

# Decision-Making in the Face of Uncertainty: Seattle Public Utilities Case Study

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Seattle Public Utilities



City of Seattle

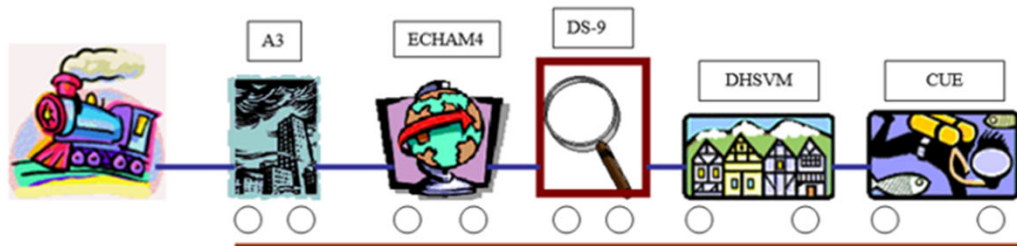
# Outline

- History of climate change at SPU
- Current approach to addressing climate change
- Planning for Future Water Supply Needs
- Broader Water Resources Planning Efforts at SPU



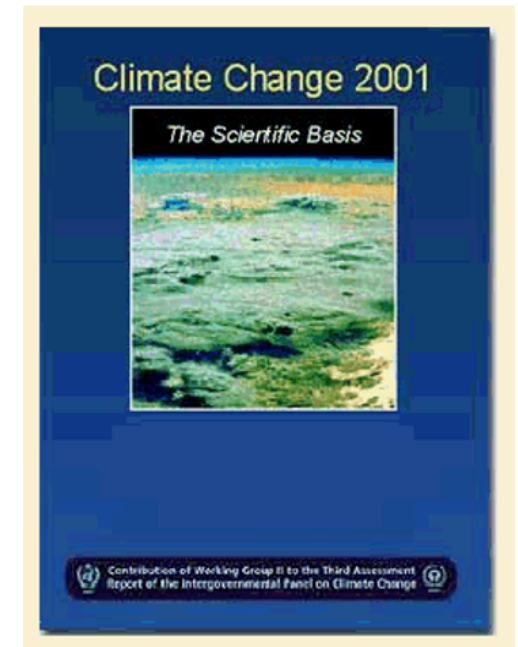
# High level climate change planning in 2000

- Focused on creating a storyline
- Used GCM data
  - Not a prediction
  - Did not assign probability of occurrence








Train of models heading into the Cascade Mountains of Uncertainty!

*Acknowledgement: Alan Chinn (retired)*



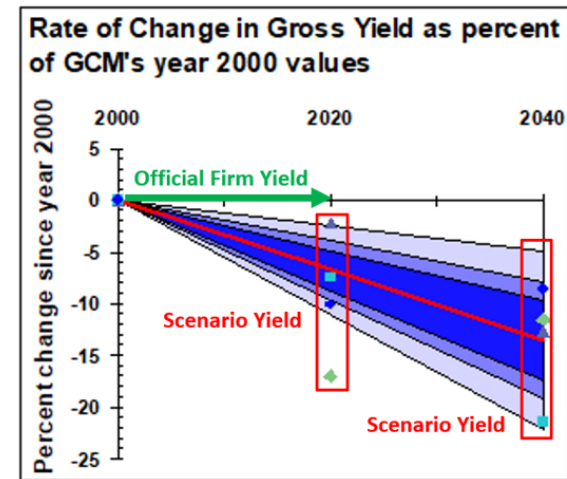
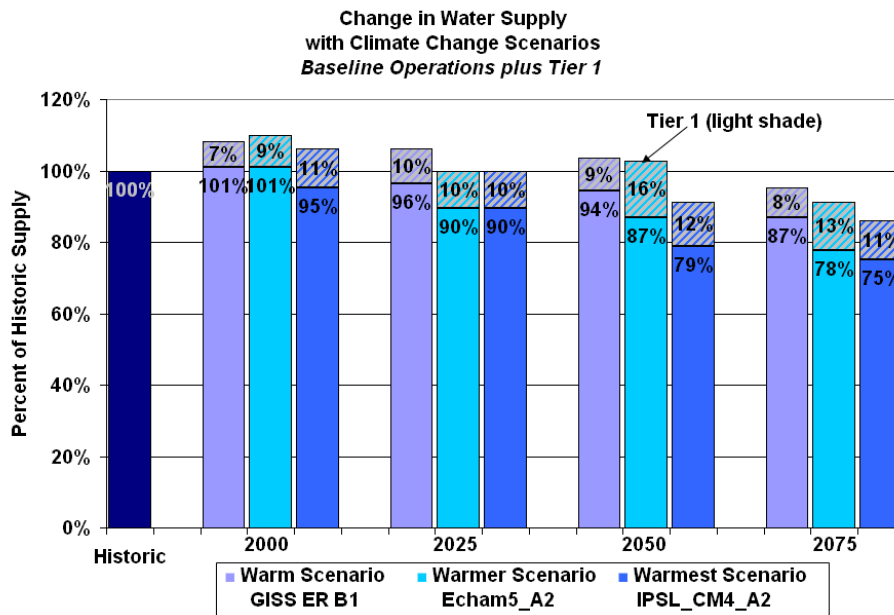
# Structured story lines for data selection

