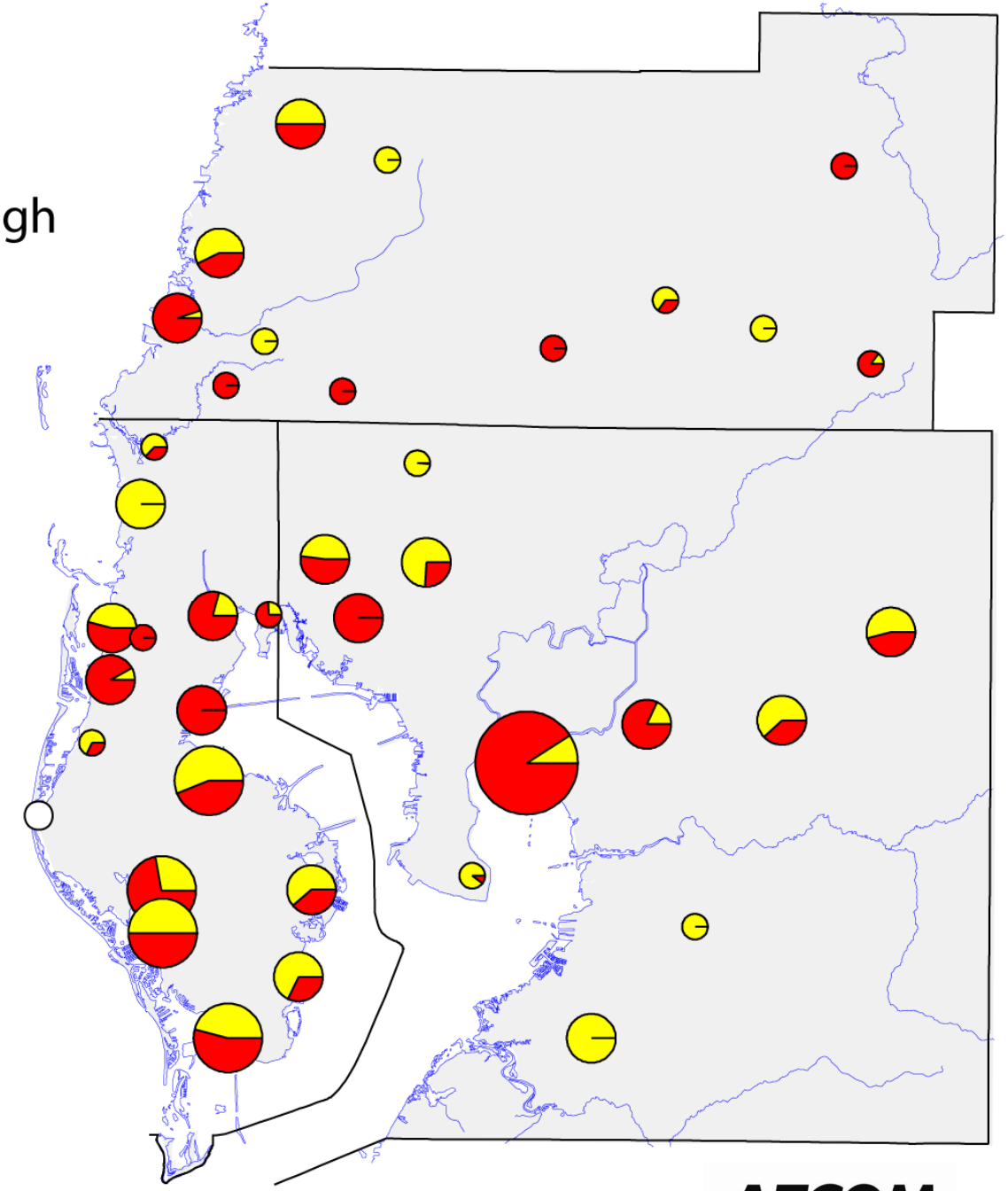
AECOM

Available Reclaimed Water in Pasco, Pinellas and Hillsborough Counties — **Dry Year (2000)**

Total WWTP Flow (MGD)

