NACWA Summer Conference
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# Climate Initiatives and the Water Utility Climate Alliance

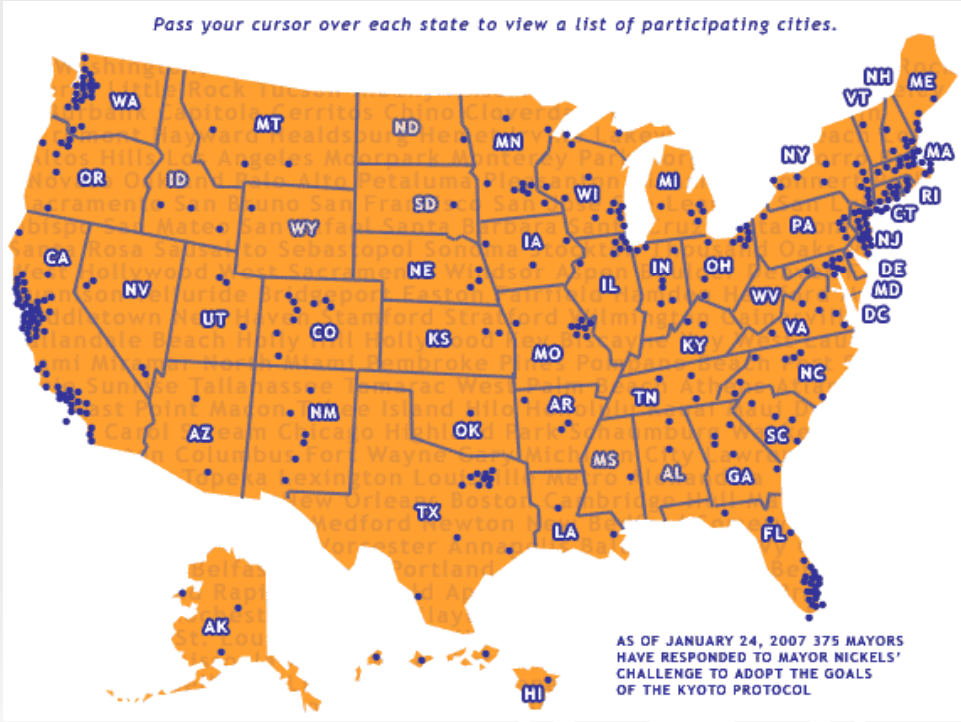
Nancy Ahern
Deputy Director
Seattle Public Utilities
nancy.ahern@seattle.gov

# My goal today

- Provide background on Seattle Public Utilities
- Focus on adaptation: describe results from assessment of climate impacts on drinking water and drainage & wastewater
- Linkages to Sustainability
- Water Utility Climate Alliance (WUCA)

# Seattle's Climate Protection Initiative

- US Mayors Climate Protection Agreement
  - 780 signatories
  - 90 million Americans
- City of Seattle Climate Action Plan
  - Mitigation (reduce emissions)
  - Adaptation (develop city-wide adaptation strategy)
  - http://www.ci.seattle.wa.us/climate/

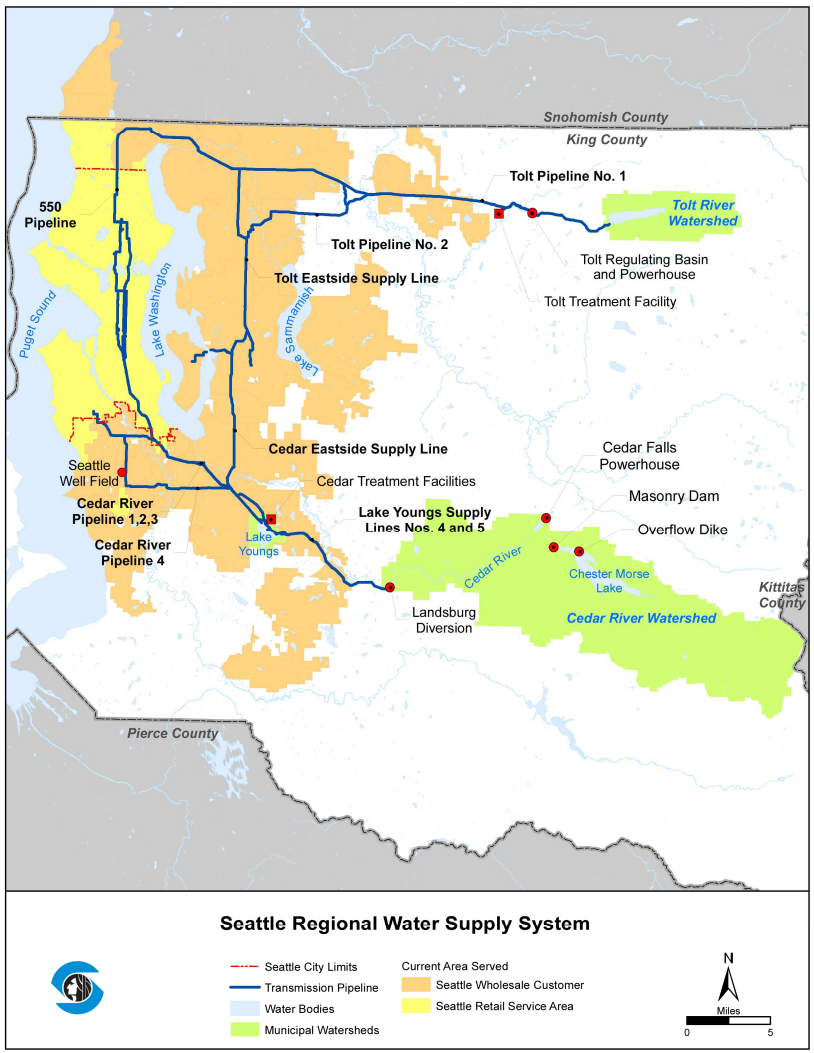


# Actions around Mitigation

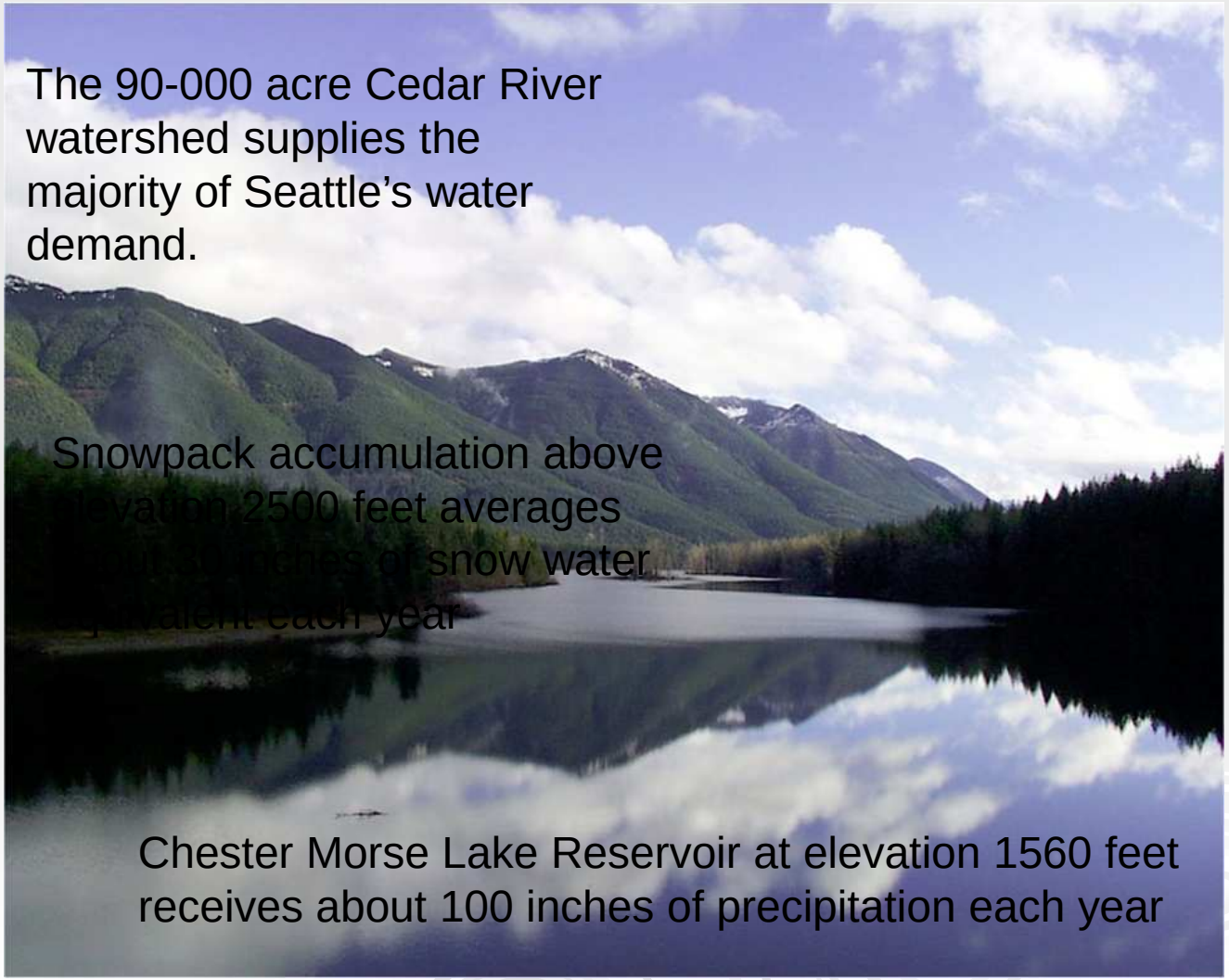
- Greenhouse Gas inventory and reduction strategy (California Climate Action Registry; others)
- Consider energy use and sources (3%; 45MT GHG)
- Fleet
- Incorporate life cycle emissions into capital planning
- Many more