A Five-Step Method for Seattle Public Utility Water Planners

Step	Icon	Choices	Information	Uncertainties/Limitations	Updates
Step 1. Choose Your Favorite IPCC CO2 Emissions Forcing Scenario		There are 40 different CO2 Emission Scenarios developed for the IPCC Third Assessment Report	These are "What-if" scenarios, or "Story Lines" created for the IPCC. Results for most scenarios are not available	?	IPCC plans to revise the CO2 Emissions Scenarios for the IPCC Fourth Assessment Report (2007)
Step 2. Choose Your Favorite Earth Simulation Model		There are 34 different Earth Simulation Models assessed in the IPCC Third Assessment Report	These models are owned and operated by major institutions around the world and many require running on the world's fastest supercomputers. Results for most models are not available	?	Many of the Earth Simulation Models are continually being revised and improved by major institutions around the world
Step 3. Choose Your Favorite Downscaling Method		There are 10 different downscaling options developed by the UW	UW has 9 different statistical method options, UW has 1 Regional Climate Model method using MM5 Model	?	UW Regional Climate Model method using MM5 Model is currently underway for a PNW study; Seattle City Light is participating
Step 4. Choose Your Favorite Local Scale Watershed Simulation Model		There are 2 different local scale watershed models for the Cedar and Tolt Watersheds	UW has the PRISM DHSVM Model, SPU has the SEAFM Model	?	SPU is revising and improving its SEAFM Model
Step 5. Choose Your Favorite Water Resources Management Simulation Model		There are 2 different water resources management simulation models for the Cedar and Tolt reservoir and river systems	UW has the CRYSTAL Model, SPU has the CUE Model	?	SPU is reviewing its CUE Model for possible revisions and improvements

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# Next system update added more storylines





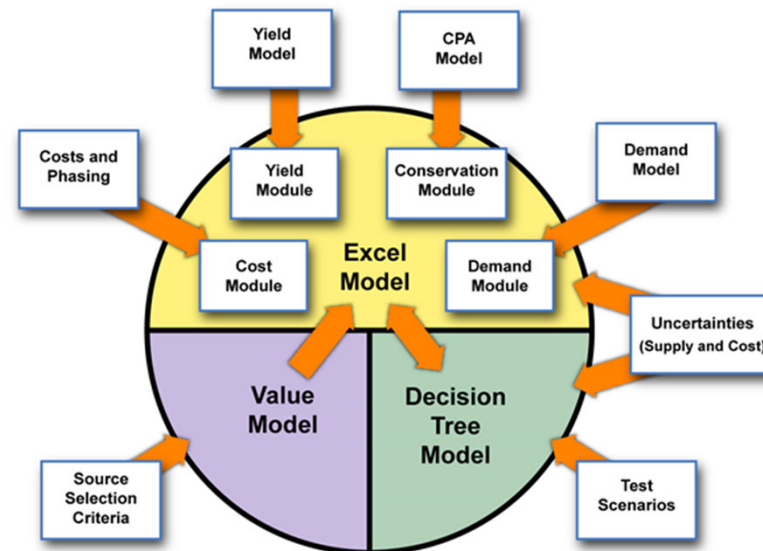
# 2007 Analysis of Major Water Supply Options