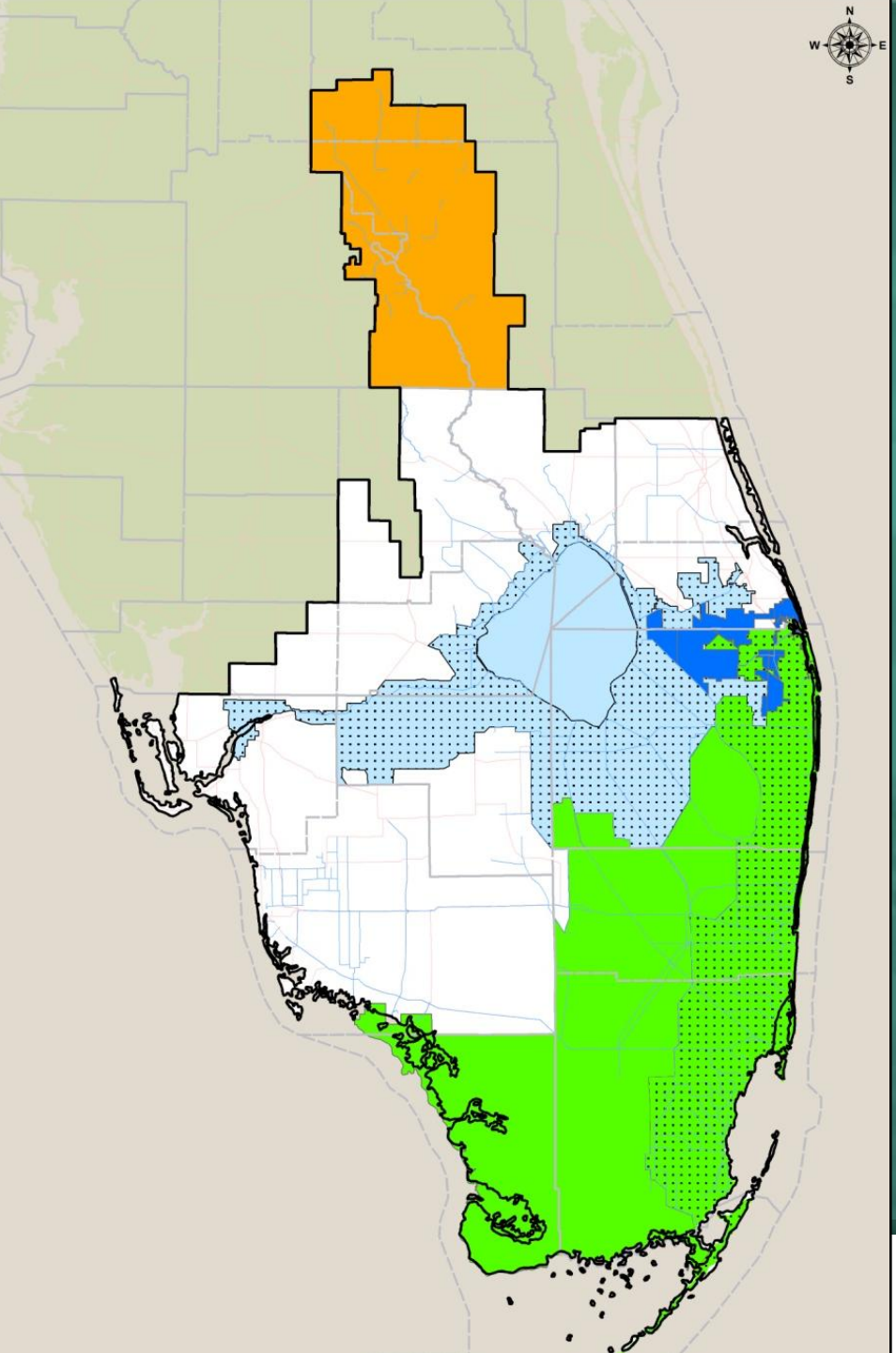
- 0–2
- 2–10
- 10–20
- 20–40
- 40–80

- % RW used in 2000
- % RW unused in 2000



February 2002

AECOM



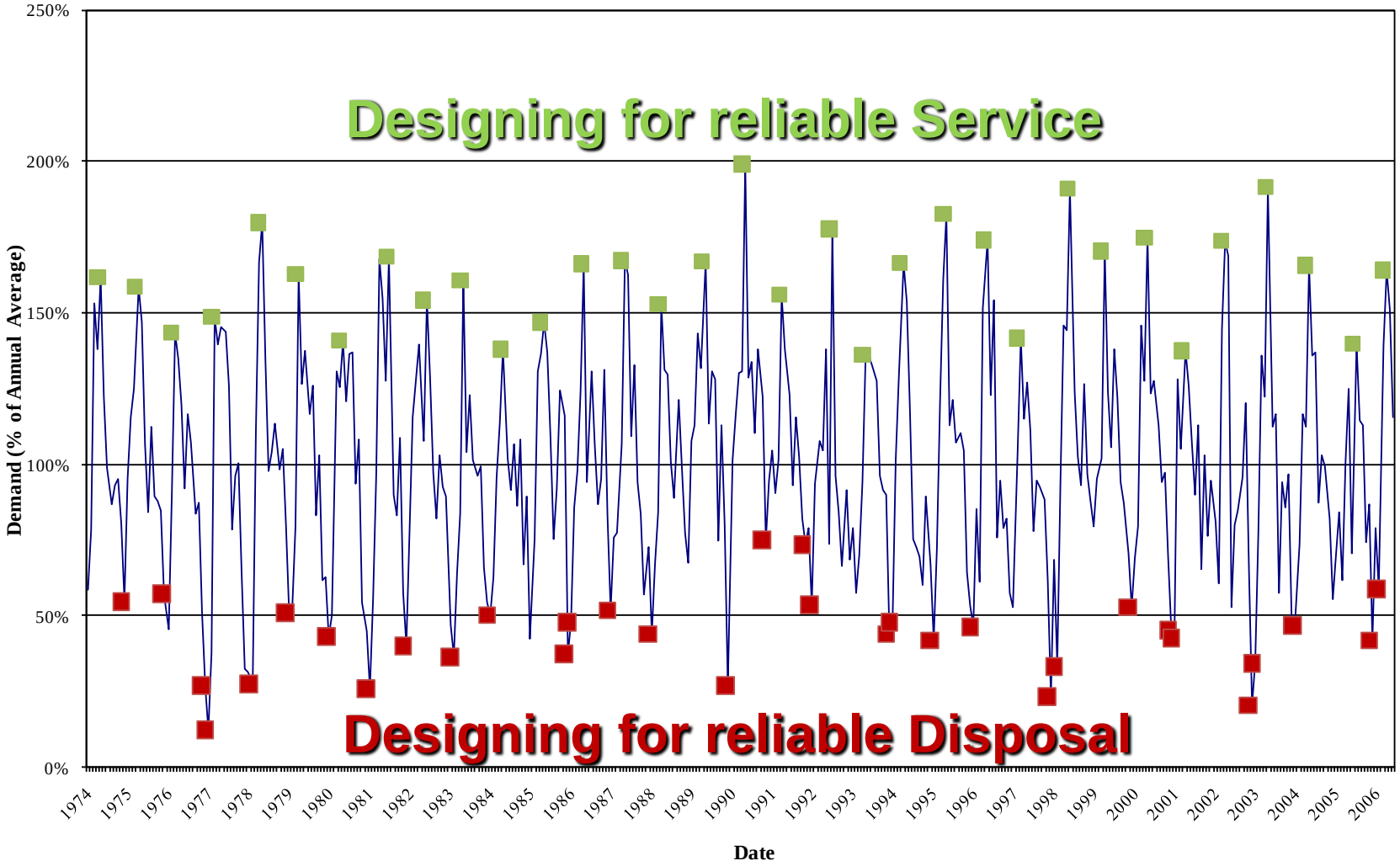
Permitting Pressures on Traditional Water Supplies:

Restricted Allocation Areas

- Central Florida Coordination Area
- North Palm/Loxahatchee River Watershed
- Lake Okeechobee Service Area
- Everglades and Lower East Coast