# Background and Context: Drinking Water

- Sources
  - Cedar and Tolt Rivers
  - Reservoirs in Cascades
- Responsibilities
  - Water supply (1.4 million people)
  - Habitat protection / instream flow management
  - Flood management
- System Drivers
  - Supply
    - Rain, snow, reservoir storage, system operations
  - Demand
    - Weather, conservation, demand management

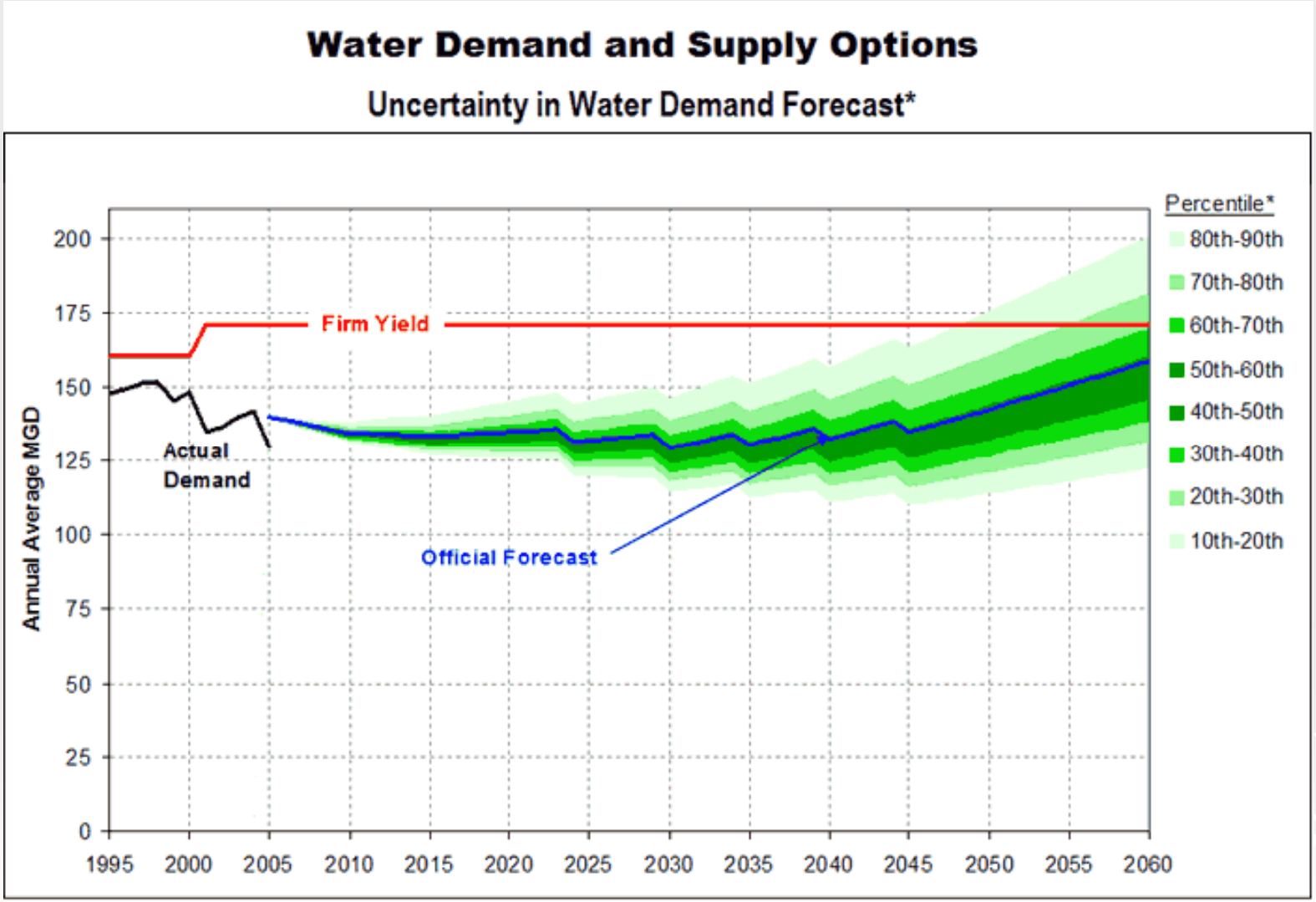


# Background and Context: Chester Morse Lake Reservoir




Adapted From: SPU Archives

# Current Demand Forecast




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 Climate Change Adaptation

Approach:

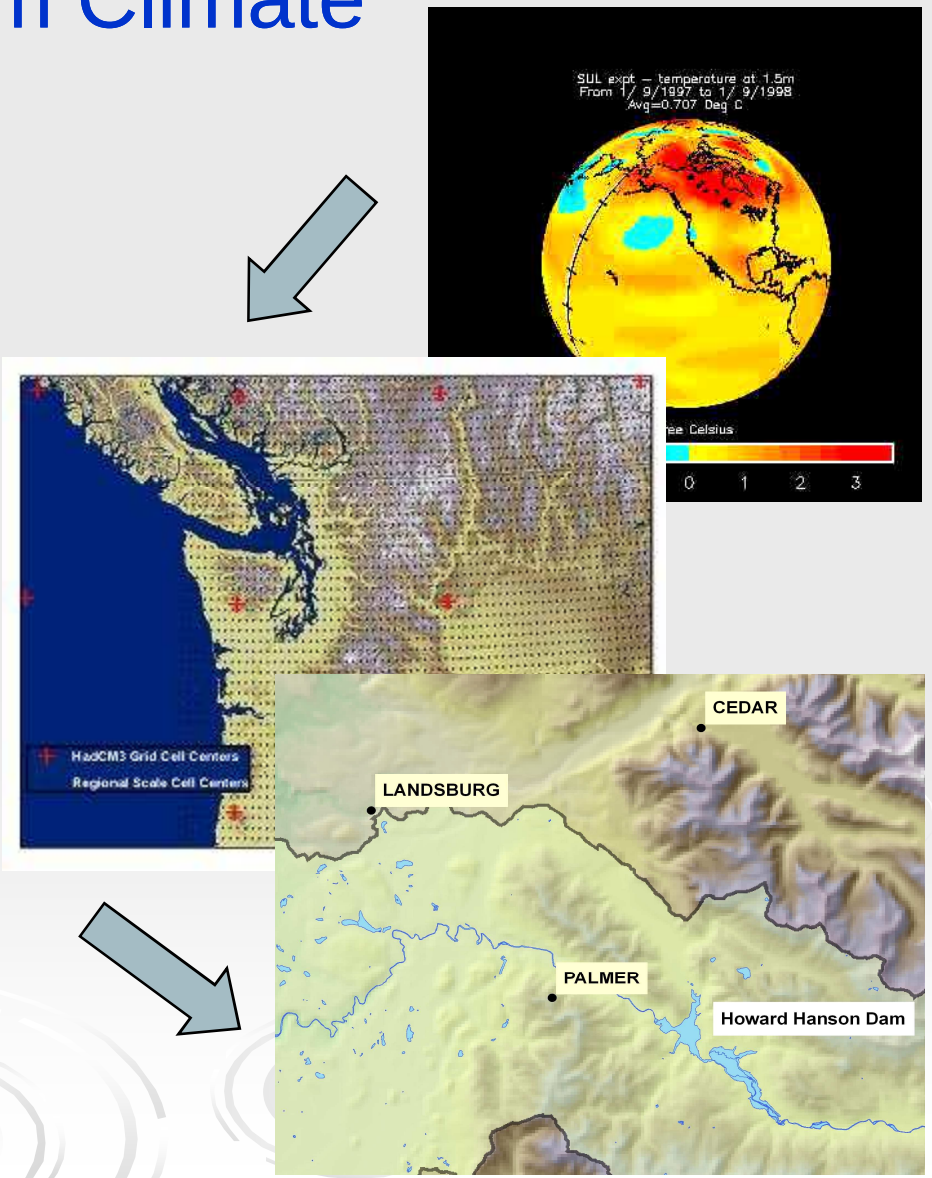
Invest in actions that mitigate uncertainty and enhance system flexibility and resiliency

Key elements:

1. Identify potential impacts through downscaling
2. Characterize system specific strengths and vulnerabilities
3. Adjust operations to test system flexibility
4. Develop portfolio of adaptation options
5. Engage in ongoing research & collaboration

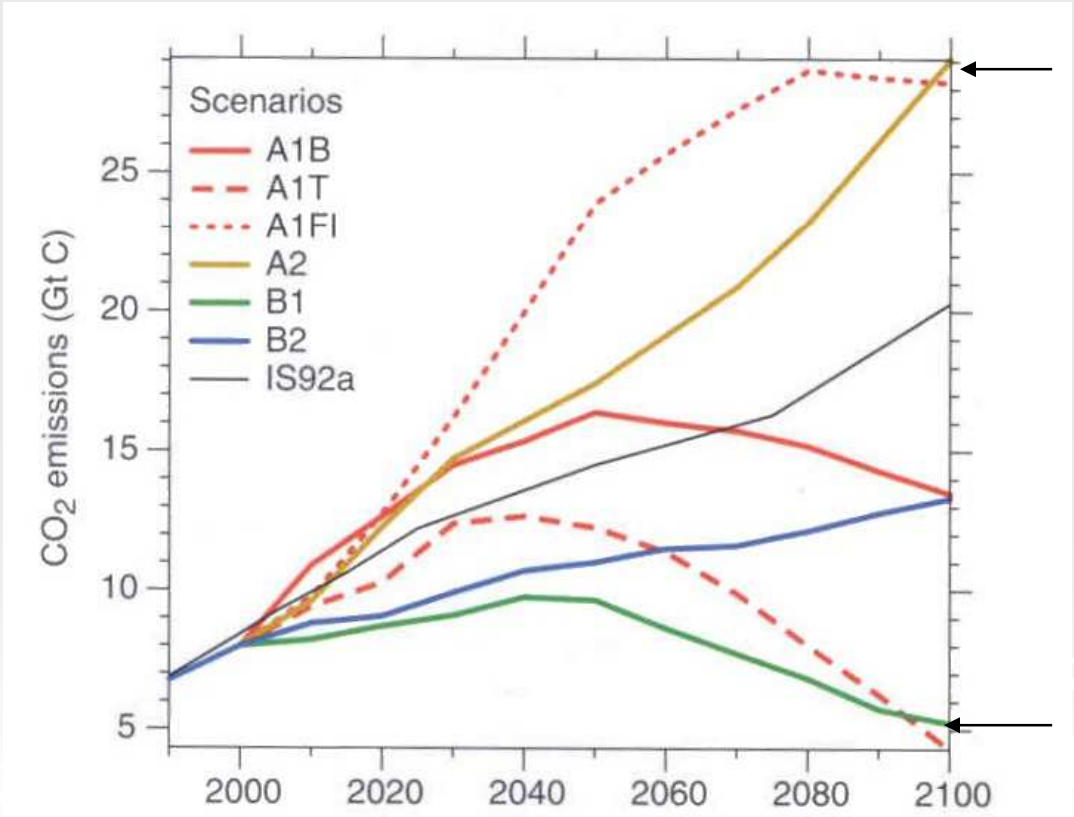
# Projecting Impacts from Climate Change