## New Water Supply Planning Model

Considered:

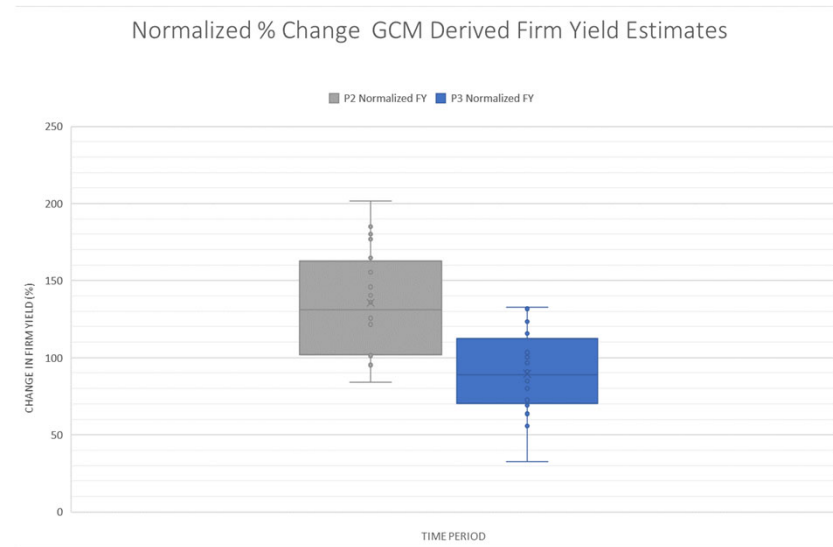
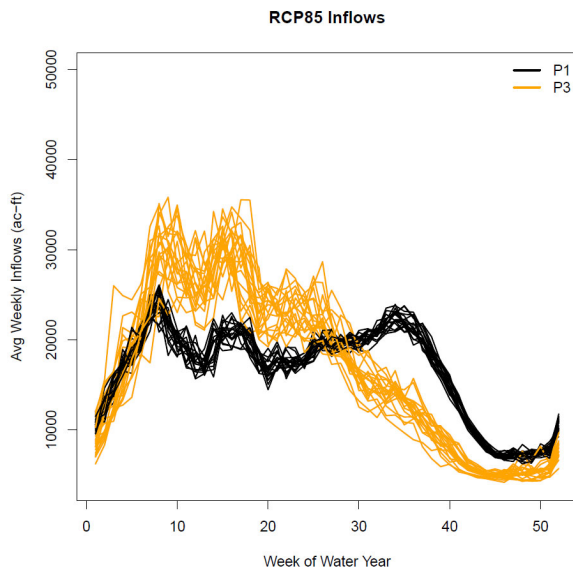
- Cost and water supply
- Environmental impact
- Regulatory impact
- Water quality
- Ease of development
- Operational reliability

Recommended an update every 7 years



# More analyses = more variability

- 2019 Climate Change analysis used data from 20 GCMs
- Science improved the data for use at regional scale (PUMA)
- Improved in-house modeling capacity



# Shift in 2019 Supply Planning: Focus on impacts

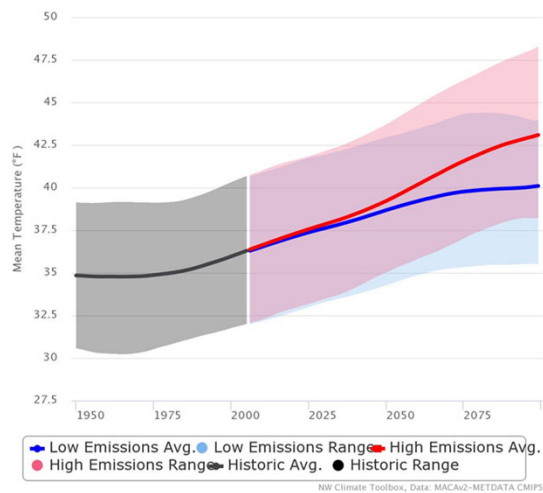


- Results from 2007 study: false precision
- Previous studies focused on calculated reductions in *supply*; Shift to trends in shortfalls
- What are our *system vulnerabilities*
- How will our system function under multiple future scenarios



