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Safe and Sustainable Water Resources

NWQMC Update
May 3, 2011

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21st Century Challenges

- Rate of waters listed for impairment exceeds rate at which they are being restored
- Causes of degradation are more complex; less visible
- Multiple sources of pollution requiring new, innovative approaches

21st Century Challenges: Aging Water Infrastructure

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National Problem

- Wastewater and drinking water systems rated D- by the American Society of Civil Engineers (2009).
- 240,000 water main breaks per year in the U.S.
- Up to 75,000 Sanitary Sewer Overflows per year resulting in the discharge of 3-10 billion gallons of untreated wastewater.

Water main break on River Road

- 5,500 annual illnesses due to exposures to contaminated recreational waters.
- 5-20% of energy expenditures on a state level are to transport water from sources to users, and back to treatment and discharge facilities.
- The U.S. geological survey estimates that water lost from water distribution systems is 1.7 trillion gallons per year at a national cost of $2.6 billion per year.

21st Century Challenge: Pathogens (still…)

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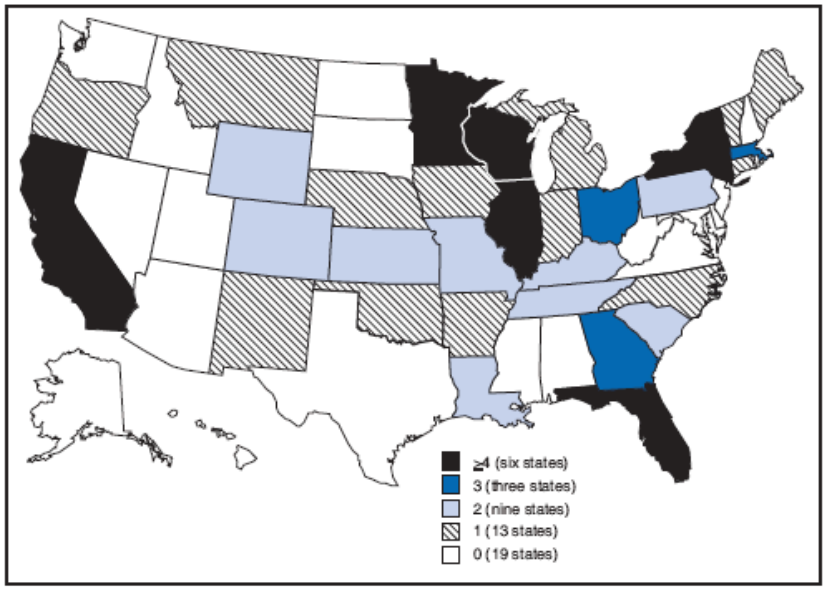
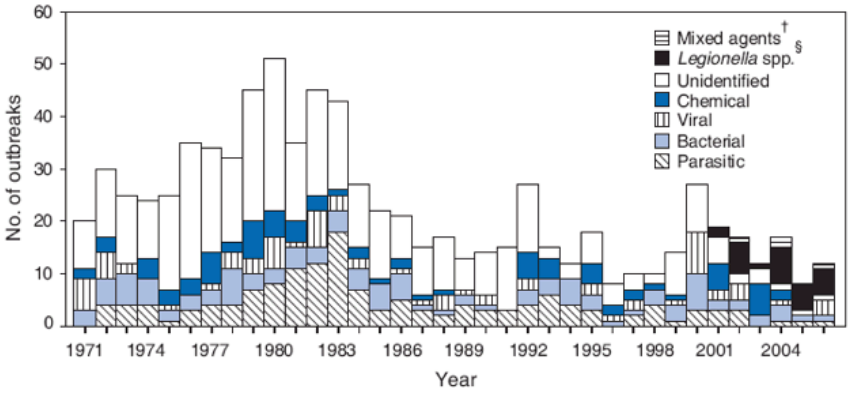
Number of waterborne disease outbreaks associated with recreational waters, 2005-2006; and drinking water, 1971-2006



*Note: These numbers are largely dependent on reporting and surveillance activities in individual states and do not necessarily indicate the true incidence in a given state.