AECOM

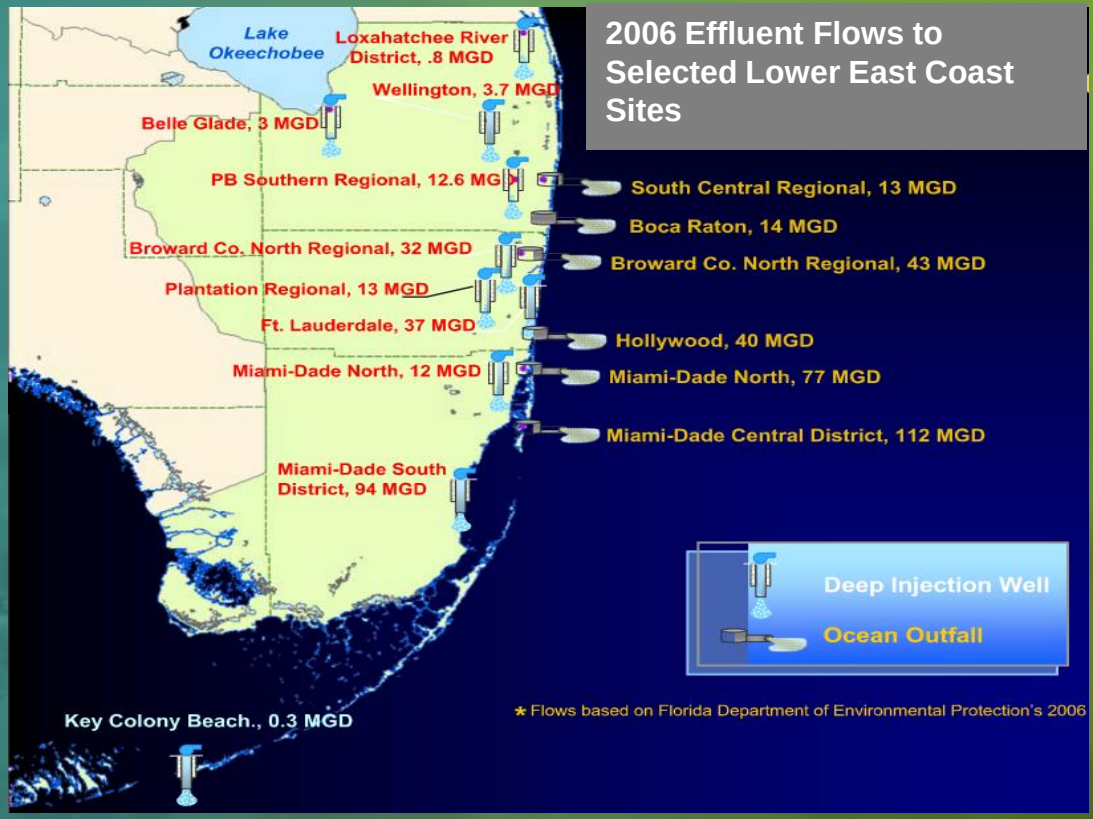
Typical Irrigation Demand Pattern



AECOM

Ocean Outfall Legislation: A Major Change in Direction for Effluent Management in Southeast Florida

- Six existing outfalls between Delray Beach and Miami currently discharge 300 mgd into ocean
- New law prohibits construction on new ocean outfalls or the expansion of the existing outfalls on the Southeast Florida coast
- 60% of diverted flows must go to beneficial reuse

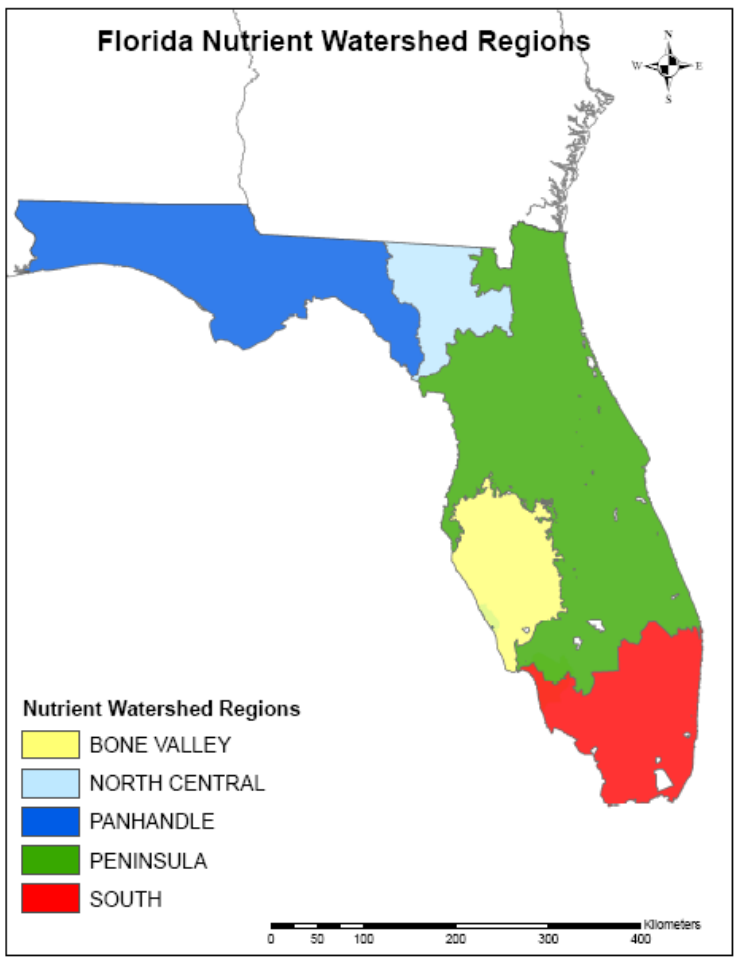


AECOM

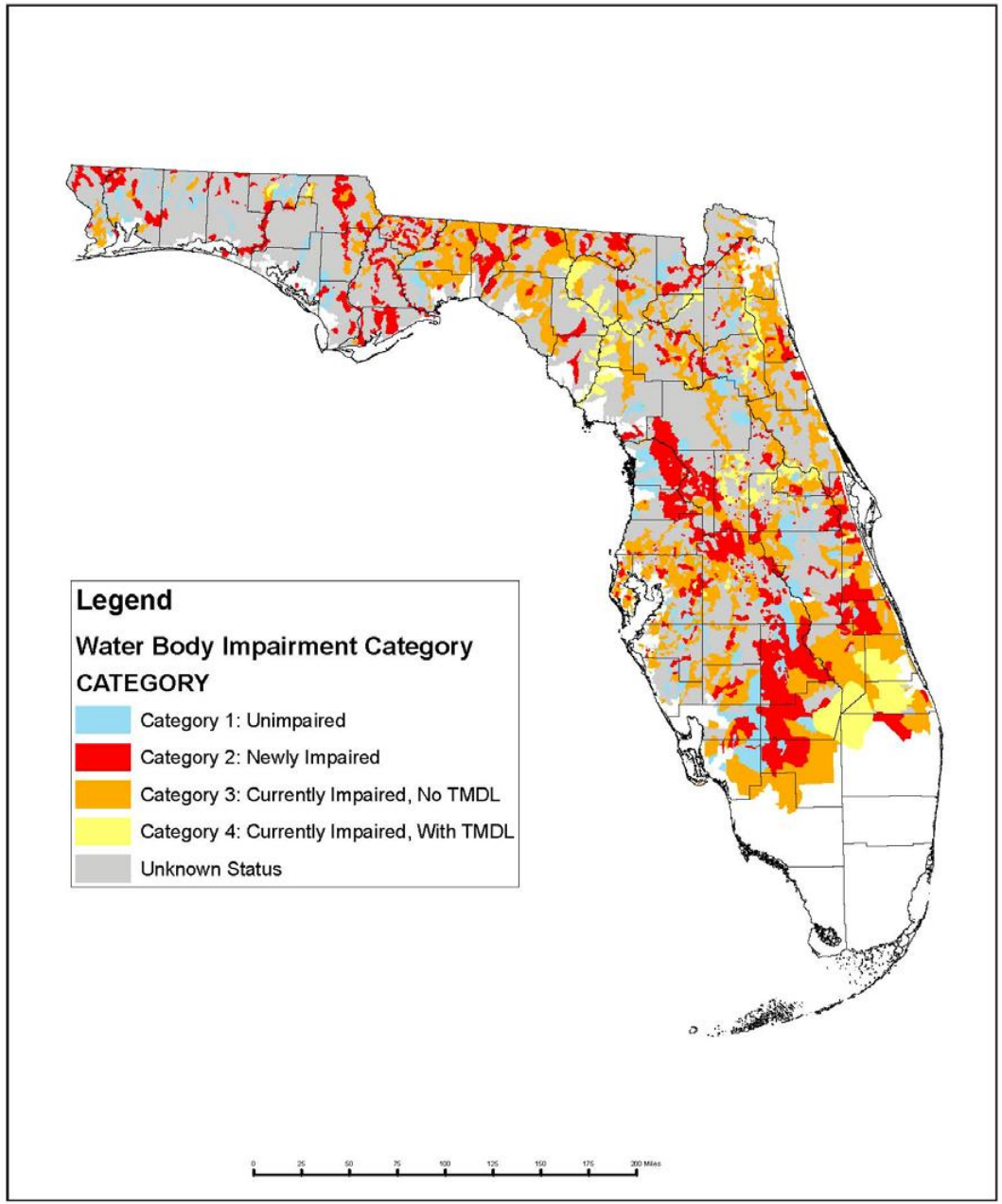
EPA Proposed Criteria for Rivers/Streams

