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A River of Energy Solutions

Water Reuse and Energy Management

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Outline

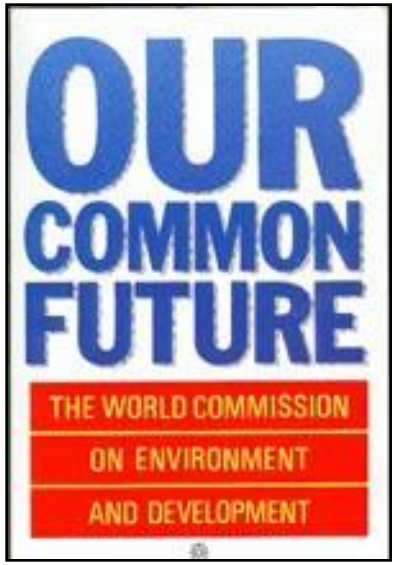
- Background
- Drivers
- Standards
- Examples

Drivers

- Energy management
  - 15% electricity used in water management
- Population pressures
  - 25% increase in population in NC
  - NO increase in water
- Water resources
  - Limited supply
  - Drought pressures

Sustainable Design – "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

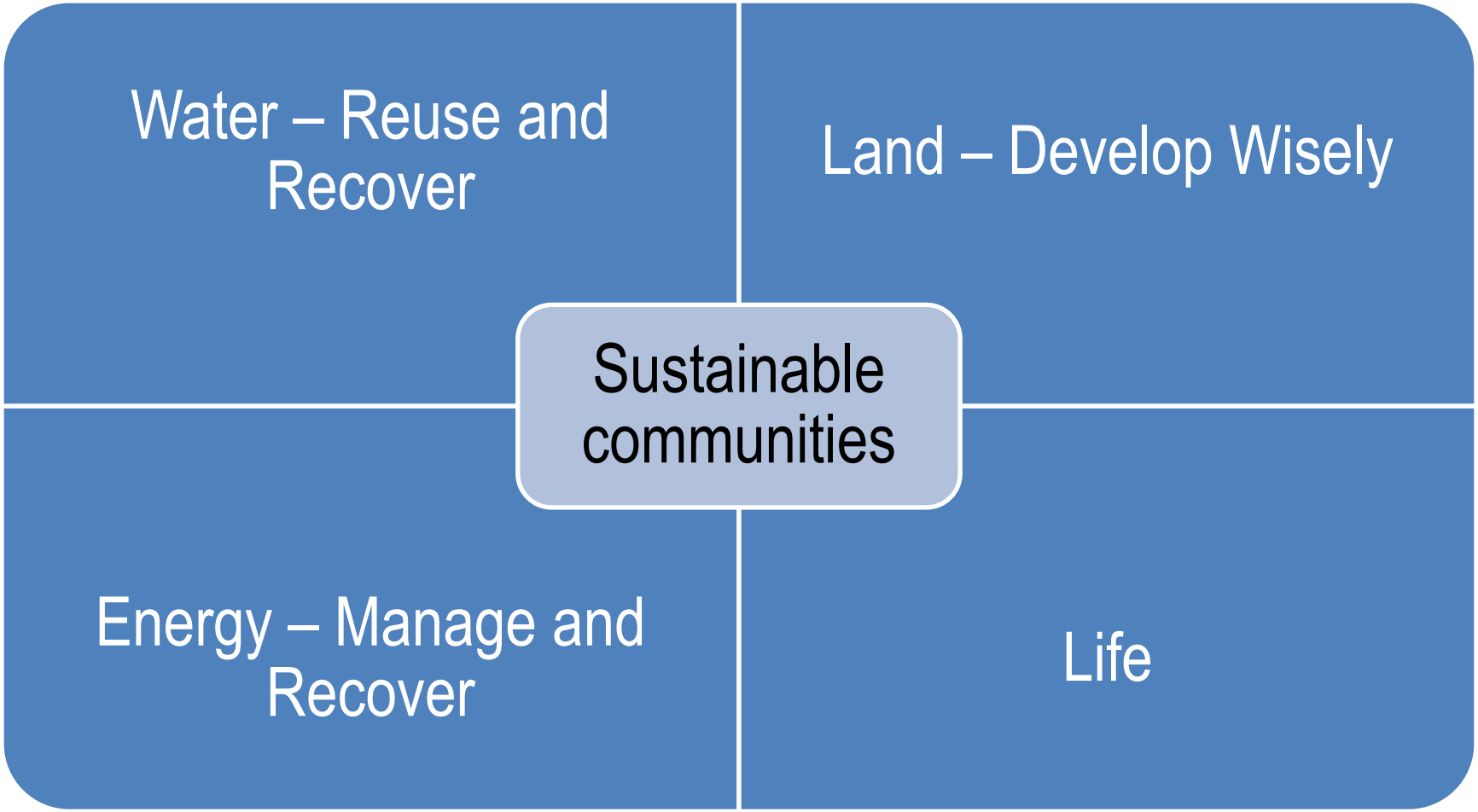
-- *Brundtland Commission, 1987*



How did we get here?

- Roads and Aqueducts -> population centers
- Agricultural and industrial “revolution” -> growth
- Limited Growth -> Urban centers
- Urban centers -> Quality of life concerns
- Uncontrolled quality of life concerns -> Sprawl
- Sprawl -> Increasing pressure on resources
- Increasing pressures -> Unsustainable Cities and Towns
- Now What

Nexus


Water – Reuse and Recover
Land – Develop Wisely
Sustainable communities
Energy – Manage and Recover
Life

Questions

- *What influence will this nexus of population growth, climate, watershed size, and availability of water and energy resources availability have on water resource management and water reuse programs?*
- *What simple steps can we take to optimize resource management?*

  Will water management practices of the future include opportunities for energy recovery and water reuse?
- *What barriers exist to promotion of wise water management strategies that recognize the value of long term planning and reuse?*
- *How can communities large and small benefit from reuse?*

Realization Requires

- *Sound and reliable technologies to treat, disinfect, distribute water and recover internal energy;*