FIGURE 3. Number of waterborne-disease outbreaks associated with drinking water (n = 814),* by year and etiologic agent — United States, 1971–2006



* Single cases of disease related to drinking water (n = 16) have been removed from this figure; therefore, it is not comparable to figures in previous *Surveillance Summaries*.
† Beginning in 2003, mixed agents of more than one etiologic agent type were included in the surveillance system. However, the first observation is a previously unreported outbreak in 2002.
§ Beginning in 2001, Legionnaires' disease was added to the surveillance system, and *Legionella* species were classified separately in this figure.

MMWR Surveillance Summary (Vol. 57, No. SS-9), "Surveillance for Waterborne Disease and Outbreaks Associated with Drinking Water and Water not Intended for Drinking---United States, 2005--2006,"

21st Century Challenge: Nutrient Pollution

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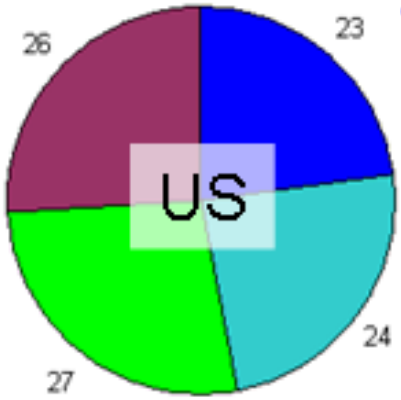
National Lakes Survey, 2007-2009