Nutrient Watershed Region	Instream Protection Value Criteria	
	TN (mg/L)	TP (ug/L)
Panhandle	0.824	43
Bone Valley	1.798	739
Peninsula	1.205	107
North Central	1.479	359

Concentrations are annual geometric means not to be surpassed more than once in a three-year period or as a long-term average



A first look at water body classifications based on FDEP's interpretation of the EPA Rules



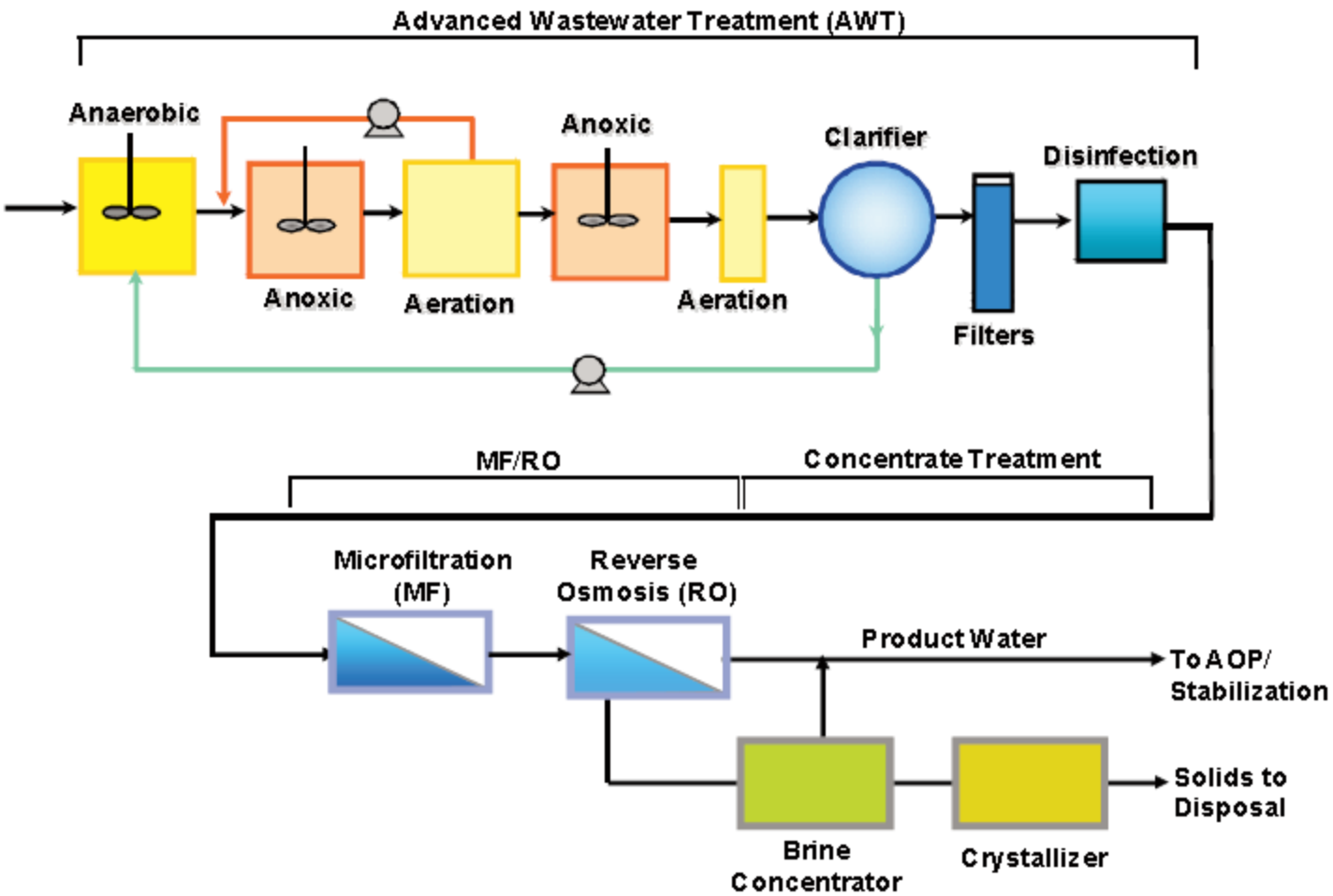


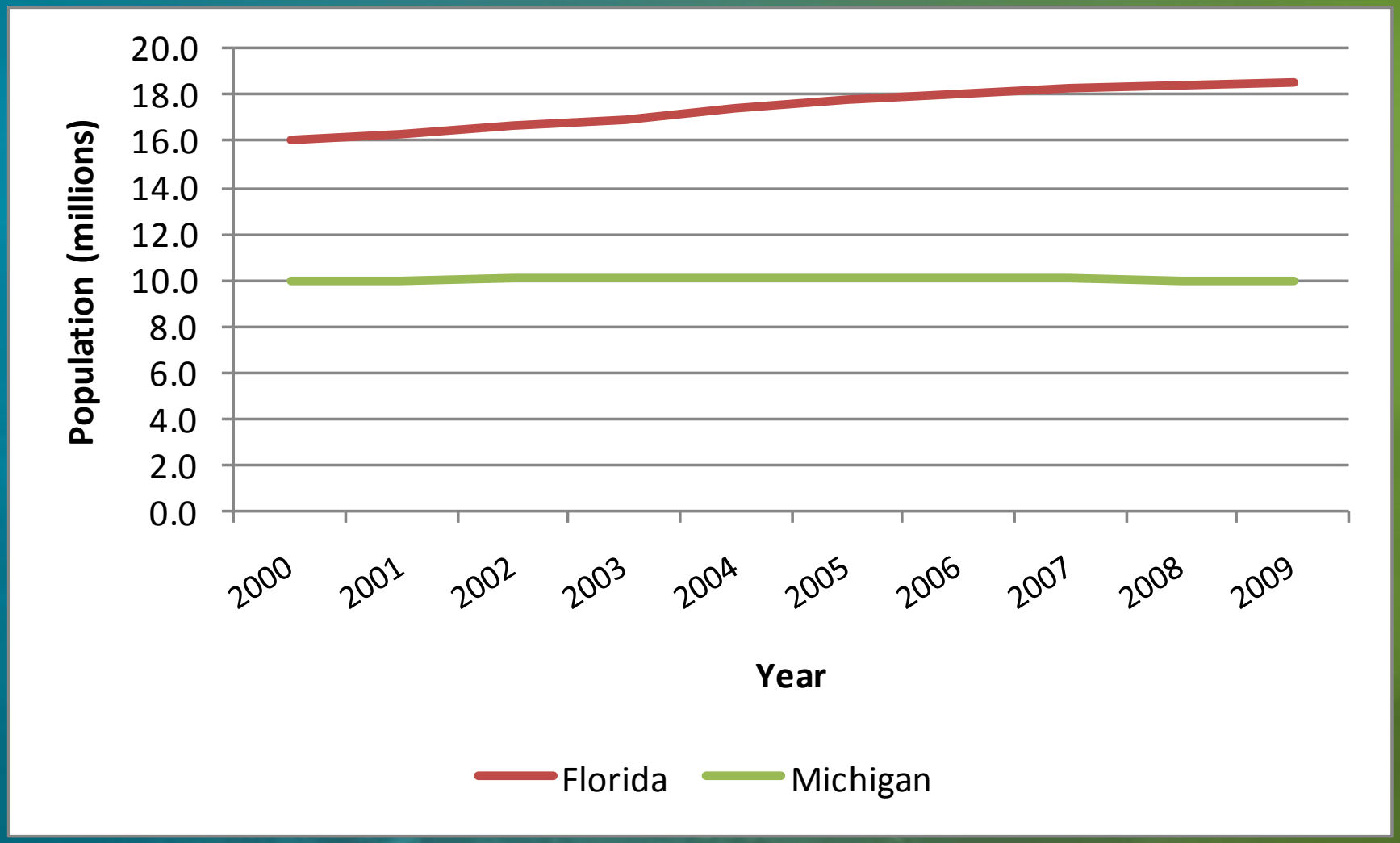
Figure 1. Schematic illustration of the type of processes likely required for Florida wastewater plants to comply with the proposed numeric nutrient criteria.