- *Standards that enable third-party technology evaluation to support acceptance and permitting*
- *Competent well trained individuals to operate and maintain components of the system;*
- *organizations manage and operate systems;*
- *Regulatory agencies which recognize the value of all resources and regulate in accord with sound science and effective public policy, and lastly;*
- *An educated populace that values the necessity to manage resources in a manner that minimizes risk to individuals and maximizes benefits to the community.*

Drivers

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Energy

- Water and energy
  - Internal energy
  - Water heat pumps
  - Carbon
  - Nutrients

Water Resources

- Fit – For – Purpose
- Sources
  - Harvested rainwater
  - Gray water (greywater)
  - Treated wastewater
  - Reclaimed water

Water resources

- NACO
  - Drought impacting many counties in SE
- Weather Service predictions
  - Weather and climate changes
    - Rainfall intensity
    - Frequency

Treatment Technologies

- Advanced levels of treatment possible with complex and simple technologies
  - High quality water
  - Fit for purpose
  - Rule compliant

Standards

- No federal reuse standard
- State rule or guideline
  - Treatment requirements
  - Water Quality Standards
    - BOD, TSS, Turbidity, Indicator Organisms, Nutrients
- NSF/ANSI 350 *Onsite residential and commercial reuse treatment systems*
  - Equipment requirements
  - Treatment levels
    - BOD, TSS, Turbidity, Indicator Organisms, Nutrients

NSF/ANSI 350

- American National Standard
- Residential and commercial treatment systems
- Sources; graywater and combined wastewater
  - Graywater: laundry and bathing, excluding toilet and kitchen.
  - Combined: blackwater and graywater.
- Non-potable effluent uses
  - Indoor; toilet and urinal flushing.
  - Outdoor; surface and subsurface irrigation.