HyperEut

Oligo



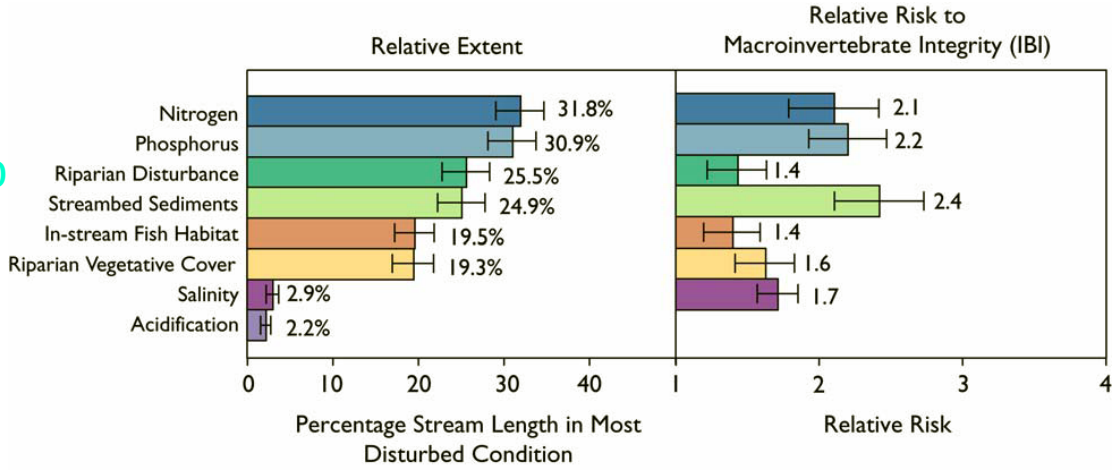
Meso

Eutro

Indicator: Chlorophyll a

% Lakes in trophic condition

Wadeable Streams Assessment, 2006



21st Century Challenge: Increased Water Demands

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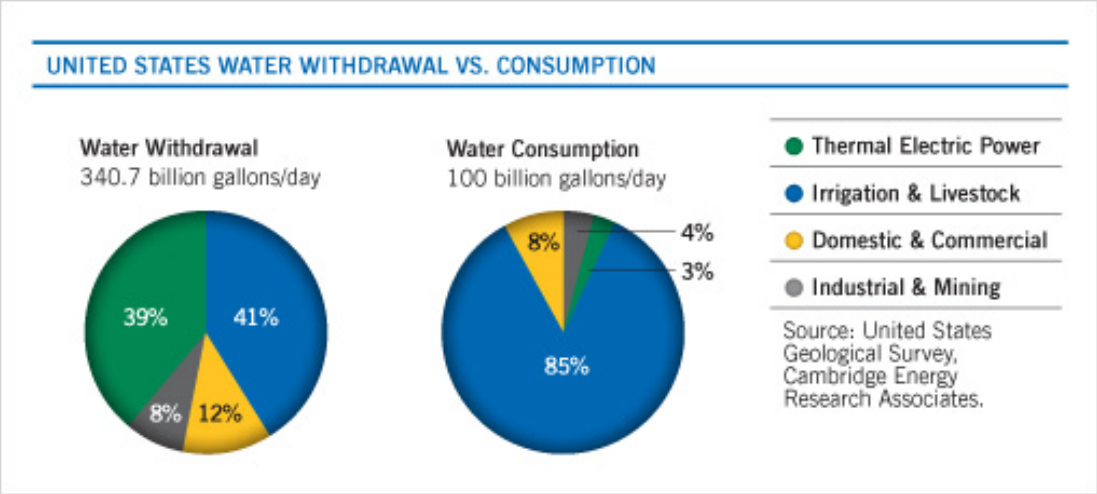
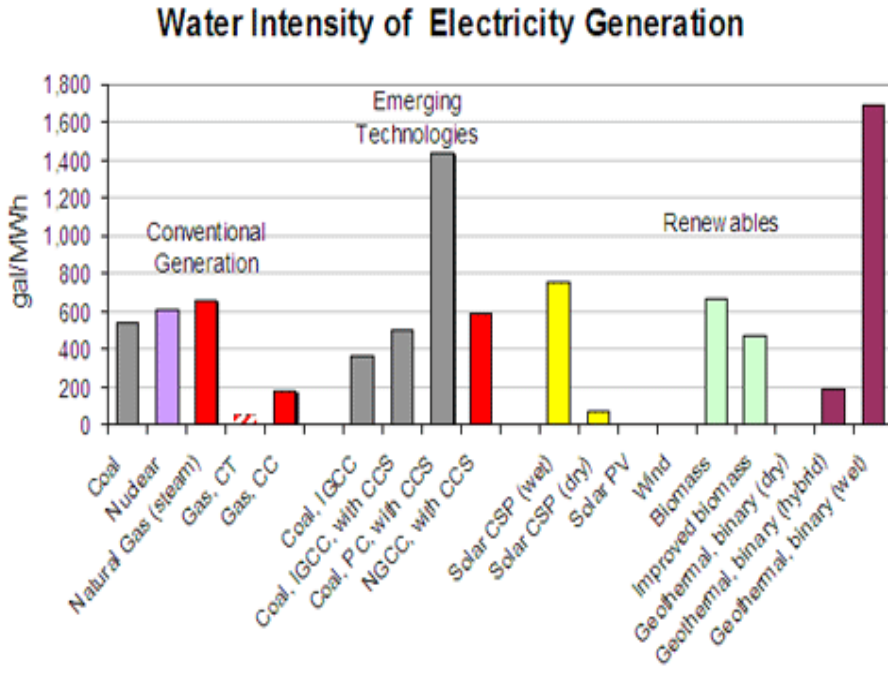


USGS Estimated Water Use, 2008

- Freshwater withdrawals were 85 percent of the total
- Surface water supplied 80 percent of all withdrawals



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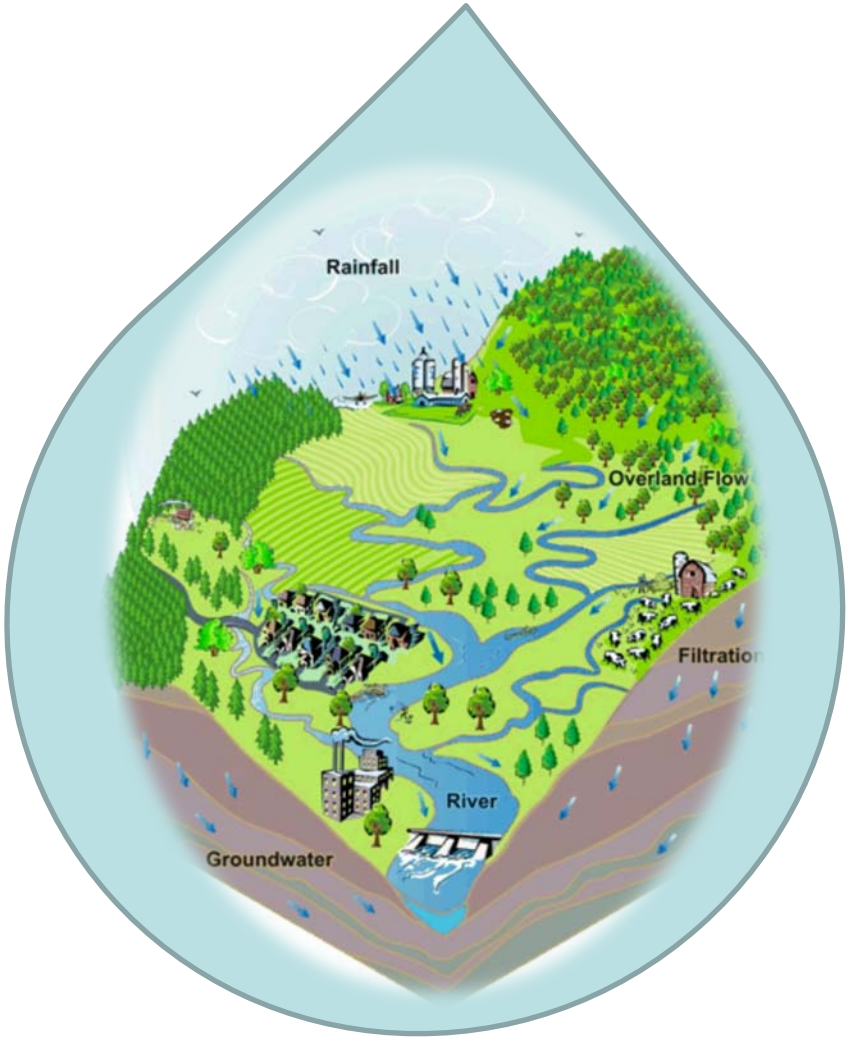
Water resources are not sustainable using 20th century approaches to address 21st Century problems