Outline of this presentation

- A brief history of reuse in Florida
- The evolution of effluent to reclaimed water
- The price of success – regulatory attention
  - Water Management Districts
  - Florida Department of Environmental Protection
  - EPA
- What does it mean for Michigan?

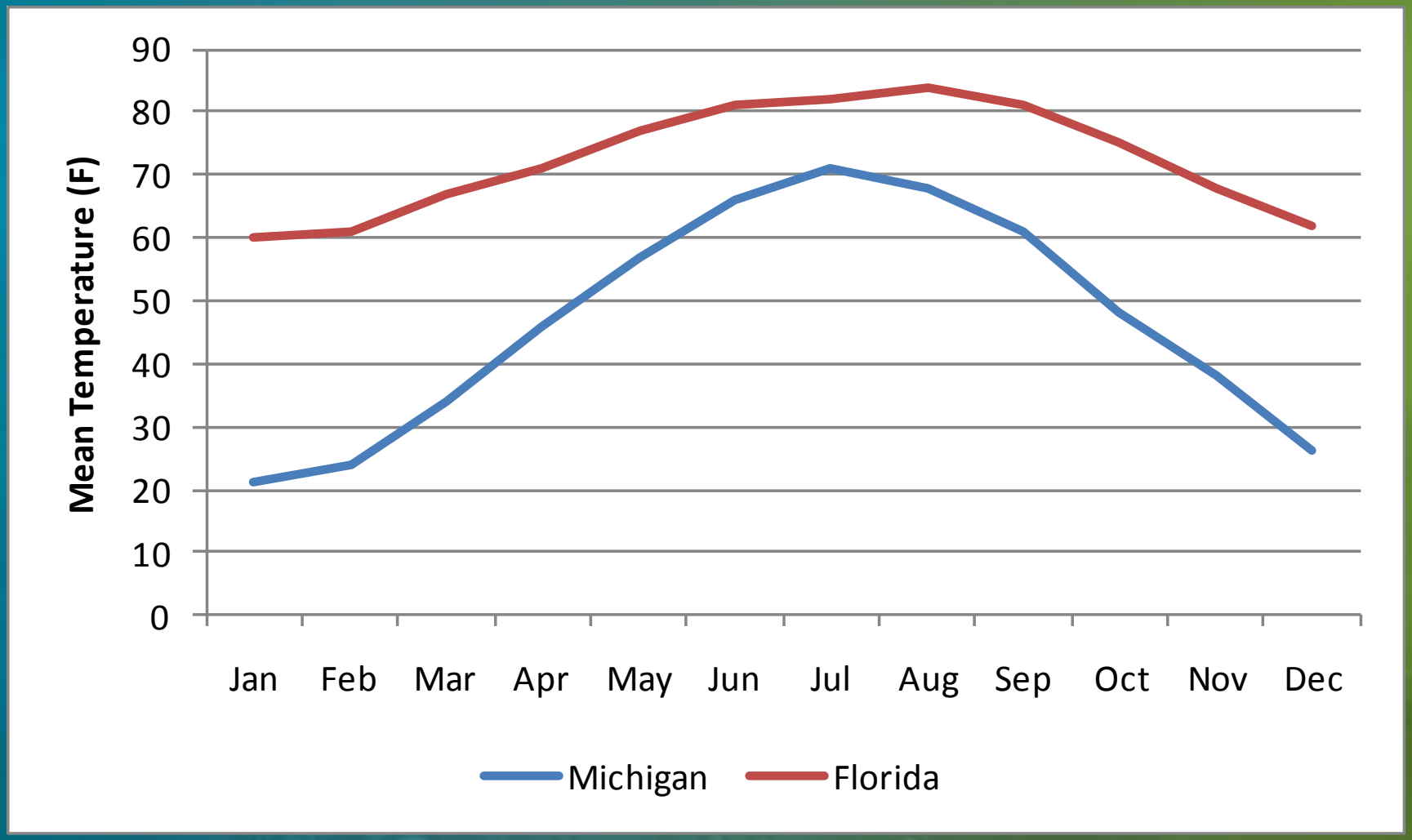