NSF/ANSI 350

- Residential wastewater; Up to 1500 gpd
  - Laboratory testing with actual wastewater.
- Graywater; Up to 1500 gpd
  - Laboratory testing with synthetic wastewater; bathing, laundry, or both
  - Exception; commercial laundry water
- Systems exceeding 1500 gpd, and commercial laundry
  - Field evaluation using actual building wastewater.

Parameter	Sample type	Sample location	
		Raw influent	Treated effluent
BOD_5	24 h composite	X	
$CBOD_5$	24 h composite		X
Total suspended solids	24 h composite	X	X
pH	Grab	X	X
Temperature (°C)	Grab	X	
E. coli	Grab	X	X
Turbidity	24 h composite	X	X
TKN	24 h composite	X	
NO_2/NO_3	24 h composite	X	
Total phosphorous	24 h composite	X	
COD	24 h composite	X	
Total coliforms	Grab	X	
TOC	24 h composite	X	
Surfactants	24 h composite	X	
Fats, oil and grease	24 h composite	X	
Iron	24 h composite	X	

NSF/ANSI 350 Effluent Criteria

Parameter	Class R	Class C
$CBOD_5$	10 mg/L (25)	10 mg/L (25)
TSS	10 mg/L (30)	10 mg/L (30)
Turbidity	5 NTU (10)	2 NTU (5)
E. coli	14 MPN/100 mL (240)	2.2 MPN/100 mL (200)
pH	6.0 – 9.0	6.0 – 9.0
Chlorine	0.5 - 2.5 mg/L	0.5 - 2.5 mg/L

Selected Standards

Jurisdiction	Turbidity	BOD	TSS	Coliform	C. perfringens	Coliphage
CA	2	NS	NS	2.2		
FL		20	5	ND		
NC	5	10	5	14	-3 log	-4 log
VA	5	10	5	14		
NYC	2	10	10	2.2		

Trained and certified operators

- Competent operators critical
- NC Certification program since 1990's
- Professionals
- ABC

Management Entities

- Public or private entities to manage systems
- Workforce development
- Condition assessment
- Resource allocation/budgeting
- Long term financial management

Enabling regulations and rules

- USEPA Guidelines - *EPA/625/R-04/108, August 2004*
- *NO FEDERAL RULES*
- *End use specifications in rule*
  - *Irrigation*
  - *Cooling towers-Boilers*
  - *Industrial process water*
  - *Indoor uses – toilet flush, laundry*

Rules

- Risk management
- Science based
- Supplanted source of high quality water
- Culinary water MUST be of highest quality
- Non-Potable quality established
- System management must be addressed

Educated Populace

- Public demanding reclaimed water
- Trusted users

NYC

- Tool to improve water management
- Dramatic reductions in potable demand in selected facilities
- Energy management improvements measured
- Onsite uses
  - Indoor
  - Outdoor
  - LEED Certification

Solaire and Visionaire

- Wastewater system incorporated into foundation
- Advanced treatment with MBR
- High quality water
- DOB approval