- Conducted two downscaling studies
  - Worked w/ University of Washington
  - General Circulation Models (GCMs) coupled with emissions scenarios
  - Model runs statistically downscaled, precipitation and temperature data through hydrology model
- Run future, climate-altered hydrology run through water supply system model
  - Substitute *historic* hydrology with *future* hydrology
  - Data for 2000, 2025, 2050 and 2075
  - Project how system would perform under various climate scenarios
- Will focus on results of the most recent assessment



# 2007 Study: Selecting GCM-Emission Scenario Couplings

| model |
| --- |
| PCM1 |
| GISS-ER |
| CSIRO-MK3 |
| CGCM3.1 |
| CCSM3 |
| HadCM3 |
| CNRM_CM3 |
| MIROC_3.2 |
| IPSL_CM4 |
| ECHAM5 |



# Climate Change Scenarios

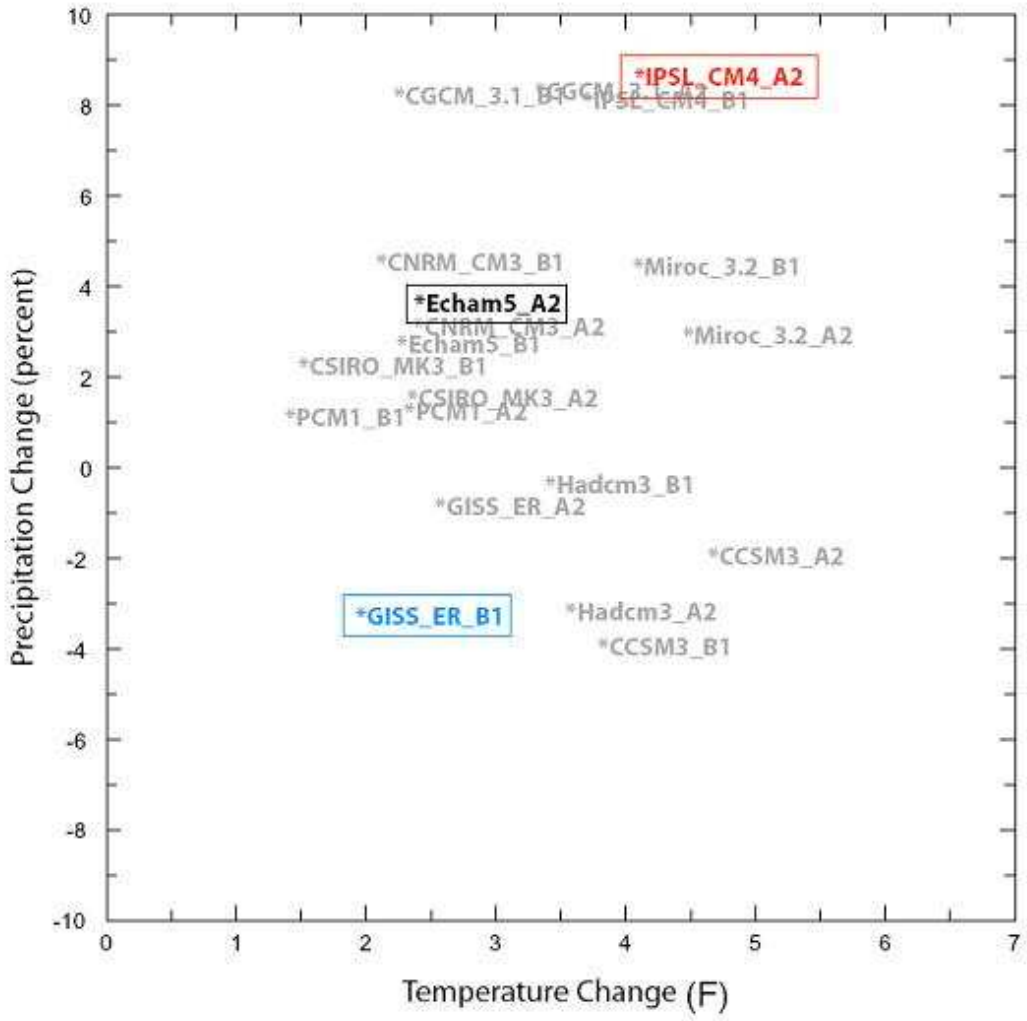
Selected 3 GCM model/scenario couples that provide a broad range of future scenarios for Pacific Northwest:

-Warm

-Warmer/Mid-range

-Warmest

*Based on simple average of the temperature and precipitation values at all the Pacific Northwest grid points to define a regionally averaged time series. Here, the Pacific Northwest is defined as the region between 124°and 111°west longitude, 42°to 49°north latitude: Washington, Oregon, Idaho, and western Montana. GCMs have different resolutions; the number of model grid points enclosed in this latitude-longitude box is typically 12-20.*



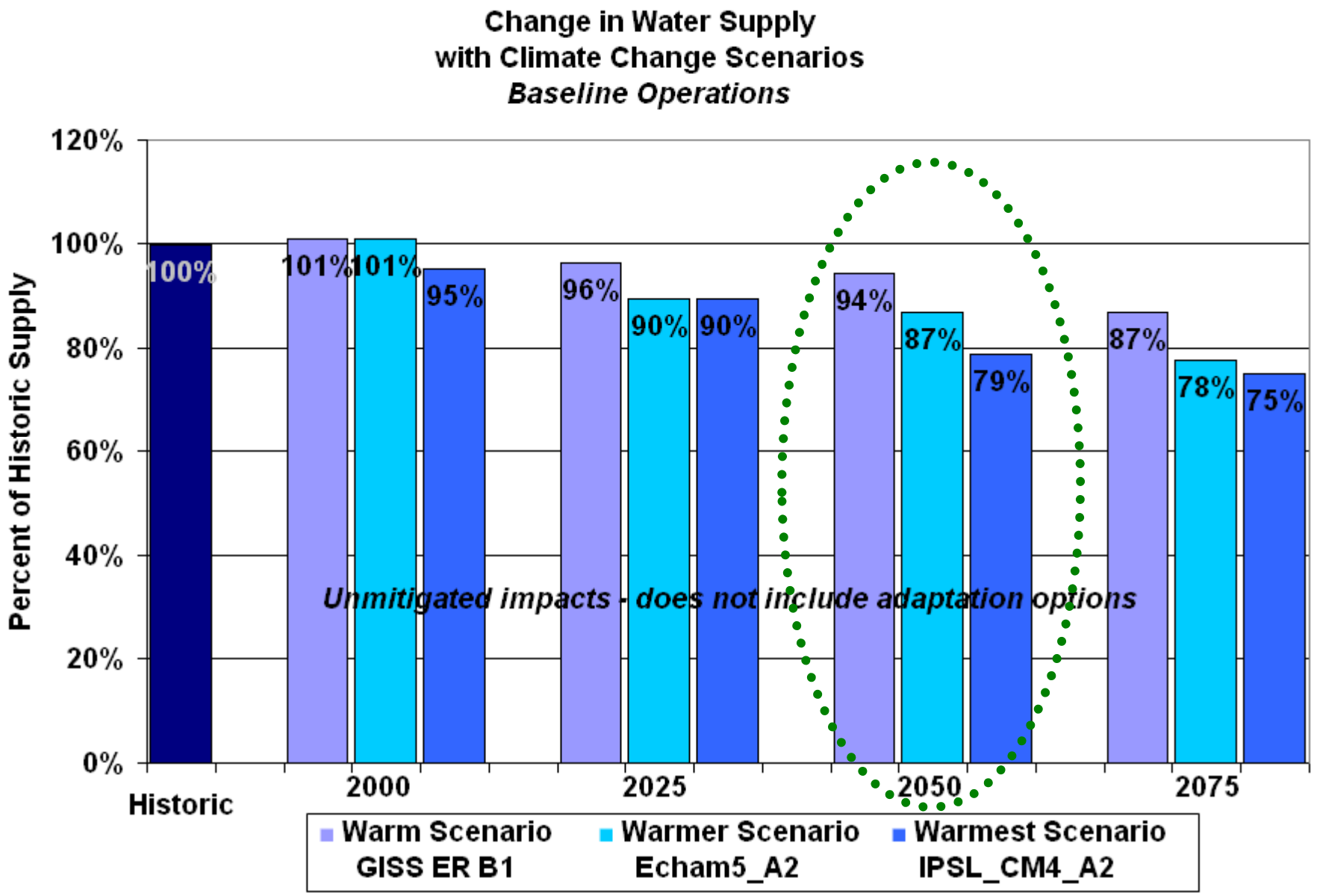

**Scatterplot of Change in Annually Averaged Temperature and Precipitation for Various GCM-scenario Combinations as of 2040's (2030 - 2059 minus 1970 - 1999)**

Source: Mote, P. W., E. Salathe, and C. Peacock. 2005. Scenarios of Future Climate for the Pacific Northwest. University of Washington: Climate Impacts Group.