AECOM

Populations



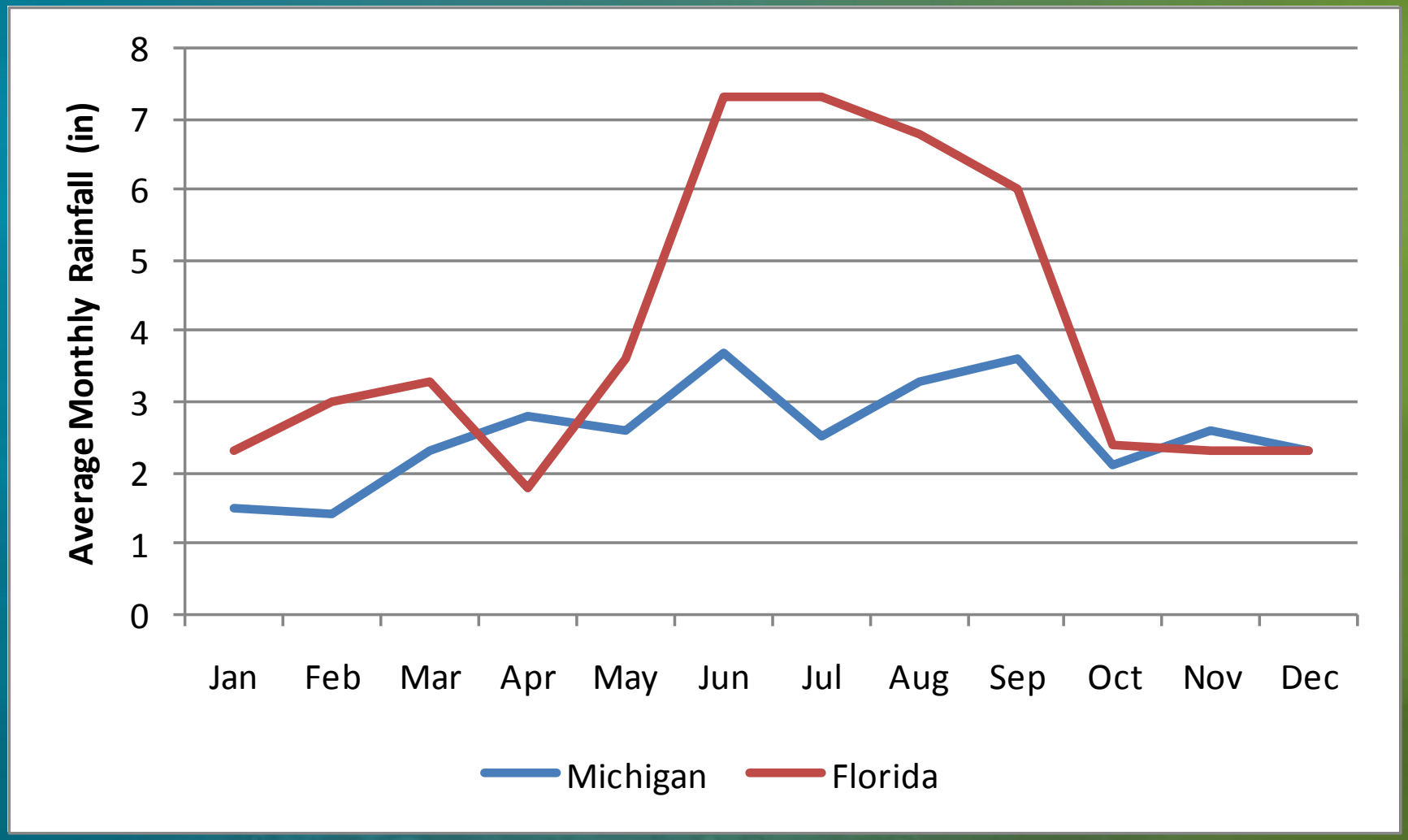
AECOM

The Weather – Florida is warmer



AECOM

The Weather – and Florida is wetter



AECOM

USGS
science for a changing world

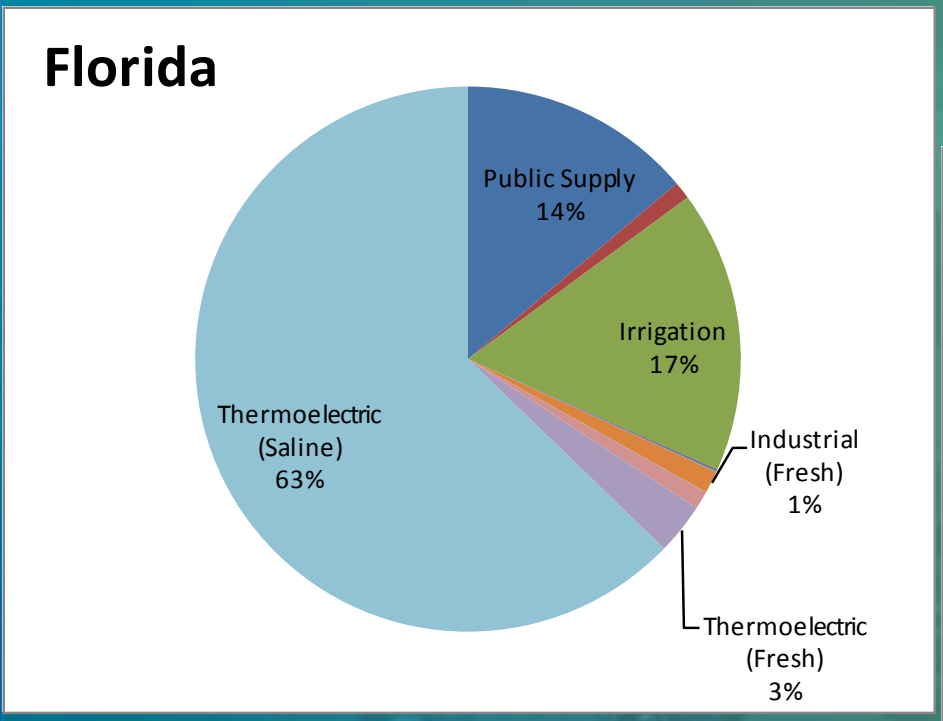
Estimated Use of Water in the United States in 2005