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NYC

Conservation plans

Comprehensive Water Reuse Incentive Program in 2004

Economic incentives for buildings that reuse a minimum of 25% of water

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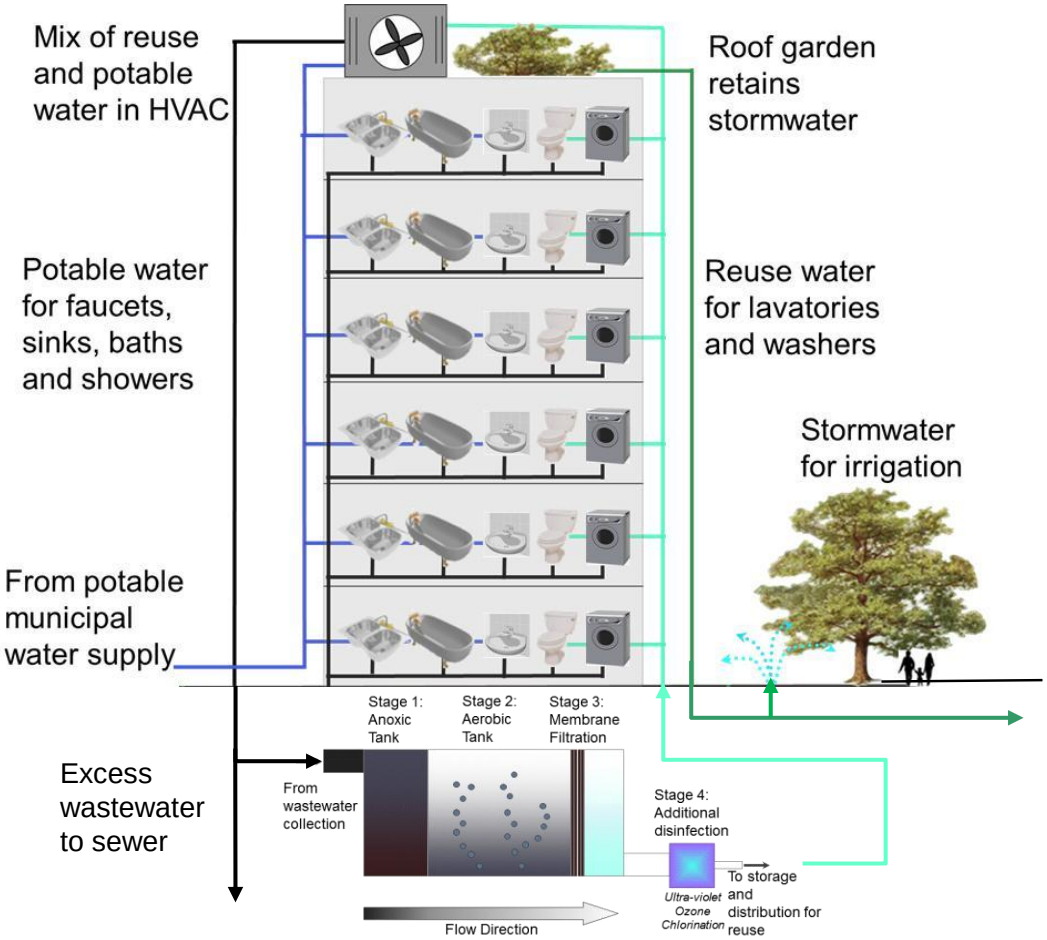
NYC

- Decentralized reuse in highly urbanized area
- LEED Platinum
- Green roof filters and captures stormwater
- Wastewater and stormwater treated for reuse
  - Toilet flushing
  - Cooling tower supply
  - Irrigation of park
- 48% reduction in potable water consumption
- 56% reduction in wastewater discharge

Reference – Battery Park City Authority Manhattan Borough, NYC, The Solaire – Alliance Environmental, LLC

