


Maintaining Sustainable Water Supplies:
Impacts of Climate Change in the
Puget Sound Region

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Results from climate impact studies by
Matthew Wiley, Andre Ball,
Nathan Van Rheenen, and Erin Clancy

Thanks to the Director of the
Center for Water and Watershed Studies

Anne Steinemann



Other Climate Impact Talks

- **Climate and the future of water resources in the Northwest**
Philip Mote, State Climatologist, Climate Impacts Group
- **Hydrologic changes due to global warming**
Alan Hamlet, Research Engineer, Civil and Environmental Engineering
- **Living with limits: Climate, water, salmon, and sustainability in the Pacific Northwest (PNW)**
Edward Miles, Director, Climate Impacts Group



Talk Outline

- Defining Sustainability
- Recent Trends in Climate
- Potential Impacts of Climate on Sustainability
- Water Demands
- Strategies for Enhancing Sustainability



Sustainability

..meeting the needs of the present without compromising the ability of future generations to meet their own needs.

Brundtland Commission, 1987

Sustainable water resource systems are designed and managed to fully contribute to the objectives of society, now and in the future, while maintaining their ecological, environmental, and hydrological integrity.

Loucks and Gladwell, 1997.



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Sustainability

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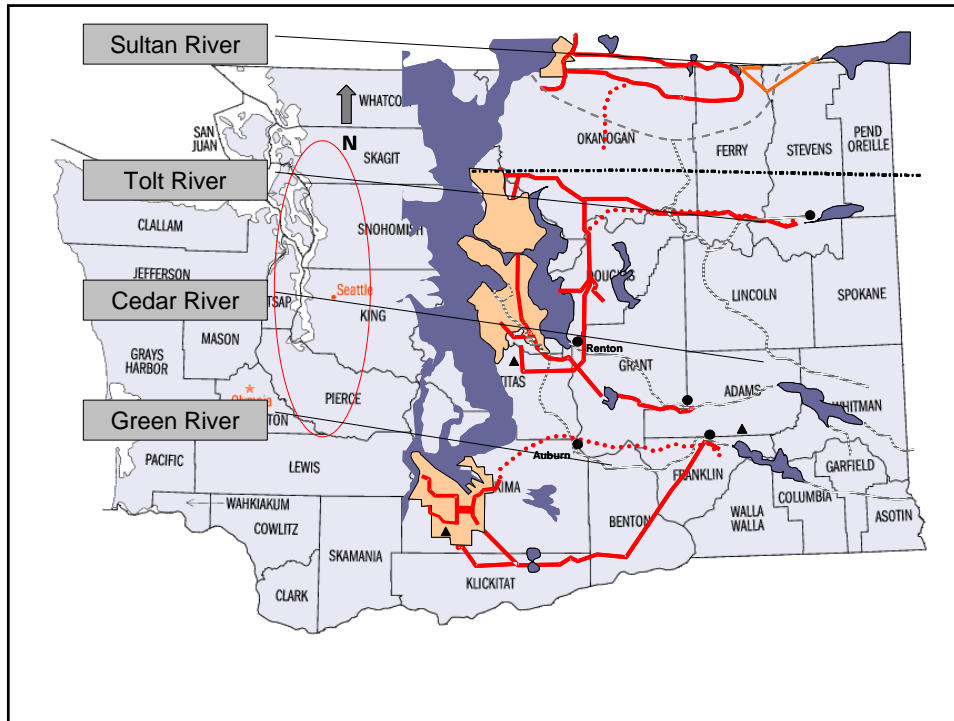
Midland Commission, 1987


Sustainability

The Cedar, Tolt, Green, and Sultan Rivers are managed to provide essential drinking water to the region in addition to providing instreamflows, hydropower, flood control, and navigation.

These systems are no longer sustainable when these operational priorities conflict to the point that these objectives can not be met.