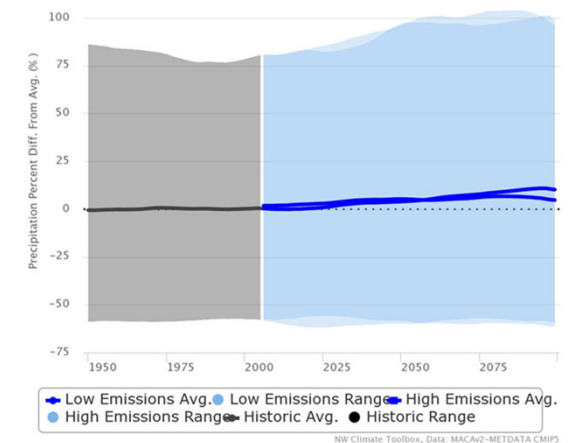
# Anticipated regional climate change impacts

## Increased Temperatures



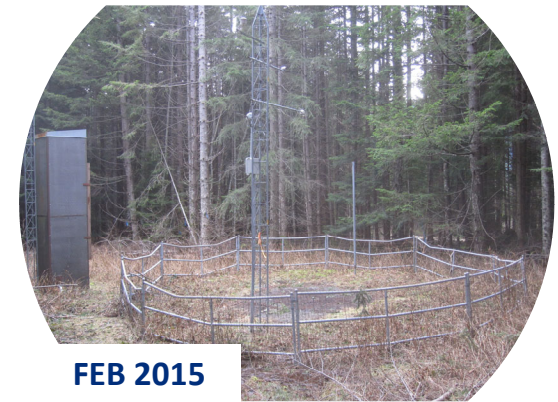
- Less winter snowpack
- Earlier snowmelt
- Dry/wet years more extreme
- Wetter winters, drier summers

## More variable precipitation

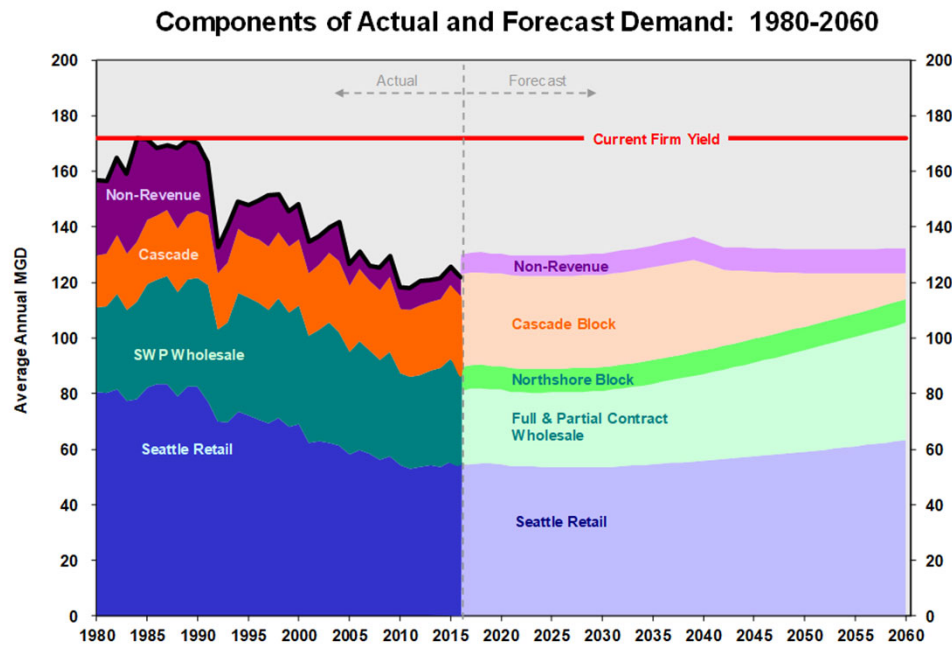


# Climate change vulnerabilities for current system

- Change in timing of reservoir drawdown
  - Drawdown begins earlier
  - Later return of fall rains
- Greater draw from current water supply storage
  - Longer drawdown season
  - Higher water demand
- More variable precipitation
  - Decreased river flows (reservoir inflows, instream flows)
  - Later return of fall rain