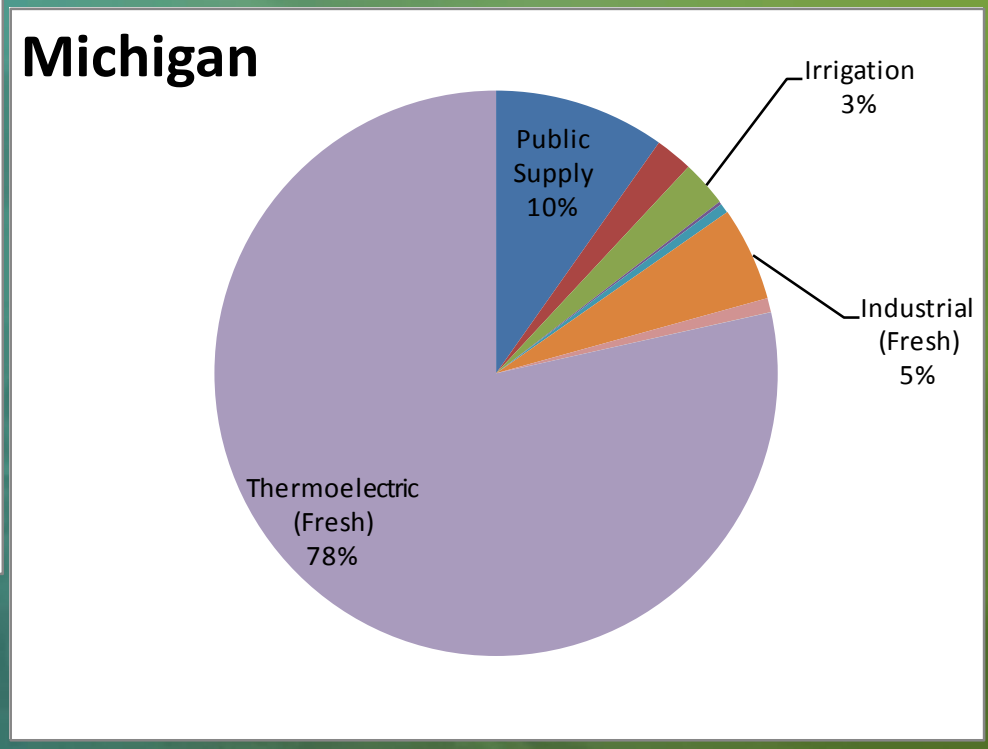
Circular 1344

U.S. Department of the Interior
U.S. Geological Survey

AECOM

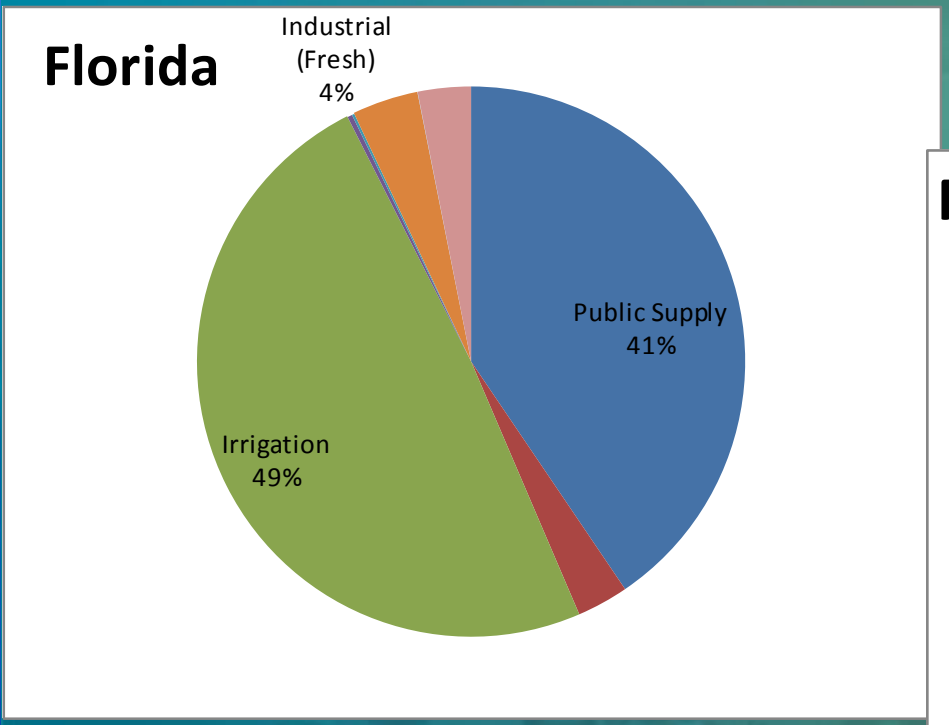
Comparison of Water Use by State

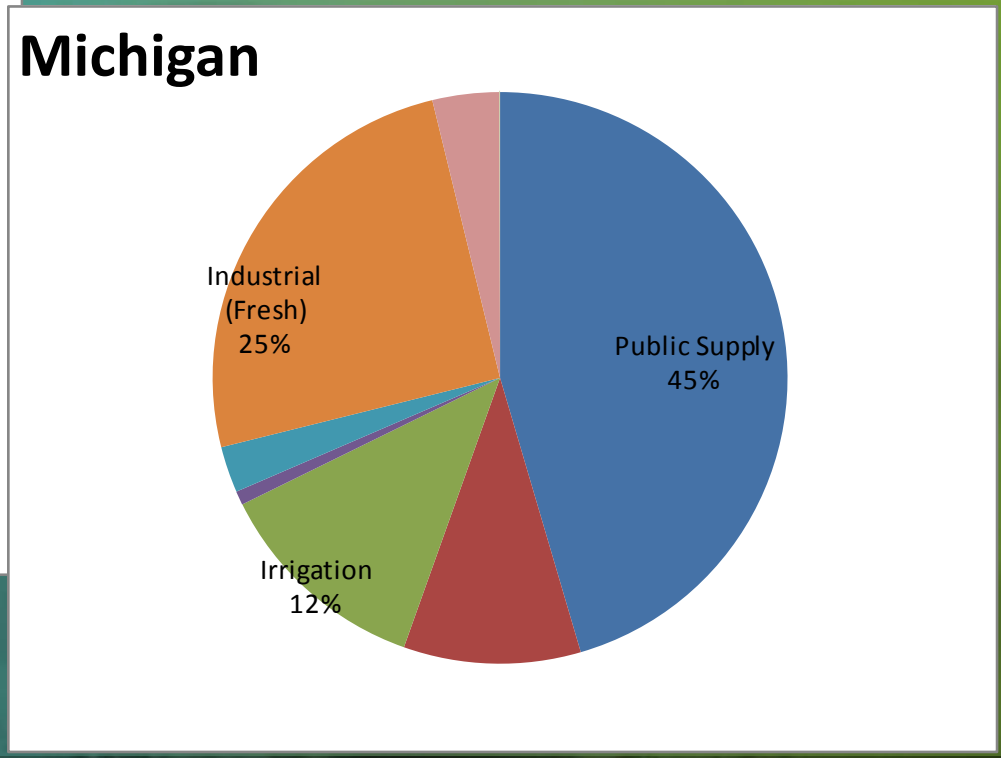




AECOM

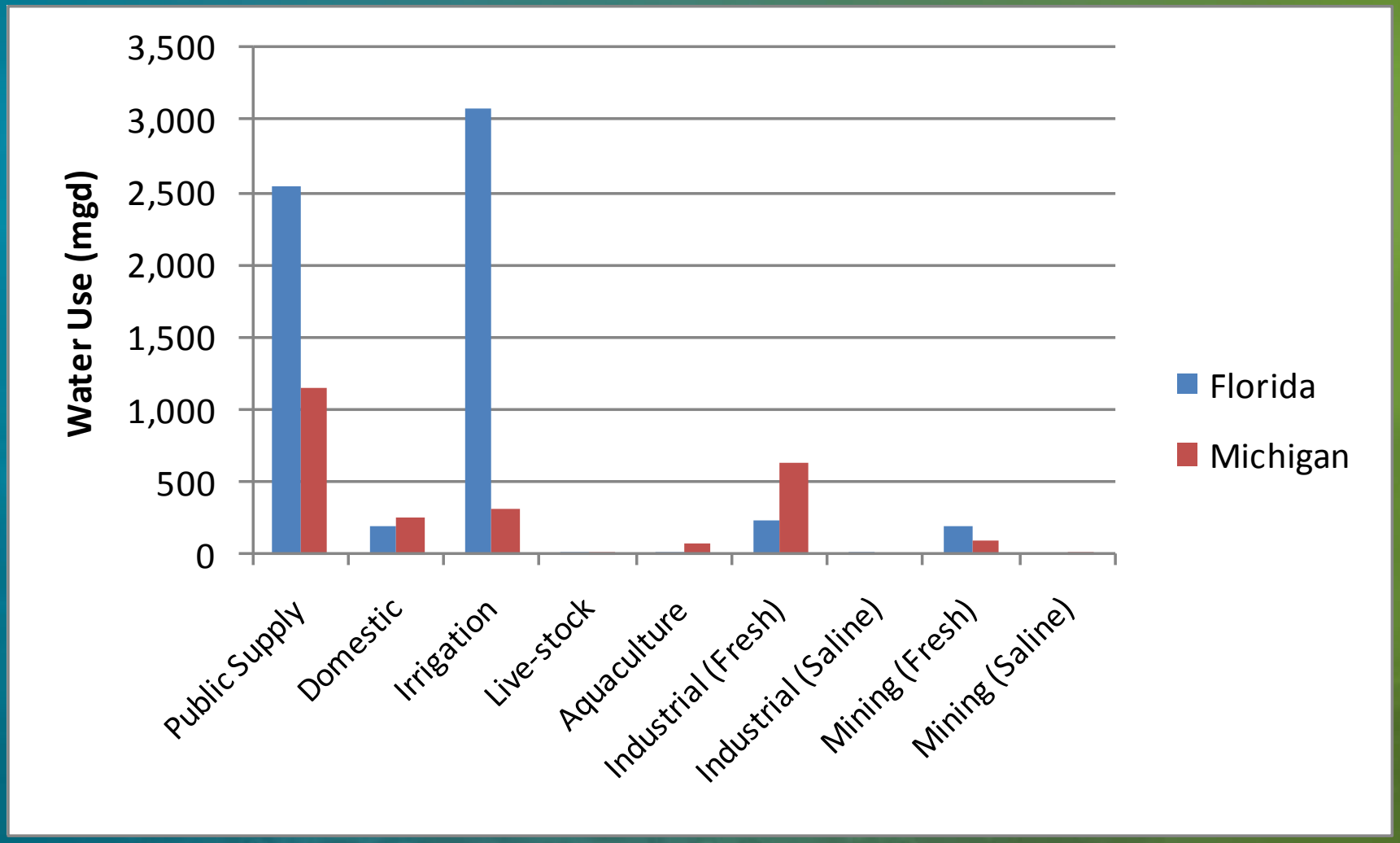
Water Use by State excluding Thermoelectric Demands





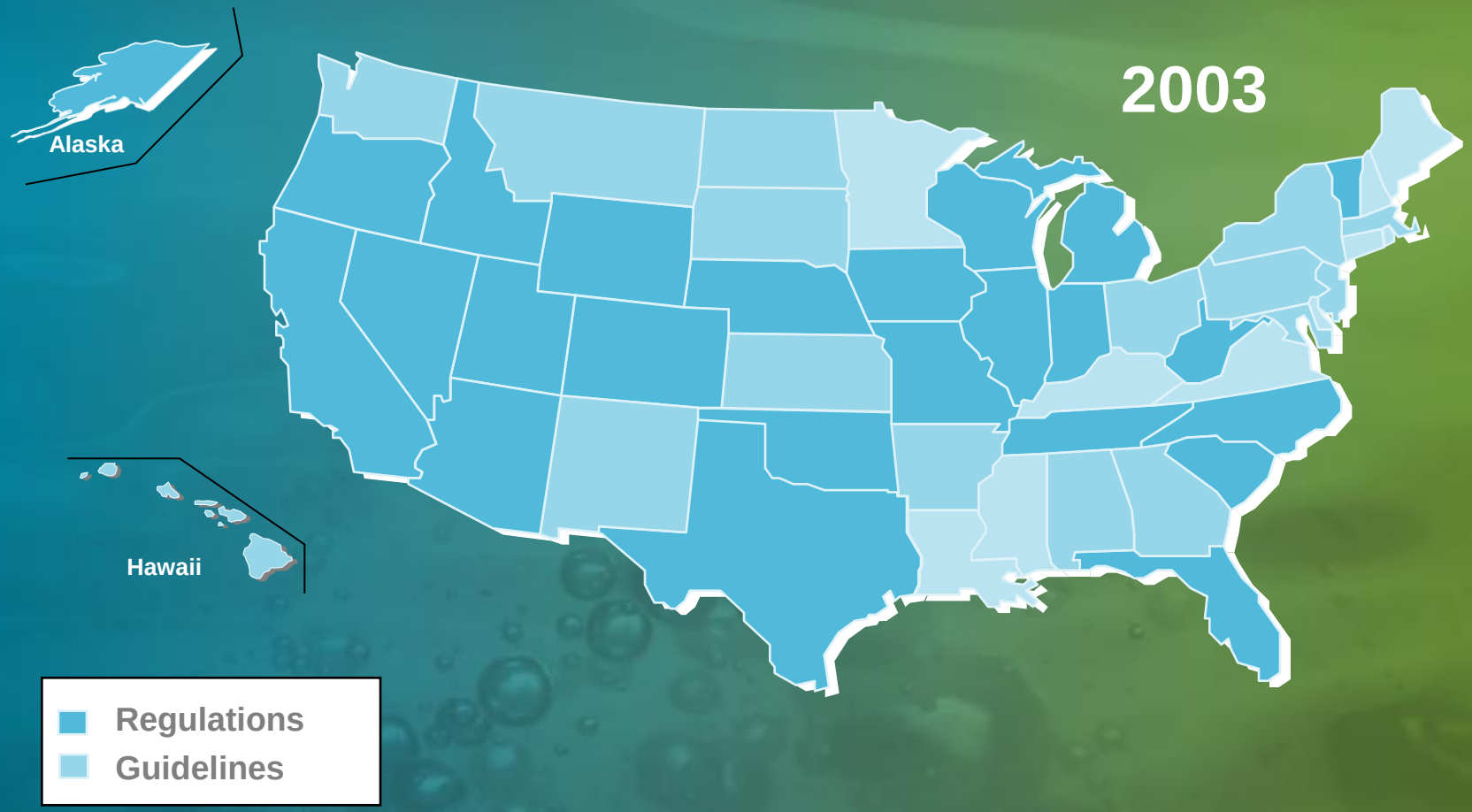
AECOM

Comparison of Water Use by State by Volume



AECOM

States with Reuse Regulations and Guidelines



AECOM

Comparison of Reuse Regulations

Michigan

- pH 5.5 - 10
- 20 mg/l total inorganic nitrogen
- 0.5 mg/l nitrite
- 5 mg/l phosphorus
- 1 mg/l phosphorus if surface water body is downgradient within 1,000 feet
- Aluminum 150 ug/l
- Chloride, 250 mg/l
- Sodium 150 mg/l
- Sulfate 250 mg/l
- Iron 300 ug/l
- Manganese 50 ug/l
- Irrigation limited to between May 1 and October 15

Florida

- pH 6.0 – 8.5
- Secondary Treatment with Filtration
  - 20 mg/l CBOD
  - 5 mg/l TSS
- 1 mg/l Chlorine Residual
- Fecal Coliform
  - 75% zero detect
  - 25/100 ml single sample max

AECOM

Questions?

AECOM