Maintaining sustainability requires selecting appropriate management actions that address the competing priorities





Limits to Sustainability

Occurs when the system is no longer able to meet those "societal objectives"

A sustainable system will remain sustainable until

- Supply Diminishes
- Demands Increase
- Management Changes



Climate Impacts Group

Global Circulation Models forecasts suggest:

A general warming trend particularly during the summers and winters in the PNW

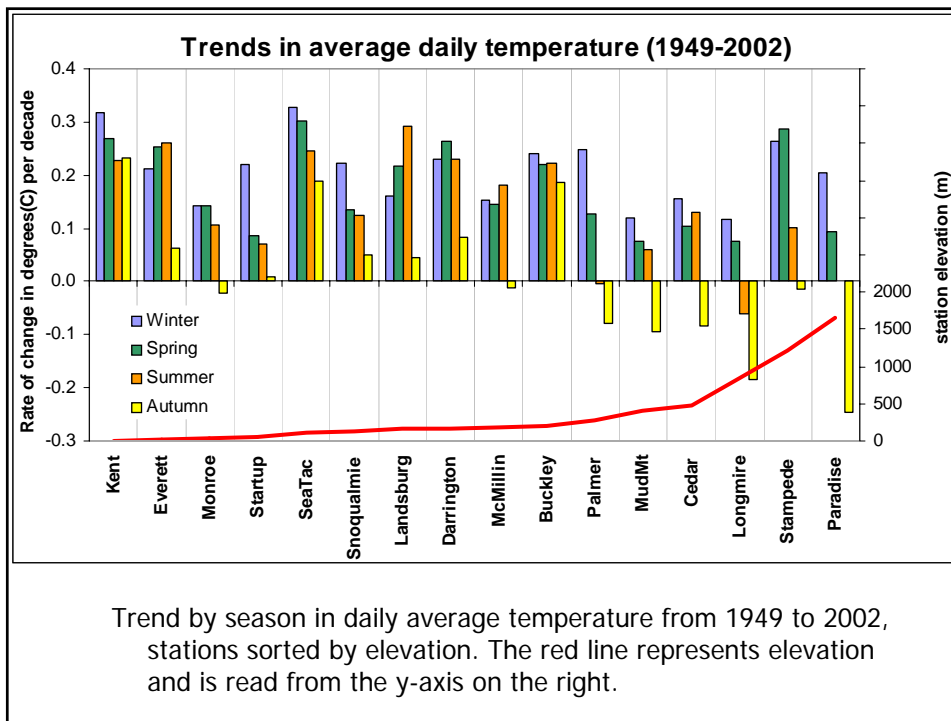
Earlier spring runoff and lower summer flows