# Regional Climate Impacts

Downscaled GCM outputs to regional scale

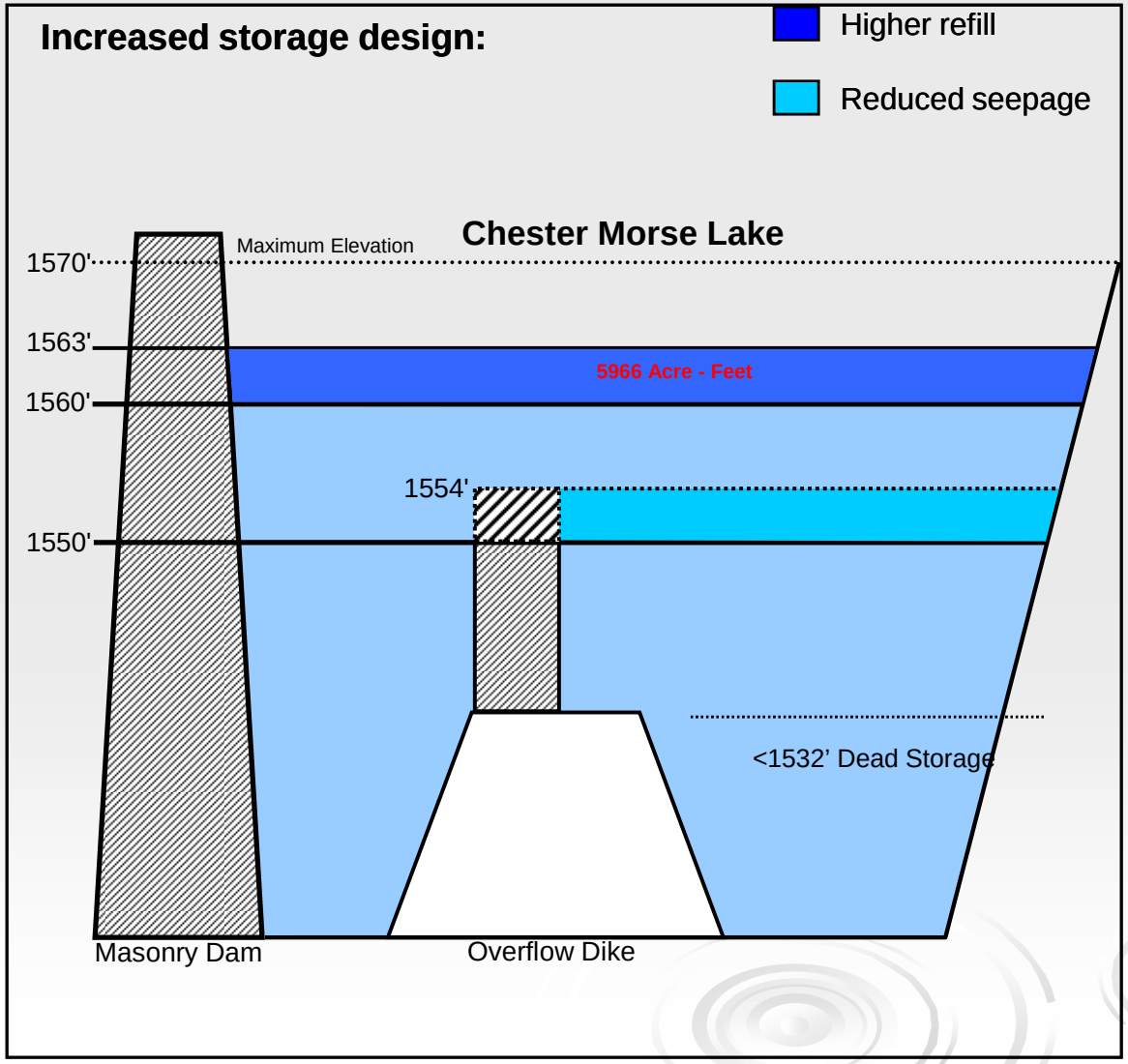
- Temperature
  - Warming trend in all scenarios
  - Most warming in winter and summer
  - Average warming is generally 1°C per 25-year period
- Precipitation
  - More precipitation relative to historic annual average; less agreement between models
  - In general, more precipitation in winter, less in summer
- Hydrology
  - Shift towards higher winter flows and lower spring/early summer flows


Change in Water Supply
with Climate Change Scenarios
Baseline Operations
Percent of Historic Supply
120%
100%
80%
60%
40%
20%
0%
100%
101%
101%
95%
96%
90%
90%
94%
87%
79%
87%
78%
75%
Unmitigated impacts - does not include adaptation options
Historic
2000
2025
2050
2075
Warm Scenario
GISS ER B1
Warmer Scenario
Echam5_A2
Warmest Scenario
IPSL_CM4_A2

# Portfolio of Adaptation Options

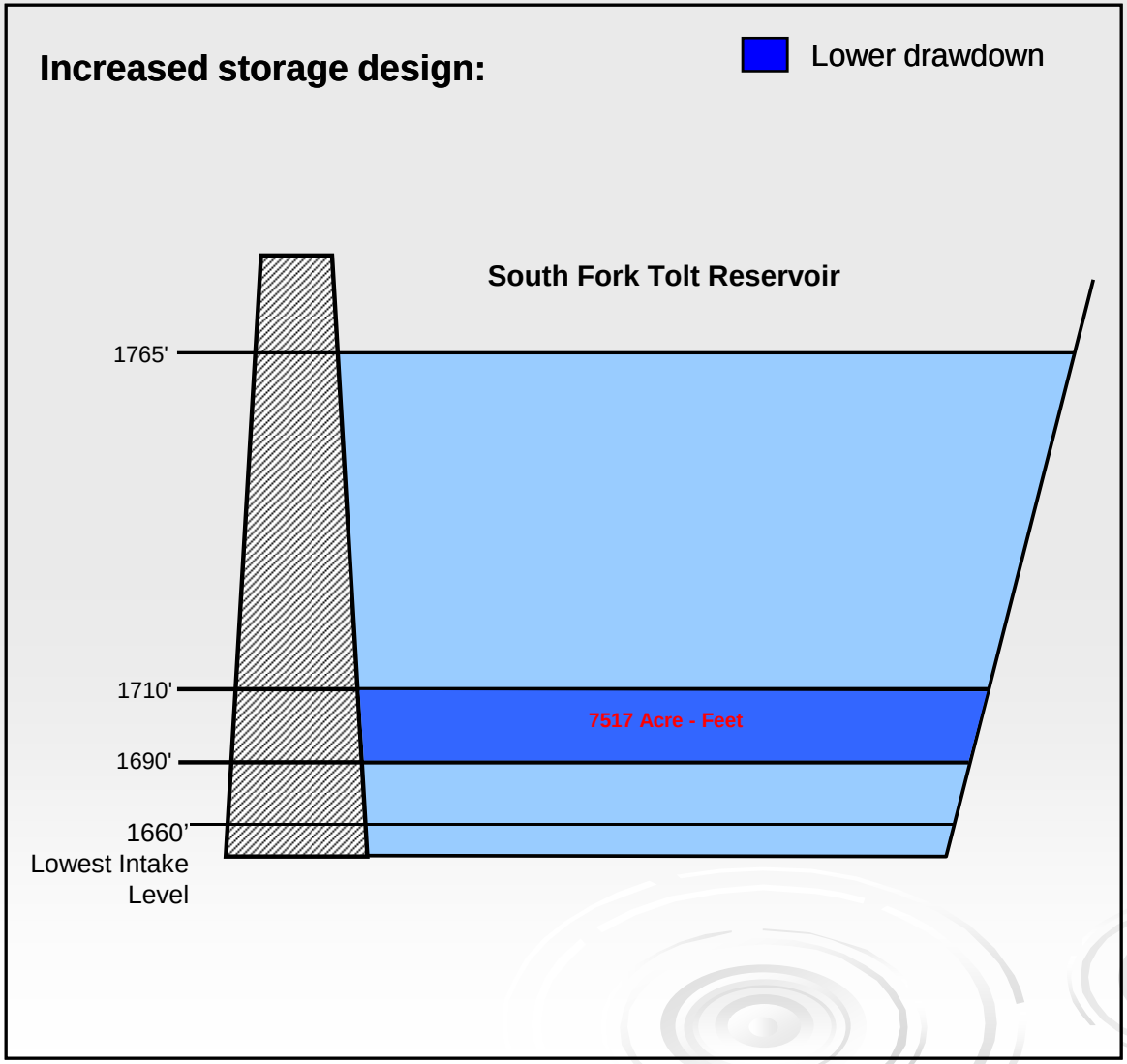
- Portfolio of options instead of single, large projects
- Identify system operation modifications before new supply
- Grouped options into tiers.  Tiers are dynamic; will change and evolve.  Increase in risk and level of investment.
- Adapt from additional tiers if necessary.