NYC Concepts



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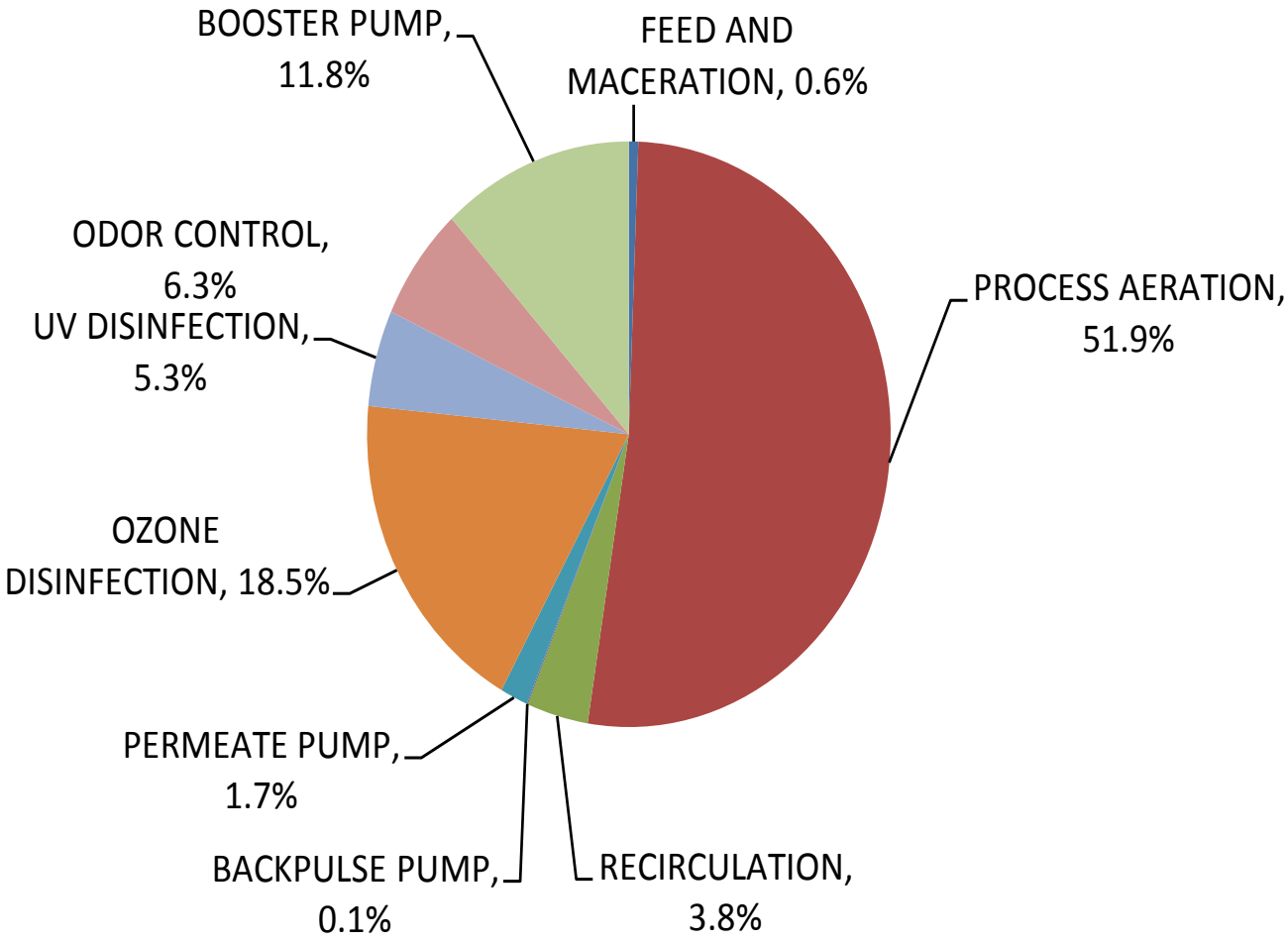
NYC Water Quality Monitoring

	BOD	TSS	Turbidity	E. Coli	T. Coli	pH
Ave	6	1	0.3	1	1	6.9
Limits	10	10	2	2.2	100	6.5-8.0