Goal of EPA Safe and Sustainable Water Resources (SSWR) Research Program:

- Seek sustainable solutions to 21st century problems facing our Nation's water resources
- Integrate the existing Drinking Water and Water Quality research programs into one holistic program



Overarching Goals

- Protect public health and the environment
- Provide safe and sustainable water to meet societal, economic and environmental needs
- Water resources are managed in a sustainable manner that: integrates wastewater, stormwater, drinking water, and reclaimed water; maximizes energy production, nutrients and materials management, and water recovery; and incorporates comprehensive water planning (such as low impact development and smart growth) and optimum combinations of built, green and natural infrastructure

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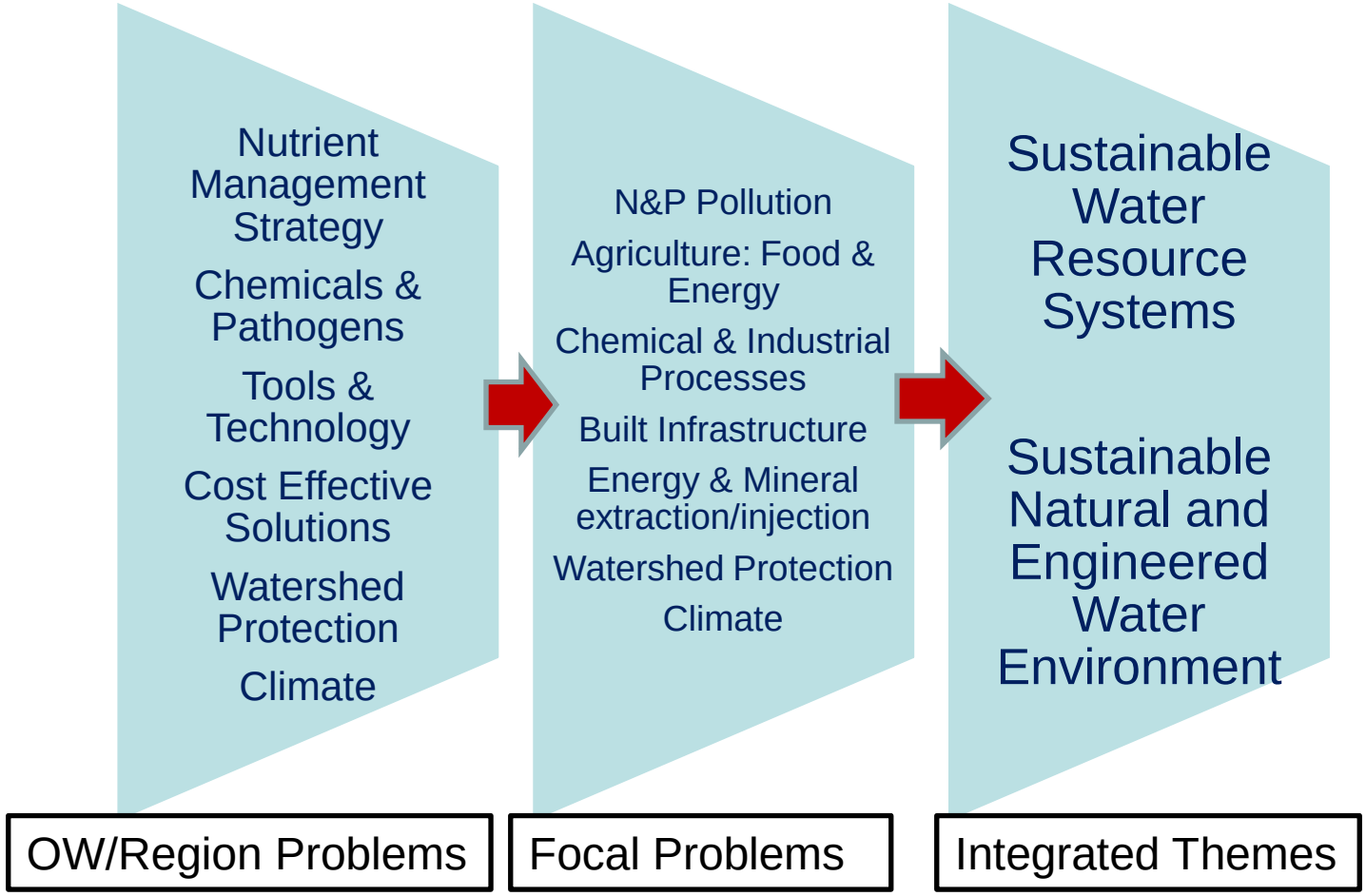
Problem Statement

