



INSTITUTE FOR  
Sustainable  
Communities

# Toward climate-resilient communities: Examples from Seattle & King County

Snowmass, CO

July 28, 2009

Steve Nicholas, Vice  
President of Climate  
& Environmental  
Programs





# My goals today...

- Give a sense of climate adaptation efforts in Seattle and King County
- Share a few observations about key challenges and lessons
- Engage in a dialogue
- Learn!

# About ISC...

- “We help communities around the world address environmental, economic, and social challenges to build a better future shaped and shared by all.”
  - NGO with 18+ years of experience
  - Specialize in community capacity-building
  - > 70 projects in > 20 countries
  - 70 staff in six offices (including China)
  - Madeleine Kunin and (Ben &) Jerry Greenfield

# Climate Leadership Academy

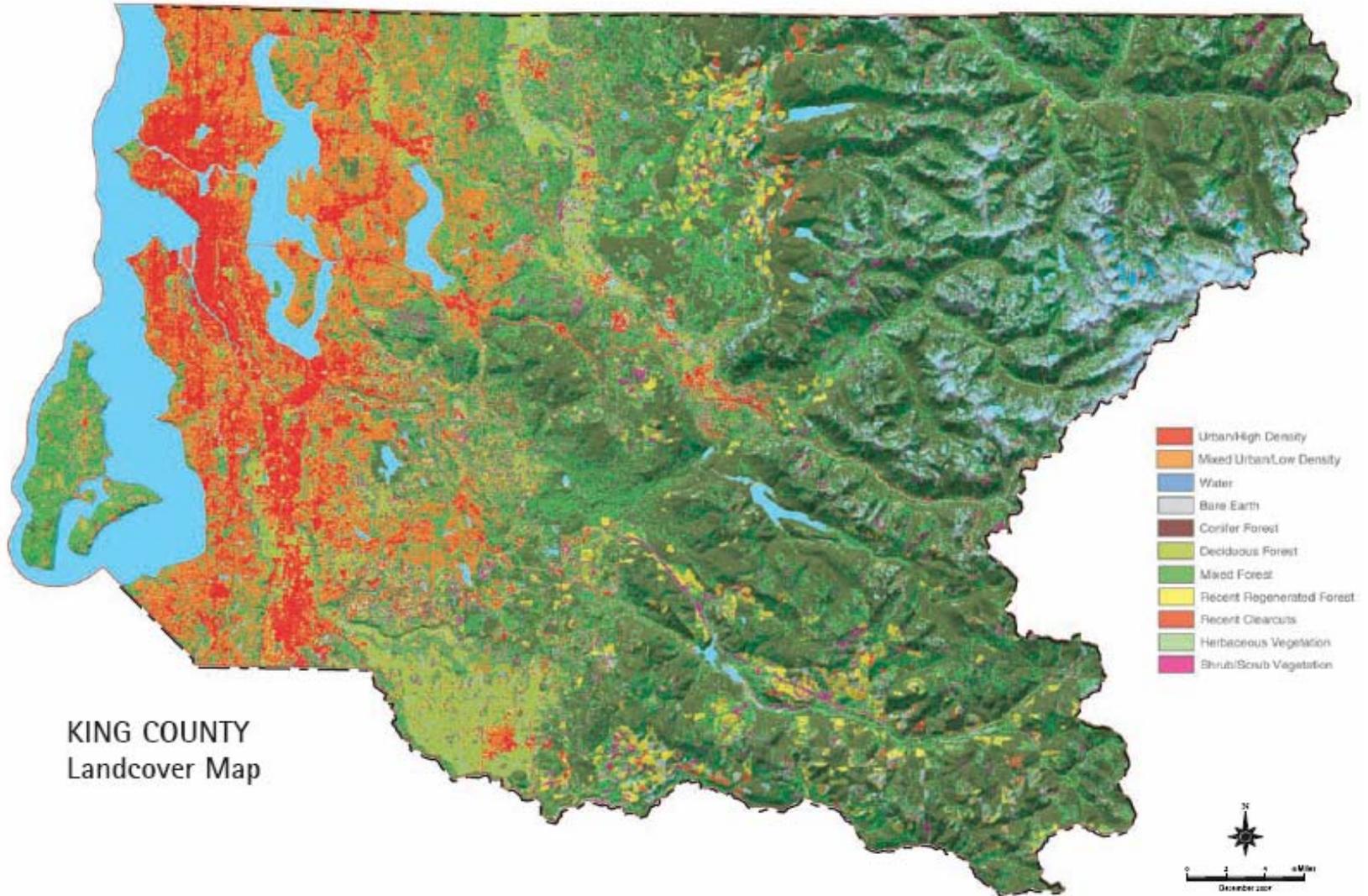
- Goal: strengthen the capacity of cities in the US and China to implement effective local climate solutions
  - mitigation and adaptation
- Mix of intensive workshops, resource guides and on-going support services
  - building energy retrofiting
  - climate-friendly transportation & land-use
  - green job/career creation
  - climate adaptation



# About me...

- Past Director of City of Seattle's Office of Sustainability & Environment (2000-2008)
- Now ISC's Vice President of Climate & Environmental Programs
- A few important caveats
  - Not a scientist!
  - Seattle vs. King County
  - Nine months removed

# Seattle & King County: climate leaders





# Seattle-led US Mayors' Climate Agreement (focus on mitigation)

965 mayors representing ~85 million people – and counting!



# King County-led Adaptation Guidebook & Urban Leaders Initiative

## PREPARING FOR CLIMATE CHANGE

A Guidebook for Local, Regional, and State Governments



Written by  
Center for Science in the Earth System (The Climate Impacts Group)  
Joint Institute for the Study of the Atmosphere and Ocean  
University of Washington

King County, Washington

With an introduction by King County Executive Ron Sims



In Association with  
**I.C.L.E.I.**  
Local  
Governments  
for Sustainability

A Report by the Center For Clean Air Policy  
Urban Leaders Adaptation Initiative

Ask the Climate Question:  
Adapting to Climate Change Impacts in Urban Regions



Ashley Lowe  
Josh Frazier  
Steve Wiselblum

June 2009

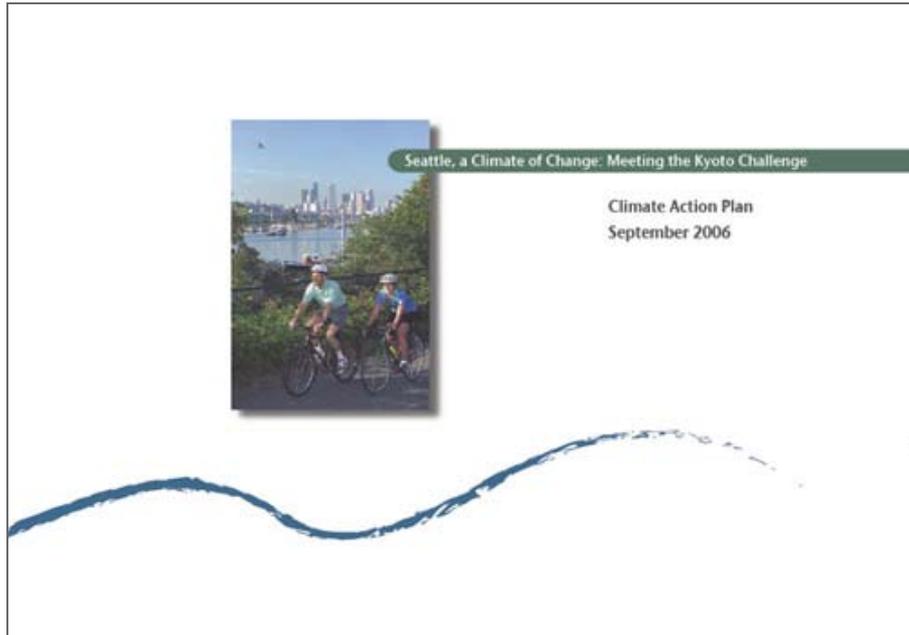
# “Report: Climate change to wallop state” (Seattle Times, 2/11/09)