Proportional Energy Demands



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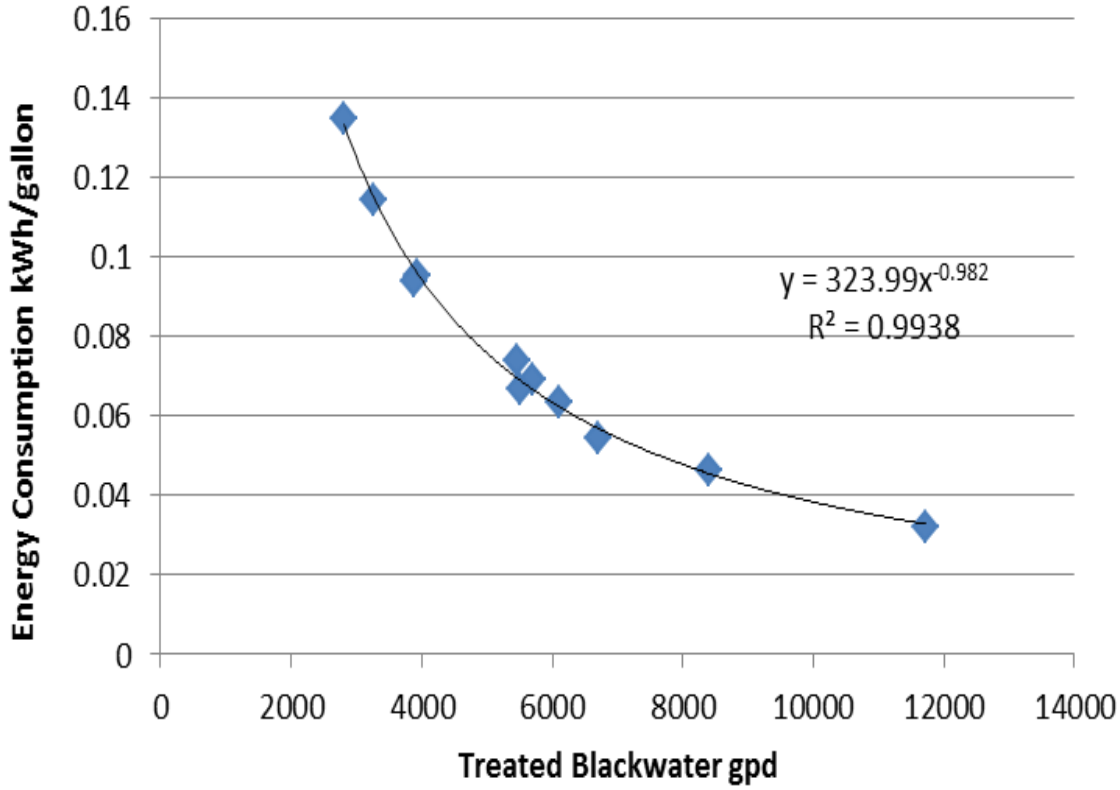
Energy Consumption vs. Flow



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Rural Settings

- High quality water from large footprint
- Low energy, natural system
- Little operator involvement
  - Water level adjustments necessary
  - Vegetation management

Rural America

- 20 home subdivision
- Ag reuse
- Groundwater recharge
- Large footprint, low energy demand