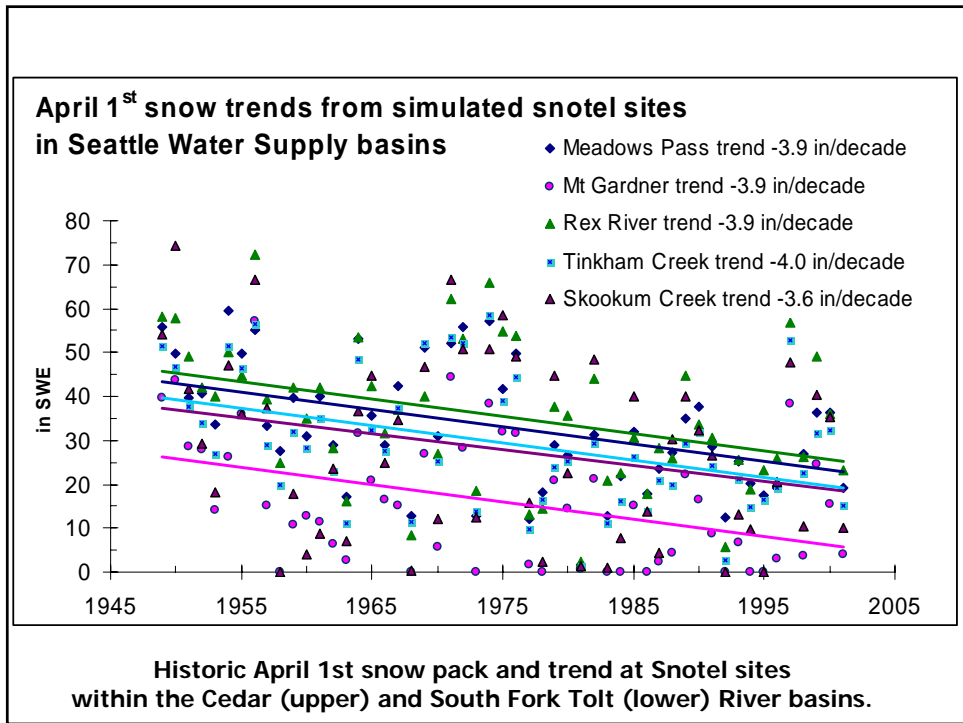
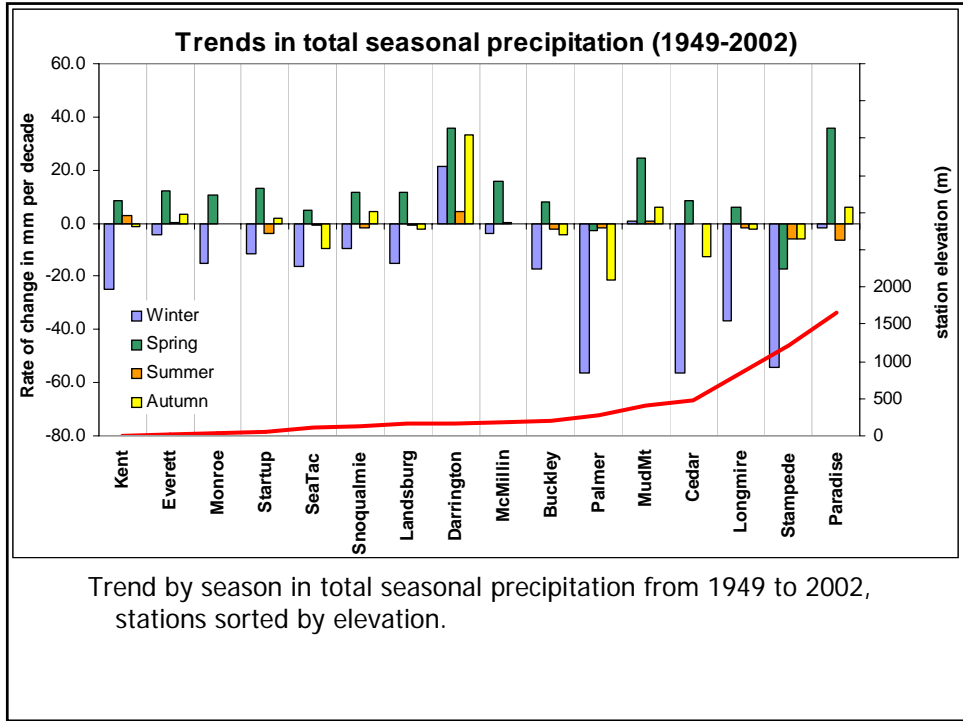
Longer "drawdown periods" for water supplies

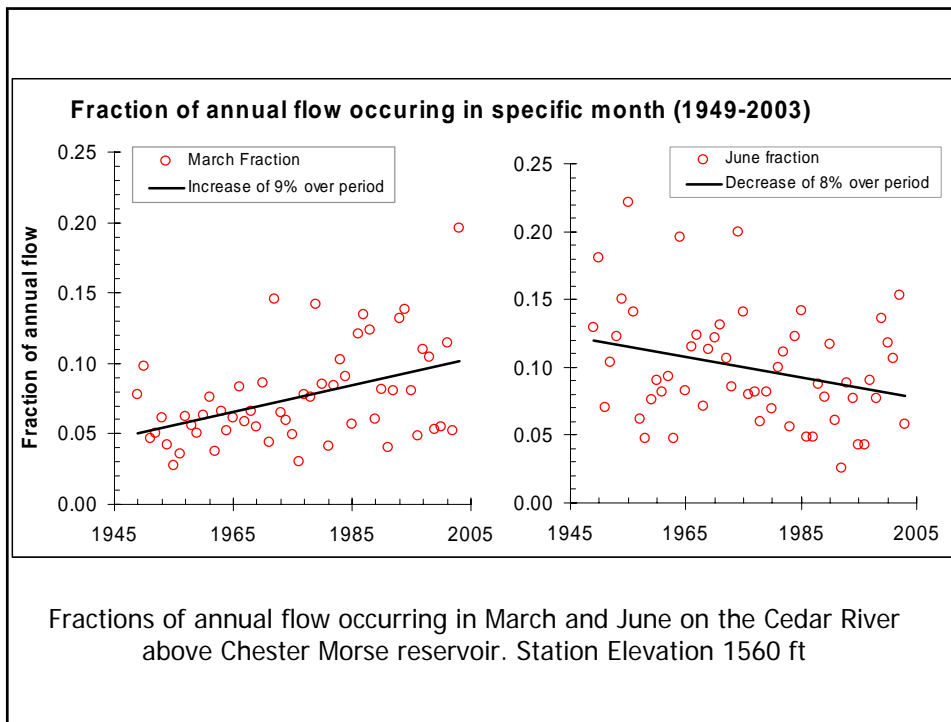
Increased water demands, both in and out of stream