# Technical Options: Tier 1 Modifications – Cedar River




- Refill to 1563 m
  - Current practice but 1560' used for firm yield
  - 12% more useable storage

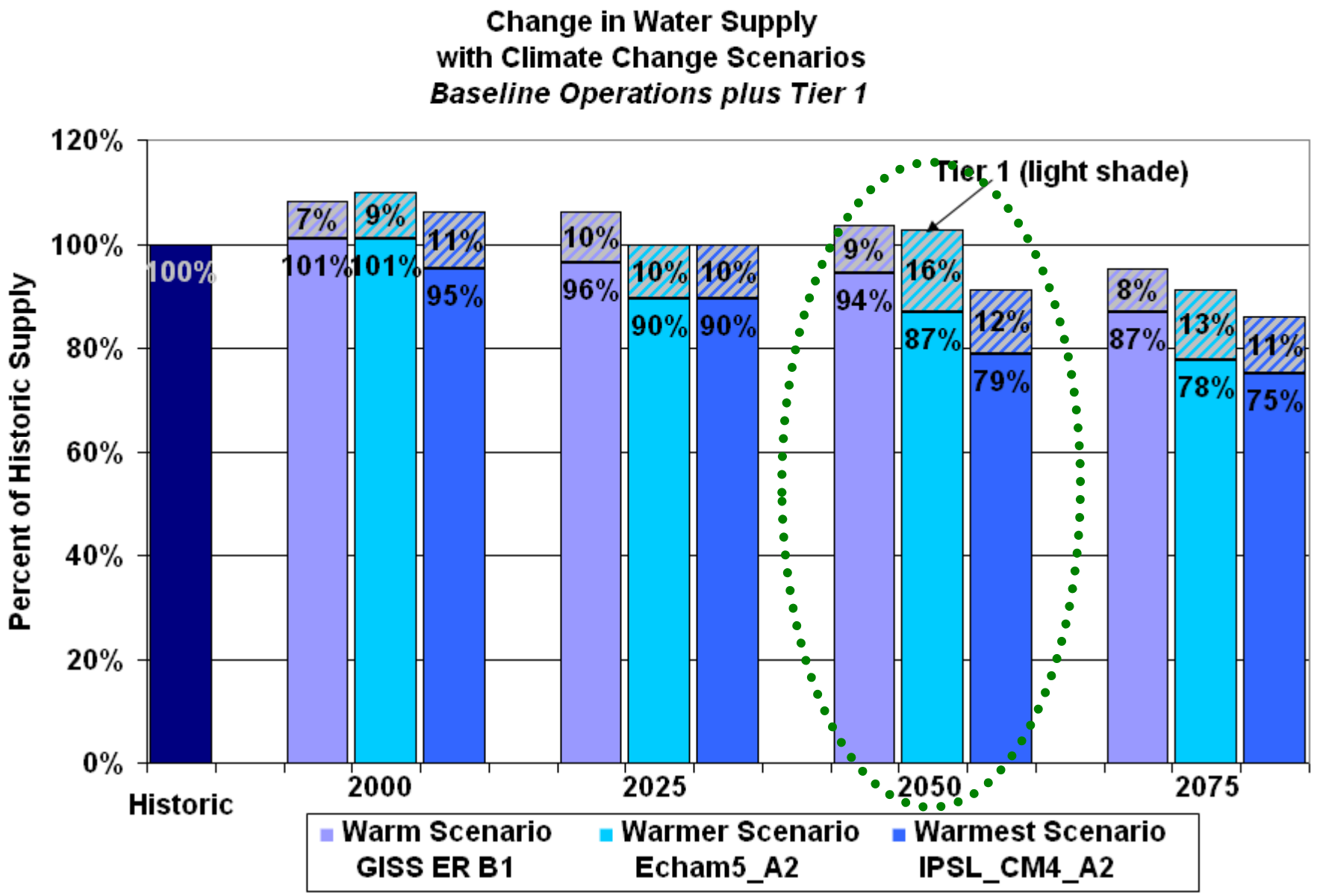
# Technical Options: Tier 1 Modifications - Tolt River




- Draw down to 1690'
  - Currently 1710' used for firm yield
  - 18% more useable storage

# Next Tiers Available to SPU

- **Tier 2 – Next Tier of Intra-System Modifications**
  - Include additional use of Lake Youngs Storage
  - Modified/optimized conjunctive use operations
  - Additional conservation programs after 2030
- **Tier 3 – Greater Use of Storage**
  - Higher refill levels at Chester Morse Lake
  - Higher flood pool level at CML (assumes max level increased to 1575)
- **Tier 4 – New Supply Alternatives**
  - Deeper drawdown of South Fork Tolt reservoir
  - Deeper drawdown of Lake Youngs, Cedar Filtration
  - Use of Dead Storage for normal supply, after pumping plant replacement
  - Develop North Fork Tolt Diversion
  - Develop Snoqualmie Aquifer Project
  - Northshore and Woodinville develop Weyerhaeuser/Everett supply
  - Reclaimed water projects in Retail Service Area
  - Additional conservation programs
- **Tier 5 – New Supply Concepts**
  - Reclaimed water projects in Wholesale Service Area
  - Desalination plant
  - Higher refill levels at Tolt reservoir (raising ring gate)
  - Etc.