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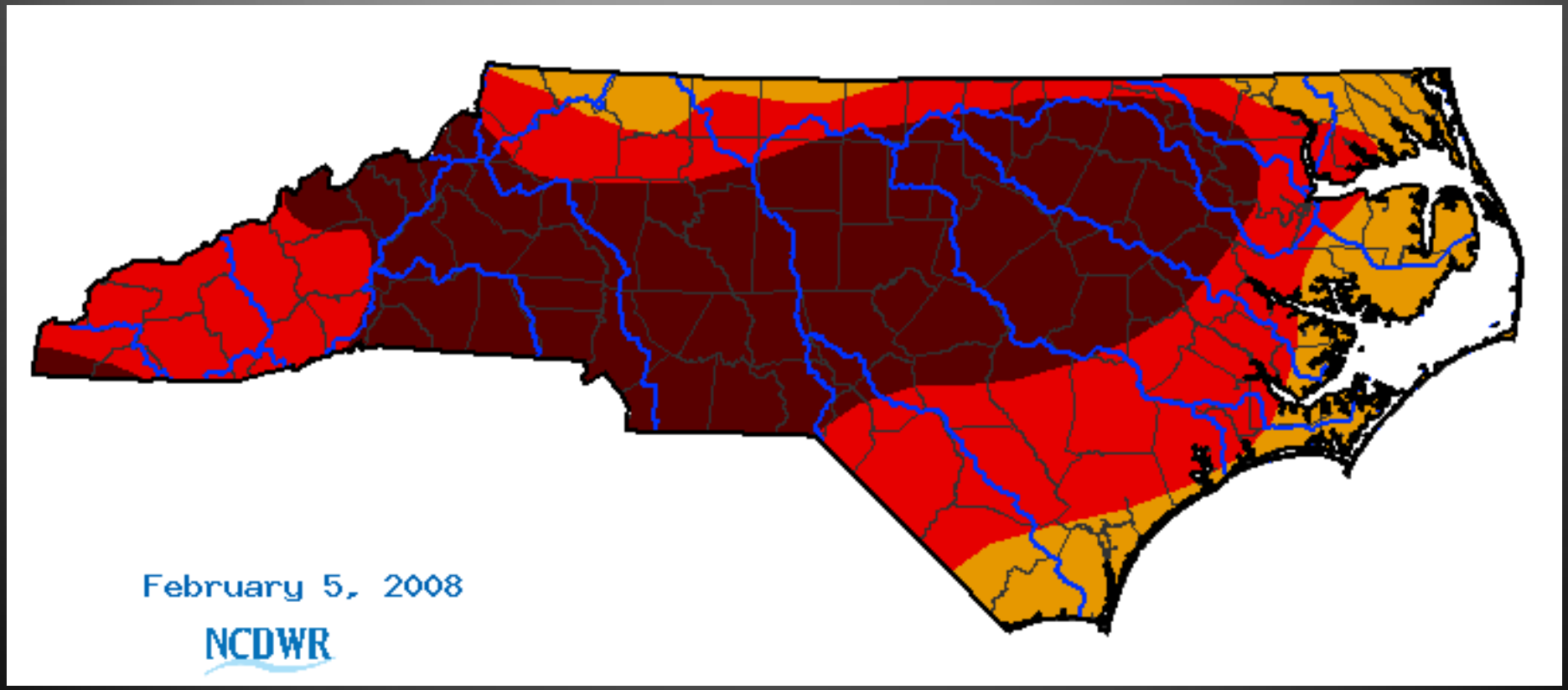
A Shift in Policy
House Bill 2499 - The Drought Bill



Basic Provisions of Recent NC Water Legislation

- Better management of water resources by state agencies and system owners
- Requires EMC to adopt rules for water conservation
- EMC adopted rules for water reuse (2U)
- Place more constraints on IBT
- Makes conservation provisions mandatory
- Streamlines drought management and water emergency powers of government
- Signals changes in water management policy in the State