Impacts felt by 2020

Are we seeing any of this now?

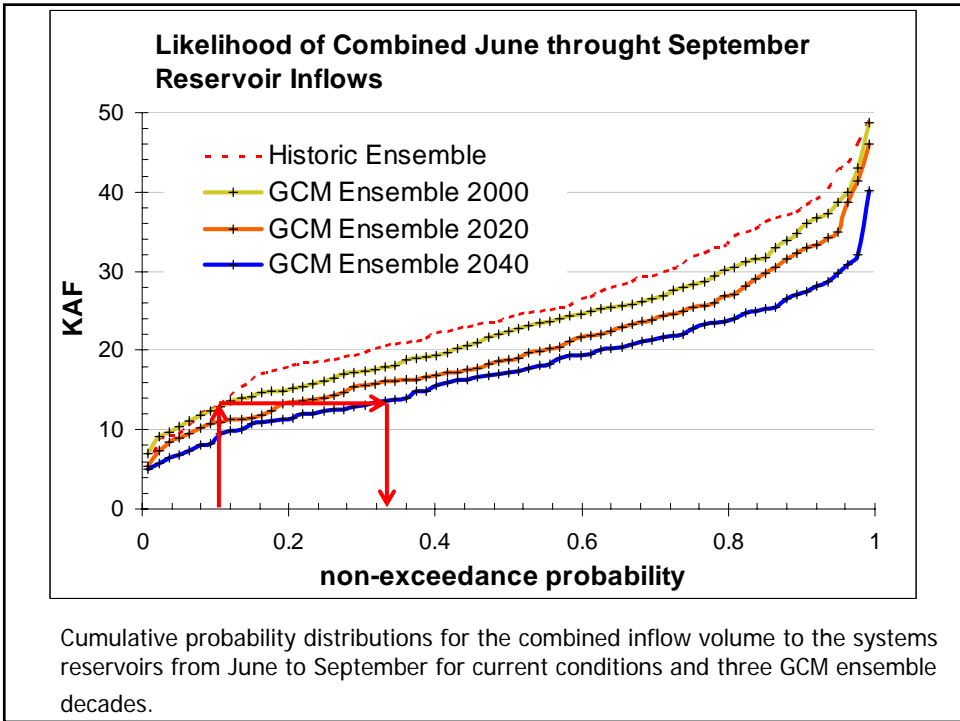
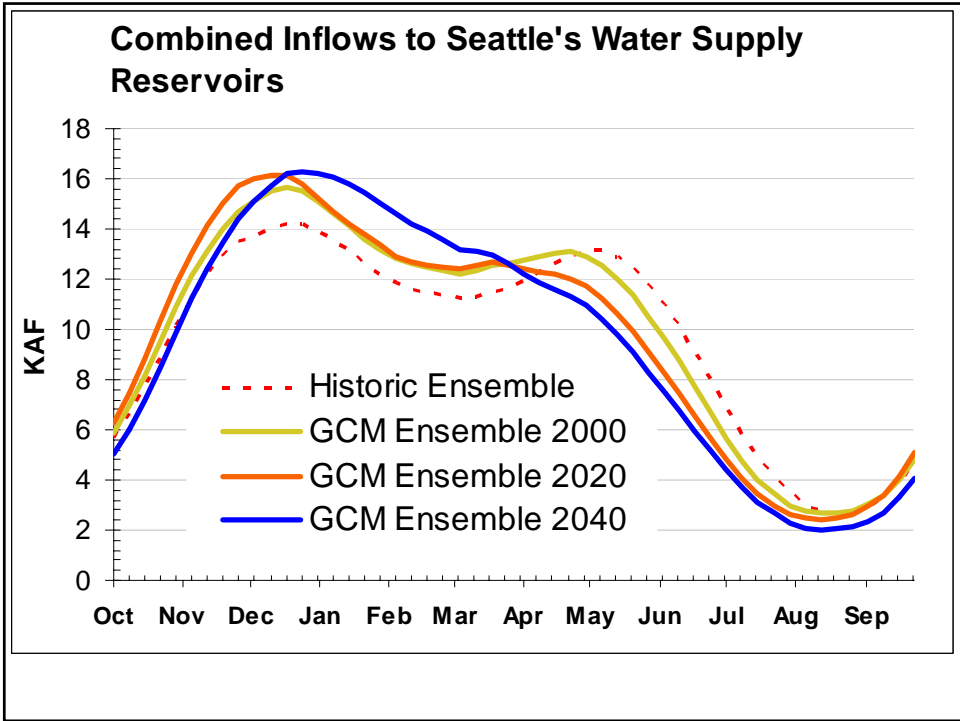