Change in Water Supply
with Climate Change Scenarios
Baseline Operations plus Tier 1
Percent of Historic Supply
120%
100%
80%
60%
40%
20%
0%
Tier 1 (light shade)
100%
7%
101%
9%
101%
11%
95%
10%
96%
10%
90%
10%
90%
9%
94%
16%
87%
12%
79%
8%
87%
13%
78%
11%
75%
Historic
2000
2025
2050
2075
Warm Scenario
GISS ER B1
Warmer Scenario
Echam5_A2
Warmest Scenario
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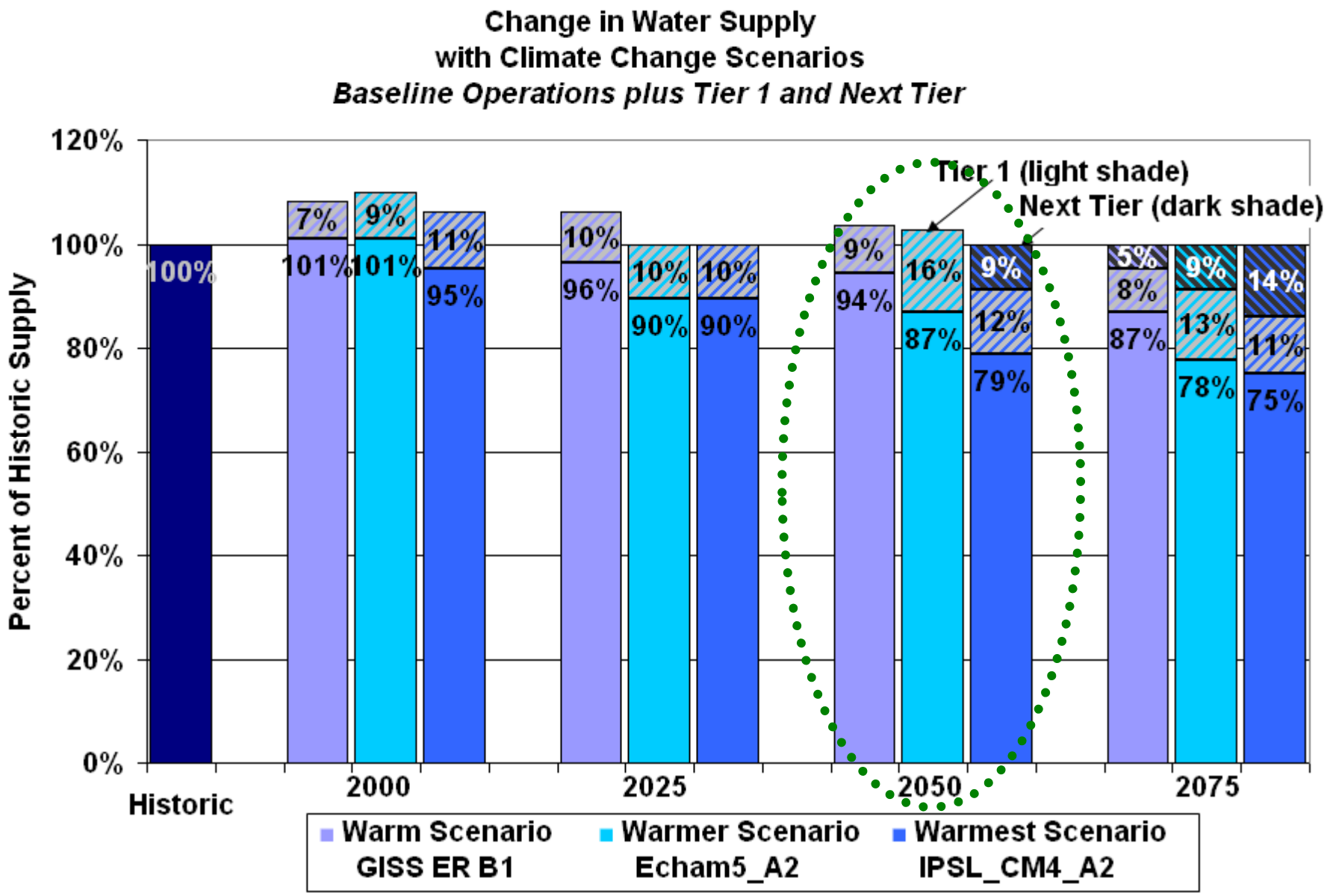
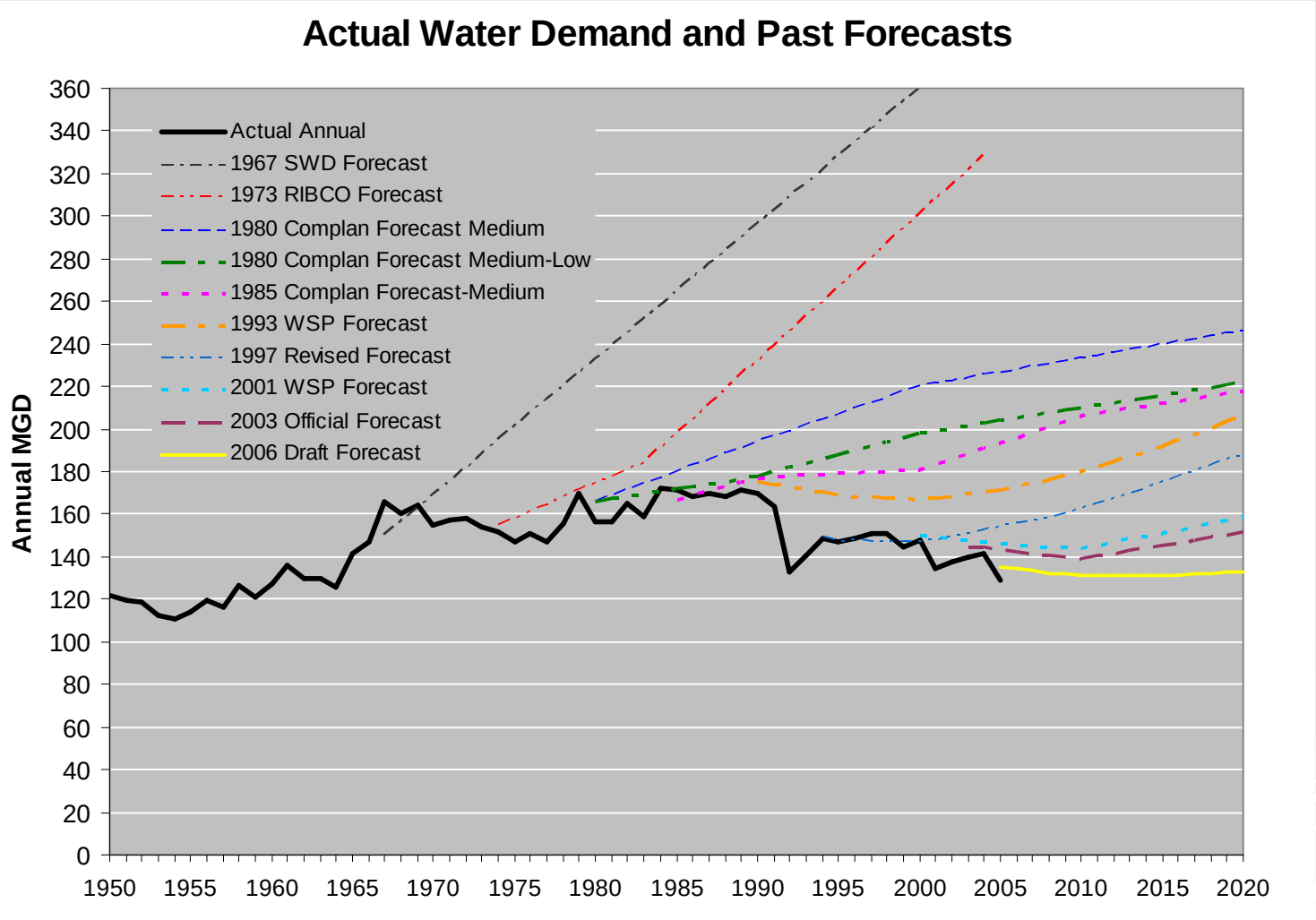
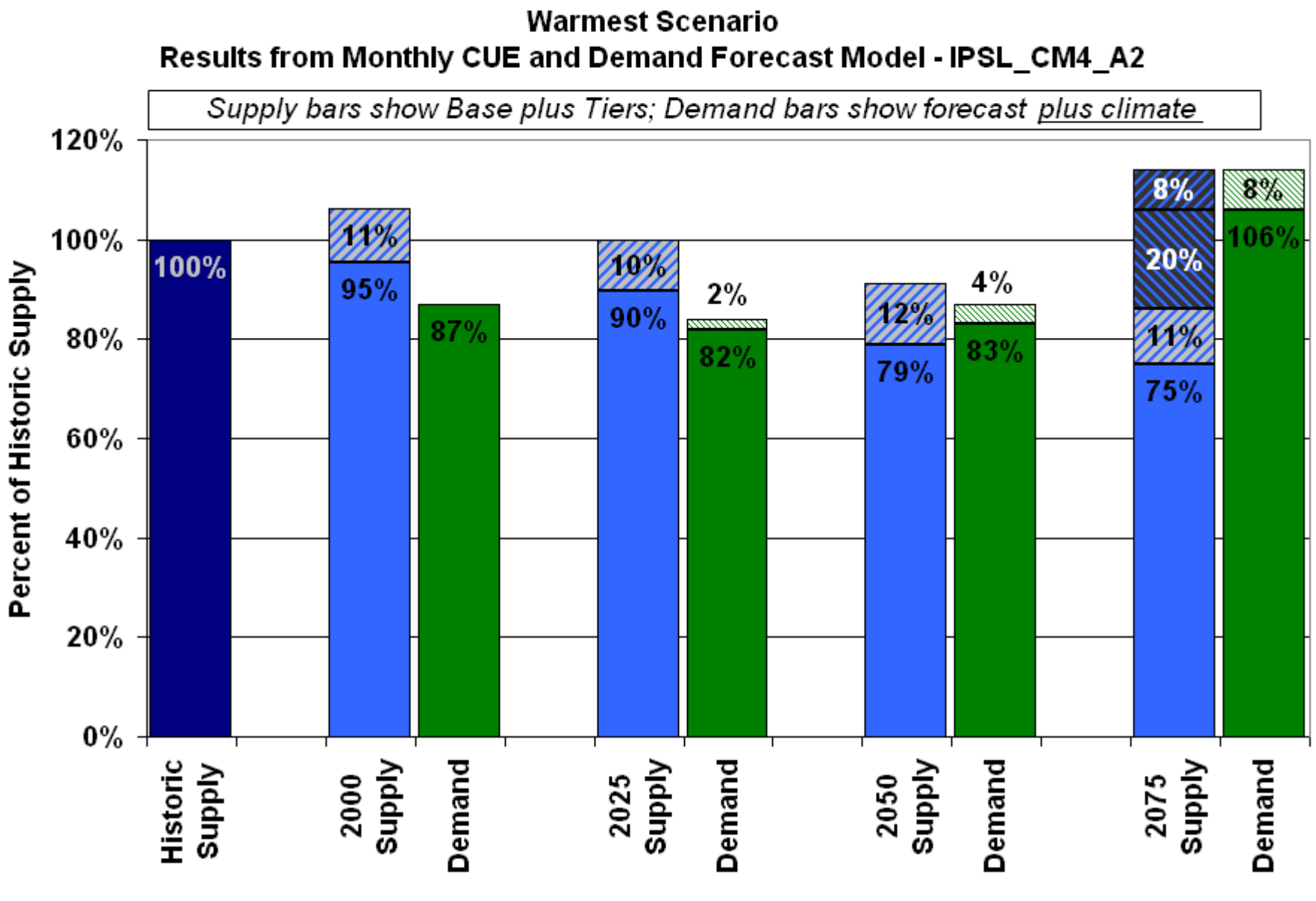

Change in Water Supply
with Climate Change Scenarios
Baseline Operations plus Tier 1 and Next Tier
Percent of Historic Supply
120%
100%
80%
60%
40%
20%
0%
Tier 1 (light shade)
Next Tier (dark shade)
100%
7%
101%
9%
101%
11%
95%
10%
96%
10%
90%
10%
90%
9%
94%
16%
87%
9%
12%
79%
5%
8%
87%
9%
13%
78%
14%
11%
75%
Historic
2000
2025
2050
2075
Warm Scenario
GISS ER B1
Warmer Scenario
Echam5_A2
Warmest Scenario
IPSL_CM4_A2

# Forecasting Demand




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
Percent of Historic Supply
120%
100%
80%
60%
40%
20%
0%
100%
11%
95%
87%
10%
90%
2%
82%
12%
79%
4%
83%
8%
20%
11%
75%
8%
106%
Historic Supply
2000 Supply
Demand
2025 Supply
Demand
2050 Supply
Demand
2075 Supply
Demand

# Conclusions & Caveats

- Climate will affect demand and supply
- Tier 1 adaptations should begin now
- Improvements in GCMs, changes in emissions scenarios will refine understanding of, and likely generate different, impacts. Ongoing research and collaboration is essential
- Impacts on water quality (temperature, algae) and catastrophic impacts (forest fire, multiple dry years) need to be further considered
- Use of rainwater, greywater, and wastewater emergent.

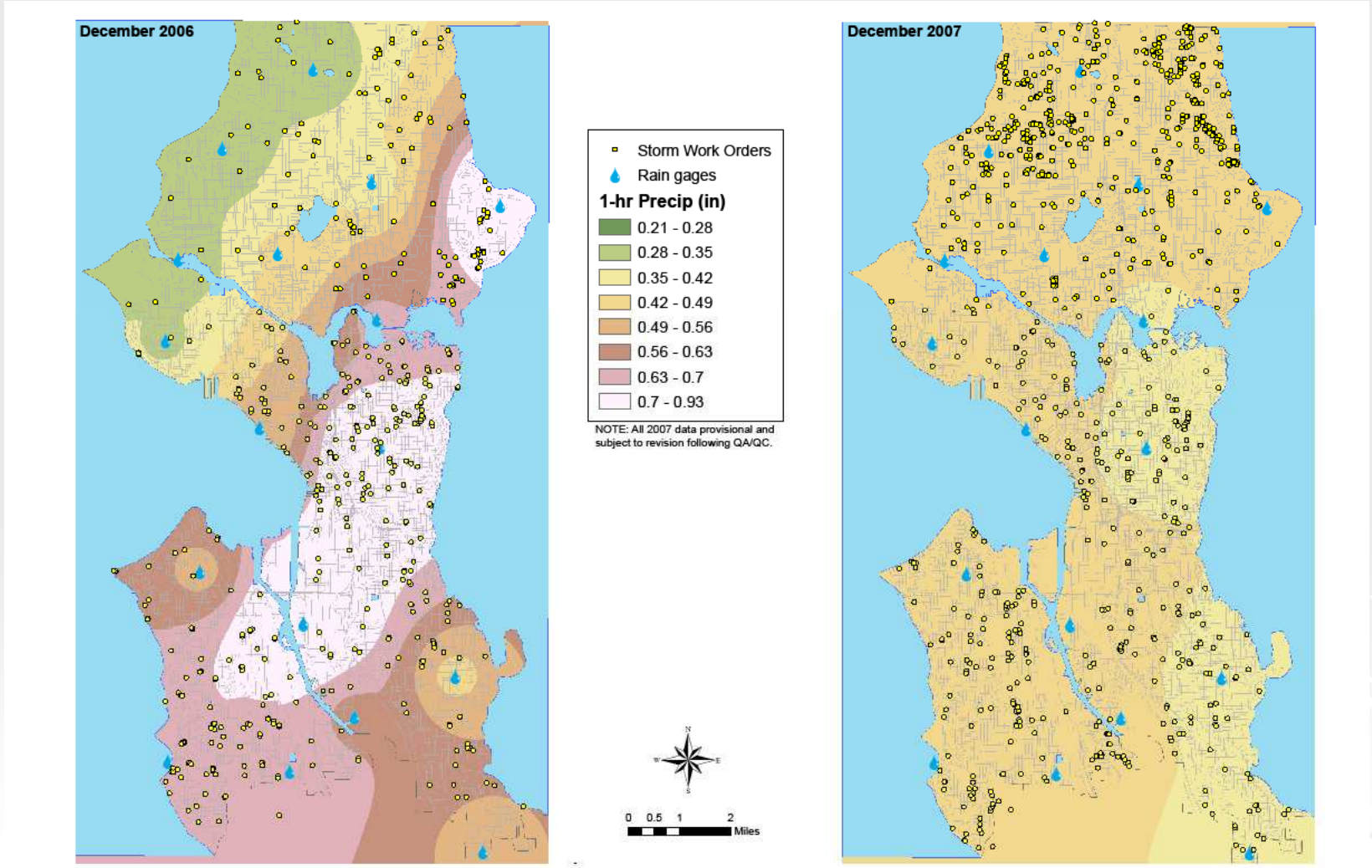
# Background & Context: Drainage and Wastewater