LEED Certification

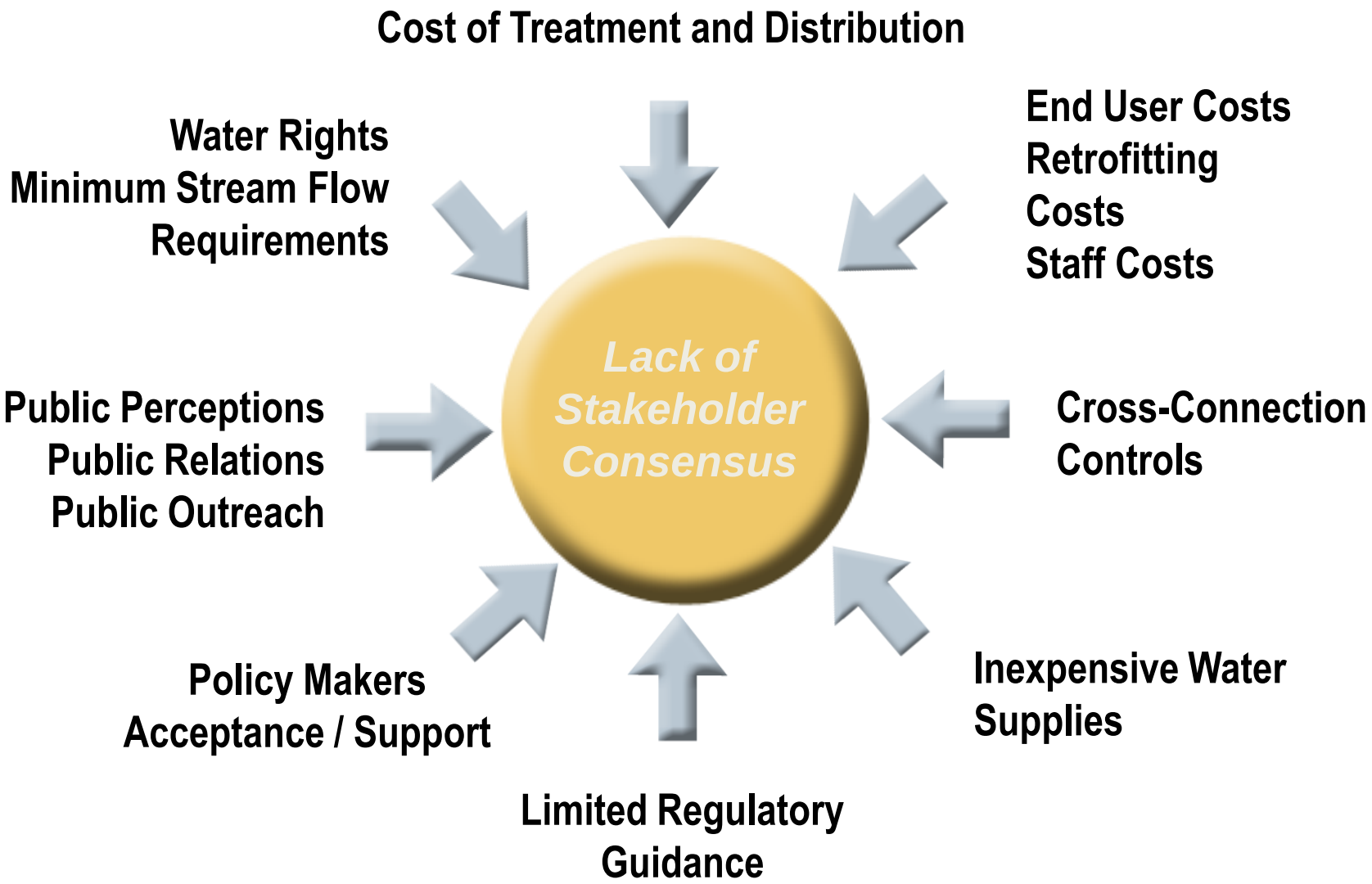
Leadership in Energy and Environmental Design

LEED for New Construction and Major Renovation 2009 Project Scorecard

Yes	?	No			
			Water Efficiency	**10**	**Points**
			Prereq 1 **Water Use Reduction,** 20% Reduction	Required	
			Credit 1.1 **Water Efficient Landscaping,** Reduce by 50%	2	
			Credit 1.2 **Water Efficient Landscaping,** No Potable Use or No Irrigation	2	
			Credit 2 **Innovative Wastewater Technologies**	2	
			Credit 3.1 **Water Use Reduction,** 30% Reduction	2	
			Credit 3.2 **Water Use Reduction**, 40% Reduction	2	
			Project Totals (Certification Estimates)	**110**	**Points**

Not Certified **Certified:** 40-49 points **Silver:** 50-59 points **Gold:** 60-79 points **Platinum:** 80+ points

Water Reuse Challenges



Some Benefits of Reclaimed Water Systems

- Reduces the demand for potable water
  - Reduces demands on WTP operation
    - Average flow
    - Summer peak flow
  - Reduces demands on raw water sources
- Reduces the discharge from WWTPs
  - Reduces impact to surface waters
  - Reduces annual loading of pollutants (nutrients, metals, BOD, etc.)
- Reduces the need for inter-basin transfers
- Use of reclaimed water will not significantly affect surface water volumes

Commencement – Not Conclusion

- Smart Policy – Your Challenge
- Unlimited opportunities
- Thank You

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