- Warmer winters, with more precipitation falling as rain vs. snow
  - Decreased snowpack
  - Increased flooding
- Diminished average streamflows in summer and early fall (when both people and salmon need water most)
- Increased drought, wildfires
- Increased heat wave events

# Key adaptation challenges in Seattle & King County...

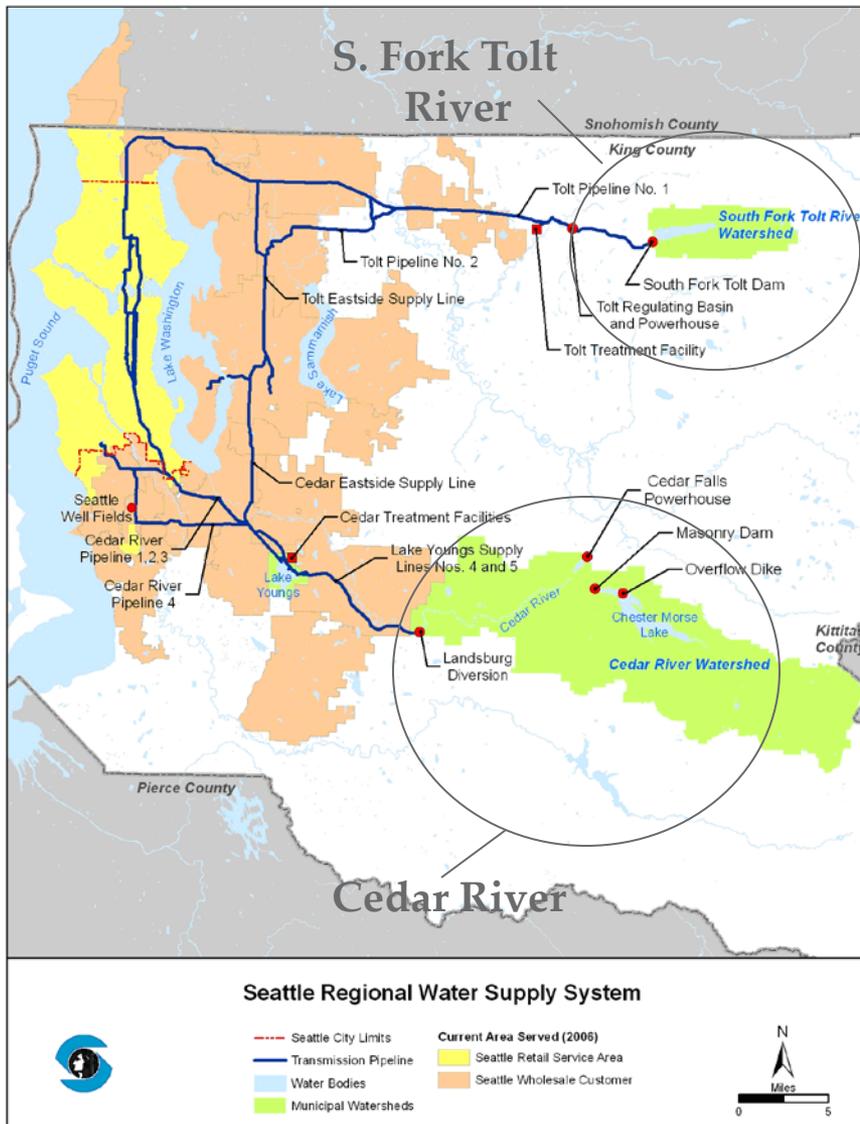
- Water supply
- Flood management (urban and otherwise)
- Hydroelectricity supply
- Potentially vulnerable infrastructure
  - Wastewater treatment
  - Transportation

# Climate Adaptation: Seattle's Approach



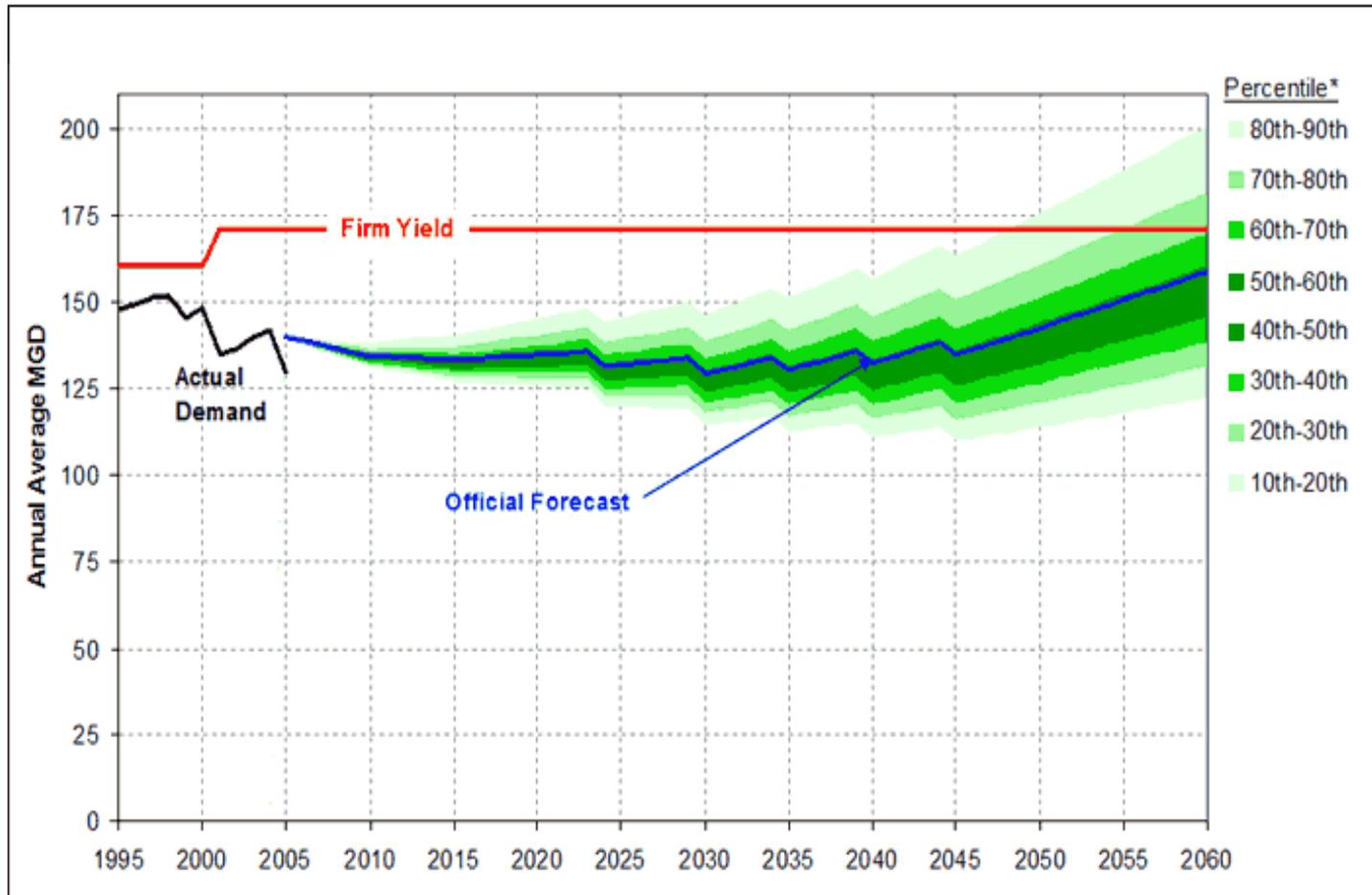
- City-wide Climate Action Plan focused initially on mitigation
- City-wide adaptation strategy underway
- Building on utilities' long-standing leadership