# Current Water Supply Outlook: Good



## 2019 Water System Plan

- Current supply is sufficient for forecasted needs
- Presented future supply sources to be more resilient to future vulnerabilities

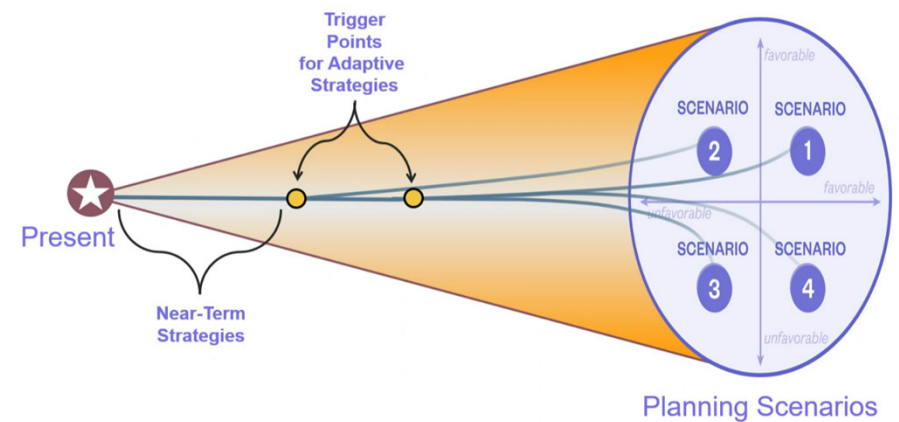


# Transition to adaptive supply planning

- Future water supply is not fixed
- Climate change will impact supply directly and indirectly
- Proactively plan for uncertainty