- Emerging area of concentration
- Storm events, land use, sea level drive system design
- Storm intensity and sea level rise could have profound impacts on system performance
- Expensive and disruptive to retrofit underground pipes in urban setting
- Need to understand potential of “soft path” approaches to extend capacity

# Drainage & Climate Adaptation

- Analyze historic storm & precip patterns
- Assess current practices
- Project future impacts through downscaling
- Identify high priority impact areas based on recent storms
- Cultivate portfolio of adaptation options
- Seek out best practices from other areas
- Facilitate interdepartmental collaboration

# A Tale of Two Storms: 1 hr precip



# Assess Current Practices

- Field O&M
  - Increased public outreach (Adopt a Drain)
  - Urban Flood Response Activation Plan
  - Strategic maintenance
- Rainfall Monitoring
  - Installed alarm triggers
  - Adding gages
- Design Methods & Standards
  - Incorporating flood resiliency
  - Integrating roads and parks into flood control
- Low Impact Development
  - Onsite approaches to maintain or improve existing capacity
  - Multiple benefits

# Portland's Green Street Demonstration Projects:

NE Siskiyou Green Street

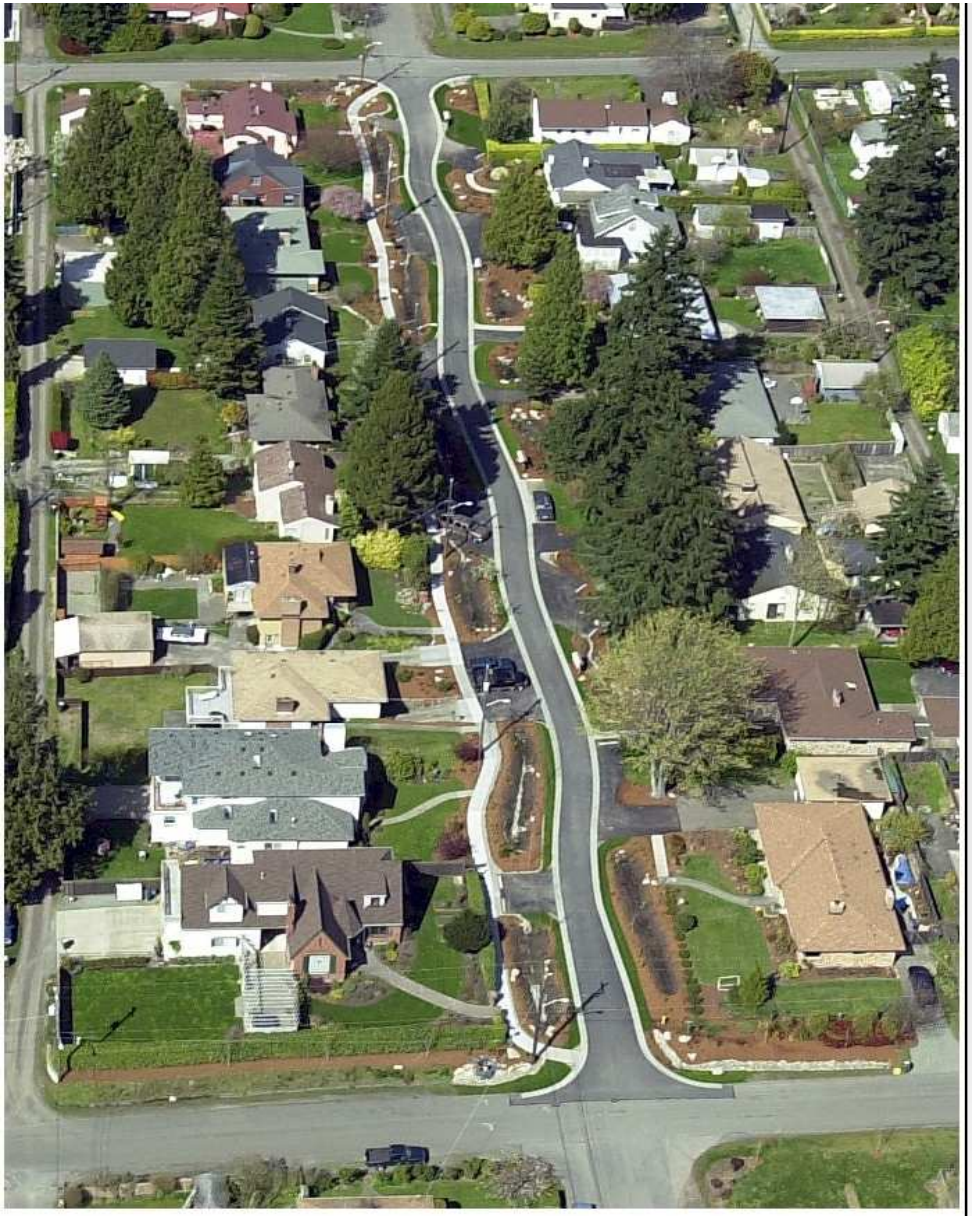
SW 12th Avenue Green Street

Glencoe Elementary Raingarden

Others…

Drawn by: Kevin Perry

April 27, 2005



SEA Streets - After Construction
2nd Ave NW - NW 117th St to NW 120th St

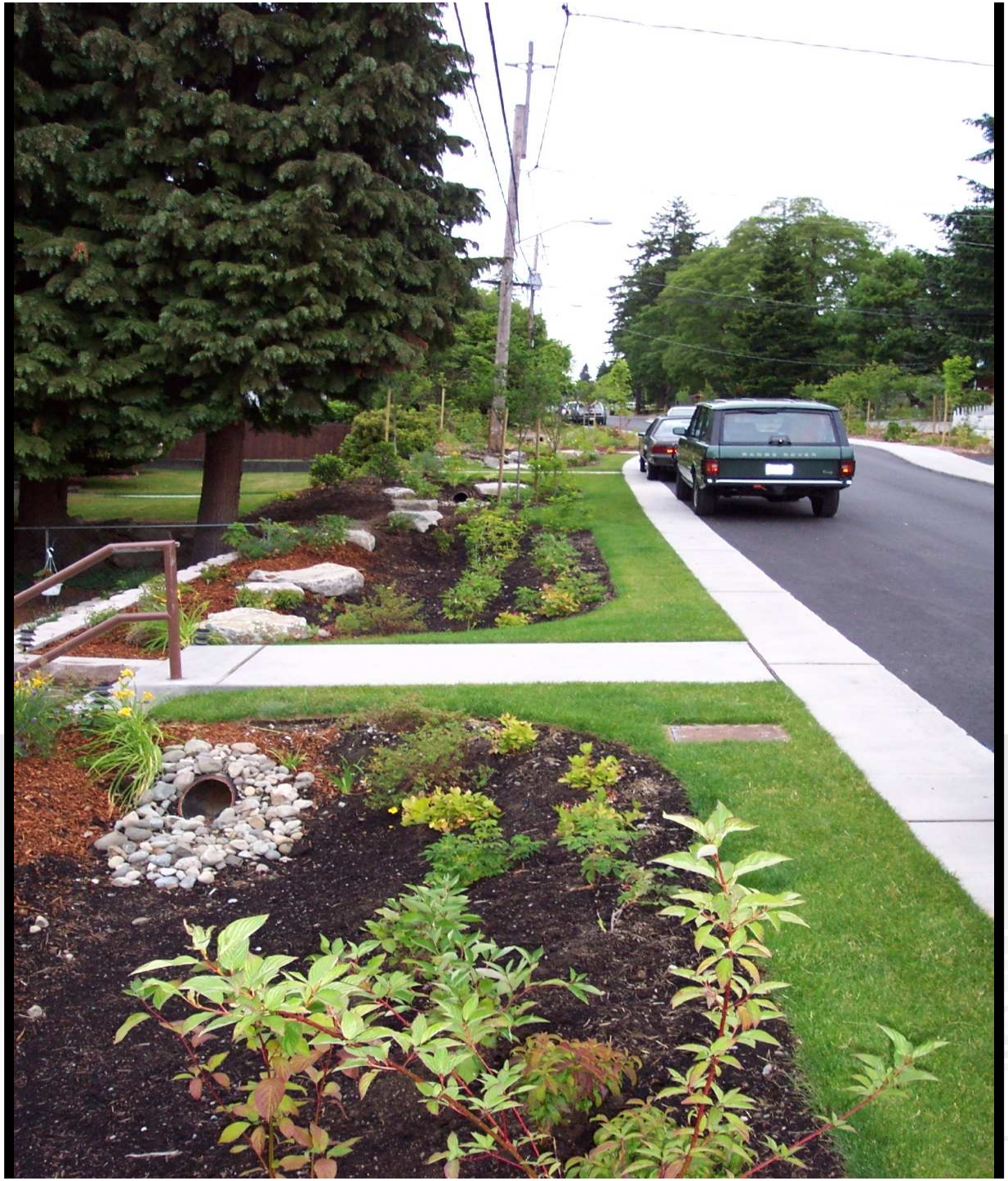
**SEA Street monitoring results for four years:**