# Example: water supply



- Seattle Public Utilities
  - Drinking water to 1.3 million people
  - In-stream flows for salmon habitat
  - Flood management
- Mountain-based surface water supplies
- Rely on snowpack and rain (more on rain)

# Seattle's Water Supply Outlook



Note: Percentiles represent the probability that actual demand will be less than the value shown. Ranges reflect uncertainty in projected household, employment, price and income growth, price elasticity, income elasticity, and conservation. Note that the Official Forecast is at about the 57th percentile.

# SPU's approach to adaptation

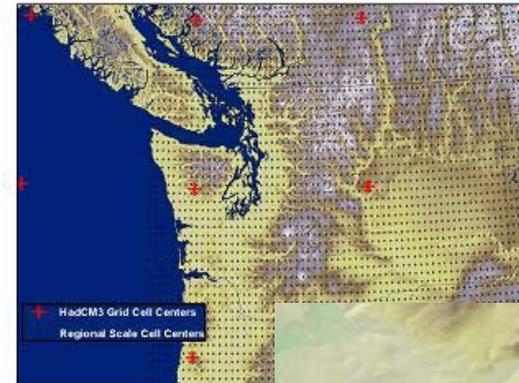
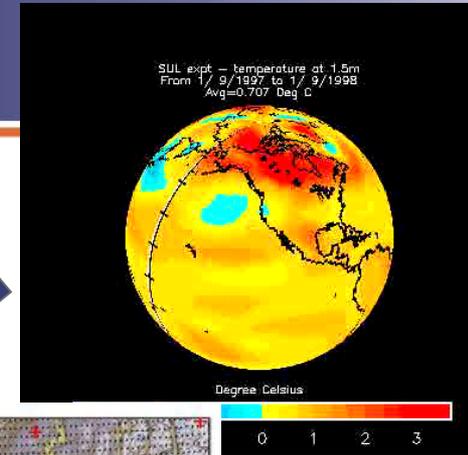
- Identify potential **impacts** through downscaling
- Invest in actions that **mitigate uncertainty & enhance flexibility**
- Adjust operations to test system flexibility
- Manage **portfolio** of response options
- Engage in ongoing **research**



# Assessing regional impacts

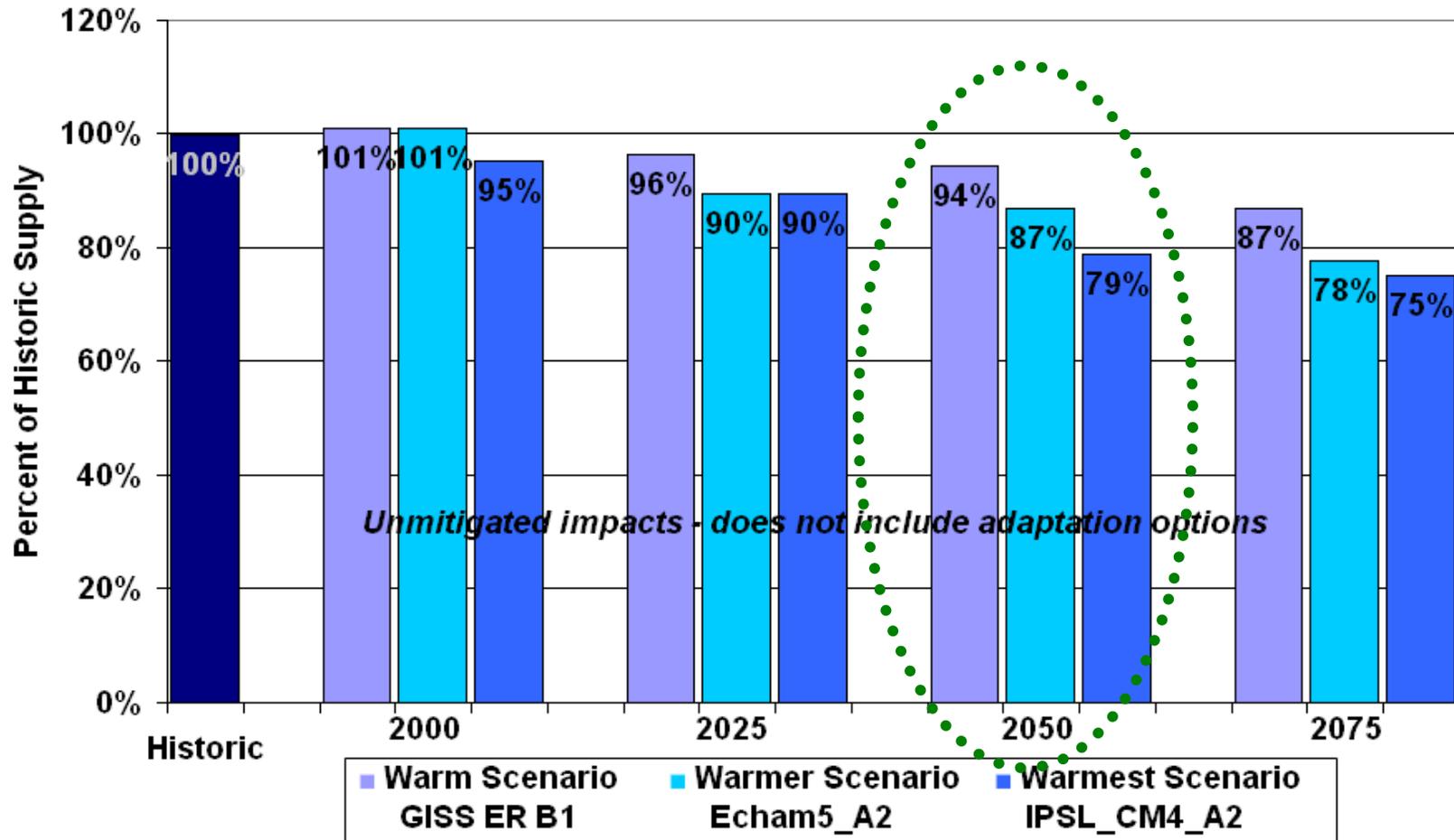
Downscaled GCM outputs to regional scale