**Scenario planning: adaptive and resilient**

The Cone of Uncertainty



# The Scenario Planning Process

Develop the  
Core Question



Identify Key  
Uncertainties



Create the  
Scenarios Matrix



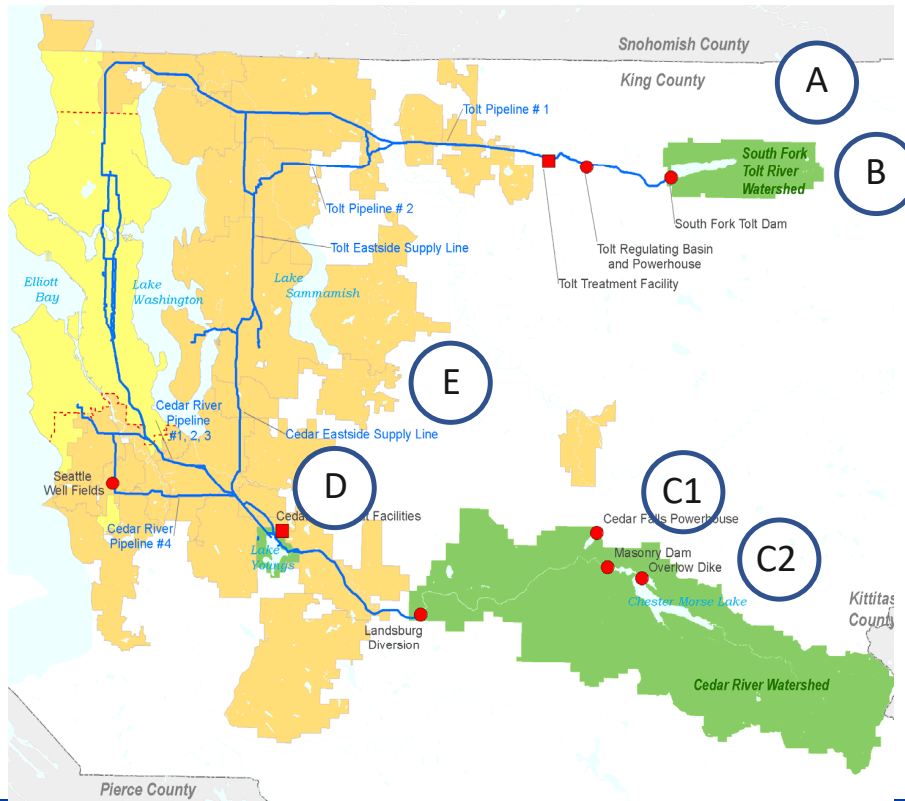
Explore Future  
Conditions



Prioritize  
Adaptive  
Strategies



# Future Water Supply Alternatives Project

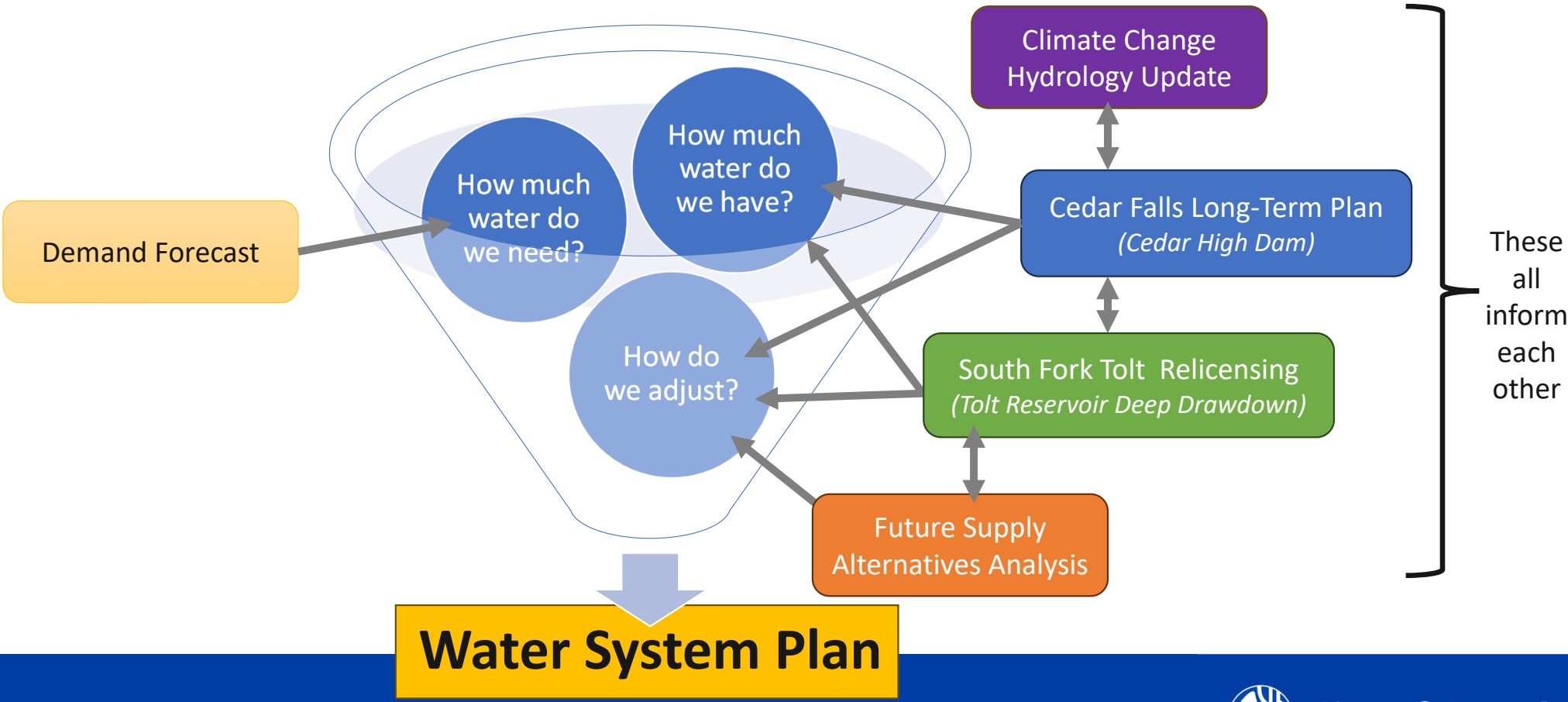


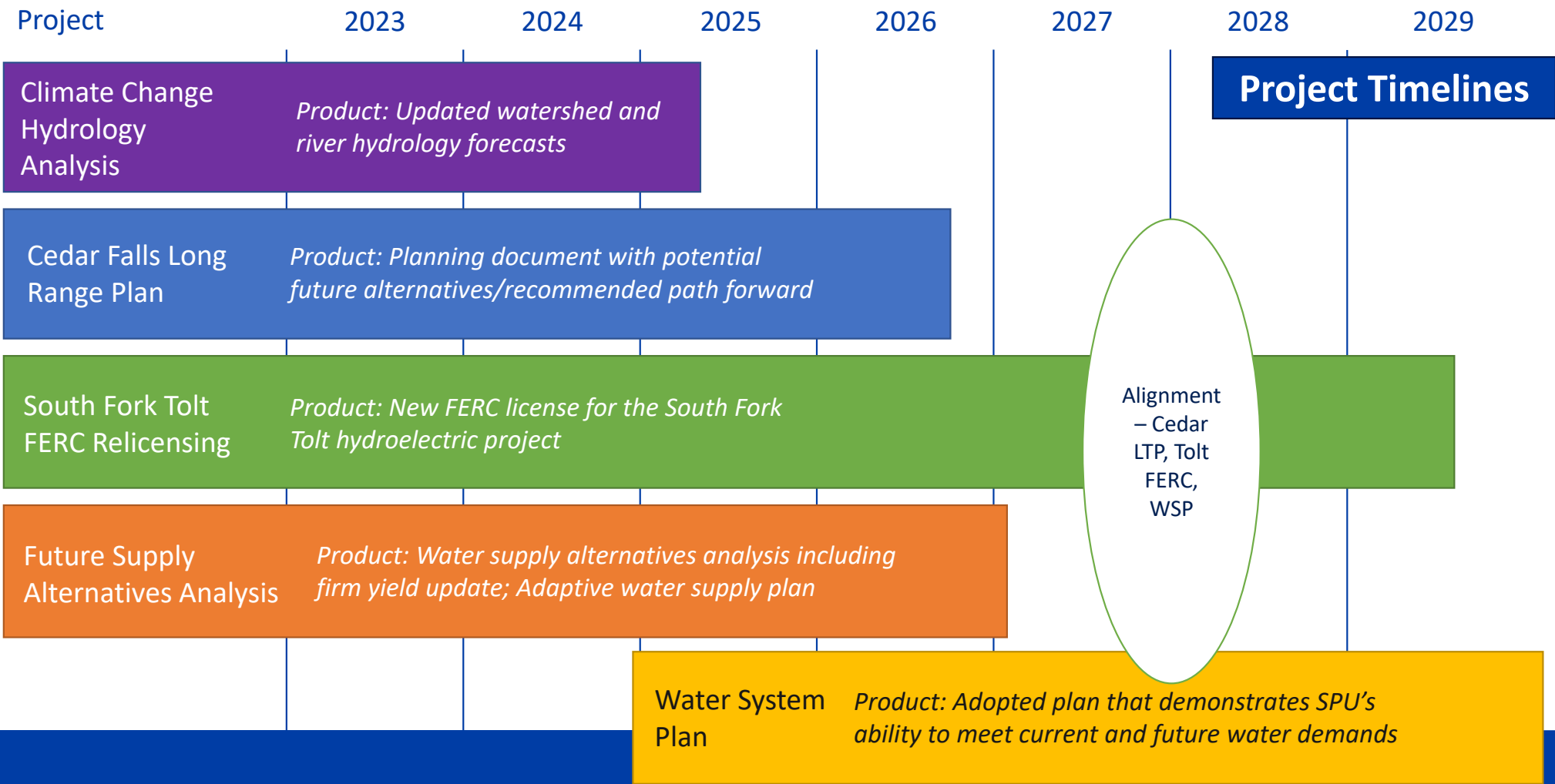
## Traditional Water Supply Projects

- A** North Fork Tolt – Diversion
- B** South Fork Tolt – Deeper Drawdown
- C1** Cedar – Permanent Drawdown
- C2** Cedar – High Dam
- D** Lake Youngs – Deeper Drawdown
- E** Snoqualmie Aquifer Project



# Long-Range Planning Projects





# Conclusion

- Water supply planning will not get easier
- SPU has a long history of data-driven planning
- Entering a new era of adaptive planning for water supply at SPU





**Thank you.**

Photo Credit: Kevin Johnson