Potential Future Impacts

- There is already evidence of increasing temperatures and shifts in runoff timing
- With the use of GCMs, downscaling, and regional hydrology models, we can estimate future impacts



Cumulative probability distributions for the combined inflow volume to the systems reservoirs from June to September for current conditions and three GCM ensemble decades.



Implications

All surface water sources “on the west side” will be impacted by climate change

Relative impact is a function of system capacity, ratio of summer demands to summer inflows, and summer demands to initial drawdown storage.

Decrease in existing systems estimated in the 2-5 mgd per decade range



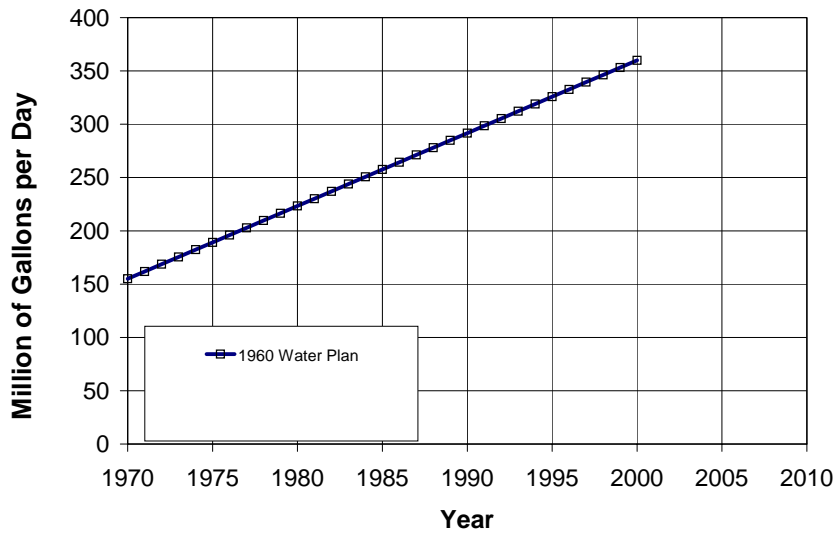
Water Demands

We have not addressed the other key issue, demands.