Increasing demands for sources of clean water combined with changing land use practices, growth, aging infrastructure, and climate change and variability, pose significant threats to our Nation's water resources. Failure to manage our Nation's waters in an integrated, sustainable manner will limit economic prosperity and jeopardize both human and aquatic ecosystem health.

Vision

SSWR uses an integrated, systems approach to research for the identification and development of the scientific, technological and behavioral innovations needed to ensure clean and adequate and equitable supplies of water that support human well-being and resilient aquatic ecosystems.

Evolution of SSWR Program



SSWR Research Themes

Theme 1: *Sustainable Water Resource Systems*

- Ensure safe and sustainable water quality and availability to protect human and ecosystem health by integrating social, economic and environmental research for use in protecting and restoring water resources and their designated uses (e.g., drinking water, recreation, industrial processes, and other designated uses) on a watershed scale.

Theme 2: *Sustainable Natural and Engineered Water Environment*

- Ensure the sustainability of critical water resources using systems-integrated water resource management where the natural, green and built water infrastructure is capable of producing, storing and delivering safe and high quality drinking water, and providing transport and use-specific treatment of wastewater and stormwater.

ORIGINS OF THE PROBLEMS

MANIFESTIONS OF THE PROBLEM IN THE WATER ENVIRONMENT

SYSTEMS APPROACH TO SOLUTIONS

Urbanization
Including:
- Land use management
- Industrial Processes

Population demographics
- aging drinking water and wastewater infrastructure

Non point source pollution
- Agriculture

Poor Water Quality
- Physical processes (e.g.,flow; degraded habitat)
- Loadings: Nutrients, Pathogens, Chemicals, Sediments