- 3 Climate Change Scenarios for 2000, 2025, 2050, 2075:
  - Warm: GISS\_ER-B1
  - Warmer: Echem5-A2
  - Warmest: IPSL\_CM4-A2
- Temperature
  - Warming trend, primarily in winter and summer
  - Average warming is generally  $1^{\circ}$  C per 25-year period
- Precipitation
  - In general, more precipitation in winter, less in summer
- Hydrology
  - Shift towards higher winter flows and lower spring/early summer flows
  - Substituted *future* hydrology for *historic* in SPU's systems models

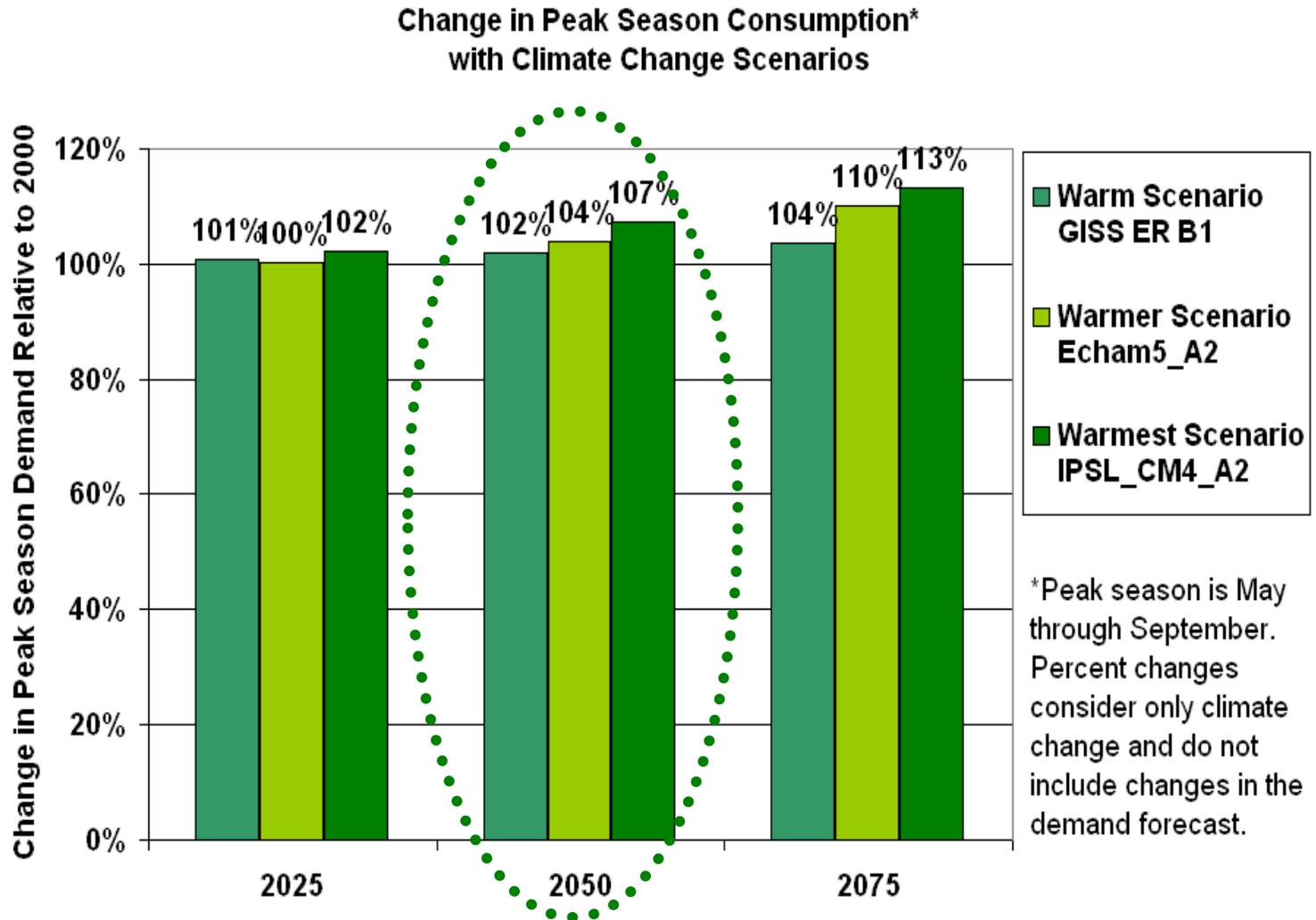


# Supply: Down

Change in Water Supply  
with Climate Change Scenarios  
*Baseline Operations*



# Peak-season demand: up





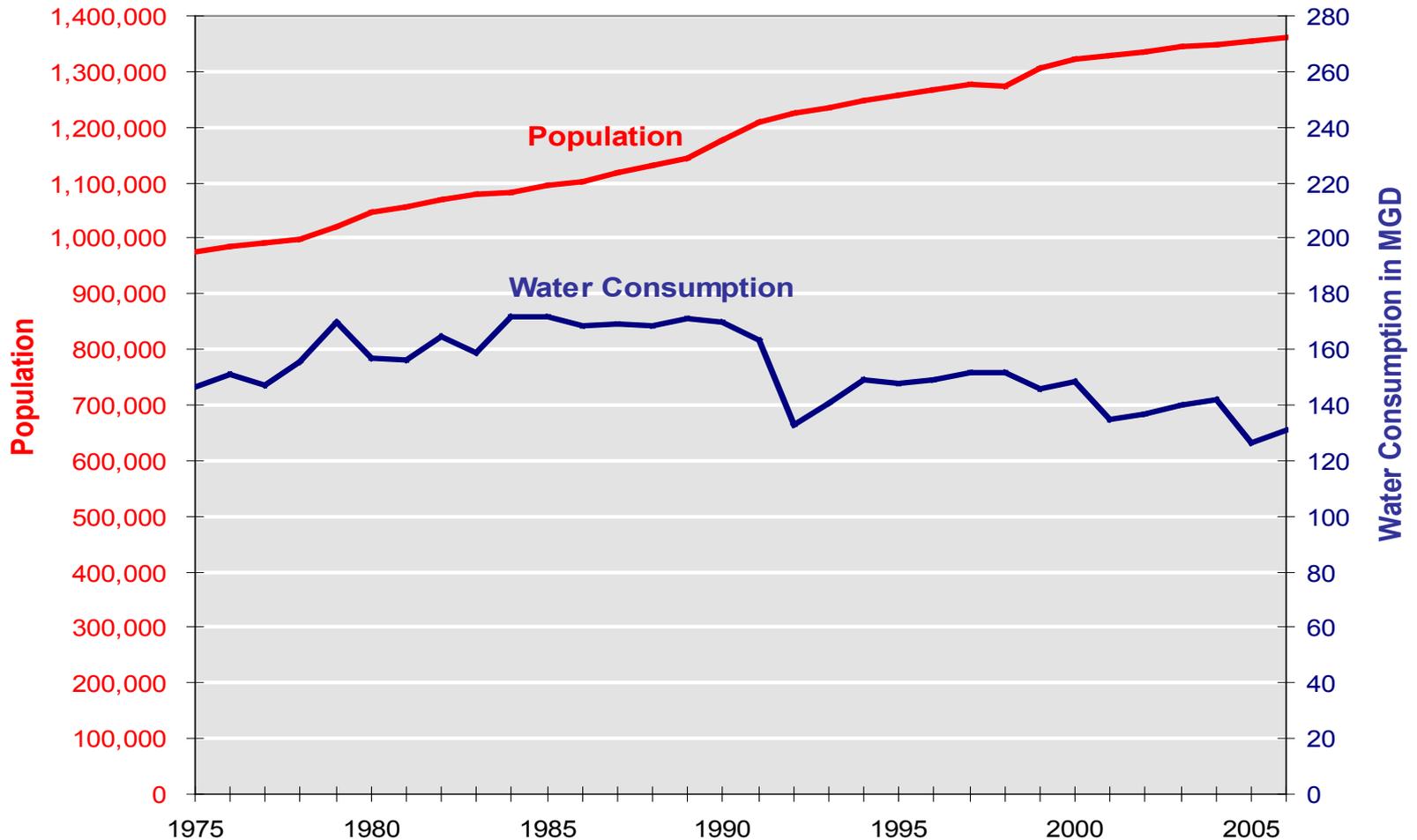
# A portfolio of adaptation options

- Behavioral
- Operational
- Technological
- Legal/Financial
- Institutional
- Technical