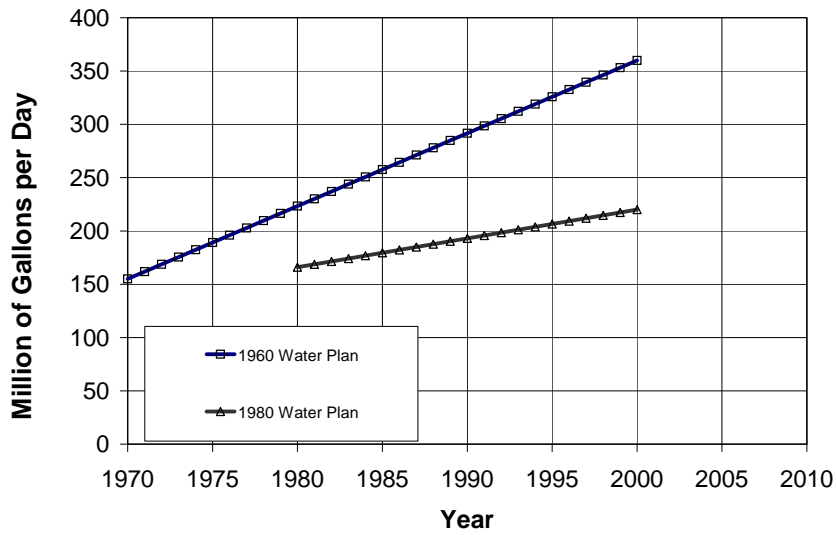
Two HCPs have set the stage for instream flows. There is continued interest in normative flows and how to best establish optimal flows for fish.

What about M&I demands? Shouldn't climate impact these demands? How well have we predicted demands?

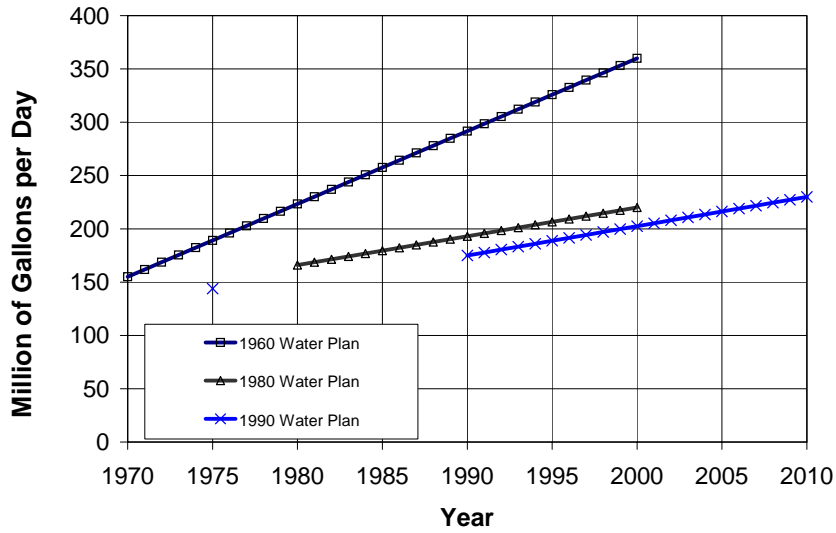
Water Demand Forecasts for Seattle Supply System