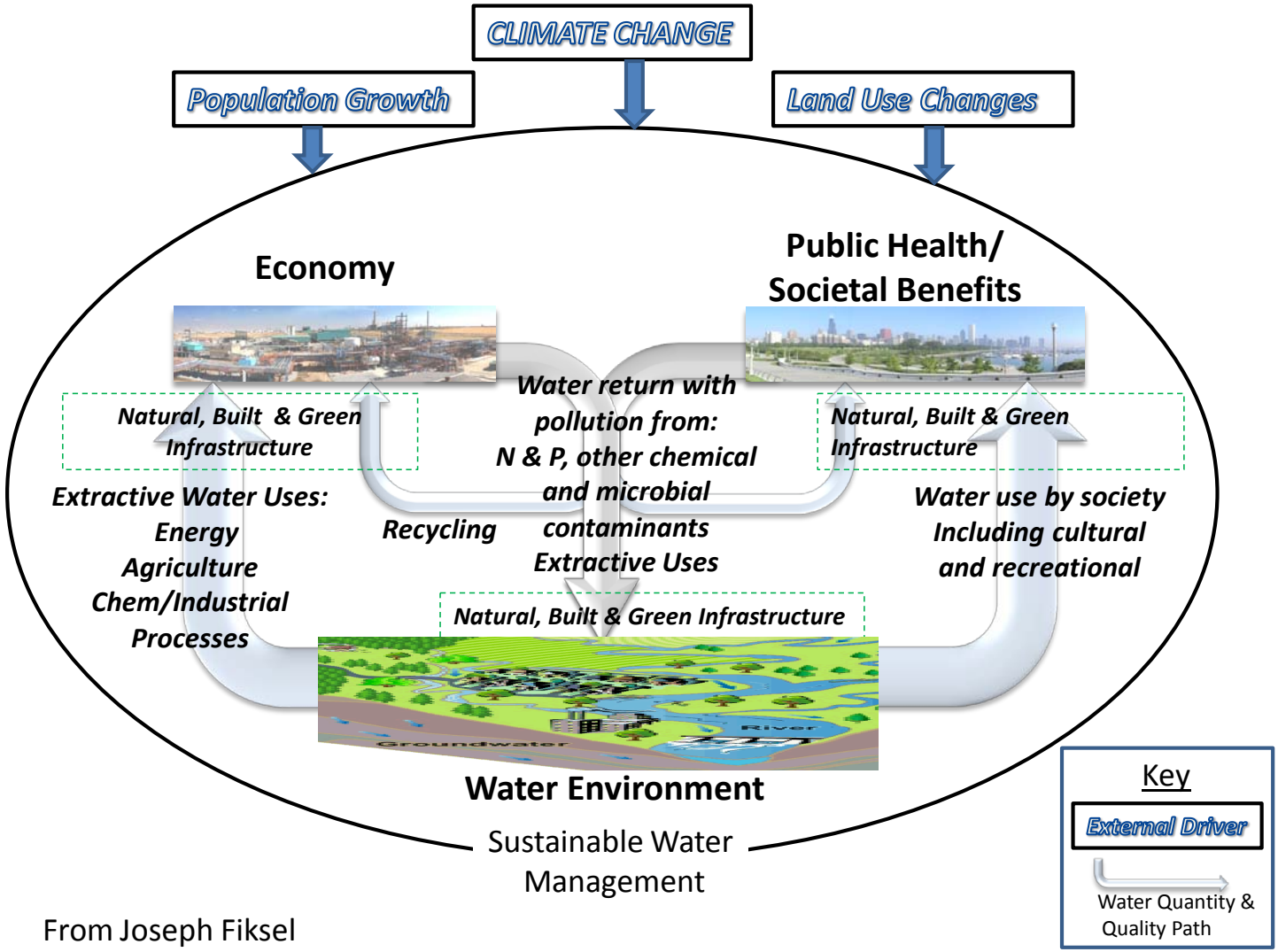
Additional stressors:
- Insufficient Water Quantity
- Climate change and variability

NEW FOCUS - Pro-active, Integrated, Sustainable Solutions

Sustainable Water Resource Systems – Ensure safe and sustainable water quality and availability to protect human and ecosystem health by integrating social, economic and environmental research for use in protecting and restoring water resources and their designated uses (e.g., drinking water, recreation, industrial processes, and other designated uses) on a watershed scale.