# 99%

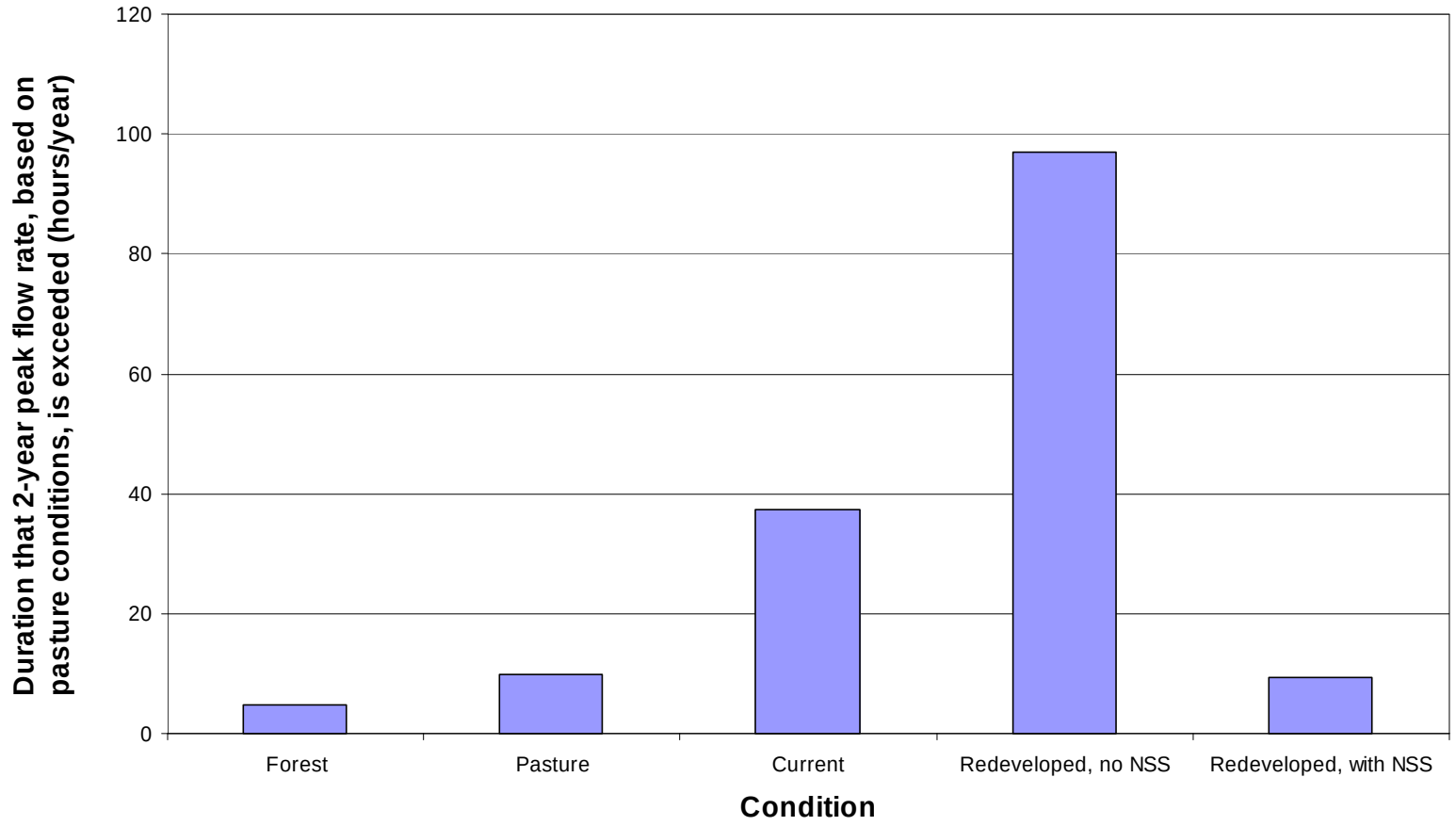
**reduction in total runoff volume**

# High Point Neighborhood


Vertical Mar 17



# Case Study: High Point Redevelopment, Seattle, WA



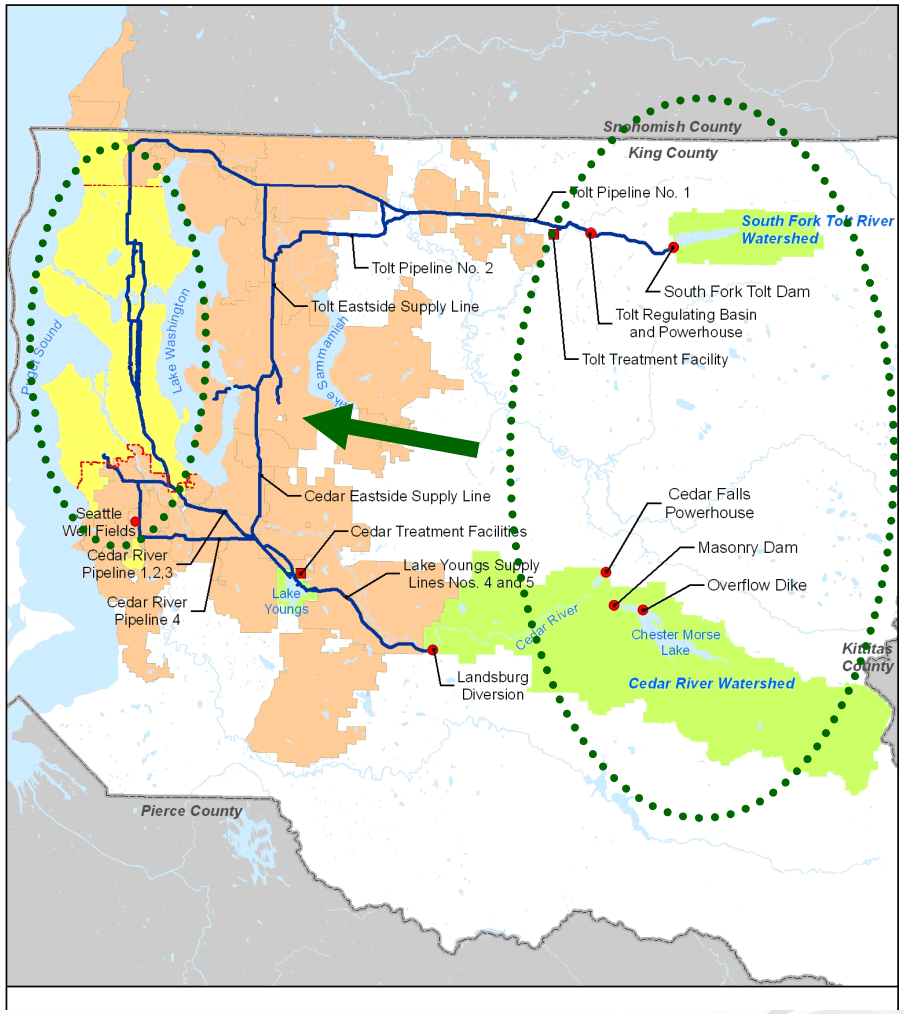
# Drainage Workshop

- Purpose – hear from researchers and practitioners about how they're approaching drainage adaptation
- Oct. 30-31
- 100 attendees
- Participants from UK, Netherlands, NYC, SF, Vancouver, Chicago and local cities

# Drainage Workshop: Themes

- Capacity building (physical and institutional), enhancing resiliency
- We can't build our way out of this challenge
- Portfolio approach (structural vs. non-structural approaches)
- "Dual" Infrastructure that serves multiple functions (roads & parks as storage)
- Public engagement
- Planning with uncertainty
- Integration of flood control & water quality; use of LID/BMPs

# Integrated Water: Blue, Grey, Black Strategies




- Context
  - 37” of rain fall in Seattle
  - 126 mgd consumption, 50% non-potable
  - Drainage and wastewater infrastructure issues
  - 1-2% redevelopment per year
- “Blue”
  - Seattle received water right to harvest rainwater
  - Multiple proejcts, one will install 1 M gal cistern, use for toilet flushing and cooling
- “Grey”
  - Allowed provided certain technology is used
- “Black”
  - Onsite wastewater treatment
  - Initial interest in marketplace
  - Exploring issues associated with permitting

# Water Utility Climate Alliance (WUCA)

- Outgrowth of Water Utility Summit in San Francisco, January 2007
- Chaired by SFPUC
- Eight large urban water suppliers
  - Seattle Public Utilities
  - Portland Water Bureau
  - SF Public Utilities Commission
  - Metropolitan Water District of Southern CA
  - San Diego County Water Authority
  - Southern NV Water Authority
  - Denver Water
  - NYC Department of Env Protection

# WUCA Mission

dedicated to providing leadership and collaboration on climate change issues affecting drinking water utilities by improving research, developing adaptation strategies and creating mitigation approaches to reduce greenhouse gas emissions.

# WUCA Initiatives

- Best practices information sharing (adaptation and mitigation)
- Decision support systems (tools to enhance decision-making in uncertainty)
- Influence the Federal climate research agenda

# Collaboration

- Water industry associations
  - American Water Works Association Research Foundation (AwwaRF)
    - Climate Change Strategic Initiative
    - Influential in lining up federal support for research on climate and drinking water
  - American Water Works Association
  - Association Metropolitan Water Agencies
  - IWA
    - Specialist Group on Climate Change
  - Water Environment Research Foundation (WERF)
  - International collaboration

# Concluding Comments

- Address both adaptation and mitigation
- Innovate and integrate across sectors
- Explore new organizational models
- Invest in staffing and technical resources
- Collaborate in research and get involved in political decision-making


Thank You