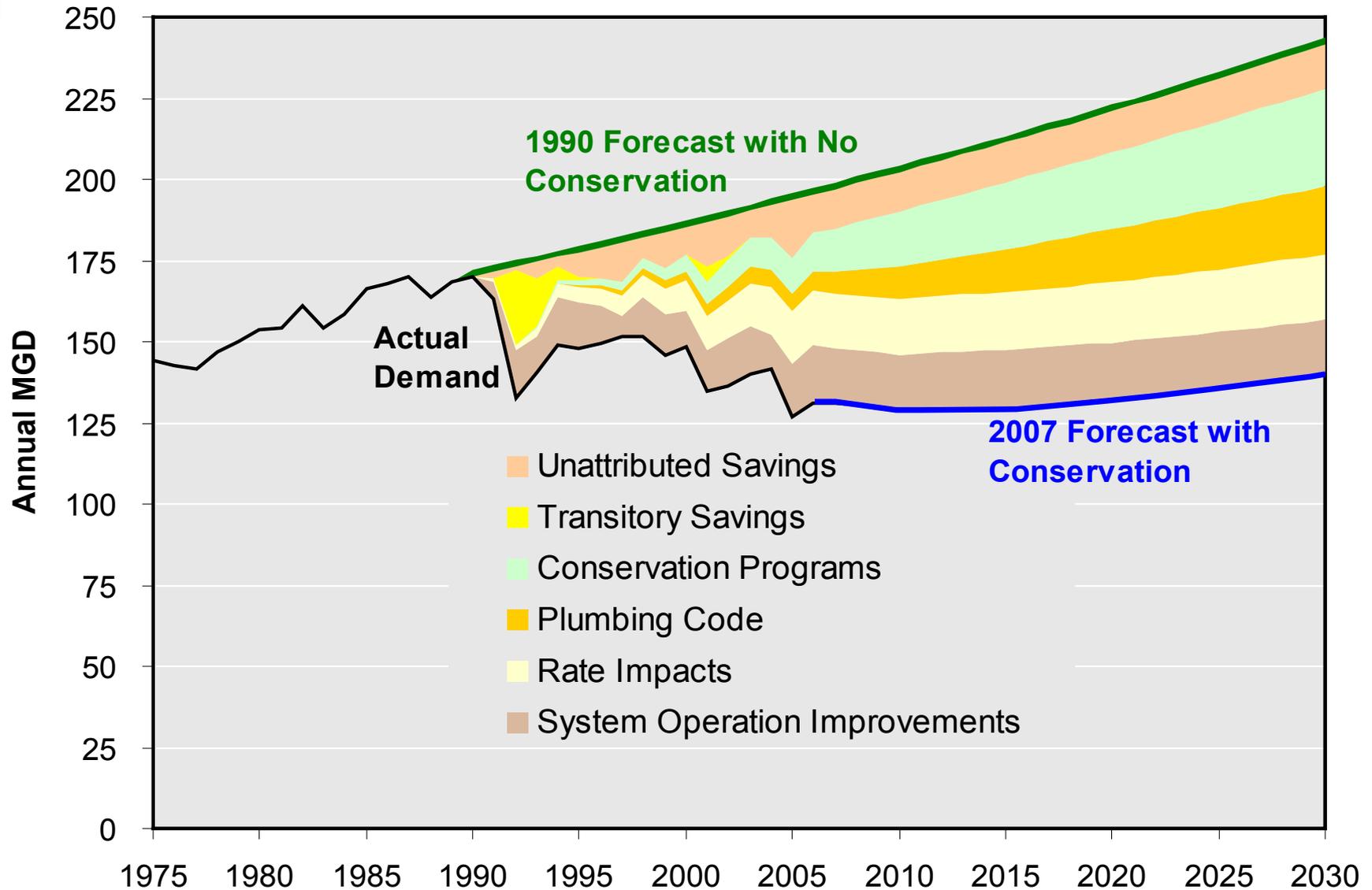


# Adapting behavior (i.e. conservation)

**Growth in Population and Water Consumption  
Seattle Regional Water System: 1975-2006**

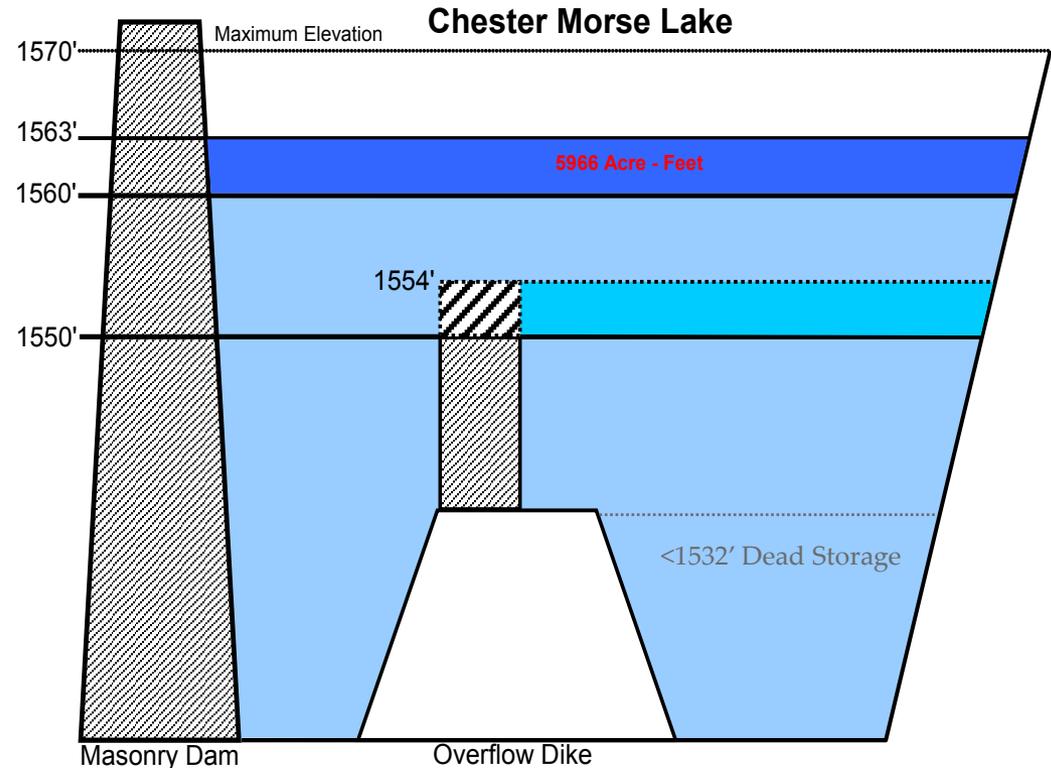


# Driving down demand...



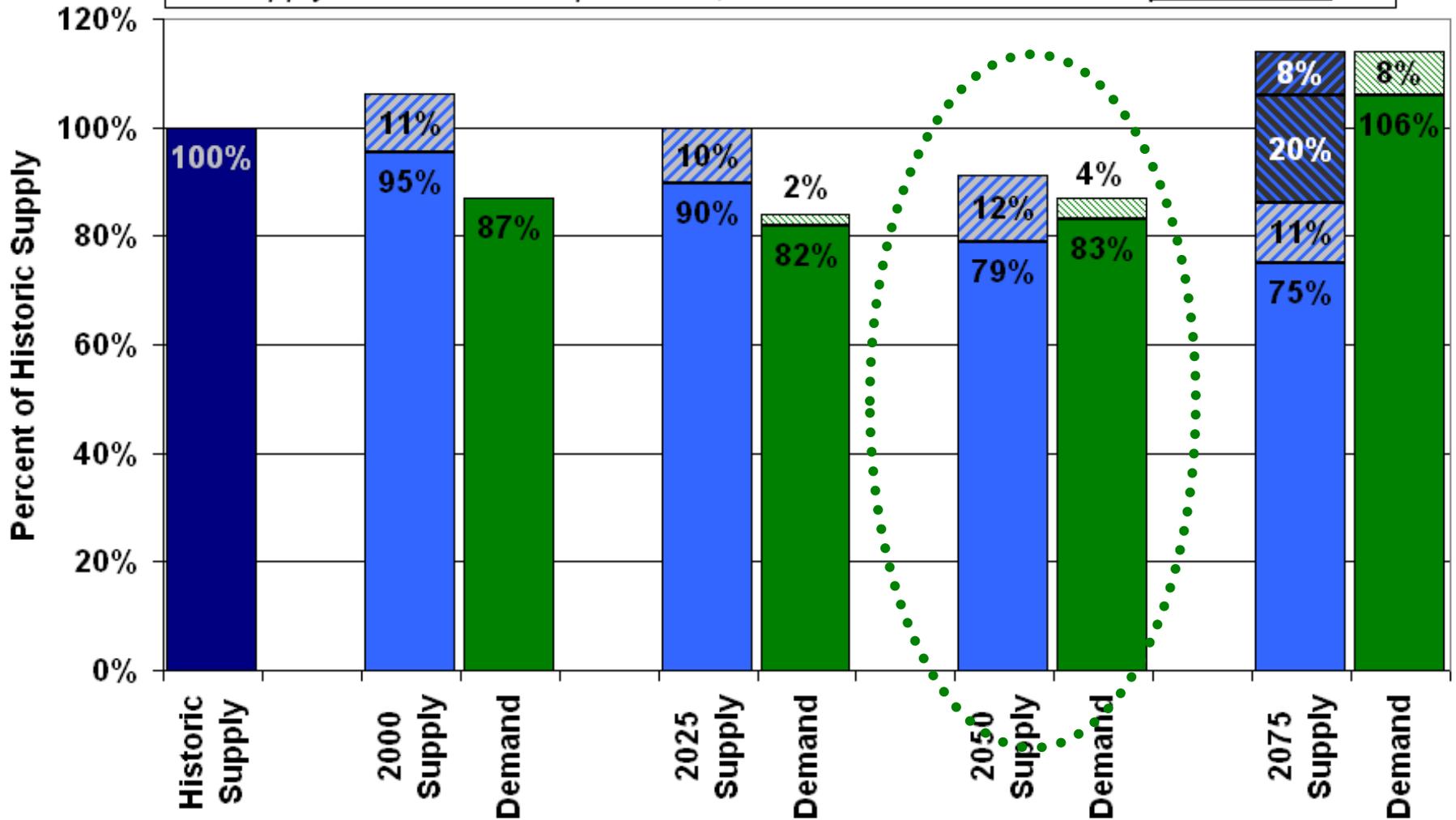
# Adapting operations

- Refill Chester Morse Reservoir 3 feet higher