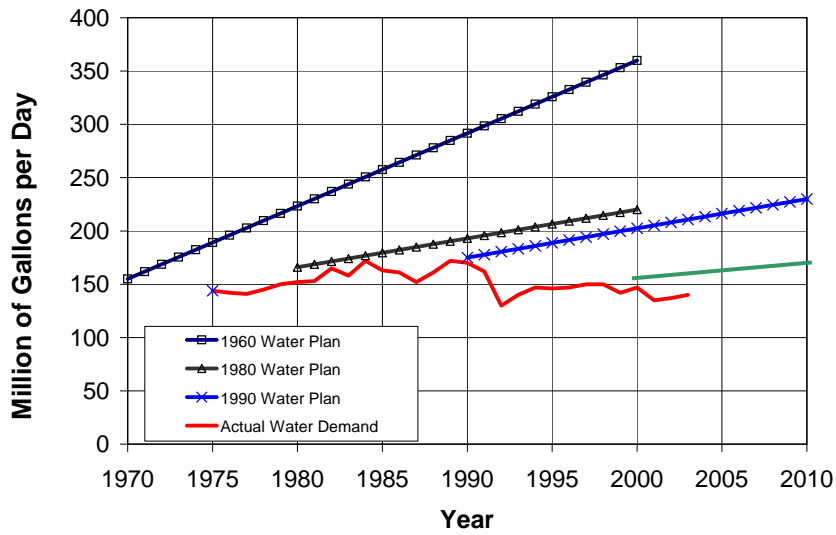
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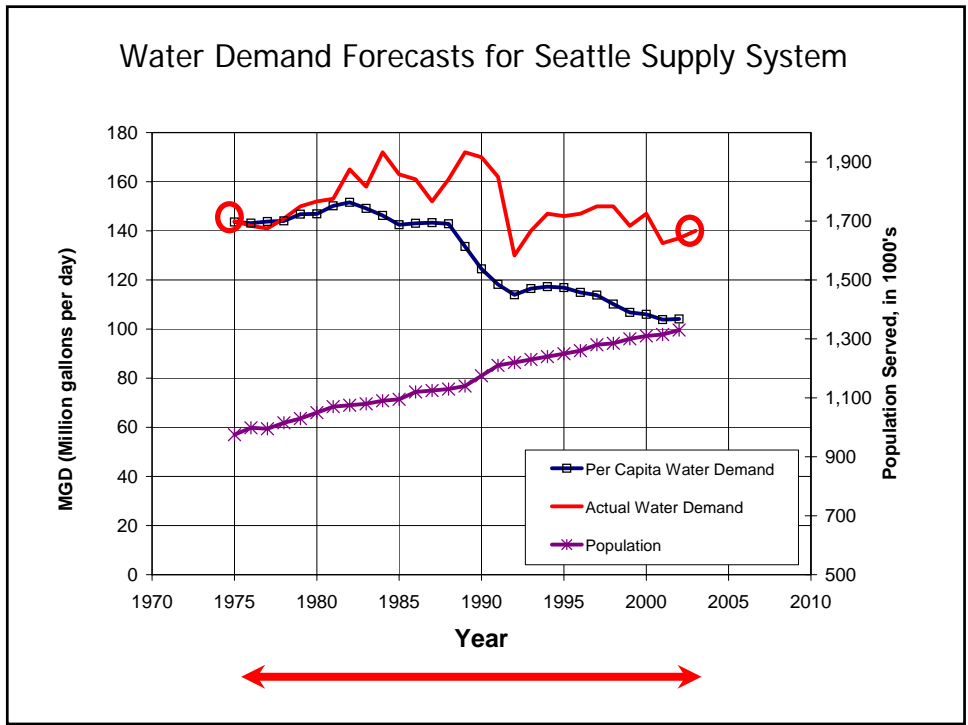


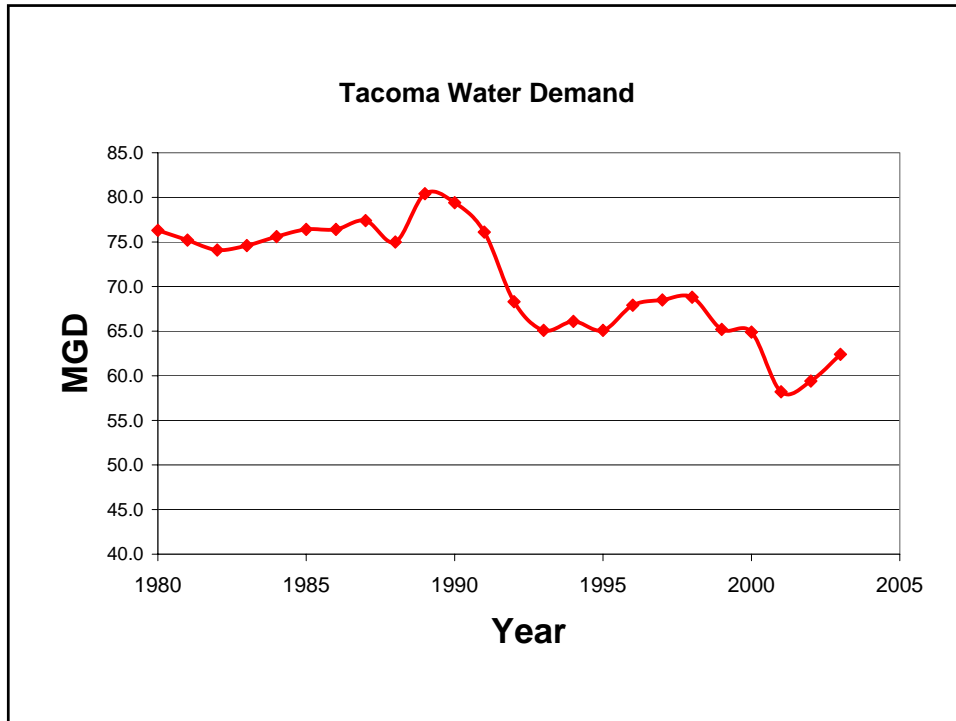
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Where is the demand going?





