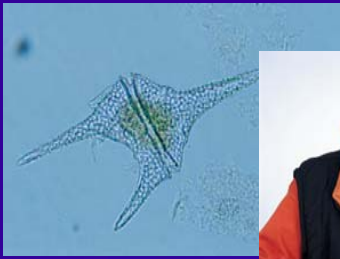




**Awwa
Research
Foundation**

Climate Change Impacts and Solutions

2008 MSSC Salinity Summit
Las Vegas, NV



AwwaRF

Mission: Advance the science of water to improve the quality of life

- Centralized research program for drinking water utilities
 - Sponsor research
 - Develop knowledge
 - Promote collaboration
- Agenda is planned and guided by drinking water utilities
- Research covers a broad range of topics including source water, treatment, infrastructure, and management for drinking water utilities



Climate Change

- Climate change interest generated from grass roots
 - Little government influence
 - High degree of interest from utilities
- AwwaRF research driven by utilities wanting answers
 - What hydrological impacts of climate change will affect water utilities?
 - How can we scale down global models of climate change processes to a watershed level?
 - How can we plan for reliable water quality and supplies in the face of climate uncertainties?

Hydrological Impacts of Climate Change

Warming intensifies the hydrologic cycle

Surface temperature increase



Increased water holding capacity



Increased atmospheric moisture



Changing Frequency



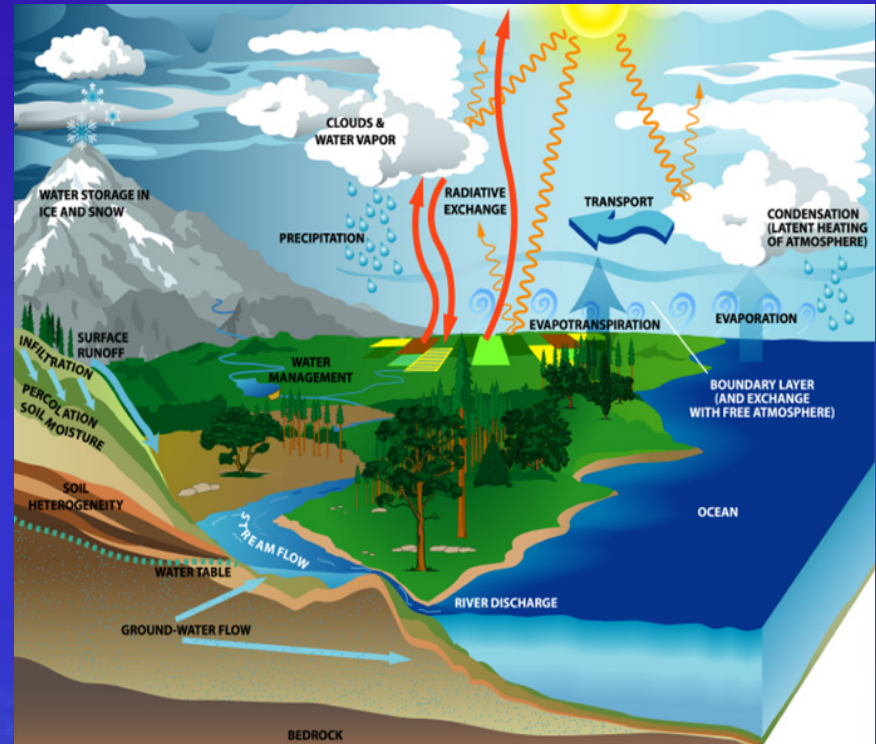
Increased Intensity



Droughts

&

Floods



Hydrological Impacts of Climate Change

- Changes in average annual snow pack runoff
 - Shorter snow season, less volume
 - Earlier peak flow, so water stored in past as snow is lost unless water system storage capacity is increased
- Less frequent more intense rainfall events
 - Water quality degradation
 - Changes in vegetation of watersheds and aquifer recharge areas
- Rising sea levels
- Glacial recession
 - summer flow ↑ near-term, but ↓ long-term

Climate Change Impacts on Water Utilities

Quantity uncertainties

- Increasing unpredictability of precipitation
- More difficult to capture
- Increased evaporation from reservoirs

Quality degradation

- Flooding - Increased erosion/turbidity
- Increased water temperatures
- Changes in watershed vegetation
- Salt-water intrusion