  - Adds **12%** more useable storage
- Raise Overflow Dike by 4 feet
  - Reduces seepage losses
  - New project under consideration



## Warmest Scenario Results from Monthly CUE and Demand Forecast Model - IPSL\_CM4\_A2

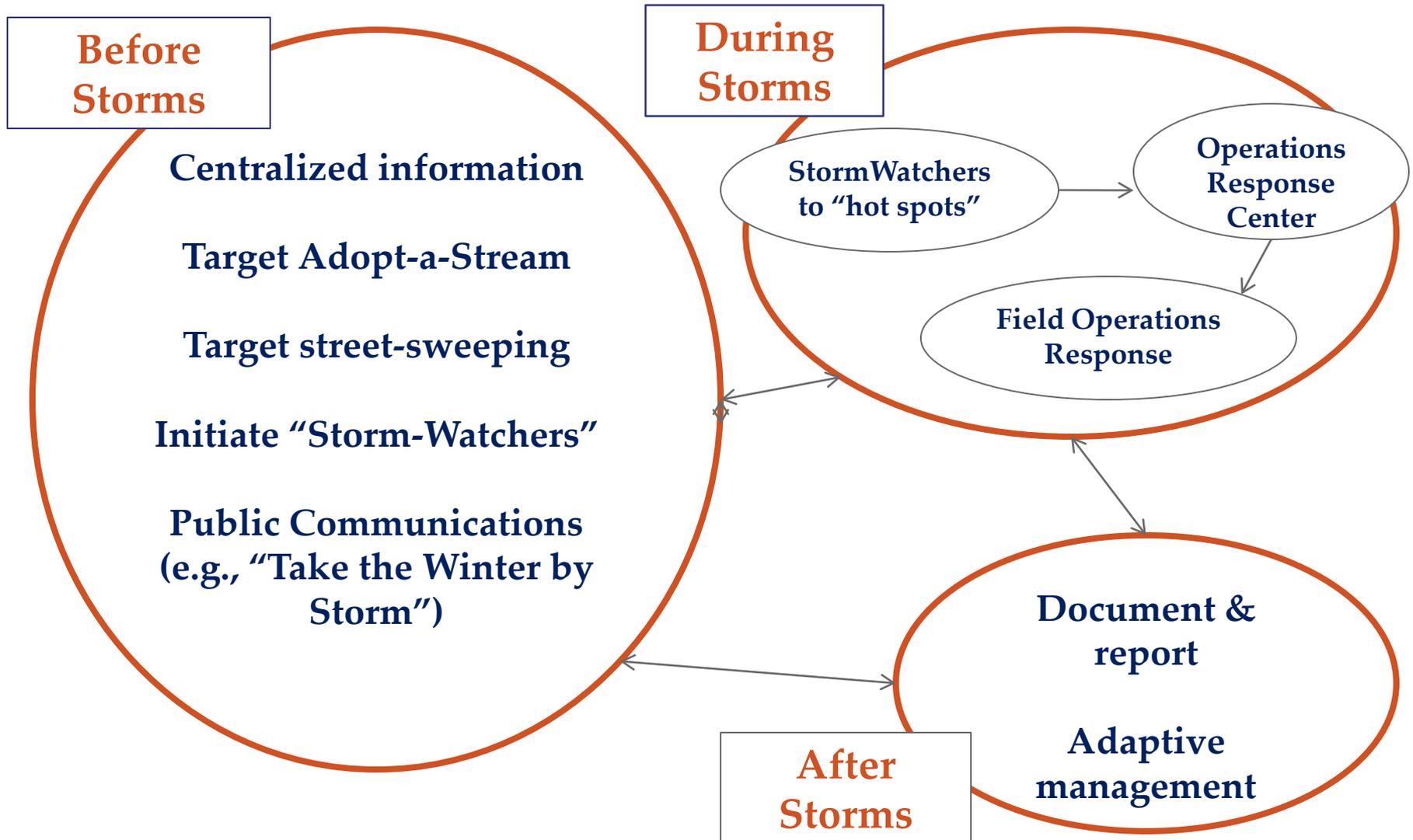
*Supply bars show Base plus Tiers; Demand bars show forecast plus climate*