Water Demands

- Despite significant growth in people served, two of the largest providers are back to pre-1975 demand levels
- Challenges remain

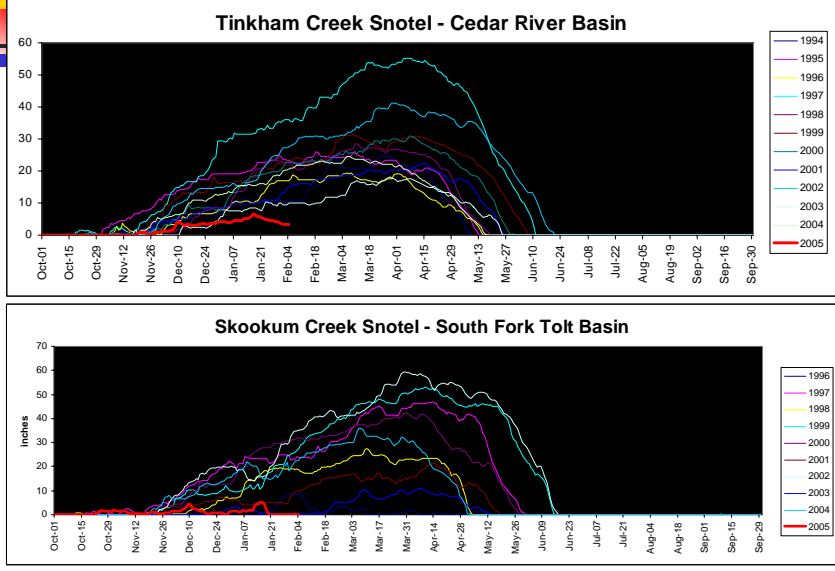


Sustainability

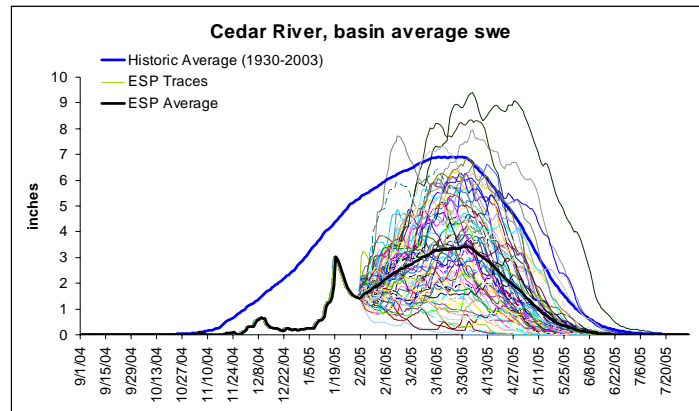
- Yields of our water supplies will decrease in the future
 - Increased emphasis on instream flows
 - Longer, dryer springs and summers



Current Conditions at two snotel sites in the Seattle



Cedar River Basin, simulated average snow water equivalent
Current Conditions as of Jan 31, 2005
Traces assuming conditions from 74 years 1929-2002



Sustainability

- Yields of our water supplies will decrease in the future
 - Increased emphasis on instream flows
 - Longer, dryer springs and summers
- Declining per Capita Water Demands will provide needed "buffer" for planning



Strategies for Enhancing Sustainability

- Maintain conservation success story
- Develop regional strategies that take advantage of unique opportunities
- Explore potential for reuse
- Plan for climate impacts