Demand

- Increased due to higher temperatures

Water Utilities Respond to Climate Change Conditions

- Developing adaptation plans to minimize water reduction impact
- Working closely with local and state officials designing water restriction guidelines
- Partnering resources with other utilities in the water community
- Requesting research to support climate change decisions



AwwaRF's Climate Change Research Program

- Responding to need to maintain adequate drinking water supplies in face of climate change
- Major AwwaRF initiative
- Co-funding of climate change projects proposed by utilities
- Key partnerships with several coalitions

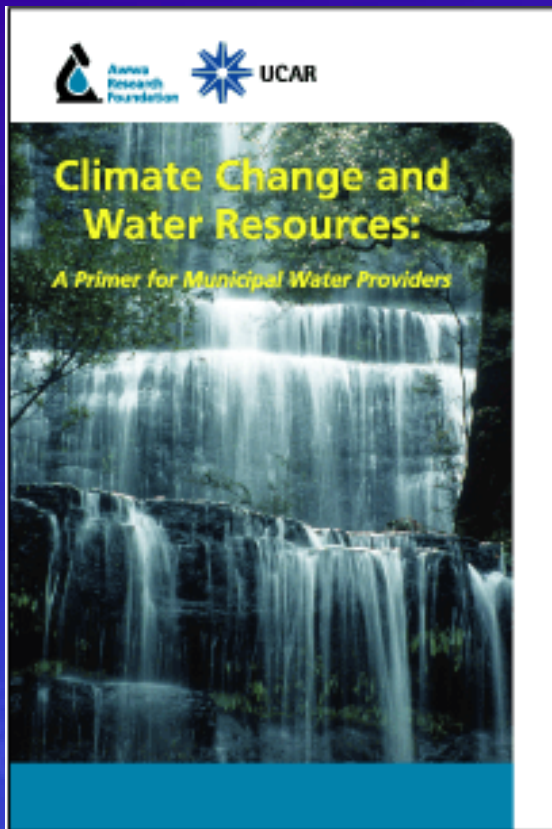


Climate Change Partnerships- Coalitions

- National Center for Atmospheric Research (NCAR)
- UKWIR – UK Water Industry Research
- CUWA – California Urban Water Utilities
- Group of 8
- WSAA – Water Services Association of Australia
- WERF

Climate Change and Water Resources: A Primer for Municipal Water Providers

AwwaRF publication 91120, 2006



- Partnership with NCAR
- Defines current state of climate change research
- Assesses water supply vulnerabilities
- Provides case studies of water utilities planning for climate change
- Summarizes lessons learned from extreme events such as wildfires, droughts, floods
- Develops range of adaptation strategies

Current AwwaRF Coalitions

- West Coast Group: LADWP, Contra Costa Water District, Seattle Public Utilities and San Diego Water Authority
 - Effects of Climate Change on Water Utility Planning and Design Standards
- California Urban Water Agencies (CUWA)
 - Utility Greenhouse Gas Emissions

Current AwwaRF Coalitions

- NCAR-Utility Alliance
 - Boston, MA
 - Raleigh/Durham, NC
 - Palm Beach County, FL
 - New York City
 - Colorado Springs, CO
 - Regional utility alliance in California
- Decision tool to incorporate climate change information in water utility planning



Current AwwaRF Coalitions

- Global: UKWIR-CRC
 - Edinburgh workshop to review research needs regarding climate change
 - Climate Change Impacts on Source Water Quality

AwwaRF, UKWIR, WERF Climate Change Workshop Issues

- Impacts of underground CO₂ sequestration on groundwater supplies
- Interpretation of climate change models for water supply
- Designing infrastructure systems of the future
- Vulnerability assessment and risk management tools
- Resource recovery and integrated process optimization

Related AwwaRF Research

- **Energy Management**
 - Historically driven by cost savings; growing interest in minimizing carbon footprint, green operations
 - >15 research projects since early 1990s
 - Strategic partnership with California Energy Commission
- **Desalination**
 - Alternative water source as hedge against climate change impacts
 - >20 research projects
 - Partnerships with Water Reuse, USBR, Sandia National Laboratories, NWRI



Conclusions

- **Drinking water utilities are keenly aware of climate change issues and are seeking answers**
- **Utility management is risk management and this is just another risk that must be assessed and added to long term planning and decision making**
- **Implementing adaptive strategies may be expensive but necessary**
- **Public communication will be essential to educate water users on the required changes necessary to ensure drinking water in the future**
- **Greater effort is needed to ensure quality research to support the needs caused by Climate Change**



Thank You

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