# Example: urban flood management



# Revamping the whole approach



# Decentralized strategies: natural drainage



# Decentralized approaches: on-site capture and re-use



# Example: hydroelectricity supply

Seattle City Light's Generation Resources



- Skagit River is fed by snowpack and glaciers
- 2050s temperature increase  $3.5^{\circ}$  F relative to 1980-2000 ( $>2^{\circ}$  F in May and  $>5^{\circ}$  F in August)
- $1.8^{\circ}$  F increase reduces April 1 Snow Water Equivalent 20%



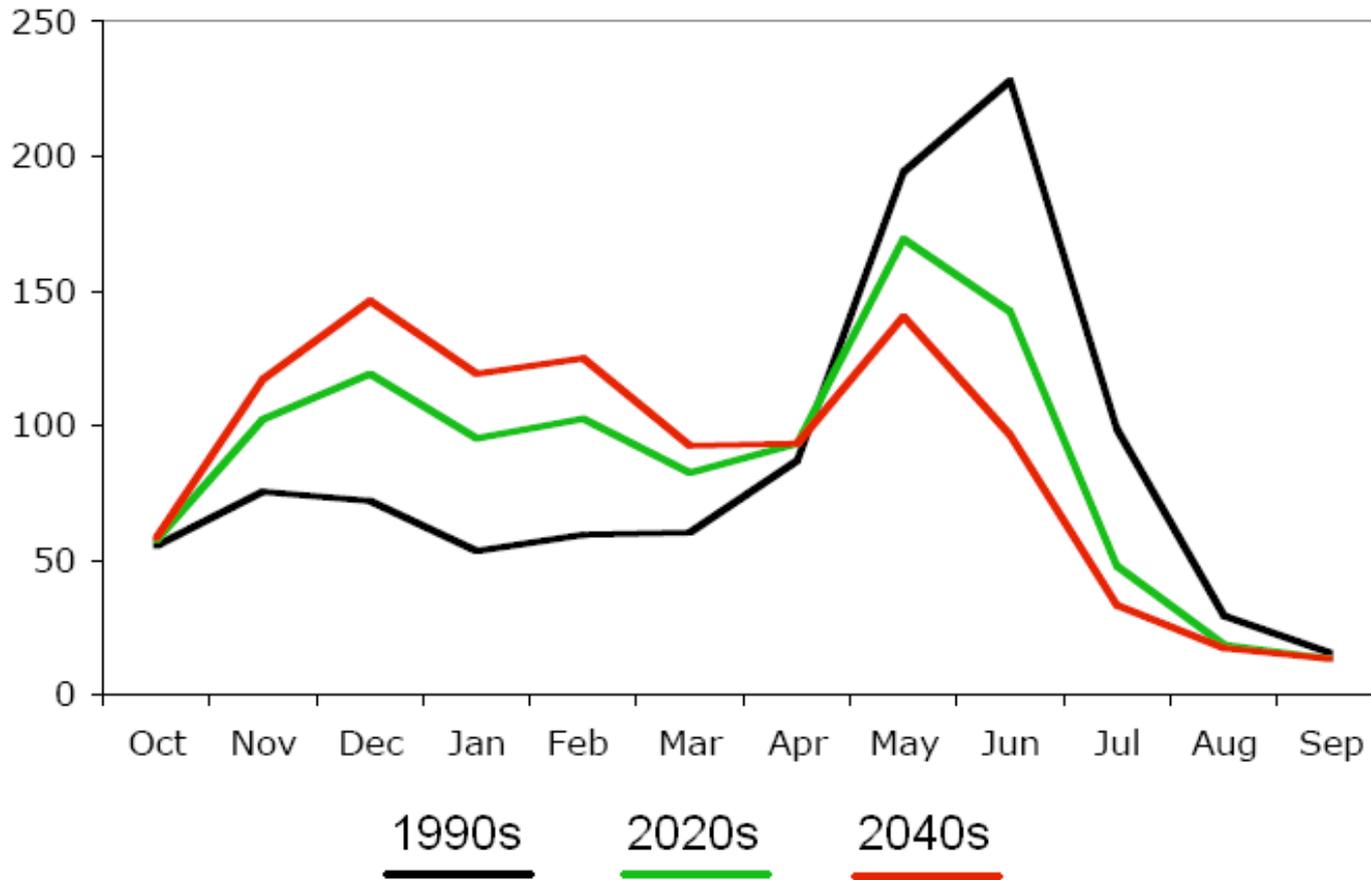
**By 2100, Aug.-  
Sept. flow could  
decrease  $>30\%$   
in some areas**

# Going, going...



**Whitechuck Glacier on Glacier Peak, 1988 & 2005**

# Supply down, demand up...



**Ross Average Monthly Inflow (cms)**

# SCL's approach to adaptation

- Understand the impacts
- Implement a portfolio of adaptation strategies
  - Conservation
  - Operational tweaks
  - Other sources of supply
  - Etc.
- Invest in research