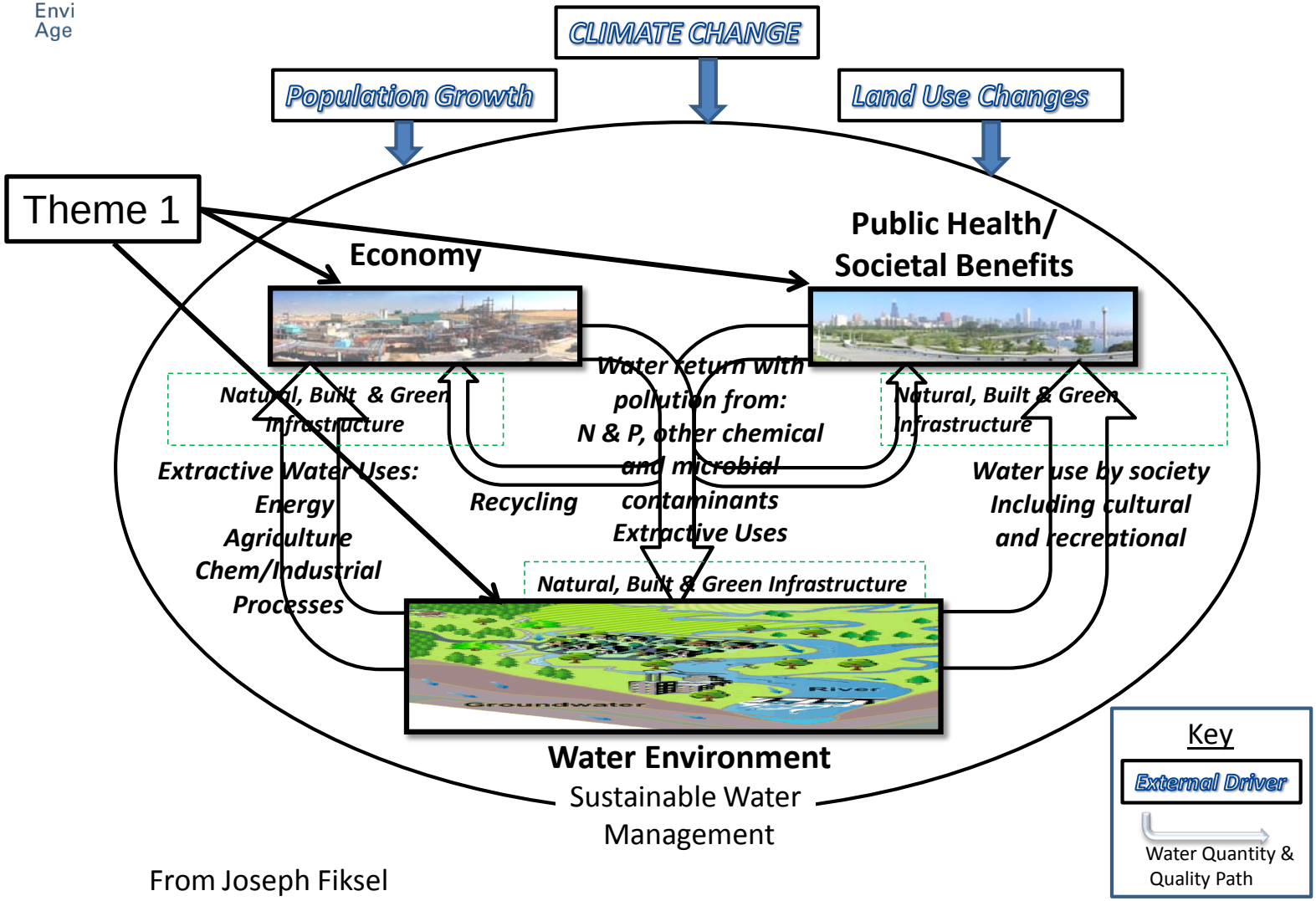
Sustainable Natural and Engineered Water Environment – Ensure the sustainability of critical water resources using systems-integrated water resource management where the natural, green and built water infrastructure is capable of producing, storing and delivering safe and high quality drinking water, and providing transport and use-specific treatment of wastewater and stormwater.