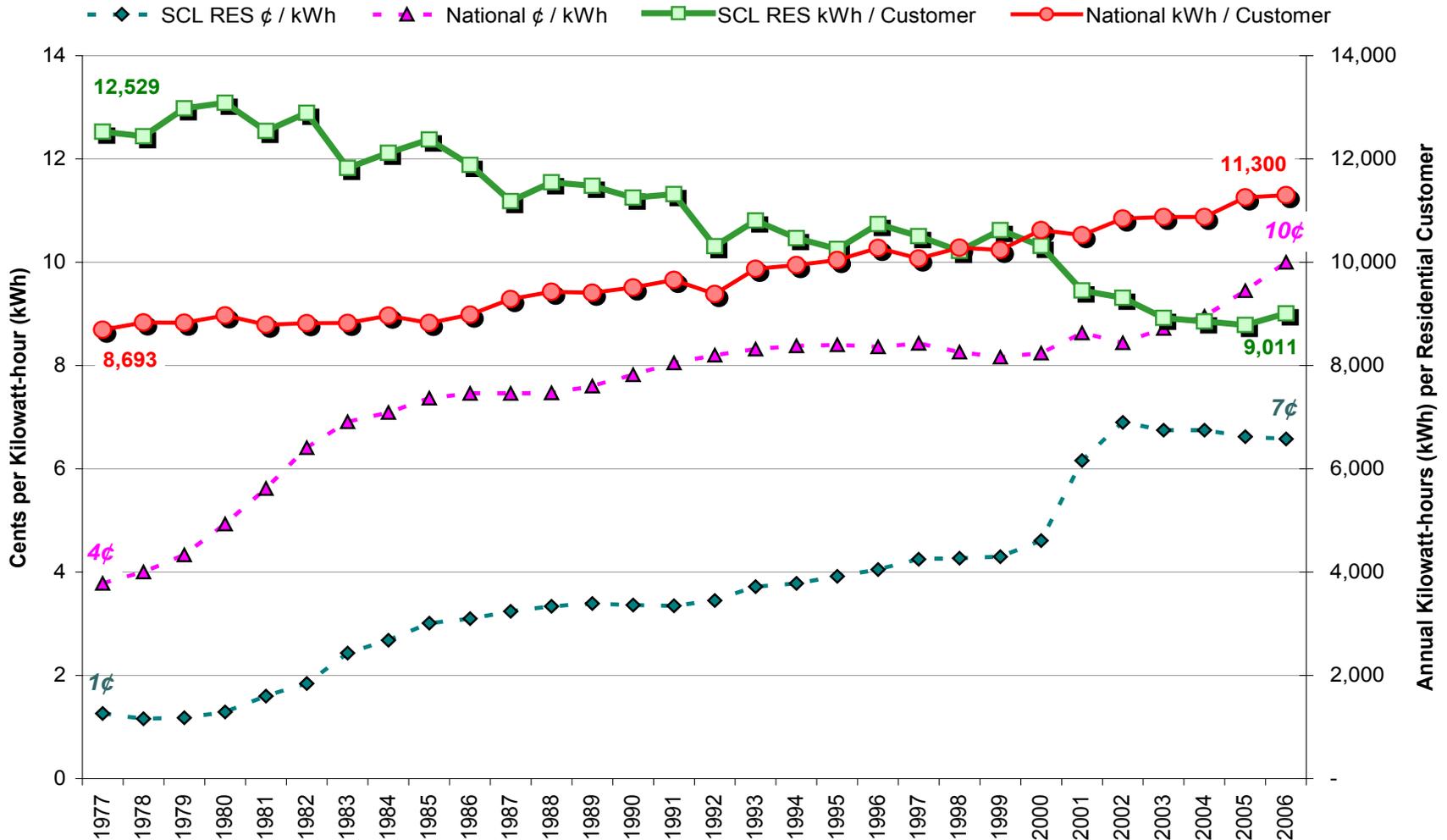


# Going “carbon-neutral”

- Seattle City Light: first US utility to go carbon-neutral (since 2005)
  - ✓ Increased conservation
  - ✓ Increased renewables (wind, geothermal)
  - ✓ Offsets (~200,000 tons/year)

# Again, conservation is key...

## Per Customer Usage and Average Residential Energy Price

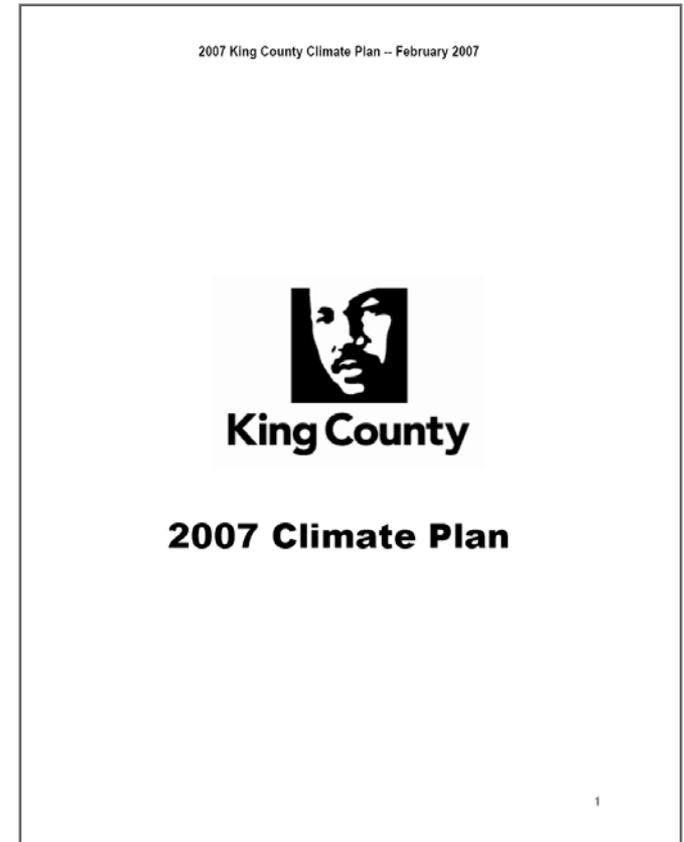


# Operational tweaks e.g. Gorge Tunnel II to increase efficiency – and supply

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# Climate adaptation: King County's approach

- Did mitigation and adaptation together
- Six focus areas:
  - Climate science
  - Public health/safety and emergency preparedness
  - Water resource management
  - Land use, buildings, transportation
  - Financial, economic impacts
  - Biodiversity & ecosystems





# Example: Flood Control District

- Up to \$335m to improve King County's system of 500 levees
- County purchase of most susceptible lands



# Example: reclaimed water from wastewater treatment

- Creating resources from wastewater
  - Continue and improve existing reclaimed water programs
  - Develop markets for reclaimed water
  - Complete a Draft Reclaimed Water Comprehensive Plan by 2011



# Example: vulnerability of wastewater treatment facilities to sea-level rise

- Identify facilities impacted by storm surges/sea level rise
  - Use GIS combining sea level rise projections + storm surge
  - Identify impact threshold
  - Characterize the impact (on-site flooding, hydraulic, operational)
- Adapt accordingly



# Example: transportation infrastructure



New \$24m bridge spanning the Snoqualmie River built with longer spans than previous bridge, increasing capacity to withstand high flows and major flooding

# Points to ponder...

- Much better to do mitigation and adaptation planning/action together
- Credible, coherent, consistent science on local/regional scale is both critical and elusive
- Institutional barriers are numerous, challenging and debilitating
- “Mitigation sells” (aka the politics of climate adaptation)
- Big need for community capacity-building on climate adaptation

# Climate Leadership Academy: Adaptation Edition

- Slated for 2010
- Intensive 2-3 day training and peer-learning workshop
  - Teams from 15-20 cities
  - Faculty/panel of experts
  - Lots of intra- and inter-team work
  - Resource guide
- Follow-up activities (on-going mentoring, etc.)

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