Putting SSWR in a Sustainability Context



From Joseph Fiksel

Putting SSWR in a Sustainability Context



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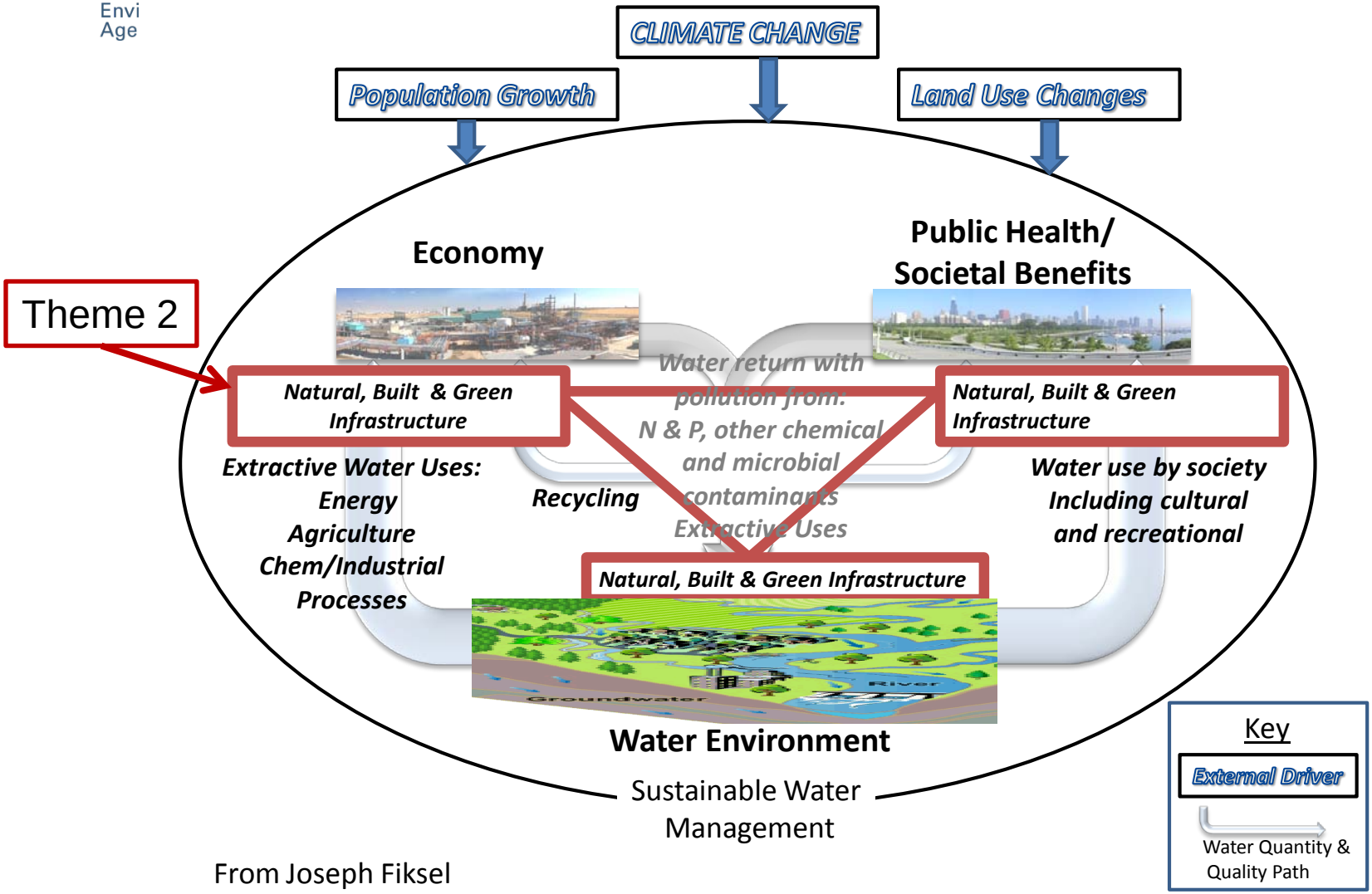

From Joseph Fiksel

Putting the Framework Together

- Characterize the problem
- Identify science needs to solve the problem
- Identify key actionable science questions
- Identify anticipated outputs
- Determine how we measure success

Where We Are in the Process

- Finalizing development of Research Framework
- Analyzing ORD's current research portfolio
- Stakeholder Webinar and Review May, 2011
- Brief joint meeting of EPA's Science Advisory Board & Board of Scientific Counselors June 29-30, 2011
- Develop Research Action Plan May-August, 2011
- Implement Program October 1, 2011

Research Questions

- Theme 1
  - What factors are most significant and effective in ensuring the sustainability and integrity of water resource and watersheds, including downstream estuarine and coastal receiving waters?
  - What approaches are most effective in minimizing the environmental impacts of different land use practices (e.g., energy production, mineral extraction and injection activities, agriculture, urbanization) leading to the sustainability of surface and subsurface water resources?
  - What are the impacts of climate variability and changing human demographics on water quality and sufficient quantity in freshwater, estuarine, coastal aquatic ecosystems, and drinking water? What approaches are needed to mitigate these impacts?

Research Questions

- Theme 2
  - What are the most effective and sustainable approaches which maintain and improve the natural and engineered water system in a manner that effectively protects the quantity and quality of water?
  - How do we effectively manage water infrastructure to produce safe and sustainable water resources from source to drinking water tap to receiving waters?
  - What effective systems-based approaches can be used to identify and manage causes of degraded water resources?

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Questions?